The present application discloses a composite cushioning material with shock-absorbing characteristics, wherein one or more resilient elements is encapsulated on all sides by at least two layers of sheeting material.
CUSHIONING PAD WITH ENCAPSULATED RESILIENT ELEMENTS

A. BENEFITS OF THE PRESENT INVENTION

[0001] The invention relates to a composite cushioning material with shock-absorbing characteristics, and the method for making the same. As described in greater detail below, this composite material is flexible, relatively lightweight, and breathable. This cushioning material can be used as an outer and inner cushioning component in apparel, footwear, or headgear, or as wearable protective padding; as cushioning pads in bags, carriers, and containers; or as a component in athletic, industrial, or military protective gear or equipment. The composite cushioning material can be made flexible, so as to better follow the contours of the wearer’s body, joint areas, or extremities, or to envelop the body parts that are intended to be protected, yet be lightweight and breathable. The invention also relates to a method for making the said composite cushioning material.

B. SUMMARY OF THE INVENTION

[0002] The invention relates to a composite cushioning material comprising one or more resilient elements surrounded, or “encapsulated,” on all sides by at least two layers of sheeting material.

C. BRIEF DESCRIPTION OF THE DRAWINGS

[0003] The present invention will become more fully understood from the detailed description given herein below, and the following accompanying drawings, which are given by way of illustration only, and thus are not limiting of the present invention:

[0004] FIG. 1A depicts an embodiment of the composite cushioning material, namely, first composite cushioning material 1.

[0005] FIG. 1B depicts a cutout view of the first composite cushioning material 1.

[0006] FIG. 2 depicts an exploded view of the first composite cushioning material 1.

[0007] FIG. 3 depicts a cutout side view of the first composite cushioning material 1.

[0008] FIG. 4A depicts an alternative embodiment of the composite cushioning material, namely, second composite cushioning material 30.

[0009] FIG. 4B a cutout view of the second composite cushioning material 30.

[0010] FIG. 5 depicts an exploded view of the second composite cushioning material 30.

[0011] FIG. 6 depicts a cutout side view of the second composite cushioning material 30.

D. DESCRIPTION OF THE INVENTION

[0012] 1. FIRST COMPOSITE CUSHIONING MATERIAL

[0013] FIGS. 1A-1B and 2 depicts first composite cushioning material 1, comprising a plurality of resilient elements 3 positioned, or “sandwiched,” between two sheeting structures, namely, first substrate 4 and second substrate 5.

[0014] FIG. 1B is a cutout view of the first composite cushioning material 1, depicting the resilient elements 3 positioned above the first substrate 4, and surrounded on all remaining sides, or “encapsulated,” by second substrate 5.

[0015] As shown in FIGS. 1B and 3, the bottom surface 313 of the resilient element 3 makes contact with top surface 417 of the first substrate 4. Portions of second substrate 5 are stretched over the resilient elements 3, and top surface 3T and side surface 3S of the resilient elements 3 are surrounded, or encapsulated, by first encapsulating cover 6 and first encapsulating cover sidewalls 6S of the second substrate 5. This can also be seen in the exploded view of the first composite cushioning material 1, shown in FIG. 2. The areas of the second substrate 5 between the resilient elements 3 make contact with first substrate 4, and are bonded along the joining surface 8, as shown in FIG. 3.

[0016] While FIGS. 1-3 depict a composite cushioning material with a plurality of resilient elements, it is understood that the composite cushioning material may optionally incorporate a single resilient element of suitable size and shape.

[0017] a. COMPOSITION OF THE RESILIENT ELEMENTS AND SUBSTRATES

[0018] In one aspect of the invention, the composition of the resilient element 3 may optionally comprise, include, or incorporate, without limitation, any suitable resilient material, such as a foam or other elastomer, including, without limitations, ethylene vinyl acetate (“EVA”) foam, olefin or polyolefin foam, polyurethane (“PU”) foam, urethane based foam, thermoplastic foam, neoprene, silicone, rubber, or any other material (including a combination of such materials) with suitable cushioning characteristics.

[0019] By way of example only, different resilient materials may be combined by bonding sheets of different materials to each other in vertical layers, or by bonding or sewing swatches of different materials.

[0020] The resilient elements 3 may have any suitable shape and/or size. While FIGS. 1-3 and FIGS. 4-6 depict resilient elements that are cylindrical or drum-shaped, it is understood that the resilient elements may have any suitable shape or size.

[0021] In another aspect of the invention, the composition of the substrate elements or sheeting structures may optionally comprise, include, or incorporate, without limitation, any suitable sheeting material, such as synthetic or natural fabric, spandex or elastane, mesh, natural or synthetic leather, thermoplastic polyurethane ("TPU") sheeting, or any other sheeting material (including a combination of such materials) with suitable elasticity and resistance to puncture or abrasion, or other desirable characteristics, provided that the sheeting material is capable of being loosely or tightly stretched over the resilient elements and thereby “encapsulate” them. By way of example only, sheets of different materials may be combined by bonding them to each other in vertical layers, or by bonding or sewing swatches made of different types of materials.

[0022] b. BONDING ELEMENTS JOINING THE MATERIAL LAYERS IN THE FIRST COMPOSITE CUSHIONING MATERIAL

[0023] In one aspect of the invention, the two substrates (for example, first substrate 4 and second substrate 5) may be bonded to each other along joining surface 8 by means of any compound, adhesive, glue, substance, attachment, or device (such as Velcro, or interlocking mechanical means, or double sided adhesive tape, and the like) that permits one substrate to adhere to another substrate.
In an advantageous embodiment of the invention, the two substrates are optionally bonded to each other using hot-melt adhesive (“HMA”) film activated by heat, or by heat and mechanical pressure.

