



(12) **DEMANDE DE BREVET CANADIEN**
CANADIAN PATENT APPLICATION

(13) **A1**

(86) **Date de dépôt PCT/PCT Filing Date:** 2019/01/11
(87) **Date publication PCT/PCT Publication Date:** 2019/07/18
(85) **Entrée phase nationale/National Entry:** 2020/06/30
(86) **N° demande PCT/PCT Application No.:** EP 2019/050697
(87) **N° publication PCT/PCT Publication No.:** 2019/138077
(30) **Priorités/Priorities:** 2018/01/11 (DK PA 2018 00018);
2018/12/11 (DK PA 2018 70805)

(51) **Cl.Int./Int.Cl.** *C08J 5/00* (2006.01),
B82Y 30/00 (2011.01), *B82Y 40/00* (2011.01),
C01B 32/152 (2017.01), *C01B 32/174* (2017.01),
C01B 32/194 (2017.01), *C04B 28/02* (2006.01),
C04B 35/10 (2006.01), *C04B 35/48* (2006.01),
C04B 35/50 (2006.01), *C04B 35/56* (2006.01),
C04B 35/565 (2006.01), *C04B 35/58* (2006.01),
C04B 35/80 (2006.01), *C08K 9/04* (2006.01),
C08K 9/08 (2006.01)

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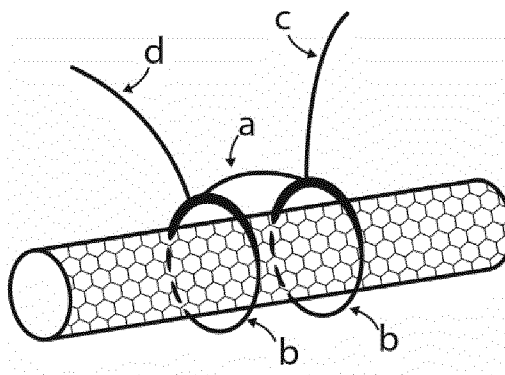
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(54) **Titre : MATERIAUX COMPOSITES COMPRENANT DES LIGANDS MECANQUES**

(54) **Title: COMPOSITE MATERIALS COMPRISING MECHANICAL LIGANDS**

Figure 4

A.



(57) **Abrégé/Abstract:**

Composite material units (CMU) of the structure (SE1-ML-LinkerL-Ligand2-SE2), are provided, wherein ML is a Mechanical Ligand, LinkerL is a chemical bond or entity that covalently links ML and Ligand2, Ligand2 is a chemical entity that is covalently linked to the structural entity SE2, or forms a mechanical bond with the structural entity SE2, and SE1 and SE2 are structural entities.

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(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property

Organization

International Bureau

(43) International Publication Date

18 July 2019 (18.07.2019)



(10) International Publication Number

WO 2019/138077 A1

(51) International Patent Classification:

C08J 5/00 (2006.01) **C04B 35/565** (2006.01)
B82Y 30/00 (2011.01) **C04B 35/58** (2006.01)
B82Y 40/00 (2011.01) **C04B 35/80** (2006.01)
C04B 28/02 (2006.01) **C08K 9/04** (2006.01)
C04B 35/10 (2006.01) **C08K 9/08** (2006.01)
C04B 35/48 (2006.01) **C01B 32/152** (2017.01)
C04B 35/50 (2006.01) **C01B 32/174** (2017.01)
C04B 35/56 (2006.01) **C01B 32/194** (2017.01)

(21) International Application Number:

PCT/EP2019/050697

(22) International Filing Date:

11 January 2019 (11.01.2019)

(25) Filing Language:

English

(26) Publication Language:

English

(30) Priority Data:

PA 2018 00018 11 January 2018 (11.01.2018) DK
 PA 2018 70805 11 December 2018 (11.12.2018) DK

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(81) Designated States (unless otherwise indicated, for every

kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DJ, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JO, JP, KE, KG, KH, KN, KP, KR, KW, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States (unless otherwise indicated, for every

kind of regional protection available): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

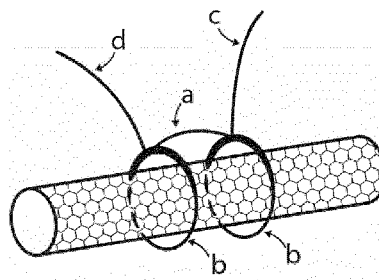
Published:

- with international search report (Art. 21(3))
- before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))

(54) **Title:** COMPOSITE MATERIALS COMPRISING MECHANICAL LIGANDS

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A.



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WO 2019/138077 A1

DEMANDE OU BREVET VOLUMINEUX

LA PRÉSENTE PARTIE DE CETTE DEMANDE OU CE BREVET COMPREND PLUS D'UN TOME.

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JUMBO APPLICATIONS/PATENTS

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NOM DU FICHIER / FILE NAME :

NOTE POUR LE TOME / VOLUME NOTE:

COMPOSITE MATERIALS COMPRISING MECHANICAL LIGANDS.

INTRODUCTION.

Technical field.

Composite materials, in particular materials where the strength of the material is of importance.

Background.

Composite materials typically consist of a polymer part and one or more additives. The polymers and additives have typically been mixed during preparation of the composite material. In the resulting composite material there are often only weak interactions between the polymer and additive components; however, the interaction can also be strong, and sometimes the polymer and additive is even held together by a covalent bond. Characteristics of the composite material such as e.g. strength is often compromised as a result of this weak interaction between the different components of the composite material.

It has been difficult to make carbon nanotube composites of high strength, although carbon nanotubes are very strong themselves. This is in part because the carbon nanotubes are difficult to anchor efficiently in the composite material. It is not ideal to link the carbon nanotubes and the matrix, e.g. the polymer, by covalent bonds, as covalent bonds tend to negatively affect the structure and other characteristics of the carbon nanotube. Thus, covalent functionalization of the carbon nanotube surface typically lowers the strength of the carbon nanotubes.

It is therefore of great interest to identify approaches that can anchor the carbon nanotubes efficiently in the composite material without compromising their intrinsic characteristics such as strength.

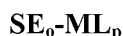
SUMMARY OF THE INVENTION.

What is provided is a Mechanical Ligand (ML), i.e. a ligand capable of forming a mechanical bond with one or more structural entities. The ligand optionally changes the characteristics of the structural entity upon binding to it. Examples of mechanical ligands are shown and described in (Figure 1).

What is further provided is the preparation, structure, and use of a complex comprising a structural entity (SE) and a Mechanical Ligand (ML), where the characteristics of the structural entity when bound by the ML is different from the characteristics of the structural entity when not bound by the

ML, or alternatively, the characteristics of said complex is different from the characteristics of the structural entity (SE) and the ML.

The ML-structural entity complex may comprise one or more ligands and one or more structural entities, and thus can be described by the formula



where SE is a structural entity, and

ML is a chemical moiety capable of forming a mechanical bond to the SE, and

o and p are integers larger than zero.

(Figure 1) shows examples of $\text{SE}_o\text{-ML}_p$ complexes.

What is further provided in this invention is a structure of, and a process for preparing, a Linker Unit (LU) of the following composition:



where

ML is a chemical entity that is capable of forming a mechanical bond with a structural entity,

LinkerL is a chemical bond or entity that links ML and Ligand2,

Ligand2 is a chemical entity that is capable of forming a covalent or non-covalent bond to a structural entity, or alternatively, is capable of forming a mechanical bond with a structural entity,

and optionally, where

a structural entity, SE1, is bound to ML, and

a structural entity, SE2, is bound to Ligand2,

thereby forming a composite material unit (CMU) of the following composition:



where

SE1 is a Structural Entity,

ML is a chemical entity that is attached to SE1 through a mechanical bond,

LinkerL is a chemical bond or entity that links ML and Ligand2,

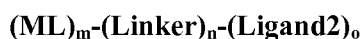
Ligand2 is a chemical entity that is covalently or non-covalently attached to SE2, or alternatively, is attached to SE2 through a mechanical bond.

SE2 is a Structural Entity.

See (Figure 2) for example structures of CMUs.

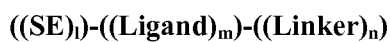
The linker unit (LU) thus may be used to link two structural entities. The LU as described in the present invention is capable of efficiently linking two or more structural entities, but at least one of the ligands is a mechanical ligand.

What is also provided is a LU comprising several MLs, Ligands and/or Linkers, of the following compositions:



where m, n, and o are any integers, at least one of the ligands is a mechanical ligand, and the MLs, Ligands and Linkers can be linked in any order and sequence.

What is also provided is a CMU comprising several SEs and LUs, of the following compositions:



or



where l, m, and n are any integers, at least one of the ligands is a mechanical ligand, and the SEs, Ligands and Linkers can be linked in any order and sequence.

The composite material unit (CMU) may be used in the preparation of composite materials with improved or novel characteristics. The CMU as described in the present invention in an appropriate manner links different parts of the composite material. Depending on the desired characteristics these links may be covalent or non-covalent; weak or strong; or may be e.g. temperature sensitive or conducting.

What is further provided is a composition, and the process of preparing a composition, comprising two or more CMUs. The two or more CMUs may be identical, essentially identical or different.

What is further provided is a polymeric structure of CMUs, consisting of a number of repeats of the palindromic structure SE1-ML-Linker-Ligand2-SE2-Ligand2-Linker-ML-SE1. Thus, the overall

structure of said polymeric structure of CMUs is (SE1-ML-Linker-Ligand2-SE2-Ligand2-Linker-ML-)_nSE1, where n is an integer larger than zero.

For n=1, the polymeric structure of CMUs is thus described by the structure SE1-ML-Linker-Ligand2-SE2-Ligand2-Linker-ML-SE1.

For n=2, the polymeric structure of CMUs is thus described by the structure SE1-ML-Linker-Ligand2-SE2-Ligand2-Linker-ML- SE1-ML-Linker-Ligand2-SE2-Ligand2-Linker-ML-SE1.

For n=3, the polymeric structure of CMUs is thus described by the structure SE1-ML-Linker-Ligand2-SE2-Ligand2-Linker-ML- SE1-ML-Linker-Ligand2-SE2-Ligand2-Linker-ML- SE1-ML-Linker-Ligand2-SE2-Ligand2-Linker-ML-SE1.

For n=5, the polymeric structure of CMUs is thus described by the structure SE1-ML-Linker-Ligand2-SE2-Ligand2-Linker-ML- SE1-ML-Linker-Ligand2-SE2-Ligand2-Linker-ML- SE1-ML-Linker-Ligand2-SE2-Ligand2-Linker-ML- SE1-ML-Linker-Ligand2-SE2-Ligand2-Linker-ML- SE1-ML-Linker-Ligand2-SE2-Ligand2-Linker-ML-SE1.

Preferred polymeric structures of CMUs are the polymeric structures where SE1 is a carbon nanotube, and n=1, 2, 3, 4, 5, 6, 7, 8, 9, 10-20, 20-100, or 100-1000, or higher.

Other preferred polymeric structures of CMUs are the polymeric structures where SE1 is a nanotube, and n=1, 2, 3, 4, 5, 6, 7, 8, 9, 10-20, 20-100, or 100-1000, or higher.

Yet other preferred polymeric structures of CMUs are the polymeric structures where SE1 is a nanotube or graphene, SE2 is a nanotube or graphene, and n=1, 2, 3, 4, 5, 6, 7, 8, 9, 10-20, 20-100, or 100-1000, or higher.

Yet other preferred polymeric structures of CMUs are the polymeric structures where SE1 is a nanotube, SE2 is a plastic polymer, and n=1, 2, 3, 4, 5, 6, 7, 8, 9, 10-20, 20-100, or 100-1000, or higher.

Yet other preferred polymeric structures of CMU are the polymeric structures where SE1 is a carbon nanotube, SE2 is not a carbon nanotube, and the number of repeats is two or higher.

The present invention describes a new approach to the anchoring of additives in a composite material, e.g. by the use of a mechanical bond between the additive (e.g. carbon nanotube) and the matrix (e.g. polypropylene polymer). The anchoring can be achieved without covalent modification to the surface of the additive. This is particularly attractive for additives such as carbon nanotubes that are particularly vulnerable to covalent modification.

FIGURES

Figure 1 shows example Mechanical Ligands (MLs) and the complexes SE_o-ML_p formed between structural entities (SEs) and Mechanical Ligands (MLs)

Figure 2 shows example Composite Material Units (CMUs)

Figure 3 shows examples of Mechanical Ligands (MLs) that are generated during or upon association of the precursor-ML with a structural entity (SE)

Figure 4 shows the generic structure of a mechanical ligand that is a closed ring around the structural entity (SE)

Figure T1 shows the structure of a precursor-ML, Compound 10

Figure T2 shows the structure of a ML, Compound 11

Figure T3 shows Compound 11, formed around a carbon nanotube (view from side)

Figure T4 shows Compound 11, formed around a carbon nanotube (view from end)

Figure T5 shows the structure of a precursor-ML, Compound 12, and the structure of the mechanical ligand (ML), Compound 13, formed upon ring closure of the precursor-ML around the carbon nanotube

Figure T6 shows the structure of a precursor-ML with a Linker moiety attached (Compound B)

Figure T7 shows the structure of a precursor-ML with a Linker moiety attached (Compound B), as well as structures of MLs with various linker moieties attached (Compounds C, D, E and F)

Figure T8 shows the structure of amine-terminated polystyrene (Compound 20)

Figure T9 shows the synthesis (Scheme 1) of Compound B

Figure T10 shows the structures of 4-aminoethyl styrene and styrene

Figure 15 shows a general structure of a precursor-ML and the specific structure of certain precursor-MLs (compounds **101**, **102**, **103**, **104**, **105**, **106**, **107**, **108**, **109**, **110**, **111**), as well as the synthesis and structure of certain other precursor-MLs (compounds **101-A**, **102-A**, **103-A**, **104-A**, **105-A**, **106-A**, **107-A**, **111-A**).

Figure 17 shows the cyclization of compound (111-A) to form a mechanical ligand around a CNT.

Figure 21 shows the principle of a molecular shock absorber, where the molecular shock absorber comprises a mechanical ligand and two non-covalent ligands.

Figure 24 shows the synthesis and use of various mechanical ligands, nanotubes and graphene, for the preparation of an ink with superior characteristics.

Figure 25 describes the benefits of coupling nucleating agents to mechanical ligands, and shows examples of such mechanical ligand-nucleating agent structures

Figure 26 describes the use of mechanical ligands and nanotubes in the preparation of ceramics e.g. cement and depicts the synthesis and structure of compounds (**221**) and (**222**).

Figure 29 describes the synthesis of compound **(251)**, which is a precursor-ML, and its cyclization around a boron nitride nanotube to form a mechanical ligand around the boron nitride nanotube. Also described is compound **(252)**, which is a precursor-ML, and its cyclization around a CdS nanorod, to form a ML wrapped around the CdS nanorod.

Figure 30 shows the structure of compound **(261)** which is a light-cleavable precursor-ML.

Figure 31 shows the synthesis of compounds **(271, 272, 273)**, which are all precursor-MLs capable of forming two mechanical ligands with a nanotube, but which vary in the type of reactive group they are carrying for reaction with eg. SE2. It is also shown how these precursor-MLs can be used to efficiently glue together several layers of CNT veil.

Figure 32 shows how compounds **(271)** and **(273)** can be used to make a macroscopic nanosensor.

Figure 33 shows how mechanical ligands can be used to produce carbon nanotube-reinforced silk.

Figure 39 provides analytical data on the synthesis of compound **(B)**, which is used as a precursor molecule in several of the synthetic schemes used in the present invention.

Figure 40 shows how the physical properties of natural latex with 0.03 wt.% carbon nanotubes can be stabilized with carboxymethyl cellulose as surfactant.

Figure 41 shows the capacity of batteries comprising carbon nanotubes.

Figure 42 shows a percolation curve with Matrix 203.

Figure 43 shows the volume resistivity of RTV silicone with CNT and with conductive carbon black.

Figure 44 shows the physical properties of RTV silicone with CNT and with conductive carbon black.

Figure 45 shows the properties of tyre compounds with carbon nanotubes.

Figure 46 shows how appropriate design of precursor-ML can lead to ML-nanotube complexes that do not comprise nanotube-binding domains.

DETAILED DESCRIPTION OF THE INVENTION.

General components and processes.

What is provided is a Mechanical Ligand (ML) capable of forming a mechanical bond with a structural entity. The ligand optionally changes the characteristics of the structural entity upon binding to it.

A mechanical bond is a bond between a mechanical ligand (ML) and a structural entity (SE) where at least one intramolecular covalent bond in either the SE or one intramolecular covalent bond in the ML must be broken in order to bring the structural entity and the mechanical ligand apart.

However, for a complex of an SE and an ML where the SE and/or ML has an aspect ratio of more than 100 (one hundred), a Mechanical Bond shall mean a bond between said ML and said SE where at least one intramolecular covalent bond in the SE or in the ML must be broken in order to bring the SE and the ML apart in a direction other than the direction of the largest dimension of said SE and/or said ML that has an aspect ratio of more than 100. An intramolecular covalent bond shall mean a covalent bond between atoms within a given molecule (i.e. within the SE or within the ML, but not between the SE and ML).

The following is an example of such a mechanical bond between MLs and SEs that keep the SE and the ML interlocked as a consequence of their topology: The ML is e.g. a closed ring such as a peptide, wrapped around a nanotube that has an aspect ratio larger than 100. The ends of the peptide have been covalently linked so that the peptide forms a continuous string of covalently linked atoms around the nanotube. The nanotube is a cylindrical structure with an aspect ratio of more than 100, which means that its length (along the cylindrical axis) is more than 100 times larger than its diameter (the diameter of the cylindrical structure). Theoretically, the ML (the closed ring peptide) and the SE (the nanotube) could be brought apart by moving the ML up or down the length of the nanotube (i.e. in the direction of the largest dimension of the nanotube), without breaking an intramolecular covalent bond of the closed ring peptide (the ML) or of the nanotube (the SE). However, it is impossible to bring the closed ring peptide and the nanotube apart in a direction other than the direction of the largest dimension of the nanotube (which has an aspect ratio of more than 100) without breaking an intramolecular covalent bond in the closed ring peptide or the nanotube, and therefore the closed ring peptide and the nanotube forms a mechanical bond between them.

MLs of the present invention may be used to increase the solubility or dispersion of structural entities, and are particularly useful when the structural entity has low solubility or dispersion in a given solvent or composite material. Addition of the ML, and the formation of a mechanical bond between the ligand and the structural entity may then increase solubility, particularly if the ML carries chemical moieties that increase solubility or dispersion of the SE to which it is bound, in the solvent or matrix that surrounds it.

MLs of the present invention may also be used to preferentially disperse subgroups of structural entities. As an example, if a mechanical ligand is more likely to become attached to a nanotube of a certain chirality, relative to another nanotube of a different chirality, it will preferentially disperse this

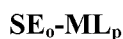
nanotube, provided that the ML carries chemical moieties that increase the solubility or dispersion of the nanotube that it binds.

ML-promoted solubilization or dispersion thus provides a means to obtain a better dispersion of e.g. additives in composite materials. Thus, addition of a ML that binds the structural entity, to the additive stock solution, or to the polymerization reaction that generates the composite material, or at any other step of composite material production, can improve solubilization or dispersion of the additive during the process and/or in the final composite material.

CNTs may be difficult to disperse in solvents used in composite material production processes. Addition of CNT-binding MLs during production of e.g. CNT-reinforced polymers may often improve dispersion and/or solubilization, leading to a better distribution of the CNT in the final composite.

What is further provided is the preparation, structure and use of a complex comprising a structural entity (SE) and a ML, where the characteristics of the structural entity when bound by the ML is different from the characteristics of the structural entity when not bound by the ML, or alternatively, the characteristics of said complex is different from the characteristics of the structural entity (SE) and the ML.

The ML-structural entity complex may comprise one or more ligands and one or more structural entities, and thus can be described by the formula



where SE is a structural entity, and

ML is a chemical moiety capable of mechanically binding to the SE, and

o and p are integers larger than zero.

Characteristics of the structural entity that may be perturbed, modified, increased or decreased, include any one or more of the following characteristics: Size of SE, Conductivity of SE, Density of SE, Specific density of SE, Strength of SE (e.g. Young's Modulus, tensile strength, other types of strength), Melting point of SE, Elongation at break of SE. For any of these characteristics of an SE, and in each characteristic's entire range, further characteristics of the SE that may be modified upon mechanical binding of the ML include any one or more of the following: stiffness, electrical conductivity, thermal conductivity, color, fluorescence, luminescence, UV protective capability, abrasion resistance, ductility, elasticity, flexibility, energy storage capability (including energy storage as heat or kinetic energy), information storage capability, hydrophilicity, hydrophobicity,

polarity, aproticity, and charge, as well as the following characteristics where the unit of measure is indicated after each characteristic: Arc Resistance, sec; Impact Strength, Charpy, J/cm; Impact Strength, Izod Notched, J/cm ; Impact Strength, Izod Unnotched, J/cm ; Impact Strength, Charpy Notched Low Temp, J/cm; Impact Strength, Izod Notched Low Temp, J/cm; Impact Strength, Charpy Unnotched Low Temp, J/cm; Impact Strength, Charpy Unnotched, J/cm; Linear Mold Shrinkage, cm/cm; Maximum Service Temperature, Air, ; Melt Flow, g/10 min; Melting Point, ; Modulus of Elasticity, GPa; Moisture Absorption at Equilibrium, % ; Oxygen Transmission, cc-mm/m; Poisson's Ratio; Processing Temperature, ; Surface Resistance, ohm; Tensile Strength, Ultimate, MPa; Tensile Strength, Yield, MPa; Thermal Conductivity, W/m-K; UL RTI, Electrical, ; UL RTI, Mechanical with Impact, ; UL RTI, Mechanical without Impact, ; Vicat Softening Point, ; Water Absorption, %; Coefficient of Friction; Comparative Tracking Index, V; Compressive Yield Strength, MPa; CTE, linear 20; Deflection Temperature at 0.46 MPa, ; Deflection Temperature at 1.8 MPa, ; Density, g/cc; Dielectric Constant; Dielectric Constant, Low Frequency ; Dielectric Strength, kV/mm; Dissipation Factor; Dissipation Factor, Low Frequency ; Electrical Resistivity, ohm-cm; Elongation @ break, %; Flammability, UL94 ; Flexural Modulus, GPa; Flexural Yield Strength, MPa; Glass Temperature, ; Hardness, Barcol; Hardness, Rockwell E; Hardness, Rockwell M; Hardness, Rockwell R; Hardness, Shore A; Hardness, Shore D; Heat Capacity, J/g.

Depending on the application, an SE with a low, medium, or high degree of each of these characteristics is preferable in the present invention.

In a preferred embodiment, the characteristic of the SE that is modified by the binding of the ML is the strength (e.g. tensile strength, Young's modulus, elongation at break). Particularly preferred embodiments involve SE-ligand complexes where the strength of the SE is increased upon attachment to the ML. The term "reinforced structural entity" will be used in the present invention to describe a complex of a structural entity and a ML in which the strength of the SE is increased compared to the strength of the SE when not bound by the ML.

In a preferred embodiment the reinforced structural entity is a component of a composite material unit (CMU) where said CMU may further be a component of a composite material. The reinforced structural entity, as well as the structural entity itself, in this case may be termed a filler or additive.

In another preferred embodiment the characteristic of the SE that is modified by the binding of the ML is the conductivity. Particularly preferred embodiments involve SE-ML complexes where the conductivity of the SE is increased upon binding of the ML. Such ML-structural entity complexes

where the conductivity of the structural entity has been perturbed by the binding of a ML may be useful as sensor molecules in various electronic circuits. In some cases, it is preferred that the conductivity of the SE is decreased upon binding of the ML. This is commonly the case when the SE-ML complex is part of a sensor molecule or sensor apparatus.

In a preferred embodiment, the ML-SE complex consists of a structural entity (SE) to which is attached a number of MLs. The characteristics of the SE-ML complex changes as more MLs are bound. In some applications, a high number of MLs is desired. This may for example be the case where the SE-ML complex is used in a nanosensor context, where the ML is further attached to e.g. a receptor molecule that binds to the analyte in question, leading to a change in conductivity of the SE, which can be followed as a change in read-out of the sensor. The more MLs that are bound to the SE, the more receptor molecules can be immobilized on the SE-ML complex, and the more the read-out will change as the analyte or more analytes bind to the nanosensor.

Thus, depending on the context, the number of MLs bound per structural entity is preferably greater than 1, such as greater than 2, such as greater than 5, such as greater than 10, such as greater than 20, such as greater than 50, such as greater than 100, such as greater than 200, such as greater than 500, such as greater than 1000, such as greater than 10^4 , such as greater than 10^5 , such as greater than 10^6 , such as greater than 10^7 , such as greater than 10^8 , such as greater than 10^9 .

In other cases, a smaller number of MLs bound to the SE is preferred. As an example, if the SE-ML complex is part of a composition of CMUs, such as part of a composite material, the ML may interfere with the polymerization- or processing process that generates the composite material, wherefore it may be preferable to use a smaller number of MLs bound to an SE. Thus, depending on the context, the number of MLs attached to a structural entity is preferably less than 10^9 , such as less than 10^8 , such as less than 10^7 , such as less than 10^6 , such as less than 10^5 , such as less than 10^4 , such as less than 10^3 , such as less than 10^2 , such as less than 10, such as less than 2.

Thus, the preferred number of MLs per structural entity is often a compromise and depends on the context, and may be in the range of 1 to 2, or 2 to 10, or 10 to 100, or 100 to 1000, or 10^3 to 10^4 , or 10^4 to 10^5 , or 10^5 to 10^6 , or 10^6 to 10^7 , or 10^7 to 10^8 , or 10^8 to 10^9 .

As described above and below, the optimal number of MLs bound to a structural entity varies depending on the context of its use and the process of its generation.

In a preferred embodiment of said preferred embodiment, the SE is a nanotube, eg. a carbon nanotube, or a graphene molecule, bound by more than 1 ML, more preferably by more than 10 MLs,

more preferably by more than 100 MLs, more preferably by more than 1000 MLs, more preferably by more than 10 000 MLs, more preferably by more than 100 000 MLs, even more preferably by more than 1 000 000 MLs. In a preferred embodiment of said preferred embodiment, the SE is a carbon nanotube, other nanotube or graphene molecule, bound by less than 10^9 MLs, such as less than 10^8 MLs, less than 10^7 MLs, less than 10^6 MLs, less than 10^5 MLs, less than 10^4 MLs, less than 10^3 MLs, less than 10^2 MLs, less than 10 MLs, less than 2 MLs.

The final chemical structure of the ML may be generated prior to association with the SE, or may be generated during or upon association with the SE. See (Figure 3) for examples of MLs that are generated during or upon association with an SE.

For MLs whose final structure is generated during or upon association with the SE, the affinity of the precursor-ML (ie. the chemical entity that binds to the SE, but is not yet capable of forming a mechanical bond – such as eg. a linear peptide binding to a carbon nanotube) for the SE, is an important characteristic of a ML. Thus, with a higher affinity of the precursor-ML for SE, a certain number of MLs, bound to SE, may be achieved with a lower amount of precursor-MLs added. Thus, in a preferred embodiment, the precursor-MLs have a dissociation constant for the SE, such as the carbon nanotube, other nanotube, or the graphene, respectively, of less than 10^{-2} M, more preferably less than 10^{-3} M, more preferably less than 10^{-4} M, more preferably less than 10^{-5} M, more preferably less than 10^{-6} M, more preferably less than 10^{-7} M, more preferably less than 10^{-8} M, more preferably less than 10^{-9} M, more preferably less than 10^{-10} M, more preferably less than 10^{-12} M, more preferably less than 10^{-14} M, more preferably less than 10^{-16} M, more preferably less than 10^{-18} M, more preferably less than 10^{-20} M, more preferably less than 10^{-25} M, more preferably less than 10^{-30} M, more preferably less than 10^{-35} M, more preferably less than 10^{-40} M, more preferably less than 10^{-50} M.

In other contexts, it is preferable that the affinity of the precursor-ML is low. For example, if the relevant characteristics of the SE (such as conductivity of a carbon nanotube) is negatively affected by strong binding of a ML, it is preferable that the ML (and precursor-ML) binds with low affinity to the SE. Thus, in a preferred embodiment, the precursor-MLs have a dissociation constant for the SE, such as the carbon nanotube, other nanotube, or the graphene, respectively, of more than 10^{-50} M, more preferably more than 10^{-40} M, more preferably more than 10^{-35} M, more preferably more than 10^{-30} M, more preferably more than 10^{-25} M, more preferably more than 10^{-20} M, more preferably more than 10^{-18} M, more preferably more than 10^{-16} M, more preferably more than 10^{-14} M, more preferably more than 10^{-12} M, more preferably more than 10^{-10} M, more preferably more than 10^{-9} M, more preferably more than 10^{-8} M, more preferably more than 10^{-7} M, more preferably more than 10^{-6} M,

more preferably more than 10^{-5} M, more preferably more than 10^{-4} M, more preferably more than 10^{-3} M, more preferably more than 10^{-2} M.

In a preferred embodiment of said preferred embodiment, the SE is a carbon nanotube or graphene molecule, bound by more than 1 ML, more preferably by more than 10 MLs, more preferably by more than 100 MLs, more preferably by more than 1000 MLs, more preferably by more than 10 000 MLs, more preferably by more than 100 000 MLs, even more preferably by more than 1 000 000 MLs, where the individual precursor MLs, corresponding to said MLs have a dissociation constant for the carbon nanotube or the graphene, respectively, of more than 10^{-50} M, more preferably more than 10^{-40} M, more preferably more than 10^{-35} M, more preferably more than 10^{-30} M, more preferably more than 10^{-25} M, more preferably more than 10^{-20} M, more preferably more than 10^{-18} M, more preferably more than 10^{-16} M, more preferably more than 10^{-14} M, more preferably more than 10^{-12} M, more preferably more than 10^{-10} M, more preferably more than 10^{-9} M, more preferably more than 10^{-8} M, more preferably more than 10^{-7} M, more preferably more than 10^{-6} M, more preferably more than 10^{-5} M, more preferably more than 10^{-4} M, more preferably more than 10^{-3} M, more preferably more than 10^{-2} M.

In a preferred embodiment of said preferred embodiment, the SE is a carbon nanotube or graphene molecule, bound by less than 10^9 MLs, such as less than 10^8 MLs, less than 10^7 MLs, less than 10^6 MLs, less than 10^5 MLs, less than 10^4 MLs, less than 10^3 MLs, less than 10^2 MLs, less than 10 MLs, less than 2 MLs, where the individual pre-cursor MLs, corresponding to said MLs have a dissociation constant for the carbon nanotube or the graphene, respectively, of more than 10^{-50} M, more preferably more than 10^{-40} M, more preferably more than 10^{-35} M, more preferably more than 10^{-30} M, more preferably more than 10^{-25} M, more preferably more than 10^{-20} M, more preferably more than 10^{-18} M, more preferably more than 10^{-16} M, more preferably more than 10^{-14} M, more preferably more than 10^{-12} M, more preferably more than 10^{-10} M, more preferably more than 10^{-9} M, more preferably more than 10^{-8} M, more preferably more than 10^{-7} M, more preferably more than 10^{-6} M, more preferably more than 10^{-5} M, more preferably more than 10^{-4} M, more preferably more than 10^{-3} M, more preferably more than 10^{-2} M.

In a preferred embodiment of said preferred embodiment, the SE is a carbon nanotube, other nanotube, or graphene molecule, bound by 1 to 10, or 10 to 10^2 , or 10^2 to 10^3 , or 10^3 to 10^4 , or 10^4 to 10^5 , or 10^5 to 10^6 , or 10^6 to 10^7 , or 10^7 to 10^8 , or 10^8 to 10^9 MLs, where the individual precursor MLs, corresponding to said MLs, have a dissociation constant for the carbon nanotube or the graphene, respectively, of 10^{-50} to 10^{-30} M, or 10^{-30} to 10^{-20} M, or 10^{-20} to 10^{-10} M, or 10^{-10} to 10^{-9} M, or 10^{-9} to 10^{-8} M, or 10^{-8} to 10^{-7} M, or 10^{-7} to 10^{-6} M, or 10^{-6} to 10^{-5} M, or 10^{-5} to 10^{-4} M, or 10^{-4} to 10^{-3} M, or 10^{-3} to 10^{-2} M.

What is further provided in this invention is a structure of, and a process for preparing, a Linker Unit (LU) of the following composition:

ML-LinkerL-Ligand2

where

ML is chemical entity that is capable of forming a mechanical bond with a structural entity,

LinkerL is a chemical bond or entity that links ML and Ligand2,

Ligand2 is a chemical entity that is capable of binding covalently or non-covalently to a structural entity, or alternatively, is capable of forming a mechanical bond with a structural entity,

and optionally, where

a structural entity, SE1, is bound to ML, and

a structural entity, SE2, is bound to Ligand2,

thereby forming a composite material unit (CMU) of the following composition:

SE1-ML-LinkerL-Ligand2-SE2

where

SE1 is a Structural Entity,

ML is chemical entity that is mechanically bound to SE1,

LinkerL is a chemical bond or entity that links ML and Ligand2,

Ligand2 is a chemical entity that is attached to SE2,

SE2 is a Structural Entity,

The LU thus may be used to link two structural entities. The LU as described in the present invention is capable of efficiently linking two or more structural entities.

A structural entity SE is a chemical or physical entity. A structural entity may be an atom (e.g. an ion), a molecule (e.g. a nylon polymer or a CNT), or part of a surface /material (e.g. metal).

SE1 can be identical to SE2; SE1 can be of the same type as SE2, e.g. can both be nanotubes; SE1 can be of a different type than SE2, e.g. SE1 may be a nanotube and SE2 may be a plastic polymer. SE1 binds an ML; SE2 may also bind an ML or may not bind an ML.

The CMU may be used in the preparation of composite materials with improved or novel characteristics. The CMU as described in the present invention links different parts of the composite material in an efficient manner. The link may either be covalent or non-covalent.

What is further claimed is a composition, and the process of preparing a composition, comprising two or more CMUs. The two or more CMUs may be identical, essentially identical or different.

CMUs can be the sole constituents of composite materials, or further components may be added to form composite materials with unique characteristics.

Preferred embodiments include compositions comprising CMUs and a matrix such as a metal, a ceramic or a polymer.

The various components of the Composite Material Unit (CMU) are described below.

Guidelines for using the present invention.

- When using the present invention to make composite materials, the characteristics sought for the composite material must first be defined. Then an appropriate matrix material and additive can be chosen, e.g. from Group 1: Polymers, or Group 2: Polymers and plastics, or Group 3: Additives. As an example, if light-weight material with high strength is sought, one may choose a light-weight polymer material (e.g. polypropylene) as one of the structural entities (SE1), and an additive with high strength (e.g. a carbon nanotube) as the other structural entity (SE2).
- Then it must be decided which ligands should be used. For good anchoring of the additive in the matrix one may choose to use a covalent bond as ligand between the polymer (SE2) and the linker. An appropriate covalent bond can be chosen from Group 6: Reactive groups and covalent bonds formed upon reactions, or Group 7: Covalent bond-forming chemical reactions, or Group 8: Covalent bonds. Thus, reactive groups on the polymer units must be present or introduced, for reaction with the linker unit. Alternatively, some or all of the polymer units must be covalently linked to the linker prior to the polymerization of the polymer matrix. In the example in which a CNT is chosen as additive, it would be appropriate to use a mechanical ligand, and thereby obtain a mechanical bond between the CNT (SE1) and the linker. In the design of a mechanical ligand, a SE1-binding moiety can be chosen from Group 4: Chemical motifs and the SEs they bind, or Group 5: Chemical motifs and the

SEs they bind, or Group 10; CNT-binding moieties. The linker may be chosen from Group 9. Linkers. If a low degradability of the composite material is desired, ligands (ML and Ligand2) should be chosen to not comprise easily cleavable bonds such as amide bonds, and also, the ligands preferably should not comprise natural amino acids.

- Once the principal components (structural entities, ligands, and linkers) of the composite material have been defined, the formation of the CMU and composite material in general can be performed, by adding the appropriate catalysts, reagents and components in appropriate amount and order.
- In the above example a composite material consisting of polypropylene (matrix material) and carbon nanotube (additive, providing strength), held together by a linker comprising a covalent ligand (covalent bond between linker and polypropylene) and a mechanical ligand (bound to carbon nanotube), will have been produced.

Further considerations may have to be taken into account when designing the process for producing the composite material:

- Solubility of the SEs is also an important parameter to consider. If the SE, that here functions as the additive, is soluble in both the solvent employed during the polymerization reaction and in the polymer itself, the SE will become evenly distributed in the composite material. However, sometimes a less soluble SE may be an advantage, as a decreased solubility might mediate interaction between SEs of the same kind, which may sometimes be an advantage, e.g. for efficient load transfer where efficient interaction is mediated by direct interactions between SEs of the same kind.
- When making composites comprising tube-like structures such as nanotubes with mechanical ligands in the form of rings around them, it is often desirable that the nature of the ring, i.e. its charge, polarity, content of various elements, etc., is similar to the nature of the structural entities that are in the composite. As an example, if one wishes to make a CNT-polyamide composite, it is desirable that the mechanical ligand has polyamide-like features. Thus, it is desirable that the mechanical ligand is itself a polyamide, and that the ring does not carry too many undesired chemical moieties. One such undesired chemical moiety could be a nanotube binding domain of the precursor-ML. Thus, it is desirable if means are applied that leads to a minimization or elimination of the content of such undesired chemical moieties in the final composites. Example 38 describes such methodologies, that remove the nanotube-binding moieties during formation of the mechanical ligand, and thus ensures that the content of nanotube-binding moieties in the final composite is minimal.

$4 \cdot 10^{-3}$ kg, 0.001–0.01 kg, 0.01–0.1 kg, 0.1–1 kg, 1–10 kg, 10–100 kg, 100–1,000 kg, 10^3 – 10^4 kg, 10^4 – 10^5 kg, 10^5 – 10^6 kg, 10^6 – 10^7 kg, 10^7 – 10^8 kg, 10^8 – 10^9 kg, or above 10^9 kg.

In most cases, it is not the absolute amount of SE that matters most, but rather the relative amount of SE versus total amount of material. Thus, depending on the context, the total weight of the SEs of a composite material relative to the weight of the composite material is preferentially greater than 0,00001%, more preferably greater than 0,0001%, more preferably greater than 0,001%, more preferably greater than 0,01%, more preferably greater than 0,1%, more preferably greater than 0,1%, more preferably greater than 1%, more preferably greater than 5%, more preferably greater than 10%, more preferably greater than 20%, more preferably greater than 30%, more preferably greater than 40%, more preferably greater than 50%, more preferably greater than 60%, more preferably greater than 70%, more preferably greater than 80%, more preferably greater than 90%, and even more preferably greater than 95%.

When producing an SE, the MW of the SE is an important parameter. In many cases, a low MW is preferred as smaller molecule are often less expensive to produce compared to larger molecules. Thus, depending on the context, the SE MW is preferably less than 10^9 Dal, such as less than 10^8 Dal, such as less than 10^7 Dal, such as less than 10^6 Dal, such as less than 10^5 Dal, such as less than 10^4 Dal, such as less than 10^3 Dal, such as less than 10^2 Dal, such as less than 10 Dal, such as less than 3 Dal.

In other cases, a high MW is preferred as larger molecules are often less expensive to purify. Thus, depending on the context, the molecular weight is preferably greater than 3 Dal, such as greater than 10 Dal, such as greater than 10^2 Dal, such as greater than 10^3 Dal, such as greater than 10^4 Dal, such as greater than 10^5 Dal, such as greater than 10^6 Dal, such as greater than 10^7 Dal, such as greater than 10^8 Dal, such as greater than 10^9 Dal.

Therefore, depending on the context, preferred molecular weight of structural entities include molecular weights ranging from 3 Dalton to more than 10^9 Dalton, such as from 3–10 Dal (e.g. Li^+ or Na^+), 10–100 Dal (e.g. benzene), 100–1000 Dal, 1000–10,000 Dal (e.g. a 20 amino acid natural polypeptide) 10,000–20,000 Dal (e.g. a polymer chain such as nylon), 20,000–30,000 Dal, 30,000–40,000 Dal, 40,000–50,000 Dal, 50,000–70,000 Dal, 70,000–100,000 Dal, 100,000–200,000 Dal, 200,000–500,000 Dal, 500,000–1,000,000 Dal (e.g. carbon nanotube), 1,000,000–2,000,000 Dal, 2,000,000–4,000,000 Dal, 4,000,000–10,000,000 Dal, 10,000,000–100,000,000 Dal, 100,000,000–1,000,000,000 Dal, or particles with molecular weight larger than 10^9 Dal (e.g. gold particles).

Another important characteristic is the number of functional groups an SE comprises, as an SE with many functional groups will often be more expensive to synthesize. Thus, depending on the context, the number of functional groups on an SE is preferably less than 10^9 , such as less than 10^8 , such as less than 10^7 , such as less than 10^6 , such as less than 10^5 , such as less than 10^4 , such as less than 10^3 , such as less than 100, such as less than 90, such as less than 80, such as less than 70, such as less than 60, such as less than 50, such as less than 40, such as less than 30, such as less than 25, such as less than 20, such as less than 15, such as less than 10, such as less than 9, such as less than 8, such as less than 7, such as less than 6, such as less than 5, such as less than 4, such as less than 3, such as less than 2.

In other cases a high number of functional groups is desired, as the functional groups can be used to link an SE to a ML or Ligand2 or another SE, or to increase the dispersibility of the SE. Thus, depending on the context, the number of functional groups on an SE is preferably greater than 1, such as greater than 2, such as greater than 3, such as greater than 4, such as greater than 5, such as greater than 6, such as greater than 7, such as greater than 8, such as greater than 9, such as greater than 10, such as greater than 15, such as greater than 20, such as greater than 25, such as greater than 30, such as greater than 40, such as greater than 50, such as greater than 60, such as greater than 70, such as greater than 90, such as greater than 100, such as greater than 10^3 , such as greater than 10^4 , such as greater than 10^5 , such as greater than 10^6 , such as greater than 10^7 , such as greater than 10^8 , such as greater than 10^9 .

Thus, the preferred compromise between having an SE with many functional groups and an SE with few functional groups depends on the context, and may be in the range of 1–2, 2–3, 3–4, 4–5, 5–6, 6–7, 7–8, 8–9, 9–10, 10–15, 15–20, 20–25, 25–30, 30–40, 40–50, 50–60, 60–70, 70–80, 80–90, 90–100, 100–1,000, 10^3 – 10^4 , 10^4 – 10^5 , 10^5 – 10^6 , 10^6 – 10^7 , 10^7 – 10^8 , 10^8 – 10^9 , or above 10^9 .

Particularly preferred structural entities include nanotubes such as carbon nanotubes, fullerenes, other carbon-based molecular structures, or any other kind of molecular-, supramolecular-, or macroscopic structures.

The SEs suitable for the present invention may have a number of characteristics.

SEs may be organic or inorganic.

In a preferred embodiment of the invention, the structural entity SE1 is a tube-like structure, such as a nanotube, nanowire, nanofiber, nanorod or other tube-like structure, preferably with a high aspect

ratio, such as an aspect ratio of at least 10, such as at least 100, such as at least 1000, such as at least 10000, or such as at least 100000, and a covalently closed ring that is wrapped around the tube-like structure constitutes the mechanical ligand.

For any characteristics of an SE mentioned above, and in each characteristic's entire range, a further characteristic of importance is the molecular weight of the SE.

Molecular weight of SEs. The molecular weight is an important determinant for the characteristics of SEs, and for the characteristics of the CMUs they are part of. For example, larger polymers typically form stronger, less flexible materials, whereas smaller polymers typically are more flexible, but have lesser strength. Therefore, depending on the context, preferred molecular weight of structural entities include molecular weights ranging from 3 Dalton to more than 10^9 Dalton, such as from 3–10 Dal (e.g. Li^+ or Na^+), 10–100 Dal (e.g. benzene), 100–1000 Dal, 1000–10,000 Dal (e.g. a 20 amino acid natural polypeptide) 10,000–20,000 Dal (e.g. a polymer chain such as nylon), 20,000–30,000 Dal, 30,000–40,000 Dal, 40,000–50,000 Dal, 50,000–70,000 Dal, 70,000–100,000 Dal, 100,000–200,000 Dal, 200,000–500,000 Dal, 500,000–1,000,000 Dal (e.g. carbon nanotube), 1,000,000–2,000,000 Dal, 2,000,000–4,000,000 Dal, 4,000,000–10,000,000 Dal, 10,000,000–100,000,000 Dal, 100,000,000–1,000,000,000 Dal, or particles with molecular weight larger than 10^9 Dal (e.g. gold particles).

In cases where the strength is of highest importance, typically a high molecular weight is preferred. Thus, depending on the context, the molecular weight is preferably greater than 3 Dal, such as greater than 10 Dal, such as greater than 10^2 Dal, such as greater than 10^3 Dal, such as greater than 10^4 Dal, such as greater than 10^5 Dal, such as greater than 10^6 Dal, such as greater than 10^7 Dal, such as greater than 10^8 Dal, such as greater than 10^9 Dal.

In cases where the flexibility is of highest importance, a low molecular weight is typically preferred. Thus, depending on the context, the molecular weight is preferably less than 10^9 Dal, such as less than 10^8 Dal, such as less than 10^7 Dal, such as less than 10^6 Dal, such as less than 10^5 Dal, such as less than 10^4 Dal, such as less than 10^3 Dal, such as less than 10^2 Dal, such as less than 10 Dal, such as less than 3 Dal.

For any characteristics of an SE mentioned above, and in each characteristic's entire range, a further characteristic of importance is the melting point of the SE.

Melting point of SE. The melting point of the SE is often an important parameter, since the melting point of the composite often is strongly dependent on the melting point of the SE. Some applications

including CMUs of the present invention involve elevated temperatures, wherefore it is important that the CMU maintains its integrity and structure at such elevated temperatures. This is for example the case when said CMU is part of a composite material, used in an application that involves high temperatures. In these cases a high melting point is preferred.

Thus, depending on the context, the melting point of the SE is preferably greater than -20 °C, such as greater than 0 °C, such as greater than 50 °C, such as greater than 100 °C, such as greater than 200 °C, such as greater than 400 °C, such as greater than 600 °C, such as greater than 800 °C, such as greater than 1000 °C, such as greater than 1500 °C, such as greater than 2000 °C, such as greater than 3000 °C, such as greater than 4000 °C, such as greater than 6000 °C, such as greater than 8000 °C.

In other cases, a composite material's flexibility at low temperatures is important, wherefore a low melting point may be advantageous. Thus, depending on the context, the melting point of the SE is preferably less than 8000 °C, such as less than 6000 °C, such as less than 4000 °C, such as less than 3000 °C, such as less than 2000 °C, such as less than 1500 °C, such as less than 1000 °C, such as less than 800 °C, such as less than 600 °C, such as less than 400 °C, such as less than 200 °C, such as less than 100 °C, such as less than 50 °C, such as less than 0 °C, such as less than -20 °C.

Depending on the context, preferred melting points of SEs thus are below 0 °C, such as between -20 °C and 0 °C; or may be higher, such as between 0 °C and 50 °C, or between 50 °C and 100 °C, or between 100 °C and 200 °C, or between 200 °C and 300 °C, or between 300 °C and 400 °C, or between 400 °C and 500 °C, or between 500 °C and 600 °C, or between 600 °C and 700 °C, or between 700 °C and 800 °C, or between 800 °C and 900 °C, or between 900 °C and 1,000 °C, or between 1,000 °C and 1,100 °C, or between 1,000 °C and 1,200 °C, or between 1,200 °C and 1,400 °C, or between 1,400 °C and 1,600 °C, or between 1,600 °C and 1,800 °C, or between 1,800 °C and 2,000 °C, or between 2,000 °C and 2,200 °C, or between 2,200 °C and 2,400 °C, or between 2,400 °C and 2,600 °C, or between 2,600 °C and 2,800 °C, or between 2,800 °C and 3,000 °C, or between 3,000 °C and 3,200 °C, or between 3,200 °C and 3,400 °C, or between 3,400 °C and 3,600 °C, or between 3,600 °C and 3,800 °C, or between 3,800 °C and 4,000 °C, or between 4,000 °C and 4,200 °C, or between 4,200 °C and 4,400 °C, or between 4,400 °C and 4,600 °C, or between 4,600 °C and 4,800 °C, or between 4,800 °C and 5,000 °C, or between 5,000 °C and 5,200 °C, or between 5,200 °C and 5,400 °C, or between 5,400 °C and 5,600 °C, or between 5,600 °C and 5,800 °C, or between 5,800 °C and 6,000 °C, or between 6,000 °C and 6,200 °C, or between 6,200 °C and 6,400 °C, or between 6,400 °C and 6,600 °C, or between 6,600 °C and 6,800 °C, or between 6,800 °C and 7,000 °C, or between 7,000 °C and 7,200 °C, or between 7,200 °C and 7,400 °C, or between 7,400 °C and 7,600 °C, or between 7,600 °C and 7,800 °C, or between 7,800 °C and 8,000 °C, or between 8,000 °C and 8,200 °C, or between 8,200 °C and 8,400 °C, or between 8,400 °C and 8,600 °C, or between 8,600 °C and 8,800 °C, or between 8,800 °C and 9,000 °C, or

between 9,000 °C and 9,200 °C, or between 9,200 °C and 9,400 °C, or between 9,400 °C and 9,600 °C, or between 9,600 °C and 9,800 °C, or between 9,800 °C and 10,000 °C, or between 10,000 °C and 11,000 °C, or between 11,000 °C and 12,000 °C, or between 12,000 °C and 13,000 °C, or between 13,000 °C and 14,000 °C, or between 14,000 °C and 15,000 °C, or between 15,000 °C and 16,000 °C, or between 16,000 °C and 17,000 °C, or between 17,000 °C and 18,000 °C, or between 18,000 °C and 19,000 °C, or between 19,000 °C and 20,000 °C, or above 20,000 °C. The matrix of a composite to a high degree determines the melting point of the composite; in particular, ceramics and metals have high melting points.

For any characteristics of an SE mentioned above, and in each characteristic's entire range, a further characteristic of importance is the conductivity of the SE.

Conductivity of SE. In certain applications, e.g. use of a composite material in wind turbine blades, it may be important that the propellers are non-conductive, in order to not attract lightning. In other cases it may be desirable to prepare composite materials of modest or high conductivity, in order to be able to detect cracks in the material by analytical measurement of the conductance of the material. Likewise, for SEs used in e.g. nanosensor technology it may be important that the SE is conductive, in order to be able to detect changes in conductivity induced by the association of an analyte with the SE. In some sensor applications it may be desirable to have high conductivity (if the analyte has a strong reducing effect on the conductance of the SE), or it may be desirable to use an SE with an intermediate conductivity in order to detect small changes in conductivity. In other applications, the composite material is used as an insulator, wherefore it is important that the SE has very low conductivity. Thus, depending on the application it may be desirable that the SE has low, intermediate or high conductivity. Structural entities may have conductivities ranging from below 10^{-30} S/m to at least 10^{11} S/m and higher, such as from below 10^{-30} S/m to 10^{-25} S/m (e.g. Teflon), such as from 10^{-25} S/m to 10^{-20} S/m (e.g. PET), such as from 10^{-20} S/m to 10^{-15} S/m (e.g. Quarts (fused) and Paraffin), such as from 10^{-15} S/m to 10^{-10} S/m (e.g. Hard Rubber, Diamond, Glass), such as from 10^{-10} S/m to 10^{-5} S/m (e.g. GaAs, Silicon), such as from 10^{-5} S/m to 1 S/m, such as from 1 S/m to 10 S/m (e.g. Germanium), such as from 10 S/m to 10^2 S/m, such as from 10^2 S/m to 10^4 S/m (e.g. graphite), such as from 10^4 S/m to 10^6 S/m (e.g. Nichrome, Mercury,), such as from 10^6 S/m to 10^8 S/m (e.g. Stainless steel, Titanium, Platinum, Iron, Lithium, Aluminum, Gold, Copper, Silver), such as from 10^8 S/m to 10^9 S/m, such as from 10^9 S/m to 10^{10} S/m, such as from 10^{10} S/m to 10^{11} S/m (e.g. Carbon nanotubes), such as from 10^{11} S/m to 10^{12} S/m (e.g. Carbon nanotubes), such as from 10^{12} S/m to 10^{14} S/m, and above 10^{14} S/m (e.g. superconducting material).

Thus, depending on the context, the conductivity of an SE is preferably greater than 10^{-30} S/m, such as greater than 10^{-25} S/m, such as greater than 10^{-20} S/m, such as greater than 10^{-15} S/m, such as greater than 10^{-10} S/m, such as greater than 10^{-5} S/m, such as greater than 1 S/m, such as greater than 10 S/m, such as greater than 10^2 S/m, such as greater than 10^4 S/m, such as greater than 10^6 S/m, such as greater than 10^8 S/m, such as greater than 10^9 S/m, such as greater than 10^{10} S/m, such as greater than 10^{11} S/m, such as greater than 10^{12} S/m, such as greater than 10^{13} S/m, such as greater than 10^{14} S/m.

In other applications, and depending on the context, the conductivity is preferably less than 10^{14} S/m, such as less than 10^{13} S/m, such as less than 10^{12} S/m, such as less than 10^{11} S/m, such as less than 10^{10} S/m, such as less than 10^9 S/m, such as less than 10^8 S/m, such as less than 10^6 S/m, such as less than 10^4 S/m, such as less than 10^2 S/m, such as less than 10 S/m, such as less than 1 S/m, such as less than 10^{-5} S/m, such as less than 10^{-10} S/m, such as less than 10^{-15} S/m, such as less than 10^{-20} S/m, such as less than 10^{-25} S/m, such as less than 10^{-30} S/m.

For any characteristics of an SE mentioned above, and in each characteristic's entire range, a further characteristic of importance is the density and strength of the SE, as well as the ratio between the density and the various types of strength.

Density and Strength of the SE. For certain applications, for example in the airplane or automotive industry, the strength and density of the composite material is of prime importance. Sometimes, one of the two features is by far the most important. For example, if a structure such as a bridge must be built and the structure must carry a lot of weight, where this weight is much larger than the weight of the structure itself, the weight of the composite material from which the structure is built, has little importance. Only strength is important. In cases where no significant force is applied to the material other than gravity, the weight of the structure becomes important, but the strength is not important. This is for example the case where the composite material is used to make a sculpture that rests on some other structure.

Often, both low density and high strength is desired. However, as these two parameters often are opposing factors, a compromise will have to be made. Therefore, sometimes a high density is acceptable to gain strength, such as high tensile strength or large Young's Modulus. In other cases, low density is necessary, even if lower strength results. Thus, in preferred embodiments the SE may have relatively low Young's modulus or low tensile strength, and in other preferred embodiments the SE has large Young's modulus or large tensile strength; and likewise, in preferred embodiments the density can vary from very small to very large.

Preferred specific densities of SEs suitable for the present invention are lower than 0.01 kg/L, but may also include specific densities in the following ranges: 0.01–0.1 kg/L; 0.1–0.4 kg/L; 0.4–0.6 kg/L; 0.6–0.8 kg/L; 0.8–1 kg/L; 1–1.2 kg/L; 1.2–1.4 kg/L; 1.4–1.6 kg/L; 1.6–1.8 kg/L; 1.8–2 kg/L; 2–2.5 kg/L; 2.5–3 kg/L; 3–3.5 kg/L; 3.5–4 kg/L; 4–4.5 kg/L; 4.5–5 kg/L; 5–5.5 kg/L; 5.5–6 kg/L; 6–6.5 kg/L; 6.5–7 kg/L; 7–7.5 kg/L; 7.5–8 kg/L; 8–8.5 kg/L; 8.5–9 kg/L; 9–9.5 kg/L; 9.5–10 kg/L; 10–11 kg/L; 11–12 kg/L; 12–13 kg/L; 13–14 kg/L; 14–16 kg/L; 16–20 kg/L; 20–30 kg/L; or above 30 kg/L.

In some cases high specific densities are preferred. This may be the case when an anchor is made of a composite material comprising SEs, as the anchor should rest heavily on the bottom of the ocean. Thus, depending on the context, the specific density is preferably greater than 0.01 kg/L, such as greater than 0.05 kg/L, such as greater than 0.2 kg/L, such as greater than 0.4 kg/L, such as greater than 0.6 kg/L, such as greater than 0.8 kg/L, such as greater than 1 kg/L, such as greater than 1.2 kg/L, such as greater than 1.5 kg/L, such as greater than 2 kg/L, such as greater than 4 kg/L, such as greater than 6 kg/L, such as greater than 8 kg/L, such as greater than 10 kg/L, such as greater than 12 kg/L, such as greater than 14 kg/L, such as greater than 16 kg/L, such as greater than 20 kg/L, such as greater than 30 kg/L.

In many cases low specific density is preferred. This is for example the case if the SE is part of a composite material, used to make ships that must float on the water, wherefore the weight must be minimized. Thus, depending on the context, the specific density is preferably less than 30 kg/L, such as less than 20 kg/L, such as less than 16 kg/L, such as less than 14 kg/L, such as less than 12 kg/L, such as less than 10 kg/L, such as less than 8 kg/L, such as less than 6 kg/L, such as less than 4 kg/L, such as less than 2 kg/L, such as less than 1.5 kg/L, such as less than 1.2 kg/L, such as less than 1 kg/L, such as less than 0.8 kg/L, such as less than 0.6 kg/L, such as less than 0.4 kg/L, such as less than 0.2 kg/L, such as less than 0.05 kg/L, such as less than 0.01 kg/L.

The Young's modulus of SEs. In the majority of applications of composite materials, a high Young's modulus is preferred, as this will allow the material to recover its original shape after force has been applied to the material. Thus, depending on the context, the Young's modulus is preferably greater than 0.001 TPa, such as greater than 0.01 TPa, such as greater than 0.1 TPa, such as greater than 0.15 TPa, such as greater than 0.2 TPa, such as greater than 0.5 TPa, such as greater than 1 TPa, such as greater than 2 TPa, such as greater than 4 TPa, such as greater than 6 TPa, such as greater than 8 TPa, such as greater than 10 TPa.

However, in a few applications, a low Young's modulus is desirable. This is for example the case when the degree of deformation of a composite material is being used as a measure of how much

force was applied to the material. Thus, depending on the context, the Young's modulus is preferably less than 10 TPa, such as less than 8 TPa, such as less than 6 TPa, such as less than 4 TPa, such as less than 2 TPa, such as less than 1 TPa, such as less than 0.5 TPa, such as less than 0.2 TPa, such as less than 0.15 TPa, such as less than 0.1 TPa, such as less than 0.01 TPa, such as less than 0.01 TPa.

The Young's modulus of SEs suitable for the present invention can thus be lower than 0.001 TPa, but may also include SEs with Young's Modulus in the following ranges: 0.001–0.01 TPa; 0.01–0.03 TPa; 0.03–0.05 TPa; 0.05–0.07 TPa; 0.07–0.09 TPa; 0.09–0.1 TPa; 0.1–0.11 TPa; 0.11–0.12 TPa; 0.12–0.13 TPa; 0.13–0.14 TPa; 0.14–0.15 TPa; 0.15–0.16 TPa; 0.16–0.17 TPa; 0.17–0.18 TPa; 0.18–0.19 TPa; 0.19–0.20 TPa; 0.20–0.22 TPa (e.g. stainless steel); 0.22–0.25 TPa; 0.25–0.30 TPa; 0.30–0.35 TPa; 0.35–0.40 TPa; 0.40–0.45 TPa; 0.45–0.50 TPa; 0.50–0.60 TPa; 0.60–0.80 TPa; 0.80–1.0 TPa; 1–2 TPa (e.g. single-walled carbon nanotubes); 2–3 TPa; 3–4 TPa; 4–5 TPa; 5–7 TPa; 7–10 TPa; or above 10 TPa.

Preferred tensile strength of SEs is in most cases high, as this will enable the generation of composite materials of high tensile strength, suitable for a large number of applications, e.g. stronger fishing lines and stronger cables. Thus, depending on the context, the tensile strength of SEs is preferably greater than 0.01 GPa, such as greater than 0.05 GPa, such as greater than 0.1 GPa, such as greater than 0.5 GPa, such as greater than 1 GPa, such as greater than 2 GPa, such as greater than 3 GPa, such as greater than 5 GPa, such as greater than 10 GPa, such as greater than 20 GPa, such as greater than 30 GPa, such as greater than 40 GPa, such as greater than 60 GPa, such as greater than 80 GPa, such as greater than 100 GPa, such as greater than 200 GPa.

However, in some cases a low tensile strength is advantageous, for example in cables or lines that must break for safety reasons, in order to avoid damage to individuals. Thus, depending on the context, the tensile strength of SEs is preferably less than 200 GPa, such as less than 100 GPa, such as less than 80 GPa, such as less than 60 GPa, such as less than 40 GPa, such as less than 30 GPa, such as less than 20 GPa, such as less than 10 GPa, such as less than 5 GPa, such as less than 3 GPa, such as less than 2 GPa, such as less than 1 GPa, such as less than 0.5 GPa, such as less than 0.1 GPa, such as less than 0.05 GPa, such as less than 0.01 GPa.

The tensile strength for SEs suitable for the present invention can thus be lower than 0.01 GPa, but may also include SEs with tensile strengths in the following ranges: 0.01–0.03 GPa; 0.03–0.05 GPa; 0.05–0.07 GPa; 0.07–0.09 GPa; 0.09–0.1 GPa; 0.1–0.11 GPa; 0.11–0.12 GPa; 0.12–0.13 GPa; 0.13–0.14 GPa; 0.14–0.15 GPa; 0.15–0.16 GPa; 0.16–0.17 GPa; 0.17–0.18 GPa; 0.18–0.19 GPa; 0.19–0.20 GPa; 0.20–0.22 GPa; 0.22–0.25 GPa; 0.25–0.30 GPa; 0.30–0.35 GPa; 0.35–0.40 GPa; 0.40–0.45 GPa; 0.45–0.50 GPa; 0.50–0.60 GPa; 0.60–0.80 GPa; 0.80–1.0 GPa; 1–2 GPa

(e.g. stainless steel); 2–3 GPa; 3–4 GPa; 4–5 GPa; 5–7 GPa; 7–10 GPa; 10–15 GPa; 15–20 GPa; 20–25 GPa; 25–30 GPa; 30–35 GPa; 35–40 GPa; 40–45 GPa; 45–50 GPa (e.g. single-walled carbon nanotubes); 50–55 GPa; 55–60 GPa; 60–65 GPa; 65–70 GPa; 70–75 GPa; 75–80 GPa; 80–85 GPa; 85–90 GPa; 90–100 GPa; 100–200 GPa, or above 200 GPa.

Ratio of strength to specific density is often important. The strength/specific density ratio for the structural entity that is preferred under the present invention is represented by all the ratios that can be obtained, by dividing the abovementioned strengths with the abovementioned specific densities. Thus, preferred embodiments have structural entities with strength/specific densities in the range 0.00003–1000 TPa L/Kg (where strength is represented by Young's modulus). More specifically, the strength/specific density (Young's Modulus) of the SE is preferably in the range 0.00003–1,000 TPa L/Kg, more preferably 0.001–1,000 TPa L/Kg, more preferably 0.01–1,000 TPa L/Kg, more preferably 0.1–1,000 TPa L/Kg, more preferably 1–1,000 TPa L/Kg, more preferably 10–1,000 TPa L/Kg, more preferably 100–1,000 TPa L/Kg, and more preferably 500–1,000 TPa L/Kg, or higher. In cases where e.g. the Young's modulus should be low (see above), the Young's modulus/specific density ratio is preferably less than 1,000 TPa L/kg, such as less than 500 TPa L/kg, such as less than 100 TPa L/kg, such as less than 10 TPa L/kg, such as less than 1 TPa L/kg, such as less than 0.1 TPa L/kg, such as less than 0.01 TPa L/kg, such as less than 0.001 TPa L/kg, such as less than 0.00003 TPa L/kg.

In cases where e.g. Young's modulus is preferably high, the Young's modulus/specific density ratio is preferably greater than 0.00003 TPa L/kg, such as greater than 0.001 TPa L/kg, such as greater than 0.01 TPa L/kg, such as greater than 0.1 TPa L/kg, such as greater than 1 TPa L/kg, such as greater than 10 TPa L/kg, such as greater than 100 TPa L/kg, such as greater than 500 TPa L/kg, such as greater than 1,000 TPa L/kg.

Where strength is measured as tensile strength, the preferred embodiments have structural entities with strength/specific density in the range 0.0003–20,000 GPa L/Kg. More specifically, the tensile strength/specific density of the SE is preferably in the range 0.0003–20,000 GPa L/Kg, more preferably 0.01–20,000 GPa L/Kg, more preferably 0.1–20,000 GPa L/Kg, more preferably 1–20,000 GPa L/Kg, more preferably 10–20,000 GPa L/Kg, more preferably 100–20,000 GPa L/Kg, more preferably 1,000–20,000 GPa L/Kg, more preferably 5,000–20,000 GPa L/Kg, and more preferably 10,000–20,000 GPa L/Kg, or higher.

In cases where e.g. the tensile strength is preferably low (see above), the tensile strength/specific density ratio is preferably less than 20,000 GPa L/kg, such as less than 10,000 GPa L/kg, such as less than 5,000 GPa L/kg, such as less than 1,000 GPa L/kg, such as less than 100 GPa L/kg, such as less

than 10 GPa L/kg, such as less than 1 GPa L/kg, such as less than 0.1 GPa L/kg, such as less than 0.0003 GPa L/kg.

In cases where e.g. tensile strength is preferably high, the tensile strength/specific density ratio is preferably greater than 0.0003 GPa L/kg, such as greater than 0.1 GPa L/kg, such as greater than 1 GPa L/kg, such as greater than 10 GPa L/kg, such as greater than 100 GPa L/kg, such as greater than 1,000 GPa L/kg, such as greater than 5,000 GPa L/kg, such as greater than 10,000 GPa L/kg, such as greater than 20,000 GPa L/kg.

Preferred fracture toughness of SEs is in most cases high, as this will enable the generation of composite materials with a low risk of cracks propagating through the composite, ultimately leading to fracture. Examples of composite materials where a high fracture toughness is desirable includes, but are not limited to, wind turbine blades and airplane wings. Thus, depending on the context, the fracture toughness is preferably greater than $0.01 \text{ MPa}\cdot\text{m}^{1/2}$, such as greater than $0.1 \text{ MPa}\cdot\text{m}^{1/2}$, such as greater than $1 \text{ MPa}\cdot\text{m}^{1/2}$, such as greater than $2 \text{ MPa}\cdot\text{m}^{1/2}$, such as greater than $5 \text{ MPa}\cdot\text{m}^{1/2}$, such as greater than $10 \text{ MPa}\cdot\text{m}^{1/2}$, such as greater than $15 \text{ MPa}\cdot\text{m}^{1/2}$, such as greater than $20 \text{ MPa}\cdot\text{m}^{1/2}$, such as greater than $25 \text{ MPa}\cdot\text{m}^{1/2}$, such as greater than $30 \text{ MPa}\cdot\text{m}^{1/2}$, such as greater than $40 \text{ MPa}\cdot\text{m}^{1/2}$, such as greater than $50 \text{ MPa}\cdot\text{m}^{1/2}$, such as greater than $75 \text{ MPa}\cdot\text{m}^{1/2}$, such as greater than $100 \text{ MPa}\cdot\text{m}^{1/2}$,

However, in some applications, a low fracture toughness is desirable. As an example, the fracture toughness of the windows in a train needs to be sufficiently low that a person can break the window using an appropriate tool in an emergency situation. Thus, depending on the context, the fracture toughness is preferably less than $100 \text{ MPa}\cdot\text{m}^{1/2}$, such as less than $75 \text{ MPa}\cdot\text{m}^{1/2}$, such as less than $50 \text{ MPa}\cdot\text{m}^{1/2}$, such as less than $40 \text{ MPa}\cdot\text{m}^{1/2}$, such as less than $30 \text{ MPa}\cdot\text{m}^{1/2}$, such as less than $25 \text{ MPa}\cdot\text{m}^{1/2}$, such as less than $20 \text{ MPa}\cdot\text{m}^{1/2}$, such as less than $15 \text{ MPa}\cdot\text{m}^{1/2}$, such as less than $10 \text{ MPa}\cdot\text{m}^{1/2}$, such as less than $5 \text{ MPa}\cdot\text{m}^{1/2}$, such as less than $2 \text{ MPa}\cdot\text{m}^{1/2}$, such as less than $1 \text{ MPa}\cdot\text{m}^{1/2}$, such as less than $0.1 \text{ MPa}\cdot\text{m}^{1/2}$, such as less than $0.01 \text{ MPa}\cdot\text{m}^{1/2}$.

The fracture toughness for SEs suitable for the present invention can thus be lower than $0.01 \text{ MPa}\cdot\text{m}^{1/2}$, but may also include SEs with fracture toughness in the following ranges: $0.01\text{--}0.1 \text{ MPa}\cdot\text{m}^{1/2}$, $0.1\text{--}1 \text{ MPa}\cdot\text{m}^{1/2}$, $1\text{--}2 \text{ MPa}\cdot\text{m}^{1/2}$, $2\text{--}5 \text{ MPa}\cdot\text{m}^{1/2}$, $5\text{--}10 \text{ MPa}\cdot\text{m}^{1/2}$, $10\text{--}15 \text{ MPa}\cdot\text{m}^{1/2}$, $15\text{--}20 \text{ MPa}\cdot\text{m}^{1/2}$, $20\text{--}25 \text{ MPa}\cdot\text{m}^{1/2}$, $25\text{--}30 \text{ MPa}\cdot\text{m}^{1/2}$, $30\text{--}40 \text{ MPa}\cdot\text{m}^{1/2}$, $40\text{--}50 \text{ MPa}\cdot\text{m}^{1/2}$, $50\text{--}75 \text{ MPa}\cdot\text{m}^{1/2}$, $75\text{--}100 \text{ MPa}\cdot\text{m}^{1/2}$, or above $100 \text{ MPa}\cdot\text{m}^{1/2}$.

Bulk modulus of SEs. In the majority of applications of composite materials, a high bulk modulus is preferred, as this will allow the composite material to withstand a high compression, which is important in structural elements of buildings, bridges, etc. Thus, depending on the context, the bulk

modulus is preferably greater than 0.001 GPa, such as greater than 0.01 GPa, such as greater than 0.1 GPa, such as greater than 1 GPa, such as greater than 10 GPa, such as greater than 50 GPa, such as greater than 100 GPa, such as greater than 200 GPa, such as greater than 300 GPa, such as greater than 400 GPa, such as greater than 500 GPa, such as greater than 600 GPa, such as greater than 700 GPa, such as greater than 800 GPa, such as greater than 900 GPa, such as greater than 1,000 GPa. However, in a few applications, a low bulk modulus is desirable. This is for example the case in some foam products, where it should be easy to compress the foam, e.g. using a person's body weight. Thus, depending on the context, the bulk modulus is preferably less than 1,000 GPa, such as less than 900 GPa, such as less than 800 GPa, such as less than 700 GPa, such as less than 600 GPa, such as less than 500 GPa, such as less than 400 GPa, such as less than 300 GPa, such as less than 200 GPa, such as less than 100 GPa, such as less than 50 GPa, such as less than 10 GPa, such as less than 1 GPa, such as less than 0.1 GPa, such as less than 0.01 GPa, such as less than 0.001 GPa.

The bulk modulus for SEs suitable for the present invention can thus be lower than 0.001 GPa, but may also include SEs with bulk modules in the following ranges: 0.001–0.01 GPa, 0.01–0.1 GPa, 0.1–1 GPa, 1–10 GPa, 10–100 GPa, 100–200 GPa, 200–300 GPa, 300–400 GPa, 400–500 GPa, 500–600 GPa, 600–700 GPa, 700–800 GPa, 800–900 GPa, 900–1,000 GPa, or above 1,000 GPa.

Shear modulus of SEs. In the majority of applications of composite materials, a high shear modulus is preferred, as this will allow the composite material to withstand large forces imposed on the composite material in opposite directions, e.g. brakes on bicycles, cars, wind turbines, etc. Thus, depending on the context, the shear modulus is preferably greater than 0.001 GPa, such as greater than 0.01 GPa, such as greater than 0.1 GPa, such as greater than 1 GPa, such as greater than 10 GPa, such as greater than 50 GPa, such as greater than 100 GPa, such as greater than 200 GPa, such as greater than 300 GPa, such as greater than 400 GPa, such as greater than 500 GPa, such as greater than 600 GPa, such as greater than 700 GPa, such as greater than 800 GPa, such as greater than 900 GPa, such as greater than 1,000 GPa.

However, in some applications, a low shear modulus is desirable. This is for example the case in plastic composite materials used for buttons, e.g. to turn on or off electronic equipment. Such buttons must have a low shear modulus so pressing them is sufficiently easy. Thus, depending on the context, the shear modulus is preferably less than 1,000 GPa, such as less than 900 GPa, such as less than 800 GPa, such as less than 700 GPa, such as less than 600 GPa, such as less than 500 GPa, such as less than 400 GPa, such as less than 300 GPa, such as less than 200 GPa, such as less than 100 GPa, such

as less than 50 GPa, such as less than 10 GPa, such as less than 1 GPa, such as less than 0.1 GPa, such as less than 0.01 GPa, such as less than 0.001 GPa.

The shear modulus for SEs suitable for the present invention can thus be lower than 0.001 GPa, but may also include SEs with shear modules in the following ranges: 0.001–0.01 GPa, 0.01–0.1 GPa, 0.1–1 GPa, 1–10 GPa, 10–100 GPa, 100–200 GPa, 200–300 GPa, 300–400 GPa, 400–500 GPa, 500–600 GPa, 600–700 GPa, 700–800 GPa, 800–900 GPa, 900–1,000 GPa, or above 1,000 GPa.

Other kinds of strength, such as torsional strength and impact strength, are also of importance. Thus, SEs with low, medium or high torsional strength, and SEs with low, medium or high impact strength are suitable for the present invention, and represent preferred embodiments.

For any characteristics of an SE mentioned above, and in each characteristic's entire range, a further characteristic of importance is the degree to which the SE can be elongated (stretched) without breaking.

Elongation at break. In many applications, a high elongation at break is preferred. This is for example important in components that absorb energy by deforming plastically such as crash barriers and car bumpers. Thus, depending on the context, the elongation at break is preferably greater than 0.1%, such as greater than 1%, such as greater than 5%, such as greater than 10%, such as greater than 20%, such as greater than 30%, such as greater than 40%, such as greater than 50%, such as greater than 60%, such as greater than 70%, such as greater than 80%, such as greater than 90%, such as greater than 100%, such as greater than 150%, such as greater than 200%, such as greater than 300%, such as greater than 400%, such as greater than 500%, such as greater than 800%, such as greater than 1,500%.

In other applications, a low elongation at break is preferred. This is important in composite materials that must not deform even under harsh conditions such as high pressure and elevated temperature; one such example is ceramic brakes on automobiles, aircrafts and trains. Thus, depending on the context, the elongation at break is preferably less than 1,500%, such as less than 800%, such as less than 500%, such as less than 400%, such as less than 300%, such as less than 200%, such as less than 150%, such as less than 100%, such as less than 90%, such as less than 80%, such as less than 70%, such as less than 60%, such as less than 50%, such as less than 40%, such as less than 30%, such as less than 20%, such as less than 10%, such as less than 5%, such as less than 1%, such as less than 0.1%.

SEs suitable for the present invention can thus have an elongation at break of less than 0.1%, or have elongation at break including the following ranges: 0.1–1%, 1–5%, 5–10%, 10–20%, 20–30%, 30–40%, 40–50%, 50–60%, 60–70%, 70–80%, 80–90%, 90–100%, 100–150%, 150–200%, 200–300%, 300–400%, 400–500%, 500–800%, 800–1,500%, or have elongation at break above 1,500%.

For any characteristics of an SE mentioned above, and in each characteristic's entire range, further characteristics of importance are size and shape of the SE.

Size of SE. The size and shape of the structural entity are important parameters. Thus, although depending on the characteristics of the structural entity, composite materials may benefit from SEs with extended shapes, preferably large in size, if the primary purpose is to increase the Young's modulus of the composite material, by including the SE. Thus, depending on the context, the size of the SE is preferably greater than 0.1 Å, such as greater than 2 Å, such as greater than 1 nm, such as greater than 10 nm, such as greater than 100 nm, such as greater than 1 µm, such as greater than 10 µm, such as greater than 100 µm, such as greater than 1 mm, such as greater than 10 mm.

For other applications, it may be an advantage to include SEs of smaller size, e.g. in order to increase molecular homogeneity of the composite material. In other cases, a primary characteristic of the composite material is even distribution of SEs and it may be generally desired that as little SE as possible should be used in the composite material, e.g. for economic reasons. In such cases, it may be desirable to include SEs of small size. Thus, depending on the context, the size of the SE is preferably less than 10 mm, such as less than 1 mm, such as less than 100 µm, such as less than 10 µm, such as less than 1 µm, such as less than 100 nm, such as less than 10 nm, such as less than 1 nm, such as less than 2 Å, such as less than 0.1 Å.

Often, the choice of size and shape will be a compromise between opposing interests. Thus, in preferred embodiments the SE may be very small to very large, depending on the application. For example, when making composite materials using thermoset polymers and glass fibers, typically long glass fibers in the size range 0.01–1 m are used, whereas when using thermoplastics shorter fibers of typically 1–10 mm are used.

Structural entities may vary in size from less than 1 Ångström dimensions to the mm dimensions, such as from 0.1–2 Å (e.g. K⁺), 2–10 Å (e.g. benzene), 1–10 nm (e.g. a short polypeptide), 10–100 nm (e.g. a carbon nanotube, a protein), 100–1,000 nm (e.g. a carbon fiber, PVC polymer molecule, a carbon nanotube), 1–10 µm (e.g. a gold particle), 10–100 µm (e.g. a nylon fiber), 100–1,000 µm (e.g. an alumina fiber), 1–10 µm (e.g. a plant cell), 10–100 µm (e.g. a bamboo fiber), 100–1,000 µm (e.g. a

silver particle), 1–10 mm (e.g. a carbon fiber), or particles larger than 10 mm in at least one dimension.

Further characteristics of SE. For any characteristics of an SE mentioned above, and in each characteristic's entire range, further characteristics of the SE that are of importance in the present invention are the stiffness, electrical conductivity, thermal conductivity, color, fluorescence, luminescence, UV protective capability, abrasion resistance, ductility, elasticity, flexibility, energy storage capability (energy storage as heat or kinetic energy), information storage capability, hydrophilicity, hydrophobicity, polarity, aproticity, and charge, as well as the following characteristics where the unit of measure is indicated after each characteristic: Arc Resistance, sec; Impact Strength, Charpy, J/cm; Impact Strength, Izod Notched, J/cm ; Impact Strength, Izod Unnotched, J/cm ; Impact Strength, Charpy Notched Low Temp, J/cm; Impact Strength, Izod Notched Low Temp, J/cm; Impact Strength, Charpy Unnotched Low Temp, J/cm; Impact Strength, Charpy Unnotched, J/cm; Linear Mold Shrinkage, cm/cm; Maximum Service Temperature, Air, ; Melt Flow, g/10 min; Melting Point, ; Modulus of Elasticity, GPa; Moisture Absorption at Equilibrium, % ; Oxygen Transmission, cc-mm/m; Poisson's Ratio; Processing Temperature, ; Surface Resistance, ohm; Tensile Strength, Ultimate, MPa; Tensile Strength, Yield, MPa; Thermal Conductivity, W/m-K; UL RTI, Electrical, ; UL RTI, Mechanical with Impact, ; UL RTI, Mechanical without Impact, ; Vicat Softening Point, ; Water Absorption, %; Coefficient of Friction; Comparative Tracking Index, V; Compressive Yield Strength, MPa; CTE, linear 20; Deflection Temperature at 0.46 MPa, ; Deflection Temperature at 1.8 MPa, ; Density, g/cc; Dielectric Constant; Dielectric Constant, Low Frequency ; Dielectric Strength, kV/mm; Dissipation Factor; Dissipation Factor, Low Frequency ; Electrical Resistivity, ohm-cm; Elongation @ break, %; Flammability, UL94 ; Flexural Modulus, GPa; Flexural Yield Strength, MPa; Glass Temperature, ; Hardness, Barcol; Hardness, Rockwell E; Hardness, Rockwell M; Hardness, Rockwell R; Hardness, Shore A; Hardness, Shore D; Heat Capacity, J/g. Depending on the application, an SE with a low, medium, or high degree of each of these characteristics is preferable in the present invention.

Further, SEs, in particular SE2, may be polymers or may be non-polymeric in structure.

The polymers can be divided into biological polymers and non-biological polymers.

Non-biological polymers include polymers that are not RNA, DNA or natural polypeptides, yet include PVC, epoxy, unnatural polypeptides (i.e. not solely comprising alpha-amino acids) and unnatural nucleic acids (e.g. PNA, LNA and other unnatural nucleic acids).

The following polymers represent preferred structural entities, suitable for the present invention:

Polymers. The following is a non-comprehensive list of preferred structural entities, in the form of polymers often categorized as the matrix material of a composite.

Group 1: Polymers.

1. Polymers of monoolefins and diolefins, for example polypropylene, polyisobutylene, polybut-1-ene, poly-4-methylpent-1-ene, polyvinylcyclohexane, polyisoprene or polybutadiene, as well as polymers of cycloolefins, for instance of cyclopentene or norbornene, polyethylene (which optionally can be crosslinked), for example high density polyethylene (HDPE), high density and high molecular weight polyethylene (HDPE-HMW), high density and ultrahigh molecular weight polyethylene (HDPE-UHMW), medium density polyethylene (MDPE), low density polyethylene (LDPE), linear low density polyethylene (LLDPE), (VLDPE) and (ULDPE).

Polyolefins, i.e. the polymers of monoolefins exemplified in the preceding paragraph, preferably polyethylene and polypropylene, can be prepared by different, and especially by the following, methods:

- a) radical polymerisation (normally under high pressure and at elevated temperature).
 - b) catalytic polymerisation using a catalyst that normally contains one or more than one metal of groups IVb, Vb, VIb or VIII of the Periodic Table. These metals usually have one or more than one ligand, typically oxides, halides, alcoholates, esters, ethers, amines, alkyls, alkenyls and/or aryls that may be either π - or σ -coordinated. These metal complexes may be in the free form or fixed on substrates, typically on activated magnesium chloride, titanium(III) chloride, alumina or silicon oxide. These catalysts may be soluble or insoluble in the polymerisation medium. The catalysts can be used by themselves in the polymerisation or further activators may be used, typically metal alkyls, metal hydrides, metal alkyl halides, metal alkyl oxides or metal alkyloxanes, said metals being elements of groups Ia, Na and/or IIa of the Periodic Table. The activators may be modified conveniently with further ester, ether, amine or silyl ether groups. These catalyst systems are usually termed Phillips, Standard Oil Indiana, Ziegler (-Natta), TNZ (DuPont), metallocene or single site catalysts (SSC).
2. Mixtures of the polymers mentioned under 1), for example mixtures of polypropylene with polyisobutylene, polypropylene with polyethylene (for example PP/HDPE, PP/LDPE) and mixtures of different types of polyethylene (for example LDPE/HDPE).

3. Copolymers of monoolefins and diolefins with each other or with other vinyl monomers, for example ethylene/propylene copolymers, linear low density polyethylene (LLDPE) and mixtures thereof with low density polyethylene (LDPE), propylene/but-1-ene copolymers, propylene/isobutylene copolymers, ethylene/but-1-ene copolymers, ethylene/hexene copolymers, ethylene/methylpentene copolymers, ethylene/heptene copolymers, ethylene/octene copolymers, ethylene/vinylcyclohexane copolymers, ethylene/cycloolefin copolymers (e.g. ethylene/norbornene like COC), ethylene/1 -olefins copolymers, where the 1 -olefin is generated in-situ; propylene/butadiene copolymers, isobutylene/isoprene copolymers, ethylene/vinylcyclohexene copolymers, ethylene/alkyl acrylate copolymers, ethylene/alkyl methacrylate copolymers, ethylene/vinyl acetate copolymers or ethylene/acrylic acid copolymers and their salts (ionomers) as well as terpolymers of ethylene with propylene and a diene such as hexadiene, dicyclopentadiene or ethylidene-norbornene; and mixtures of such copolymers with one another and with polymers mentioned in 1) above, for example polypropylene/ethylene-propylene copolymers, LDPE/ethylene-vinyl acetate copolymers (EVA), LDPE/ethylene-acrylic acid copolymers (EAA), LLDPE/EVA, LLDPE/EAA and alternating or random polyalkylene/carbon monoxide copolymers and mixtures thereof with other polymers, for example polyamides.

4. Hydrocarbon resins (for example C⁵-C⁸) including hydrogenated modifications thereof (e.g. tackifiers) and mixtures of polyalkylenes and starch.

Homopolymers and copolymers from 1.) - 4.) may have any stereostructure including syndiotactic, isotactic, hemi-isotactic or atactic.. Stereoblock polymers are also included.

5. Polystyrene, poly(p-methylstyrene), poly(α -methylstyrene).

6. Aromatic homopolymers and copolymers derived from vinyl aromatic monomers including styrene, α -methylstyrene, all isomers of vinyl toluene, especially p-vinyltoluene, all isomers of ethyl styrene, propyl styrene, vinyl biphenyl, vinyl naphthalene, and vinyl anthracene, and mixtures thereof. Homopolymers and copolymers may have any stereostructure including syndiotactic, isotactic, hemi-isotactic or atactic; where atactic polymers are preferred. Stereoblock polymers are also included.

6a. Copolymers including aforementioned vinyl aromatic monomers and comonomers selected from ethylene, propylene, dienes, nitriles, acids, maleic anhydrides, maleimides, vinyl acetate and vinyl chloride or acrylic derivatives and mixtures thereof, for example styrene/butadiene, styrene/acrylonitrile, styrene/ethylene (interpolymers), styrene/alkyl methacrylate, styrene/butadiene/alkyl acrylate, styrene/butadiene/alkyl methacrylate, styrene/maleic anhydride, styrene/acrylonitrile/methyl acrylate; mixtures of high impact strength of styrene copolymers and

another polymer, for example a polyacrylate, a diene polymer or an ethylene/propylene/diene terpolymer; and block copolymers of styrene such as styrene/butadiene/styrene, styrene/isoprene/styrene, styrene/ethylene/butylene/styrene or styrene/ethylene/propylene/styrene.

6b. Hydrogenated aromatic polymers derived from hydrogenation of polymers mentioned under 6.), especially including polycyclohexylethylene (PCHE) prepared by hydrogenating atactic polystyrene, often referred to as polyvinylcyclohexane (PVCH).

6c. Hydrogenated aromatic polymers derived from hydrogenation of polymers mentioned under 6a.).

Homopolymers and copolymers may have any stereostructure including syndiotactic, isotactic, hemi-isotactic or atactic; where atactic polymers are preferred. Stereoblock polymers are also included.

7. Graft copolymers of vinyl aromatic monomers such as styrene or α -methylstyrene, for example styrene on polybutadiene, styrene on polybutadiene-styrene or polybutadiene-acrylonitrile copolymers; styrene and acrylonitrile (or methacrylonitrile) on polybutadiene; styrene, acrylonitrile and methyl methacrylate on polybutadiene; styrene and maleic anhydride on polybutadiene; styrene, acrylonitrile and maleic anhydride or maleimide on polybutadiene; styrene and maleimide on polybutadiene; styrene and alkyl acrylates or methacrylates on polybutadiene; styrene and acrylonitrile on ethylene/propylene/diene terpolymers; styrene and acrylonitrile on polyalkyl acrylates or polyalkyl methacrylates, styrene and acrylonitrile on acrylate/butadiene copolymers, as well as mixtures thereof with the copolymers listed under 6), for example the copolymer mixtures known as ABS, MBS, ASA or AES polymers.

8. Halogen-containing polymers such as polychloroprene, chlorinated rubbers, chlorinated and brominated copolymer of isobutylene-isoprene (halobutyl rubber), chlorinated or sulfo-chlorinated polyethylene, copolymers of ethylene and chlorinated ethylene, epichlorohydrin homo- and copolymers, especially polymers of halogen-containing vinyl compounds, for example polyvinyl chloride, polyvinylidene chloride, polyvinyl fluoride, polyvinylidene fluoride, as well as copolymers thereof such as vinyl chloride/vinylidene chloride, vinyl chloride/vinyl acetate or vinylidene chloride/vinyl acetate copolymers.

9. Polymers derived from α,β -unsaturated acids and derivatives thereof such as polyacrylates and polymethacrylates; polymethyl methacrylates, polyacrylamides and polyacrylonitriles, impact-modified with butyl acrylate.

10. Copolymers of the monomers mentioned under 9) with each other or with other unsaturated monomers, for example acrylonitrile/ butadiene copolymers, acrylonitrile/alkyl acrylate copolymers, acrylonitrile/alkoxyalkyl acrylate or acrylonitrile/vinyl halide copolymers or acrylonitrile/ alkyl methacrylate/butadiene terpolymers.
11. Polymers derived from unsaturated alcohols and amines or the acyl derivatives or acetals thereof, for example polyvinyl alcohol, polyvinyl acetate, polyvinyl stearate, polyvinyl benzoate, polyvinyl maleate, polyvinyl butyral, polyallyl phthalate or polyallyl melamine; as well as their copolymers with olefins mentioned in 1) above.
12. Homopolymers and copolymers of cyclic ethers such as polyalkylene glycols, polyethylene oxide, polypropylene oxide or copolymers thereof with bisglycidyl ethers.
13. Polyacetals such as polyoxymethylene and those polyoxymethylenes which contain ethylene oxide as a comonomer; polyacetals modified with thermoplastic polyurethanes, acrylates or MBS.
14. Polyphenylene oxides and sulfides, and mixtures of polyphenylene oxides with styrene polymers or polyamides.
15. Polyurethanes derived from hydroxyl-terminated polyethers, polyesters or polybutadienes on the one hand and aliphatic or aromatic polyisocyanates on the other, as well as precursors thereof.
16. Polyamides and copolyamides derived from diamines and dicarboxylic acids and/or from aminocarboxylic acids or the corresponding lactams, for example polyamide 4, poly-amide 6, polyamide 6/6, 6/10, 6/9, 6/12, 4/6, 12/12, polyamide 11, polyamide 12, aromatic polyamides starting from m-xylene diamine and adipic acid; polyamides prepared from hexamethylenediamine and isophthalic or/and terephthalic acid and with or without an elastomer as modifier, for example poly-2,4,4'-trimethylhexamethylene terephthalamide or poly-m-phenylene isophthalamide; and also block copolymers of the aforementioned polyamides with polyolefins, olefin copolymers, ionomers or chemically bonded or grafted elastomers; or with polyethers, e.g. with polyethylene glycol, polypropylene glycol or polytetra-methylene glycol; as well as polyamides or copolyamides modified with EPDM or ABS; and polyamides condensed during processing (RIM polyamide systems).
17. Polyureas, polyimides, polyamide-imides, polyetherimides, polyesterimides, polyhydantoins and polybenzimidazoles.

18. Polyesters derived from dicarboxylic acids and diols and/or from hydroxycarboxylic acids or the corresponding lactones or lactides, for example polyethylene terephthalate, polybutylene terephthalate, poly-1,4-dimethylolcyclohexane terephthalate, polyalkylene naphthalate and polyhydroxybenzoates as well as copolyether esters derived from hydroxyl-terminated polyethers, and also polyesters modified with polycarbonates or MBS. Copolyesters may comprise, for example - but are not limited to - polybutylenesuccinate/terephthalate, polybutyleneadipate/terephthalate, polytetramethyleneadipate/terephthalate, polybutylensuccinate/adipate, polybutylensuccinate/carbonate, poly-3-hydroxybutyrate/octanoate copolymer, poly-3-hydroxybutyrate/hexanoate/decanoate terpolymer. Furthermore, aliphatic polyesters may comprise, for example - but are not limited to - the class of poly(hydroxyalkanoates), in particular, poly(propiolactone), poly(butyrolactone), poly(pivalolactone), poly(valerolactone) and poly(caprolactone), polyethylenesuccinate, polypropylenesuccinate, polybutylenesuccinate, polyhexamethylenesuccinate, polyethyleneadipate, polypropyleneadipate, polybutyleneadipate, polyhexamethyleneadipate, polyethyleneoxalate, polypropyleneoxalate, polybutylene-oxalate, polyhexamethyleneoxalate, polyethylenesebacate, polypropylenesebacate and polybutylenesebacate, as well as corresponding polyesters modified with polycarbonates or MBS.

19. Polycarbonates and polyester carbonates.

20. Polyketones.

21. Polysulfones, polyether sulfones and polyether ketones.

22. Crosslinked polymers derived from aldehydes on the one hand and phenols, ureas and melamines on the other hand, such as phenol/formaldehyde resins, urea/formaldehyde resins and melamine/formaldehyde resins.

23. Drying and non-drying alkyd resins.

24. Unsaturated polyester resins derived from copolyesters of saturated and unsaturated dicarboxylic acids with polyhydric alcohols and vinyl compounds as crosslinking agents, and also halogen-containing modifications thereof of low flammability.

25. Crosslinkable acrylic resins derived from substituted acrylates, for example epoxy acrylates, urethane acrylates or polyester acrylates.

26. Alkyd resins, polyester resins and acrylate resins crosslinked with melamine resins, urea resins, isocyanates, isocyanurates, polyisocyanates or epoxy resins.

27. Crosslinked epoxy resins derived from aliphatic, cycloaliphatic, heterocyclic or aromatic glycidyl compounds, e.g. products of diglycidyl ethers of bisphenol A and bisphenol F, which are crosslinked with customary hardeners such as anhydrides or amines, with or without accelerators.

28. Natural polymers such as cellulose, rubber, gelatin and chemically modified homologous derivatives thereof, for example cellulose acetates, cellulose propionates and cellulose butyrates, or the cellulose ethers such as methyl cellulose; as well as rosins and their derivatives.

29. Blends of the aforementioned polymers (polyblends), for example PP/EPDM, Poly-amide/EPDM or ABS, PVC/EVA, PVC/ABS, PVC/MBS, PC/ABS, PBTP/ABS, PC/ASA, PC/PBT, PVC/CPE, PVC/acrylates, POM/thermoplastic PUR, PC/thermoplastic PUR, POM/acrylate, POM/MBS, PPO/HIPS, PPO/PA 6.6 and copolymers, PA/HDPE, PA/PP, PA/PPO, PBT/PC/ABS or PBT/PET/PC.

The polymers can be further divided into thermosets such as polyester resin, epoxy resin, and polyurethanes, and thermoplastics such as nylon, polycarbonate and polyethylene.

The polymers can be further divided into linear and branched polymers. The branched polymers may be further divided into short-chain branched polymers, long-chain branched polymers, star-branched polymers, ladder polymers and network polymers.

Polymers and plastics. In preferred embodiments, a suitable SE is chosen from the list comprising polymers & plastics.

Group 2: Polymers and plastics.

