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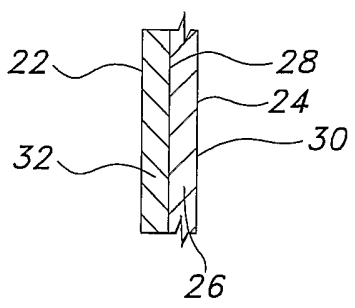
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(54) Title: READILY DONNED ELASTOMERIC ARTICLE



(57) Abstract: An elastomeric article includes a substrate body (26) including a first surface (28). The substrate body (26) is formed from an elastomeric material. A donning layer (32) overlies at least a portion of the first surface (28). The donning layer (32) is formed from a styrenic block copolymer.

READILY DONNED ELASTOMERIC ARTICLE

BACKGROUND

Highly elastic articles such as surgical and examination gloves have traditionally been formed from natural rubber latex due to its combination of good elasticity and strength. In recent years, synthetic gloves with comparable properties have been introduced for such applications. One such glove is formed from styrene-ethylene-butylene-styrene (S-EB-S) synthetic block copolymers.

Tightly fitting elastomeric articles, whether made of natural or synthetic polymers, can be difficult to don. To overcome this problem, it has been conventional practice to apply a powdered lubricant to the surface that is to contact the body of the user, such as the inside of the glove. However, the presence of such powders may be undesirable in certain situations, for example, for surgical procedures. As such, a need exists for a synthetic glove that is easily donned without the use of powders.

SUMMARY OF THE INVENTION

The present invention generally relates to a readily donned elastomeric article, such as a glove or a condom, and a method of forming such an article.

The present invention relates to an elastomeric article including a substrate body formed from an elastomeric material, the substrate body having a first surface, and a donning layer overlying at least a portion of the first surface. The donning layer may be formed from a styrenic block copolymer. The elastomeric material may include a mid block saturated styrene block copolymer, for example, a styrene-ethylene-butylene-styrene block copolymer. The styrenic block copolymer used to form the donning layer may include a styrene-butadiene-styrene block copolymer. The article may further include a lubricant layer overlying at least a portion of the donning layer.

The present invention further relates to an elastomeric article including a substrate body formed from an elastomeric material, the substrate body having a first surface and a second surface, a donning layer overlying at least a portion of the first surface, the donning layer formed from a styrene-butadiene-styrene block copolymer, and a gripping layer overlying at least a portion of the second

surface of the substrate body. In some instances, the elastomeric material may include a mid block saturated styrene block copolymer, such as a styrene-ethylene-butylene-styrene block copolymer. In some instances, the gripping layer may be formed from a styrene-butadiene-styrene block copolymer. The article may further include a lubricant layer overlying at least a portion of the donning layer.

The present invention also relates to a method for preparing an elastomeric article. The method includes preparing a substrate body from an elastomeric material, the substrate body having a first surface and a second surface, and forming a donning layer over at least a portion of the first surface, where the donning layer may be formed from a styrene-butadiene-styrene block copolymer. The method contemplates forming a gripping layer over at least a portion of the second surface of the substrate body, where the gripping layer may be formed from a styrene-butadiene-styrene block copolymer. In some instances, the gripping layer may be contacted with a source of chlorine. The method further contemplates forming a lubricant layer over at least a portion of the donning layer, where the lubricant layer may include a silicone.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of an elastomeric article, namely a glove, according to the present invention;

FIG. 2A is an exemplary cross-sectional illustration of the article of FIG. 1 taken along a line 2-2, the article including a substrate body and a donning layer;

FIG. 2B is an exemplary cross-sectional illustration of the article of FIG. 1 taken along a line 2-2, the article including a substrate body, a donning layer, and a gripping layer; and

FIG. 2C is an exemplary cross-sectional illustration of the article of FIG. 1 taken along a line 2-2, the article including a substrate body, a donning layer, a gripping layer, and a lubricant layer.

DESCRIPTION

The present invention generally relates to an elastomeric article, such as a condom or glove, and a method of forming such an elastomeric article. As used herein, the term "elastomeric article" refers to an article formed predominantly

from an elastomeric material. As used herein, the term "elastomeric material" refers to a polymeric material that is capable of being easily stretched or expanded, and will substantially return to its previous shape upon release of the stretching or expanding force.

An article made according to the present invention features improved donning characteristics without the use of powders. The article, for example, the glove 20, generally includes an inside surface 22 and an outside surface 24 (FIG. 1). As used herein, the "inside surface" refers to the surface of the article that contacts the body of the wearer. As used herein, the "outside surface" refers to the surface of the article that is distal from the body of the wearer. The glove includes a substrate body 26 having a first surface 28 and a second surface 30 (FIG. 2A-2C). As used herein, "first surface" refers to the surface of the substrate body proximal to the body of the wearer. As used herein, "second surface" refers to the surface of the substrate body distal to the body of the wearer.

The article of the present invention may include a single layer or multiple layers as desired. In a single layer glove including only the substrate body, the first surface may form the inside surface of the glove. However, in a multi-layer glove having additional layers proximal the body of the wearer, the additional layer or layers may each form a portion of the inside surface, or the entire inside surface, as desired. Likewise, in a single layer glove including only the substrate body, the second surface may form the outside surface of the glove. However, in a multi-layer glove having additional layers distal from the body of the wearer, the additional layer or layers may each form a portion of the outside surface, or the entire outside surface, as desired.

