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(54) Title: SOLAR PANEL ASSEMBLY AND METHOD FOR PREPARING THEREOF

(57) Abstract: The present invention relates to a solar panel assembly and a method for preparing the same. The solar panel assembly has a non-light receiving surface and a support member. The support member is attached to the non-light receiving surface of the solar panel through both a handling adhesive and a structural adhesive.

SOLAR PANEL ASSEMBLY AND METHOD FOR PREPARING THEREOF

This application claims priority to U.S. Serial No. 61/310,901, filed March, 5, 2010, which is incorporated herein.

BACKGROUNDOF THE INVENTION

The invention is directed to a solar panel assembly and a method for preparing thereof.

Solar panels are widely known in the art and are developed for the production of electricity from solar energy.

Solar panels arranged on rooftops and on the ground in fields have unique requirements in that they must maintain the integrity under conditions of high humidity, because they are often positioned outdoors and exposed to rain, freezing rain, and snow and under conditions of widely varying temperature extremes, because they are often positioned in hot deserts, on hot asphalt rooftops, and in climates that experience extremely high temperatures, extremely low temperatures, and strong winds. Thus, any mechanism used to secure and maintain solar panels in a fixed position must function under a difficult set of environment conditions.

A solar panel has usually a planar, rectangular configuration and comprises a light receiving surface and a non-light receiving surface. The thin film solar panel generally requires the attachment of some means of fixing the panel to a substructure and elements which reinforce the panel. Typically these functions are combined by attaching a backrail. Conventional crystalline silica cell based panels are typically framed both for stabilization and mechanical attachment to a substructure. Both types of panels can benefit from the present invention. In the prior art, solar panel and support member are assembled by means of flexible glue or a double-sided tape, see for example WO 2009/102772 A2.

SUMMARY OF THE INVENTION

In one aspect, the invention features a solar panel assembly including a solar panel having a non-light receiving surface and a support member. The support member is attached to the non-light receiving surface of the solar panel through both a handling adhesive and a structural adhesive.

In another aspect, the invention relates to a method for preparing a solar panel assembly. The method includes applying a handling adhesive and a structural adhesive onto a non-light receiving surface of a solar panel and/or a support member, and assembling the non-light receiving surface of the solar panel and the support member.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a schematic cross-sectional view of an inventive solar panel assembly.

Figure 2 is a top view of a backrail as a support member for preparing an inventive solar panel assembly.

DETAILED DESCRIPTION OF THE INVENTION

The solar panel assembly of the invention includes a solar panel having a non-light receiving surface and a support member. The support member is attached to the non-light receiving surface of the solar panel through both a handling adhesive and a structural adhesive.

HANDLING ADHESIVE AND STRUCTURAL ADHESIVE

The term "handling adhesive" herein refers to an adhesive that facilitates assembly of a support member and a solar panel, e.g., offering a resistance to compression while a structural adhesive is curing. The term "structural adhesive" herein refers to any adhesive that, upon final cure, provides a solar panel assembly with sufficient structural durability regarding the attachment of the support member and the solar panel. In other words, handling adhesive and structural adhesive are two different materials or compositions.

In a preferred embodiment, the handling adhesive is a hot melt composition and the structural adhesive is a curable composition.

When a hot melt composition is utilized as the handling adhesive, such hot melt composition is to be applied at higher temperatures, e.g., at least about 65°C or higher whereas the curable composition as the structural adhesive is normally applied at ambient temperature.

Suitable hot melt compositions as a handling adhesive include those that will provide enough green strength to allow initial handling of the solar panel.

Suitable curable compositions as a structural adhesive include those that will provide ultimate strong, durable adhesive bond that will stand for a long period of time under the environment conditions that a solar panel will experience.

In some embodiments suitable hot melt compositions as a handling adhesive include thermoplastic material based hot melt compositions that are non-reactive hot melt compositions.

In some embodiments, hot melt compositions suitable as handling adhesives also include reactive hot melt compositions. A reactive hot melt composition is any thermoplastic adhesive or sealant that can be applied at elevated temperatures as liquid or semi liquid melt, cools to become solid at room temperature, and then subsequently reacts to become a thermosetting polymer with enhanced physical properties. Due to their thermoplastic nature during application but before curing, reactive hot melt compositions have many of the desirable processing characteristics of conventional hot melts, such as no solvents present, no mixing requirements, and immediate green strength.