- polyimide, PTFE, PMMA, Kapton, Vespel, Cirlex, ABS
- polyimides (kapton, upilex, etc)
- polyamides
- polycarbonates (PC/lexan)
- polyesters (PET/mylar, melinex, dacron., PEN/teonex)
- polyethylenes (LDPE, HDPE)
- polypropylenes (PP)
- styrenics (polystyrenes/PS, acrylonitriles/ABS)

- vinyls (PVC, nylon)
- acrylics (PMMA/perspex, plexiglas)
- fluoroplastics (PTFE/teflon, FEP, PFA, PVDF)
- polysulphones (PES)
- ketones (PEEK)
- polyurethanes
- barrier resins (PVA/polyvinyl alcohol)
- epoxy resins (FR4)
- silicone resins
- elastomes (PDMS)
- biopolymers (wood, cellulose, starch based)
- conductive polymers (Pedot:PSS/baytron,orgacon, TIPS pentacene)
- light emitting polymers (white LEP, etc)
- copolymers
- metalised polymers
- Co-polymers
- Block co-polymers
- Rubber
- Latex

Polyacetylene, Polydiacetylenes, Polyethylene - very low density (VLDPE), Polyethylene -low density (LDPE), Polyethylene - linear low density (LLDPE), Polyethylene - medium density (MDPE), Polyethylene - high density (HDPE), Polyethylene - ultrahigh molecular weight (UHMWPE), Polyethylene - cross-linked polyethylene, Polyisoprene, Polybutadiene, Polypropylene, Polypropylene, Poly-1-butene, Poly-1-hexene, Polymethylpentene, polyisobutylene, poly(ethylene propylene) , Poly-1-octene, Ethylene-propylene-diene rubbers, Ethylene-propylene bases thermoplastic elastomers, Polyhexene, Polyheptene, Polyoctene, Polystyrene-butadiene, Parylene, Polystyrene, Polymers of styrene in primary forms, Expansible polystyrene in primary forms, Expanded polystyrene (EPS), Poly(p-phenylene), High-impact polystyrene (HIPS), Poly(p-phenylene-vinylene), Poly(2,5-dioctyl-1,4-phenylenevinylene), Poly(2,6-naphthalenevinylene), Polyanthracene, Poly(anthracene-vinylene), Polyvinylchloride, Polychloroprene, Non plasticised PVC mixed with any other substance in primary forms, Plasticised PVC mixed with any other substance in primary forms, Polyvinylidene chloride (PVDC), Polytetrafluorethylene (PTFE), Polyvinylidene fluoride (PVDF), ethylene tetrafluoro-ethylene copolymer (Tefzel), Polyvinylfluoride,

Polyperfluoropropylene, Polyoxymethylene, Polyethyleneoxide, Polypropyleneoxide, Poly(ethylene-propylene oxide), polybutyleneoxide, Polyphenylene ether (PPE), polyacrylate, polyacrylic acid, Polymethylmethacrylate, Polymethylacrylate, Poly(ethyl acrylate), Polyhydroxyethylmethacrylate, Polybutylacrylate, Polybutylmethacrylate, Ethylene vinyl acetate (EVA) and ethylene vinyl alcohol (EVOH), Poly vinyl acetate in primary forms, Poly vinyl acetate in aqueous dispersion in primary forms, Polyvinylacetate, Polyvinylalcohol, Polycarbonate, Polyetherketon, Polyetheretherketon, Polyethyleneterephthalate, Polybutyleneterephthalate, polylactic acid, Polybutylene terephthalate (PBT), Other PET, Polycaprolactone (PCL), Polyglycolide (PG), Liquid crystalline polymers (aromatic) containing esters, Polyethylene adipate (PEA), Polytrimethylene terephthalate (PTT), Polyethylene naphthalate (PEN), Vectran, Alkyd resins, Polymers of vinyl esters or other vinyl polymers in primary forms, Polyacetals in primary forms, Bekalite, Phenol formaldehyde resins (PF), Diglycidyl Ether of Bisphenol-A (DGEBA), Phenolic (Novolac) Epoxy Resins, Poly-o-vinylbenzylalcohol, Poly-p-vinylbenzylalcohol, Polyvinyl formal, Polyvinyl acetal, Polyvinyl isobutyral, Polyvinyl butyral, Polyvinyl-n-butyl ether, Polytetramethylene sebacate, Polybutylene oxide, polypropylene oxide, Polyethylene adipate, Polyacrylonitrile (PAN) and copolymers, Acrylonitrile-butadiene-styrene (ABS) terpolymer, Styrene-acrylonitrile (SAN) copolymer, Polyaniline, Polypyrrole, Polymethacrylonitrile, Polysulphones, Polysulphides, ethylene chlorotrifluoro ethylene copolymer (ECTFE), fluorinated ethylene-propylene copolymer (Teflon FEP), polychlorotrifluoro-ethylene, Nylon PA1,1, Nylon PA1,2, Nylon PA1,3, Nylon PA1,4, Nylon PA1,5, Nylon PA1,6, Nylon PA2,1, Nylon PA6,6, Nylon PA6,10, Polyurethane based on, polyimide, polycaprolactam, aramid, Polyphenylene benzobisoxazole, Poly(m-phenyleneisophthalamide) (MPD-I) (Nomex®), Poly(p-phenyleneterephthalamide) (PPD-T) (Kevlar® and Twaron®), Polyisocyanurates, Polyimides, Bismaleimides (BMI), Polyacenaphthylene, Polyvinyl pyrrolidone, Vinyl chloride-vinyl acetate copolymers and other vinyl chloride copolymers in primary forms, perfluoroalkoxy Teflon PFA, Polydimethylsiloxanes (PDMS), Organomodified siloxanes (OMS), Polymethylhydrosiloxane (PMHS), Silicones in primary forms, PolyAPTAC, (poly (acrylamido-N-propyltrimethylammonium chloride) and PolyMAPTAC (poly[(3-(methacryloylamino)-propyl] trimethylammonium chloride) are all suitable polymers for the structural entities SE.

Organic SEs include natural and unnatural polypeptides, lipids, polysaccharides, wood flour, etc.

The following additives represent preferred structural entities, suitable for the present invention: a carbon fibre, a carbon nanofibre, a carbon nanothread, a ceramic material, a composite material, a fullerene, a MWCNT, a SWCNT, graphane, graphene oxide, graphite, graphyne, a COOH-functionalized carbon nanotube, a OH-functionalized carbon nanotube, an NH₂-functionalized carbon

nanotube, an SH-functionalized CNT, COOH-functionalized graphene, multi-layer graphene, NH₂-functionalized graphene, OH-functionalized graphene, reduced graphene oxide, thiol-functionalized graphene, a glass fibre, aramid, E-glass, iron, polyester, polyethylene, S-glass, steel, a battery, a borosilicate, a buckyball, a buckytube, a capacitor, a carbon dome, a carbon material, a carbon megatube, a carbon nanofoam, a carbon polymer, a catalyst, a cathode, a coated carbon nanotube, a conductor, a covalent crystal, a crystal, a crystalline material, a defect-free graphene sheet, a defect-free MWCNT, a defect-free SWCNT, a dielectric material, a diode, a dodecahedrane, a doped glass, a fibre, a fullerite, a fused silica, a glue, a green ceramic, a lanthanides, a machinable ceramic, a metal alloy, a metal-functionalized carbon nanotube, a metalised dielectric, a metallised ceramic, a metalloid, a mineral, a non-covalent crystal, a piezoelectric material, a platinum group metal, a post-transition metal, a rare earth element, a sapphire, a semiconductor, a sensor, a silicon nitride, a single crystal fiber, a sol-gel, a synthetic diamond, a transition metal, a triple-wall carbon nanotube, a tungsten carbide, alumina, alumina trihydrate, aluminium, aluminum boride, aluminum oxide, aluminum trihydroxide, amorphous carbon, an actinides, an amalgam, an anode, an elastomers, an electrode, an endohedral fullerene, an insulator, an intermetallic, an ionic crystal, an organic material, anode, anthracite, asbestos, barium, bone, boron, brass, buckypaper, calcium carbonite, calcium metasilicate, calcium sulfate, calcium sulphate, carbon black, carbon nanofoam, cathode, chromium, clay, coal, copper, diamond, diamond-like carbon, double-layer graphene, exfoliated graphite, exfoliated silicate, flourinated graphene, fused silica, gallium arsenide, gallium nitride, germanium, glass, glass microsphere, glass ribbons, glassy carbon, gold, hardened steel, hydrous magnesium silicate, hyperdiamond, iron oxides, lead zirconium titanate, lignite, lithium niobate, lonsdaleite, magnesium dihydroxide, magnesium oxide, manganese, metal, metal oxide, mica, molybdenum, nickel, nylon, palladium, pencil lead, platinum, prismane, pyrolytic graphite, rubber, silica, silica gel, silicon, silicon carbide, silicon dioxide, silicon nitride, silver, soot, stainless steel, tantalum, titanium, titanium oxide, tooth cementum, tooth dentine, tooth enamel, tungsten, tungsten carbide, wood, zinc oxide, zirconia.

The SEs can be further divided into SEs comprising solely aliphatic moieties, comprising solely aromatic moieties, or comprising both aliphatic and aromatic moieties.

The SEs can be further divided into SEs comprising solely single bonds, solely double bonds, solely triple bonds, or a combination of single-, double- and triple bonds.

Biological polymers are here defined as the polymers involved in the transcriptional and translational process, i.e. natural nucleic acids (RNA or DNA), and natural polypeptides. Natural polypeptides can be further divided into peptides, proteins and antibodies.

In preferred embodiments, a suitable organic SE is chosen from the list comprising biologicals, such as hair, nail, horn, ligaments, bone, cornea, teeth, fibrous cartilage, vitreous cells, intervertebral disc, womb, skin, intestines, heart membranes, membranes, stomach membrane, cartilage, chondrocytes, intervertebral cartilage, bone enamel, ligaments, tendons and tooth enamel, organs, lung, heart, brain, skin, kidney, tooth material, bone material, tendon material, skin, hair, nails, a biological surface, such as a vein, a biological macromolecule, such as a protein, such as a naturally occurring protein, such as a consensus sequence protein, a modified protein, such as a mutant protein where one or more amino acids have been changed relative to the consensus sequence.

Preferred embodiments of SEs include gold particles, carbon nanotubes, carbon fibers, aluminum fibers, nanotubes, graphene, metal ions, metal, ceramic, polyester, concrete, polystyrene, BN (boron nitride aka "white graphene"), BNNT (boron nitride nanotubes), nanotubes and nanowires and nanocrystals and nanospheres and nanochains e.g. comprising any one or more of the following elements: C, Si, Se, Cu, S, Co, Zn, Al, Au, Ag, N, B and Cd.

Particularly preferred embodiments of SEs include carbon nanotubes, multi-walled carbon nanotubes, single-walled carbon nanotubes, functionalized carbon nanotubes, carbon nanofibres, carbon nanothreads, fullerenes, aluminum nitride nanotubes (AlNNTs), boron carbon nanotubes (BCNNT), DNA nanotube, RNA nanotube, protein nanotube, silicon nanotube, titanium oxide nanotubes, tungsten sulfide nanotubes, gallium nitride nanotubes (GaNNTs), aluminum phosphide nanotube (AlPNT), gallium phosphide nanotube (GaPNT), carbon/diamond nanothread, copper nanotubes, gold nanotubes, silver nanotube, platinum nanotube, zinc oxide nanotube, zinc ferrite nanotube, aluminium nanotube, sulphide nanotubes such as WS_2 and MoS_2 , selenide nanotubes such as Cadmium Selenide Nanotube, CdSe, cobalt Selenide Nanotube, bismuth selenide nanotube, niobium selenide nanotubes, halide nanotubes, such as nickel chloride nanotubes, nanotubes of transition metal oxides such as SiO_2 , TiO_2 , MoO_3 , V_2O_5 and graphene, functionalized graphene, graphene oxide, graphyne, reduced graphyne, graphane, graphdiyne, graphone, fluorographene, chlorographene

In preferred embodiments, a suitable SE is chosen from the list comprising

- Concrete admixtures
- Chemical admixtures
- Mineral admixtures.
- Air entrainers
- Water reducers
- Set retarders
- Set accelerators
- Superplasticizers
- Corrosion inhibitors
- Shrinkage control admixtures
- Alkali-silica reactivity inhibitors
- Coloring admixtures.
- Plasticizers
- Water reducers
- Superplasticizer
- High range water reducers
- Organic polymers
- Lignin
- Naphthalene
- Melamine sulfonate superplasticisers
- Pozzolans and other cementitious materials
- Natural pozzolans (such as the volcanic ash used in Roman concrete)
- Fly ash
- Silica fume.
- Dispersants.
- Polycarboxylate ether superplasticizer (PCE)
- Polycarboxylate (PC)
- Coal
- Soot
- Carbon black
- Anthracite
- Lignite
- Kevlar
- Carbon fiber

- Carbon nanofiber
- Carbon allotropes
 - Activated carbon
 - Powdered activated carbon
 - Granular activated carbon
 - Extruded activated carbon
 - Fullerenes
 - Buckyball
 - Buckypaper
 - Buckytube
 - Dodecahedrane
 - Endohedral fullerenes
 - Geodesic carbon domes
 - Prismane
 - Carbon nanotube
 - Single-wall carbon nanotubes
 - Double-wall carbon nanotubes
 - Triple-wall carbon nanotube
 - Multi-wall carbon nanotubes
 - Pristine carbon nanotubes
 - Coated carbon nanotubes
 - Perfect carbon nanotubes
 - Imperfect carbon nanotubes
 - Functionalized carbon nanotubes
 - Thiol-functionalized
 - Hydroxyl-functionalized
 - Carboxylic acid-functionalized
 - Amine-functionalized
 - Carbon nanotubes that contain gadolinium
 - Buckypaper
 - Fullerite
 - Ultrahard fullerite
 - Buckminsterfullerene

- Graphene
 - Single-layer graphene
 - Double-layer graphene
 - Triple-layer graphene
 - Multi-layer graphene
 - Pristine graphene
 - Coated graphene
 - Perfect graphene
 - Imperfect graphene
 - Functionalized graphene
 - Graphane
 - Flourinated graphene
 - Graphene oxide
 - Reduced graphene oxide
- Buckyball clusters
- Carbon megatubes
- Carbon polymers
- Carbon nano-onions
- Carbon nanobuds
- Fullerene rings
- Glassy carbon
- Diamond
 - Hyperdiamonds
 - Aggregated diamonds
- Graphite
 - Pyrolytic graphite
- Pencil lead
- Lonsdaleite
- Amorphous carbon
- Carbon nanofoam
- Metals
 - Transition metals, Lanthanides, Actinides, Rare earth elements, Platinum group metals (PGMs), Post-transition metals
 - (Al) aluminium

- (Fe) steel and stainless steel
- (Mo) molybdenum
- (Cu) copper
- (Ti) titanium
- (Pt) platinum
- (Au) gold
- (Ni) nickel
- (Pa) palladium
- (Mn) manganese
- (Ta) tantalum
- (Cr) chromium
- (Ag) silver
- (Wo) Tungsten
- Metalloids
- Alloys
 - Stainless steel
 - Steel fibers
 - Hardened steel
 - Brass
 - Brass fibers
- Amalgams
- Intermetallics
- Glasses
 - Glass fibre
 - Glass spheres
- Crystal
 - Ionic crystals, Covalent crystals, Non-covalent crystals
 - Non-covalent crystal
- Crystalline materials
 - BK7, sapphire, fused silica
- Glue
- Ceramic
 - alumina, zirconia, machinable ceramic, green ceramic, PZT, silicon nitride, tungsten carbide
 - alumina (Al₂O₃)

- silicon nitrides (bulk and thin film)
 - silicon carbides
 - lithium niobates
 - zirconia
 - metallised ceramic
- Elastomers
- Fibres
- Composite materials
 - Wood
 - Cellulose fibers
 - lignin
 - Bone
 - Tooth enamel
 - Tooth cementum
 - Tooth dentine
- Sol-gel
- Mineral
- Montmorillonite nanoclays
- Cellulose nanowhiskers
- Talc
- Cellulose nanofibers (e.g. Curran)
- Organic-Inorganic
 - Organic-Inorganic hybrids
 - Polymer hybrids of poly (vinyl alcohol) and silica gel
 - Boron nitride nanotube
 - Single-wall boron nitride nanotubes
 - Double-wall boron nitride nanotubes
 - Triple-wall boron nitride nanotube
 - Multi-wall boron nitride nanotubes
 - Pristine boron nitride nanotubes
 - Coated boron nitride nanotubes
 - Perfect boron nitride nanotubes
 - Imperfect boron nitride nanotubes
 - Functionalized boron nitride nanotubes

- Thiol-functionalized boron nitride nanotubes
 - Hydroxyl-functionalized boron nitride nanotubes
 - Carboxylic acid-functionalized boron nitride nanotubes
 - Amine-functionalized boron nitride nanotubes
- Boron nitride nanotubes that contain gadolinium
- Bucky paper
- Boron nitride
 - Single-layer boron nitride
 - Double-layer boron nitride
 - Triple-layer boron nitride
 - Multi-layer boron nitride
 - Pristine boron nitride
 - Coated boron nitride
 - Perfect boron nitride
 - Imperfect boron nitride
 - Functionalized boron nitride
 - Fluorinated boron nitride
 - Boron nitride oxide
 - Reduced boron nitride oxide

For any characteristics of an SE mentioned above or below, and in each characteristic's entire range, a further characteristic of importance is the content of elements in the SE. The kinds of elements in an SE will be reflected in the characteristics of the SE, but can in some cases also affect other parts of a CMU. As an example, the elements of SE1 may interfere with the integrity of SE2, or alternatively, if SE2 is made in situ, i.e. after the mixing of SE1 and the precursors from which SE2 will be made, SE1 may interfere with the formation of SE2 and/or its final form, through interaction of its elements with the reactive monomers that react to form SE2.

Identities and number of elements of a structural entity. The structural entity may be composed of only one type of element, two types of elements, three types of elements, four types of elements, or more than four types of elements.

SEs consisting of one element or one type of element. Preferred embodiments of SEs comprising only one element are often ions, and often serve an essential structural role in the CMU. The following ions are particularly preferred structural entities: K⁺, Cl⁻, Ca⁺⁺, Mg⁺⁺, Gd⁺⁺⁺, Cu⁺, Cu²⁺, Fe²⁺,

Fe³⁺, Hg²⁺, Hg₂²⁺, Pb²⁺, Pb⁴⁺, Sn²⁺, Sn⁴⁺, Cr²⁺, Cr³⁺, Mn²⁺, Mn³⁺, Co²⁺, Co³⁺. If comprising only one element, the element may be any one of the following: Lithium (Li), Beryllium (Be), Boron (B), Carbon (C), Nitrogen (N), Oxygen (O), Fluorine (F), Sodium (Na), Magnesium (Mg), Aluminium (Al), Silicon (Si), Phosphorus (P), Sulfur (S), Chlorine (Cl), Potassium (K), Calcium (Ca), Scandium (Sc), Titanium (Ti), Vanadium (V), Chromium (Cr), Manganese (Mn), Iron (Fe), Cobalt (Co), Nickel (Ni), Copper (Cu), Zinc (Zn), Gallium (Ga), Germanium (Ge), Arsenic (As), Selenium (Se), Bromine (Br), Rubidium (Rb), Strontium (Sr), Yttrium (Y), Zirconium (Zr), Niobium (Nb), Molybdenum (Mo), Technetium (Tc), Ruthenium (Ru), Rhodium (Rh), Palladium (Pd), Silver (Ag), Cadmium (Cd), Indium (In), Tin (Sn), Antimony (Sb), Tellurium (Te), Iodine (I), Caesium (Cs), Barium (Ba), Platinum (Pt), Gold (Au), Mercury (Hg), Thallium (Tl), Lead (Pb), Bismuth (Bi).

SEs comprising only one type of element have no polarity, and are therefore attractive in cases where no polarity is desired. This may e.g. be the case where the polymer (e.g. SE1) of a composite has no polarity, and where it therefore may be beneficial to add an additive (SE2) with no polarity as well.

The following structural entities comprising only one element or one type of element, are particularly preferred structural entities:

Comprising carbon atoms only: Buckyball, Buckypaper, Buckytube, Dodecahedrane, Endohedral fullerenes, Gedodesic carbon domes, Prismane, Pristine carbon nanotubes, Coated carbon nanotubes, Perfect carbon nanotubes, Imperfect carbon nanotubes, Fullerite, Ultrahard fullerite, Buckminsterfullerene, Graphene, Single-layer graphene, Double-layer graphene, Triple-layer graphene, Multi-layer graphene, Pristine graphene, Perfect graphene, Imperfect graphene, Buckyball clusters, Carbon megatubes, Carbon polymers, Carbon nano-onions, Carbon nanobuds, Fullerene rings, diamond, fullerenes in general, and specifically Carbon nanotubes, Single-wall carbon nanotubes, Double-wall carbon nanotubes, Triple-wall carbon nanotube, Multi-wall carbon nanotubes including single-walled carbon nanotubes and multiwalled nanotubes, and including Carbon nanotubes with the following chiral vectors (n, m); (0,0); (1,0); (2,0); (3,0); (4,0); (5,0); (6,0); (7,0); (8,0); (9,0); (10,0); (11,0); (12,0); (13,0); (14,0); (15,0); (16,0); (17,0); (18,0); (19,0); (20,0); (0,1); (1,1); (2,1); (3,1); (4,1); (5,1); (6,1); (7,1); (8,1); (9,1); (10,1); (11,1); (12,1); (13,1); (14,1); (15,1); (16,1); (17,1); (18,1); (19,1); (20,1); (0,2); (1,2); (2,2); (3,2); (4,2); (5,2); (6,2); (7,2); (8,2); (9,2); (10,2); (11,2); (12,2); (13,2); (14,2); (15,2); (16,2); (17,2); (18,2); (19,2); (20,2); (0,3); (1,3); (2,3); (3,3); (4,3); (5,3); (6,3); (7,3); (8,3); (9,3); (10,3); (11,3); (12,3); (13,3); (14,3); (15,3); (16,3); (17,3); (18,3); (19,3); (20,3); (0,4); (1,4); (2,4); (3,4); (4,4); (5,4); (6,4); (7,4); (8,4); (9,4); (10,4); (11,4); (12,4); (13,4); (14,4); (15,4); (16,4); (17,4); (18,4); (19,4); (20,4); (0,5); (1,5); (2,5); (3,5); (4,5); (5,5); (6,5); (7,5); (8,5); (9,5); (10,5); (11,5); (12,5); (13,5); (14,5); (15,5); (16,5); (17,5); (18,5); (19,5); (20,5); (0,6); (1,6); (2,6); (3,6); (4,6); (5,6); (6,6); (7,6); (8,6); (9,6); (10,6); (11,6); (12,6); (13,6);

(14,6); (15,6); (16,6); (17,6); (18,6); (19,6); (20,6); (0,7); (1,7); (2,7); (3,7); (4,7); (5,7); (6,7); (7,7); (8,7); (9,7); (10,7); (11,7); (12,7); (13,7); (14,7); (15,7); (16,7); (17,7); (18,7); (19,7); (20,7); (0,8); (1,8); (2,8); (3,8); (4,8); (5,8); (6,8); (7,8); (8,8); (9,8); (10,8); (11,8); (12,8); (13,8); (14,8); (15,8); (16,8); (17,8); (18,8); (19,8); (20,8); (0,9); (1,9); (2,9); (3,9); (4,9); (5,9); (6,9); (7,9); (8,9); (9,9); (10,9); (11,9); (12,9); (13,9); (14,9); (15,9); (16,9); (17,9); (18,9); (19,9); (20,9); (0,10); (1,10); (2,10); (3,10); (4,10); (5,10); (6,10); (7,10); (8,10); (9,10); (10,10); (11,10); (12,10); (13,10); (14,10); (15,10); (16,10); (17,10); (18,10); (19,10); (20,10); (0,11); (1,11); (2,11); (3,11); (4,11); (5,11); (6,11); (7,11); (8,11); (9,11); (10,11); (11,11); (12,11); (13,11); (14,11); (15,11); (16,11); (17,11); (18,11); (19,11); (20,11); (0,12); (1,12); (2,12); (3,12); (4,12); (5,12); (6,12); (7,12); (8,12); (9,12); (10,12); (11,12); (12,12); (13,12); (14,12); (15,12); (16,12); (17,12); (18,12); (19,12); (20,12); (0,13); (1,13); (2,13); (3,13); (4,13); (5,13); (6,13); (7,13); (8,13); (9,13); (10,13); (11,13); (12,13); (13,13); (14,13); (15,13); (16,13); (17,13); (18,13); (19,13); (20,13); (0,14); (1,14); (2,14); (3,14); (4,14); (5,14); (6,14); (7,14); (8,14); (9,14); (10,14); (11,14); (12,14); (13,14); (14,14); (15,14); (16,14); (17,14); (18,14); (19,14); (20,14); (0,15); (1,15); (2,15); (3,15); (4,15); (5,15); (6,15); (7,15); (8,15); (9,15); (10,15); (11,15); (12,15); (13,15); (14,15); (15,15); (16,15); (17,15); (18,15); (19,15); (20,15); (0,16); (1,16); (2,16); (3,16); (4,16); (5,16); (6,16); (7,16); (8,16); (9,16); (10,16); (11,16); (12,16); (13,16); (14,16); (15,16); (16,16); (17,16); (18,16); (19,16); (20,16); (0,17); (1,17); (2,17); (3,17); (4,17); (5,17); (6,17); (7,17); (8,17); (9,17); (10,17); (11,17); (12,17); (13,17); (14,17); (15,17); (16,17); (17,17); (18,17); (19,17); (20,17); (0,18); (1,18); (2,18); (3,18); (4,18); (5,18); (6,18); (7,18); (8,18); (9,18); (10,18); (11,18); (12,18); (13,18); (14,18); (15,18); (16,18); (17,18); (18,18); (19,18); (20,18); (0,19); (1,19); (2,19); (3,19); (4,19); (5,19); (6,19); (7,19); (8,19); (9,19); (10,19); (11,19); (12,19); (13,19); (14,19); (15,19); (16,19); (17,19); (18,19); (19,19); (20,19); (0,20); (1,20); (2,20); (3,20); (4,20); (5,20); (6,20); (7,20); (8,20); (9,20); (10,20); (11,20); (12,20); (13,20); (14,20); (15,20); (16,20); (17,20); (18,20); (19,20); (20,20)

In a preferred embodiment the structural entity is a CNT with the following chiral vectors (n, m):

n is between 0 and 20, such as between 0 and 10, such as between 0 and 5, such as between 0 and 2.

n is between 0 and 20, such as between 10 and 20, such as between 15 and 20, such as between 17 and 20.

p is between 0 and 20, such as between 0 and 10, such as between 0 and 5, such as between 0 and 2.

p is between 0 and 20, such as between 10 and 20, such as between 15 and 20, such as between 17 and 20.

Examples of structural entities consisting of only gold (Au) include gold nanotubes and gold nanowires.

Examples of structural entities consisting of only titanium include titanium rods and titanium plates.

Examples of structural entities consisting of only silver include silver fibres and silver cones.

Examples of structural entities consisting of only zinc include zinc nanotubes and zinc particles.

Examples of structural entities consisting of only copper include copper spheres and copper wires.

SEs consisting of two elements, or two types of elements. Examples of SEs comprising zinc and oxygen, or boron and nitride are ZnO nanorods, ZnO nanowires, ZnO nanotubes, ZnO Nanohelices/nanosprings, seamless nanorings, nanopropellers, nanowires, such as single-crystal nanowires, ZnO nanobelts, polyhedral cages, single-wall boron nitride nanotubes, double-wall boron nitride nanotubes, triple-wall boron nitride nanotube, multi-wall boron nitride nanotubes, pristine boron nitride nanotubes, coated boron nitride nanotubes, perfect boron nitride nanotubes, imperfect boron nitride nanotubes, bucky paper, single-layer boron nitride, double-layer boron nitride, triple-layer boron nitride, multi-layer boron nitride, pristine boron nitride, coated boron nitride, perfect boron nitride and imperfect boron nitride.

If comprising only two elements, the elements may include any of the following: Hydrogen (H), Lithium (Li), Beryllium (Be), Boron (B), Carbon (C), Nitrogen (N), Oxygen (O), Fluorine (F), Sodium (Na), Magnesium (Mg), Aluminium (Al), Silicon (Si), Phosphorus (P), Sulfur (S), Chlorine (Cl), Potassium (K), Calcium (Ca), Scandium (Sc), Titanium (Ti), Vanadium (V), Chromium (Cr), Manganese (Mn), Iron (Fe), Cobalt (Co), Nickel (Ni), Copper (Cu), Zinc (Zn), Gallium (Ga), Germanium (Ge), Arsenic (As), Selenium (Se), Bromine (Br), Rubidium (Rb), Strontium (Sr), Yttrium (Y), Zirconium (Zr), Niobium (Nb), Molybdenum (Mo), Technetium (Tc), Ruthenium (Ru), Rhodium (Rh), Palladium (Pd), Silver (Ag), Cadmium (Cd), Indium (In), Tin (Sn), Antimony (Sb), Tellurium (Te), Iodine (I), Caesium (Cs), Barium (Ba), Platinum (Pt), Gold (Au), Mercury (Hg), Thallium (Tl), Lead (Pb), Bismuth (Bi).

Examples of structural entities consisting of only zinc (Zn) and oxygen (O) include ZnO nanotubes.

Examples of structural entities consisting of only carbon (C) and hydrogen (H) include polyethylene, polypropylene, polystyrene, graphane.

Examples of structural entities consisting of only boron (B) and nitrogen (N) include boron nitride and boron nitride nanotubes

Examples of structural entities consisting of two elements include polytetrafluoroethylene (comprising C, F).

Comprising C and O: Graphene oxide

Comprising C and F: Fluorinated graphene

SEs consisting of three elements, or three types of elements. If comprising only three elements, the elements may include any of the following:

Hydrogen (H), Lithium (Li), Beryllium (Be), Boron (B), Carbon (C), Nitrogen (N), Oxygen (O), Fluorine (F), Sodium (Na), Magnesium (Mg), Aluminium (Al), Silicon (Si), Phosphorus (P), Sulfur (S), Chlorine (Cl), Potassium (K), Calcium (Ca), Scandium (Sc), Titanium (Ti), Vanadium (V), Chromium (Cr), Manganese (Mn), Iron (Fe), Cobalt (Co), Nickel (Ni), Copper (Cu), Zinc (Zn), Gallium (Ga), Germanium (Ge), Arsenic (As), Selenium (Se), Bromine (Br), Rubidium (Rb), Strontium (Sr), Yttrium (Y), Zirconium (Zr), Niobium (Nb), Molybdenum (Mo), Technetium (Tc), Ruthenium (Ru), Rhodium (Rh), Palladium (Pd), Silver (Ag), Cadmium (Cd), Indium (In), Tin (Sn), Antimony (Sb), Tellurium (Te), Iodine (I), Caesium (Cs), Barium (Ba), Platinum (Pt), Gold (Au), Mercury (Hg), Thallium (Tl), Lead (Pb), Bismuth (Bi).

Examples of structural entities consisting of three elements include the following:

Comprising C, H, Cl: polyvinylchloride

Comprising C, H, O: poly(vinylalcohol)

Comprising C, H, N: polyacrylonitrile

Comprising C, H, Si: Poly[(dimethylsilylene)methylene]

Comprising C, H, S: Poly(thiophene)

Comprising C, S, H: thiol-functionalized graphene

Comprising C, O, H: hydroxide-functionalized graphene

Comprising C, S, H: thiol-functionalized carbon nanotubes

Comprising C, O, H: hydroxide-functionalized carbon nanotubes

Comprising B, N, O: boron nitride oxide

Comprising B, N, F: fluorinated boron nitride

SEs consisting of four elements, or four kinds of elements. If comprising only four elements, the elements may include any of the following: Hydrogen (H), Lithium (Li), Beryllium (Be), Boron (B), Carbon (C), Nitrogen (N), Oxygen (O), Fluorine (F), Sodium (Na), Magnesium (Mg), Aluminium (Al), Silicon (Si), Phosphorus (P), Sulfur (S), Chlorine (Cl), Potassium (K), Calcium (Ca), Scandium (Sc), Titanium (Ti), Vanadium (V), Chromium (Cr), Manganese (Mn), Iron (Fe), Cobalt (Co), Nickel (Ni), Copper (Cu), Zinc (Zn), Gallium (Ga), Germanium (Ge), Arsenic (As), Selenium (Se), Bromine (Br), Rubidium (Rb), Strontium (Sr), Yttrium (Y), Zirconium (Zr), Niobium (Nb), Molybdenum (Mo), Technetium (Tc), Ruthenium (Ru), Rhodium (Rh), Palladium (Pd), Silver (Ag), Cadmium (Cd), Indium (In), Tin (Sn), Antimony (Sb), Tellurium (Te), Iodine (I), Caesium (Cs), Barium (Ba), Platinum (Pt), Gold (Au), Mercury (Hg), Thallium (Tl), Lead (Pb), Bismuth (Bi).

Examples of structural entities consisting of four elements include the following:

Comprising C, H, Cl, O: Poly(vinyl chloroacetate)

Comprising C, H, O, N: Proteins, peptides.

SEs consisting of more than four elements. If comprising more than four elements, the elements may include any of the following kinds: Hydrogen (H), Lithium (Li), Beryllium (Be), Boron (B), Carbon (C), Nitrogen (N), Oxygen (O), Fluorine (F), Sodium (Na), Magnesium (Mg), Aluminium (Al), Silicon (Si), Phosphorus (P), Sulfur (S), Chlorine (Cl), Potassium (K), Calcium (Ca), Scandium (Sc), Titanium (Ti), Vanadium (V), Chromium (Cr), Manganese (Mn), Iron (Fe), Cobalt (Co), Nickel (Ni), Copper (Cu), Zinc (Zn), Gallium (Ga), Germanium (Ge), Arsenic (As), Selenium (Se), Bromine (Br), Rubidium (Rb), Strontium (Sr), Yttrium (Y), Zirconium (Zr), Niobium (Nb), Molybdenum (Mo), Technetium (Tc), Ruthenium (Ru), Rhodium (Rh), Palladium (Pd), Silver (Ag), Cadmium (Cd), Indium (In), Tin (Sn), Antimony (Sb), Tellurium (Te), Iodine (I), Caesium (Cs), Barium (Ba), Platinum (Pt), Gold (Au), Mercury (Hg), Thallium (Tl), Lead (Pb), Bismuth (Bi).

Examples of structural entities consisting of more than four elements include the following:

Comprising C, H, N, O, P: Nucleic acids

A structural entity may consist of just one atom (in its non-charged form or as an ion, e.g. Gd or Gd⁺⁺⁺), or may consist of several atoms, held together in an organized structure.

Comprising zinc only: Zinc nanotubes.

Example SEs. The following is a non-exhaustive list of structural entities: polymer, plastic, metal, additive, filler, inorganic polymer, organic polymer, supramolecular structure, fibers or filaments of

human, animal or plant origin, macromolecular structure, polyethylene (PE), polypropylene (PP), polyvinylchloride (PVC), polystyrene (PS), poly(vinylalcohol) (PVAL), polyvinylacetate (PVAC), poly(4-methyl-1-pentene), poly(1,4-butadiene), polyisoprene, polyacrylonitrile (PAN), polymethylmethacrylate (PMMA), poly(n-alkylmethacrylate), poly(n-alkylacrylate), poly(ethylene terephthalate) (PETP), poly(butylenes terephthalate) (PBTP), polytetrafluoroethylene (PTFE), polyamide 6 (PA 6), polyamide n (PAn), polyamide 6,10 (PA 6,10), polyoxymethylene (POM), polyethyleneoxide (PEO), poly(vinylidene dichloride) (PVDC), poly(vinylidene difluoride) (PVDF), epoxy, boron nitride, boron nitride nanotubes, carbon nanotube, zinc nanotube, graphene, myosin, actin, metal, steel, Kevlar filament, metal-oxide, alloy, silk, cotton, wool, latex, rubber, aluminum, copper, polymers, ceramic, metals, cement, and concrete.

Example SEs also include naturally occurring and synthetic organic materials which are pure monomeric compounds or mixtures of such compounds, for example mineral oils, animal and vegetable fats, oil and waxes, or oils, fats and waxes based on synthetic esters (e.g. phthalates, adipates, phosphates or trimellitates) and also mixtures of synthetic esters with mineral oils in any weight ratios, typically those used as spinning compositions, as well as aqueous emulsions of such materials.

Additives. The following is a non-comprehensive list of preferred structural entities, often categorized as the additives of a composite material.

Group 3: Additives.

Calcium carbonate, silicates, glass fibres, glass bulbs, asbestos, talc, kaolin, mica, barium sulfate, metal oxides and hydroxides, wood fiber, carbon fiber, bamboo fiber, UV absorbers, colourants, plasticisers, aluminum fiber, carbon black, graphite, wood flour and flours or fibers of other natural products, synthetic fibers; nano-materials, very finely dispersed or exfoliated layer structures are particularly useful, as for example montmorillonite, bentonite and the like, as well as natural or synthetic nano-tube fillers like halloysites, zeolites or carbon-based nano-tubes or layer materials of the graphene or boron nitride type.

In a preferred embodiment, the structural entity is a nucleating agent. Nucleating agents minimize the size of the interphase around fillers. By incorporating the nucleating agent into the CMU of the present invention, it is possible to control the crystalizing tendency of the interphase, and in this way improve the quality of a composite material. See also Example 13 and Figure 25.

Nucleating agents suitable for the present invention includes, but are not limited to: aromatic carboxylic acid salts; sodium benzoate; talc; pigment colorants; phosphate ester salts; calcium

carbonate; glass; chalk; clay; kaolin; silicates; pigments; cadmium red; cobalt yellow; chromium oxide; titanium dioxide; magnesium oxide; carbonates; sulfates; carbon black; salts of carboxylic acids; benzophenone; polymers; organic liquids; polyamide-66; molybdenum disulfide; iron sulfide; titanium dioxide; sodium phenylphosphinate; potassium stearate; organic pigments; sodium benzoate; kaolin; triphenodithiazine; pimelic acid with calcium stearate; calcium stearate; pimelic acid; quinacridone permanent red dye; N,N-dicyclohexylnaphthalene-2,6-dicarboxamide; 1,2,3,4-bis-dibenzylidene sorbitol (DBS); 1,2,3,4-bis-(p-methoxybenzylidene sorbitol) (DOS); 1,2,3,4-bis-(3,4-dimethylbenzylidene sorbitol) (MBDS); 1,3:2,4-di(3,4-dimethylbenzylidene) sorbitol (DMDBS); metal salts of substituted aromatic heterocyclic phosphate; sodium 2,2'-methylene-bis-(4,6-di-t-butylphenylene)phosphate (NA-11); salts of 2,2'-methylene-bis-(4,6-di-t-butylphenylene)phosphate; lithium 2,2'-methylene-bis-(4,6-di-t-butylphenylene)phosphate; potassium 2,2'-methylene-bis-(4,6-di-t-butylphenylene)phosphate; linear trans quinacridone (LTQ); γ -modification of LTO; calcium carboxylates, calcium salts of suberic acid (Ca-sub), calcium salts of pimelic acid (Ca-pim); N,N'-dicyclohexyl-2,6-naphthalene dicarboxamide (NJS); bicyclo[2.2.1]heptane dicarboxylate salt (HPN-68); Hyperform HPN-20E; ionomers; metal oxides; metal hybrids; organic compounds; residual catalysts; polymers; fibers; hydroxyl group-containing triglyceride oils; organic acid metal salts.

As can be seen, the structural entities SE1 and SE2 may e.g. both be a polymer, both may be an additive, both may be a filler, or one may be an additive and the other a polymer, or some other structural entity.

SE1 or SE2 may be the most abundant part of a matrix material. For example, in a composite material of PVC and carbon nanotubes, where a linker carrying two MLs or Ligand2s, one of which is attached to a PVC polymer molecule and the other is attached to a carbon nanotube, and where the PVC polymers constitute ~99 % of the composite material and the carbon nanotubes constitute ~1 % of the composite material, the PVC is considered the matrix material of the composite.

SE1 and SE2 may be the same or different. Example pairs of SE1 and SE2 are shown below:

<u>SE1</u>	<u>SE2</u>
Carbon nanotube	Epoxy
Carbon nanotube	Polyvinyl
Carbon nanotube	Polystyrene
Graphene	Epoxy
Kevlar	Polypropylene
Silk	Metal (e.g. iron, zinc, copper)

Metal alloy	Collagen
Collagen	Carbon nanotube
Myosin	Steel
Actin	Carbon nanotube
Cement (C-S-H)	Nanotube
Carbon nanotube	Carbon nanotube
Graphene	Graphene
Carbon nanotube	Carbon nanotube
Polyvinyl	Polyvinyl
BN	BNNT

The abovementioned structural entities (SEs) may be modified. Thus, a structural entity may be modified by the addition of one or more functional groups. Examples of simple functional groups are OH, NH₂, CO, COOH, SH. More complex functional groups are biotin, antibody, and metal chelate.

In a preferred embodiment this modification introduces a charged or polar group. The polar or charged group may be advantageous in order to make the SE soluble, or in order to allow strong ionic bond interactions with another SE or with a linker moiety. As an example, CNTs may be modified with charged or polar groups in order to make the CNTs soluble in polar solvents. In another preferred embodiment the modification of the SE introduces a reactive yet non-polar, non-charged group. Such groups may be preferable in cases where for example the polymerization reaction forming a composite material is inhibited by polar or charged groups. An example functionalisation is the introduction of a polyvinyl group on the surface of a CNT. Alternatively, the functionalization may be mediated by the binding of mechanical ligands that either themselves modify the characteristics of the CNT in a desired way, or mechanical ligands that carry functional groups that mediate the desired change in characteristics of the CNT.

Mechanical Ligand (ML) and Ligand2.

A precursor-ML, ML or Ligand2 suitable for the present invention may have a number of characteristics. One important characteristic is the affinity (or dissociation constant) of the interaction between the SE and either of the precursor-ML, ML, or Ligand2. A high affinity of the precursor-ML for the SE will increase the number of precursor-MLs that are bound at a given time, and therefore may increase the number of precursor-MLs that are turned into a ML. However, if certain binding modes of the precursor-ML are incompatible with the formation of the ML, a lower affinity may be preferred, as a lower affinity is typically associated with faster off-rates and therefore faster kinetics

of association/dissociation, which will allow the precursor-ML to be involved in a larger number of binding events, potentially increasing the likelihood of the correct binding mode to take place, and thereby promoting ML formation. Once the ML has been formed, a high affinity may serve to lock the ML at the position where it was formed, which can be advantageous in some cases. In other cases, an even distribution of the MLs on the SE may be promoted by MLs with lower affinity for the SE. For Ligand2 it may be attractive in some cases that the Ligand2 is tightly associated with the SE, as this may increase eg. the strength of a composite material. If on the other hand flexibility of a composite material is desired, it may be advantageous that the Ligand2 binds the SE with lower affinity, allowing the Ligand2 to dissociate more easily from the SE.

For any characteristics of a precursor-ML, ML or Ligand2 mentioned above, and in each characteristic's entire range, a further characteristic of importance is the molecular weight (MW) of the precursor-ML, ML or Ligand2.

MW of precursor-ML, ML or Ligand2. The molecular weight of the precursor-ML, ML or Ligand2 may be of high economic importance (smaller compounds typically cost less to produce), and also, a smaller molecular weight is often indicative of a smaller surface of interaction with the SE, wherefore typically a higher number of precursor-ML, ML or Ligand2s can bind simultaneously to the SE if their MWs are low. Thus, depending on the context, the MW is preferably less than 100,000,000 Dal, such as less than 10,000,000 Dal, such as less than 5,000,000 Dal, such as less than 2,000,000 Dal, such as less than 1,000,000 Dal, such as less than 500,000 Dal, such as less than 200,000 Dal, such as less than 100,000 Dal, such as less than 40,000 Dal, such as less than 20,000 Dal, such as less than 10,000 Dal, such as less than 7,000 Dal, such as less than 5,000 Dal, such as less than 3,000 Dal, such as less than 2,000 Dal, such as less than 1,700 Dal, such as less than 1,400 Dal, such as less than 1,200 Dal, such as less than 1,000 Dal, such as less than 900 Dal, such as less than 800 Dal, such as less than 700 Dal, such as less than 600 Dal, such as less than 500 Dal, such as less than 400 Dal, such as less than 300 Dal, such as less than 200 Dal, such as less than 100 Dal, such as less than 1 Dal.

However, it is typically easier to prepare a precursor-ML, ML or Ligand2 of high affinity if its molecular weight is higher. Thus, depending on the context, the MW is preferably greater than 1 Dal, such as greater than 100 Dal, such as greater than 200 Dal, such as greater than 300 Dal, such as greater than 400 Dal, such as greater than 500 Dal, such as greater than 600 Dal, such as greater than 700 Dal, such as greater than 800 Dal, such as greater than 900 Dal, such as greater than 1,000 Dal, such as greater than 1,200 Dal, such as greater than 1,400 Dal, such as greater than 1,700 Dal, such as greater than 2,000 Dal, such as greater than 3,000 Dal, such as greater than 5,000 Dal, such as greater

than 7,000 Dal, such as greater than 10,000 Dal, such as greater than 20,000 Dal, such as greater than 40,000 Dal, such as greater than 100,000 Dal, such as greater than 200,000 Dal, such as greater than 500,000 Dal, such as greater than 1,000,000 Dal, such as greater than 2,000,000 Dal, such as greater than 5,000,000 Dal, such as greater than 10,000,000 Dal, such as greater than 100,000,000 Dal.

Therefore, depending on the application and context, the molecular weight of a precursor-ML, ML or Ligand2 may preferably be low, medium or high. Preferred embodiments of the present invention therefore include precursor-ML, ML or Ligand2s with molecular weight of 1–100 Dal; 100–200 Dal, 200–300 Dal, 300–400 Dal, 400–500 Dal, 500–600 Dal, 600–700 Dal, 700–800 Dal, 800–900 Dal, 900–1000 Dal, 1,000–1200 Dal, 1,200–1,400 Dal, 1,400–1,700 Dal, 1,700–2,000 Dal, 2,000–3,000 Dal, 3,000–5,000 Dal, 5,000–7,000 Dal, 7,000–10,000 Dal, 10,000–20,000 Dal, 20,000–40,000 Dal, 40,000–100,000 Dal, 100,000–200,000 Dal, 200,000–500,000 Dal, 500,000–1,000,000 Dal, 1,000,000–2,000,000 Dal, 2,000,000–5,000,000 Dal, 5,000,000–10,000,000 Dal, 10,000,000–100,000,000 Dal, or larger than 100,000,000 Dal.

Chemical moieties. The precursor-ML's, ML's or Ligand2's content of chemical moieties is important, either because the chemical moiety is important for the interaction with the SE, or because the chemical moiety is important for reactivity or non-reactivity of the precursor-ML, ML or Ligand2 with e.g. the polymerization reaction. Generally preferred chemical moieties include –NH₂, –COOH, –CONH₂, –SH, phenyl, benzene, and . The following chemical motifs are preferred chemical motifs comprised within fullerene-binding precursor-MLs, MLs or Ligand2s, and are particularly preferred chemical motifs of CNT- and graphene-binding precursor-MLs, MLs, or Ligand2s, suitable for use in the present invention:

- Aromatic systems, including benzene, nitrobenzene, toluene, 1,2,3-trichlorobenzene, 1,2,4-trichlorobenzene, m-dinitrobenzene, p-nitrobenzene, naphthalene, anthracene, fluoranthene, phenanthrene, pyrene, pyrene-diamine, pyrene-phenyl ester, dipyrene (phenyl ester), tetracycline, as well as their substituted variants;
- Halogens, nitro group, amine, thiol, alcohol, ester, amide, carboxylic acid, phenol, indole, imidazole, sulfonate and phosphate;
- Alkane, including hexane and heptane;
- Soap-type molecules, including chemical motifs comprising a long alkane (including C₄, C₅, C₆, C₇, C₈, C₉, C₁₀, C₁₁, C₁₂, C₁₃, C₁₄, C₁₅, C₁₆, C₁₇, C₁₈, C₁₉, C₂₀, C₂₁, C₂₂, C₂₃, C₂₄, C₂₅) and a polar end group such as sulfonate, for example SDBS, Sodium dodecylbenzenesulfonate;
- Lactames, such as N-methyl-pyrrolidone and lactones;

- Peptides, in particular peptides with hydrophilic amino acids at the ends of the peptide and hydrophobic amino acids in the middle.
- Peptides such as QLMHDYR, CPTSTGQAC, CTLHVSSYC, RLNPPSQMDPPF, QTWPPPLWFSTS, HTDWRLGTWHHS, ELWSIDTSAHRK, IFRLSWGTYFS, HWKHPWGAWDTL, ELWR, ELWRPTR, KPRSVSG-dansyl, TGTG-F-GTCT, TGTG-V-GTCT, TGTG-W-GTCT, TGTG-T-GTCT, TGTG-G-GTCT, TGTG-N-GTCT, TGTG-K-GTCT, TGTG-D-GTCT, MHGKTQATSGTIQS, DAEFRHDSGYEVHHQKLVFFAEDVGSNKGAIIGLMVGGVVIA, DAEFRHDSGYEVHHQKLVFFAEDVGSNKGAIIGLMVGGVV, CHKKPSKSC, RKLDPAPGMHTW, SCSDCLKSVDFIPSSLASS, YLTMPTP, FSWEAFA, HLESTPG, GETRAPL, RHEPPLA, GETQCAA, FPGRPSP, HTAQSTA, HKPDANR, FPGHSGP, THLPWQT, GETQCAA, FPGRPSP, HTAQSTA, VKTQATSREEPPRLPSKHRPG
- Amino acids such as phenylalanine, tyrosine, tryptophan, histidine;
- Heteroaromatic systems, including pyrrole, thiophene, furane, pyrazole, imidazole, isoxazole, oxazole, isothiazole, thiazole, pyridine and perylene bisimides
- Fused ring systems, composed of either aromatic, non-aromatic or anti-aromatic rings or combinations thereof.

Affinity of non-covalent Ligand2. For non-covalent interactions, a low affinity (i.e. a high dissociation constant) may sometimes be preferred. For example, if flexibility of a composite material is desired, it may be preferred that the Ligand2-SE interaction is weak, allowing easy dissociation. Thus, depending on the context, the dissociation constant is preferably greater than 10^{-30} M, such as greater than 10^{-25} M, such as greater than 10^{-20} M, such as greater than 10^{-18} M, such as greater than 10^{-16} M, such as greater than 10^{-15} M, such as greater than 10^{-14} M, such as greater than 10^{-13} M, such as greater than 10^{-12} M, such as greater than 10^{-11} M, such as greater than 10^{-10} M, such as greater than 10^{-9} M, such as greater than 10^{-8} M, such as greater than 10^{-7} M, such as greater than 10^{-6} M, such as greater than 10^{-5} M, such as greater than 10^{-4} M, such as greater than 10^{-3} M, such as greater than 10^{-2} M, such as greater than 10^{-1} M.

Alternatively, if high strength and low flexibility of a composite material is required, it may be desired to have a very tight binding of a non-covalent Ligand2 to the SE. Thus, depending on the context, the dissociation constant is preferably less than 10^{-1} M, such as less than 10^{-2} M, such as less than 10^{-3} M, such as less than 10^{-4} M, such as less than 10^{-5} M, such as less than 10^{-6} M, such as less than 10^{-7} M, such as less than 10^{-8} M, such as less than 10^{-9} M, such as less than 10^{-10} M, such as less than 10^{-11} M, such as less than 10^{-12} M, such as less than 10^{-13} M, such as less than 10^{-14} M, such as

less than 10^{-15} M, such as less than 10^{-16} M, such as less than 10^{-18} M, such as less than 10^{-20} M, such as less than 10^{-25} M, such as less than 10^{-30} M.

Also, if a Ligand2's binding strength is strongly dependent on temperature, systems can be designed that are flexible at high temperatures and rigid at lower temperatures, effectuated by the Ligand2's affinity for the SE. Thus, preferred embodiments of non-covalently interacting Ligand2s of the present invention include Ligand2s whose dissociation constant for the interaction with SE is smaller than 10^{-30} M, and include Ligand2s whose dissociation constant is in one of the following ranges: 10^{-30} – 10^{-25} M, 10^{-25} – 10^{-20} M, 10^{-20} – 10^{-18} M, 10^{-18} – 10^{-16} M, 10^{-16} – 10^{-15} M, 10^{-15} – 10^{-14} M, 10^{-14} – 10^{-13} M, 10^{-13} – 10^{-12} M, 10^{-12} – 10^{-11} M, 10^{-11} – 10^{-10} M, 10^{-10} – 10^{-9} M, 10^{-9} – 10^{-8} M, 10^{-8} – 10^{-7} M, 10^{-7} – 10^{-6} M, 10^{-6} – 10^{-5} M, 10^{-5} – 10^{-4} M, 10^{-4} – 10^{-3} M, 10^{-3} – 10^{-2} M, 10^{-2} – 10^{-1} M, or larger than 10^{-1} M.

As described above and below, the precursor-ML, ML and/or Ligand2 will often contain chemical motifs that interact with the SE. Below is a list of such preferred chemical motifs, appropriate for making CMUs by combination with the indicated SEs, and their binding strength for different SEs (e.g. in the form of a dissociation constant).

Group 4: Chemical motifs and the structural entities with which they react.

Chemical Motif ^a	MW [g/mol]	K _d ^b [M]	K _d /MW [M/Dal]	SE ^c	Affinity parameter value ^d	Ref. ^e
Nitrobenzene	123.1			MWNT	1,380 L/kg	Kragulj <i>et al.</i> 2013
Hexane	86.2			MWNT	2,291 L/kg	Kragulj <i>et al.</i> 2013
Benzene	78.1			MWNT	126 L/kg	Kragulj <i>et al.</i> 2013
Toluene	92.1			MWNT	331 L/kg	Kragulj <i>et al.</i> 2013
1,2,3-Trichloro- benzene	181.5			MWNT	12,882 L/kg	Kragulj <i>et al.</i> 2013
1,2,4-Trichloro- benzene	181.5			MWNT	5,370 L/kg	Kragulj <i>et al.</i> 2013

Chemical Motif ^a	MW [g/mol]	K _d ^b [M]	K _d /MW [M/Dal]	SE ^c	Affinity parameter value ^d	Ref. ^e
Naphtalene	128.2			MWNT	2,951 L/kg	Kragulj <i>et al.</i> 2013
Phenanthrene	178.2			MWNT	87,096 L/kg	Kragulj <i>et al.</i> 2013
Pyrene	202.3			MWNT	229,087 L/kg	Kragulj <i>et al.</i> 2013
Fluoranthene	202.3			MWNT	204,174 L/kg	Kragulj <i>et al.</i> 2013
Nitrobenzene	123.1			MWNT (acid treated, 3 hours)	575 L/kg	Kragulj <i>et al.</i> 2013
Hexane	86.2			MWNT (acid treated, 3 hours)	813 L/kg	Kragulj <i>et al.</i> 2013
Benzene	78.1			MWNT (acid treated, 3 hours)	302 L/kg	Kragulj <i>et al.</i> 2013
Toluene	92.1			MWNT (acid treated, 3 hours)	269 L/kg	Kragulj <i>et al.</i> 2013
1,2,3-Trichloro- benzene	181.5			MWNT (acid treated, 3 hours)	7,586 L/kg	Kragulj <i>et al.</i> 2013
1,2,4-Trichloro- benzene	181.5			MWNT (acid treated, 3 hours)	2,754 L/kg	Kragulj <i>et al.</i> 2013

Chemical Motif ^a	MW [g/mol]	K _d ^b [M]	K _d /MW [M/Dal]	SE ^c	Affinity parameter value ^d	Ref. ^e
Naphtalene	128.2			MWNT (acid treated, 3 hours)	4,786 L/kg	Kragulj <i>et al.</i> 2013
Phenanthrene	178.2			MWNT (acid treated, 3 hours)	199,526 L/kg	Kragulj <i>et al.</i> 2013
Pyrene	202.3			MWNT (acid treated, 3 hours)	457,088 L/kg	Kragulj <i>et al.</i> 2013
Fluoranthene	202.3			MWNT (acid treated, 3 hours)	371,535 L/kg	Kragulj <i>et al.</i> 2013
Nitrobenzene	123.1			MWNT (acid treated, 6 hours)	182 L/kg	Kragulj <i>et al.</i> 2013
Hexane	86.2			MWNT (acid treated, 6 hours)	562 L/kg	Kragulj <i>et al.</i> 2013
Benzene	78.1			MWNT (acid treated, 6 hours)	20 L/kg	Kragulj <i>et al.</i> 2013
Toluene	92.1			MWNT (acid treated, 6 hours)	32 L/kg	Kragulj <i>et al.</i> 2013
1,2,3-Trichloro- benzene	181.5			MWNT (acid treated, 6 hours)	8,511 L/kg	Kragulj <i>et al.</i> 2013

Chemical Motif ^a	MW [g/mol]	K _d ^b [M]	K _d /MW [M/Dal]	SE ^c	Affinity parameter value ^d	Ref. ^e
1,2,4-Trichloro- benzene	181.5			MWNT (acid treated, 6 hours)	9,772 L/kg	Kragulj <i>et al.</i> 2013
Naphtalene	128.2			MWNT (acid treated, 6 hours)	6,918 L/kg	Kragulj <i>et al.</i> 2013
Phenanthrene	178.2			MWNT (acid treated, 6 hours)	301,995 L/kg	Kragulj <i>et al.</i> 2013
Pyrene	202.3			MWNT (acid treated, 6 hours)	3,548,134 L/kg	Kragulj <i>et al.</i> 2013
Fluoranthene	202.3			MWNT (acid treated, 6 hours)	3,715,352 L/kg	Kragulj <i>et al.</i> 2013
Naphtalene	128.2			SWNT	10,000 L/kg	Ji <i>et al.</i> 2008
Naphtalene	128.2			MWNT	1,000 L/kg	Ji <i>et al.</i> 2008
Naphtalene	128.2			Activated carbon	1,000,000 L/kg	Ji <i>et al.</i> 2008
Naphtalene	128.2			Graphite	1,000 L/kg	Ji <i>et al.</i> 2008
Tetracycline	444.4			SWNT	100,000 L/kg	Ji <i>et al.</i> 2008
Tetracycline	444.4			MWNT	10,000 L/kg	Ji <i>et al.</i> 2008

Chemical Motif ^a	MW [g/mol]	K _d ^b [M]	K _d /MW [M/Dal]	SE ^c	Affinity parameter value ^d	Ref. ^e
Tetracycline	444.4			Activated carbon	10,000 L/kg	Ji <i>et al.</i> 2008
Tetracycline	444.4			Graphite	10,000 L/kg	Ji <i>et al.</i> 2008
QLMHDYR	962.1	1.6E-05	1.7E-08	PLLA (melt crystallization)	6.1E+04 M ⁻¹	Matsuno <i>et al.</i> 2008
QLMHDYR	962.1	1.8E-04	1.8E-07	PMMA (atactic)	5.7E+03 M ⁻¹	Matsuno <i>et al.</i> 2008
QLMHDYR	962.1	1.5E-04	1.5E-07	PLLA (amorphous)	6.8E+03 M ⁻¹	Matsuno <i>et al.</i> 2008
QLMHDYR	962.1	6.7E-05	6.9E-08	PLLA (layer by layer)	1.5E+04 M ⁻¹	Matsuno <i>et al.</i> 2008
QLMHDYR	962.1	2.1E-05	2.2E-08	PDLA	4.8E+04 M ⁻¹	Matsuno <i>et al.</i> 2008
CPTSTGQAC	867	2.8E-07	3.2E-10	Platinum	3.6E+06 M ⁻¹	Seker <i>et al.</i> 2011
CTLHVSSYC	1,012	1.1E-06	1.1E-09	Platinum	9.0E+05 M ⁻¹	Seker <i>et al.</i> 2011
RLNPPSQMD-PPF	1,399	8.3E-06	6.0E-09	Silica	1.2E+05 M ⁻¹	Seker <i>et al.</i> 2011
QTWPPPLWF-STs	1,447	8.1E-07	5.6E-10	Silica	1.2E+06 M ⁻¹	Seker <i>et al.</i> 2011
HTDWRLGT-WHHS	1,533	1.3E-06	8.5E-10	PPV (hyper- branched)	7.7E+05 M ⁻¹	Eijima <i>et al.</i> 2010

Chemical Motif ^a	MW [g/mol]	K _d ^b [M]	K _d /MW [M/Dal]	SE ^c	Affinity parameter value ^d	Ref. ^e
HTDWRLGT-WHHS	1,533	1.9E-05	1.3E-08	PPV (linear)	5.2E+04 M ⁻¹	Eijima <i>et al.</i> 2010
ELWSIDTSA-HRK	1,443	2.7E-05	1.9E-08	PPV (hyper-branched)	3.7E+04 M ⁻¹	Eijima <i>et al.</i> 2010
ELWSIDTSA-HRK	1,443	1.3E-05	9.0E-09	PPV (linear)	7.7E+04 M ⁻¹	Eijima <i>et al.</i> 2010
Sodium dodecyl-benzenesulfonate	288.4	8.9E-04	3.1E-06	SWNT (8,6)	1.1E+03 M ⁻¹	Sim <i>et al.</i> 2013
Sodium dodecyl-benzenesulfonate	288.4	7.1E-04	2.5E-06	SWNT (6,5)	1.4E+03 M ⁻¹	Sim <i>et al.</i> 2013
Sodium dodecyl-benzenesulfonate	288.4	6.4E-04	2.2E-06	SWNT (10,2)	1.6E+03 M ⁻¹	Sim <i>et al.</i> 2013
IFRLSWGTYFS	1,377	2.0E-05	1.5E-08	SWNT (HiPco, raw)	5.0E+04 M ⁻¹	Li <i>et al.</i> 2013
HWKHPWGA-WDTL	1,534	5.0E-05	3.3E-08	MWNT (array)	2.0E+04 M ⁻¹	Wang <i>et al.</i> 2003
ELWR	602.7	6.3E-04	1.0E-06	PMMA (isotactic)	1.6E+03 M ⁻¹	Serizawa <i>et al.</i> 2007
ELWRPTR	957.1	3.6E-06	3.7E-09	PMMA (isotactic)	2.8E+05 M ⁻¹	Serizawa <i>et al.</i> 2007
ELWRPTR	957.1	1.5E-04	1.5E-07	PMMA (syndio-tactic)	6.8E+03 M ⁻¹	Serizawa <i>et al.</i> 2007
KPRSVSG	965	5.4E-06	5.6E-09	Ceramic fluorapatite	1.9E+05 M ⁻¹	Islam <i>et al.</i> 2012

Chemical Motif ^a	MW [g/mol]	K _d ^b [M]	K _d /MW [M/Dal]	SE ^c	Affinity parameter value ^d	Ref. ^e
KPRSVSG	965	7.2E-06	7.5E-09	Ceramic hydroxyl- apatite	1.4E+05 M ⁻¹	Islam <i>et al.</i> 2012
Pyrene	202.3	6.1E-02	3.0E-04	SWNT (plasma purified)	1.6E+01 M ⁻¹	Juan <i>et al.</i> 2015
Pyrene	202.3	4.2E-02	2.1E-04	SWNT (plasma purified)	2.4E+01 M ⁻¹	Juan <i>et al.</i> 2015
Pyrene	202.3	4.8E-02	2.4E-04	SWNT (plasma purified)	2.1E+01 M ⁻¹	Juan <i>et al.</i> 2015
Pyrene	202.3	1.1E-01	5.5E-04	SWNT (plasma purified)	9.0E+00 M ⁻¹	Juan <i>et al.</i> 2015
Pyrene	202.3	2.2E-01	1.1E-03	SWNT (plasma purified)	4.5E+00 M ⁻¹	Juan <i>et al.</i> 2015
Pyrene	202.3	3.8E-04	1.9E-06	SWNT (plasma purified)	2.6E+03 M ⁻¹	Juan <i>et al.</i> 2015
Pyrene	202.3	2.4E-02	1.2E-04	SWNT (6,5)	4.1E+01 M ⁻¹	Juan <i>et al.</i> 2015
Pyrene	202.3	6.3E-01	3.1E-03	SWNT (6,5)	1.6E+00 M ⁻¹	Juan <i>et al.</i> 2015
Pyrene	202.3	6.3E-01	3.1E-03	SWNT (6,5)	1.6E+00 M ⁻¹	Juan <i>et al.</i> 2015

Chemical Motif ^a	MW [g/mol]	K _d ^b [M]	K _d /MW [M/Dal]	SE ^c	Affinity parameter value ^d	Ref. ^e
Pyrene	202.3	1.0E-03	4.9E-06	SWNT (6,5)	1.0E+03 M ⁻¹	Juan <i>et al.</i> 2015
Pyrene diamine	230	4.5E-03	2.0E-05	SWNT (plasma purified)	2.2E+02 M ⁻¹	Juan <i>et al.</i> 2015
Pyrene diamine	230	3.4E-02	1.5E-04	SWNT (6,5)	2.9E+01 M ⁻¹	Juan <i>et al.</i> 2015
Pyrene phenyl ester	240	1.1E-02	4.6E-05	SWNT (plasma purified)	9.0E+01 M ⁻¹	Juan <i>et al.</i> 2015
Pyrene phenyl ester	240	5.0E-02	2.1E-04	SWNT (plasma purified)	2.0E+01 M ⁻¹	Juan <i>et al.</i> 2015
Dipyrene phenyl ester	440	1.5E-04	3.5E-07	SWNT (plasma purified)	6.5E+03 M ⁻¹	Juan <i>et al.</i> 2015
Dipyrene phenyl ester	440	2.5E-04	5.7E-07	SWNT (plasma purified)	4.0E+03 M ⁻¹	Juan <i>et al.</i> 2015
Bis-pyrene U-shape molecule	640	1.4E-04	2.2E-07	SWNT (plasma purified)	7.0E+03 M ⁻¹	Juan <i>et al.</i> 2015
TGTGFGTCT	844			Quartz	-0.8 kcal/mol	Aby <i>et al.</i> 2012
TGTGVGTCT	796			Quartz	0.0 kcal/mol	Aby <i>et al.</i> 2012
TGTGWGTCT	883			Quartz	0.0 kcal/mol	Aby <i>et al.</i> 2012

Chemical Motif ^a	MW [g/mol]	K _d ^b [M]	K _d /MW [M/Dal]	SE ^c	Affinity parameter value ^d	Ref. ^e
TGTGTGTCT	798			Quartz	0.0 kcal/mol	Aby <i>et al.</i> 2012
TGTGGGTCT	754			Quartz	−0.9 kcal/mol	Aby <i>et al.</i> 2012
TGTGNGTCT	811			Quartz	−1.2 kcal/mol	Aby <i>et al.</i> 2012
TGTGKGTCT	825			Quartz	−0.2 kcal/mol	Aby <i>et al.</i> 2012
TGTGDGTCT	812			Quartz	−0.1 kcal/mol	Aby <i>et al.</i> 2012
TGTGFGTCT	844			Glass	−2.2 kcal/mol	Aby <i>et al.</i> 2012
TGTGVGTCT	796			Glass	−0.9 kcal/mol	Aby <i>et al.</i> 2012
TGTGWTCT	883			Glass	−0.3 kcal/mol	Aby <i>et al.</i> 2012
TGTGTGTCT	798			Glass	−1.0 kcal/mol	Aby <i>et al.</i> 2012
TGTGGGTCT	754			Glass	−1.9 kcal/mol	Aby <i>et al.</i> 2012
TGTGNGTCT	811			Glass	−2.2 kcal/mol	Aby <i>et al.</i> 2012
TGTGKGTCT	825			Glass	−0.9 kcal/mol	Aby <i>et al.</i> 2012
TGTGDGTCT	812			Glass	−0.2 kcal/mol	Aby <i>et al.</i> 2012

Chemical Motif ^a	MW [g/mol]	K _d ^b [M]	K _d /MW [M/Dal]	SE ^c	Affinity parameter value ^d	Ref. ^e
TGTGFGTCT	844			PMMA	−2.2 kcal/mol	Aby <i>et al.</i> 2012
TGTGVGTCT	796			PMMA	−2.0 kcal/mol	Aby <i>et al.</i> 2012
TGTGWTCT	883			PMMA	−0.9 kcal/mol	Aby <i>et al.</i> 2012
TGTGTGTCT	798			PMMA	−0.3 kcal/mol	Aby <i>et al.</i> 2012
TGTGGGTCT	754			PMMA	−2.1 kcal/mol	Aby <i>et al.</i> 2012
TGTGNGTCT	811			PMMA	−2.8 kcal/mol	Aby <i>et al.</i> 2012
TGTGKGTCT	825			PMMA	−1.2 kcal/mol	Aby <i>et al.</i> 2012
TGTGDGTCT	812			PMMA	−2.5 kcal/mol	Aby <i>et al.</i> 2012
TGTGFGTCT	844			HDPE	−3.9 kcal/mol	Aby <i>et al.</i> 2012
TGTGVGTCT	796			HDPE	−4.0 kcal/mol	Aby <i>et al.</i> 2012
TGTGWTCT	883			HDPE	−2.1 kcal/mol	Aby <i>et al.</i> 2012
TGTGTGTCT	798			HDPE	−1.8 kcal/mol	Aby <i>et al.</i> 2012
TGTGGGTCT	754			HDPE	−3.6 kcal/mol	Aby <i>et al.</i> 2012

Chemical Motif ^a	MW [g/mol]	K _d ^b [M]	K _d /MW [M/Dal]	SE ^c	Affinity parameter value ^d	Ref. ^e
TGTGNGTCT	811			HDPE	−3.5 kcal/mol	Aby <i>et al.</i> 2012
TGTGKGTCT	825			HDPE	−3.9 kcal/mol	Aby <i>et al.</i> 2012
TGTGDGTCT	812			HDPE	−2.8 kcal/mol	Aby <i>et al.</i> 2012
m-Dinitrobenzene	168.11			Graphene	0.0569 L/mg	Chen <i>et al.</i> 2015
m-Dinitrobenzene	168.11			Graphene oxide	0.00299 L/mg	Chen <i>et al.</i> 2015
m-Dinitrobenzene	168.11			Graphene oxide (reduced)	0.162 L/mg	Chen <i>et al.</i> 2015
Nitrobenzene	123.06			Graphene	0.0118 L/mg	Chen <i>et al.</i> 2015
Nitrobenzene	123.06			Graphene oxide	0.00105 L/mg	Chen <i>et al.</i> 2015
Nitrobenzene	123.06			Graphene oxide (reduced)	0.0330 L/mg	Chen <i>et al.</i> 2015
p-Nitrotoluene	137.14			Graphene	0.0939 L/mg	Chen <i>et al.</i> 2015
p-Nitrotoluene	137.14			Graphene oxide	0.00395 L/mg	Chen <i>et al.</i> 2015
p-Nitrotoluene	137.14			Graphene oxide (reduced)	0.121 L/mg	Chen <i>et al.</i> 2015

Chemical Motif ^a	MW [g/mol]	K _d ^b [M]	K _d /MW [M/Dal]	SE ^c	Affinity parameter value ^d	Ref. ^e
MHGKTQATS- GTIQS ₇	10,018	1.5E-10	1.5E-14	Gold	6.7E+09 M ⁻¹	Brown 1997
DAEFRHDSGY- EVHHQKLVFF- AEDVGSNKG- IIGLMVGGVVIA	4,514	6.3E-18	1.4E-21	Copper	1.6E+17 M ⁻¹	Atwood <i>et al.</i> 2000
DAEFRHDSGY- EVHHQKLVFF- AEDVGSNKG- IIGLMVGGVV	4,330	5.0E-11	1.2E-14	Copper	2.0E+10 M ⁻¹	Atwood <i>et al.</i> 2000
CHKKPSKSC	1,015	4.1E-09	4.0E-12	Silica	2.5E+08 M ⁻¹	Chen <i>et al.</i> 2006
RKLDPAPGM- HTW	1,408	1.3E-05	9.4E-09	Titanium	7.6E+04 M ⁻¹	Sano <i>et al.</i> 2005
SCSDCLKSVD- FIPSSLASS	1,946	2.5E-07	1.3E-10	Titanium	4.0E+06 M ⁻¹	Meyers <i>et al.</i> 2007
YLTMPPT	822	5.0E-12	6.1E-15	Polystyrene (syndiotactic)	2.0E+11 M ⁻¹	Serizawa <i>et al.</i> 2007
FSWEAFA	857	8.5E-11	9.9E-14	Polystyrene (atactic)	1.2E+10 M ⁻¹	Serizawa <i>et al.</i> 2007
FSWEAFA	857	3.4E-11	4.0E-14	Polystyrene (isotactic)	2.9E+10 M ⁻¹	Serizawa <i>et al.</i> 2007
FSWEAFA	857	6.1E-12	7.1E-15	Polystyrene (syndiotactic)	1.6E+11 M ⁻¹	Serizawa <i>et al.</i> 2007
HLESTPG	740	1.0E-10	1.4E-13	Polystyrene (atactic)	9.8E+09 M ⁻¹	Serizawa <i>et al.</i> 2007
HLESTPG	740	6.5E-11	8.8E-14	Polystyrene (isotactic)	1.5E+10 M ⁻¹	Serizawa <i>et al.</i> 2007

Chemical Motif ^a	MW [g/mol]	K _d ^b [M]	K _d /MW [M/Dal]	SE ^c	Affinity parameter value ^d	Ref. ^e
HLESTPG	740	7.9E-12	1.1E-14	Polystyrene (syndiotactic)	1.3E+11 M ⁻¹	Serizawa <i>et al.</i> 2007
GETRAPL	743	6.7E-11	9.0E-14	Polystyrene (atactic)	1.5E+10 M ⁻¹	Serizawa <i>et al.</i> 2007
GETRAPL	743	3.6E-11	4.9E-14	Polystyrene (isotactic)	2.8E+10 M ⁻¹	Serizawa <i>et al.</i> 2007
GETRAPL	743	6.7E-12	9.0E-15	Polystyrene (syndiotactic)	1.5E+11 M ⁻¹	Serizawa <i>et al.</i> 2007
RHEPPLA	819	5.6E-11	6.8E-14	Polystyrene (atactic)	1.8E+10 M ⁻¹	Serizawa <i>et al.</i> 2007
RHEPPLA	819	2.1E-11	2.6E-14	Polystyrene (isotactic)	4.7E+10 M ⁻¹	Serizawa <i>et al.</i> 2007
RHEPPLA	819	1.1E-11	1.3E-14	Polystyrene (syndiotactic)	9.4E+10 M ⁻¹	Serizawa <i>et al.</i> 2007
GETQCAA	679	3.4E-11	5.0E-14	Polystyrene (atactic)	3.0E+10 M ⁻¹	Serizawa <i>et al.</i> 2007
YLTMPPT	822	2.2E-11	2.6E-14	Polystyrene (atactic)	4.6E+10 M ⁻¹	Serizawa <i>et al.</i> 2007
FPGRPSP	757	3.1E-11	4.1E-14	Polystyrene (atactic)	3.2E+10 M ⁻¹	Serizawa <i>et al.</i> 2007
HTAQSTA	715	1.4E-11	2.0E-14	Polystyrene (atactic)	7.0E+10 M ⁻¹	Serizawa <i>et al.</i> 2007
HKPDANR	837	2.5E-11	3.0E-14	PMMA (conditioned syndiotactic film)	4.0E+10 M ⁻¹	Serizawa <i>et al.</i> 2007

Chemical Motif ^a	MW [g/mol]	K _d ^b [M]	K _d /MW [M/Dal]	SE ^c	Affinity parameter value ^d	Ref. ^e
FPGHSGP	698	1.0E-10	1.4E-13	PMMA (non- conditioned syndiotactic film)	1.0E+10 M ⁻¹	Serizawa <i>et al.</i> 2007
THLPWQT	882	6.7E-11	7.6E-14	PMMA (non- conditioned syndiotactic film)	1.5E+10 M ⁻¹	Serizawa <i>et al.</i> 2007
GETQCAA	679	7.4E-12	1.1E-14	Polystyrene (syndiotactic)	1.4E+11 M ⁻¹	Serizawa <i>et al.</i> 2007
FPGRPSP	757	8.5E-12	1.1E-14	Polystyrene (syndiotactic)	1.2E+11 M ⁻¹	Serizawa <i>et al.</i> 2007
HTAQSTA	715	1.0E-11	1.4E-14	Polystyrene (syndiotactic)	9.7E+10 M ⁻¹	Serizawa <i>et al.</i> 2007
VKTQATSREE- PPRLPSKHPG ₄	9,433	1.0E-10	1.1E-14	Zeolite	1.0E+10 M ⁻¹	Nygaard <i>et al.</i> 2002
PQAQDVELPQ- ELQDQHREVEV ₅	12,366	4.0E-11	3.2E-15	SWNT (HiPco, purified)	2.5E+10 M ⁻¹	Brown <i>et al.</i> 2008

^aAll chemical motifs denoted by capital letters are peptide sequences; for polypeptides, the subscripts denote how many times the peptide sequence is repeated. ^bK_d is the dissociation constant. ^cMWNT is multi walled carbon nanotube; SWNT is single walled carbon nanotube; PLLA is polylactic acid; PMMA is poly(methyl methacrylate); PDLA is poly-D-lactide; PPV is poly(*p*-phenylene vinylene); HDPE is high-density polyethylene; numbers in brackets after SWNTs denote chirality, e.g. (6,5).

^dAffinity parameter values with the unit L/kg are affinities expressed as the adsorption distribution coefficient; affinity parameter values with the unit M⁻¹ are affinities expressed as the affinity constant K_a, which is equal to 1/K_d; affinity parameter values with the unit kcal/mol are affinities expressed as

the standard-state adsorption free energy values ($\Delta G^{\circ}_{\text{ads}}$); affinity parameter values with the unit L/mg are affinities expressed as Langmuir affinity constant (K_L).

For any characteristics of a precursor-ML, ML or Ligand2 mentioned above, and in each characteristic's entire range, a further characteristic of importance is the Affinity-to-MW ratio of the precursor-ML, ML or Ligand2, respectively.

Binding constant-to-MW ratio of precursor-ML, ML or Ligand2. In some cases, it is not the absolute affinity of a precursor-ML, ML or Ligand2 for an SE that is important, but rather the affinity-to-MW (K_B/MW) ratio that is important. As an example, if the economical cost of preparing two small Ligand2s with a combined binding constant for an SE of $K_B = 10^{10} \text{ M}^{-1}$ is smaller than the cost of preparing one larger Ligand2 with the same binding constant, it may be desirable to use the smaller Ligand2s. Thus, depending on the context, the K_B/MW ratio is preferably greater than $1 \text{ M}^{-1}/\text{Dal}$, such as greater than $10^6 \text{ M}^{-1}/\text{Dal}$, such as greater than $10^{10} \text{ M}^{-1}/\text{Dal}$, such as greater than $10^{13} \text{ M}^{-1}/\text{Dal}$, such as greater than $10^{16} \text{ M}^{-1}/\text{Dal}$, such as greater than $10^{18} \text{ M}^{-1}/\text{Dal}$, such as greater than $10^{20} \text{ M}^{-1}/\text{Dal}$.

However, if the processing of the composite material is performed more easily using fewer precursor-MLs, MLs, or Ligand2s, it may be desirable to use larger precursor-MLs, MLs, or Ligand2s, respectively. Thus, depending on the context, the K_B/MW ratio is preferably less than $10^{20} \text{ M}^{-1}/\text{Dal}$, such as less than $10^{18} \text{ M}^{-1}/\text{Dal}$, such as less than $10^{16} \text{ M}^{-1}/\text{Dal}$, such as less than $10^{13} \text{ M}^{-1}/\text{Dal}$, such as less than $10^{10} \text{ M}^{-1}/\text{Dal}$, such as less than $10^6 \text{ M}^{-1}/\text{Dal}$, such as less than $1 \text{ M}^{-1}/\text{Dal}$.

Thus, the preferred compromise between many small precursor-MLs, MLs, or Ligand2s with relatively high K_B/MW ratios and fewer large precursor-MLs, MLs, or Ligand2s, respectively, with relatively low K_B/MW ratios depends on the context. Preferred embodiments include precursor-MLs, MLs, or Ligand2s with K_B/MW ratios of from $1 \text{ M}^{-1}/\text{Dal}$ to $10^{20} \text{ M}^{-1}/\text{Dal}$, more preferably precursor-MLs, MLs, or Ligand2s with K_B/MW ratios of from $10^3 \text{ M}^{-1}/\text{Dal}$ to $10^{20} \text{ M}^{-1}/\text{Dal}$, more preferably precursor-MLs, MLs, or Ligand2s with K_B/MW ratios of from $10^6 \text{ M}^{-1}/\text{Dal}$ to $10^{20} \text{ M}^{-1}/\text{Dal}$, more preferably precursor-MLs, MLs, or Ligand2s with K_B/MW ratios of from $10^{10} \text{ M}^{-1}/\text{Dal}$ to $10^{20} \text{ M}^{-1}/\text{Dal}$, more preferably precursor-MLs, MLs, or Ligand2s with K_B/MW ratios of from $10^{13} \text{ M}^{-1}/\text{Dal}$ to $10^{20} \text{ M}^{-1}/\text{Dal}$, more preferably precursor-MLs, MLs, or Ligand2s with K_B/MW ratios of from $10^{16} \text{ M}^{-1}/\text{Dal}$ to $10^{20} \text{ M}^{-1}/\text{Dal}$, more preferably precursor-MLs, MLs, or Ligand2s with K_B/MW ratios of from $10^{18} \text{ M}^{-1}/\text{Dal}$ to $10^{20} \text{ M}^{-1}/\text{Dal}$, and more preferably precursor-MLs, MLs, or Ligand2s with K_B/MW ratios larger than $10^{20} \text{ M}^{-1}/\text{Dal}$.

For any characteristics of a precursor-ML or Ligand2 mentioned above, and in each characteristic's entire range, a further characteristic of importance is the half-life of the precursor-ML-SE complex or the Ligand2-SE complex, respectively.

Half-life of precursor-ML or Ligand2. In many cases, precursor-MLs or Ligand2s with large half-lives are preferred. This is for example the case for Ligand2s in composite materials where the characteristics of the composite material should change as little over time as possible, e.g. in structural elements of buildings, bridges, etc. Thus, depending on the context, the half-life is preferably greater than 0.01 second, such as greater than 0.1 second, such as greater than 1 second, such as greater than 10 seconds, such as greater than 1 minute, such as greater than 10 minutes, such as greater than 1 hour, such as greater than 5 hours, such as greater than 10 hours, such as greater than 24 hours, such as greater than 2 days, such as greater than 10 days, such as greater than 50 days, such as greater than 100 days, such as greater than 1 year, such as greater than 10 years.

In other cases, precursor-MLs or Ligand2s with short half-lives are preferred. This may be the case if it is desirable that a material gives in after some prespecified time. Thus, depending on the context, the half-life is preferably less than 10 years, such as less than 1 year, such as less than 100 days, such as less than 50 days, such as less than 10 days, such as less than 2 days, such as less than 24 hours, such as less than 10 hours, such as less than 5 hours, such as less than 1 hour, such as less than 10 minutes, such as less than 1 minute, such as less than 10 seconds, such as less than 1 second, such as less than 0.1 second, such as less than 0.01 second.

Thus, the preferred compromise between long half-lives and short half-lives depends on the context and half-lives suitable for the present invention can be shorter than 0.01 second, but may also include half-lives in the following ranges: 0.01–0.1 seconds, 0.1–1 seconds, 1–10 seconds, 10–60 seconds, 1–10 minutes, 10–60 minutes, 1–5 hours, 5–10 hours, 10–24 hours, 1–2 days, 2–10 days, 10–50 days, 50–100 days, 100–365 days, 1–10 years, or more than 10 years. Eg. when the Ligand2-SE interaction is characterized by an appropriately long half-life, the SE and Ligand2 will remain associated for a long time, and the composite material comprising such CMUs will retain its characteristics for a longer period of time.

Half-life-to-MW ratio of precursor-ML or Ligand2. In some cases, it is not the half-life ($T_{1/2}$) of a precursor-ML or Ligand2 for an SE that is important, but rather the half-life-to-MW ($T_{1/2}/MW$) ratio that is important. As an example, if the economical cost of preparing two small precursor-MLs with a combined half life for an SE of $T_{1/2} = 5$ days is smaller than the cost of preparing one larger precursor-

ML with the same binding constant, it may be desirable to use the smaller precursor-MLs. Thus, depending on the context, the $T_{1/2}/MW$ ratio is preferably greater than 10^{-8} days/Dal, such as greater than 10^{-6} days/Dal, such as greater than 10^{-4} days/Dal, such as greater than 0.01 days/Dal, such as greater than 1 days/Dal, such as greater than 100 days/Dal, such as greater than 10,000 days/Dal.

However, if the processing of the composite material is performed more easily using fewer precursor-MLs or Ligand2s, it may be desirable to use larger precursor-MLs or Ligand2s. Thus, depending on the context, the $T_{1/2}/MW$ ratio is preferably less than 10,000 days/Dal, such as less than 100 days/Dal, such as less than 1 days/Dal, such as less than 0.01 days/Dal, such as less than 10^{-4} days/Dal, such as less than 10^{-6} days/Dal, such as less than 10^{-8} days/Dal.

Thus, the preferred compromise between a high and low $T_{1/2}/MW$ ratio depends on the context, and may be lower than 10^{-8} days/Dal, but may also be in the range of 10^{-8} – 10^{-6} days/Dal, 10^{-6} – 10^{-4} days/Dal, 10^{-4} –0.01 days/Dal, 0.01–1 days/Dal, 1–100 days/Dal, 100–10,000 days/Dal, or above 10,000 days/Dal.

For any characteristics of a precursor-ML, ML or Ligand2 mentioned above, and in each characteristic's entire range, a further characteristic of importance is the charge of the precursor-ML, ML or Ligand2.

Charge of precursor-ML, ML or Ligand2. The charge of the precursor-ML, ML or Ligand2 can be important. As an example, if the precursor-ML, ML or Ligand2 is used as a means to prepare a nanosensor, where a conducting nanotube is used to sense the binding of certain analytes to another SE, linked to the nanotube by way of the precursor-ML, ML or Ligand2, then the charge of the precursor-ML, ML or Ligand2, respectively, is likely to have an effect on the conductivity of the nanotube (and hence, an effect on the read-out), which may not always be desirable. A precursor-ML, ML or Ligand2 carrying a charge may also be a disadvantage during the preparation of a composite material comprising CMUs, because the charge may interfere with e.g. polymerization of the matrix material. Alternatively, a ligand carrying a charge can help disperse an SE in certain solvents, in which case it will be an advantage to have a charged precursor-ML, ML or Ligand2. Thus, depending on the context, the net charge at pH 7 is preferably greater than -10, such as greater than -9, such as greater than -8, such as greater than -7, such as greater than -6, such as greater than -5, such as greater than -4, such as greater than -3, such as greater than -2, such as greater than -1, such as greater than 0, such as greater than 1, such as greater than 2, such as greater than 3, such as greater than 4, such as greater than 5, such as greater than 6, such as greater than 7, such as greater than 8, such as greater

than 9, such as greater than 10, such as greater than 11, such as greater than 12, such as greater than 13. Preferred embodiments of the present invention include precursor-MLs, MLs or Ligand2s with a net charge at pH 7 of less than -10, or a net charge of -10, or -9, -8, -7, -6, -5, -4, -3, -2, -1, 0 (e.g. the amino acid alanine) , +1, +2, +3, +4, +5, +6, +7, +8, +9, +10, +11, +12, +13, or more than a net charge of +13.

Likewise, preferred embodiments of the present invention include precursor-MLs, MLs or Ligand2s with a total number of charges (positive or negative charges) of 0, 1, 2 (e.g. the amino acid alanine at pH 7), 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13–15, 15–20, 20–30, 30–50, 50–100, or more than 100.

For any characteristics of a precursor-ML, ML or Ligand2 mentioned above, and in each characteristic's entire range, a further characteristic of importance is the surface area of interaction of the precursor-ML, ML or Ligand2 with the SE.

Surface area of the interaction of the precursor-ML, ML or Ligand2 with the SE. The surface area of interaction between the precursor-ML, ML or Ligand2 and SE determines how many precursor-MLs, MLs, or Ligand2s can bind to a given SE. Therefore, the surface area of interaction can be an important parameter and in some cases, a large surface area of interaction is desirable, as it may allow the precursor-ML to bind with a higher affinity to the SE. Thus, depending on the context, the surface area of interaction is preferably greater than 20 Å², such as greater than 100 Å², such as greater than 200 Å², such as greater than 300 Å², such as greater than 500 Å², such as greater than 700 Å², such as greater than 1,000 Å², such as greater than 2,000 Å², such as greater than 4,000 Å², such as greater than 8,000 Å², such as greater than 15,000 Å², such as greater than 30,000 Å², such as greater than 100,000 Å².

In other cases, a small surface area of interaction is desirable, e.g if a higher number of precursor-ML, ML or Ligand2 must be bound to the SE, and thus, depending on the context, the surface area of interaction is preferably less than 100,000 Å², such as less than 30,000 Å², such as less than 15,000 Å², such as less than 8,000 Å², such as less than 4,000 Å², such as less than 2,000 Å², such as less than 1,000 Å², such as less than 700 Å², such as less than 500 Å², such as less than 300 Å², such as less than 200 Å², such as less than 100 Å², such as less than 20 Å².

Preferred embodiments of the present invention include precursor-MLs, MLs, or Ligand2s that contact the SE over a surface area of less than 20 Å², or contact the SE over a surface area of 20–100 Å², 100–200 Å², 200–300 Å², 300–500 Å², 500–700 Å², 700–1,000 Å², 1,000–2,000 Å², 2,000–4,000 Å², 4,000–8,000 Å², 8,000–15,000 Å², 15,000–30,000 Å², 30,000–100,000 Å², or more than 100,000 Å².

For any characteristics of a precursor-ML, ML or Ligand2 mentioned above, and in each characteristic's entire range, further characteristics of importance are the Affinity-to-charge ratio of the precursor-ML, ML or Ligand2, respectively, the Affinity to area-of-interaction ratio of the precursor-ML, ML or Ligand2, respectively, the degradability and biodegradability of the precursor-ML, ML or Ligand2, respectively, and the intrinsic stability of the precursor-ML, ML or Ligand2, respectively.

Particularly the biodegradability is of importance. Degradation by enzymes such as peptidases, nucleases and other enzymes commonly found in nature can decrease the lifetime of a composite material, wherefore it is often advantageous to avoid the use of natural and unnatural oligonucleotides, natural and unnatural polypeptides (comprising natural and unnatural amino acids), and in general avoid the use of polyamides or amide bonds in general, or any other kind of chemical entity or bond that is commonly found in nature.

In short, when trying to avoid biodegradation, it is often advantageous to use components for the making of composite materials that do not resemble too strongly the chemical entities found in nature. Thus, use of precursor-MLs, MLs, or Ligand2s (and structural entities and linkers) that do not contain peptides or nucleotides is often preferable.

Chemical stability is also of importance. It is generally advantageous to use precursor-MLs, MLs, or Ligand2s that are chemically stable (e.g. stable towards high temperature, low or high pH, high pressure, etc), in order to ensure that the precursor-ML's, ML's or Ligand2's characteristics, especially the affinity for the structural entity, remain relatively constant under varying conditions.

In another preferred embodiment it is advantageous to use biodegradable components, to avoid e.g. long term pollution of the environment.

Precursor-MLs, MLs, or Ligand2s may be organic or inorganic.

Further, precursor-MLs, MLs, or Ligand2s may be polymers or may be non-polymeric in structure. Preferred polymeric precursor-MLs, MLs, or Ligand2s include the polymers listed above and below.

The polymeric precursor-MLs, MLs, or Ligand2s can be divided into biological polymers and non-biological polymers.

Biological polymers shall here be defined as the polymers involved in the transcriptional and translational process, i.e. natural nucleic acids (RNA or DNA), or natural polypeptides. Natural polypeptides can be further divided into peptides, proteins and antibodies.

Peptide-based precursor-MLs, MLs, or Ligand2s. The number of amino acids (AA) of the precursor-ML, ML or Ligand2 may be of high economic importance (smaller peptides typically cost less to produce), and also, a smaller peptide is often indicative of a smaller surface of interaction with the SE, wherefore typically a higher number of precursor-MLs, MLs, or Ligand2s can bind simultaneously to the SE if each precursor-ML, ML or Ligand2 comprise fewer amino acids. Thus, depending on the context, the peptide-based precursor-ML, ML or Ligand2 is preferably comprised of fewer than 100 AA, such as fewer than 90 AA, such as fewer than 80 AA, such as fewer than 70 AA, such as fewer than 60 AA, such as fewer than 50 AA, such as fewer than 40 AA, such as fewer than 30 AA, such as fewer than 25 AA, such as fewer than 20 AA, such as fewer than 15 AA, such as fewer than 10 AA, such as fewer than 9 AA, such as fewer than 8 AA, such as fewer than 7 AA, such as fewer than 6 AA, such as fewer than 5 AA, such as fewer than 4 AA, such as fewer than 3 AA, such as fewer than 2 AA.

However, it is typically easier to prepare a peptide-based precursor-ML, ML or Ligand2 of high affinity if it comprises more amino acids. Thus, depending on the context, the peptide-based precursor-ML, ML or Ligand2 is preferably comprised of more than 1 AA, such as more than 2 AA, such as more than 3 AA, such as more than 4 AA, such as more than 5 AA, such as more than 6 AA, such as more than 7 AA, such as more than 8 AA, such as more than 9 AA, such as more than 10 AA, such as more than 15 AA, such as more than 20 AA, such as more than 25 AA, such as more than 30 AA, such as more than 40 AA, such as more than 50 AA, such as more than 60 AA, such as more than 70 AA, such as more than 80 AA, such as more than 90 AA, such as more than 100 AA.

Thus, the preferred compromise between peptide-based precursor-MLs, MLs, or Ligand2s comprising few or many amino acids depends on the context, and may be lower than 2 AA, but may also be in the range: 2–3 AA, 3–4 AA, 4–5 AA, 5–6 AA, 6–7 AA, 7–8 AA, 8–9 AA, 9–10 AA, 10–15 AA, 15–20 AA, 20–25 AA, 25–30 AA, 30–40 AA, 40–50 AA, 50–60 AA, 60–70 AA, 70–80 AA, 80–90 AA, 90–100 AA, or more than 100 AA.

Preferred peptide-based precursor-MLs, MLs, or Ligand2s include the following peptides, as well as all shorter peptide sequences that may be derived from these peptid sequences:

PQAQDVLPQELQDQHREVEV₅ =

PQAQDVELPQELQDQHREVEVPQAQDVELPQELQDQHREVEVPQAQDVELPQELQDQHRE
VEVPQAQDVELPQELQDQHREVEVPQAQDVELPQELQDQHREVEV)

Non-biological polymers include polymers that are not RNA, DNA or natural polypeptides, e.g. including PVC, epoxy, unnatural polypeptides (i.e. not solely comprising alpha-amino acids) and unnatural nucleic acids (e.g. PNA, LNA and other unnatural nucleic acids).

The polymeric precursor-MLs, MLs, or Ligand2s can be further divided into linear and branched polymers. The branched polymers may be further divided into short-chain branched polymers, long-chain branched polymers, star-branched polymers, ladder polymers and network polymers.

The precursor-MLs, MLs, or Ligand2s can be further divided into precursor-MLs, MLs, or Ligand2s comprising solely aliphatic moieties, comprising solely aromatic moieties, or comprising both aliphatic and aromatic moieties.

The precursor-MLs, MLs, or Ligand2s can be further divided into precursor-MLs, MLs, or Ligand2s comprising solely single bonds, solely double bonds, solely triple bonds, solely aromatic bonds, or a combination of single-, double-, triple and aromatic bonds.

Organic precursor-MLs, MLs, or Ligand2s include natural and unnatural polypeptides, lipids, polysaccharides, wood, flour,

Inorganic precursor-MLs, MLs, or Ligand2s include metal ions, Cu⁺, Cu²⁺, Fe²⁺, Fe³⁺, Hg²⁺, Hg₂²⁺, Pb²⁺, Pb⁴⁺, Sn²⁺, Sn⁴⁺, Cr²⁺, Cr³⁺, Mn²⁺, Mn³⁺, Co²⁺, Co³⁺.

Identities and number of different elements of a Precursor-ML, ML or Ligand2. The Precursor-ML, ML or Ligand2 may be composed of only one element, two elements, three elements, four elements, or more than four elements.

Precursor-MLs, MLs, or Ligand2s consisting of one element. The precursor-ML, ML or Ligand2 may consist of just one atom (in its non-charged form or as an ion, e.g. Gd or Gd⁺⁺⁺), or may consist of several atoms, held together in an organized structure.

The following ions are particularly preferred precursor-MLs, MLs, or Ligand2s : K⁺, Cl⁻, Ca⁺⁺, Mg⁺⁺, Gd⁺⁺⁺, Cu⁺, Cu²⁺, Fe²⁺, Fe³⁺, Hg²⁺, Hg₂²⁺, Pb²⁺, Pb⁴⁺, Sn²⁺, Sn⁴⁺, Cr²⁺, Cr³⁺, Mn²⁺, Mn³⁺, Co²⁺, Co³⁺.

If comprising only one element, or one type of element, the element may be any one of the following elements: Lithium (Li), Beryllium (Be), Boron (B), Carbon (C), Nitrogen (N), Oxygen (O), Fluorine (F), Sodium (Na), Magnesium (Mg), Aluminium (Al), Silicon (Si), Phosphorus (P), Sulfur (S), Chlorine (Cl), Potassium (K), Calcium (Ca), Scandium (Sc), Titanium (Ti), Vanadium (V), Chromium (Cr), Manganese (Mn), Iron (Fe), Cobalt (Co), Nickel (Ni), Copper (Cu), Zinc (Zn), Gallium (Ga), Germanium (Ge), Arsenic (As), Selenium (Se), Bromine (Br), Rubidium (Rb), Strontium (Sr), Yttrium (Y), Zirconium (Zr), Niobium (Nb), Molybdenum (Mo), Technetium (Tc), Ruthenium (Ru), Rhodium (Rh), Palladium (Pd), Silver (Ag), Cadmium (Cd), Indium (In), Tin (Sn), Antimony (Sb), Tellurium (Te), Iodine (I), Caesium (Cs), Barium (Ba), Platinum (Pt), Gold (Au), Mercury (Hg), Thallium (Tl), Lead (Pb), Bismuth (Bi).

Examples of precursor-MLs, MLs, or Ligand2s consisting of only carbon (C) include the following: Fullerenes including graphene and carbon nanotubes, carbon fiber, and pyrene.

Precursor-MLs, MLs, or Ligand2s consisting of two elements. If comprising only two elements, or two types of elements, the elements may include any of the following:

Hydrogen (H), Lithium (Li), Beryllium (Be), Boron (B), Carbon (C), Nitrogen (N), Oxygen (O), Fluorine (F), Sodium (Na), Magnesium (Mg), Aluminium (Al), Silicon (Si), Phosphorus (P), Sulfur (S), Chlorine (Cl), Potassium (K), Calcium (Ca), Scandium (Sc), Titanium (Ti), Vanadium (V), Chromium (Cr), Manganese (Mn), Iron (Fe), Cobalt (Co), Nickel (Ni), Copper (Cu), Zinc (Zn), Gallium (Ga), Germanium (Ge), Arsenic (As), Selenium (Se), Bromine (Br), Rubidium (Rb), Strontium (Sr), Yttrium (Y), Zirconium (Zr), Niobium (Nb), Molybdenum (Mo), Technetium (Tc), Ruthenium (Ru), Rhodium (Rh), Palladium (Pd), Silver (Ag), Cadmium (Cd), Indium (In), Tin (Sn), Antimony (Sb), Tellurium (Te), Iodine (I), Caesium (Cs), Barium (Ba), Platinum (Pt), Gold (Au), Mercury (Hg), Thallium (Tl), Lead (Pb), Bismuth (Bi).

