



US 20160068721A1

(19) **United States**(12) **Patent Application Publication**
Malcolm et al.(10) **Pub. No.: US 2016/0068721 A1**(43) **Pub. Date: Mar. 10, 2016**(54) **ELASTIC HOT MELT ADHESIVE
COMPOSITION AND AN ELASTIC
COMPOSITE MADE WITH THE SAME****Publication Classification**(71) Applicant: **H.B. FULLER COMPANY**, St. Paul,
MN (US)(72) Inventors: **David B. Malcolm**, Maplewood, MN
(US); **Kevin P. Davis**, Woodbury, MN
(US); **Yuanyan Gu**, St. Paul, MN (US);
Peter Remmers, Hamburg (DE);
Thomas Wittkopf, Vogelsen (DE);
Kristy J. Beckman, Dellwood, MN
(US); **Mark S. Kroll**, Arden Hills, MN
(US)(51) **Int. Cl.****C09J 153/00** (2006.01)
B32B 27/12 (2006.01)
B32B 27/30 (2006.01)
B32B 5/02 (2006.01)(52) **U.S. Cl.**CPC **C09J 153/00** (2013.01); **B32B 5/022**
(2013.01); **B32B 27/12** (2013.01); **B32B**
27/302 (2013.01); **B32B 2535/00** (2013.01)(21) Appl. No.: **14/849,139**(22) Filed: **Sep. 9, 2015****Related U.S. Application Data**(60) Provisional application No. 62/048,047, filed on Sep.
9, 2014, provisional application No. 62/048,066, filed
on Sep. 9, 2014, provisional application No. 62/171,
129, filed on Jun. 4, 2015.(57) **ABSTRACT**

This invention claims hot melt adhesive compositions that can be used to form elastic composites that are useful in disposable absorbent articles. The compositions have good elastic recovery and high peel adhesion at a viscosity of less than about 15,000 cps at 177° C. (350° F.). The low viscosity makes it possible to apply the hot melt adhesive at a high line speed and target application to only those areas requiring elastic performance.

ELASTIC HOT MELT ADHESIVE COMPOSITION AND AN ELASTIC COMPOSITE MADE WITH THE SAME

[0001] This application claims priority to and benefit of provisional filed patent application Nos. 62/048047 and 62/048066 filed on Sep. 9, 2014 and provisional patent application No. 62/171129 filed on Jun. 4, 2015.

BACKGROUND

[0002] Adhesives are often used to bond substrates together. In the area of industrial adhesives, hot melt adhesives are commonly used to bond together a wide variety of articles including disposable absorbent articles comprising non-woven substrates e.g. diapers, training pants, surgical garments, swim wear, absorbent underpants, adult incontinence products, sanitary napkins and medical dressings (e.g. wound care products).

[0003] There can be multiple hot melt adhesives used in the manufacture of a disposable absorbent article. For example, in the manufacture of a disposable diaper, hot melt adhesives are used for construction (e.g. bonding the backsheet to the nonwoven and optionally the absorbent pad), elastic attachment (e.g. bonding the elastic material to the backsheet in for example the leg or waist area), and for the core stabilization (e.g. applying a hot melt adhesive to the absorbent core to increase the strength of the core).

[0004] Hot melt adhesives can also be used to form elastic composites that are useful in disposable articles. Currently, elastic composites are often formed in a 5-layer configuration including the following layers: nonwoven, hot melt adhesive, elastic material, hot melt adhesive, nonwoven. The hot melt adhesive bonds the non-adhesive elastic to the nonwoven to form a composite.

[0005] Alternately, a hot melt adhesive with elastic properties can replace both the elastic material and the adhesive layers to form a simplified 3-layer elastic composite that can impart stretch to various portions of the disposable article.

SUMMARY

[0006] In one embodiment, the invention includes an elastic composite including a first and second substrate; and a hot melt adhesive composition between the first and second substrates thereby permanently bonding the first and second substrates to each other and providing elasticity in the bonded area, said hot melt adhesive composition including about 35% by weight to about 60% by weight of one or more styrene block copolymers, wherein the one or more styrene block copolymers has an average styrene content of at least about 30% by weight and an average MFR (200° C./5 kg) of no less than about 20, greater than about 15% of a plasticizer and, a tackifying agent; wherein the hot melt adhesive composition has a viscosity of less than about 15,000 cps at 350° F.

[0007] In one aspect, the elastic composite includes a hot melt adhesive composition with a viscosity of less than about 10,000 cps at 350° F. In another aspect, the one or more styrene block copolymers have an average styrene content of at least about 35% by weight. In a different aspect, the elastic composite includes a hot melt adhesive composition includes from about 25% by weight to about 40% by weight tackifying agent.

[0008] In another aspect, the elastic composite includes a hot melt adhesive composition comprises at least one tackifying agent with a melt point of less than 100° C.

[0009] In one aspect, elastic composite includes a first and second substrate that are nonwoven. In a different aspect, the nonwoven is airlaid, carded and hydroentangled. In another aspect, the nonwoven is extensible to greater than 100% in the cross web direction.

