An extensible laminate includes a sheet of an extensible nonwoven material that has a fabric side and a film side, a sheet of an elastomeric film, and an adhesive. The adhesive is applied to at least a portion of the film side of the extensible nonwoven material. The extensible nonwoven material is selectively attached to the elastomeric film by a plurality of intermittent adhesive bonds. The extensible nonwoven material is further selectively attached to the elastomeric film by a plurality of thermal point bonds. The intermittent adhesive bonds cover a greater percentage of an interfacial plane between the extensible nonwoven material and the elastomeric film material than the thermal point bonds. A process for making the extensible laminate is also disclosed.
FIG. 1
EXTENSIBLE LAMINATE OF NONWOVEN AND ELASTOMERIC MATERIALS AND PROCESS FOR MAKING THE SAME

FIELD OF INVENTION

This invention is directed to laminates of extensible nonwoven material and elastomeric material that are bonded using both intermittent adhesive bonds and thermal point bonds wherein the adhesive bonds cover a greater percentage of an interfacial plane between the extensible nonwoven material and the elastomeric material than the thermal bonds. The resulting extensible laminates exhibit increased elasticity in the cross direction compared to laminates in which the elastomeric material is fully bonded to the extensible nonwoven material. Additionally, the resulting laminates exhibit desirable surface aesthetics due to the pattern created by the thermal point bonds. A process for making the extensible laminates that provides greater flexibility in the manufacturing process is also disclosed.

BACKGROUND OF THE INVENTION

Composites of elastic and nonelastic material have been made by bonding the elastic material to the nonelastic material in a manner that allows the entire composite to stretch or elongate. Often these composites are used in garment materials, pads, diapers, adult incontinence products and feminine care products. One such composite or laminate includes an extensible nonwoven material that has been bonded to an elastomeric sheet.

The ability of these laminates to stretch and recover is affected by the level of bonding or attachment between the elastomeric sheet and the extensible nonwoven material. Generally, the greater the level of attachment between the elastomeric sheet and the extensible nonwoven material the higher the extension force and permanent set and the lower the retraction force/extension force ratio of the laminate will be. However, the level of bonding between the nonwoven material and the elastomeric sheet must be sufficient enough to provide internal cohesion to the laminate so that the layers do not peel or separate from each other during use.

The layers of the laminate may be bonded together using a variety of techniques including thermal bonding, adhesive bonding and point bonding which may also be thermal. Thermal bonding techniques include extruding a molten elastomeric material in the form of a film onto the extensible nonwoven web. The film and the nonwoven material are then smooth calendered to bond the two layers together. Thermal bonding techniques also include passing a cast elastomeric film or a meltblown elastomeric web and an extensible nonwoven material web through heated smooth calender rolls to affect bonding. However, in both cases, the elastomeric material is substantially fully bonded to the nonwoven thereby increasing the extension force and set and decreasing the retraction force/extension force ratio. Additionally, in thermal bonding techniques, great care must be taken not to overheat the laminates during the extrusion and/or calendering processes. Overheating can result in degradation and/or melting of both the elastomeric material and the extensible nonwoven material causing defects in the laminate and failure of the laminate during use.

Adhesive bonding techniques achieve similar results. Generally, an adhesive, typically a hot melt or molten type adhesive or a pressure sensitive adhesive, is applied to a surface of either the elastomeric sheet or the extensible nonwoven. The layers are then calendered to achieve bonding. The layers of the resulting laminate may be fully attached or selectively attached to each other.

Point bonding techniques, which may be thermal, may also be used to join the layers of the laminate. Point bonding techniques generally involve the mechanical forcing of portions of one layer into areas of a second layer such that portions of the first layer become entrapped in the second layer thereby bonding the layers together. Desirably, in the production of extensible nonwoven composites, the elastomeric material is in a molten or near-molten state in order to achieve effective bonding between the layers of material. The elastomeric material may also be softed by heating the patterned and/or smooth calender roll. An example of a process for point bonding a nonwoven material to an elastomeric sheet is disclosed in U.S. Pat. No. 6,001,460 to Mormon et al., the disclosure of which is hereby incorporated by reference.

