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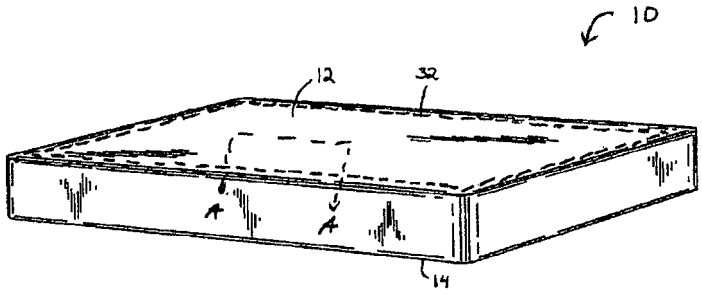

FIG. 1

(57) Abstract: A body support cushion, such as a mattress, mattress topper or overlay, or pillow, is comprised of a layer of flexible foam and further has a volume of gelatinous material, e.g., elastomer gel, applied to a surface thereof. The gelatinous material alters a physical property, such as firmness or feel, of the layer of flexible foam. The gelatinous material can be applied in a number of ways including, but not limited to a spray application whereupon the spray force can be used to control how much gelatinous material penetrates into the layer of foam. The foam layer may be comprised of reticulated or non-reticulated foam. The foam layer may also be comprised of viscoelastic or non-viscoelastic foam.

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BODY SUPPORT MODIFIED WITH VISCOUS GEL AND METHOD OF MANUFACTURING A BODY SUPPORT USING THE SAME

CROSS-REFEREENCE TO RELATED APPLICATION

This application claims the benefit of U.S. Ser. No. 61/535,045, filed September 15, 2011, the disclosure of which is incorporated herein in its entirety.

BACKGROUND

[0001] Conventional body supports are found in a wide variety of shapes and sizes, each of which is adapted for supporting one or more body parts of a user. As used herein, the term "body support" includes without limitation any deformable element or structure adapted to support one or more parts of (or the entire body of) a human or animal in one or more positions. Examples of body supports include but are not limited to mattresses, pillows, and cushions of any type, including those for use in beds, seats, and other applications.

[0002] Body supports are often constructed entirely or partially out of foam material. For example, polyurethane foam is commonly used in many mattresses, pillows, and cushions, and can be used alone or in combination with other types of cushion materials. In many body supports, viscoelastic material is used, providing the body support with an increased ability to conform to a user and to thereby distribute the weight or other load of the user. Some viscoelastic body support materials are also temperature sensitive, thereby also enabling the body support to change firmness based at least in part upon the temperature of the body part(s) supported thereon.

[0003] Polyurethane foam inherently has characteristics that define design limitations for manufacturers of body supports desiring to use the foam for particular applications. For example, some body supports include one or more layers of foam in which uniform characteristics of the foam throughout the thickness of the foam is not necessarily a design objective. Modifying the layers of foam to enhance physical and thermal properties could aid in making the foam layer(s) and/or body support suitable for a particular application. This is particularly the case when one or more of the layers of the body support include viscoelastic foam material, which can dramatically change firmness and shape in use.

[0004] Although the number and types of body supports constructed with one or more layers of foam continue to increase, including those having one or more layers of foam comprising viscoelastic foam, the capabilities of such materials, including taking advantage of their physical and thermal properties, are often underutilized.

comprising viscoelastic foam, the capabilities of such materials, including taking advantage of their physical and thermal properties, are often underutilized.

[0005] Based at least in part upon the limitations of existing body supports and the high consumer demand for improved body supports in a wide variety of applications, new body supports and material modifications for body supports are welcome additions to the art.

SUMMARY OF THE INVENTION

[0006] In some embodiments of the present invention, a body support having at least one layer of reticulated or non-reticulated viscoelastic foam is provided, and includes at least one surface upon which a viscous gel has been applied to modify at least one characteristic of the viscoelastic foam.

[0007] Some embodiments of the present invention provide a method of producing a body support including the steps of directing one or more nozzles toward a surface of a layer of reticulated or non-reticulated viscoelastic foam, spraying a viscous gel from the nozzle(s) upon the surface of the layer of viscoelastic foam, and permitting the gel to set on the layer of viscoelastic foam. In some embodiments, this method further includes permitting the gel to penetrate the surface of the layer of viscoelastic foam to occupy an interior of the layer of viscoelastic foam to a desired depth below the surface.

[0008] Other aspects of the present invention will become apparent by consideration of the detailed description and accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] Fig. 1 is a perspective view of a body support according to an embodiment of the present invention.

[0010] Fig. 1A is a section view of the body support of Fig. 1 taken along line A-A of Fig. 1.

[0011] Fig. 2 is an exploded perspective view of a body support according to another embodiment of the present invention.

[0012] Fig. 3 is an exploded perspective view of a body support according to yet another embodiment of the present invention.

DETAILED DESCRIPTION

[0013] Before the various embodiments of the present invention are explained in detail, it is to be understood that the invention is not limited in its application to the details of construction and the arrangements of components set forth in the following description or illustrated in the drawings. The invention is capable of other embodiments and of being practiced or of being carried out in various ways. Also, it is to be understood that phraseology and terminology used herein with reference to order or importance (e.g., "first", "second", and "third") are used herein and in the appended claims for purposes of description, and are not alone intended to indicate or imply relative order or importance unless otherwise specified.

[0014] A body support 10 according to an embodiment of the present invention is illustrated in Fig. 1. The body support 10 includes a top surface 12 oriented to support a user and a bottom surface 14 positioned to be proximate a frame, floor, or other surface to support the body support 10. Although the body support 10 illustrated in Fig. 1 comprises a single layer of foam (described in greater detail below), the body support 10 can instead include any number of additional layers of foam (described in greater detail in connection with Figs. 2 and 3), and in some embodiments can also include one or more layers of other material.

[0015] The body support 10 illustrated in Figs. 1 and 2 is a mattress. However, in other embodiments, the body support 10 is only a portion of a mattress or other body support, and therefore defines a component of a larger body support. Also, the body support 10 can take other forms, such as a mattress topper, overlay, or futon. It will be appreciated that the features of the body support 10 described herein are applicable to any type of body support having any size and shape. By way of example only, these features are equally applicable to head pillows, seat cushions (including the base and/or back cushions of a seat), neck pillows, leg spacer pillows, eye masks, and any other structure used to support and/or cushion any part or all of a human's or animal's body. Accordingly, as used herein and in the appended claims, the term "body support" refers to any and all of such structures (in addition to mattresses, mattress toppers, overlays, sleeper sofas, and futons) and portions of such structures. It should also be noted that each of the body supports described and/or illustrated herein is presented in a particular form, such as a mattress, mattress topper, overlay, or futon. However, absent description herein to the contrary, any or all of the features of each such

body support can be applied to any other type of body support having any other shape and size, including the various types of body supports mentioned above.

[0016] With reference again to the illustrated body support 10 of Fig. 1, the body support 10 can be enclosed within a cover of any type (not shown), such as a woven or non-woven material, a knitted material, a material comprising cotton, wool, or other natural fiber, polyester, rayon, nylon, foam, or other synthetic material, and a material that is liquid and vapor impermeable, liquid impermeable and vapor permeable, or liquid and vapor permeable.

[0017] The body support 10 illustrated in Fig. 1 comprises a layer of viscoelastic foam 10 having an upper surface 12 and a lower surface 14 opposite the upper surface 12. The upper surface 12 is also the top surface of the body support 10, whereas the lower surface 14 is also the bottom surface of the body support 10. The viscoelastic foam of the body support 10 be reticulated or non-reticulated foam, and/or can comprise any expanded polymer (e.g., expanded ethylene vinyl acetate, polypropylene, polystyrene, or polyethylene), latex, and the like. The viscoelastic foam can, in some embodiments, be temperature-sensitive to the body heat of a user, thereby changing in firmness in response to receiving the body heat of a user upon the foam.

[0018] Also in some embodiments, the viscoelastic foam of the body support 10 can comprise reticulated viscoelastic foam. Reticulated foam (viscoelastic or otherwise) is a cellular foam structure in which the cells of the foam are essentially skeletal. In other words, the cells of the reticulated foam are each defined by a plurality of apertured windows surrounded by cell struts. The cell windows of reticulated foam can be entirely gone (leaving only the cell struts) or substantially gone. In some embodiments, the foam is considered "reticulated" if at least 50% of the windows of the cells are missing (i.e., windows having apertures therethrough, or windows that are completely missing and therefore leaving only the cell struts). Such structures can be created by destruction or other removal of cell window material, or preventing the complete formation of cell windows during the manufacturing process of the foam.

