

SPECIFICATION

Preformed sheet-like structures

- 5 This invention relates to preformed sheet-like structures and to methods of making them. The structures of the invention are particularly, but not exclusively, useful for application to concrete surfaces.
- 10 In the past, concrete surfaces such as flat concrete roofs have usually been sealed by application of hot asphalt, a roofing felt with the aid of hot bitumen, or sheet-like membranes laid with the aid of hot bitumen or solvent-or emulsion-based adhesives.
- 15 Such methods suffered from the disadvantages that they require the employment of skilled men, local heating of the bitumen or the use of liquid applied materials so that the labour costs are high.
- To avoid this difficulty there previously have been
- 20 proposed sheet-like structures comprising two layers of bituminous material attached to each other, one layer being substantially non-adhesive and the other layer being a pressure-sensitive adhesive, the compositions of each layer having at least one
- 25 polymer distributed therein.
- In practice, the two layers may differ from one another in the proportions of the polymer in the bituminous compositions and/or by reason of the use of different polymers or bituminous substances in
- 30 them.
- A drawback with the prior proposals is that there is a tendency for the oils in the bituminous substances to migrate from one of the layers to the other, and it has been found that this tendency is increased if the
- 35 polymers in the two layers are different and have different affinities with oils. There is, in fact a need to use such different polymers as the polymer in what will be the upper layer must be of a type which offers good weather resistance while that in the lower layer
- 40 must be of a type which retains its adhesive properties so that over a long period of time the structure will remain adhered to any surface to which it is applied. Eventually, an equilibrium stage is reached and it can happen that the layer which
- 45 was initially non-adhesive becomes adhesive while the layer which was initially adhesive becomes substantially non-adhesive. In extreme cases, and in particular where different polymers are employed in the two layers, it can come about that the two layers
- 50 actually reverse their properties. This is, of course, unacceptable, because such a preformed structure cannot be regarded as a success if the two layers reverse or alter their properties after it has been installed.
- 55 One way in which it might be expected that this difficulty could be overcome would be including a preformed film or foil between the two layers of bituminous material. When this has been tried, however, the drawback is encountered that
- 60 delamination of the product tends to occur, for instance due to different coefficients of expansion, rendering the product useless initially or after only a short period of use.
- According to one aspect of the present invention
- 65 there is provided a sheet-like structure comprising

- two layers of respective bituminous compositions each including a polymer, one layer being substantially non-adhesive and the other layer being a pressure-sensitive adhesive and, between the
- 70 layers and in intimate contact with each layer, a coating of an oil resistant material.

- The present invention also provides a method of making a sheet-like structure comprising two layers of respective bituminous compositions, each
- 75 including a polymer, one layer being substantially non-adhesive and the other being a pressure-sensitive adhesive, such method including steps of forming one of the layers, applying onto that layer, when it is hot, an oil resistant material in liquid
- 80 form, allowing the liquid to solidify so that the material forms a coating on that layer and applying the other layer, when it is hot, to the exposed face of the coating.

- It is preferable, though not essential, to employ an
- 85 oil resistant material which presents a tacky surface when it solidifies.

- In accordance with the invention, rather than take the step of providing a preformed film or foil between the two layers, or to try to modify that step
- 90 so as to be more successful, there is provided an oil resistant coating which is in more intimate contact with both layers than could ever be achieved by a preformed further member. In accordance with the method of the invention, the coating is formed by
- 95 application of the oil resistant material to one of the layers, when it is hot, in liquid form so that the coating closely follows the microscopic contours of the surface of the layer to which it is applied. The liquid rapidly solidifies and the second layer is
- 100 applied hot to the thus formed coating and in turn closely conforms to the microscopic contours of the surface beneath. As a consequence, far greater affinity and mutual adhesion between the layers and the coating, in effect a non-detachability, is obtained
- 105 than can be obtained using a preformed film insert between layers, and a satisfactory oil barrier is achieved.

- By the term "pressure-sensitive adhesive" we mean in this specification a material which, at
- 110 ambient temperatures and without the application of heat or a solvent will adhere permanently under normal hand pressure to a concrete surface. Clearly, therefore, the pressure-sensitive adhesive is for application to a surface to be covered, the
- 115 non-adhesive surface being suitable for exposure.

