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Cushions and shoe insoles comprising elastomeric material and methods of forming same

Abstract

An insole for a shoe includes an insole body of elastomeric material having a first major surface and a second major surface opposite the first major surface. A distance between the first major surface and the second major surface is between about 1 mm and about 10 mm. The elastomeric material defines a plurality of voids extending through the elastomeric material from the first major surface to the second major surface. Each void has a dimension between about 1 mm and about 3 mm in a plane parallel at least one of to the first major surface and the second major surface. A minimum distance between adjacent voids is between about 0.5 mm and about 3 mm. A shoe insole includes such a cushion. A method of forming an insole for a shoe includes providing an elastomeric material within a mold to form an insole body of elastomeric material.

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Background/Summary

FIELD
(1) Embodiments of the present disclosure relate generally to cushions and cushioning materials comprising elastomeric materials.
BACKGROUND
(2) Cushioning materials have a variety of uses, such as for mattresses, seating surfaces, shoe inserts, packaging, medical devices, etc. Cushioning materials may be formulated and/or configured to reduce peak pressure on a cushioned body, which may increase comfort for humans or animals, and may protect objects from damage. Cushioning materials may be formed of materials that deflect or deform under load, such as polyethylene or polyurethane foams (e.g., convoluted foam), vinyl, rubber, springs, natural or synthetic fibers, fluid-filled flexible containers, etc. Different cushioning materials may have different responses to a given pressure, and some materials may be well suited to different applications. Cushioning materials may be used in combination with one another to achieve selected properties.
(3) For example, cushioning materials may include a foam layer topped with a layer of thermoset elastomeric gel, such as a polyurethane gel or a silicone gel. Because polyurethane gels and silicone gels are generally structurally weak and/or sticky, cushioning materials may include film covering such gels, such as a thin thermoplastic polyurethane film. The film may reinforce the strength of the gel, and may prevent other materials from sticking to the gel, since the film generally adheres to the gel but is not itself sticky.
(4) Gels may be used for cushioning and/or temperature management. Gels may provide cushioning because the gels may hydrostatically flow to the shape of a cushioned object and may tend to relieve pressure peaks. Gels may also reduce stresses from shear. Gels may have high thermal mass and/or thermal conductivity, and may therefore be used for heating (such as in hot packs for sore muscles), cooling (such as in cold packs for sprains or for a feeling of coolness when lying on a mattress or pillow), or maintaining a given temperature (such as in a mattress being used in a warm or cool room). For example, gel may be fused to the top of a mattress core, and a film may cover the gel. As another example, gels may be used as the top layer of a gel-on-foam wheelchair cushion.
(5) A conventional gel layer, with or without a plastic film, may be a barrier to gases (e.g., air,

vapors, or other gases). This barrier may cause difficulties such as discomfort, such as when body heat and/or perspiration accumulate between the user's body and the gel layer. Even when a breathable material (such as a cover comprising foam or batting fiber) is disposed between a cushioned object and the gel, gases can only travel laterally through the breathable material. Since gases cannot penetrate the plastic film or the gel, the plastic film or the gel inhibits the flow of the gases away from the cushioned object. When the weight of the cushioned object compresses the breathable material, the lateral gas flow paths may become more constricted.
BRIEF SUMMARY
(6) In some embodiments, an insole for a shoe includes a body including elastomeric material having a first major surface and a second major surface opposite the first major surface. A distance between the first major surface and the second major surface is between about 1 mm and about 10 mm. The elastomeric material defines a plurality of voids extending through the elastomeric material from the first major surface to the second major surface. Each void of the plurality has a dimension between about 1 mm and about 3 mm in a plane parallel to at least one of the first major surface and the second major surface. A minimum distance between adjacent voids of the plurality is between about 0.5 mm and about 3 mm.
(7) In some embodiments, a method of forming an insole for a shoe includes providing an elastomeric material within a mold to form an insole body of elastomeric material having a first major surface and a second major surface opposite the first major surface. A distance between the first major surface and the second major surface is between about 1 mm and about 10 mm. Portions of the mold occupy a plurality of voids extending through the elastomeric material from the first major surface to the second major surface. Each void of the plurality has a dimension between about 1 mm and about 3 mm in a plane parallel to at least one of the first major surface and the second major surface. A minimum distance between adjacent voids of the plurality is between about 0.5 mm and about 3 mm.
(8) In certain embodiments, a shoe includes an insole body having a non-gel component and a gel component adjacent the non-gel component. The gel component comprises a body of elastomeric material having a first major surface and a second major surface opposite the first major surface. A distance between the first major surface and the second major surface is between about 1 mm and about 10 mm. The gel component defines a plurality of voids extending through the gel component from the first major surface to the second major surface. Each void of the plurality has a dimension between about 1 mm and about 3 mm in a plane parallel to at least one of the first major surface and the second major surface. A minimum distance between adjacent voids of the plurality is between about 0.5 mm and about 3 mm.

Description

BRIEF DESCRIPTION OF THE DRAWINGS
(1) FIG. **1** is a simplified drawing showing a major surface of a cushioning element.
(2) FIG. **2** is simplified cross-sectional side view of the cushioning element shown in FIG. **1**.
(3) FIG. **3** is an expanded view showing a portion of the cushioning element of FIG. **1**.
(4) FIGS. **4-6** are simplified cross-sectional side views showing how the cushioning element of FIG. **1** may be formed in a mold.
(5) FIG. **7** is a simplified cross-sectional side view illustrating how cushioning elements may buckle.
(6) FIG. **8** is a simplified cross-sectional side views illustrating how cushioning elements may bulge.
(7) FIG. **9** is a simplified drawing showing an insole for a shoe.
(8) FIG. **10** shows a cross-section of a portion of the insole of FIG. **9** in more detail.

(9) FIG. **11** is a simplified drawing showing an insert for a shoe insole.
(10) FIGS. **12-14** are graphs illustrating test data obtained from various conventional insoles.
(11) FIG. **15** and FIG. **16** are graphs illustrating test data obtained from insoles comprising gel.

DETAILED DESCRIPTION

(12) As used herein, the term "cushioning element" means and includes any deformable device intended for use in cushioning one body relative to another. As a non-limiting example, cushioning elements (e.g., seat cushions) include materials intended for use in cushioning the body of a person relative to another object (e.g., a chair seat) that might otherwise abut against the body of the person.