Examples of precursor-MLs, MLs, or Ligand2s consisting of only carbon (C) and hydrogen (H) include the following: polyethylene, polypropylene, polystyrene, phenylacetylene, naphthalene, ethylbenzene, phenanthrene, pyrene, decane, benzo(a)pyrene, trans-cyclooctene, anhydrous 1-octyne, meso-1,2-diphenylethylene, 1,2,3,4-tetrahydro-naphthalene, benzo[a]phenanthrene, 1,1-di(phenyl)ethylene, 1,2-benzacenaphthene, 1,2-dihydroacenaphthylene, 1,2-benzanthracene, perylene, 1-iso-propyl-4-methylbenzene, N-dodecane, tert-butyl benzene, 1-methyl-naphthalene, α -n-hexadecene, 1-n-decene, phenylenemethyl-ethylene, trans-2-methylstyrene, ethylmethylbenzene, 2-methyl-naphthalene, 4-methyl-styrene, triphenylemethane, 1-phenyl-1-propyne, 2,2,4-trimethylpentane, 4-methyl phenyl acetylene, hexamethyl-benzene, [3.3.1]nonane, p-mentha-1,8-diene, acetnaphthylene, 1,2,4,5-tetramethyl benzene, 2,6,6-trimethylbicyclo[3.1.1]hept-2-ene, 1,2,4-

trimethyl benzene, tricyclo[3.3.1.1 {3,7}]decane, butylbenzene, 2,3-benzanthracene, 4-methyl-biphenyl, β -carotene, and derivatives thereof.

Comprising Al and Cl: Aluminium trichloride

Comprising Al and O: Aluminum oxide

Comprising Nb and O: Niobium oxide

Comprising C and F: Polytetrafluoroethylene, pentafluoropropylene, 1,1,4,4,4-pentafluoro-2-butyne, pentafluoro-ethane.

Comprising C and Cl: 1,1,2,2-tetrachloroethylene, hexachloro-benzene.

Precursor-MLs, MLs, or Ligand2s consisting of three elements. If comprising only three elements, or three types of elements, the elements may include any of the following:

Hydrogen (H), Lithium (Li), Beryllium (Be), Boron (B), Carbon (C), Nitrogen (N), Oxygen (O), Fluorine (F), Sodium (Na), Magnesium (Mg), Aluminium (Al), Silicon (Si), Phosphorus (P), Sulfur (S), Chlorine (Cl), Potassium (K), Calcium (Ca), Scandium (Sc), Titanium (Ti), Vanadium (V), Chromium (Cr), Manganese (Mn), Iron (Fe), Cobalt (Co), Nickel (Ni), Copper (Cu), Zinc (Zn), Gallium (Ga), Germanium (Ge), Arsenic (As), Selenium (Se), Bromine (Br), Rubidium (Rb), Strontium (Sr), Yttrium (Y), Zirconium (Zr), Niobium (Nb), Molybdenum (Mo), Technetium (Tc), Ruthenium (Ru), Rhodium (Rh), Palladium (Pd), Silver (Ag), Cadmium (Cd), Indium (In), Tin (Sn), Antimony (Sb), Tellurium (Te), Iodine (I), Caesium (Cs), Barium (Ba), Platinum (Pt), Gold (Au), Mercury (Hg), Thallium (Tl), Lead (Pb), Bismuth (Bi).

Examples of precursor-MLs, MLs, or Ligand2s consisting of three elements include:

Comprising C, H, Cl: Polyvinylchloride

Comprising C, H, O: Poly(vinylalcohol)

Comprising Ag, C, O: Silver carbonate, silver(I) oxalate

Comprising C, H, Cl: 3,3',4,4',5,5'-hexachlorobiphenyl; 1,2,4,5-TeCB; 2,4'-DDT; pentachloroethane; pentachloro-benzene

Precursor-MLs, MLs, or Ligand2s consisting of four elements. If comprising only four elements, or three types of elements, the elements may include any of the following:

Hydrogen (H), Lithium (Li), Beryllium (Be), Boron (B), Carbon (C), Nitrogen (N), Oxygen (O), Fluorine (F), Sodium (Na), Magnesium (Mg), Aluminium (Al), Silicon (Si), Phosphorus (P), Sulfur (S), Chlorine (Cl), Potassium (K), Calcium (Ca), Scandium (Sc), Titanium (Ti), Vanadium (V), Chromium (Cr), Manganese (Mn), Iron (Fe), Cobalt (Co), Nickel (Ni), Copper (Cu), Zinc (Zn), Gallium (Ga), Germanium (Ge), Arsenic (As), Selenium (Se), Bromine (Br), Rubidium (Rb), Strontium (Sr), Yttrium (Y), Zirconium (Zr), Niobium (Nb), Molybdenum (Mo), Technetium (Tc), Ruthenium (Ru), Rhodium (Rh), Palladium (Pd), Silver (Ag), Cadmium (Cd), Indium (In), Tin (Sn), Antimony (Sb), Tellurium (Te), Iodine (I), Caesium (Cs), Barium (Ba), Platinum (Pt), Gold (Au), Mercury (Hg), Thallium (Tl), Lead (Pb), Bismuth (Bi).

Precursor-MLs, MLs, or Ligand2s consisting of four elements include:

Comprising C, H, Cl, O: 1,2,3,6,7,8-hexachlorooxanthrene; 4,4'-dichloro-benzophenone; Dieldrite; α,α -diphenylacetyl chloride; 1,2,3,4,6,7,8-H7CDF; 1,2,3,4,7,8-hexachlorooxanthrene; 2,3-dichloro-1,4-dihydro-1,4-dioxonaphthalene; 1,2,3,7,8,9-hexachlorooxanthrene.

Precursor-MLs, MLs, or Ligand2s consisting of more than four elements. If comprising more than four elements, the elements may include any of the following:

Hydrogen (H), Lithium (Li), Beryllium (Be), Boron (B), Carbon (C), Nitrogen (N), Oxygen (O), Fluorine (F), Sodium (Na), Magnesium (Mg), Aluminium (Al), Silicon (Si), Phosphorus (P), Sulfur (S), Chlorine (Cl), Potassium (K), Calcium (Ca), Scandium (Sc), Titanium (Ti), Vanadium (V), Chromium (Cr), Manganese (Mn), Iron (Fe), Cobalt (Co), Nickel (Ni), Copper (Cu), Zinc (Zn), Gallium (Ga), Germanium (Ge), Arsenic (As), Selenium (Se), Bromine (Br), Rubidium (Rb), Strontium (Sr), Yttrium (Y), Zirconium (Zr), Niobium (Nb), Molybdenum (Mo), Technetium (Tc), Ruthenium (Ru), Rhodium (Rh), Palladium (Pd), Silver (Ag), Cadmium (Cd), Indium (In), Tin (Sn), Antimony (Sb), Tellurium (Te), Iodine (I), Caesium (Cs), Barium (Ba), Platinum (Pt), Gold (Au), Mercury (Hg), Thallium (Tl), Lead (Pb), Bismuth (Bi).

Precursor-MLs, MLs, or Ligand2s consisting of more than four elements include:

Comprising N, H, Br, O, C: 1-amino-4-bromo-2-nitrobenzene, 5,7-dibromo-8-hydroxy quinolone; 4-Bromophenyl isothiocyanate; 2-(bromoacetyl)-thiophene

A precursor-ML, ML or Ligand2 may contain chemical motifs that bind SE, as described above. The following is a non-comprehensive list of such chemical motifs that bind SE, where the SE that the chemical motif binds to, or may bind to, follows in parenthesis. Some of these chemical motifs bind only weakly to the SEs.

Group 5: Chemical motifs and the SEs they bind.

- Polystyrene (carbon nanotube)
- Riboflavin (carbon nanotube)
- DNA (carbon nanotube)
- Porphyrine (carbon nanotube)
- Pyrenyl (carbon nanotube)
- SDBS (carbon nanotube)
- Polypeptide with sequence SVSVGMKPSRPGGGK (hydroxyapatite)
- Polypeptide with sequence THRTSTLDYFVI (chlorine-doped polypyrrole)
- Benzene (carbon nanotubes)
- Naphthalene (carbon nanotubes)
- Biphenyl (carbon nanotubes)
- Fluorene (carbon nanotubes)
- Phenanthrene (carbon nanotubes)
- Anthracene (carbon nanotubes)
- Pyrene (carbon nanotubes; graphene)
- Triphenylene (carbon nanotubes)
- P-terphenyl (carbon nanotubes)
- Tetraphene (carbon nanotubes)
- Pyrenecarboxylic acid (carbon nanotubes)
- SDS (carbon nanotubes)
- SDSA (carbon nanotubes)
- DTAB (carbon nanotubes)
- NaDDBS (carbon nanotubes)
- Tween-60 (carbon nanotubes)
- Tween-80 (carbon nanotubes)
- Monostearate (carbon nanotubes)
- Monooleate (carbon nanotubes)
- PSPEO (carbon nanotubes)
- PVP (carbon nanotubes)
- Sulfonate (carbon nanotubes)

Subligands.

Ligand2 may comprise one or more subligands held together by one or more sub-linkers. As an example, Ligand2 may comprise two subligands, each of which is capable of binding SE1, and which are linked by a sub-linker. The subligands of Ligand2 may be linked in series or in parallel.

The subligands may be of varying affinities. In a preferred embodiment, the subligands of Ligand2 are arranged in series, and the SubLigand closest to LinkerL is of weak affinity, and therefore easy to dissociate from SE1, and the SubLigand farthest away from LinkerL is of high affinity and therefore difficult to dissociate from SE1. In composite materials where SE1 is a structural entity of high strength (e.g. a carbon nanotube) and SE2 is a polymer such as epoxy or polypropylene, the composite material made up of CMUs comprising subligands as described immediately above will be very flexible, but will also be of high strength. By using SubLigands of varying affinities, as well as using linkers of varying lengths, the flexibility and strength of the composite material can be varied. Moreover, CMUs comprising Ligands with more than one SubLigand will add self-healing properties to a composite material in which they are used. Thus, if during applied stress to the composite material one of the SubLigand-SE interactions is interrupted, the other SubLigand may stay associated with the SE, and upon removal of the applied stress, the interrupted SubLigand-SE interaction may re-form, thereby re-establishing the shape of the composite material. The subligands may also be arranged in parallel, in which case the corresponding composite material will be less flexible but often have higher strength.

A similar principle is applied in Example 9, D. Here, the linker connecting the ML (here attached to a nanotube) and SE2 (here a polymer molecule) comprises two ligands with affinity for the nanotube. As described in example 9, D this functions as a molecular shock absorber.

Covalent bonds.

Mechanical ligands as well as Ligand2s typically comprise one or more covalent bonds. Ligand2s capable of covalently linking SEs with the linker may comprise functional groups such as OH, COOH, NH₂, SH and CO, but can be any atom or molecule capable of forming a chemical bond with another atom or molecule. Below is shown a number of reactive/functional groups, and the covalent bond that each pair of functional groups may form. These functional groups as well as the covalent bond that they form, may be contained in SEs, Linkers, precursor-MLs, MLs and Ligand2s of the present invention:

Group 6: Reactive groups, and covalent bond formed upon reaction.

Functional group 1

Functional group 2

Covalent bond formed

NH ₂	COOH	CONH (amide bond)
SH	SH	SS (disulfide bond)
CO (aldehyde bond)	NH ₂	CNH (secondary amine bond)

Covalent bond-forming chemical reactions suitable for forming the covalent bond of or between SEs, Linkers, precursor-MLs, MLs and/or Ligand2s, including the ring-forming reactions of precursor-MLs to produce MLs, include any one or more of the reactions in the list below.

Group 7: Covalent bond-forming chemical reactions.

- Chemical reactions for synthesizing polymers, small molecules, or other chemical compounds such as those listed in March's Advanced Organic Chemistry, Organic Reactions, Organic Syntheses, organic text books, journals such as Journal of the American Chemical Society, Journal of Organic Chemistry, Tetrahedron, etc., and Carruther's Some Modern Methods of Organic Chemistry can be used. For example, substitution reactions, carbon-carbon bond forming reactions, elimination reactions, acylation reactions, and addition reactions. An illustrative but not exhaustive list of aliphatic nucleophilic substitution reactions useful in the present invention includes, for example, S_N2 reactions, S_N1 reactions, S_Ni reactions, allylic rearrangements, nucleophilic substitution at an aliphatic trigonal carbon, and nucleophilic substitution at a vinylic carbon.
- Specific aliphatic nucleophilic substitution reactions with oxygen nucleophiles include, for example, hydrolysis of alkyl halides, hydrolysis of gem-dihalides, hydrolysis of 1,1,1-trihalides, hydrolysis of alkyl esters or inorganic acids, hydrolysis of diazo ketones, hydrolysis of acetal and enol ethers, hydrolysis of epoxides, hydrolysis of acyl halides, hydrolysis of anhydrides, hydrolysis of carboxylic esters, hydrolysis of amides, alkylation with alkyl halides (Williamson Reaction), epoxide formation, alkylation with inorganic esters, alkylation with diazo compounds, dehydration of alcohols, transesterification, alcoholysis of epoxides, alkylation with onium salts, hydroxylation of silanes, alcoholysis of acyl halides, alcoholysis of anhydrides, esterification of carboxylic acids, alcoholysis of carboxylic esters (transesterification), alcoholysis of amides, alkylation of carboxylic acid salts, cleavage of ether with acetic anhydride, alkylation of carboxylic acids with diazo compounds, acylation of carboxylic acids with acyl halides; acylation of carboxylic acids with carboxylic acids, formation of oxonium salts, preparation of peroxides and hydroperoxides, preparation of inorganic esters (e.g., nitrites, nitrates, sulfonates), preparation of alcohols from amines, and preparation of mixed organic-inorganic anhydrides.

- Specific aliphatic nucleophilic substitution reactions with sulfur nucleophiles, which tend to be better nucleophiles than their oxygen analogs, include, for example, attack by SH at an alkyl carbon to form thiols, attack by S at an alkyl carbon to form thioethers, attack by SH or SR at an acyl carbon, formation of disulfides, formation of Bunte salts, alkylation of sulfuric acid salts, and formation of alkyl thiocyanates.
- Aliphatic nucleophilic substitution reactions with nitrogen nucleophiles include, for example, alkylation of amines, N-arylation of amines, replacement of a hydroxy by an amino group, transamination, transamidation, alkylation of amines with diazo compounds, amination of epoxides, amination of oxetanes, amination of aziridines, amination of alkanes, formation of isocyanides, acylation of amines by acyl halides, acylation of amines by anhydrides, acylation of amines by carboxylic acids, acylation of amines by carboxylic esters, acylation of amines by amides, acylation of amines by other acid derivatives, N-alkylation or N-arylation of amides and imides, N-acylation of amides and imides, formation of aziridines from epoxides, formation of nitro compounds, formation of azides, formation of isocyanates and isothiocyanates, and formation of azoxy compounds. Aliphatic nucleophilic substitution reactions with halogen nucleophiles include, for example, attack at an alkyl carbon, halide exchange, formation of alkyl halides from esters of sulfuric and sulfonic acids, formation of alkyl halides from alcohols, formation of alkyl halides from ethers, formation of halohydrins from epoxides, cleavage of carboxylic esters with lithium iodide, conversion of diazo ketones to alpha-halo ketones, conversion of amines to halides, conversion of tertiary amines to cyanamides (the von Braun reaction), formation of acyl halides from carboxylic acids, and formation of acyl halides from acid derivatives.
- Aliphatic nucleophilic substitution reactions using hydrogen as a nucleophile include, for example, reduction of alkyl halides, reduction of tosylates, other sulfonates, and similar compounds, hydrogenolysis of alcohols, hydrogenolysis of esters (Barton-McCombie reaction), hydrogenolysis of nitriles, replacement of alkoxyl by hydrogen, reduction of epoxides, reductive cleavage of carboxylic esters, reduction of a C-N bond, desulfurization, reduction of acyl halides, reduction of carboxylic acids, esters, and anhydrides to aldehydes, and reduction of amides to aldehydes.
- Aliphatic nucleophilic substitution reactions using carbon nucleophiles include, for example, coupling with silanes, coupling of alkyl halides (the Wurtz reaction), the reaction of alkyl halides and sulfonate esters with Group I (I A), and II (II A) organometallic reagents, reaction of alkyl halides and sulfonate esters with organocuprates, reaction of alkyl halides and sulfonate esters with other organometallic reagents; allylic and propargylic coupling with a halide substrate, coupling of organometallic reagents with esters of sulfuric and sulfonic

acids, sulfoxides, and sulfones, coupling involving alcohols, coupling of organometallic reagents with carboxylic esters, coupling of organometallic reagents with compounds containing an ester linkage, reaction of organometallic reagents with epoxides, reaction of organometallics with aziridine, alkylation at a carbon bearing an active hydrogen, alkylation of ketones, nitriles, and carboxylic esters, alkylation of carboxylic acid salts, alkylation at a position alpha to a heteroatom (alkylation of 1,3-dithianes), alkylation of dihydro-1,3-oxazine (the Meyers synthesis of aldehydes, ketones, and carboxylic acids), alkylation with trialkylboranes, alkylation at an alkynyl carbon, preparation of nitriles, direct conversion of alkyl halides to aldehydes and ketones, conversion of alkyl halides, alcohols, or alkanes to carboxylic acids and their derivatives, the conversion of acyl halides to ketones with organometallic compounds, the conversion of anhydrides, carboxylic esters, or amides to ketones with organometallic compounds, the coupling of acyl halides, acylation at a carbon bearing an active hydrogen, acylation of carboxylic esters by carboxylic esters (the Claisen and Dieckmann condensation), acylation of ketones and nitriles with carboxylic esters, acylation of carboxylic acid salts, preparation of acyl cyanides, and preparation of diazo ketones, ketonic decarboxylation.

- Reactions which involve nucleophilic attack at a sulfonyl sulfur atom may also be used in the present invention and include, for example, hydrolysis of sulfonic acid derivatives (attack by OH), formation of sulfonic esters (attack by OR), formation of sulfonamides (attack by nitrogen), formation of sulfonyl halides (attack by halides), reduction of sulfonyl chlorides (attack by hydrogen), and preparation of sulfones (attack by carbon).
- Aromatic electrophilic substitution reactions may also be used. Hydrogen exchange reactions are examples of aromatic electrophilic substitution reactions that use hydrogen as the electrophile. Aromatic electrophilic substitution, reactions which use nitrogen electrophiles include, for example, nitration and nitro-dehydrogenation, nitrosation of nitroso-dehydrogenation, diazonium coupling, direct introduction of the diazonium group, and amination or amino-dehydrogenation. Reactions of this type with sulfur electrophiles include, for example, sulfonation, sulfo-dehydrogenation, halosulfonation, halosulfo-dehydrogenation, sulfurization, and sulfonylation. Reactions using halogen electrophiles include, for example, halogenation, and halo-dehydrogenation. Aromatic electrophilic substitution reactions with carbon electrophiles include, for example, Friedel-Crafts alkylation, alkylation, alkyl-dehydrogenation, Friedel-Crafts arylation (the Scholl reaction), Friedel-Crafts acylation, formylation with disubstituted formamides, formylation with zinc cyanide and HCl (the Gatterman reaction), formylation with chloroform (the Reimer-Tiemann reaction), other formylations, formyl-dehydrogenation, carboxylation with carbonyl halides, carboxylation

with carbon dioxide (the Kolbe-Schmitt reaction), amidation with isocyanates, N-alkylcarbamoyl-dehydrogenation, hydroxyalkylation, hydroxyalkyl-dehydrogenation, cyclodehydration of aldehydes and ketones, haloalkylation, halo-dehydrogenation, aminoalkylation, amidoalkylation, dialkylaminoalkylation, dialkylamino-dehydrogenation, thioalkylation, acylation with nitriles (the Hoesch reaction), cyanation, and cyano-dehydrogenation. Reactions using oxygen electrophiles include, for example, hydroxylation and hydroxy-dehydrogenation.

- Rearrangement reactions include, for example, the Fries rearrangement, migration of a nitro group, migration of a nitroso group (the Fischer-Hepp Rearrangement), migration of an arylazo group, migration of a halogen (the Orton rearrangement), migration of an alkyl group, etc. Other reaction on an aromatic ring include the reversal of a Friedel-Crafts alkylation, decarboxylation of aromatic aldehydes, decarboxylation of aromatic acids, the Jacobsen reaction, deoxygenation, desulfonation, hydro-desulfonation, dehalogenation, hydro-dehalogenation, and hydrolysis of organometallic compounds.
- Aliphatic electrophilic substitution reactions are also useful. Reactions using the SEI, SE₂ (front), SE₂ (back), SE_i, addition-elimination, and cyclic mechanisms can be used in the present invention. Reactions of this type with hydrogen as the leaving group include, for example, hydrogen exchange (deuterio-de-hydrogenation, deuteration), migration of a double bond, and keto-enol tautomerization. Reactions with halogen electrophiles include, for example, halogenation of aldehydes and ketones, halogenation of carboxylic acids and acyl halides, and halogenation of sulfoxides and sulfones. Reactions with nitrogen electrophiles include, for example, aliphatic diazonium coupling, nitrosation at a carbon bearing an active hydrogen, direct formation of diazo compounds, conversion of amides to alpha-azido amides, direct amination at an activated position, and insertion by nitrenes. Reactions with sulfur or selenium electrophiles include, for example, sulfonylation, sulfonation, and selenylation of ketones and carboxylic esters. Reactions with carbon electrophiles include, for example, acylation at an aliphatic carbon, conversion of aldehydes to beta-keto esters or ketones, cyanation, cyano-de-hydrogenation, alkylation of alkanes, the Stork enamine reaction, and insertion by carbenes. Reactions with metal electrophiles include, for example, metalation with organometallic compounds, metalation with metals and strong bases, and conversion of enolates to silyl enol ethers. Aliphatic electrophilic substitution reactions with metals as leaving groups include, for example, replacement of metals by hydrogen, reactions between organometallic reagents and oxygen, reactions between organometallic reagents and peroxides, oxidation of trialkylboranes to borates, conversion of Grignard reagents to sulfur compounds, halo-demetalation, the conversion of organometallic compounds to amines, the

conversion of organometallic compounds to ketones, aldehydes, carboxylic esters and amides, cyano-de-metalation, transmetalation with a metal, transmetalation with a metal halide, transmetalation with an organometallic compound, reduction of alkyl halides, metallo-de-halogenation, replacement of a halogen by a metal from an organometallic compound, decarboxylation of aliphatic acids, cleavage of alkoxides, replacement of a carboxyl group by an acyl group, basic cleavage of beta-keto esters and beta-diketones, haloform reaction, cleavage of non-enolizable ketones, the Haller-Bauer reaction, cleavage of alkanes, decyanation, and hydro-de-cyanation. Electrophilic substitution reactions at nitrogen include, for example, diazotization, conversion of hydrazines to azides, N-nitrosation, N-nitroso-de-hydrogenation, conversion of amines to azo compounds, N-halogenation, N-halo-de-hydrogenation, reactions of amines with carbon monoxide, and reactions of amines with carbon dioxide.

- Aromatic nucleophilic substitution reactions may also be used in the present invention. Reactions proceeding via the S_NAr mechanism, the S_NI mechanism, the benzyne mechanism, the S_{RN}1 mechanism, or other mechanism, for example, can be used. Aromatic nucleophilic substitution reactions with oxygen nucleophiles include, for example, hydroxy-de-halogenation, alkali fusion of sulfonate salts, and replacement of OR or OAr. Reactions with sulfur nucleophiles include, for example, replacement by SH or SR. Reactions using nitrogen nucleophiles include, for example, replacement by NH₂, NHR, or NR₂, and replacement of a hydroxy group by an amino group: Reactions with halogen nucleophiles include, for example, the introduction halogens. Aromatic nucleophilic substitution reactions with hydrogen as the nucleophile include, for example, reduction of phenols and phenolic esters and ethers, and reduction of halides and nitro compounds. Reactions with carbon nucleophiles include, for example, the Rosenmund-von Braun reaction, coupling of organometallic compounds with aryl halides, ethers, and carboxylic esters, arylation at a carbon containing an active hydrogen, conversions of aryl substrates to carboxylic acids, their derivatives, aldehydes, and ketones, and the Ullmann reaction. Reactions with hydrogen as the leaving group include, for example, alkylation, arylation, and amination of nitrogen heterocycles. Reactions with N₂⁺ as the leaving group include, for example, hydroxy-de-diazonation, replacement by sulfur-containing groups, iodo-de-diazonation, and the Schiemann reaction. Rearrangement reactions include, for example, the von Richter rearrangement, the Sommelet-Hauser rearrangement, rearrangement of aryl hydroxylamines, and the Smiles rearrangement. Reactions involving free radicals can also be used, although the free radical reactions used in nucleotide-templated chemistry should be carefully chosen to avoid modification or cleavage of the nucleotide template. With that limitation, free radical

substitution reactions can be used in the present invention. Particular free radical substitution reactions include, for example, substitution by halogen, halogenation at an alkyl carbon, allylic halogenation, benzylic halogenation, halogenation of aldehydes, hydroxylation at an aliphatic carbon, hydroxylation at an aromatic carbon, oxidation of aldehydes to carboxylic acids, formation of cyclic ethers, formation of hydroperoxides, formation of peroxides, acyloxylation, acyloxy-de-hydrogenation, chlorosulfonation, nitration of alkanes, direct conversion of aldehydes to amides, amidation and amination at an alkyl carbon, simple coupling at a susceptible position, coupling of alkynes, arylation of aromatic compounds by diazonium salts, arylation of activated alkenes by diazonium salts (the Meerwein arylation), arylation and alkylation of alkenes by organopalladium compounds (the Heck reaction), arylation and alkylation of alkenes by vinyltin compounds (the Stille reaction), alkylation and arylation of aromatic compounds by peroxides, photochemical arylation of aromatic compounds, alkylation, acylation, and carbalkoxylation of nitrogen heterocycles. Particular reactions in which N_2^+ is the leaving group include, for example, replacement of the diazonium group by hydrogen, replacement of the diazonium group by chlorine or bromine, nitro-de-diazoni-ation, replacement of the diazonium group by sulfur-containing groups, aryl dimerization with diazonium salts, methylation of diazonium salts, vinylation of diazonium salts, arylation of diazonium salts, and conversion of diazonium salts to aldehydes, ketones, or carboxylic acids. Free radical substitution reactions with metals as leaving groups include, for example, coupling of Grignard reagents, coupling of boranes, and coupling of other organometallic reagents. Reaction with halogen as the leaving group are included. Other free radical substitution reactions with various leaving groups include, for example, desulfurization with Raney Nickel, conversion of sulfides to organolithium compounds, decarboxylase dimerization (the Kolbe reaction), the Hunsdiecker reaction, decarboxylative allylation, and decarbonylation of aldehydes and acyl halides.

- Reactions involving additions to carbon-carbon multiple bonds are also used. Any mechanism may be used in the addition reaction including, for example, electrophilic addition, nucleophilic addition, free radical addition, and cyclic mechanisms. Reactions involving additions to conjugated systems can also be used. Addition to cyclopropane rings can also be utilized. Particular reactions include, for example, isomerization, addition of hydrogen halides, hydration of double bonds, hydration of triple bonds, addition of alcohols, addition of carboxylic acids, addition of H_2S and thiols, addition of ammonia and amines, addition of amides, addition of hydrazoic acid, hydrogenation of double and triple bonds, other reduction of double and triple bonds, reduction of the double and triple bonds of conjugated systems, hydrogenation of aromatic rings, reductive cleavage of cyclopropanes, hydroboration, other

hydrometalations, addition of alkanes, addition of alkenes and/or alkynes to alkenes and/or alkynes (e.g., pi-cation cyclization reactions, hydro-alkenyl-addition), ene reactions, the Michael reaction, addition of organometallics to double and triple bonds not conjugated to carbonyls, the addition of two alkyl groups to an alkyne, 1,4-addition of organometallic compounds to activated double bonds, addition of boranes to activated double bonds, addition of tin and mercury hydrides to activated double bonds, acylation of activated double bonds and of triple bonds, addition of alcohols, amines, carboxylic esters, aldehydes, etc., carbonylation of double and triple bonds, hydrocarboxylation, hydroformylation, addition of aldehydes, addition of HCN, addition of silanes, radical addition, radical cydization, halogenation of double and triple bonds (addition of halogen, halogen), halolactonization, halolactamization, addition of hypohalous acids and hypohalites (addition of halogen, oxygen), addition of sulfur compounds (addition of halogen, sulfur), addition of halogen and an amino group (addition of halogen, nitrogen), addition of NOX and NO2X (addition of halogen, nitrogen), addition of XN3 (addition of halogen, nitrogen), addition of alkyl halides (addition of halogen, carbon), addition of acyl halides (addition of halogen, carbon), hydroxylation (addition of oxygen, oxygen) (e.g., asymmetric dihydroxylation reaction with OSO₄), dihydroxylation of aromatic rings, epoxidation (addition of oxygen, oxygen) (e.g., Sharpless asymmetric epoxidation), photooxidation of dienes (addition of oxygen, oxygen), hydroxysulfonylation (addition of oxygen, sulfur), oxyamination (addition of oxygen, nitrogen), diamination (addition of nitrogen, nitrogen), formation of aziridines (addition of nitrogen), aminosulferiylation (addition of nitrogen, sulfur), acylacyloxylation and acylamidation (addition of oxygen, carbon or nitrogen, carbon), 1,3-dipolar addition; (addition of oxygen, nitrogen, carbon), Diels-Alder reaction, heteroatom Diels-Alder reaction, all carbon 3 +2 cycloadditions, dimerization of alkenes, the addition of carbenes and carbenoids to double and triple bonds, trimerization and tetramerization of alkynes, and other cycloaddition reactions.

- In addition to reactions involving additions to carbon-carbon multiple bonds, addition reactions to carbon-hetero multiple bonds can be used in nucleotide-templated chemistry. Exemplary reactions include, for example, the addition of water to aldehydes and ketones (formation of hydrates), hydrolysis of carbon-nitrogen double bond, hydrolysis of aliphatic nitro compounds, hydrolysis of nitriles, addition of alcohols and thiols to aldehydes and ketones, reductive alkylation of alcohols, addition of alcohols to isocyanates, alcoholysis of nitriles, formation of xanthates, addition of H₂S and thiols to carbonyl compounds, formation of bisulfite addition products, addition of amines to aldehydes and ketones, addition of amides to aldehydes, reductive alkylation of ammonia or amines, the Mannich reaction, the

addition of amines to isocyanates, addition of ammonia or amines to nitriles, addition of amines to carbon disulfide and carbon dioxide, addition of hydrazine derivative to carbonyl compounds, formation of oximes, conversion of aldehydes to nitriles, formation of gem-dihalides from aldehydes and ketones, reduction of aldehydes and ketones to alcohols, reduction of the carbon-nitrogen double bond, reduction of nitriles to amines, reduction of nitriles to aldehydes, addition of Grignard reagents and organolithium reagents to aldehydes and ketones, addition of other organometallics to aldehydes and ketones, addition of trialkylallylsilanes to aldehydes and ketones, addition of conjugated alkenes to aldehydes (the Baylis-Billmah reaction), the Reformatsky reaction, the conversion of carboxylic acid salts to ketones with organometallic compounds, the addition of Grignard reagents to acid derivatives, the addition of Organometallic compounds to CO₂ and CS₂, addition of organometallic compounds to C=IM compounds, addition of carbenes and diazoalkanes to C=N compounds, addition of Grignard reagents to nitriles and isocyanates, the Aldol reaction, Mukaiyama Aldol and related reactions, Aldol-type reactions between carboxylic esters or amides and aldehydes or ketones, the Knoevenagel reaction (e.g., the Nef reaction, the Favorskii reaction), the Peterson alkenylation reaction, the addition of active hydrogen compounds to CO₂ and CS₂, the Perkin reaction, Darzens glycidic ester condensation, the Tollens reaction, the Wittig reaction, the Tebbe alkenylation, the Petasis alkenylation, alternative alkenylations, the Thorpe reaction, the Thorpe-Ziegler reaction, addition of silanes, formation of cyanohydrins, addition of HCN to C=N and C-N bonds, the Prins reaction, the benzoin condensation, addition of radicals to C=O, C=S, C=N compounds, the Ritter reaction, acylation of aldehydes and ketones, addition of aldehydes to aldehydes, the addition of isocyanates to isocyanates (formation of carbodiimides), the conversion of carboxylic acid salts to nitriles, the formation of epoxides from aldehydes and ketones, the formation of episulfides and episulfones, the formation of beta-lactones and oxetanes (e.g., the Paterno-Buchi reaction), the formation of beta-lactams, etc. Reactions involving addition to isocyanides include the addition of water to isocyanides, the Passerini reaction, the Ugi reaction, and the formation of metalated aldimines.

- Elimination reactions, including alpha, beta, and gamma eliminations, as well as extrusion reactions, can be performed using nucleotide-templated chemistry, although the strength of the reagents and conditions employed should be considered. Preferred elimination reactions include reactions that go by E1, E2, E1cB, or E2C mechanisms. Exemplary reactions include, for example, reactions in which hydrogen is removed from one side (e.g., dehydration of alcohols, cleavage of ethers to alkenes, the Chugaev reaction, ester decomposition, cleavage of quaternary ammonium hydroxides, cleavage of quaternary ammonium salts with strong

bases, cleavage of amine oxides, pyrolysis of keto-ylids, decomposition of toluene-p-sulfonylhydrazones, cleavage of sulfoxides, cleavage of selenoxides, cleavage of sulfornes, dehydrohalogenation of alkyl halides, dehydrohalogenation of acyl halides, dehydrohalogenation of sulfonyl halides, elimination of boranes, conversion of alkenes to alkynes, decarbonylation of acyl halides), reactions in which neither leaving atom is hydrogen (e.g., deoxygenation of vicinal diols, cleavage of cyclic thionocarbonates, conversion of epoxides to episulfides and alkenes, the Ramberg-Bäcklund reaction, conversion of aziridines to alkenes, dehalogenation of vicinal dihalides, dehalogenation of alpha-halo acyl halides, and elimination of a halogen and a hetero group), fragmentation reactions (i.e., reactions in which carbon is the positive leaving group or the electrofuge, such as, for example, fragmentation of gamma-amino and gamma-hydroxy halides, fragmentation of 1,3-diols, decarboxylation of beta-hydroxy carboxylic acids, decarboxylation of (3-lactones, fragmentation of alpha-beta-epoxy hydrazones, elimination of CO from bridged bicyclic compounds, and elimination of CO₂ from bridged bicyclic compounds), reactions in which C=N or C=N bonds are formed (e.g., dehydration of aldoximes or similar compounds, conversion of ketoximes to nitriles, dehydration of unsubstituted amides, and conversion of N-alkylformamides to isocyanides), reactions in which C=O bonds are formed (e.g., pyrolysis of beta-hydroxy alkenes), and reactions in which N=N bonds are formed (e.g., eliminations to give diazoalkenes). Extrusion reactions include, for example, extrusion of N₂ from pyrazolines, extrusion of N₂ from pyrazoles, extrusion of N₂ from triazolines, extrusion of CO, extrusion of CO₂, extrusion of SO₂, the Stork synthesis, and alkene synthesis by twofold extrusion.

- Rearrangements, including, for example, nucleophilic rearrangements, electrophilic rearrangements, prototropic rearrangements, and free-radical rearrangements, can also be performed. Both 1,2 rearrangements and non-1,2 rearrangements can be performed. Exemplary reactions include, for example, carbon-to-carbon migrations of R, H, and Ar (e.g., Wagner-Meerwein and related reactions, the Pinacol rearrangement, ring expansion reactions, ring contraction reactions, acid-catalyzed rearrangements of aldehydes and ketones, the dienone-phenol rearrangement, the Favorskii rearrangement, the Arndt-Eistert synthesis, homologation of aldehydes, and homologation of ketones), carbon-to-carbon migrations of other groups (e.g., migrations of halogen, hydroxyl, amino, etc.; migration of boron; and the Neber rearrangement), carbon-to-nitrogen migrations of R and Ar (e.g., the Hofmann rearrangement, the Curtius rearrangement, the Lossen rearrangement, the Schmidt reaction, the Beckmann rearrangement, the Stieglitz rearrangement, and related rearrangements), carbon-to-oxygen migrations of R and Ar (e.g., the Baeyer-Villiger rearrangement and rearrangement of hydroperoxides), nitrogen-to-carbon, oxygen-to-carbon, and sulfur-to-carbon

migration (e.g., the Stevens rearrangement, and the Wittig rearrangement), boron-to-carbon migrations (e.g., conversion of boranes to alcohols (primary or otherwise), conversion of boranes to aldehydes, conversion of boranes to carboxylic acids, conversion of vinylic boranes to alkenes, formation of alkynes from boranes and acetylides, formation of alkenes from boranes and acetylides, and formation of ketones from boranes and acetylides), electrocyclic rearrangements (e.g., of cyclobutenes and 1,3-cyclohexadienes, or conversion of stilbenes to phenanthrenes), sigmatropic rearrangements (e.g., (1,5) sigmatropic migrations of hydrogen, (1,3) sigmatropic migrations of carbon, conversion of vinylcyclopropanes to cyclopentenes, the Cope rearrangement, the Claisen rearrangement, the Fischer indole synthesis, (2,3) sigmatropic rearrangements, and the benzidine rearrangement), other cyclic rearrangements (e.g., metathesis of alkenes, the di-*n*-methane and related rearrangements, and the Hofmann-Löffler and related reactions), and non-cyclic rearrangements (e.g., hydride shifts, the Chapman rearrangement, the Wallach rearrangement, and dyotropic rearrangements).

Oxidative and reductive reactions may also be performed. Exemplary reactions may involve, for example, direct electron transfer, hydride transfer, hydrogen-atom transfer, formation of ester intermediates, displacement mechanisms, or addition-elimination mechanisms. Exemplary oxidations include, for example, eliminations of hydrogen (e.g., aromatization of six-membered rings, dehydrogenations yielding carbon-carbon double bonds, oxidation or dehydrogenation of alcohols to aldehydes and ketones, oxidation of phenols and aromatic amines to quinones, oxidative cleavage of ketones, oxidative cleavage of aldehydes, oxidative cleavage of alcohols, ozonolysis, oxidative cleavage of double bonds and aromatic rings, oxidation of aromatic side chains, oxidative decarboxylation, and bisdecarboxylation), reactions involving replacement of hydrogen by oxygen (e.g., oxidation of methylene to carbonyl, oxidation of methylene to OH, CO₂R, or OR, oxidation of arylmethanes, oxidation of ethers to carboxylic esters and related reactions, oxidation of aromatic hydrocarbons to quinones, oxidation of amines or nitro compounds to aldehydes, ketones, or dihalides, oxidation of primary alcohols to carboxylic acids or carboxylic esters, oxidation of alkenes to aldehydes or ketones, oxidation of amines to nitroso compounds and hydroxylamines, oxidation of primary amines, oximes, azides, isocyanates, or nitroso compounds, to nitro compounds, oxidation of thiols and other sulfur compounds to sulfonic acids), reactions in which oxygen is added to the substrate (e.g., oxidation of alkynes to alpha-diketones, oxidation of tertiary amines to amine oxides, oxidation of thioesters to sulfoxides and sulfones, and oxidation of carboxylic acids to peroxy acids, and oxidative coupling reactions (e.g., coupling involving carbanions, dimerization of silyl enol ethers or of lithium enolates, and oxidation of thiols to disulfides). Exemplary reductive reactions include, for example, reactions

involving replacement of oxygen by hydrogen {e.g., reduction of carbonyl to methylene in aldehydes and ketones, reduction of carboxylic acids to alcohols, reduction of amides to amines, reduction of carboxylic esters to ethers, reduction of cyclic anhydrides to lactones and acid derivatives to alcohols, reduction of carboxylic esters to alcohols, reduction of carboxylic acids and esters to alkanes, complete reduction of epoxides, reduction of nitro compounds to amines, reduction of nitro compounds to hydroxylamines, reduction of nitroso compounds and hydroxylamines to amines, reduction of oximes to primary amines or aziridines, reduction of azides to primary amines, reduction of nitrogen compounds, and reduction of sulfonyl halides and sulfonic acids to thiols), removal of oxygen from the substrate {e.g., reduction of amine oxides and azoxy compounds, reduction of sulfoxides and sulfones, reduction of hydroperoxides and peroxides, and reduction of aliphatic nitro compounds to oximes or nitrites), reductions that include cleavage {e.g., de-alkylation of amines and amides, reduction of azo, azoxy, and hydrazo compounds to amines, and reduction of disulfides to thiols), reductive coupling reactions {e.g., bimolecular reduction of aldehydes and ketones to 1,2-diols, bimolecular reduction of aldehydes or ketones to alkenes, acyloin ester condensation, reduction of nitro to azoxy compounds, and reduction of nitro to azo compounds), and. reductions in which an organic substrate is both oxidized and reduced {e.g., the Cannizzaro reaction, the Tishchenko reaction, the Pummerer rearrangement, and the Willgerodt reaction).

Covalent bonds relevant for the present invention, including those formed above, are listed in the following.

Group 8: Covalent bonds.

A single bond, such as a single carbon-carbon bond, a carbon-heteroatom single bond, a heteroatom-heteroatom single bond, a double bond, such as a carbon-carbon double bond or a carbon-heteroatom double bond, a heteroatom-heteroatom double bond, triple bond, such as a carbon-carbon triple bond or a carbon-heteroatom triple bond, a heteroatom-heteroatom triple bond, -CH₂-, -C(O)-, -NH-, -O-, -S-, -SO₂-, -CH₂CH₂-, -C(O)CH₂-, -CH₂C(O)-, -NHCH₂-, -CH₂NH-, -OCH₂-, -CH₂O-, -SCH₂-, -CH₂S-, -SO₂CH₂-, -CH₂SO₂-, -NHC(O)-, -C(O)NH-, -NHSO₂-, -SO₂NH-, -CH₂CH₂CH₂-, -CH₂CH₂C(O)-, -CH₂CH₂NH-, -CH₂CH₂O-, -CH₂CH₂S-, -CH₂CH₂SO₂-, -CH₂C(O)CH₂-, -CH₂NHCH₂-, -CH₂OCH₂-, -CH₂SCH₂-, -CH₂SO₂CH₂-, -C(O)CH₂CH₂-, -NHCH₂CH₂-, -OCH₂CH₂-, -SCH₂CH₂-, -SO₂CH₂CH₂-, -CH₂C(O)NH-, -CH₂SO₂NH-, -CH₂NHC(O)-, -CH₂NHSO₂-, -C(O)NHCH₂-, -SO₂NHCH₂-, -NHC(O)CH₂-, -NHSO₂CH₂-, and -NHC(O)NH-

Linkers.

A linker may consist of just one bond, or a number of covalent and/or non-covalent bonds. A linker may have any length. A longer and more flexible linker will more easily allow the precursor-MLs, MLs and Ligand2s and SEs to interact independently of the linker; however, a short linker connecting two precursor-MLs, MLs or Ligand2s bound to the same SE may result in high synergy in the binding of the two precursor-MLs, MLs or Ligand2s to the same SE – but may also interfere with efficient binding of the two precursor-MLs, MLs and Ligand2s because of linker constraints and/or inappropriate orientation of the interacting molecules. Thus, in some cases a short linker is preferable; in other cases a long linker is preferable. The linker may thus have a length of 0.1–100,000 nm, such as in the ranges of 0.1–0.4 nm, 0.4–1 nm, 1–2 nm, 2–4 nm, 4–8 nm, 8–15 nm, 15–25 nm, 25–40 nm, 40–100 nm, 100–200 nm, 200–500 nm, 500–1,000 nm, 1,000–10,000 nm, or 10,000–100,000 nm, or larger.

In a preferred embodiment the linker has a length of less than 1 μm , such as less than 100 nm, such as less than 50 nm, such as less than 40 nm, such as less than 30, such as less than 25 nm, such as less than 20 nm, such as less than 15 nm, such as less than 10 nm, such as less than 5 nm, such as less than 2 nm, such as less than 1 nm, such as less than 0.7 nm, such as less than 0.5 nm, such as less than 0.2 nm. Shorter linker lengths will often result in composite materials with higher tensile strength, wherefore it may be desirable to use shorter linkers to obtain higher strength of the composite material. In another preferred embodiment the linker has a length of more than 0.1 nm, such as more than 0.2 nm, such as more than 0.3 nm, such as more than 0.6 nm, such as more than 0.8 nm, such as more than 1 nm, such as more than 2 nm, such as more than 4 nm, such as more than 6 nm, such as more than 8 nm, such as more than 12 nm, such as more than 15 nm, such as more than 20 nm, such as more than 25 nm, such as more than 50 nm, such as more than 80 nm, such as more than 100 nm, such as more than 200 nm, such as more than 500 nm, such as more than 1 μm , such as more than 5 μm . Longer linkers will often lead to composite materials with higher flexibility, wherefore it may be desirable to increase the length of the linker if a higher flexibility is desired.

Shorter linker lengths may result in composite materials with higher tensile strength, and longer linkers may result in increased flexibility of the composite material. Therefore, the appropriate compromise between strength and flexibility of a composite material may be obtained by appropriate choice of linker length. In a preferred embodiment the linker length is between 1 and 10 nm, less preferably between 0.5 nm and 25 nm, as this linker length often is a good compromise between flexibility and strength of the composite material.

A linker may connect two, three, four or more precursor-MLs, MLs or Ligand2s. Thus, the linker may be linear (connecting two precursor-MLs, MLs or Ligand2s) or may be branched (connecting three or more precursor-MLs, MLs and Ligand2s).

Example linkers are organic molecules such as consisting of alkanes or alkenes, or polyvinyl, polypropylene, ethylene glycol, and the linkers may consist of just one element (e.g. carbon) or several elements (e.g. C, O, N).

A linker may comprise or consist of any polymer mentioned above or below, or may comprise or consist of any part of any polymer mentioned above or below, such as any number of repeating units of any polymer mentioned above or below, such as e.g. one, two, three, four or more repeating units of any polymer mentioned above or below.

Group 9: Linkers.

The following is a non-comprehensive list of linkers: alkanes, alkenes, alkynes or combinations thereof (C1, C2, C3, C4, C5, C6, C7, C8, C9, C10, C12, C13, C14, C15, C16, C17, C18, C19, C20) and any other alkane, alkene, alkyne or combinations thereof comprising between 20 and 30 carbon atoms, or between 30 and 40 carbon atoms, or between 40 and 50 carbon atoms, or more than 50 carbon atoms; polyethylene glycol.

Any of the structural entities listed above or below may also be used as a linker.

The linkers may be modified. The modifications may be added to the linker before, after or during synthesis of the composite material unit or composite material. The modification may involve covalent attachment of aromatic or aliphatic rings, charged or polar groups such as NH₂, CO, COOH, and COSH.

Ideally, the chemical and physical characteristics of the linker should be similar to at least some of the characteristics of the structural entities of the CMU, in order to prepare composite materials where the characteristics of the matrix material and the additive are not significantly perturbed by the presence of the linker. However, under certain circumstances, such as for example when using carbon nanotubes as the additive, using processes and conditions under which e.g. solubility of the carbon nanotubes in the solution or matrix material is low, the linker may due to its solubility characteristics help make the carbon nanotube more soluble, because the linker becomes bound to the carbon nanotube by way of the precursor-ML, ML and/or Ligand2s.

CMUs – combination of SE1, ML, Linker, Ligand2, and SE2.

A composite material unit (CMU) comprises a first structural entity (SE1), a mechanical ligand (ML), a Linker, a Ligand (Ligand2), and a second structural entity (SE2). Preferred CMUs of the present invention include anyone of the following CMUs, here identified as any specific combination of said first structural entity (SE1), ML, Linker, Ligand2, and second structural entity (SE2):

SE1-ML-Linker-Ligand2-SE2 (a CMU)

where SE1 is any specific Structural Entity, or any specific type of Structural Entity, listed above or below;

where ML is any specific mechanical ligand, or any specific type of mechanical ligand, listed above or below;

where Linker is any specific Linker, or any specific type of Linker, listed above or below;

where Ligand2 is any specific Ligand2, or any specific type of Ligand2, listed above or below;

and where SE2 is any specific Structural Entity, or any specific type of Structural Entity, listed above or below.

What is further provided is a polymeric structure of CMUs, consisting of a number of repeats of the structure SE1-ML-Linker-Ligand2-SE2-Ligand2-Linker-ML-SE1. Thus, the overall structure of said polymeric structure of CMUs is (SE1-ML-Linker-Ligand2-SE2-Ligand2-Linker-ML-)_nSE1, where n is an integer larger than zero.

For n=1, the polymeric structure of CMUs is thus described by the structure -SE1-ML-Linker-Ligand2-SE2-Ligand2-Linker-ML-SE1.

For n=2, the polymeric structure of CMUs is thus described by the structure SE1-ML-Linker-Ligand2-SE2-Ligand2-Linker-ML- SE1-ML-Linker-Ligand2-SE2-Ligand2-Linker-ML-SE1.

For n=3, the polymeric structure of CMUs is thus described by the structure SE1-ML-Linker-Ligand2-SE2-Ligand2-Linker-ML- SE1-ML-Linker-Ligand2-SE2-Ligand2-Linker-ML- SE1-ML-Linker-Ligand2-SE2-Ligand2-Linker-ML-SE1.

For n=5, the polymeric structure of CMUs is thus described by the structure SE1-ML-Linker-Ligand2-SE2-Ligand2-Linker-ML- SE1-ML-Linker-Ligand2-SE2-Ligand2-Linker-ML- SE1-ML-Linker-Ligand2-SE2-Ligand2-Linker-ML- SE1-ML-Linker-Ligand2-SE2-Ligand2-Linker-ML- SE1-ML-Linker-Ligand2-SE2-Ligand2-Linker-ML-SE1.

Preferred polymeric structures of CMUs are the polymeric structures where SE1 is a carbon nanotube, and $n=1, 2, 3, 4, 5, 6, 7, 8, 9, 10-20, 20-100, \text{ or } 100-1000, \text{ or higher}$.

Other preferred polymeric structures of CMUs are the polymeric structures where SE1 is a nanotube, and $n=1, 2, 3, 4, 5, 6, 7, 8, 9, 10-20, 20-100, \text{ or } 100-1000, \text{ or higher}$.

Other preferred polymeric structures of CMUs are the polymeric structures where SE1 is a nanotube or graphene, SE2 is a nanotube or graphene, and $n=1, 2, 3, 4, 5, 6, 7, 8, 9, 10-20, 20-100, \text{ or } 100-1000, \text{ or higher}$.

Other preferred polymeric structures of CMUs are the polymeric structures where SE1 is a nanotube, SE2 is a plast polymer, and $n=1, 2, 3, 4, 5, 6, 7, 8, 9, 10-20, 20-100, \text{ or } 100-1000, \text{ or higher}$.

Other preferred polymeric structures of CMU are the polymeric structures where SE1 is a carbon nanotube, SE2 is not a carbon nanotube, and the number of repeats is two or higher.

Methods of preparing composite material units and composite materials.

The individual components of the composite material units (CMU), i.e. the structural entities (SEs), the MLs, Ligand2s, and the linker(s), may be synthesized before, during or after linking the SE, ML, Ligand2, and linker(s).

The following three processes for the synthesis of reinforced polymers (composite materials comprising a polymer component and an additive) are examples of processes where the individual components of the CMU are prepared before, during or after linking its SEs, linker(s), Ligand2 and ML:

Solution mixing: The additive (e.g. a nanotube dispersion) is mixed with a solution of preformed polymer (e.g. polyvinyl alcohol, polystyrene, polycarbonate, or poly(methyl methacrylate)) and precursor-MLs, MLs and/or Ligand2s and linker(s). CMUs will now form in the solution, whereafter the solvents are evaporated, leaving the reinforced polymer as a solid material. In this approach, the linker, precursor-ML or ML, Ligand2, polymer, and structural entities (polymer and additive) may associate during incubation in solvent, or may be partly associated prior to their mixing with the other components.

Melt processing: This process employs thermoplastic polymers (e.g. high-impact polystyrene, acrylonitrile-butadiene-styrene, polypropylene) that soften and melt when heated. The preformed, thermoplastic polymers are melted and then mixed with precursor-MLs, MLs and/or Ligand2slinkers and additive(s). Upon lowering of the temperature, and optionally fibre-spinning, melt-spinning, extrusion or other relevant process, reinforced polymers of desired characteristics are formed. As for solution mixing, the linker, precursor-ML, ML, Ligand2, polymer, and structural entities (polymer

and additive) may associate during incubation, or may be partly associated prior to their mixing with the other components.

In situ polymerization: In this process, the monomer(s) rather than the polymer(s) are used as starting material, whereafter the polymerization is carried out in situ. Thus, the additive is mixed with the monomer (e.g. epoxy resin), linkers and precursor-MLs, MLs and/or Ligand2s. As for the two processes described immediately above, the linker and precursor-MLs, MLs and/or Ligand2s may be preformed as one moiety which is then added to the polymerization mixture. In the example of a reinforced epoxy, one would therefore use an excess of the non-modified epoxy resin, plus a modified epoxy resin which had been coupled to a precursor-ML, ML and/or Ligand2s capable of binding the additive in question.

Precursor-MLs, MLs and Ligand2s, linkers and SEs suitable for the present invention include small compact molecules, linear structures, polymers, polypeptides, poly-ureas, polycarbamates, scaffold structures, cyclic structures, natural compound derivatives, alpha-, beta-, gamma-, and omega-peptides, mono-, di- and tri-substituted peptides, L- and D-form peptides, cyclohexane- and cyclopentane-backbone modified beta-peptides, vinylogous polypeptides, glycopolypeptides, polyamides, vinylogous sulfonamide peptide, Polysulfonamide conjugated peptide (i.e., having prosthetic groups), Polyesters, Polysaccharides, polycarbamates, polycarbonates, polyureas, poly-peptidylphosphonates, Azatides, peptoids (oligo N-substituted glycines), Polyethers, ethoxyformacetal oligomers, poly-thioethers, polyethylene, glycols (PEG), polyethylenes, polydisulfides, polyarylene sulfides, Polynucleotides, PNAs, LNAs, Morpholinos, oligo pyrrolinone, polyoximes, Polyimines, Polyethyleneimine, Polyacetates, Polystyrenes, Polyacetylene, Polyvinyl, Lipids, Phospholipids, Glycolipids, polycycles, (aliphatic), polycycles (aromatic), polyheterocycles, Proteoglycan, Polysiloxanes, Polyisocyanides, Polyisocyanates, polymethacrylates, Monofunctional, Difunctional, Trifunctional and Oligofunctional open-chain hydrocarbons.

Monofunctional, Difunctional, Trifunctional and Oligofunctional Nonaromatic Carbocycles, Monocyclic, Bicyclic, Tricyclic and Polycyclic Hydrocarbons, Bridged Polycyclic Hydrocarbones, Monofunctional, Difunctional, Trifunctional and Oligofunctional Nonaromatic, Heterocycles, Monocyclic, Bicyclic, Tricyclic and Polycyclic Heterocycles, bridged Polycyclic Heterocycles, Monofunctional, Difunctional, Trifunctional and Oligofunctional Aromatic Carbocycles.

Monocyclic, Bicyclic, Tricyclic and Polycyclic Aromatic Carbocycles.

Monofunctional, Difunctional, Trifunctional and Oligofunctional Aromatic Hetero-cycles.

Monocyclic, Bicyclic, Tricyclic and Polycyclic Heterocycles. Chelates, fullerenes, and any combination of the above.

In preferred embodiments, the structural entity, the precursor-ML, ML or Ligand2, the linker or the composite material comprises one or more entities chosen from the list comprising:

Aluminium antimonide – AlSb, Aluminium arsenide – AlAs, Aluminium chloride – AlCl₃, Aluminium fluoride – AlF₃, Aluminium hydroxide – Al(OH)₃, Aluminium nitrate – Al(NO₃)₃, Aluminium nitride – AlN, Aluminium oxide – Al₂O₃, Aluminium phosphide – AlP, Aluminium sulfate – Al₂(SO₄)₃, Ammonia – NH₃, Ammonium bicarbonate – NH₄HCO₃, Ammonium cerium(IV) nitrate – (NH₄)₂Ce(NO₃)₆, Ammonium chloride – NH₄Cl, Ammonium hydroxide – NH₄OH, Ammonium nitrate – NH₄NO₃, Ammonium sulfate – (NH₄)₂SO₄, Ammonium tetrathiocyanatodiamminechromate(III) – NH₄[Cr(SCN)₄(NH₃)₂], Antimony hydride – SbH₃, Antimony pentachloride – SbCl₅, Antimony pentafluoride – SbF₅, Antimony trioxide – Sb₂O₃, Arsenic trioxide (Arsenic(III) oxide) – As₂O₃, Arsenous acid – As(OH)₃, Arsine – AsH₃, Baking soda – NaHCO₃, Barium chloride – BaCl₂, Barium chromate – BaCrO₄, Barium hydroxide – Ba(OH)₂, Barium iodide – BaI₂, Barium nitrate – Ba(NO₃)₂, Barium sulfate – BaSO₄, Barium titanate – BaTiO₃, Beryllium borohydride – Be(BH₄)₂, Beryllium bromide – BeBr₂, Beryllium carbonate – BeCO₃, Beryllium chloride – BeCl₂, Beryllium fluoride – BeF₂, Beryllium hydride – BeH₂, Beryllium hydroxide – Be(OH)₂, Beryllium iodide – BeI₂, Beryllium nitrate – Be(NO₃)₂, Beryllium nitride – Be₃N₂, Beryllium oxide – BeO, Beryllium sulfate – BeSO₄, Beryllium sulfite – BeSO₃, Beryllium telluride – BeTe, Bismuth(III) oxide – Bi₂O₃, Bismuth(III) telluride – Bi₂Te₃, Borane – Diborane: B₂H₆, Pentaborane: B₅H₉ Decaborane: B₁₀H₁₄, Borax – Na₂B₄O₇·10H₂O, Boric acid – H₃BO₃, Boron carbide – B₄C, Boron nitride – BN, Boron oxide – B₂O₃, Boron suboxide – B₆O, Boron trichloride – BCl₃, Boron trifluoride – BF₃, Bromine pentafluoride – BrF₅, Bromine trifluoride – BrF₃, Cacodylic acid – (CH₃)₂AsO₂H, Cadmium arsenide – Cd₃As₂, Cadmium bromide – CdBr₂, Cadmium chloride – CdCl₂, Cadmium fluoride – CdF₂, Cadmium iodide – CdI₂, Cadmium nitrate – Cd(NO₃)₂, Cadmium selenide – CdSe (of quantum dot fame), Cadmium sulfate – CdSO₄, Cadmium telluride – CdTe, Caesium bicarbonate – CsHCO₃, Caesium carbonate – Cs₂CO₃, Caesium chloride – CsCl, Caesium chromate – Cs₂CrO₄, Caesium fluoride – CsF, Caesium hydride – CsH, Calcium carbide – CaC₂, Calcium chlorate – Ca(ClO₃)₂, Calcium chloride – CaCl₂, Calcium chromate – CaCrO₄, Calcium cyanamide – CaCN₂, Calcium fluoride – CaF₂, Calcium hydride – CaH₂, Calcium hydroxide – Ca(OH)₂, Calcium sulfate (Gypsum) – CaSO₄, Carbon dioxide – CO₂, Carbon disulfide – CS₂, Carbon monoxide – CO, Carbon tetrabromide – CBr₄, Carbon tetrachloride – CCl₄, Carbon tetraiodide – CI₄, Carbonic acid – H₂CO₃, Carbonyl fluoride – COF₂, Carbonyl sulfide – COS, Carboplatin – C₆H₁₂N₂O₄Pt, carborundum SiC, Cerium aluminium – CeAl, Cerium cadmium – CeCd, Cerium magnesium – CeMg, Cerium mercury – CeHg, Cerium silver – CeAg, Cerium thallium – CeTl, Cerium zinc – CeZn, Cerium(III) bromide – CeBr₃,

Cerium(III) chloride – CeCl_3 , Cerium(IV) sulfate – $\text{Ce}(\text{SO}_4)_2$, Chrome-alum;
 $\text{K}_2\text{SO}_4\text{Cr}_2(\text{SO}_4)_3 \cdot 24\text{H}_2\text{O}$, Chromic acid – CrO_3 , Chromium trioxide (Chromic acid) – CrO_3 ,
 Chromium(II) chloride – CrCl_2 (also chromous chloride), Chromium(II) sulfate – CrSO_4 ,
 Chromium(III) chloride – CrCl_3 , Chromium(III) oxide – Cr_2O_3 , Chromium(IV) oxide – CrO_2 ,
 Chromyl chloride – CrO_2Cl_2 , Cisplatin (cis-platinum(II) chloride diammine)– $\text{PtCl}_2(\text{NH}_3)_2$,
 Cobalt(II) bromide – CoBr_2 , Cobalt(II) carbonate – CoCO_3 , Cobalt(II) chloride – CoCl_2 , Cobalt(II)
 sulfate – CoSO_4 , Columbite – $\text{Fe}_2\text{Nb}_2\text{O}_6$, Copper(I) chloride – CuCl , Copper(I) oxide – Cu_2O ,
 Copper(I) sulfide – Cu_2S , Copper(II) carbonate – CuCO_3 , Copper(II) chloride – CuCl_2 , Copper(II)
 hydroxide – $\text{Cu}(\text{OH})_2$, Copper(II) nitrate – $\text{Cu}(\text{NO}_3)_2$, Copper(II) oxide – CuO , Copper(II) sulfate –
 CuSO_4 , Copper(II) sulfide – CuS , Cyanogen – $(\text{CN})_2$, Cyanogen chloride – CNCl , Cyanuric chloride
 – $\text{C}_3\text{Cl}_3\text{N}_3$, Decaborane (Diborane) – $\text{B}_{10}\text{H}_{14}$, Diammonium phosphate – $(\text{NH}_4)_2\text{HPO}_4$, Diborane –
 B_2H_6 , Dichlorosilane – SiH_2Cl_2 , Digallane – Ga_2H_6 , Dinitrogen pentoxide (nitronium nitrate) –
 N_2O_5 , Disilane – Si_2H_6 , Disulfur dichloride S_2Cl_2 , Dysprosium(III) chloride – DyCl_3 , Erbium(III)
 chloride – ErCl_3 , Erbium-copper – ErCu , Erbium-gold – ErAu , Erbium-Iridium – ErIr , Erbium-silver
 – ErAg , Europium(III) chloride – EuCl_3 , Fluorosulfuric acid – $\text{FSO}_2(\text{OH})$, Gadolinium(III) chloride –
 GdCl_3 , Gadolinium(III) oxide – Gd_2O_3 , Gallium antimonide – GaSb , Gallium arsenide – GaAs ,
 Gallium nitride – GaN , Gallium phosphide – GaP , Gallium trichloride – GaCl_3 , Germanium (IV)
 nitride – Ge_3N_4 , Germanium telluride – GeTe , Germanium(II) bromide – GeBr_2 , Germanium(II)
 chloride – GeCl_2 , Germanium(II) fluoride – GeF_2 , Germanium(II) iodide – GeI_2 , Germanium(II)
 oxide – GeO , Germanium(II) selenide – GeSe , Germanium(II) sulfide – GeS , Germanium(III) hydride
 – Ge_2H_6 , Germanium(IV) bromide – GeBr_4 , Germanium(IV) chloride – GeCl_4 , Germanium(IV)
 fluoride – GeF_4 , Germanium(IV) hydride (Germane)– GeH_4 , Germanium(IV) iodide – GeI_4 ,
 Germanium(IV) oxide – GeO_2 , Germanium(IV) selenide – GeSe_2 , Germanium(IV) sulfide – GeS_2 ,
 Gold ditelluride – AuTe_2 , Gold(I) bromide – AuBr , Gold(I) chloride – AuCl , Gold(I) iodide – AuI ,
 Gold(I) sulfide – Au_2S , Gold(I,III) chloride – Au_4Cl_8 , Gold(III) bromide – $(\text{AuBr}_3)_2$, Gold(III)
 chloride – $(\text{AuCl}_3)_2$, Gold(III) chloride – AuCl_3 , Gold(III) fluoride – AuF_3 , Gold(III) iodide – AuI_3 ,
 Gold(III) oxide – Au_2O_3 , Gold(III) selenide – Au_2Se_3 , Gold(III) selenide – AuSe , Gold(III) sulfide –
 Au_2S_3 , Gold(V) fluoride – AuF_5 , Hafnium fluoride, Hafnium tetrachloride – HfCl_4 ,
 Hexadecacarbonylhexarhodium – $\text{Rh}_6\text{CO}_{16}$, Hydrazine – N_2H_4 , Hydrazoic acid – HN_3 ,
 Hydrobromic acid – HBr , Hydrochloric acid – HCl , Hydrogen bromide – HBr , Hydrogen chloride –
 HCl , Hydrogen fluoride – HF , Hydrogen peroxide – H_2O_2 , Hydrogen selenide – H_2Se , Hydrogen
 sulfide – H_2S , Hydrogen telluride – H_2Te , Hydroiodic acid – HI , Hydroxylamine – NH_2OH ,
 Hypochlorous acid – HClO , Hypophosphorous acid – H_3PO_2 , Indium antimonide – InSb , Indium
 arsenide – InAs , Indium nitride – InN , Indium phosphide – InP , Indium(I) chloride, Iodic acid –
 HIO_3 , Iodine heptafluoride – IF_7 , Iodine monochloride – ICl , Iodine pentafluoride – IF_5 , Iridium(IV)

chloride, Iron(II) chloride – FeCl_2 including hydrate, Iron(II) oxide – FeO , Iron(II,III) oxide – Fe_3O_4 , Iron(III) chloride – FeCl_3 , Iron(III) nitrate – $\text{Fe}(\text{NO}_3)_3(\text{H}_2\text{O})_9$, Iron(III) oxide – Fe_2O_3 , Iron(III) thiocyanate, Iron-sulfur cluster, Krypton difluoride – KrF_2 , Lanthanum aluminium – LaAl , Lanthanum cadmium – LaCd , Lanthanum carbonate – $\text{La}_2(\text{CO}_3)_3$, Lanthanum magnesium – LaMg , Lanthanum mercury – LaHg , Lanthanum silver – LaAg , Lanthanum tellurium – LaTe , Lanthanum zinc – LaZn , Lead zirconate titanate – $\text{Pb}[\text{TixZr}_{1-x}]\text{O}_3$ (e.g., $x = 0.52$ is Lead zirconium titanate), Lead(II) carbonate – $\text{Pb}(\text{CO}_3)$, Lead(II) chloride – PbCl_2 , Lead(II) iodide – PbI_2 , Lead(II) nitrate – $\text{Pb}(\text{NO}_3)_2$, Lead(II) oxide – PbO , Lead(II) phosphate – $\text{Pb}_3(\text{PO}_4)_2$, Lead(II) selenide – PbSe , Lead(II) sulfate – $\text{Pb}(\text{SO}_4)$, Lead(II) sulfide – PbS , Lead(II) telluride – PbTe , Lead(IV) oxide – PbO_2 , Lithium aluminium hydride – LiAlH_4 , Lithium bromide – LiBr , Lithium carbonate (Lithium salt) – Li_2CO_3 , Lithium chloride – LiCl , Lithium hydride – LiH , Lithium hydroxide – LiOH , Lithium iodide – LiI , Lithium nitrate – LiNO_3 , Lithium sulfate – Li_2SO_4 , Magnesium antimonide – MgSb , Magnesium carbonate – MgCO_3 , Magnesium chloride – MgCl_2 , Magnesium oxide – MgO , Magnesium phosphate – $\text{Mg}_3(\text{PO}_4)_2$, Magnesium sulfate – MgSO_4 , Manganese(II) chloride – MnCl_2 , Manganese(II) phosphate – $\text{Mn}_3(\text{PO}_4)_2$, Manganese(II) sulfate monohydrate – $\text{MnSO}_4 \cdot \text{H}_2\text{O}$, Manganese(III) chloride – MnCl_3 , Manganese(IV) fluoride – MnF_4 , Manganese(IV) oxide (manganese dioxide) – MnO_2 , Mercury fulminate – $\text{Hg}(\text{ONC})_2$, Mercury(I) chloride – Hg_2Cl_2 , Mercury(I) sulfate – Hg_2SO_4 , Mercury(II) chloride – HgCl_2 , Mercury(II) selenide – HgSe , Mercury(II) sulfate – HgSO_4 , Mercury(II) sulfide – HgS , Mercury(II) telluride – HgTe , Metaphosphoric acid – HPO_3 , Molybdate orange, Molybdenum disulfide – MoS_2 , Molybdenum hexacarbonyl – $\text{C}_6\text{O}_6\text{Mo}$, Molybdenum trioxide – MoO_3 , Molybdic acid – H_2MoO_4 , Neodymium(III) chloride – NdCl_3 , Nessler's reagent – $\text{K}_2[\text{HgI}_4]$, Nickel(II) carbonate – NiCO_3 , Nickel(II) chloride – NiCl_2 and hexahydrate, Nickel(II) hydroxide – $\text{Ni}(\text{OH})_2$, Nickel(II) nitrate – $\text{Ni}(\text{NO}_3)_2$, Nickel(II) oxide – NiO , Niobium oxychloride – NbOCl_3 , Niobium pentachloride – NbCl_5 , Nitric acid – HNO_3 , Nitrogen dioxide – NO_2 , Nitrogen monoxide – NO , Nitrosylsulfuric acid – NOHSO_4 , Osmium tetroxide (osmium(VIII) oxide) – OsO_4 , Osmium trioxide (osmium(VI) oxide) – OsO_3 , Oxybis(tributyltin) – $\text{C}_{24}\text{H}_{54}\text{OSn}_2$, Oxygen difluoride – OF_2 , Ozone – O_3 , Palladium(II) chloride – PdCl_2 , Palladium(II) nitrate – $\text{Pd}(\text{NO}_3)_2$, Pentaborane – B_5H_9 , Pentasulfide antimony – Sb_2S_5 , Perchloric acid – HClO_4 , Perchloryl fluoride – ClFO_3 , Persulfuric acid (Caro's acid) – H_2SO_5 , Perxenic acid – H_4XeO_6 , Phenylarsine oxide – $(\text{C}_6\text{H}_5)\text{AsO}$, Phenylphosphine – $\text{C}_6\text{H}_7\text{P}$, Phosgene – COCl_2 , Phosphine – PH_3 , Phosphite – HPO_3^{2-} , Phosphomolybdic acid – $\text{HMoNiO}_6\text{P}_4$, Phosphoric acid – H_3PO_4 , Phosphorous acid (Phosphoric(III) acid) – H_3PO_3 , Phosphorus pentabromide – PBr_5 , Phosphorus pentafluoride – PF_5 , Phosphorus pentasulfide – P_4S_{10} , Phosphorus pentoxide – P_2O_5 , Phosphorus sesquisulfide – P_4S_3 , Phosphorus tribromide – PBr_3 , Phosphorus trichloride – PCl_3 , Phosphorus trifluoride – PF_3 , Phosphorus triiodide – PI_3 ,

Phosphotungstic acid – $\text{H}_3\text{PW}_{12}\text{O}_{40}$, Platinum(II) chloride – PtCl_2 , Platinum(IV) chloride – PtCl_4 , Plutonium dioxide (Plutonium(IV) oxide) – PuO_2 , Plutonium(III) chloride – PuCl_3 , Potash Alum – $\text{K}_2\text{SO}_4 \cdot \text{Al}_2(\text{SO}_4)_3 \cdot 24\text{H}_2\text{O}$, Potassium aluminium fluoride – KAlF_4 , Potassium borate – $\text{K}_2\text{B}_4\text{O}_7 \cdot 4\text{H}_2\text{O}$, Potassium bromide – KBr , Potassium calcium chloride – KCaCl_3 , Potassium carbonate – K_2CO_3 , Potassium chlorate – KClO_3 , Potassium chloride – KCl , Potassium ferrioxalate – $\text{K}_3[\text{Fe}(\text{C}_2\text{O}_4)_3]$, Potassium hydrogen fluoride – HF_2K , Potassium hydrogencarbonate – KHCO_3 , Potassium hydroxide – KOH , Potassium iodide – KI , Potassium monopersulfate – $\text{K}_2\text{SO}_4 \cdot \text{KHSO}_4 \cdot 2\text{KHSO}_5$, Potassium nitrate – KNO_3 , Potassium perbromate – KBrO_4 , Potassium perchlorate – KClO_4 , Potassium permanganate – KMnO_4 , Potassium sulfate – K_2SO_4 , Potassium sulfide – K_2S , Potassium titanyl phosphate – KTiOPO_4 , Potassium vanadate – KVO_3 , Praseodymium(III) chloride – PrCl_3 , Protonated molecular hydrogen – H_3^+ , Prussian blue (Iron(III) hexacyanoferrate(II)) – $\text{Fe}_4[\text{Fe}(\text{CN})_6]_3$, Pyrosulfuric acid – $\text{H}_2\text{S}_2\text{O}_7$, Radium chloride – RaCl_2 , Radon difluoride – RnF_2 , Rhodium(III) chloride – RhCl_3 , Rubidium bromide – RbBr , Rubidium chloride – RbCl , Rubidium fluoride – RbF , Rubidium hydroxide – RbOH , Rubidium iodide – RbI , Rubidium nitrate – RbNO_3 , Rubidium oxide – Rb_2O , Rubidium telluride – Rb_2Te , Ruthenium(VIII) oxide – RuO_4 , Samarium(II) iodide – SmI_2 , Samarium(III) chloride – SmCl_3 , Scandium(III) chloride – ScCl_3 and hydrate, Scandium(III) fluoride – ScF_3 , Scandium(III) nitrate – $\text{Sc}(\text{NO}_3)_3$, Scandium(III) oxide – Sc_2O_3 , Scandium(III) triflate – $\text{Sc}(\text{OSO}_2\text{CF}_3)_3$, Selenic acid – H_2SeO_4 , Selenious acid – H_2SeO_3 , Selenium dioxide – SeO_2 , Selenium trioxide – SeO_3 , Silane – SiH_4 , Silica gel – $\text{SiO}_2 \cdot n\text{H}_2\text{O}$, Silicic acid – $[\text{SiO}_x(\text{OH})_{4-2x}]_n$, Silicochloroform – Cl_3HSi , Silicofluoric acid – H_2SiF_6 , Silicon dioxide – SiO_2 , Silver chloride – AgCl , Silver iodide – AgI , Silver nitrate – AgNO_3 , Silver sulfide – Ag_2S , Silver(I) fluoride – AgF , Silver(II) fluoride – AgF_2 , Soda lime –, Sodamide – NaNH_2 , Sodium borohydride – NaBH_4 , Sodium bromate – NaBrO_3 , Sodium bromide – NaBr , Sodium carbonate – Na_2CO_3 , Sodium chlorate – NaClO_3 , Sodium chloride – NaCl , Sodium cyanide – NaCN , Sodium ferrocyanide – $\text{Na}_4\text{Fe}(\text{CN})_6$, Sodium hydride – NaH , Sodium hydrogen carbonate (Sodium bicarbonate) – NaHCO_3 , Sodium hydrosulfide – NaSH , Sodium hydroxide – NaOH , Sodium iodide – NaI , Sodium monofluorophosphate (MFP) – Na_2PFO_3 , Sodium nitrate – NaNO_3 , Sodium nitrite – NaNO_2 , Sodium percarbonate – $2\text{Na}_2\text{CO}_3 \cdot 3\text{H}_2\text{O}_2$, Sodium persulfate – $\text{Na}_2\text{S}_2\text{O}_8$, Sodium phosphate; see Trisodium phosphate – Na_3PO_4 , Sodium silicate – Na_2SiO_3 , Sodium sulfate – Na_2SO_4 , Sodium sulfide – Na_2S , Sodium sulfite – Na_2SO_3 , Sodium tellurite – Na_2TeO_3 , Stannous chloride (tin(II) chloride) – SnCl_2 , Stibine – SbH_3 , Strontium chloride – SrCl_2 , Strontium nitrate – $\text{Sr}(\text{NO}_3)_2$, Strontium titanate – SrTiO_3 , Sulfamic acid – $\text{H}_3\text{NO}_3\text{S}$, Sulfane – H_2S , Sulfur dioxide – SO_2 , Sulfuric acid – H_2SO_4 , Sulfurous acid – H_2SO_3 , Sulfuryl chloride – SO_2Cl_2 , Tantalum carbide – TaC , Tantalum(V) oxide – Ta_2O_5 , Telluric acid – H_6TeO_6 , Tellurium dioxide – TeO_2 , Tellurium tetrachloride – TeCl_4 , Tellurous acid – H_2TeO_3 , Terbium(III) chloride – TbCl_3 , Tetraborane(10) –

B4H10, Tetrachloroauric acid – AuCl₃, Tetrafluorohydrazine – N₂F₄, Tetramminecopper(II) sulfate – [Cu(NH₃)₄]SO₄, Tetrasulfur tetranitride – S₄N₄, Thallium(I) carbonate – Tl₂CO₃, Thallium(I) fluoride – TlF, Thallium(III) oxide Tl₂O₃, Thallium(III) sulfate, Thionyl chloride – SOCl₂, Thiophosgene – CSCl₂, Thiophosphoryl chloride – Cl₃PS, Thorium dioxide – ThO₂, Thortveitite – (Sc,Y)₂Si₂O₇, Thulium(III) chloride – TmCl₃, Tin(II) chloride – SnCl₂, Tin(II) fluoride – SnF₂, Tin(IV) chloride – SnCl₄, Titanium boride – TiB₂, Titanium carbide – TiC, Titanium dioxide (B) (titanium(IV) oxide) – TiO₂, Titanium dioxide (titanium(IV) oxide) – TiO₂, Titanium nitride – TiN, Titanium(II) chloride – TiCl₂, Titanium(III) chloride – TiCl₃, Titanium(IV) bromide (titanium tetrabromide) – TiBr₄, Titanium(IV) chloride (titanium tetrachloride) – TiCl₄, Titanium(IV) iodide (titanium tetraiodide) – TiI₄, Trifluoromethanesulfonic acid – CF₃SO₃H, Trifluoromethylisocyanide – C₂NF₃, Trimethylphosphine – C₃H₉P, Trioxidane – H₂O₃, Tripotassium phosphate – K₃PO₄, Trisodium phosphate – Na₃PO₄, Triuranium octaoxide (pitchblende or yellowcake) – U₃O₈, Tungsten carbide – WC, Tungsten hexacarbonyl – W(CO)₆, Tungsten(VI) chloride – WCl₆, Tungsten(VI) Fluoride – WF₆, Tungstic acid – H₂WO₄, Uranium hexafluoride – UF₆, Uranium pentafluoride – UF₅, Uranium tetrachloride – UCl₄, Uranium tetrafluoride – UF₄, Uranyl carbonate – UO₂CO₃, Uranyl chloride – UO₂Cl₂, Uranyl fluoride – UO₂F₂, Uranyl hydroxide – (UO₂)₂(OH)₄, Uranyl hydroxide – UO₂(OH)₂, Uranyl nitrate – UO₂(NO₃)₂, Uranyl sulfate – UO₂SO₄, Vanadium carbide – VC, Vanadium oxytrichloride (Vanadium(V) oxide trichloride) – VOCl₃, Vanadium(II) chloride – VCl₂, Vanadium(II) oxide – VO, Vanadium(III) bromide – VBr₃, Vanadium(III) chloride – VCl₃, Vanadium(III) fluoride – VF₃, Vanadium(III) nitride – VN, Vanadium(III) oxide – V₂O₃, Vanadium(IV) chloride – VCl₄, Vanadium(IV) fluoride – VF₄, Vanadium(IV) oxide – VO₂, Vanadium(IV) sulfate – VOSO₄, Vanadium(V) oxide – V₂O₅, Water – H₂O, Xenic acid – H₂XeO₄, Xenon difluoride – XeF₂, Xenon hexafluoroplatinate – Xe[PtF₆], Xenon tetrafluoride – XeF₄, Xenon tetroxide – XeO₄, Ytterbium(III) chloride – YbCl₃, Ytterbium(III) oxide – Yb₂O₃, Yttrium aluminium garnet – Y₃Al₅O₁₂, Yttrium barium copper oxide – YBa₂Cu₃O₇, Yttrium cadmium – YCd, Yttrium copper – YCu, Yttrium gold – YAu, Yttrium iridium – YIr, Yttrium iron garnet – Y₃Fe₅O₁₂, Yttrium magnesium – YMg, Yttrium rhodium – YRh, Yttrium silver – YAg, Yttrium zinc – YZn, Yttrium(III) antimonide – YSb, Yttrium(III) arsenide – YAs, Yttrium(III) bromide – YBr₃, Yttrium(III) fluoride – YF₃, Yttrium(III) oxide – Y₂O₃, Yttrium(III) sulfide – Y₂S₃, Zinc bromide – ZnBr₂, Zinc carbonate – ZnCO₃, Zinc chloride – ZnCl₂, Zinc cyanide – Zn(CN)₂, Zinc fluoride – ZnF₂, Zinc iodide – ZnI₂, Zinc oxide – ZnO, Zinc selenide – ZnSe, Zinc sulfate – ZnSO₄, Zinc sulfide – ZnS, Zinc telluride – ZnTe, Zirconia hydrate – ZrO₂.nH₂O, Zirconium carbide – ZrC, Zirconium hydroxide – Zr(OH)₄, Zirconium nitride – ZrN, Zirconium orthosilicate – ZrSiO₄, Zirconium tetrahydroxide – H₄O₄Zr, or Zirconium tungstate – ZrW₂O₈, Zirconium(IV) chloride – ZrCl₄, Zirconium(IV) oxide – ZrO₂.

Combinations of SEs, precursor-MLs, MLs and Ligand2s and linkers, and composite materials.

Preferred embodiments include i) Embodiments in which ML and Ligand2 are both capable of mechanically binding, or are both mechanically bound, to SE1 and SE2, respectively, ii)

Embodiments in which ML and Ligand2 are both capable of non-covalent binding, or are both non-covalently bound, to SE1 and SE2, respectively, iii) Embodiments in which Ligand2 is covalently bound to SE2, and where for each of i), ii) and iii), SE1 and SE2 are defined as follows:

- SE1 is a metal; more preferably SE1 is a metal and SE2 is a ceramic; more preferably SE1 is a metal and SE2 is a polymer; yet more preferably SE1 is metal and SE2 is a metal, or
- SE1 is a polymer; more preferably SE1 is a polymer and SE2 is a ceramic; more preferably SE1 is a polymer and SE2 is a polymer; yet more preferably SE1 is polymer and SE2 is a metal, or
- SE1 is a ceramic; more preferably SE1 is a ceramic and SE2 is a ceramic; more preferably SE1 is a ceramic and SE2 is a polymer; yet more preferably SE1 is ceramic and SE2 is a metal, or
- SE1 is a fullerene; more preferably SE1 is a fullerene and SE2 is a ceramic; more preferably SE1 is a fullerene and SE2 is a polymer; yet more preferably SE1 is fullerene and SE2 is a metal, or
- SE1 is a carbon nanotube; more preferably SE1 is a carbon nanotube and SE2 is a ceramic; more preferably SE1 is a carbon nanotube and SE2 is a polymer; yet more preferably SE1 is carbon nanotube and SE2 is a metal, or
- SE1 is a graphene; more preferably SE1 is a graphene and SE2 is a ceramic; more preferably SE1 is a graphene and SE2 is a polymer; yet more preferably SE1 is graphene and SE2 is a metal, or
- SE1 is a diamond or diamond film; more preferably SE1 is a diamond or diamond film and SE2 is a ceramic; more preferably SE1 is a diamond or diamond film and SE2 is a polymer; yet more preferably SE1 is diamond or diamond film and SE2 is a metal, or
- SE1 is a nanotube; more preferably SE1 is a nanotube and SE2 is a ceramic; more preferably SE1 is a nanotube and SE2 is a polymer; yet more preferably SE1 is nanotube and SE2 is a metal, or
- SE1 is an epoxy polymer; more preferably SE1 is an epoxy polymer and SE2 is a ceramic; more preferably SE1 is an epoxy polymer and SE2 is a polymer; yet more preferably SE1 is an epoxy polymer and SE2 is a metal, or

- SE1 is a quartz; more preferably SE1 is a quartz and SE2 is a ceramic; more preferably SE1 is a quartz and SE2 is a polymer; yet more preferably SE1 is quartz and SE2 is a metal, or
- SE1 is a carbon nanofiber; more preferably SE1 is a carbon nanofiber and SE2 is a ceramic; more preferably SE1 is a carbon nanofiber and SE2 is a polymer; yet more preferably SE1 is carbon nanofiber and SE2 is a metal, or
- SE1 is a linear polymer; more preferably SE1 is a linear polymer and SE2 is a ceramic; more preferably SE1 is a linear polymer and SE2 is a polymer; yet more preferably SE1 is linear polymer and SE2 is a metal, or
- SE1 is a short-chain branched polymer; more preferably SE1 is a short-chain branched polymer and SE2 is a ceramic; more preferably SE1 is a short-chain branched polymer and SE2 is a polymer; yet more preferably SE1 is short-chain branched polymer and SE2 is a metal, or
- SE1 is a long-chain branched polymer; more preferably SE1 is a long-chain branched polymer and SE2 is a ceramic; more preferably SE1 is a long-chain branched polymer and SE2 is a polymer; yet more preferably SE1 is long-chain branched polymer and SE2 is a metal, or
- SE1 is a ladder-type polymer; more preferably SE1 is a ladder-type polymer and SE2 is a ceramic; more preferably SE1 is a ladder-type polymer and SE2 is a polymer; yet more preferably SE1 is ladder-type polymer and SE2 is a metal, or
- SE1 is a star-branched polymer; more preferably SE1 is a star-branched polymer and SE2 is a ceramic; more preferably SE1 is a star-branched polymer and SE2 is a polymer; yet more preferably SE1 is star-branched polymer and SE2 is a metal, or
- SE1 is a network polymer; more preferably SE1 is a network polymer and SE2 is a ceramic; more preferably SE1 is a network polymer and SE2 is a polymer; yet more preferably SE1 is network polymer and SE2 is a metal.

In any of the above examples, SE1 and SE2 may be components of a CMU. Said CMU may be part of a composite material, or the CMU may be a sensor or some other partly isolated entity.

Particularly preferred LUs include LUs that comprise a ML that binds CNT

Particularly preferred LUs include LUs that consist of two MLs that bind CNT

Particularly preferred LUs include LUs that comprise two MLs that bind graphene

Particularly preferred LUs include LUs that consist of two MLs that bind graphene

Particularly preferred LUs include LUs that comprise two MLs that bind bornitride

Particularly preferred LUs include LUs that consist of two MLs that bind bornitride

Particularly preferred LUs include LUs that comprise two MLs that bind bornitride nanotube

Particularly preferred LUs include LUs that consist of two MLs that bind bornitride nanotube

Particularly preferred LUs include LUs that comprise two MLs where one binds CNT and the other binds graphene

Particularly preferred LUs include LUs that consist of two MLs where one binds CNT and the other binds bornitride

Particularly preferred LUs include LUs that comprise two MLs where one binds CNT and the other binds bornitride nanotube

Particularly preferred LUs include LUs that consist a ML and a Ligand2 where one binds graphene and the other binds bornitride nanotube

Preferably, SE1 is a ceramic material, a COOH-functionalized CNT, a OH-functionalized carbon nanotube, an NH₂-functionalized carbon nanotube, an SH-functionalized CNT, COOH-functionalized graphene, multi-layer graphene, NH₂-functionalized graphene, OH-functionalized graphene, a glass fibre, aramid, E-glass, iron, polyester, polyethylene, S-glass, steel, a battery, a borosilicate, a buckyball, a buckytube, a capacitor, a carbon dome, a carbon material, a carbon megatube, a carbon nanofoam, a carbon polymer, a catalyst, a cathode, a coated carbon nanotube, a conductor, a covalent crystal, a crystal, a crystalline material, a defect-free graphene sheet, a defect-free MWCNT, a defect-free SWCNT, a dielectric material, a diode, a dodecahedrane, a doped glass, a fibre, a fullerite, a fused silica, a glue, a green ceramic, a lanthanides, a machinable ceramic, a metal alloy, a metal-functionalized carbon nanotube, a metalised dielectric, a metallised ceramic, a metalloid, a mineral, a non-covalent crystal, a piezoelectric material, a platinum group metal, a post-transition metal, a rare earth element, a sapphire, a semiconductor, a sensor, a silicon nitride, a single crystal fiber, a sol-gel, a synthetic diamond, a transition metal, a triple-wall carbon nanotube, a tungsten carbide, alumina, alumina trihydrate, aluminium, aluminum boride, aluminum oxide, aluminum trihydroxide, amorphous carbon, an actinides, an amalgam, an anode, an elastomers, an electrode, an endohedral fullerene, an insulator, an intermetallic, an ionic crystal, an organic material, anode, anthracite, asbestos, barium, bone, boron, brass, buckypaper, calcium carbonite, calcium metasilicate, calcium sulfate, calcium sulphate, carbon black, carbon nanofoam, cathode, chromium, clay, coal, copper, diamond, diamond-like carbon, double-layer graphene, exfoliated graphite, exfoliated silicate, flourinated graphene, fused silica, gallium arsenide, gallium nitride, germanium, glass, glass microsphere, glass ribbons, glassy carbon, gold, hardened steel, hydrous magnesium silicate, hyperdiamond, iron oxides, lead zirconium titanate, lignite, lithium niobate, lonsdaleite, magnesium dihydroxide, magnesium oxide, manganese, metal oxide, mica, molybdenum, nickel, nylon, palladium, pencil lead, platinum, prismane, pyrolytic graphite, rubber, silica, silica gel, silicon, silicon carbide, silicon dioxide, silicon nitride, silver, soot, stainless steel, tantalum, titanium, titanium oxide,

tooth cementum, tooth dentine, tooth enamel, tungsten, tungsten carbide, wood, zinc oxide, zirconia, a nanofibre, a plastic, a fibre, a nanomaterial, graphite, a cellulose nanofibre, a ceramic, curran, a nanothread, a functionalized nanotube, a plastic material, a metal material, a polymer material, or a thio-functionalized graphene molecule

More preferably, SE1 is a graphane molecule, a graphene oxide molecule, a graphyne molecule, a reduced graphene oxide molecule, or a metal

Most preferably, SE1 is a carbon fibre, a carbon nanofibre, a carbon nanothread, a composite material, a fullerene, a MWCNT, a SWCNT, a graphene molecule, a nanotube, a boron nitride sheet, a one-layer molecule, a one-atom layer molecule, a boron nitride nanotube, a functionalized CNT, a functionalized graphene, a functionalized boron nitride nanotube or sheet, a multi-walled nanotube, or a single-walled nanotube

Preferably, SE2 is a biopolymer, a block copolymer, a conductive polymer, a cross-linked polyethylene, a fluoroelastomer, a high density polypropylene, a low density polypropylene, a medium density polyethylene, a medium density polypropylene, a polyacrylonitrile, a polycaprolactone molecule, a polychloroprene, a polychlorotrifluoroethylene, a polyester molecule, a polyimide, a polylactic acid, a polyphenol, a polysulphone, a polytetrafluoroethylene, a polyurea, a polyurethane, a polyvinyl, a silicone, an elastomer, an inorganic polymer, an ultra-high-molecular-weight polyethylene, a melamin resin, a neoprene, a superlinear polyethylene, a poly(ethylene-vinyl acetate) (PEVA), a polyamide, a polyoxymethylene (POM), polyethylene, polyurethane, epoxy-based polymer, poly ethylvinyl acetate, polystyrene, polypropylene, polyether, polyethylene oxide, polypropylene oxide, polyacrylates, a polymer, a non-biologic polymer, a biologic polymer, polyaromatic polymer, polyaliphatic polymer, a polymer consisting of C, a polymer consisting of C and H, a polymer consisting of C and H and O, a polymer comprising C, a polymer comprising C and H, a polymer comprising C and H and O, polytetrafluoroethylene (PTFE), a polymer comprising C, a polymer comprising O, a polymer comprising N, a polymer comprising Cl, a polymer comprising H, a polymer comprising a carbonyl, a polymer comprising an OH, a polymer comprising an amide bond, a polymer comprising F, a polymer comprising S, a polymer comprising Si, a polymer consisting of C and H and O and N, a polymer comprising C and H and O and N, a polymer consisting of C and H and Cl, a polymer comprising C and H and Cl, a polymer consisting of C and H and F, a polymer comprising C and H and F, a shape memory polymer, a polymer consisting of 4-(ethoxycarbonyl)benzoic ester, a polymer consisting of butyl, a polymer consisting of chloro-ethyl, a polymer consisting of ethyl, a polymer consisting of ethyl-acetate, a polymer consisting of ethyl-nitril, a polymer consisting of ethylbenzene, a polymer consisting of isobutyl, a polymer consisting of isopentyl, a polymer consisting of isopropyl, a polymer consisting of methyl, a polymer consisting of methyl 2-

methyl-propionate, a polymer consisting of neopentyl, a polymer consisting of pentyl, a polymer consisting of phenyl-sulfide, a polymer consisting of propanoic acid, a polymer consisting of propanoic acid methyl ester, a polymer consisting of propyl, a polymer consisting of sec-butyl, a polymer consisting of sec-pentyl, a polymer consisting of tert-butyl, a polymer consisting of tert-pentyl, a polymer consisting of tetra-fluoro-ethyl, a polymer comprising 2-methyl-propanoic acid methyl ester, a polymer comprising 4-(2-phenylpropan-2-yl)phenyl hydrogen carbonate, a polymer comprising 4-(4-phenoxybenzoyl)benzaketone, a polymer comprising 4-(ethoxycarbonyl)benzoic ester, a polymer comprising butyl, a polymer comprising chloro-ethyl, a polymer comprising ethyl, a polymer comprising ethyl-acetate, a polymer comprising ethyl-nitril, a polymer comprising ethylbenzene, a polymer comprising isobutyl, a polymer comprising isopentyl, a polymer comprising isopropyl, a polymer comprising methyl, a polymer comprising methyl 2-methyl-propionate, a polymer comprising neopentyl, a polymer comprising pentyl, a polymer comprising phenyl-sulfide, a polymer comprising propanoic acid, a polymer comprising propanoic acid methyl ester, a polymer comprising propyl, a polymer comprising sec-butyl, a polymer comprising sec-pentyl, a polymer comprising tert-butyl, a polymer comprising tert-pentyl, or a polymer comprising tetra-flour-ethyl

More preferably, SE2 is a polyacrylate, a polyolefine, an acrylonitrile butadiene styrene polymer (ABS), an organic polymer, a styrene acrylonitrile copolymer, a styrene butadiene latex, an unsaturated polyester (UPR), a bis-maleimide (BMI), a polymeric cyanate ester, A6 nylon, a polyarylether-etherketone (PEEK), a polyethylenimine (PEI), a poly-ether-ketone-ketone (PEKK), a poly(methyl methacrylate) (PMMA), a polyphenylene sulfide (PPS), poly(ethylvinyl alcohol) (EVA), a carbon fibre, a carbon nanofibre, a carbon nanothread, a composite material, a fullerene, a graphane molecule, a graphene oxide molecule, a graphyne molecule, a reduced graphene oxide molecule, a metal, a boron nitride sheet, a one-layer molecule, a one-atom layer molecule, a functionalized CNT, a functionalized graphene, a functionalized boron nitride, a multi-walled nanotube, or a single-walled nanotube.

Most preferably, SE2 is a copolymer, a high density polyethylene (HDPE), a linear low density polyethylene (LLDPE), a low density polyethylene (LDPE), a nylon, a polyamide (PA), a polycarbonate (PC), a polyethylene (PE), a polymer, a polypropylene (PP), a polystyrene (PS), an epoxy-based polymer, a polyethylene terephthalate (PET), a polyvinylchloride (PVC), a MWCNT, a SWCNT, a graphene molecule, a nanotube, or a boron nitride nanotube.