[0019] With continued reference to the embodiment of Fig. 1, a quantity of viscous gel 32 is applied to the upper surface 12 of the viscoelastic foam of the body support 10. The gel 32 in Fig. 1 has been applied across the entire upper surface 12 (or substantially the entire upper surface 12) of the viscoelastic foam. In other embodiments, the viscous gel 32 can be applied

to any fraction of the upper surface 12 (e.g., only in a central location of the upper surface 12, in bands or islands on the upper surface 12, and the like), and in any number of separate or connected regions of the upper surface 12. The viscous gel 32 can also or instead be applied to any other surface of the viscoelastic foam, such as on any one or more of the sides shown in Fig. 1, on the lower surface 14 of the viscoelastic foam, and the like.

[0020] Viscous gel can be used to modify and enhance both the physical and thermal properties of the viscoelastic foam. The viscous gel applied to the viscoelastic foam provides a way of modifying the foam after its manufacture to increase desired properties of the viscoelastic foam and articles made from the viscoelastic foam, including without limitation an increase in the density of the article (by increasing the mass of the foam on which the gel is deposited), an increase in the bulk heat capacity or other property of the viscoelastic foam, and the like. The viscous gel can also or instead alter the softness or "feel" of the body support 10, such as in cases where the viscous gel cures or otherwise hardens to a significantly firmer and/or less flexible state.

[0021] In the illustrated construction of the body support 10, the viscous gel 32 is applied by spraying the viscous gel from one or more spray nozzles (not shown) directed toward the upper surface 12. In this manner, a substantially even and well-distributed coating of viscous gel 32 can be applied to the upper surface 12, and in some embodiments can penetrate to a depth within the viscoelastic foam at least partially due to the spray force. In these and other embodiments, the viscous gel 32 can penetrate to a depth within the viscoelastic foam based at least in part upon the porosity and/or pore sizes within the viscoelastic foam.

[0022] As used herein, the term "gel" refers to a gel elastomer – a highly viscoelastic polymer gel that is flowable prior to setting, and that assumes a deformable and elastic shape when set. The inventor has discovered that a polyurethane gel can produce excellent results in some applications. For example, the viscous gel 32 can be a polyurethane gel. In some embodiments, the viscous gel has a hardness of no greater than about 90 Shore OOO and no less than about 10 Shore OOO at room temperature (i.e., 21-23 degrees Celsius). In other embodiments, a viscous gel hardness of no greater than about 80 Shore OOO and no less than about 25 Shore OOO at room temperature can provide good performance results in a number of body support applications. In other embodiments, a viscous gel hardness of no greater than about 70 Shore OOO and no less than about 40 Shore OOO at room temperature can

provide good performance results in a number of body support applications. All such measurements are made after any necessary set time of the viscous gel.

[0023] A desirable characteristic of some viscous gels used in embodiments of the present invention is the density of such gels, as the density of such gels can correlate to the overall elastomeric properties of the gels. In some embodiments, the viscous gel 32 has a density of no less than about 100 kg/m^3 and no greater than about 1500 kg/m^3. In other embodiments, a viscous gel density of no less than about 250 kg/m^3 and no greater than about 1200 kg/m^3 can provide good performance results in a number of body support applications. In other embodiments, a viscous gel density of no less than about 500 kg/m^3 and no greater than about 1000 kg/m^3 can provide good performance results in a number of body support applications. In yet other embodiments, a viscous gel density of no less than about 900 kg/m^3 and no greater than about 1000 kg/m^3 can provide good performance results in a number of body support applications. Also, in some embodiments, the viscous gel can have a complex viscosity of about 900 Pa at 1 HZ shear frequency and at 25°C. All such measurements are made after any necessary set time of the viscous gel.

[0024] In some embodiments, the viscous gel 32 is applied at or near room temperature (i.e., between about 15 degrees Celsius and about 20 degrees Celsius). However, in other embodiments, it may not be required to heat up the viscous gel 32 prior to applying the viscous gel 32 to one or more surfaces of the body support 10. However, it should be noted that in various embodiments, the viscous gel 32 can be applied within a broad range of temperatures above and below room temperature, such as between about 0 degrees Celsius and about 100 degrees Celsius.

[0025] The viscous gel 32 can be applied as a surface gel in some embodiments, and in other embodiments, the viscous gel 32 can penetrate the layer of viscoelastic foam into the interior of the viscoelastic foam to set and bond to struts of the viscoelastic foam cells. For example, in some embodiments, the viscous gel 32 permeates about 1-2 mm into the layer of viscoelastic foam. The amount of layer penetration can depend at least in part upon the properties of the viscoelastic foam used for the layer of the body support 10. For example, a deeper penetration (i.e., greater than 2 mm) can be provided in reticulated viscoelastic foam, whereas some non-reticulated viscoelastic foams provide little to no viscous gel penetration. In some embodiments, the viscous gel 32 penetrates the viscoelastic foam to a depth of at

least about 5mm. In other embodiments, the viscous gel 32 penetrates the viscoelastic foam to a depth of no greater than about 3mm.

[0026] In some embodiments, spraying the viscous gel on the viscoelastic foam layer increases the density of the viscoelastic foam layer (by virtue of the fact that the gel increases the mass on or in the layer). In such embodiments, the density of the layer increases within the depth of viscoelastic foam penetrated by the viscous gel – in some embodiments without sacrifice of permeability of the viscoelastic foam layer. It will be appreciated that the gel can be spray-applied using one of many known spraying applications and systems.

[0027] In some embodiments, the viscous gel 32 acts as a medium to contain and transport other substances onto and/or into the viscoelastic foam, thereby further modifying the properties of the viscoelastic foam layer. For instance, and by way of example only, as shown in FIG. 1A, the viscous gel 32 can be used to carry a phase change material (PCM), e.g., microspheres 34 containing PCM dispersed within the viscous gel 32. A phase change material can modify the thermal properties of the viscoelastic foam, in addition to the increased viscoelastic foam density provided by the viscous gel 32 as described above. It should be noted that the PCM can modify the surface properties of the viscoelastic foam, and in those embodiments in which the viscous gel 32 penetrates the surface of the viscoelastic foam, the PCM can also modify the internal thermal properties of the viscoelastic foam.

[0028] Fig. 2 illustrates another embodiment of a body support 110 according to the present invention. This embodiment employs much of the same structure and has many of the same properties as the embodiments of the body support 10 described above in connection with Fig. 1. Accordingly, the following description focuses primarily upon the structure and features that are different than the embodiments described above in connection with Fig. 1. Reference should be made to the description above in connection with Fig. 1 for additional information regarding the structure and features, and possible alternatives to the structure and features of the body support illustrated in Fig. 2 and described below. Structure and features of the embodiment shown in Fig. 2 that correspond to structure and features of the embodiment of Fig. 1 are designated hereinafter in the 100 series of reference numbers.

[0029] The body support 110 shown in Fig. 2 has two layers of foam: a top layer 120 and a bottom layer 126 underlying the top layer 120. The top layer 120 has an upper surface 112 and a lower surface 124 opposite the upper surface 112. The upper surface 112 of the top

layer 120 is also the top surface of the body support 110 (which may or may not be provided with a cover, as described above). The bottom layer 126 has an upper surface 128 and a lower surface 130 opposite the upper surface 128. The lower surface 130 of the bottom layer 126 is also the bottom surface 114 of the body support 110.

[0030] In some embodiments, either or both layers 120, 126 are entirely or partially enclosed in a covering material (not shown), as described in greater detail above in connection with the illustrated embodiment of Fig. 1. In some embodiments, each of the layers 120, 126 is entirely or partially enclosed within a respective cover, thereby enabling the layers 120, 126 to be moved and positioned with respect to one another more easily.

[0031] The top layer 120 and the bottom layer 126 of the body support 110 comprise foam material, such as a polyurethane foam, latex foam, any expanded polymer (e.g., expanded ethylene vinyl acetate, polypropylene, polystyrene, or polyethylene), and the like, and can be reticulated or non-reticulated. In some embodiments, either or both layers 120, 126 comprise viscoelastic foam which can, in some embodiments, be temperature-sensitive to the body heat of a user, thereby changing in firmness in response to receiving the body heat of a user upon the body support 110.

[0032] The body 110 illustrated in Fig. 2 is an example of how viscous gel 132 can be applied to other surfaces of a body support 110, such as to any layer in a multi-layer body support 110 as shown in Fig. 1. In the illustrated embodiment of Fig. 1, a quantity of viscous gel 132 is applied to a region of the upper surface 128 of a bottom layer 126 of viscoelastic foam. As described in greater detail above, viscous gel 132 can be applied to any portion of the upper surface 128 of the viscoelastic foam, such as to the entire upper surface 128 of the bottom layer 126, to any number of regions of the upper surface 128, and/or to the sides and or lower surface 130 of the bottom layer 126. Also, although the viscous gel 132 is illustrated in Fig. 2 as being applied only to the bottom layer 126 of the body support 110, the viscous gel 132 can also or instead be applied to any surface of the top layer 120.

