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This invention relates to waterproofing materials which are in the form of pre-formed, sheet-like laminates of (a) a waterproof and waterproofing bituminous membrane adhered to (b) a support sheet material covering at least one major surface of the bituminous membrane.

It is known that building surfaces, such as foundations, concrete decks, roofs, and the like, can be sealed in a waterproof manner by formation thereon of a continuous membrane of a bituminous composition that is substantially impermeable to moisture. The term "bituminous composition" as used in the present disclosure refers to compositions based on tar, asphalt or pitch with or without added components. Historically, such waterproofing membranes were formed by "in situ" application of a bituminous composition, along with one or more "plys" of bitumen-saturated felts. One disadvantage of this procedure is that the formation of a layer of waterproofing sealant at the job site was dependent upon uniform application. Such application caused additional expenses of labor at the job site. Moreover, vertical substructural membranes were often unmanageable.

In more recent times, waterproofing of structural surfaces was done by using preformed, flexible membranes of bituminous compositions that were pressure-sensitive. These waterproofing materials had a laminate structure comprising a support sheet, such as a polymer film, adhered to a membrane of a flexible self-adhesive bituminous composition superimposed on the support sheet. As taught in Canadian Pat. No. 1,008,738 of Davis, it was known to employ in the support sheet a cross-laminated or biaxially-oriented synthetic polymeric film to avoid wrinkling after exposure to outdoor sunlight.

In some applications, it is necessary to provide a reflective surface to minimise temperature gain due to solar exposure. While pigments could be incorporated into the polymer film, it was taught by Martin in GB 2,212,417 that this rendered the film tearable during the stretching operation which is part of the manufacturing process in the making of oriented films. Accordingly, Martin taught the use of a pigmented polymer layer which is coated onto the support sheet material by extrusion coating. The use of the pigmented polymer imparted a light color to the waterproofing laminate, so as to keep it cooler and reduce the temperature elevation in sunlight.

In addressing the issue of solar heating, it is one purpose of the present invention to minimize the number of manufacturing steps required to provide a pre-formed waterproofing laminate membrane. Thus, the present invention is directed to membrane systems wherein a reflecting pigment coating is not separately coated in the process of forming the laminate membrane structure.

Moreover, reflective pigments, which appear white or whitish in color, are sometimes discolored due to the migration of oils from the bituminous rubber adhesive layer. The use of oil-barrier layers in waterproofing laminate membranes is known, and can be referred to with respect to the issues just discussed above. For example, U.S. Pat. No. 4,396,665 of Rowe and No. 4,585,682 of Colarusso et al. teach the use of a thin layer of metal film to prevent migration of oils in the bitumen adhesive composition layer from reaching an uppermost polymeric support film. However, the use of the metal film is expensive, and presents thermal expansion issues which must be considered.

Canadian Patent No. 1,145,109 of Hurst disclosed an oil-resistant polymer coating applied in liquid form between a first layer of bituminous self-adhesive composition and a second layer of bituminous composition which was substantially non-adhesive. The oil barrier coating prevented oil from one of the bituminous layers from migrating to the other layer. Along these lines, U.S. Pat. No. 4,442,148 of Stierli taught the use of an oil barrier coating layer, but one which was located between the polymeric carrier sheet and contiguous bituminous adhesive layer.

While an oil barrier film or coating material can indeed be employed within a multilayer waterproofing membrane composite to prevent discoloration of a white or whitish pigment, and in extreme cases to prevent bleeding-through of oil migrating from the bituminous adhesive layer, there is still the further problem of providing a laminate which can be assembled in a convenient, efficient, and cost-saving manner. It is desired herein to obtain a novel laminate which retains the kind of flexibility and manageability that might not be otherwise obtained through an excessively multi-layered or multi-coated structure, but which provides the desired durability in the face of rough job site demands, sunlight, and the elements.

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It is a purpose of the present invention to integrate in an effective, convenient, and cost-saving manner certain diverse properties, such as light-reflectivity to minimize thermal gain from sunlight, light absorptivity to minimize light transmission to the bituminous layer, and oil-barrier properties to prevent migration of oils which would stain a light reflective outer layer which is usually white or whitish in color.

As will be further described herein, the present invention is directed to providing novel laminates in which an oil-barrier layer is used in conjunction with an incorporated additive that provides light reflectivity; and, according to the invention, one of the purposes is to provide both of these features in the same step so that they do not need to be separately applied. In still further embodiments of the invention, an additive for blocking the transmission of light (including ultraviolet light), such as carbon black, is further incorporated in a layer beneath the outermost layer which incorporates the light-reflective additive as just described.