(13) As used herein, the term "elastomeric polymer" means and includes a polymer capable of recovering its original size and shape after deformation. In other words, an elastomeric polymer is a polymer having elastic or viscoelastic properties. Elastomeric polymers may also be referred to as "elastomers" in the art. Elastomeric polymers include, without limitation, homopolymers (polymers having a single chemical unit repeated) and copolymers (polymers having two or more chemical units).

(14) As used herein, the term "elastomeric block copolymer" means and includes an elastomeric polymer having groups or blocks of homopolymers linked together, such as A-B diblock copolymers and A-B-A triblock copolymers. A-B diblock copolymers have two distinct blocks of homopolymers. A-B-A triblock copolymers have two blocks of a single homopolymer (A) each linked to a single block of a different homopolymer (B).

(15) As used herein, the term "plasticizer" means and includes a substance added to another material (e.g., an elastomeric polymer) to increase a workability of the material. For example, a plasticizer may increase the flexibility, softness, or extensibility of the material. Plasticizers include, without limitation, hydrocarbon fluids, such as mineral oils. Hydrocarbon plasticizers may be aromatic or aliphatic.

(16) As used herein, the term "elastomeric material" means and includes elastomeric polymers and mixtures of elastomeric polymers with plasticizers and/or other materials. Elastomeric materials are elastic (i.e., capable of recovering size and shape after deformation). Elastomeric materials include, without limitation, materials referred to in the art as "elastomer gels," "gelatinous elastomers," or simply "gels."

(17) As used herein, any relational term, such as "first," "second," "top," "bottom," etc., is used for clarity and convenience in understanding the disclosure and accompanying drawings, and does not connote or depend on any specific preference, orientation, or order, except where the context clearly indicates otherwise.

(18) As used herein, the term "and/or" means and includes any and all combinations of one or more of the associated listed items.

(19) The illustrations presented herein are not actual views of any particular material or device, but are merely idealized representations employed to describe embodiments of the present disclosure. Elements common between figures may retain the same numerical designation.

(20) The present disclosure describes cushioning elements including a gel (i.e., an elastomeric material) having voids extending through the gel. In response to an applied force, the gel may be configured to deform by bulging before the gel can buckle. Buckling occurs when a support member changes shape abruptly. When a support member buckles, the load it applies to a cushioned object decreases. The load on the cushioned object may be transferred to other support members, if any. Buckling is described generally in U.S. Pat. No. 7,730,566, "Multi-walled Gelastic Material," issued Jun. 8, 2010; and U.S. Pat. No. 8,919,750, "Cushioning Elements Comprising Buckling Walls and Methods of Forming Such Cushioning Elements," issued Dec. 30, 2014; the entire disclosure of each of which is hereby incorporated herein by reference. Bulging includes the deformation outward of a material, typically in all directions perpendicular to the applied force. Bugling is described generally in U.S. Pat. No. 3,997,151, "Modular Cushioning

Pad," issued Dec. 14, 1976. Cushioning elements that deform by buckling and bulging may be referred to as "semi-buckling, semi-bulging."

(21) FIG. **7** illustrates cushioning element members **2**, **4**, **6**, **8** that buckle when a force is applied (i.e., to the top and bottom of the members **2**, **4**, **6**, **8**, in the orientation of FIG. **7**). For example, member **2** is illustrated buckling approximately in half. Member **4** is illustrated buckling at multiple points, such that a center portion of the member **4** folds over itself. Members **6** and **8** are illustrated buckling outward, in opposite directions as one another. In other embodiments, members may buckle toward one another.

(22) FIG. **8** illustrates cushioning members **10** that bulge when a force is applied (i.e., to the top and bottom of the members **10**, in the orientation of FIG. **8**). The cross section of the members **10** increases in the middle as the height of the material shrinks. Cushioning elements disclosed herein may exhibit bulging characteristics. Such cushioning elements may offer enough resistance to withstand relatively high levels of force in a concentrated area.

(23) FIG. **1** is a simplified drawing showing a major surface (e.g., a top or bottom surface) of a cushioning element **102**. FIG. **2** is simplified cross-sectional side view of the cushioning element **102**. FIG. **3** is an expanded view showing a portion **103** of the cushioning element **102**. The cushioning element **102** includes a gel **105** that defines voids **104** extending through the cushioning element **102** from a first major surface **106**, referred to for simplicity as a top surface **106**, to a second major surface **108**, referred to for simplicity as a bottom surface **108**. The cushioning element **102** may be in any orientation, and the top surface **106** and bottom surface **108** need to be located at the top and bottom, respectively.

(24) The gel **105** may be a gel or elastomeric material as described in, for example, U.S. Pat. No. 5,994,450, "Gelatinous Elastomer and Methods of Making and Using the Same and Articles Made Therefrom," issued Nov. 30, 1999; U.S. Pat. No. 7,964,664, "Gel with Wide Distribution of MW in Mid-Block" issued Jun. 21, 2011; U.S. Pat. No. 4,369,284, "Thermoplastic Elastomer Gelatinous Compositions" issued Jan. 18, 1983; U.S. Pat. No. 8,919,750, "Cushioning Elements Comprising Buckling Walls and Methods of Forming Such Cushioning Elements," issued Dec. 30, 2014; the entire disclosures of each of which are incorporated herein by this reference. The gel **105** may include an elastomeric polymer and a plasticizer. The gel **105** may be a gelatinous elastomer, a thermoplastic elastomer, a natural rubber, a synthetic elastomer, a blend of natural and synthetic elastomers, etc.

(25) The gel **105** may include an A-B-A triblock copolymer such as styrene ethylene propylene styrene (SEPS), styrene ethylene butylene styrene (SEBS), and styrene ethylene ethylene propylene styrene (SEEPS). For example, A-B-A triblock copolymers are currently commercially available from Kuraray America, Inc., of Houston, TX, under the trade name SEPTON® 4055, and from Kraton Polymers, LLC, of Houston, TX, under the trade names KRATON® E1830, KRATON® G1650, and KRATON® G1651. In these examples, the "A" blocks are styrene. The "B" block may be rubber (e.g., butadiene, isoprene, etc.) or hydrogenated rubber (e.g., ethylene/propylene, ethylene/butylene, ethylene/ethylene/propylene, etc.) capable of being plasticized with mineral oil or other hydrocarbon fluids. The gel **105** may include elastomeric polymers other than styrene-based copolymers, such as non-styrenic elastomeric polymers that are thermoplastic in nature or that can be solvated by plasticizers or that are multi-component thermoset elastomers.