In some embodiments, suitable reactive hot melt compositions as a handling adhesive include hot melt moisture curable compositions. In other embodiments, suitable reactive hot melt compositions as a handling adhesive include other reactive hot melt compositions that are not moisture curable systems.

Examples of suitable non-reactive hot melt compositions as a handling adhesive include e.g., hot melt adhesives based on butyl rubber, or ethylene polyvinyl acetate (EVA), or amorphous poly-alpha olefin (APAO), with additives e.g., tackifying resin, wax, filler, and/or other materials known in the formulating art.

In one embodiment, a hot melt moisture curable composition is used as a handling adhesive. The hot melt moisture curable composition is a one-part thermoplastic moisture cure polyurethane composition that includes a) a polyurethane prepolymer component including the reaction product of at least one isocyanate compound and at least one amorphous polyester polyol which is formed from a diol and a diacid; and b) at least one thermoplastic rubber component. Preferably, the diacid has a chain length of greater than about 10 carbon atoms. Further information regarding the hot melt moisture curable composition can be found in US 6,355,317 B1, incorporated by reference in its entireties.

In one embodiment, a hot melt moisture curable composition is used as a handling adhesive. The hot melt moisture curable composition includes from about 5 % by weight to about 80 % by weight a silane functional amorphous poly-α-olefin polymer, from at least 10 % by weight to about 75 % by weight a thermoplastic elastomer, and from at least 5 % by weight to about 60 % by weight a tackifying agent. Further information regarding the hot melt moisture curable composition can be found in US 2004/0180154, incorporated by reference in its entirety.Suitable structural adhesives include curable compositions that are applied at ambient temperature and gelled in several minutes to one hour and cured in a matter of days.

In some embodiments, suitable curable compositions include one-part curable compositions or two-part curable compositions.

In some embodiments, one-part compositions include, e.g., one-part moisture curable silicones, one-part moisture curable silane functional polymers (including e.g., silyl-terminated polyethers (STPE), silane terminated polyurethane polymers (SPUR) and grafted materials), and one-part moisture curable polyurethanes, etc.

In some embodiments two-part curable compositions include e.g., two-part epoxy-based compositions, two-part silicone-based compositions, two-part urethane-based compositions, two-part polysulfide-based compositions, two-part acrylic-based compositions, or combinations thereof.

Examples of commercially available curable compositions include e.g., "SP 5737" (one-part silicone, from Otto-Chemie), "S 640" (two-part silicone from Otto-Chemie), "PVA-400" (one-part MS polymer based adhesive from ADCO global); "PVA500" (two-component polyurethane from ADCO global).

SOLAR PANEL ASSEMBLY AND METHOD OF MAKING THEREOF

The solar panel assembly of the invention includes a solar panel having a non-light receiving surface and a support member. The support member is attached to the non-light receiving surface of the solar panel through both a handling adhesive and a structural adhesive.In one embodiment, the support member is a backrail. The backrail is typically a roll formed galvanized steel profile. However aluminum extrusions, stainless steel profiles

or even profiles of non-metal materials can also be chosen. Respective backrails are well-known in the art.

In one embodiment, the handling adhesive and/or structural adhesive is (are) applied as continuous or non-continuous bead(s). However, other modes of application can be used for applying the structural adhesive. The structural adhesive can be sprayed; knife edge applied or roll coated. The handling adhesive can be continuously applied along the side of the structural adhesive, or in as few as 1-2 spots along the bond line to hold the parts in place during cure.

In one embodiment, the structural adhesive is applied in at least two substantially parallel, preferably continuous, beads, and the handling adhesive is applied, preferably non-continuously, between two adjoining beads of structural adhesive.

The handling adhesive and/or structural adhesive may be present as foam. In one embodiment, a foaming agent, for example air, may contain a reactant, for example water vapour or amines, for the reactive groups in the handling adhesive, preferably reactive hot melt composition, to cross link.

Preferably, the structural adhesive is flush with edges of the support member.

Optionally, spacer elements can be added into handling and/or structural adhesive. The spacer elements may preferably have a defined geometry, i.e. the spacer elements may be spheres, cylinders, tubes, strips or ropes.

In another aspect, the invention features a method for preparing a solar panel assembly. The method includes applying a handling adhesive and a structural adhesive onto a non-light receiving surface of a solar panel and/or a support member, and assembling the non-light receiving surface of the solar panel and the support member.

Preferably, the structural adhesive is applied simultaneously or subsequently to the application of the handling adhesive.

If spacer elements are present, these can be added to the handling adhesive and/or structural adhesive prior to or after application thereof onto the non-light receiving surface of the solar panel and/or the support member.

