Examencommissie Octrooigemachtigden

Tentamen Octrooigemachtigden

Tentamen: “Schrijven van een advies”

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29 november 2021

09.30 – 17.45 uur

(inclusief 15 minuten verplichte pauze)

TENTAMEN 'SCHRIJVEN VAN EEN ADVIES' 2021

Uw cliënt (Solarclient) heeft een fotovoltaïsch (PV) zonnepaneel ontwikkeld dat conventionele zonnecellen in een meerlaags systeem verpakt. Alle lagen van het systeem zijn gemaakt van polypropyleen. Polypropyleen is een thermoplastisch polymeer. Het voordeel van het gebruik van een thermoplastisch polymeer is dat dergelijke polymeren bij verhitting zacht worden en daarom is het mogelijk om de zonnepanelen na het einde van hun levensduur om te smelten en opnieuw te verwerken tot een zonnepaneel of een ander product. De zonnecellen kunnen eveneens worden gerecycled in speciale zonnecelrecyclefabrieken. De achterlaag is gebaseerd op een schuim, waardoor het PV paneel licht is. Hierdoor kan het PV paneel dus ook op daken die qua constructie minder gewicht aankunnen worden geplaatst.

Solarclient heeft octrooi aangevraagd (ANNEX 2), en deze aanvraag zit momenteel in de PCT fase.

Er zijn twee zonnepaneel systemen (Zonnepaneelsysteem 1 en Zonnepaneelsysteem 2) die de cliënt in productie wil gaan nemen in Nederland.

Het zonnepaneelsysteem 1 is gelijk aan voorbeeld 1 van de octrooiaanvrage van Solarclient. Zonnepaneelsysteem 2 is gelijk aan zonnepaneelsysteem 1, maar in zonnepaneelsysteem 2 zitten nog glasvezels in de schuimlaag (voorbeeld 2 van de octrooiaanvrage van Solarclient).

Solarclient wil deze zonnepanelen samen met Solarpartner gaan verkopen aan bouwbedrijf "zonnige dagen", eveneens gevestigd in Nederland. Solarclient heeft een samenwerkingsverband met Solarpartner om de zonnepaneelsystemen verder te ontwikkelen, te produceren en te vermarkten. De IP rechten die uit deze samenwerking voortvloeien zijn als volgt verdeeld:

- Alle IP rechten gebaseerd op de keuze van de (polymere) materialen zijn voor Solarclient.
- Alle IP rechten gebaseerd op het functionele ontwerp van de zonnepaneelsystemen, zoals bevestigingssystemen, zijn voor Solarpartner.

In de overeenkomst die hierover gaat staat dat de partijen een co-exclusieve licentie onder elkaars IP rechten krijgen, dat wil zeggen dat alleen Solarclient en Solarpartner onder de patentrechten mogen opereren.

Echter, vorige week kwam Solarclient op solarnieuws.nl een bericht tegen van zijn grootste concurrent Solarcompetitor. In dit bericht kondigt Solarcompetitor aan dat het zijn gepatenteerde zonnepaneelsysteem (EP3104021B1, ANNEX 1) op de markt gaat brengen in Spanje. Solarclient heeft in het Europese octrooiregister gekeken en heeft geconstateerd dat dit Europese octrooi is gevalideerd in Nederland, Duitsland, België, Polen en Spanje.

Omdat Solarclient zich afvroeg of het patent van Solarcompetitor wel nieuw was, heeft Solarclient op Zoekliteratuur.nl een search uitgevoerd en documenten D1, D2 en D3 gevonden. D1 is een Europese octrooipublicatie. D2 is een presentatie die staat vermeld in de in 2013 uitgegeven bundel met presentaties, die zijn gegeven op een conferentie over zonnepanelen in Lunteren. D3 is een kopie van een tabel uit een Polymeer handboek uit 2005.

Tijdens deze search, kwam Solarclient ook een octrooiaanvrage tegen van Solarpartner. Om problemen te voorkomen, heeft Solarclient de octrooiaanvrage van ANNEX 2, voor indiening van de aanvrage onder geheimhouding gedeeld met Solarpartner. Tot zijn schrik staat er nu wat van deze geheime informatie in de octrooiaanvrage van Solarpartner en Solarclient vraagt zich af of dit de octrooiaanvrage van Solarclient kan schaden.

Solarclient heeft u de belangrijkste delen van de octrooiaanvrage van Solarpartner met het international preliminary report on patentability gestuurd (ANNEX 6), zodat u de situatie kunt beoordelen.

In het beoordelen van de situatie vraag hij u rekening te houden met de volgende zaken:
- een goede relatie met Solarpartner is van essentieel belang voor de verdere ontwikkeling van en het commerciële succes van de zonnepaneelsystemen.
- Een zo breed mogelijke bescherming van de zonnepaneelsystemen is nodig om Solarcompetitor en andere concurrenten buiten de deur te houden.

