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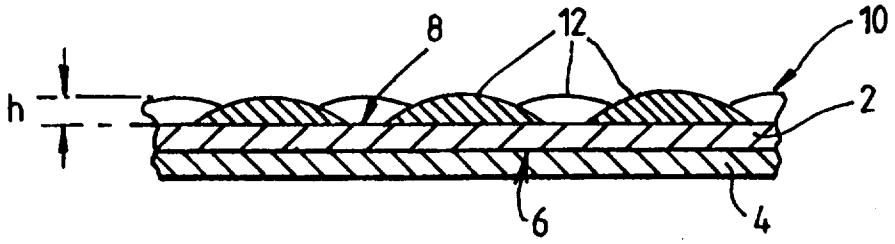
(54) Title: WATER-VAPOUR-PERMEABLE COMPOSITE MATERIAL

(57) Abstract

The invention relates to a composite lining material for a garment or the like comprising a water resistant water-vapour-permeable flexible substrate (2) having a fabric (4) secured to a first side of the substrate (2). A second side of the substrate (2) is provided with an abrasion resisting discontinuous layer (10) made up of a plurality of discrete abrasion resisting polymeric dots (12). The dots (12) prevent abrasion of the flexible substrate (2) and, in use, form a lining for the material.



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WATER-VAPOUR-PERMEABLE COMPOSITE MATERIAL

The present invention relates to a flexible water-resistant water-vapour-permeable composite material, particularly for use in garments, which exhibits a combination of good breathability (i.e. water vapour transmission) and good durability.

Water-vapour-permeable laminate materials which are resistant to liquid water penetration are known from US patents 3,953,566 and 4,194,041 (W. L. Gore & Associates Inc.) US Patent No. 3,953,566 refers to the production of an expanded porous polytetrafluoroethylene (PTFE) membrane. Such membranes generally have intrinsically poor abrasion resistance. US Patent No. 4,194,041 discloses a material which comprises a porous membrane (particularly expanded PTFE) provided on one surface thereof with a continuous layer of a hydrophilic material which is water-vapour-permeable, such as a hydrophilic polyurethane which has poor abrasion resistance. Other water-resistant water-vapour-permeable materials also having poor abrasion resistance are also commercially available and these include polyurethane coatings applied to a fabric, polyurethane membranes laminated to a fabric, and polyester membrane-fabric combinations.

Such materials often include an inner liner which protects against abrasion the polyurethane-coated face of the material in use. The preformed liner is generally laminated to the polyurethane-coated face by means of a layer of adhesive. However, the liner adds to the cost, weight and bulk of the material. In some applications, it may be desirable to eliminate the liner. However, this has the disadvantage of exposing the soft hydrophilic polyurethane directly to abrasive forces.

US Patent No. 5,026,591 discloses coating a

scaffold material (expanded PTFE or microporous polypropylene) with a continuous coating of a hydrophilic material (hot melt hydrophilic polyurethane or polyurethane acrylate) and pressing directly into the coating a substrate (a polyamide non-woven, a polycotton woven blend etc.) and then allowing the coating to cure. The objective is to provide a continuous coating of hydrophilic material without any leaks therein, sandwiched between the scaffold material and the substrate.

US Patent No. 4,925,732 discloses the production of a laminate for making shoes composed of a pair of moisture permeable materials (e.g. leather and fabric) adhered together by means of a moisture permeable adhesive (e.g. a polyurethane adhesive).

European Patent No. 0465817 discloses a laminate for use as a protective material comprising an expanded PTFE liquid barrier layer, having a water-vapour permeable adhesive layer thereon, and active carbon beads and a net partially embedded in the adhesive layer. The net however remains above the surface of the adhesive so as to protect the active carbon beads from being mechanically dislodged. The net thickness is typically about 0.5 mm (500 microns).

Water-resistant materials which resist liquid water penetration are well known to persons skilled in the art of making rainwear. Clearly, the degree of water-resistance required in a so-called waterproof garment depends upon the severity of the climatic conditions to which it is subjected. A suitable test of water-resistance (Suter test) is described herein. An acceptable practical indication of water-resistance is one in which there is no evidence of water being forced through a sample by a pressure of 1.4 pounds per square inch (0.1kg/cm^2), or more typically 2.0 pounds per square inch (0.14kg/cm^2). This also gives a measure of hydrophobicity in respect of porous materials.

The benefit of a water-vapour-permeable material is that perspiration from the wearer's body is allowed to escape from within the garment by passage through the material, thus preventing build-up of liquid water within the garment and consequent clammy feeling. In order to be considered as water-vapour-permeable, the flexible substrate should generally have a water-vapour-permeability of at least 1,000, preferably greater than 1500 and more preferably greater than 3000 $g/m^2/day$. However, values in excess of 100,000 $g/m^2/day$ are possible with certain substrates. The overall water-vapour-permeability of the flexible composite material of the present invention will usually be somewhat lower than this (e.g. 5,000 to 12,000 $g/m^2/day$ or up to 30,000 g/m^2 for certain substrates) but generally speaking its water-vapour-permeability may also be within the ranges outlined above.

A suitable water-resistant water-vapour-permeable flexible membrane is disclosed in US Patent No. 3,953,566 which discloses a porous expanded polytetrafluoroethylene (PTFE) material. The expanded porous PTFE has a micro-structure characterised by nodes interconnected by fibrils. If necessary, the water-resistance may be enhanced by impregnating the expanded PTFE with an hydrophobic impregnant (such as a low molecular weight perfluoro compound, for example a perfluoroalkyl acrylate or methacrylate). Such impregnants are also oleophobic. The impregnants can coat the nodes and fibrils of the porous PTFE.

The water-resistant water-vapour-permeable membrane might also be a microporous material such as a high molecular weight microporous polyethylene or polypropylene, microporous polyurethanes or polyesters.

In addition, the water-resistant water-vapour-permeable flexible membrane may include a coating of a water-resistant water-vapour-permeable hydrophilic film of the type disclosed in US Patent No. 4,194,041, the

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