The inventors have discovered that a solar panel assembly can be prepared in a simple and cost effective manner and a method for preparing such a solar panel assembly with improved automation and productivity.

Surprisingly, it was found that the inventive solar panel assembly can be mounted in a very simple and cost effective manner. The invention allows for a higher degree of automation with reduced cost and improved productivity as the application of handling adhesive and structural adhesive does not need to be applied manually, but can be applied in an automation line for preparing the solar panel assembly. Also the reproducibility of the inventive solar panel assembly is improved as the handling adhesive will offer a resistance to compression thereby allowing a defined and sustainable spacing of the support member from the panel ensuring a defined thickness of the structural adhesive. In other words, the support member is held in place by the handling adhesive allowing the structural adhesive to be fully cured.

Further features and advantages of the invention can be derived from the following description, wherein preferred embodiments of the invention are explained in detail by way of an example on the basis of schematic drawings. It is, however, to be noted that the drawings only illustrate typical embodiments of the invention and are therefore not to be construed to limit the scope of protection which is only defined by the attached claims.

A solar panel assembly 1 of the present invention is shown in figure 1. The solar panel assembly 1 is supported from the non-light receiving surface thereof via a support member 20. Any suitable support member in any desired shape can be used. The support member 20 may have a V-shape including a lower mounting surface 21 for engagement with a mounting structure (not shown). Flexible support portions 22 extend upwardly and outwardly from structural mounting surface 21 in a V-shaped manner. Panel mounting portions 23 extend outwardly from each flexible support portion 22 and are configured to engage the non-light receiving surface of a solar panel 30. Two beads 40 of a curable composition, e.g., any one of the aforementioned curable compositions as a structural adhesive are applied on each panel mounting portion 23 between the solar panel 30 and the support member 20, wherein each bead 40 is flush with the respective edge of the support member 20to ensure that no moisture or other detrimental agents can accumulate in the interface. Between the two beads 40 of the curable composition on each panel mounting portion 23 there is provided a bead 50 of a hot melt composition, e.g., a hot melt moisture curable composition as a handling adhesive.

The solar panel assembly according to the present invention can be prepared by applying a hot melt composition (preferably a reactive hot melt composition) as a handling adhesive to either support member 20 or solar panel 30, or both, and simultaneously or subsequently applying a curable composition, preferably a one-part or two-part curable adhesive/sealant as a structural adhesive, before placing the support member 20 on the solar panel 30. Preferably, the hot melt composition and the curable composition are applied in the form of beads, either continuously or non-continuously.

As already disclosed above, the hot melt composition 50 will offer a resistance to compression thereby allowing a defined and sustainable spacing of the support member 20 from the solar panel 30 ensuring a defined thickness of the curable composition once cured. Further, the support member 20 is held in place by the hot melt composition 50 allowing the curing of the curable composition.

Figure 2 illustrates a top view of a part of a panel mounting portion 23. A curable composition as the structural adhesive can be applied as multiple continuous beads 40 having various shapes, such as round, rectangular or triangular, etc. A hot melt composition as the handling adhesive can be simultaneously or consecutively applied onto the support member 20 in, for example, non-continuous beads 50.

Between the two beads of the curable composition a channel can be formed when attached to the solar panel. One end of the channel can be covered by a suitable cover or cap (not shown). The material of the cover or cap may be gas permeable, which allows the exchange of water vapour but limits the ingress of contaminating particles or insects.

The inventive method allows a high degree of automation, reduces costs and improves productivity as well as reproducibility. The handling adhesive and structural adhesive can be applied in an automated manner so no manual application is necessary. The handling adhesive and structural adhesive can also be applied in other configurations than beads, or by roll coating, or by screen printing.

The features disclosed in the foregoing description, the claims and the drawings may, both separately and in any combination thereof, be material for realizing the invention in diverse forms thereof. The relevant portions of all documents disclosed herein are hereby incorporated by reference in their entirety.

Other embodiments are within the claims.

What is claimed is:

1. A solar panel assembly comprising a solar panel having a non-light receiving surface and a support member, wherein the support member is attached to the non-light receiving surface of the solar panel through both a handling adhesive and a structural adhesive.

2. The solar panel assembly according to claim 1, wherein the handling adhesive is a hot melt composition.

3. The solar panel assembly according to claim 1, wherein the handling adhesive is a reactive hot melt composition.

4. The solar panel assembly according to claim 1, wherein the handling adhesive is a hot melt moisture curable composition.