[0033] In some embodiments, a method of assembling the body support 110 illustrated in Fig. 2 includes applying the viscous gel 132 to the bottom layer 126, and then positioning the top layer 120 on the modified bottom layer 126 following the application of the viscous gel 132. In some embodiments, the top layer 120 is coupled to the bottom layer 126 by adhesive or cohesive bonding material, or in any other suitable manner. The viscous gel 132 can be

applied to the body support 110 by spraying as described in greater detail above, or in any of the other manners described herein.

[0034] Fig. 3 illustrates another embodiment of a body support 210 according to the present invention. This embodiment employs much of the same structure and has many of the same properties as the embodiments of the body support 10, 110 described above in connection with Figs. 1 and 2. Accordingly, the following description focuses primarily upon the structure and features that are different than the embodiments described above in connection with Figs. 1 and 2. Reference should be made to the description above in connection with Figs. 1 and 2 for additional information regarding the structure and features, and possible alternatives to the structure and features of the body support illustrated in Fig. 3 and described below. Structure and features of the embodiment shown in Fig. 3 that correspond to structure and features of the embodiments of Figs. 1 and 2 are designated hereinafter in the 200 series of reference numbers.

[0035] As mentioned above, the body support 210 can have any number of layers of foam (and other materials, if desired) coupled together by an adhesive or cohesive bonding material, or in any other suitable manner. The body support 210 illustrated in Fig. 3 is another example of a multi-layered body support 210 in which a viscous gel 232 has been applied to viscoelastic foam. The body support 210 illustrated in Fig. 3 includes a top layer 220 having an upper surface 212 and a lower surface 224 on an opposite side of the top layer 220. In some embodiments, the top layer 220 is a pillow top layer, and can be at least partially defined by a layer of viscoelastic or non-viscoelastic foam that is either reticulated or non-reticulated. For example, the top layer 220 of the body support 210 illustrated in Fig. 3 is a layer of viscoelastic foam, and can be quilted in some embodiments. The body support 210 illustrated in Fig. 3 also includes a bottom layer 226 having an upper surface 228 and a lower surface 214 opposite the upper surface 228. The body support 210 illustrated in Fig. 3 also includes a middle layer 244 positioned between the top layer 220 and the bottom layer 226. The middle layer 244 has an upper surface 246 positioned adjacent the lower surface 224 of top layer 220, and a lower surface 248 opposite the upper surface 246 and positioned adjacent the upper surface 228 of the bottom layer 226. The middle and bottom layers 244, 226 in the illustrated embodiment of Fig. 3 comprise viscoelastic foam and non-viscoelastic polyurethane foam, respectively. However, as with the top layer 220, the middle and bottom layers 244, 226 can comprise any other material desired, including without limitation any

combination of viscoelastic foam, non-viscoelastic foam, latex foam, reticulated foam, non-reticulated foam, any expanded polymer (e.g., expanded ethylene vinyl acetate, polypropylene, polystyrene, or polyethylene), and the like.

[0036] The description above regarding the viscous gel application (and manner of viscous gel application) to the top or underlying layers of a body support 10, 110 applies equally to the embodiment of Fig. 3 with respect to the top and/or middle and/or bottom layers 120, 144, 126 illustrated in Fig. 3. Also, in some alternative embodiments of Fig. 3, the top layer 120 rests upon the middle layer 144 without being secured thereto, and/or the middle layer 144 rests upon the bottom layer 126 without being secured thereto.

[0037] In the illustrated embodiment of Fig. 3, viscous gel 232 extends across substantially the entire surface area of the top surface 228 of the bottom layer 226 and the bottom surface 248 of the middle layer 244, whereas viscous gel 232 on the top and middle layers 220, 244 is located only in discrete areas between the top and middle layers 220, 244, it being understood that the viscous gel 232 can be located in any other number of areas having any other locations, shapes, and sizes between the top and middle layers 220, 244. The locations, shapes, and sizes of the viscous gel areas on the top, middle, and bottom layers 220, 244 and 226, respectively, in the embodiment of Fig. 3 are illustrated by way of example only, and are not intended to limit the scope of the present invention.

[0038] Although the invention has been described in detail with reference to certain preferred embodiments, variations and modifications exist within the scope and spirit of one or more independent aspects of the invention described.

CLAIMS

I claim:

1. A body support cushion, comprising:

a layer of flexible polyurethane foam having an upper surface defining a top surface of the body support cushion and a lower surface opposite the upper surface;

a gelatinous layer formed in the layer of flexible polyurethane foam and altering a physical property of the polyurethane foam.

2. The body support cushion of claim 1 wherein the gelatinous layer is spray-applied to the upper surface.

3. The body support cushion of claim 1 wherein the gelatinous layer substantially covers the upper surface.

4. The body support cushion of claim 3 wherein the gelatinous layer entirely covers the upper surface.

5. The body support cushion of claim 1 wherein the gelatinous layer is comprised of a single layer of gel elastomer that is flowable prior to setting and that assumes a deformable and elastic shape when set.

6. The body support cushion of claim 1 wherein the gelatinous layer is comprised of a single layer of polyurethane gel having a hardness of no greater than 90 Shore OOO and no less than about 10 Shore OOO at an ambient temperature between 21-23 degrees Celsius.

7. The body support cushion of claim 6 wherein the polyurethane gel has a density of no less than about 100 kg/m^3 and no greater than about 1500 kg/m^3 at a temperature between 0 degrees Celsius and 100 degrees Celsius.

8. The body support cushion of claim 6 where the single layer of polyurethane gel permeates the upper surface of the first layer of polyurethane foam to a depth of no less than 1mm and no more than 5mm.

9. The body support cushion of claim 1 wherein the layer of polyurethane foam is comprised of viscoelastic foam.

10. The body support cushion of claim 9 wherein the viscoelastic foam is reticulated viscoelastic foam.

11. The body support cushion of claim 9 wherein the viscoelastic foam is temperature-sensitive viscoelastic foam.

12. The body support cushion of claim 1 wherein the gelatinous layer alters a feel of the top surface of the layer of flexible polyurethane foam.

13. The body support cushion of claim 12 wherein the gelatinous layer increases a firmness of the top surface of the layer of flexible polyurethane foam.

14. The body support cushion of claim 12 wherein the gelatinous layer decreases a firmness of the top surface of the layer of flexible polyurethane foam.

15. A mattress comprising:

first and second layers of foam arranged in a stacked arrangement with an upper surface of the first layer of foam defining a top surface of the mattress; and

elastomer gel applied to at least one of the first and second layers of foam, and wherein the elastomer gel is flowable during application and penetrates into the at least one layer of foam to a depth of at least 1.0mm.

16. The mattress of claim 15 further comprising a third layer of foam that provides support for the first and second layers of foam, and wherein the third layer of foam has an upper surface containing elastomer gel.

17. The mattress of claim 15 wherein the first and second layers is each viscoelastic foam.

18. The mattress of claim 17 wherein at least of the first and second layers is reticulated viscoelastic foam.

19. The mattress of claim 15 wherein the elastomer gel includes phase change material dispersed therein.

20. A mattress comprising:

first and second layers of foam arranged in a stacked arrangement with the first layer of foam defining an uppermost foam layer of the mattress;

viscous gel dispersed in at least one of the first and second layers; and

phase change material dispersed in at least one of the first and second layers.