In an exemplary embodiment of the invention, a rollable, pre-formed membrane laminate for waterproofing structural surfaces, comprises a flexible waterproof and waterproofing self-adhesive bituminous membrane layer having oil therein; and a polymeric support carrier sheet non-removably adhered to the bituminous membrane layer, the carrier sheet comprising a first polymeric layer, a

second polymeric layer that is laminated to the first layer and is co-extensive therewith, the first layer comprising an additive that is operative to reflect light, the second layer being located between the first layer and bituminous membrane layer, and at least one polymeric film operative as an oil-resistant and oil-impermeable barrier located between the carrier sheet first layer and the bituminous membrane layer, the oil-resistant polymeric film being co-extensive with the first and second carrier sheet layers by virtue of being co-extruded with at least one of them.

An exemplary method of the invention for fabricating a rollable waterproofing membrane laminate comprises the steps of: providing a carrier support sheet assembly by providing a first polymer film incorporating an additive operative to reflect light, laminating said first film to a second film; providing at least one oil-resistant and oil-impermeable polymeric film by coextruding said oil-resistant and oil-impermeable polymeric film with at least one of said first and second carrier support sheet layers; and providing a waterproof and waterproofing bituminous layer whereby said bituminous layer is non-removably attached to said carrier support sheet assembly on a side opposite said first polymer film which incorporates said light reflecting additive.

Further exemplary laminates and methods are discribed with further particularity hereinafter, with reference to the accompanying drawings in which:-

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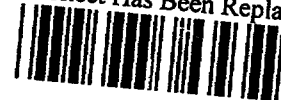


Fig. 1 is a graphical illustration along a cross section of an exemplary bituminous waterproofing membrane laminate of the invention.

As shown in Fig. 1, an exemplary waterproofing membrane laminate 10 of the invention comprises a self-adhesive, or pressure-sensitive, bituminous composition layer 12 which is generally contiguous with and non-removably adhered to a carrier support sheet assembly or structure 14. By the term "non-removably adhered," it is meant that the bituminous layer 12 cannot be removed from the carrier sheet assembly 14 without destroying the integrity of the bituminous layer 12.

The bituminous adhesive composition 12 comprises a mixture of (a) a bituminous material and (b) natural or synthetic polymer, preferably a rubber or other elastomer polymer. The term "bituminous material" as used herein includes compositions containing asphalt, tar such as coal tar, or pitch. The bituminous adhesive may be reinforced with fibers and/or particulate fillers. In addition to any oils normally present in the bitumen, the adhesive composition may also contain a conventional extender component such as an aromatic oil. As aforementioned, the preferred polymer component is rubber which may be virgin rubber or a synthetic rubber (e.g., SBS, SBR) blended into the bitumen, and preferably extender oil at an elevated temperature, to form a smooth mix.

The bituminous adhesive layer 12, at least at its surface remote from the carrier support sheet 14 is, as mentioned, preferably pressure-sensitive and tacky at normal ambient temperature in order that it be self-adhesive to the substrate surface (e.g., foundation, concrete deck, roof). The bituminous layer 12 serves to form a continuous waterproofing layer which is elastic and self-sealing against punctures at high and low temperature. Preferably, the thickness of the bituminous layer 12 is in the range of 10 to 200 mils thick, and more preferably is about 30 to 60 mils

thickness.

The support carrier sheet assembly or structure 14 serves as a strength imparting and supporting member within the laminate 10 and as a barrier to prevent moisture vapor transmission through the laminate. Preferably, the thickness of the carrier sheet assembly 14 is less than that of the bituminous waterproofing adhesive layer 12. However, the carrier sheet assembly 14 should be of sufficient thickness to impart tear- and puncture-resistance to the laminate 10. The carrier sheet assembly 14 should preferably have a thickness of about 1 to 50 mils (.001 to .050 inches).

The carrier sheet assembly 14 comprises a first polymeric layer 16 and a second polymeric layer 18 which may be laminated to this first layer 16. The dimensional stability of these two layers 16 and 18 can be, and are typically, adversely affected by oils present in the bituminous membrane 12, especially when the laminate 10 is exposed to elevated temperatures as may be experienced in roof top environments.. The first and second layers 16 and 18 may be comprised of a polyolefin film such as polyethylene, and the film may be uniaxially oriented, biaxially-oriented or cross laminated, as is known in the art.

In the present invention, the first carrier sheet layer 16, which is located on the side of the second carrier sheet layer 18 opposite the bituminous layer 12, further comprises at least one additive operative to reflect visible light. Preferably, the additive 17 imparts a white or whitish color to the first polymeric layer 16. The additive can be selected from the group consisting of titanium dioxide, calcium carbonate, and zinc oxide. Titanium dioxide is preferred.