The bonding techniques typically used to join the layers of extensible laminates, point bonding creates the most aesthetically desirable surface pattern, as well as, functional attachment between the layers. Often the surface appearance, in addition to performance characteristics, of a laminate is a key factor driving consumer preference for one product over another. However, bonding techniques relying on heat to affect bonding have limited flexibility in terms of the production speeds and types of materials that may be used in the individual layers.

Adhesive bonding provides greater flexibility in the manufacturing process because a wide variety of adhesives, such as, for example, inelastic, elastomeric, pressure sensitive, melt blown or hot melt adhesives, may be utilized to bond a greater variety of materials. Additionally, adhesive bonding may be more cost effective and less process and material limiting than thermal bonding. Furthermore, adhesives can be applied in a wide variety of patterns capable of mimicking point bond patterns without the use of expensive calender or embossing rolls. This feature also makes it possible to change the adhesive bond pattern quickly during production such that different patterns and/or levels of adhesive bond coverage can be achieved during a single production run.

With the foregoing in mind, there is a need or desire for an extensible laminate having improved elastic properties that has an aesthetically desirable surface pattern.

It is a feature and advantage of the invention to provide an extensible laminate that can be produced at greater speed and with greater flexibility. It is also a feature and advantage of the invention to provide an extensible laminate that can be produced without thermally degrading and/or melting the nonwoven web.

DEFINITIONS

The term “extensible” refers to a material that can be stretched without breaking by at least 50% (to at least 150% of its initial unstretched length) in at least one direction, suitably by at least 100% (to at least 200% of its initial unstretched length). For example, an extensible material having an initial unstretched length of 3 inches may be...
stretched without breaking to at stretched length of at least 4.5 inches in at least one direction. The term includes elastic materials as well as materials that stretch but do not significantly retract such as, for example, needled nonwoven materials and inherently extensible nonwoven materials like bonded carded webs.

[0012] As used herein, the terms “elastic” and “elastomeric” mean a material which upon application of a biasing force, is stretchable to a stretched, biased length that is at least about 150 percent of its relaxed, unstretched length, and which will recover at least 55 percent of its elongation upon release of the stretching, biasing force within about one minute.

[0013] As used herein, the term “recover” refers to a contraction of a stretched material upon termination of a biasing force following stretching of the material by application of the biasing force. For example, if a material having relaxed, unbiased width of 1 inch is extended 50 percent in the cross direction by stretching to a width of 1.5 inches the material would be extended 50 percent (0.5 inch) and would have a stretched width that is 150 percent of its relaxed width. If this exemplary stretched material relaxed, and recovered to a width of 1.1 inches after release of the biasing and stretching force, the material would have recovered 80 percent (0.4 inch) of its 0.5 inch extension. Recovery may be expressed as (maximum stretched dimension minus final sample dimension)/(maximum stretched dimension minus initial sample dimension)×100.

[0014] The term “biaxially extensible” refers to a material that may be stretched by at least about 50% in two directions perpendicular to each other (e.g. stretchable in a machine direction and cross direction, or in a longitudinal direction, front to back, and a lateral direction, side to side). The term includes biaxially extensible laminates such as those disclosed in, for example, U.S. Pat. Nos. 5,114,781 and 5,116,662 to Mornan, which are incorporated by reference.

[0015] As used herein, the term “machine direction” or “MD” means the length of a material in the direction in which it is produced. The term “cross direction” or “CD” means the width of a material, (e.g., a direction generally perpendicular to the machine direction).

[0016] As used herein, the term “polymer” generally includes, but is not limited to, homopolymers, copolymers, such as for example, block, graft, random and alternating copolymers, terpolymers, etc. and blends and modifications thereof. Furthermore, unless otherwise specifically limited, the term “polymer” shall include all possible geometrical configurations of the material. These configurations include, but are not limited to, isotactic, syndiotactic and random symmetries.

[0017] As used herein, the terms “elastomeric sheet” and “elastomeric web” refer to elastomeric films formed by extrusion, casting or other methods known in the art, as well as, elastomeric nonwoven fabrics such as, for example, meltblown elastomeric webs as disclosed in U.S. Pat. No. 4,663,220 in Wisneski et al., which is incorporated by reference, and elastomeric foams.


