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- (71) **Applicant:** BAYER MATERIALSCIENCE AG
[DE/DE]; 51368 Leverkusen (DE).
- (72) **Inventors:** ZHOU, Zhiping; 1650 Jinxiu Road, Building 16, Room 102, Pudong, Shanghai 201206 (CN).
EHBING, Hubert; c/o Bayer MaterialScience (China) Co. Ltd., 33 Qin Qiao Road, Pudong, Shanghai 201206 (CN).
CHEN, Zhan; Dongxiu Road 1085, Building 11, Room 1301, Pudong New District, Shanghai 200127 (CN).
- (74) **Agent:** BIP PATENTS; c/o Bayer Intellectual Property GmbH, Creative Campus Monheim, Alfred-Nobel-Str. 10, 40789 Monheim (DE).
- (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, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, 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, 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.

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Declarations under Rule 4.17:

- *as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))*

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- *with international search report (Art. 21(3))*

- (54) **Title:** A MEMBER FOR SUPPORTING PHOTOVOLTAIC MODULES

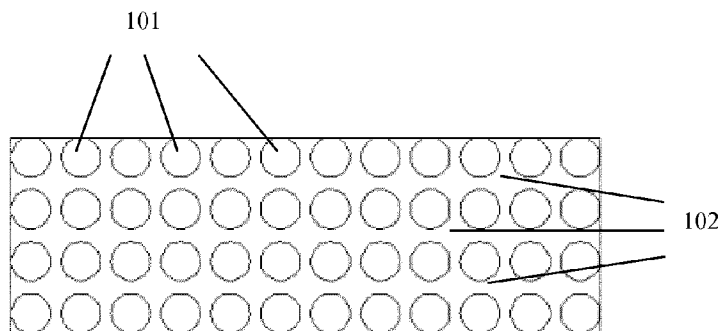


FIG 1

- (57) **Abstract:** The present disclosure teaches a member for supporting and/or protecting photovoltaic modules, which comprises fibers extending along an axial direction of the member and plastics as a matrix. The fibers include glass fibers, carbon fibers, metallic fibers and any combination thereof; the plastics include polyurethane. The weight of the fibers is about 30 wt.% ~95 wt.% relative to the total weight of the member. The present disclosure possesses mechanical strength and stiffness similar to aluminum profiles, good electrical insulation properties, resistance to corrosion and a coefficient of thermal expansion compatible with other materials, such as glass, used in photovoltaic modules.



TITLE OF THE INVENTION

A Member for Supporting Photovoltaic Modules

FIELD OF THE INVENTION

5 [0001] The present teaching relates to a compositional member of photovoltaic modules.

BACKGROUND OF THE INVENTION

[0002] Photovoltaic modules capable of directly converting solar energy to electrical energy can meet the need of environmental protection and conservation of non-renewable energy. However, the wide application of photovoltaic modules depends upon factors impacting its cost and profit margin, which include energy conversion efficiency, production, transportation and installation costs as well as service lifetime.

10 [0003] A typical photovoltaic module includes the following components: a front side, a back side, one or more interconnected photovoltaic cells disposed between the front side and the back side, an encapsulant material and a member for further supporting and/or protecting the photovoltaic module.

15 [0004] The front side is usually made with transparent glass. Tempered glass of low iron content that has good transmittance of light with a wavelength between 300 nm and 1150 nm is particularly suitable.

[0005] Photovoltaic cells are generally prepared using single crystalline or polycrystalline silicon.

20 [0006] Encapsulant materials bond components such as the front side, the back side and the photovoltaic cells together. Common encapsulant materials include ethylene-vinyl acetate (EVA) copolymer, whose function is to prevent the corrosion of metallic contacts in the photovoltaic cells by oxygen and moisture. Once the metallic contacts are damaged, all photovoltaic cells electrically connected in series are damaged.

25 [0007] The back side not only protects the photovoltaic cells and the encapsulant materials from the corrosion caused by oxygen and moisture, but also protects them from scratches and it also functions as an electrical insulator. The back side can be made with glass or composite materials, of which the most commonly used is

polyfluoroethylene film.