At least one oil-resistant and oil-impermeable synthetic polymer layer 20, as may be known in the art, is located between the first layer 16 and bituminous layer 12. In a preferred method for making the second polymer layer 18, at least one oil-impermeable synthetic polymer layer film 20 is co-extruded with the second polymeric layer 18. If only one oil-impermeable polymeric layer 20 is co-extruded with the second polymer layer 18, the oil-barrier layer 20 side can be positioned such that it is located between the first 16 and 18 carrier sheet layers or between the two

layers 16/18 and the bituminous layer 12. In another embodiment, the oil-impermeable polymeric layer 20 can be co-extruded with the first layer 16, and positioned such that it resides between the two polymeric carrier layers 16 and 18 when they are laminated together.

In another exemplary embodiment, at least one oil-impermeable barrier film layer 20 can be co-extruded with each of the two carrier sheet layers 16 and 18. A number of possibilities are envisioned, and each is contemplated within the scope of the present invention. Thus, a carrier sheet structure 14 can have an oil-impermeable barrier or layer 20 located between each of the layers 16, 18, and 12 by coextruding an oil-impermeable film layer with each of said first 16 and second 18 polymer layers, or by co-extruding an oil-impermeable layer on the opposing sides of the second polymer carrier layer 18.

In further exemplary embodiments, an oil-barrier film 20 can be extruded on each of the first 16 and second 18 polymeric film layers and located on opposing sides of those two layers 16/18. One or more oil-barrier film layers 20 can, of course, be located between the first 16 and second 18 polymer layers. Further exemplary embodiments comprise an oil barrier film layer 20 located on both sides of each of the first and second polymer sheet layers 16 and 18. The advantage of locating one or more oil-impermeable layers 20 in a symmetrical fashion within the carrier sheet assembly 14 is to increase dimensional stability over time.

The oil-resistant polymeric layer 20 can be any known polymeric material which is capable of acting as an oil passage barrier with respect to the support sheet member, and in particular the outer-most first polymeric layer 16. Suitable oil-resistant polymer layer 20 materials can comprise a material such as a polyamide, a polyethylene terephthalate, a polyvinyl acetate, a polyvinylidene chloride, and other co-extrudable film materials that might be known in the film packaging arts. The polymer 20 material can also contain additives to improve its properties.

In further exemplary embodiments, a light absorbing additive, as may be known in the coating arts, preferably such as carbon black, can be incorporated into



the polymer which is extruded to form the polymeric support sheet layer 18 and/or any oil-impermeable barrier layer 20 located beneath the top first layer 16 and the bituminous layer 12. Accordingly, the first polymeric layer 16 contains a light reflective additive such as titanium dioxide, such that it reflects light and reduces solar thermal gain, while the second carrier sheet layer 18 and/or an oil-resistant barrier layer 20 (located such as adjacent the bituminous layer 12 and/or between the first polymer layer 16 and the bituminous layer 12) contains a light-absorptive material, such as carbon black, to minimize transmission of solar energy to the bituminous layer 12. The light-absorptive material 19 is operative to block visible or ultra-violet light from reaching the bituminous composition 12 when the waterproofing laminate 10 is installed on the substrate surface (not shown) to be protected.

The advantages of the novel selection and arrangement of components described herein is to lower thermal gain from sunlight, to improve thereby the dimensional characteristics of the laminate, especially in southern climates, and to eliminate the migration of oils, especially aromatic oils, into the film composite which would otherwise cause loss of reflectivity and have deleterious effects on dimensional stability. Furthermore, the solar effects on the bituminous compound are minimized due to decrease light transmissivity in the laminate.

Preferably, although not necessarily, where more than one oil-impermeable polymeric layer 20 is used, the support carrier assembly 14 should employ such layers in a symmetrical arrangement to minimize curling or other deformation due to the use of different materials in the first and second layers 16/18 and in the oil-impermeable polymeric layer 20. For example, the waterproofing membrane laminate 10 may contain a carrier sheet assembly 14 comprising first and second sheet layers 16 and 18, laminated together, each of which is formed by co-extruding between two polyethylene films an oil-impermeable polymeric film. A tie coat adhesive as will be known to those in the art may be used to adhere the two polyethylene layers co-extruded with the inner oil-impermeable layer.