In hetzelfde bericht op solarnieuws.nl waarin Solarcompetitor aankondigt dat het zijn gepatenteerde zonnepaneelsysteem (EP3104021B1, ANNEX 1) op de markt gaat brengen in Spanje, staat ook het volgende: “Solarcompetitor is ook van plan om binnenkort een lichtgewicht versie van het zonnepaneelsysteem op de markt te brengen in Nederland en België, die zal worden geproduceerd in de fabriek in België. We houden u op de hoogte wanneer het zover is.”

Solarclient vermoedt dat Solarcompetitor daarvoor ook gebruik gaat maken van een schuimachterlaag zoals beschreven in de octrooiaanvrage van Solarclient (ANNEX 2). Solarclient weet geen verdere details, zoals of Solarcompetitor hiervoor ook gebruik gaat maken van polypropyleen.

Uw cliënt vraagt u nu om te adviseren:

1. Maakt Solarclient met haar zonnepaneelsysteem 1 en zonnepaneelsysteem 2 inbreuk op het EP octrooi van Solarcompetitor (ANNEX 1), in het geval dat dit octrooi rechtsgeldig blijkt? Gebruik argumentatie pro/contra inbreuk en geef aan welke argumenten naar uw inschatting het sterkst zijn.

2. Wat vindt u van de geldigheid van het EP octrooi van Solarcompetitor (ANNEX 1) in het licht van de documenten die uit de search van Zoekliteratuur naar boven zijn gekomen (ANNEX 3, = D1, ANNEX 4 = D2, ANNEX 5 = D3) ?
   Bespreek nieuwheid en inventiviteit van zowel conclusies 1 als 2 en gebruik – bij inventiviteit - de problem-solution approach.

3. Solarclient is bang dat Solarcompetitor Solarclient gaat aanklagen voor inbreuk.
   Wat is uw advies?

4. A. Hoe beoordeelt u de octrooieerbaarheid van de octrooiaanvrage van Solarclient (ANNEX 2) in het licht van de octrooiaanvrage van Solarpartner (ANNEX 6)?
   B. Wat kunt u Solarclient adviseren om een zo goed mogelijke octrooipositie voor de zonnepaneelsystemen te verwerven in EP (NL, DE, BE, UK) in het licht van de octrooiaanvrage van Solarpartner?

5. Wat adviseert u Solarclient over de mogelijke inbreuk van Solarcompetitor op de octrooiaanvrage van Solarclient voor de nieuwe panelen die aangekondigd werden in het bericht op solarnieuws?
   Hoe kan Solarclient het beste te werk gaan?

ANNEX 1: EP314021B1, octrooi van Solarcompetitor
ANNEX 2: WO2020/053926A1, octrooiaanvrage van Solarclient
ANNEX 3: D1 , EP2560721A1
ANNEX 4: D2, presentatie op een conferentie in 2013.
ANNEX 5: D3, Polymer handbook: properties and applications, 2005, pagina 745
ANNEX 6: gedeeltes uit de octrooiaanvrage van Solarpartner en het internationaal rapport over de octrooieerbaarheid.

Indicatieve waardering van de vragen

vraag	punten
1)	30
2)	34
3)	8
4)	20
5)	8

Annex 1

EP3104021B1
Title: Photovoltaic module
ES priority document, 7 April 2014
Filing date 6 April 2015

Publication date 7 October 2015

Date of publication of the grant: 28 Augustus 2021

All EP States designated

Proprietor: Solarcompetitor

Description

[0001] The invention relates to a photovoltaic module.

[0002] Photovoltaic modules, also known as solar cell modules, produce electricity from light and are used in various kinds of applications as well known in the field. The type of photovoltaic module can vary. The modules typically have a multilayer structure, i.e. several layer elements with different functions, and can be rigid or flexible. The layer elements of the photovoltaic module can vary with respect to layer materials and layer structure. The rigid photovoltaic module can for example contain a rigid glass top element, front encapsulation layer element, a backsheet layer element and e.g. an aluminium frame.

[0003] EP2560721A1 discloses a rigid photovoltaic module comprising
a transparent frontlayer
at least one photovoltaic element located between the transparent frontlayer (1) and the solid backlayer (5)
a glue layer surrounding the at least one photovoltaic element
and a solid backlayer prepared from a crosslinked EVA.

[0004] However, the water barrier properties of this rigid photovoltaic module are not sufficient, causing condensation water to seep into the photovoltaic element over time. Once sufficient water has reached the photovoltaic element, electrical failure of the photovoltaic element will occur. Therefore, especially in humid or wet climates, the life-time of the photovoltaic modules of EP2560721A1 is significantly decreased.

[0005] It is an object of the invention therefore to provide rigid photovoltaic modules which have an increased life-time.