[0019] As used herein the term “nonwoven web” or “nonwoven material” means a material that has a structure of individual fibers or threads which are interlaid, but not in an identifiable repeating manner. Nonwoven webs or materials have been formed by a variety of processes such as, for example, melt-blowing processes, spunbonding processes, airlaying processes, coforming processes, and bonded carded web processes.

[0020] As used herein, the term “film side” when referring to a nonwoven web or nonwoven material means a surface of the nonwoven web or material that may be joined, attached or bonded to an elastomeric sheet to form a laminate. The term “fabric side” when referring to a nonwoven web or material means a surface opposite the film side.

[0021] As used herein, the term “microfibers” means small diameter fibers having an average diameter of not greater than about 100 microns, for example, having a diameter of from about 0.5 microns to about 50 microns, more specifically microfibers may also have an average diameter of from about 4 microns to about 40 microns.

[0022] As used herein, the term “bonded carded web” refers to webs that are made from staple fibers which are oriented through a combing or carding unit, which separates or breaks apart and aligns the staple fibers in the machine direction to form a generally machine direction-oriented fibrous nonwoven web. Such fibers are usually purchased in bales which are placed in an opener/blender or picker which separates the fibers prior to the carding unit. Once the web is formed, it is bonded by one or more of several known bonding methods. One such bonding method is powder bonding, wherein a powdered adhesive is distributed through the web and then activated, usually by heating the web and adhesive with hot air. Another suitable bonding method is pattern bonding, wherein heated calender rolls or ultrasonic bonding equipment are used to bond the fibers together, usually in a localized bond pattern, though the web can be bonded across its entire surface if so desired. Another suitable and well known bonding method, particularly when using bicomponent staple fibers, is through-air bonding.

[0023] As used herein, the term “meltblown fibers” means fibers formed by extruding a molten thermoplastic material through a plurality of fine, usually circular, die capillaries as molten threads or filaments into a high velocity gas (e.g., air) stream which attenuates the filaments of molten thermoplastic material to reduce their diameters, which may be to microfiber diameter. Thereafter, the meltblown fibers are carried by the high velocity gas stream and are deposited on a collecting surface to form a web of randomly dispersed meltblown fibers. Such a process is disclosed, for example, in U.S. Pat. No. 3,849,241 to Butin, the disclosure of which is hereby incorporated by reference.

[0024] As used herein, the term “spunbond fibers” refers to small diameter fibers which are formed by extruding a molten thermoplastic material as filaments from a plurality of fine, usually circular, capillaries in a spinneret with the diameter of the extruded filaments then being rapidly reduced, for example, by eductive drawing or other well-
known spun bonding mechanisms. The production of spun bonded nonwoven webs is illustrated in patents such as, for example, in U.S. Pat. No. 4,340,563 to Appel et al., and U.S. Pat. No. 3,692,618 to Dorschner et al. The disclosures of which are hereby incorporated by reference.

[0025] As used herein, the term “interfiber bonding” means bonding produced by thermal bonding or entanglement between the individual nonwoven fibers to form a coherent web structure. Fiber entangling is inherent in the meltblown process but may be generated or increased by processes such as, for example, hydraulic entangling or needlepunching. One or more thermal bonding steps are employed in most processes for forming spunbonded webs. Alternatively and/or additionally, a bonding agent can be utilized to increase the desired bonding and to maintain structural coherency of the web. For example, powdered bonding agents and chemical solvent bonding may be used.

[0026] As used herein, the term “inherently extensible nonwoven material” refers to a nonwoven material that may be stretched by at least 50% in at least one direction without further processing such as necking or creping.

[0027] As used herein, the term “necked material” refers to any material that has been constricted in at least one dimension by processes such as, for example, drawing or gathering.

[0028] As used herein, the term “neckable material” means any material which can be necked.

[0029] As used herein, the term “reversibly necked material” refers to a necked material that has been treated while necked to impart memory to the material so that, when a force is applied to extend the material to its pre-necked dimensions, the necked and treated portions will generally recover to their necked dimensions upon termination of the force. One form of treatment is the application of heat. Generally speaking, extension of the reversibly necked material is substantially limited to extension to its pre-necked dimensions. Therefore, unless the material is elastic, extension too far beyond its pre-necked dimensions will result in material failure. A reversibly necked material may include more than one layer, for example, multiple layers of spunbonded web, multiple layers of meltblown web, multiple layers of bonded carded web or any other suitable combination or mixtures thereof, as described in U.S. Pat. No. 4,965,122 to Morman, which is incorporated by reference.