[0008] CN102097504 discloses a supporting frame for photovoltaic modules made of aluminum. Aluminum frames are prone to corrosion and their weight increase transportation and installation cost.

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[0009] US4,830,038 and US5,008,062 disclose a polyurethane elastomer manufactured with reaction injection molding (RIM) process. Such a polyurethane elastomer may be used for supporting, sealing and insulating photovoltaic modules. Preferably, its elastic modulus is in the range of 200~1000 psi, (equals to 1.4~69.0 N/mm²). The RIM process increases the cost and complexity for manufacturing photovoltaic modules and the stiffness of the produced elastomer is much lower than that of aluminum.

10

[0010] CN1893121 teaches a circumferential frame for photovoltaic modules, which is made of composite materials possessing long-lasting elasticity and flexibility.

15

[0011] WO2008/060539 discloses a photovoltaic module frame made of pultruded fiber reinforced composite materials, wherein the fibers can be glass fibers, carbon fibers or synthetic fibers.

20

[0012] The above patents and patent publications are incorporated by reference herein in their entirety.

SUMMARY OF THE INVENTION

[0013] Aluminum and other composite materials have some drawbacks as supporting and protecting components for photovoltaic modules. These drawbacks are in the area of strength and stiffness of the material, electrical insulation properties, corrosion resistance, and thermal expansion compatibility with other materials used in photovoltaic modules such as glass.

25

5 [0014] One object of the invention is to provide a compositional member for supporting and/or protecting photovoltaic modules, wherein the member is made of a composite material. The strength of the composite material is similar to aluminum, thus the material fits frame designs and installation methods that are currently used for aluminum.

10 [0015] Another object of the invention is to provide a compositional member for supporting and/or protecting photovoltaic modules, wherein the member has good electrical insulation properties. Therefore, the employment of the member can reduce the possibility of electrical breakdown due to lightening or electrical leakage, and decrease the potential induced degradation (PID), which can lead to loss of efficiency for the photovoltaic cells.

15 [0016] Yet another object of the invention is to provide a compositional member for supporting and/or protecting photovoltaic modules, wherein the member provides inertness toward chemical and/or electrochemical corrosion, which extends the service lifetime of photovoltaic modules.

20 [0017] Still another object of the invention is to provide a compositional member for supporting and/or protecting photovoltaic modules, wherein the member possesses a thermal expansion coefficient similar to other materials used in the solar module, such as the glass of the front side. As a result, glass cracking caused by effect of thermal expansion and contraction over regular use can be prevented.

25 [0018] In one aspect, the invention discloses a member for supporting and/or protecting photovoltaic modules. Such member includes fibers extending along an axial direction of the member and a plastic as a matrix, wherein the plastic includes polyurethanes and the fibers include glass fibers, carbon fibers, metallic fibers and any combination thereof. The weight of said fibers is in the range of about 30% - 90%, based on the total weight of the member as 100%.

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[0019] The member of the present disclosure can be prepared using pultrusion process, and its axial tensile modulus parallel to the direction of glass fibers is at least 20000 N/mm², its axial flexural modulus parallel to the direction of glass fibers is at least 20000 N/mm², its surface electrical resistivity is at least $1 \times 10^{14} \Omega$, its coefficient of thermal expansion parallel to the direction of glass fibers is at most $20 \times 10^{-6} /K$ (-20 °C to 100 °C) and its density is at least 1500 kg/m³.

[0020] In another aspect, the present invention discloses a photovoltaic module including a front side, a back side, at least one photovoltaic cell disposed between the front side and the back side, an encapsulant material and a member for supporting and/or protecting the photovoltaic module.

[0021] In yet another aspect, the present invention discloses a method for preparing a member for supporting photovoltaic modules, including preparing profiles using pultrusion process, wherein the profiles include fibers extending along an axial direction of the profiles, and a plastic as a matrix; cutting the profiles to form cut profiles with suitable size and shape; and attaching the cut profiles to the photovoltaic module. The plastic includes polyurethane, and the fibers include glass fibers, carbon fibers, metallic fibers and any combination thereof. The properties of the member include an axial tensile modulus parallel to the direction of glass fibers of at least 20000 N/mm², an axial flexural modulus parallel to the direction of glass fibers of at least 20000 N/mm², a surface electrical resistivity of at least $1 \times 10^{14} \Omega$, a coefficient of thermal expansion parallel to the direction of glass fibers of at most $20 \times 10^{-6} /K$ (-20 °C to 100 °C) and a density of at least 1500 kg/m³.