[0006] This object is achieved by a photovoltaic module comprising
a transparent frontlayer (1)
at least one photovoltaic element (3)
and a solid backlayer (5) comprising a polypropylene composition,
wherein the polypropylene composition comprises at least 50wt% polypropylene based on the polypropylene composition.

[0007] It has surprisingly been found that the use of a solid backlayer of polypropylene in rigid photovoltaic modules increases the water resistance. Furthermore, the photovoltaic modules of the invention also shows an improved rigidity.

[0008] In the photovoltaic modules of the invention, the transparent frontlayer transmits the lights frequencies which the photovoltaic element(s) are capable of converting into a current. Examples of typical frontlayers include but are not limited to glass and polycarbonate.

[0009] The “photovoltaic element” means that the element has photovoltaic activity, that is the ability to convert light into electricity. Typically, such conversion is achieved using semiconducting materials that exhibit a photovoltaic effect.

[0010] The solid backlayer comprises a polypropylene composition, preferably in an amount of at least 95wt% based on the solid backlayer. In a preferred embodiment, the solid backlayer consists of the polypropylene composition.

[0011] The polypropylene composition comprises at least 50wt% polypropylene. Suitable polypropylenes are produced by the petrochemical industry and are commercially available.

[0012] The polypropylene composition may further comprise fillers. It has been found that the use of fillers enhances the rigidity of the photovoltaic module without affecting the photovoltaic yield of the photovoltaic element. Examples of such fillers include but are not limited to: inorganic reinforcement fibers, for example glass fibers and organic reinforcement fibers, preferably plant based fibers, such as cotton fibers, flax fibers, hemp fibers and jute fibers.

[0013] Preferably, the bending stiffness of the solid backlayer is further enhanced by use of inorganic reinforcement fibers in the polypropylene composition. More preferably, the inorganic reinforment fibers are present in an amount of 10 to 40wt% based on the polypropylene composition . As compared to plant based fibers, inorganic reinforcement fibers such as glass fibers have the advantage that they do not influence the water barrier properties.

[0014] The polypropylene composition may further comprise additives other than fillers, for example flame retardants, antioxidants, clarifiers, brighteners, acid scavengers, slip agents, pigments (e.g. carbon black or titanium oxide). Such additives can be used in conventional amounts and are generally commercially available and are described, for example in "Thermoplastic additives Handbook", 6th edition 2005 of S.U.N. Stroom.

[0015] It should be noted that the total amount of polypropylene, fillers and additives other than fillers totals 100% based on the polypropylene composition.

[0016] Due to the high rigidity provided by the solid backlayer, the overall thickness of the photovoltaic module can be reduced. The thickness of the backlayer is preferably in the range from 0.1 to 100 mm, more preferably in the range from 10 to 40 mm.

[0017] As well known, the elements and the layer structure of the photovoltaic module of the invention can vary depending on the desired type of module. One preferable photovoltaic module of the invention comprises a protective top element, e.g. a glass front sheet (glass front cover), front encapsulation element (front encapsulation), element(s) of photovoltaic cells (photovoltaic cells + connectors), back sheet encapsulation element (rear encapsulant), backsheet layer.

[0018] Figure 1 (Fig. 1) schematically shows the cross-section of the above described embodiment of the photovoltaic module of the invention, comprising a glass sheet frontlayer (1), a front encapsulation layer (2), photovoltaic cells (3), a back encapsulation layer (4) and the solid backsheet layer (5).

[0019] The glass sheet, photovoltaic element, which is preferably element(s) of photovoltaic cells together with connectors, and further materials for layers for encapsulation element(s) are well known in the photovoltaic module field and are commercially available or can be produced according to or in accordance to the methods known in the literature for the photovoltaic module field.

[0020] The photovoltaic module of the invention can be produced in a manner well known in the field of the photovoltaic modules. The polymeric layer elements including the backsheet element are produced for example by extrusion in a conventional manner using the conventional extruder and film formation equipment.

[0021] The different elements of the photovoltaic module are typically assembled together by conventional means to produce the final photovoltaic module. Elements can be provided separately or partly in integrated form to such assembly step. The different elements are then typically attached together by lamination using the conventional lamination techniques in the field. Such assembly of photovoltaic modules is well known in the field.

[0022] The invention will now be elucidated by way of the following examples without however being limited thereto.

Example 1.

[0023] A photovoltaic module was assembled to form a photovoltaic module as illustrated in Figure 1. As a front layer (1), a commercial glass sheet was used. Encapsulant layers (2) and (4) were prepared from Solarencapsulant® sheets supplied by the company PVglue. Photovoltaic cells (3) supplied by the company 'light in the dark' were used. As a solid back layer (5) an extruded sheet prepared from a polypropylene composition containing 95wt% polypropylene and 5wt% flame retardant was used of 30 mm thickness.