Preferably, the ML or Ligand2 comprises any of the following molecule structures: compound 1 from de Juan et al., 2015, doi: 10.1039/c5sc02916c, compound 2 from de Juan et al., 2015, doi: 10.1039/c5sc02916c, compound 3 from de Juan et al., 2015, doi: 10.1039/c5sc02916c, compound 4 from de Juan et al., 2015, doi: 10.1039/c5sc02916c, compound 5 from de Juan et al., 2015, doi:

10.1039/c5sc02916c, 1,2,3-Trichlorobenzene, 1,2,4-Trichlorobenzene, 9,10-dihydroanthracene, covalent bond, non-covalent bond, peptide composed of 5 amino acids, peptide composed of 6 amino acids, pyrene phenyl ester, small molecule with a molecular weight of 12 to 1200 dalton, benzene, biphenyl, peptide with the sequence CPTSTGQAC, peptide with the sequence CTLHVSSYC, dodecyl-trimethylammonium bromide (DTAB), peptide with the sequence ELWR, peptide with the sequence ELWRPTR, with the sequence ELWSIDTSAHRK, fluoranthene, hexane, peptide with the sequence HTDWRLGTWHHS, peptide with the sequence KPRSVSG-dansyl, m-dinitrobenzene, , monooleate, monostearate, nitrobenzene, p-nitrotoluene, p-terphenyl, polycyclic carbonhydrides, polystyrene-polyethylene oxide copolymer, polyvinylpyrrolidone, porphyrine, pyrenecarboxylic acid, pyrenyl, peptide with the sequence QLMHDYR, peptide with the sequence QTWPPPLWFSTS, riboflavin, peptide with the sequence RLNPPSQMDPPF, sodium Dodecyl Benzene Sulphonate (SDBS), sodium dodecyl sulfate (SDS), tetraphene, peptide with the sequence IFRLSWGTYFS, peptide with the sequence KTQATSESGSAGRQMFVADMG, peptide with the sequence KTQATSRGTRGMRTSGGFPVG, peptide with the sequence KTQATSVPRKAARRWEQVDSV, peptide with the sequence MHGKTQATSGTIQS, peptide with the sequence PQAQDVELPQELQDQHREVEV, peptide with the sequence SKTSGRDQSKRVPRYWNVHRD, peptide with the sequence SKTSRESSAVQMGKARFLCT, toluene, trans-1,2-diaminocyclohexane-N,N,N',N'-tetraacetic acid (CDTA), triphenylene, tween-60, tween-80, aromatic molecule, aromatic amino acid, aromatic ring, heteroaromatic ring, non-aromatic molecule, triple bond, Annulene, Aceanthrylene, Acenaphthylene, Acephenanthrylene, Anthracene, as-Indacene, Azulene, Benzene, Biphenylene, Chrysene, Coronene, Decacene, Decahelicene, Decaphene, Fluoranthene, Fluorene, Heptacene, Heptahelicene, Heptaphene, Heptaphenylene, Hexacene, Hexahelicene, Hexaphene, Hexaphenylene, Indene, Naphthalene, Nonacene, Nonahelicene, Nonaphene, Nonaphenylene, Octacene, Octahelicene, Octaphene, Octaphenylene, Ovalene, Pentacene, Pentalene, Pentaphene, Pentaphenylene, Perylene, Phenalene, Phenanthrene, Picene, Pleiadene, Polyacene, Polyallene, Polyaphene, Polyhelicene, Polynaphthylene, Polyphenylene, Pyranthrene, Rubicene, s-Indacene, Tetracene, Tetranaphthylene, Tetraphene, Tetraphenylene, Trinaphthylene, Triphenylene, 1,10-Phenanthroline, 1,5-Naphthyridine, 1,6-Naphthyridine, 1,7-Naphthyridine, 1,7-Phenanthroline, 1,8-Naphthyridine, 1,8-Phenanthroline, 1,9-Phenanthroline, 2,6-Naphthyridine, 2,7-Naphthyridine, 2,7-Phenanthroline, 2,8-Phenanthroline, 2,9-Phenanthroline, 3,7-Phenanthroline, 3,8-Phenanthroline, 4,7-Phenanthroline, Acridarsine, Acridine, Acridophosphine, Arsanthrene, Arsanthridine, Arsindole, Arsindolizine, Arsinoline, Arsinolizine, Boranthrene, Carbazole, Chromene, Cinnoline, Furan, Imidazole, Indazole, Indole, Indolizine, Isoarsindole, Isoarsinoline, Isochromene, Isoindole, Isophosphindole, Isophosphinoline, Isoquinoline, Isoselenochromene, Isotellurochromene, Isothiochromene, Mercuranthrene, Oxanthrene, Perimidine, Phenanthridine, Phenarsazinine,

Phenazine, Phenomercurazine, Phenophosphazinine, Phenoselenazine, Phenotellurazine, Phenothiarsinine, Phenothiazine, Phenoxaphosphinine, Phenoxarsinine, Phenoxaselenine, Phenoxastibinine, Phenoxatellurine, Phenoxathiine, Phenoxazine, Phosphanthrene, Phosphanthridine, Phosphindole, Phosphindolizine, Phosphinoline, Phosphinolizine, Phthalazine, Pteridine, Purine, Pyran, Pyrazine, Pyrazole, Pyridazine, Pyridine, Pyrimidine, Pyrrole, Pyrrolizine, Quinazoline, Quinoline, Quinolizine, Quinoxaline, Selenanthrene, Selenochromene, Selenoxanthene, Silanthrene, Telluranthrene, Tellurochromene, Telluroxanthene, Thianthrene, Thiochromene, Thioxanthene, or Xanthene

More preferably, ML and/or Ligand2 comprises a diamino pyrene, covalent ligand, anthracene, peptide with the sequence IFRLSWGTYFS, naphthalene, phenanthrene, aminogroup-containing carbonhydride, peptide with the sequence HWKHPWGAWDTL, bis-pyrene, dipyrene (phenyl ester), tetracycline, peptide with the sequence

DAEFRHDSGYEVHHQKLVFFAEDVGSNKGAIIGLMVGGVV, or peptide with the sequence DAEFRHDSGYEVHHQKLVFFAEDVGSNKGAIIGLMVGGVVIA.

Most preferably, ML and/or Ligand2 comprises a pyrene, aromatic system, such as benzene, nitrobenzene, toluene, 1,2,3-trichlorobenzene, 1,2,4-trichlorobenzene, m-dinitrobenzene, p-nitrobenzene, naphthalene, anthracene, fluoranthene, phenanthrene, pyrene, pyrene-diamine, pyrene-phenyl ester, dipyrene (phenyl ester), tetracycline, as well as their substituted variants, a halogen, nitro group, amine, thiol, alcohol, ester, amide, carboxylic acid, phenol, indole, imidazole, sulfonate or phosphate, C1-C10 alkane, such as hexane and heptane, detergent including chemical motifs comprising a C4-C25 alkane and a polar end group such as sulfonate, for example SDBS, Sodium dodecylbenzenesulfonate, lactam, such as N-methyl-pyrrolidone and lactone, amino acid residue such as phenylalanine, tyrosine, tryptophan, histidine, heteroaromatic system, including pyrrole, thiophene, furane, pyrazole, imidazole, isoxazole, oxazole, isothiazole, thiazole, pyridine and perylene bisimides, fused ring system, composed of either aromatic, non-aromatic or anti-aromatic rings or combinations thereof

Preferably, Ligand2 is a non-covalent bond, a single bond, a double bond, a triple bond, peptide with the sequence DAEFRHDSGYEVHHQKLVFFAEDVGSNKGAIIGLMVGGVV, peptide with the sequence DAEFRHDSGYEVHHQKLVFFAEDVGSNKGAIIGLMVGGVVIA or covalent ligand.

More preferably, Ligand2 is an aminogroup-containing carbonhydride, peptide with the sequence HWKHPWGAWDTL, bis-pyrene, dipyrene (phenyl ester), or tetracycline.

Preferably, ML and/or Ligand2 comprises a peptide, anthracene, peptide with the sequence IFRLSWGTYFS, pyrene, diamino pyrene, naphthalene, phenanthrene, aromatic system, such as

benzene, nitrobenzene, toluene, 1,2,3-trichlorobenzene, 1,2,4-trichlorobenzene, m-dinitrobenzene, p-nitrobenzene, naphthalene, anthracene, fluoranthene, phenanthrene, pyrene, pyrene-diamine, pyrene-phenyl ester, dipyrene (phenyl ester), tetracycline, as well as their substituted variants, a halogen, nitro group, amine, thiol, alcohol, ester, amide, carboxylic acid, phenol, indole, imidazole, sulfonate or phosphate, C1-C10 alkane, such as hexane and heptane, detergent including chemical motifs comprising a long alkane (including C4, C5, C6, C7, C8, C9, C10, C11, C12, C13, C14, C15, C16, C17, C18, C19, C20, C21, C22, C23, C24, C25) and a polar end group such as sulfonate, for example SDBS, Sodium dodecylbenzenesulfonate, lactam, such as N-methyl-pyrrolidone and lactone, amino acid residue such as phenylalanine, tyrosine, tryptophan, histidine, a heteroaromatic system, including pyrrole, thiophene, furane, pyrazole, imidazole, isoxazole, oxazole, isothiazole, thiazole, pyridine and perylene bisimides, fused ring system, composed of either aromatic, non-aromatic or anti-aromatic rings or combinations thereof, or an amide bond, made up of two amide bonds arranged in parallel

Preferably, the Linker is a covalent bond, a nylon polymer molecule, an alkyl chain, a branched alkyl, an aromatic molecule, a heteroaromatic molecule, a dendrimer, a polyethylene glycol, or a C1-C50 hydrocarbon chain, with 0-20 double bonds and 0-20 triple bonds.

More preferably, the Linker is a polymer, a polyolefine, a polypropylene (PP), a polystyrene (PS), an acrylonitrile butadiene styrene polymer (ABS), an epoxy-based polymer, an organic polymer, a polyethylene terephthalate (PET), a polyvinylchloride (PVC), a styrene acrylonitrile copolymer, a styrene butadiene latex, an unsaturated polyester (UPR), a bis-maleimide (BMI), a polymeric cyanate ester, a polyarylether-etherketone (PEEK), a polyethylenimine (PEI), a poly-ether-ketone-ketone (PEKK), a poly(methyl methacrylate) (PMMA), a polyphenylene sulfide (PPS) or poly(ethylvinyl alcohol) (EVA).

Most preferably, Linker is a linear molecule, a branched molecule, a rigid molecule, a flexible molecule, a polymer, a linear polymer, a branched polymer, a copolymer, a nylon, a polyacrylate, a polyamide (PA), a polycarbonate (PC), a polyethylene (PE), a high density polyethylene (HDPE), a linear low density polyethylene (LLDPE), or a low density polyethylene (LDPE)

Preferred matrices are inorganic matter, biologic matter, non-biologic matter, polymers.

Most preferred matrices are a metal, a ceramic, organic matter, a plastic, a resin, a copolymer, a high density polyethylene (HDPE), a linear low density polyethylene (LLDPE), a low density polyethylene (LDPE), a nylon, a polyamide (PA), a polycarbonate (PC), a polyethylene (PE), a polymer, a polypropylene (PP), a polystyrene (PS), an epoxy-based polymer, a polyethylene terephthalate (PET), or a polyvinylchloride (PVC)

Preferred polymerisation methods are a polycondensation., a uv-induced polymerisation., a step-growth polymerisation, a chain-growth polymerisation, an emulsion polymerisation, a solution polymerisation, a suspension polymerisation, and a precipitation polymerization.

Preferred processing methods are injection molding, compression molding, transfer molding, blow molding, extrusion, injection molding, liquid casting, DMC, SMC, RIM, RRIM, GRP (hand-layup), GRP (spray and match die), filament winding, pultrusion, rotational molding, thermoforming, screw extrusion, calendering, powder injection molding, thixomolding, coating, cold pressure molding, encapsulation, filament winding, laminating, contact molding and slush molding,

Preferred embodiments are a CMU; or a composite material comprising a CMU;

or a composite material comprising a CMU and a matrix chosen from; a metal, a ceramic, organic matter, a plastic, a resin, a copolymer, a high density polyethylene (HDPE), a linear low density polyethylene (LLDPE), a low density polyethylene (LDPE), a nylon, a polyamide (PA), a polycarbonate (PC), a polyethylene (PE), a polymer, a polypropylene (PP), a polystyrene (PS), an epoxy-based polymer, a polyethylene terephthalate (PET), a polyvinylchloride (PVC); wherein the CMU is chosen from the following;

C1.1.1: a CMU, where SE1 is a carbon fibre.

C1.1.2: a CMU, where SE1 is a carbon fibre and SE2 is copolymer.

C1.1.3: a CMU, where SE1 is a carbon fibre, and SE2 is a high density polyethylene.

C1.1.4: a CMU, where SE1 is a carbon fibre, and SE2 is a linear low density polyethylene.

C1.1.5: a CMU, where SE1 is a carbon fibre, and SE2 is a low density polyethylene.

C1.1.6: a CMU, where SE1 is a carbon fibre, and SE2 is a nylon.

C1.1.7: a CMU, where SE1 is a carbon fibre, and SE2 is a polyamide.

C1.1.8: a CMU, where SE1 is a carbon fibre, and SE2 is a polycarbonate.

C1.1.9: a CMU, where SE1 is a carbon fibre, and SE2 is a polyethylene.

C1.1.10: a CMU, where SE1 is a carbon fibre, and SE2 is a polymer.

C1.1.11: a CMU, where SE1 is a carbon fibre, and SE2 is a polypropylene.

C1.1.12: a CMU, where SE1 is a carbon fibre, and SE2 is a polystyrene.

C1.1.13: a CMU, where SE1 is a carbon fibre, and SE2 is an epoxy-based polymer.

C1.1.14: a CMU, where SE1 is a carbon fibre, and SE2 is a polyethylene terephthalate.

C1.1.15: a CMU, where SE1 is a carbon fibre, and SE2 is a polyvinylchloride.

C1.1.16: a CMU, where SE1 is a carbon fibre, and SE2 is a MWCNT.

C1.1.17: a CMU, where SE1 is a carbon fibre, and SE2 is a SWCNT.

C1.1.18: a CMU, where SE1 is a carbon fibre, and SE2 is a GS.

C1.1.19: a CMU, where SE1 is a carbon fibre, and SE2 is a nanotube.

C1.1.20: a CMU, where SE1 is a carbon fibre, and SE2 is a BNNT.

C1.1.21: a CMU, where SE1 is a carbon fibre, and SE2 is a polyacrylate.

C1.1.22: a CMU, where SE1 is a carbon fibre, and SE2 is a polyolefine.

ophan, or histidine, and SE2 is an epoxy-based polymer.

Desired characteristics of composite materials described herein.

For any characteristics of composite material mentioned above and below, and in each characteristic's entire range, further characteristics of the composite material that are of importance in the present invention are the crystallinity of the matrix material, stiffness, electrical conductivity, thermal conductivity, color, fluorescence, luminescence, UV protective capability, abrasion resistance, ductility, elasticity, flexibility, energy storage capability (energy storage as heat or kinetic energy), information storage capability, hydrophilicity, hydrophobicity, polarity, aproticity, and charge, as well as the following characteristics where the unit of measure is indicated after each characteristic: Arc Resistance, sec; Impact Strength, Charpy, J/cm; Impact Strength, Izod Notched, J/cm ; Impact Strength, Izod Unnotched, J/cm ; Impact Strength, Charpy Notched Low Temp, J/cm; Impact Strength, Izod Notched Low Temp, J/cm; Impact Strength, Charpy Unnotched Low Temp, J/cm; Impact Strength, Charpy Unnotched, J/cm; Linear Mold Shrinkage, cm/cm; Maximum Service Temperature, Air, ; Melt Flow, g/10 min; Melting Point, ; Modulus of Elasticity, GPa; Moisture Absorption at Equilibrium, % ; Oxygen Transmission, cc-mm/m; Poisson's Ratio; Processing Temperature, ; Surface Resistance, ohm; Tensile Strength, Ultimate, MPa; Tensile Strength, Yield, MPa; Thermal Conductivity, W/m-K; UL RTI, Electrical, ; UL RTI, Mechanical with Impact, ; UL RTI, Mechanical without Impact, ; Vicat Softening Point, ; Water Absorption, %; Coefficient of Friction; Comparative Tracking Index, V; Compressive Yield Strength, MPa; CTE, linear 20;

Deflection Temperature at 0.46 MPa, ; Deflection Temperature at 1.8 MPa, ; Density, g/cc; Dielectric Constant; Dielectric Constant, Low Frequency ; Dielectric Strength, kV/mm; Dissipation Factor; Dissipation Factor, Low Frequency ; Electrical Resistivity, ohm-cm; Elongation @ break, %; Flammability, UL94 ; Flexural Modulus, GPa; Flexural Yield Strength, MPa; Glass Temperature, ; Hardness, Barcol; Hardness, Rockwell E; Hardness, Rockwell M; Hardness, Rockwell R; Hardness, Shore A; Hardness, Shore D; Heat Capacity, J/g.

Depending on the application, composite material with a low, medium, or high degree of each of these characteristics is preferable in the present invention.

Composite material.

The composite materials of the present invention may have a number of characteristics. One such characteristic is the number of different CMUs in the composite. Several different CMUs may be preferred in cases where a number of different characteristics of the composite is sought, and wherefore several different CMUs may be used, each representing one or more sought characteristic.

Number of different CMUs in the composite. The composite may comprise 2 or more different CMUs, preferably 3 or more, such as 4 or more, 5 or more, 6 or more, 7 or more, 8 or more, 9 or more, 10 or more, 15 or more, 20 or more, 30 or more or 50 or more different CMUs.

For any characteristics of a composite material mentioned above, and in each characteristic's entire range, a further characteristic of importance is the number of CMUs per area or volume in the composite.

Number of CMUs per area or volume in the composite. Often it is not the absolute number of CMUs in a composite material, but rather the number of CMUs per area or volume that is most important for obtaining the desired properties of the composite material. If the CMUs are solely providing attractive characteristics at a small cost, it will in most cases be preferable to have as many CMUs as practically possible per square millimeter or per cubic millimeter. However, if the CMU provides advantageous characteristics (e.g. high strength) as well as disadvantageous characteristics (e.g. high conductivity), a compromise must be sought where the desired characteristic (e.g. a certain strength) is obtained, and where the disadvantageous characteristics (e.g. conductivity) is kept appropriately low.

Thus, depending on the context, the total number of CMUs per square millimeter of the composite material is preferably less than 10^{12} , such as less than 10^{10} , such as less than 10^9 , such as less than 10^8 , such as less than 10^7 , such as less than 10^6 , such as less than 10^5 , such as less than 10^4 , such as less than 10^3 , such as less than 100, such as less than 10.

As described above, sometimes the highest possible number of CMUs per square millimeter is sought. Thus, depending on the context, the total number of CMUs per square millimeter of the composite material is preferably more than 10, such as more than 100, such as more than 10^3 , such as more than 10^4 , such as more than 10^5 , such as more than 10^6 , such as more than 10^7 , such as more than 10^8 , such as more than 10^9 , such as more than 10^{10} , such as more than 10^{12} .

Composite materials may thus preferably comprise only a few CMUs per square millimeter, such as less than 10 CMUs per square millimeter, or may comprise more, such as 10-100 CMUs per square millimeter, such as 100-1000 CMUs per square millimeter, such as 10^3 - 10^4 CMUs per square millimeter, such as 10^4 - 10^5 CMUs per square millimeter, such as 10^5 - 10^6 CMUs per square millimeter, such as 10^6 - 10^7 CMUs per square millimeter, such as 10^7 - 10^8 CMUs per square millimeter, such as 10^8 - 10^9 CMUs per square millimeter, such as 10^9 - 10^{10} CMUs per square millimeter, such as 10^{10} - 10^{11} CMUs per square millimeter, such as 10^{11} - 10^{12} CMUs per square millimeter, or more than 10^{12} per square millimeter.

Thus, depending on the context, the total number of CMUs per cubic millimeter of the composite material is preferably less than 10^{18} , such as less than 10^{16} , such as less than 10^{14} , such as less than 10^{12} , such as less than 10^{10} , such as less than 10^8 , such as less than 10^7 , such as less than 10^6 , such as less than 10^4 , such as less than 1000, such as less than 100.

As described above, sometimes the highest possible number of CMUs per cubic millimeter is sought. Thus, depending on the context, the total number of CMUs per cubic millimeter of the composite material is preferably more than 100, such as more than 1000, such as more than 10^4 , such as more than 10^6 , such as more than 10^8 , such as more than 10^{10} , such as more than 10^{12} , such as more than 10^{14} , such as more than 10^{16} , such as more than 10^{18} , such as more than 10^{20} .

Composite materials may thus preferably comprise only a few CMUs per cubic millimeter, such as less than 100 CMUs per cubic millimeter, or may comprise more, such as 100-1000 CMUs per cubic millimeter, such as 10^3 - 10^5 CMUs per cubic millimeter, such as 10^5 - 10^8 CMUs per cubic millimeter, such as 10^8 - 10^{11} CMUs per cubic millimeter, such as 10^{11} - 10^{14} CMUs per cubic millimeter, such as 10^{14} - 10^{16} CMUs per cubic millimeter, such as 10^{16} - 10^{18} CMUs per cubic millimeter, such as 10^{18} - 10^{20} CMUs per cubic millimeter, or more than 10^{20} per cubic millimeter.

For any characteristics of a composite material mentioned above, and in each characteristic's entire range, a further characteristic of importance is the number of different SEs in the composite.

Number of different SEs in the composite. The composite may comprise 2 or more different SE, preferably 3 or more, such as 4 or more, 5 or more, 6 or more, 7 or more, 8 or more, 9 or more, 10 or more, 15 or more, 20 or more, 30 or more or 50 or more different SEs.

For any characteristics of a composite material mentioned above, and in each characteristic's entire range, a further characteristic of importance is the melting point of the composite material.

Melting point of composite material. The melting point of the composite material is an important parameter and in some cases, such as ceramic brakes for automobiles, aircrafts and trains, a high melting point is desired. Thus, depending on the context, the melting point of the composite material is preferably greater than -20 °C, such as greater than 0 °C, such as greater than 50 °C, such as greater than 100 °C, such as greater than 200 °C, such as greater than 400 °C, such as greater than 600 °C, such as greater than 800 °C, such as greater than 1,000 °C, such as greater than 1,500 °C, such as greater than 2,000 °C, such as greater than 3,000 °C, such as greater than 4,000 °C, such as greater than 6,000 °C, such as greater than 8,000 °C.

In other cases, a composite material's flexibility at low temperatures is important, wherefore a low melting point may be advantageous. Thus, depending on the context, the melting point of the composite material is preferably less than 8,000 °C, such as less than 6,000 °C, such as less than 4,000 °C, such as less than 3,000 °C, such as less than 2,000 °C, such as less than 1,500 °C, such as less than 1,000 °C, such as less than 800 °C, such as less than 600 °C, such as less than 400 °C, such as less than 200 °C, such as less than 100 °C, such as less than 50 °C, such as less than 0 °C, such as less than -20 °C.

Composite materials may have melting points below 0 °C, such as between -20 °C and 0 °C; or may be higher, such as between 0 °C and 50 °C, or between 50 °C and 100 °C, or between 100 °C and 200 °C, or between 200 °C and 300 °C, or between 300 °C and 400 °C, or between 400 °C and 500 °C, or between 500 °C and 600 °C, or between 600 °C and 700 °C, or between 700 °C and 800 °C, or between 800 °C and 900 °C, or between 900 °C and 1,000 °C, or between 1,000 °C and 1,100 °C, or between 1,000 °C and 1,200 °C, or between 1,200 °C and 1,400 °C, or between 1,400 °C and 1,600 °C, or between 1,600 °C and 1,800 °C, or between 1,800 °C and 2,000 °C, or between 2,000 °C and 2,200 °C, or between 2,200 °C and 2,400 °C, or between 2,400 °C and 2,600 °C, or between 2,600 °C and 2,800 °C, or between 2,800 °C and 3,000 °C, or between 3,000 °C and 3,200 °C, or between 3,200 °C and 3,400 °C, or between 3,400 °C and 3,600 °C, or between 3,600 °C and 3,800 °C, or between 3,800 °C and 4,000 °C, or between 4,000 °C and 4,200 °C, or between 4,200 °C and 4,400 °C, or between 4,400 °C and 4,600 °C, or between 4,600 °C and 4,800 °C, or between 4,800 °C and 5,000 °C, or

between 5,000 °C and 5,200 °C, or between 5,200 °C and 5,400 °C, or between 5,400 °C and 5,600 °C, or between 5,600 °C and 5,800 °C, or between 5,800 °C and 6,000 °C, or between 6,000 °C and 6,200 °C, or between 6,200 °C and 6,400 °C, or between 6,400 °C and 6,600 °C, or between 6,600 °C and 6,800 °C, or between 6,800 °C and 7,000 °C, or between 7,000 °C and 7,200 °C, or between 7,200 °C and 7,400 °C, or between 7,400 °C and 7,600 °C, or between 7,600 °C and 7,800 °C, or between 7,800 °C and 8,000 °C, or between 8,000 °C and 8,200 °C, or between 8,400 °C and 8,600 °C, or between 8,600 °C and 8,800 °C, or between 8,800 °C and 9,000 °C, or between 9,000 °C and 9,200 °C, or between 9,200 °C and 9,400 °C, or between 9,400 °C and 9,600 °C, or between 9,600 °C and 9,800 °C, or between 9,800 °C and 10,000 °C, or between 10,000 °C and 11,000 °C, or between 11,000 °C and 12,000 °C, or between 12,000 °C and 13,000 °C, or between 13,000 °C and 14,000 °C, or between 14,000 °C and 15,000 °C, or between 15,000 °C and 16,000 °C, or between 16,000 °C and 17,000 °C, or between 17,000 °C and 18,000 °C, or between 18,000 °C and 19,000 °C, or between 19,000 °C and 20,000 °C, or above 20,000 °C.

For any characteristics of a composite material mentioned above, and in each characteristic's entire range, a further characteristic of importance is the density and strength of the composite material.

Density and Strength of the composite material. For certain applications, for example in the airplane or automotive industry, the strength and density of the composite material is of prime importance. Often, both low density and high strength is desired. However, as these two parameters often are opposing factors, a compromise will have to be made. Therefore, sometimes a high density is acceptable to gain strength, such as high tensile strength or large Young's Modulus. In other cases, low density is necessary, even if lower strength results. Thus, in preferred embodiments the composite material may have relatively low Young's modulus or low tensile strength, and in other preferred embodiments the composite material has large Young's modulus or large tensile strength; and likewise, in preferred embodiments the density can vary from very small to very large.

The specific density of composite materials of the present invention may be lower than 0.01 kg/L, but may also include specific densities in the following ranges: 0.01–0.1 kg/L; 0.1–0.4 kg/L; 0.4–0.6 kg/L; 0.6–0.8 kg/L; 0.8–1 kg/L; 1–1.2 kg/L; 1.2–1.4 kg/L; 1.4–1.6 kg/L; 1.6–1.8 kg/L; 1.8–2 kg/L; 2–2.5 kg/L; 2.5–3 kg/L; 3–3.5 kg/L; 3.5–4 kg/L; 4–4.5 kg/L; 4.5–5 kg/L; 5–5.5 kg/L; 5.5–6 kg/L; 6–6.5 kg/L; 6.5–7 kg/L; 7–7.5 kg/L; 7.5–8 kg/L; 8–8.5 kg/L; 8.5–9 kg/L; 9–9.5 kg/L; 9.5–10 kg/L; 10–11 kg/L; 11–12 kg/L; 12–13 kg/L; 13–14 kg/L; 14–16 kg/L; 16–20 kg/L; 20–30 kg/L; or above 30 kg/L.

In some cases high specific densities are preferred. This may be the case when the composite material is e.g. an anchor, as an anchor should rest heavily on the bottom. Thus, depending on the context, the specific density is preferably greater than 0.01 kg/L, such as greater than 0.05 kg/L, such as greater than 0.2 kg/L, such as greater than 0.4 kg/L, such as greater than 0.6 kg/L, such as greater than 0.8 kg/L, such as greater than 1 kg/L, such as greater than 1.2 kg/L, such as greater than 1.5 kg/L, such as greater than 2 kg/L, such as greater than 4 kg/L, such as greater than 6 kg/L, such as greater than 8 kg/L, such as greater than 10 kg/L, such as greater than 12 kg/L, such as greater than 14 kg/L, such as greater than 16 kg/L, such as greater than 20 kg/L, such as greater than 30 kg/L.

In many cases low specific density is preferred. This is for example the case if the composite material is used to make ships that must float on the water, wherefore the weight must be minimized. Thus, depending on the context, the specific density is preferably less than 30 kg/L, such as less than 20 kg/L, such as less than 16 kg/L, such as less than 14 kg/L, such as less than 12 kg/L, such as less than 10 kg/L, such as less than 8 kg/L, such as less than 6 kg/L, such as less than 4 kg/L, such as less than 2 kg/L, such as less than 1.5 kg/L, such as less than 1.2 kg/L, such as less than 1 kg/L, such as less than 0.8 kg/L, such as less than 0.6 kg/L, such as less than 0.4 kg/L, such as less than 0.2 kg/L, such as less than 0.05 kg/L, such as less than 0.01 kg/L.

The Young's modulus of composite materials. In the majority of applications of composite materials, a high Young's modulus is preferred, as this will allow the material to recover its original shape after force has been applied to the material. Thus, depending on the context, the Young's modulus is preferably greater than 0.001 TPa, such as greater than 0.01 TPa, such as greater than 0.1 TPa, such as greater than 0.15 TPa, such as greater than 0.2 TPa, such as greater than 0.5 TPa, such as greater than 1 TPa, such as greater than 2 TPa, such as greater than 4 TPa, such as greater than 6 TPa, such as greater than 8 TPa, such as greater than 10 TPa.

However, in a few applications, a low Young's modulus is desirable. This is for example the case when the degree of deformation of a composite material is being used as a measure of how much force was applied to the material. Thus, depending on the context, the Young's modulus is preferably less than 10 TPa, such as less than 8 TPa, such as less than 6 TPa, such as less than 4 TPa, such as less than 2 TPa, such as less than 1 TPa, such as less than 0.5 TPa, such as less than 0.2 TPa, such as less than 0.15 TPa, such as less than 0.1 TPa, such as less than 0.01 TPa, such as less than 0.01 TPa.

The Young's modulus of composite materials suitable for the present invention can thus be lower than 0.001 TPa, but may also include SEs with Young's Modulus in the following ranges: 0.001–0.01 TPa; 0.01–0.03 TPa; 0.03–0.05 TPa; 0.05–0.07 TPa; 0.07–0.09 TPa; 0.09–0.1 TPa; 0.1–0.11 TPa; 0.11–0.12 TPa; 0.12–0.13 TPa; 0.13–0.14 TPa; 0.14–0.15 TPa; 0.15–0.16 TPa; 0.16–0.17 TPa;

0.17–0.18 TPa; 0.18–0.19 TPa; 0.19–0.20 TPa; 0.20–0.22 TPa (e.g. stainless steel); 0.22–0.25 TPa; 0.25–0.30 TPa; 0.30–0.35 TPa; 0.35–0.40 TPa; 0.40–0.45 TPa; 0.45–0.50 TPa; 0.50–0.60 TPa; 0.60–0.80 TPa; 0.80–1.0 TPa; 1–2 TPa (e.g. single-walled carbon nanotubes); 2–3 TPa; 3–4 TPa; 4–5 TPa; 5–7 TPa; 7–10 TPa; or above 10 TPa.

Preferred tensile strength of composite materials is in most cases high, as this is suitable for a large number of applications, e.g. stronger fishing lines and stronger cables. Thus, depending on the context, the tensile strength of the composite material is preferably greater than 0.01 GPa, such as greater than 0.05 GPa, such as greater than 0.1 GPa, such as greater than 0.5 GPa, such as greater than 1 GPa, such as greater than 2 GPa, such as greater than 3 GPa, such as greater than 5 GPa, such as greater than 10 GPa, such as greater than 20 GPa, such as greater than 30 GPa, such as greater than 40 GPa, such as greater than 60 GPa, such as greater than 80 GPa, such as greater than 100 GPa, such as greater than 200 GPa.

However, in some cases a low tensile strength is advantageous, for example in cables or lines that must break for safety reasons, in order to avoid damage to individuals. Thus, depending on the context, the tensile strength of the composite material is preferably less than 200 GPa, such as less than 100 GPa, such as less than 80 GPa, such as less than 60 GPa, such as less than 40 GPa, such as less than 30 GPa, such as less than 20 GPa, such as less than 10 GPa, such as less than 5 GPa, such as less than 3 GPa, such as less than 2 GPa, such as less than 1 GPa, such as less than 0.5 GPa, such as less than 0.1 GPa, such as less than 0.05 GPa, such as less than 0.01 GPa.

The tensile strength for composite materials suitable for the present invention can thus be lower than 0.01 GPa, but may also include composite materials with tensile strengths in the following ranges: 0.01–0.03 GPa; 0.03–0.05 GPa; 0.05–0.07 GPa; 0.07–0.09 GPa; 0.09–0.1 GPa; 0.1–0.11 GPa; 0.11–0.12 GPa; 0.12–0.13 GPa; 0.13–0.14 GPa; 0.14–0.15 GPa; 0.15–0.16 GPa; 0.16–0.17 GPa; 0.17–0.18 GPa; 0.18–0.19 GPa; 0.19–0.20 GPa; 0.20–0.22 GPa; 0.22–0.25 GPa; 0.25–0.30 GPa; 0.30–0.35 GPa; 0.35–0.40 GPa; 0.40–0.45 GPa; 0.45–0.50 GPa; 0.50–0.60 GPa; 0.60–0.80 GPa; 0.80–1.0 GPa; 1–2 GPa (e.g. stainless steel); 2–3 GPa; 3–4 GPa; 4–5 GPa; 5–7 GPa; 7–10 GPa; 10–15 GPa; 15–20 GPa; 20–25 GPa; 25–30 GPa; 30–35 GPa; 35–40 GPa; 40–45 GPa; 45–50 GPa (e.g. single-walled carbon nanotubes); 50–55 GPa; 55–60 GPa; 60–65 GPa; 65–70 GPa; 70–75 GPa; 75–80 GPa; 80–85 GPa; 85–90 GPa; 90–100 GPa; 100–200 GPa, or above 200 GPa.

Often, it is the ratio of strength to density that is most important. The strength/specific density ratio for the composite material that is preferred under the present invention is represented by all the ratios that can be obtained, by dividing the abovementioned strengths with the abovementioned specific densities. Thus, preferred embodiments have composite materials with strength/specific densities in the range 0,00003-1000 TPa L/Kg (where strength is represented by Young's modulus). More specifically, the strength/specific density (Young's Modulus) of the composite material is preferably in the range 0.00003-1000 TPa L/Kg, more preferably 0.001-1000 TPa L/Kg, more preferably 0.01-1000 TPa L/Kg, more preferably 0, 1-1000 TPa L/Kg, more preferably 1-1000 TPa L/Kg, more preferably 10-1000 TPa L/Kg, more preferably 100-1000 TPa L/Kg, and more preferably 500-1000 TPa L/Kg, or higher. Where strength is measured as Tensile strength, the preferred embodiments have composite materials with strength/specific density in the range 0.0003-20000 GPa L/Kg. More specifically, the tensile strength/specific density of the composite material is preferably in the range 0.0003-20000 TPa L/Kg, more preferably 0.01-20000 TPa L/Kg, more preferably 0, 1-20000 TPa L/Kg, more preferably 1-20000 TPa L/Kg, more preferably 10-20000 TPa L/Kg, more preferably 100-20000 TPa L/Kg, more preferably 1000-20000 TPa L/Kg, more preferably 5000-20000 TPa L/Kg, and more preferably 10000-20000 TPa L/Kg, or higher.

Ratio of strength to specific density is often important. The strength/specific density ratio for the composite material that is preferred under the present invention is represented by all the ratios that can be obtained, by dividing the abovementioned strengths with the abovementioned specific densities. Thus, preferred embodiments have composite material with strength/specific densities in the range 0.00003-1,000 TPa L/Kg (where strength is represented by Young's modulus). More specifically, the strength/specific density (Young's Modulus) of the composite material is preferably in the range 0.00003-1,000 TPa L/Kg, more preferably 0.001-1,000 TPa L/Kg, more preferably 0.01-1,000 TPa L/Kg, more preferably 0.1-1,000 TPa L/Kg, more preferably 1-1,000 TPa L/Kg, more preferably 10-1,000 TPa L/Kg, more preferably 100-1,000 TPa L/Kg, and more preferably 500-1,000 TPa L/Kg, or higher.

In cases where e.g. the Young's modulus should be low (see above), the Young's modulus/specific density ratio is preferably less than 1,000 TPa L/kg, such as less than 500 TPa L/kg, such as less than 100 TPa L/kg, such as less than 10 TPa L/kg, such as less than 1 TPa L/kg, such as less than 0.1 TPa L/kg, such as less than 0.01 TPa L/kg, such as less than 0.001 TPa L/kg, such as less than 0.00003 TPa L/kg.

In cases where e.g. Young's modulus is preferably high, the Young's modulus/specific density ratio is preferably greater than 0.00003 TPa L/kg, such as greater than 0.001 TPa L/kg, such as greater than 0.01 TPa L/kg, such as greater than 0.1 TPa L/kg, such as greater than 1 TPa L/kg, such as greater

than 10 TPa L/kg, such as greater than 100 TPa L/kg, such as greater than 500 TPa L/kg, such as greater than 1,000 TPa L/kg.

Where strength is measured as tensile strength, the preferred embodiments have composite materials with strength/specific density in the range 0.0003–20,000 GPa L/Kg. More specifically, the tensile strength/specific density of the composite material is preferably in the range 0.0003–20,000 GPa L/Kg, more preferably 0.01–20,000 GPa L/Kg, more preferably 0.1–20,000 GPa L/Kg, more preferably 1–20,000 GPa L/Kg, more preferably 10–20,000 GPa L/Kg, more preferably 100–20,000 GPa L/Kg, more preferably 1,000–20,000 GPa L/Kg, more preferably 5,000–20,000 GPa L/Kg, and more preferably 10,000–20,000 GPa L/Kg, or higher.

In cases where e.g. the tensile strength is preferably low (see above), the tensile strength/specific density ratio is preferably less than 20,000 GPa L/kg, such as less than 10,000 GPa L/kg, such as less than 5,000 GPa L/kg, such as less than 1,000 GPa L/kg, such as less than 100 GPa L/kg, such as less than 10 GPa L/kg, such as less than 1 GPa L/kg, such as less than 0.1 GPa L/kg, such as less than 0.0003 GPa L/kg.

In cases where e.g. tensile strength is preferably high, the tensile strength/specific density ratio is preferably greater than 0.0003 GPa L/kg, such as greater than 0.1 GPa L/kg, such as greater than 1 GPa L/kg, such as greater than 10 GPa L/kg, such as greater than 100 GPa L/kg, such as greater than 1,000 GPa L/kg, such as greater than 5,000 GPa L/kg, such as greater than 10,000 GPa L/kg, such as greater than 20,000 GPa L/kg.

Preferred fracture toughness of composite materials is in most cases high, as this results in a low risk of cracks propagating through the composite, ultimately leading to fracture. Examples of composite materials where a high fracture toughness is desirable includes, but are not limited to, wind turbine blades and airplane wings. Thus, depending on the context, the fracture toughness is preferably greater than $0.01 \text{ MPa}\cdot\text{m}^{1/2}$, such as greater than $0.1 \text{ MPa}\cdot\text{m}^{1/2}$, such as greater than $1 \text{ MPa}\cdot\text{m}^{1/2}$, such as greater than $2 \text{ MPa}\cdot\text{m}^{1/2}$, such as greater than $5 \text{ MPa}\cdot\text{m}^{1/2}$, such as greater than $10 \text{ MPa}\cdot\text{m}^{1/2}$, such as greater than $15 \text{ MPa}\cdot\text{m}^{1/2}$, such as greater than $20 \text{ MPa}\cdot\text{m}^{1/2}$, such as greater than $25 \text{ MPa}\cdot\text{m}^{1/2}$, such as greater than $30 \text{ MPa}\cdot\text{m}^{1/2}$, such as greater than $40 \text{ MPa}\cdot\text{m}^{1/2}$, such as greater than $50 \text{ MPa}\cdot\text{m}^{1/2}$, such as greater than $75 \text{ MPa}\cdot\text{m}^{1/2}$, such as greater than $100 \text{ MPa}\cdot\text{m}^{1/2}$,

However, in some applications, a low fracture toughness is desirable. As an example, the fracture toughness of the windows in a train needs to be sufficiently low that a person can break the window using an appropriate tool in an emergency situation. Thus, depending on the context, the fracture toughness is preferably less than $100 \text{ MPa}\cdot\text{m}^{1/2}$, such as less than $75 \text{ MPa}\cdot\text{m}^{1/2}$, such as less than $50 \text{ MPa}\cdot\text{m}^{1/2}$, such as less than $40 \text{ MPa}\cdot\text{m}^{1/2}$, such as less than $30 \text{ MPa}\cdot\text{m}^{1/2}$, such as less than $25 \text{ MPa}\cdot\text{m}^{1/2}$,

such as less than $20 \text{ MPa}\cdot\text{m}^{1/2}$, such as less than $15 \text{ MPa}\cdot\text{m}^{1/2}$, such as less than $10 \text{ MPa}\cdot\text{m}^{1/2}$, such as less than $5 \text{ MPa}\cdot\text{m}^{1/2}$, such as less than $2 \text{ MPa}\cdot\text{m}^{1/2}$, such as less than $1 \text{ MPa}\cdot\text{m}^{1/2}$, such as less than $0,1 \text{ MPa}\cdot\text{m}^{1/2}$, such as less than $0.01 \text{ MPa}\cdot\text{m}^{1/2}$.

The fracture toughness for composite materials suitable for the present invention can thus be lower than $0.01 \text{ MPa}\cdot\text{m}^{1/2}$, but may also include composite materials with fracture toughness in the following ranges: $0.01\text{--}0.1 \text{ MPa}\cdot\text{m}^{1/2}$, $0.1\text{--}1 \text{ MPa}\cdot\text{m}^{1/2}$, $1\text{--}2 \text{ MPa}\cdot\text{m}^{1/2}$, $2\text{--}5 \text{ MPa}\cdot\text{m}^{1/2}$, $5\text{--}10 \text{ MPa}\cdot\text{m}^{1/2}$, $10\text{--}15 \text{ MPa}\cdot\text{m}^{1/2}$, $15\text{--}20 \text{ MPa}\cdot\text{m}^{1/2}$, $20\text{--}25 \text{ MPa}\cdot\text{m}^{1/2}$, $25\text{--}30 \text{ MPa}\cdot\text{m}^{1/2}$, $30\text{--}40 \text{ MPa}\cdot\text{m}^{1/2}$, $40\text{--}50 \text{ MPa}\cdot\text{m}^{1/2}$, $50\text{--}75 \text{ MPa}\cdot\text{m}^{1/2}$, $75\text{--}100 \text{ MPa}\cdot\text{m}^{1/2}$, or above $100 \text{ MPa}\cdot\text{m}^{1/2}$.

Bulk modulus of composite materials. In the majority of applications of composite materials, a high bulk modulus is preferred, as this will allow the composite material to withstand a high compression, which is important in structural elements of buildings, bridges, etc. Thus, depending on the context, the bulk modulus is preferably greater than 0.001 GPa , such as greater than 0.01 GPa , such as greater than 0.1 GPa , such as greater than 1 GPa , such as greater than 10 GPa , such as greater than 50 GPa , such as greater than 100 GPa , such as greater than 200 GPa , such as greater than 300 GPa , such as greater than 400 GPa , such as greater than 500 GPa , such as greater than 600 GPa , such as greater than 700 GPa , such as greater than 800 GPa , such as greater than 900 GPa , such as greater than $1,000 \text{ GPa}$.

However, in a few applications, a low bulk modulus is desirable. This is for example the case in some foam products, where it should be easy to compress the foam, e.g. using a person's body weight. One such example may be skiing boots where the foam must be able to deform, in order to take up the shape of the skier's foot. Thus, depending on the context, the bulk modulus is preferably less than $1,000 \text{ GPa}$, such as less than 900 GPa , such as less than 800 GPa , such as less than 700 GPa , such as less than 600 GPa , such as less than 500 GPa , such as less than 400 GPa , such as less than 300 GPa , such as less than 200 GPa , such as less than 100 GPa , such as less than 50 GPa , such as less than 10 GPa , such as less than 1 GPa , such as less than 0.1 GPa , such as less than 0.01 GPa , such as less than 0.001 GPa .

The bulk modulus for composite materials suitable for the present invention can thus be lower than 0.001 GPa , but may also include composite materials with bulk modules in the following ranges: $0.001\text{--}0.01 \text{ GPa}$, $0.01\text{--}0.1 \text{ GPa}$, $0.1\text{--}1 \text{ GPa}$, $1\text{--}10 \text{ GPa}$, $10\text{--}100 \text{ GPa}$, $100\text{--}200 \text{ GPa}$, $200\text{--}300 \text{ GPa}$, $300\text{--}400 \text{ GPa}$, $400\text{--}500 \text{ GPa}$, $500\text{--}600 \text{ GPa}$, $600\text{--}700 \text{ GPa}$, $700\text{--}800 \text{ GPa}$, $800\text{--}900 \text{ GPa}$, $900\text{--}1,000 \text{ GPa}$, or above $1,000 \text{ GPa}$.

Shear modulus of composite materials. In the majority of applications of composite materials, a high shear modulus is preferred, as this will allow the composite material to withstand large forces imposed on the composite material in parallel, but opposite directions, e.g. brakes on bicycles, cars, wind turbines, etc. Thus, depending on the context, the shear modulus is preferably greater than 0.001 GPa, such as greater than 0.01 GPa, such as greater than 0.1 GPa, such as greater than 1 GPa, such as greater than 10 GPa, such as greater than 50 GPa, such as greater than 100 GPa, such as greater than 200 GPa, such as greater than 300 GPa, such as greater than 400 GPa, such as greater than 500 GPa, such as greater than 600 GPa, such as greater than 700 GPa, such as greater than 800 GPa, such as greater than 900 GPa, such as greater than 1,000 GPa.

However, in some applications, a low shear modulus is desirable. This is for example the case in plastic composite materials used for buttons, e.g. to turn on or off electronic equipment. Such buttons must have a low shear modulus so pressing them is sufficiently easy. Thus, depending on the context, the shear modulus is preferably less than 1,000 GPa, such as less than 900 GPa, such as less than 800 GPa, such as less than 700 GPa, such as less than 600 GPa, such as less than 500 GPa, such as less than 400 GPa, such as less than 300 GPa, such as less than 200 GPa, such as less than 100 GPa, such as less than 50 GPa, such as less than 10 GPa, such as less than 1 GPa, such as less than 0.1 GPa, such as less than 0.01 GPa, such as less than 0.001 GPa.

The shear modulus for composite materials suitable for the present invention can thus be lower than 0.001 GPa, but may also include composite materials with shear modules in the following ranges: 0.001–0.01 GPa, 0.01–0.1 GPa, 0.1–1 GPa, 1–10 GPa, 10–100 GPa, 100–200 GPa, 200–300 GPa, 300–400 GPa, 400–500 GPa, 500–600 GPa, 600–700 GPa, 700–800 GPa, 800–900 GPa, 900–1,000 GPa, or above 1,000 GPa.

Other kinds of strength, such as torsional strength and impact strength, are also of importance. Thus, composite materials with low, medium or high torsional strength, and composite materials with low, medium or high impact strength are suitable for the present invention, and thus represent preferred embodiments.

For any characteristics of a composite material mentioned above, and in each characteristic's entire range, a further characteristic of importance is the conductivity of the composite material.

Conductivity of composite material. In certain applications, e.g. use of a composite material in wind turbine blades, it may be important that the propellers are non-conductive, in order to not attract

lightning. In other cases, it may be desirable to prepare composite materials of modest or high conductivity, in order to be able to detect cracks in the material by analytical measurement of the conductance of the material. Likewise, for composite materials used in e.g. nanosensor technology it may be important that the composite material is conductive, in order to be able to detect changes in conductivity induced by the association of an analyte with the composite material. In some sensor applications it may be desirable to have high conductivity (if the analyte has a strong reducing effect on the conductance of the composite material), or it may be desirable to use a composite material with an intermediate conductivity in order to detect small changes in conductivity. Thus, depending on the application it may be desirable that the composite material has low, intermediate or high conductivity. Composite materials may have conductivities ranging from below 10^{-30} S/m to at least 10^{11} S/m and higher, such as from below 10^{-30} S/m to 10^{-25} S/m (e.g. Teflon), such as from 10^{-25} S/m to 10^{-20} S/m (e.g. PET), such as from 10^{-20} S/m to 10^{-15} S/m (e.g. Quarts (fused) and Paraffin), such as from 10^{-15} S/m to 10^{-10} S/m (e.g. Hard Rubber, Diamond, Glass), such as from 10^{-10} S/m to 10^{-5} S/m (e.g. GaAs, Silicon), such as from 10^{-5} S/m to 1 S/m, such as from 1 S/m to 10 S/m (e.g. Germanium), such as from 10 S/m to 10^2 S/m, such as from 10^2 S/m to 10^4 S/m (e.g. graphite), such as from 10^4 S/m to 10^6 S/m (e.g. Nichrome, Mercury,), such as from 10^6 S/m to 10^8 S/m (e.g. Stainless steel, Titanium, Platinum, Iron, Lithium, Aluminum, Gold, Copper, Silver), such as from 10^8 S/m to 10^9 S/m, such as from 10^9 S/m to 10^{10} S/m, such as from 10^{10} S/m to 10^{11} S/m (e.g. Carbon nanotubes), such as from 10^{11} S/m to 10^{12} S/m (e.g. Carbon nanotubes), such as from 10^{12} S/m to 10^{14} S/m, and above 10^{14} S/m (e.g. superconducting material).

Thus, depending on the context, the conductivity of a composite material is preferably greater than 10^{-30} S/m, such as greater than 10^{-25} S/m, such as greater than 10^{-20} S/m, such as greater than 10^{-15} S/m, such as greater than 10^{-10} S/m, such as greater than 10^{-5} S/m, such as greater than 1 S/m, such as greater than 10 S/m, such as greater than 10^2 S/m, such as greater than 10^4 S/m, such as greater than 10^6 S/m, such as greater than 10^8 S/m, such as greater than 10^9 S/m, such as greater than 10^{10} S/m, such as greater than 10^{11} S/m, such as greater than 10^{12} S/m, such as greater than 10^{13} S/m, such as greater than 10^{14} S/m.

In other applications, and depending on the context, the conductivity is preferably less than 10^{14} S/m, such as less than 10^{13} S/m, such as less than 10^{12} S/m, such as less than 10^{11} S/m, such as less than 10^{10} S/m, such as less than 10^9 S/m, such as less than 10^8 S/m, such as less than 10^6 S/m, such as less than 10^4 S/m, such as less than 10^2 S/m, such as less than 10 S/m, such as less than 1 S/m, such as less than 10^{-5} S/m, such as less than 10^{-10} S/m, such as less than 10^{-15} S/m, such as less than 10^{-20} S/m, such as less than 10^{-25} S/m, such as less than 10^{-30} S/m.

For any characteristics of a composite material mentioned above, and in each characteristic's entire range, a further characteristic of importance is the degree to which the composite material can be elongated (stretched) without breaking.

Elongation at break. In many applications, a high elongation at break is preferred. This is for example important in composite materials that absorb energy by deforming plastically such as crash barriers and car bumpers. Thus, depending on the context, the elongation at break of a composite material is preferably greater than 0.1%, such as greater than 1%, such as greater than 5%, such as greater than 10%, such as greater than 20%, such as greater than 30%, such as greater than 40%, such as greater than 50%, such as greater than 60%, such as greater than 70%, such as greater than 80%, such as greater than 90%, such as greater than 100%, such as greater than 150%, such as greater than 200%, such as greater than 300%, such as greater than 400%, such as greater than 500%, such as greater than 800%, such as greater than 1,500%.

In other applications, a low elongation at break is preferred. This is important in composite materials that must not deform even under harsh conditions such as high pressure and elevated temperature; one such example is ceramic brakes on automobiles, aircrafts and trains. Thus, depending on the context, the elongation at break of a composite material is preferably less than 1,500%, such as less than 800%, such as less than 500%, such as less than 400%, such as less than 300%, such as less than 200%, such as less than 150%, such as less than 100%, such as less than 90%, such as less than 80%, such as less than 70%, such as less than 60%, such as less than 50%, such as less than 40%, such as less than 30%, such as less than 20%, such as less than 10%, such as less than 5%, such as less than 1%, such as less than 0.1%.

Composite materials suitable for the present invention can thus have an elongation at break of less than 0.1%, or have elongation at break including the following ranges: 0.1–1%, 1–5%, 5–10%, 10–20%, 20–30%, 30–40%, 40–50%, 50–60%, 60–70%, 70–80%, 80–90%, 90–100%, 100–150%, 150–200%, 200–300%, 300–400%, 400–500%, 500–800%, 800–1,500%, or have elongation at break above 1,500%.

For any characteristics of a composite material mentioned above, and in each characteristic's entire range, a further characteristic of importance is the size of the composite material.

Size of composite material. The size and shape of the composite material are important parameters. Thus, although depending on the characteristics of the composite material, composite materials may benefit from being large in size, as measured by the total weight of a piece of the composite material,

the largest single dimension of a piece of composite material, or the total volume of a piece of composite material. Thus, depending on the context, the total weight of the composite material is preferably greater than 10^{-12} kg, such as greater than 10^{-11} kg, such as greater than 10^{-10} kg, such as greater than 10^{-9} kg, such as greater than 10^{-8} kg, such as greater than 10^{-7} kg, such as greater than 10^{-6} kg, such as greater than 10^{-5} kg, such as greater than 10^{-4} kg, such as greater than 10^{-3} kg, such as greater than 0.01 kg, such as greater than 0.1 kg, such as greater than 1 kg, such as greater than 10 kg, such as greater than 100 kg, such as greater than 10^3 kg, such as greater than 10^4 kg, such as greater than 10^5 kg, such as greater than 10^6 kg, such as greater than 10^7 kg, such as greater than 10^8 kg, such as greater than 10^9 kg.

And the largest dimension of a composite material is preferably, depending on the context, greater than 0.1 Å, such as greater than 2 Å, such as greater than 1 nm, such as greater than 10 nm, such as greater than 100 nm, such as greater than 1 µm, such as greater than 10 µm, such as greater than 100 µm, such as greater than 1 mm, such as greater than 10 mm, such as greater than 100 mm, such as greater than 1 m, such as greater than 10 m, such as greater than 100 m, such as greater than 1,000 m.

And the total volume of a composite material is preferably, depending on the context, greater than 1 nm³, such as greater than 1,000 nm³, such as greater than 1,000,000 nm³, such as greater than 1 µm³, such as greater than 1,000 µm³, such as greater than 1,000,000 µm³, such as greater than 1 mm³, such as greater than 1,000 mm³, such as greater than 1,000,000 mm³, such as greater than 1 m³, such as greater than 10 m³, such as greater than 100 m³, such as greater than 1,000 m³.

On the other hand, a composite material, depending on other characteristics of the composite material, may benefit from being small in size, as measured by the total weight of a piece of the composite material, the largest single dimension of a piece of composite material, or the total volume of a piece of composite material. Thus, depending on the context, the total weight of the composite material is preferably less than 10^9 kg, such as less than 10^8 kg, such as less than 10^7 kg, such as less than 10^6 kg, such as less than 10^5 kg, such as less than 10^4 kg, such as less than 10^3 kg, such as less than 100 kg, such as less than 10 kg, such as less than 1 kg, such as less than 0.1 kg, such as less than 0.01 kg, such as less than 10^{-3} kg, such as less than 10^{-4} kg, such as less than 10^{-5} kg, such as less than 10^{-6} kg, such as less than 10^{-7} kg, such as less than 10^{-8} kg, such as less than 10^{-9} kg, such as less than 10^{-10} kg, such as less than 10^{-11} kg, such as less than 10^{-12} kg.

And the largest dimension of a composite material is preferably, depending on the context, less than 1,000 m, such as less than 100 m, such as less than 10 m, such as less than 1 m, such as less than 100 mm, such as less than 10 mm, such as less than 1 mm, such as less than 100 µm, such as less than 10

μm , such as less than 1 μm , such as less than 100 nm, such as less than 10 nm, such as less than 1 nm, such as less than 2 Å, such as less than 0.1 Å.

And the total volume of a composite material is preferably, depending on the context, less than 1,000 m^3 , such as less than 100 m^3 , such as less than 10 m^3 , such as less than 1 m^3 , such as less than 1,000,000 mm^3 , such as less than 1,000 mm^3 , such as less than 1 mm^3 , such as less than 1,000,000 μm^3 , such as less than 1,000 μm^3 , such as less than 1 μm^3 , such as less than 1,000,000 nm^3 , such as less than 1,000 nm^3 , such as less than 1 nm^3 .

Often, the choice of size and shape will be a compromise between opposing interests. Thus, in preferred embodiments the composite material may be very small to very large, depending on the application.

Therefore, the preferred compromise between high and low weight of the composite material depends on the context, and may be smaller than 10^{-12} kg, but may also be in the range of 10^{-12} – 10^{-11} kg, 10^{-11} – 10^{-10} kg, 10^{-10} – 10^{-9} kg, 10^{-9} – 10^{-8} kg, 10^{-8} – 10^{-7} kg, 10^{-7} – 10^{-6} kg, 10^{-6} – 10^{-5} kg, 10^{-5} – 10^{-4} kg, 10^{-4} – 10^{-3} kg, 0.001–0.01 kg, 0.01–0.1 kg, 0.1–1 kg, 1–10 kg, 10–100 kg, 100–1,000 kg, 10^3 – 10^4 kg, 10^4 – 10^5 kg, 10^5 – 10^6 kg, 10^6 – 10^7 kg, 10^7 – 10^8 kg, 10^8 – 10^9 kg, or above 10^9 kg.

Therefore, the preferred compromise between large and small dimensions of the composite material depends on the context, and may be smaller than 0.01 Å, but may also be in the range of 0.1–2 Å, 0.2–1 nm, 1–10 nm, 10–100 nm, 0.1–1 μm , 1–10 μm , 10–100 μm , 0.1–1 mm, 1–10 mm, 10–100 mm, 0.1–1 m, 1–10 m, 10–100 m, 100–1,000 m, or above 1,000 m.

Therefore, the preferred compromise between a large and a low volume of the composite material depends on the context, and may be smaller than 1 nm^3 , but may also be in the range of 1–1,000 nm^3 , 1,000–1,000,000 nm^3 , 0.001–1 μm^3 , 1–1,000 μm^3 , 1,000–1,000,000 μm^3 , 0.001–1 mm^3 , 1–1,000 mm^3 , 1,000–1,000,000 mm^3 , 0.001–1 m^3 , 1–10 m^3 , 10–100 m^3 , 100–1,000 m^3 , or above 1,000 m^3 .

For any characteristics of a composite material mentioned above, and in each characteristic's entire range, a further characteristic of importance is the number of SEs in the composite material.

In many applications, a high number of SEs in a composite material is preferred, as the characteristics of the SE (e.g. high tensional strength) become more pronounced in the composite material. Thus, depending on the context, the total number of SEs in a composite material is preferably greater than $1\text{E}+00$, such as greater than $1\text{E}+01$, such as greater than $1\text{E}+02$, such as greater than $1\text{E}+03$, such as greater than $1\text{E}+04$, such as greater than $1\text{E}+05$, such as greater than $1\text{E}+06$, such as greater than $1\text{E}+07$, such as greater than $1\text{E}+08$, such as greater than $1\text{E}+09$, such as greater than $1\text{E}+10$, such as

greater than $1\text{E}+11$, such as greater than $1\text{E}+12$, such as greater than $1\text{E}+13$, such as greater than $1\text{E}+14$, such as greater than $1\text{E}+15$, such as greater than $1\text{E}+16$, such as greater than $1\text{E}+17$, such as greater than $1\text{E}+18$, such as greater than $1\text{E}+19$, such as greater than $1\text{E}+20$.

In other applications, a low number of SEs in a composite material is preferred, as it makes processing of the composite material easier and/or reduces the cost of the final composite material. Thus, depending on the context, the total number of SEs in a composite material is preferably less than $1\text{E}+20$, such as less than $1\text{E}+19$, such as less than $1\text{E}+18$, such as less than $1\text{E}+17$, such as less than $1\text{E}+16$, such as less than $1\text{E}+15$, such as less than $1\text{E}+14$, such as less than $1\text{E}+13$, such as less than $1\text{E}+12$, such as less than $1\text{E}+11$, such as less than $1\text{E}+10$, such as less than $1\text{E}+09$, such as less than $1\text{E}+08$, such as less than $1\text{E}+07$, such as less than $1\text{E}+06$, such as less than $1\text{E}+05$, such as less than $1\text{E}+04$, such as less than $1\text{E}+03$, such as less than $1\text{E}+02$, such as less than $1\text{E}+01$, such as less than $2\text{E}+00$.

Thus, the preferred compromise between a high and a low number of SEs in a composite material depends on the context, and may be smaller than 2, but may also be in the range of $1\text{E}+00$ – $1\text{E}+01$, $1\text{E}+01$ – $1\text{E}+02$, $1\text{E}+02$ – $1\text{E}+03$, $1\text{E}+03$ – $1\text{E}+04$, $1\text{E}+04$ – $1\text{E}+05$, $1\text{E}+05$ – $1\text{E}+06$, $1\text{E}+06$ – $1\text{E}+07$, $1\text{E}+07$ – $1\text{E}+08$, $1\text{E}+08$ – $1\text{E}+09$, $1\text{E}+09$ – $1\text{E}+10$, $1\text{E}+10$ – $1\text{E}+11$, $1\text{E}+11$ – $1\text{E}+12$, $1\text{E}+12$ – $1\text{E}+13$, $1\text{E}+13$ – $1\text{E}+14$, $1\text{E}+14$ – $1\text{E}+15$, $1\text{E}+15$ – $1\text{E}+16$, $1\text{E}+16$ – $1\text{E}+17$, $1\text{E}+17$ – $1\text{E}+18$, $1\text{E}+18$ – $1\text{E}+19$, $1\text{E}+19$ – $1\text{E}+20$, or above $1\text{E}+20$.

For any characteristics of a composite material mentioned above, and in each characteristic's entire range, a further characteristic of importance is the total weight of the SEs in the composite material.

In many applications, a high total weight of an SE in a composite material is preferred, as the preferred characteristics of the SE (e.g. a high Young's modulus) then become more pronounced in the composite material. Thus, depending on the context, the total weight of SEs in a composite material is preferably greater than $1\text{E}-15$ kg, such as greater than $1\text{E}-14$ kg, such as greater than $1\text{E}-13$ kg, such as greater than $1\text{E}-12$ kg, such as greater than $1\text{E}-11$ kg, such as greater than $1\text{E}-10$ kg, such as greater than $1\text{E}-09$ kg, such as greater than $1\text{E}-08$ kg, such as greater than $1\text{E}-07$ kg, such as greater than $1\text{E}-06$ kg, such as greater than $1\text{E}-05$ kg, such as greater than $1\text{E}-04$ kg, such as greater than $1\text{E}-03$ kg, such as greater than $1\text{E}-02$ kg, such as greater than $1\text{E}-01$ kg, such as greater than $1\text{E}+00$ kg, such as greater than $1\text{E}+01$ kg, such as greater than $1\text{E}+02$ kg, such as greater than $1\text{E}+03$ kg, such as greater than $1\text{E}+04$ kg, such as greater than $1\text{E}+05$ kg, such as greater than $1\text{E}+06$ kg, such as greater than $1\text{E}+07$ kg, such as greater than $1\text{E}+08$ kg, such as greater than $1\text{E}+09$ kg.

In other applications, a low total weight of an SE in a composite material is preferred, as it reduces the total weight of the composite material. Thus, depending on the context, the total number of SEs in a composite material is preferably less than $1\text{E}+09$ kg, such as less than $1\text{E}+08$ kg, such as less than $1\text{E}+07$ kg, such as less than $1\text{E}+06$ kg, such as less than $1\text{E}+05$ kg, such as less than $1\text{E}+04$ kg, such as less than $1\text{E}+03$ kg, such as less than $1\text{E}+02$ kg, such as less than $1\text{E}+01$ kg, such as less than $1\text{E}+00$ kg, such as less than $1\text{E}-01$ kg, such as less than $1\text{E}-02$ kg, such as less than $1\text{E}-03$ kg, such as less than $1\text{E}-04$ kg, such as less than $1\text{E}-05$ kg, such as less than $1\text{E}-06$ kg, such as less than $1\text{E}-07$ kg, such as less than $1\text{E}-08$ kg, such as less than $1\text{E}-09$ kg, such as less than $1\text{E}-10$ kg, such as less than $1\text{E}-11$ kg, such as less than $1\text{E}-12$ kg, such as less than $1\text{E}-13$ kg, such as less than $1\text{E}-14$ kg, such as less than $1\text{E}-15$ kg.

Thus, the preferred compromise between a high and a low total weight of an SE in a composite material depends on the context, and may be smaller than $1\text{E}-15$ kg, but may also be in the range of $1\text{E}-15$ – $1\text{E}-14$ kg, $1\text{E}-14$ – $1\text{E}-13$ kg, $1\text{E}-13$ – $1\text{E}-12$ kg, $1\text{E}-12$ – $1\text{E}-11$ kg, $1\text{E}-11$ – $1\text{E}-10$ kg, $1\text{E}-10$ – $1\text{E}-09$ kg, $1\text{E}-09$ – $1\text{E}-08$ kg, $1\text{E}-08$ – $1\text{E}-07$ kg, $1\text{E}-07$ – $1\text{E}-06$ kg, $1\text{E}-06$ – $1\text{E}-05$ kg, $1\text{E}-05$ – $1\text{E}-04$ kg, $1\text{E}-04$ – $1\text{E}-03$ kg, $1\text{E}-03$ – $1\text{E}-02$ kg, $1\text{E}-02$ – $1\text{E}-01$ kg, $1\text{E}-01$ – $1\text{E}+00$ kg, $1\text{E}+00$ – $1\text{E}+01$ kg, $1\text{E}+01$ – $1\text{E}+02$ kg, $1\text{E}+02$ – $1\text{E}+03$ kg, $1\text{E}+03$ – $1\text{E}+04$ kg, $1\text{E}+04$ – $1\text{E}+05$ kg, $1\text{E}+05$ – $1\text{E}+06$ kg, $1\text{E}+06$ – $1\text{E}+07$ kg, $1\text{E}+07$ – $1\text{E}+08$ kg, $1\text{E}+08$ – $1\text{E}+09$ kg, or above $1\text{E}+09$ kg.

For any characteristics of a composite material mentioned above, and in each characteristic's entire range, a further characteristic of importance is the total number of CMUs in the composite material.

In many applications, a high number of CMUs in a composite material is preferred, as the characteristics of the CMUs (e.g. high tensional strength) then become more pronounced in the composite material. Thus, depending on the context, the total number of CMUs in a composite material is preferably greater than $1\text{E}+00$, such as greater than $1\text{E}+01$, such as greater than $1\text{E}+02$, such as greater than $1\text{E}+03$, such as greater than $1\text{E}+04$, such as greater than $1\text{E}+05$, such as greater than $1\text{E}+06$, such as greater than $1\text{E}+07$, such as greater than $1\text{E}+08$, such as greater than $1\text{E}+09$, such as greater than $1\text{E}+10$, such as greater than $1\text{E}+11$, such as greater than $1\text{E}+12$, such as greater than $1\text{E}+13$, such as greater than $1\text{E}+14$, such as greater than $1\text{E}+15$, such as greater than $1\text{E}+16$, such as greater than $1\text{E}+17$, such as greater than $1\text{E}+18$, such as greater than $1\text{E}+19$, such as greater than $1\text{E}+20$.

In other applications, a low number of CMUs in a composite material is preferred, as it makes processing of the composite material easier and reduces the cost of the final composite material. Thus, depending on the context, the total number of CMUs in a composite material is preferably less than

1E+20, such as less than 1E+19, such as less than 1E+18, such as less than 1E+17, such as less than 1E+16, such as less than 1E+15, such as less than 1E+14, such as less than 1E+13, such as less than 1E+12, such as less than 1E+11, such as less than 1E+10, such as less than 1E+09, such as less than 1E+08, such as less than 1E+07, such as less than 1E+06, such as less than 1E+05, such as less than 1E+04, such as less than 1E+03, such as less than 1E+02, such as less than 1E+01, such as less than 2E+00.

Thus, the preferred compromise between a high and a low number of CMUs in a composite material depends on the context, and may be smaller than 2, but may also be in the range of 1E+00–1E+01, 1E+01–1E+02, 1E+02–1E+03, 1E+03–1E+04, 1E+04–1E+05, 1E+05–1E+06, 1E+06–1E+07, 1E+07–1E+08, 1E+08–1E+09, 1E+09–1E+10, 1E+10–1E+11, 1E+11–1E+12, 1E+12–1E+13, 1E+13–1E+14, 1E+14–1E+15, 1E+15–1E+16, 1E+16–1E+17, 1E+17–1E+18, 1E+18–1E+19, 1E+19–1E+20, or 1E+20–1E+30.

For any characteristics of a composite material mentioned above, and in each characteristic's entire range, a further characteristic of importance is homogeneity of the composite material.

A material can be homogeneous on a number of levels. Here, homogeneity is defined at the following levels: macroscopic homogeneity (objects ≥ 0.01 m), milliscopic homogeneity (objects 1–10 mm), microscopic homogeneity (objects 1–1,000 μm), nanoscopic homogeneity (objects 1–1,000 nm), and picoscopic homogeneity (objects 1–1,000 pm). For composite materials, homogeneity is here defined as the additive being uniformly dispersed in the composite material as evaluated by the naked eye or microscopy. Composite materials can be homogeneous on the macroscopic, milliscopic, microscopic and nanoscopic level, but not on the picoscopic level, as individual atoms can be visualized at the picoscopic level.

In many applications, the homogeneity of the composite material is an important characteristic, as a homogeneous dispersion of SEs in the composite material results in a better transfer of the properties of the SE (e.g. tensile strength) to the composite material. Thus, depending on the context, the composite material is preferably homogenous on a level less than the macroscopic level, such as a level less than the milliscopic level, such as a level less than the microscopic level.

In other applications, the homogeneity of the composite material is a less important characteristic, and processing costs can be reduced and a less expensive material produced, if the composite material is less homogeneous. Thus, depending on the context, the composite material is preferably homogenous

on a level greater than the nanoscopic level, such as greater than the microscopic level, such as greater than the milliscopic level, such as greater than the macroscopic level.

Thus, the preferred compromise between a high and a low homogeneity depends on the context, and may be less than on the nanoscopic level, but may also be in the range of the nanoscopic–microscopic level, the microscopic–milliscopic level, the milliscopic–macroscopic level, or above the macroscopic level.

Further characteristics of composite material. For any characteristics of an composite material mentioned above, and in each characteristic's entire range, further characteristics of the composite material that are of importance in the present invention are the stiffness, electrical conductivity, thermal conductivity, color, fluorescence, luminescence, UV protective capability, abrasion resistance, ductility, elasticity, flexibility, energy storage capability (energy storage as heat or kinetic energy), information storage capability, hydrophilicity, hydrophobicity, polarity, aproticity, and charge, as well as the following characteristics where the unit of measure is indicated after each characteristic: Arc Resistance, sec; Impact Strength, Charpy, J/cm; Impact Strength, Izod Notched, J/cm ; Impact Strength, Izod Unnotched, J/cm ; Impact Strength, Charpy Notched Low Temp, J/cm; Impact Strength, Izod Notched Low Temp, J/cm; Impact Strength, Charpy Unnotched Low Temp, J/cm; Impact Strength, Charpy Unnotched, J/cm; Linear Mold Shrinkage, cm/cm; Maximum Service Temperature, Air, ; Melt Flow, g/10 min; Melting Point, ; Modulus of Elasticity, GPa; Moisture Absorption at Equilibrium, % ; Oxygen Transmission, cc-mm/m; Poisson's Ratio; Processing Temperature, ; Surface Resistance, ohm; Tensile Strength, Ultimate, MPa; Tensile Strength, Yield, MPa; Thermal Conductivity, W/m-K; UL RTI, Electrical, ; UL RTI, Mechanical with Impact, ; UL RTI, Mechanical without Impact, ; Vicat Softening Point, ; Water Absorption, %; Coefficient of Friction; Comparative Tracking Index, V; Compressive Yield Strength, MPa; CTE, linear 20; Deflection Temperature at 0.46 MPa, ; Deflection Temperature at 1.8 MPa, ; Density, g/cc; Dielectric Constant; Dielectric Constant, Low Frequency ; Dielectric Strength, kV/mm; Dissipation Factor; Dissipation Factor, Low Frequency ; Electrical Resistivity, ohm-cm; Elongation @ break, %; Flammability, UL94 ; Flexural Modulus, GPa; Flexural Yield Strength, MPa; Glass Temperature, ; Hardness, Barcol; Hardness, Rockwell E; Hardness, Rockwell M; Hardness, Rockwell R; Hardness, Shore A; Hardness, Shore D; Heat Capacity, J/g.

Depending on the application, a composite material with a low, medium, or high degree of each of these characteristics is preferable in the present invention.

Example Composite Materials.

The CMUs described herein may be used to form composite materials comprising a large number of CMUs.

Structural entities and preferred embodiments.

Polymer and additive. In a preferred embodiment the matrix of a composite material is non-polar. As a result, non-polar additives (e.g. CNT, graphene) will typically integrate more efficiently in the polymer, making the composite material more homogeneous, which is often an advantage, as described above. Polar additives, on the other hand, may in some cases have a strong effect on the electronic and thermal characteristics of the composite material compared to the matrix material without the additive, because of the non-polarity of the matrix and the polarity of the additive. This can be advantageous in certain cases, e.g. when used in sensor applications. A preferred embodiment thus is a composite material where the matrix (SE2) is non-polar and the additive (SE1) is polar. Another preferred embodiment is a composite material where SE1 is non-polar, and the other structural entity of the same CMU is polar (i.e. SE2 is polar).

Nanosensor. The remarkable sensitivity of carbon nanotube or graphene properties (e.g. carbon nanotube conductivity) to the surface adsorbates permits the use of carbon nanotubes and graphene as highly sensitive sensors.

In a preferred embodiment, one of the structural entities of a CMU comprises an entity chosen from the list of nucleic acid, single-stranded DNA, double-stranded DNA, protein, antibody, enzyme, receptor, where each entity may be attached to another entity chosen from the list comprising carbon nanotube, single-walled carbon nanotube, multi-walled carbon nanotube, graphene, single layer graphene, multi-layer graphene, or graphene oxide. If a CMU comprises e.g. a structural entity SE1 (e.g. an antibody) that binds to a molecule X, and if the other structural entity SE2 is e.g. a conducting CNT, the CMU may be used as a nanosensor for the detection of molecule X.

CNT-reinforced polymer. In a preferred embodiment, one of the structural entities of a CMU is a polymer and the other structural entity of the same CMU is an additive providing increased strength to the composite material made of the CMUs, compared to the material that does not contain the additive. In a preferred embodiment of said embodiment the precursor-ML, ML, or Ligand2 attaching the additive to the linker is capable of non-covalently binding said additive. In a preferred embodiment of said embodiment the additive is a carbon nanotube.

Mixed polymer composite material. In some circumstances it may be desirable to mix two or more polymers. In one preferred embodiment, SE1 represents a molecule of one kind of polymer and SE2 represents a molecule of another kind of polymer. As an example, SE1 may be PVC and SE2 may be polycarbamate. In another preferred embodiment, SE1 represents a polymer molecule and SE2 is an additive, and the composite material additionally comprises one or more polymer types different from SE1.

In a preferred embodiment, the CMU comprises two structural entities SE1 and SE2, where SE1 is an additive of high strength, and SE2 is a polymer and part of the matrix material in a composite material. Ligand2 comprises a large number of SubLigands, such as 4, 5, 6 or more Subligands, where the dissociation constant of the individual SubLigands is relatively high, such as in the range between 10^{-10} - 10^{-2} M. Such relatively weak interactions of the individual SubLigand with SE2, e.g. in a setting where a large number of serially connected SubLigands can interact with SE2, will provide a very high degree of flexibility and self-healing to a composite material made of such CMUs.

In another preferred embodiment, the CMU comprises two structural entities SE1 and SE2, where SE1 is an additive of high strength, and SE2 is a polymer and part of the matrix material in a composite material. The Ligand2-SE2 interaction is covalent.

In a preferred embodiment, SE1 and SE2 are both a carbon nanotube, and the linker connecting SE1 and SE2 is of a length between 0.1 nm and 10 nm. In a preferred embodiment, the composite material is a material made up of a large number of CMUs, each of which comprise two structural entities SE, both of which are carbon nanotubes, and Ligand2 is either mechanically bound to a carbon nanotube or is non-covalently bound to a carbon nanotube. The linker is relatively short, such as e.g. between 1 and 10 nm. The material is essentially a tight aggregate of carbon nanotubes. As a result, the material is of high strength.

In another preferred embodiment, SE1 and SE2 are both graphene, and the linker connecting SE1 and SE2 is of a length between 0.1 nm and 10 nm. The resulting CMU will have higher strength than each of the two individual graphenes.

In a preferred embodiment, a composite material comprises more than one kind of CMUs. For example, if the composite material is intended to function as a glue between two surfaces, it may be desirable to have one kind of CMU (e.g. made up of a polymer (SE1) and a strengthening additive such as graphene (SE2) that is the core of a reinforced polymer that does not easily break apart, and another kind of CMU (e.g. comprising the same polymer (SE1) but a third structural entity (SE3) that is part of the two surfaces that must be glued together.

Carbon nanotube-reinforced ceramics

Ceramics cover a wide range of materials, including structural materials and technical ceramics. Concrete and piezoelectric materials are prototypical ceramics. Ceramics are usually defined as solids with a mixture of metallic or semi-metallic and non-metallic elements (often, although not always, oxygen), and they are often quite hard, non-conducting and corrosion-resistant.

Concrete is the most widely used construction material, which among other things comprises silicates. Concrete is produced by mixing cement with sand and water and adding aggregates. Other ingredients in the concrete are termed admixtures, for example air and water reducers such as superplasticizers. An example of a superplasticizer is Mapai, Dynamon SP1. Retarders and accelerators are other useful admixtures. Another ingredient in many concrete mixtures is supplementary cementitious materials also called pozzolans. These materials include fly ash, slag cement (sometimes called ground granulated blast furnace slag or slag cement), silica fume, and metakaolin. Supplementary cementitious materials are used as replacement for cement and since they have a very small particle size they reduce the permeability of concrete.

The relative amount of the water and cement is one of the key parameters that determines the strength of concrete – a lower water-to-cement ratio gives higher strength but at the expense of a higher viscosity.

Addition of fillers such as fullerenes, e.g. CNTs, to concrete in the form of linker units (LUs) or composite material units (CMUs) according to the present invention may help disperse the CNTs more efficiently, and increase the strength of the concrete.

In a preferred embodiment, SE1 or SE2 is a silicate, superplasticizer (e.g. Mapai, Dynamon SP1), a retarder, an accelerator, a pozzolan, or metakaolin, and optionally, SE1 is a carbon nanotube or graphene. In said preferred embodiment, the water-to-cement ratio is preferably lower than 0,01; more preferably between 0,01 and 0,1; more preferably between 0,1 and 0,2; more preferably between 0,2 and 0,3; more preferably between 0,3 and 0,5; more preferably between 0,5 and 1; more preferably between 1 and 2; more preferably between 2 and 5; or even more preferably between 5 and 10.

Items

The following items are particularly preferred embodiments of the present invention.

Item A1. A composite material comprising a nanotube

Item A2. The composite material of item A1 where the nanotube is a carbon nanotube

Item A3. The composite material of item A1 or A2 that comprises a second structural entity that is not a nanotube

Item A4. The composite material of item A3 where the second structural entity is a polymer

Item A5. The composite material of item A3 where the second structural entity comprises less than 10 identical chemical moieties and less than 10 repeats and less than 10 monomer units.

Item A6. The composite material of any of items A1-A5 that has a volume of 1 mm^3 and comprises at least 10^6 covalently closed rings, such as at least 10^7 covalently closed rings, such as at least 10^8 covalently closed rings, such as at least 10^9 covalently closed rings, such as at least 10^{10} covalently closed rings, such as at least 10^{11} covalently closed rings, such as at least 10^{12} covalently closed rings, such as at least 10^{13} covalently closed rings, such as at least 10^{14} covalently closed rings, such as at least 10^{15} covalently closed rings, such as at least 10^{16} covalently closed rings, such as at least 10^{17} covalently closed rings, such as at least 10^{18} covalently closed rings, such as at least 10^{19} covalently closed rings, such as at least 10^{20} covalently closed rings, such as at least 10^{21} covalently closed rings, such as at least 10^{22} covalently closed rings, and where the covalently closed ring is not a nanotube or part of a nanotube.

Item A7. The composite material of any one of items A1-A6 where at least one nanotube is complexed to a covalently closed ring that wraps around the nanotube, where there are no covalent bonds between the nanotube and the covalently closed ring, and where the covalently closed ring is not a nanotube or part of a nanotube.

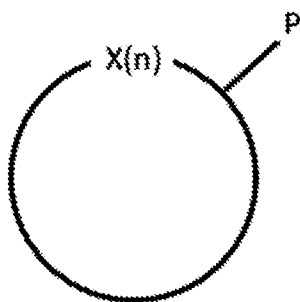
Item A8. The composite material of item A7 that has a volume of 1 mm^3 , and that comprises at least one nanotube, such as at least 10 nanotubes, such as at least 10^2 nanotubes, such as at least 10^3 nanotubes, such as at least 10^4 nanotubes, such as at least 10^5 nanotubes, such as at least 10^6 nanotubes, such as at least 10^7 nanotubes, such as at least 10^8 nanotubes, such as at least 10^9 nanotubes, such as at least 10^{10} nanotubes, such as at least 10^{11} nanotubes, such as at least 10^{12} nanotubes, such as at least 10^{13} nanotubes, such as at least 10^{14} nanotubes, where each nanotube is complexed to a covalently closed ring that wraps around the nanotube, where there are no covalent

bonds between the nanotube and the covalently closed ring, and where the covalently closed ring is not a nanotube or part of a nanotube.

Item A9. The composite material of item A8 where each of the nanotubes are complexed to at least 1 covalently closed ring, such as to at least 5 covalently closed rings, such as to at least 10 covalently closed rings, such as to at least 30 covalently closed rings, such as to at least 100 covalently closed rings, such as to at least 300 covalently closed rings, such as to at least 1000 covalently closed rings.

Item A10. The composite material of any one of items A6-A9 where the covalently closed ring corresponds to the ring of a compound of formula ML-1 as described in the following;

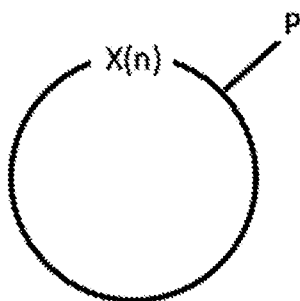
A compound of formula ML-1 comprising a ring forming an unbroken circular chain of n atoms (X) around a hole where a molecule with a smallest diameter of more than 2 Ångstrom can reside in or pass through, and wherein said ring corresponds to an unbroken circular chain of atoms which has the lowest total molecular weight of any such possible unbroken circular chain of atoms in the compound, and wherein $n = 8$ to 10000.



(ML-1)

Item A11. The composite material of any one of items A6-A9 where the covalently closed ring corresponds to the ring of a compound of formula ML-2 as described in the following;

A compound of formula ML-2 comprising a ring forming an unbroken circular chain of n atoms (X) around a nanotube, wherein there is no covalent bonds between said compound and said nanotube, and wherein said ring corresponds to an unbroken circular chain of atoms which has the lowest total molecular weight of any such possible unbroken circular chain of atoms around a nanotube in the compound, and wherein $n = 8$ to 10000.



(ML-2)

The number of atoms (n) of ML-1 and ML-2 is preferably more than 10, such as more than 20, such as more than 30, such as more than 40, such as more than 50, such as more than 60, such as more than 70, such as more than 80, such as more than 90, such as more than 100, such as more than 200, such as more than 300, such as more than 400, such as more than 500, such as more than 600, such as more than 700, such as more than 800, such as more than 900, such as more than 1000, such as more than 1500, such as more than 2000, such as more than 2500, such as more than 3000, such as more than 3500, such as more than 4000, such as more than 4500, such as more than 5000, such as more than 6000, such as more than 7000, such as more than 8000, such as more than 9000, or less than 10000, such as less than 9000, such as less than 8000, such as less than 7000, such as less than 6000, such as less than 5000, such as less than 4500, such as less than 4000, such as less than 3500, such as less than 3000, such as less than 2500, such as less than 2000, such as less than 1500, such as less than 1000, such as less than 900, such as less than 800, such as less than 700, such as less than 600, such as less than 500, such as less than 400, such as less than 300, such as less than 200, such as less than 100, such as less than 90, such as less than 80, such as less than 70, such as less than 60, such as less than 50, such as less than 40, such as less than 30, such as less than 20, or 10 to 20, 20 to 30, 30 to 40, 40 to 50, 50 to 60, 60 to 70, 70 to 80, 80 to 90, 90 to 100, 100 to 200, 200 to 300, 300 to 400, 400 to 500, 500 to 600, 600 to 700, 700 to 800, 800 to 900, 900 to 1000, 1000 to 1500, 1500 to 2000, 2000 to 2500, 2500 to 3000, 3000 to 3500, 3500 to 4000, 4000 to 4500, 4500 to 5000, 5000 to 6000, 6000 to 7000, 7000 to 8000, 8000 to 9000, or 9000 to 10000.

Item A12. The composite material of any one of items A6-A11 where the covalently closed ring comprises a chemical moiety chosen from the following list of chemical moieties: ((2,2'-((1,3,6,8-tetraoxobenzo[*lmn*][3,8] phenanthroline-2,7(1*h*,3*h*,6*h*,8*h*)-diyl)bis(3-(4-iodophenyl)propanoic acid))), 1-methylpyrene, 1,2,3-trichlorobenzene, 1,2,4-trichlorobenzene, 2-methylpyrene, 2,6,6-trimethylbicyclo[3.1.1]hept-2-ene, 4-methylpyrene, benzo[*a*]pyrene, benzo[*e*]pyrene, compound 1 in romero-nieto et al. 2012 (doi:10.1021/ja211362z), compound 1 in

de juan et al. 2015 (doi:10.1039/c5sc02916c), compound 2 in de juan et al. 2015 (doi:10.1039/c5sc02916c), compound 3 in de juan et al. 2015 (doi:10.1039/c5sc02916c), compound 4 in de juan et al. 2015 (doi:10.1039/c5sc02916c), compound 5 in de juan et al. 2015 (doi:10.1039/c5sc02916c), cyclopenta[cd]pyrene, dibenzo[a,1]pyrene, dibenzo[a,e]pyrene, dibenzo[a,h]pyrene, dibenzo[a,i]pyrene, dibenzo[a,l]pyrene, dibenzo[e,l]pyrene, dipyrene phenylester, hexane, indeno[1,2,3-cd]pyrene, naphtalene, naphthalene diimide, naphtho[2,1-a]pyrene, naphtho[2,3-e]pyrene, nitrobenzene, porphyrine, pyrene, pyrene diamine, pyrene phenyl ester, sodium dodecyl benzenesulfonate, tetracycline, the polypeptide CPTSTGQAC, the polypeptide CTLHVSSYC, the polypeptide ELWR, the polypeptide ELWRPTR, the polypeptide ELWSIDTSAHRK, the polypeptide HTDWRLGTWHHS, the polypeptide HWKHPWGAWDTL, the polypeptide IFRLSWGTYFS, the polypeptide KPRSVSG, the polypeptide QLMHDYR, the polypeptide QTWPPPLWFSTS, the polypeptide RLNPPSQMDPPF, the polypeptide KPRSVSG-dansyl, the polypeptide KTQATSESGSAGRQMFVADMG, the polypeptide KTQATSRGTRGMRTSGGFVPG, the polypeptide KTQATSVPRKAARRWEQVDSV, the polypeptide MHGKTQATSGTIQS, the polypeptide PQAQDVELPQELQDQHREVEV, the polypeptide SKTSGRDQSKRVPRYWNVHRD, the polypeptide SKTSRESSAVQMKGARFLCT, toluene.

Item A13. The composite material of any one of items A6-A11 where the covalently closed ring does not comprise a chemical moiety chosen from the following list of chemical moieties: ((2s,2's)-2,2'-(1,3,6,8-tetraoxobenzo[lmn][3,8] phenanthroline-2,7(1h,3h,6h,8h)-diyl)bis(3-(4-iodophenyl)propanoic acid)), 1-methylpyrene, 1,2,3-trichlorobenzene, 1,2,4-trichlorobenzene, 2-methylpyrene, 2,6,6-trimethylbicyclo[3.1.1]hept-2-ene, 4-methylpyrene, benzo[a]pyrene, benzo[e]pyrene, compound 1 in romero-nieto et al. 2012 (doi:10.1021/ja211362z), compound 1 in de juan et al. 2015 (doi:10.1039/c5sc02916c), compound 2 in de juan et al. 2015 (doi:10.1039/c5sc02916c), compound 3 in de juan et al. 2015 (doi:10.1039/c5sc02916c), compound 4 in de juan et al. 2015 (doi:10.1039/c5sc02916c), compound 5 in de juan et al. 2015 (doi:10.1039/c5sc02916c), cyclopenta[cd]pyrene, dibenzo[a,1]pyrene, dibenzo[a,e]pyrene, dibenzo[a,h]pyrene, dibenzo[a,i]pyrene, dibenzo[a,l]pyrene, dibenzo[e,l]pyrene, dipyrene phenylester, hexane, indeno[1,2,3-cd]pyrene, naphtalene, naphthalene diimide, naphtho[2,1-a]pyrene, naphtho[2,3-e]pyrene, nitrobenzene, porphyrine, pyrene, pyrene diamine, pyrene phenyl ester, sodium dodecyl benzenesulfonate, tetracycline, the polypeptide CPTSTGQAC, the polypeptide CTLHVSSYC, the polypeptide ELWR, the polypeptide ELWRPTR, the polypeptide ELWSIDTSAHRK, the polypeptide HTDWRLGTWHHS, the polypeptide HWKHPWGAWDTL, the polypeptide IFRLSWGTYFS, the polypeptide KPRSVSG, the polypeptide QLMHDYR, the polypeptide QTWPPPLWFSTS, the

polypeptide RLNPPSQMDPPF, the polypeptide KPRSVSG-dansyl, the polypeptide KTQATSESGSAGRQMFVADMG, the polypeptide KTQATSRGTRGMRTSGGFPVG, the polypeptide KTQATSVPRKAARRWEQVDSV, the polypeptide MHGKTQATSGTIQS, the polypeptide PQAQDVELPQELQDQHREVEV, the polypeptide SKTSGRDQSKRVPRYWNVHRD, the polypeptide SKTSRESSAVQMGKARFLCT, toluene.

Item A14. The composite material of any one of items A6-A13 where the covalently closed ring comprises a chemical moiety of at least 50 Dal, such as of at least 100 Dal, such as of at least 200 Dal, such as of at least 300 Dal, such as of at least 400 Dal, such as of at least 500 Dal, such as of at least 600 Dal, such as of at least 800 Dal, such as of at least 1000 Dal, such as of at least 1500 Dal, such as of at least 2000 Dal, such as of at least 4000 Dal, where said chemical moiety is identical to a part of the second structural entity where said second structural entity is not a nanotube.

Item A15. The composite material of any one of items A6-A13 where the covalently closed ring is a closed ring around the nanotube and has a molecular weight (MW) of 100-200 Dal, or 200-300 Dal, or 300-500 Dal, or 500-800 Dal, or 800-1200 Dal, or 1200-2000 Dal, or 2000-4000 Dal, or 4000-10000 Dal, where said molecular weight is the combined molecular weight of the atoms constituting the shortest string of covalently linked atoms that form a ring around the nanotube.

Item A16. The composite material of any one of items A6-A13 where the covalently closed ring does not comprise a chemical moiety of at least 50 Dal, such as of at least 100 Dal, such as of at least 200 Dal, such as of at least 300 Dal, such as of at least 400 Dal, such as of at least 500 Dal, such as of at least 600 Dal, such as of at least 800 Dal, such as of at least 1000 Dal, such as of at least 1500 Dal, such as of at least 2000 Dal, such as of at least 4000 Dal, where said chemical moiety is identical to a part of the second structural entity where said second structural entity is not a nanotube.

Item A17. The composite material of any one of items A6-A13 where the covalently closed ring is a closed ring around the nanotube, where at least one of the atoms constituting the shortest string of covalently linked atoms that form a ring around the nanotube are chosen from the following list: carbon atom, nitrogen atom, oxygen atom.

Item A18. The composite material of any one of items A6-A17 where the covalently closed ring is covalently linked to the second structural entity where said second structural entity is not a nanotube.

Item A19. The composite material of any one of items A6-A17 where the covalently closed ring is a closed ring around the nanotube, where none of the atoms constituting the shortest string of covalently linked atoms that form a ring around the nanotube is a carbon atom.

Item A20. The composite material of any one of items A1-A19 where two covalently closed rings are covalently linked together, and where the two covalently closed rings are each complexed with a separate nanotube, where the covalently closed ring is not a nanotube or part of a nanotube.

Item B1. A composite material comprising a nanotube and a mechanical ligand.

Item B2. A composite material of item B1 which additionally comprises a second structural entity.

Item B3. A composite material of items B1 or B2 where the second structural entity is a polymer

Item B4. A composite material of any one of items B1-B3 where a nanotube is bound to a mechanical ligand via a mechanical bond.

Item B5. A composite material of any one of items B1-B4 where a mechanical ligand is linked to a second structural entity via a mechanical bond or a covalent bond.

Item B6. A composite material of any one of items B1-B5 where the mechanical ligand is a compound of formula ML-1

Item B7. A composite material of any one of items B1-B6 where the mechanical ligand is a compound of formula ML-2

Item B8. A composite material of any one of items B1-B7 where n is more than 10, such as more than 20, such as more than 30, such as more than 40, such as more than 50, such as more than 60, such as more than 70, such as more than 80, such as more than 90, such as more than 100, such as more than 200, such as more than 300, such as more than 400, such as more than 500, such as more than 600, such as more than 700, such as more than 800, such as more than 900, such as more than 1000, such as more than 1500, such as more than 2000, such as more than 2500, such as more than 3000, such as more than 3500, such as more than 4000, such as more than 4500, such as more than 5000, such as more than 6000, such as more than 7000, such as more than 8000, such as more than 9000.

Item B9. A composite material of any one of items B1-B7 where n is less than 10000, such as less than 9000, such as less than 8000, such as less than 7000, such as less than 6000, such as less than 5000, such as less than 4500, such as less than 4000, such as less than 3500, such as less than 3000, such as less than 2500, such as less than 2000, such as less than 1500, such as less than 1000, such as less than 900, such as less than 800, such as less than 700, such as less than 600, such as less than 500, such as less than 400, such as less than 300, such as less than 200, such as less than 100, such as less than 90, such as less than 80, such as less than 70, such as less than 60, such as less than 50, such as less than 40, such as less than 30, such as less than 20.

Item B10. A composite material of any one of items B1-B7 where n is 10 to 20, 20 to 30, 30 to 40, 40 to 50, 50 to 60, 60 to 70, 70 to 80, 80 to 90, 90 to 100, 100 to 200, 200 to 300, 300 to 400, 400 to 500, 500 to 600, 600 to 700, 700 to 800, 800 to 900, 900 to 1000, 1000 to 1500, 1500 to 2000, 2000 to 2500, 2500 to 3000, 3000 to 3500, 3500 to 4000, 4000 to 4500, 4500 to 5000, 5000 to 6000, 6000 to 7000, 7000 to 8000, 8000 to 9000, or 9000 to 10000.