BRIEF DESCRIPTION OF THE DRAWINGS

[0022] Figure 1 is a schematic diagram of a cross section of a fiber reinforced composite material prepared with pultrusion process.

[0023] Figure 2 is a schematic diagram of a cross section of a profile prepared with pultrusion process.

DETAILED DESCRIPTION OF THE INVENTION

[0024] The member of the present disclosure for supporting and/or protecting photovoltaic modules can be made with fiber reinforced composite materials. Such composite materials are generally prepared using pultrusion process. In pultrusion process, the fibers need to be long enough to have one end passing through at least one resin impregnation box, optionally a shaping die, at least one resin curing region, and the end is attached to a device providing pulling force. Usually the resin curing region is heated to allow resins gel and cure within. Pultrusion process can continually produce profiles of the same strength in the same direction, and the shape of such profiles, the content and distribution of fibers within such profiles can all be achieved through adjusting process conditions, such as the design of the molds. Figure 1 illustrates a cross section of a fiber reinforced composite material prepared with pultrusion process, including fibers 101, which is situated in the center and extending along the axial direction (perpendicular to the surface of paper) and plastic 102, which surrounds above-mentioned fibers as matrix. In addition to the illustration of Figure 1, profiles prepared with multilayers of same or different fibers, which are impregnated in one or more different types of resins can also be used. Prepared profiles can be cut to suitable length according to the need. Details of pultrusion process is known in the field, for example, US patent US3,960,629 and US5,617,692 are incorporated by reference herein in their entirety. Winding-pultrusion process can also be employed to prepare profiles of the present disclosure.

[0025] The direction along which the fibers are being pulled during pultrusion process is referred to as the direction of the fiber. Such direction is also defined as the axial direction of the prepared profiles and the axial direction of the prepared member. A

direction perpendicular to the axial direction is referred to as the transversal direction of the profile or member. When installing photovoltaic modules, the axial direction of the member providing a supporting and/or protecting function is substantially parallel to the border of the photovoltaic modules.

5

[0026] Fibers of the present disclosure can be single-strand, braided-strand, woven or nonwoven, single-ply or multi-ply structures of mats and combinations thereof. Although a single strand of fiber can be broken or discontinued, as a whole, the fibers extend through the profile along the axial direction.

10

[0027] In order to achieve desired mechanical strength, fibers of the present disclosure contain at least glass fibers, carbon fibers, metallic fibers and any combination thereof. Other suitable fibers that can be added include polyester fibers, natural fibers, polyamide fibers, nylon fibers or any combination thereof. Preferred fibers are glass fibers, carbon fibers, more preferably glass fibers.

15

[0028] In the member of the present disclosure, the weight of the fibers is about 30% - 95%, or about 50% - 90%, more preferably about 75%-85%, based on the total weight of the member. Such member can achieve the objectives of the present invention, and can have the following properties:

20

[0029] Axial tensile modulus, parallel to the direction of glass fibers and is measured with the method DIN EN ISO 527-4, is at least about 20000 N/mm², or at least about 30000 N/mm², or at least about 40000 N/mm², preferably is at least about 45000 N/mm².

25

[0030] Axial flexural modulus, parallel to the direction of glass fibers and is measured with the method DIN EN ISO 14125, is at least about 20000 N/mm², or at least about 30000 N/mm², preferably is at least about 40000 N/mm².

30

[0031] When the axial tensile modulus and axial flexural modulus of the member is greater

than or equal to the minimum values listed above, the member has good stability and rigidity, and will not be easily deformed during transportation, installation and usage.

5 **[0032]** Surface electrical resistivity of the member, which is measured with GB/T 1410, is at least about $1 \times 10^{14} \Omega$, preferably about $5 \times 10^{14} \Omega$, more preferably about $1 \times 10^{15} \Omega$. High surface electrical resistivity can improve electrical insulation and corrosion resistance.

