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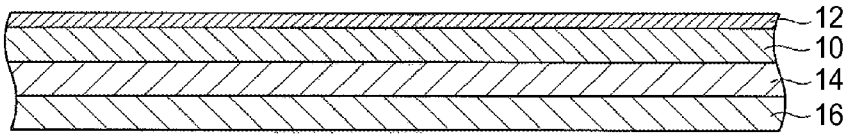


FIG. 2

(57) Abstract: The present disclosure provides a lamina that can be advantageously used as a back sheet constituting the rear surface of a solar cell module, and for which components can be fitted using adhesive (or tacky material). One embodiments of the present disclosure is a laminate, including: a fluorine resin layer; and a primer layer provided on a first side of the fluorine resin layer, and that includes an acrylic polymer that includes an amino ethyl group.

LAMINATE AND SOLAR CELL MODULE INCLUDING SAME

Technical Field

The present disclosure relates to a laminate, and to a solar cell module and primer including the laminate.

Background

Conventionally a laminate that combines different materials to satisfy various required properties such as weather resistance, electrical insulation, and so on, is used as a front sheet or back sheet that constitutes a front or rear surface of a solar cell module. Also, a laminate having a fluorine resin layer that includes fluorine resin as an outermost layer is being studied as this type of front or back sheet due to excellent weather resistance properties thereof. For example, Japanese Unexamined Patent Application Publication No. 2008-546557discloses a multi-layer film backsheet that includes a semi-crystalline fluoropolymer as a first external layer, a polyester intermediate layer, and an olefin polymer second outermost layer. Emerging solar technologies such as organic photovoltaic devices (OPVs) and thin film solar cells like copper indium gallium selenium di-selenide (CIGS) require protection from water vapor and need to be durable (*e.g.,* to ultra-violet (UV) light) in outdoor environments. Typically, glass has been used as an encapsulating material for such solar devices because glass is a very good barrier to water vapor, is optically transparent, and is stable to UV light. However, glass is heavy, brittle, difficult to make flexible, and difficult to handle. There is interest in developing transparent flexible encapsulating materials to replace glass that will not share the drawbacks of glass but have glass-like barrier properties and UV stability. Such front side solar cell modules that replace glass with fluoropolymers are known.

Summary of the Disclosure

Frequently components such as a junction box, a reinforcing frame, or the like are fitted to the rear surface of solar cell modules, and it is desirable that an adhesive layer (for example a pressure sensitive adhesive (PSA)) be used for fitting these components because of an excellent operability of these materials. However, if a laminate having a fluorine resin layer as the outermost layer is used as the back sheet, the adhesion between the fluorine resin layer and the adhesive layer is low, so it is difficult to fit the components using an adhesive layer. Likewise fluoropolymers are fitted to the front side of solar cell modules and it may be desirable to affix

an adhesive layer such as a PSA.

An object of the present disclosure is to provide a laminate that can be advantageously used as the front or back sheet constituting respectively the front or rear surface of a solar cell module, and for which components can be fitted using an adhesive layer and to provide a solar cell module that includes this laminate.

One aspect of the present disclosure is a laminate, including a fluorine resin layer; and a primer layer provided on a first side of the fluorine resin layer, and that includes an acrylic polymer that includes a primary or secondary amine group.

The laminate according to the above aspect includes a fluorine resin layer, so it has excellent weather resistance, water resistance, humidity resistance, and so on, and it can be advantageously used as a front or back sheet that constitutes a front or rear surface of a solar cell module. Also, the laminate according to this aspect is provided with a primer layer on the first side of the fluorine resin layer, and the primer layer has excellent adhesion to both the fluorine resin layer and an adhesive layer. Therefore components such as a junction box, reinforcing frame, or the like can be easily fixed to the laminate using an adhesive layer.

In another aspect, the laminate further includes an adhesive layer that includes a polymer with carboxylate or amide functionality provided on the primer layer. The adhesion of the primer layer to the adhesive layer is particularly excellent. Therefore, if components such as a junction box, reinforcing frame, or the like are fitted to the adhesive layer of this laminate, excellent adhesion between the fluorine resin and the components can be obtained. The adhesive layer may comprise a pressure sensitive adhesive, a hot melt adhesive or other adhesives comprising polymers with carboxylate or amide functionality such as carboxylic acids, carboxylic esters, amides, etc.

Also, in another aspect, the laminate includes a first resin layer that includes a polyester resin and a second resin layer that includes an olefin polymer, provided in that order on a second side of the fluorine resin layer. Such a laminate can be more advantageously used as the back sheet that constitutes the rear surface of the solar cell module.

An aspect of the present disclosure provides a solar cell module that includes the above laminate. According to this solar cell module, it is possible to install components such as junction boxes, reinforcement frames, and the like on a rear side of the solar cell module with good adhesion using an adhesive layer.