(26) The gel **105** may include one or more plasticizers, such as hydrocarbon fluids. For example, the gel **105** may include aromatic-free food-grade white paraffinic mineral oils, such as those sold by Sonneborn, Inc., of Mahwah, NJ, under the trade names BLANDOL® and CARNATION®.

(27) In some embodiments, the gel **105** may have a plasticizer-to-polymer ratio from about 0.1:1 to about 50:1 by weight. For example, the gel **105** may have a plasticizer-to-polymer ratio from about 1:1 to about 30:1 by weight, or even from about 1.5:1 to about 10:1 by weight. In further embodiments, the gel **105** may have a plasticizer-to-polymer ratio of about 4:1 by weight.

(28) The gel **105** may have one or more fillers (e.g., lightweight microspheres). Fillers may affect

thermal properties, density, processing, etc., of the gel **105**. For example, hollow microspheres (e.g., hollow glass microspheres or hollow acrylic microspheres) may decrease the thermal conductivity of the gel **105** by acting as an insulator because such hollow microspheres (e.g., hollow glass microspheres or hollow acrylic microspheres) may have lower thermal conductivity than the plasticizer or the polymer. As another example, metal particles (e.g., aluminum, copper, etc.) may increase the thermal conductivity of the resulting gel **105** because such particles may have greater thermal conductivity than the plasticizer or polymer. Microspheres filled with wax or another phase-change material (i.e., a material formulated to undergo a phase change near a temperature at which a cushioning element may be used) may provide temperature stability at or near the phase-change temperature of the wax or other phase-change material within the microspheres (i.e., due to the heat of fusion of the phase change). The phase-change material may have a melting point from about 20° C. to about 45° C.
(29) The gel **105** may also include antioxidants. Antioxidants may reduce the effects of thermal degradation during processing or may improve long-term stability. Antioxidants include, for example, pentaerythritol tetrakis(3-(3,5-di-tert-butyl-4-hydroxyphenyl) propionate), commercially available as IRGANOX® 1010, from BASF Corp., of Iselin, NJ or as EVERNOX®-10, from Everspring Corp. USA, of Los Angeles, CA; octadecyl-3-(3,5-di-tert-butyl-4 -hydroxyphenyl)propionate, commercially available as IRGANOX® 1076, from BASF Corp. or as EVERNOX® 76, from Everspring Chemical; and tris(2,4-di-tert-butylphenyl)phosphite, commercially available as IRGAFOS® 168, from BASF Corp. or as EVERFOS™ 168, from Everspring Chemical. One or more antioxidants may be combined in a single formulation of elastomeric material. The use of antioxidants in mixtures of plasticizers and polymers is described in columns 25 and 26 of U.S. Pat. No. 5,994,450, previously incorporated by reference. The gel **105** may include up to about 5 wt % antioxidants. For instance, the gel **105** may include from about 0.10 wt % to about 1.0 wt % antioxidants.
(30) In some embodiments, the gel **105** may include a resin. The resin may be selected to modify the elastomeric material to slow a rebound of the cushioning element **102** after deformation. The resin, if present, may include a hydrogenated pure monomer hydrocarbon resin, such as those commercially available from Eastman Chemical Company, of Kingsport, TN, under the trade name REGALREZ®. The resin, if present, may function as a tackifier, increasing the stickiness of a surface of the gel **105**.
(31) In some embodiments, the gel **105** may include a pigment or a combination of pigments. Pigments may be aesthetic and/or functional. That is, pigments may provide the cushioning element **102** with an appearance appealing to consumers. In addition, a cushioning element **102** having a dark color may absorb radiation differently than a cushioning element **102** having a light color.
(32) The gel **105** may include any type of gelatinous elastomer. For example, the elastomeric material may include a melt-blend of one part by weight of a styrene-ethylene-ethylene-propylene-styrene (SEEPS) elastomeric triblock copolymer (e.g., SEPTON® 4055) with four parts by weight of a 70-weight straight-cut white paraffinic mineral oil (e.g., CARNATION® white mineral oil) and, optionally, pigments, antioxidants, and/or other additives.
(33) The gel **105** may include a material that may return to its original shape after deformation, and that may be elastically stretched. The gel **105** may be rubbery in feel, but may deform to the shape of an object applying a deforming pressure better than conventional rubber materials, and may have a durometer hardness lower than conventional rubber materials. For example, the gel **105** may have a hardness on the Shore A scale of less than about 50, from about 0.1 to about 50, or less than about 5.
(34) In an undeformed state, the cushioning element **102** may have a thickness between about 1 mm and about 10 mm. That is, a distance between the top surface **106** and the bottom surface **108** may be between about 1 mm and about 10 mm In some embodiments, the cushioning element **102**