10 **[0033]** Axial coefficient of thermal expansion, which is parallel to the direction of glass fibers and thus is parallel to the border of the photovoltaic modules, is measured with the method DIN 53752 in a temperature range from -20°C to 100°C , and has a value $\alpha \leq 20 \times 10^{-6} / \text{K}$. When the coefficient of thermal expansion of the member is similar to that of the material (generally glass) for the front side and/or back side, the member is less likely to cause cracking of the front side and/or back side caused by effect of
15 thermal expansion and contraction over regular use. The coefficient of thermal expansion of the member in the direction perpendicular to the direction of glass fibers (referred to as transversal direction) does not affect the application and thus can be $> 20 \times 10^{-6} / \text{K}$.

20 **[0034]** The density of the member of the current disclosure can be measured with the method DIN EN ISO 845. The density is at least about 1500 kg/m^3 , more preferably is at least about 2000 kg/m^3 .

25 **[0035]** When installing, the member can be fixed to the entire or part of the border, or the back side of the photovoltaic modules. When the member is in contact with the border of the photovoltaic module, its axial direction shall be substantially parallel to such border. The member can be attached to the photovoltaic module through adhesive and/or mechanical means. Adhesive means generally employs adhesives such as silicone and mechanical means include bolted connection, rivet connection, buckled
30 connection, snapped connection and any combination thereof. As shown by

experiments, when the plastic in the member is polyurethane, compared to other types of plastic, such as unsaturated polyester, the member is less likely to crack when screw holes are drilled for fixing purposes.

5 **[0036]** The shape and dimension of the member can be designed in advance based on the shape and dimension of the photovoltaic modules, and the member can be produced as one unit with pultrusion process. Figure 2 illustrates a cross section of a member as a non-limiting example. The direction of glass fibers, which is also the direction of the member, is perpendicular to the surface of the paper. In figure 2, groove 201 wraps
10 around the edge of the photovoltaic module and has a width of 6 mm; 204 and 205 are parts that are in contact with and are adapted for attaching to the front and back side of the photovoltaic modules, respectively, and their thicknesses a and b are both 39 mm; 203 is a part for connecting to roof or other bases and its thickness e is 2 mm. The corners of parts that bear more weight are designed to be curves of a circle with a
15 radius of 1.5 mm. Such a design helps to distribute the stress received.

[0037] The polyurethane reaction system used to produce pultruded polyurethane composite containing glass fibers for frames of photovoltaic modules includes polyisocyanates, isocyanate-reactive compounds, auxiliary agents/additives, and/or
20 fillers.

[0038] The polyisocyanates can be one type of polyisocyanate or a mixture of several types of polyisocyanates. The polyisocyanates can be described by the formula, $R(NCO)_n$, wherein R represents an aliphatic hydrocarbon radical containing 2-18
25 carbon atoms, an aromatic hydrocarbon radical containing 6-15 carbon atoms, or an araliphatic hydrocarbon radical containing 8-15 carbon atoms, and $n = 2-4$. The polyisocyanates can be, but not limited to, 1,6-hexamethylene diisocyanate (HDI), toluene 2,4- and 2,6-diisocyanates (TDI), diphenylmethane-2,4'-, 2,2'-and 4,4'-diisocyanates (MDI), naphthylene-1,5-diisocyanate (NDI), their isomers and mixtures
30 thereof. The polyisocyanates can also include those modified with carbodiimide,

uretoneimine, allophanate or isocyanate-terminated prepolymers.

[0039] The isocyanate-reactive compounds contain active hydrogen atoms, and can be, but not limited to, polyols and polyamines, preferably polyols. The polyol can be one type
5 of polyol, or a mixture of several types of polyols. The polyols can be those with an average molecular weight of 100-10000, and functionalities of 1 to 10, preferably 1.8 to 8, more preferably 2-6. The polyol can be, but not limited to, polyester polyols, polyether polyols, polycarbonate polyols, vegetable oil based polyols, and mixtures thereof.