Item B11. A composite material of any one of items B1-B10 where the mechanical ligand comprises ((2s,2's)-2,2'-(1,3,6,8-tetraoxobenzo[lmn][3,8] phenanthroline-2,7(1h,3h,6h,8h)-diyl)bis(3-(4-iodophenyl)propanoic acid)), 1-methylpyrene, 1,2,3-trichlorobenzene, 1,2,4-trichlorobenzene, 2-methylpyrene, 2,6,6-trimethylbicyclo[3.1.1]hept-2-ene, 4-methylpyrene, benzo[a]pyrene, benzo[e]pyrene, compound 1 in romero-nieto et al. 2012 (doi:10.1021/ja211362z), compound 1 in de juan et al. 2015 (doi:10.1039/c5sc02916c), compound 2 in de juan et al. 2015 (doi:10.1039/c5sc02916c), compound 3 in de juan et al. 2015 (doi:10.1039/c5sc02916c), compound 4 in de juan et al. 2015 (doi:10.1039/c5sc02916c), compound 5 in de juan et al. 2015 (doi:10.1039/c5sc02916c), cyclopenta[cd]pyrene, dibenzo[a,1]pyrene, dibenzo[a,e]pyrene, dibenzo[a,h]pyrene, dibenzo[a,i]pyrene, dibenzo[a,l]pyrene, dibenzo[e,l]pyrene, dipyrene phenylester, hexane, indeno[1,2,3-cd]pyrene, naphthalene, naphthalene diimide, naphtho[2,1-a]pyrene, naphtho[2,3-e]pyrene, nitrobenzene, porphyrine, pyrene, pyrene diamine, pyrene phenyl ester, sodium dodecyl benzenesulfonate, tetracycline, the polypeptide CPTSTGQAC, the polypeptide CTLHVSSYC, the polypeptide ELWR, the polypeptide ELWRPTR, the polypeptide ELWSIDTSAHRK, the polypeptide HTDWRRLGTWHHS, the polypeptide HWKHPWGAWDTL, the polypeptide IFRLSWGTYFS, the polypeptide KPRSVSG, the polypeptide QLMHDYR, the polypeptide QTWPPPLWFSTS, the polypeptide RLNPPSQMDPPF, the polypeptide KPRSVSG-dansyl, the polypeptide KTQATSESGSAGRQMFVADMG, the polypeptide KTQATSRGTRGMRTSGGFPVG, the polypeptide KTQATSVPRKAARRWEQVDSV, the polypeptide MHGKTQATSGTIQS, the polypeptide

Item B12. A composite material of any one of items B1-B11 where the mechanical ligand comprises one or more entities chosen from the list consisting of; [3.3.1]nonane, [1-d]thiophene, 1-iso-propyl-4-methylbenzene, 1-methyl-naphthalene, 1-methylfluoranthene, 1-methylphenanthrene, 1-n-decene, 1-phenyl-1-propyne, 1,1-di(phenyl)ethylene, 1,10-phenanthroline, 1,2-benzacenaphthene, 1,2-benzanthracene, 1,2-dihydroacenaphthylene, 1,2,3,4-tetrahydro-naphthalene, 1,2,4-trimethylbenzene, 1,2,4,5-tetramethylbenzene, 1,5-naphthyridine, 1,6-naphthyridine, 1,7-dimethylphenanthrene, 1,7-naphthyridine, 1,7-phenanthroline, 1,8-naphthyridine, 1,8-phenanthroline, 1,9-phenanthroline, 11h-benzo[a]fluorene, 13h-dibenzo[a,i]carbazole, 1h-indole, 1h-phenalene, 2-methyl-naphthalene, 2-methylchrysene, 2-methylnaphthalene, 2-methylphenanthrene, 2,2,4-trimethylpentane, 2,3-benzanthracene, 2,6-naphthyridine, 2,7-naphthyridine, 2,7-phenanthroline, 2,8-phenanthroline, 2,9-phenanthroline, 3-methylchrysene, 3-methylfluoranthene, 3-methylphenanthrene, 3,7-phenanthroline, 3,8-phenanthroline, 4-methylphenyl acetylene, 4-methyl-biphenyl, 4-methyl-styrene, 4,7-phenanthroline, 4h-cyclopenta[def]phenanthrene, 7h-benz[de]anthracen-7-one, 7h-benzo[c]fluorene, 7h-dibenzo[a,g]carbazole, 8-methylfluoranthene, 9,10-anthracenedione, 9,10-dihydroanthracene, 9,10-phenanthrenedione, 9(10h)-anthracenone, 9h-carbazole, 9h-fluoren-9-one, 9h-fluorene, 9h-xanthene, aceanthrylene, acenaphthene, acenaphthylene, acephenanthrylene, acetnaphthylene, acridarsine, acridine, acridophosphine, anhydrous 1-octyne, annulene, anthanthrene, anthracene, anthraquinone, anthrone, arsanthrene, arsanthridine, arsinane, arsinole, arsinolizine, arsinine, arsinoline, arsinolizine, arsolane, arsole, as-indacene, azepane, azepine, azete, azetidione, azirine, azocine, azulene, azulene, benz[a]anthracene, benz[c]acridine, benz[e]acephenanthrylene, benzanthrone, benzene, benzo[a]dibenzothiophene, benzo[a]fluoranthene, benzo[a]pentacene, benzo[a]phenanthrene, benzo[b]chrysene, benzo[b]fluoranthene, benzo[b]naphtho[2, benzo[b]triphenylene, benzo[c]chrysene, benzo[c]cinnoline, benzo[c]pentaphene, benzo[c]phenanthrene, benzo[f]quinoline, benzo[f]tetraphene, benzo[g]chrysene, benzo[ghi]fluoranthene, benzo[ghi]perylene, benzo[h]naphtho [1,2-f]quinolene, benzo[h]quinoline, benzo[j]fluoranthene, benzo[k]tetraphene, benzo[pqr]tetraphene, benzo[rst]pentaphene, biphenyl, biphenylene, bismolane, bismole, boranthrene, borinane, borinine, borolane, borole, butylbenzene, carbazole, chromene, chrysene, cinnoline, corannulene, coronene, decacene, decahelicene, decane, decaphene, diazepine, diazetidine, diazine, diazirine, dibenz[a,c]anthracene, dibenz[a,h]acridine, dibenz[a,h]anthracene, dibenz[a,i]acridine, dibenz[a,i]anthracene, dibenz[c,h]acridine,

dibenzo[a,j]anthracene, dibenzo[a,k]fluoranthene, dibenzo[b,def]chrysene,
 dibenzo[b,e]fluoranthene, dibenzo[b,h]phenanthrene, dibenzo[b,k]fluoranthene,
 dibenzo[c,g]phenanthrene, dibenzo[c,pqr]tetraphene, dibenzo[def,mno]chrysene,
 dibenzo[def,p]chrysene, dibenzo[f,k]tetraphene, dibenzo[f,pqr]tetraphene, dibenzo[fg,op]tetracene,
 dibenzo[h,rst]pentaphene, dibenzo[j,l]fluoranthene, dibenzothiophene, dioxane, dioxetane, dioxete,
 dioxine, dioxirane, dioxolane, dithiane, dithiazole, dithietane, dithiete, dithiine, dodecyl-
 trimethylammonium bromide (dtab) , episulfides, epoxide, ethylbenzene, ethylmethylbenzene,
 fluoranthene, fluorene, free-base tetraphenyl-porphyrin , furan, furane, furazan, germinane,
 germine, heptacene, heptacene , heptahelicene, heptalene, heptaphene, heptaphenylene,
 hexacene, hexacene , hexahelicene, hexamethyl-benzene, hexaphene, hexaphenylene,
 homopiperazine, imidazole, imidazolidine, imidazoline, indazole, indene, indole, indolizine,
 isoarsindole, isoarsinoline, isochromene, isoindole, isophosphindole, isophosphinoline, isoquinoline,
 isoselenochromene, isotellurochromene, isothiazole, isothiazolidine, isothiochromene, isoxazole,
 isoxazolidine, m-dinitrobenzene, mercuranthrene, meso-1,2-diphenylethylene, monooleate,
 monostearate, morpholine, n-dodecane, naphthacene, naphthalene, naphtho[1,2-b]fluoranthene,
 naphtho[1,2,3,4-def] chrysene, naphtho[1,2,3,4-pqr]tetraphene, naphtho[2,1,8-qa]tetracene,
 naphtho[2,3-b]fluoranthene, naphtho[2,3-f]quinoline, naphtho[7,8,1,2,3-nopqr]tetraphene,
 nonacene, nonahelicene, nonaphene, nonaphenylene, octacene, octahelicene, octaphene,
 octaphenylene, ovalene, oxadiazole, oxane, oxanthrene, oxazine, oxaziridine, oxazole, oxazolidine,
 oxazoline, oxecane, oxepane, oxepine, oxetane, oxete, oxirane, oxirene, oxolane, ozocane, p-
 mentha-1,8-diene, p-nitrotoluene, p-terphenyl, pentacene, pentalene, pentaphene,
 pentaphenylene, perimidine, perylene, phenalene, phenanthraquinone, phenanthrene,
 phenanthrene , phenanthridine, phenanthro[4,5-bcd]thiophene, phenarsazinine, phenazine,
 phenazone, phenomercurazine, phenophosphazinine, phenoselenazine, phenotellurazine,
 phenothiarsinine, phenothiazine, phenoxaphosphinine, phenoxarsinine, phenoxaselenine,
 phenoxastibinine, phenoxatellurine, phenoxathiine, phenoxazine, phenylenemethyl-ethylene,
 phosphanthrene, phosphanthridine, phosphinane, phosphindole, phosphindolizine, phosphinine,
 phosphinoline, phosphinolizine, phospholane, phosphole, phthalazine, picene, piperazine,
 piperidine, pleiadene, pleiadene, polyacene, polyalene, polyaphene, polycyclic carbonhydrides,
 polyhelicene, polynaphthylene, polyphenylene, polystyrene-polyethylene oxide copolymer,
 polyvinylpyrrolidone, pteridine, purine, pyran, pyranthrene, pyrazine, pyrazole, pyrazolidine,
 pyrazoline, pyrenecarboxylicacid, pyrenyl, pyridazine, pyridine, pyrimidine, pyrrole, pyrrolidine,
 pyrrolizine, quinoxaline, quinoline, quinolizine, quinoxaline, retene, riboflavin, rubicene, s-indacene,

salinane, saline, sdbcs, selenanthrene, selenochromene, selenoxanthene, silanthrene, silolane, silole, sodium dodecyl benzene sulphonate (SDBS), sodium dodecyl sulfate (SDS), stanninane, stannine, stannolane, stannole, stibolane, stibole, telluranthrene, tellurochromene, telluroxanthene, tert-butyl benzene, tetracene, tetranaphthylene, tetraphene, tetraphenylene, tetraphenylene, tetrazine, tetrazole, thiadiazole, thiane, thianthrene, thiazepine, thiazine, thiazole, thiazolidine, thiazoline, thiepane, thiepine, thietane, thiete, thiirane, thiirene, thiocane, thiochromene, thiolane, thiomorpholine, thiophene, thiopyran, thioxanthene, thithiolane, trans-1,2-diaminocyclohexane-N, N, N9, N9-tetraacetic acid (CDTA), trans-2-methylstyrene, trans-cyclooctene, triazine, triazole, tribenzo[c,f,pqr]tetraphene, tricyclo[3.3.1.1{3,7}]decane, trinaphthylene, trinaphthylene, trioxane, triphenylemethane, triphenylene, tween-60, tween-80, xanthene, ziridine, α -n-hexadecene, β -carotene.

Item B13. The composite material of any of items B1-B12 that has a volume of 1 mm^3 and comprises at least 10^6 mechanical ligands, such as at least 10^7 mechanical ligands, such as at least 10^8 mechanical ligands, such as at least 10^9 mechanical ligands, such as at least 10^{10} mechanical ligands, such as at least 10^{11} mechanical ligands, such as at least 10^{12} mechanical ligands, such as at least 10^{13} mechanical ligands, such as at least 10^{14} mechanical ligands, such as at least 10^{15} mechanical ligands, such as at least 10^{16} mechanical ligands, such as at least 10^{17} mechanical ligands, such as at least 10^{18} mechanical ligands, such as at least 10^{19} mechanical ligands, such as at least 10^{20} mechanical ligands, such as at least 10^{21} mechanical ligands, such as at least 10^{22} mechanical ligands

Item B14. The composite material of any of items B1-B13 that has a volume of 1 mm^3 , and that comprises at least one nanotube, such as at least 10 nanotubes, such as at least 10^2 nanotubes, such as at least 10^3 nanotubes, such as at least 10^4 nanotubes, such as at least 10^5 nanotubes, such as at least 10^6 nanotubes, such as at least 10^7 nanotubes, such as at least 10^8 nanotubes, such as at least 10^9 nanotubes, such as at least 10^{10} nanotubes, such as at least 10^{11} nanotubes, such as at least 10^{12} nanotubes, such as at least 10^{13} nanotubes, such as at least 10^{14} nanotubes

Item B15. The composite material of any one of items B1-B14 where two mechanical ligands are covalently linked together, and where the two mechanical ligands are each bound by a mechanical bond to separate nanotubes.

The following items below relate to nanotubes.

Item A21. The composite material of any one of items A1-A20 or B1-B15 where the nanotube is a carbon nanotube.

Item A22. The composite material of any one of items A1-A20 or B1-B15 where the nanotube is a single wall carbon nanotube.

Item A23. The composite material of any one of items A1-A20 or B1-B15 where the nanotube is a multi wall carbon nanotube.

Item A24. The composite material of any one of items A1-A20 or B1-B15 where the nanotube is a metallic carbon nanotube.

Item A25. The composite material of any one of items A1-A20 or B1-B15 where the nanotube is a semiconductive carbon nanotube.

Item A26. The composite material of any one of items A1-A20 or B1-B15 where the nanotube is a aluminium nanotube.

Item A27. The composite material of any one of items A1-A20 or B1-B15 where the nanotube is a aluminum nitride nanotube (AlNNT).

Item A28. The composite material of any one of items A1-A20 or B1-B15 where the nanotube is a aluminum phosphide nanotube (AlPNT).

Item A29. The composite material of any one of items A1-A20 or B1-B15 where the nanotube is a bismuth nanotube.

Item A30. The composite material of any one of items A1-A20 or B1-B15 where the nanotube is a bismuth selenide nanotube.

Item A31. The composite material of any one of items A1-A20 or B1-B15 where the nanotube is a boron carbon nanotubes (BCNNT).

Item A32. The composite material of any one of items A1-A20 or B1-B15 where the nanotube is a boron nitride nanotube.

Item A33. The composite material of any one of items A1-A20 or B1-B15 where the nanotube is a cadmium selenide nanotube.

Item A34. The composite material of any one of items A1-A20 or B1-B15 where the nanotube is a cobalt selenide nanotube.

Item A35. The composite material of any one of items A1-A20 or B1-B15 where the nanotube is a copper nanotube.

Item A36. The composite material of any one of items A1-A20 or B1-B15 where the nanotube is a DNA nanotube.

Item A37. The composite material of any one of items A1-A20 or B1-B15 where the nanotube is a gallium nitride nanotube (GaNNT).

Item A38. The composite material of any one of items A1-A20 or B1-B15 where the nanotube is a gallium phosphide nanotube (GaPNT).

Item A39. The composite material of any one of items A1-A20 or B1-B15 where the nanotube is a gold nanotube.

Item A40. The composite material of any one of items A1-A20 or B1-B15 where the nanotube is a halide nanotube.

Item A41. The composite material of any one of items A1-A20 or B1-B15 where the nanotube is a iobium selenide nanotube.

Item A42. The composite material of any one of items A1-A20 or B1-B15 where the nanotube is a molybdenum disulfide nanotube.

Item A43. The composite material of any one of items A1-A20 or B1-B15 where the nanotube is a nanotube of transition metal oxides.

Item A44. The composite material of any one of items A1-A20 or B1-B15 where the nanotube is a nickel chloride nanotube.

Item A45. The composite material of any one of items A1-A20 or B1-B15 where the nanotube is a platinum nanotube.

Item A46. The composite material of any one of items A1-A20 or B1-B15 where the nanotube is a protein nanotube.

Item A47. The composite material of any one of items A1-A20 or B1-B15 where the nanotube is a RNA nanotube.

Item A48. The composite material of any one of items A1-A20 or B1-B15 where the nanotube is a selenide nanotube.

Item A49. The composite material of any one of items A1-A20 or B1-B15 where the nanotube is a silicon nanotube.

Item A50. The composite material of any one of items A1-A20 or B1-B15 where the nanotube is a silver nanotube.

Item A51. The composite material of any one of items A1-A20 or B1-B15 where the nanotube is a sulphide nanotube.

Item A52. The composite material of any one of items A1-A20 or B1-B15 where the nanotube is a tin disulfide nanotube.

Item A53. The composite material of any one of items A1-A20 or B1-B15 where the nanotube is a titanium dioxide nanotube.

Item A54. The composite material of any one of items A1-A20 or B1-B15 where the nanotube is a titanium oxide nanotube.

Item A55. The composite material of any one of items A1-A20 or B1-B15 where the nanotube is a tungsten disulfide nanotube.

Item A56. The composite material of any one of items A1-A20 or B1-B15 where the nanotube is a tungsten sulfide nanotube.

Item A57. The composite material of any one of items A1-A20 or B1-B15 where the nanotube is a wolfram disulphide nanotube.

Item A58. The composite material of any one of items A1-A20 or B1-B15 where the nanotube is a zinc ferrite nanotube.

Item A59. The composite material of any one of items A1-A20 or B1-B15 where the nanotube is a zinc oxide nanotube.

Item A60. The composite material of any one of items A1-A20 or B1-B15 where the nanotube is a zirconia dioxide nanotube.

Item A61. The composite material of any one of items A1-A20 or B1-B15 where the nanotube is a nanofiber.

Item A62. The composite material of any one of items A1-A20 or B1-B15 where the nanotube is a nanothread.

Item A63. The composite material of any one of items A1-A20 or B1-B15 where the nanotube is a nanorod.

Item A64. The composite material of any one of items A1-A20 or B1-B15 where the nanotube is a nanoball.

Item A65. The composite material of any one of items A1-A20 or B1-B15 where the nanotube is a nanobud.

Item A66. The composite material of any one of items A1-A20 or B1-B15 where the nanotube is a buckyball.

Item A67. The composite material of any one of items A1-A20 or B1-B15 where the nanotube is a multi wall nanotube.

Item A68. The composite material of any one of items A1-A20 or B1-B15 where the nanotube is a single wall nanotube.

Item A69. The composite material of any one of items A1-A20 or B1-B15 where the nanotube has the chirality $(n,0)$ where $n = 0$ to 20.

Item A70. The composite material of any one of items A1-A20 or B1-B15 where the nanotube has the chirality $(n,1)$ where $n = 0$ to 20.

Item A71. The composite material of any one of items A1-A20 or B1-B15 where the nanotube has the chirality $(n,2)$ where $n = 0$ to 20.

Item A72. The composite material of any one of items A1-A20 or B1-B15 where the nanotube has the chirality $(n,3)$ where $n = 0$ to 20.

Item A73. The composite material of any one of items A1-A20 or B1-B15 where the nanotube has the chirality $(n,4)$ where $n = 0$ to 20.

Item A74. The composite material of any one of items A1-A20 or B1-B15 where the nanotube has the chirality $(n,5)$ where $n = 0$ to 20.

Item A75. The composite material of any one of items A1-A20 or B1-B15 where the nanotube has the chirality $(n,6)$ where $n = 0$ to 20.

Item A76. The composite material of any one of items A1-A20 or B1-B15 where the nanotube has the chirality $(n,7)$ where $n = 0$ to 20.

Item A77. The composite material of any one of items A1-A20 or B1-B15 where the nanotube has the chirality $(n,8)$ where $n = 0$ to 20.

Item A78. The composite material of any one of items A1-A20 or B1-B15 where the nanotube has the chirality $(n,9)$ where $n = 0$ to 20.

Item A79. The composite material of any one of items A1-A20 or B1-B15 where the nanotube has the chirality $(n,10)$ where $n = 0$ to 20.

Item A80. The composite material of any one of items A1-A20 or B1-B15 where the nanotube has the chirality $(n,11)$ where $n = 0$ to 20.

Item A81. The composite material of any one of items A1-A20 or B1-B15 where the nanotube has the chirality $(n,12)$ where $n = 0$ to 20.

Item A82. The composite material of any one of items A1-A20 or B1-B15 where the nanotube has the chirality $(n,13)$ where $n = 0$ to 20.

Item A83. The composite material of any one of items A1-A20 or B1-B15 where the nanotube has the chirality $(n,14)$ where $n = 0$ to 20.

Item A84. The composite material of any one of items A1-A20 or B1-B15 where the nanotube has the chirality $(n,15)$ where $n = 0$ to 20.

Item A85. The composite material of any one of items A1-A20 or B1-B15 where the nanotube has the chirality $(n,16)$ where $n = 0$ to 20.

Item A86. The composite material of any one of items A1-A20 or B1-B15 where the nanotube has the chirality $(n,17)$ where $n = 0$ to 20.

Item A87. The composite material of any one of items A1-A20 or B1-B15 where the nanotube has the chirality $(n,18)$ where $n = 0$ to 20.

Item A88. The composite material of any one of items A1-A20 or B1-B15 where the nanotube has the chirality $(n,19)$ where $n = 0$ to 20.

Item A89. The composite material of any one of items A1-A20 or B1-B15 where the nanotube has the chirality $(n,20)$ where $n = 0$ to 20.

Item A90. The composite material of any one of items A1-A20 or B1-B15 where the nanotube has the chirality $(0,n)$ where $n = 0$ to 20.

Item A91. The composite material of any one of items A1-A20 or B1-B15 where the nanotube has the chirality $(1,n)$ where $n = 0$ to 20.

Item A92. The composite material of any one of items A1-A20 or B1-B15 where the nanotube has the chirality $(2,n)$ where $n = 0$ to 20.

Item A93. The composite material of any one of items A1-A20 or B1-B15 where the nanotube has the chirality $(3,n)$ where $n = 0$ to 20.

Item A94. The composite material of any one of items A1-A20 or B1-B15 where the nanotube has the chirality $(4,n)$ where $n = 0$ to 20.

Item A95. The composite material of any one of items A1-A20 or B1-B15 where the nanotube has the chirality $(5,n)$ where $n = 0$ to 20.

Item A96. The composite material of any one of items A1-A20 or B1-B15 where the nanotube has the chirality $(6,n)$ where $n = 0$ to 20.

Item A97. The composite material of any one of items A1-A20 or B1-B15 where the nanotube has the chirality $(7,n)$ where $n = 0$ to 20.

Item A98. The composite material of any one of items A1-A20 or B1-B15 where the nanotube has the chirality $(8,n)$ where $n = 0$ to 20.

Item A99. The composite material of any one of items A1-A20 or B1-B15 where the nanotube has the chirality (9,n) where $n = 0$ to 20.

Item A100. The composite material of any one of items A1-A20 or B1-B15 where the nanotube has the chirality (10,n) where $n = 0$ to 20.

Item A101. The composite material of any one of items A1-A20 or B1-B15 where the nanotube has the chirality (11,n) where $n = 0$ to 20.

Item A102. The composite material of any one of items A1-A20 or B1-B15 where the nanotube has the chirality (12,n) where $n = 0$ to 20.

Item A103. The composite material of any one of items A1-A20 or B1-B15 where the nanotube has the chirality (13,n) where $n = 0$ to 20.

Item A104. The composite material of any one of items A1-A20 or B1-B15 where the nanotube has the chirality (14,n) where $n = 0$ to 20.

Item A105. The composite material of any one of items A1-A20 or B1-B15 where the nanotube has the chirality (15,n) where $n = 0$ to 20.

Item A106. The composite material of any one of items A1-A20 or B1-B15 where the nanotube has the chirality (16,n) where $n = 0$ to 20.

Item A107. The composite material of any one of items A1-A20 or B1-B15 where the nanotube has the chirality (17,n) where $n = 0$ to 20.

Item A108. The composite material of any one of items A1-A20 or B1-B15 where the nanotube has the chirality (18,n) where $n = 0$ to 20.

Item A109. The composite material of any one of items A1-A20 or B1-B15 where the nanotube has the chirality (19,n) where $n = 0$ to 20.

Item A110. The composite material of any one of items A1-A20 or B1-B15 where the nanotube has the chirality (20,n) where $n = 0$ to 20.

Item A111. The composite material of any one of items A1-A20 or B1-B15 where the nanotube has a percentage of sp² bonds of more than 90%, such as more than 95%, such as more than 96%, such as more than 97%, such as more than 98%, such as more than 99%, such as more than 99%.

Item A112. The composite material of any one of items A1-A20 or B1-B15 where the nanotube has a percentage of sp² bonds of less than 100%, such as less than 99%, such as less than 98%, such as less than 97%, such as less than 96%, such as less than 95%.

Item A113. The composite material of any one of items A1-A20 or B1-B15 where the nanotube has a percentage of sp² bonds of from 95%-96%, from 96% to 97%, from 97% to 98%, from 98% to 99%, from 99% to 100%.

Item A114. The composite material of any one of items A1-A20 or B1-B15 where the nanotube has a percentage of carbon atoms of more than 90%, such as more than 95%, such as more than 96%, such as more than 97%, such as more than 98%, such as more than 99%, such as more than 99%.

Item A115. The composite material of any one of items A1-A20 or B1-B15 where the nanotube has a percentage of carbon atoms of less than 100%, such as less than 99%, such as less than 98%, such as less than 97%, such as less than 96%, such as less than 95%.

Item A116. The composite material of any one of items A1-A20 or B1-B15 where the nanotube has a percentage of carbon atoms of from 95%-96%, from 96% to 97%, from 97% to 98%, from 98% to 99%, from 99% to 100%.

Item A117. The composite material of any one of items A1-A20 or B1-B15 where the nanotube has a percentage of functionalization of less than 10%, such as less than 5%, such as less than 4%, such as less than 3%, such as less than 2%, such as less than 1%

Item A118. The composite material of any one of items A1-A20 or B1-B15 where the nanotube has a percentage of functionalization of more than 0%, such as more than 1%, such as more than 2%, such as more than 3%, such as more than 4%, such as more than 5%, such as more than 10%.

Item A119. The composite material of any one of items A1-A20 or B1-B15 where the nanotube has a percentage of functionalization of from 0% to 1%, from 1% to 2%, from 2% to 3%, from 3% to 4%, from 4% to 5%, from 5% to 10%.

Item A120. The composite material of any one of items A1-A20 or B1-B15 where the nanotube has an aspect ratio of more than 1, such as more than 10, such as more than 10², more 10³, such as more than 10⁴, such as more than 10⁵, such as more than 10⁶, such as more than 10⁷, such as more than 10⁹, such as more than 10¹⁰.

Item A121. The composite material of any one of items A1-A20 or B1-B15 where the nanotube has an aspect ratio of less than 10^{10} such as less than 10^9 , such as less than 10^8 , such as less than 10^7 , such as less than 10^6 , such as less than 10^5 , such as less than 10^4 , such as less than 10^3 , such as less than 10^2 , such as less than 10.

Item A122. The composite material of any one of items A1-A20 or B1-B15 where the nanotube has an aspect ratio of from 10 to 10^2 , from 10^2 to 10^3 , from 10^3 to 10^4 , from 10^4 to 10^5 , from 10^5 to 10^6 , from 10^6 to 10^7 , from 10^7 to 10^8 , from 10^8 to 10^9 , from 10^9 to 10^{10} .

Item A123. The composite material of any one of items A1-A20 or B1-B15 where the nanotube has a diameter in Ångstrom of more than 3, such as more than 4, such as more than 5, such as more than 6, such as more than 7, such as more than 8, such as more than 9, such as more than 10, such as more than 11, such as more than 12, such as more than 13, such as more than 14, such as more than 15, such as more than 16, such as more than 17, such as more than 18, such as more than 19, such as more than 20, such as more than 25, such as more than 30, such as more than 35, such as more than 40, such as more than 45, such as more than 50, such as more than 60, such as more than 70, such as more than 80, such as more than 90, such as more than 100, such as more than 200, such as more than 300, such as more than 400 Ångstrom,.

Item A124. The composite material of any one of items A1-A20 or B1-B15 where the nanotube has a diameter in Ångstrom of less than 400, such as less than 300, such as less than 200, such as less than 100, such as less than 90, such as less than 80, such as less than 70, such as less than 60, such as less than 50, such as less than 45, such as less than 40, such as less than 35, such as less than 30, such as less than 25, such as less than 20, such as less than 19, such as less than 18, such as less than 17, such as less than 16, such as less than 15, such as less than 14, such as less than 13, such as less than 12, such as less than 11, such as less than 10, such as less than 9, such as less than 8, such as less than 7, such as less than 6, such as less than 5, such as less than 4.

Item A125. The composite material of any one of items A1-A20 or B1-B15 where the nanotube has a diameter in Ångstrom of from 3 to 4, 4 to 5, 5 to 6, 6 to 7, 7 to 8, 8 to 9, 9 to 10, 10 to 11, 11 to 12, 12 to 13, 13 to 14, 14 to 15, 15 to 16, 16 to 17, 17 to 18, 18 to 19, 19 to 20, 20 to 25, 25 to 30, 30 to 35, 35 to 40, 40 to 45, 45 to 50, 50 to 60, 60 to 70, 70 to 80, 80 to 90, 90 to 100, 100 to 200, 200 to 300, 300 to 400.

The following items relate to second structural entities.

Item A126. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is (Ag) silver.

Item A127. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is (Al) aluminium.

Item A128. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is (Au) gold.

Item A129. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is (Cr) chromium.

Item A130. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is (Cu) copper.

Item A131. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is (Fe) steel and stainless steel.

Item A132. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is (Mn) manganese.

Item A133. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is (Mo) molybdenum.

Item A134. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is (Ni) nickel.

Item A135. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is (Pd) palladium.

Item A136. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is (Pt) platinum.

Item A137. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is (Ta) tantalum.

Item A138. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is (Ti) titanium.

Item A139. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is (Wo) Tungsten.

Item A140. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is a battery.

Item A141. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is a borosilicate.

Item A142. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is a buckyball.

Item A143. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is a buckytube.

Item A144. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is a capacitor.

Item A145. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is a carbon dome.

Item A146. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is a carbon fibre.

Item A147. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is a carbon megatube.

Item A148. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is a carbon nanofibre.

Item A149. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is a carbon nanofoam.

Item A150. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is a carbon nanothread.

Item A151. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is a carbon polymer.

Item A152. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is a catalyst.

Item A153. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is a cathode.

Item A154. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is a ceramic material.

Item A155. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is a composite material.

Item A156. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is a conductor.

Item A157. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is a covalent crystal.

Item A158. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is a crystal.

Item A159. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is a crystalline material.

Item A160. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is a defect-free graphene sheet.

Item A161. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is a dielectric material.

Item A162. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is a diode.

Item A163. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is a dodecahedrane.

Item A164. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is a doped glass.

Item A165. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is a fibre.

Item A166. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is a fullerite.

Item A167. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is a fused silica.

Item A168. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is a glass fibre.

Item A169. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is a glue.

Item A170. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is a green ceramic.

Item A171. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is a lanthanides.

Item A172. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is a machinable ceramic.

Item A173. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is a metal alloy.

Item A174. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is a metalised dielectric.

Item A175. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is a metallised ceramic.

Item A176. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is a metalloid.

Item A177. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is a mineral.

Item A178. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is a non-covalent crystal.

Item A179. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is a nucleic acid.

Item A180. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is a peptide.

Item A181. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is a piezoelectric material.

Item A182. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is a platinum group metal.

Item A183. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is a polypeptide.

Item A184. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is a post-transition metal.

Item A185. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is a protein.

Item A186. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is a rare earth element.

Item A187. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is a sapphire.

Item A188. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is a semiconductor.

Item A189. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is a sensor.

Item A190. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is a silicon nitride.

Item A191. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is a single crystal fiber.

Item A192. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is a sol-gel.

Item A193. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is a synthetic diamond.

Item A194. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is a transition metal.

Item A195. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is a tungsten carbide.

Item A196. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is actinides.

Item A197. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is activated carbon.

Item A198. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is aggregated diamonds.

Item A199. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is air entrainers.

Item A200. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is alkali-silica reactivity inhibitors.

Item A201. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is alloys.

Item A202. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is alumina.

Item A203. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is alumina (Al_2O_3).

Item A204. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is alumina trihydrate.

Item A205. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is alumina, zirconia, machinable ceramic, green ceramic, pzt, silicon nitride, tungsten carbide .

Item A206. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is aluminium.

Item A207. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is aluminum boride.

Item A208. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is aluminum fibers.

Item A209. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is aluminum oxide.

Item A210. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is aluminum trihydroxide.

Item A211. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is amalgams.

Item A212. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is amorphous carbon.

Item A213. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is actinides.

Item A214. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is an amalgam.

Item A215. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is an anode.

Item A216. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is an antibody.

Item A217. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is electrode.

Item A218. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is an endohedral fullerene.

Item A219. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is an insulator.

Item A220. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is an intermetallic.

Item A221. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is an ionic crystal.

Item A222. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is an organic material.

Item A223. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is anode.

Item A224. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is anthracite.

Item A225. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is aramid.

Item A226. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is asbestos .

Item A227. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is barium .

Item A228. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is bn (boron nitride aka "white graphene").

Item A229. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is bone.

Item A230. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is boron.

Item A231. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is boron nitride.

Item A232. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is boron nitride nanoscroll,.

Item A233. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is boron nitride oxide.

Item A234. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is brass.

Item A235. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is brass fibers.

Item A236. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is buckminsterfullerene.

Item A237. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is bucky paper.

Item A238. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is buckyball.

Item A239. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is buckyball clusters.

Item A240. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is buckypaper.

Item A241. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is buckytube.

Item A242. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is calcium carbonite.

Item A243. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is calcium metasilicate.

Item A244. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is calcium sulfate.

Item A245. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is calcium sulphate.

Item A246. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is carbon black.

Item A247. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is carbon fiber.

Item A248. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is carbon fibers.

Item A249. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is carbon megatubes.

Item A250. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is carbon nano-onions.

Item A251. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is carbon nanobuds.

Item A252. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is carbon nanofiber.

Item A253. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is carbon nanofibres.

Item A254. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is carbon nanofoam.

Item A255. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is carbon nanothread.

Item A256. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is carbon polymers.

Item A257. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is carbon/diamond nanothread.

Item A258. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is cathode.

Item A259. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is cellulose fibers.

Item A260. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is cellulose nanofibers (e.g. curran).

Item A261. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is cellulose nanowhiskers.

Item A262. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is ceramic.

Item A263. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is chemical admixtures .

Item A264. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is chlorographene.

Item A265. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is chromium.

Item A266. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is clay.

Item A267. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is coal.

Item A268. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is coated boron nitride.

Item A269. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is coated graphene.

Item A270. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is coloring admixtures.

Item A271. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is composite materials.

Item A272. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is concrete.

Item A273. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is concrete admixtures .

Item A274. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is COOH-functionalized graphene.

Item A275. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is copper.

Item A276. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is corrosion inhibitors.

Item A277. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is covalent crystals.

Item A278. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is crystal.

Item A279. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is crystalline materials.

Item A280. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is diamond.

Item A281. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is diamond-like carbon.

Item A282. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is dispersants. .

Item A283. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is dodecahedrane.

Item A284. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is double-layer boron nitride.

Item A285. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is double-layer graphene.

Item A286. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is e-glass.

Item A287. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is elastomers.

Item A288. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is endohedral fullerenes.

Item A289. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is exfoliated graphite.

Item A290. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is exfoliated silicate.

Item A291. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is extruded activated carbon.

Item A292. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is fibres.

Item A293. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is flourinated boron nitride.

Item A294. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is flourinated graphene.

Item A295. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is fluorographene.

Item A296. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is fly ash .

Item A297. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is fullerene rings.

Item A298. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is fullerenes.

Item A299. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is fullerite.

Item A300. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is functionalized boron nitride.

Item A301. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is functionalized graphene.

Item A302. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is fused silica.

Item A303. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is fused silica .

Item A304. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is gallium arsenide.

Item A305. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is gallium nitride.

Item A306. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is gedodesic carbon domes.

Item A307. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is germanium.

Item A308. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is glass.

Item A309. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is glass fibre.

Item A310. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is glass microsphere.

Item A311. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is glass ribbons.

Item A312. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is glass spheres.

Item A313. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is glasses.

Item A314. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is glassy carbon.

Item A315. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is glue.

Item A316. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is gold.

Item A317. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is gold particles.

Item A318. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is granular activated carbon.

Item A319. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is graphane.

Item A320. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is graphdiyne.

Item A321. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is graphene.

Item A322. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is graphene oxide.

Item A323. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is graphene,.

Item A324. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is graphite.

Item A325. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is graphone.

Item A326. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is graphyne.

Item A327. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is hardened steel.

Item A328. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is high range water reducers.

Item A329. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is hydrous magnesium silicate.

Item A330. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is hyperdiamond.

Item A331. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is hyperdiamonds.

Item A332. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is imperfect boron nitride.

Item A333. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is imperfect graphene.

Item A334. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is intermetallics.

Item A335. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is ionic crystals.

Item A336. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is iron.

Item A337. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is iron oxides.

Item A338. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is kevlar.

Item A339. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is lanthanides .

Item A340. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is lead zirconium titanate.

Item A341. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is lignin.

Item A342. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is ligning.

Item A343. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is lignite.

Item A344. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is lithium niobate.

Item A345. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is lithium niobates.

Item A346. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is lonsdaleite.

Item A347. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is magnesium dihydroxide.

Item A348. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is magnesium oxide.

Item A349. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is manganese.

Item A350. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is melamine sulfonate superplasticisers.

Item A351. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is metal.

Item A352. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is metal ions.

Item A353. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is metal oxide.

Item A354. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is metallised ceramic.

Item A355. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is metalloids.

Item A356. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is metals.

Item A357. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is mica.

Item A358. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is mineral.

Item A359. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is mineral admixtures.

Item A360. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is molybdenum.

Item A361. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is montmorillonite nanoclays.

Item A362. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is multi-layer boron nitride.

Item A363. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is multi-layer graphene.

Item A364. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is nanochain.

Item A365. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is nanocrystal.

Item A366. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is nanowire.

Item A367. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is naphthalene.

Item A368. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is Natural pozzolans (such as the volcanic ash used in Roman concrete).

Item A369. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is NH₂-functionalized graphene.

Item A370. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is nickel.

Item A371. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is non-covalent crystal.

Item A372. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is non-covalent crystals.

Item A373. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is nylon.

Item A374. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is OH-functionalized graphene.

Item A375. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is palladium.

Item A376. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is pencil lead.

Item A377. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is perfect boron nitride.

Item A378. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is perfect graphene.

Item A379. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is plasticizers .

Item A380. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is platinum.

Item A381. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is platinum group metals.

Item A382. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is post-transition metals.

Item A383. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is powdered activated carbon.

Item A384. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is pozzolans and other cementitious materials .

Item A385. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is prismane.

Item A386. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is pristine boron nitride.

Item A387. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is pristine graphene.

Item A388. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is pyrolytic graphite.

Item A389. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is quantum dots.

Item A390. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is rare earth elements.

Item A391. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is reduced boron nitride oxide.

Item A392. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is reduced graphene oxide.

Item A393. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is reduced graphyne.

Item A394. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is rubber.

Item A395. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is s-glass.

Item A396. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is sapphire.

Item A397. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is set accelerators.

Item A398. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is set retarders.

Item A399. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is shrinkage control admixtures.

Item A400. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is silica.

Item A401. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is silica fume.

Item A402. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is silica gel.

Item A403. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is silicon.

Item A404. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is silicon carbide.

Item A405. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is silicon carbides.

Item A406. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is silicon dioxide.

Item A407. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is silicon nitride.

Item A408. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is silicon nitrides (bulk and thin film).

Item A409. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is silver.

Item A410. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is single-layer boron nitride.

Item A411. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is single-layer graphene.

Item A412. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is sol-gel.

Item A413. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is soot.

Item A414. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is stainless steel.

Item A415. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is steel.

Item A416. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is steel fibers.

Item A417. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is superplasticizer .

Item A418. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is superplasticizers.

Item A419. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is talc.

Item A420. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is tantalum.

Item A421. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is thiol-functionalized graphene.

Item A422. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is titanium.

Item A423. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is titanium oxide.

Item A424. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is tooth cementum.

Item A425. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is tooth dentine.

Item A426. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is tooth enamel.

Item A427. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is transition metals.

Item A428. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is triple-layer boron nitride.

Item A429. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is triple-layer graphene.

Item A430. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is tungsten.

Item A431. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is tungsten carbide.

Item A432. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is ultrahard fullerite.

Item A433. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is water reducers.

Item A434. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is wood.

Item A435. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is zinc oxide.

Item A436. The composite material of any one of items A3-A125 or B2-B15 where the second structural entity is zirconia.

The following items relate to polymers.

Item A437. The composite material of any one of items A4-A436 or B3-B15 where the polymer is epoxy.

Item A438. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polybenzimidazole.

Item A439. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polyethylene.

Item A440. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polycarbonate.

Item A441. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polyethylene terephthalate.

Item A442. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polypropylene.

Item A443. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polyester.

Item A444. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polystyrene.

Item A445. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polyolefin.

Item A446. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polyvinylchloride.

Item A447. The composite material of any one of items A4-A436 or B3-B15 where the polymer is vinyl ester.

Item A448. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polyamide.

Item A449. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polyetherketoneketone.

Item A450. The composite material of any one of items A4-A436 or B3-B15 where the polymer is poly(methyl methacrylate).

Item A451. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polyamide imide .

Item A452. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polyaryletheretherketone.

Item A453. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polyether imide.

Item A454. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polyimide.

Item A455. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polyoxymethylene.

Item A456. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polyphenylene sulfide.

Item A457. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polytetrafluoroethylene.

Item A458. The composite material of any one of items A4-A436 or B3-B15 where the polymer is thermoplastic elastomer .

Item A459. The composite material of any one of items A4-A436 or B3-B15 where the polymer is ultra-high-molecular-weight polyethylene.

Item A460. The composite material of any one of items A4-A436 or B3-B15 where the polymer is acrylonitrile butadiene styrene.

Item A461. The composite material of any one of items A4-A436 or B3-B15 where the polymer is A6 nylon.

Item A462. The composite material of any one of items A4-A436 or B3-B15 where the polymer is acrylics (PMMA/perspex, plexiglas).

Item A463. The composite material of any one of items A4-A436 or B3-B15 where the polymer is acrylonitrile styrene acrylate.

Item A464. The composite material of any one of items A4-A436 or B3-B15 where the polymer is acrylonitrile-butadiene-styrene (ABS) terpolymer.

Item A465. The composite material of any one of items A4-A436 or B3-B15 where the polymer is alkyd resins.

Item A466. The composite material of any one of items A4-A436 or B3-B15 where the polymer is amino resin.

Item A467. The composite material of any one of items A4-A436 or B3-B15 where the polymer is an elastomer.

Item A468. The composite material of any one of items A4-A436 or B3-B15 where the polymer is an epoxy-based polymer.

Item A469. The composite material of any one of items A4-A436 or B3-B15 where the polymer is an inorganic polymer.

Item A470. The composite material of any one of items A4-A436 or B3-B15 where the polymer is an ultra-high-molecular-weight polyethylene.

Item A471. The composite material of any one of items A4-A436 or B3-B15 where the polymer is aramid.

Item A472. The composite material of any one of items A4-A436 or B3-B15 where the polymer is barrier resins (PVA/polyvinyl alcohol).

Item A473. The composite material of any one of items A4-A436 or B3-B15 where the polymer is bakelite.

Item A474. The composite material of any one of items A4-A436 or B3-B15 where the polymer is biaxially oriented polypropylene .

Item A475. The composite material of any one of items A4-A436 or B3-B15 where the polymer is biologic polymer.

Item A476. The composite material of any one of items A4-A436 or B3-B15 where the polymer is biopolymer.

Item A477. The composite material of any one of items A4-A436 or B3-B15 where the polymer is biopolymers (wood, cellulose, starch based).

Item A478. The composite material of any one of items A4-A436 or B3-B15 where the polymer is bis-maleimide.

Item A479. The composite material of any one of items A4-A436 or B3-B15 where the polymer is block copolymer.

Item A480. The composite material of any one of items A4-A436 or B3-B15 where the polymer is bulk moulding compound .

Item A481. The composite material of any one of items A4-A436 or B3-B15 where the polymer is butadiene rubber .

Item A482. The composite material of any one of items A4-A436 or B3-B15 where the polymer is butadiene-styrene block copolymer .

Item A483. The composite material of any one of items A4-A436 or B3-B15 where the polymer is carboxymethyl cellulose .

Item A484. The composite material of any one of items A4-A436 or B3-B15 where the polymer is cellulose .

Item A485. The composite material of any one of items A4-A436 or B3-B15 where the polymer is cellulose acetate .

Item A486. The composite material of any one of items A4-A436 or B3-B15 where the polymer is cellulose acetate-butyrate .

Item A487. The composite material of any one of items A4-A436 or B3-B15 where the polymer is cellulose nitrate .

Item A488. The composite material of any one of items A4-A436 or B3-B15 where the polymer is cellulose propionate .

Item A489. The composite material of any one of items A4-A436 or B3-B15 where the polymer is cellulose acetate propionate .

Item A490. The composite material of any one of items A4-A436 or B3-B15 where the polymer is chlorinated polyvinyl chloride .

Item A491. The composite material of any one of items A4-A436 or B3-B15 where the polymer is chopped strand mat (or) chlorosulphonated polyethylene (rubber) .

Item A492. The composite material of any one of items A4-A436 or B3-B15 where the polymer is conductive polymer.

Item A493. The composite material of any one of items A4-A436 or B3-B15 where the polymer is copolymer.

Item A494. The composite material of any one of items A4-A436 or B3-B15 where the polymer is cross-linked polyethylene.

Item A495. The composite material of any one of items A4-A436 or B3-B15 where the polymer is diglycidyl Ether of Bisphenol-A (DGEBA).

Item A496. The composite material of any one of items A4-A436 or B3-B15 where the polymer is DNA.

Item A497. The composite material of any one of items A4-A436 or B3-B15 where the polymer is dough moulding compound .

Item A498. The composite material of any one of items A4-A436 or B3-B15 where the polymer is elastomes (PDMS).

Item A499. The composite material of any one of items A4-A436 or B3-B15 where the polymer is epoxy-based polymer.

Item A500. The composite material of any one of items A4-A436 or B3-B15 where the polymer is ethylene chlorotrifluoro ethylene copolymer (ECTFE).

Item A501. The composite material of any one of items A4-A436 or B3-B15 where the polymer is ethylene propylene diene monomer (M-class) rubber.

Item A502. The composite material of any one of items A4-A436 or B3-B15 where the polymer is ethylene propylene rubber.

Item A503. The composite material of any one of items A4-A436 or B3-B15 where the polymer is ethylene tetrafluoro-ethylene copolymer (Tefzel).

Item A504. The composite material of any one of items A4-A436 or B3-B15 where the polymer is ethylene vinyl acetate .

Item A505. The composite material of any one of items A4-A436 or B3-B15 where the polymer is ethylene vinyl acetate (EVA).

Item A506. The composite material of any one of items A4-A436 or B3-B15 where the polymer is ethylene vinyle achol .

Item A507. The composite material of any one of items A4-A436 or B3-B15 where the polymer is ethylene-propylene rubber.

Item A508. The composite material of any one of items A4-A436 or B3-B15 where the polymer is ethylene-propylene-diene monomer (elastomer) .

Item A509. The composite material of any one of items A4-A436 or B3-B15 where the polymer is expanded polystyrene.

Item A510. The composite material of any one of items A4-A436 or B3-B15 where the polymer is expansible polystyrene in primary forms.

Item A511. The composite material of any one of items A4-A436 or B3-B15 where the polymer is flouroplastic.

Item A512. The composite material of any one of items A4-A436 or B3-B15 where the polymer is fluorinated ethylene-propylene .

Item A513. The composite material of any one of items A4-A436 or B3-B15 where the polymer is fluoroplastics (PTFE/teflon, FEP, PFA, PVDF).

Item A514. The composite material of any one of items A4-A436 or B3-B15 where the polymer is general purpose polystyrene .

Item A515. The composite material of any one of items A4-A436 or B3-B15 where the polymer is glass mat thermoplastic .

Item A516. The composite material of any one of items A4-A436 or B3-B15 where the polymer is high density polyethylene.

Item A517. The composite material of any one of items A4-A436 or B3-B15 where the polymer is high density polypropylene.

Item A518. The composite material of any one of items A4-A436 or B3-B15 where the polymer is high impact polystyrene.

Item A519. The composite material of any one of items A4-A436 or B3-B15 where the polymer is hydroxyethyl methacrylate polymer .

Item A520. The composite material of any one of items A4-A436 or B3-B15 where the polymer is inorganic polymer.

Item A521. The composite material of any one of items A4-A436 or B3-B15 where the polymer is ketones (PEEK).

Item A522. The composite material of any one of items A4-A436 or B3-B15 where the polymer is latex.

Item A523. The composite material of any one of items A4-A436 or B3-B15 where the polymer is light emitting polymers (white LEP, etc).

Item A524. The composite material of any one of items A4-A436 or B3-B15 where the polymer is linear low density polyethylene.

Item A525. The composite material of any one of items A4-A436 or B3-B15 where the polymer is lipids.

Item A526. The composite material of any one of items A4-A436 or B3-B15 where the polymer is liquid crystalline polymers (aromatic) containing esters.

Item A527. The composite material of any one of items A4-A436 or B3-B15 where the polymer is liquid crystal polymer.

Item A528. The composite material of any one of items A4-A436 or B3-B15 where the polymer is low density polyethylene.

Item A529. The composite material of any one of items A4-A436 or B3-B15 where the polymer is low density polypropylene.

Item A530. The composite material of any one of items A4-A436 or B3-B15 where the polymer is medium density polyethylene.

Item A531. The composite material of any one of items A4-A436 or B3-B15 where the polymer is medium density polypropylene.

Item A532. The composite material of any one of items A4-A436 or B3-B15 where the polymer is melamin resin.

Item A533. The composite material of any one of items A4-A436 or B3-B15 where the polymer is melamine formaldehyde .

Item A534. The composite material of any one of items A4-A436 or B3-B15 where the polymer is metalised polymers.

Item A535. The composite material of any one of items A4-A436 or B3-B15 where the polymer is methacrylate-butadiene-styrene terpolymer .

Item A536. The composite material of any one of items A4-A436 or B3-B15 where the polymer is natural and unnatural polypeptides.

Item A537. The composite material of any one of items A4-A436 or B3-B15 where the polymer is natural polypeptides.

Item A538. The composite material of any one of items A4-A436 or B3-B15 where the polymer is natural rubber .

Item A539. The composite material of any one of items A4-A436 or B3-B15 where the polymer is neoprene.

Item A540. The composite material of any one of items A4-A436 or B3-B15 where the polymer is nitrile rubber (acrylonitrile butadiene rubber).

Item A541. The composite material of any one of items A4-A436 or B3-B15 where the polymer is non plasticised PVC mixed with any other substance in primary forms.

Item A542. The composite material of any one of items A4-A436 or B3-B15 where the polymer is non-biologic polymer.

Item A543. The composite material of any one of items A4-A436 or B3-B15 where the polymer is nylon.

Item A544. The composite material of any one of items A4-A436 or B3-B15 where the polymer is nylon 11 .

Item A545. The composite material of any one of items A4-A436 or B3-B15 where the polymer is nylon 12 .

Item A546. The composite material of any one of items A4-A436 or B3-B15 where the polymer is nylon 46 .

Item A547. The composite material of any one of items A4-A436 or B3-B15 where the polymer is nylon 6 .

Item A548. The composite material of any one of items A4-A436 or B3-B15 where the polymer is nylon 610 .

Item A549. The composite material of any one of items A4-A436 or B3-B15 where the polymer is nylon 66 .

Item A550. The composite material of any one of items A4-A436 or B3-B15 where the polymer is nylon 66/610 copolymer .

Item A551. The composite material of any one of items A4-A436 or B3-B15 where the polymer is nylon PA1,1.

Item A552. The composite material of any one of items A4-A436 or B3-B15 where the polymer is nylon PA1,2.

Item A553. The composite material of any one of items A4-A436 or B3-B15 where the polymer is nylon PA1,3.

Item A554. The composite material of any one of items A4-A436 or B3-B15 where the polymer is nylon PA1,4.

Item A555. The composite material of any one of items A4-A436 or B3-B15 where the polymer is nylon PA1,5.

Item A556. The composite material of any one of items A4-A436 or B3-B15 where the polymer is nylon PA1,6.

Item A557. The composite material of any one of items A4-A436 or B3-B15 where the polymer is nylon PA2,1.

Item A558. The composite material of any one of items A4-A436 or B3-B15 where the polymer is nylon PA6,10.

Item A559. The composite material of any one of items A4-A436 or B3-B15 where the polymer is nylon PA6,6.

Item A560. The composite material of any one of items A4-A436 or B3-B15 where the polymer is organic polymer.

Item A561. The composite material of any one of items A4-A436 or B3-B15 where the polymer is organomodified siloxanes (OMS).

Item A562. The composite material of any one of items A4-A436 or B3-B15 where the polymer is oriented polypropylene .

Item A563. The composite material of any one of items A4-A436 or B3-B15 where the polymer is other PET.

Item A564. The composite material of any one of items A4-A436 or B3-B15 where the polymer is parylene.

Item A565. The composite material of any one of items A4-A436 or B3-B15 where the polymer is perfluoro alkoxyl alkane .

Item A566. The composite material of any one of items A4-A436 or B3-B15 where the polymer is perfluoroalkoxy Teflon PFA.

Item A567. The composite material of any one of items A4-A436 or B3-B15 where the polymer is PET copolymer .

Item A568. The composite material of any one of items A4-A436 or B3-B15 where the polymer is phenol formaldehyde .

Item A569. The composite material of any one of items A4-A436 or B3-B15 where the polymer is phenol formaldehyde resins (PF).

Item A570. The composite material of any one of items A4-A436 or B3-B15 where the polymer is phenolic (Novolac) Epoxy Resins.

Item A571. The composite material of any one of items A4-A436 or B3-B15 where the polymer is phenolic resin.

Item A572. The composite material of any one of items A4-A436 or B3-B15 where the polymer is plasticised PVC mixed with any other substance in primary forms.

Item A573. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polaryl amide .

Item A574. The composite material of any one of items A4-A436 or B3-B15 where the polymer is poly ethylvinyl acetate .

Item A575. The composite material of any one of items A4-A436 or B3-B15 where the polymer is poly vinyl acetate in aqueous dispersion in primary forms.

Item A576. The composite material of any one of items A4-A436 or B3-B15 where the polymer is poly vinyl acetate in primary forms.

Item A577. The composite material of any one of items A4-A436 or B3-B15 where the polymer is poly-1-butene.

Item A578. The composite material of any one of items A4-A436 or B3-B15 where the polymer is poly-1-hexene.

Item A579. The composite material of any one of items A4-A436 or B3-B15 where the polymer is poly-1-octene.

Item A580. The composite material of any one of items A4-A436 or B3-B15 where the polymer is poly-o-vinylbenzylalcohol.

Item A581. The composite material of any one of items A4-A436 or B3-B15 where the polymer is poly-p-vinylbenzylalcohol.

Item A582. The composite material of any one of items A4-A436 or B3-B15 where the polymer is poly(2,5-dioctyl-1,4-phenylenevinylene).

Item A583. The composite material of any one of items A4-A436 or B3-B15 where the polymer is poly(2,6-naphthalenevinylene).

Item A584. The composite material of any one of items A4-A436 or B3-B15 where the polymer is poly(acrylamido-N-propyltrimethylammonium chloride).

Item A585. The composite material of any one of items A4-A436 or B3-B15 where the polymer is Poly(anthracene-vinylene).

Item A586. The composite material of any one of items A4-A436 or B3-B15 where the polymer is poly(ethyl acrylate).

Item A587. The composite material of any one of items A4-A436 or B3-B15 where the polymer is poly(ethylene propylenqwe).

Item A588. The composite material of any one of items A4-A436 or B3-B15 where the polymer is poly(ethylene-propylene oxide).

Item A589. The composite material of any one of items A4-A436 or B3-B15 where the polymer is poly(ethylene-vinyl acetate).

Item A590. The composite material of any one of items A4-A436 or B3-B15 where the polymer is poly(ethylvinyl alcohol).

Item A591. The composite material of any one of items A4-A436 or B3-B15 where the polymer is poly(m-phenyleneisophthalamide) (MPD-I) (Nomex®).

Item A592. The composite material of any one of items A4-A436 or B3-B15 where the polymer is poly(p-phenylene-vinylene).

Item A593. The composite material of any one of items A4-A436 or B3-B15 where the polymer is poly(p-phenylene).

Item A594. The composite material of any one of items A4-A436 or B3-B15 where the polymer is poly(p-phenyleneterephthalamide) (PPD-T) (Kevlar® and Twaron®).

Item A595. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polyacenaphthylene.

Item A596. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polyacetals in primary forms.

Item A597. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polyacetylene.

Item A598. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polyacrylate.

Item A599. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polyacrylic acid.

Item A600. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polyacrylonitrile.

Item A601. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polyacrylonitrile (PAN) and copolymers.

Item A602. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polyaliphatic polymer.

Item A603. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polyaniline.

Item A604. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polyanthracene.

Item A605. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polyAPTAC.

Item A606. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polyaromatic polymer.

Item A607. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polybutadiene.

Item A608. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polybutylacrylate.

Item A609. The composite material of any one of items A4-A436 or B3-B15 where the polymer is Polybutylene adipate terephthalate.

Item A610. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polybutylene oxide.

Item A611. The composite material of any one of items A4-A436 or B3-B15 where the polymer is Polybutylene succinate.

Item A612. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polybutylene terephthalate.

Item A613. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polybutylene, such as polybutylene-1.

Item A614. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polybutyleneoxide.

Item A615. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polybutyleneterephthalate.

Item A616. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polybutylmethacrylate.

Item A617. The composite material of any one of items A4-A436 or B3-B15 where the polymer is Polybutyrate.

Item A618. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polybutyrate adipate terephthalate.

Item A619. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polycaprolactam.

Item A620. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polycaprolactone (PCL).

Item A621. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polycarbonates (PC/lexan).

Item A622. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polychloroprene.

Item A623. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polychlorotrifluoroethylene.

Item A624. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polydiacetylenes.

Item A625. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polydimethylsiloxanes (PDMS).

Item A626. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polyester elastomer .

Item A627. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polyester imide .

Item A628. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polyester molecule.

Item A629. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polyesters (PET/mylar, melinex, dacron., PEN/teonex).

Item A630. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polyether.

Item A631. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polyether block amide .

Item A632. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polyether sulphone .

Item A633. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polyetheretherketon.

Item A634. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polyetherketone .

Item A635. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polyethylene - cross-linked polyethylene.

Item A636. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polyethylene - high density (HDPE).

Item A637. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polyethylene - linear low density (LLDPE).

Item A638. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polyethylene - low density (LDPE).

Item A639. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polyethylene - medium density (MDPE).

Item A640. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polyethylene - ultrahigh molecular weight (UHMWPE).

Item A641. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polyethylene - very low density (VLDPE).

Item A642. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polyethylene (PE).

Item A643. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polyethylene adipate.

Item A644. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polyethylene furanoate.

Item A645. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polyethylene naphthalate (PEN).

Item A646. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polyethylene oxide.

Item A647. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polyethyleneoxide.

Item A648. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polyethylenes (LDPE , HDPE).

Item A649. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polyethyleneterephthalate.

Item A650. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polyethylenimine.

Item A651. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polyglycolide (PG).

Item A652. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polyheptene.

Item A653. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polyhexene.

Item A654. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polyhydroxyalkanoate.

Item A655. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polyhydroxybutyrate .

Item A656. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polyhydroxyethylmethacrylate.

Item A657. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polyimide, PTFE , PMMA, Kapton, Vespel, Cirlex, ABS.

Item A658. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polyimides (kapton, upilex, etc).

Item A659. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polyisobutylene.

Item A660. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polyisocyanurate rigid.

Item A661. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polyisocyanurates.

Item A662. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polyisoprene.

Item A663. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polylactic acid.

Item A664. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polyMAPTAC (poly[(3-(methacryloylamino)-propyl) trimethylammonium chloride).

Item A665. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polymer comprising 2-methyl-propanoic acid methyl ester.

Item A666. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polymer comprising 4-(2-phenylpropan-2-yl)phenyl hydrogen carbonate.

Item A667. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polymer comprising 4-(4-phenoxybenzoyl)benzaketone.

Item A668. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polymer comprising 4-(ethoxycarbonyl)benzoic ester.

Item A669. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polymer comprising a carbonyl.

Item A670. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polymer comprising an amide bond.

Item A671. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polymer comprising an OH.

Item A672. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polymer comprising butyl.

Item A673. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polymer comprising carbonyl.

Item A674. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polymer comprising chloro-ethyl.

Item A675. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polymer comprising Cl.

Item A676. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polymer comprising ethyl.

Item A677. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polymer comprising ethyl-acetate.

Item A678. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polymer comprising ethyl-nitril.

Item A679. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polymer comprising ethylbenzene.

Item A680. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polymer comprising F.

Item A681. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polymer comprising H.

Item A682. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polymer comprising isobutyl.

Item A683. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polymer comprising isopentyl.

Item A684. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polymer comprising isopropyl.

Item A685. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polymer comprising methyl.

Item A686. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polymer comprising methyl 2-methyl-propionate.

Item A687. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polymer comprising N.

Item A688. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polymer comprising neopentyl.

Item A689. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polymer comprising O.

Item A690. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polymer comprising pentyl.

Item A691. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polymer comprising phenyl-sulfide.

Item A692. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polymer comprising propanoic acid.

Item A693. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polymer comprising propanoic acid methyl ester.

Item A694. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polymer comprising propyl.

Item A695. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polymer comprising S.

Item A696. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polymer comprising sec-butyl.

Item A697. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polymer comprising sec-pentyl.

Item A698. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polymer comprising Si.

Item A699. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polymer comprising tert-butyl.

Item A700. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polymer comprising tert-pentyl.

Item A701. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polymer comprising tetra-flour-ethyl.

Item A702. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polymer consisting of C.

Item A703. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polymer consisting of C and H.

Item A704. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polymer consisting of C and H and Cl.

Item A705. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polymer consisting of C and H and F.

Item A706. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polymer consisting of C and H and O.

Item A707. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polymer consisting of C and H and O and N.

Item A708. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polymer consisting of 4-(ethoxycarbonyl)benzoic ester.

Item A709. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polymer consisting of butyl.

Item A710. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polymer consisting of chloro-ethyl.

Item A711. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polymer consisting of ethyl.

Item A712. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polymer consisting of ethyl-acetate.

Item A713. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polymer consisting of ethyl-nitril.

Item A714. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polymer consisting of ethylbenzene.

Item A715. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polymer consisting of isobutyl.

Item A716. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polymer consisting of isopentyl.

Item A717. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polymer consisting of isopropyl.

Item A718. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polymer consisting of methyl.

Item A719. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polymer consisting of methyl 2-methyl-propionate.

Item A720. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polymer consisting of neopentyl.

Item A721. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polymer consisting of pentyl.

Item A722. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polymer consisting of phenyl-sulfide.

Item A723. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polymer consisting of propanoic acid.

Item A724. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polymer consisting of propanoic acid methyl ester.

Item A725. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polymer consisting of propyl.

Item A726. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polymer consisting of sec-butyl.

Item A727. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polymer consisting of sec-pentyl.

Item A728. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polymer consisting of tert-butyl.

Item A729. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polymer consisting of tert-pentyl.

Item A730. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polymer consisting of tetra-flour-ethyl.

Item A731. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polymeric cyanate ester.

Item A732. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polymers of styrene in primary forms.

Item A733. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polymers of vinyl esters or other vinyl polymers in primary forms.

Item A734. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polymethacrylonitrile.

Item A735. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polymethyl pentene .

Item A736. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polymethyl pentene copolymer .

Item A737. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polymethylacrylate.

Item A738. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polymethylhydrosiloxane (PMHS).

Item A739. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polymethylmethacrylate.

Item A740. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polymethylpentene.

Item A741. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polyoctene.

Item A742. The composite material of any one of items A4-A436 or B3-B15 where the polymer is Polyolefin elastomers.

Item A743. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polyperfluoropropylene.

Item A744. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polyphenol.

Item A745. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polyphenylene benzobisoxazole.

Item A746. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polyphenylene ether .

Item A747. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polyphenylene oxide .

Item A748. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polyphenylene sulphide sulphone .

Item A749. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polypropylene.

Item A750. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polypropylene oxide.

Item A751. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polypyrrole.

Item A752. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polysaccharides.

Item A753. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polystyrene.

Item A754. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polystyrene-butadiene.

Item A755. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polysulphides.

Item A756. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polysulphone.

Item A757. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polysulphones (PES).

Item A758. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polytetramethylene sebacate.

Item A759. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polytetramethylene terephthalate.

Item A760. The composite material of any one of items A4-A436 or B3-B15 where the polymer is Polytrimethylene terephthalate .

Item A761. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polyurea.

Item A762. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polyurethane.

Item A763. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polyvinyl.

Item A764. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polyvinyl acetal.

Item A765. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polyvinyl acetate .

Item A766. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polyvinyl alcohol .

Item A767. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polyvinyl butyral.

Item A768. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polyvinyl butyral.

Item A769. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polyvinyl chloride plasticised .

Item A770. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polyvinyl chloride unplasticised .

Item A771. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polyvinyl formal.

Item A772. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polyvinyl isobutyral.

Item A773. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polyvinyl pyrrolidone.

Item A774. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polyvinyl-n-butyl ether.

Item A775. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polyvinylacetate.

Item A776. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polyvinylalcohol.

Item A777. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polyvinylflouride .

Item A778. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polyvinylidene chloride .

Item A779. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polyvinylidene flouride .

Item A780. The composite material of any one of items A4-A436 or B3-B15 where the polymer is polyvinylidene fluoride (PVDF).

Item A781. The composite material of any one of items A4-A436 or B3-B15 where the polymer is reduced graphene oxide molecule.

Item A782. The composite material of any one of items A4-A436 or B3-B15 where the polymer is RNA.

Item A783. The composite material of any one of items A4-A436 or B3-B15 where the polymer is rubber.

Item A784. The composite material of any one of items A4-A436 or B3-B15 where the polymer is self reinforcing polymer.

Item A785. The composite material of any one of items A4-A436 or B3-B15 where the polymer is shape memory polymer.

Item A786. The composite material of any one of items A4-A436 or B3-B15 where the polymer is sheet moulding compound .

Item A787. The composite material of any one of items A4-A436 or B3-B15 where the polymer is silicone.

Item A788. The composite material of any one of items A4-A436 or B3-B15 where the polymer is silicone resins.

Item A789. The composite material of any one of items A4-A436 or B3-B15 where the polymer is silicones in primary forms.

Item A790. The composite material of any one of items A4-A436 or B3-B15 where the polymer is starch.

Item A791. The composite material of any one of items A4-A436 or B3-B15 where the polymer is styrene acrylonitrile.

Item A792. The composite material of any one of items A4-A436 or B3-B15 where the polymer is styrene acrylonitrile copolymer.

Item A793. The composite material of any one of items A4-A436 or B3-B15 where the polymer is styrene butadiene .

Item A794. The composite material of any one of items A4-A436 or B3-B15 where the polymer is styrene butadiene latex.

Item A795. The composite material of any one of items A4-A436 or B3-B15 where the polymer is styrene maleic anhydride .

Item A796. The composite material of any one of items A4-A436 or B3-B15 where the polymer is styrene-acrylonitrile (SAN) copolymer.

Item A797. The composite material of any one of items A4-A436 or B3-B15 where the polymer is styrene-ethylene-butadiene-styrene .

Item A798. The composite material of any one of items A4-A436 or B3-B15 where the polymer is styrene-isoprene-styrene .

Item A799. The composite material of any one of items A4-A436 or B3-B15 where the polymer is styrenics.

Item A800. The composite material of any one of items A4-A436 or B3-B15 where the polymer is superlinear polyethylene.

Item A801. The composite material of any one of items A4-A436 or B3-B15 where the polymer is thermoplastic olefin.

Item A802. The composite material of any one of items A4-A436 or B3-B15 where the polymer is thermoplastic polyurethane rubber.

Item A803. The composite material of any one of items A4-A436 or B3-B15 where the polymer is thermoplastic rubber .

Item A804. The composite material of any one of items A4-A436 or B3-B15 where the polymer is toughened polystyrene.

Item A805. The composite material of any one of items A4-A436 or B3-B15 where the polymer is unnatural nucleic acids (e.g. PNA, LNA and other unnatural nucleic acids).

Item A806. The composite material of any one of items A4-A436 or B3-B15 where the polymer is unnatural polypeptides (i.e. polypeptides not solely comprising alpha-amino acids).

Item A807. The composite material of any one of items A4-A436 or B3-B15 where the polymer is unsaturated polyester resin.

Item A808. The composite material of any one of items A4-A436 or B3-B15 where the polymer is urea formaldehyde .

Item A809. The composite material of any one of items A4-A436 or B3-B15 where the polymer is urea resin.

Item A810. The composite material of any one of items A4-A436 or B3-B15 where the polymer is Vectran.

Item A811. The composite material of any one of items A4-A436 or B3-B15 where the polymer is vinyl chloride.

Item A812. The composite material of any one of items A4-A436 or B3-B15 where the polymer is vinyl chloride copolymers.

Item A813. The composite material of any one of items A4-A436 or B3-B15 where the polymer is vinyl chloride monomer.

Item A814. The composite material of any one of items A4-A436 or B3-B15 where the polymer is vinyl chloride-vinyl acetate copolymers.

Item A815. The composite material of any one of items A4-A436 or B3-B15 where the polymer is vinyls (PVC, nylon).

Item A816. The composite material of any one of items A4-A436 or B3-B15 where the polymer is wood flour.

Item A817. The composite material of any one of items A4-A436 or B3-B15 where the polymer comprises C and H.

Item A818. The composite material of any one of items A4-A436 or B3-B15 where the polymer comprises C and H and O.

Item A819. The composite material of any one of items A4-A436 or B3-B15 where the polymer comprises C and H and O and N.

Item A820. The composite material of any one of items A4-A436 or B3-B15 where the polymer comprises C and H and Cl.

Item A821. The composite material of any one of items A4-A436 or B3-B15 where the polymer comprises C and H and F.

Item A822. The composite material of any one of items A4-A436 or B3-B15 where the polymer comprises -CH₂-.

Item A823. The composite material of any one of items A4-A436 or B3-B15 where the polymer comprises -CH(CH₃)- .

Item A824. The composite material of any one of items A4-A436 or B3-B15 where the polymer comprises -C(CH₃)₂-.

Item A825. The composite material of any one of items A4-A436 or B3-B15 where the polymer comprises -CF₂-.

Item A826. The composite material of any one of items A4-A436 or B3-B15 where the polymer comprises -CH(C₆H₆)-.

Item A827. The composite material of any one of items A4-A436 or B3-B15 where the polymer is an inorganic polymer.

Item A828. The composite material of any one of items A4-A436 or B3-B15 where the polymer is an organic polymer.

Item A829. The composite material of any one of items A4-A436 or B3-B15 where the polymer is a thermoplastic polymer.

Item A830. The composite material of any one of items A4-A436 or B3-B15 where the polymer is a thermoset polymer.

Item A831. The composite material of any one of items A4-A436 or B3-B15 where the polymer is a copolymer.

Item A832. The composite material of any one of items A4-A436 or B3-B15 where the polymer is a homopolymer.

Item A833. The composite material of any one of items A4-A436 or B3-B15 where the polymer is a block copolymer.

Item A834. The composite material of any one of items A4-A436 or B3-B15 where the polymer is a random copolymer.

Item A835. The composite material of any one of items A4-A436 or B3-B15 where the polymer is a cyclic polymer.

Item A836. The composite material of any one of items A4-A436 or B3-B15 where the polymer is a non-cyclic polymer.

Item A837. The composite material of any one of items A4-A436 or B3-B15 where the polymer is a branched polymer.

Item A838. The composite material of any one of items A4-A436 or B3-B15 where the polymer is a non-branched polymer.

Item A839. The composite material of any one of items A4-A436 or B3-B15 where the polymer is a polymer with a ratio of repeating units to branching units of more than 1, such as more than 2, such as more than 3, such as more than 4, such as more than 5, such as more than 6, such as more than 7, such as more than 8, such as more than 9, such as more than 10, such as more than 15, such as more than 20, such as more than 30, such as more than 40, such as more than 50, such as more than 100, such as more than 200, such as more than 300, such as more than 400, such as more than 500.

Item A840. The composite material of any one of items A4-A436 or B3-B15 where the polymer is a polymer with a ratio of repeating units to branching units of less than 500, such as less than 300, such as less than 200, such as less than 100, such as less than 50, such as less than 40, such as less than 30, such as less than 20, such as less than 15, such as less than 10, such as less than 9, such as less than 8, such as less than 7, such as less than 6, such as less than 5, such as less than 4, such as less than 3, such as less than 2, such as less than 1.

Item A841. The composite material of any one of items A4-A436 or B3-B15 where the polymer is a polymer with a ratio of repeating units to branching units of from 1 to 2, or from 2 to 3, or from 3 to 4, or from 4 to 5, or from 5 to 6, or from 6 to 7, or from 7 to 8, or from 8 to 9, or from 9 to 10, or from 10 to 15, or from 15 to 20, or from 20 to 30, or from 30 to 40, or from 40 to 50, or from 50 to 100, or from 100 to 200, or from 200 to 300, or from 300 to 500.

Item A842. The composite material of any one of items A4-A436 or B3-B15 where the polymer is a polymer in which all bonds are single bonds. .

Item A843. The composite material of any one of items A4-A436 or B3-B15 where the polymer is a polymer in which all bonds are single bonds or double bonds.

Item A844. The composite material of any one of items A4-A436 or B3-B15 where the polymer is a polymer in which all bonds are single bonds or triple bonds.

Item A845. The composite material of any one of items A4-A436 or B3-B15 where the polymer is a polymer in which all bonds are single bonds or double bonds or triple bonds.

Item A846. The composite material of any one of items A4-A436 or B3-B15 where the polymer is a polymer consisting of C and H.

Item A847. The composite material of any one of items A4-A436 or B3-B15 where the polymer is a polymer consisting of C and H and O.

Item A848. The composite material of any one of items A4-A436 or B3-B15 where the polymer is a polymer consisting of C and H and O and N.

Item A849. The composite material of any one of items A4-A436 or B3-B15 where the polymer is a polymer consisting of C and H and Cl.

Item A850. The composite material of any one of items A4-A436 or B3-B15 where the polymer is a polymer consisting of C and H and F.

Item A851. The composite material of any one of items A4-A436 or B3-B15 where the polymer is a polymer consisting of -CH₂-.

Item A852. The composite material of any one of items A4-A436 or B3-B15 where the polymer is a polymer consisting of -CH(CH₃)-. .

Item A853. The composite material of any one of items A4-A436 or B3-B15 where the polymer is a polymer consisting of -C(CH₃)₂-. .

Item A854. The composite material of any one of items A4-A436 or B3-B15 where the polymer is a polymer consisting of -CF₂-.

Item A855. The composite material of any one of items A4-A436 or B3-B15 where the polymer is a polymer consisting of -CH(C₆H₆)-.

Item A856. The composite material of any one of items A4-A436 or B3-B15 where the polymer has a molecular weight in Dalton chosen from more than 10, such as more than 10², such as more than 10³, such as more than 10⁴, such as more than 10⁵, such as more than 10⁶, such as more than 10⁷, such as more than 10⁸, such as more than 10⁹, such as more than 10¹⁰, such as more than 10¹¹, such as more than 10¹², such as more than 10¹³, such as more than 10¹⁴, such as more than 10¹⁵, such as more than 10¹⁶, such as more than 10¹⁷, such as more than 10¹⁸, such as more than 10¹⁹, such as more than 10²⁰, such as more than 10²¹, such as more than 10²², such as more than 10²³, such as more than 10²⁴, such as more than 10²⁵, such as more than 10²⁶, such as more than 10²⁷, such as more than 10²⁸, such as more than 10²⁹, such as more than 10³⁰, such as more than 10³¹, such as more than 10³², such as more than 10³³, such as more than 10³⁴, such as more than 10³⁵.

Item A857. The composite material of any one of items A4-A436 or B3-B15 where the polymer has molecular weight in Dalton chosen from less than 10³⁵, such as less than 10³⁴, such as less than 10³³, such as less than 10³², such as less than 10³¹, such as less than 10³⁰, such as less than 10²⁹, such as less than 10²⁸, such as less than 10²⁷, such as less than 10²⁶, such as less than 10²⁵, such as less than 10²⁴, such as less than 10²³, such as less than 10²², such as less than 10²¹, such as less than 10²⁰, such as less than 10¹⁹, such as less than 10¹⁸, such as less than 10¹⁷, such as less than 10¹⁶, such as less than 10¹⁵, such as less than 10¹⁴, such as less than 10¹³, such as less than 10¹², such as less than 10¹¹, such as less than 10¹⁰, such as less than 10⁹, such as less than 10⁸, such as less than 10⁷, such as less

than 10^6 , such as less than 10^5 , such as less than 10^4 , such as less than 10^3 , such as less than 10^2 , such as less than 10.

Item A858. The composite material of any one of items A4-A436 or B3-B15 where the polymer has a molecular weight in Dalton chosen from 10 to 10^2 , or from 10^2 to 10^3 , or from 10^3 to 10^4 , or from 10^4 to 10^5 , or from 10^5 to 10^6 , or from 10^6 to 10^7 , or from 10^7 to 10^8 , or from 10^8 to 10^9 , or from 10^9 to 10^{10} , or from 10^{10} to 10^{11} , or from 10^{11} to 10^{12} , or from 10^{12} to 10^{13} , or from 10^{13} to 10^{14} , or from 10^{14} to 10^{15} , or from 10^{15} to 10^{16} , or from 10^{16} to 10^{17} , or from 10^{17} to 10^{18} , or from 10^{18} to 10^{19} , or from 10^{19} to 10^{20} , or from 10^{20} to 10^{21} , or from 10^{21} to 10^{22} , or from 10^{22} to 10^{23} , or from 10^{23} to 10^{24} , or from 10^{24} to 10^{25} , or from 10^{25} to 10^{26} , or from 10^{26} to 10^{27} , or from 10^{27} to 10^{28} , or from 10^{28} to 10^{29} , or from 10^{29} to 10^{30} , or from 10^{30} to 10^{31} , or from 10^{31} to 10^{32} , or from 10^{32} to 10^{33} , or from 10^{33} to 10^{34} , or from 10^{34} to 10^{35} .

Item A859. The composite material of any one of items A4-A436 or B3-B15 where the polymer is an aliphatic polymer.

Item A860. The composite material of any one of items A4-A436 or B3-B15 where the polymer is an aromatic polymer.

Item A861. The composite material of any one of items A4-A436 or B3-B15 where the polymer is a mixed aliphatic-aromatic polymer with a percentage of aromaticity chosen from more than 0%, such as more than 5%, such as more than 10%, such as more than 15%, such as more than 20%, such as more than 25%, such as more than 30%, such as more than 35%, such as more than 40%, such as more than 45%, such as more than 50%, such as more than 55%, such as more than 60%, such as more than 65%, such as more than 70%, such as more than 75%, such as more than 80%, such as more than 85%, such as more than 90%, such as more than 95%.

Item A862. The composite material of any one of items A4-A436 or B3-B15 where the polymer is a mixed aliphatic-aromatic polymer with a percentage of aromaticity of 100% or less than 100%, such as less than 95%, such as less than 90%, such as less than 85%, such as less than 80%, such as less than 75%, such as less than 70%, such as less than 65%, such as less than 60%, such as less than 55%, such as less than 50%, such as less than 45%, such as less than 40%, such as less than 35%, such as less than 30%, such as less than 25%, such as less than 20%, such as less than 15%, such as less than 10%, such as less than 5%.

Item A863. The composite material of any one of items A4-A436 or B3-B15 where the polymer is a mixed aliphatic-aromatic polymer with a percentage of aromaticity of 0% to 5%, or 5% to 10%, or 10% to 15%, or 15% to 20%, or 20% to 25%, or 25% to 30%, or 30% to 35%, or 35% to 40%, or 40% to 45%, or 45% to 50%, or 50% to 55%, or 55% to 60%, or 60% to 65%, or 65% to 70%, or 70% to 75%, or 75% to 80%, or 80% to 85%, or 85% to 90%, or 90% to 95%, or 95% to 100%.

The following items relate to nanotubes and second structural entities.

Item A864. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is a carbon fibre.

Item A865. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is boron nitride.

Item A866. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is a ceramic.

Item A867. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is graphene.

Item A868. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is a metal.

Item A869. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is a nucleic acid.

Item A870. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is a polypeptide.

Item A871. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is a cathode.

Item A872. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is a metalised dielectric.

Item A873. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is a peptide.

Item A874. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is a protein.

Item A875. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is a semiconductor.

Item A876. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is a sensor.

Item A877. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is aluminium.

Item A878. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is an anode.

Item A879. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is an antibody.

Item A880. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is electrode.

Item A881. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is boron nitride.

Item A882. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is buckyball.

Item A883. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is carbon nanofibres.

Item A884. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is concrete.

Item A885. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is glass fibre.

Item A886. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is graphene oxide.

Item A887. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is graphyne.

Item A888. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is stainless steel.

Item A889. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is a cathode.

Item A890. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is a carbon polymer.

Item A891. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is (Ag) silver.

Item A892. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is (Al) aluminium.

Item A893. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is (Au) gold.

Item A894. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is (Cr) chromium.

Item A895. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is (Cu) copper.

Item A896. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is (Fe) steel and stainless steel.

Item A897. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is (Mn) manganese.

Item A898. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is (Mo) molybdenum.

Item A899. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is (Ni) nickel.

Item A900. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is (Pa) palladium.

Item A901. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is (Pt) platinum.

Item A902. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is (Ta) tantalum.

Item A903. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is (Ti) titanium.

Item A904. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is (Wo) Tungsten.

Item A905. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is a battery.

Item A906. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is a borosilicate.

Item A907. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is a buckyball.

Item A908. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is a buckytube.

Item A909. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is a capacitor.

Item A910. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is a carbon dome.

Item A911. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is a carbon megatube.

Item A912. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is a carbon nanofibre.

Item A913. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is a carbon nanofoam.

Item A914. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is a carbon nanothread.

Item A915. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is a catalyst.

Item A916. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is a ceramic material.

Item A917. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is a composite material.

Item A918. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is a conductor.

Item A919. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is a covalent crystal.

Item A920. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is a crystal.

Item A921. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is a crystalline material.

Item A922. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is a defect-free graphene sheet.

Item A923. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is a dielectric material.

Item A924. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is a diode.

Item A925. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is a dodecahedrane.

Item A926. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is a doped glass.

Item A927. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is a fibre.

Item A928. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is a fullerite.

Item A929. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is a fused silica.

Item A930. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is a glass fibre.

Item A931. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is a glue.

Item A932. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is a green ceramic.

Item A933. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is a lanthanides.

Item A934. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is a machinable ceramic.

Item A935. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is a metal alloy.

Item A936. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is a metallised ceramic.

Item A937. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is a metalloid.

Item A938. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is a mineral.

Item A939. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is a non-covalent crystal.

Item A940. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is a piezoelectric material.

Item A941. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is a platinum group metal.

Item A942. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is a post-transition metal.

Item A943. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is a rare earth element.

Item A944. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is a sapphire.

Item A945. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is a silicon nitride.

Item A946. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is a single crystal fiber.

Item A947. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is a sol-gel.

Item A948. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is a synthetic diamond.

Item A949. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is a transition metal.

Item A950. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is a tungsten carbide.

Item A951. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is actinides.

Item A952. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is activated carbon.

Item A953. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is aggregated diamonds.

Item A954. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is air entrainers.

Item A955. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is alkali-silica reactivity inhibitors.

Item A956. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is alloys.

Item A957. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is alumina.

Item A958. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is alumina trihydrate.

Item A959. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is aluminum boride.

Item A960. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is aluminum fibers.

Item A961. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is aluminum oxide.

Item A962. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is aluminum trihydroxide.

Item A963. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is amalgams.

Item A964. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is amorphous carbon.

Item A965. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is actinides.

Item A966. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is an amalgam.

Item A967. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is an endohedral fullerene.

Item A968. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is an insulator.

Item A969. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is an intermetallic.

Item A970. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is an ionic crystal.

Item A971. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is an organic material.

Item A972. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is anthracite.

Item A973. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is aramid.

Item A974. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is asbestos .

Item A975. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is barium .

Item A976. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is bone.

Item A977. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is boron.

Item A978. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is boron nitride nanoscroll,.

Item A979. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is boron nitride oxide.

Item A980. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is brass.

Item A981. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is brass fibers.

Item A982. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is buckminsterfullerene.

Item A983. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is bucky paper.

Item A984. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is buckyball clusters.

Item A985. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is buckypaper.

Item A986. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is buckytube.

Item A987. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is calcium carbonite.

Item A988. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is calcium metasilicate.

Item A989. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is calcium sulfate.

Item A990. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is calcium sulphate.

Item A991. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is carbon black.

Item A992. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is carbon fiber.

Item A993. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is carbon fibers.

Item A994. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is carbon megatubes.

Item A995. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is carbon nano-onions.

Item A996. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is carbon nanobuds.

Item A997. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is carbon nanofiber.

Item A998. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is carbon nanofoam.

Item A999. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is carbon nanothread.

Item A1000. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is carbon/diamond nanothread.

Item A1001. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is cellulose fibers.

Item A1002. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is cellulose nanofibers (e.g. curran).

Item A1003. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is cellulose nanowhiskers.

Item A1004. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is chemical admixtures .

Item A1005. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is chlorographene.

Item A1006. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is chromium.

Item A1007. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is clay.

Item A1008. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is coal.

Item A1009. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is coated boron nitride.

Item A1010. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is coated graphene.

Item A1011. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is coloring admixtures.

Item A1012. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is composite materials.

Item A1013. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is concrete admixtures .

Item A1014. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is COOH-functionalized graphene.

Item A1015. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is copper.

Item A1016. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is corrosion inhibitors.

Item A1017. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is covalent crystals.

Item A1018. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is crystal.

Item A1019. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is crystalline materials.

Item A1020. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is diamond.

Item A1021. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is diamond-like carbon.

Item A1022. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is dispersants. .

Item A1023. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is dodecahedrane.

Item A1024. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is double-layer boron nitride.

Item A1025. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is double-layer graphene.

Item A1026. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is e-glass.

Item A1027. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is elastomers.

Item A1028. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is endohedral fullerenes.

Item A1029. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is exfoliated graphite.

Item A1030. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is exfoliated silicate.

Item A1031. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is extruded activated carbon.

Item A1032. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is fibres.

Item A1033. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is flourinated boron nitride.

Item A1034. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is flourinated graphene.

Item A1035. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is fluorographene.

Item A1036. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is fly ash .

Item A1037. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is fullerene rings.

Item A1038. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is fullerenes.

Item A1039. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is fullerite.

Item A1040. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is functionalized boron nitride.

Item A1041. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is functionalized graphene.

Item A1042. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is fused silica.

Item A1043. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is gallium arsenide.

Item A1044. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is gallium nitride.

Item A1045. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is gedodesic carbon domes.

Item A1046. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is germanium.

Item A1047. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is glass.

Item A1048. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is glass microsphere.

Item A1049. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is glass ribbons.

Item A1050. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is glass spheres.

Item A1051. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is glasses.

Item A1052. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is glassy carbon.

Item A1053. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is glue.

Item A1054. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is gold.

Item A1055. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is gold particles.

Item A1056. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is granular activated carbon.

Item A1057. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is graphane.

Item A1058. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is graphdiyne.

Item A1059. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is graphene.

Item A1060. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is graphite.

Item A1061. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is graphone.

Item A1062. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is hardened steel.

Item A1063. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is high range water reducers.

Item A1064. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is hydrous magnesium silicate.

Item A1065. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is hyperdiamond.

Item A1066. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is hyperdiamonds.

Item A1067. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is imperfect boron nitride.

Item A1068. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is imperfect graphene.

Item A1069. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is intermetallics.

Item A1070. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is ionic crystals.

Item A1071. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is iron.

Item A1072. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is iron oxides.

Item A1073. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is kevlar.

Item A1074. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is lanthanides .

Item A1075. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is lead zirconium titanate.

Item A1076. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is lignin.

Item A1077. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is lignite.

Item A1078. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is lithium niobate.

Item A1079. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is lithium niobates.

Item A1080. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is lonsdaleite.

Item A1081. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is magnesium dihydroxide.

Item A1082. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is magnesium oxide.

Item A1083. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is manganese.

Item A1084. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is melamine sulfonate superplasticisers.

Item A1085. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is metal ions.

Item A1086. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is metal oxide.

Item A1087. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is metallised ceramic.

Item A1088. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is metalloids.

Item A1089. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is metals.

Item A1090. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is mica.

Item A1091. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is mineral.

Item A1092. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is mineral admixtures.

Item A1093. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is molybdenum.

Item A1094. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is montmorillonite nanoclays.

Item A1095. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is multi-layer boron nitride.

Item A1096. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is multi-layer graphene.

Item A1097. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is nanochain.

Item A1098. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is nanocrystal.

Item A1099. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is nanowire.

Item A1100. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is naphthalene.

Item A1101. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is Natural pozzolans (such as the volcanic ash used in Roman concrete).

Item A1102. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is NH₂-functionalized graphene.

Item A1103. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is nickel.

Item A1104. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is non-covalent crystal.

Item A1105. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is nylon.

Item A1106. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is OH-functionalized graphene.

Item A1107. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is palladium.

Item A1108. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is pencil lead.

Item A1109. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is perfect boron nitride.

Item A1110. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is perfect graphene.

Item A1111. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is plasticizers .

Item A1112. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is platinum.

Item A1113. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is platinum group metals.

Item A1114. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is post-transition metals.

Item A1115. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is powdered activated carbon.

Item A1116. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is pozzolans and other cementitious materials .

Item A1117. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is prismane.

Item A1118. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is pristine boron nitride.

Item A1119. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is pristine graphene.

Item A1120. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is pyrolytic graphite.

Item A1121. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is quantum dots.

Item A1122. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is rare earth elements.

Item A1123. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is reduced boron nitride oxide.

Item A1124. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is reduced graphene oxide.

Item A1125. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is reduced graphyne.

Item A1126. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is rubber.

Item A1127. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is s-glass.

Item A1128. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is sapphire.

Item A1129. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is set accelerators.

Item A1130. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is set retarders.

Item A1131. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is shrinkage control admixtures.

Item A1132. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is silica.

Item A1133. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is silica fume.

Item A1134. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is silica gel.

Item A1135. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is silicon.

Item A1136. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is silicon carbide.

Item A1137. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is silicon dioxide.

Item A1138. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is silicon nitride.

Item A1139. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is silicon nitrides (bulk and thin film).

Item A1140. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is silver.

Item A1141. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is single-layer boron nitride.

Item A1142. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is single-layer graphene.

Item A1143. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is sol-gel.

Item A1144. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is soot.

Item A1145. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is steel.

Item A1146. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is steel fibers.

Item A1147. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is superplasticizer .

Item A1148. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is superplasticizers.

Item A1149. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is talc.

Item A1150. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is tantalum.

Item A1151. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is thiol-functionalized graphene.

Item A1152. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is titanium.

Item A1153. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is titanium oxide.

Item A1154. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is tooth cementum.

Item A1155. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is tooth dentine.

Item A1156. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is tooth enamel.

Item A1157. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is transition metals.

Item A1158. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is triple-layer boron nitride.

Item A1159. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is triple-layer graphene.

Item A1160. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is tungsten.

Item A1161. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is tungsten carbide.

Item A1162. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is ultrahard fullerite.

Item A1163. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is water reducers.

Item A1164. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is wood.

Item A1165. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is zinc oxide.

Item A1166. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a carbon nanotube and the second structural entity is zirconia.

Item A1167. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is a carbon fibre.

Item A1168. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is boron nitride.

Item A1169. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is a ceramic.

Item A1170. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is graphene.

Item A1171. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is a metal.

Item A1172. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is a nucleic acid.

Item A1173. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is a polypeptide.

Item A1174. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is a cathode.

Item A1175. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is a metalised dielectric.

Item A1176. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is a peptide.

Item A1177. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is a protein.

Item A1178. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is a semiconductor.

Item A1179. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is a sensor.

Item A1180. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is aluminium.

Item A1181. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is an anode.

Item A1182. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is an antibody.

Item A1183. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is electrode.

Item A1184. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is boron nitride.

Item A1185. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is buckyball.

Item A1186. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is carbon nanofibres.

Item A1187. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is concrete.

Item A1188. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is glass fibre.

Item A1189. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is graphene oxide.

Item A1190. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is graphyne.

Item A1191. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is stainless steel.

Item A1192. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is a cathode.

Item A1193. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is a carbon polymer.

Item A1194. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is (Ag) silver.

Item A1195. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is (Al) aluminium.

Item A1196. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is (Au) gold.

Item A1197. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is (Cr) chromium.

Item A1198. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is (Cu) copper.

Item A1199. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is (Fe) steel and stainless steel.

Item A1200. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is (Mn) manganese.

Item A1201. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is (Mo) molybdenum.

Item A1202. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is (Ni) nickel.

Item A1203. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is (Pd) palladium.

Item A1204. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is (Pt) platinum.

Item A1205. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is (Ta) tantalum.

Item A1206. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is (Ti) titanium.

Item A1207. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is (W) Tungsten.

Item A1208. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is a battery.

Item A1209. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is a borosilicate.

Item A1210. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is a buckyball.

Item A1211. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is a buckytube.

Item A1212. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is a capacitor.

Item A1213. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is a carbon dome.

Item A1214. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is a carbon megatube.

Item A1215. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is a carbon nanofibre.

Item A1216. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is a carbon nanofoam.

Item A1217. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is a carbon nanothread.

Item A1218. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is a catalyst.

Item A1219. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is a ceramic material.

Item A1220. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is a composite material.

Item A1221. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is a conductor.

Item A1222. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is a covalent crystal.

Item A1223. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is a crystal.

Item A1224. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is a crystalline material.

Item A1225. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is a defect-free graphene sheet.

Item A1226. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is a dielectric material.

Item A1227. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is a diode.

Item A1228. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is a dodecahedrane.

Item A1229. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is a doped glass.

Item A1230. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is a fibre.

Item A1231. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is a fullerite.

Item A1232. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is a fused silica.

Item A1233. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is a glass fibre.

Item A1234. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is a glue.

Item A1235. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is a green ceramic.

Item A1236. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is a lanthanides.

Item A1237. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is a machinable ceramic.

Item A1238. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is a metal alloy.

Item A1239. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is a metallised ceramic.

Item A1240. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is a metalloid.

Item A1241. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is a mineral.

Item A1242. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is a non-covalent crystal.

Item A1243. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is a piezoelectric material.

Item A1244. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is a platinum group metal.

Item A1245. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is a post-transition metal.

Item A1246. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is a rare earth element.

Item A1247. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is a sapphire.

Item A1248. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is a silicon nitride.

Item A1249. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is a single crystal fiber.

Item A1250. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is a sol-gel.

Item A1251. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is a synthetic diamond.

Item A1252. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is a transition metal.

Item A1253. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is a tungsten carbide.

Item A1254. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is actinides.

Item A1255. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is activated carbon.

Item A1256. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is aggregated diamonds.

Item A1257. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is air entrainers.

Item A1258. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is alkali-silica reactivity inhibitors.

Item A1259. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is alloys.

Item A1260. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is alumina.

Item A1261. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is alumina trihydrate.

Item A1262. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is aluminum boride.

Item A1263. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is aluminum fibers.

Item A1264. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is aluminum oxide.

Item A1265. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is aluminum trihydroxide.

Item A1266. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is amalgams.

Item A1267. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is amorphous carbon.

Item A1268. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is actinides.

Item A1269. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is an amalgam.

Item A1270. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is an endohedral fullerene.

Item A1271. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is an insulator.

Item A1272. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is an intermetallic.

Item A1273. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is an ionic crystal.

Item A1274. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is an organic material.

Item A1275. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is anthracite.

Item A1276. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is aramid.

Item A1277. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is asbestos .

Item A1278. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is barium .

Item A1279. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is bone.

Item A1280. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is boron.

Item A1281. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is boron nitride nanoscroll,.

Item A1282. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is boron nitride oxide.

Item A1283. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is brass.

Item A1284. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is brass fibers.

Item A1285. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is buckminsterfullerene.

Item A1286. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is bucky paper.

Item A1287. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is buckyball clusters.

Item A1288. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is buckypaper.

Item A1289. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is buckytube.

Item A1290. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is calcium carbonite.

Item A1291. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is calcium metasilicate.

Item A1292. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is calcium sulfate.

Item A1293. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is calcium sulphate.

Item A1294. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is carbon black.

Item A1295. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is carbon fiber.

Item A1296. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is carbon fibers.

Item A1297. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is carbon megatubes.

Item A1298. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is carbon nano-onions.

Item A1299. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is carbon nanobuds.

Item A1300. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is carbon nanofiber.

Item A1301. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is carbon nanofoam.

Item A1302. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is carbon nanothread.

Item A1303. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is carbon/diamond nanothread.

Item A1304. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is cellulose fibers.

Item A1305. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is cellulose nanofibers (e.g. curran).

Item A1306. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is cellulose nanowhiskers.

Item A1307. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is chemical admixtures .

Item A1308. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is chlorographene.

Item A1309. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is chromium.

Item A1310. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is clay.

Item A1311. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is coal.

Item A1312. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is coated boron nitride.

Item A1313. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is coated graphene.

Item A1314. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is coloring admixtures.

Item A1315. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is composite materials.

Item A1316. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is concrete admixtures .

Item A1317. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is COOH-functionalized graphene.

Item A1318. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is copper.

Item A1319. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is corrosion inhibitors.

Item A1320. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is covalent crystals.

Item A1321. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is crystal.

Item A1322. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is crystalline materials.

Item A1323. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is diamond.

Item A1324. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is diamond-like carbon.

Item A1325. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is dispersants. .

Item A1326. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is dodecahedrane.

Item A1327. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is double-layer boron nitride.

Item A1328. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is double-layer graphene.

Item A1329. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is e-glass.

Item A1330. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is elastomers.

Item A1331. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is endohedral fullerenes.

Item A1332. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is exfoliated graphite.

Item A1333. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is exfoliated silicate.

Item A1334. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is extruded activated carbon.

Item A1335. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is fibres.

Item A1336. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is fluorinated boron nitride.

Item A1337. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is fluorinated graphene.

Item A1338. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is fluorographene.

Item A1339. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is fly ash .

Item A1340. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is fullerene rings.

Item A1341. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is fullerenes.

Item A1342. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is fullerite.

Item A1343. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is functionalized boron nitride.

Item A1344. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is functionalized graphene.

Item A1345. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is fused silica.

Item A1346. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is gallium arsenide.

Item A1347. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is gallium nitride.

Item A1348. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is gedodesic carbon domes.

Item A1349. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is germanium.

Item A1350. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is glass.