For example, as depicted in FIG. 2A, the article may include a donning layer 32 overlying at least a portion of the first surface 28 of the substrate body 26. In such an article, the donning layer 32 forms at least a portion of the inside surface 22 of the glove 20. As depicted in FIG. 2B, the article 20 may also include a gripping layer 34 overlying at least a portion of the second surface 30 of the substrate body 26. In such an article, the gripping layer 34 forms at least a portion of the outside surface 24 of the glove 20. As depicted in FIG. 2C, the article may also include other layers, such as a lubricant layer 36 that overlies at

least a portion of the donning layer 32. In such an article, the lubricant layer 36 forms at least a portion of the inside surface 22 of the glove 20.

The substrate body 26 (FIG.'s 2A-2C) may be formed from an elastomeric material, and in some embodiments, the substrate body may be formed from a mid block saturated stryenic block copolymer. For instance, the substrate body may be formed from a styrene-ethylene-butylene-styrene (S-EB-S) block copolymer. In other embodiments, the substrate body may be formed from two or more elastomeric materials. For instance, the substrate body may be formed from two or more S-EB-S block copolymers, such as those described in U.S. Patent Nos. 5,112,900 and 5,407,715 to Buddenhagen et al., both incorporated herein by reference in their entirety. Examples of S-EB-S polymers that may be suitable for use with the present invention include those commercially available from Kraton Polymers (Houston, Texas) under the trade name KRATON® 1650 and KRATON® 1651. KRATON® 1650 is believed to contain 30 mass % block styrene. KRATON® 1651 is believed to contain 33 mass % block styrene.

While articles formed from S-EB-S are described in detail herein, it should be understood that any other suitable polymer or combination of polymers may be used with the present invention. For instance, in another embodiment, the elastomeric material may include natural rubber, which may generally be provided as natural rubber latex. In yet another embodiment, the elastomeric material may include nitrile butadiene rubber, and in particular, may include carboxylated nitrile butadiene rubber. In other embodiments, the elastomeric material may include a styrene-isoprene-styrene block copolymer, styrene-butadiene-styrene block copolymer, styrene-isoprene block copolymer, styrene-butadiene block copolymer, synthetic isoprene, chloroprene rubber, polyvinyl chloride, silicone rubber, or a combination thereof.

The donning layer 32 (FIG.'s 2A-2C) may be formed from any polymer that facilitates donning of the article, and in some embodiments, may include a block copolymer. One such polymer that may be suitable for use with the present invention is a styrenic block copolymer. In one embodiment, the donning may be formed from a styrene-butadiene-styrene (SBS) block copolymer. One example of an SBS polymer that may be suitable for use as a donning layer is commercially available from Dexco Polymers (Houston, Texas)

under the trade name VECTOR® 8508. VECTOR® 8508 is believed to be a linear, pure triblock copolymer (containing less than 1% diblock copolymer) produced using anionic polymerization. Another example of an SBS polymer that may be suitable for use as a donning layer is also commercially available from Dexco Polymers (Houston, Texas) under the trade name VECTOR® 8550.

In another embodiment, an unsaturated styrene-isoprene (SIS) having tri- or radial-blocks may be used. In some instances, the SIS block copolymer may have a polystyrene end block content of from about 10 mass % to about 20 mass % of the total mass of the SIS block copolymer. In another embodiment, the SIS block copolymer may have a polystyrene end block content of from about 15 mass % to about 18 mass % of the total mass of the SIS block copolymer. Moreover, the molecular weight of the polystyrene end blocks may be at least about 5,000 grams per mole. Some examples of suitable mid-block unsaturated SIS block copolymers include, but are not limited to, KRATON® D1107 available from Kraton Polymers (Houston, Texas) and VECTOR® 511 and VECTOR® 4111 available from Dexco Polymers (Houston, Texas).

The article may also include a gripping layer 34 (FIG.'s 2B-2C), which overlies the second surface 30 of the substrate body 26. The gripping layer may be formed from any polymer, and in some embodiments, the gripping layer may be formed from an unsaturated elastomeric polymer capable of being chlorinated. For instance, the gripping layer may be formed from a styrene-butadiene-styrene block copolymer. One example of an SBS polymer that may be suitable for use as a gripping layer is commercially available from Dexco Polymers (Houston, Texas) under the trade name VECTOR® 8508, described in detail above. Another example of an SBS polymer that may be suitable for use as a gripping layer is also commercially available from Dexco Polymers (Houston, Texas) under the trade name VECTOR® 8550.

The article may also include a lubricant layer 36 (FIG. 2C) overlying at least a portion of the donning layer to further facilitate donning. In one embodiment, the lubricant layer may contain a silicone or silicone-based component. As used herein, the term "silicone" generally refers to a broad family of synthetic polymers that have a repeating silicon-oxygen backbone, including, but not limited to, polydimethylsiloxane and polysiloxanes having

hydrogen-bonding functional groups selected from the group consisting of amino, carboxyl, hydroxyl, ether, polyether, aldehyde, ketone, amide, ester, and thiol groups. In some embodiments, polydimethylsiloxane and/or modified polysiloxanes may be used as the silicone component in accordance with the present invention. For instance, some suitable modified polysiloxanes that can be used in the present invention include, but are not limited to, phenyl-modified polysiloxanes, vinyl-modified polysiloxanes, methyl-modified polysiloxanes, fluoro-modified polysiloxanes, alkyl-modified polysiloxanes, alkoxy-modified polysiloxanes, amino-modified polysiloxanes, and combinations thereof.