10 [0040] The additives can include catalysts, internal mold release additives, foaming agents, flame retardants, coloring agents, surfactants, plasticizers, cross linkers, chain extenders, chain terminators and any combination thereof.

15 [0041] The fillers, which are optionally to be included, can be inorganic and organic fillers, and their mixtures. Examples of organic fillers include aramide fibers, crystalline paraffins or fats, powders based on polystyrene, polyvinyl chloride, urea-formaldehyde compositions, cork, or combinations thereof. Examples of inorganic
20 fillers include wollastonite, silicate minerals, metal oxides, metal salts, glass microspheres, or any combinations of the above.

[0042] While there is shown and described certain specific structures embodying the invention, it will be manifest to those skilled in the art that various modifications and rearrangements of the parts may be made without departing from the spirit and scope
25 of the underlying inventive concept and that the same is not limited to the particular forms herein shown and described.

EXAMPLES

[0043] The following Examples are only for the purposes of illustration, and not by any means limiting the scope of the current disclosure.

5

Example 1Materials

Desmodur [®] 1151L	Modified MDI, supplied by Bayer MaterialScience.
Baydur [®] PUL 2500 Component B	Blended polyols, supplied by Bayer MaterialScience.
Baydur [®] 18BD101	Additive, supplied by Bayer MaterialScience
CPIC [®] ETC 468G- 2400	Glass fiber, supplied by Chongqing Polycomp International Corporation

10 [0044] In the production of pultruded profiles, glass fibers are guided through the impregnation box or injection box, and the resin impregnated glass fibers then are pulled at suitable speed into the shaping die at appropriate temperatures. After leaving the shaping die, the pulled glass fibers are fully cured in a curing region. The four-ton crawler pultrusion machine used for the Examples is produced by Nanjing Loyalty Composites Equipment Co. Ltd., and the metering unit MVP MINI LINK is produced
15 by Magnum Venus Plastech (USA).

[0045] The plate-shaped profiles produced with the above process have a cross section of 200 mm×3.2 mm. According to the need of respective testing methods, standard
20 specimens were prepared by cutting the profile into appropriate dimensions and shapes. Measurements of their properties are listed in Table 1.

Table 1. Properties of polyurethane composites containing 80 wt.% of glass fibers

1. Density	DIN EN ISO 845	2150 kg/cm ³
2. Axial tensile modulus	Parallel to the direction of glass fibers DIN EN ISO 527-4	52000 N/mm ²
3. Transversal tensile modulus	Transversal to the direction of glass fibers DIN EN ISO 527-4	13000 N/mm ²
4. Axial flexural modulus	Parallel to the direction of glass fibers DIN EN ISO 14125	45000 N/mm ²
5. Transversal flexural modulus	Transversal to the direction of glass fibers DIN EN ISO 14125	13000 N/mm ²
6. surface electrical resistivity	GB/T 1410	3 x 10 ¹⁵ Ω
7. Axial coefficient of thermal expansion	Parallel to the direction of glass fibers (-20 °C to 100 °C) DIN 53752	5.3 x 10 ⁻⁶ /K
8. Transversal coefficient of thermal expansion	Transversal to the direction of glass fibers (-20 °C to 100 °C) DIN 53752	28.3 x 10 ⁻⁶ /K

5 **[0046]** It can be seen from Table 1 that various properties of the profiles (1, 2, 4, 6, 7) meet the desired values and satisfy the requirements of members for supporting and/or protecting photovoltaic modules.

10 **[0047]** It is understood by persons skilled in the art that the present invention is not limited to the above specifics, and when not deviating from the spirit or main characteristics of the present invention, it may be carried out in other forms. Therefore from every aspect, the above examples shall be construed as illustrative, and not limiting. Thus the scope of the invention shall be defined by the claims and not the above description. And any modification, as long as it falls into the meaning and scope of an equivalent
15 to what is claimed, shall be considered as the present invention.

CLAIMS

1. A member for supporting a photovoltaic module comprising fibers extending along an axial direction of the member and a plastic as a matrix.