In another aspect of the invention, the resilient elements (such as resilient element 3) may optionally be bonded to one or more substrate elements (such as first substrate 4 and/or second substrate 5). The bonding may occur by joining any one or more sides of the resilient element to a substrate. By way of example only, a joining element (such as glue or HMA film 9 depicted in FIGS. 1B and 2) may optionally be applied to first substrate 4, and cause the bottom surface 3B of the resilient elements 3 to bond to the top surface 4T of the first substrate 4, and cause the bottom surface 5B of the second substrate 5 to bond to the top surface 4T of the first substrate 4 along the joining surface 8.

Alternatively, and optionally, a joining element such as glue or HMA film 9 may be applied to the top surface 3T of the resilient elements 3, and/or the bottom surface 5B of the second substrate 5, causing the said elements to bond to each other. Also optionally, a joining element may be applied to the side walls 3S of the resilient elements 3, causing them to bond to the inner surface of the first encapsulating cover sidewalls 6S.

In yet another aspect of the invention, the resilient elements 3 are optionally not bonded to any substrate, and are encapsulated and held in place by the first encapsulating covers 6 of the second substrate 5, which surround and encapsulate the resilient elements within the void space 7 defined by loosely or tightly stretching the second substrate 5 around the resilient elements 3, and by bonding the edges around the void space 7 to the top surface 4T of the first substrate 4.

2. SECOND COMPOSITE CUSHIONING MATERIAL

In another alternative aspect of the invention, the resilient elements 3 are optionally encapsulated by two sheeting structures, such as third substrate 10 and fourth substrate 11 shown in FIGS. 4A-4B and FIGS. 5-6.

FIGS. 4A and 4B depict the second composite cushioning material 30, wherein resilient elements 3 are surrounded on all sides, or “encapsulated,” by both third substrate 10 and fourth substrate 11.

As shown in FIGS. 4B and 6, in the second composite cushioning material 30, neither the top surfaces 3T nor bottom surfaces 3B of the resilient elements 3 rest against a surface of a substrate that lies flat along a single plane. (By way of comparison only, first substrate 4 as depicted in FIGS. 1B and 3 does lie flat along a single plane).

As shown in FIGS. 4B, 5, and 6, portions of third substrate 10 are stretched over the resilient elements 3, and top surface 3T and a portion of side surface 3S of the resilient elements 3 are surrounded, or encapsulated, by second encapsulating cover 12. In this optional embodiment of the invention, top surface 3T of the resilient elements makes contact with the second encapsulating cover inner surface 12T of third substrate 10.

As also shown in FIGS. 4B, 5, and 6, portions of fourth substrate 11 are stretched over the resilient elements 3, and bottom surface 3B and a portion of side surface 3S of the resilient elements 3 are surrounded, or encapsulated, by third encapsulating cover 14. In this optional embodiment of the invention, bottom surface 3B of the resilient elements makes contact with the third encapsulating cover inner surface 14B of fourth substrate 11.

As shown in the exploded view in FIG. 5, the resilient elements in the second composite cushioning material 30 are “contained” within void space 13 and void space 15 defined by loosely or tightly stretching the third substrate 10 and fourth substrate 11, respectively, around the resilient elements 3, and by bonding the joining surface 16, that is, the surface areas of the two substrates comprising the edges around the void spaces.

While FIGS. 4-6 depict a composite cushioning material with a plurality of resilient elements, it is understood that the composite cushioning material may optionally incorporate a single resilient element of suitable size and shape.

It is also understood that the third substrate 10 and fourth substrate 11 may be comprised of any material or combination of materials used to fabricate the first substrate 4 or the second substrate 5.

It is understood that the various materials and components disclosed herein may be made of any suitable material and may be any size and shape consistent with their functions. The specific embodiments of the materials, components, and processes disclosed and illustrated herein are not to be considered in a limiting sense as numerous variations are possible. Ordinal indicators, such as first, second or third, for identified elements in the specification and descriptions herein are used to distinguish between the elements, and do not indicate a required or limited number of such elements, and do not indicate a particular position or order of such elements unless otherwise specifically indicated. Directional terms, such as “top” or “bottom,” are used merely to facilitate the identification of the elements or components thereof as depicted in the drawings, and are not intended to indicate a particular position or orientation of the articles, materials, components, or elements disclosed herein, or limitations on their position or orientation in practice or otherwise. The subject matter of this disclosure includes all novel and non-obvious combinations and sub-combinations of the various features, elements, functions and/or properties disclosed herein. No single feature, function, element or property of the disclosed embodiments is essential.

The present invention is not to be limited in scope by the specific embodiments described in this application. Indeed, various modifications of the invention in addition to those described herein will become apparent to those skilled in the art from the foregoing description and accompanying figures. Such modifications are intended to fall within the scope of the disclosures herein. It is understood that the examples disclosed below are offered by way of illustration of the present invention, and not by way of limitation. What is claimed is:

1. A composite cushioning material with shock-absorbing characteristics, wherein one or more resilient elements is encapsulated on all sides by at least two layers of sheeting material.

2. The composite cushioning material according to claim 1, which is flexible, relatively lightweight, and breathable.

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