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A further advantage of the invention is to provide convenient and cost-effective methods for fabricating the waterproofing membrane laminate 10. Accordingly, one exemplary method for fabricating the waterproofing membrane laminate 10 comprises the steps of providing a carrier support sheet assembly 14 by providing a first polymer film 16 incorporating an additive 17 operative to reflect light, laminating said first film 16 to a second film 18 which is generally co-extensive with said first film 16; providing at least one oil-resistant and oil-impermeable polymeric film 20 by coextruding said polymeric film 20 with at least one of said first 16 and/or second 18 carrier support sheet layers; and providing a waterproof and waterproofing bituminous layer 12 whereby said bituminous layer is non-removably attached to said carrier support sheet assembly 14 on a side opposite said first polymer film 16 incorporating said light reflecting additive 17. The co-extrusion of said oil-impermeable layer is indeed of structural and process significance when one takes into account the extra sequentially necessitated step of otherwise laminating two separate layers together using a compatible adhesive. Further exemplary methods comprise the step of incorporating a light absorptive material 18, preferably carbon black, into either or both of said second carrier sheet layer 18 and/or at least one oil-impermeable layer 20, prior to extrusion of said layers 18/20..

A further exemplary method for fabricating a waterproofing membrane laminate comprises the steps of: coextruding together a first polymer layer, preferably comprised of polyethylene, said first layer incorporating a light reflective additive such as titanium dioxide, with a second polymer layer operative as an oil-resistant and oil-impermeable barrier, said barrier layer comprising a polyethylene terephthalate, a polyamide, a polyvinyl acetate, a polyvinylidene chloride, or mixture thereof, and said oil-impermeable layer further comprising carbon black; and providing thereupon a contiguous non-removably adhered waterproof and waterproofing bituminous adhesive layer.

As modifications and equivalents may appear evident to those skilled in the art in viewing the disclosure herein, the scope of the invention is not intended to be

limited by any of the exemplary or preferred foregoing embodiments, which are provided for illustrative purposes only.

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CLAIMS



1. A rollable, pre-formed membrane laminate for waterproofing structural surfaces, comprising:-
 - 5 a flexible waterproof and waterproofing self-adhesive bituminous membrane layer having oil therein: and
 - a polymeric support carrier sheet structure non-removably adhered to said bituminous membrane layer said carrier sheet structure comprising a first polymeric layer,
 - 10 a second polymeric layer that is coextensive with said first layer, said first layer comprising an additive that is operative to reflect light, said second layer being located between said first layer and said bituminous membrane layer, and at least one oil-resistant and oil-
 - 15 impermeable synthetic polymer film layer, located between said carrier sheet first layer and said bituminous membrane layer.
2. A waterproofing membrane laminate according to
20 claim 1 wherein said at least one oil-impermeable polymeric film is co-extruded with at least one of said first and second carrier sheet polymeric layers.
3. A waterproofing membrane laminate according to
25 claim 1 or claim 2 wherein said first and second polymeric layers of said carrier sheet are cross-laminated with respect to each other and comprise polyethylene.
4. A waterproofing membrane laminate according to
30 any one of claims 1 to 3 wherein said oil-resistant polymeric layer comprises a polyvinyl acetate, a polyvinylidene chloride, a polyethylene terephthalate, or a polyamide.
- 35 5. A waterproofing membrane laminate according to

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any preceding claim wherein said light-reflecting additive incorporated into said first carrier sheet polymeric layer comprises titanium dioxide, calcium carbonate or zinc oxide.

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6. A waterproofing membrane laminate according to any preceding claim wherein said second carrier sheet polymeric layer further comprises carbon black.

10 7. The waterproofing membrane laminate according to any preceding claim wherein said oil-impermeable polymeric layer further comprises carbon black.

15 8. A waterproofing membrane laminate according to any preceding claim wherein said second polymeric carrier layer further comprises titanium dioxide.

20 9. A waterproofing membrane laminate according to any preceding claim wherein said oil-impermeable polymeric layer is located between said first and second carrier sheet layers.

25 10. A waterproofing membrane laminate according to any preceding claim comprising at least two oil-impermeable polymer film layers, one located adjacent each of said first and second carrier sheet structure polymer layers.

30 11. A waterproofing membrane laminate according to claim 10 wherein said two oil-impermeable polymer film layers are located on opposing faces of said first and second carrier sheet structure polymer layers.

35 12. A waterproofing membrane laminate according to any preceding claim wherein said first and second layers of said carrier support sheet structure are oriented with respect to each other.

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13. A method for fabricating a rollable waterproofing membrane laminate comprising the steps of: providing a carrier support sheet structure by providing a first polymer film incorporating an additive operative to
5 reflect light, laminating said first film to a second film which is thereby co-extensive with said first film; providing at least one oil-impermeable polymeric film by co-extruding said oil-resistant and oil-impermeable polymeric film with at least one of said first and second
10 carrier support sheet layers; and providing a waterproof and waterproofing bituminous layer whereby said bituminous layer is non-removably attached to said carrier support sheet assembly on a side opposite said first polymer film which incorporates said light reflecting additive.

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14. The method of claim 13 further comprising the step of providing a light absorber in at least one of said second support carrier sheet structure layer and said at least one oil-impermeable polymer film layer.

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