Also, in another aspect of the present disclosure, a primer is provided that includes an acrylic polymer that includes a primary or secondary amino group, that is used in forming the primer layer of the above laminate.

In addition, in another aspect of the present disclosure, a laminate is provided that includes a fluorine resin layer in which the first side of the fluorine resin layer is primed with a compound that includes an acrylic polymer that includes a plurality of primary or secondary amino groups. The fluorine resin layer of this laminate is primed with the primer specified above, so adhesion properties of the adhesive to the fluorine resin layer are good. Therefore when the laminate is used as the back sheet of a solar cell module, components such as junction boxes, reinforcement frames, or the like can be easily fitted to the fluorine resin layer, which is an outermost layer, using an adhesive layer.

According to the present disclosure it is possible to provide a laminate that can be advantageously used as the back sheet constituting the rear surface of a solar cell module, and for which components can be fitted using an adhesive layer, and a solar cell module that includes this laminate. The laminate may also be advantageously used as part of a front sheet or front portion of a solar cell module.

Brief Description of the Drawings

FIG. 1 is a perspective view illustrating an embodiment of a laminate according to the present disclosure;

FIG. 2 is a schematic cross-sectional view illustrating a cross-section at the section line I-I in FIG. 1;

FIG. 3 is a perspective view illustrating an embodiment of a solar cell module according to the present disclosure; and

FIG. 4 is a schematic cross-sectional view illustrating a cross-section at the section line II-II in FIG. 3.

Detailed Description

Preferred embodiments of the present disclosure are described below in detail while referring to the drawings, but the present disclosure is not restricted to the following embodiments. Note that in the following descriptions, identical or similar parts are assigned the same reference number and a duplicate description is omitted.

FIG. 1 is a perspective view illustrating an embodiment of a laminate according to the present disclosure, and FIG. 2 is a schematic cross-sectional view illustrating a cross-section at the section line I-I in FIG. 1. A laminate 100 includes a fluorine resin layer 10, and a primer layer 12 that includes an acrylic polymer having a primary or secondary amino group provided

on a first side of the fluorine resin layer. Also, the laminate 100 includes a first resin layer 14 that includes a polyester resin, and a second resin layer 16 that includes an olefin polymer in that order on a second side of the fluorine resin layer.

The fluorine resin layer 10 is a layer that includes a fluorine resin. The fluorine resin is a polymer of a monomer that includes, for example, tetrafluorethylene (TFE), hexafluoropropylene (HFP), perfluoroalkoxy vinyl ether (PFA), vinylidene fluoride (VDF), chloro trifluoro ethylene, and so on.

Specifically, the fluorine resin may be a tetrafluoroethylene-ethylene copolymer, tetrafluoroethylene-hexafluoropropylene copolymer, tetrafluoroethylene-perfluoroalkoxy vinyl ether copolymer, vinylidene fluoride-chloro trifluoro ethylene copolymer, tetrafluoroethylene-hexafluoropropylene-ethylene copolymer, vinylidene fluoride-tetrafluoroethylene copolymer, vinylidene fluoride-hexafluoropropylene copolymer, tetrafluoroethylene-hexafluoropropylene-vinylidene fluoride copolymer (THV), and so on.

Preferably the fluorine resin includes a vinylidene fluoride unit (in other words, this resin is a polymer of a monomer that includes vinylidene fluoride). According to this fluorine resin, an adhesion between the fluorine resin layer 10 and the primer layer 12 is further improved.

Also, preferably the fluorine resin includes a vinylidene fluoride unit and a tetrafluoroethylene unit, and more preferably includes a vinylidene fluoride unit, a tetrafluoroethylene unit, and a hexafluoropropylene unit.

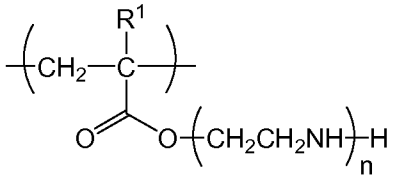
In addition, for excellent transparency, barrier properties, and flexibility, preferably the fluorine resin is a polymer of a monomer that includes 36 to 72 wt% tetrafluoroethylene, 0 to 56 wt% hexafluoropropylene, and 8 to 45 wt% vinylidene fluoride.

Preferably a content of fluorine resin in the fluorine resin layer 10 is at least 90 wt% of the gross weight of the fluorine resin layer 10.

There is no particular limitation on a thickness of the fluorine resin layer 10, but the thickness may be in the range of 0.01 to 0.15 mm, or it may be in the range of 0.03 to 0.05 mm.

The primer layer 12 includes an acrylic polymer that includes a primary or secondary amino group, and has excellent adhesion to both the fluorine resin layer 10 and an adhesive.