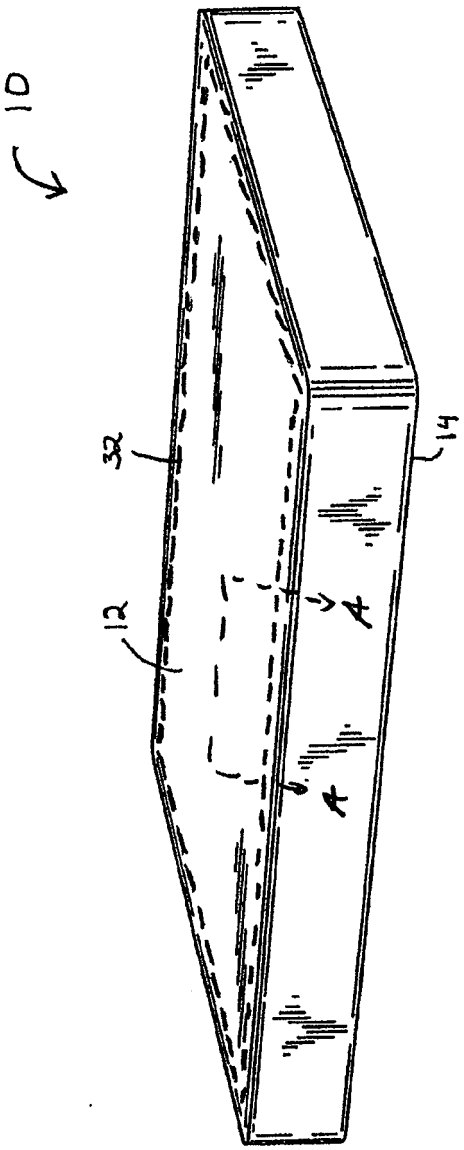

FIG. 1

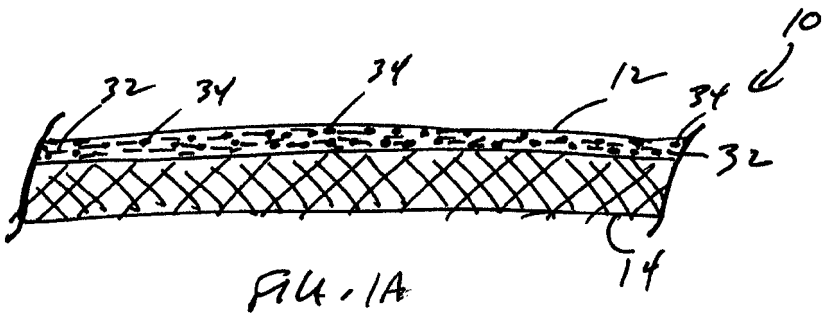

FIG. 1A

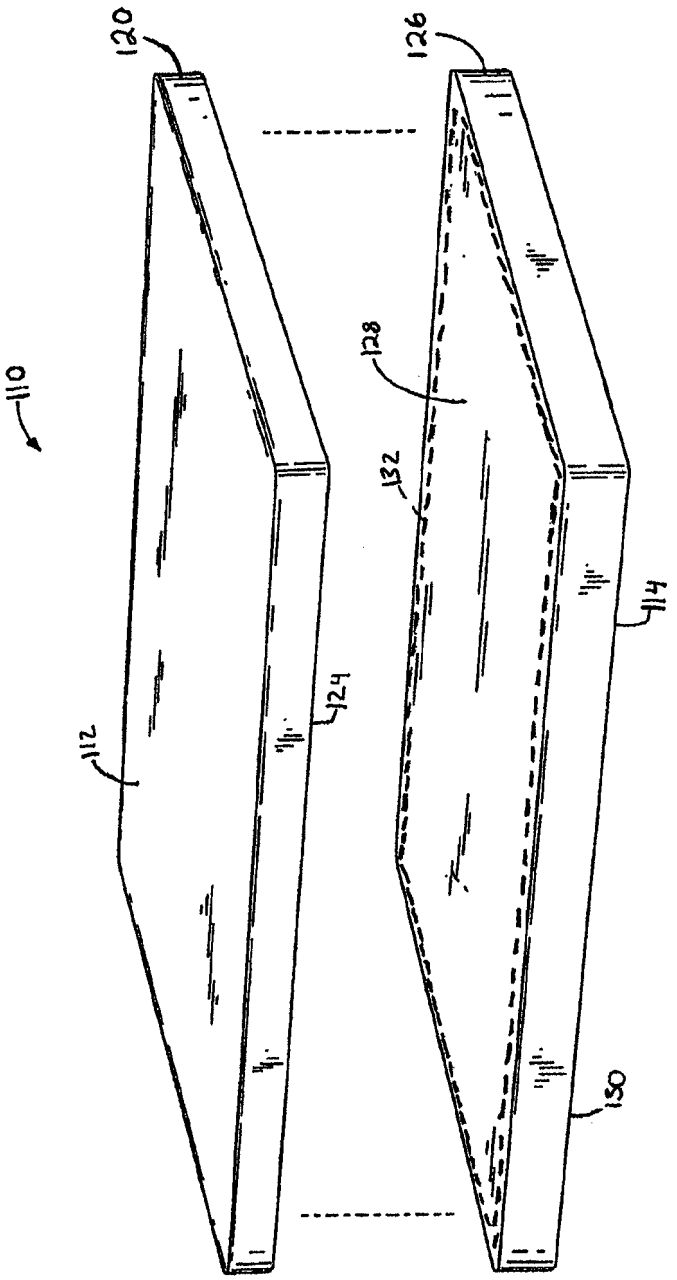

FIG. 2

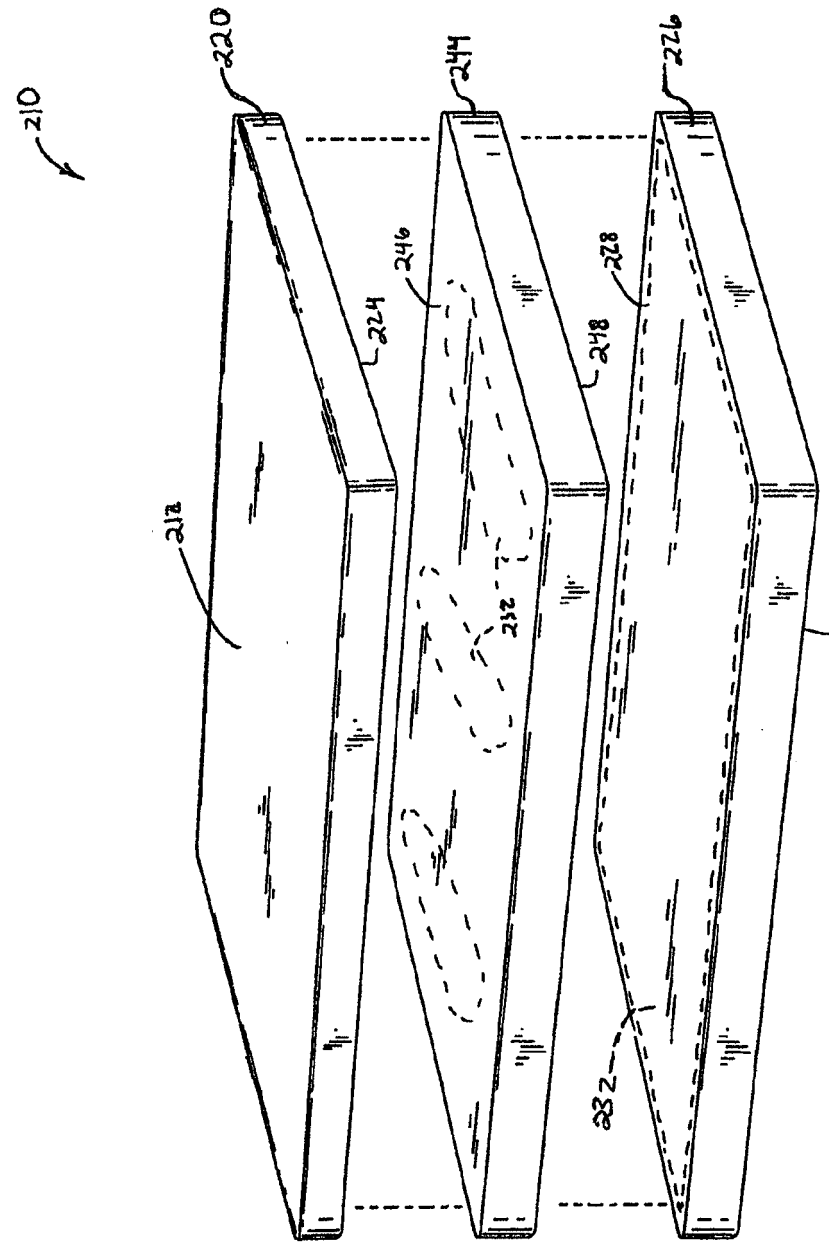

FIG. 3

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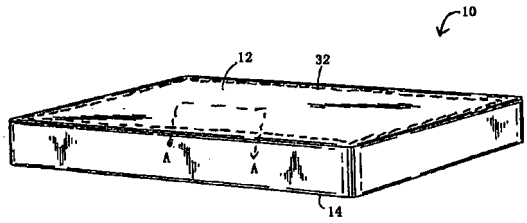
(54)发明名称