may have a thickness between about 1.5 mm and about 7 mm, or between about 2 mm and about 3 mm.
(35) The voids **104** are depicted in FIG. **1** as cylindrical (i.e., having a circular cross-section in the planes of the top surface **106** and the bottom surface **108**), but may have any selected shape. For example, the voids **104** may have cross sections that are triangular, square, rectangular, trapezoidal, rhomboidal, hexagonal, squares intermingled with octagons, etc.
(36) As shown in FIG. **3**, in an undeformed state, the voids **104** may have a maximum dimension x in the planes of the top surface **106** and the bottom surface **108**. For cylindrical voids **104**, the maximum dimension x is the diameter. For other shapes, the maximum dimension x may be the length of a side, the length of a diagonal, etc. The maximum dimension x may be between about 1 mm and about 3 mm, such as between about 1.5 mm and about 2.5. In some embodiments, the maximum dimension x may be about 2 mm.
(37) As shown in FIG. **3**, in an undeformed state, the voids **104** may be separated by the gel **105**, such that a minimum distance y between adjacent voids **104** is between about 0.5 mm and about 3 mm, such as between about 0.8 mm and 1.5 mm. For example, the minimum distance y may be about 1.2 mm.
(38) The distance x+y is the center-to-center distance between adjacent voids **104**, which may be between about 1.5 mm and about 6 mm, such as between about 2.0 mm and 4.0 mm. For example, the distance x+y may be about 3.0 mm. The ratio of x to the thickness may be selected to be low enough that the gel **105** does not buckle when a force is applied to the cushioning element **102**. That is, thicker cushioning elements **102** may need relatively thicker walls to prevent buckling.
(39) In an undeformed state, each void **104** may have a major axis perpendicular to each of the top surface **106** and the bottom surface **108**. For example, if the voids **104** have a circular cross-section, as shown in FIGS. **1** and **3**, the voids **104** may be right circular cylinders. The voids **104** may each have a uniform cross-sectional area in each plane parallel to the top surface **106** and/or the bottom surface **108** when the cushioning element **102** is in an undeformed state.
(40) When the cushioning element **102** is in an undeformed state, the volume of the voids **104** may be between about 25% and about 40% of the total volume of the cushioning element **102** (i.e., the volume between the top surface **106** and the bottom surface **108**). For example, the volume of the voids **104** may be between about 30% and about 35% of the total volume of the cushioning element **102**.
(41) The thickness of the cushioning element **102**, the maximum dimension x of the voids **104**, and the minimum distance y between adjacent voids **104** may be selected such that when a force is applied to the cushioning element **102** in a direction perpendicular to the top surface **106** (or a force having a component perpendicular to the top surface), a portion of the gel **105** bulges to deform or collapse voids **104** in the vicinity of the applied force before the top surface **106** bottoms out against the bottom surface **108**. The voids **104** may be large enough to allow the gel **105** to bulge, but too small for the gel **105** to buckle. Thus, the load on the cushioning element **102** may spread over a larger area, decreasing maximum pressure and increasing comfort (if the cushioned object is a human or other animal).
(42) In some embodiments, the cushioning element **102** may include a non-gel material secured to the gel **105**. For example, and as shown in FIG. **2**, the cushioning element **102** may include a material **110**, such as a fabric, a foam, a polymer sheet, etc. The material **110** may be secured to the gel **105** by an adhesive, or may be melt-bonded or held in place by friction. In certain embodiments, the gel **105** may be secured to the material **110** by overmolding, without physical interlocking of the material **110** and the gel **105**.
(43) The cushioning elements **102** may be used, as non-limiting examples, as shoe insoles; shoe midsoles; sock liners; foot beds of any kind; wrist rests; bathroom mats (often referred to as bath mats) for use, for example, near a shower, bathtub, or sink; mats for use near a toilet; mats for use near a kitchen sink (often referred to as kitchen mats); standing mats for cashiers or clerks in retail

stores or machinists or other machine attendants in manufacturing (often referred to as anti-fatigue mats); seat cushions; yoga mats; mats for use in kneeling during prayer or religious acts or services (often known as prayer mats); mats for landing in sporting events such as gymnastics or track and field; carpet pad; flooring; area rugs, pads, and mats; zabutons for kneeling or sitting; seat cushions; personal exercise pads; pads for use during weight lifting; martial arts mats; wearable impact pads for sports and martial arts; martial arts pads for punching or kicking; mats for the prevention of injury to the body if the body falls out of bed; mats for use by horses in moving horse trailers; and cushions for shipping sensitive electronic components.

(44) The cushioning element **102** may be formed in a mold structured and adapted to receive a gel material (e.g., a liquid form of the gel **105** or a precursor to the gel **105**) and form the gel material into the shape of the cushioning element **102**. For example, and as shown in FIG. **4**, if the cushioning element **102** to be formed will include a material **110** bonded to gel **105**, the material **110** may be placed between sections **202**, **204** of a mold **206**. The sections **202** may have complementary shapes, such that when the sections **202**, **204** are pressed together, as shown in FIG. **5**, the material **110** conforms to the shape of the mold **206**. The mold **206** may include walls and surfaces configured to define the voids **104** of the cushioning element **102** shown in FIGS. **1** through **3**.

(45) A gel material may be provided within the mold **206** to form the cushioning element **102**. For example, the gel **105** may formed by heating an A-B-A triblock copolymer and any other components, as described above, and injecting the gel material into the mold **206**. Injection molding is described in, for example, U.S. Pat. No. 9,446,542, “Small Footprint Apparatus, Method, and Tooling for Molding Large Thermoplastic Parts,” issued Sep. 20, 2016, the entire disclosure of which is incorporated herein by reference. If the mold **206** contains a material **110**, molten gel may at least partially penetrate the material **110** (e.g., permeate between fibers of a fabric or permeate pores of a porous material). In some embodiments, the molten gel may penetrate the material **110** entirely, such that the molten gel may flow across the material **110** through the mold **206**.

(46) In some embodiments, pressure may be used to assist the gel material to permeate the mold **206**, including fibers and/or pores of the material **110** and/or to assist in overmolding adhesion, and to shape the component to a selected end shape. The mold **206** may be used to shape the gel material in the desired final shape of the gel segments or gel pattern as well as the overall shape of the final cushioning element **102**. For example, the sections **202**, **204** may define a flat interior with beveled edges. In some embodiments, the gel may be molded in such as a way that the molten gel is provided into the mold **206** on the same side of the material **110** as it may reside after cooling. In other embodiments, the molten gel may be provided into the mold **206** in such a way as to pass through the material **110** and into mold cavities on the other side of the material **110**, and this passing through may be in part enabled by the porosity of the material **110** or by tearing or otherwise parting the material **110**. In some embodiments, an injection molding process may be used to force the gel under pressure into the mold cavities and into the pores of the material **110** or against the material **110** in overmolding.

(47) As the gel cools, the gel may bond to the material **110**. After the gel cools, the cushioning element **102** may be removed from the mold **206** by separating the sections **202**, **204** of the mold **206**, as shown in FIG. **6**. For example, separation of the sections **202**, **204** may leave the cushioning element **102** attached to one section **202**. The cushioning element **102** may subsequently be removed from the section **202**, as shown in FIG. **2**.

(48) In some embodiments, a precursor to the gel **105**, formulated to react upon exposure to heat, pressure, humidity, etc., may be provided in the mold **206**, and the gel **105** may form within the mold **206**. For example, the precursor may include a curative, such that the precursor will cure without exposure to heat, pressure, humidity, etc. The precursor may react to form cross-linking bonds between polymeric chains. Before curing, the precursor may be pourable, such that the mold

206 may be easily filled with elastomeric precursor.

(49) In other embodiments, the gel **105** may be heated and cooled reversibly. In such embodiments, the gel **105** may be provided into the mold **206** in excess of the amount needed to form the cushioning element **102**. The gel **105** may be cooled, and the cushioning element **102** and any excess material may be removed from the mold **206**. The excess material may be separated from the cushioning element **102**, remelted, and reused to form another cushioning element **102** (e.g., by re-injecting the gel **105** into the mold **206**). A gel **105** that may be heated and cooled reversibly may be advantageously used because excess material is not wasted. Thus, cushioning elements **102** may be formed with relatively lower average material costs than cushioning elements formed with materials that cannot be reused. Furthermore, the cushioning elements **102** may be formed having higher quality if the gel material can be pushed into and through the mold **206** without regard for wasting excess gel material. That is, flushing gel material through the mold **206** may help to ensure the gel material fills the entire mold **206**, without leaving air bubbles (which would tend to form additional voids, which would cause the cushioning element **102** to have different properties). Also, the cushioning elements **102** may be formed with fewer processing steps as compared to conventional cushioning elements, such as by eliminating the need to separately locate and bond the material **110** to the gel **105** after formation thereof.