[0030] As used herein, the term “percent neckdown” refers to the ratio determined by measuring the difference between the pre-necked dimension (width) and the necked dimension (width) of a neckable material and then dividing that difference by the pre-necked dimension of the neckable material x 100.

[0031] As used herein, the term “extensible laminate” refers to a material having an elastomeric sheet joined to an extensible material at least at two places (e.g., a single-faced extensible laminate). The elastomeric sheet may be joined to the extensible material at intermittent points or may be completely bonded thereto. The joining is accomplished while the elastomeric sheet and the extensible material are in juxtaposed configuration. An extensible laminate may include more than two layers. For example, the elastomeric sheet may have an extensible material joined to both of its sides so that a three-layer extensible laminate is formed having a structure of extensible material/elastomeric sheet/extensible material (e.g., a two-faced extensible laminate). Additional elastic or elastomeric sheets, necked material layers, and/or inherently extensible materials such as bonded carded webs may be added. Other combinations of elastomeric sheets and extensible materials may be used, for instance, as indicated in commonly assigned U.S. Pat. Nos. 5,114,781 and 5,116,662 to Morman and U.S. Pat. No. 5,336,545 to Morman et al., which are hereby incorporated by reference.

[0032] As used herein, the term “interfacial plane” refers to a two-dimensional plane defined by the width dimension and the length dimension of a laminate between two adjacent webs, webs or layers of a single-faced extensible laminate or a two-dimensional plane defined by the width dimension and the length dimension of a laminate between the two outer webs, webs or layers of a two-faced extensible laminate including three or more sheets, webs or layers.

[0033] As used herein, the term “cycling test” refers to a method, using a constant-strain-of-extension tensile tester such as, for example, Sintech 2, Model 3397-139, available from Sintech Corporation, Cary, N.C., to determine the level of cross-directional elasticity of an extensible laminate. Specifically, a sample of an extensible laminate is cut to a 4.5 x 3 inch dimension, the 4.5 inches being in the cross-direction. The 3-inch long sample is clamped between two pneumatic jaws so that the gauge length (jaw separation) is two inches, and the direction of pull is in the cross-direction. The pulling speed is 20 inches/min. Testing is done during two extension/retraction cycles. The sample is first pulled to 100% elongation (4-inch jaw separation) and immediately returned (retracted) to the starting gauge length. The extension/retraction cycle is then repeated. Finally, the sample is pulled to an extension where it breaks, at which time the test is stopped. Force and extension are measured by an appropriate loadcell and other sensors. Data are recorded and analyzed by a computer program. The samples are characterized by the load (force) measured at 30% elongation during the first cycle extension (pull) cycle and the load at 30% elongation during the second cycle retraction mode. The elasticity measurement is reported as a ratio of retraction force per extension force.

[0034] As used herein, the terms “cross-directional elasticity” and “elasticity measurement” refer to the ratio between the retraction force and extension force as determined by the cycling test.

[0035] As used herein, the terms “bond coverage” and “percent bond coverage” refer to the amount of the interfacial plane that is covered by intermittent adhesive bonds and/or thermal point bonds.

[0036] As used herein, the terms “interruption bonds” or “interrupting bonding” refer to discreet areas of attachment between two or more layers of material. The layers in the area surrounding the intermittent bonds remain substantially unattached to each other allowing independent movement of each of the layers.

[0037] As used herein, the term “intermittent adhesive bonds” refers to intermittent bonds formed by applying a discontinuous or random pattern of adhesive to portions of
a first sheet of fabric, film or fibrous material and passing the first sheet and a second sheet of fabric, film or fibrous material through a nip between two smooth nip rolls such that portions of the first sheet are selectively adhered to areas of the second sheet. The level of intermittent adhesive bond coverage is determined by, at least in part, the amount of adhesive applied and the pattern of application.