用粘性凝胶改性的身体支撑件及使用该粘性凝胶制造身体支撑件的方法

(57)摘要

一种身体支撑垫，例如床垫、床垫套或罩、或枕头，其由弹性泡沫层组成，并且进一步包括施加在其表面的一定量的凝胶状材料，例如弹性体凝胶。所述凝胶状材料改变弹性泡沫层的物理特性，例如硬度或手感。所述凝胶状材料能够以多种方式施加，包括但不限于喷涂施加，在喷涂施加的情况下喷涂力可以用于控制多少凝胶状材料渗入泡沫层。所述泡沫层由网状或非网状泡沫组成。所述泡沫层还可以由粘弹性或非粘弹性泡沫组成。



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1. 一种身体支撑垫，包括：

柔性聚氨酯泡沫层，具有限定所述身体支撑垫的顶表面的上表面，以及与所述上表面相背的下表面；

凝胶状层，形成在所述柔性聚氨酯泡沫层中，并且改变聚氨酯泡沫的物理特性。

2. 如权利要求 1 所述的身体支撑垫，其中所述凝胶状层喷涂施加到所述上表面。

3. 如权利要求 1 所述的身体支撑垫，其中所述凝胶状层大体覆盖所述上表面。

4. 如权利要求 3 所述的身体支撑垫，其中所述凝胶状层完全覆盖所述上表面。

5. 如权利要求 1 所述的身体支撑垫，其中所述凝胶状层由一个凝胶弹性体层组成，所述凝胶弹性体在凝固之前是可流动的，并且在凝固时呈现可变形的弹性形状。

6. 如权利要求 1 所述的身体支撑垫，其中所述凝胶状层由一个聚氨酯凝胶层构成，所述聚氨酯凝胶在 21-23 摄氏度的环境温度下，具有不大于大约 90Shore 000 并且不小于大约 10Shore 000 的硬度。

7. 如权利要求 6 所述的身体支撑垫，其中所述聚氨酯凝胶在 0 摄氏度 -100 摄氏度的温度下具有不小于大约 100kg/m^3 并且不大于大约 1500kg/m^3 的密度。

8. 如权利要求 6 所述的身体支撑垫，其中所述一个聚氨酯凝胶层渗入第一聚氨酯泡沫层的上表面达不小于 1mm 且不大于 5mm 的深度。

9. 如权利要求 1 所述的身体支撑垫，其中所述聚氨酯泡沫层由粘弹性泡沫组成。

10. 如权利要求 9 所述的身体支撑垫，其中所述粘弹性泡沫是网状粘弹性泡沫。

11. 如权利要求 9 所述的身体支撑垫，其中所述粘弹性泡沫是温度敏感的粘弹性泡沫。

12. 如权利要求 1 所述的身体支撑垫，其中所述凝胶状层改变所述柔性聚氨酯泡沫层的顶表面的手感。

13. 如权利要求 12 所述的身体支撑垫，其中所述凝胶状层增加所述柔性聚氨酯泡沫层的顶表面的硬度。

14. 如权利要求 12 所述的身体支撑垫，其中所述凝胶状层降低所述柔性聚氨酯泡沫层的顶表面的硬度。

15. 一种床垫，包括：

以堆叠方式放置的第一泡沫层和第二泡沫层，其中第一泡沫层的上表面限定所述床垫的顶表面；

施加至第一泡沫层和第二泡沫层中的至少一个的弹性体凝胶，并且其中所述弹性体凝胶在施加期间是可流动的，并且渗入至少一个泡沫层达至少 1.0mm 的深度。

16. 如权利要求 15 所述的床垫，进一步包括第三泡沫层，所述第三泡沫层为第一泡沫层和第二泡沫层提供支撑，并且其中所述第三泡沫层具有包含弹性体凝胶的上表面。

17. 如权利要求 15 所述的床垫，其中所述第一层和第二层中的每一个都是粘弹性泡沫。

18. 如权利要求 17 所述的床垫，其中第一层和第二层中的至少一个是网状粘弹性泡沫。

19. 如权利要求 15 所述的床垫，其中所述弹性体凝胶包括分散在其中的相变材料。

20. 一种床垫，包括：

以堆叠方式放置的第一泡沫层和第二泡沫层，其中第一泡沫层限定所述床垫最上面的

泡沫层；

粘性凝胶，分散在第一泡沫层和第二泡沫层中的至少一个中；以及

相变材料，分散在第一泡沫层和第二泡沫层中的至少一个中。

用粘性凝胶改性的身体支撑件及使用该粘性凝胶制造身体支撑件的方法

[0001] 相关申请的交叉引用

[0002] 本申请要求2011年9月15日提交的美国申请No.61/535045的优先权，其全部内容通过引用在此并入。

背景技术

[0003] 可以见到具有各种各样的形状和尺寸的传统身体支撑件，它们中的每一种身体支撑件都适合于支撑使用者的一个或更多身体部分。如同本文中所使用的那样，术语“身体支撑件”包括但不限于：适合于在一个或更多位置支撑人或动物的一个或更多部分（或整个身体）的任何可变形元件或结构。身体支撑件的示例包括但不限于：床垫、枕头和任何类型的垫子，包括在床上、座椅上以及在其它应用中使用的那些垫子。

[0004] 身体支撑件通常完全或部分由泡沫材料构成。例如，聚氨酯泡沫通常用于很多床垫、枕头和垫子，并且能够单独使用或者与其它类型的缓冲材料组合使用。在很多身体支撑件中使用了粘弹性材料，从而为身体支撑件提供增强的能力，以顺应使用者并且从而对使用者的重量或其它负载进行分配。一些粘弹性身体支撑件材料还是温度敏感的，从而还使得该身体支撑件能够至少部分地基于支撑在其上的身体部分（或多个身体部分）的温度而改变硬度。

[0005] 聚氨酯泡沫本身具有的特性为期望将所述泡沫用于特定应用的身体支撑件的制造商限定了设计的局限性。例如，一些身体支撑件包括一层或多层泡沫，其中在整个泡沫厚度上的泡沫均匀特性不一定是设计目标。改性泡沫层以提高其物理和热特性可以有助于使所述泡沫层（或多个泡沫层）和/或身体支撑件适于特定应用。特别是当身体支撑件的一个或多个层包括粘弹性泡沫材料时尤其如此，所述粘弹性泡沫材料可以显著地改变使用中的硬度和形状。

[0006] 尽管由一层或多层泡沫构成的身体支撑件的数量和类型持续增加（包括那些包含粘弹性泡沫的一层或更多层泡沫的身体支撑件），但通常未充分利用这样的材料的能力（包括利用其物理和热特性）。

[0007] 包括粘弹性泡沫在内的这种材料的能力，包括利用它们的物理和热特性，通常未得到充分利用。

[0008] 至少部分地基于现有身体支撑件的局限以及在各种应用中消费者对于改进身体支撑件的高涨需求，在本领域中增加新的身体支撑件和用于身体支撑件的材料变体是受欢迎的。

发明内容

[0009] 本发明的一些实施例中，提供了一种身体支撑件，其具有至少一个网状或非网状的粘弹性泡沫层，并且包括至少一个表面，在所述表面上施加有粘性凝胶以改变所述粘弹性泡沫的至少一种特性。

[0010] 本发明的一些实施例提供一种制造身体支撑件的方法，包括以下步骤：将一个或多个喷嘴引导为朝向网状或非网状的粘弹性泡沫层的表面上，将来自所述喷嘴的粘性凝胶喷涂到所述粘弹性泡沫层的表面上，并且允许凝胶凝固在所述粘弹性泡沫层上。在一些实施例中，该方法还包括允许所述凝胶渗透所述粘弹性泡沫层的表面，以占据所述粘弹性泡沫层内部达所述表面下方的所需深度。

[0011] 通过考虑详细描述和附图，本发明的其它方面将会变得显而易见。

附图说明

[0012] 图 1 是根据本发明一个实施例的身体支撑件的透视图。

[0013] 图 1A 是沿着图 1 中线 A-A 截取的图 1 中的身体支撑件的剖视图。

[0014] 图 2 是根据本发明另一个实施例的身体支撑件的分解透视图。

[0015] 图 3 是根据本发明又一个实施例的身体支撑件的分解透视图。

具体实施方式

[0016] 在对本发明的各个实施例进行具体解释之前，应该理解的是，本发明并不是在其应用中限于在以下描述中说明或者在附图中示出的部件的构造和布置的细节。本发明可以具有其它实施例，并且能够以各种方式实施或实现。而且，应该理解的是，为了描述的目的，在本文中以及在所附权利要求中参考顺序或重要性使用在本文中使用的措辞和术语（例如，“第一”、“第二”和“第三”），并且除非特别指明，这些措辞和术语并不单独意在表示或暗示相对顺序或重要性。