[0010] In one aspect, the hot melt adhesive of the elastic composite is applied to the substrate using an applicator method selected from the group consisting of slot and non contact coating. In a different aspect, the hot melt adhesive is applied to the substrate using an applicator method selected from the group consisting of screen printing, spraying, comb shim slot and gravure roll.

[0011] In another embodiment, includes a disposable article that includes the elastic composite. In one aspect, the elastic composite is used in an application selected from the group consisting of ear, waist band, belly band and side panel. In another aspect, the disposable article is selected from the group consisting of diaper, adult incontinence product, feminine hygiene product and medical bandage.

[0012] In one aspect, the invention includes a hot melt adhesive composition that can be used to create a bonded, elasticized region, including from about 35% to about 60% by weight of one or more styrene block copolymers wherein the one or more styrene block copolymers has an average styrene content of at least about 35% and an average MFR (200° C./5 kg) of no less than about 20, greater than about 15% plasticizing oil and, a tackifying agent where the adhesive composition has a viscosity of less than about 15,000 cps at 350° F.

[0013] In one embodiment, the hot melt adhesive composition has a Viscosity Ratio (Viscosity @ 300° F. (cps)/Viscosity @ 350° F.) of no greater than about 5. In another embodiment, the tackifying agent is a hydrocarbon resin with about 5% to about 20% by weight of aromatic content and the plasticizing oil is a naphthertic oil.

[0014] In another aspect, the invention includes a hot melt adhesive composition that can be used to create a bonded, elasticized region, including from about 40% to about 55% by weight of one or more styrene block copolymers wherein the one or more styrene block copolymers has an average styrene content of at least about 35% and an average MER (200° C./5 kg) of no less than about 20, from about 15% to about 30% of a naphthenic plasticizing oil and, from about 30% to about 40% by weight of an aromatic modified hydrocarbon resin where the adhesive composition has a viscosity of less than about 15,000 cps at 350° F.

[0015] In one embodiment, at least one of the styrene block copolymers has a diblock content of greater than about 30% by weight. In another embodiment, the average styrene content of the one or more styrene block copolymers is at least about 40% by weight. In still another embodiment, the one or more styrene block copolymers has an average MFR (200° C./5 kg) of no less than about 30.

[0016] In another aspect, the elastic composite includes a substrate, and a hot melt adhesive composition that can be used to create a bonded, elasticized region, including from about 35% to about 60% by weight of one or more styrene block copolymers wherein the one or more styrene block copolymers has an average styrene content of at least about 35% and an average MFR (200° C./5 kg) of no less than about 20, greater than about 15% plasticizing oil and, a tackifying agent where the adhesive composition has a viscosity of less than about 15,000 cps at 350° F. and wherein the hot melt adhesive provides elasticity to the bonded area.

DETAILED DESCRIPTION

[0017] Applicants have discovered hot melt adhesive compositions that can be used to form elastic composites that are useful in disposable articles (e.g. disposable absorbent articles). The compositions have good elastic recovery and high peel adhesion and have a viscosity of less than about 15,000 cps at 350° F. The low viscosity makes it possible to apply the hot melt adhesive at a high line speed and register i.e. provide zoned application to only those areas requiring elastic performance. The low viscosity further makes it possible to apply the hot melt adhesive within the disposable article manufacturing line.

Elastic Composite

[0018] The elastic composite can include a first substrate and a hot melt adhesive composition. The hot melt adhesive composition imparts elasticity to the first substrate.

[0019] Alternately, the elastic composite can include a first substrate, a second substrate and a hot melt adhesive composition. The hot melt adhesive composition is present between the first and second substrate, permanently bonding the substrates to each other and providing elasticity in the bonded area.

[0020] At least one of the substrates is selected from the group consisting of nonwoven and polymer film.

[0021] Any nonwoven can be used. The nonwoven can be an elastic nonwoven (e.g. core and shell type). The nonwoven can contain fibers made from one or more polymers (e.g. PET (polyethylene terephthalate), PBT (polybutylene terephthalate), nylon, polypropylene and polyethylene), one or more natural fibers (e.g. rayon cellulose, cotton cellulose, hemp and viscose) or combinations thereof. The nonwoven can be formed by a number of different methods, including e.g. airlaid, wetlaid, spunbound or meltblown. The fibers can be carded (e.g. run through a comb) so that they are oriented in a particular direction. The webs can be bonded together in any manner including e.g. hydroentangled, chemical bonded, needle punched or thermally bonded. In one embodiment, the nonwoven is comprised of a blend of polypropylene and polyethylene fibers which are airlaid, carded and hydroentangled.

[0022] Any polymer film can be used. The polymer film can be selected from the group consisting of polyethylene, polypropylene, polyethylene copolymers, polypropylene copolymers, and PET.

[0023] The first and second substrates can be nonwoven. The nonwoven can have a basis weight of less than 40 grams per square meter (gsm), less than 35 gsm, or even less than about 30 gsm. The nonwoven can be extensible to greater than 100% in the cross-web direction.