[0038] As used herein, the term “thermal point bonds” refers to intermittent bonds formed through the use of heat and/or pressure. For example, thermal point bonds may be formed by using a heated, patterned calender roll to push portions of a first sheet of fabric, film or fibrous material into a second sheet of fabric, film or fibrous material such that portions of the second sheet encapsulate areas of the first sheet and bond thereto. Alternatively, thermal point bonds may be formed by using a patterned ultrasonic bonding horn to create localized areas of heat such that when the materials to be bonded are passed between the ultrasonic bonding horn and an ultrasonic bonding anvil the combination of heat and pressure form discreet bonds between the materials. The thermal point bonds may have a variety of shapes. The thermal point bonds may appear as discreet dots that are, for example, circular or elliptical, or may appear as stars, animals, line segments or other shapes. Various thermal point bond shapes can be combined to create thermal point bond patterns such as, for example, wire weave, I&P and Ramisch patterns. The level of thermal point bond coverage is determined by, at least in part, the size and quantity of thermal point bonds.

[0039] As used herein, the terms “selectively” encompass the terms “only” and “to a greater extent.”

[0040] As used herein, the term “consisting essentially of” does not exclude the presence of additional materials or process steps which do not significantly affect the desired characteristics of a given composition or product. Exemplary materials of this sort would include, without limitation, pigments, antioxidants, stabilizers, surfactants, waxes, flow promoters, solvents, particulates and materials added to enhance processability of the composition.

[0041] As used herein, the term “comprising” opens the claim to inclusion of additional materials or process steps other than those recited.

[0042] These terms may be defined with additional language in the remaining portions of the specification.

SUMMARY OF THE INVENTION

[0043] The present invention is directed to extensible laminates having improved elasticity properties in the cross direction. The extensible laminate includes both intermittent adhesive bonds and thermal point bonds with regions of non-attachment therebetween. The regions of non-attachment between the bonds preserve the independent movement of the layers of the laminate thereby maximizing the elasticity properties of the extensible laminate. Desirably, the extensible laminates of the present invention have an elasticity measurement of greater than about 0.22 retraction force/extension force ratio. By utilizing both intermittent adhesive bonds and thermal point bonds, the extensible laminate having a desirable surface aesthetic can be produced faster while the peel strength and the internal cohesion are maintained.

[0044] In one embodiment of the present invention, an extensible laminate includes a sheet of an extensible nonwoven material, a sheet of an elastomeric material and an adhesive. The adhesive is applied to at least a portion of a film side of the extensible nonwoven material such that the extensible nonwoven material is selectively attached to the elastomeric sheet by a plurality of intermittent adhesive bonds. The extensible nonwoven material is further selectively attached to the elastomeric sheet by a plurality of thermal point bonds such that the intermittent adhesive bonds cover a greater percentage of an interfacial plane between the extensible nonwoven material and the elastomeric sheet than the thermal point bonds.

[0045] In another embodiment, an extensible laminate includes a first sheet of extensible nonwoven material, a second sheet of extensible nonwoven material and a sheet of an elastomeric material positioned between the first and second sheets of extensible nonwoven material. An adhesive is applied to at least a portion of a film side of the first sheet of extensible nonwoven material and/or the second sheet of extensible nonwoven material such that the first sheet and/or second sheet of extensible nonwoven material is selectively attached to the sheet of elastomeric material by a plurality of intermittent adhesive bonds. The first and/or second sheet of extensible nonwoven material is further selectively attached to the sheet of elastomeric material by a plurality of thermal point bonds such that the intermittent adhesive bonds cover a greater percentage of an interfacial plane between the first and second sheets of nonwoven material than the thermal point bonds. Desirably, at least about 50 percent of the interfacial plane is free of both intermittent adhesive and thermal point bonds.

[0046] A process for making an extensible laminate includes the steps of: providing a web of an extensible nonwoven material; providing a web of an elastomeric material; an adhesive in a discontinuous or random pattern to at least a portion of a film side of the extensible nonwoven web; selectively attaching the extensible nonwoven web to the elastomeric web by a plurality of intermittent adhesive bonds; and selectively attaching the extensible nonwoven web to the elastomeric web by a plurality of thermal point bonds, whereby the intermittent adhesive bonds cover a greater percentage of an interfacial plane between the extensible nonwoven web and the elastomeric web than the thermal point bonds.