(50) In some embodiments, the material **110** may be provided in a roll, and the material **110** may be moved as or after injection molding shots are performed. The gel **105** may be configured to be applied with no gaps between shots. In certain embodiments, there may be gel-on-gel overlapping or overmolding so that the gel **105** will be continuous on the material **110** in the rolling direction. For example, a continuous carpet pad or continuous carpet with integral gel pad may be made in this manner.

(51) The material **110** may be trimmed by for example cutting around the exterior of the gel **105**, to form a mat. Piping or other binding or sewing may be used to ‘trim’ the edges of the mat, or it may be left as cut. The cut may be in the material **110** away from the edge of the gel **105**, or at the perimeter of the gel **105**, or through part of the gel **105**, etc. It may be easier to sew piping on if the cut is a slight distance from the gel **105** so that sewing machine needles may not need to penetrate the gel **105**. In another embodiment, no fabric or non-gel material is applied between the plates in the molding process, and the molten gel fills the cavity, is cooled in the mold **206**, and is removed from the mold **206** as semi-bulging, semi-buckling gel with no other materials.

(52) The overall shape of the mold **206** may advantageously provide benefits and aesthetics. For example, though a mold **206** could be used to make a cushioning element **102** as a flat shoe insole with perpendicular edges, it may be more aesthetic and more comfortable for the user if the edges are beveled or otherwise shaped to not abruptly end in a plane corresponding to the mold opening direction. The force of the molding pressure may form the material **110** into a desired shape which may be part of the mold's cavity shape, and the solidifying of the gel **105** may cause the material **110** to stay generally in that shape when the mold **206** opens. A 45-degree flat bevel may be used, or any other angle, or a curved-surface bevel may be used, or any other edge shape. The cushioning element **102** may not be flat, but may be shaped for any selected use. For example, the cushioning element **102** may include a raised arch support, a heel cup or another contour to accommodate a human foot. Because injection molds (as opposed to poured-gel casting molds) may be shaped to nearly limitless shapes, and because the material **110** may be forced from an original flat shape to conform to the mold's shape and stay there due to permanent stretching during molding and/or the shape of the gel **105** after solidification, cushioning elements **102** formed as described need not be flat on any side, but may have nearly any selected end shape.

(53) It has been a surprising result that the molten gel may in some embodiments be inserted into a mold **206** on the side of the material **110** (often fabric) opposite the side where the gel **105** may reside. The molten gel may also be injected onto the side of the material **110** on which the gel **105** may reside in the finished product. In either case, the molding pressure may be sufficient to partly

or fully penetrate the porosity of the material **110** immediately adjacent to the gel **105** of the cushioning element **102**.

(54) In some embodiments, the material **110** may be a laminated non-gel component having an outer material (e.g., a non-porous material) laminated to an inner material (e.g., a material porous enough for the gel to penetrate and interlock, or a material to which gel can overmold). Such a laminated material may be formed by any selected method, including adhesive bonding, thermal bonding, welding, etc. In certain embodiments, the outer material may be more porous than the inner material.

(55) For some applications, it may be necessary to cover the gel **105** of the cushioning element **102** on both sides with a non-gel material, such as foam or fabric. For example, a shoe insole may benefit from a bottom scrim layer (i.e., a reinforcement) to maintain the shape of the insole and adhere the insole to surfaces such as a shoe outsole or midsole. A shoe insole may also benefit from a fabric covering on the top of the gel **105** to provide moisture wicking, to guard against dirt or other undesirable substances sticking to the gel **105**, and to improve a user's experience in donning or removing a shoe with gel inside (e.g., because the gel can be excessively grippy against socks). In order to achieve layers of covering on both sides of the gel **105**, one or both sides of the gel **105** may be laminated using pressure and heat, or one or both sides may be adhered during the molding process.

(56) In some embodiments, where the gel **105** is adhered to another surface, such as a midsole or an outsole, the cushioning element **102** may be glued completely or only in strategic places. For example, if the cushioning element **102** has a stiff scrim on one side to help it maintain its shape, gluing the cushioning element **102** in one place, (e.g., the heel of an insole) may be sufficient to keep the cushioning element **102** in place. This may provide for simplified and less expensive manufacturing processes due to decreased amounts of glue or other adhesive being required, and a smaller surface area on which to manage coverage of the adhesive.

(57) FIG. **9** is a simplified drawing showing an insole **302** for a shoe. The insole **302** includes cushioning elements **304**, **306**, which may include a gel material as described above. The cushioning elements **304**, **306** may be secured within a non-gel component **308**. The non-gel component **308** of the insole **302** may include, for example, poly ethylene-vinyl acetate (EVA) or foam. The cushioning elements **304**, **306** may be in patches throughout the insole **302**, such as in a heel area, an arch area, or other selected portions of the insole **302**. For example, the non-gel component **308** may laterally surround each of the cushioning elements **304**, **306**. In other embodiments, an insole may consist essentially of a gel cushioning element, without a lateral non-gel component (with or without a cover above or below the gel cushioning element). FIG. **10** shows a cross-section of a portion of the insole **302** in more detail. The cushioning element **304** is shown in a center portion of the insole **302**, such that the cushioning element **304** may support the majority of the load (i.e., force) of a foot resting on the insole. The edges of the insole **302** may be tapered to fit the shoe, and may carry a relatively small portion of the load under normal use. To fasten the cushioning elements **304**, **306** to the non-gel component **308**, the cushioning elements **304**, **306** may be adhered using an adhesive such as glue. In some embodiments, a cover material, such as a fabric liner, may be adhered over the top of the cushioning elements **304**, **306** and fastened to the non-gel component **308** surrounding the cushioning elements **304**, **306**.