Example 2

[0024] A photovoltaic module was assembled to form a photovoltaic module as illustrated in Figure 1. As a front layer (1), a commercial glass sheet was used. Encapsulant layers (2) and (4) were prepared from Solarencapsulant® sheets supplied by the company PVglue. Photovoltaic cells (3) supplied by the company 'light in the dark' were used. As a solid back layer (5) an extruded sheet prepared from a polypropylene composition containing 75wt% polypropylene, 5wt% flame retardant and 20wt% glass fibers was used of 30 mm thickness.

Comparative example

[0025] A photovoltaic module was assembled to form a photovoltaic module as illustrated in Figure 1. As a front layer (1), a commercial glass sheet was used. Encapsulant layers (2) and (4) were prepared from Solarencapsulant® sheets supplied by the company PVglue. Photovoltaic cells (3) supplied by the company 'light in the dark' were used. As a solid back layer (5) a sheet of crosslinked EVA (ethylene-vinyl acetate thermoplastic polymer) was used of 40 mm thickness.

[0026] The photovoltaic modules were tested for their rigidity and their resistance to water.

[0027] The rigidity was measured using the bending stiffness test in accordance with ASTM10000-15, specimen A. A higher bending stiffness (in MPa) indicates a higher rigidity.

[0028] The resistance to water was measured using the water vapor transmission test in accordance with ISO 21000, test condition B. In Table 1, - stands for an insufficient water barrier, + indicates a good water barrier and ++ indicates a very good water barrier.

[0029] The results are listed in Table 1 below.

Table 1. Bending stiffness and water barrier properties of the photovoltaic modules

	Unit	Example 1	Example 2	Comparative example
Bending stiffness	MPa	1536	1821	1336
Water barrier		++	++	-

[0030] As can be seen form the examples, the photovoltaic modules of the invention show an increase in rigidity and an increased resistance to water.

Claims

1. A photovoltaic module comprising
a transparent frontlayer (1)
at least one photovoltaic element (3) located between the transparent frontlayer (1) and the solid backlayer (5)
and a solid backlayer (5) comprising a polypropylene composition,
wherein the polypropylene composition comprises at least 50wt% polypropylene based on the polypropylene composition.

2. The photovoltaic module according to claim 1, wherein the polypropylene composition in the solid backlayer (5) further comprises inorganic reinforcement fibers in an amount of 10-40wt% based on the polypropylene composition.

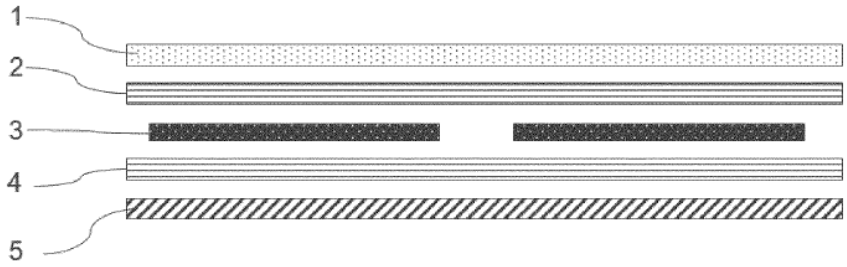


Fig. 1

Annex 2

WO2020/053926A1

Title: LIGHTWEIGHT PHOTOVOLTAIC MODULE

Filing date: 20 JUNE.2019
Publication date: 20 DECEMBER 2020

Applicant: Solarclient

Description

[0001] The invention relates to photovoltaic modules.

[0002] In recent years, the use of photovoltaic modules has increased sixfold in the past five years, as more and more people want to move away from the use of fossil energy and seek for a cleaner power source.

[0003] EP2560721A1 discloses an example of a rigid photovoltaic module that is widely used. The rigid photovoltaic module of EP2560721A1 comprises
a transparent frontlayer
at least one photovoltaic element
a glue layer surrounding the at least one photovoltaic element
and a solid backlayer prepared from a crosslinked EVA.

[0004] However, the current photovoltaic modules also have environmental downsides. One of those downsides is that at the end of their lifetime the photovoltaic modules will end up as waste, as especially crosslinked EVA and transparent frontlayers such as glass cannot be recycled. It is clear that the more photovoltaic modules are used, the larger the waste problem will become.

[0005] Another disadvantage of the currently available photovoltaic modules is that their weight does not allow them to be mounted onto all roofs. Especially, roofs of industrial buildings (such as stable roofs) are usually not designed to carry the additional weight of the photovoltaic modules.

[0006] Therefore, it is the object of the invention to provide lightweight, fully-recyclable photovoltaic modules.