An example of the acrylic polymer that includes a primary or secondary amino group is an acrylic polymer having a structural unit represented below:



(1)

In the structural unit shown above, n is an integer equal to 1 or higher (preferably an integer in the range 1 to 3), and R^1 is a hydrogen atom or methyl group. The acrylic polymer having the structural unit represented above can be obtained, for example, by reacting an acrylic polymer that includes an acrylate unit with aziridine.

Preferably the acrylic polymer includes a plurality of primary or secondary amino groups, more preferably a plurality of amino ethyl groups, and most preferably includes a plurality of the structural units shown above.

Preferably a content of acrylic polymer in the primer layer 12 is at least 90 wt% of the gross weight of the primer layer 12.

The primer layer 12 may include components other than the above acrylic polymer. For example, the primer layer 12 may include organic solvent or the like, as described later. The primer layer may also include organo-onium compounds. Any suitable organo-onium compound, such as a quaternary organo-onium compound may be used. In one embodiment, the quaternary organo-onium compound may be defined by relatively positive and relatively negative ions wherein a phosphorus, arsenic, antimony or nitrogen generally comprises the central atom of the positive ion, and the negative ion may be an organic or inorganic anion (e.g., halide, sulfate, acetate, phosphate, phosphonate, hydroxide, alkoxide, phenoxide, bisphenoxide, etc.). In one example, the quaternary organo-onium compound includes an organic phosphonium salt represented by the following formula: $[P(R)_4^+]X^-$ wherein R can be an alkyl group (including cycloalkyl groups), aryl group, alkaryl group or arylalkyl group; and X can be any halide. For example, the organic phosphonium salt may be an organic phosphonium chloride salt, such as triphenylbenzylphosphonium chloride, tributylallyl phosphonium chloride, and tributylbenzyl ammonium chloride.

In the laminate 100, the primer layer 12 is provided so as to cover a whole of the first side of the fluorine resin layer 10, but in the present disclosure the primer layer 12 is not necessarily provided covering the whole of the first side of the fluorine resin layer 10. For example, the primer layer 12 may be provided only at a position where a junction box is fixed to a back sheet that is used in a solar cell module.

The primer layer 12 can be produced by applying a primer that includes the acrylic

polymer and an organic solvent on the first side of the fluorine resin layer 10, then removing at least a part of the of the organic solvent.

There is no particular limitation on the organic solvent provided it is possible to dissolve or disperse the acrylic polymer. For example, methyl ethyl ketone, isopropyl alcohol, ethyl acetate toluene, and so on can be used as the organic solvent.

There is no particular limitation on a thickness of the primer layer 12, but it can be equal to or less than 5 μm, or equal to or less than 2 μm. The thickness of the primer layer 12 can be adjusted as appropriate by adjusting the quantity of the primer solution or the % solids of the primer solution applied to the first side of the fluorine resin layer 10.

As stated above, the adhesion between the fluorine resin layer 10 and the primer layer 12 is improved when the fluorine resin layer 10 includes fluorine resin that includes a vinylidene fluoride unit. The reason for this is not clear, but it is considered to be because when the vinylidene fluoride unit of the fluorine resin and the primary or secondary amino group of the acrylic polymer react, the fluorine resin and the acrylic polymer are chemically or ionically bonded.

Also, the adhesion on the primer layer 12 to the adhesion layer is particularly excellent. The reason for this is not clear, but it is considered to be because when the carboxylate or amide functionality of the polymer in the adhesion layer and the primary or secondary amino group of the acrylic polymer react, the polymer in the adhesion layer and the acrylic polymer are chemically or ionically bonded.

In addition, it is possible to further improve the adhesion to the adhesion layer by providing fluorine resin that includes a vinylidene fluoride unit in the fluorine resin layer 10 and providing acrylic polymer that includes a plurality of primary or secondary amino groups in the primer layer 12. The reason for this is considered to be because when the acrylic polymer included in the primer layer 12 includes a plurality of primary or secondary amino groups, the vinylidene fluoride unit in the fluorine resin of the fluorine resin layer 10 and the polymer in the adhesion layer chemically bond via the acrylic polymer.

The first resin layer 14 is a layer that includes, for example, polyester resin, and performs the role of reinforcing member and/or electrically insulating layer.

The polyester resin may be polyethylene terephthalate (PET), polyethylene naphthalate (PEN), or the like, and of these polyethylene terephthalate is preferable.