[0024] Various post treatments, such as treatment with grooved rolls i.e. activation can be used to adjust the mechanical properties (e.g. extensibility) of the composite.

[0025] The hot melt adhesive can be applied to the first and or second substrate using a variety of applicator methods including slot coating, non-contact coating, comb shim coating, spraying including, e.g., spiral spraying and random spraying, screen printing, foaming (e.g. using chemical foaming agents or Nordson FoamMelt® Dispensing equipment), engraved roller, gravure roller, extrusion and meltblown.

[0026] The hot melt adhesive can be applied to one substrate.

[0027] Alternatively, the hot melt adhesive can be applied to the first substrate and then contacted by the second substrate to form the composite. Pressure, tension and/or line speed can be used to aid in forming the bonded composite. The composite can be formed within a disposable article manufacturing process. Alternatively, the composite is formed prior to the disposable article manufacturing process.

[0028] In one embodiment, the elastic composite is formed by applying the hot melt adhesive using a discontinuous application method. The hot melt adhesive application method can be selected from the group consisting of comb shim coating and spraying. Alternatively, any other method of coating could be used to give a discontinuous coating. In one embodiment, the bonded elastic region alternates with an area free of adhesive in a vertical stripe pattern throughout the absorbent article. These vertical stripes can be more like a pin stripe. In one embodiment, the bonded elastic region is a 2 to about 10 mm wide stripe and the area free of adhesive is a 0.5 to about 5 mm wide stripe, or even a 0.5 to about 3 mm wide strip. Having areas free of adhesive, or using a discontinuous method of hot melt adhesive application to form the elastic composite can be useful to give breathability to the composite.

Hot Melt Adhesive Composition

[0029] The hot melt adhesive can be a pressure sensitive adhesive (i.e. have some tack at room temperature). The hot melt adhesive composition can be light in color and can have good thermal stability. In a cooled film, the hot melt adhesive can be clear i.e. translucent or alternatively the hot melt adhesive can be opaque. The hot melt adhesive can have an initial Molten Gardner Color after manufacturing of less than about 3, or even less than about 2. Alternately, the hot melt adhesive can be pigmented to an opaque color such as e.g. pink, blue, white, gray, etc.

[0030] The hot melt adhesive composition has low viscosity at application temperature. The viscosity can be no greater than about 15,000 cps at around 177° C. (350° F.), no greater than about 10,000 cps at around 177° C. (350° F.), no greater than about 7,500 cps at around 177° C. (350° F.), or even no greater than about 5,000 cps at 177° C. (350° F.). The hot melt adhesive composition gives a set after 50% hysteresis of no more than about 20%, no more than about 12%, no more than about 10% or even no more than about 8% when tested according to the 2-Peak Hysteresis Test Method.

[0031] The hot melt adhesive composition provides good adhesion when tested according to the Peel Force Test Method. In some embodiments, the hot melt adhesive has peel adhesion of greater than about 100 grams/inch, greater than about 200 grams/inch, or even greater than about 300 grams/inch.

[0032] The hot melt adhesive composition includes one or more styrene block copolymers, a tackifying agent, and greater than about 15% by weight of a plasticizer.

[0033] The hot melt adhesive composition can have a viscosity curve with a Viscosity Ratio (Viscosity @ 149° C. (300° F.) (cps)/Viscosity @ 177° C. (350° F.)) that is no greater than about 7.5, no greater than about 6, no greater than about 5, or even no greater than about 4. A low viscosity ratio can indicate improved machining at high line speeds as the hot melt adhesive gains viscosity more slowly as it cools.

[0034] The hot melt adhesive composition can include a tackifying agent with at least some aromatic content and a naphthenic oil.

[0035] Styrene Block Copolymers

[0036] The hot melt adhesive includes one or more styrene block copolymers.

[0037] A styrene block copolymer includes an aromatic vinyl polymer block and a conjugated diene polymer block, a hydrogenated conjugated diene polymer block, or a combination thereof. The blocks can be arranged in a variety of configurations including, e.g., linear, branched, radial, star block, and combinations thereof. The aromatic vinyl polymer block can be derived from a variety of aromatic vinyl compounds including, e.g., styrene, alpha-methylstyrene, beta-methylstyrene, o-, m-, p-methylstyrene, t-butylstyrene, 2,4,6-trimethylstyrene, monofluorostyrene, difluorostyrene, monochlorostyrene, dichlorostyrene, methoxystyrene, 1,3-vinylnaphthalene, vinylanthracene, indene, acenaphthylene, and combinations thereof. The diene polymer block can be derived from a variety of diene-containing compounds including, e.g., isoprene, butadiene, hexadiene, 2,3-dimethyl-1,3-butadiene, 3-pentadiene, and hydrogenated versions thereof and combinations thereof.