In some embodiments, the lubricant layer may include a silicone emulsion. One such silicone emulsion that may be suitable for use with the present invention is DC 365, a pre-emulsified silicone (35% TSC) that is commercially available from Dow Corning Corporation (Midland, Michigan). DC 365 is believed to contain 40-70 mass % water, 30-60 mass % methyl-modified polydimethylsiloxane, 1-5 mass % propylene glycol, 1-5 mass % polyethylene glycol sorbitan monolaurate, and 1-5 mass % octylphenoxy polyethoxy ethanol. Another silicone emulsion that may be may be suitable for use with the present invention is SM 2140, commercially available from GE Silicones (Waterford, New York). SM 2140 is a pre-emulsified silicone (50% TSC) that is believed to contain 30-60 mass % water, 30-60 mass % amino-modified polydimethylsiloxane, 1-5% ethoxylated nonyl phenol, 1-5 mass % trimethyl-4-nonyloxypolyethyleneoxy ethanol, and minor percentages of acetaldehyde, formaldehyde, and 1,4 dioxane. Another silicone emulsion that may be suitable for use with the present invention is SM 2169 available from GE Silicones (Waterford, New York). SM 2169 is a pre-emulsified silicone that is believed to contain 30-60 mass % water, 60-80 mass % polydimethylsiloxane, 1-5 mass % polyoxyethylene lauryl ether, and a small amount of formaldehyde. Yet another silicone that may be may be suitable for use with the present invention is commercially available from GE Silicones (Waterford, New York) under the trade name AF-60. AF-60 is believed to contain polydimethylsiloxane, acetylaldehyde, and small percentages of emulsifiers. If desired, these pre-emulsified silicones may be diluted with water or other solvents prior to use.

In another embodiment, the lubricant layer may contain a quaternary ammonium compound, such as that commercially available from Goldschmidt

Chemical Corporation of Dublin, Ohio under the trade name VERISOFT® BTMS. VERISOFT® BTMS is believed to contain behnyl trimethyl sulfate and cetyl alcohol. Thus for example, in one embodiment, the lubricant layer includes a quaternary ammonium compound such as VERISOFT® BTMS and a silicone emulsion such as SM 2169.

In other embodiments, the lubricant layer may include, for example, a cationic surfactant (e.g., cetyl pyridinium chloride), an anionic surfactant (e.g., sodium lauryl sulfate), a nonionic surfactant, or the like.

In some embodiments, one or more cationic surfactants may be used. Examples of cationic surfactants that may be suitable for use with the present invention include, for example, behenetrimonium methosulfate, distearyldimonium chloride, dimethyl dioctadecyl ammonium chloride, cetylpyridinium chloride, methylbenzethonium chloride, hexadecylpyridinium chloride, hexadecyltrimethylammonium chloride, benzalkonium chloride, dodecylpyridinium chloride, the corresponding bromides, hydroxyethylheptadecylimidazolium halides, coco aminopropyl betaine, and coconut alkyldimethylammonium betaine. Additional cationic surfactants that may be used include methyl bis(hydrogenated tallow amidoethyl)-2-hydroxyethly ammonium methyl sulfate, methyl bis(tallowamido ethyl)-2-hydroxyethyl ammonium methyl sulfate, methyl bis(soya amidoethyl)-2-hydroxyethyl ammonium methyl sulfate, methyl bis(canola amidoethyl)-2-hydroxyethyl ammonium methyl sulfate, methyl bis(tallowamido ethyl)-2-tallow imidazolinium methyl sulfate, methyl bis(hydrogenated tallowamido ethyl)-2-hydrogenated tallow imidazolinium methyl sulfate, methyl bis(ethyl tallowate)-2- hydroxyethyl ammonium methyl sulfate, methyl bis(ethyl tallowate)-2-hydroxyethyl ammonium methyl sulfate, dihydrogenated tallow dimethyl ammonium chloride, didecyl dimethyl ammonium chloride, dioctyl dimethyl ammonium chloride, octyl decyl dimethyl ammonium chloride
diamidoamine ethoxylates, diamidoamine imidazolines, and quaternary ester salts.

In some embodiments, one or more nonionic surfactants may be used. Nonionic surfactants typically have a hydrophobic base, such as a long chain alkyl group or an alkylated aryl group, and a hydrophilic chain comprising a certain number (e.g., 1 to about 30) of ethoxy and/or propoxy moieties.

Examples of some classes of nonionic surfactants that may be used include, but are not limited to, ethoxylated alkylphenols, ethoxylated and propoxylated fatty alcohols, polyethylene glycol ethers of methyl glucose, polyethylene glycol ethers of sorbitol, ethylene oxide-propylene oxide block copolymers, ethoxylated esters of fatty (C_8 -C_{18}) acids, condensation products of ethylene oxide with long chain amines or amides, condensation products of ethylene oxide with alcohols, and mixtures thereof.