(58) FIG. **11** is a simplified drawing showing an insert **402** for a shoe insole **404**. The insert **402** may be configured to be disposed within a slot or pocket **406** within the insole **404**. The insert **402** may be modular, such that a different insert **402′** may be used instead of or in addition to the insert **402**. Inserts **402**, **402′** may be selected to have different thicknesses or different cushioning properties. The shape or cushioning properties of the insole **404** may be changed by exchanging one insert **402**, **402′** (or group thereof) for another. Thus, the insole **404** may be changed to accommodate different users or different applications (e.g., walking vs. running). Furthermore, a user may try different inserts **402**, **402′** as his or her leisure, and may change to different inserts

402, **402′** as necessary to find a comfortable fit.

(59) The inserts **402**, **402′** may be made partially or entirely of gel, as described above. In some embodiments, a portion of the insole **404** near the pocket **406** may also be made of gel, such that when the inserts **402**, **402′** are inserted into the pocket **406**, the inserts **402**, **402′** tend to stick to the walls of the pocket **406**. The tacky nature of the gel may prevent the inserts **402**, **402′** from slipping with respect to the pocket **406** once the insert **402** is placed into a shoe. In addition, the pliable nature of gel may enable the pocket **406** to accommodate different sizes of inserts **402**, **402′** effectively. One benefit of insoles **404** having modular inserts **402**, **402′** is that manufacturers and retailers can limit the number of unique packages (SKUs or stock keeping units), since a single package having multiple inserts **402**, **402′** can accommodate a wider variety of users than a single unitary insole.

EXAMPLES

Comparative Example 1: Conventional Insoles

(60) FIGS. **12-16** illustrate test data obtained from various insoles having a thickness of about 3 mm. To obtain the data shown in FIGS. **12-14**, three different commercially available memory-foam insoles were tested to determine the amount of force the insoles could support as a function of compression depth. The force was applied over an area of 0.75 square inches. In each case, an inflection point appears in the curve, indicating buckling of the material and a relatively abrupt change in how the insoles would feel in use.

Example 2: Formation and Use of a Mold

(61) A mold was made by machining cavities into a lower plate (as an example, see the lower section **204** of the mold **206** shown in FIG. **4**). An upper plate (as an example, see the upper section **202** of the mold **206** shown in FIG. **4**) was made that when fitted to the lower plate completes the overall shape of the gel component to be formed and completes the cavities for the gel. A mixture of one part by weight SEPTON® 4055 SEEPS polymer and three parts by weight Carnation Oil (a 70-weight straight-cut white paraffinic mineral oil) were combined with 0.25% by weight IRGANOX® 1070 antioxidant (available from BASF Corp., of Iselin, NJ), 0.25% by weight IRGAFOS® 168 antioxidant (available from BASF Corp.), and 0.25% by weight Horizon Blue aluminum lake pigment (available from Day-Glo Color Corp., of Cleveland, OH). The mixture was passed through a heated extruder to melt-blend the material, then pumped into a piston heated above the melt temperature of the gel. A fabric was inserted between the two plates, which were temperature-controlled, and the plates were closed onto the fabric (see FIG. **5**). The heated piston was connected to a heated pipe connected to a heated sprue-and-runner system in one of the plates to allow gel to flow into the cavities of the lower plate. The piston was driven forward so that the molten gel filled the cavities and permeated the fabric under pressure.

(62) After the molten gel filled the mold cavity and penetrated into the fabric, the gel was cooled. The plates were separated (see FIG. **6**), and the fabric with molded gel was lifted out of the mold.

Example 3: Gel Cushioning Insole

(63) An insole was formed having similar dimensions as the insoles tested in Example 1. The insole was formed of a gel material about 3 mm thick using a mold as described in Example 2. The gel material had cylindrical voids approximately 2 mm in diameter, with a minimum distance y (see FIG. 3) of approximately 1.2 mm. The voids constituted approximately 33% of the volume of the insole in an undeformed state. The insole was subjected to the same test described in Example 1. The data depicted in FIG. **15** appear to lack an inflection point. Thus, the gel material of the insole appears to bulge, limiting the effect of any buckling that may occur.

Example 4: Gel Cushioning Insole

(64) An insole was formed and tested as described in Example 3, except that the gel material was about 13 mm thick. The data depicted in FIG. **16** show an inflection point. This indicates that the gel material buckled. Without being bound to any particular theory, it appears that the thickness of the material, in combination with the other dimensions and properties of the gel, determines

whether the gel material buckles. To avoid an abrupt change in the force applied to a user of the insole due to buckling, the thickness of the insole may be selected to be below a threshold at which the inflection point appears.

(65) Again without being bound to any particular theory, it appears that the insole of Example 3 lacks an inflection point because the voids in the gel allow the gel room to bulge in different directions. In contrast, when gel is solid and constrained, it lacks a place to deform into as force is applied. Therefore, such a gel may feel hard and non-conforming, despite its soft, pliable nature. In Example 3, the gel can bulge on the outside, but the walls of the internal voids can also bulge into the surrounding voids, which may enable better cushioning by providing a space into which the gel can deform. Such internal deformation may occur even if the gel is constrained by a boundary on the outside. Conventional formed gel, or gel with molded-in voids (such as hollow columns or gaps between gel segments or gel with a geometric pattern embossed in) may be effective in cushioning, and may be less expensive than solid gel because less gel material may be used, but may not provide adequate force deflection when pressure is applied on a small surface area. In order to achieve adequate force deflection for small pressure points, the voids may be selected to be small enough and the walls thick enough that the walls cannot buckle before bulging into adjacent voids.

(66) Buckling alone may be undesirable because at the point in time when the material collapses, the user feels an abrupt change in pressure. Furthermore, buckling material may bottom out at the time of collapse. Material that bulges may provide benefits such as pressure equalization, vibration attenuation, and shock absorption.

(67) One property of a solid mass of gel (i.e., without voids) that may be desirable in some products is that residue, dirt, water/liquid, or other substances may be prevented from entering the gel component. This effect may be achieved with the gel materials having voids as described herein at least in part by adding a solid gel “skin” at the interface between the gel and a non-gel component, and the skin may be integrally formed with the remainder of the gel. In such a case, the skin may be the portion of the overall gel component which is interlocked with or overmolded onto the non-gel component.

(68) In some embodiments, the molding of semi-buckling, semi-bulging gel or any other gel configuration with internal spaces or voids creates a pattern on the outside of an adjacent non-gel component. For example, round-holed semi-buckling, semi-bulging gel may create an aesthetically desirable design pattern that would enhance the branding or look of a shoe into which it is placed.