[0038] Useful styrene block copolymers include, e.g., diblock, triblock and multiblock copolymers including, e.g., styrene-butadiene, styrene-butadiene-styrene, styrene-isoprene, styrene-isoprene-styrene, styrene-ethylene/butene, styrene-ethylene/butene-styrene, styrene-ethylene/propylene, styrene-ethylene/propylene-styrene, styrene-ethylene-ethylene/propylene-styrene, farnesene styrene and combinations thereof and hydrogenated or functionatized versions thereof.

[0039] The one or more styrene block copolymers have an average styrene content of at least about 30%, at least about 35%, at least about 40%, or even from about 35% to about 45% by weight.

[0040] As an example, if a hot melt composition comprises two styrene block copolymers A and B. Polymer A is present at 25 weight % with a styrene content of 35% and polymer B is present at 25 weight % with a styrene content of 45 weight %. The average styrene content of the one or more styrene block copolymers is calculated in the following way: $0.5(35) + 0.5(45) = 40$ weight %.

[0041] The one or more styrene block copolymers have an average Melt Flow Rate (MFR) according to ASTM D 1238 (200° C./5 kg) in dg/min of no less than about 20 dg/min, no less than about 25 dg/min, or even no less than about 30 dg/min. The average MFR of the styrene block copolymers is calculated in a similar manner as the average styrene content.

[0042] The hot melt adhesive can include at least one styrene block copolymer with a styrene content of at least about 40% by weight.

[0043] The composition has a total styrene block copolymer content of greater than 40% by weight, greater than 45% by weight, from about 35% to about 60% by weight, or even from about 40% to about 50% by weight.

[0044] The styrene block copolymers can be pure tri-block copolymers containing no di-block. Alternately, the styrene block copolymer can include a portion of di-block. The styrene block copolymer can include diblock content of greater than 30%.

[0045] Useful styrene block copolymers include VECTOR 6241 (Linear, styrene-butadiene-styrene, pure triblock copolymer, 43 wt % styrene, MFR (200° C./5 kg)=23

dg/min), VECTOR 8508 (Linear, styrene-butadiene-styrene, pure triblock copolymer, 29 wt % styrene, MFR (200° C./5 kg)=12 dg/min and VECTOR 4411 (Linear, styrene-isoprene-styrene, pure triblock copolymer, 44 wt % styrene, MFR (200° C./5 kg)=40 dg/min) all available from TSRC Dexco (Houston, Tex.) and GLOBALPRENE 3545 (Linear, styrene-butadiene-styrene block copolymer, 63% diblock, 45 wt % styrene, MFR (190° C./5 kg)=55) available from LCY CHEMICAL CORP. (Taipei, Taiwan).

[0046] Tackifying Agent

[0047] The hot melt adhesive includes a tackifying agent. The tackifying agent can be fluid or solid at room temperature. Suitable classes of tackifying agents include, e.g., aromatic, aliphatic and cycloaliphatic hydrocarbon resins, mixed aromatic and aliphatic modified hydrocarbon resins, aromatic modified aliphatic hydrocarbon resins, and hydrogenated versions thereof; terpenes, modified terpenes and hydrogenated versions thereof; natural rosins, modified rosins, rosin esters, and hydrogenated versions thereof; low molecular weight polylactic acid; and combinations thereof. Examples of useful natural and modified rosins include gum rosin, wood rosin, tall oil rosin, distilled rosin, hydrogenated rosin, dimerized rosin and polymerized rosin. Examples of useful rosin esters include e.g., glycerol esters of pale wood rosin, glycerol esters of hydrogenated rosin, glycerol esters of polymerized rosin, pentaerythritol esters of natural and modified rosins including pentaerythritol esters of pale wood rosin, pentaerythritol esters of hydrogenated rosin, pentaerythritol esters of tall oil rosin, and phenolic-modified pentaerythritol esters of rosin.

[0048] Useful tackifying agents are commercially available under a variety of trade designations including, e.g., the ESCOREZ series of trade designations from Exxon Mobil Chemical Company (Houston, Tex.) including ESCOREZ 5400 (1% aromatic content), ESCOREZ 5600 (9.8% aromatic content), ESCOREZ 5690 (10% aromatic content), ESCOREZ 5615 (9.9% aromatic content), the EASTOTAC series of trade designations from Eastman Chemical (Kingsport, Tenn.) including EASTOTAC H-100R and EASTOTAC H-100L, and the WINGTACK series of trade designations from Cray Valley HSC (Exton, Pa.) including WINGTACK 86, WINGTACK EXTRA, and WINGTACK 95 and the PICCOTAC and KRISTALEX series of trade designations from Eastman Chemical Company (Kingsport, Tenn.) including, e.g., PICCOTAC 8095 and KRISTALEX 3100.

[0049] The hot melt adhesive can be free from end block resin that has a melting point greater than about 110° C., greater than about 120° C., or even greater than about 130° C.

[0050] The hot melt adhesive composition can include at least one tackifying agent with aromatic content. The tackifying agent can have an aromatic content of greater than 5%, greater than 20%, greater than 50%, from about 5% to about 20% by weight, or even from about 7.5% to about 15% by weight. The aromatic content is measured by Nuclear Magnetic Resonance (NMR) spectroscopy.