Also, the first resin layer 14 may also include other polymers, such as, for example, polyarylates; polyamides such as polyamide 6, polyamide 11, polyamide 12, polyamide 46, polyamide 66, polyamide 69, polyamide 610, polyamide 612, and so on; aromatic polyamides;

polyphthalamides; thermoplastic polyimides; polyetherimides; polycarbonates such as bisphenol A polycarbonate; (meta)acrylic polymers such as polymethylmetacrylate; chloride polymers such as poly vinyl chloride, polyvinylidene chloride; poly ketones such as poly (aryl ether ether ketone) (PEEK), alternating copolymers with ethylene or propylene and carbon monoxide; polystyrenes with an arbitrary stereoregularity, ring- or chain-substituted polystyrenes; polyethers such as polyphenylene oxide, poly (dimethyl phenylene oxide), polyethylene oxide, polyoxymethylene; cellulose derivatives such as cellulose acetate; sulfur containing polymers such as polyphenylene sulfide, polysulfones, polyether sulfones; and so on.

In addition, the first resin layer 14 may include polyester resin and components other than the above polymers. Also, the first resin layer 14 may be whitened. If the first resin layer 14 is whitened, in an embodiment of the solar cell module that is described later, light of solar light that is incident on a glass plate 24 side and that passes through a solar cell module 20, or light that is not incident on the solar cell module 20 but is directly incident on the first resin layer 14 is reflected by the first resin layer 14, and can be supplied to the surface of the solar cell module 20. In this way an electrical generation efficiency of a solar cell module 200 is further improved. Methods of whitening include, for example, a method of including titanium oxide, a method of mixing in bubbles, and so on.

Preferably a content of ester resin in the first resin layer 14 is at least 90 wt% of the gross weight of the first resin layer 14.

There is no particular limitation on a thickness of the first resin layer 14, but for example the thickness may be in the range 0.03 to 0.25 mm.

The second resin layer 16 is a layer that includes an olefin polymer, and when used as a back sheet of a solar cell module, it can act as an adhesive layer to bond the solar cell module to the laminate 100. Also, after application to the solar cell module, it can serve the role of electrical insulation layer.

The olefin polymer may be a polymer that includes, for example, one or more types of monomeric unit originating from an olefin monomer as represented by the Formula CH_2-CHR^3 (in the Formula, R indicates a hydrogen atom or an alkyl group of carbon number 1 to 18). This olefin monomer may be ethylene, propylene, 1-butene, and so on, and of these ethylene is preferable.

More specifically, the olefin polymer may be polyethylene, polypropylene, polybutene-1, poly(3-methyl butene), poly(4-methyl pentene), and copolymers of at least one of ethylene and propylene, 1-butene, 1-hexene, 1-octene, 1-decene, 4-methyl-1-pentene and 1-octadecene, and so on.

The olefin polymer may be a copolymer of the above olefin monomers and one or more comonomers that can be copolymerized. Preferably the comonomer is in the range 1 to 10 wt% of the gross weight of olefin polymer.

The comonomer may be, for example, vinyl ester monomer such as vinyl acetate, vinyl propionate, vinyl butyrate, vinyl chloroacetate, vinyl chloropropionate; acrylic monomer such as acrylate, methacrylate, ethacrylate, methyl acrylate, ethyl acrylate, N, N-dimethyl acryl amide, methacrylamide, acrylonitrile; vinyl aryl monomer such as styrene, o-methoxystyrene, p-methoxystyrene, vinyl naphthalene; vinyl and vinylidene halogenized monomers such as vinyl chloride, vinylidene chloride, vinylidene bromide; maleate and fumarate alkyl ester monomers such as dimethyl maleate, diethyl maleate; vinyl alkyl ether monomers such as vinyl methyl ether, vinyl ethyl ether, vinyl isobutyl ether, 2-chloro ethyl vinyl ether; vinyl pyridine monomer; N-vinyl carbazole monomer; N-vinyl pyrrolidine monomer; and so on.

Also, the olefin polymer may also include a metal salt monomer that includes a carboxyl group. The metal to form the metal salt of the monomer may be a monovalent, divalent, or trivalent metal such as sodium, lithium, potassium, calcium, magnesium, aluminum, barium, zinc, zirconium, beryllium, iron, nickel, cobalt, and so on.

The second resin layer 16 may include components other than olefin polymer. For example, the second resin layer 16 may include anti-oxidation agent, light stabilizer, alkalizing agent, fillers, surface lubricant, pigment, adhesion promoting agent, and other auxiliary agents.

Preferably a content of olefin polymer in the second resin layer 16 is at least 90 wt% of the gross weight of the second resin layer 16.

There is no particular limitation on a thickness of the second resin layer 16, but the thickness may be in the range 0.03 to 0.51 mm.

The laminate 100 may have a constitution different from that described above, for example, a protective film may be laminated onto a side of the primer layer 12 on a side opposite the fluorine resin layer 10, or on a side of the second resin layer 16 on a side opposite the first resin layer 14. The protective film is provided to prevent damage, dirt, or the like on the laminate 100, and may be peeled off for use.