Item A1351. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is glass microsphere.

Item A1352. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is glass ribbons.

Item A1353. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is glass spheres.

Item A1354. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is glasses.

Item A1355. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is glassy carbon.

Item A1356. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is glue.

Item A1357. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is gold.

Item A1358. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is gold particles.

Item A1359. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is granular activated carbon.

Item A1360. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is graphane.

Item A1361. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is graphdiyne.

Item A1362. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is graphene.

Item A1363. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is graphite.

Item A1364. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is graphone.

Item A1365. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is hardened steel.

Item A1366. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is high range water reducers.

Item A1367. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is hydrous magnesium silicate.

Item A1368. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is hyperdiamond.

Item A1369. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is hyperdiamonds.

Item A1370. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is imperfect boron nitride.

Item A1371. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is imperfect graphene.

Item A1372. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is intermetallics.

Item A1373. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is ionic crystals.

Item A1374. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is iron.

Item A1375. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is iron oxides.

Item A1376. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is kevlar.

Item A1377. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is lanthanides .

Item A1378. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is lead zirconium titanate.

Item A1379. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is lignin.

Item A1380. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is lignite.

Item A1381. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is lithium niobate.

Item A1382. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is lithium niobates.

Item A1383. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is lonsdaleite.

Item A1384. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is magnesium dihydroxide.

Item A1385. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is magnesium oxide.

Item A1386. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is manganese.

Item A1387. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is melamine sulfonate superplasticisers.

Item A1388. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is metal ions.

Item A1389. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is metal oxide.

Item A1390. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is metallised ceramic.

Item A1391. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is metalloids.

Item A1392. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is metals.

Item A1393. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is mica.

Item A1394. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is mineral.

Item A1395. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is mineral admixtures.

Item A1396. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is molybdenum.

Item A1397. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is montmorillonite nanoclays.

Item A1398. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is multi-layer boron nitride.

Item A1399. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is multi-layer graphene.

Item A1400. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is nanochain.

Item A1401. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is nanocrystal.

Item A1402. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is nanowire.

Item A1403. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is naphthalene.

Item A1404. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is Natural pozzolans (such as the volcanic ash used in Roman concrete).

Item A1405. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is NH₂-functionalized graphene.

Item A1406. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is nickel.

Item A1407. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is non-covalent crystal.

Item A1408. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is nylon.

Item A1409. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is OH-functionalized graphene.

Item A1410. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is palladium.

Item A1411. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is pencil lead.

Item A1412. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is perfect boron nitride.

Item A1413. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is perfect graphene.

Item A1414. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is plasticizers .

Item A1415. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is platinum.

Item A1416. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is platinum group metals.

Item A1417. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is post-transition metals.

Item A1418. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is powdered activated carbon.

Item A1419. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is pozzolans and other cementitious materials .

Item A1420. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is prismane.

Item A1421. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is pristine boron nitride.

Item A1422. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is pristine graphene.

Item A1423. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is pyrolytic graphite.

Item A1424. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is quantum dots.

Item A1425. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is rare earth elements.

Item A1426. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is reduced boron nitride oxide.

Item A1427. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is reduced graphene oxide.

Item A1428. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is reduced graphyne.

Item A1429. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is rubber.

Item A1430. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is s-glass.

Item A1431. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is sapphire.

Item A1432. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is set accelerators.

Item A1433. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is set retarders.

Item A1434. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is shrinkage control admixtures.

Item A1435. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is silica.

Item A1436. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is silica fume.

Item A1437. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is silica gel.

Item A1438. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is silicon.

Item A1439. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is silicon carbide.

Item A1440. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is silicon dioxide.

Item A1441. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is silicon nitride.

Item A1442. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is silicon nitrides (bulk and thin film).

Item A1443. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is silver.

Item A1444. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is single-layer boron nitride.

Item A1445. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is single-layer graphene.

Item A1446. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is sol-gel.

Item A1447. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is soot.

Item A1448. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is steel.

Item A1449. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is steel fibers.

Item A1450. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is superplasticizer .

Item A1451. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is superplasticizers.

Item A1452. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is talc.

Item A1453. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is tantalum.

Item A1454. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is thiol-functionalized graphene.

Item A1455. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is titanium.

Item A1456. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is titanium oxide.

Item A1457. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is tooth cementum.

Item A1458. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is tooth dentine.

Item A1459. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is tooth enamel.

Item A1460. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is transition metals.

Item A1461. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is triple-layer boron nitride.

Item A1462. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is triple-layer graphene.

Item A1463. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is tungsten.

Item A1464. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is tungsten carbide.

Item A1465. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is ultrahard fullerite.

Item A1466. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is water reducers.

Item A1467. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is wood.

Item A1468. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is zinc oxide.

Item A1469. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall carbon nanotube and the second structural entity is zirconia.

Item A1470. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is a carbon fibre.

Item A1471. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is boron nitride.

Item A1472. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is a ceramic.

Item A1473. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is graphene.

Item A1474. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is a metal.

Item A1475. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is a nucleic acid.

Item A1476. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is a polypeptide.

Item A1477. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is a cathode.

Item A1478. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is a metalised dielectric.

Item A1479. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is a peptide.

Item A1480. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is a protein.

Item A1481. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is a semiconductor.

Item A1482. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is a sensor.

Item A1483. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is aluminium.

Item A1484. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is an anode.

Item A1485. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is an antibody.

Item A1486. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is electrode.

Item A1487. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is boron nitride.

Item A1488. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is buckyball.

Item A1489. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is carbon nanofibres.

Item A1490. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is concrete.

Item A1491. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is glass fibre.

Item A1492. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is graphene oxide.

Item A1493. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is graphyne.

Item A1494. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is stainless steel.

Item A1495. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is a cathode.

Item A1496. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is a carbon polymer.

Item A1497. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is (Ag) silver.

Item A1498. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is (Al) aluminium.

Item A1499. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is (Au) gold.

Item A1500. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is (Cr) chromium.

Item A1501. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is (Cu) copper.

Item A1502. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is (Fe) steel and stainless steel.

Item A1503. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is (Mn) manganese.

Item A1504. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is (Mo) molybdenum.

Item A1505. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is (Ni) nickel.

Item A1506. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is (Pd) palladium.

Item A1507. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is (Pt) platinum.

Item A1508. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is (Ta) tantalum.

Item A1509. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is (Ti) titanium.

Item A1510. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is (W) Tungsten.

Item A1511. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is a battery.

Item A1512. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is a borosilicate.

Item A1513. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is a buckyball.

Item A1514. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is a buckytube.

Item A1515. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is a capacitor.

Item A1516. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is a carbon dome.

Item A1517. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is a carbon megatube.

Item A1518. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is a carbon nanofibre.

Item A1519. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is a carbon nanofoam.

Item A1520. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is a carbon nanothread.

Item A1521. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is a catalyst.

Item A1522. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is a ceramic material.

Item A1523. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is a composite material.

Item A1524. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is a conductor.

Item A1525. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is a covalent crystal.

Item A1526. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is a crystal.

Item A1527. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is a crystalline material.

Item A1528. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is a defect-free graphene sheet.

Item A1529. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is a dielectric material.

Item A1530. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is a diode.

Item A1531. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is a dodecahedrane.

Item A1532. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is a doped glass.

Item A1533. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is a fibre.

Item A1534. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is a fullerite.

Item A1535. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is a fused silica.

Item A1536. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is a glass fibre.

Item A1537. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is a glue.

Item A1538. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is a green ceramic.

Item A1539. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is a lanthanides.

Item A1540. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is a machinable ceramic.

Item A1541. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is a metal alloy.

Item A1542. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is a metallised ceramic.

Item A1543. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is a metalloid.

Item A1544. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is a mineral.

Item A1545. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is a non-covalent crystal.

Item A1546. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is a piezoelectric material.

Item A1547. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is a platinum group metal.

Item A1548. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is a post-transition metal.

Item A1549. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is a rare earth element.

Item A1550. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is a sapphire.

Item A1551. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is a silicon nitride.

Item A1552. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is a single crystal fiber.

Item A1553. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is a sol-gel.

Item A1554. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is a synthetic diamond.

Item A1555. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is a transition metal.

Item A1556. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is a tungsten carbide.

Item A1557. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is actinides.

Item A1558. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is activated carbon.

Item A1559. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is aggregated diamonds.

Item A1560. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is air entrainers.

Item A1561. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is alkali-silica reactivity inhibitors.

Item A1562. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is alloys.

Item A1563. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is alumina.

Item A1564. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is alumina trihydrate.

Item A1565. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is aluminum boride.

Item A1566. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is aluminum fibers.

Item A1567. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is aluminum oxide.

Item A1568. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is aluminum trihydroxide.

Item A1569. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is amalgams.

Item A1570. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is amorphous carbon.

Item A1571. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is actinides.

Item A1572. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is an amalgam.

Item A1573. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is an endohedral fullerene.

Item A1574. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is an insulator.

Item A1575. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is an intermetallic.

Item A1576. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is an ionic crystal.

Item A1577. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is an organic material.

Item A1578. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is anthracite.

Item A1579. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is aramid.

Item A1580. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is asbestos .

Item A1581. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is barium .

Item A1582. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is bone.

Item A1583. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is boron.

Item A1584. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is boron nitride nanoscroll,.

Item A1585. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is boron nitride oxide.

Item A1586. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is brass.

Item A1587. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is brass fibers.

Item A1588. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is buckminsterfullerene.

Item A1589. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is bucky paper.

Item A1590. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is buckyball clusters.

Item A1591. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is buckypaper.

Item A1592. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is buckytube.

Item A1593. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is calcium carbonite.

Item A1594. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is calcium metasilicate.

Item A1595. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is calcium sulfate.

Item A1596. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is calcium sulphate.

Item A1597. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is carbon black.

Item A1598. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is carbon fiber.

Item A1599. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is carbon fibers.

Item A1600. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is carbon megatubes.

Item A1601. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is carbon nano-onions.

Item A1602. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is carbon nanobuds.

Item A1603. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is carbon nanofiber.

Item A1604. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is carbon nanofoam.

Item A1605. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is carbon nanothread.

Item A1606. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is carbon/diamond nanothread.

Item A1607. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is cellulose fibers.

Item A1608. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is cellulose nanofibers (e.g. curran).

Item A1609. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is cellulose nanowhiskers.

Item A1610. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is chemical admixtures .

Item A1611. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is chlorographene.

Item A1612. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is chromium.

Item A1613. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is clay.

Item A1614. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is coal.

Item A1615. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is coated boron nitride.

Item A1616. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is coated graphene.

Item A1617. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is coloring admixtures.

Item A1618. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is composite materials.

Item A1619. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is concrete admixtures .

Item A1620. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is COOH-functionalized graphene.

Item A1621. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is copper.

Item A1622. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is corrosion inhibitors.

Item A1623. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is covalent crystals.

Item A1624. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is crystal.

Item A1625. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is crystalline materials.

Item A1626. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is diamond.

Item A1627. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is diamond-like carbon.

Item A1628. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is dispersants. .

Item A1629. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is dodecahedrane.

Item A1630. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is double-layer boron nitride.

Item A1631. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is double-layer graphene.

Item A1632. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is e-glass.

Item A1633. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is elastomers.

Item A1634. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is endohedral fullerenes.

Item A1635. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is exfoliated graphite.

Item A1636. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is exfoliated silicate.

Item A1637. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is extruded activated carbon.

Item A1638. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is fibres.

Item A1639. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is flourinated boron nitride.

Item A1640. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is flourinated graphene.

Item A1641. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is fluorographene.

Item A1642. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is fly ash .

Item A1643. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is fullerene rings.

Item A1644. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is fullerenes.

Item A1645. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is fullerite.

Item A1646. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is functionalized boron nitride.

Item A1647. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is functionalized graphene.

Item A1648. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is fused silica.

Item A1649. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is gallium arsenide.

Item A1650. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is gallium nitride.

Item A1651. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is gedodesic carbon domes.

Item A1652. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is germanium.

Item A1653. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is glass.

Item A1654. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is glass microsphere.

Item A1655. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is glass ribbons.

Item A1656. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is glass spheres.

Item A1657. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is glasses.

Item A1658. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is glassy carbon.

Item A1659. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is glue.

Item A1660. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is gold.

Item A1661. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is gold particles.

Item A1662. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is granular activated carbon.

Item A1663. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is graphane.

Item A1664. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is graphdiyne.

Item A1665. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is graphene.

Item A1666. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is graphite.

Item A1667. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is graphone.

Item A1668. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is hardened steel.

Item A1669. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is high range water reducers.

Item A1670. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is hydrous magnesium silicate.

Item A1671. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is hyperdiamond.

Item A1672. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is hyperdiamonds.

Item A1673. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is imperfect boron nitride.

Item A1674. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is imperfect graphene.

Item A1675. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is intermetallics.

Item A1676. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is ionic crystals.

Item A1677. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is iron.

Item A1678. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is iron oxides.

Item A1679. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is kevlar.

Item A1680. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is lanthanides .

Item A1681. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is lead zirconium titanate.

Item A1682. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is lignin.

Item A1683. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is lignite.

Item A1684. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is lithium niobate.

Item A1685. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is lithium niobates.

Item A1686. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is lonsdaleite.

Item A1687. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is magnesium dihydroxide.

Item A1688. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is magnesium oxide.

Item A1689. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is manganese.

Item A1690. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is melamine sulfonate superplasticisers.

Item A1691. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is metal ions.

Item A1692. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is metal oxide.

Item A1693. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is metallised ceramic.

Item A1694. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is metalloids.

Item A1695. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is metals.

Item A1696. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is mica.

Item A1697. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is mineral.

Item A1698. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is mineral admixtures.

Item A1699. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is molybdenum.

Item A1700. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is montmorillonite nanoclays.

Item A1701. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is multi-layer boron nitride.

Item A1702. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is multi-layer graphene.

Item A1703. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is nanochain.

Item A1704. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is nanocrystal.

Item A1705. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is nanowire.

Item A1706. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is naphthalene.

Item A1707. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is Natural pozzolans (such as the volcanic ash used in Roman concrete).

Item A1708. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is NH₂-functionalized graphene.

Item A1709. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is nickel.

Item A1710. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is non-covalent crystal.

Item A1711. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is nylon.

Item A1712. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is OH-functionalized graphene.

Item A1713. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is palladium.

Item A1714. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is pencil lead.

Item A1715. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is perfect boron nitride.

Item A1716. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is perfect graphene.

Item A1717. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is plasticizers .

Item A1718. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is platinum.

Item A1719. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is platinum group metals.

Item A1720. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is post-transition metals.

Item A1721. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is powdered activated carbon.

Item A1722. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is pozzolans and other cementitious materials .

Item A1723. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is prismane.

Item A1724. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is pristine boron nitride.

Item A1725. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is pristine graphene.

Item A1726. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is pyrolytic graphite.

Item A1727. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is quantum dots.

Item A1728. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is rare earth elements.

Item A1729. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is reduced boron nitride oxide.

Item A1730. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is reduced graphene oxide.

Item A1731. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is reduced graphyne.

Item A1732. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is rubber.

Item A1733. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is s-glass.

Item A1734. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is sapphire.

Item A1735. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is set accelerators.

Item A1736. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is set retarders.

Item A1737. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is shrinkage control admixtures.

Item A1738. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is silica.

Item A1739. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is silica fume.

Item A1740. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is silica gel.

Item A1741. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is silicon.

Item A1742. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is silicon carbide.

Item A1743. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is silicon dioxide.

Item A1744. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is silicon nitride.

Item A1745. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is silicon nitrides (bulk and thin film).

Item A1746. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is silver.

Item A1747. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is single-layer boron nitride.

Item A1748. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is single-layer graphene.

Item A1749. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is sol-gel.

Item A1750. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is soot.

Item A1751. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is steel.

Item A1752. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is steel fibers.

Item A1753. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is superplasticizer .

Item A1754. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is superplasticizers.

Item A1755. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is talc.

Item A1756. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is tantalum.

Item A1757. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is thiol-functionalized graphene.

Item A1758. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is titanium.

Item A1759. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is titanium oxide.

Item A1760. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is tooth cementum.

Item A1761. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is tooth dentine.

Item A1762. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is tooth enamel.

Item A1763. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is transition metals.

Item A1764. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is triple-layer boron nitride.

Item A1765. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is triple-layer graphene.

Item A1766. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is tungsten.

Item A1767. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is tungsten carbide.

Item A1768. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is ultrahard fullerite.

Item A1769. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is water reducers.

Item A1770. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is wood.

Item A1771. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is zinc oxide.

Item A1772. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall carbon nanotube and the second structural entity is zirconia.

Item A1773. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is a carbon fibre.

Item A1774. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is boron nitride.

Item A1775. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is a ceramic.

Item A1776. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is graphene.

Item A1777. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is a metal.

Item A1778. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is a nucleic acid.

Item A1779. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is a polypeptide.

Item A1780. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is a cathode.

Item A1781. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is a metalised dielectric.

Item A1782. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is a peptide.

Item A1783. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is a protein.

Item A1784. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is a semiconductor.

Item A1785. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is a sensor.

Item A1786. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is aluminium.

Item A1787. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is an anode.

Item A1788. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is an antibody.

Item A1789. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is electrode.

Item A1790. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is boron nitride.

Item A1791. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is buckyball.

Item A1792. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is carbon nanofibres.

Item A1793. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is concrete.

Item A1794. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is glass fibre.

Item A1795. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is graphene oxide.

Item A1796. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is graphyne.

Item A1797. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is stainless steel.

Item A1798. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is a cathode.

Item A1799. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is a carbon polymer.

Item A1800. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is (Ag) silver.

Item A1801. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is (Al) aluminium.

Item A1802. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is (Au) gold.

Item A1803. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is (Cr) chromium.

Item A1804. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is (Cu) copper.

Item A1805. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is (Fe) steel and stainless steel.

Item A1806. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is (Mn) manganese.

Item A1807. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is (Mo) molybdenum.

Item A1808. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is (Ni) nickel.

Item A1809. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is (Pd) palladium.

Item A1810. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is (Pt) platinum.

Item A1811. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is (Ta) tantalum.

Item A1812. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is (Ti) titanium.

Item A1813. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is (Wo) Tungsten.

Item A1814. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is a battery.

Item A1815. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is a borosilicate.

Item A1816. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is a buckyball.

Item A1817. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is a buckytube.

Item A1818. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is a capacitor.

Item A1819. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is a carbon dome.

Item A1820. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is a carbon megatube.

Item A1821. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is a carbon nanofibre.

Item A1822. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is a carbon nanofoam.

Item A1823. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is a carbon nanothread.

Item A1824. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is a catalyst.

Item A1825. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is a ceramic material.

Item A1826. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is a composite material.

Item A1827. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is a conductor.

Item A1828. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is a covalent crystal.

Item A1829. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is a crystal.

Item A1830. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is a crystalline material.

Item A1831. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is a defect-free graphene sheet.

Item A1832. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is a dielectric material.

Item A1833. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is a diode.

Item A1834. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is a dodecahedrane.

Item A1835. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is a doped glass.

Item A1836. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is a fibre.

Item A1837. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is a fullerite.

Item A1838. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is a fused silica.

Item A1839. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is a glass fibre.

Item A1840. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is a glue.

Item A1841. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is a green ceramic.

Item A1842. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is a lanthanides.

Item A1843. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is a machinable ceramic.

Item A1844. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is a metal alloy.

Item A1845. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is a metallised ceramic.

Item A1846. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is a metalloid.

Item A1847. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is a mineral.

Item A1848. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is a non-covalent crystal.

Item A1849. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is a piezoelectric material.

Item A1850. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is a platinum group metal.

Item A1851. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is a post-transition metal.

Item A1852. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is a rare earth element.

Item A1853. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is a sapphire.

Item A1854. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is a silicon nitride.

Item A1855. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is a single crystal fiber.

Item A1856. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is a sol-gel.

Item A1857. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is a synthetic diamond.

Item A1858. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is a transition metal.

Item A1859. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is a tungsten carbide.

Item A1860. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is actinides.

Item A1861. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is activated carbon.

Item A1862. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is aggregated diamonds.

Item A1863. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is air entrainers.

Item A1864. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is alkali-silica reactivity inhibitors.

Item A1865. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is alloys.

Item A1866. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is alumina.

Item A1867. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is alumina trihydrate.

Item A1868. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is aluminum boride.

Item A1869. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is aluminum fibers.

Item A1870. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is aluminum oxide.

Item A1871. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is aluminum trihydroxide.

Item A1872. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is amalgams.

Item A1873. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is amorphous carbon.

Item A1874. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is actinides.

Item A1875. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is an amalgam.

Item A1876. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is an endohedral fullerene.

Item A1877. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is an insulator.

Item A1878. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is an intermetallic.

Item A1879. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is an ionic crystal.

Item A1880. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is an organic material.

Item A1881. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is anthracite.

Item A1882. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is aramid.

Item A1883. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is asbestos .

Item A1884. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is barium .

Item A1885. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is bone.

Item A1886. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is boron.

Item A1887. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is boron nitride nanoscroll,.

Item A1888. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is boron nitride oxide.

Item A1889. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is brass.

Item A1890. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is brass fibers.

Item A1891. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is buckminsterfullerene.

Item A1892. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is bucky paper.

Item A1893. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is buckyball clusters.

Item A1894. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is buckypaper.

Item A1895. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is buckytube.

Item A1896. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is calcium carbonite.

Item A1897. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is calcium metasilicate.

Item A1898. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is calcium sulfate.

Item A1899. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is calcium sulphate.

Item A1900. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is carbon black.

Item A1901. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is carbon fiber.

Item A1902. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is carbon fibers.

Item A1903. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is carbon megatubes.

Item A1904. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is carbon nano-onions.

Item A1905. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is carbon nanobuds.

Item A1906. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is carbon nanofiber.

Item A1907. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is carbon nanofoam.

Item A1908. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is carbon nanothread.

Item A1909. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is carbon/diamond nanothread.

Item A1910. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is cellulose fibers.

Item A1911. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is cellulose nanofibers (e.g. curran).

Item A1912. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is cellulose nanowhiskers.

Item A1913. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is chemical admixtures .

Item A1914. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is chlorographene.

Item A1915. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is chromium.

Item A1916. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is clay.

Item A1917. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is coal.

Item A1918. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is coated boron nitride.

Item A1919. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is coated graphene.

Item A1920. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is coloring admixtures.

Item A1921. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is composite materials.

Item A1922. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is concrete admixtures .

Item A1923. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is COOH-functionalized graphene.

Item A1924. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is copper.

Item A1925. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is corrosion inhibitors.

Item A1926. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is covalent crystals.

Item A1927. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is crystal.

Item A1928. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is crystalline materials.

Item A1929. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is diamond.

Item A1930. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is diamond-like carbon.

Item A1931. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is dispersants. .

Item A1932. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is dodecahedrane.

Item A1933. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is double-layer boron nitride.

Item A1934. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is double-layer graphene.

Item A1935. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is e-glass.

Item A1936. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is elastomers.

Item A1937. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is endohedral fullerenes.

Item A1938. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is exfoliated graphite.

Item A1939. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is exfoliated silicate.

Item A1940. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is extruded activated carbon.

Item A1941. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is fibres.

Item A1942. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is flourinated boron nitride.

Item A1943. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is flourinated graphene.

Item A1944. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is fluorographene.

Item A1945. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is fly ash .

Item A1946. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is fullerene rings.

Item A1947. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is fullerenes.

Item A1948. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is fullerite.

Item A1949. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is functionalized boron nitride.

Item A1950. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is functionalized graphene.

Item A1951. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is fused silica.

Item A1952. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is gallium arsenide.

Item A1953. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is gallium nitride.

Item A1954. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is gedodesic carbon domes.

Item A1955. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is germanium.

Item A1956. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is glass.

Item A1957. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is glass microsphere.

Item A1958. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is glass ribbons.

Item A1959. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is glass spheres.

Item A1960. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is glasses.

Item A1961. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is glassy carbon.

Item A1962. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is glue.

Item A1963. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is gold.

Item A1964. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is gold particles.

Item A1965. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is granular activated carbon.

Item A1966. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is graphane.

Item A1967. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is graphdiyne.

Item A1968. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is graphene.

Item A1969. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is graphite.

Item A1970. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is graphone.

Item A1971. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is hardened steel.

Item A1972. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is high range water reducers.

Item A1973. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is hydrous magnesium silicate.

Item A1974. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is hyperdiamond.

Item A1975. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is hyperdiamonds.

Item A1976. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is imperfect boron nitride.

Item A1977. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is imperfect graphene.

Item A1978. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is intermetallics.

Item A1979. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is ionic crystals.

Item A1980. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is iron.

Item A1981. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is iron oxides.

Item A1982. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is kevlar.

Item A1983. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is lanthanides .

Item A1984. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is lead zirconium titanate.

Item A1985. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is lignin.

Item A1986. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is lignite.

Item A1987. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is lithium niobate.

Item A1988. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is lithium niobates.

Item A1989. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is lonsdaleite.

Item A1990. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is magnesium dihydroxide.

Item A1991. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is magnesium oxide.

Item A1992. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is manganese.

Item A1993. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is melamine sulfonate superplasticisers.

Item A1994. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is metal ions.

Item A1995. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is metal oxide.

Item A1996. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is metallised ceramic.

Item A1997. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is metalloids.

Item A1998. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is metals.

Item A1999. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is mica.

Item A2000. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is mineral.

Item A2001. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is mineral admixtures.

Item A2002. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is molybdenum.

Item A2003. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is montmorillonite nanoclays.

Item A2004. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is multi-layer boron nitride.

Item A2005. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is multi-layer graphene.

Item A2006. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is nanochain.

Item A2007. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is nanocrystal.

Item A2008. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is nanowire.

Item A2009. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is naphthalene.

Item A2010. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is Natural pozzolans (such as the volcanic ash used in Roman concrete).

Item A2011. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is NH₂-functionalized graphene.

Item A2012. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is nickel.

Item A2013. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is non-covalent crystal.

Item A2014. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is nylon.

Item A2015. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is OH-functionalized graphene.

Item A2016. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is palladium.

Item A2017. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is pencil lead.

Item A2018. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is perfect boron nitride.

Item A2019. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is perfect graphene.

Item A2020. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is plasticizers .

Item A2021. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is platinum.

Item A2022. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is platinum group metals.

Item A2023. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is post-transition metals.

Item A2024. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is powdered activated carbon.

Item A2025. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is pozzolans and other cementitious materials .

Item A2026. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is prismane.

Item A2027. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is pristine boron nitride.

Item A2028. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is pristine graphene.

Item A2029. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is pyrolytic graphite.

Item A2030. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is quantum dots.

Item A2031. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is rare earth elements.

Item A2032. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is reduced boron nitride oxide.

Item A2033. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is reduced graphene oxide.

Item A2034. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is reduced graphyne.

Item A2035. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is rubber.

Item A2036. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is s-glass.

Item A2037. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is sapphire.

Item A2038. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is set accelerators.

Item A2039. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is set retarders.

Item A2040. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is shrinkage control admixtures.

Item A2041. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is silica.

Item A2042. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is silica fume.

Item A2043. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is silica gel.

Item A2044. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is silicon.

Item A2045. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is silicon carbide.

Item A2046. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is silicon dioxide.

Item A2047. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is silicon nitride.

Item A2048. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is silicon nitrides (bulk and thin film).

Item A2049. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is silver.

Item A2050. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is single-layer boron nitride.

Item A2051. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is single-layer graphene.

Item A2052. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is sol-gel.

Item A2053. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is soot.

Item A2054. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is steel.

Item A2055. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is steel fibers.

Item A2056. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is superplasticizer .

Item A2057. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is superplasticizers.

Item A2058. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is talc.

Item A2059. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is tantalum.

Item A2060. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is thiol-functionalized graphene.

Item A2061. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is titanium.

Item A2062. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is titanium oxide.

Item A2063. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is tooth cementum.

Item A2064. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is tooth dentine.

Item A2065. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is tooth enamel.

Item A2066. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is transition metals.

Item A2067. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is triple-layer boron nitride.

Item A2068. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is triple-layer graphene.

Item A2069. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is tungsten.

Item A2070. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is tungsten carbide.

Item A2071. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is ultrahard fullerite.

Item A2072. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is water reducers.

Item A2073. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is wood.

Item A2074. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is zinc oxide.

Item A2075. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a metallic carbon nanotube and the second structural entity is zirconia.

Item A2076. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is a carbon fibre.

Item A2077. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is boron nitride.

Item A2078. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is a ceramic.

Item A2079. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is graphene.

Item A2080. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is a metal.

Item A2081. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is a nucleic acid.

Item A2082. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is a polypeptide.

Item A2083. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is a cathode.

Item A2084. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is a metalised dielectric.

Item A2085. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is a peptide.

Item A2086. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is a protein.

Item A2087. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is a semiconductor.

Item A2088. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is a sensor.

Item A2089. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is aluminium.

Item A2090. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is an anode.

Item A2091. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is an antibody.

Item A2092. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is electrode.

Item A2093. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is boron nitride.

Item A2094. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is buckyball.

Item A2095. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is carbon nanofibres.

Item A2096. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is concrete.

Item A2097. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is glass fibre.

Item A2098. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is graphene oxide.

Item A2099. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is graphyne.

Item A2100. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is stainless steel.

Item A2101. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is a cathode.

Item A2102. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is a carbon polymer.

Item A2103. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is (Ag) silver.

Item A2104. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is (Al) aluminium.

Item A2105. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is (Au) gold.

Item A2106. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is (Cr) chromium.

Item A2107. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is (Cu) copper.

Item A2108. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is (Fe) steel and stainless steel.

Item A2109. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is (Mn) manganese.

Item A2110. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is (Mo) molybdenum.

Item A2111. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is (Ni) nickel.

Item A2112. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is (Pd) palladium.

Item A2113. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is (Pt) platinum.

Item A2114. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is (Ta) tantalum.

Item A2115. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is (Ti) titanium.

Item A2116. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is (W) Tungsten.

Item A2117. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is a battery.

Item A2118. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is a borosilicate.

Item A2119. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is a buckyball.

Item A2120. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is a buckytube.

Item A2121. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is a capacitor.

Item A2122. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is a carbon dome.

Item A2123. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is a carbon megatube.

Item A2124. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is a carbon nanofibre.

Item A2125. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is a carbon nanofoam.

Item A2126. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is a carbon nanothread.

Item A2127. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is a catalyst.

Item A2128. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is a ceramic material.

Item A2129. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is a composite material.

Item A2130. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is a conductor.

Item A2131. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is a covalent crystal.

Item A2132. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is a crystal.

Item A2133. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is a crystalline material.

Item A2134. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is a defect-free graphene sheet.

Item A2135. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is a dielectric material.

Item A2136. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is a diode.

Item A2137. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is a dodecahedrane.

Item A2138. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is a doped glass.

Item A2139. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is a fibre.

Item A2140. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is a fullerite.

Item A2141. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is a fused silica.

Item A2142. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is a glass fibre.

Item A2143. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is a glue.

Item A2144. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is a green ceramic.

Item A2145. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is a lanthanides.

Item A2146. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is a machinable ceramic.

Item A2147. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is a metal alloy.

Item A2148. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is a metallised ceramic.

Item A2149. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is a metalloid.

Item A2150. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is a mineral.

Item A2151. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is a non-covalent crystal.

Item A2152. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is a piezoelectric material.

Item A2153. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is a platinum group metal.

Item A2154. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is a post-transition metal.

Item A2155. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is a rare earth element.

Item A2156. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is a sapphire.

Item A2157. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is a silicon nitride.

Item A2158. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is a single crystal fiber.

Item A2159. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is a sol-gel.

Item A2160. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is a synthetic diamond.

Item A2161. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is a transition metal.

Item A2162. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is a tungsten carbide.

Item A2163. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is actinides.

Item A2164. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is activated carbon.

Item A2165. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is aggregated diamonds.

Item A2166. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is air entrainers.

Item A2167. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is alkali-silica reactivity inhibitors.

Item A2168. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is alloys.

Item A2169. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is alumina.

Item A2170. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is alumina trihydrate.

Item A2171. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is aluminum boride.

Item A2172. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is aluminum fibers.

Item A2173. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is aluminum oxide.

Item A2174. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is aluminum trihydroxide.

Item A2175. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is amalgams.

Item A2176. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is amorphous carbon.

Item A2177. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is actinides.

Item A2178. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is an amalgam.

Item A2179. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is an endohedral fullerene.

Item A2180. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is an insulator.

Item A2181. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is an intermetallic.

Item A2182. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is an ionic crystal.

Item A2183. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is an organic material.

Item A2184. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is anthracite.

Item A2185. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is aramid.

Item A2186. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is asbestos .

Item A2187. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is barium .

Item A2188. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is bone.

Item A2189. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is boron.

Item A2190. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is boron nitride nanoscroll,.

Item A2191. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is boron nitride oxide.

Item A2192. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is brass.

Item A2193. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is brass fibers.

Item A2194. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is buckminsterfullerene.

Item A2195. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is bucky paper.

Item A2196. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is buckyball clusters.

Item A2197. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is buckypaper.

Item A2198. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is buckytube.

Item A2199. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is calcium carbonate.

Item A2200. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is calcium metasilicate.

Item A2201. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is calcium sulfate.

Item A2202. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is calcium sulphate.

Item A2203. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is carbon black.

Item A2204. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is carbon fiber.

Item A2205. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is carbon fibers.

Item A2206. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is carbon megatubes.

Item A2207. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is carbon nano-onions.

Item A2208. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is carbon nanobuds.

Item A2209. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is carbon nanofiber.

Item A2210. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is carbon nanofoam.

Item A2211. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is carbon nanothread.

Item A2212. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is carbon/diamond nanothread.

Item A2213. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is cellulose fibers.

Item A2214. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is cellulose nanofibers (e.g. curran).

Item A2215. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is cellulose nanowhiskers.

Item A2216. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is chemical admixtures .

Item A2217. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is chlorographene.

Item A2218. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is chromium.

Item A2219. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is clay.

Item A2220. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is coal.

Item A2221. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is coated boron nitride.

Item A2222. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is coated graphene.

Item A2223. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is coloring admixtures.

Item A2224. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is composite materials.

Item A2225. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is concrete admixtures .

Item A2226. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is COOH-functionalized graphene.

Item A2227. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is copper.

Item A2228. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is corrosion inhibitors.

Item A2229. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is covalent crystals.

Item A2230. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is crystal.

Item A2231. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is crystalline materials.

Item A2232. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is diamond.

Item A2233. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is diamond-like carbon.

Item A2234. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is dispersants. .

Item A2235. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is dodecahedrane.

Item A2236. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is double-layer boron nitride.

Item A2237. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is double-layer graphene.

Item A2238. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is e-glass.

Item A2239. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is elastomers.

Item A2240. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is endohedral fullerenes.

Item A2241. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is exfoliated graphite.

Item A2242. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is exfoliated silicate.

Item A2243. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is extruded activated carbon.

Item A2244. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is fibres.

Item A2245. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is flourinated boron nitride.

Item A2246. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is flourinated graphene.

Item A2247. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is fluorographene.

Item A2248. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is fly ash .

Item A2249. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is fullerene rings.

Item A2250. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is fullerenes.

Item A2251. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is fullerite.

Item A2252. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is functionalized boron nitride.

Item A2253. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is functionalized graphene.

Item A2254. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is fused silica.

Item A2255. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is gallium arsenide.

Item A2256. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is gallium nitride.

Item A2257. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is gedodesic carbon domes.

Item A2258. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is germanium.

Item A2259. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is glass.

Item A2260. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is glass microsphere.

Item A2261. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is glass ribbons.

Item A2262. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is glass spheres.

Item A2263. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is glasses.

Item A2264. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is glassy carbon.

Item A2265. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is glue.

Item A2266. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is gold.

Item A2267. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is gold particles.

Item A2268. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is granular activated carbon.

Item A2269. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is graphene.

Item A2270. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is graphdiyne.

Item A2271. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is graphene.

Item A2272. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is graphite.

Item A2273. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is graphone.

Item A2274. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is hardened steel.

Item A2275. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is high range water reducers.

Item A2276. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is hydrous magnesium silicate.

Item A2277. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is hyperdiamond.

Item A2278. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is hyperdiamonds.

Item A2279. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is imperfect boron nitride.

Item A2280. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is imperfect graphene.

Item A2281. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is intermetallics.

Item A2282. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is ionic crystals.

Item A2283. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is iron.

Item A2284. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is iron oxides.

Item A2285. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is kevlar.

Item A2286. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is lanthanides .

Item A2287. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is lead zirconium titanate.

Item A2288. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is lignin.

Item A2289. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is lignite.

Item A2290. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is lithium niobate.

Item A2291. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is lithium niobates.

Item A2292. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is lonsdaleite.

Item A2293. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is magnesium dihydroxide.

Item A2294. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is magnesium oxide.

Item A2295. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is manganese.

Item A2296. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is melamine sulfonate superplasticisers.

Item A2297. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is metal ions.

Item A2298. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is metal oxide.

Item A2299. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is metallised ceramic.

Item A2300. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is metalloids.

Item A2301. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is metals.

Item A2302. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is mica.

Item A2303. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is mineral.

Item A2304. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is mineral admixtures.

Item A2305. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is molybdenum.

Item A2306. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is montmorillonite nanoclays.

Item A2307. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is multi-layer boron nitride.

Item A2308. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is multi-layer graphene.

Item A2309. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is nanochain.

Item A2310. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is nanocrystal.

Item A2311. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is nanowire.

Item A2312. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is naphthalene.

Item A2313. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is Natural pozzolans (such as the volcanic ash used in Roman concrete).

Item A2314. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is NH₂-functionalized graphene.

Item A2315. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is nickel.

Item A2316. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is non-covalent crystal.

Item A2317. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is nylon.

Item A2318. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is OH-functionalized graphene.

Item A2319. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is palladium.

Item A2320. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is pencil lead.

Item A2321. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is perfect boron nitride.

Item A2322. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is perfect graphene.

Item A2323. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is plasticizers .

Item A2324. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is platinum.

Item A2325. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is platinum group metals.

Item A2326. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is post-transition metals.

Item A2327. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is powdered activated carbon.

Item A2328. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is pozzolans and other cementitious materials .

Item A2329. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is prismane.

Item A2330. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is pristine boron nitride.

Item A2331. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is pristine graphene.

Item A2332. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is pyrolytic graphite.

Item A2333. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is quantum dots.

Item A2334. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is rare earth elements.

Item A2335. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is reduced boron nitride oxide.

Item A2336. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is reduced graphene oxide.

Item A2337. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is reduced graphyne.

Item A2338. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is rubber.

Item A2339. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is s-glass.

Item A2340. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is sapphire.

Item A2341. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is set accelerators.

Item A2342. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is set retarders.

Item A2343. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is shrinkage control admixtures.

Item A2344. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is silica.

Item A2345. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is silica fume.

Item A2346. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is silica gel.

Item A2347. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is silicon.

Item A2348. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is silicon carbide.

Item A2349. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is silicon dioxide.

Item A2350. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is silicon nitride.

Item A2351. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is silicon nitrides (bulk and thin film).

Item A2352. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is silver.

Item A2353. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is single-layer boron nitride.

Item A2354. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is single-layer graphene.

Item A2355. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is sol-gel.

Item A2356. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is soot.

Item A2357. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is steel.

Item A2358. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is steel fibers.

Item A2359. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is superplasticizer .

Item A2360. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is superplasticizers.

Item A2361. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is talc.

Item A2362. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is tantalum.

Item A2363. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is thiol-functionalized graphene.

Item A2364. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is titanium.

Item A2365. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is titanium oxide.

Item A2366. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is tooth cementum.

Item A2367. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is tooth dentine.

Item A2368. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is tooth enamel.

Item A2369. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is transition metals.

Item A2370. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is triple-layer boron nitride.

Item A2371. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is triple-layer graphene.

Item A2372. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is tungsten.

Item A2373. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is tungsten carbide.

Item A2374. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is ultrahard fullerite.

Item A2375. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is water reducers.

Item A2376. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is wood.

Item A2377. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is zinc oxide.

Item A2378. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a semiconductive carbon nanotube and the second structural entity is zirconia.

Item A2379. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a aluminium nanotube and the second structural entity is a cathode.

Item A2380. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a aluminium nanotube and the second structural entity is a metalised dielectric.

Item A2381. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a aluminium nanotube and the second structural entity is a peptide.

Item A2382. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a aluminium nanotube and the second structural entity is a protein.

Item A2383. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a aluminium nanotube and the second structural entity is a semiconductor.

Item A2384. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a aluminium nanotube and the second structural entity is a sensor.

Item A2385. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a aluminium nanotube and the second structural entity is aluminium.

Item A2386. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a aluminium nanotube and the second structural entity is an anode.

Item A2387. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a aluminium nanotube and the second structural entity is an antibody.

Item A2388. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a aluminium nanotube and the second structural entity is electrode.

Item A2389. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a aluminium nanotube and the second structural entity is boron nitride.

Item A2390. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a aluminium nanotube and the second structural entity is buckyball.

Item A2391. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a aluminium nanotube and the second structural entity is carbon nanofibres.

Item A2392. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a aluminium nanotube and the second structural entity is concrete.

Item A2393. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a aluminium nanotube and the second structural entity is glass fibre.

Item A2394. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a aluminium nanotube and the second structural entity is graphene oxide.

Item A2395. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a aluminium nanotube and the second structural entity is graphyne.

Item A2396. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a aluminium nanotube and the second structural entity is stainless steel.

Item A2397. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a aluminium nanotube and the second structural entity is an organic material.

Item A2398. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a aluminium nanotube and the second structural entity is a capacitor.

Item A2399. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a aluminum nitride nanotube and the second structural entity is a cathode.

Item A2400. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a aluminum nitride nanotube and the second structural entity is a metalised dielectric.

Item A2401. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a aluminum nitride nanotube and the second structural entity is a peptide.

Item A2402. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a aluminum nitride nanotube and the second structural entity is a protein.

Item A2403. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a aluminum nitride nanotube and the second structural entity is a semiconductor.

Item A2404. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a aluminum nitride nanotube and the second structural entity is a sensor.

Item A2405. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a aluminum nitride nanotube and the second structural entity is aluminium.

Item A2406. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a aluminum nitride nanotube and the second structural entity is an anode.

Item A2407. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a aluminum nitride nanotube and the second structural entity is an antibody.

Item A2408. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a aluminum nitride nanotube and the second structural entity is electrode.

Item A2409. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a aluminum nitride nanotube and the second structural entity is boron nitride.

Item A2410. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a aluminum nitride nanotube and the second structural entity is buckyball.

Item A2411. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a aluminum nitride nanotube and the second structural entity is carbon nanofibres.

Item A2412. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a aluminum nitride nanotube and the second structural entity is concrete.

Item A2413. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a aluminum nitride nanotube and the second structural entity is glass fibre.

Item A2414. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a aluminum nitride nanotube and the second structural entity is graphene oxide.

Item A2415. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a aluminum nitride nanotube and the second structural entity is graphyne.

Item A2416. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a aluminum nitride nanotube and the second structural entity is stainless steel.

Item A2417. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a aluminum nitride nanotube and the second structural entity is an organic material.

Item A2418. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a aluminum nitride nanotube and the second structural entity is a capacitor.

Item A2419. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a boron carbon nanotube and the second structural entity is a cathode.

Item A2420. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a boron carbon nanotube and the second structural entity is a metalised dielectric.

Item A2421. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a boron carbon nanotube and the second structural entity is a peptide.

Item A2422. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a boron carbon nanotube and the second structural entity is a protein.

Item A2423. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a boron carbon nanotube and the second structural entity is a semiconductor.

Item A2424. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a boron carbon nanotube and the second structural entity is a sensor.

Item A2425. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a boron carbon nanotube and the second structural entity is aluminium.

Item A2426. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a boron carbon nanotube and the second structural entity is an anode.

Item A2427. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a boron carbon nanotube and the second structural entity is an antibody.

Item A2428. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a boron carbon nanotube and the second structural entity is electrode.

Item A2429. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a boron carbon nanotube and the second structural entity is boron nitride.

Item A2430. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a boron carbon nanotube and the second structural entity is buckyball.

Item A2431. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a boron carbon nanotube and the second structural entity is carbon nanofibres.

Item A2432. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a boron carbon nanotube and the second structural entity is concrete.

Item A2433. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a boron carbon nanotube and the second structural entity is glass fibre.

Item A2434. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a boron carbon nanotube and the second structural entity is graphene oxide.

Item A2435. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a boron carbon nanotube and the second structural entity is graphyne.

Item A2436. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a boron carbon nanotube and the second structural entity is stainless steel.

Item A2437. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a boron carbon nanotube and the second structural entity is an organic material.

Item A2438. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a boron carbon nanotube and the second structural entity is a capacitor.

Item A2439. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a boron nitride nanotube and the second structural entity is a cathode.

Item A2440. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a boron nitride nanotube and the second structural entity is a metalised dielectric.

Item A2441. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a boron nitride nanotube and the second structural entity is a peptide.

Item A2442. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a boron nitride nanotube and the second structural entity is a protein.

Item A2443. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a boron nitride nanotube and the second structural entity is a semiconductor.

Item A2444. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a boron nitride nanotube and the second structural entity is a sensor.

Item A2445. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a boron nitride nanotube and the second structural entity is aluminium.

Item A2446. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a boron nitride nanotube and the second structural entity is an anode.

Item A2447. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a boron nitride nanotube and the second structural entity is an antibody.

Item A2448. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a boron nitride nanotube and the second structural entity is electrode.

Item A2449. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a boron nitride nanotube and the second structural entity is boron nitride.

Item A2450. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a boron nitride nanotube and the second structural entity is buckyball.

Item A2451. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a boron nitride nanotube and the second structural entity is carbon nanofibres.

Item A2452. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a boron nitride nanotube and the second structural entity is concrete.

Item A2453. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a boron nitride nanotube and the second structural entity is glass fibre.

Item A2454. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a boron nitride nanotube and the second structural entity is graphene oxide.

Item A2455. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a boron nitride nanotube and the second structural entity is graphyne.

Item A2456. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a boron nitride nanotube and the second structural entity is stainless steel.

Item A2457. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a boron nitride nanotube and the second structural entity is an organic material.

Item A2458. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a boron nitride nanotube and the second structural entity is a capacitor.

Item A2459. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a gallium nitride nanotube and the second structural entity is a cathode.

Item A2460. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a gallium nitride nanotube and the second structural entity is a metalised dielectric.

Item A2461. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a gallium nitride nanotube and the second structural entity is a peptide.

Item A2462. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a gallium nitride nanotube and the second structural entity is a protein.

Item A2463. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a gallium nitride nanotube and the second structural entity is a semiconductor.

Item A2464. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a gallium nitride nanotube and the second structural entity is a sensor.

Item A2465. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a gallium nitride nanotube and the second structural entity is aluminium.

Item A2466. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a gallium nitride nanotube and the second structural entity is an anode.

Item A2467. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a gallium nitride nanotube and the second structural entity is an antibody.

Item A2468. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a gallium nitride nanotube and the second structural entity is electrode.

Item A2469. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a gallium nitride nanotube and the second structural entity is boron nitride.

Item A2470. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a gallium nitride nanotube and the second structural entity is buckyball.

Item A2471. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a gallium nitride nanotube and the second structural entity is carbon nanofibres.

Item A2472. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a gallium nitride nanotube and the second structural entity is concrete.

Item A2473. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a gallium nitride nanotube and the second structural entity is glass fibre.

Item A2474. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a gallium nitride nanotube and the second structural entity is graphene oxide.

Item A2475. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a gallium nitride nanotube and the second structural entity is graphyne.

Item A2476. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a gallium nitride nanotube and the second structural entity is stainless steel.

Item A2477. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a gallium nitride nanotube and the second structural entity is an organic material.

Item A2478. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a gallium nitride nanotube and the second structural entity is a capacitor.

Item A2479. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a gallium phosphide nanotube and the second structural entity is a cathode.

Item A2480. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a gallium phosphide nanotube and the second structural entity is a metalised dielectric.

Item A2481. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a gallium phosphide nanotube and the second structural entity is a peptide.

Item A2482. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a gallium phosphide nanotube and the second structural entity is a protein.

Item A2483. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a gallium phosphide nanotube and the second structural entity is a semiconductor.

Item A2484. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a gallium phosphide nanotube and the second structural entity is a sensor.

Item A2485. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a gallium phosphide nanotube and the second structural entity is aluminium.

Item A2486. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a gallium phosphide nanotube and the second structural entity is an anode.

Item A2487. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a gallium phosphide nanotube and the second structural entity is an antibody.

Item A2488. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a gallium phosphide nanotube and the second structural entity is electrode.

Item A2489. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a gallium phosphide nanotube and the second structural entity is boron nitride.

Item A2490. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a gallium phosphide nanotube and the second structural entity is buckyball.

Item A2491. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a gallium phosphide nanotube and the second structural entity is carbon nanofibres.

Item A2492. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a gallium phosphide nanotube and the second structural entity is concrete.

Item A2493. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a gallium phosphide nanotube and the second structural entity is glass fibre.

Item A2494. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a gallium phosphide nanotube and the second structural entity is graphene oxide.

Item A2495. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a gallium phosphide nanotube and the second structural entity is graphyne.

Item A2496. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a gallium phosphide nanotube and the second structural entity is stainless steel.

Item A2497. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a gallium phosphide nanotube and the second structural entity is an organic material.

Item A2498. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a gallium phosphide nanotube and the second structural entity is a capacitor.

Item A2499. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a gold nanotube and the second structural entity is a cathode.

Item A2500. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a gold nanotube and the second structural entity is a metalised dielectric.

Item A2501. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a gold nanotube and the second structural entity is a peptide.

Item A2502. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a gold nanotube and the second structural entity is a protein.

Item A2503. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a gold nanotube and the second structural entity is a semiconductor.

Item A2504. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a gold nanotube and the second structural entity is a sensor.

Item A2505. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a gold nanotube and the second structural entity is aluminium.

Item A2506. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a gold nanotube and the second structural entity is an anode.

Item A2507. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a gold nanotube and the second structural entity is an antibody.

Item A2508. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a gold nanotube and the second structural entity is electrode.

Item A2509. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a gold nanotube and the second structural entity is boron nitride.

Item A2510. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a gold nanotube and the second structural entity is buckyball.

Item A2511. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a gold nanotube and the second structural entity is carbon nanofibres.

Item A2512. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a gold nanotube and the second structural entity is concrete.

Item A2513. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a gold nanotube and the second structural entity is glass fibre.

Item A2514. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a gold nanotube and the second structural entity is graphene oxide.

Item A2515. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a gold nanotube and the second structural entity is graphyne.

Item A2516. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a gold nanotube and the second structural entity is stainless steel.

Item A2517. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a gold nanotube and the second structural entity is an organic material.

Item A2518. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a gold nanotube and the second structural entity is a capacitor.

Item A2519. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall nanotube and the second structural entity is a cathode.

Item A2520. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall nanotube and the second structural entity is a metalised dielectric.

Item A2521. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall nanotube and the second structural entity is a peptide.

Item A2522. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall nanotube and the second structural entity is a protein.

Item A2523. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall nanotube and the second structural entity is a semiconductor.

Item A2524. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall nanotube and the second structural entity is a sensor.

Item A2525. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall nanotube and the second structural entity is aluminium.

Item A2526. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall nanotube and the second structural entity is an anode.

Item A2527. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall nanotube and the second structural entity is an antibody.

Item A2528. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall nanotube and the second structural entity is electrode.

Item A2529. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall nanotube and the second structural entity is boron nitride.

Item A2530. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall nanotube and the second structural entity is buckyball.

Item A2531. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall nanotube and the second structural entity is carbon nanofibres.

Item A2532. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall nanotube and the second structural entity is concrete.

Item A2533. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall nanotube and the second structural entity is glass fibre.

Item A2534. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall nanotube and the second structural entity is graphene oxide.

Item A2535. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall nanotube and the second structural entity is graphyne.

Item A2536. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall nanotube and the second structural entity is stainless steel.

Item A2537. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall nanotube and the second structural entity is an organic material.

Item A2538. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a multi wall nanotube and the second structural entity is a capacitor.

Item A2539. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a platinum nanotube and the second structural entity is a cathode.

Item A2540. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a platinum nanotube and the second structural entity is a metalised dielectric.

Item A2541. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a platinum nanotube and the second structural entity is a peptide.

Item A2542. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a platinum nanotube and the second structural entity is a protein.

Item A2543. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a platinum nanotube and the second structural entity is a semiconductor.

Item A2544. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a platinum nanotube and the second structural entity is a sensor.

Item A2545. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a platinum nanotube and the second structural entity is aluminium.

Item A2546. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a platinum nanotube and the second structural entity is an anode.

Item A2547. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a platinum nanotube and the second structural entity is an antibody.

Item A2548. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a platinum nanotube and the second structural entity is electrode.

Item A2549. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a platinum nanotube and the second structural entity is boron nitride.

Item A2550. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a platinum nanotube and the second structural entity is buckyball.

Item A2551. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a platinum nanotube and the second structural entity is carbon nanofibres.

Item A2552. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a platinum nanotube and the second structural entity is concrete.

Item A2553. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a platinum nanotube and the second structural entity is glass fibre.

Item A2554. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a platinum nanotube and the second structural entity is graphene oxide.

Item A2555. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a platinum nanotube and the second structural entity is graphyne.

Item A2556. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a platinum nanotube and the second structural entity is stainless steel.

Item A2557. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a platinum nanotube and the second structural entity is an organic material.

Item A2558. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a platinum nanotube and the second structural entity is a capacitor.

Item A2559. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall nanotube and the second structural entity is a cathode.

Item A2560. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall nanotube and the second structural entity is a metalised dielectric.

Item A2561. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall nanotube and the second structural entity is a peptide.

Item A2562. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall nanotube and the second structural entity is a protein.

Item A2563. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall nanotube and the second structural entity is a semiconductor.

Item A2564. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall nanotube and the second structural entity is a sensor.

Item A2565. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall nanotube and the second structural entity is aluminium.

Item A2566. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall nanotube and the second structural entity is an anode.

Item A2567. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall nanotube and the second structural entity is an antibody.

Item A2568. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall nanotube and the second structural entity is electrode.

Item A2569. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall nanotube and the second structural entity is boron nitride.

Item A2570. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall nanotube and the second structural entity is buckyball.

Item A2571. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall nanotube and the second structural entity is carbon nanofibres.

Item A2572. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall nanotube and the second structural entity is concrete.

Item A2573. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall nanotube and the second structural entity is glass fibre.

Item A2574. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall nanotube and the second structural entity is graphene oxide.

Item A2575. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall nanotube and the second structural entity is graphyne.

Item A2576. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall nanotube and the second structural entity is stainless steel.

Item A2577. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall nanotube and the second structural entity is an organic material.

Item A2578. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a single wall nanotube and the second structural entity is a capacitor.

Item A2579. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a titanium dioxide nanotube and the second structural entity is a cathode.

Item A2580. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a titanium dioxide nanotube and the second structural entity is a metalised dielectric.

Item A2581. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a titanium dioxide nanotube and the second structural entity is a peptide.

Item A2582. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a titanium dioxide nanotube and the second structural entity is a protein.

Item A2583. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a titanium dioxide nanotube and the second structural entity is a semiconductor.

Item A2584. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a titanium dioxide nanotube and the second structural entity is a sensor.

Item A2585. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a titanium dioxide nanotube and the second structural entity is aluminium.

Item A2586. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a titanium dioxide nanotube and the second structural entity is an anode.

Item A2587. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a titanium dioxide nanotube and the second structural entity is an antibody.

Item A2588. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a titanium dioxide nanotube and the second structural entity is electrode.

Item A2589. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a titanium dioxide nanotube and the second structural entity is boron nitride.

Item A2590. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a titanium dioxide nanotube and the second structural entity is buckyball.

Item A2591. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a titanium dioxide nanotube and the second structural entity is carbon nanofibres.

Item A2592. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a titanium dioxide nanotube and the second structural entity is concrete.

Item A2593. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a titanium dioxide nanotube and the second structural entity is glass fibre.

Item A2594. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a titanium dioxide nanotube and the second structural entity is graphene oxide.

Item A2595. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a titanium dioxide nanotube and the second structural entity is graphyne.

Item A2596. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a titanium dioxide nanotube and the second structural entity is stainless steel.

Item A2597. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a titanium dioxide nanotube and the second structural entity is an organic material.

Item A2598. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a titanium dioxide nanotube and the second structural entity is a capacitor.

Item A2599. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a titanium oxide nanotube and the second structural entity is a cathode.

Item A2600. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a titanium oxide nanotube and the second structural entity is a metalised dielectric.

Item A2601. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a titanium oxide nanotube and the second structural entity is a peptide.

Item A2602. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a titanium oxide nanotube and the second structural entity is a protein.

Item A2603. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a titanium oxide nanotube and the second structural entity is a semiconductor.

Item A2604. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a titanium oxide nanotube and the second structural entity is a sensor.

Item A2605. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a titanium oxide nanotube and the second structural entity is aluminium.

Item A2606. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a titanium oxide nanotube and the second structural entity is an anode.

Item A2607. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a titanium oxide nanotube and the second structural entity is an antibody.

Item A2608. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a titanium oxide nanotube and the second structural entity is electrode.

Item A2609. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a titanium oxide nanotube and the second structural entity is boron nitride.

Item A2610. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a titanium oxide nanotube and the second structural entity is buckyball.

Item A2611. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a titanium oxide nanotube and the second structural entity is carbon nanofibres.

Item A2612. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a titanium oxide nanotube and the second structural entity is concrete.

Item A2613. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a titanium oxide nanotube and the second structural entity is glass fibre.

Item A2614. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a titanium oxide nanotube and the second structural entity is graphene oxide.

Item A2615. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a titanium oxide nanotube and the second structural entity is graphyne.

Item A2616. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a titanium oxide nanotube and the second structural entity is stainless steel.

Item A2617. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a titanium oxide nanotube and the second structural entity is an organic material.

Item A2618. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a titanium oxide nanotube and the second structural entity is a capacitor.

Item A2619. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a tungsten disulfide nanotube and the second structural entity is a cathode.

Item A2620. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a tungsten disulfide nanotube and the second structural entity is a metalised dielectric.

Item A2621. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a tungsten disulfide nanotube and the second structural entity is a peptide.

Item A2622. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a tungsten disulfide nanotube and the second structural entity is a protein.

Item A2623. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a tungsten disulfide nanotube and the second structural entity is a semiconductor.

Item A2624. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a tungsten disulfide nanotube and the second structural entity is a sensor.

Item A2625. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a tungsten disulfide nanotube and the second structural entity is aluminium.

Item A2626. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a tungsten disulfide nanotube and the second structural entity is an anode.

Item A2627. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a tungsten disulfide nanotube and the second structural entity is an antibody.

Item A2628. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a tungsten disulfide nanotube and the second structural entity is electrode.

Item A2629. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a tungsten disulfide nanotube and the second structural entity is boron nitride.

Item A2630. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a tungsten disulfide nanotube and the second structural entity is buckyball.

Item A2631. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a tungsten disulfide nanotube and the second structural entity is carbon nanofibres.

Item A2632. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a tungsten disulfide nanotube and the second structural entity is concrete.

Item A2633. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a tungsten disulfide nanotube and the second structural entity is glass fibre.

Item A2634. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a tungsten disulfide nanotube and the second structural entity is graphene oxide.

Item A2635. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a tungsten disulfide nanotube and the second structural entity is graphyne.

Item A2636. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a tungsten disulfide nanotube and the second structural entity is stainless steel.

Item A2637. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a tungsten disulfide nanotube and the second structural entity is an organic material.

Item A2638. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a tungsten disulfide nanotube and the second structural entity is a capacitor.

Item A2639. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a tungsten sulfide nanotube and the second structural entity is a cathode.

Item A2640. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a tungsten sulfide nanotube and the second structural entity is a metalised dielectric.

Item A2641. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a tungsten sulfide nanotube and the second structural entity is a peptide.

Item A2642. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a tungsten sulfide nanotube and the second structural entity is a protein.

Item A2643. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a tungsten sulfide nanotube and the second structural entity is a semiconductor.

Item A2644. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a tungsten sulfide nanotube and the second structural entity is a sensor.

Item A2645. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a tungsten sulfide nanotube and the second structural entity is aluminium.

Item A2646. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a tungsten sulfide nanotube and the second structural entity is an anode.

Item A2647. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a tungsten sulfide nanotube and the second structural entity is an antibody.

Item A2648. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a tungsten sulfide nanotube and the second structural entity is electrode.

Item A2649. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a tungsten sulfide nanotube and the second structural entity is boron nitride.

Item A2650. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a tungsten sulfide nanotube and the second structural entity is buckyball.

Item A2651. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a tungsten sulfide nanotube and the second structural entity is carbon nanofibres.

Item A2652. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a tungsten sulfide nanotube and the second structural entity is concrete.

Item A2653. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a tungsten sulfide nanotube and the second structural entity is glass fibre.

Item A2654. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a tungsten sulfide nanotube and the second structural entity is graphene oxide.

Item A2655. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a tungsten sulfide nanotube and the second structural entity is graphyne.

Item A2656. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a tungsten sulfide nanotube and the second structural entity is stainless steel.

Item A2657. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a tungsten sulfide nanotube and the second structural entity is an organic material.

Item A2658. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a tungsten sulfide nanotube and the second structural entity is a capacitor.

Item A2659. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a zinc ferrite nanotube and the second structural entity is a cathode.

Item A2660. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a zinc ferrite nanotube and the second structural entity is a metalised dielectric.

Item A2661. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a zinc ferrite nanotube and the second structural entity is a peptide.

Item A2662. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a zinc ferrite nanotube and the second structural entity is a protein.

Item A2663. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a zinc ferrite nanotube and the second structural entity is a semiconductor.

Item A2664. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a zinc ferrite nanotube and the second structural entity is a sensor.

Item A2665. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a zinc ferrite nanotube and the second structural entity is aluminium.

Item A2666. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a zinc ferrite nanotube and the second structural entity is an anode.

Item A2667. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a zinc ferrite nanotube and the second structural entity is an antibody.

Item A2668. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a zinc ferrite nanotube and the second structural entity is electrode.

Item A2669. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a zinc ferrite nanotube and the second structural entity is boron nitride.

Item A2670. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a zinc ferrite nanotube and the second structural entity is buckyball.

Item A2671. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a zinc ferrite nanotube and the second structural entity is carbon nanofibres.

Item A2672. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a zinc ferrite nanotube and the second structural entity is concrete.

Item A2673. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a zinc ferrite nanotube and the second structural entity is glass fibre.

Item A2674. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a zinc ferrite nanotube and the second structural entity is graphene oxide.

Item A2675. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a zinc ferrite nanotube and the second structural entity is graphyne.

Item A2676. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a zinc ferrite nanotube and the second structural entity is stainless steel.

Item A2677. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a zinc ferrite nanotube and the second structural entity is an organic material.

Item A2678. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a zinc ferrite nanotube and the second structural entity is a capacitor.

Item A2679. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a zinc oxide nanotube and the second structural entity is a cathode.

Item A2680. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a zinc oxide nanotube and the second structural entity is a metalised dielectric.

Item A2681. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a zinc oxide nanotube and the second structural entity is a peptide.

Item A2682. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a zinc oxide nanotube and the second structural entity is a protein.

Item A2683. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a zinc oxide nanotube and the second structural entity is a semiconductor.

Item A2684. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a zinc oxide nanotube and the second structural entity is a sensor.

Item A2685. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a zinc oxide nanotube and the second structural entity is aluminium.

Item A2686. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a zinc oxide nanotube and the second structural entity is an anode.

Item A2687. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a zinc oxide nanotube and the second structural entity is an antibody.

Item A2688. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a zinc oxide nanotube and the second structural entity is electrode.

Item A2689. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a zinc oxide nanotube and the second structural entity is boron nitride.

Item A2690. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a zinc oxide nanotube and the second structural entity is buckyball.

Item A2691. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a zinc oxide nanotube and the second structural entity is carbon nanofibres.

Item A2692. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a zinc oxide nanotube and the second structural entity is concrete.

Item A2693. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a zinc oxide nanotube and the second structural entity is glass fibre.

Item A2694. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a zinc oxide nanotube and the second structural entity is graphene oxide.

Item A2695. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a zinc oxide nanotube and the second structural entity is graphyne.

Item A2696. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a zinc oxide nanotube and the second structural entity is stainless steel.

Item A2697. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a zinc oxide nanotube and the second structural entity is an organic material.

Item A2698. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a zinc oxide nanotube and the second structural entity is a capacitor.

Item A2699. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a zirconia dioxide nanotube and the second structural entity is a cathode.

Item A2700. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a zirconia dioxide nanotube and the second structural entity is a metalised dielectric.

Item A2701. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a zirconia dioxide nanotube and the second structural entity is a peptide.

Item A2702. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a zirconia dioxide nanotube and the second structural entity is a protein.

Item A2703. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a zirconia dioxide nanotube and the second structural entity is a semiconductor.

Item A2704. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a zirconia dioxide nanotube and the second structural entity is a sensor.

Item A2705. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a zirconia dioxide nanotube and the second structural entity is aluminium.

Item A2706. The composite material of any one of items A3-A863 or B2-B15 where the nanotube is a zirconia dioxide nanotube and the second structural entity is an anode.

DEMANDE OU BREVET VOLUMINEUX

LA PRÉSENTE PARTIE DE CETTE DEMANDE OU CE BREVET COMPREND PLUS D'UN TOME.

CECI EST LE TOME 1 DE 4
CONTENANT LES PAGES 1 À 354

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JUMBO APPLICATIONS/PATENTS

THIS SECTION OF THE APPLICATION/PATENT CONTAINS MORE THAN ONE VOLUME

THIS IS VOLUME 1 OF 4
CONTAINING PAGES 1 TO 354

NOTE: For additional volumes, please contact the Canadian Patent Office

NOM DU FICHIER / FILE NAME :

NOTE POUR LE TOME / VOLUME NOTE:

CLAIMS

1. A composite material unit (CMU) of the structure (SE1-ML-LinkerL-Ligand2-SE2),
wherein

ML is a Mechanical Ligand, a chemical entity that forms a mechanical bond with the
structural entity SE1, where ML is not a nanotube,

LinkerL is a chemical bond or entity that covalently links ML and Ligand2,

Ligand2 is a chemical entity that is covalently linked to the structural entity SE2, or
forms a mechanical bond with the structural entity SE2, and

SE1 and SE2 are structural entities.

2. The composite material unit (CMU) of claim 1, where SE1 is a carbon nanotube and
ML is a covalently closed ring around said carbon nanotube.

3. The composite material unit (CMU) of claim 1 or 2, where the structural entity SE2 is
a polymer.

4. The composite material unit (CMU) of any of claims 1-3, where the structural entity
SE2 is chosen from the list of epoxy, polybenzimidazole, polyethylene, polycarbonate,
polyethylene terephthalate, polypropylene, polyester, polystyrene, polyolefin,
polyvinylchloride, vinyl ester, polyamide, polyetherketoneketone, poly(methyl
methacrylate), poly(methyl methacrylate), polyamide imide,
polyaryletheretherketone, polyether imide, polyimide, polyoxymethylene,
polyphenylene sulfide, polytetrafluoroethylene, nylon, and acrylonitrile butadiene
styrene.

5. The composite material unit (CMU) of claim 1 or 2, where the structural entity SE2 is
a carbon nanotube.

6. The composite material unit (CMU) of any one of claims 1-5, where the structural
entity SE2 is bound by a mechanical ligand.

7. The composite material unit (CMU) of any one of claims 1-6, where the ML comprises
a pyrene motif, a nitrobenzene motif, a phenanthrene motif, a naphthalene motif,
and/or a tetrathiafulvalene motif.

8. The composite material unit (CMU) of any one of claims 1-7, where the ML comprises a chemical moiety of more than 50 Dal, such as more than 100 Dal, such as more than 200 Dal, such as more than 300 Dal, such as more than 400 Dal, such as more than 500 Dal, that is identical to a part of the structural entity SE2.
9. The composite material unit (CMU) of any one of claims 1-8, where the structural entity SE1 is a single-walled carbon nanotube (SWNT) or a multi-walled (MWNT) carbon nanotube.
10. The composite material unit (CMU) according to any one of claims 1-9, wherein the ML is a covalently closed ring around the structural entity SE1 and has a molecular weight (MW) of 100-200 Dal, or 200-300 Dal, or 300-500 Dal, or 500-800 Dal, or 800-1200 Dal, or 1200-2000 Dal, or 2000-4000 Dal, or 4000-10000 Dal, where said molecular weight is the combined molecular weight of the atoms constituting the shortest string of covalently linked atoms that form a ring around the structural entity SE1.
11. The composite material unit (CMU) according to any one of claims 1-10, wherein at least 2 SE2s, such as at least 5 SE2s, such as at least 10 SE2s, such as at least 50 SE2s are linked to the same SE1.
12. The composite material unit (CMU) according to any one of claims 1-11, wherein at least 2 SE1s, such as at least 5 SE1s, such as at least 10 SE1s, such as at least 50 SE1s are linked to the same SE2.
13. The composite material unit (CMU) according to any one of claims 1-12, wherein the structural entity SE1 is bound by more than 1 mechanical ligand, such as by more than 2 mechanical ligands, such as by more than 5 mechanical ligands, such as by more than 10 mechanical ligands, such as by more than 30 mechanical ligands, such as by more than 100 mechanical ligands, such as by more than 300 mechanical ligands, such as by more than 500 mechanical ligands, such as by more than 1000 mechanical ligands.
14. The composite material unit (CMU) of any one of claims 1-4 and 6-13 where SE2 is not a nanotube.
15. A composite material comprising at least 10^8 composite material units (CMUs), such as at least 10^9 CMUs, such as at least 10^{10} CMUs, such as at least 10^{11} CMUs, such as

at least 10^{12} CMUs, such as at least 10^{13} CMUs, such as at least 10^{14} CMUs, such as at least 10^{15} CMUs, such as at least 10^{16} CMUs, such as at least 10^{17} CMUs, such as at least 10^{18} CMUs, such as at least 10^{19} CMUs, such as at least 10^{20} CMUs, such as at least 10^{21} CMUs, such as at least 10^{22} CMUs, said composite material units (CMUs) being as defined in any one of claims 1-14 .

16. The composite material of claim 15 comprising at least 10^4 CMUs per cubic millimeter, such as at least 10^5 CMUs per cubic millimeter, such as at least 10^6 CMUs per cubic millimeter, such as at least 10^7 CMUs per cubic millimeter, such as at least 10^8 CMUs per cubic millimeter, such as at least 10^9 CMUs per cubic millimeter, such as at least 10^{10} CMUs per cubic millimeter, such as at least 10^{11} CMUs per cubic millimeter, such as at least 10^{12} CMUs per cubic millimeter, such as at least 10^{13} CMUs per cubic millimeter, such as at least 10^{14} CMUs per cubic millimeter, such as at least 10^{15} CMUs per cubic millimeter, such as at least 10^{16} CMUs per cubic millimeter, such as at least 10^{17} CMUs per cubic millimeter, such as at least 10^{18} CMUs per cubic millimeter, such as at least 10^{19} CMUs per cubic millimeter of said composite material.

17. The composite material of claim 15 or 16 that has an electrical conductivity of at least 10^3 s/m, such as at least 10^4 s/m, such as at least 10^5 s/m, such as at least 10^6 s/m, such as at least 10^7 s/m, such as at least 10^8 s/m, such as at least 10^9 s/m.

18. The composite material of any one of claims 15-17 that has a torsional strength of at least 1 MPa, such as at least 10 MPa, such as at least 100 MPa, such as at least 100 MPa, such as at least 100 MPa, such as at least 300 MPa, such as at least 600 MPa, such as at least 900 MPa, such as at least 1200 MPa, such as at least 1500 MPa, such as at least 2000 MPa.

19. The composite material of any one of claims 15-18 that has a Young's Modulus of at least 0.01 GPa, such as at least 0.1 GPa, such as at least 0.5 GPa, such as at least 1 GPa, such as at least 1.5 GPa, such as at least 2 GPa, such as at least 3 GPa.

20. The composite material of any one of claims 15-19 that comprises silica, silicate, sand, aluminosilicates, quartz, or flint at a concentration of at least 0.01 wt % in the composite material.

21. The composite material of any one of claims 15-20, being a ceramics matrix composite material or a metal matrix composite material.

22. A linker unit (LU) having the structure

ML-LinkerL-Ligand2

wherein

ML is a Mechanical Ligand, a chemical entity capable of forming a mechanical bond with a structural entity,

LinkerL is a chemical bond or entity that links ML and Ligand2,

Ligand2 is a chemical entity that is capable of binding covalently or non-covalently to a structural entity, or is capable of forming a mechanical bond with a structural entity.

23. A structure (SE1-ML-LinkerL-Ligand2), where SE1 is a first structural entity, ML is an entity as defined in claim 22 bound to SE1, Ligand2 is an entity as defined in claim 22 capable of binding a second structural entity SE2, and LinkerL is a chemical entity as defined in claim 22 which links ML and Ligand2.

24. A composite material unit (CMU) of the structure (SE1-ML-LinkerL-Ligand2-SE2), where SE1 and SE2 are structural entities, ML and Ligand2 are chemical entities as defined in claim 22 which are bound to SE1 and SE2, respectively, and LinkerL is a chemical entity as defined in claim 22 which physically links ML and Ligand2.

25. The composite material unit (CMU) of claim 24, where the structural entity SE1 is a nanotube and ML is a covalently closed ring around SE1.

26. The composite material unit (CMU) of claim 24 or claim 25, where ML comprises a pyrene motif, a nitrobenzene motif, a phenanthrene motif, a naphthalene motif, and/or a tetrathiafulvalene motif.

27. The composite material unit (CMU) of any of claims 24-26, where SE2 is a plastic polymer such as epoxy, polypropylene, nylon, and polyvinylchloride, with a molecular weight (MW) of at least 10.000 dalton.

28. The composite material unit (CMU) of claim 25, where the closed ring comprises a peptide comprising at least four amino acid residues, and comprising at least two

sulfur atoms, where said two sulfur atoms have been reacted to form a disulfide bond.

- 5 29. The composite material unit according to any one of claims 24, 25, 26 or 28, where SE1 and/or SE2 are inorganic, preferably a fullerene, such as a carbon nanotube, buckyball or graphene molecule.
- 10 30. The composite material unit according to any one of claims 24-28, where SE2 is a polymer, preferably a polyolefin; such as polyethylene, polypropylene and polybutene, or blends or block-copolymers of polyolefins.
- 15 31. The composite material unit (CMU) of any of claims 24-30, where the ML is a covalently closed ring around SE1, where said covalently closed ring is formed from a precursor-ML, during or after binding of said precursor-ML to said SE1.
32. The composite material unit according to any one of claims 24-31, wherein the molecular weight (MW) of ML is less than 2000 dalton.
- 20 33. A composite material unit according to any one of claims 24-32, of the structure (SE1-ML-LinkerL-Ligand2-SE2), wherein
SE1 is a nanotube, carbon nanotube, buckyball or graphene molecule;
SE2 is a polymer;
ML is a chemical entity which is mechanically bound to SE1;
Ligand2 is a chemical entity which is covalently bound to SE2;
25 LinkerL is a chemical entity as defined in claim 1 which physically links ML and Ligand2.
- 30 34. A composition of one million or more composite material units according to any one of claims 24-33.
35. A composition of two or more composite material units according to any one of claims 24-33, where at least one of SE1 and SE2 is linked to at least two other structural entities.
- 35 36. A composite material comprising a composition of two or more composite material units of claims 24-33, where at least one of SE1 and SE2 is linked to at least two other structural entities through at least two Linker Units (LUs).

37. A composite material comprising a composition of one million or more composite material units of claims 24-33, where in each of said composite material units at least one of SE1 and SE2 is linked to at least two other structural entities through at least two Linker Units (LUs).

5

38. A method for preparing a Composite Material Unit (CMU) according to any one of claims 24-33, said method comprising the following steps:

- a. Providing a first structural entity (SE1)
- b. Providing a second structural entity (SE2)
- c. Providing a linker, LinkerL
- d. Providing a precursor-ML or a ML
- e. Providing a Ligand2
- f. Reacting, in any order, the provided structural entities, linker and ligands, to form a composite material unit (CMU) of the structure (SE1-ML-LinkerL-Ligand2-SE2),

10

wherein the first structural entity (SE1), the second structural entity (SE2), LinkerL, ML and Ligand2 are as defined in claims 24-33.

15

39. A carbon-nanotube (CNT) reinforced polymer comprising one or more composite material units according to any one of claims 24-33.

20

40. A Mechanical Ligand (ML) capable of forming a mechanical bond with a structural entity

41. A CMU as defined in any of claims 24-33, where SE1 is a nanotube with an aspect ratio of at least 100.

25

42. A polymeric structure of CMUs, of the structure (SE1-ML-Linker-Ligand2-SE2-Ligand2-Linker-ML-)_n-SE1, where n is any integer larger than one.

43. The polymeric structure of CMUs of claim 42, where SE1 is a carbon nanotube, SE2 is not a carbon nanotube, and n=2, 3, 4 or higher

30

44. The polymeric structure of CMUs of claim 42, where SE1 is a carbon nanotube, SE2 is another carbon nanotube, and n=2, 3, 4 or higher

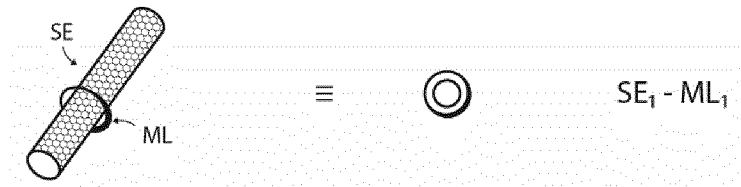
35

45. The polymeric structure of CMUs according to claims 42-44, where all of the SE1s in the structure (SE1-ML-Linker-Ligand2-SE2-Ligand2-Linker-ML-)_nSE1 are separate and

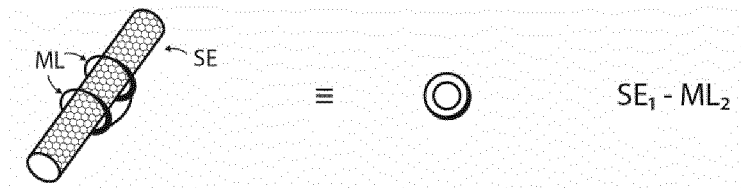
distinct molecules, and all of the SE2s in the structure (SE1-ML-Linker-Ligand2-SE2-Ligand2-Linker-ML-)_nSE1 are separate and distinct molecules.

Figure 1

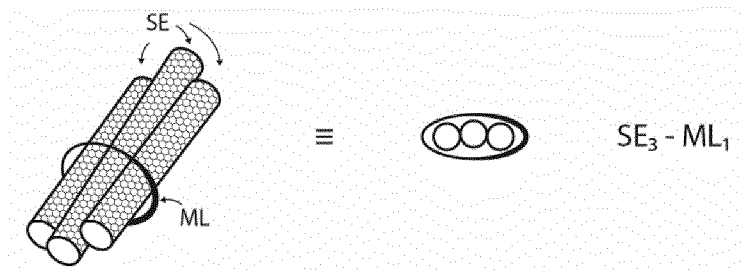
A.



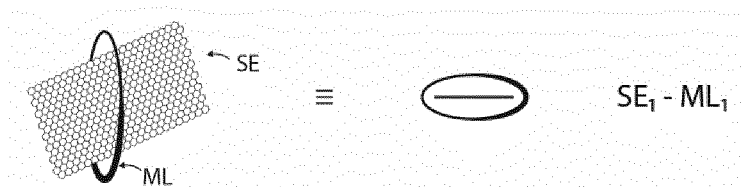
B.



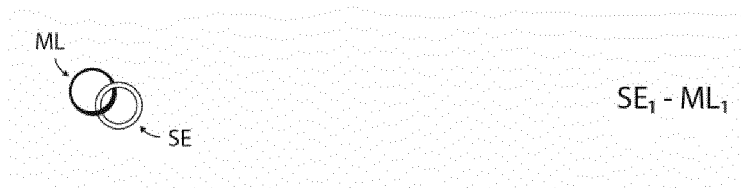
C.



D.



E.



F.

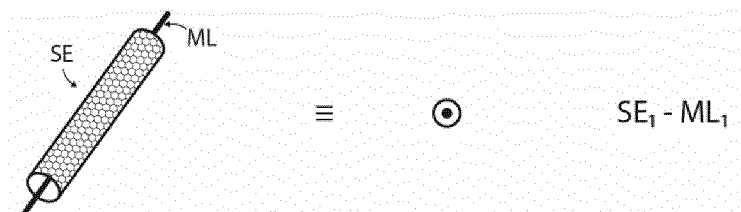
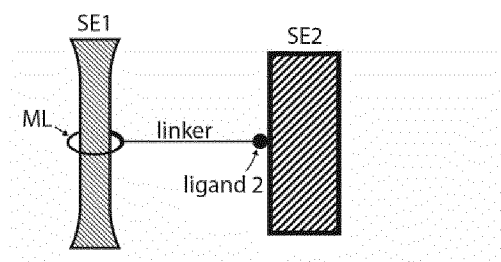
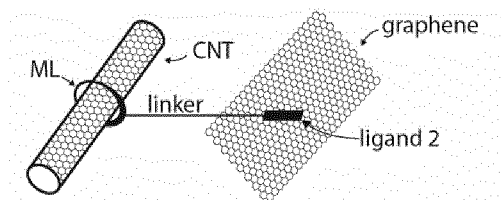


Figure 2

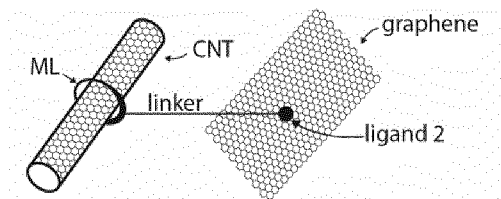
A.



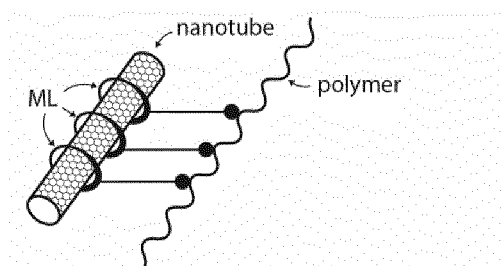
B.



C.



D.



E.

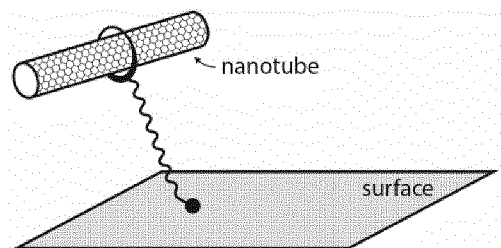
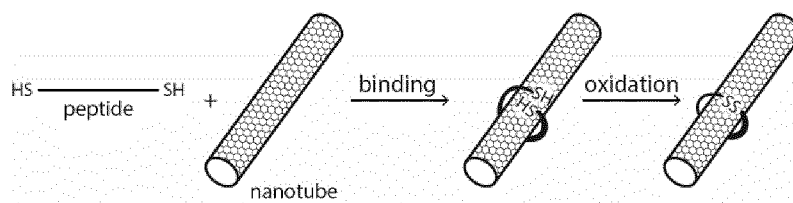
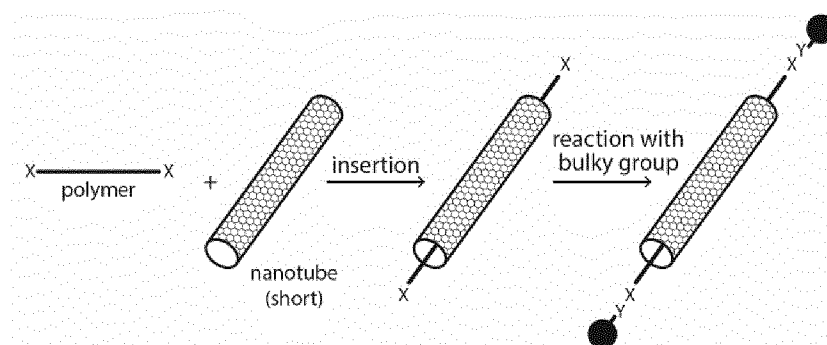


Figure 3

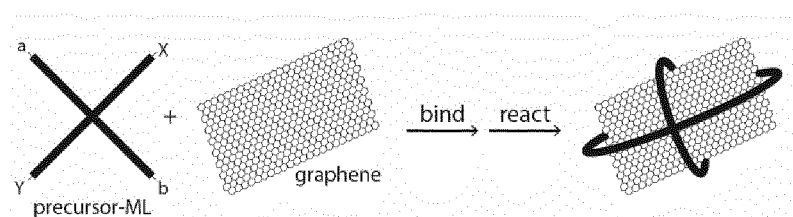
A.



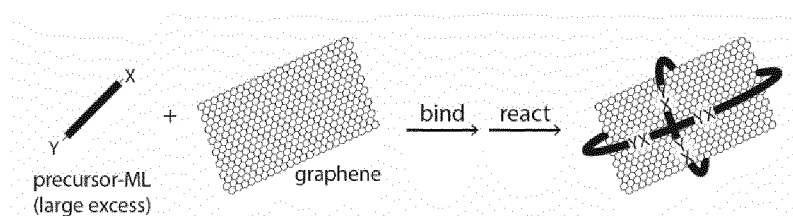
B.



C.



D.



E.

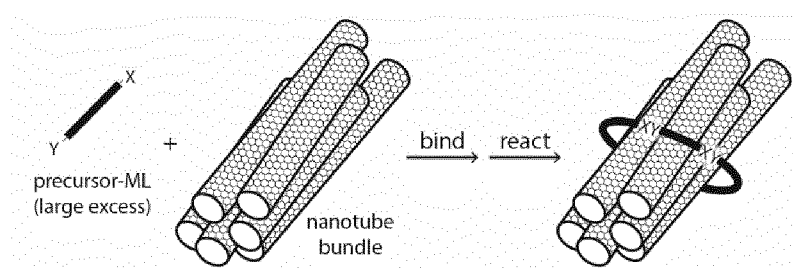


Figure 4

A.

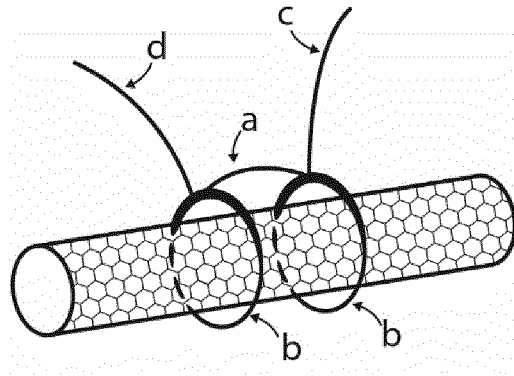


Figure T1

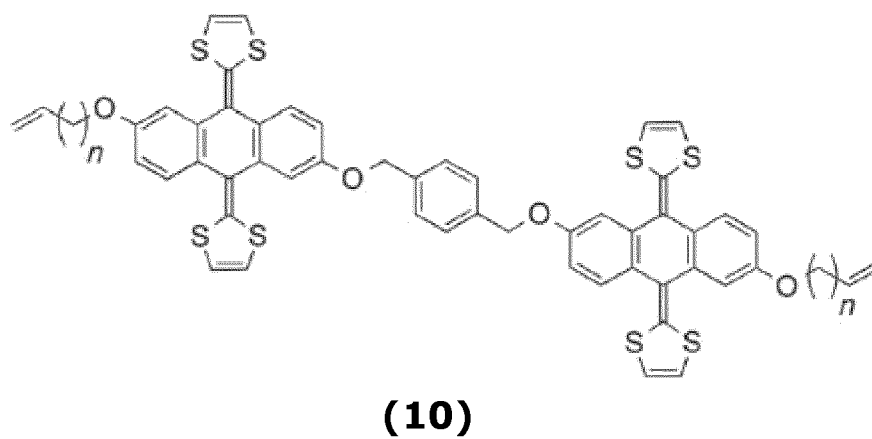
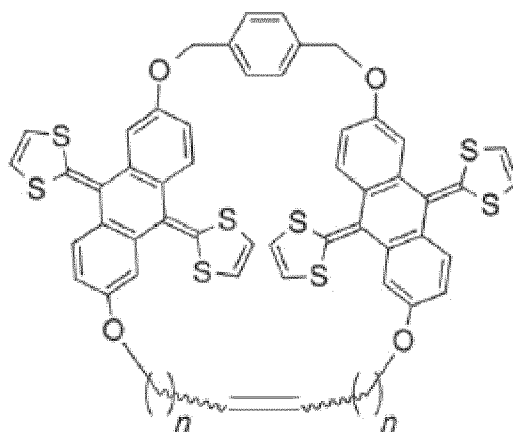


Figure T2



(11)

Figure T3

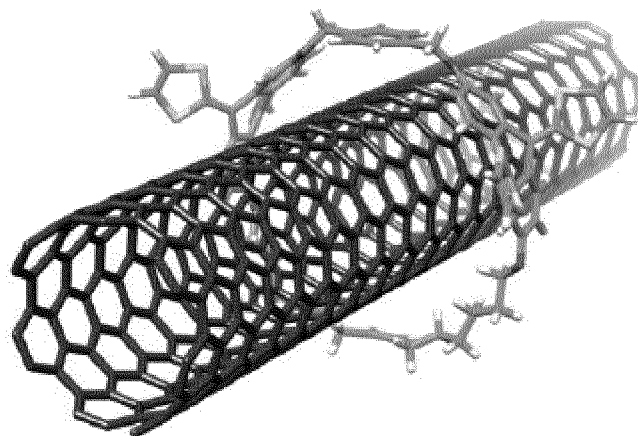
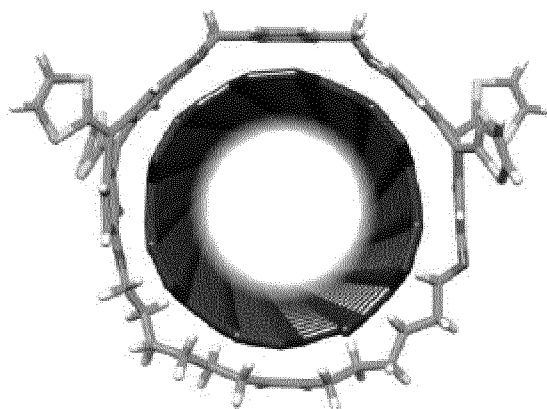


Figure T4



The reaction scheme illustrates the macrocyclization of a bis-phenanthrene precursor (12) to a macrocyclic dimer (13) via Ring-Closing Metathesis (RCM). Precursor 12 consists of two phenanthrene units linked by a central benzene ring through their 10-positions. Each phenanthrene unit has an ether linkage at the 3-position to a terminal vinyl group, with the chain length denoted as n . An arrow labeled "RCM" points to the product 13, which is a macrocyclic dimer where the two phenanthrene units are linked by a new C-C bond between their terminal vinyl groups, forming a large ring structure.

Chemical reaction scheme showing the synthesis of macrocyclic compounds **30** and **31**.

Reaction i): A phthalimide derivative reacts with an amine $\text{H}_2\text{N}-(\text{CH}_2)_n-\text{NH}_2$ to form an N-alkyl phthalimide intermediate.

Reaction ii): The N-alkyl phthalimide intermediate reacts with a diamine $\text{H}_2\text{N}-\text{Ar}-\text{NH}_2$ (where Ar is a 1,3-disubstituted benzene ring with OR groups) to form a linear dimer **30**. The R group is defined as a branched alkyl chain.

Reaction iii): The linear dimer **30** undergoes cyclization to form a macrocyclic compound **31**.

Structures and Parameters:

- 30** (Linear dimer): $n = 5$ (1), $n = 7$ (2), $n = 8$ (3).
- 31** (Macrocyclic compound): $n = 5$ (4), $n = 7$ (5), $n = 8$ (6).

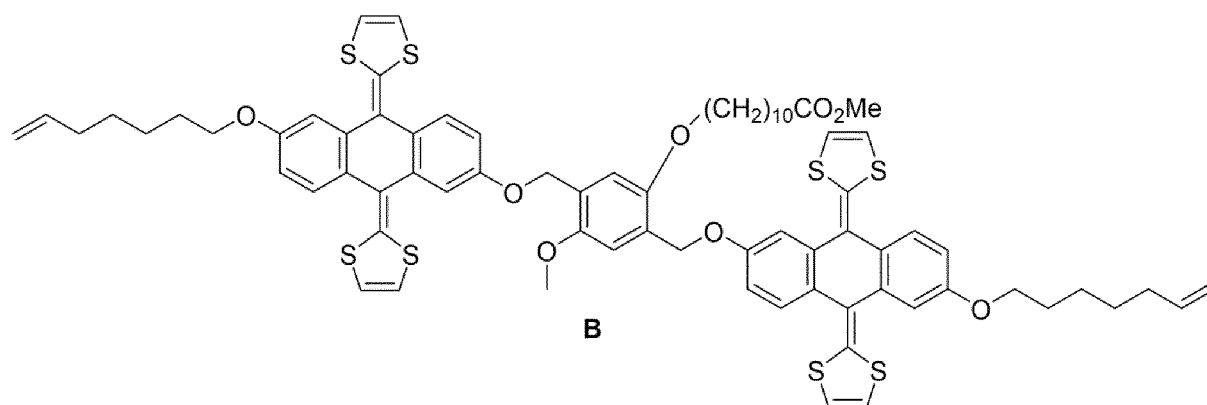
Figure T6

Figure T7

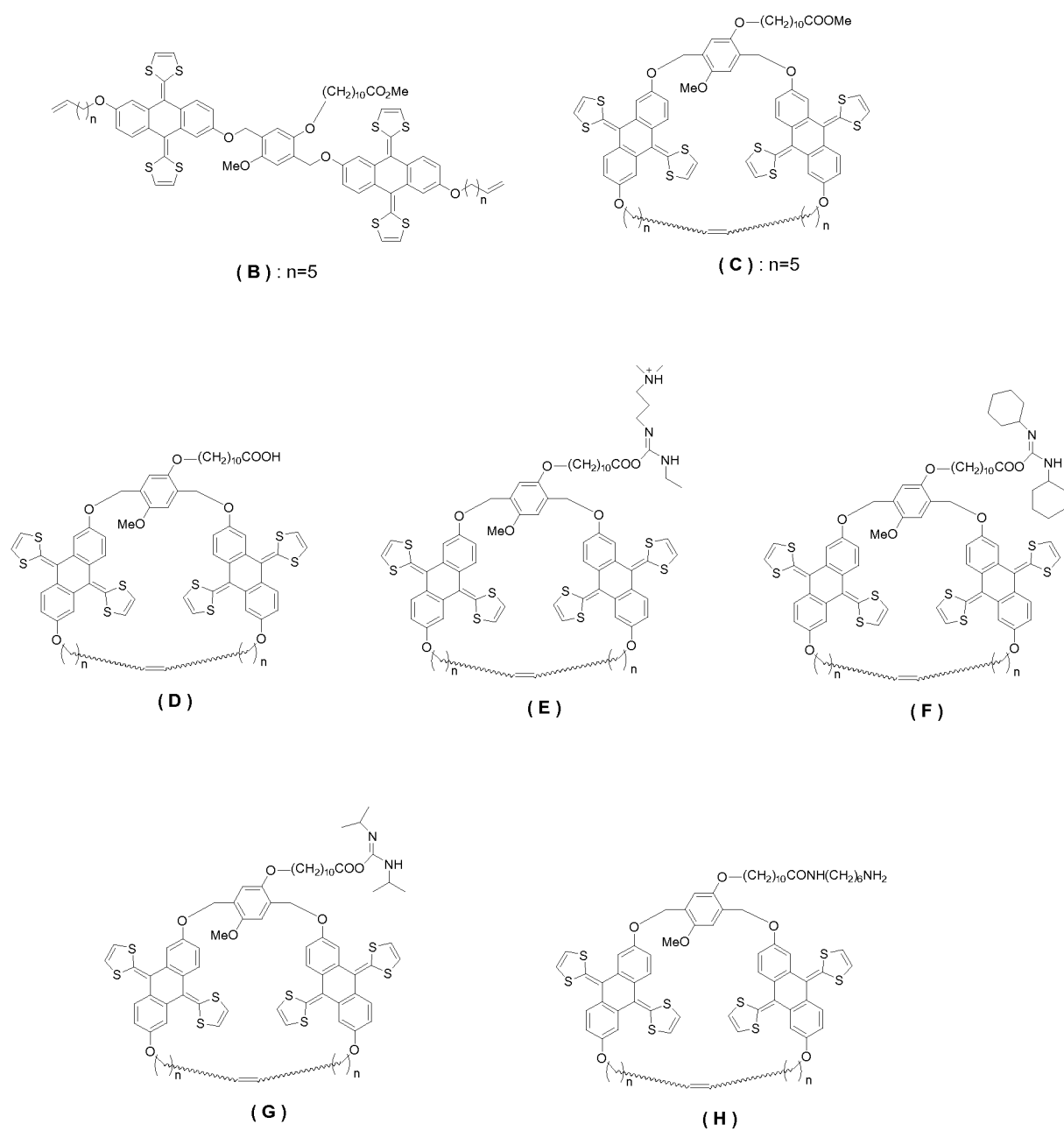
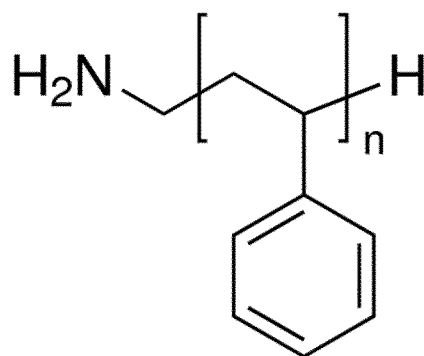
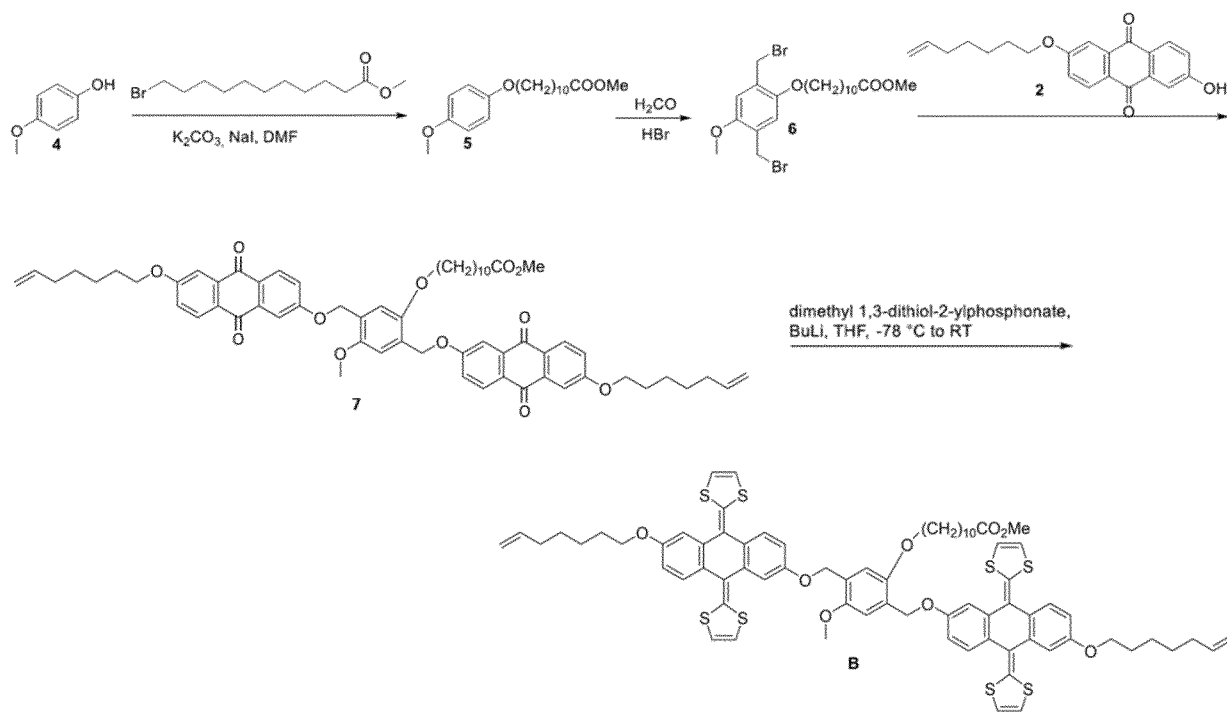


Figure T8



(20)

Figure T9



Scheme 1

Figure T10

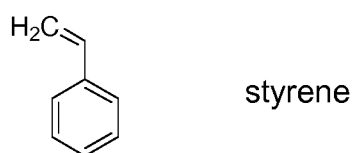
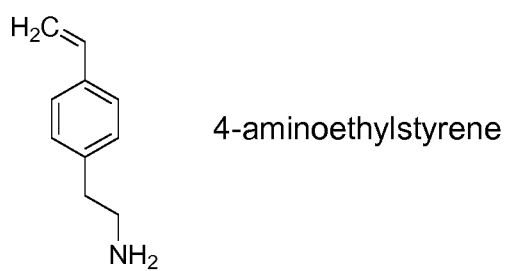


Figure 15

A.