[0047] In another embodiment, a process for making an extensible laminate includes the steps of: providing a first web of an extensible nonwoven material having a film side and a fabric side; applying an adhesive in a discontinuous pattern to the film side of the first extensible nonwoven material web; providing a web of an elastomeric material; selectively attaching the first extensible nonwoven web to the elastomeric web by a plurality of intermittent adhesive bonds; providing a second web of extensible nonwoven material; and selectively attaching the second extensible nonwoven web to the elastomeric web by a plurality of thermal point bonds, whereby the intermittent adhesive bonds cover a greater percentage of an interfacial plane between the first and second webs of extensible nonwoven material than the thermal point bonds.
BRIEF DESCRIPTION OF THE DRAWINGS

[0048] FIG. 1 is a detail view of a single-faced extensible laminate of the present invention.

[0049] FIG. 2 is a detail view of an intermittent adhesive bonding pattern.

[0050] FIG. 3 is a detail view of a thermal point bonding pattern.

[0051] FIG. 4 is a detail view of an intermittent adhesive and thermal point bonding pattern.

[0052] FIGS. 5 and 6 are detail views of two-faced extensible laminates of the present invention.

[0053] FIGS. 7, 8 and 9 are schematic views of processes for making the extensible laminates of the present invention.

DESCRIPTION OF PREFERRED EMBODIMENTS

[0054] The present invention provides an extensible laminate having areas of discreet intermittent bonds and areas of non-bonding between the layers. Both intermittent adhesive bonds and thermal point bonds are used to selectively attach one or more extensible nonwoven layers to an elastomeric layer. The intermittent adhesive bonds, however, cover a greater percentage of an interfacial plane between the extensible nonwoven layer and the elastomeric layer than the thermal point bonds. The thermal point bonds impart an aesthetically desirable pattern to the surface of the laminate. Also provided is a process for making the extensible laminate.

[0055] The use of intermittent adhesive bonds in combination with thermal point bonds provides both greater manufacturing flexibility and improved cross-directional stretch properties. Thermal point bonding has been found to be an effective means for joining the individual layers of an extensible laminate having cross-directional extensibility. However, at commercial production speeds, the heated, patterned calender rolls need to be heated to a higher temperature in order to produce the necessary level of bonding. Unfortunately, the higher temperature detrimentally impacts the softness and loft of the extensible nonwoven layers resulting in a less desirable extensible laminate.

[0056] It has been discovered that higher production speeds can be achieved without detrimentally affecting the extensible laminate. By utilizing both intermittent adhesive bonds and thermal point bonds, the heated, patterned calender rolls can be maintained at a temperature that does not destroy or degrade the extensible nonwoven layers while the desired peel strength and the internal cohesion of the resulting extensible laminate are maintained because the intermittent adhesive bonds supplement the thermal point bonds.

[0057] Generally, the interfacial intermittent adhesive bonds should cover at least 5 percent more of the total interfacial plane than the interfacial thermal point bonds. For instance, if the thermal point bonds cover 20 percent of the planar area between the film and nonwoven layer, the intermittent adhesive bonds should cover at least 25 percent of the interfacial plane. Suitably, the intermittent adhesive bonds should cover at least 10 percent more of the interfacial plane than the thermal point bonds. By “interfacial bonds” we refer only to bonds between the layers excluding interfiber bonds in the nonwoven web.

[0058] In one embodiment, shown in FIG. 1, an extensible laminate 10 includes a first sheet of an extensible nonwoven material 12 and a second sheet of an elastomeric material 14. The extensible nonwoven sheet 12 has a film side 16 oriented toward elastomeric sheet 14 and a fabric side 18. An adhesive is applied to at least a portion of the film side 16 of the extensible nonwoven sheet 12 such that a plurality of intermittent adhesive bonds 20 selectively attach the extensible nonwoven sheet 12 to the elastomeric sheet 14. The extensible nonwoven sheet 12 is further selectively attached to elastomeric sheet 14 by a plurality of thermal point bonds 24. The intermittent adhesive bonds 20 cover a greater percentage of an interfacial plane 22 between the extensible nonwoven sheet 12 and the elastomeric sheet 14 than the thermal point bonds 24. The intermittent adhesive bonds 20 may coincide with the thermal point bonds 24, but such coincidence is not essential.