(69) In some embodiments, the edge of a non-gel component may, even after trimming to final product dimensions, be encapsulated in gel, such as a gel border. This may be desirable from an aesthetic standpoint, and may have functional benefits (e.g., as discussed above with respect to a skin). The gel may be passed through or around the edges of the fabric and then trimmed, or the fabric may be trimmed before molding and located precisely in a mold by locating pins or other means.

(70) The gel components may be in whole or in part waterproof, water resistant, and/or washable with or without soap/detergent by hand or machine.

(71) The gel components may be of any color, and gels may be water-clear and effectively colorable by dyes and/or pigments.

(72) The gel components may have members that extend laterally (e.g., parallel with the generally flat standing surface of an insole) through the voids within the gel. For example, there may be cross beams running diagonally from corner to corner that are not as thick as the hollow columns are tall, and these cross beams of gel may serve to stiffen or stabilize the insole so that the gel may have less tendency to deform in one direction under pressure, which may cause irritation to a human foot. The skins mentioned above in some embodiments may also effectively serve to stiffen the insole laterally, and may be considered as a laterally extending member as described in this paragraph.

(73) Additional non limiting example embodiments of the disclosure are described below.

(74) Embodiment 1: An insole for a shoe comprising an insole body comprising elastomeric material having a first major surface and a second major surface opposite the first major surface. A distance between the first major surface and the second major surface is between about 1 mm and about 10 mm. The elastomeric material defines a plurality of voids extending through the elastomeric material from the first major surface to the second major surface. Each void of the plurality has a dimension between about 1 mm and about 3 mm in a plane parallel to at least one of the first major surface and the second major surface. A minimum distance between adjacent voids of the plurality is between about 0.5 mm and about 3 mm.
(75) Embodiment 2: The insole of Embodiment 1, wherein when a force is applied to the insole body in a direction perpendicular to the first major surface, a portion of the elastomeric material bulges to collapse voids in a vicinity of the applied force before the first major surface bottoms out against the second major surface.
(76) Embodiment 3: The insole of Embodiment 1 or Embodiment 2, wherein the elastomeric material is coupled to another component having a material composition differing from a material composition of the elastomeric material.
(77) Embodiment 4: The insole of Embodiment 3, wherein the body of elastomeric material is coupled to the another component by an adhesive.
(78) Embodiment 5: The insole of Embodiment 3, wherein the elastomeric material is melt-bonded to the another component.
(79) Embodiment 6: The insole of any of Embodiments 3 through 5, wherein the another component comprises a fabric.
(80) Embodiment 7: The insole of any of Embodiments 1 through 6, wherein each void of the plurality has a major axis perpendicular to each of the first major surface and the second major surface.
(81) Embodiment 8: The insole of any of Embodiments 1 through 7, wherein each void of the plurality has a uniform cross-sectional area in each plane parallel to each of the first major surface and the second major surface when the cushion is in an undeformed state.
(82) Embodiment 9: The insole of any of Embodiments 1 through 8, wherein a volume of the voids is between about 25% and about 40% of a volume between the first major surface and the second major surface.
(83) Embodiment 10: The insole of any of Embodiments 1 through 9, wherein a distance between the first major surface and the second major surface is between about 2 mm and about 3 mm.
(84) Embodiment 11: The insole of any of Embodiments 1 through 10, wherein each void of the plurality has a dimension between about 1.5 mm and about 2.5 mm in a plane parallel to at least one of the first major surface and the second major surface.
(85) Embodiment 12: The insole of any of Embodiments 1 through 11, wherein a minimum distance between adjacent voids of the plurality is between about 0.8 mm and about 1.5 mm.
(86) Embodiment 13: The insole of any of Embodiments 1 through 12, wherein the elastomeric material comprises an A-B-A triblock copolymer.
(87) Embodiment 14: The insole of Embodiment 13, wherein the elastomeric material further comprises a plasticizer.
(88) Embodiment 15: The insole of Embodiment 14, wherein a ratio of a weight of the plasticizer to a weight of the triblock copolymer is from about 0.1 to about 50.
(89) Embodiment 16: A shoe comprising an insole of any of Embodiments 1 through 15.
(90) Embodiment 17: A method of forming an insole for a shoe, comprising providing an elastomeric material within a mold to form an insole body comprising elastomeric material having a first major surface and a second major surface opposite the first major surface. A distance between the first major surface and the second major surface is between about 1 mm and about 10 mm. Portions of the mold occupy a plurality of voids extending through the elastomeric material from the first major surface to the second major surface. Each void of the plurality has a dimension

between about 1 mm and about 3 mm in a plane parallel to at least one of the first major surface and the second major surface. A minimum distance between adjacent voids of the plurality is between about 0.5 mm and about 3 mm.

(91) Embodiment 18: The method of Embodiment 17, wherein providing an elastomeric material within a mold comprises injection molding the elastomeric material within the mold.

(92) Embodiment 19: The method of Embodiment 17 or Embodiment 18, further comprising at least partially penetrating a fabric with the elastomeric material.

(93) Embodiment 20: The method of any of Embodiments 17 through 19, further comprising solidifying the elastomeric material within the mold.

(94) Embodiment 21: The method of Embodiment 20, further comprising melting at least a portion of the solidified elastomeric material and reusing the melted elastomeric material.

(95) Embodiment 22: A shoe comprising: an insole body comprising a non-gel component and a gel component adjacent the non-gel component. The gel component comprises a body of elastomeric material having a first major surface and a second major surface opposite the first major surface. A distance between the first major surface and the second major surface is between about 1 mm and about 10 mm. The gel component defines a plurality of voids extending through the gel component from the first major surface to the second major surface. Each void of the plurality has a dimension between about 1 mm and about 3 mm in a plane parallel to at least one of the first major surface and the second major surface. A minimum distance between adjacent voids of the plurality is between about 0.5 mm and about 3 mm.

(96) Embodiment 23: The shoe insole of Embodiment 22, wherein the gel component is disposed within a pocket within the body comprising the non-gel component.

(97) Embodiment 24: The shoe insole of Embodiment 22 or Embodiment 23, wherein the non-gel component comprises poly ethylene-vinyl acetate.

(98) Embodiment 25: The shoe insole of any of Embodiments 22 through 24, wherein the non-gel component comprises foam.

(99) Embodiment 26: The shoe insole of any of Embodiments 22 through 25, further comprising a fabric over the non-gel component and the gel component.

(100) Embodiment 27: The shoe insole of any of Embodiments 22 through 26, further comprising a scrim layer under the non-gel component and the gel component.