[0007] This object is achieved by a photovoltaic module comprising:
(a) a front layer (1) arranged on the sunlight facing side of the photovoltaic module, which frontlayer comprises a polypropylene polymer, wherein the transmission of the front layer for light in the wavelength range of 350 to 1200 nm is on average at least 65% as determined in accordance with ISO1234-17,
(b) a sealing layer (2) (4) which at least partly encapsulates a plurality of photovoltaic cells (3) and a back layer (5) comprising a polypropylene foam and one or more polypropylene skin layers.

[0008] Inventors have found that the photovoltaic module of the invention can be fully recycled and is lightweight. In addition, by the use of a backlayer which has polypropylene in the foam and in the skin layer(s), the photovoltaic module is sufficiently rigid to be installed onto a roof.

[0009] Polypropylene is a thermoplastic polymer. A thermoplastic polymer, also called a thermoplast, is a polymer material that becomes pliable or moldable at a certain elevated temperature and solidifies below its melting temperature. Therefore, the use of a thermoplastic polymer allows the recyclability of the photovoltaic module.

[0010] The front layer of the photovoltaic module is arranged on the sunlight facing side of the photovoltaic module. The transmission of the front layer for light in the wavelength range of 350 to 1200 nm needs to be on average at least 65% as determined in accordance with ISO1234-17 in order to allow sufficient light to reach the photovoltaic cells.

[0011] The skilled person is aware which polypropylene polymers show such transmission and therefore, the skilled person can easily select the suitable polypropylene polymer for use in the front layer of the photovoltaic module. Polypropylene polymers and sheets prepared therefrom are commercially available.

[0012] The sealing layer in the photovoltaic module at least partly encapsulates a plurality of photovoltaic cells. Sealing layers are well known in the art. An example of a commercially available sealing layer is a sheet that is available under the trademark Solarencapsulant®.

[0013] Photovoltaic cells are cells capable of converting sunlight into electrical power. In a photovoltaic module they are typically connected to electrical cables and connectors.

[0014] The back layer comprises a polypropylene foam and one or more polypropylene skin layers. The use of one or more polypropylene skin layers in the back layer of the photovoltaic module increases the bending stiffness of the photovoltaic module. In addition, the use of a polypropylene skin layer increases the moisture barrier as compared to the use of just the foam layer in the back layer. For an optimal water resistance and aesthetics, preferably, the back layer comprises a polypropylene foam and two polypropylene skin layers on either side of the polypropylene foam.

[0015] The polypropylene foam is prepared in a manner known in the art by introduction of a gas into the molten polymer such that upon cooling, a foam is formed in which gas bubbles are trapped into the polypropylene. The polypropylene foam for the back layer is preferably produced in the form of a sheet, which can be prepared by sheet extrusion foaming technology. The back layer can be prepared by coextrusion of the foam sheet with one or more polypropylene skin layer(s).

[0016] The thickness of the backlayer (polypropylene foam and one or more polypropylene skin layers) will generally be in the range from 40 to 60 mm. The skin layers generally will have a thickness of less than 0.1 mm, preferably less than 0.05 mm as these are typically films.

[0017] Preferably, the polypropylene foam is reinforced by the use of glass fibers to increase the bending stiffness of the photovoltaic module. For example, glass fibers may be present in the polypropylene foam in an amount from 20-35wt% based on the polypropylene foam.

[0018] The different elements of the photovoltaic module are typically assembled together by conventional means to produce the final photovoltaic module. Elements can be provided separately or partly in integrated form to such assembly step. The different elements are then typically attached together by lamination using the conventional lamination techniques in the field. Such assembly of photovoltaic modules is well known in the field.

[0019] Figure 1 (Fig. 1) depicts the cross section of a preferred embodiment of the photovoltaic module of the invention and contains a polypropylene frontlayer (1), a front sealing layer (2), a back sealing layer (4), photovoltaic cells (3) and a back layer with two polypropylene skin layers (5A, 5C) on both sides of a polypropylene foam layer (5B).

[0020] The invention will now be elucidated by way of the following examples without however being limited thereto.

Example 1.

[0021] A photovoltaic module was assembled to form a photovoltaic module as illustrated in Figure 1. As a front layer (1), a polypropylene sheet 'PP75™' from suPPlier having 75% transmission for light in the wavelength range of 350 to 1200 nm as determined in accordance with ISO1234-17, was used. As sealing layers (2) and (4) Solarencapsulant® sheets were used. Photovoltaic cells (3) supplied by the company 'cheap current' were used. As a backlayer, a polypropylene foam sandwich panel prepared by coextrusion of two solid polypropylene skin layers of 0.04 mm thickness, with a polypropylene foam of 40 mm thickness to form a foam with skin layers on both sides, was used.

Example 2.