[0017] 在图 1 中示出了根据本发明的实施例的身体支撑件 10。身体支撑件 10 包括顶表面 12 和底表面 14，顶表面 12 被取向为支撑使用者，底表面 14 定位为接近框架、地板或其它表面以支撑身体支撑件 10。虽然图 1 中示出的身体支撑件 10 包括一个泡沫层（下面更详细地描述），但是身体支撑件 10 也可以包括任何数量的附加泡沫层（针对图 2 和 3 更详细地描述），并且在一些实施例中还可以包括一个或多个其他材料层。

[0018] 在图 1 和图 2 中示出的身体支撑件 10 是床垫。然而，在其它实施例中，所述身体支撑件 10 仅是床垫或其他身体支撑件的一部分，并且因此限定了较大身体支撑件的部件。另外，身体支撑件 10 可以具有其它形式，例如床垫套、床垫罩或蒲团。可以理解的是，本文公开的身体支撑件 10 的特征可应用于具有任何尺寸和形状的任何类型的身体支撑件。仅仅举例而言，这些特征同样可应用于头枕、座椅垫（包括座椅的底垫和 / 或靠背垫）、颈枕、垫腿枕、眼罩以及用于支撑和 / 或衬垫人体或动物体的全部或任何部分的任何其它结构。因此，如在本文中以及在所附权利要求中所使用的那样，术语“身体支撑件”表示（包含床垫、床垫套、床垫罩、沙发床和蒲团在内）任何以及全部这样的结构以及这样结构的一部分。还应该注意到，本文描述和 / 或示出的每一个身体支撑件都具有特别的形式，例如床垫、床垫套、床垫罩、或蒲团。然而，相比之下关于在本文中没有描述的，每个这样的身体支撑件的任何特征或所有特征都能够应用于具有任何其它形状和尺寸的任何其它类型的身体支撑件，包括上述各种类型的身体支撑件。

[0019] 再次参考图 1 示出的身体支撑件 10，身体支撑件 10 可以封装在任何类型的罩之内（未示出），例如机织或非机织材料、编织材料、包括棉、毛、或其它天然纤维、聚酯、人造

丝、尼龙、泡沫、或其它合成材料，以及不能渗透液体且不能渗透水蒸气、不能渗透液体但能渗透水蒸气、或者能渗透液体且能渗透水蒸气的材料。

[0020] 如图 1 中所示的身体支撑件 10 包括粘弹性泡沫层 10，该弹性泡沫层 10 包括上表面 12 和下表面 14，所述下表面 14 与上表面 12 相背。所述上表面 12 也是身体支撑件 10 的顶表面，而所述下表面 14 也是身体支撑件 10 的底表面。所述身体支撑件 10 的粘弹性泡沫是网状或非网状泡沫，和 / 或可以包括任何膨胀聚合物（例如，膨胀的乙烯醋酸乙烯酯、聚丙烯、聚苯乙烯或聚乙烯），乳胶等等。在一些实施例中，粘弹性泡沫可以是对于使用者的身体热量而温度敏感的，从而响应于接收到的泡沫上的使用者的身体热量而改变硬度。

[0021] 此外在一些实施例中，所述身体支撑件 10 的粘弹性泡沫可以包括网状粘弹性泡沫。网状泡沫（粘弹性或其它）是一种细胞状泡沫结构，其中泡沫的细胞本质上是骨骼状的。换句话说，网状泡沫的每一个细胞由多个有孔窗限定，所述多个有孔窗被细胞支柱包围。网状泡沫的细胞窗口可以是完全空出来的（只留下细胞支柱）或者是大体空出来的。在一些实施例中，如果细胞的窗口的至少 50％没有了（即，具有通孔的窗口，或者完全没有窗口因此只留下细胞支柱），那么就认为泡沫是“网状”的。这样的结构可以通过以下方式产生：破坏或者去除细胞窗口材料，或者在泡沫的制造过程中防止细胞窗口的完全形成。

[0022] 继续参考图 1 的实施例，一定量的粘性凝胶 32 施加在所述身体支撑件 10 的粘弹性泡沫的上表面 12。在图 1 中凝胶 32 已经施加在粘弹性泡沫的整个上表面 12 上（或大体整个上表面 12）。在其他实施例中，粘性凝胶 32 可以施加在上表面 12 的任何部分（例如，仅在上表面 12 的中心位置，在所述上表面 12 上呈条带或岛状，等等），并且在上表面 12 的任何数量的分离或连通区域中。所述粘性凝胶 32 还可以或替代地施加在粘弹性泡沫的任何其他表面，例如图 1 所述的任何一个或多个侧面上，粘弹性泡沫的下表面 14 上，等等。

[0023] 粘性凝胶可以用于改变和提高粘弹性泡沫的物理和热特性。施加到弹性泡沫的粘性凝胶提供了在其制造后改进泡沫的一种方式，以增强粘弹性泡沫以及由粘弹性泡沫制成的制品所需的特性，包括但不限于：增加制品的密度（通过增加在泡沫上沉积的凝胶量），增加体积热容量或粘弹性泡沫的其他特性，等等。粘性凝胶还可以或替代地改变所述身体支撑件 10 柔软度或“手感”，例如在粘性凝胶固化或者硬化到明显更坚硬和 / 或较不柔软的状态的情况下。

[0024] 在示出的身体支撑件 10 的结构中，通过喷涂来自一个或多个喷涂喷嘴（未示出）的粘性凝胶来施加粘性凝胶 32，所述喷嘴被引导为朝向上表面 12。在这种方式下，大体均匀且良好分布的粘性凝胶 32 涂层可以施加到上表面 12，并且在一些实施例中，至少部分地由于喷涂力，粘性凝胶可以渗透到粘弹性泡沫内的一定深度。在这些或其他实施例中，至少部分地基于粘弹性泡沫内的多孔性和 / 或孔的尺寸，粘性凝胶 32 可以渗透到粘弹性泡沫内的一定深度。

[0025] 如同本文中所使用的那样，术语“凝胶”表示凝胶弹性体，即一种高度粘弹性聚合物凝胶，其在凝固之前是可流动的，并且在凝固时呈现可变形的弹性形状。发明人已经发现，在一些应用中，聚氨酯凝胶可以产生非常好的结果。例如，粘性凝胶 32 可以是聚氨酯凝胶。在一些实施例中，在室温下（即，21-23 摄氏度），粘性凝胶 32 具有不大于大约 90Shore（肖氏）000 并且不小于大约 10Shore 000 的硬度。在其它实施例中，在室温下不大于大约 80Shore 000 并且不小于大约 25Shore 000 的粘性凝胶硬度能够在一些身体支撑

件应用中提供良好的特性结果。在其它实施例中，在室温下不大于大约 70Shore 000 并且不小于大约 40Shore 000 的粘性凝胶硬度能够在一些身体支撑件应用中提供良好的特性结果。所有这些测量都是在粘性凝胶的任何必要凝固时间之后进行的。

[0026] 在本发明的实施例中使用的一些粘性凝胶的理想特性是这些凝胶的密度，因为这些凝胶的密度能够与凝胶的总体弹性特性相互关联。在一些实施例中，粘性凝胶 32 具有不小于大约 100kg/m^3 并且不大于大约 1500kg/m^3 的密度。在其它实施例中，不小于大约 250kg/m^3 并且不大于大约 1200kg/m^3 的粘性凝胶硬度能够在一些身体支撑件应用中提供良好的特性结果。在其它实施例中，不小于大约 500kg/m^3 并且不大于大约 1000kg/m^3 的粘性凝胶硬度能够在一些身体支撑件应用中提供良好的特性结果。在其它实施例中，不小于大约 900kg/m^3 并且不大于大约 1000kg/m^3 的粘性凝胶硬度能够在一些身体支撑件应用中提供良好的特性结果。而且，在一些实施例中，在 1HZ 剪切频率和 25℃下，粘性凝胶可以具有大约 900Pa 的复数粘度。所有这些测量都是在粘性凝胶的任何必要凝固时间之后进行的。

[0027] 在一些实施例中，在室温或接近室温下（即，在大约 15 摄氏度到大约 20 摄氏度之间）施加粘性凝胶 32。然而，在其他实施例中，在将粘性凝胶 32 施加至身体支撑件 10 的一个或多个表面之前，可以不需要对粘性凝胶 32 进行加热。然而，应该注意到，在各种实施例中，粘性凝胶 32 能够在室温上下的宽广温度范围之内应用，例如在大约 0 摄氏度到大约 100 摄氏度之间。