Specific examples of suitable nonionic surfactants include, but are not limited to, methyl gluceth-10, PEG-20 methyl glucose distearate, PEG-20 methyl glucose sesquistearate, C_{11-15} pareth-20, ceteth-8, ceteth-12, dodoxynol-12, laureth-15, PEG-20 castor oil, polysorbate 20, steareth-20, polyoxyethylene-10 cetyl ether, polyoxyethylene-10 stearyl ether, polyoxyethylene-20 cetyl ether, polyoxyethylene-10 oleyl ether, polyoxyethylene-20 oleyl ether, an ethoxylated nonylphenol, ethoxylated octylphenol, ethoxylated dodecylphenol, or ethoxylated fatty (C_6 -C_{22}) alcohol, including 3 to 20 ethylene oxide moieties, polyoxyethylene-20 isohexadecyl ether, polyoxyethylene-23 glycerol laurate, polyoxy-ethylene-20 glyceryl stearate, PPG-10 methyl glucose ether, PPG-20 methyl glucose ether, polyoxyethylene-20 sorbitan monoesters, polyoxyethylene-80 castor oil, polyoxyethylene-15 tridecyl ether, polyoxy-ethylene-6 tridecyl ether, laureth-2, laureth-3, laureth-4, PEG-3 castor oil, PEG 600 dioleate, PEG 400 dioleate, oxyethanol, 2,6,8-trimethyl-4-nonyloxypolyethylene oxyethanol; octylphenoxy polyethoxy ethanol, nonylphenoxy polyethoxy ethanol, 2,6,8-trimethyl-4-nonyloxypolyethylene alkyleneoxypolyethyleneoxyethanol, alkyleneoxypolyethyleneoxyethanol, alkyleneoxypolyethyleneoxyethanol, and mixtures thereof.

Additional nonionic surfactants that may be used include water soluble alcohol ethylene oxide condensates that are the condensation products of a secondary aliphatic alcohol containing between about 8 to about 18 carbon atoms in a straight or branched chain configuration condensed with between about 5 to about 30 moles of ethylene oxide. Such nonionic surfactants are commercially available under the trade name TERGITOL® from Union Carbide Corp. (Danbury, Connecticut). Specific examples of such commercially available nonionic surfactants of the foregoing type are C_{11} -C_{15} secondary alkanols condensed with either 9 moles of ethylene oxide (TERGITOL® 15-S-9) or 12

moles of ethylene oxide (TERGITOL® 15-S-12) marketed by Union Carbide Corp. (Danbury, Connecticut).

Other suitable nonionic surfactants include the polyethylene oxide condensates of one mole of alkyl phenol containing from about 8 to 18 carbon atoms in a straight- or branched chain alkyl group with about 5 to 30 moles of ethylene oxide. Specific examples of alkyl phenol ethoxylates include nonyl condensed with about 9.5 moles of ethylene oxide per mole of nonyl phenol, dinonyl phenol condensed with about 12 moles of ethylene oxide per mole of phenol, dinonyl phenol condensed with about 15 moles of ethylene oxide per mole of phenol and diisoctylphenol condensed with about 15 moles of ethylene oxide per mole of phenol. Commercially available nonionic surfactants of this type include IGEPAL® CO-630 (a nonyl phenol ethoxylate) marketed by ISP Corp. (Wayne, New Jersey). Suitable non-ionic ethoxylated octyl and nonyl phenols include those having from about 7 to about 13 ethoxy units.

In some embodiments, one or more amphoteric surfactants may be used. One class of amphoteric surfactants that may suitable for use with the present invention includes the derivatives of secondary and tertiary amines having aliphatic radicals that are straight chain or branched, where one of the aliphatic substituents contains from about 8 to 18 carbon atoms and at least one of the aliphatic substituents contains an anionic water-solubilizing group, such as a carboxy, sulfonate, or sulfate group. Some examples of amphoteric surfactants include, but are not limited to, sodium 3-(dodecylamino)propionate, sodium 3-(dodecylamino)-propane-1-sulfonate, sodium 2-(dodecylamino)ethyl sulfate, sodium 2-(dimethylamino)octadecanoate, disodium 3-(N-carboxymethyl-dodecylamino)propane-1-sulfonate, sodium 1-carboxymethyl-2-undecylimidazole, disodium octadecyliminodiacetate, and sodium N, N-bis(2-hydroxyethyl)-2-sulfato-3-dodecoxypropylamine.

Additional classes of suitable amphoteric surfactants include phosphobetaines and phosphitaines. For instance, some examples of such amphoteric surfactants include, but are not limited to, sodium coconut N-methyl taurate, sodium oleyl N-methyl taurate, sodium tall oil acid N-methyl taurate, cocodimethylcarboxymethylbetaine, lauryldimethylcarboxymethylbetaine, lauryldimethylcarboxyethylbetaine, cetyldimethylcarboxymethylbetaine, sodium palmitoyl N-methyl taurate, oleyldimethylgammacarboxypropylbetaine, lauryl-

bis-(2-hydroxypropyl)-carboxyethylbetaine, di-sodium oleamide PEG-2 sulfosuccinate, laurylamido-bis-(2-hydroxyethyl) propylsultaine, lauryl-bis-(2-hydroxyethyl) carboxymethylbetaine, cocoamidodimethylpropylsultaine, stearylamidodimethylpropylsultaine, TEA oleamido PEG-2 sulfosuccinate, disodium oleamide MEA sulfosuccinate, disodium oleamide MIPA sulfosuccinate, disodium ricinoleamide MEA sulfosuccinate, disodium undecylenamide MEA sulfosuccinate, disodium wheat germamido MEA sulfosuccinate, disodium wheat germamido PEG-2 sulfosuccinate, disodium isostearamideo MEA sulfosuccinate, cocoamido propyl monosodium phosphitaine, lauric myristic amido propyl monosodium phosphitaine, cocoamido disodium 3-hydroxypropyl phosphobetaine, lauric myristic amido disodium 3-hydroxypropyl phosphobetaine, lauric myristic amido glyceryl phosphobetaine, lauric myristic amido carboxy disodium 3-hydroxypropyl phosphobetaine, cocoamphoglycinate, cocoamphocarboxyglycinate, capryloamphocarboxyglycinate, lauroamphocarboxyglycinate, lauroamphoglycinate, capryloamphocarboxypropionate, lauroamphocarboxypropionate, cocoamphopropionate, cocoamphocarboxypropionate, dihydroxyethyl tallow glycinate, and mixtures thereof.

