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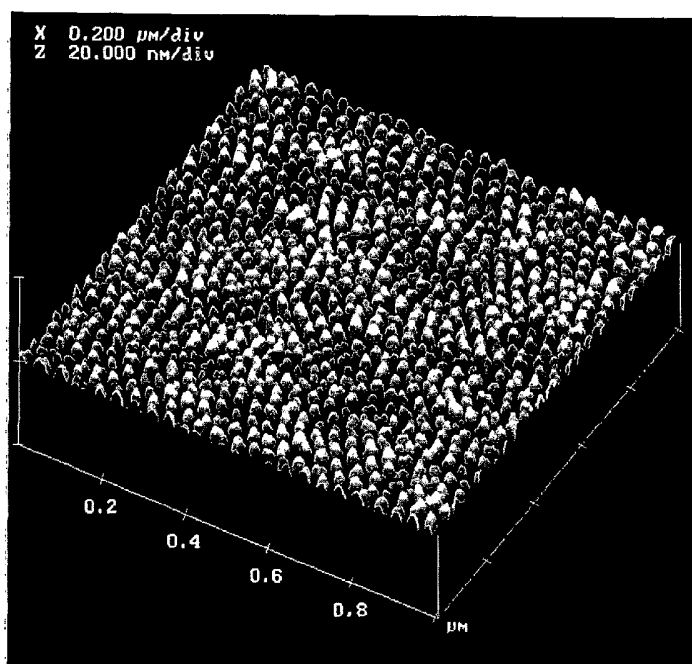
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- (21) International Application Number: PCT/US02/10811 (74) Agents: PIKE, Bernard, G. et al.; Kirkpatrick & Lockhart LLP, Henry W. Oliver Building, 535 Smithfield Street, Pittsburgh, PA 15222-2312 (US).
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- (30) Priority Data: 60/282,132 6 April 2001 (06.04.2001) US
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[Continued on next page]

(54) Title: A PROCESS FOR THE PREPARATION OF NANOSTRUCTURED MATERIALS



(57) Abstract: The present invention comprises a novel process for the preparation of carbon based structured materials with controlled topology, morphology and functionality. The nanostructured materials are prepared by controlled carbonization, or pyrolysis, of precursors comprising phase separated copolymers. The carbon based structures can find application in photovoltaics, supercapacitors, batteries, fuel cells, computer memory, carbon electrodes, carbon foams, actuators and hydrogen storage.



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For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

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INTERNATIONAL SEARCH REPORT

International Application No

PCT/US 02/10811

A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 C01B31/02 D01F9/12 H01G4/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 C01B D01F H01G

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data, PAJ, COMPENDEX, INSPEC

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5 089 135 A (NISHIHARA YOSHIHIRO ET AL) 18 February 1992 (1992-02-18) column 3, line 27 -column 7, line 42 --- -/--	1-9, 11-20, 28-39, 42-45, 81-85, 87-89, 94-96, 99,115

 Further documents are listed in the continuation of box C. Patent family members are listed in annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search

10 April 2003

Date of mailing of the international search report

13.06.03

Name and mailing address of the ISA

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INTERNATIONAL SEARCH REPORT

International Application No.

PCT/US 02/10811

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT		
Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	<p>WU Z-C ET AL: "Pyrolytic behavior and in-situ paramagnetism of star-like C60(CH3)x(PAN)x copolymers" EUROPEAN POLYMER JOURNAL, PERGAMON PRESS LTD. OXFORD, GB, vol. 34, no. 3-4, 1 March 1998 (1998-03-01), pages 421-429, XP004137941 ISSN: 0014-3057 the whole document</p>	<p>1-8, 10-20, 28-40, 43-45, 87-89, 96, 111-114</p>
X	<p>CARTER K R ET AL: "POLYIMIDE NANOFOAMS FROM PHASE-SEPARATED BLOCK COPOLYMERS" ELECTROCHEMICAL SOCIETY PROCEEDINGS, ELECTROCHEMICAL SOCIETY, PENNINGTON, NJ, US, vol. 97, no. 8, 1997, pages 32-43, XP001119975 ISSN: 0161-6374 the whole document</p>	<p>1-4,6-8, 10-20, 28-34, 37-40, 42-85, 87-89, 94-99, 111,112, 115</p>
X	<p>TAKEICHI T ET AL: "Preparation of porous carbon films by the pyrolysis of poly(urethane-imide) films and their pore characteristics" CARBON, XX, XX, vol. 39, no. 2, February 2001 (2001-02), pages 257-265, XP004319848 ISSN: 0008-6223 the whole document</p>	<p>1-4,6-8, 10-20, 28-34, 37-40, 43-57, 69-84, 87-89, 94-96</p>
A	<p>DREEZEN G ET AL: "Nano-structured polymer blends: phase structure, crystallisation behaviour and semi-crystalline morphology of phase separated binary blends of poly(ethylene oxide) and poly(ether sulphone)" POLYMER, ELSEVIER SCIENCE PUBLISHERS B.V, GB, vol. 41, no. 4, February 2000 (2000-02), pages 1395-1407, XP004244129 ISSN: 0032-3861 the whole document</p>	<p>1-99</p>
A	<p>US 4 073 870 A (SAJI YASUO ET AL) 14 February 1978 (1978-02-14) the whole document</p>	<p>1-99</p>
A	<p>EP 0 576 198 A (ROHM & HAAS) 29 December 1993 (1993-12-29) the whole document</p>	<p>1-99</p>

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US 02/10811

Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. Claims Nos.:
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:

3. Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.
2. As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:
4. No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

1-99, 106-108, 111-115

Remark on Protest

- The additional search fees were accompanied by the applicant's protest.
- No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. Claims: 1-99, 106-108, 111-115

Process for preparing nanostructured materials comprising pyrolyzing a precursor including a phase-separated copolymer. A high surface area carbon nanostructured material and a supercapacitor electrode produced by the above-mentioned process.

2. Claims: 100-104

Process for the preparation of a reinforced macrofiber.

3. Claim : 105

A reinforced fiber comprising carbon nanotubes.

4. Claims: 109-110

A supercapacitor electrode comprising a nano-porous structure having a high effective surface area.

5. Claims: 116-118

A method for preparing a nanopattern of a transition metal on a substrate.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/US 02/10811

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
US 5089135	A	18-02-1992	EP 0394449 A1	31-10-1990
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