[0028] 在一些实施例中，粘性凝胶 32 可以被用作表面凝胶，而在其他实施例中，粘性凝胶 32 渗透粘弹性泡沫层进入粘弹性泡沫层的内部，以凝固并结合粘弹性泡沫细胞的支柱。例如，在一些实施例中，粘性凝胶 32 渗入粘弹性泡沫层大约 1-2mm。层渗透量可以至少部分地取决于用于身体支撑件 10 的层的粘弹性泡沫的特性。例如，在网状粘弹性泡沫中可以提供较深的渗透（即，大于 2mm），然而在非网状粘弹性泡沫中可以提供较浅的粘性凝胶渗透甚至没有粘性凝胶渗透。在一些实施例中，粘性凝胶 32 渗入粘弹性泡沫到至少大约 5mm 的深度。在其他实施例中，粘性凝胶 32 渗入粘弹性泡沫到不大于大约 3mm 的深度。

[0029] 在一些实施例中，将粘性凝胶喷涂到粘弹性泡沫层上增加了所述粘弹性泡沫层的密度（基于如下这样的事实，即，凝胶增加了在层上或层中的质量）。在这样的实施例中，通过渗入所述粘性凝胶使所述层在粘弹性泡沫的深度内的密度增加——在一些实施例中，无需牺牲粘弹性泡沫层的透气性。可以理解的是，所述凝胶可以使用许多已知喷涂应用和系统中的一种来喷涂施加。

[0030] 在一些实施例中，所述粘性凝胶 32 作为介质容纳并且输送其他物质到粘弹性泡沫上和/或中，从而进一步改变粘弹性泡沫层的特性。例如，并且仅作为示例，如图 1A 所示，所述粘性凝胶 32 可以用于承载相变材料 (PCM)，例如分散在粘性凝胶 32 内包含 PCM 的微球 34。除了如上所述的由粘性凝胶 32 提供增加的粘弹性泡沫密度，相变材料还可以改变粘弹性泡沫的热特性。应当注意的是，PCM 可以改变粘弹性泡沫的表面特性，并且在那些粘性凝胶 32 渗入粘弹性泡沫的表面的实施例中，PCM 还可以改变粘弹性泡沫的内部热特性。

[0031] 图 2 示出了根据本发明的身体支撑件 110 的另一个实施例。所述实施例采用的很多结构以及具有的很多特性都与上文中结合图 1 进行描述的身体支撑件 10 的实施例相同。因此，以下描述主要集中于与上文中结合图 1 进行描述的实施例不同的结构和特征。应该参考上文中与图 1 结合的描述，以获得关于结构和特征的附加信息，以及在图 2 中示出并且

在下文中描述的身体支撑件的结构和特征的可能的替代物。在下文中将在图 2 中示出的实施例的与图 1 的实施例的结构和特征对应的结构和特征以 100 系列的附图标记表示。

[0032] 图 2 中示出的身体支撑件 110 具有两层泡沫 :顶层 120 和在顶层 120 下面的底层 126。顶层 120 具有上表面 112 和下表面 124,下表面 124 与上表面 112 相背。顶层 120 的上表面 112 也是身体支撑件 110(如上所述,其可以设有或不设有罩) 的顶表面。底层 126 具有上表面 128 和下表面 130,下表面 130 与上表面 128 相背。底层 126 的下表面 130 也是身体支撑件 110 的底表面 114。

[0033] 在一些实施例中,层 120、126 的任一层或两层都完全或部分封装在覆盖材料 (未示出) 中,如上面结合图 1 示出的实施例的更详细地描述。在一些实施例中,层 120、126 的每一层都完全或部分封装在各自的罩内,因此层 120、126 能够更加容易地相对于彼此移动和定位。

[0034] 所述身体支撑件 110 的顶层 120 和底层 126 包括泡沫材料,例如聚氨酯泡沫、胶乳泡沫、任何膨胀聚合物 (例如,膨胀的乙烯醋酸乙烯酯、聚丙烯、聚苯乙烯或聚乙烯),等等,并且可以是网状或非网状的。在一些实施例中,层 120、126 的任一层或两层包括粘弹性泡沫,在一些实施例中,粘弹性泡沫可以是对于使用者的身体热量而温度敏感的,从而响应于接收到的身体支撑件 110 上的使用者的身体热量而改变硬度。

[0035] 图 2 所示的身体支撑件 110 是如何能够将粘性凝胶 132 施加到身体支撑件 110 的其他表面的示例,例如,施加到如图 1 所示的多层身体支撑件 110 的任一层。在图 1 所示的实施例中,一定量的粘性凝胶 132 施加到粘弹性泡沫的底层 126 的上表面 128 的区域。如上面更详细地描述,粘性凝胶 132 可以施加到粘弹性泡沫的上表面 128 的任何部分,例如底层 126 的整个上表面 128,上表面 128 的任何数量的区域,和 / 或底层 126 的侧面和或下表面 130。此外,虽然图 2 中示出的粘性凝胶 132 仅施加到身体支撑件 110 的底层 126,但是粘性凝胶 132 还可以或也可以替换地施加到顶层 120 的任何表面。

[0036] 在一些实施例中,图 2 中示出的组装身体支撑件 110 的方法包括 :将粘性凝胶 132 施加到底层 126,然后在施加粘性凝胶 132 之后将顶层 120 定位在改性的底层 126 上。在一些实施例中,顶层 120 通过粘合剂或粘性粘接材料,或任何其他适合的方式连接到底层 126。粘性凝胶 132 可以通过如上面更详细地描述的喷涂或本文中描述的任何其他方式施加到身体支撑件 110。

[0037] 图 3 示出了根据本发明的身体支撑件 210 的另一个实施例。所述实施例采用的很多结构以及具有的很多性质都与上文中结合图 1 和图 2 进行描述的身体支撑件 10,110 的实施例相同。因此,以下描述主要集中于与上文中结合图 1 和图 2 进行描述的实施例不同的结构和特征。应该参考上文中与图 1 和图 2 结合的描述,以获得关于结构和特征的附加信息,以及在图 3 中示出并且在下文中描述的身体支撑件的结构和特征的可能的替代物。在下文中将在图 3 中示出的实施例的与图 1 和图 2 的实施例的结构和特征对应的结构和特征以 200 系列的附图标记表示。

[0038] 如上文所述,身体支撑件 210 可以具有通过粘合剂或粘性粘接材料,或任何其他适合的方式连接在一起的任何数量的泡沫 (如果需要,和其他材料) 层。在图 3 中示出的身体支撑件 210 是多层身体支撑件 210 的另一个示例,其中粘性凝胶 232 已经施加到粘弹性泡沫。在图 3 中示出的身体支撑件 210 包括顶层 220,所述顶层 220 具有上表面 212 和与

顶层 220 相背的下表面 224。在一些实施例中，顶层 220 是枕头顶层，并且可以由粘弹性或非粘弹性的泡沫层至少部分地限定，所述泡沫是网状或非网状的。例如，在图 3 中示出的身体支撑件 210 的顶层 220 是粘弹性泡沫层，并且在一些实施方案中可以是缝合的。图 3 中示出的身体支撑件 210 还包括底层 226，所述底层 226 具有上表面 228 和下表面 214，所述下表面 214 与上表面 228 相背。在图 3 中示出的身体支撑件 210 还包括位于顶层 220 和底层 226 之间的中间层 244。中间层 244 具有上表面 246 和下表面 248，上表面 246 定位为邻近顶层 220 的下表面 224，所述下表面 248 与上表面 246 相背并且定位为邻近底层 226 的上表面 228。在图 3 中示出的实施例中，中间层和底层 244，226 分别包括粘弹性泡沫和非粘弹性聚氨酯泡沫。然而，如顶层 220 一样，中间层和底层 244，226 可以包括任何所需的其它材料，包括但不限于：粘弹性泡沫、非粘弹性泡沫、乳胶泡沫、网状泡沫、非网状泡沫、任何膨胀聚合物（例如，膨胀的乙烯醋酸乙烯酯、聚丙烯、聚苯乙烯或聚乙烯）等等的任意组合。

[0039] 关于图 3 中示出的顶层 220 和 / 或中间层 244 和 / 或底层 226，上文中关于在身体支撑件 10，110 的顶层或下面层施加的粘性凝胶的描述同样应用于在图 3 中示出的实施例。此外，在图 3 的一些可选实施例中，顶层 220 放置在中间层 244 上而并不与之紧固，和 / 或中间层 244 放置在底层 226 上而并不与之紧固。

[0040] 在图 3 中示出的实施例中，粘性凝胶 232 大体在底层 226 的上表面 228 和中间层 244 的下表面 248 的整个表面区域上延伸，而顶层和中间层 220，244 上的粘性凝胶 232 仅仅位于顶层 220 和中间层 244 之间的离散区域中，可以理解的是，粘性凝胶 232 能够位于顶层 220 和中间层 244 之间具有任何其它位置、形状和尺寸的任何其它数量的区域中。在图 3 的实施例中，分别在顶层 220，中间层 244 和底层 226 上的粘性凝胶区域的位置、形状和尺寸仅仅是示例性示出的，并不旨在对本发明的范围进行限制。