- The bituminous compositions of which the two layers of the structure of the invention are constituted each include at least one bituminous constituent, that is to say one or more of bitumen,
- 120 asphaltic bitumen, tars and pitches and their derivatives both natural and synthetic and at least one polymer. The polymers may for instance be natural or synthetic rubber, elastomeric or non-elastomeric, there being no requirement for the
- 125 polymers in the two layers to be the same or for the polymers to be uniformly distributed within the layers. The compositions of the layers can differ from one another as to the proportions of bituminous constituents to polymer, in the
- 130 bituminous constituents, in the polymers or by

reason of a combination of two or three of these features. For the adhesive layer, preferably, the bituminous composition is a bitumen-rubber composition, preferably formed of natural or

- 5 synthetic rubber, virgin or reclaimed, blended into bitumen to provide a smooth mix. The ratio by weight of bitumen to rubber is preferably from 70:30 to 95:5, especially about 90:10. Alternatively the bitumen can be a blend of different bitumens
- 10 containing also, if desired, heavy or light mineral oils and other plasticisers. Generally, suitable bitumen compositions have softening points (measured by the Ring and Ball method) of 70 to 195°C and penetration values of 5-300 at 25°C (100 g. 5
- 15 sec.-Institute of Petroleum method); the softening point and penetration value may vary, within these ranges, from one side of the layer to the other, or they may be the same throughout the layer.

- If desired a layer of reinforcing material can be
- 20 contained within either or both of the layers. The non-adhesive layer of the structure can if desired be provided with an outer coating of a light mineral aggregate or metallic powder to increase its weathering properties. A protective coating which
- 25 can be physically removed without damaging substantially the self-adhesive layer of the structure can usefully be applied thereto for storage and transportation purposes, as the structure will normally be supplied in roll form. A wide variety of
- 30 materials can be used to provide the protective coating. Paper having a release coating thereon, e.g. siliconised paper or paper having a coating thereon of a suitable polymer, is satisfactory. Other materials include films of organic polymers, particularly vinyl
- 35 chloride polymers. As stated, the structure is conveniently available in the form of rolls and in use can be unrolled, the protective coating being simultaneously removed, and laid directly into place.

- In referring to the "non-adhesive" layer, we mean
- 40 that this layer is substantially non-adhesive at ambient temperatures but it will obviously be adhesive when sufficiently heated and will be so in the manufacturing step. It can comprise any suitable bituminous composition including a polymer such
- 45 as are well known to these skilled in the art. If desired, this non-adhesive layer can be treated to protect it from damage and/or so that it offers an improved keying surface for other material, e.g. concrete or asphalt, subsequently applied thereto.
- 50 Thus this face can be textured or gritted.

- In width, the structures can vary for instance from 2.5 to 120 centimetres or more, depending upon the use to which they are to be put and generally they are at least 5 centimetres wide, for instance 15-90 or
- 55 100 centimetres wide with the larger range of widths being preferred where a whole surface, for instance a roof, is to be rendered waterproof. The thickness can also vary depending upon the intended use, but in the adhesive layer will generally be greater than
- 60 0.025 cms in order to ensure good adhesion over a long period of time even if the underlying surface should move and expand and contract with age and seasons. While the thickness can be as much as 0.6 to 0.9 cms, a maximum thickness of the adhesive
- 65 layer of 0.4 cms may be preferable to ensure against

slippage, especially if the structure bears loads.

- Among oil resistant materials which can be used for the coating on and between the layers and applied in liquid form according to the method of the invention there may be mentioned polyvinyl acetate,
- 70 polyvinyl alcohol, a carboxylated-styrene-butadiene polymer, a styrene-butadiene polymer with high styrene content, an acrylonitrile-butadiene polymer, an acrylonitrile-styrene-butadiene polymer,
- 75 polyurethane, polyvinylchloride, acrylic resins, chlorinated rubber and polymethacrylates but other natural or synthetic oil resistant polymers or other suitable materials which can be applied in liquid form can alternatively be employed.