(101) Embodiment 28: A cushioning element comprising a body of elastomeric material having a first major surface and a second major surface opposite the first major surface. A distance between the first major surface and the second major surface is between about 1 mm and about 10 mm. The elastomeric material defines a plurality of voids extending through the elastomeric material from the first major surface to the second major surface. Each void of the plurality has a dimension between about 1 mm and about 3 mm in a plane parallel to at least one of the first major surface and the second major surface. A minimum distance between adjacent voids of the plurality is between about 0.5 mm and about 3 mm.

(102) Embodiment 29: A cushioning element comprising a body of elastomeric material having a first major surface and a second major surface opposite the first major surface. The elastomeric material defines a plurality of voids extending through the elastomeric material from the first major surface to the second major surface. When a force is applied to the cushioning element, the elastomeric material bulges to at least partially fill some of the voids, but does not buckle.

(103) While the present invention has been described herein with respect to certain illustrated embodiments, those of ordinary skill in the art will recognize and appreciate that it is not so limited. Rather, many additions, deletions, and modifications to the illustrated embodiments may be made without departing from the scope of the invention as hereinafter claimed, including legal equivalents thereof. In addition, features from one embodiment may be combined with features of another embodiment while still being encompassed within the scope of the invention as

contemplated by the inventors. Further, embodiments of the disclosure have utility with different and various cushion types and configurations.

Claims

1. An insole for a shoe, comprising: a substantially non-gel component; and a gel component comprising: a plasticizer extended A-B-A triblock copolymer having a first major surface and a second major surface opposite from the first major surface, the plasticizer extended A-B-A triblock copolymer defining a plurality of voids extending completely through the gel component, from the first major surface to the second major surface, a distance across each void of the plurality of voids measured in a plane parallel to at least one of the first major surface and the second major surface, a distance between adjacent voids of the plurality of voids, the plasticizer extended A-B-A triblock copolymer, and a thickness of the gel component designed to cause the plasticizer extended A-B-A triblock copolymer of the gel component to bulge into a void of the plurality of voids in a vicinity of a force of a load on an area of the gel component in a direction perpendicular to the first major surface and to limit buckling of the plasticizer extended A-B-A triblock copolymer of the gel component under the force of the load, wherein each void of the plurality of voids has a uniform cross-sectional area in each plane parallel to each of the first major surface and the second major surface when the gel component is in an undeformed state, wherein the gel component is disposed within a pocket of the substantially non-gel component, and wherein at least a portion of the pocket is made of the plasticizer extended A-B-A triblock copolymer and is at least partially in contact with the gel component disposed within the pocket.
2. The insole of claim 1, wherein the plasticizer extended A-B-A triblock copolymer is coupled to the substantially non-gel component, the substantially non-gel component apart from the portion of the pocket having a material composition differing from a material composition of the plasticizer extended A-B-A triblock copolymer.
3. The insole of claim 1, wherein a collective volume of the plurality of voids is about 25% to about 40% of a total volume between the first major surface and the second major surface.
4. The insole of claim 1, wherein a distance between the first major surface and the second major surface is about 2 mm to about 3 mm.
5. The insole of claim 1, wherein the distance across each void of the plurality of voids is about 1.5 mm to about 2.5 mm, as measured in a plane parallel to at least one of the first major surface and the second major surface.
6. The insole of claim 1, wherein the distance between adjacent voids of the plurality of voids is between about 0.8 mm and about 1.5 mm.
7. The insole of claim 1, wherein the plasticizer extended A-B-A triblock copolymer has a ratio of a weight of the plasticizer to a weight of the triblock copolymer of from about 0.1 to about 50.
8. A shoe, comprising: an insole comprising a substantially non-gel component and a gel component adjacent the non-gel component, the gel component comprising a plasticizer extended A-B-A triblock copolymer and having a first major surface and a second major surface opposite from the first major surface, the gel component defining a plurality of voids extending completely through the gel component, from the first major surface to the second major surface, a dimension of each void of the plurality of voids measured in a plane parallel to at least one of the first major surface and the second major surface, a minimum distance between adjacent voids of the plurality of voids, the plasticizer extended A-B-A triblock copolymer, and a thickness of the gel component causing the plasticizer extended A-B-A triblock copolymer to bulge under a force of a load on an area of the first major surface of the gel component and to limit buckling of the plasticizer extended A-B-A triblock copolymer of the gel component under the force of the load, wherein each void of the plurality of voids has a uniform cross-sectional area in each plane parallel to each of the first major surface and the second major surface when the gel component is in an undeformed state,

wherein the gel component is disposed within a pocket of the substantially non-gel component, and wherein at least a portion of the pocket is made of the plasticizer extended A-B-A triblock copolymer and is at least partially in contact with the gel component disposed within the pocket.

9. The shoe of claim 8, wherein the substantially non-gel component is formed from polyethylene-vinyl acetate.

10. The shoe of claim 8, wherein the substantially non-gel component comprises foam.

11. The shoe of claim 8, further comprising a fabric over the substantially non-gel component and the gel component.

12. The shoe of claim 8, further comprising a scrim layer under the substantially non-gel component and the gel component.

13. An insole for a shoe, comprising: a substantially non-gel component; and a gel component comprising: a layer of a plasticizer extended A-B-A triblock copolymer having a first major surface and a second major surface opposite from the first major surface; and a plurality of voids extending completely through the plasticizer extended A-B-A triblock copolymer, from the first major surface to the second major surface, a maximum dimension across each void of the plurality of voids, a minimum distance between adjacent voids of the plurality of voids, and the plasticizer extended A-B-A triblock copolymer causing the plasticizer extended A-B-A triblock copolymer to bulge under a force of a load on an area of the first major surface of the gel component and to limit buckling of the plasticizer extended A-B-A triblock copolymer of the gel component under the force of the load, wherein each void of the plurality of voids has a uniform cross-sectional area in each plane parallel to each of the first major surface and the second major surface when the gel component is in an undeformed state, wherein the gel component is disposed within a pocket of the substantially non-gel component, and wherein at least a portion of the pocket is made of the plasticizer extended A-B-A triblock copolymer and is at least partially in contact with the gel component disposed within the pocket.

14. The insole of claim 13, wherein the plasticizer extended A-B-A triblock copolymer is coupled to the substantially non-gel component, the substantially non-gel component having a material composition differing from a material composition of the plasticizer extended A-B-A triblock copolymer.

15. The insole of claim 13, wherein a collective volume of the plurality of voids is about 25% to about 40% of a total volume between the first major surface and the second major surface.