[0041] 虽然本发明已经参照某些优选实施例进行了详细描述，但在本发明所描述的一个或多个独立方面的范围和精神内存在各种变化和修改。

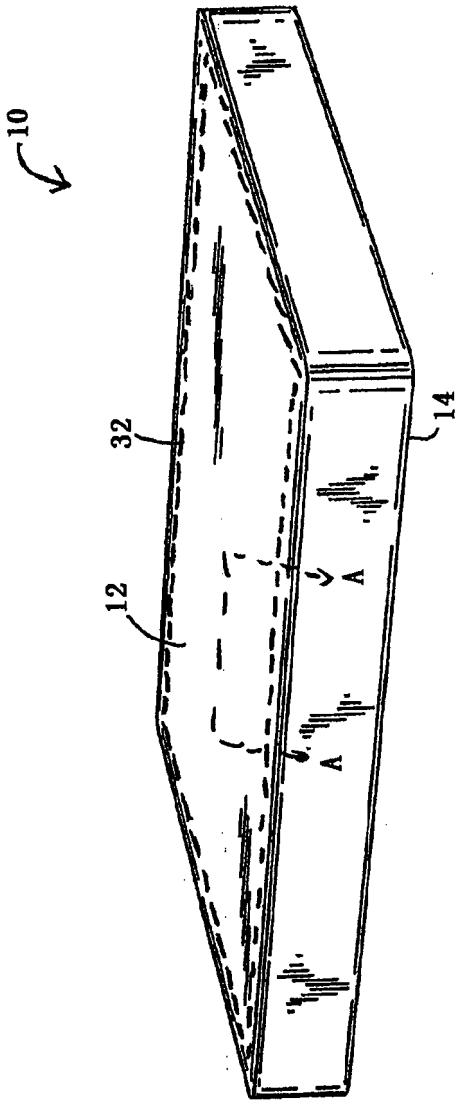

图 1

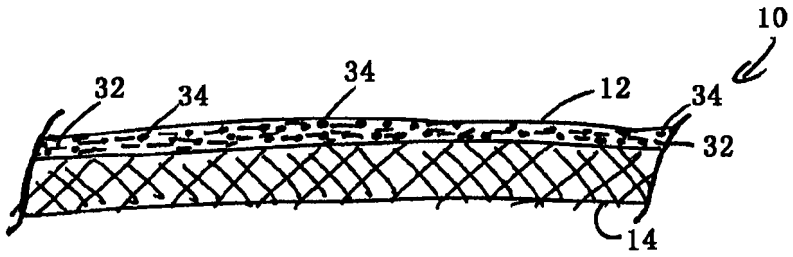

图 1A

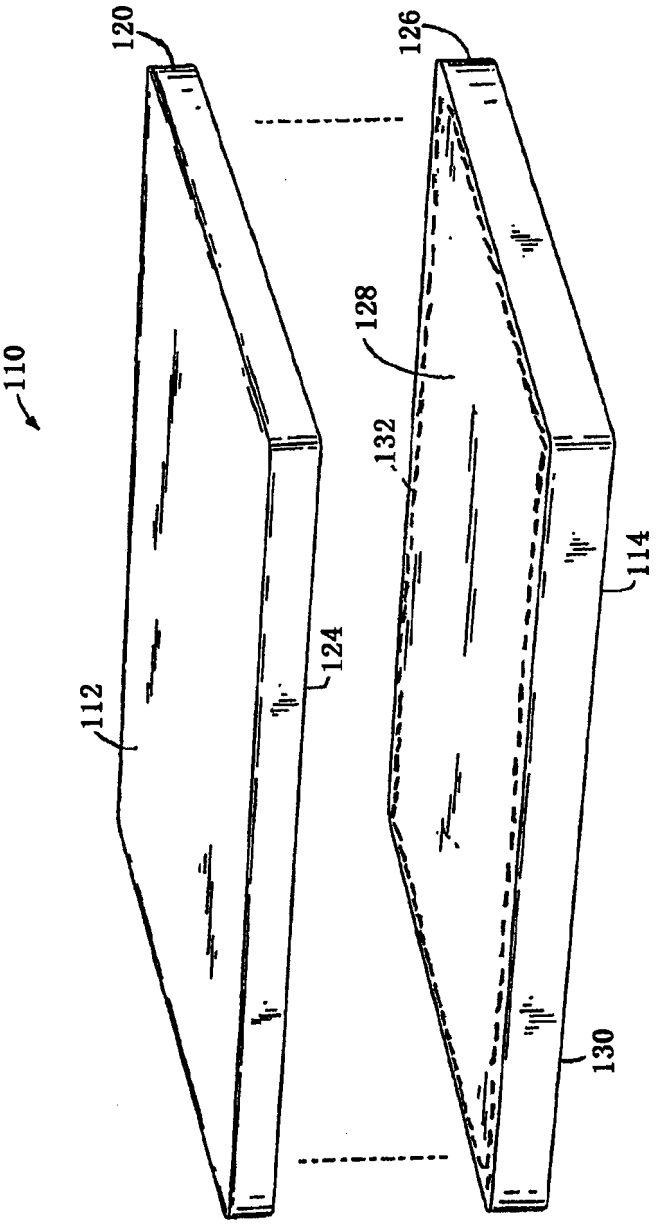

图 2

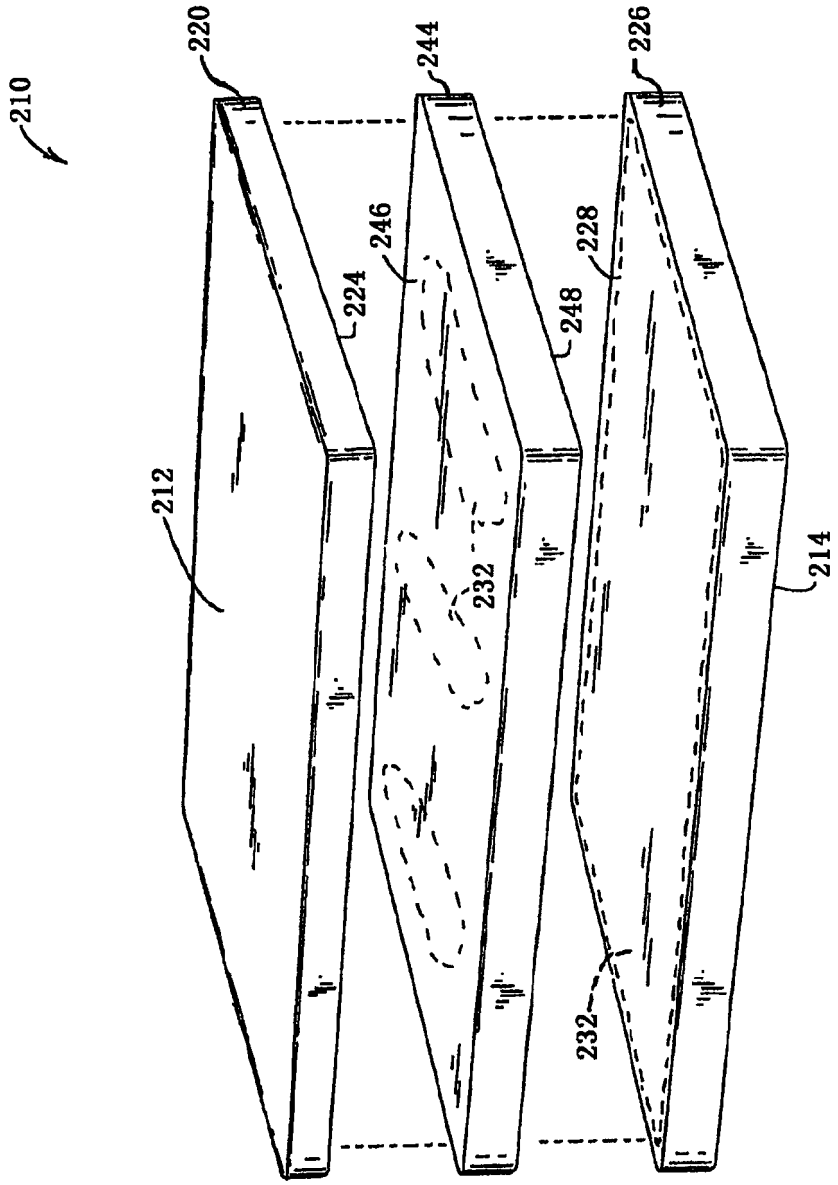

图 3