[0022] A photovoltaic module was assembled to form a photovoltaic module as illustrated in Figure 1. As a front layer (1), a polypropylene sheet 'PP75™' from suPPlier having 75% transmission for light in the wavelength range of 350 to 1200 nm as determined in accordance with ISO1234-17, was used. As sealing layers (2) and (4) Solarencapsulant® sheets were used. Photovoltaic cells (3) supplied by the company 'cheap current' were used. As a backlayer, a polypropylene foam sandwich panel prepared by coextrusion of two solid polypropylene skin layers (0.04 mm thickness) with a polypropylene foam filled with 30wt% glass fibers (40mm thickness) based on the polypropylene foam to form a foam with skin layers on both sides, was used.

Comparative example.

[0023] A photovoltaic module similar to example 1 as a front layer (1) was assembled with the following difference: as a front layer, glass was used instead of a polypropylene sheet, as a backlayer, instead of the polypropylene foam sandwich panel of example 1, a sheet of non-foamed crosslinked EVA of 30 mm thickness was used. Glass and crosslinked EVA cannot be recycled.

[0024] The rigidity was measured using the bending stiffness test in accordance with ASTM10000-15, specimen A. A higher bending stiffness (in MPa) indicates a higher rigidity.

[0025] The weight per square meter of the different photovoltaic modules is compared in the below table.

Table 1. Weight and bending stiffness of the photovoltaic modules.

	Unit	Example 1	Example 2	Comparative example
weight	kg/m^2	5.2	7.1	7.5
bending stiffness	MPa	1480	1716	1189

Claims

1. Photovoltaic module comprising:
(a) a front layer (1) arranged on the sunlight facing side of the photovoltaic module, which frontlayer comprises a polypropylene polymer, wherein the transmission of the front layer for light in the wavelength range of 350 to 1200 nm is on average at least 65% as determined in accordance with ISO1234-17,
(b) a sealing layer (2) (4) which at least partly encapsulates a plurality of photovoltaic cells (3) and a back layer (5) comprising a polypropylene foam and one or more polypropylene skin layers.

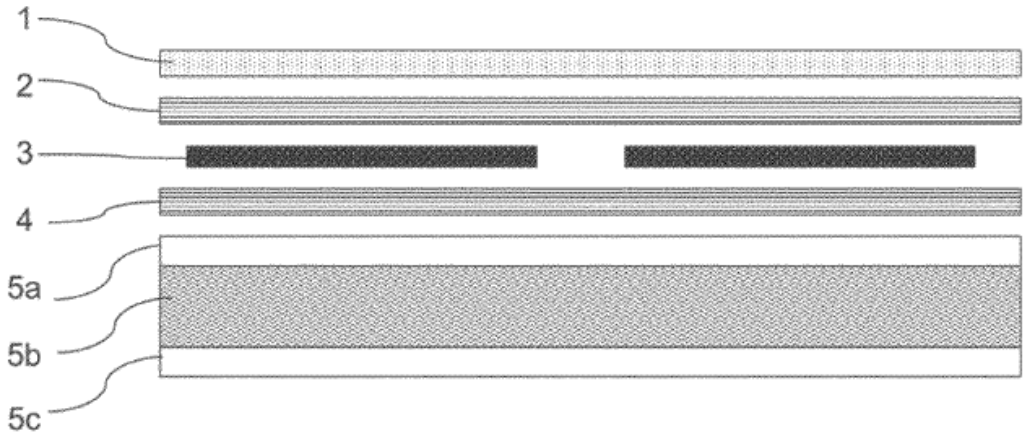


Fig. 1

D1

Annex 3

EP2560721A1
Title: Rigid photovoltaic module

Filing date: 5 December 2000

Publication date: 5 May 2002

All EP States designated

Applicant: Eva Bauhaus GmbH

Description

[0001] The invention relates to a rigid photovoltaic module.

[0002] Rigid photovoltaic modules are commonly used for the conversion of light into electricity.

[0004] However, the commercially available types of rigid photovoltaic modules have the disadvantage that they are not sufficiently waterproof and contain a metal backlayer. As is well known, electricity and water do not go together. When people are exposed to water with an electrical charge, it can be fatal. Moisture is also one of the biggest causes of a short circuit. Short circuits on their turn are one of the main causes of fires in houses and industrial buildings.

[0005] Therefore, it is an object of the invention to provide a rigid photovoltaic module which are sufficiently waterproof, thereby increasing the safety of the use of photovoltaic modules.

[0006] This object is achieved by a rigid photovoltaic module comprising
a transparent frontlayer
at least one photovoltaic element
a glue layer surrounding the at least one photovoltaic element
and a solid backlayer prepared from a crosslinked EVA.

[0007] The transparent frontlayer may for example be prepared from glass.

[0008] The rigid photovoltaic module of the invention may further comprise a glue layer surrounding the photovoltaic element.

[0009] The glue layer may comprise additives such as flame retardants, antioxidants, clarifiers, brighteners, glass fibers, acid scavengers, slip agents, pigments (e.g. carbon black or titanium oxide). Such additives can be used in conventional amounts and are generally commercially available and are described, for example in “Thermoplastics additives Handbook”, 5th edition 1999 of S.U.N. Stroom.