In certain instances, one or more anionic surfactants may be used. Suitable anionic surfactants include, but are not limited to, alkyl sulfates, alkyl ether sulfates, alkyl ether sulfonates, sulfate esters of an alkylphenoxy polyoxyethylene ethanol, alpha-olefin sulfonates, beta-alkoxy alkane sulfonates, alkylauryl sulfonates, alkyl monoglyceride sulfates, alkyl monoglyceride sulfonates, alkyl carbonates, alkyl ether carboxylates, fatty acids, sulfosuccinates, sarcosinates, octoxynol or nonoxynol phosphates, taurates, fatty taurides, fatty acid amide polyoxyethylene sulfates, isethionates, or mixtures thereof.

Particular examples of some suitable anionic surfactants include, but are not limited to, C_8 -C_{18} alkyl sulfates, C_8 -C_{18} fatty acid salts, C_8 -C_{18} alkyl ether sulfates having one or two moles of ethoxylation, C_8 -C_{18} alkamine oxides, C_8 -C_{18} alkoyl sarcosinates, C_8 -C_{18} sulfoacetates, C_8 -C_{18} sulfosuccinates, C_8 -C_{18} alkyl diphenyl oxide disulfonates, C_8 -C_{18} alkyl carbonates, C_8 -C_{18} alpha-olefin sulfonates, methyl ester sulfonates, and blends thereof. The C_8 -C_{18} alkyl group may be straight chain (e.g., lauryl) or branched (e.g., 2-ethylhexyl). The cation of

the anionic surfactant may be an alkali metal (e.g., sodium or potassium), ammonium, C_1 -C_4 alkylammonium (e.g., mono-, di-, tri), or C_1 -C_3 alkanolammonium (e.g., mono-, di-, tri).

Specific examples of such anionic surfactants include, but are not limited to, lauryl sulfates, octyl sulfates, 2-ethylhexyl sulfates, lauramine oxide, decyl sulfates, tridecyl sulfates, cocoates, lauroyl sarcosinates, lauryl sulfosuccinates, linear C_{10} diphenyl oxide disulfonates, lauryl sulfosuccinates, lauryl ether sulfates (1 and 2 moles ethylene oxide), myristyl sulfates, oleates, stearates, tallates, ricinoleates, cetyl sulfates, and so forth.

The article of the present invention may be formed using a variety of processes, for example, dipping, spraying, tumbling, drying, and curing. An exemplary dipping process for forming a glove is described herein, though other processes may be employed to form various articles having different shapes and characteristics. For example, a condom may be formed in substantially the same manner, although some process conditions may differ from those used to form a glove. Furthermore, it should be understood that a batch, semi-batch, or a continuous process may be used with the present invention.

A glove is formed on a hand-shaped mold, termed a "former". The former may be made from any suitable material, such as glass, metal, porcelain, or the like. The surface of the former defines at least a portion of the surface of the glove to be manufactured.

In general, the substrate body 26 (FIG.'s 1-2C) is formed by dipping the former into a series of compositions as needed to attain the desired glove characteristics. The glove may be allowed to solidify between layers. Any combination of layers may be used, and although specific layers are described herein, it should be understood that other layers and combinations of layers may be used as desired.

In one embodiment, the substrate body may be formed using a solvent-based dipping process. Exemplary processes have been described in U.S. Patent No. 5,112,900 to Buddenhagen et al., U.S. Patent No. 5,407,715 to Buddenhagen et al., and U.S. Patent No. 5,792,531 to Littleton et al., each incorporated by reference herein in their entirety, and will be described here only briefly. For example, in such a process, the S-EB-S block copolymer is dissolved in a solvent, for example, toluene, and then mixed with a plasticizer. A glove former is then

dipped into the solution and permitted to dry to evaporate the solvent. Several dips may be used as needed to build the desired thickness. The final article may be rinsed or otherwise treated as desired.

In another embodiment, the glove may be formed using an aqueous dispersion-based dipping process. Exemplary processes have been described in U.S. Patent No. 5,900,452 to Plamthottam and U.S. Patent No. 6,414,083 to Plamthottam, both incorporated by reference herein in their entirety, and will be described here only briefly. For example, a dispersion medium is prepared from water and a surfactant. Other additives, such as thickeners, defoamers, or buffers may be added to the dispersion medium. Separately, a mixture of the S-EB-S block copolymer, a solvent, and a mineral oil plasticizer is prepared. The two mixtures are then combined under high shear conditions to form the desired dispersion. The solvent is then removed from the dispersion via a suitable stripping process. An elastomeric article is then formed by dipping a former into a volume of the dispersion one or more times to build up the desired thickness, and thereafter evaporating the water to form a film on the surface of the former. The final article may be rinsed or otherwise treated as desired.