[0051] The composition can include a tackifying agent with a melt point of less than 100° C., or even less than 95° C.

[0052] The hot melt adhesive composition can include at least about 20% by weight, at least about 25% by weight, from about 10% by weight to about 50% by weight, from about 15% by weight to about 40% by weight, or even from about 20% by weight to about 37% by weight tackifying agent.

[0053] Plasticizer

[0054] The hot melt adhesive composition includes a plasticizer. Suitable plasticizers include, e.g., napinhenic oils, paraffinic oils (e.g., cycloparaffin oils), mineral oils, phthalate esters, adipate esters, olefin oligomers (e.g., oligomers of polypropylene, polybutene, and hydrogenated polyisoprene), polybutenes, polyisoprene, hydrogenated polyisoprene, polybutadiene, benzoate esters, animal oil, plant oils (e.g., castor oil, soybean oil (e.g. high oleic soy oil), derivatives of oils, glycerol esters of fatty acids, polyesters, polyethers, lactic acid derivatives and combinations thereof.

[0055] Useful commercially available plasticizers include CALSOL 550 naphthenic oil from Calumet Specialty Products Partners, LP (Indianapolis, Ind.), KAYDOL OIL mineral oil from Sonneborn (Tarrytown N.Y.) PARAPOL polybutene from Exxon Mobil Chemical Company (Houston, Tex.), OPPANOL polyisobutylene from BASF (Ludwigshafen, Germany), KRYSTOL 550 mineral oil from Petrochem Carless Limited (Surrey, England), PURETOL 35 and 15 both mineral oils from Petro Canada Lubricants Inc. (Mississauga, Ontario) and PLENISH from Pioneer Dupont.

[0056] The plasticizer can be a naphthenic oil. Alternately, the plasticizer includes aromatic or naphthenic groups.

[0057] The plasticizer is present in the hot melt adhesive composition in an amount of at least about 15% by weight, at least about 18% by weight, from about 10% to about 30% by weight, or even from about 15% to about 25% by weight.

[0058] Wax

[0059] The hot melt adhesive composition can include a wax. Useful classes of wax include, e.g., paraffin waxes, microcrystalline waxes, high density low molecular weight polyethylene waxes, by-product polyethylene waxes, polypropylene waxes, Fischer-Tropsch waxes, oxidized Fischer-Tropsch waxes, functionalized waxes such as acid, anhydride, and hydroxy modified waxes, animal waxes, vegetable waxes (e.g. soy wax) and combinations thereof. Useful waxes are solid at room temperature and preferably have a Ring and Ball softening point of from 50° C. to 170° C. Useful waxes are commercially available from a variety of suppliers including EPOLENE N and C series of trade designations from Westlake Chemical Corporation (Houston, Tex.) including e.g. EPOLENE N-21 and the LICOCENE series of trade designations from Clariant International Ltd. (Muttentz, Switzerland) including e.g. TP LICOCENE PP 6102.

[0060] The hot melt adhesive composition can include no greater than about 8.0% by weight, no greater than about 5% by weight, from about 1% by weight to about 7.5 by weight, or even from about 1% to about 5% by weight wax.

[0061] Additional Components

[0062] The hot melt adhesive composition optionally includes additional components including but not limited to, e.g., foaming agents, stabilizers, antioxidants, additional polymers (e.g. olefin based polymers (e.g. propylene homopolymers, propylene copolymers, ethylene homopolymers, ethylene copolymers, etc.), functionalized polymers such as acid, anhydride, and hydroxy modified polymers), amorphous poly-alpha olefins), adhesion promoters, ultraviolet light stabilizers, corrosion inhibitors, odor absorbers/neutralizers, colorants (e.g., pigments (e.g. titanium dioxide, carbon black, and mixtures thereof) and dyes), fragrances, fillers (e.g. nano particles, calcium carbonate, clay, talc, fumed silica), surfactants, wetness indicators, superabsorbents, coextrusion coatings, processing aids and combinations thereof.

[0063] The hot melt adhesive can comprise from about 0.05 to about 2.0% by weight pigment, or even from about 0.05 to about 0.5% pigment.

[0064] Useful antioxidants include, e.g., pentaerythritol tetrakis[3,(3,5-di-tert-butyl-4-hydroxyphenyl)propionate], 2,2'-methylene bis(4-methyl-6-tert-butylphenol), phosphites including, e.g., tris-(p-nonylphenyl)-phosphite (TNPP) and bis(2,4-di-tert-butylphenyl)4,4'-diphenylene-diphosphonite, di-stearyl-3,3'-thiodipropionate (DSTD), and combinations thereof. Useful antioxidants are commercially available under a variety of trade designations including, e.g., the IRGANOX series of trade designations including, e.g., IRGANOX 1010, IRGANOX 565, and IRGANOX 1076 hindered phenolic antioxidants and IRGAFOS 168 phosphite antioxidant, all of which are available from BASF Corporation (Florham Park, N.J.), and ETHYL 702 4,4'-methylene bis(2,6-di-tert-butylphenol). When present, the hot melt adhesive composition preferably includes from about 0.1% by weight to about 2% weight antioxidant.