5. The solar panel assembly according to claim 1, wherein the structural adhesive is a curable composition.

6. The solar panel assembly according to claim 1, wherein the handling adhesive is a reactive hot melt composition and the structural adhesive is a curable composition.

7. The solar panel assembly according to claim 1, wherein the structural adhesive comprises one-part curable compositions or two-part curable compositions.

8. The solar panel assembly according to claim 1, wherein the support member is a backrail.

9. The solar panel assembly according to claim 1, wherein the handling adhesive and/or structural adhesive is present as foam.

10. The solar panel assembly according to claim 1, wherein the structural adhesive is flush with edges of the support member.

11. A method for preparing the solar panel assembly according to any one of claims 1-10, comprising applying the handling adhesive and the structural adhesive onto the non-light receiving surface of the solar panel and/or the support member, and assembling the non-light receiving surface of the solar panel and the support member.

12. The method according to claim 11, wherein the handling adhesive and/or the structural adhesive is (are) applied as continuous or non-continuous bead(s).

13. The method according to claim 11, wherein the structural adhesive is applied in at least two substantially parallel, preferably continuous, beads, and the handling adhesive is applied, preferably non-continuously, between two adjoining beads of the structural adhesive.

14. The method according to claim 11, wherein the structural adhesive is flush with edges of the support member.

15. The method according to claim 11, wherein the structural adhesive is applied simultaneously or subsequently to the application of the handling adhesive.

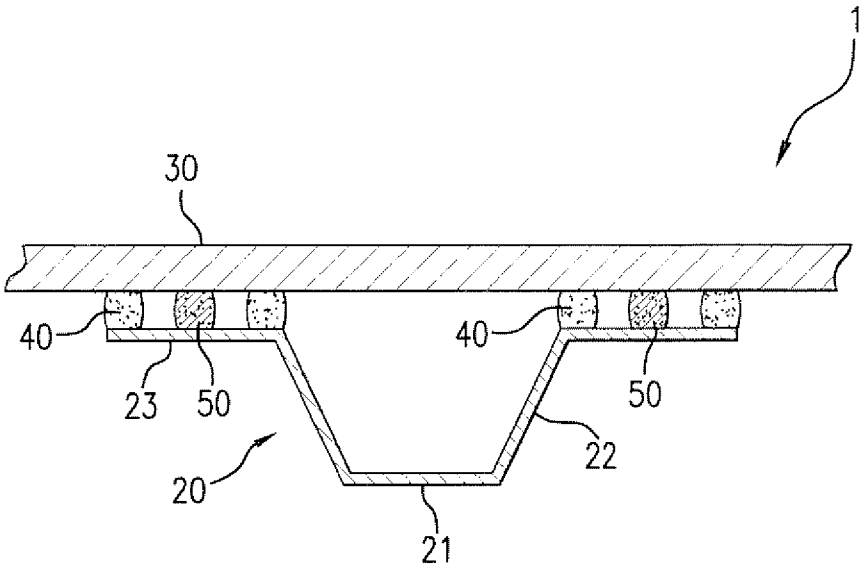

FIG. 1

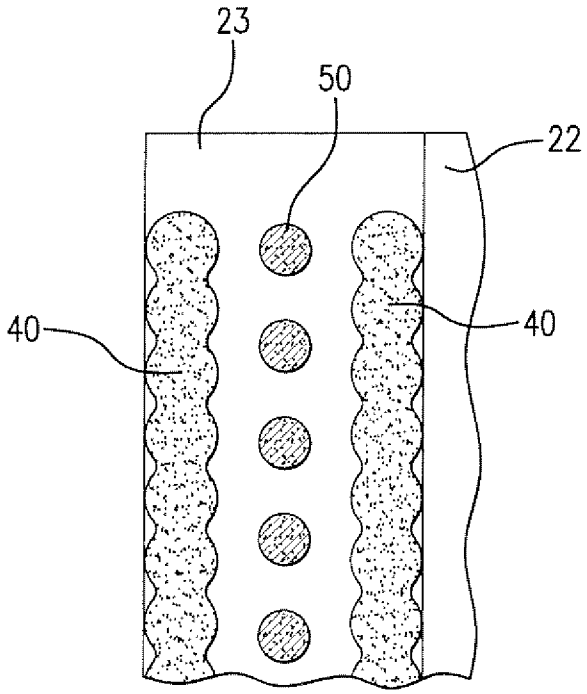

FIG. 2