SYNTHETIC LEATHER-LIKE COMPOSITE WITH SMOKE AND FLAME RESISTANT PROPERTIES

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ABSTRACT

A synthetic leather-like composite product comprising a polysiloxane top surface having the appearance and surface characteristics of leather, a polysiloxane solid or cellular core, and a textile fabric barrier layer.
SYNTHETIC LEATHER-LIKE COMPOSITE WITH SMOKE AND FLAME RESISTANT PROPERTIES

FIELD OF THE INVENTION

This invention relates to a synthetic leather-like composite with low smoke and flame resistant properties. More particularly, the product is a synthetic leather-like solid homogeneous composite material with a polysiloxane top surface having a leather-like appearance, backed by a polysiloxane solid or cellular core and a knitted, woven or non-woven textile fabric of aramid fiber, including 3 mesh/3D knit spacer fabric, knits of Nomex®, Kevlar®, graphite or similar heat and flame barrier therebetween. The product is especially useful for aircraft and aerospace or helicopter seating, and for use as seating in sea vessels, automotive and train transportation, in which the suppression or elimination of smoke and no propagation of flame is of particular importance for safety purposes.

SUMMARY OF THE INVENTION

This invention relates to a synthetic leather-like composite material with smoke and flame resistant properties that is useful in a variety of products, including aircraft and aerospace seating, and for use as seating in sea vessels, automotive and train transportation. The inventive product is a composite material comprised of a leather-like polysiloxane top surface, a polysiloxane core, and a flame and smoke barrier layer of knitted, woven or non-woven textile fabric of aramid fiber. The product exhibits low smoke properties and low or no ignition propagation. The composite has a top surface, which is chemically bonded to the polysiloxane core(s). The core layers can be solid or cellular and are chemically bonded to the textile smoke and flame suppressant. The textile portion of the composite may have a spacer laminated to give a soft touch and feel to the product as well as comfort. Some spacers can also be woven with features inserted therein to both heat or cool the seat cushion. The composite material contains no ignition or smoke producing materials, is easy to care for and has a fine leather-like surface. The synthetic silicone composite can be used to replace a flame barrier, glass and the like. A cloth type product for the same purpose can also be used in upholstery, stadium seating, movie theaters and hospitals, where safety is always an issue. The product can be used in many other different applications where safety is an issue, such as hotels, high rise buildings, in upholstery products such as bed boards, mattress covers, elevators, wall coverings, chairs and sofas to name a few.

The preferred product may be transfer coated, but can be direct coated with two synthetic leather surface grains or direct coated to a release paper to achieve the synthetic leather surface characteristics and appearance. Because the product generates low smoke and does not propagate flame it not only has excellent surface characteristics, but also acts as a flame barrier to other products used in combination there with. Aircraft are a major, but not exclusive, application for this product since passengers are located in a confined space with no escape route while the plane is in flight at high altitudes.

BRIEF DESCRIPTION OF THE DRAWINGS

The features and advantages of the invention will become apparent when considered in conjunction with the accompanying drawings, in which:

FIG. 1 is an enlarged detailed isometric view of the composite product of the invention, showing a top layer of polysiloxane with a leather-like appearance, a polysiloxane solid or cellular core chemically bonded thereto, and a barrier layer comprising a textile fabric of aramid fiber.

FIG. 2 is a cross-sectional view of the composite product of the invention shown in FIG. 1, showing a top layer of polysiloxane with a leather-like appearance, a polysiloxane solid or cellular core chemically bonded thereto, and a barrier layer comprising a textile fabric of aramid fiber.

FIG. 3 is a cross-sectional view of the composite product of the invention, showing a top layer of polysiloxane with a leather-like appearance, a solid polysiloxane core chemically blown and expanded, and chemically bonded thereto, and a barrier layer comprising a textile fabric of aramid fiber with a 3-D textile spacer centrally located therein. 3D spacer knits can provide comfort and air transmission between knitted layers for heat or for cooling.
DETAILED DESCRIPTION OF THE INVENTION

[0011] The composite product is transfer or direct coated to a release paper to achieve the synthetic leather look and surface characteristics. The product is produced in multiple layers with a top surface having the leather-like appearance, and adhesive intermediate layers (from 2 to 8 layers) which consist of polysiloxane chemistry. These layers are transferred/direct coated to a textile. In the case of a transfer coated product, they are chemically coated. There is no laminating in the direct coating method of making the product. The top surface layer is from about 2 to 10 mils in thickness, while the core itself is from about 6 to about 30 mils in thickness. The barrier layer is typically about 200 mils in thickness, although layers of greater or lesser thicknesses may also be used effectively. Polysiloxane adhesives of varying viscosities, such as between about 6,000,000 to 6,000,0000 cps are useful, although more typically from about 10,000,000 to 100,000,0000 cps. Viscosities of from about 120-200,000,000 cps can be used depending upon the strength of adhesion required for the particular product.

[0012] Textile substrates that are used in the composite are primarily aramid fibers such as Kevlar® and Nomex® and blends thereof, fiberglass or graphite, said textiles either knitted, woven or non-woven substrates that have FR properties and have protein leather in constructions, including non wovens, microdenier nylon, which are FR treated, or 4-way stretch, depending on the particular requirements of the blend, which include nylon, polyester polymers. Thermoplastic polyolefins such as polylefins and polyethylene can also be used but will not produce the same performance as the polysiloxanes. The preferred formulation exhibits excellent low temperature properties in regard to exposure at temperatures as low as 100°F, and can be in constant use at constant heat flow temperatures exceeding 600°F without any flame ignition.