[0010] The invention will now be elucidated by way of the following example without however being limited thereto.

Example

A photovoltaic module was assembled to form a rigid photovoltaic module. A Solarencapsulant® sheet was placed on top of a sheet of crosslinked EVA, then 5 photovoltaic elements were placed onto the sheet of crosslinked EVA. On top of the photovoltaic elements, another sheet of Solarencapsulant® sheet was placed. The layers were then pressed in between hot plates to laminate the layers together. A glass plate was placed on top of the laminated layers.

Comparative example

As a comparative example, a rigid photovoltaic module having a metal backlayer, a glass frontlayer and in the middle 5 photovoltaic elements surrounded by a glue layer was used.

Water resistance test

The water resistance was determined by immersion of the rigid photovoltaic module in water for 5 minutes. The rigid photovoltaic module was then disassembled and the photovoltaic elements were visually inspected for the presence of (condensation) water.

Droplets of water were seen on 3 out of 5 photovoltaic elements of the module of the comparative example, but the photovoltaic elements of the rigid photovoltaic module of the example in accordance with the invention were completely dry.

Claims

1. Rigid photovoltaic module comprising
a transparent frontlayer
at least one photovoltaic element
a glue layer surrounding the at least one photovoltaic element
and a solid backlayer prepared from a crosslinked EVA.

D2

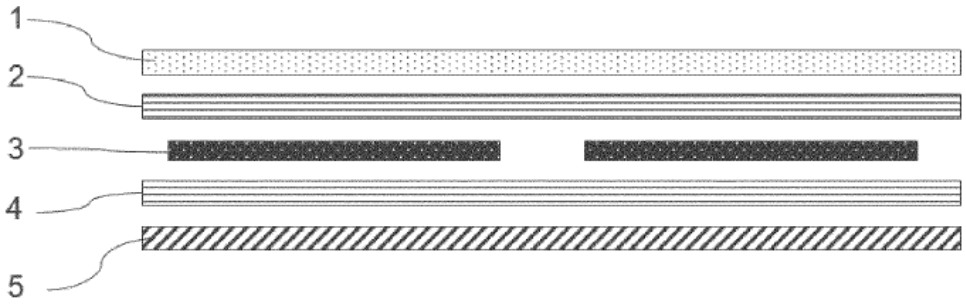
Annex 4

Conferentie: Op weg naar een zonnigere toekomst

Lunteren, 13 februari 2013

Gepresenteerd door: prof. dr. Luna Sol, Universiteit Wageningen

Multilaags zonnepaneel systeem – de laatste stand van zaken



Materialen per laag:

1. glas, polycarbonaat en/of transparante thermoplastische polymeren
2. polyethyleen, vernet elastomeer en/of polyamide
3. Zonnecellen
4. Polyethyleen, vernet elastomeer en/of polyamide
5. Compositie van polyethyleen, polypropyleen, polycarbonaat en/of polyamide

Lagen 2 en 4 zijn dunne lijmlagen die de zonnecellen geheel inkapselen.

Aandachtspunten in het ontwerp:

- Laag 5 kan geschuimd, of niet geschuimd zijn. Door het schuimen van laag 5 wordt het zonnepaneel systeem lichter gemaakt.
- Echter, de buigstijfheid van het zonnepaneel gaat omlaag door het schuimen van laag 5.
- Om de buigstijfheid van het schuim te verhogen, wordt aanbevolen om een hoeveelheid van 10-40 gewichtsprocent glasvezels aan de schuimlaag toe te voegen.

D3

Annex 5

From: Polymer handbook: properties and applications, 2005
page 745

Table 1331: water barrier properties and bending stiffness of various polymers

	Crosslinked EVA	**polyethylene**	**polypropylene**
Water barrier properties (10mm sheet)	**+**	**-**	**++**
Bending stiffness	**-**	**+**	**+**

- unsatisfactory
+ good
++ very good

Annex 6

WO2020/053899A1

Title: MEANS FOR ATTACHING A PHOTOVOLTAIC MODULE

Filing date: 02 JUNE 2019
Publication date: 2 DECEMBER 2020

Applicant: Solarpartner

Description

[0001] The invention relates to a means for attaching photovoltaic modules.

Brief description of the figures

[0012] Figure 1 depicts the cross section of the photovoltaic module of the example.

[0013] Figure 2 depicts the photovoltaic module of the example comprising a hook (6) affixed to the backlayer (5) for mounting the photovoltaic module to a rail (7)

Example

[0034] A photovoltaic module was assembled to form a photovoltaic module as illustrated in Figure 1. As a front layer (1), a polypropylene sheet 'PP75™' from suPPlier having 75% transmission for light in the wavelength range of 350 to 1200 nm as determined in accordance with ISO1234-17, was used. As sealing layers (2) and (4) Solarencapsulant® sheets were used. Photovoltaic cells (3) supplied by the company 'cheap current' were used. As a backlayer, a polypropylene foam sandwich panel prepared by coextrusion of two solid polypropylene skin layers with a polypropylene foam to form a foam with skin layers on both sides, was used.