[0059] The extensible laminate has cross-directional extensibility due to the influence of the extensible nonwoven material. When a cross-directional extension force is removed, the laminate will return substantially to its manufactured configuration due to the influence of the elastomeric material. As shown in FIG. 1, the extensible nonwoven sheet 12 is substantially unattached to the elastomeric sheet 14 in portions of the interfacial plane 22 not covered by intermittent adhesive bonds 20 and/or thermal point bonds 24. As a result, the laminate has improved cross-directional elasticity because the independence of movement of the extensible nonwoven sheet 12 and the elastomeric sheet 14 between the bond points 20 and 24 permits less restricted stretching and recovery of the elastomeric sheet 14.

[0060] Desirably, the laminate 10 has an elasticity measurement in the cross direction 26 greater than about 0.22 retraction force/extension force ratio. The elasticity of the laminate 10 is measured according to method described in the foregoing “DEFINITION” of cross-directional elasticity.

[0061] Suitably, the extensible nonwoven material 12 may be an inherently extensible nonwoven materials such as, for example, a crimped bicomponent spunbond material as disclosed in commonly assigned U.S. Pat. No. 5,418,045 to Pike et al., which is hereby incorporated by reference, or an oriented bonded carded web.

[0062] Other suitable extensible nonwoven materials include biaxially extensible nonwoven materials such as neck-stretched/creped spunbond. The machine direction and cross direction extensible nonwoven material can be provided by stretching a fibrous nonwoven web in a machine direction to cause necking (and extensibility) in the cross direction. Alternatively, the nonwoven material may be a very loose collection of fibers bonded discontinuously in the cross direction such that the material can be stretched in the cross direction. The same material with the imparted cross direction extensibility may be crimped or creped in the machine direction to cause machine direction extensibility.

[0063] The extensible nonwoven material 12 may also be a necked spunbonded web, a necked meltblown web or a necked bonded carded web. If the necked nonwoven material is a web of meltblown fibers, it may include meltblown microfi-
bers. The necked nonwoven material may be made from any material that can be necked by tension and extended, upon application of a force to extend the necked material, to its pre-necked dimensions. Certain polymers such as, for example, polyolefins, polyesters and polyamides may be heat treated under suitable conditions to impart such memory. Exemplary polyolefins include one or more of polyethylene, polypropylene, polybutene, ethylene copolymers, propylene copolymers and butene copolymers. Polypropylenes that have been found useful include, for example, polypropylene available from the Himont Corporation of Wilmington, Del. under the trade designation PP-304, polypropylene available from the Exxon-Mobil Chemical Company of Baytown, Texas under the registered trademark ESCORENE PD-3445, and polypropylene available from the Shell Chemical Company of Houston, Tex. under the trade designation DX5A09. Polyethylene may also be used, including ASPUN 6811A and 2553 linear low density polyethylene from the Dow Chemical Company of Midland, Mich., as well as various high density polyethylenes. Chemical characteristics of these materials are available from their respective manufacturers.

[0064] In one embodiment of the present invention, the extensible nonwoven material 12 may be a multilayer material having, for example, at least one layer of spunbonded web joined to at least one layer of meltblown web, bonded carded web or other suitable material. For example, the extensible nonwoven material 12 may be a multilayer material having a first layer of spunbonded polyolefin having a basis weight from about 0.2 to about 8 ounces per square yard (osy) (about 6.8 to about 271.3 grams per meter (gsm)), a layer of meltblown polyolefin having a basis weight from about 0.1 to about 4 osy (about 3.4 to about 113.4 gsm), and a second layer of spunbonded polyolefin having a basis weight of about 0.2 to about 8 osy (about 6.8 to about 271.3 gsm).

[0065] Alternatively, the extensible nonwoven material 12 may be single layer of material such as, for example, a spunbonded web having a basis weight of from about 0.2 to about 10 osy (about 6.8 to about 339.1 gsm) or a meltblown web having a basis weight of from about 0.2 to about 8 osy (about 6.8 to about 271.3 gsm). Suitably the extensible nonwoven material 12 may have a percent neckdown of from about 15% to about 75%. Desirably, the extensible nonwoven material 12 may have a percent neckdown of from about 25% to about 70%.