[0013] If a flame occurs with low smoke generation, the composite remains intact and does not enter into the air and create hazardous breathing issues. Any by-products of the flame combustion are not hazardous because they are based on polysiloxane chemistry, which forms silica dust, a non-hazardous substance. In addition, if desired, the back side of the carrier, i.e., knit, woven or non-woven materials, glass, Kevlar® and aramid knits can be coated with the same chemistry with a metalized finish, such as backcoat knit non wovens with reflective aluminum silver to deflect heat.

[0014] The product can be produced in any color, prints, surface gloss, film synthetic leather to textile appearance to enhance surface characteristics such as coefficient of friction. The process can also produce an aesthetics leather product to provide the proper hand, feel, touch and appearance. The product can be top coated to achieve additional characteristics and firmness if desired. The product construction can be applied to a spacer knitted product to apply an air transmission layer below the coated surfaces for comfort and aesthetics, to be softer and more pliable. Spacer knits can be woven with electrical setup for heated seats or comfort because of the space between the top and bottom knitted layers.

[0015] The same coating chemistry can be applied to micro denier knits and non-woven products to duplicate a soft pliable product for upholstery or products having such components. This chemistry allows the use of four way stretch knit substrates to make ease of vacuum forming applications and configurations to different stages of upholstery. The chemistry involved allows flexibility to coat products with large elongation and hysteresis. Due to the casting process, this technology can be applied to very different thicknesses of knits and woven products and coating weights, and can also be produced as a film.

[0016] As shown in FIG. 1, which is an enlarged detailed isometric view of the composite product of the invention 1, a top layer 2, of polysiloxane with a leather-like appearance, is adhesively bonded to a polysiloxane core 3, which is adhesively bonded to a barrier layer comprising a textile fabric of aramid fiber 4, such as Kevlar® or Nomex® or blends thereof, both of which are manufactured by the Du Pont Company, or graphite or fiberglass. Polyether or polyester foams can also be used in place of the non-woven, non-burning layer. The various layers are chemically bonded by layers (not shown) of a polysiloxane adhesive. The layers of the composite product are shown in FIG. 2, a cross-sectional view of the composite product of the invention, in which the top leather-like surface layer 2 is chemically bonded by a polysiloxane adhesive layer 2a to the polysiloxane solid cellular core 3. The polysiloxane core 3 is chemically bonded to the textile fabric layer 4 by a polysiloxane adhesive layer 3a. The textile fabric layer 4 may be a knitted, woven, non-woven type fabric or a 4-way stretchable fabric.

[0017] A further embodiment of the invention is shown in FIG. 3, a cross-sectional view of the composite product of the invention, in which the textile fabric layer 4 includes an intermediate 3-D spacer textile 5 for comfort and to enhance the flow of air therethrough. Spacer textiles such as the mesh textile fabric manufactured by Muller Textiles, Inc. of Germany, dba Ames Holland and Highland Industries USA, may be used for such applications as climatic and ventilated seats. The 3 mesh textile provides a soft cushioning effect, excellent recovery, high shock absorption, low weight and high forming properties.

[0018] It should be understood that the applications for which the above-described composite may be used is non-exclusive and many other uses may be made of the invention, such as in helicopters, elevators, engine rooms, enclosed areas, sound stages, appliances, electronics, computers and telephones, in which contact heat from lithium batteries are fire hazards.

1. claim:
1. A synthetic leather-like composite product comprising a polysiloxane top surface having the appearance and surface characteristics of leather, a polysiloxane core, and a textile fabric barrier layer.

2. The composite product of claim 1, in which the textile fabric barrier layer is a knitted, woven or non-woven fiber comprising aramid fiber, fiberglass, or synthetic polymeric fibers.

3. The composite product of claim 1, in which the textile fabric barrier layer is a 4-way stretchable fabric.

4. The composite product of claim 1, in which the top surface is smooth with no stretch.

5. The composite product of claim 1, in which the top surface is smooth with high stretch.

6. The composite product of claim 1, in which the textile fabric barrier layer is a 4-way stretchable fabric.

7. The composite product of claim 1, in which the textile fabric barrier layer includes a 3-D spacer textile fabric therein.

8. The composite product of claim 1, in which the textile fabric barrier is Kevlar® fiber.

9. The product of claim 1, in which the textile fabric backing is Nomex® fiber.
10. The composite product of claim 1, in which the top surface layer, the core and the textile fabric layers are adhesively bonded by a polysiloxane adhesive.

11. A synthetic leather-like composite product comprising a polysiloxane top surface having the appearance and surface characteristics of leather, coated with an amid knit backing.

12. A synthetic leather-like composite product comprising a cast polysiloxane top surface having the appearance and surface characteristics of leather, a polysiloxane core, and a textile fabric barrier layer.

13. A synthetic leather-like composite product comprising a polysiloxane top surface coated to aramid fiber, stainless steel, reflective metallic fiber or a fiberglass woven surface.