The following is an explanation of an embodiment of the solar cell module according to the present disclosure. FIG. 3 is a perspective view illustrating an embodiment of a solar cell module according to the present disclosure, and FIG. 4 is a schematic cross-sectional view illustrating a cross-section at the section line II-II in FIG. 3.

In a solar cell module 200, a glass plate 24, a first sealing film 22, a solar cell module 20, a second sealing film 18, a second resin layer 16, a first resin layer 14, a fluorine resin layer 10,

and a primer layer 12 are laminated in that order, and supported by an aluminum frame 30 that covers the side surfaces. Also, a junction box 210 is bonded to the primer layer 12 via an acrylic tacky material layer 26.

There is no particular limitation on the glass plate 24, the first sealing film 22, the solar cell module 20, the second sealing film 18, and the junction box 210, and commonly known items can be used.

The adhesion layer 26 is a layer that includes a polymer with carboxylate or amide functionality. The adhesion layer preferably includes at least a monomeric unit of acrylic acid origin. According to this adhesion layer, it is considered that it is possible to chemically or ionically bond with the acrylic polymer of the primer layer 12, so the adhesion with the primer layer 12 is excellent.

In the above the preferred embodiments of the present disclosure were explained, but the present disclosure is not limited to these embodiments. For example, in the above embodiment, it is stated that the laminate 100 includes the first resin layer 14 and the second resin layer 16, but the laminate according to the present disclosure does not necessarily have to include the first resin layer 14 and the second resin layer 16, but may only include the fluorine resin layer and the primer layer 12.

Also, in the above embodiment, the laminate according to the present disclosure was explained as a laminate that includes the fluorine resin layer 10 and the primer layer 12, but the laminate according to the present disclosure can also be a laminate that includes a fluorine resin layer in which the first side of the fluorine resin layer 10 is primed with a compound that includes acrylic polymer that includes a plurality of amino ethyl groups.

Examples

The present disclosure will be explained in further detail below based on working examples, but the present disclosure is not limited to the following working examples.

Working Example 1

Film with a multi-layer structure that included a fluorine resin layer (THV layer), a polyethylene terephthalate layer, and an ethylene-vinyl acetate copolymer layer laminated in that order (Scotchshield Film 17T, manufactured by 3M Minnesota,USA) was prepared. Methyl ethyl ketone solvent containing 2 wt% amino ethylated acrylic polymer (NK350: Nippon Shokubai,Co.,LTD.; Osaka-shi Osaka, Japan) was applied to the fluorine resin layer of the film and dried, to obtain a laminate including a primer layer. Adhesion properties of the laminate

obtained were evaluated by the following method.

Adhesion Property Evaluation

A side of the laminate opposite the primer layer was placed on 3 mm thick glass, and vacuum laminated. Next, acrylic foam tape backed with aluminum foil (double sided tape, Y4300-08, manufactured by Sumitomo-3M) was placed on the primer layer of the laminate, and was adhered by passing a 5 kg roller over it (forward and back). The initial sample was left in 23°C 55% humidity conditions for one day.

The initial sample was subject to a 90 degree peel test in accordance with JIS Z 0237 at a tension speed of 300 mm/minute. The peeling strengths (N/cm) were as shown in Table 1.

Next, an initial sample manufactured in the same way as described above was left for 2 weeks in conditions of 85°C and 85% humidity, then left for a further day in conditions of 23°C and 55% humidity, and after high temperature high humidity testing the sample was obtained. The sample obtained was subject to a 90 degree peel test in accordance with JIS Z 0237 at a tension speed of 300 mm/minute. The peeling strengths (N/cm) were as shown in Table 1.

Also, the samples after evaluation were inspected after both the initial test and the high temprature high humidity test, and an occurrence of peeling due to rupture of the acrylic foam tape was checked.

Comparative Example 1

Film with the same three layer structure as used in Working Example 1 was prepared, and toluene solution containing 1 to 5 wt% each of polymethylene polyphenylene isocyanate and chlorinated rubber (Primer N200; Sumitomo-3M, Setagaya-ku,Tokyo, Japan) was applied to the fluorine resin layer of this film and dried to obtain a laminate having a primer layer.

Comparative Example 2

Film with the same three layer structure as used in Working Example 1 was prepared, and toluene solution containing 1 to 5 wt% each of polymethylene polyphenylene isocyanate and chlorinated polypropylene (Primer 500; Sumitomo-3M, Setagaya-ku,Tokyo, Japan) was applied to the fluorine resin layer of this film and dried to obtain a laminate having a primer layer.

Comparative Example 3

Film with the same three layer structure as used in Working Example 1 was prepared, and a solution containing 1 to 5 wt% each of acrylic polymer and chlorinated rubber (Primer

4298UV; 3M, Minnesota,USA)was applied to the fluorine resin layer of this film and dried to obtain a laminate having a primer layer.