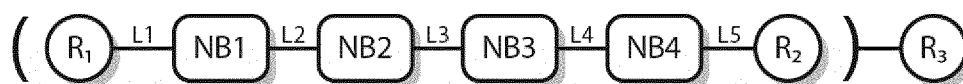


Figure 15.

B1.

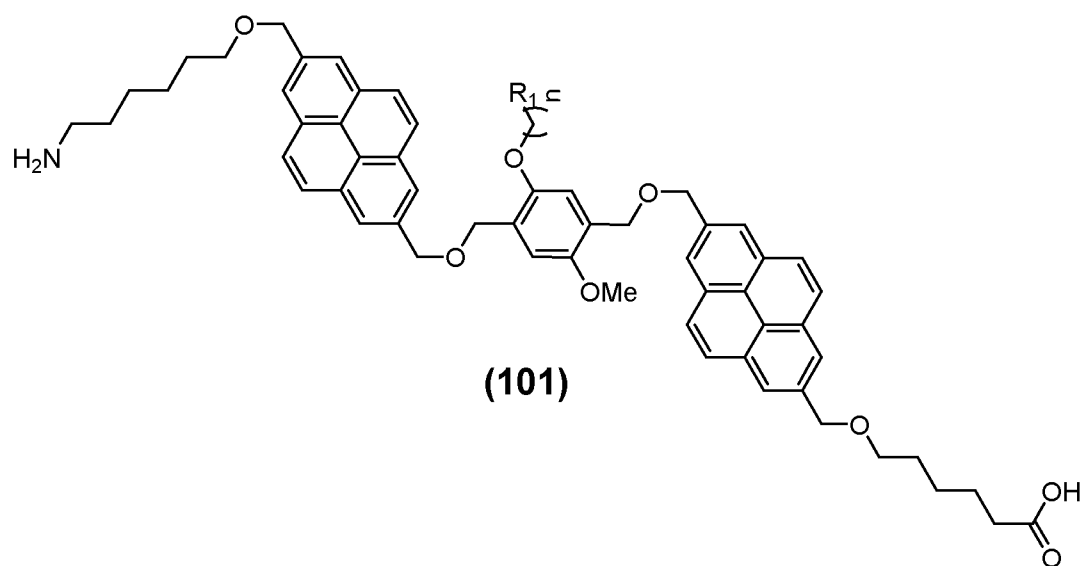


Figure 15

B2

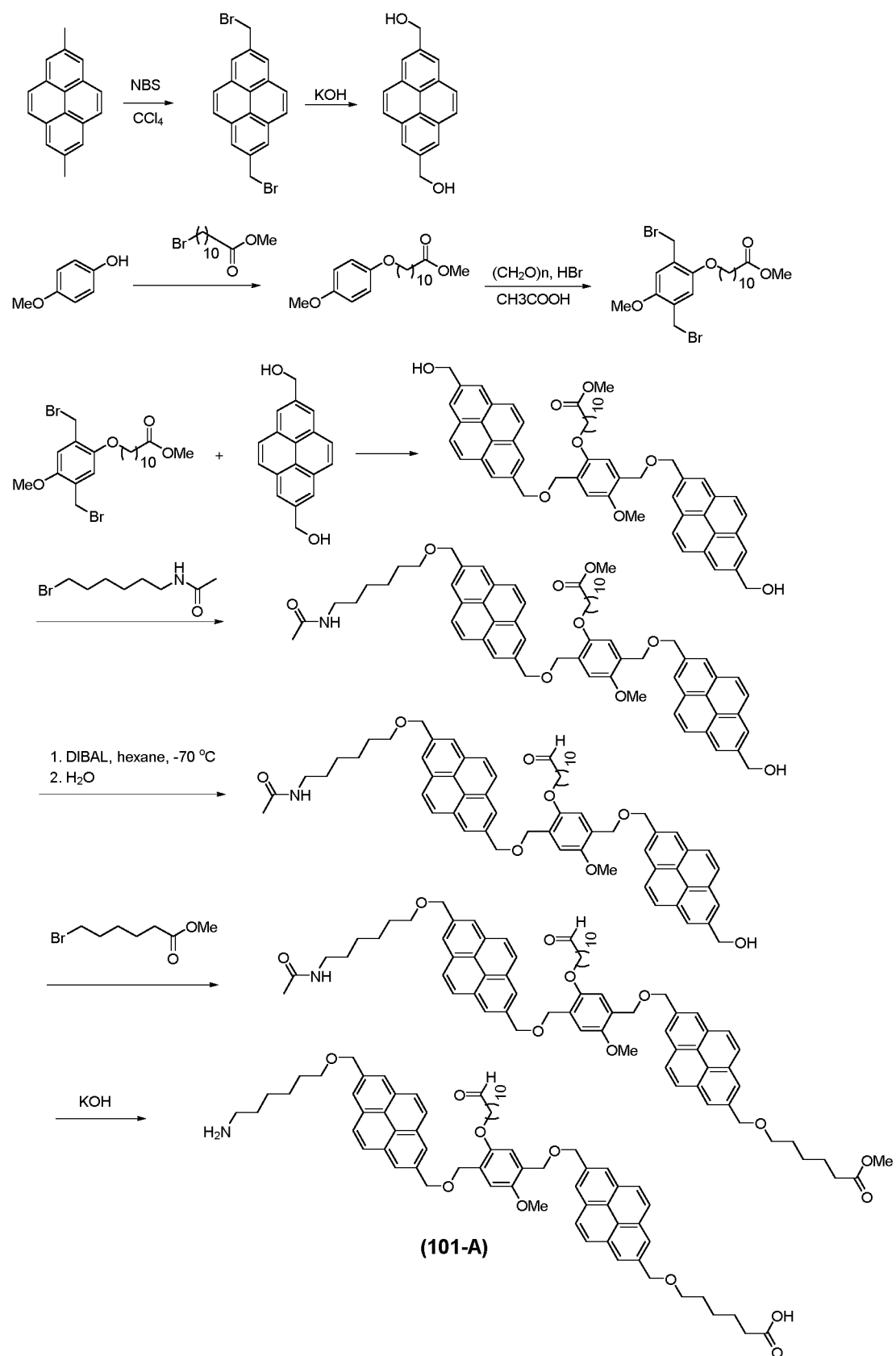


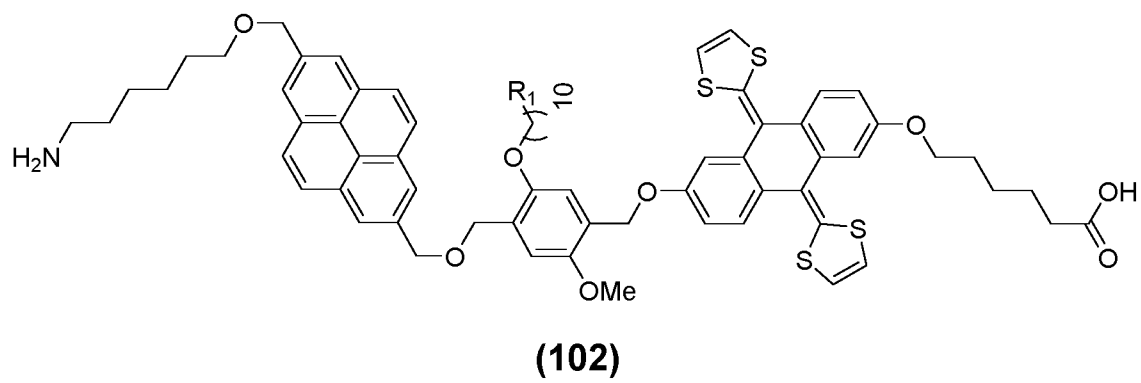
Figure 15**C1**

Figure 15

C2

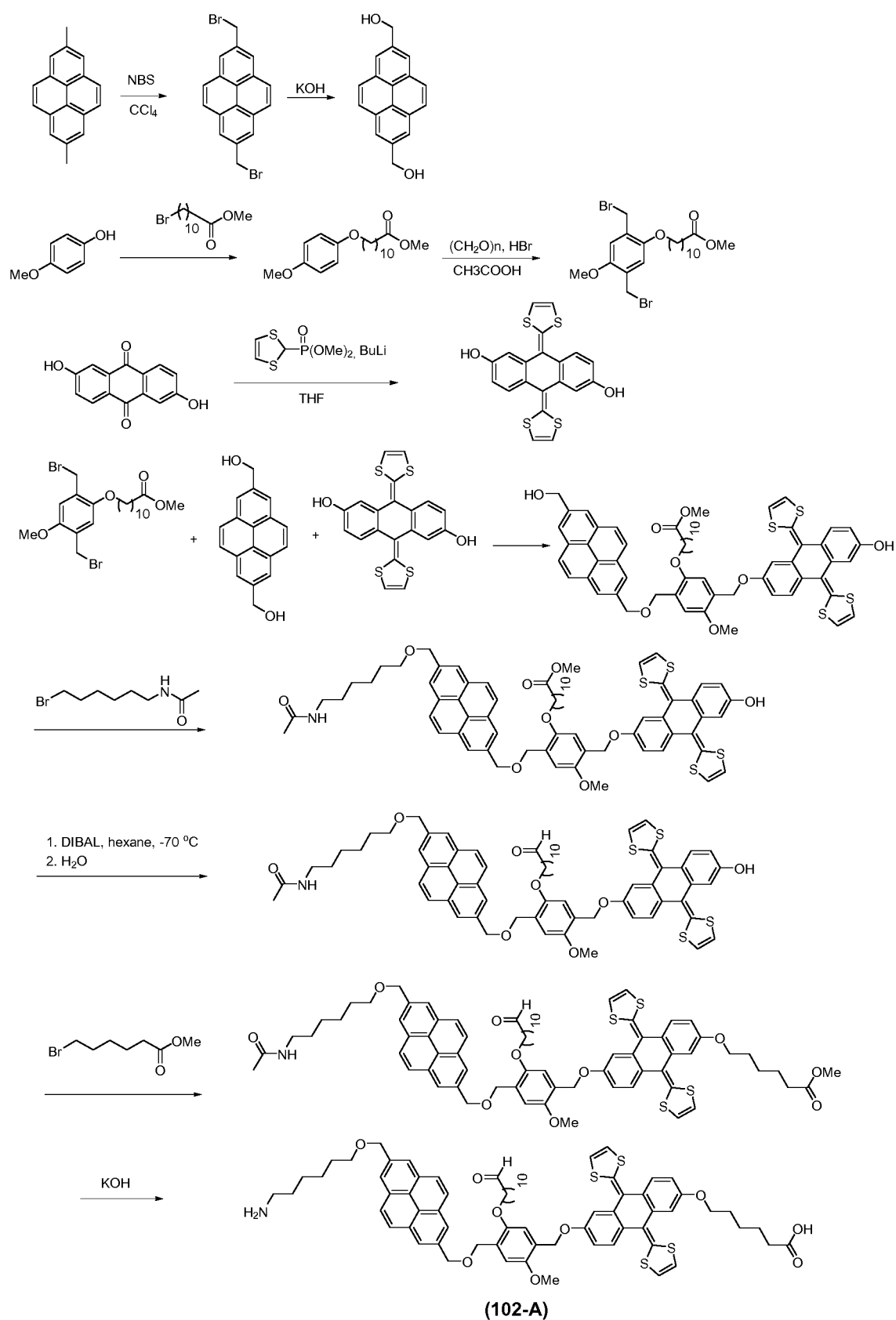


Figure 15

D1

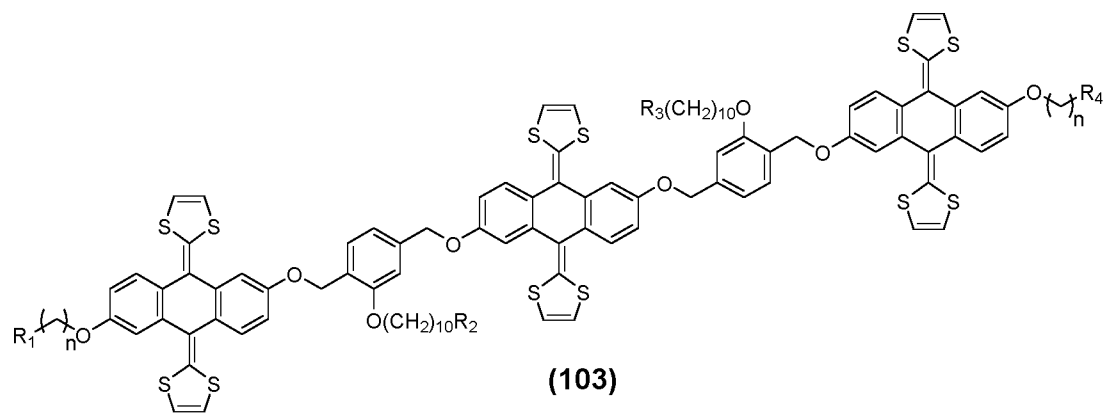


Figure 15

D2

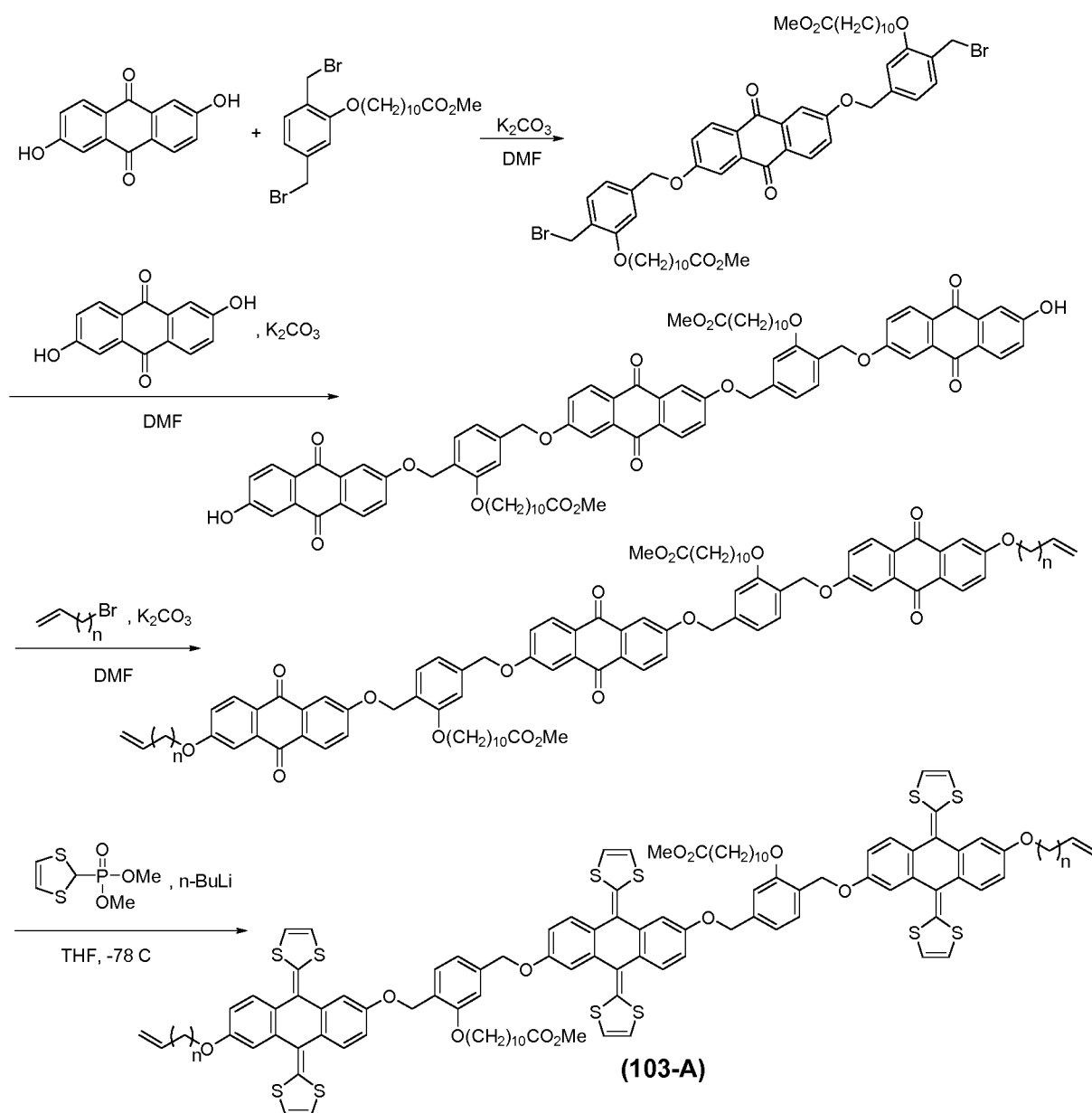
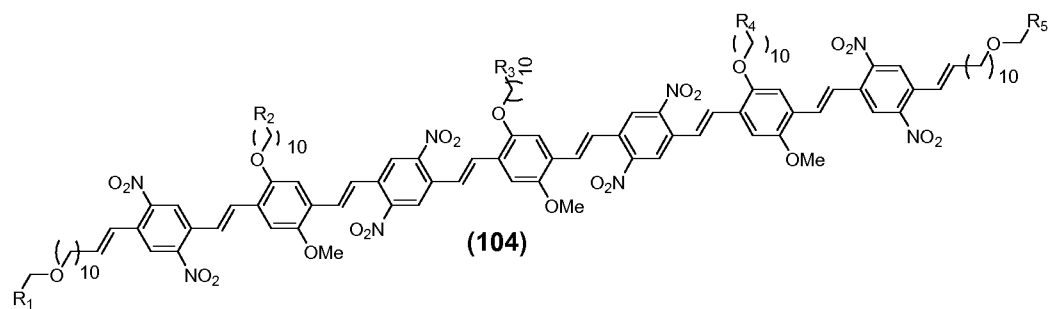


Figure 15

E1



E2

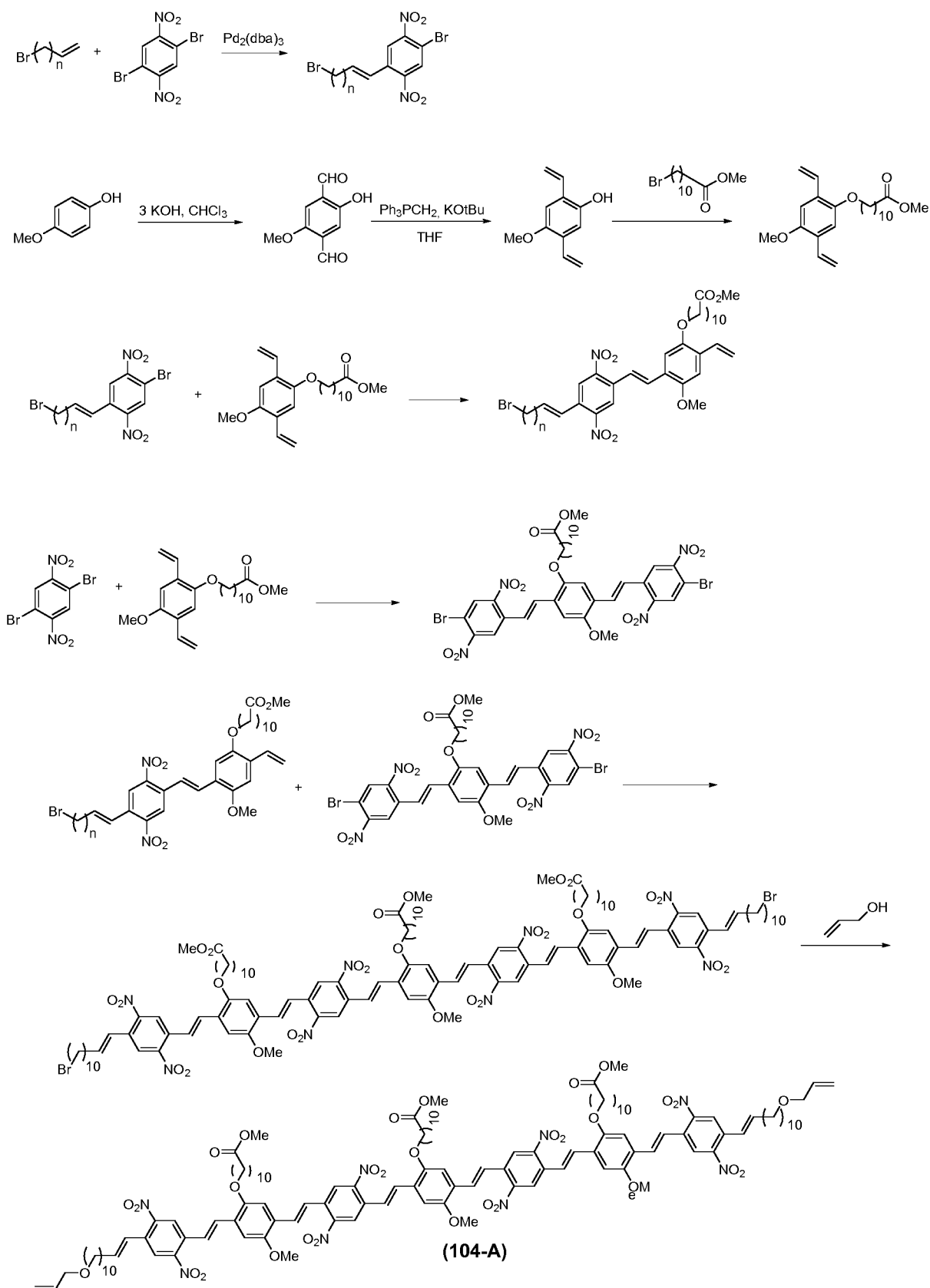
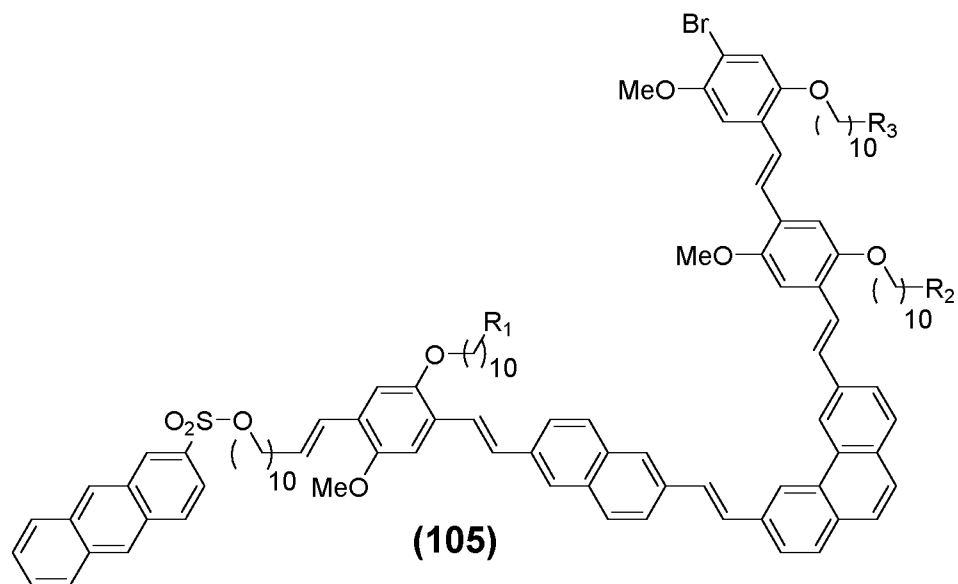


Figure 15

F1



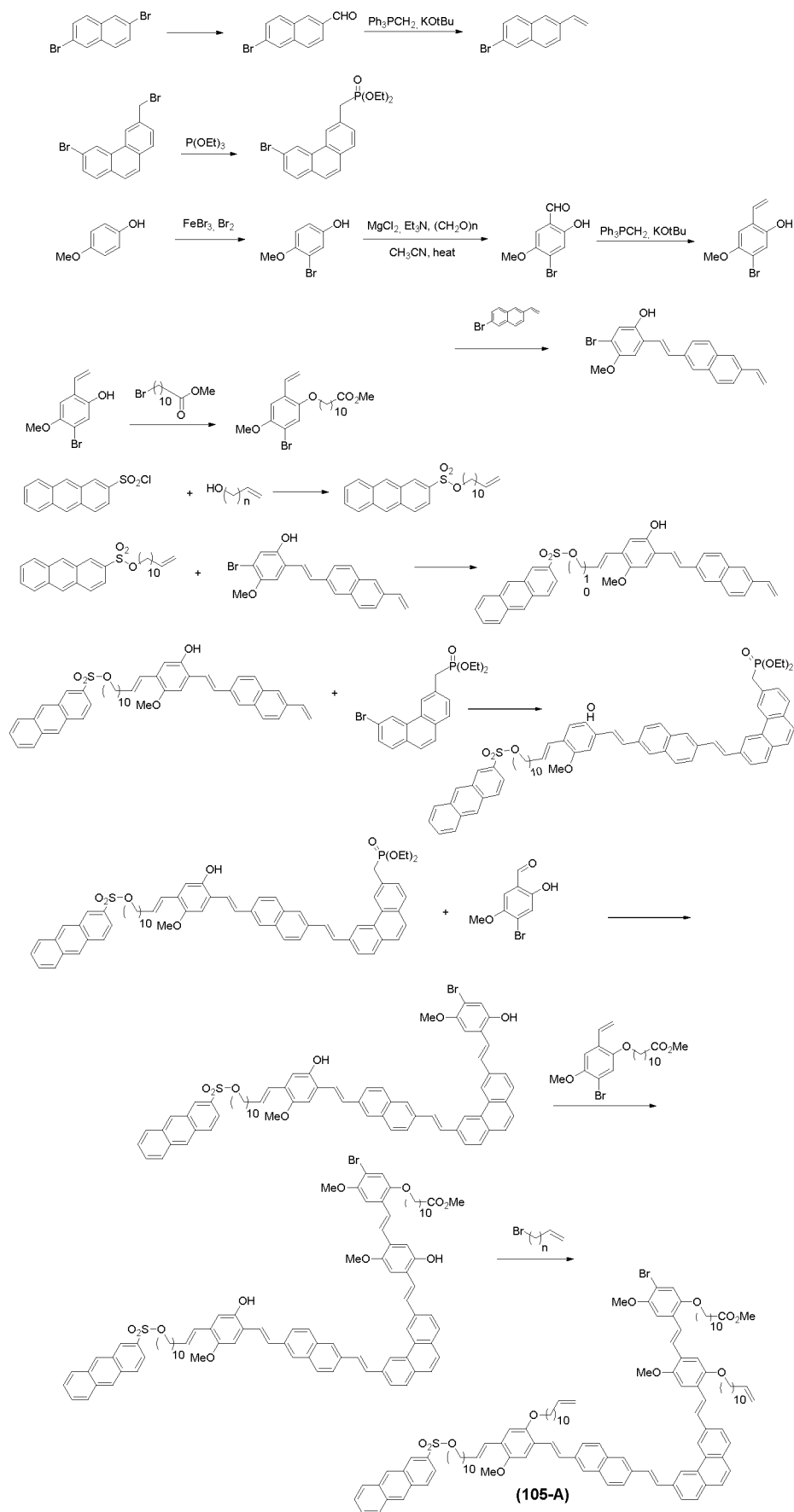


Figure 15

G1

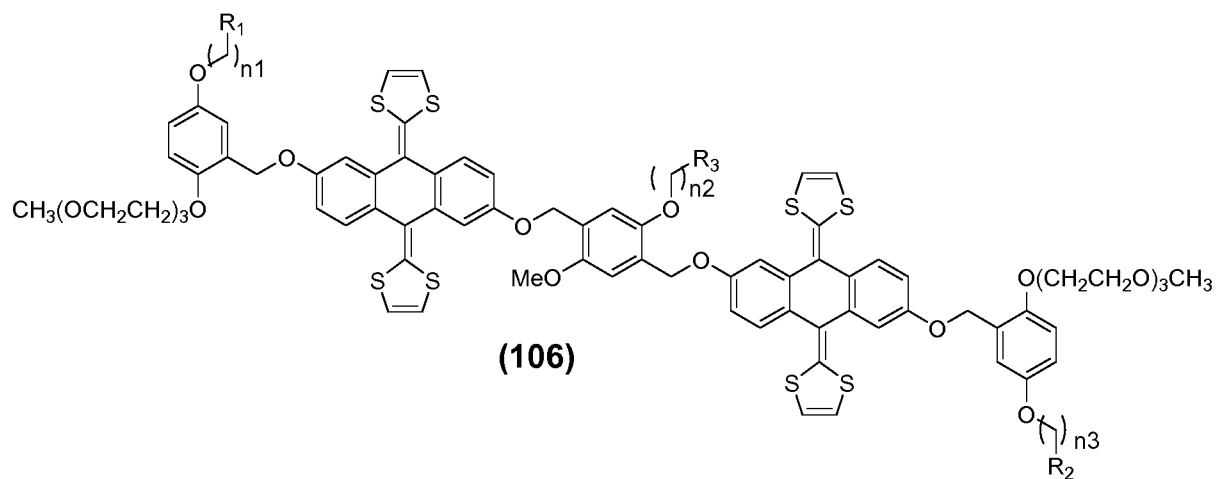


Figure 15

G2

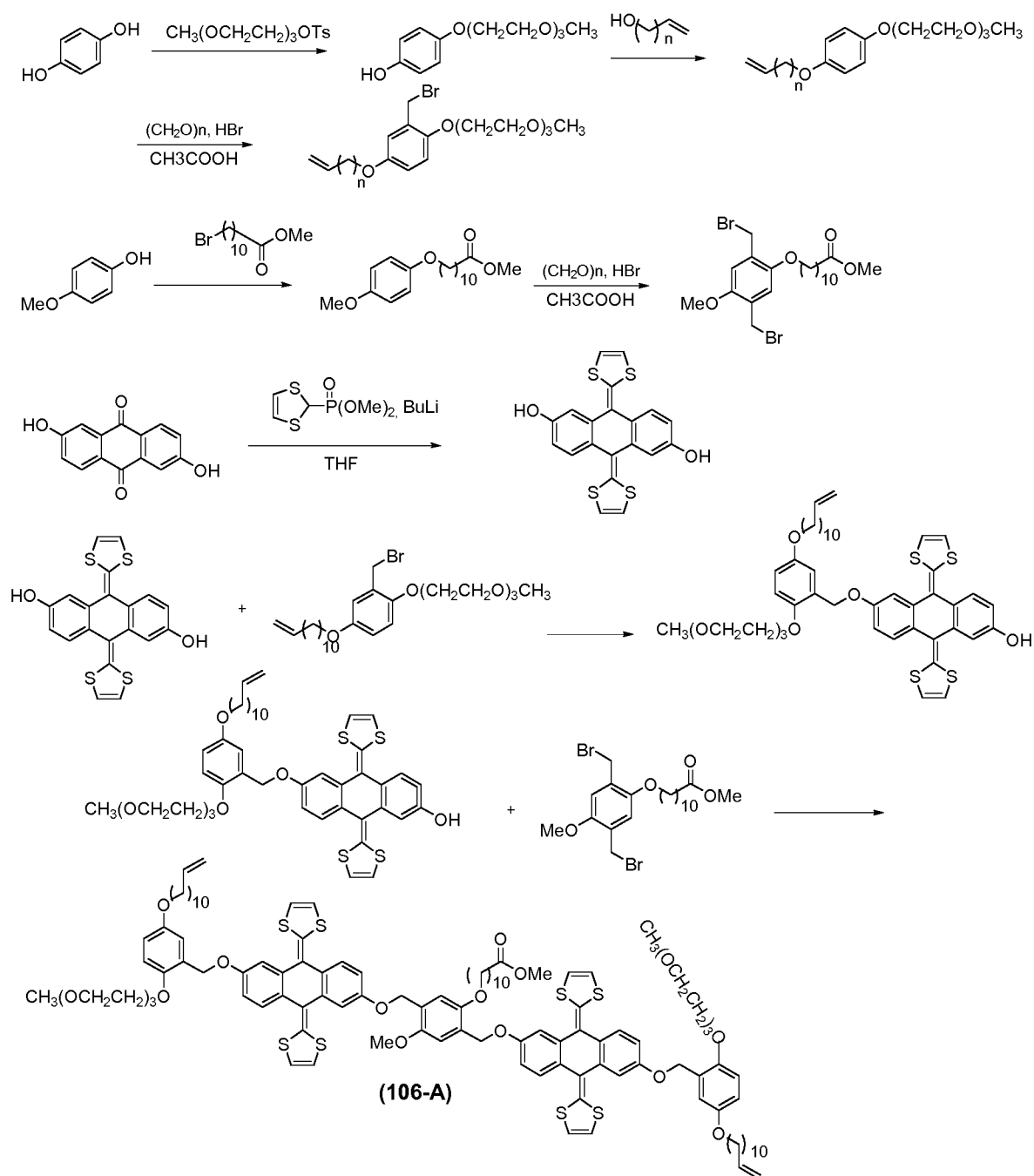


Figure 15

H.

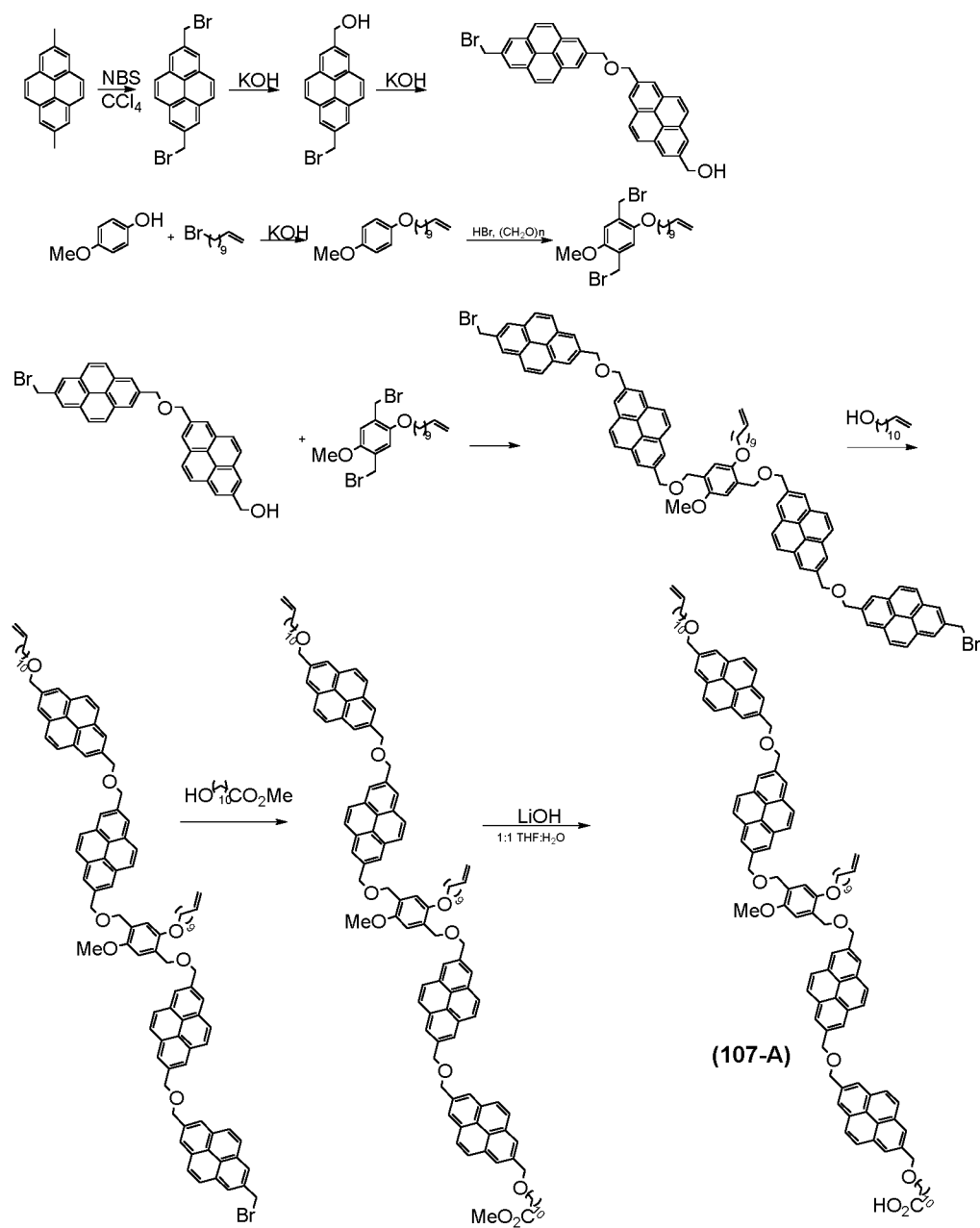
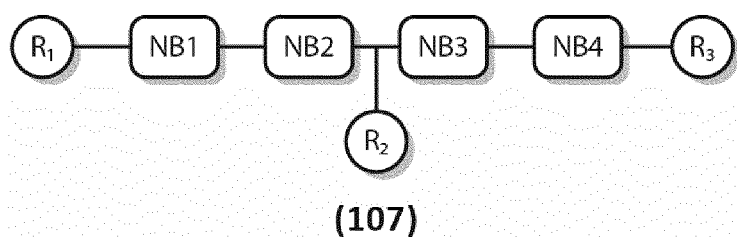
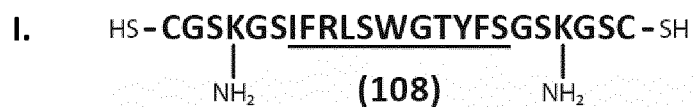
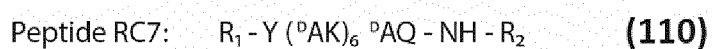
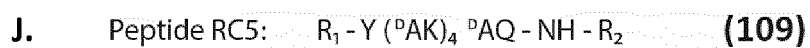
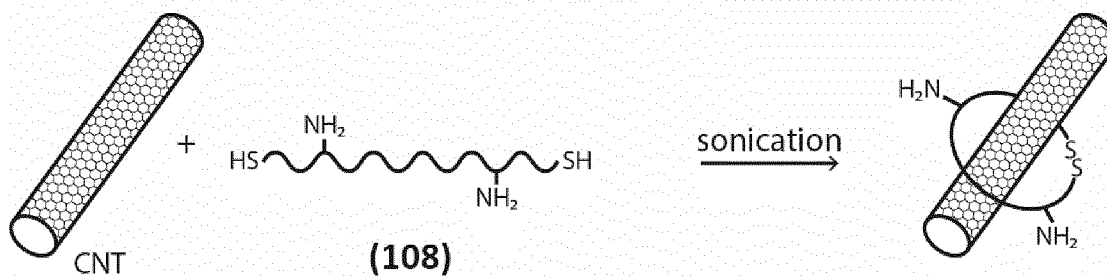


Figure 15



CNT-binding motif is underlined



Where

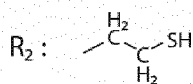
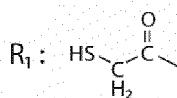


Figure 15

K

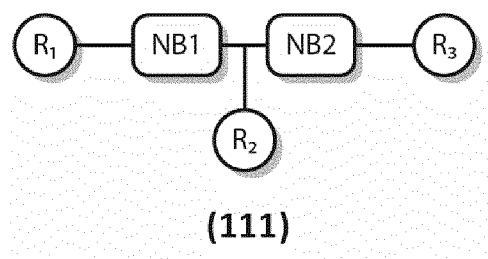


Figure 15

K, continued

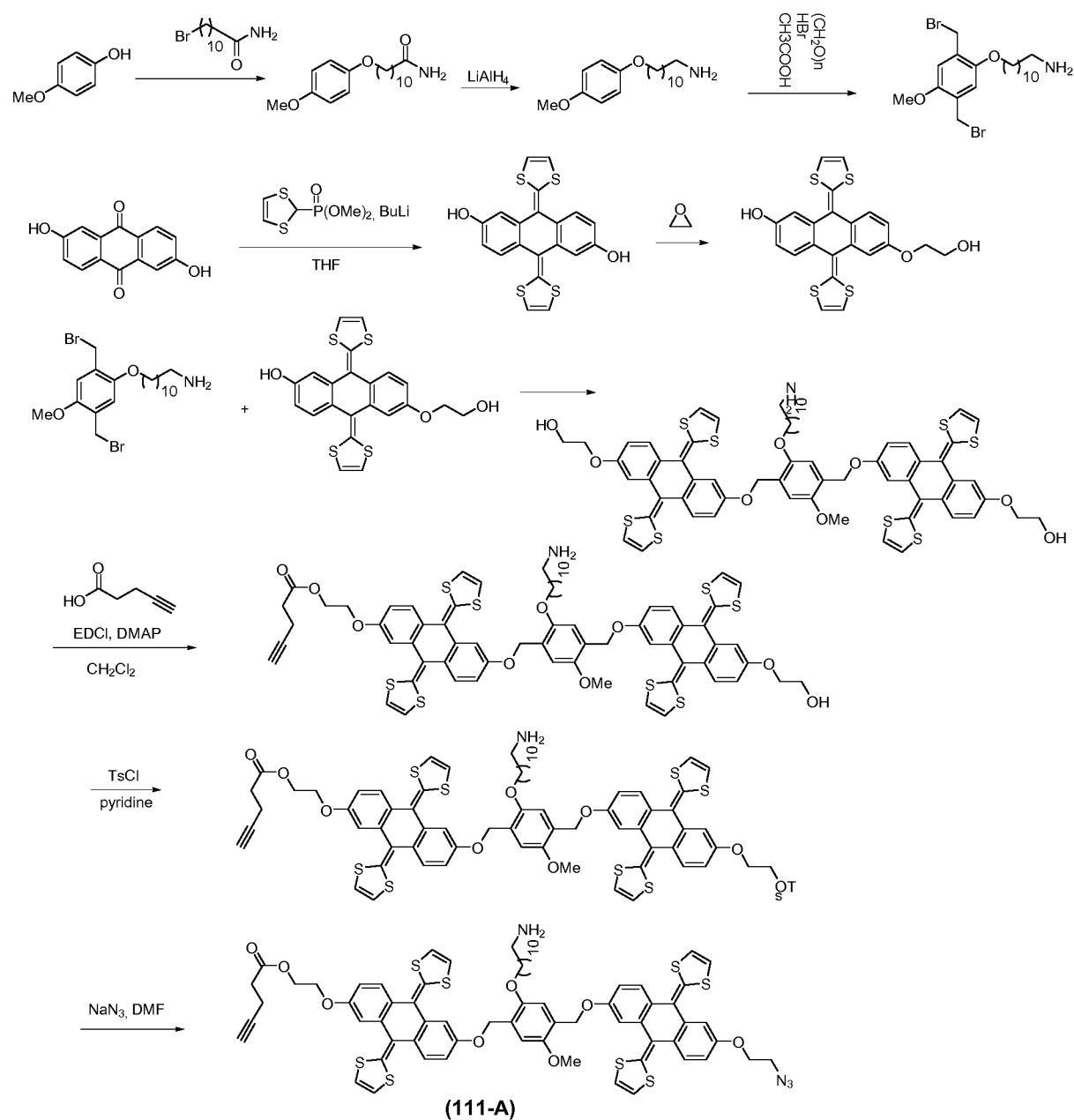


Figure 17

(111-A)

A

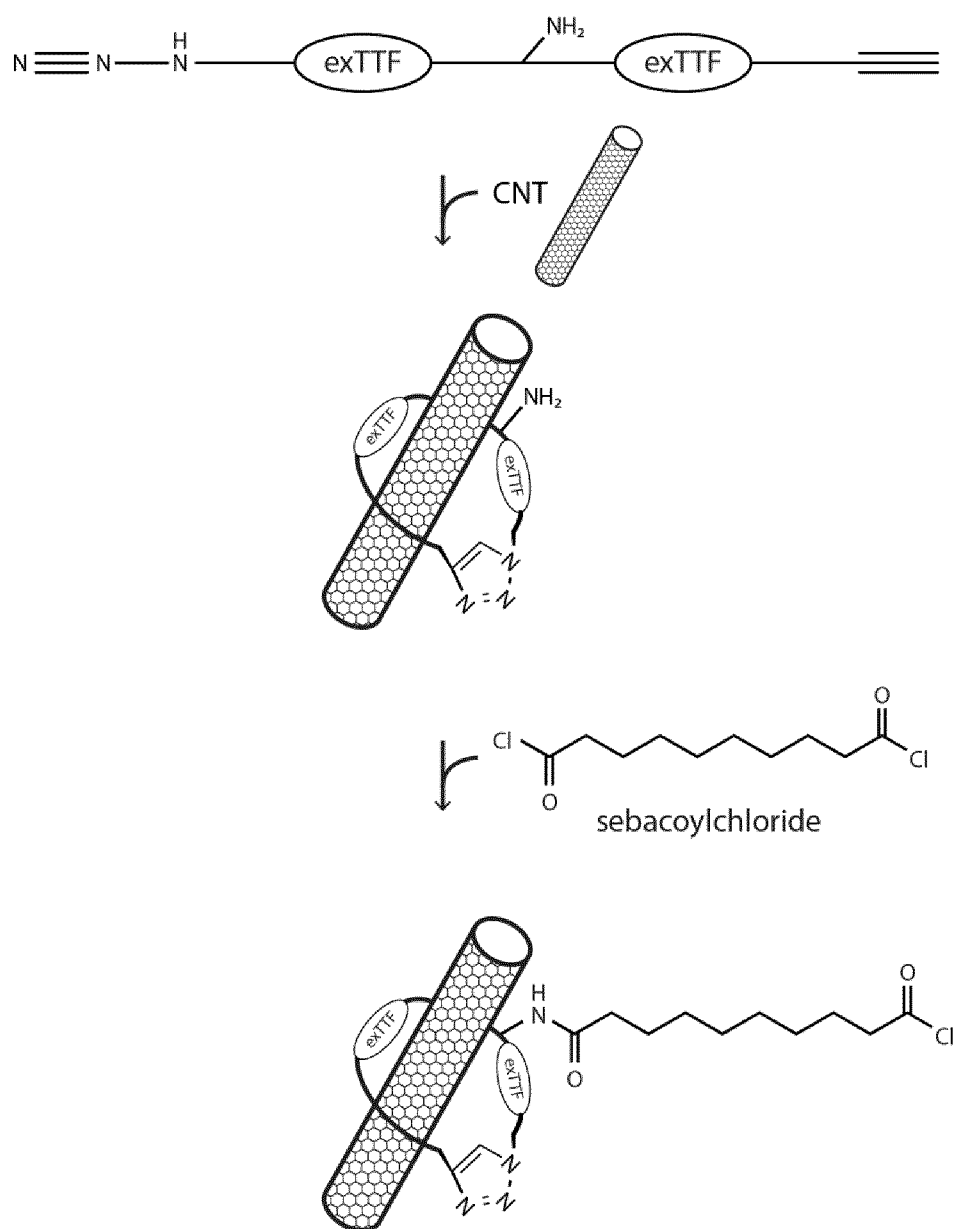


Figure 21

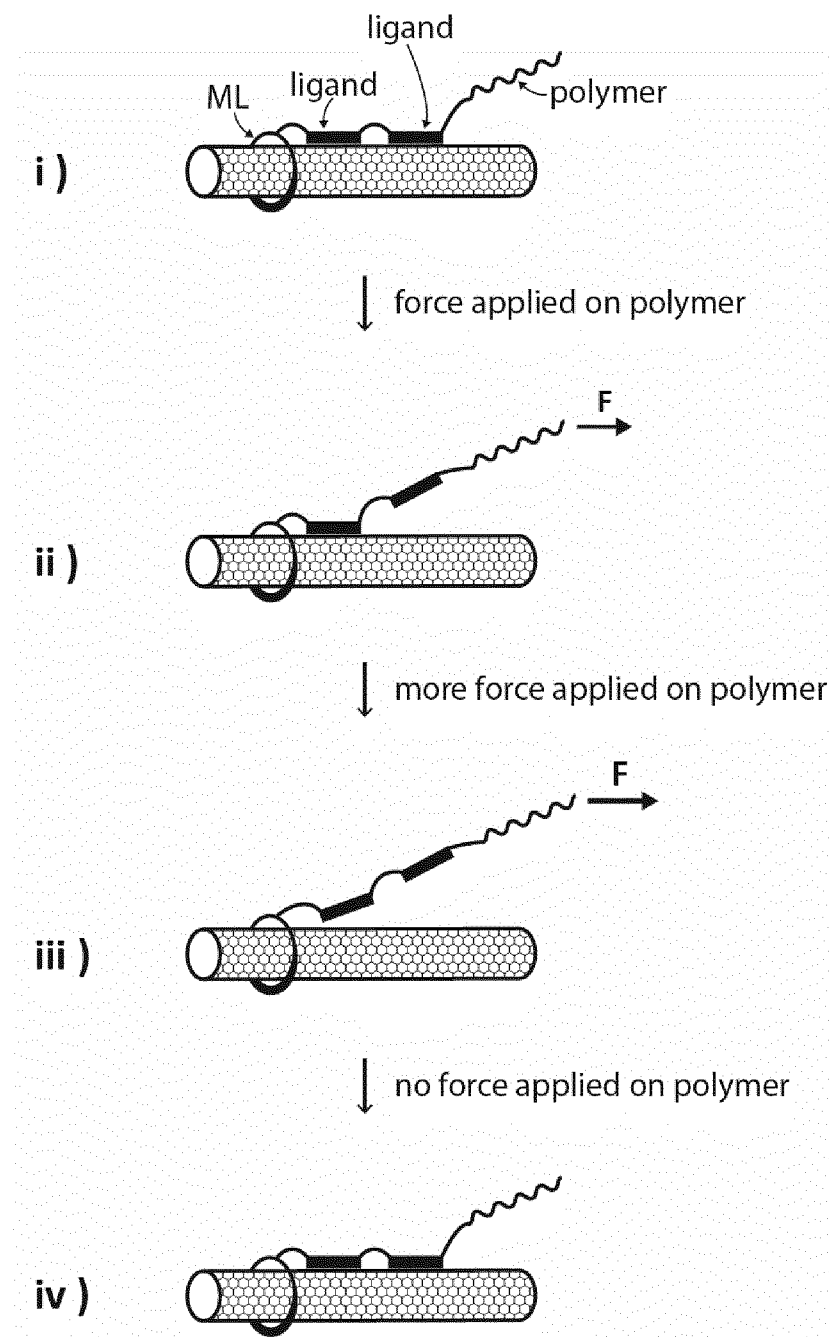


Figure 24

A.

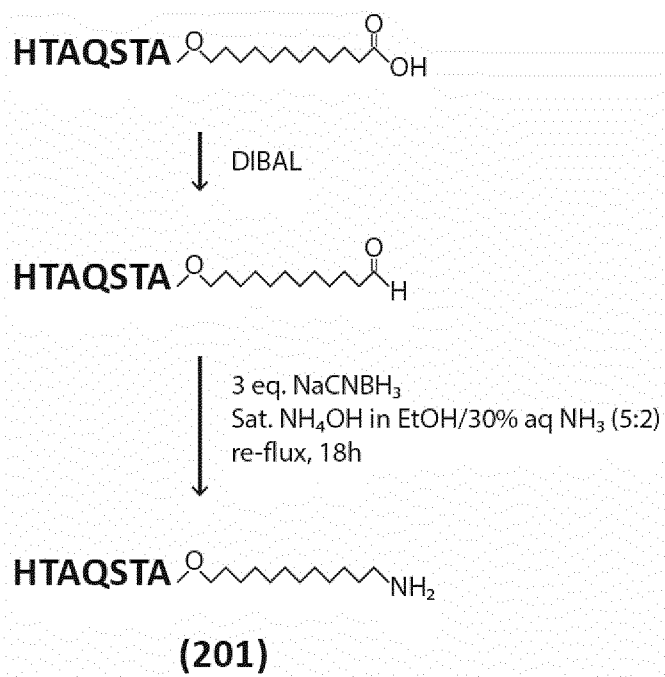
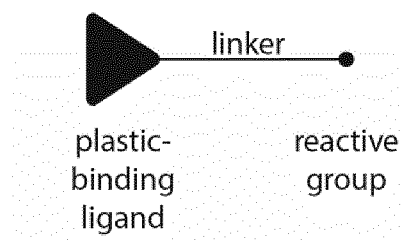


Figure 24

B.

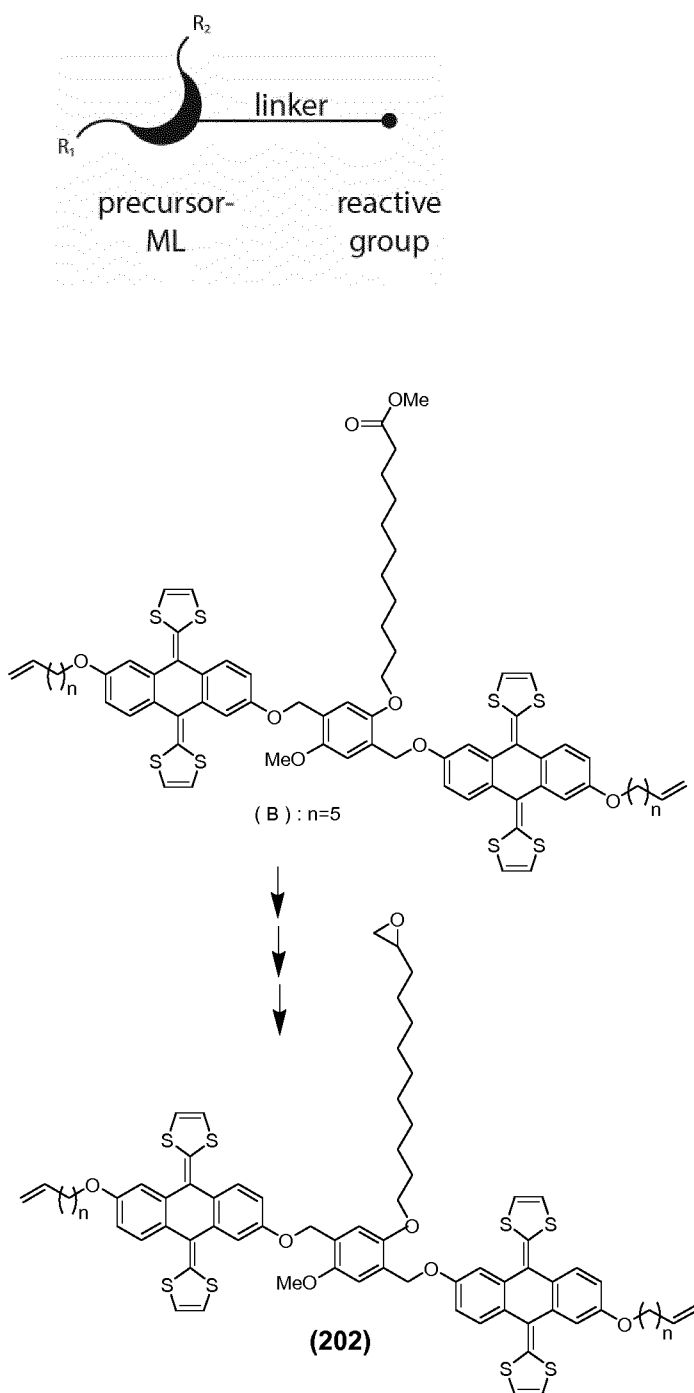


Figure 24

C.

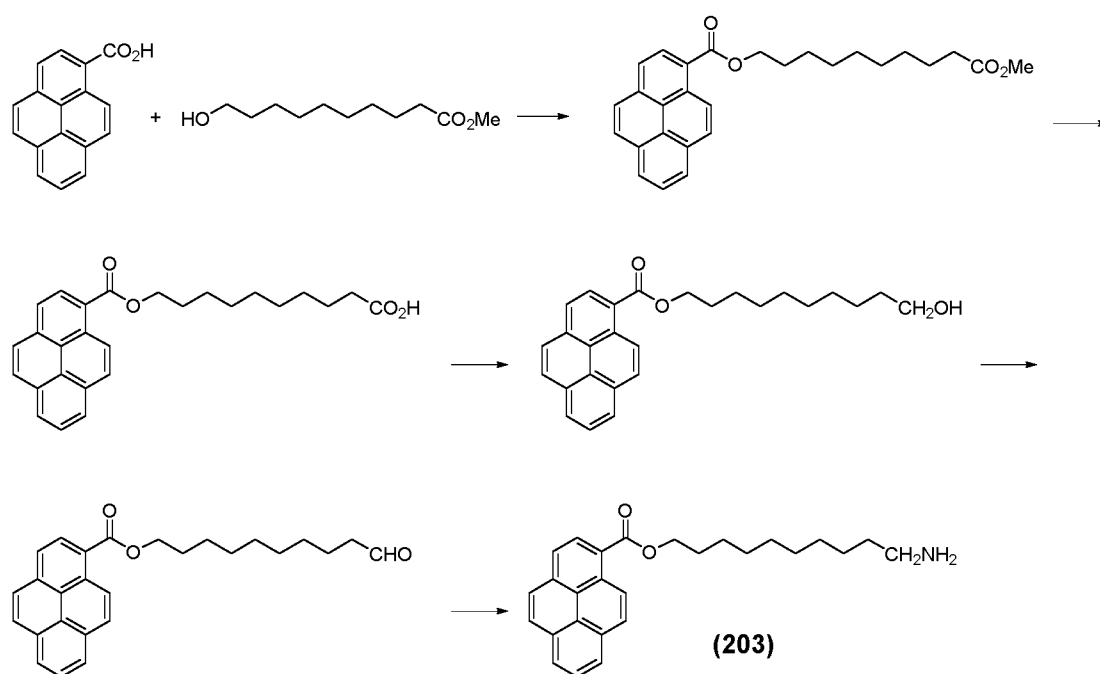
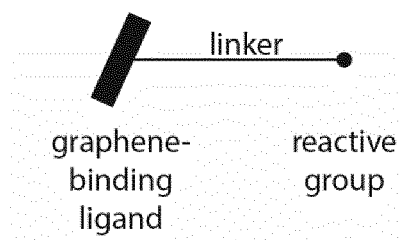


Figure 24

D

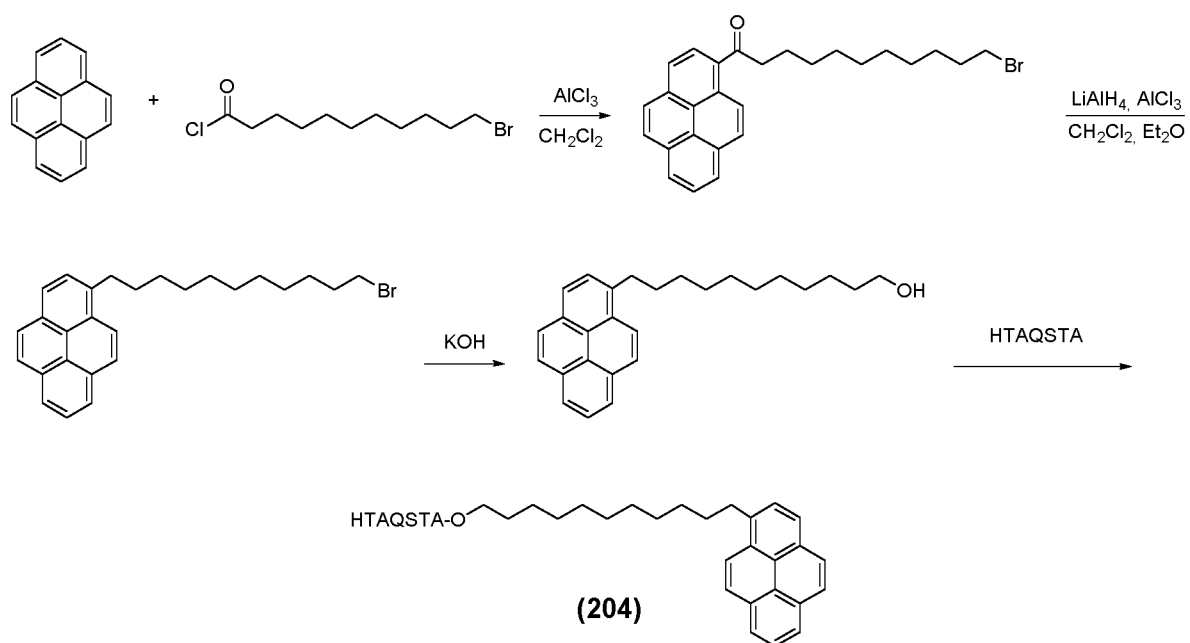
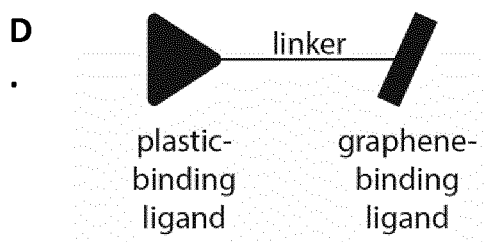


Figure 24

E.

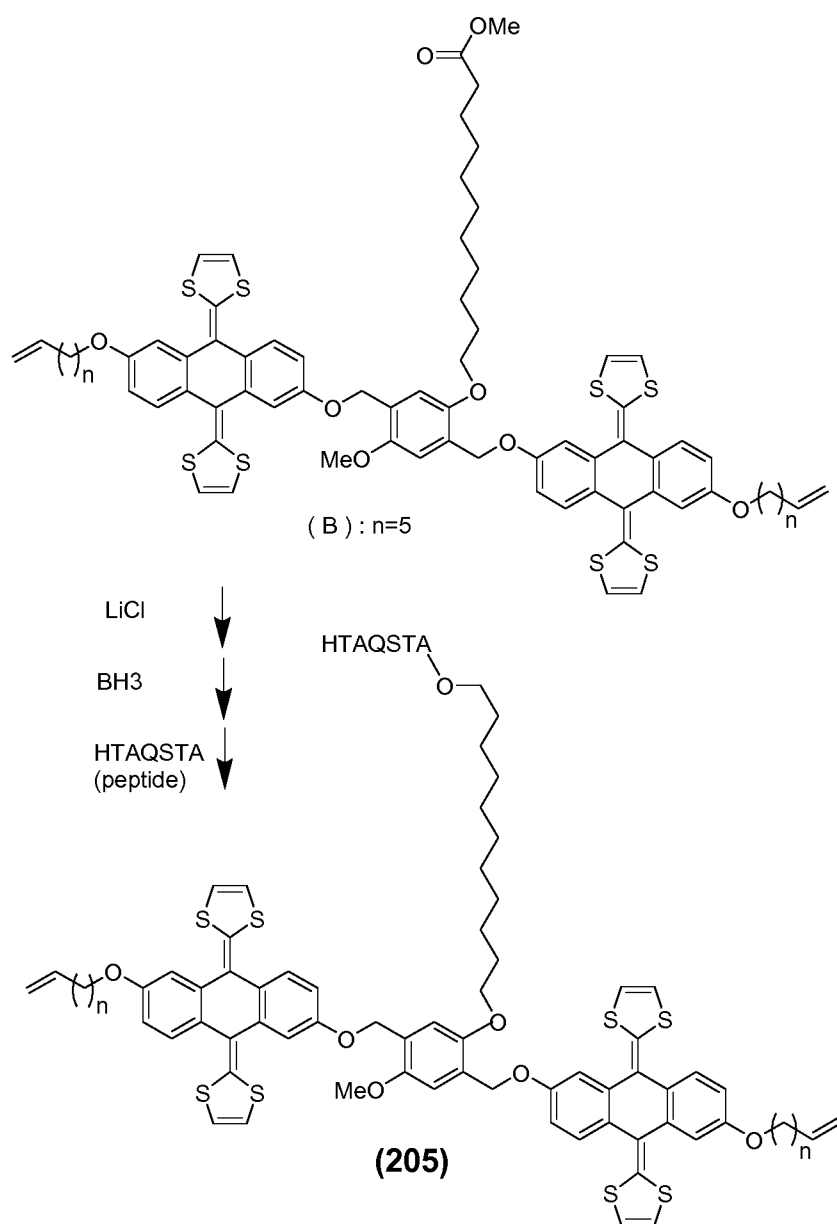
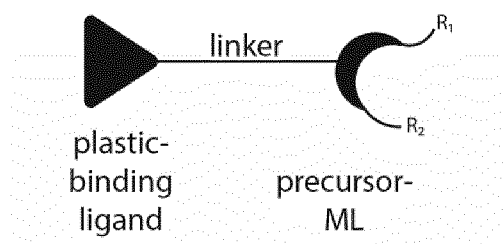


Figure 24

F.

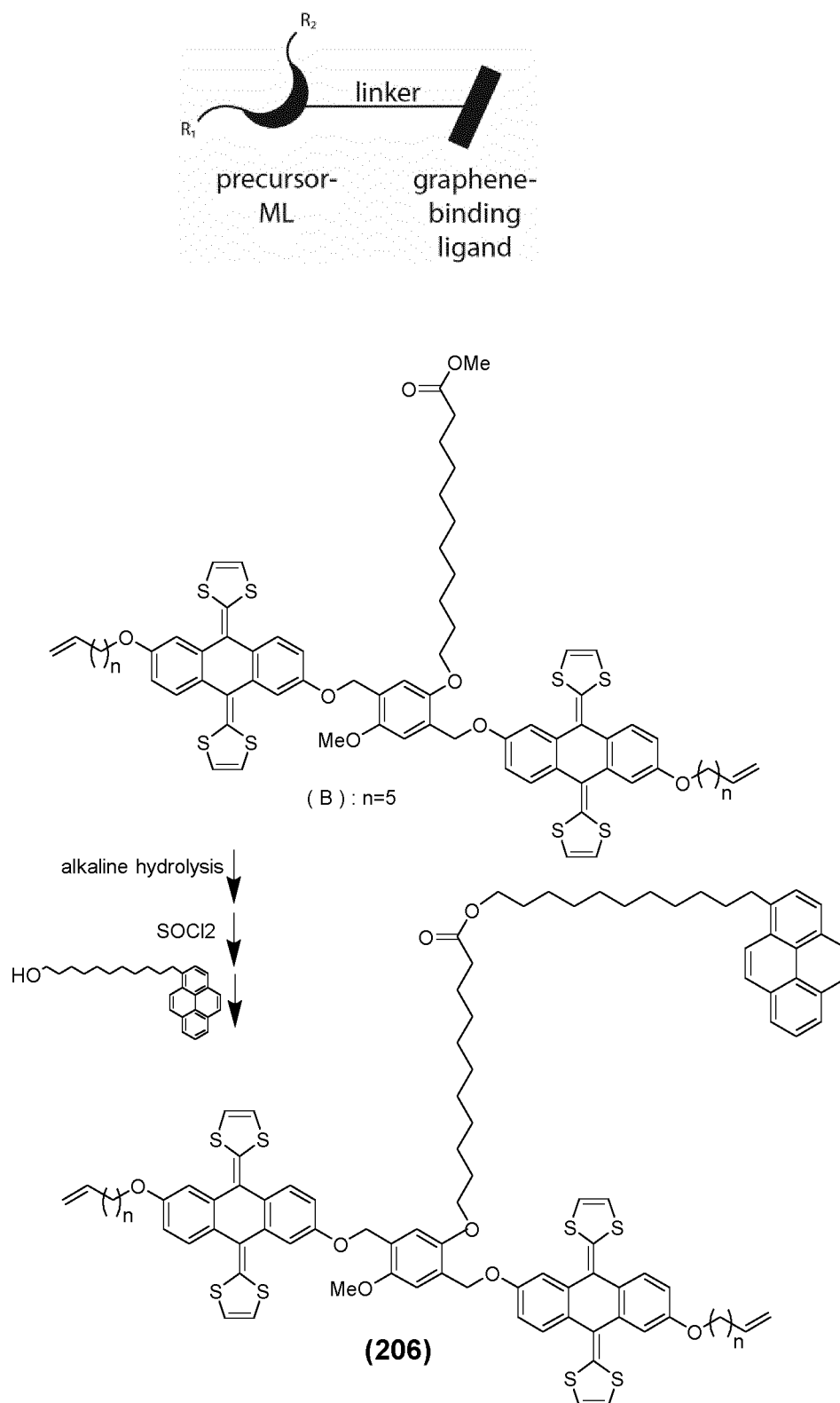


Figure 24

G.

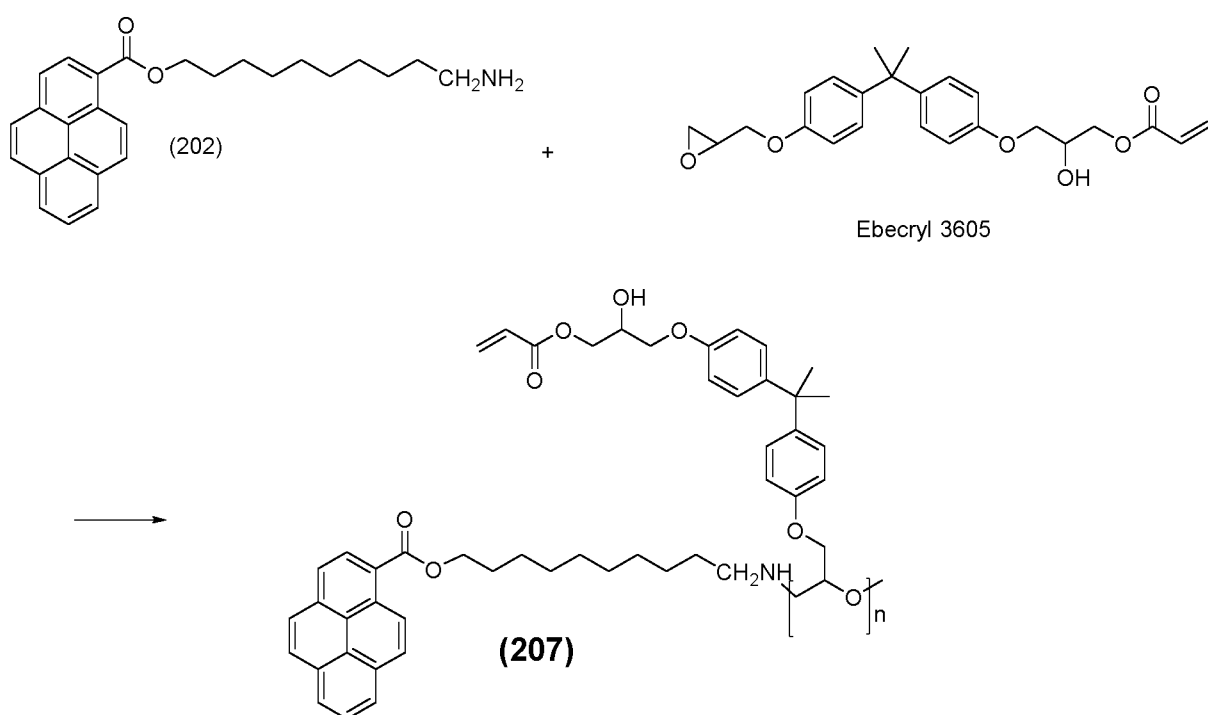
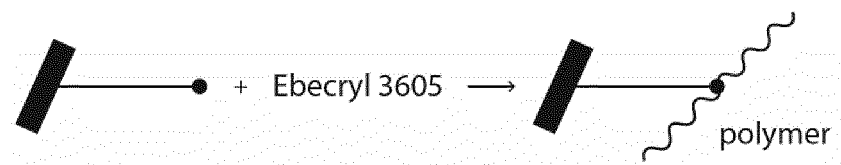


Figure 24

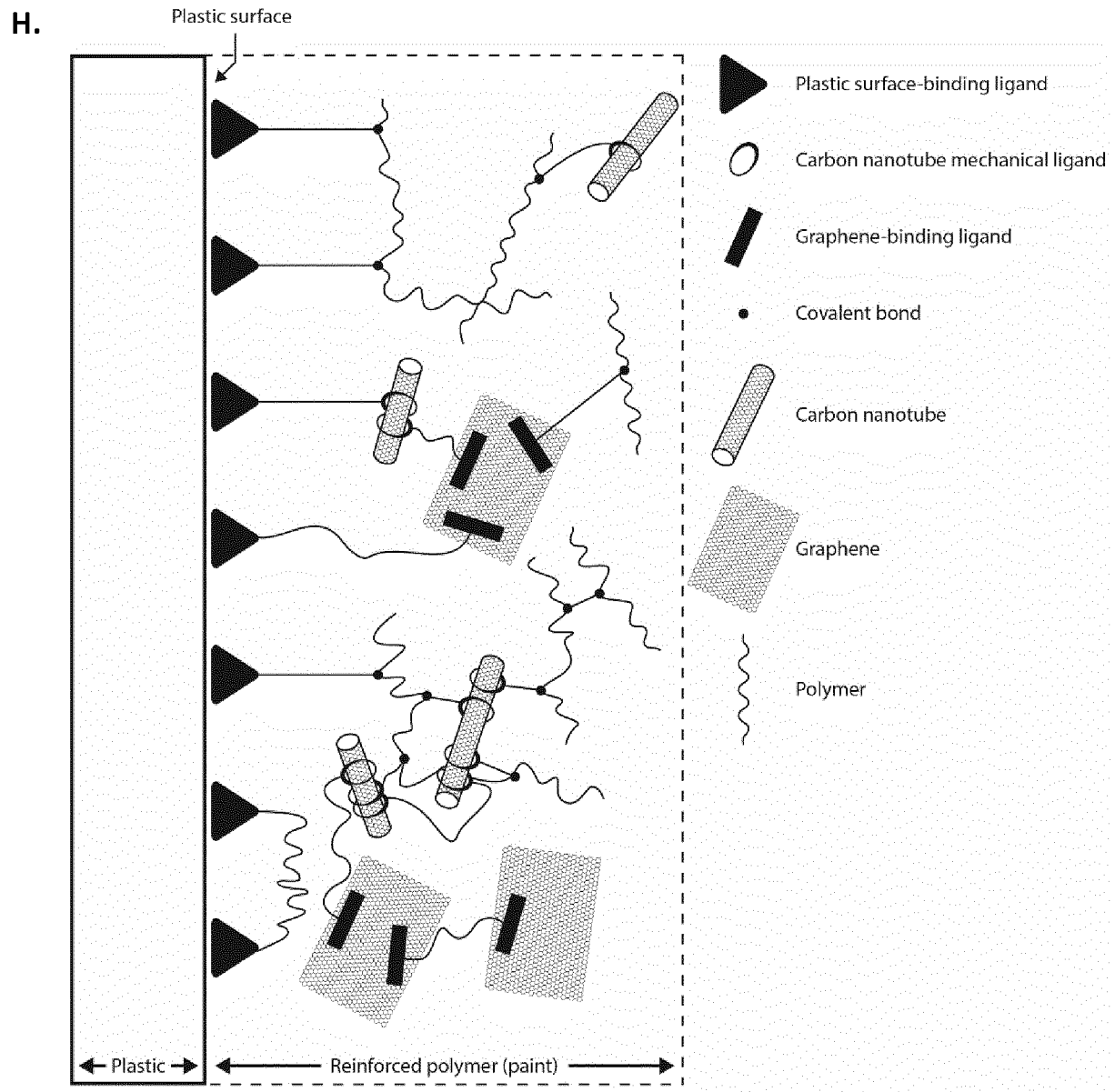
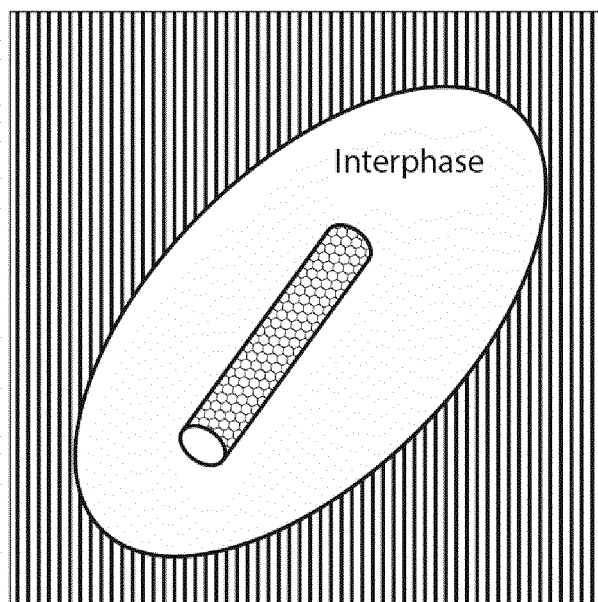
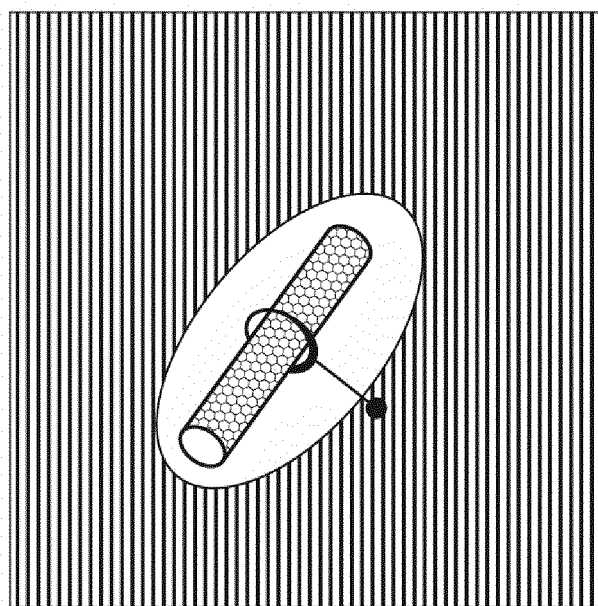


Figure 25

A.



B.



Mechanical ligand



Nucleating agent

Figure 25

C.

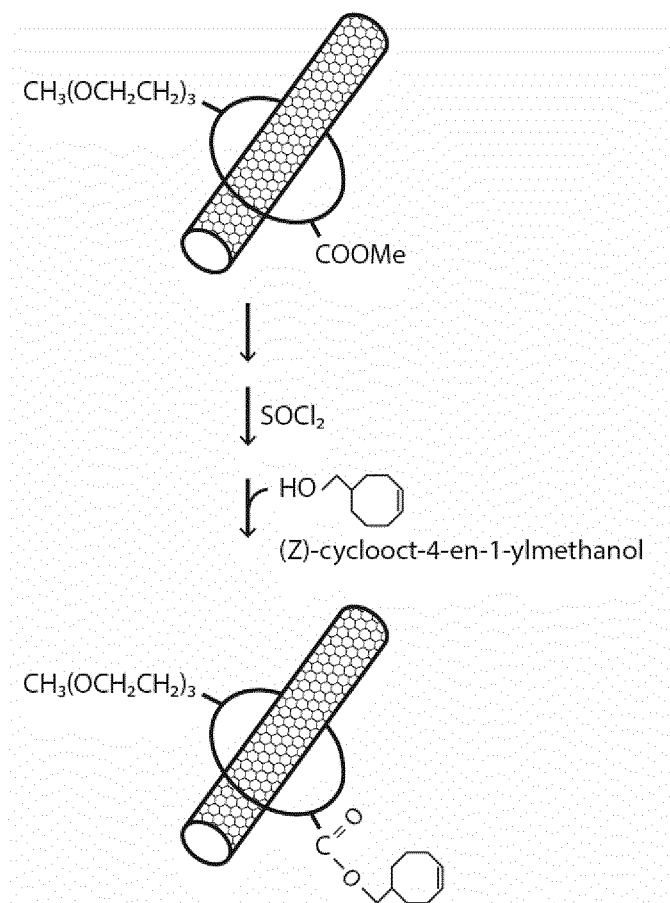


Figure 25

D.

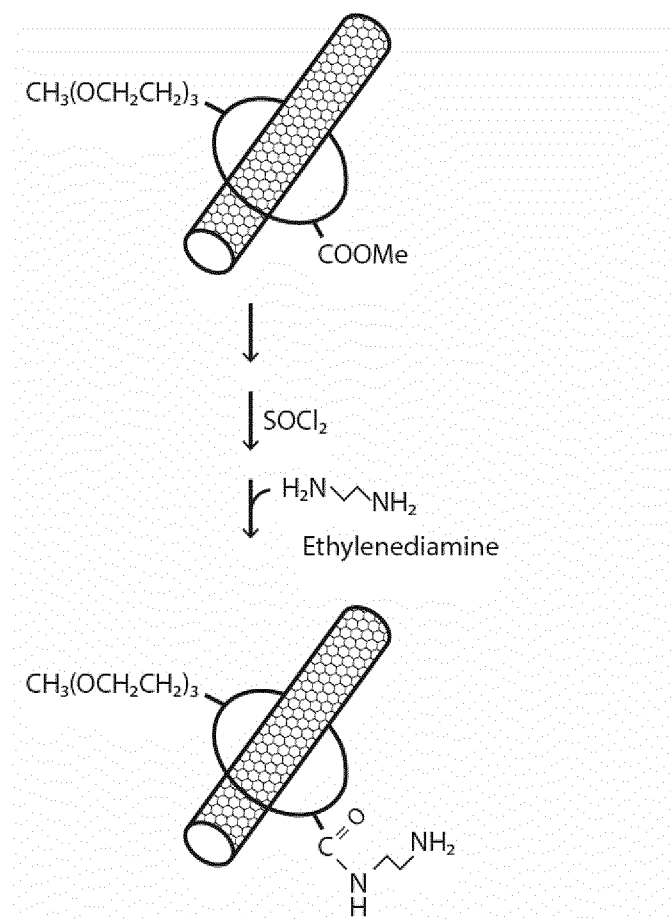


Figure 26

A.

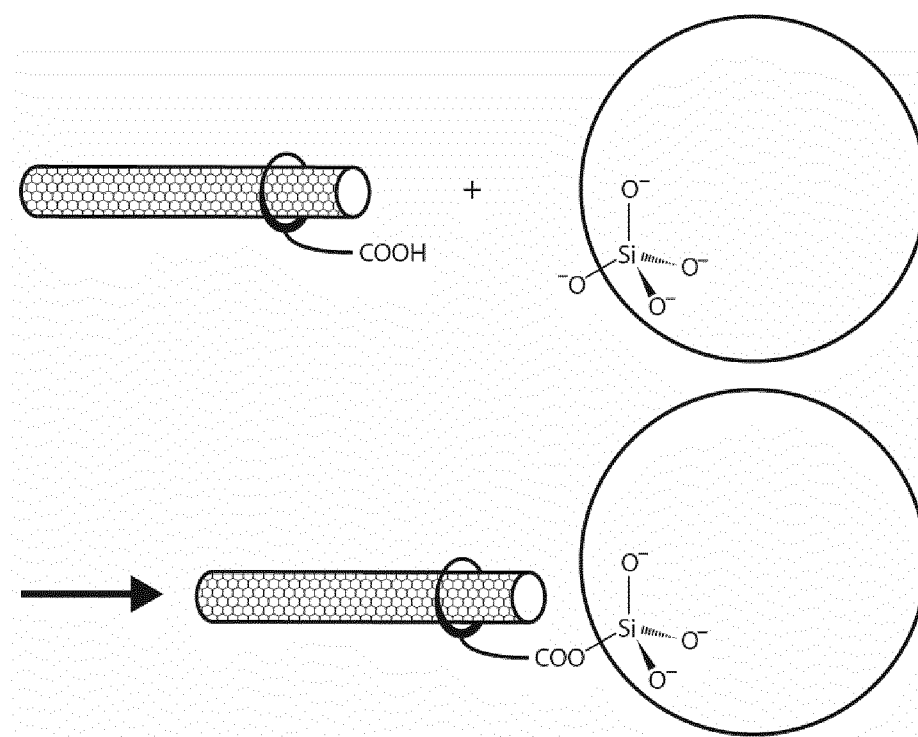
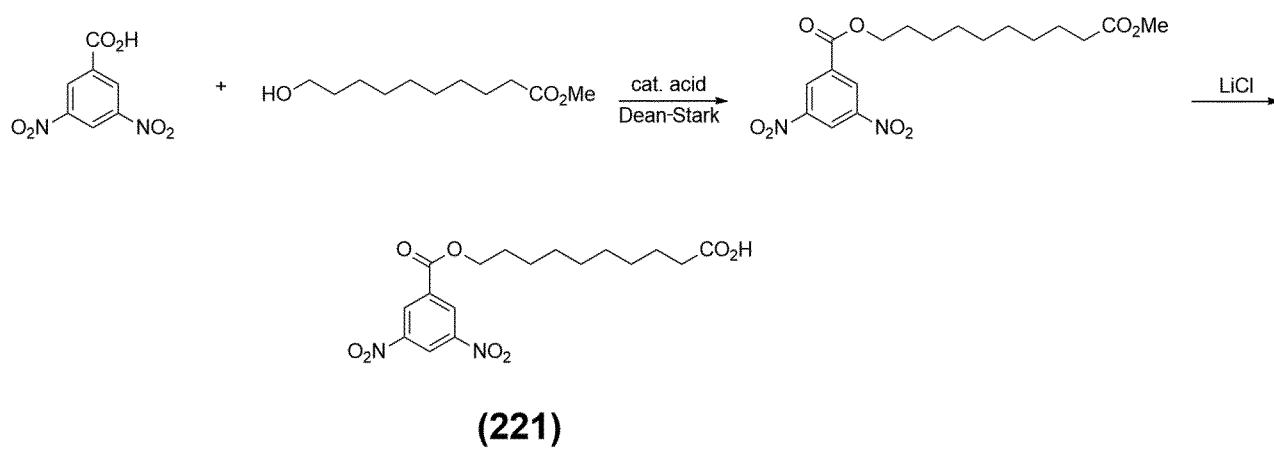


Figure 26

B



D

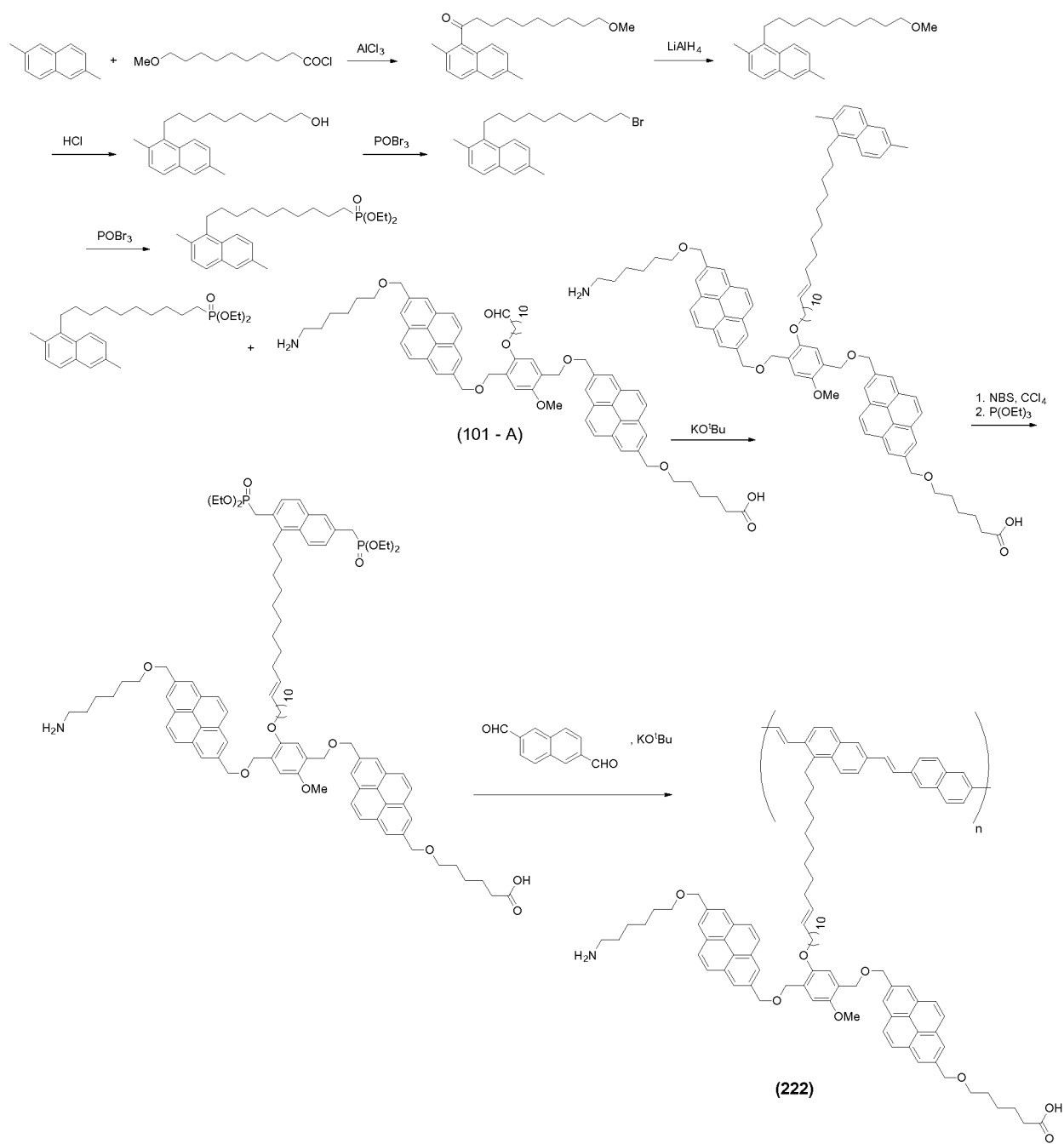


Figure 29

A.