[0035] A hook (6) was then attached onto the backlayer by way of a screw, to enable the mounting of the photovoltaic module to a rail (7).

Claims

1. Photovoltaic module comprising:
a back layer (5) comprising a polypropylene foam and one or more polypropylene skin layers.

2. Photovoltaic module according to claim 1, comprising a means (6), preferably a hook affixed to the backlayer (5) for mounting the photovoltaic module to a rail (7).

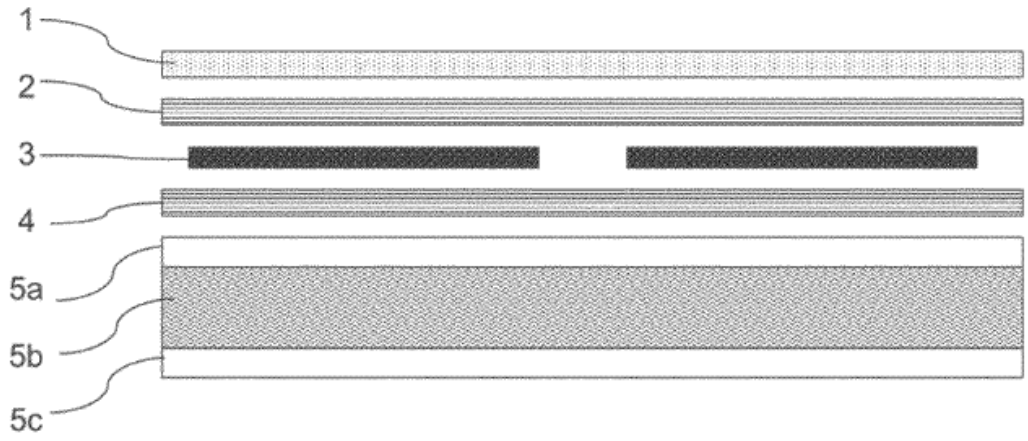


Fig. 1

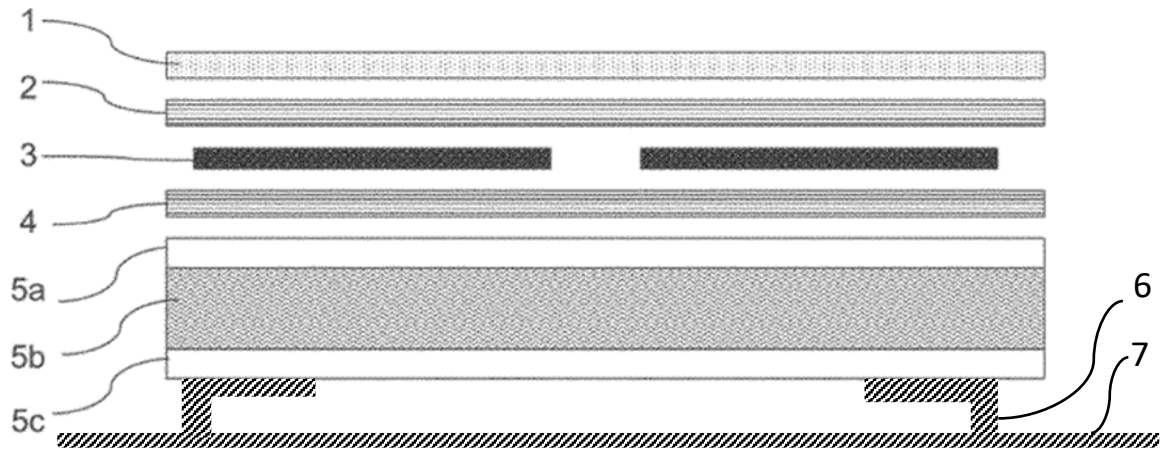


Fig. 2

International Preliminary Report on Patentability

Lack of clarity Art 5 PCT

The present application contains only one example. There is no description on how to achieve such photovoltaic modules over the whole scope. Therefore, the description does not disclose the invention of claim 1 in a manner sufficiently clear and complete for it to be carried out by a person skilled in the art (Art 5 PCT). Additionally, the description provides no further information on the propylene foam or skin layers, nor on any other technical detail apart from the mounting means. This, together with the use of trademarks for products used in the example leads to a fundamental clarity issue for at least claim 1.

Art 33(2) PCT.

The additional elements in Claim 2 lack novelty in view of each of D8, examples 1 and 3; D9, examples 10-15; D10, claim 3; D11, [0019].