Comparative Example 4

Film with the same three layer structure as used in Working Example 1 was prepared, and PAA-HCL-3L (50% solution in water of polyallylamine hydrochloride with average molecular weight 15,000) manufactured by Nitto Boseki Co., Ltd., was applied to the fluorine resin layer of this film and dried to obtain a laminate having a primer layer.

Comparative Example 5

Film with the same three layer structure as used in Working Example 1 was prepared, and PAA-HCL-10L (40% solution in water of polyallylamine hydrochloride with average molecular weight 150,000) manufactured by Nitto Boseki Co., Ltd., was applied to the fluorine resin layer of this film and dried to obtain a laminate having a primer layer.

Comparative Example 6

Film with the same three layer structure as used in Working Example 1 was prepared, and PAA-15 (15% solution in water of allylamine polymer with average molecular weight 15,000) manufactured by Nitto Boseki Co., Ltd., was applied to the fluorine resin layer of this film and dried to obtain a laminate having a primer layer.

Adhesion Property Evaluation

The adhesion properties of the laminates obtained in Comparative Examples 1 to 6 were evaluated by the above method. The evaluation results were as shown in Table 1. Also, as a result of checking the samples after evaluation, it was found that apart from the initial adhesion evaluation of Comparative Example 6 in which a small amount of rupture of the acrylic foam tape was seen, in each of the other comparative examples there was no rupture of the acrylic foam tape, but peeling occurred at the boundary between the acrylic foam tape and the laminate.

Comparative Example 7

Using the same method as in Working Example 1, the adhesion of the fluorine resin layer to the acrylic foam tape was evaluated, using a film of the same three layer structure as used in Working Example 1, however without applying the primer. The evaluation results were as shown in Table 1.Also, as a result of checking the samples after evaluation, it was found that for both the initial test and the high temperature high humidity test that there was no rupture of the

acrylic foam tape, but peeling occurred at the boundary between the acrylic foam tape and the laminate.

Table 1. Adhesion of the Fluorine Resin Layer to the Acrylic Foam Tape

	Initial (N/cm)	After high temperature high humidity test (N/cm)
Working Example 1	32	32
Comparative Example 1	11	10
Comparative Example 2	15	19
Comparative Example 3	15	21
Comparative Example 4	9	10
Comparative Example 5	9	9
Comparative Example 6	26	15
Comparative Example 7	7	6

What is claimed is:

1. A laminate comprising:

a fluorine resin layer; and

a primer layer provided on a first side of the fluorine resin layer, and that includes an acrylic polymer that contains a primary or secondary amino group.

2. The laminate of claim 1 wherein the amino group is an ethyl amino group.

3. The laminate of claim 1 wherein the primer layer further comprises an organo-onium compound.

4. The laminate according to any one of claims 1-3, further comprising an adhesive layer on the primer layer, the adhesive layer comprising a polymer with carboxylate or amide functionality.

5. The laminate of claim 4 wherein the adhesive layer comprises an acrylic pressure sensitive adhesive or a hot melt adhesive.

6. The laminate according to any one of claims 1-5, further comprising:

a first resin layer that includes a polyester resin, and

a second resin layer that includes an olefin polymer, provided subsequently on a second side of the fluorine resin layer.

7. A solar cell module comprising a laminate according to any of claims 1 through 6.

8. A primer, comprising:

an acrylic polymer that includes a primary or secondary amino group, used for forming a primer layer in a laminate according to any of claims 1 through 6.

9. A laminate, comprising:

a fluorine resin layer that is primed on a first side thereof with a compound that includes an acrylic polymer including a plurality of primary or secondary amino groups.