Disposable Article

[0065] The hot melt adhesive compositions and elastic composites of this invention can be incorporated into any suitable article including personal care garments, medical garments and industrial worker garments.

[0066] The elastic composite of this invention is useful in a variety of applications and constructions to improve comfort and fit including e.g., disposable absorbent articles including, e.g., diapers, training pants, swim wear, absorbent underpants, adult incontinence products, sanitary napkins, medical dressings (e.g., wound care products and bandages), surgical pads, medical gowns, caps, gloves, drapes, face masks, laboratory coats, coveralls, meat-packing products, and components of absorbent articles including, e.g., an absorbent clement, absorbent cores, impermeable layers (e.g., backsheets), tissue (e.g., wrapping tissue), acquisition layers and woven and nonwoven web layers (e.g., top sheets, absorbent tissue).

[0067] The elastic composite of this invention is useful for elasticizing many areas of disposable articles including leg cuffs, waist portions, belly bands, side panels and fastening tabs/ears. The elastic composite of this invention can further be used to elasticize any portion of the disposable article, one or more portions of the disposable article, or even the entire disposable article.

EXAMPLES

[0068] Composition amounts in tables are all in weight %.

Test Procedures

[0069] Test procedures used in the examples and throughout the specification, unless stated otherwise, include the following.

Viscosity Test Method

[0070] Viscosity is determined in accordance with ASTM D-3236 entitled, "Standard Test Method for Apparent viscosity of Adhesives and Coating Materials," (Oct. 31, 1988), using a Brookfield Thermoset viscometer Model RVDV 2 and a number 27 spindle. The results are reported in centipoise (cps).

Molten Gardner Color

[0071] The hot melt adhesive is tested (in the molten state) to determine Molten Gardner Color by comparing the color of the sample against the Gardner Color Standards as set forth in ASTM D-1544. The comparison is made using a Gardner Delta Comparator equipped with an Illuminator available from Pacific Scientific (Bethesda, Md.).

Test Lamination Preparation

[0072] Test laminations were prepared by continuous slot coating the elastic hot melt adhesive composition between two nonwoven* substrates at an application temperature of 177° C. (350° F.), a nip pressure of 10.5 Newtons/centimeter (N/cms) (6 pounds per linear inch (PLI)), and a run speed of at least 6.1 meters/min (m/min) (20 feet/min). Laminations were prepared with an adhesive coat weight of 100 grams per square meter (gsm) and the width of the adhesive was at least 7.6 cms (3 inches). A sufficient amount of laminate was prepared such that at least 1.5 m (60 inches) of representative lamination was collected for testing.

*The nonwoven used is carded, hydroentangled and comprises 50/50 (PET/PP). It has a basis weight of 29 g/m², a cross direction tensile strength of 93 grams/cm² (600 grams/in²), a CD elongation at break=217% WSP Method 110.4, and an elongation ratio (CD/MD)=4.3.

Peel Force Test Method

[0073] Test laminates were prepared by coating adhesive between two substrates according to the Test Lamination Preparation method above. Peel force is determined using ASTM D1876-01 entitled; "Test Method for Determining Peel Resistance of Adhesive (T-Peel Test Method)," with the exception that the test is run at a rate of 30.5 cms per minute (12 inches per minute), instead of 25.4 cms per minute (10 in per minute), over a period of 10 seconds, and 7 replicates are run instead of the 10 specified in ASTM D1876. The samples are run on an INSTRON type-test instrument. The test samples are 2.54 cms (1 inch) in width and at least 10.16 cms (4 inches) in length. The average peel force over 10 seconds of peeling is recorded, and the results are reported in grams. The initial peel force is measured at least 24 hours after the laminate is prepared.

2-Peak Hysteresis Test Method

[0074] Test laminates were prepared by coating hot melt adhesive between two substrates according to the Test Lami-

nation Preparation method above. Test samples are prepared by cutting the laminates in cross-web direction, with 1 inch in width and at least 3 inches in length. The test is conducted at least 24 hours after the non-woven laminate is prepared.

[0075] The strips prepared are extended to a certain strain (e.g. 50%, 100%, 150% or 200%) and then retracted to their original dimension. Subsequently the specimen goes through a second extension-retraction cycle with the same deformation. The cross head speed is set to 50.8 cms per minute (20 inches per minute). There is no holding time between extension and retraction. The samples are run on an INSTRON type-test instrument with at least 3 replicates. The permanent set after each cycle is determined by the tensile strain on the retraction curve when the tensile stress reduces to 5 gram force. The peak loadstress at maximum deformation, and percent energy loss between each cycles are also recorded.