After formation of the substrate body 26, the former may be dipped into a composition containing a suitable polymeric material to coat the first surface 28 of the substrate body 26. Such a coating forms a donning layer 32 (FIG.'s 2A-2C) to facilitate donning of the finished article, namely glove 20. In one embodiment, the donning layer may include an SBS block copolymer. One example of an SBS polymer that may be suitable for use as a donning layer is commercially available from Dexco Polymers (Houston, Texas) under the trade name VECTOR® 8508, described in detail above. In some embodiments, the donning layer composition may include from about 1 mass % to about 10 mass % SBS in a suitable solvent, such as toluene. In another embodiment, the donning layer composition may include from about 2 mass % to about 5 mass % SBS in a suitable solvent. In yet another embodiment, the donning layer composition may include from about 3 mass % to about 4 mass % SBS in a suitable solvent. In still another embodiment, the donning layer composition may include about 3.4 mass % SBS in a suitable solvent. While exemplary compositions are set forth herein, it should be understood that other polymers

may be used in any suitable quantities to form the donning layer as described herein.

Thus, for example, the article of the present invention may include a substrate body 26 and a donning layer 32 (FIG. 2A), where the substrate body 26 may be formed from one or more S-EB-S block copolymers, and the donning layer 32 may be formed from a SBS block copolymer. The donning layer may be present in any suitable amount, and in some embodiments, the donning layer may be present in an amount of from about 0.1% mass % to about 2.5 mass % of the elastomeric article. In other embodiments, the donning layer may be present in an amount of from about 0.25 mass % to about 1.5 mass % of the elastomeric article. In yet other embodiments, the donning layer may be present in an amount of about 0.5 mass % of the elastomeric article.

Where a gripping layer 34 is desired (FIG. 2B-2C), the former may be dipped into a composition containing a suitable polymeric material prior to formation of the substrate body 26. The gripping layer enables the wearer to securely grasp articles without excessive tackiness or stickiness. In one embodiment, the gripping layer may include an SBS block copolymer. One example of an SBS polymer that may be suitable for use as a gripping layer is commercially available from Dexco Polymers (Houston, Texas) under the trade name VECTOR® 8508, described in detail above. In one embodiment, the gripping layer composition may include from about 1 mass % to about 10 mass % SBS in a suitable solvent, such as toluene. In another embodiment, the gripping layer composition may include from about 2 mass % to about 5 mass % SBS in a suitable solvent. In yet another embodiment, the gripping layer composition may include from about 3 mass % SBS to about 4 mass % SBS in a suitable solvent. In still another embodiment, the gripping layer composition may include about 3.4 mass % SBS in a suitable solvent. While exemplary compositions are set forth herein, it should be understood that other polymers may be used in any quantities to form the gripping layer as described herein.

Thus, for example, the article of the present invention may include a substrate body and a gripping layer, where the substrate body is formed from one or more S-EB-S block copolymers, and the gripping layer is formed from a SBS block copolymer. In another example depicted in FIG. 2B, the article of the present invention may include a substrate body 26, a donning layer 32, and a

gripping layer 34, where the substrate body 26 may be formed from one or more S-EB-S block copolymers, the donning layer 32 may be formed from a SBS block copolymer, and the gripping layer 34 may be formed from an SBS block copolymer. The gripping layer may be present in any suitable amount, and in some embodiments, the gripping layer may be present in an amount of from about 0.1% mass % to about 2.5 mass % of the elastomeric article. In other embodiments, the gripping layer may be present in an amount of from about 0.25 mass % to about 1.5 mass % of the elastomeric article. In yet other embodiments, the gripping layer may be present in an amount of about 0.5 mass % of the elastomeric article.

When all of the desired polymer layers have been formed and the glove is solidified, the former may be transferred to a stripping station where the glove is removed from the former. The stripping station may involve automatic or manual removal of the glove from the former. For example, in one embodiment, the glove is manually removed and turned inside out as it is stripped from the former.

The solidified glove may then undergo various post-formation processes. In some instances, the glove may be inverted as needed to expose the donning layer and/or the gripping layer for halogenation. The halogenation (e.g., chlorination) may be performed in any suitable manner known to those skilled in the art. Chlorination generally entails contacting the surface to be chlorinated to a source of chlorine. Such methods include: (1) direct injection of chlorine gas into a water mixture, (2) mixing high density bleaching powder and aluminum chloride in water, (3) brine electrolysis to produce chlorinated water, and (4) acidified bleach. Examples of such methods are described in U.S. Patent Nos. 3,411,982 to Kavalir; 3,740,262 to Agostinelli; 3,992,221 to Homsy, et al.; 4,597,108 to Momose; and 4,851,266 to Momose, 5,792,531 to Littleton, et al., which are incorporated herein in their entirety by reference. In one embodiment, for example, chlorine gas is injected into a water stream and then fed into a chlorinator (a closed vessel) containing the glove. The concentration of chlorine can be altered to control the degree of chlorination. The chlorine concentration is typically at least about 100 parts per million (ppm), in some embodiments from about 200 ppm to about 3500 ppm, and in some embodiments, from about 300 ppm to about 600 ppm, for example, about 400 ppm. The duration of the

chlorination step may also be controlled to vary the degree of chlorination and may range, for example, from about 1 to about 10 minutes, for example, 4 minutes.

Still within the chlorinator, the chlorinated glove may then be rinsed with tap water at about room temperature. This rinse cycle may be repeated as necessary. Once all water is removed, the glove is tumbled to drain the excess water.