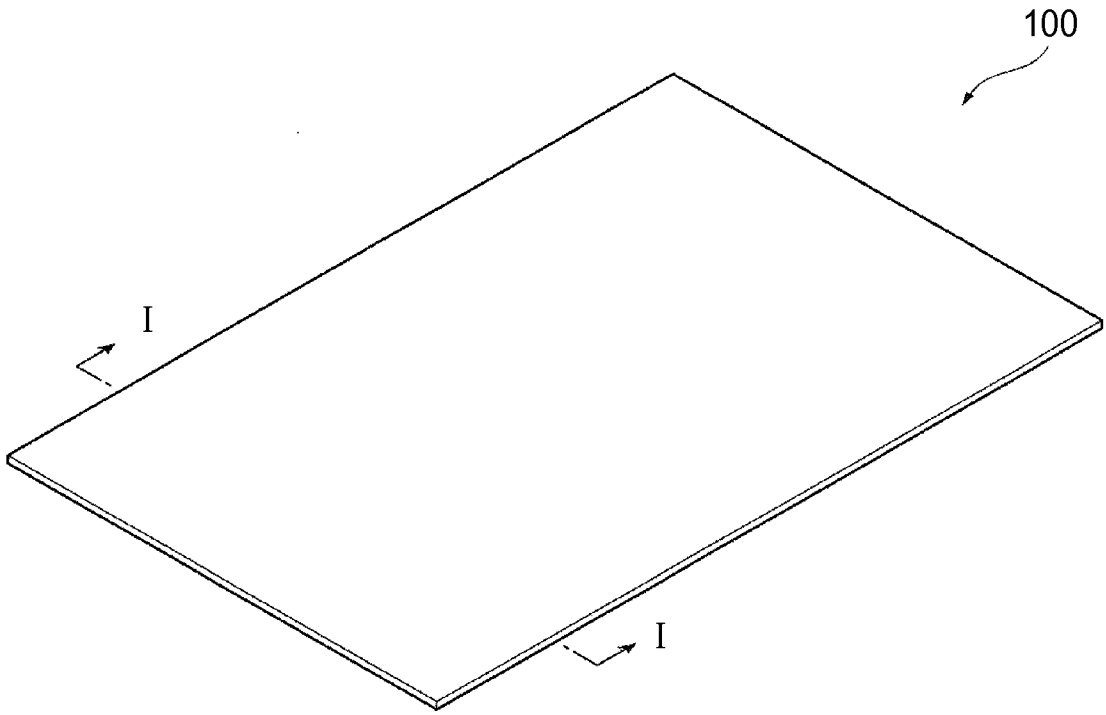


FIG. 1

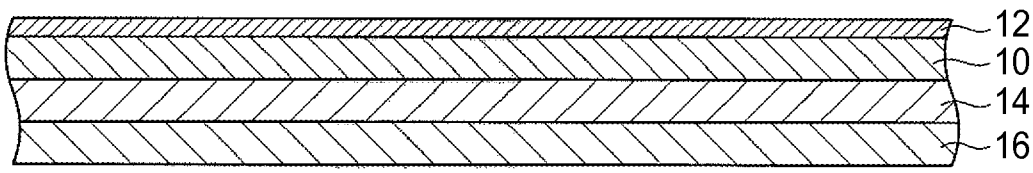


FIG. 2

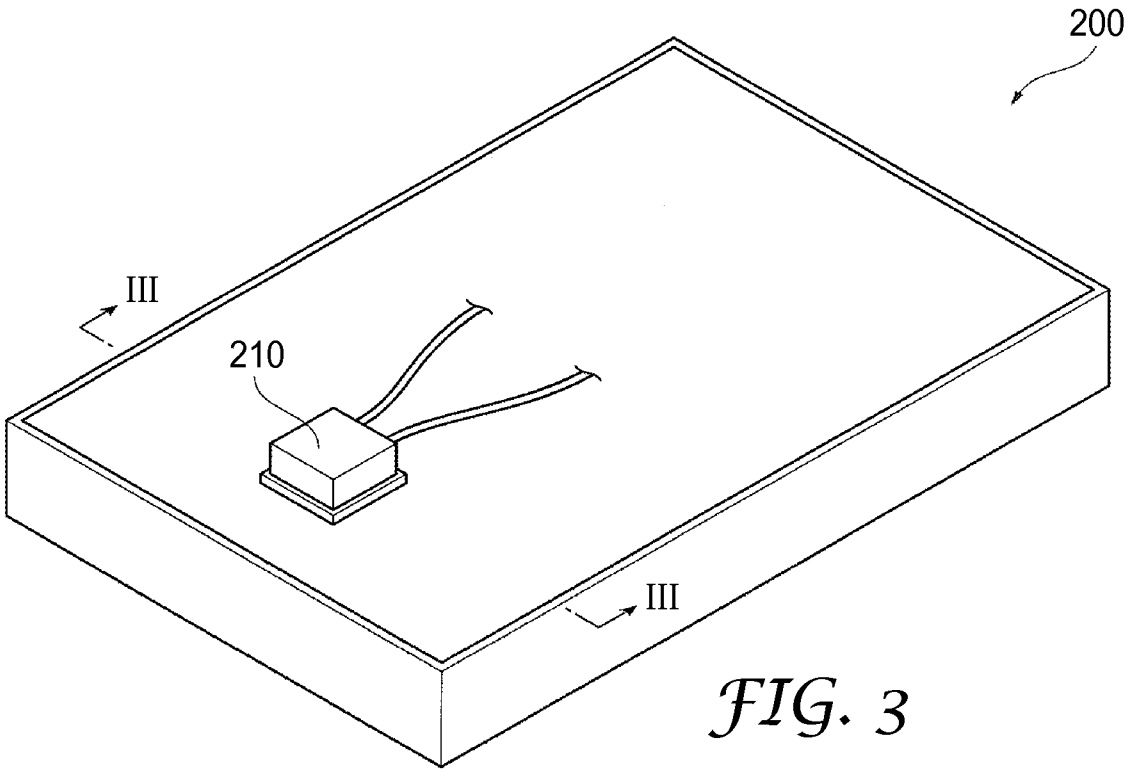


FIG. 3

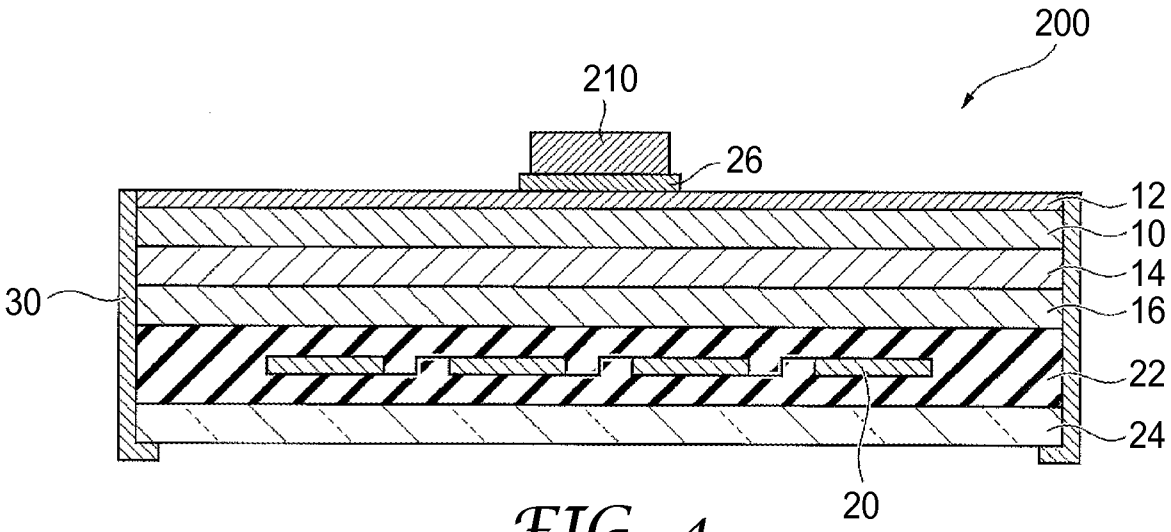


FIG. 4

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US 12/39308

A. CLASSIFICATION OF SUBJECT MATTER
IPC(8) - B32B 27/08; C08J 5/12 (2012.01)
USPC - 428/335 ; 428/421; 428/476.3
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(8) - B32B 27/08; C08J 5/12 (2012.01)
USPC - 428/335 ; 428/421; 428/476.3

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
IPC(8) - B32B 27/08; C08J 5/12 (2012.01)
USPC - 428/335 ; 428/421; 428/476.3 (keyword delimited)

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
PubWEST (USPT,PGPB,EPAB,JPAB); Google, Google Patent
Search terms used: laminate layers fluorine resin fluoropolymer pimer adhsive onium organo-onium phosphonium acrylic ethylamino ethylamino

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X --- Y	US 6,632,518 B1 (Schmidt et al.) 14 October 2003 (14.10.2003), col 2, ln 20-col 3, ln 10; col 6, ln 36-40; col 6, ln 63-col 7, ln 9; col 10, ln 44-45	1, 2, 4/(1), 4/(2), 5 --- 4/(3)
X --- Y	US 6,346,328 B1 (Parsonage et al.) 12 February 2002 (12.02.2002), col 3, ln 6-11; col 8, ln 51-59	1, 3, 9 --- 4/(3)
Y	US 6,759,129 B2 (Fukushi) 06 July 2004 (06.07.2004), col 2, ln 67-col 3, ln 2; col 3, ln 54-55; col 5, ln 19-25	3, 4/(3)
Y	US 6,479,158 B1 (Kuntz et al.) 12 November 2002 (12.11.2002), col 4, ln 48-col 5, ln 32	3, 4/(3)
Y	US 6,482,522 B1 (Parsonage et al.) 19 November 2002 (19.11.2002), col 2, ln 63-col 3, ln 38	3, 4/(3)

☐ Further documents are listed in the continuation of Box C. ☐

* 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 application or patent 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	Date of mailing of the international search report
03 August 2012 (03.08.2012)	14 AUG 2012
Name and mailing address of the ISA/US Mail Stop PCT, Attn: ISA/US, Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450 Facsimile No. 571-273-3201	Authorized officer: Lee W. Young PCT Helpdesk: 571-272-4300 PCT OSP: 571-272-7774

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US 12/39308

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 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.: 6-8
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

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

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 additional fees, this Authority did not invite payment of additional fees.

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.:

Remark on Protest

☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.

☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.

☐ No protest accompanied the payment of additional search fees.