- 80 In one way of performing the method of the invention, one of the layers of the composition is firstly prepared and, while it is hot, the liquid is sprayed thereon. The heat of the layer quickly solidifies the liquid and immediately thereafter the
- 85 second layer, while itself hot is placed in contact with the thus formed coating on the first layer. The two layers are thus bound to one another, and each coated most intimately by the coating which is compatible with both layers. An extremely good and
- 90 even contact between the coating and the first layer is obtained by reason of the initial application in the form of a liquid, and this enhances the coating effect with regard to the second layer. With the coating in place, oil migration from one layer to the other can
- 95 be avoided where it might take place for instance by reason of different oil contents, or by reason of different polymers in the two layers or both.

- The structures are intended for use in providing a waterproof seal over a surface, particularly a
- 100 concrete surface, by applying the adhesive layer to the surface, a plurality of overlapping structures being used if necessary in order to form a continuous membrane over the whole surface. The structure may be left exposed to the weather, or, if
- 105 desired, after the structure has thus been applied, another surface, e.g. another mass of concrete, a sand or cement screed or other floor finish, a layer of asphalt or a cladding material, can be placed on the structure or can be formed in situ.

- 110 Examples of suitable materials for the reinforcement for incorporation within the layers are glass fibre (woven, mesh, tissue or strand), synthetic polymers (woven, mesh or strand), expanded or perforated metal or fabric (woven or non-woven).

- 115 The structures can be used on floors and roofs, particularly the flat roofs of factories or blocks of flats. They can also be used on bridge decks where the structures are applied as indicated above and hot asphalt is laid on top as a wearing course.

120 CLAIMS

1. A sheet-like structure comprising two layers of respective bituminous compositions, each including
- 125 a polymer, one layer being substantially non-adhesive and the other layer being a pressure-sensitive adhesive and, between the layers and in intimate contact with each layer, a coating of an oil resistant material.
- 130 2. A structure according to claim 1, wherein the

reason of a combination of two or three of these features. For the adhesive layer, preferably, the bituminous composition is a bitumen-rubber composition, preferably formed of natural or synthetic rubber, virgin or reclaimed, blended into bitumen to provide a smooth mix. The ratio by weight of bitumen to rubber is preferably from 70:30 to 95:5, especially about 90:10. Alternatively the bitumen can be a blend of different bitumens containing also, if desired, heavy or light mineral oils and other plasticisers. Generally, suitable bitumen compositions have softening points (measured by the Ring and Ball method) of 70 to 195°C and penetration values of 5-300 at 25°C (100 g. 5 sec.-Institute of Petroleum method); the softening point and penetration value may vary, within these ranges, from one side of the layer to the other, or they may be the same throughout the layer.

If desired a layer of reinforcing material can be contained within either or both of the layers. The non-adhesive layer of the structure can if desired be provided with an outer coating of a light mineral aggregate or metallic powder to increase its weathering properties. A protective coating which can be physically removed without damaging substantially the self-adhesive layer of the structure can usefully be applied thereto for storage and transportation purposes, as the structure will normally be supplied in roll form. A wide variety of materials can be used to provide the protective coating. Paper having a release coating thereon, e.g. siliconised paper or paper having a coating thereon of a suitable polymer, is satisfactory. Other materials include films of organic polymers, particularly vinyl chloride polymers. As stated, the structure is conveniently available in the form of rolls and in use can be unrolled, the protective coating being simultaneously removed, and laid directly into place.

In referring to the "non-adhesive" layer, we mean that this layer is substantially non-adhesive at ambient temperatures but it will obviously be adhesive when sufficiently heated and will be so in the manufacturing step. It can comprise any suitable bituminous composition including a polymer such as are well known to those skilled in the art. If desired, this non-adhesive layer can be treated to protect it from damage and/or so that it offers an improved keying surface for other material, e.g. concrete or asphalt, subsequently applied thereto. Thus this face can be textured or gritted.

In width, the structures can vary for instance from 2.5 to 120 centimetres or more, depending upon the use to which they are to be put and generally they are at least 5 centimetres wide, for instance 15-90 or 100 centimetres wide with the larger range of widths being preferred where a whole surface, for instance a roof, is to be rendered waterproof. The thickness can also vary depending upon the intended use, but in the adhesive layer will generally be greater than 0.025 cms in order to ensure good adhesion over a long period of time even if the underlying surface should move and expand and contract with age and seasons. While the thickness can be as much as 0.6 to 0.9 cms, a maximum thickness of the adhesive layer of 0.4 cms may be preferable to ensure against

slippage, especially if the structure bears loads.