Where desired, a lubricant composition may then be added into the chlorinator for about five minutes. The lubricant forms a lubricant layer 36 over at least a portion of the donning layer 32 to further enhance donning of the glove 20 (FIG. 2C). Any suitable lubricant may be used to form the lubricant layer as described herein. One such lubricant may include a quaternary ammonium compound such as VERISOFT® BTMS and a silicone emulsion such as SM 2169, both described in detail above.

The lubricant solution is then drained from the chlorinator and may be reused if desired. It should be understood that the lubricant composition may be applied at a later stage in the forming process, and may be applied using any technique, such as dipping, spraying, immersion, printing, tumbling, or the like.

The coated glove is then put into a drier and dried for about 10 to 60 minutes (e.g., 40 minutes) at from about 20°C to about 80°C (e.g., 40°C) to dry the inside surface of the glove. The glove 20 is then inverted and the outside surface of the glove dried for about 20 to 100 minutes (e.g., 60 minutes) at from about 20°C to about 80°C (e.g., 40°C).

These discoveries are evidenced by the following example, which is not intended to be limiting in any manner.

EXAMPLE

The ability to don and use an article formed according to the present invention was demonstrated. Several hundred glove formers were dipped into an about 3.4 mass % solution of VECTOR® 8508 styrene-butadiene-styrene (SBS) block copolymer available from Dexco Polymers (Houston, Texas) in toluene to form a gripping layer. Afterwards, the glove formers were exposed to air to permit the solvent to evaporate.

The glove formers were then dipped into a solution of 20.7 mass % of equal amounts of KRATON® 1650 and KRATON® 1651 (with 67 parts per hundred rubber (phr) by mass of mineral oil) in toluene to form the substrate body. The solution was mixed in a high shear mixer with a cowl blade. After dipping the formers into the solution, the glove formers were exposed to air to permit most of the solvent to evaporate. The glove formers were then dipped a second time into the same solution, and the formers were subsequently exposed to air to permit most of the solvent to evaporate.

The formers were then again dipped into a solution of VECTOR 8508® SBS block copolymer in toluene (about 3.4 mass % SBS) to form a donning layer. Afterwards, the formers were exposed to air to permit the solvent to evaporate.

A glove bead was then rolled on the gloves by contacting the rotating formers to two opposing rotating brushes.

The formers were then dipped into a slurry solution containing calcium carbonate and a surfactant to facilitate the stripping of the glove. The formers were then exposed to air again to remove the water from the slurry and the remainder of the toluene solvent. The gloves were then manually stripped from the formers.

The gloves were then exposed to a solution of water, chlorine gas, and sufficient hydrochloric acid to produce a solution having a pH of 2 for a period of about 7 minutes. The gloves were then inverted and exposed to another solution of water, chlorine gas, and hydrochloric acid. The gloves were then coated with an aqueous lubricant composition containing a quaternary ammonium compound and a silicone emulsion. The gloves were then air dried, inverted, and air dried again. The gloves were then donned and manipulated. Overall, the gloves exhibited good grip and damp donning characteristics without the use of powder.

In sum, the article of the present invention features improved donning without the use of traditional lubricating powders. The article is readily donned due to the presence of a donning layer formed from a styrenic block copolymer. A styrenic block copolymer may also be used to form the gripping layer. Donning may be further enhanced by forming a lubricating layer over at least a portion of the donning layer.

The invention may be embodied in other specific forms without departing from the scope and spirit of the inventive characteristics thereof. The present embodiments therefore are to be considered in all respects as illustrative and not restrictive, the scope of the invention being indicated by the appended claims rather than by the foregoing description, and all changes which come within the meaning and range of equivalency of the claims are therefore intended to be embraced therein.

What is claimed is:

1. An elastomeric article comprising:

a substrate body comprising an elastomeric material, the substrate body having a first surface; and

a donning layer overlying at least a portion of the first surface, the donning layer comprising a styrenic block copolymer.

2. The article of claim 1, wherein the elastomeric material comprises a mid block saturated styrene block copolymer.

3. The article of claim 1, wherein the elastomeric material comprises a styrene-ethylene-butylene-styrene block copolymer.

4. The article of claim 1, wherein the elastomeric material is selected from the group consisting of natural rubber, nitrile butadiene rubber, styrene-isoprene-styrene block copolymer, styrene-butadiene-styrene block copolymer, styrene-isoprene block copolymer, styrene-butadiene block copolymer, synthetic isoprene, chloroprene rubber, polyvinyl chloride, silicone rubber, and a combination thereof.

5. The article of claim 1, wherein the styrenic block copolymer comprises a styrene-butadiene-styrene block copolymer.

6. The article of claim 1, wherein the donning layer is present in an amount of about 0.1 mass % to about 2.5 mass % of the article.

7. The article of claim 1, wherein the donning layer is present in an amount of about 0.25 mass % to about 1.5 mass % of the article.

8. The article of claim 1, further comprising a lubricant layer overlying at least a portion of the donning layer.

9. The article of claim 8, wherein the lubricant layer comprises a silicone.

10. The article of claim 1, wherein the article is a glove.

11. An elastomeric article comprising:

a substrate body comprising an elastomeric material, the substrate body having a first surface and a second surface;

a donning layer overlying at least a portion of the first surface, the donning layer comprising a styrene-butadiene-styrene block copolymer; and

a gripping layer overlying at least a portion of the second surface.