Rheological Creep and Recovery

[0076] Rheological Creep and Recovery was run on a Texas Instruments AR-G2 rheometer using parallel plate geometry with a 8 mm plate. The test was run isothermally at 38° C. with a gap of 300 um.

[0077] Once equilibrated at 38° C., a pressure of 26,800 Pa was applied. The sample was held at this pressure for 20 minutes (creep portion of test). The pressure was then released to 0 Pa for 20 minutes (recovery portion of test).

[0078] The strain was measured. Values at specified intervals are reported in the table.

TABLE ONE

Comparative 1 and 2 are compositions outside of the inventive ranges (Comparative 1 has less than 15% plasticizer and Comparative 2 has a styrene block copolymer with an average MFR of 12 dg/Min. Both have a viscosity at 350° F. of greater than 15,000 cps). Both would be expected not to apply well on a high speed production line.		
	Comparative 1	Comparative 2
VECTOR 8508	40	45
(Avg. MFR (200° C./5 kg) = 12)		
ESCOREZ 5615	49.5	29.5
CALSOL 550	10	25
IRGANOX 1010	0.5	0.5
Viscosity @ 350° F. (cps)	43,400	30,870

TABLE TWO

	Ex. 1	Ex. 2	Ex. 3	Ex. 4	Ex. 5	Ex. 6
VECTOR 6241						20
VECTOR 4411	46	46	46	42.5	42.5	26
ESCOREZ 5490				32		
ESCOREZ 5400	33.5					
ESCOREZ 5690		33.5	33.5		32	31.5
PURETOL 35	20	20		25		
CALSOL 550			20		25	22
PLENISH						
IRG 1010	0.5	0.5	0.5	0.5	0.5	0.5
Viscosity (cps)						
@149° C. (300° F.)	204,500	68,000	38,800	77,000	18,250	33,500
@177° C. (350° F.)	14,050	9,700	8,020	6,950	4,210	8,940

TABLE TWO-continued

Viscosity	14.56	7.01	4.83	11.10	4.34	3.75
Ratio						
@149° C./						
@177° C.						
Rheo.						
Creep						
Strain @				.078	.067	
0.01 sec						
Strain @				.232	.169	
600 sec						
Strain @				.246	.192	
1200 sec						
Rheo.						
Recovery						
Strain @				.246	.192	
1200 sec						
Strain @				.05	.041	
1800						
seconds						
Strain @				.043	.033	
2400 sec						
	Ex. 7	Ex. 8	Ex. 9	Ex. 10	Ex. 11	
VECTOR 6241	20					
VECTOR 4411	26	50	50	35	35	
ESCOREZ 5490	29.5	29.5		38.5		
ESCOREZ 5400						
ESCOREZ 5690	31.5		29.5		38.5	
PURETOL 35		20		26		
CALSOL 550			20		26	
PLENISH	22					
IRG 1010	0.5	0.5	0.5	0.5	0.5	
Viscosity						
(cps)						
@149° C.	28,100	279,600	74,800	18400	6000	
(300° F.)						
@177° C.	7,750	30,150	12,550	2545	2065	
(350° F.)						
Viscosity	3.63	9.27	6.0	7.23	2.91	
Ratio						
@149° C./						
@177° C.						
Rheo.						
Creep						
Strain @			.052	.084	.078	
0.01 sec						
Strain @			.162	.457	.377	
600 sec						
Strain @			.189	.488	.424	
1200 sec						
Rheo.						
Recovery						
Strain @			.189	.488	.424	
1200 sec						
Strain @			.048	.106	.104	
1800						
seconds						
Strain @			.039	.094	.087	
2400 sec						

TABLE THREE

	Ex. 12	Ex. 13	Ex. 6	Ex. 14	Ex. 15	Ex. 16	Ex. 17
VECTOR 8508	20	15					
VECTOR 4411	26	31	26	26		46.5	
VECTOR 6241			20	20	30		46.5
GLOBALPRENE 3545					15		

TABLE THREE-continued

	Ex. 12	Ex. 13	Ex. 6	Ex. 14	Ex. 15	Ex. 16	Ex. 17
Avg. Styrene Content of SBC	37.5	39.1	43.6	43.6	43.7	44	43
Avg. MFR (200° C./5 kg)	27.8	30.9	32.6	32.6	>33	40	23
ESCOREZ 5690	31.5	31.5	31.5	33.5		29.75	29.75
ESCOREZ 5615					34.5		
CALSOL 550	22	22	22	20	20	23.25	23.25
IRGANOX 1010	0.5	0.5	0.5	0.5	0.5	0.5	0.5