5

2. The member of claim 1, wherein the plastic comprises polyurethane.

3. The member of claim 1, wherein the fibers comprise glass fibers, carbon fibers, metallic fibers, or any combination thereof.

10

4. The member of claim 1, wherein the member is attached to an entire border of the photovoltaic module.

5. The member of claim 1, wherein the member is attached to part of the border of the photovoltaic module.

15

6. The member of claim 1, wherein the member is attached to a back side of the photovoltaic module.

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7. The member of claim 1, wherein the weight of the fibers is about 30 % to 95 % relative to the total weight of the member.

8. The member of claim 7, wherein the weight of the fibers is about 50 % to 90 % relative to the total weight of the member.

25

9. The member of claim 8, wherein the weight of the fibers is about 75 % to 85 % relative to the total weight of the member.

10. The member of claim 7, wherein the member possesses an axial tensile modulus of at least 20000 N/mm², an axial flexural modulus of at least 20000 N/mm², a surface

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electrical resistivity of at least $1 \times 10^{14} \Omega$ and an axial coefficient of thermal expansion of at most $20 \times 10^{-6} /K$.

11. The member of claim 7 wherein the member is prepared by a pultrusion process.

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12. The member of claim 7, further comprising glass mats for improving a transversal strength of the member.

13. The member of claim 7, wherein said member has a density of at least 1500 kg/m^3 .

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14. The member of claim 7, wherein said member has a density of at least 2000 kg/m^3 .

15. The member of claim 7, wherein the fibers comprise single strands, braided strands, woven or non-woven, single-ply or multi-ply structures of mats, or any combination thereof.

15

16. The member of claim 2, wherein the plastic further comprises an auxiliary and/or an additive.

17. The member of claim 16, wherein the auxiliary and/or additive comprise a catalyst, an internal mold release additive, a foaming agent, a flame retardant, a coloring agent, a surfactant, a plasticizer, a cross linker, a chain extender, a chain terminator, or any combination thereof.

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18. The member of claim 7, further comprising an organic filler, an inorganic filler, or any combination thereof.

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19. The member of claim 18, wherein the organic filler comprises aramide fiber, crystalline paraffin or fat, powder based on polystyrene, polyvinyl chloride, a urea-formaldehyde composition, cork, or any combination thereof.

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20. The member of claim 18, wherein the inorganic filler comprises wollastonite, silicate mineral, metal oxide, metal salt, glass microsphere, or any combination thereof.

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21. The member of claim 7, wherein the member is attached to the photovoltaic module through adhesion and/or mechanical connection.

22. The member of claim 21, wherein said adhesion is achieved with silicone.

10

23. The member of claim 21, wherein said mechanical connection comprises a bolted connection, a rivet connection, a buckled connection, a snapped connection, or any combination thereof.

15

24. A photovoltaic module comprising a front side, a back side, at least one photovoltaic cell disposed between the front side and the back side, an encapsulating material and a member according to claim 7.

20

25. A method for preparing a member for supporting a photovoltaic module, comprising:

- a) pultruding a profile, said profile comprising fibers extending along an axial direction of the profile and a plastic as a matrix;
- b) cutting the profile to form a cut profile with suitable size and shape; and
- c) attaching the cut profile to the photovoltaic module.

25

26. The method of claim 25, wherein the plastic comprises polyurethane.

27. The method of claim 25, wherein the fibers comprise glass fibers, carbon fibers, metallic fibers, or any combination thereof.

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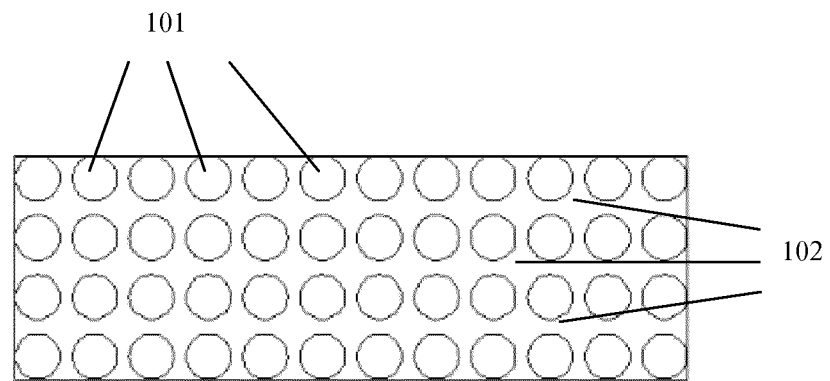
Drawings:

FIG 1

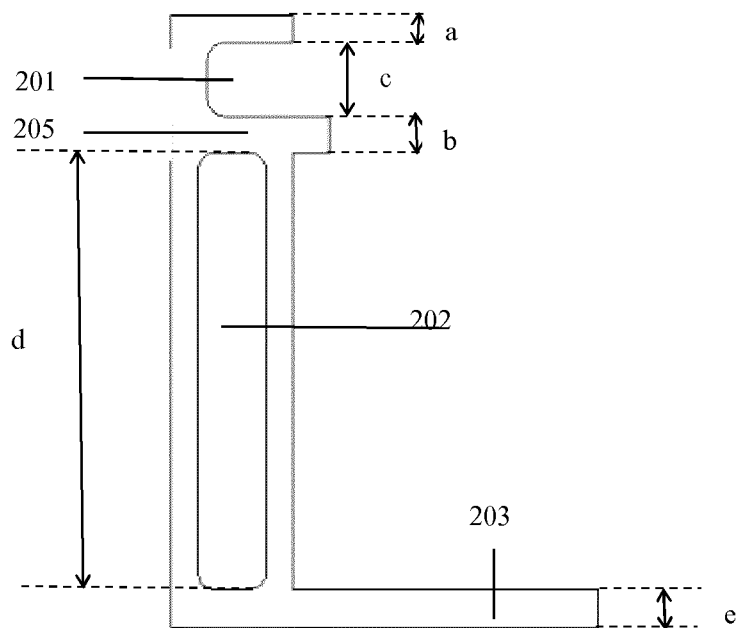


FIG 2

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2013/065826

A. CLASSIFICATION OF SUBJECT MATTER
INV. H01L31/042
ADD.

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)
H01L

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 practicable, search terms used)

EPO-Internal, CHEM ABS Data, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X,P	WO 2013/010091 A1 (RAYMOND A & CIE [FR]; JACKSON NICHOLAS JR [US]) 17 January 2013 (2013-01-17) paragraph [0086] - paragraph [0088]; figures 10,11	1-4, 25-27
X	----- US 2011/030767 A1 (EHBING HUBERT [DE] ET AL) 10 February 2011 (2011-02-10) paragraph [0023] - paragraph [0028]; claims 1, 15; examples glass fibres; paragraphs [0052], [0072]; claim 15 fibers 30wt.%; paragraph [0048]; claim 10 flame retardant, fibers and polyurethane; paragraphs [0057], [0058]; claim 18 ----- -/-	1-5,7, 15-17



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents :

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

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Date of the actual completion of the international search

4 October 2013

Date of mailing of the international search report

10/10/2013

Name and mailing address of the ISA/

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040,
Fax: (+31-70) 340-3016

Authorized officer

Stabel, Andreas

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2013/065826

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	KR 2011 0078800 A (UNIV HONGIK IND ACAD COOP FDN [KR]) 7 July 2011 (2011-07-07) paragraph [0026]; claims 1,7 -----	1,5,6,25
X	JP 4 809374 B (MITSUI CHEM INC) 9 November 2011 (2011-11-09) Preglon = polypropylene sheet reinforced with long glass fibers (from Mitsui Chemicals); paragraph [0073] - paragraph [0075]; claims 1,6; examples 1,2 -----	1-3,6-8, 24
X	US 2011/139224 A1 (KRAJEWSKI TODD [US]) 16 June 2011 (2011-06-16) claims 1,8-13; figures 1A,1B claim 35; figure 2 -----	1,3,6
X	KR 2011 0126383 A (MILLINET SOLAR CO LTD [KR]) 23 November 2011 (2011-11-23) paragraph [0022] - paragraph [0025]; claims 1-3; figures 1-3 -----	1-3,6

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/EP2013/065826

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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