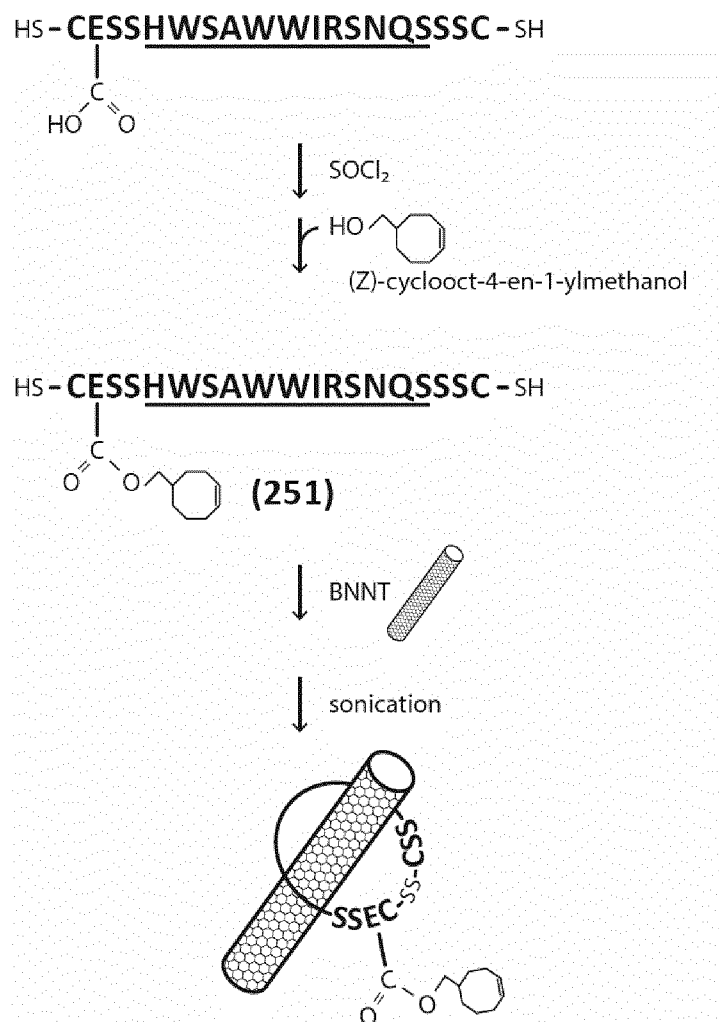


Figure 29

B

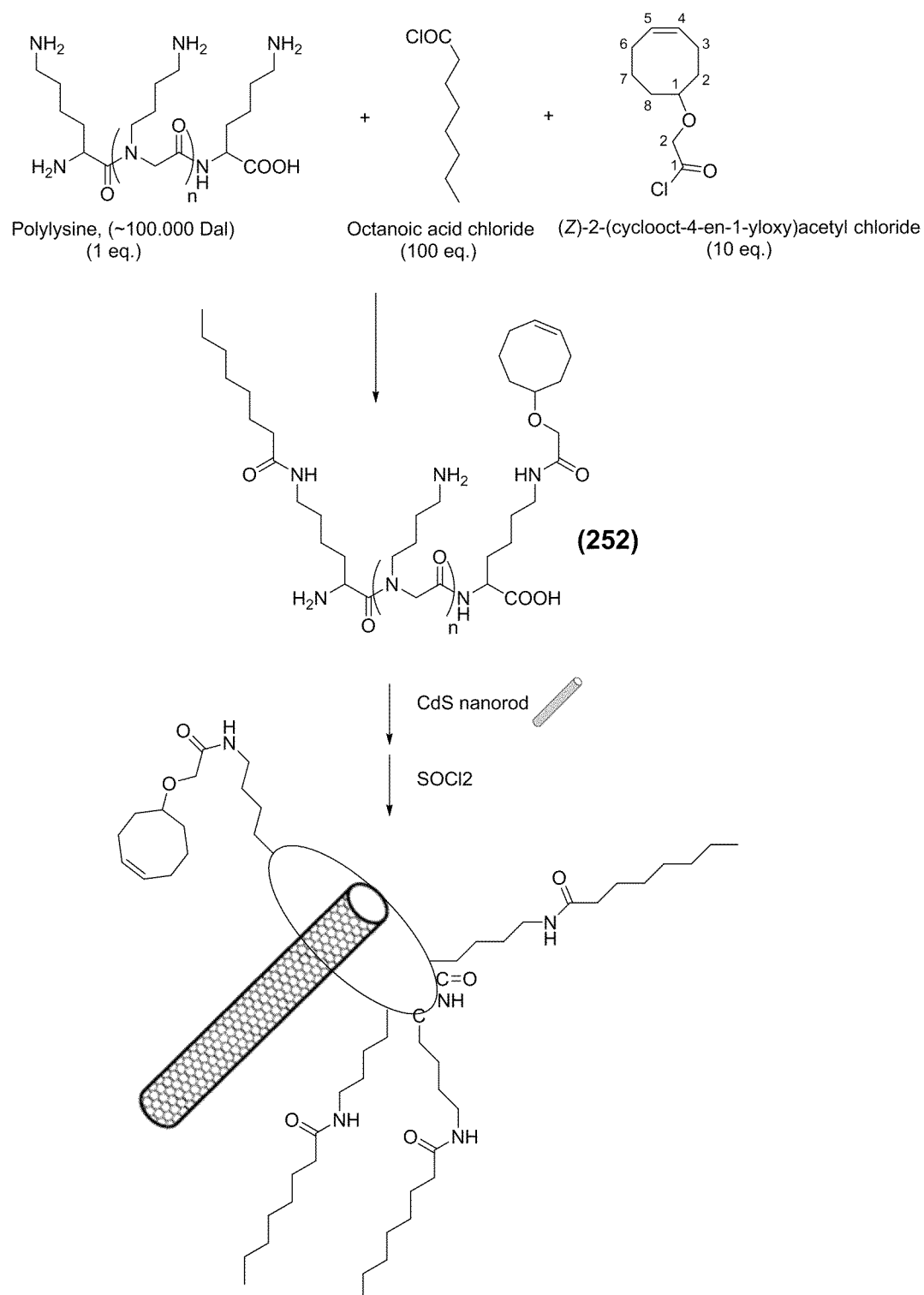


Figure 30

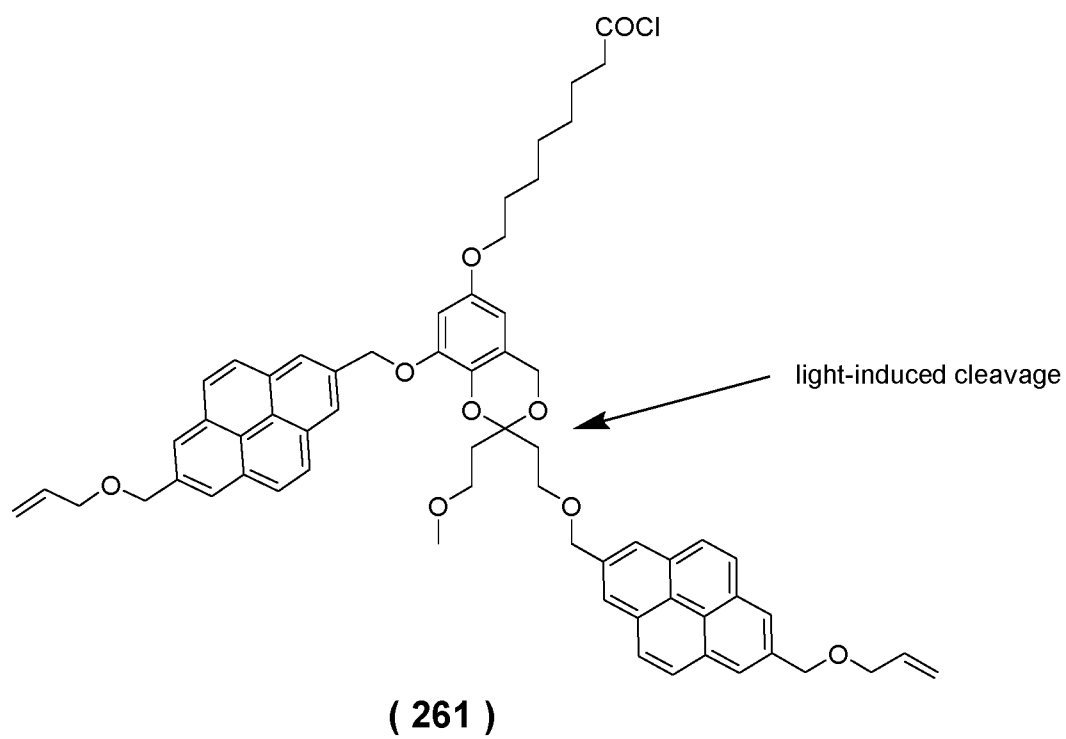


Figure 31

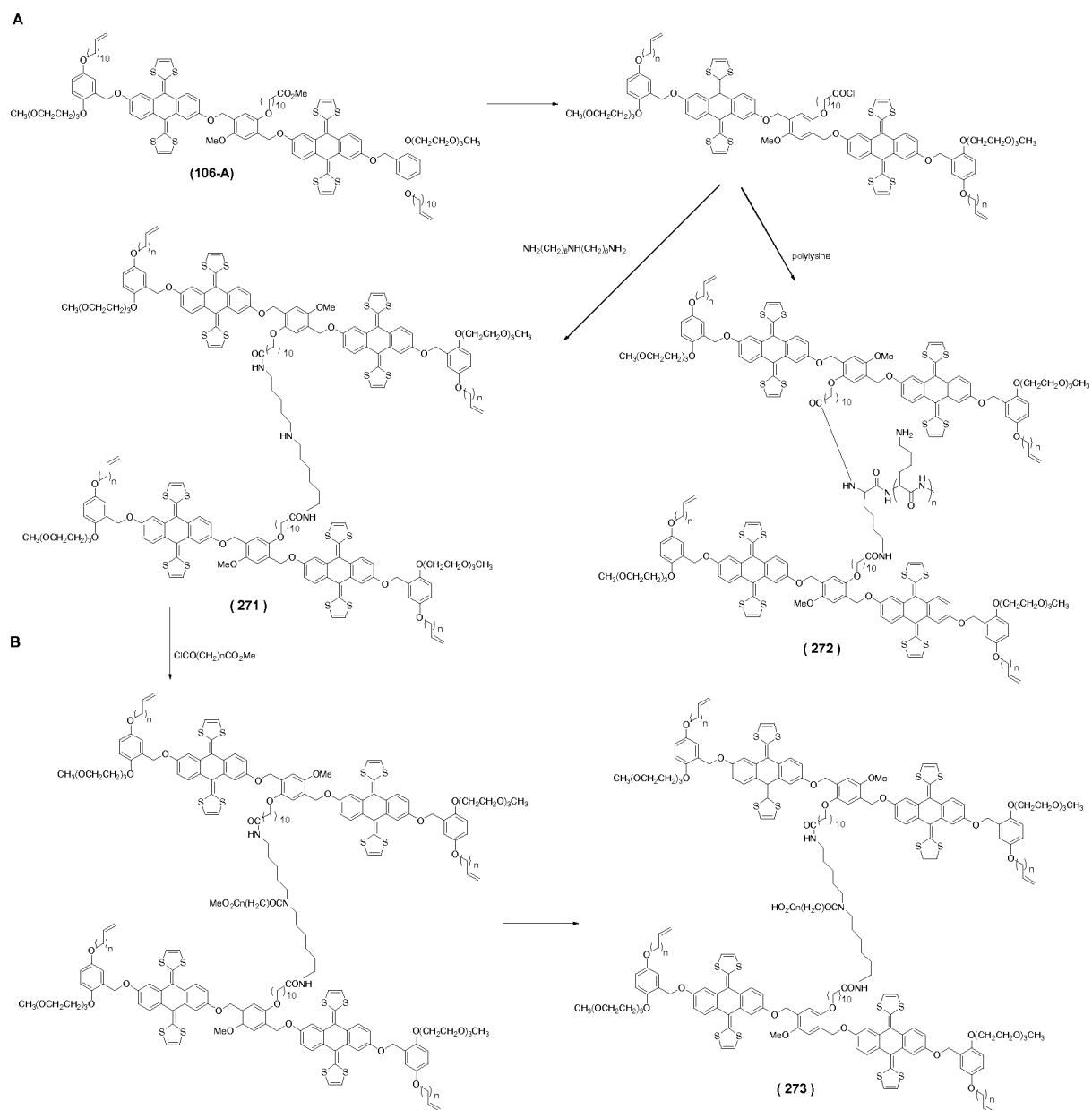


Figure 31

C.

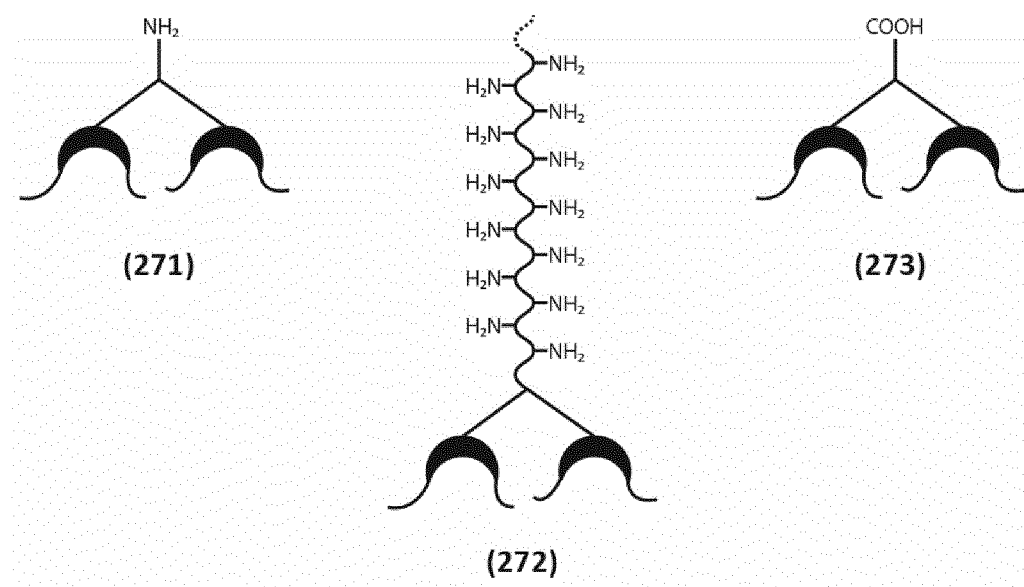
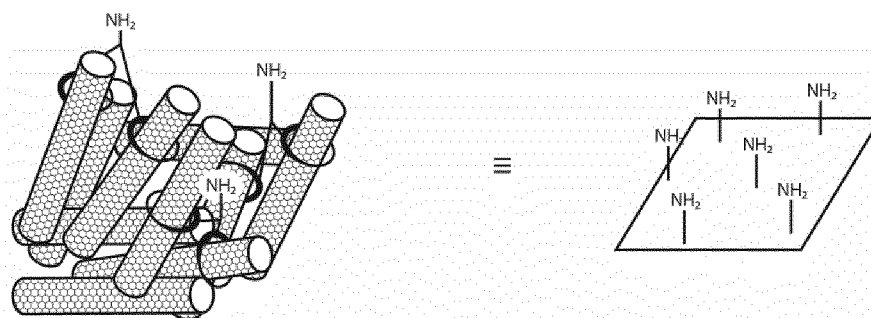


Figure 31

D. Amine-modified CNT veil:



E. Carboxylic acid chloride-modified veil:

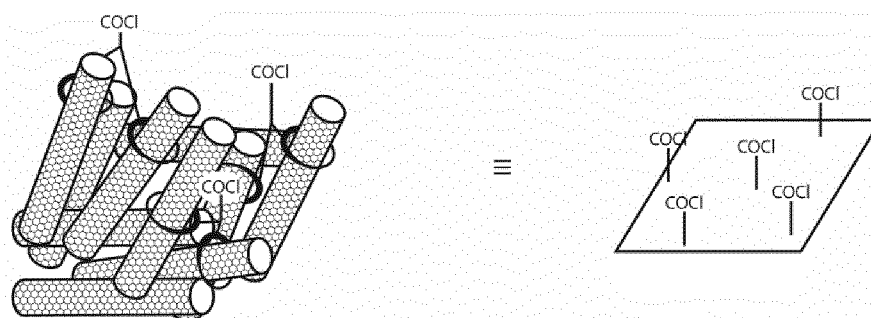
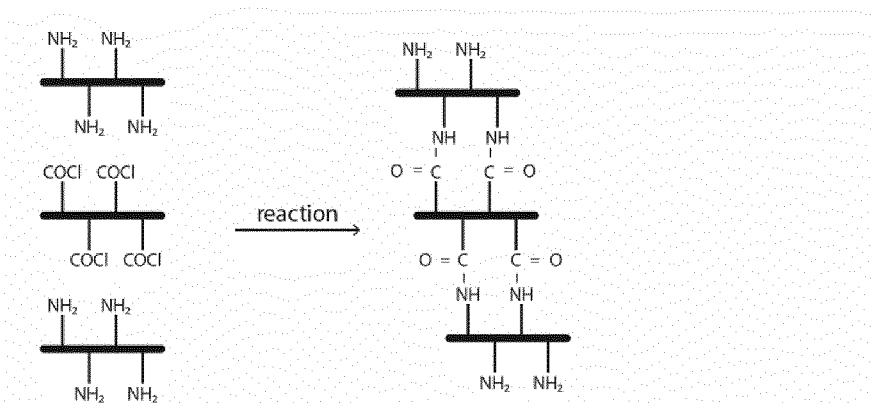
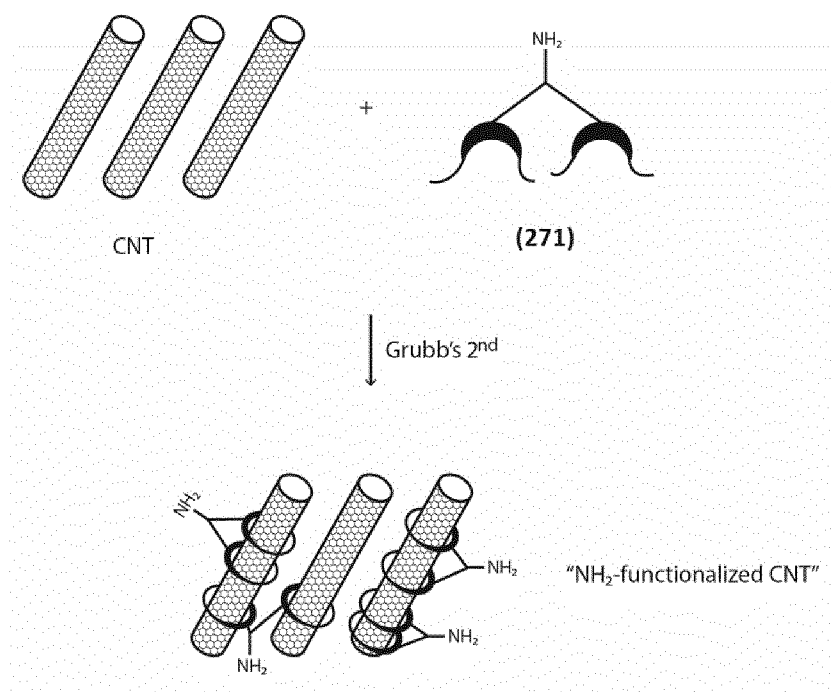
F. Gluing NH_2 -modified veils together with COCl -modified veils:

Figure 32

A.



B.

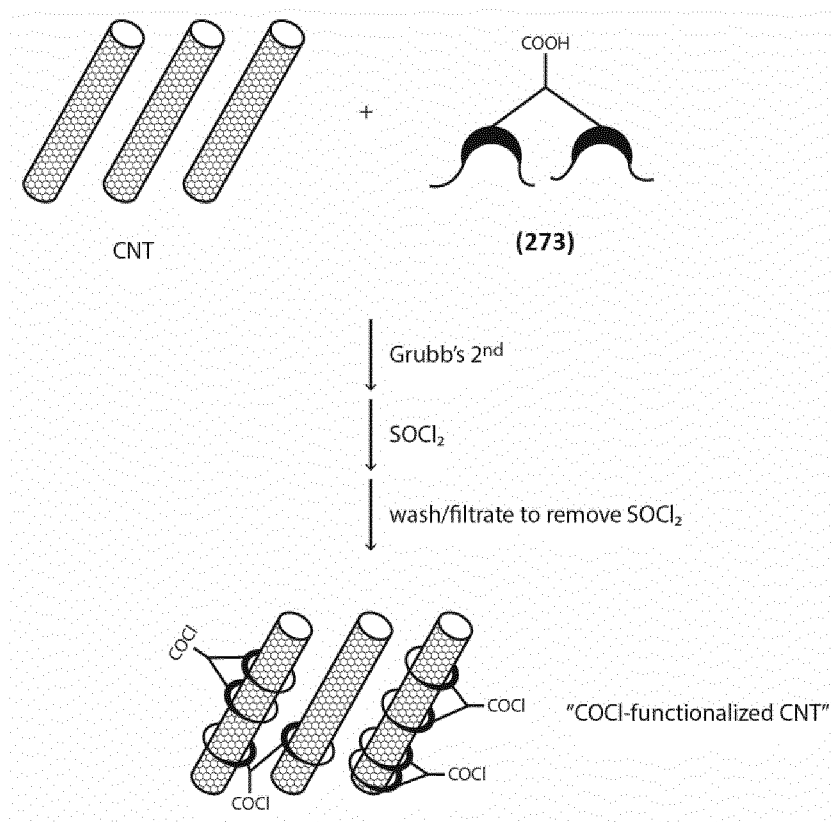


Figure 32

C.

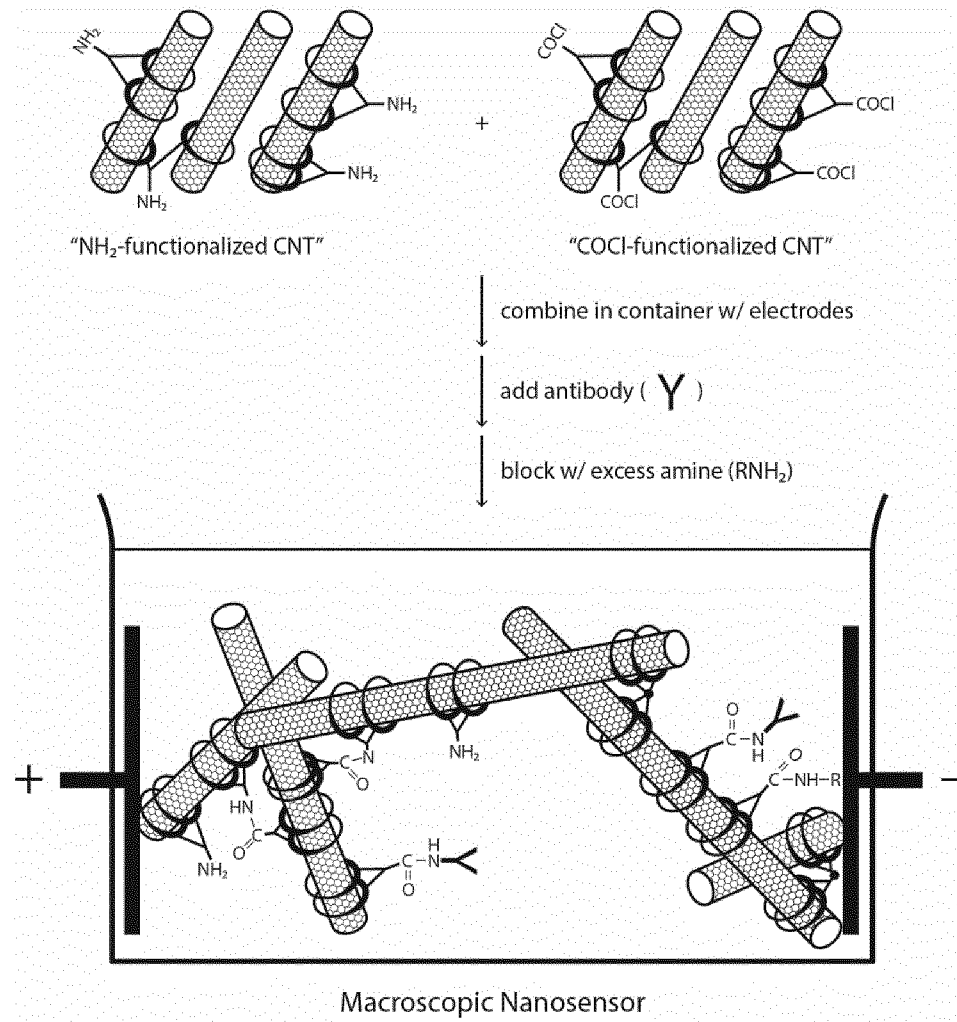
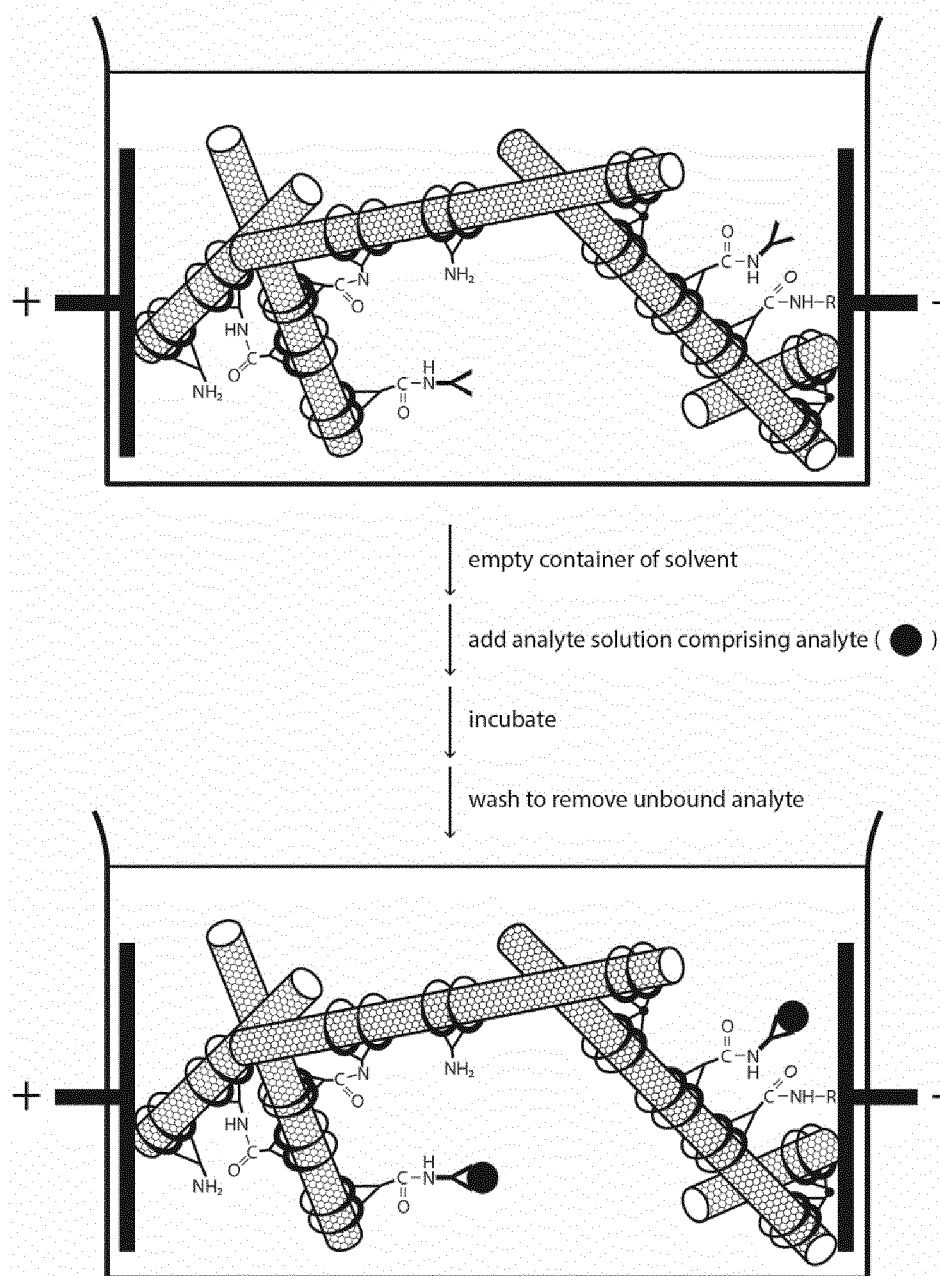


Figure 32

D.

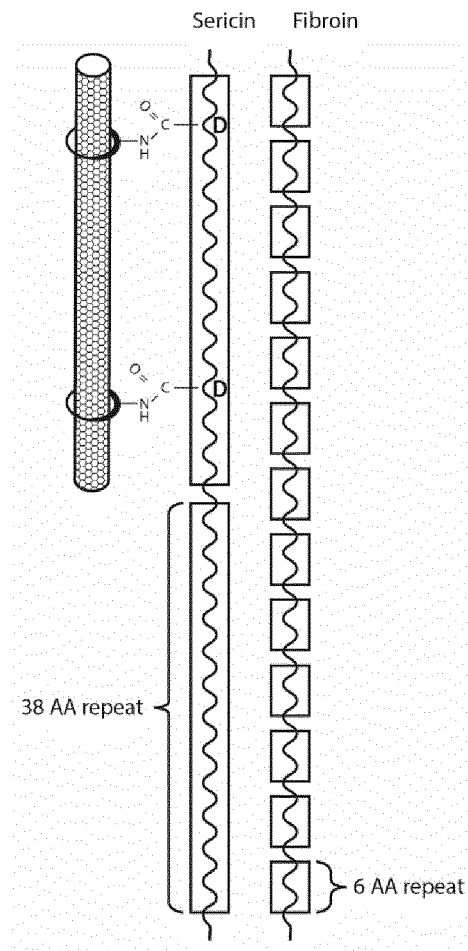
First step: measure current through sensor apparatus



Final step: measure current through sensor apparatus

Figure 33

A.



B.

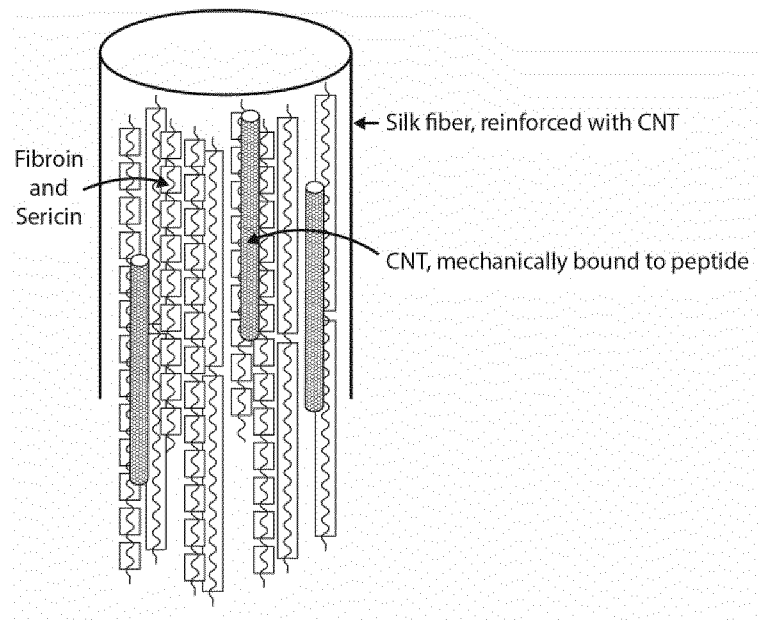


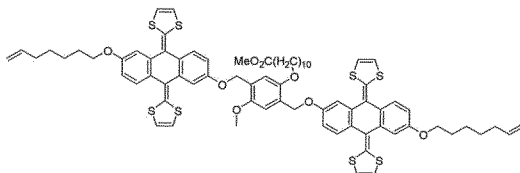
Figure 39 A

Certificate of Analysis

Compound Name : Methyl 11-(2,5-bis(((9,10-di(1,3-dithiol-2-ylidene)-6-(hept-6-en-1-yloxy)-9,10-dihydroanthracen-2-yl)oxy)methyl)-4-methoxyphenoxy)undecanoate

Syncom Number : 29652

Chemical Structure :

Molecular Formula : $C_{75}H_{78}O_8S_8$

Molecular Weight : 1363.92 g/mol

Quantity Shipped : 300 mg

Last Solvent(s) : Heptane, Ethyl acetate

Appearance : Orange solid

NMR : Enclosed
(¹H, 300 MHz, CDCl₃) in accordance with chemical structure
(¹³C, 75 MHz, CDCl₃) in accordance with chemical structure

UPC-MS : Enclosed + Mass Only
Purity: 92.0% (at 215 nm) and 92.2% (at 238 nm)
MS (ES⁺): m/z: 681.38 [M/2], 1363 [M+1]

Batch # : MPZ264526-A

Storage Conditions : Room temperature

Retest Date : February 19, 2019

Sample Sent to : NanoCore ApS
Att: Tore Dehli
Universitetsparken 5, CS08 DK-2100 Copenhagen

Issued By : M. Poizat (PhD)

Approved By : T. Visser (PhD)

Date : February 19, 2018

Date : February 19, 2018

Figure 39 B

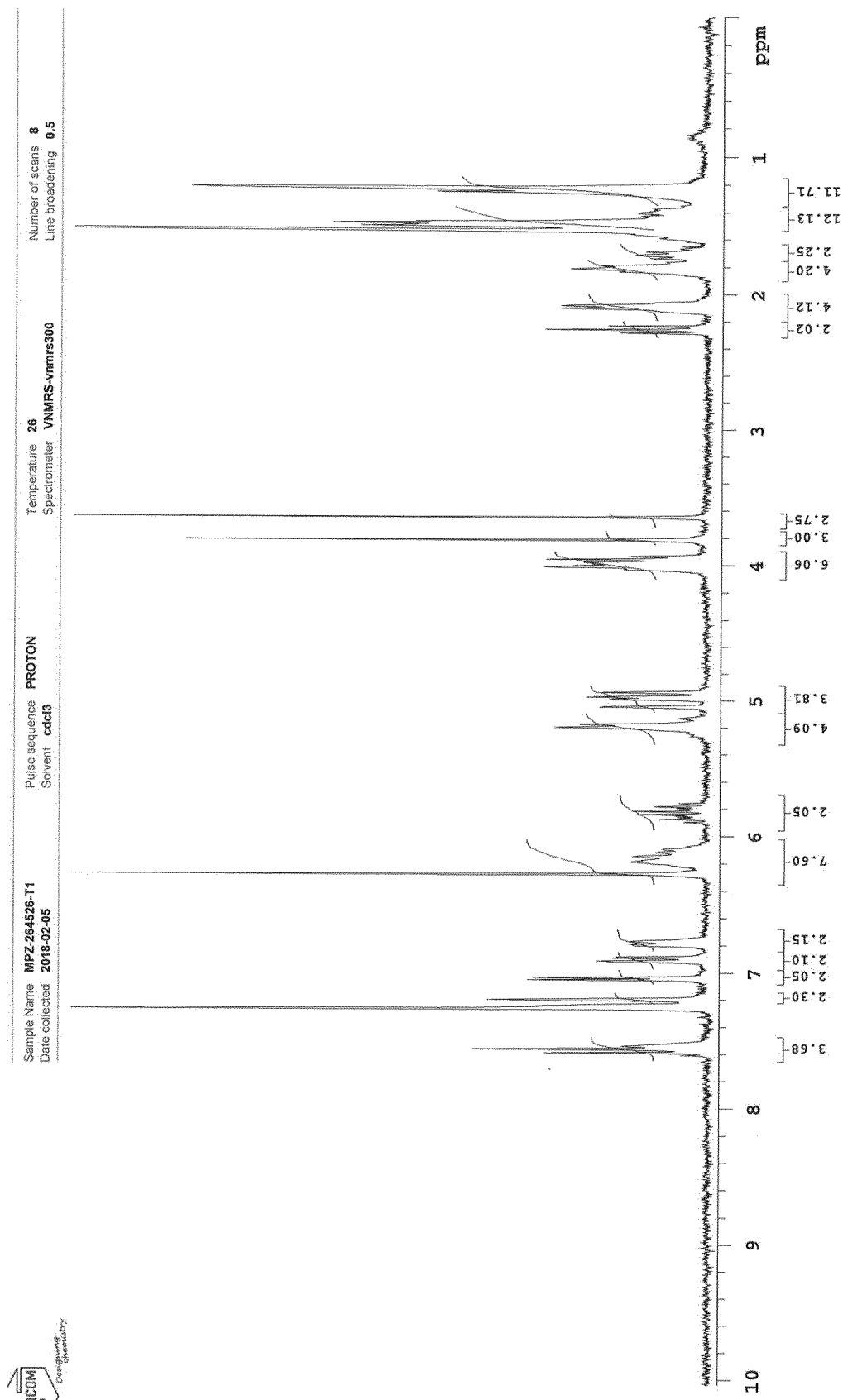


Figure 39 C

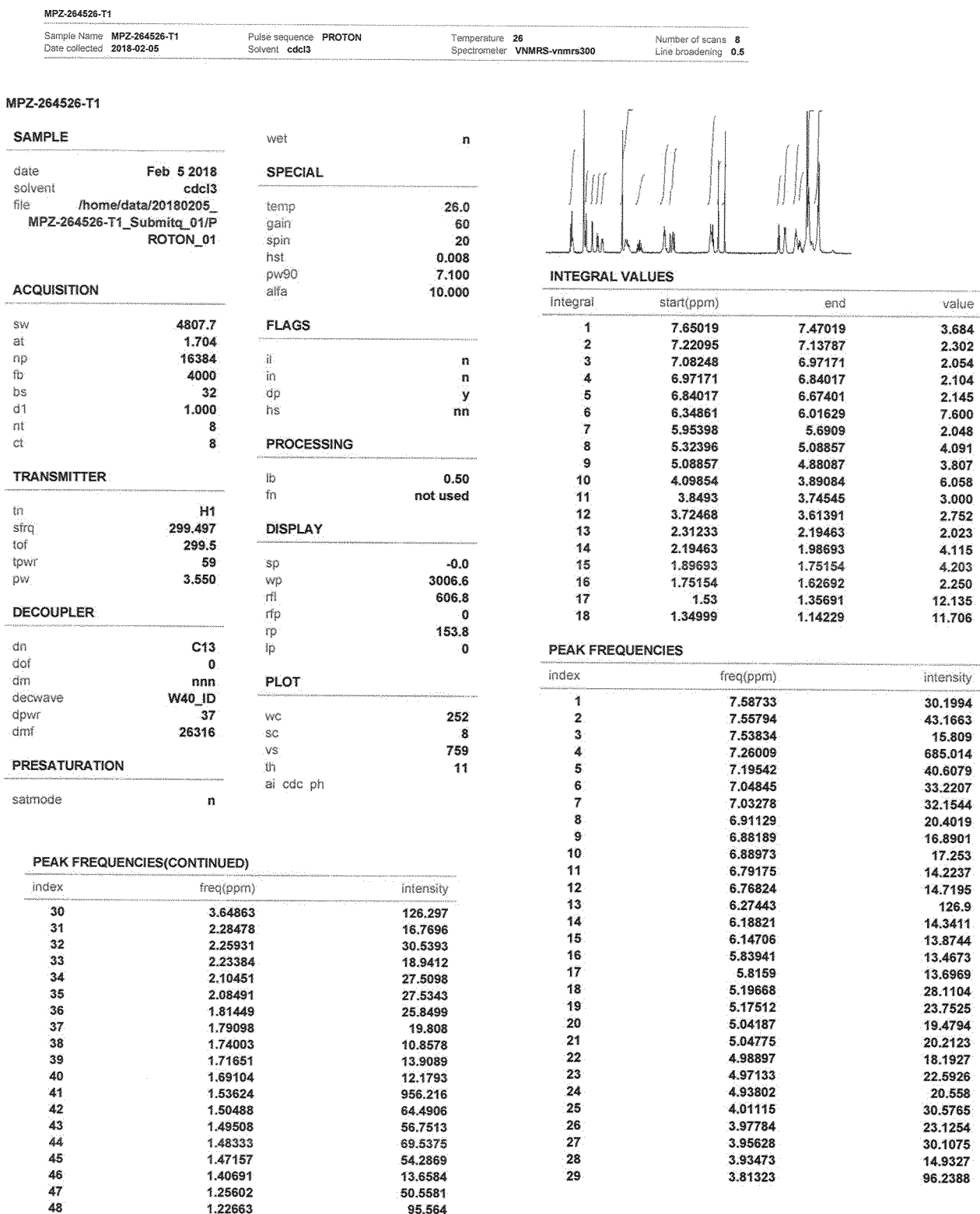


Figure 39 D

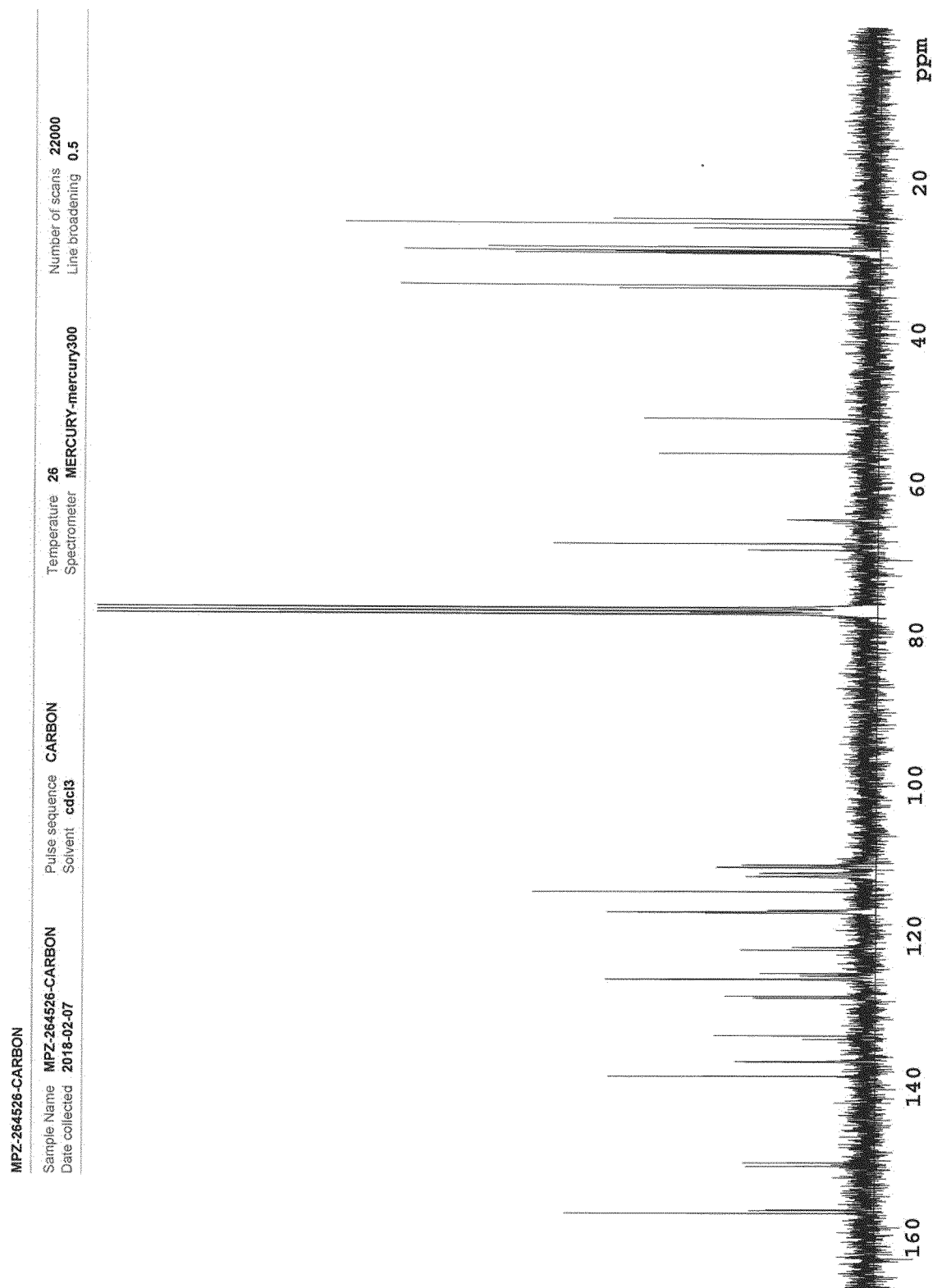


Figure 39 E

MPZ-264526-CARBON

Sample Name	MPZ-264526-CARBON	Pulse sequence	CARBON	Temperature	26	Number of scans	22000
Date collected	2018-02-07	Solvent	cdcl3	Spectrometer	MERCURY-mercury300	Line broadening	0.5

MPZ-264526-CARBON

SAMPLE

date Feb 7 2018
 solvent cdcl3
 file /home/data/20180207
 _MPZ-264526-CARBON_Submit
 q_02/CARBON_01

ACQUISITION

sw 18867.9
 at 0.868
 np 32768
 fb 10400
 bs 64
 d1 1.000
 nt 22000
 ct 22000

TRANSMITTER

ln C13
 sfrq 75.480
 tof 1156.3
 tpwr 58
 pw 7.350

DECOUPLER

dn H1
 dof 0
 dm yyy
 decwave w
 dpwr 39
 dmf 5400

PRESATURATION

satmode n
 wet n

SPECIAL

temp 26.0
 gain 30
 spin 20
 hst 0.008
 pw90 14.700
 alfa 10.000

FLAGS

il n
 in n
 dp y
 hs nn

PROCESSING

lb 0.50
 fn not used

DISPLAY

sp 10.3
 wp 14990.5
 rfi 1132.1
 rfp 0
 rp -149.1
 lp -328.6

PLOT

wc 252
 sc 8

vs 3459
 th 6
 ai cdc ph

INTEGRAL VALUES

Integral	start(ppm)	end	value
1	198.76	0.136609	100.000

PEAK FREQUENCIES

index	freq(ppm)	intensity
1	174.362	7.88104
2	163.101	-8.46855
3	157.043	50.1275
4	156.692	19.0459
5	156.585	16.1447
6	150.787	19.5639
7	150.329	20.0432
8	138.87	42.8311
9	137.008	19.8647
10	136.916	21.5075
11	134.002	10.1384
12	133.56	25.0597
13	128.524	18.4166
14	128.28	23.2342
15	126.052	43.1977
16	125.991	43.4087
17	125.564	10.5894
18	125.243	17.2761
19	122.146	20.6171
20	121.795	11.9535
21	117.263	26.5789
22	117.141	43.0966
23	116.897	16.132
24	114.44	55.6421
25	112.441	19.8634
26	111.999	17.5087
27	111.175	24.6507
28	111.236	24.7634
29	110.885	20.5115
30	77.4377	713.122
31	77.2088	29.4098
32	77.0104	796.385
33	76.5832	735.479
34	70.2508	-7.68868
35	68.9385	19.7466
36	68.0993	52.4336
37	64.9255	13.2802
38	56.1211	34.8072
39	51.4367	37.3929
40	34.1027	41.7301
41	33.706	78.3333
42	29.5556	33.994
43	29.4335	59.21
44	29.3419	23.1045
45	29.2657	42.3501
46	29.1436	77.7897
47	28.6706	63.7283
48	26.1681	29.2476
49	25.573	87.7055
50	24.9474	42.767

Data file /home/data/20180207_MPZ-264526-CARBON_Submitq_02/CARBON_01

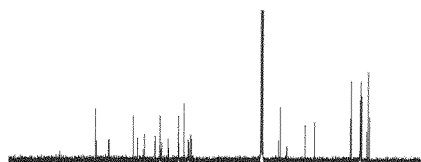


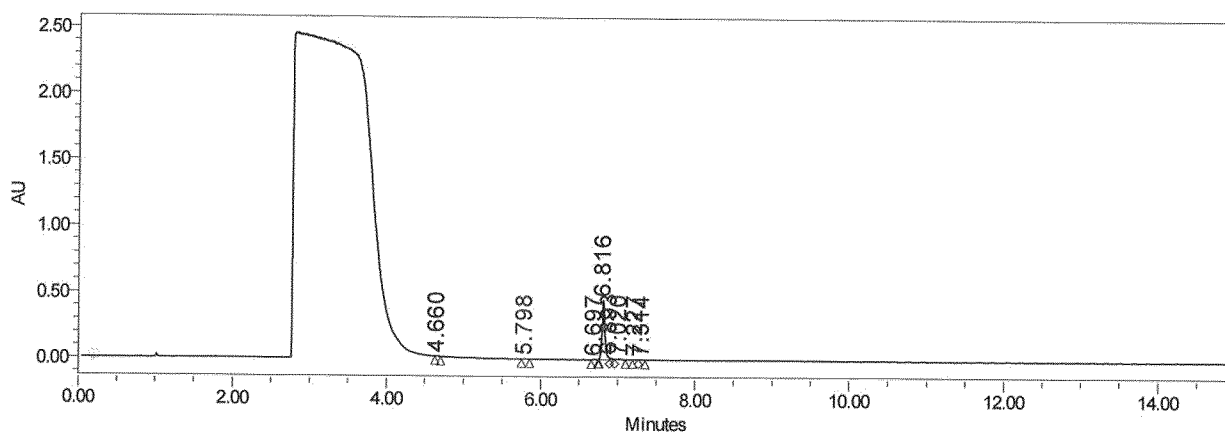
Figure 39 F



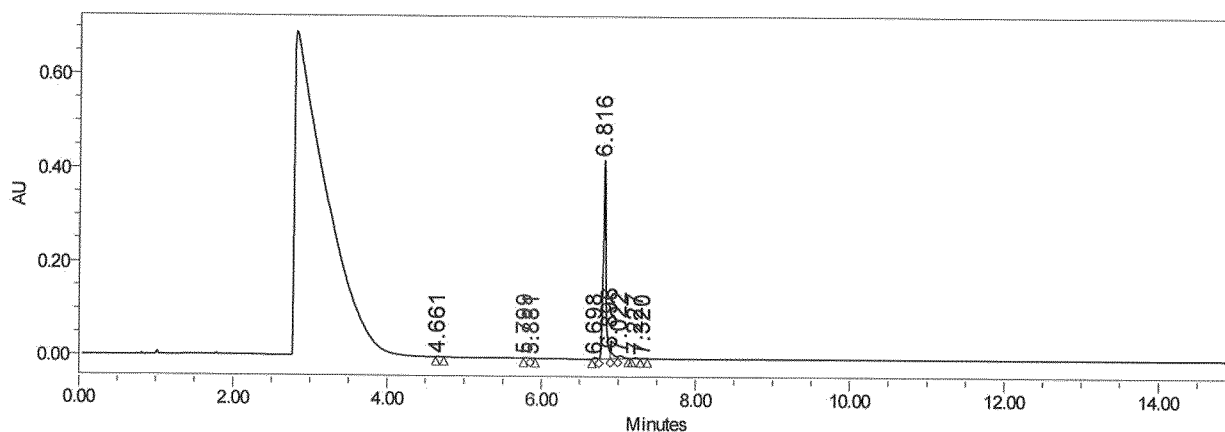
Syncom Report PDA QDA 2

SAMPLE INFORMATION

Sample Name:	MPZ264526-03	Acquired By:	System
Sample Type:	Unknown	Sample Set Name:	08022018s03
Vial:	2:B,3	Acq. Method Set:	29652 UPC2 15m Diol ACN
Injection #:	1	Processing Method:	29652 UPC2 15m Diol ACN
Injection Volume:	1.00 ul	Run Time:	15.0 Minutes
Channel Name:	PDA Ch1 215nm@4.8nm -Compens., PDA Ch2 238nm@4.8nm -Compens.		
Proc. Chnl. Descr.:	PDA Ch1 215nm@4.8nm -Compens., PDA Ch2 238nm@4.8nm -Compens.		
Date Acquired:	2/8/2018 11:50:12 AM CET		
Date Processed:	2/8/2018 1:09:33 PM CET, 2/8/2018 1:11:39 PM CET		



Channel Description PDA Ch1 215nm@4.8nm -Compens.



Channel Description PDA Ch2 238nm@4.8nm -Compens.

Figure 39 G

Processed Channel: PDA
Ch1 215nm@4.8nm
-Compens.

	Retention Time (min)	Area	% Area	Height
1	4.660	5316	0.42	2148
2	5.798	5435	0.43	1955
3	6.697	11746	0.93	4385
4	6.816	1161899	92.04	455067
5	6.893	37934	3.01	15114
6	7.020	31043	2.46	5726
7	7.227	4922	0.39	2132
8	7.314	4021	0.32	1431

Processed Channel: PDA
Ch2 238nm@4.8nm
-Compens.

	Retention Time (min)	Area	% Area	Height
1	4.661	2378	0.20	823
2	5.799	1845	0.16	759
3	5.881	805	0.07	369
4	6.698	10972	0.93	3565
5	6.816	1090664	92.19	425112
6	6.896	45247	3.82	14480
7	7.022	24490	2.07	5616
8	7.227	5012	0.42	1980
9	7.320	1605	0.14	674

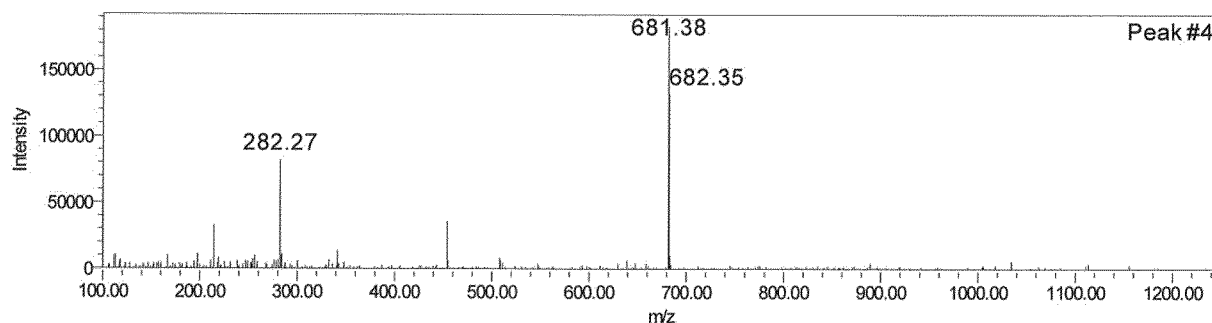


Figure 39 H

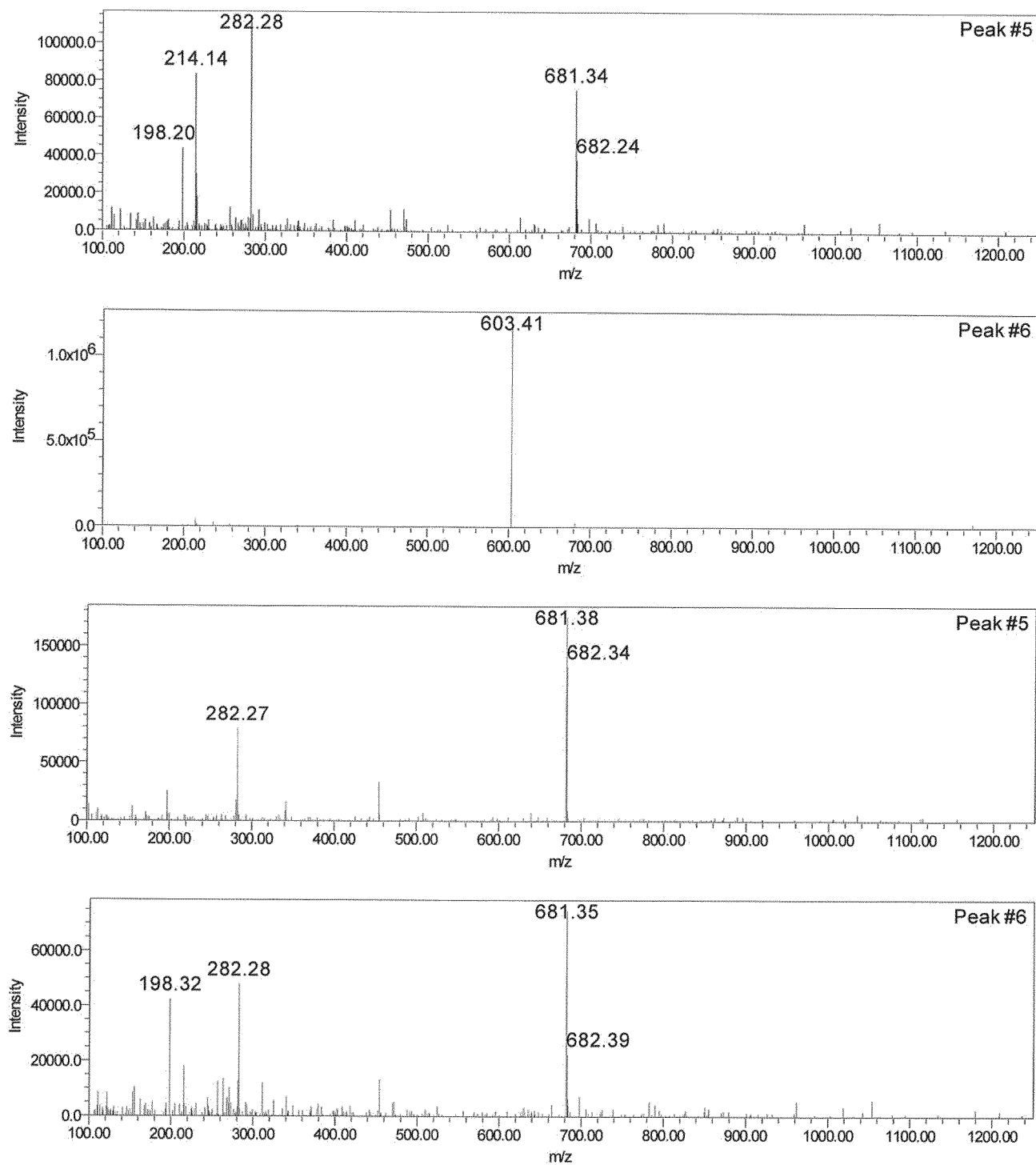


Figure 39 I

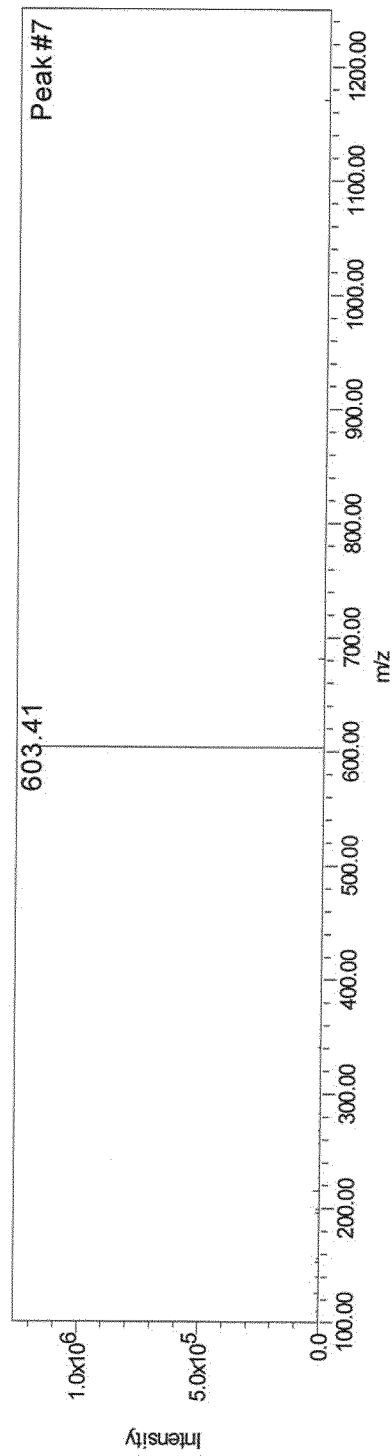


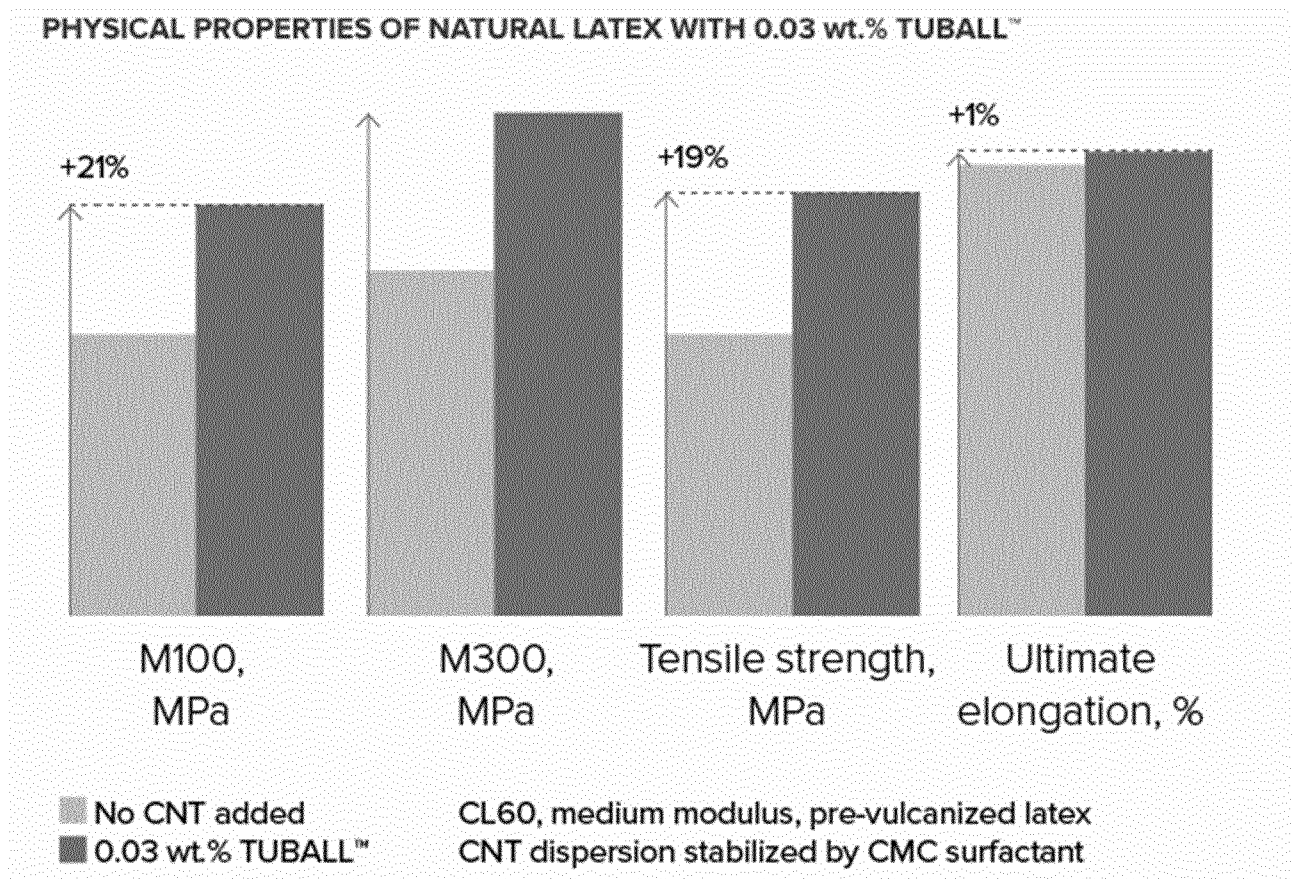
Figure 40

Figure 41

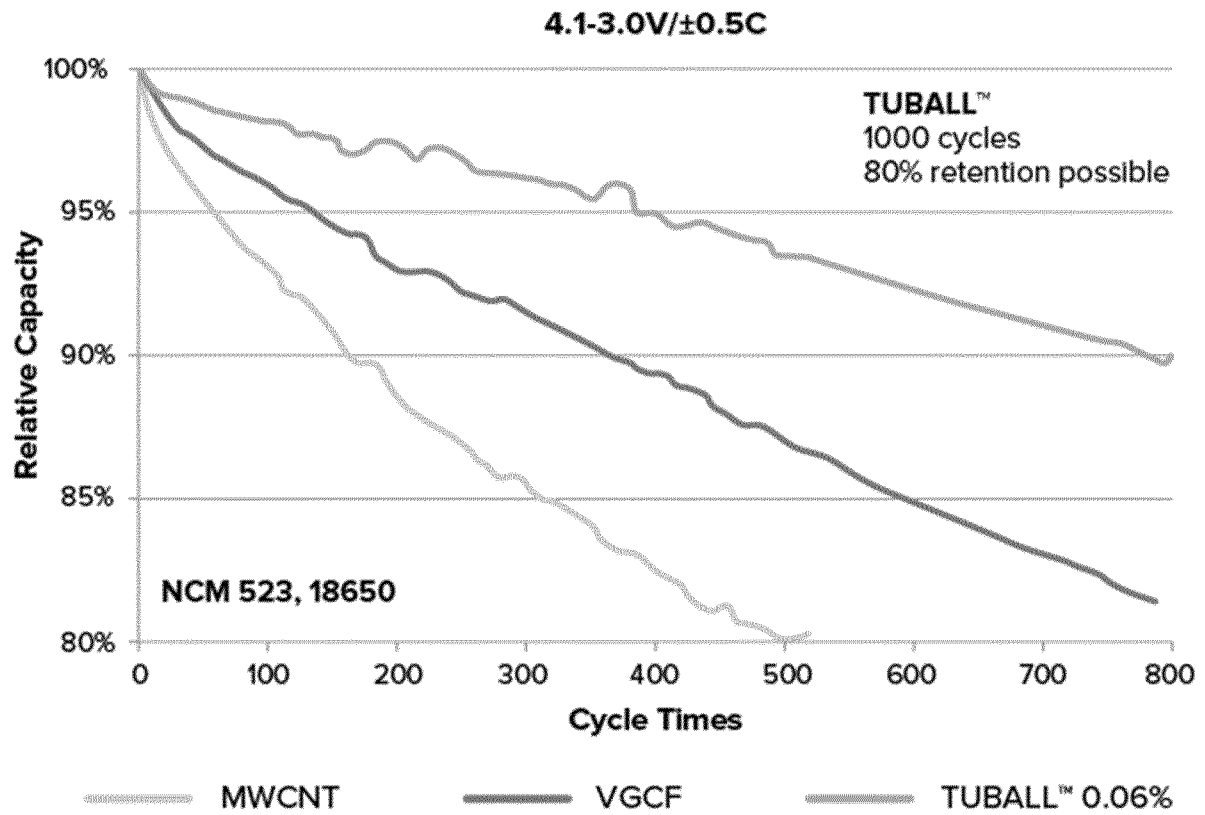


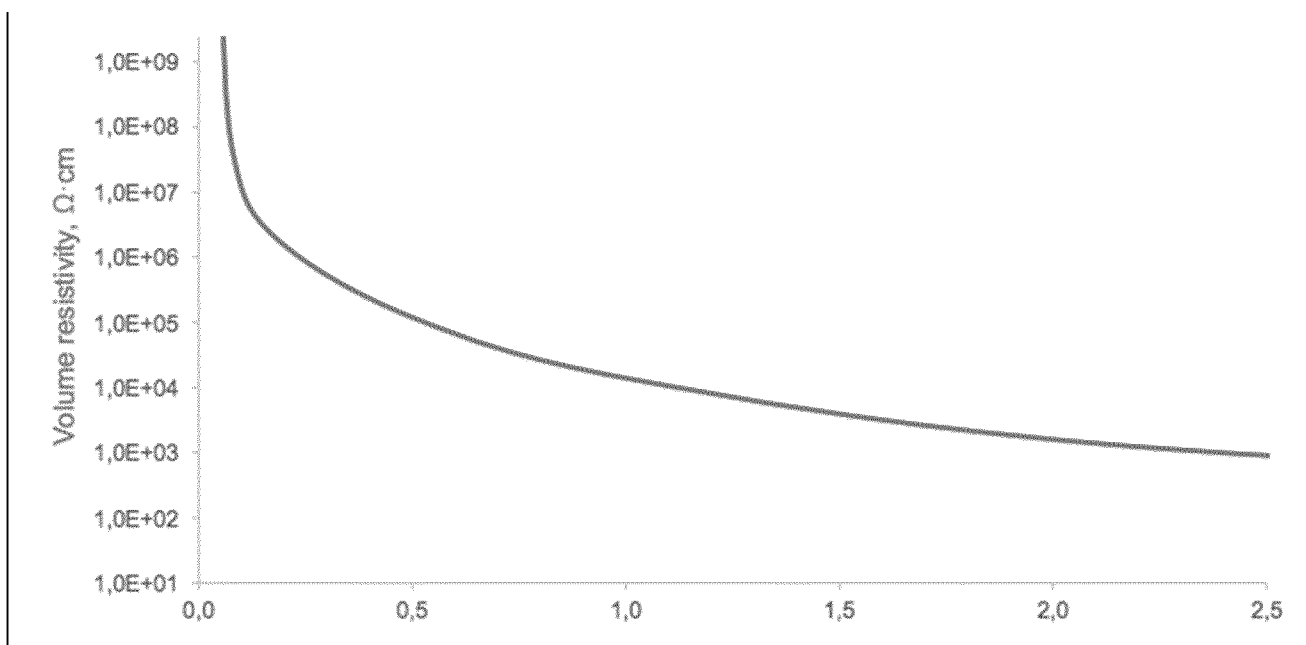
Figure 42

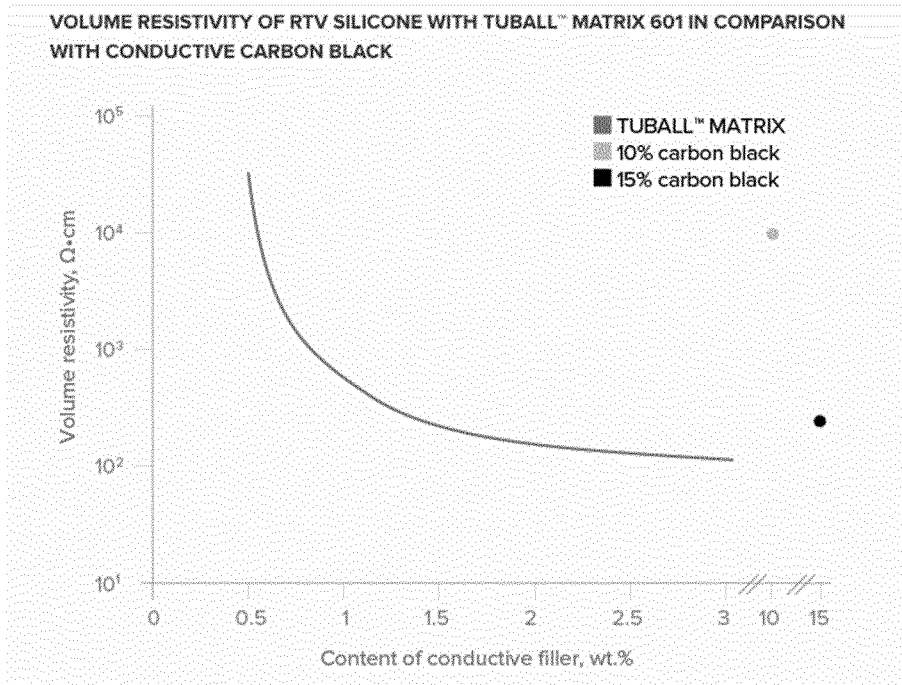
Figure 43

Figure 44

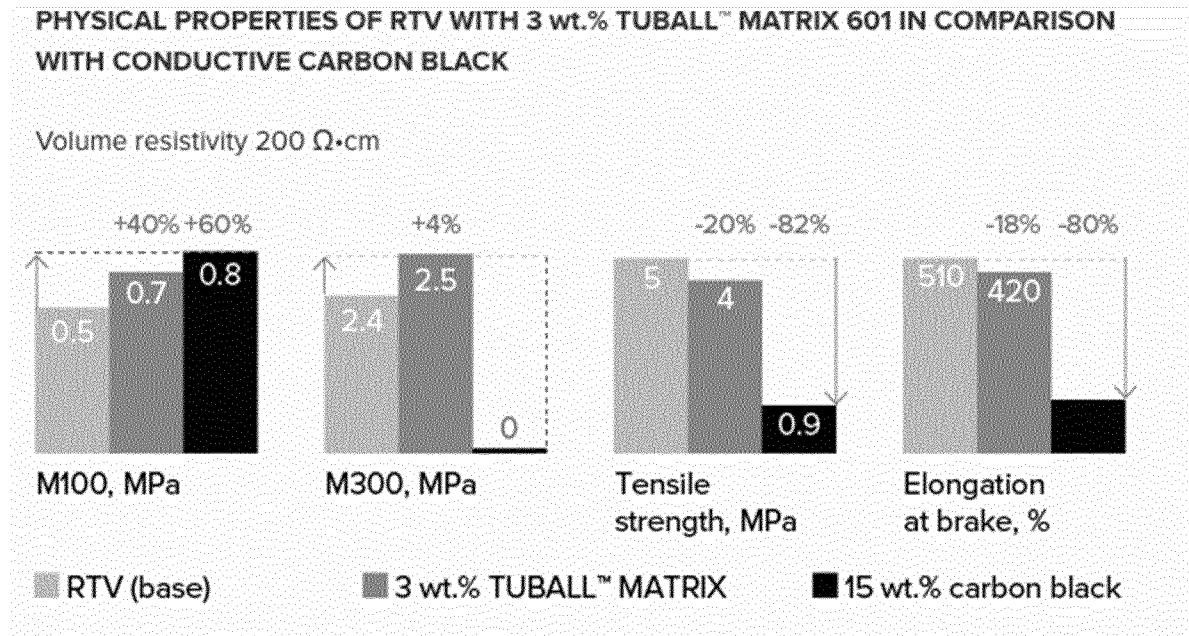


Figure 45

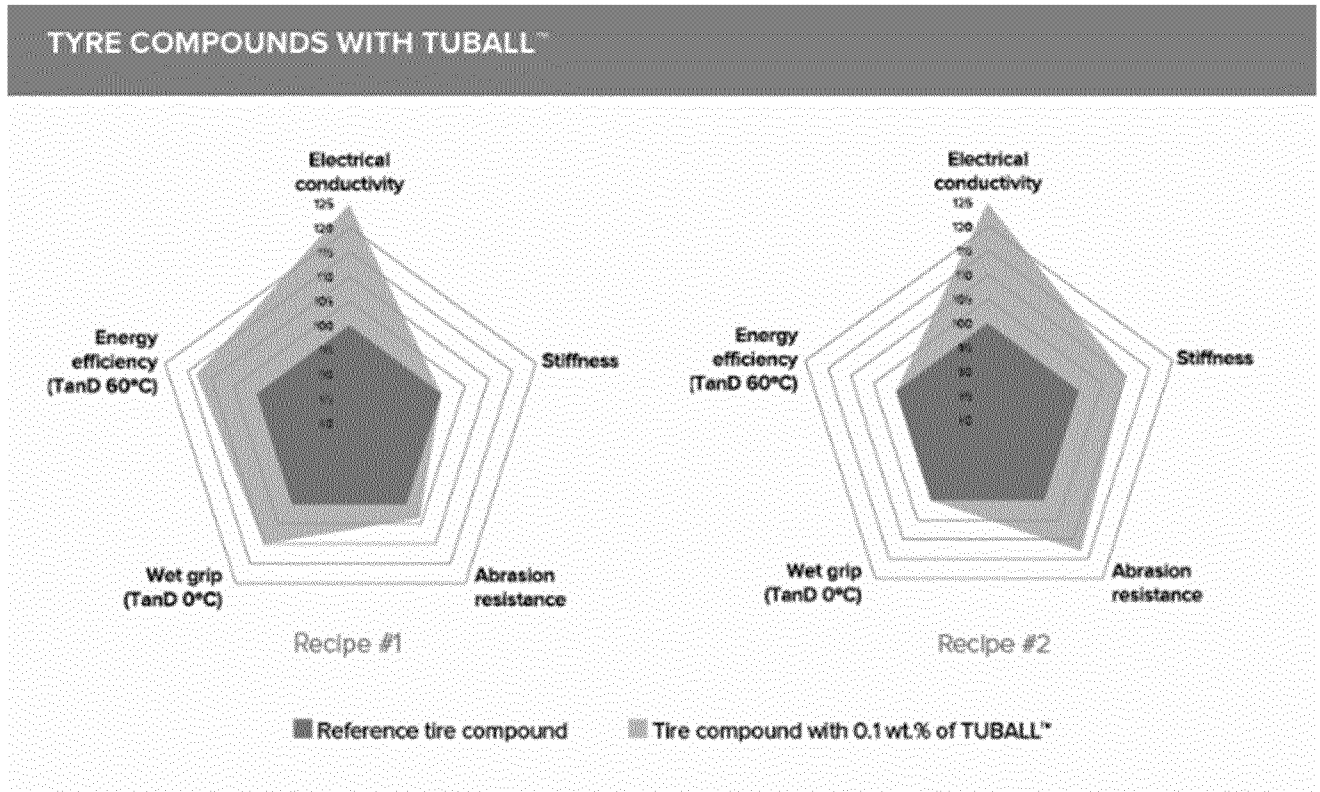


Figure 46

A.

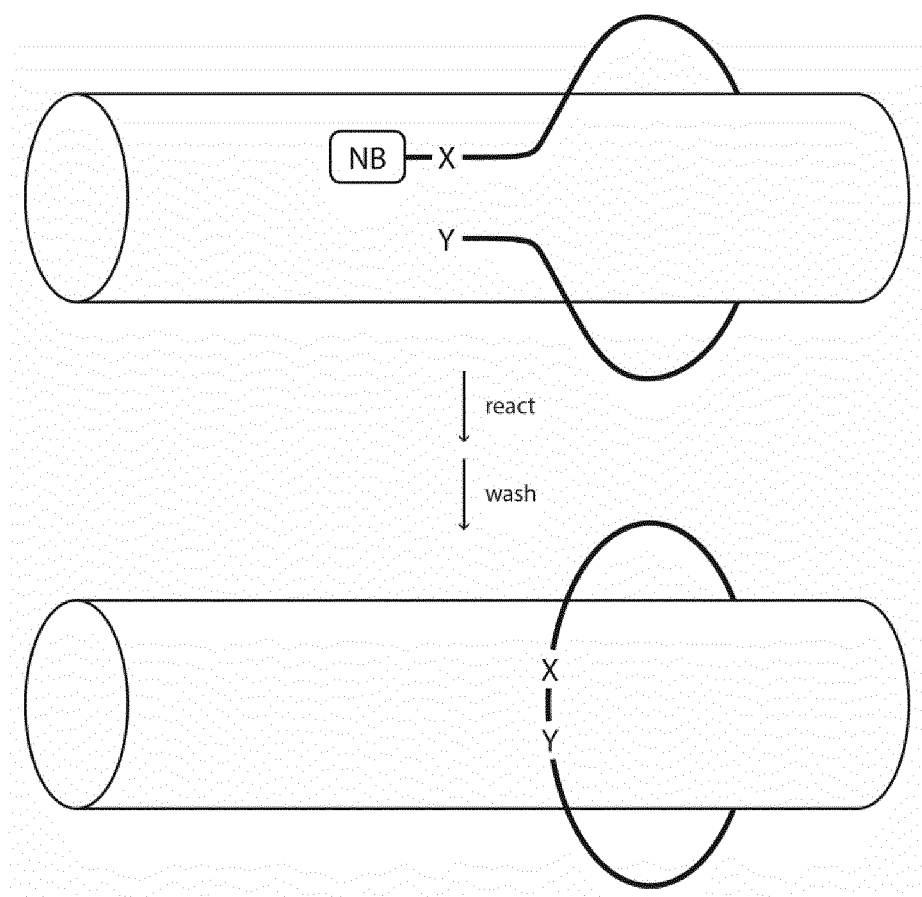


Figure 46

B.

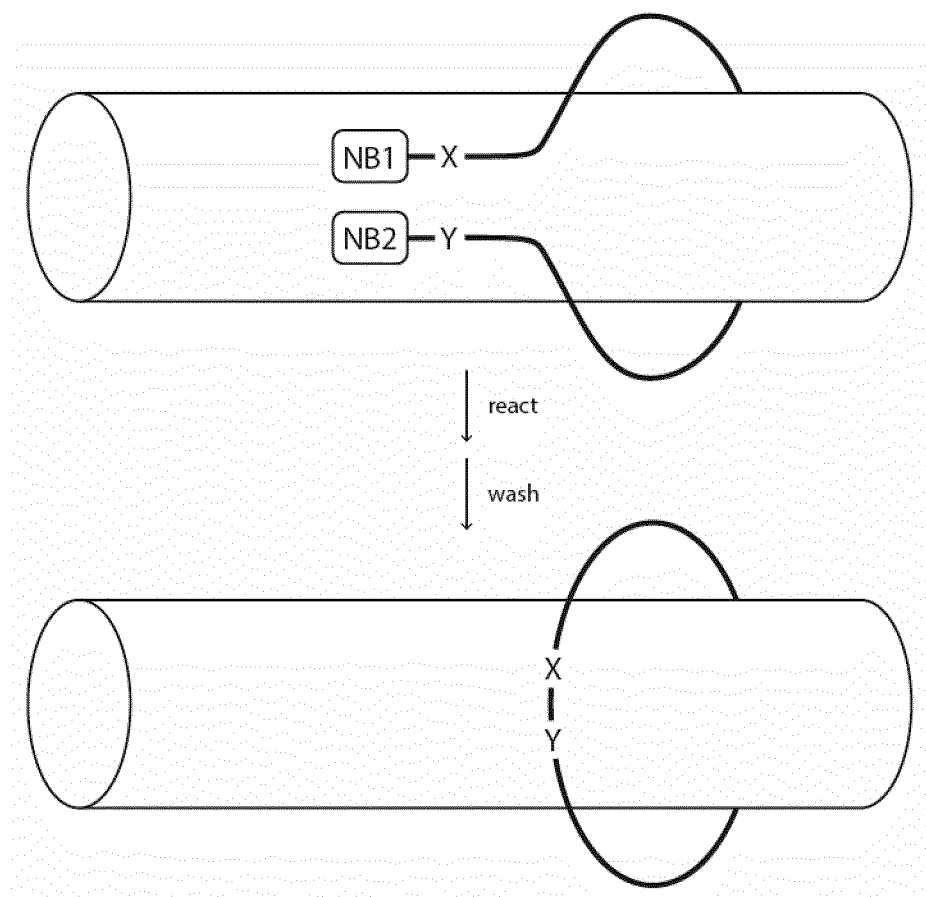


Figure 46

C

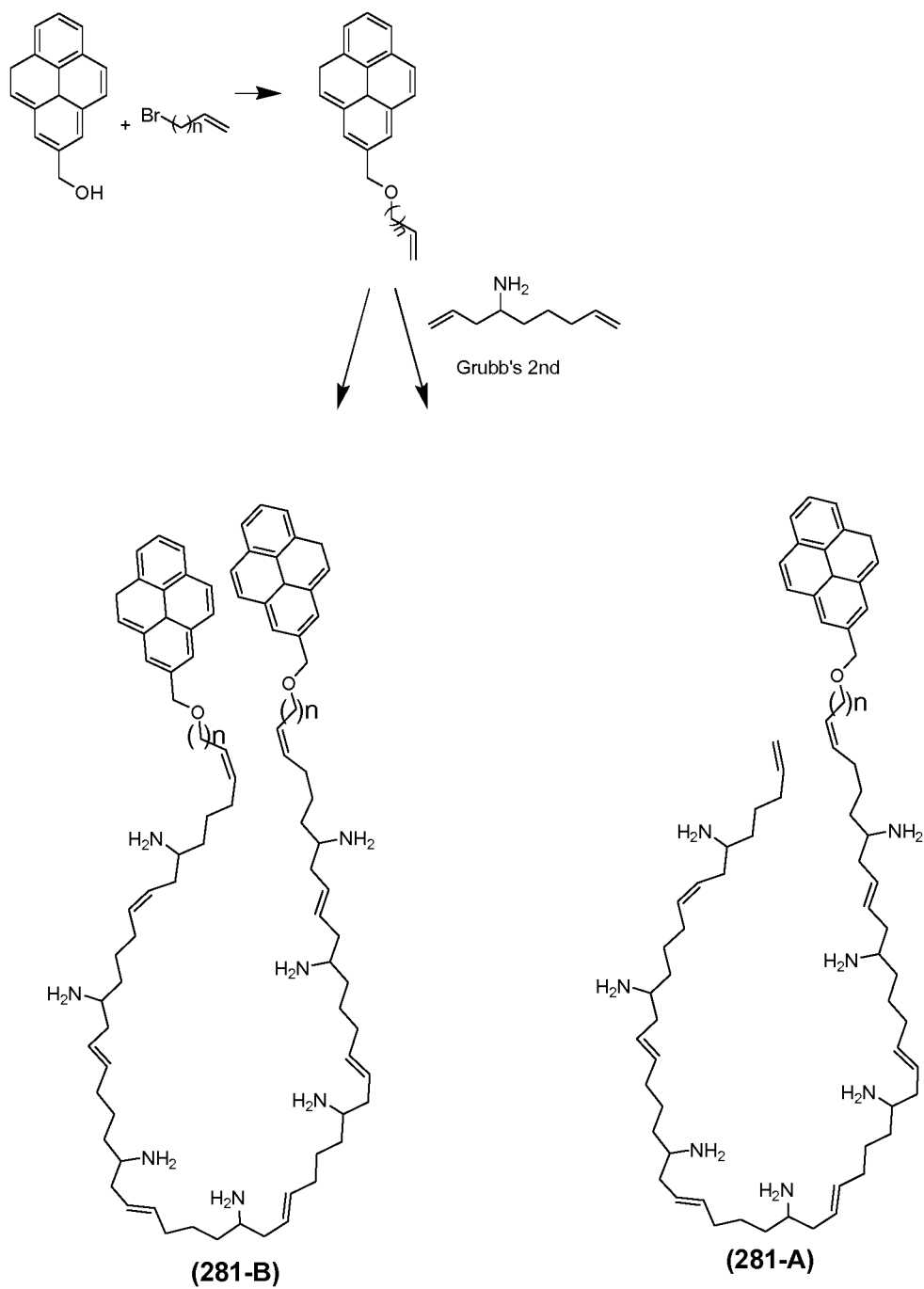


Figure 46

D

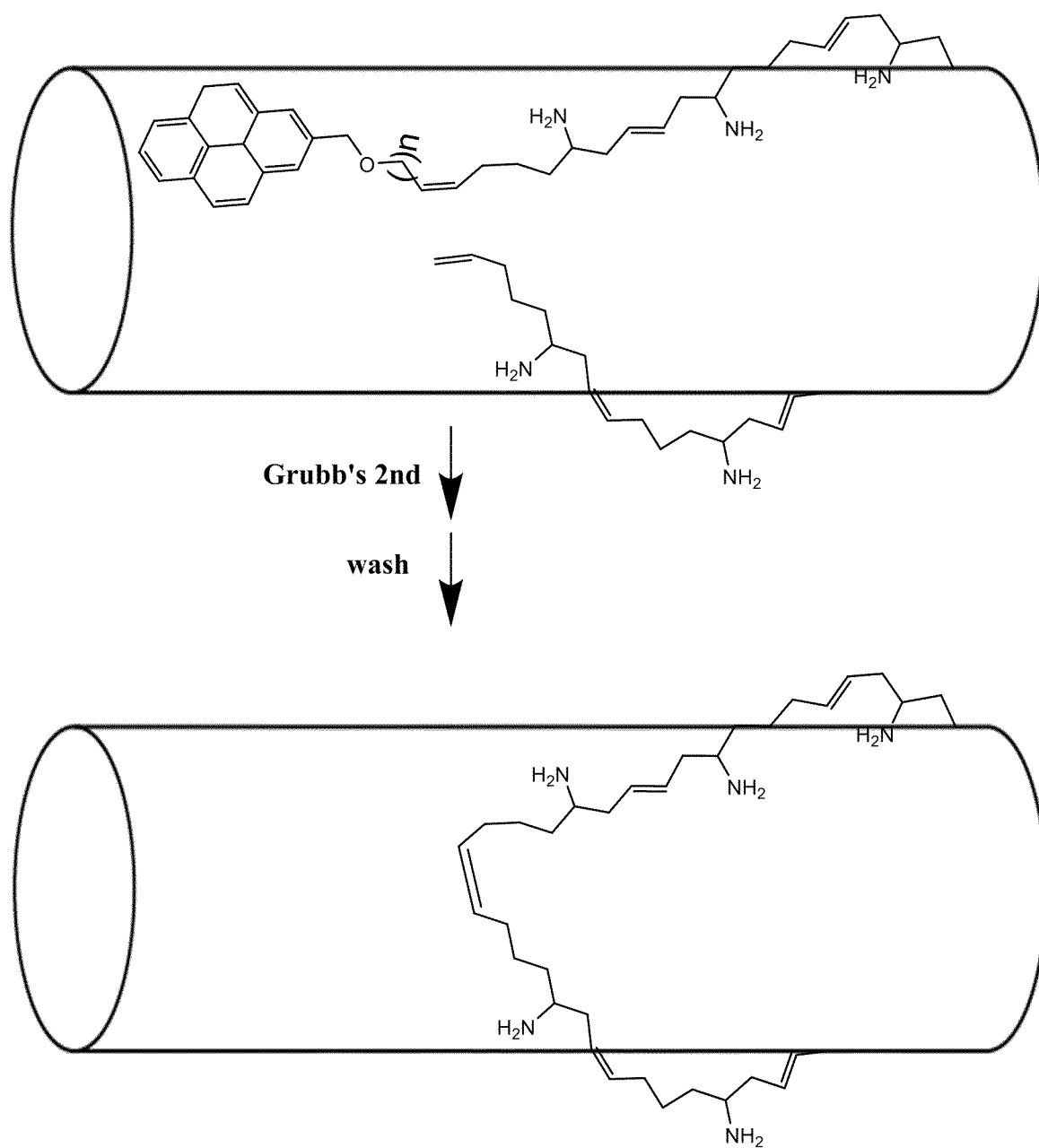


Figure 46

E

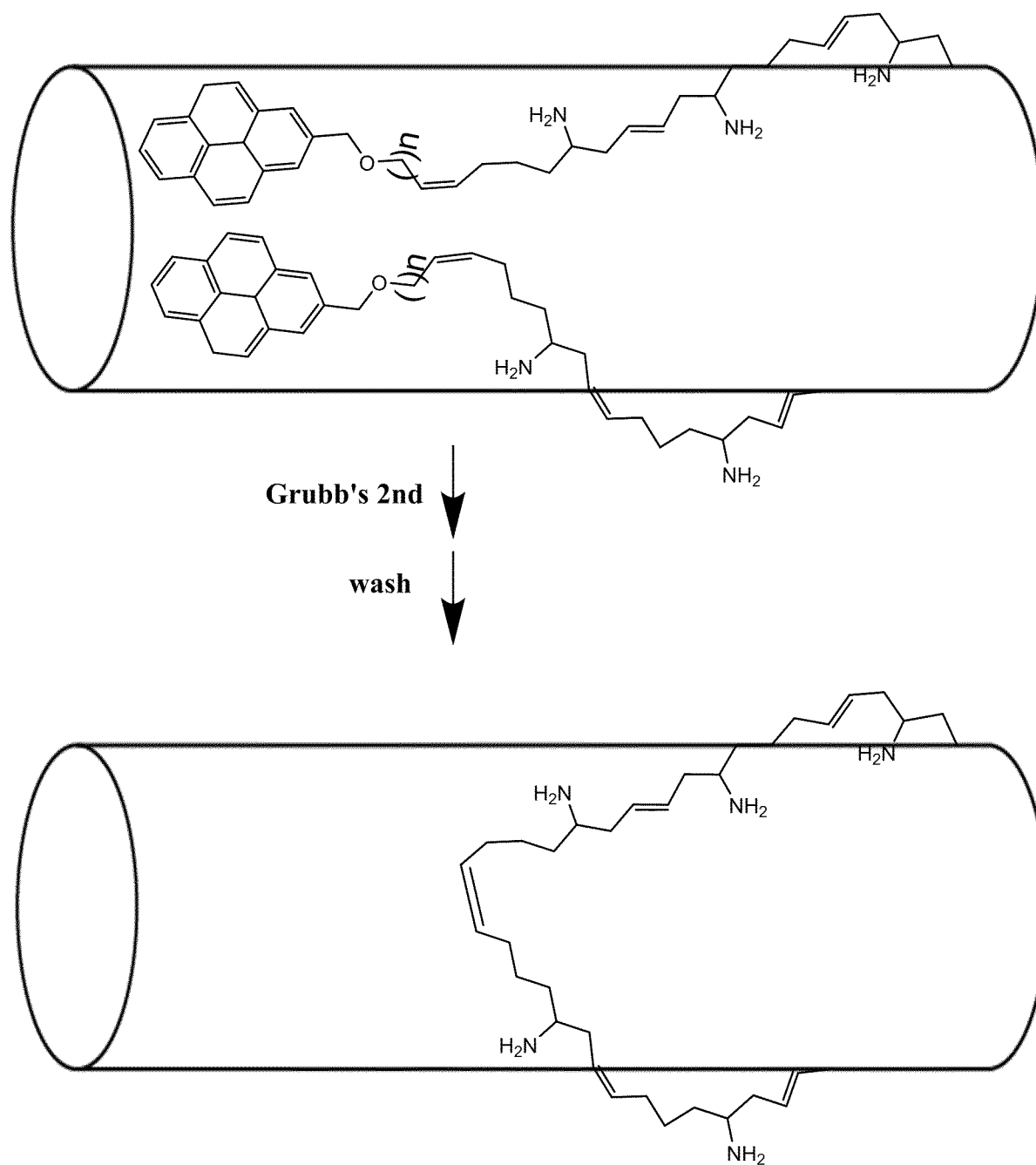


Figure 46

F

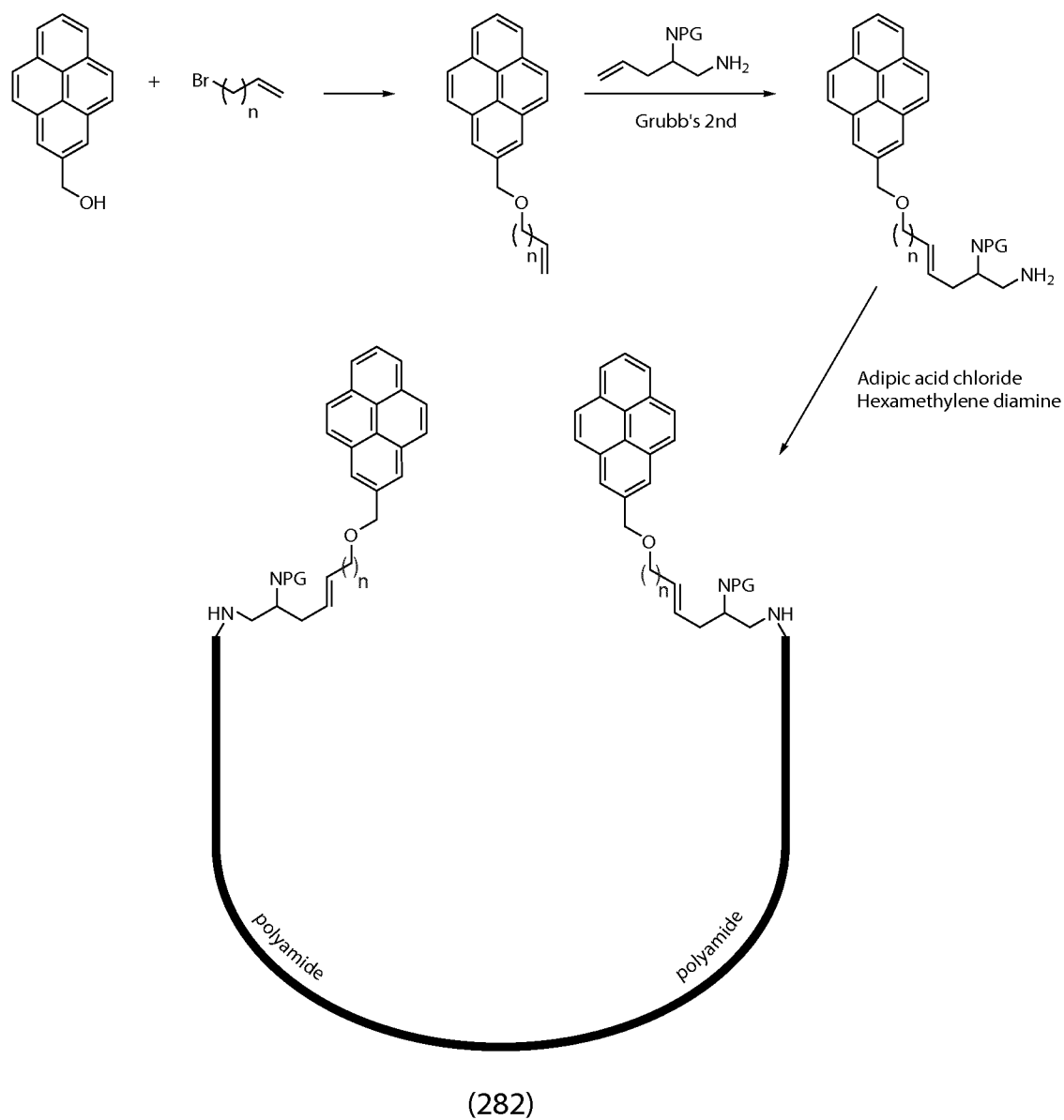


Figure 46

G

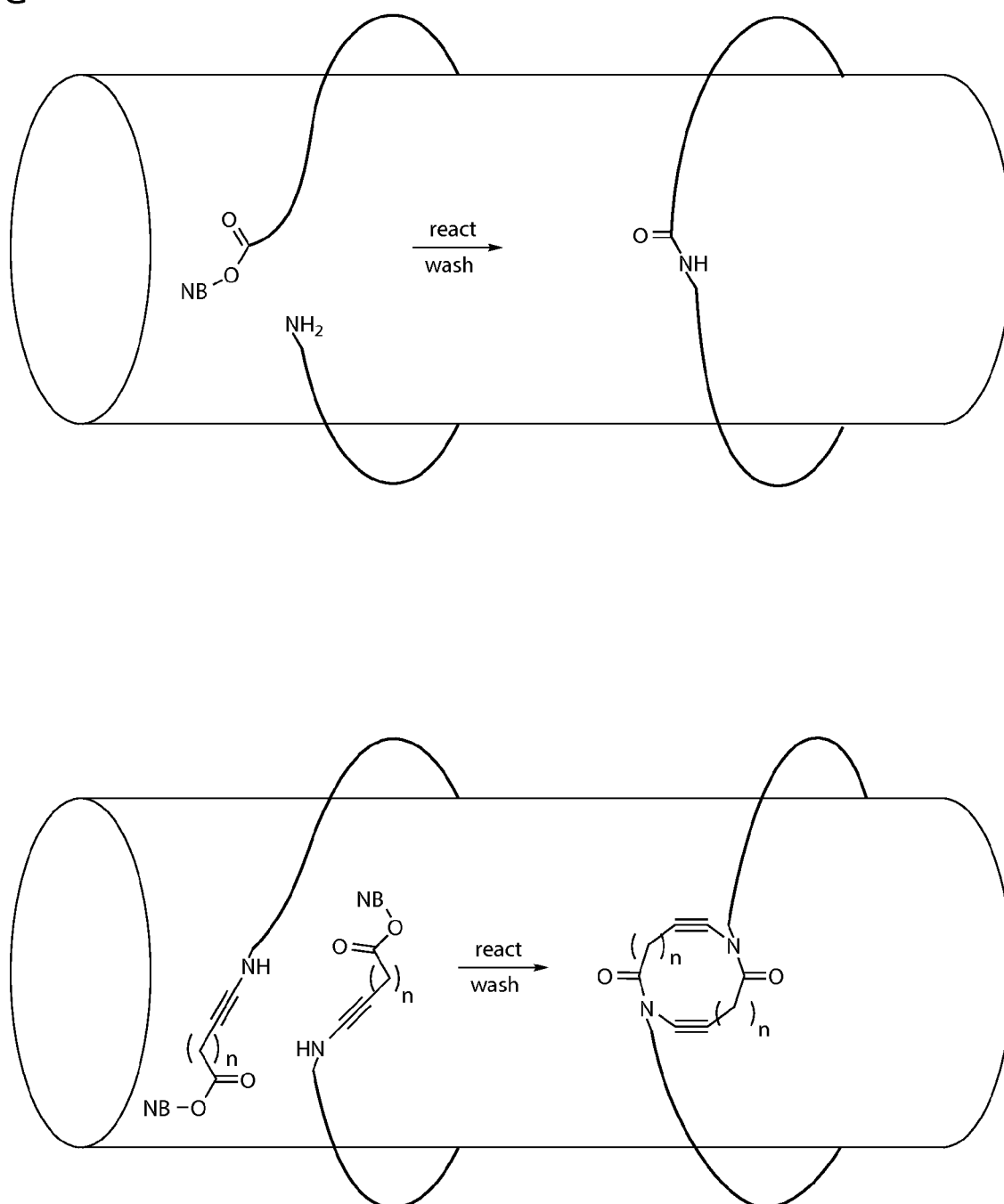


Figure 4

A.