TABLE FOUR

	Ex. 12	Ex. 13	Ex. 6	Ex. 14	Ex. 15	Ex. 16	Ex. 17
Viscosity (cps)							
@149° C.(300° F.)	47,000	48,590	33,500	33,000	33,800	35,150	37,800
@163° C.(325° F.)	23,125	21,570	16,290	16,150	17,750	14,250	18,850
@177° C.(350° F.)	12,700	12,800	8,940	9,250	11,050	7,050	12,050
Viscosity Ratio @149° C./177° C.	3.70	3.80	3.75	3.56	3.06	4.99	3.11
2-Peak Hysteresis Testing							
50% hysteresis							
Set 1 st cycle (%)	6	6	6	8	9	6	5
Set 2 nd cycle (%)	7	6	7	10	10	7	6
Energy loss (%)	31.1	31.1	35.1	37.0	37.9	35.1	34.5
100% hysteresis							
Set 1 st cycle (%)	15	14	15	21	23	16	14
Set 2 nd cycle (%)	17	17	17	23	26	18	16
Energy loss (%)	43.0	44.2	46.7	48.7	51.2	46.9	45.6
150% hysteresis							
Set 1 st cycle (%)	24	24	27	37	41	26	23
Set 2 nd cycle (%)	27	27	30	40	45	28	27
Energy loss (%)	54.3	55.1	55.2	59.8	61.6	56.2	54.4
Adhesion							
Average peel (gram force)	278	238	437	256	852	68	272

What is claimed is:

1. An elastic composite comprising:
a first and second substrate; and
a hot melt adhesive composition between the first and second substrates thereby permanently bonding the first and second substrates to each other and providing elasticity in the bonded area, said hot melt adhesive composition comprising:
about 35% by weight to about 60% by weight of one or more styrene block copolymers wherein the one or more styrene block copolymers has an average styrene content of at least about 30% by weight and an average MFR (200° C./5 kg) of no less than about 20, greater than about 15% of a plasticizer and,
a tackifying agent;
wherein the hot melt adhesive composition has a viscosity of less than about 15,000 cps at 177° C. (350° F.).
2. The elastic composite of claim 1 wherein the hot melt adhesive composition has a viscosity of less than about 10,000 cps at 177° C. (350° F.).
3. The elastic composite of claim 1 wherein the one or more styrene block copolymers have an average styrene content of at least about 35% by weight.

4. The elastic composite of claim 1 wherein the hot melt adhesive composition comprises from about 25% by weight to about 40% by weight tackifying agent.

5. The elastic composite of claim 1 wherein the hot melt adhesive composition comprises at least one tackifying agent with a melt point of less than 100° C.

6. The elastic composite of claim 1 wherein the first and second substrate are nonwoven.

7. The elastic composite of claim 6 wherein the nonwoven is airlaid, carded and hydroentangled.

8. The elastic composite of claim 6 wherein the nonwoven is extensible to greater than 100% in the cross web direction.

9. The elastic composite of claim 1 wherein the hot melt adhesive is applied to the substrate using an applicator method selected from the group consisting of slot and non contact coating.

10. The elastic composite of claim 1 wherein the hot melt adhesive is applied to the substrate using an applicator method selected from the group consisting of screen printing, spraying, comb shim slot and gravure roll.

11. A disposable article comprising the elastic composite of claim 1.

12. The disposable article of claim **11** wherein the elastic composite is used in an application selected from the group consisting of ear, waist band, belly band and side panel.

13. The disposable article of claim **11** selected from the group consisting of diaper, adult incontinence product, feminine hygiene product and medical bandage.

14. A hot melt adhesive composition that can be used to create a bonded, elasticized region, comprising:

from about 35% to about 60% by weight of one or more styrene block copolymers wherein the one or more styrene block copolymers has an average styrene content of at least about 35% and an average MFR (200° C./5 kg) of no less than about 20,
greater than about 15% plasticizing oil and,
a tackifying agent

wherein the adhesive composition has a viscosity of less than about 15,000 cps at 177° C. (350° F.).

15. The hot melt adhesive of claim **14** wherein the hot melt adhesive composition has a Viscosity Ratio (Viscosity @ 149° C. (300° F.) (cps)/Viscosity @ 177° C. (350° F.) of no greater than about 5.

16. The hot melt adhesive composition of claim **14** wherein the tackifying agent is a hydrocarbon resin with about 5% to about 20% by weight of aromatic content and the plasticizing oil is a naphthenic oil.

17. A hot melt adhesive composition that can be used to create a bonded, elasticized region, comprising:

from about 40% to about 50% by weight of one or more styrene block copolymers wherein the one or more styrene block copolymers has an average styrene content of at least about 35% and an average MFR (200° C./5 kg) of no less than about 20,
from about 15% to about 30% of a naphthenic plasticizing oil and,
from about 30% to about 40% by weight of an aromatic modified hydrocarbon resin;

wherein the adhesive composition has a viscosity of less than about 15,000 cps at 350° F.

18. The hot melt adhesive of claim **17** wherein at least one of the styrene block copolymers has a diblock content of greater than about 30% by weight.

19. The hot melt adhesive of claim **17** wherein the average styrene content of the one or more styrene block copolymers is at least about 40% by weight.

20. An elastic composite comprising:

a nonwoven substrate, and

the hot melt adhesive composition of claim **14** bonded to the substrate;

wherein the hot melt adhesive provides elasticity to the bonded area.

* * * * *