Among oil resistant materials which can be used for the coating on and between the layers and applied in liquid form according to the method of the invention there may be mentioned polyvinyl acetate, polyvinyl alcohol, a carboxylated-styrene-butadiene polymer, a styrene-butadiene polymer with high styrene content, an acrylonitrile-butadiene polymer, an acrylonitrile-styrene-butadiene polymer, polyurethane, polyvinylchloride, acrylic resins, chlorinated rubber and polymethacrylates but other natural or synthetic oil resistant polymers or other suitable materials which can be applied in liquid form can alternatively be employed.

In one way of performing the method of the invention, one of the layers of the composition is firstly prepared and, while it is hot, the liquid is sprayed thereon. The heat of the layer quickly solidifies the liquid and immediately thereafter the second layer, while itself hot is placed in contact with the thus formed coating on the first layer. The two layers are thus bound to one another, and each coated most intimately by the coating which is compatible with both layers. An extremely good and even contact between the coating and the first layer is obtained by reason of the initial application in the form of a liquid, and this enhances the coating effect with regard to the second layer. With the coating in place, oil migration from one layer to the other can be avoided where it might take place for instance by reason of different oil contents, or by reason of different polymers in the two layers or both.

The structures are intended for use in providing a waterproof seal over a surface, particularly a concrete surface, by applying the adhesive layer to the surface, a plurality of overlapping structures being used if necessary in order to form a continuous membrane over the whole surface. The structure may be left exposed to the weather, or, if desired, after the structure has thus been applied, another surface, e.g. another mass of concrete, a sand or cement screed or other floor finish, a layer of asphalt or a cladding material, can be placed on the structure or can be formed in situ.

Examples of suitable materials for the reinforcement for incorporation within the layers are glass fibre (woven, mesh, tissue or strand), synthetic polymers (woven, mesh or strand), expanded or perforated metal or fabric (woven or non-woven).

The structures can be used on floors and roofs, particularly the flat roofs of factories or blocks of flats. They can also be used on bridge decks where the structures are applied as indicated above and hot asphalt is laid on top as a wearing course.

CLAIMS

1. A sheet-like structure comprising two layers of respective bituminous compositions, each including a polymer, one layer being substantially non-adhesive and the other layer being a pressure-sensitive adhesive and, between the layers and in intimate contact with each layer, a coating of an oil resistant material.

2. A structure according to claim 1, wherein the

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coating is of one of polyvinyl acetate, polyvinyl alcohol, a carboxylated-styrene-butadiene polymer, a styrene-butadiene polymer with high styrene content, an acrylonitrilebutadiene polymer, an acrylonitrile-styrene-butadiene polymer, polyurethane, polyvinylchloride, acrylic resins, chlorinated rubber and polymethacrylates.

3. A structure according to claim 1 or 2, wherein in one or both of the layers, the polymer is a rubber.

10 4. A structure according to claim 1 or 2 or 3 which is at least 15 centimetres wide.

5. A method of making a sheet-like structure comprising two layers of respective bituminous compositions, each including a polymer, one layer

15 being substantially non-adhesive and the other layer being a pressure-sensitive adhesive such method including the steps of forming one of the layers, applying onto that layer, when it is hot, an oil resistant material in liquid form, allowing the liquid
20 solidify so that the material forms a coating on that layer, and applying the other layer, when it is hot, to the exposed face of the coating.

6. A method according to claim 5, wherein the coating is one of polyvinyl acetate, polyvinyl alcohol,
25 a carboxylated-styrene-butadiene polymer, a styrene-butadiene polymer with high styrene content, an acrylonitrile-butadiene polymer, an acrylonitrile-styrene butadiene polymer, polyurethane, polyvinylchloride, acrylic resins,
30 chlorinated rubber and polymethacrylates.

7. Sheet-like structures according to claim 1 and substantially as hereinbefore described.

8. A method of making a sheet-like structure substantially as hereinbefore described.

35 9. A method of forming a waterproof seal on a surface by applying to the surface the adhesive face of a structure according to any one of claims 1 to 4 and 7 or a structure made by the method of any one of claims 5, 6 and 8.