12. The article of claim 11, wherein the elastomeric material comprises a styrene-ethylene-butylene-styrene block copolymer.

13. The article of claim 11, wherein the gripping layer comprises a styrene-butadiene-styrene block copolymer.

14. The article of claim 11, wherein the gripping layer is present in an amount of from about 0.1 mass % to about 2.5 mass % of the article.

15. The article of claim 11, wherein the gripping layer is present in an amount of from about 0.25 mass % to about 1.5 mass % of the article.

16. The article of claim 11, further comprising a lubricant layer overlying at least a portion of the donning layer.

17. A method for preparing an elastomeric article comprising:

preparing a substrate body comprising an elastomeric material, the substrate body having a first surface and a second surface; and

forming a donning layer over at least a portion of the first surface, the donning layer comprising a styrene-butadiene-styrene block copolymer.

18. The method of claim 17, further comprising forming a gripping layer over at least a portion of the second surface, the gripping layer comprising a styrene-butadiene-styrene block copolymer.

19. The method of claim 18, further comprising contacting the gripping layer with a source of chlorine.

20. The method of claim 17, further comprising forming a lubricant layer over at least a portion of the donning layer, the lubricant layer comprising a silicone and a quaternary ammonium compound.

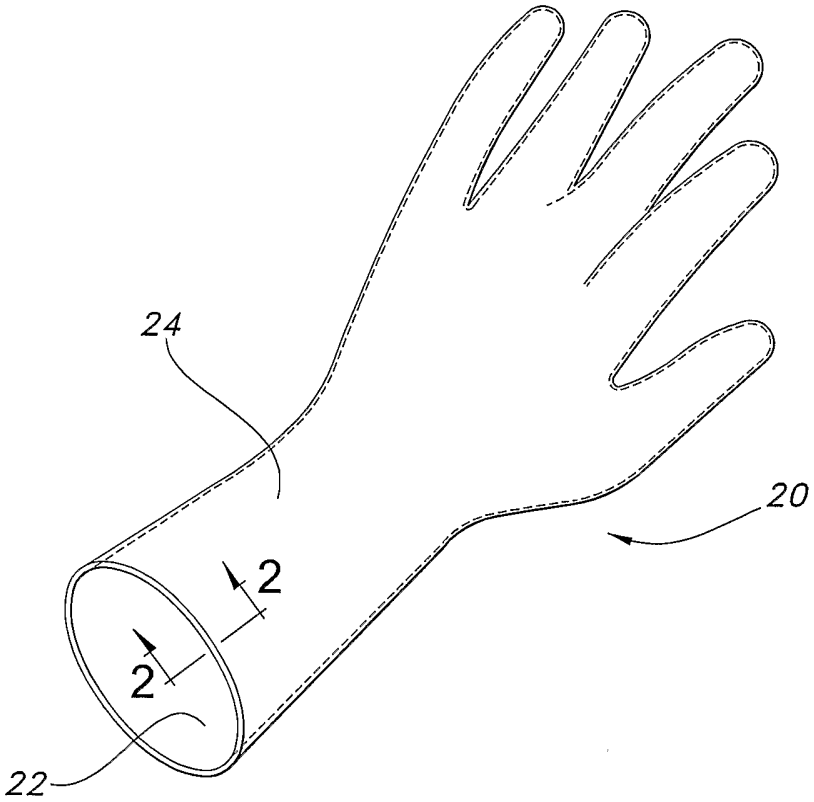


FIG. 1

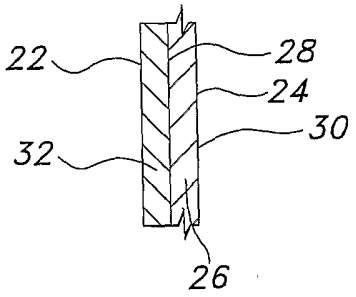


FIG. 2A

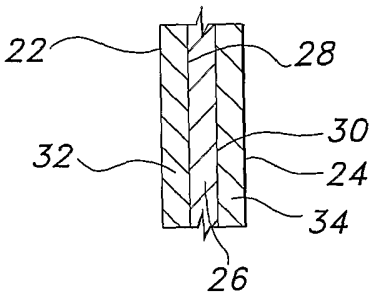


FIG. 2B

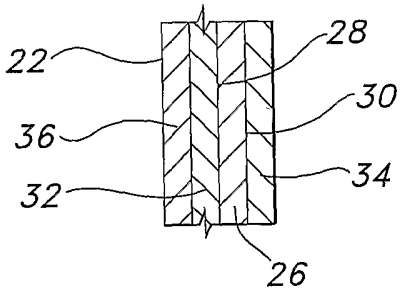


FIG. 2C

INTERNATIONAL SEARCH REPORT

International Application No
PCT/US2004/010202

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 A41D19/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 A41D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, PAJ, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 97/30839 A (TACTYL TECH INC) 28 August 1997 (1997-08-28) claims 1-5,9-11 page 4, line 10 - page 5, line 12	1-3,5-20
Y	page 6, line 8 - page 7, line 1	4
Y	WO 98/29484 A (JOHNSON & JOHNSON MEDICAL) 9 July 1998 (1998-07-09) claims 6,7,9-19 page 6, line 39 - page 7, line 21 page 8, line 6 - line 16	4

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
11 August 2004	20/08/2004

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No
PCT/US2004/010202

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WO 9730839 A	28-08-1997	US 5792531 A	11-08-1998
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