[0066] The extensible nonwoven material 12 may also include a composite material made of a mixture of two or more different fibers or a mixture of fibers and particulates. Such mixtures may be formed by adding fibers and/or particulates to a gas stream in which meltblown fibers are carried so that an intimate entangled commingling of meltblown fibers and other materials (e.g., wood pulp, staple fibers or particulates such as, for example, superabsorbent materials) occurs prior to collection of the fibers upon a collecting device to form a coherent web of randomly dispersed meltblown fibers and other materials such as disclosed in U.S. Pat. No. 4,100,324 to Anderson et al., which is incorporated by reference.

[0067] The fibers of the extensible nonwoven material 12 may be joined by interfiber bonding using one or more of the bonding processes described in the foregoing “DEFINITION” of interfiber bonding.

[0068] The elastomeric sheet 14 may be made from any material that may be manufactured in sheet form. The elastomeric sheet 14 may be a nonwoven elastomeric web. For example, a nonwoven elastomeric web may be formed by meltblowing a suitable resin or blends containing the same to provide a nonwoven elastomeric web. A specific example of a nonwoven elastomeric web is disclosed in U.S. Pat. No. 4,663,220 to Wisneski et al, which is hereby incorporated by reference.

[0069] Alternatively, the elastomeric sheet 14 may be an elastomeric film formed by extruding, casting or the like any suitable film forming resins or blends containing the same. For example, the elastomeric film may be made from elastic block copolymers having the general formula A-B-A' where A and A' are thermoplastic polymer endblocks which contain a synergetic moiety such as poly(vinyl arene) and where B is an elastomeric polymer midblock such as a conjugated diene or a lower alkene polymer. The elastomeric film may be formed from, for example, (polysytrene/poly(ethylenebutylene)/polystyrene) block copolymers available from KRA- TON Polymers of Houston, Tex. under the registered trademark KRA TON G. One such block copolymer may be, for example, KRA TON G-1657. Suitable blends containing block copolymers include, for example, KRA TON G-2755, KRA TON G-2760, KRA TON MD6659 and KRA TON RP6578.

[0070] Other exemplary materials which may be used include polyurethane elastomeric materials such as, for example, those available under the registered trademark ESTANE from Noveno, Inc. of Cleveland, Ohio, polyamide elastomeric materials such as, for example, those available under the registered trademark PEBAX from ATOFINA Chemical Company of Philadelphia, Pa., and polyester elastomeric materials such as, for example, those available under the registered trademark HYTREL from E.I. duPont De Nemours & Company of Wilmington, Del. Formation of elastic sheets from polyester elastic materials is disclosed in, for example, U.S. Pat. No. 4,741,949 to Morman et al., hereby incorporated by reference.

[0071] The elastomeric film may be a blend of an elastomeric polymer and a polymer with limited elastic properties. For example, the elastomeric polymer(s) may be blended with single site catalyzed polymers such as “metalloocene” polymers produced according to a metallocone process. The term “metallocone-catalyzed polymers” as used herein includes those polymer materials that are produced by the polymerization of at least ethylene using metalloccenes or constrained geometry catalysts, a class of organometallic complexes, as catalysts. For example, a common metallocone is ferrocene, a complex of a metal between two cyclopentadienyl (Cp) ligands. Metallocone process catalysts include bis(n-butylcyclopentadienyl) titanium dichlo- ride, bis(n-butylcyclopentadienyl) zirconium dichloride, bis(cyclopentadienyl)scandium chloride, bis(indenyl)zirconium dichloride, bis(methylcyclopentadienyltitanium dichloride, bis(methylcyclopentadienyl)zirconium dichloride, cobaltocene, cyclopentadienyltitanium trichloride, ferrocene, hafnocene dichloride, isopropyl(cyclopentadieny1-1,1-fluoreny1)zirconium dichloride, molybdenoc dichloride, nickelocene, niobocene dichloride, ruthenocene, titanocene dichloride, zirconocene chloride hydrate, zirconocene dichloride, among others. A more exhaustive list of such compounds is included in U.S. Pat. No. 5,374,696 to Rosen
et al. and assigned to Dow Chemical Company. Such compounds are also discussed in U.S. Pat. No. 5,064,802 to Stevens et al., also assigned to Dow.

[0072] Desirably, the metallocene polymers are selected from copolymers of ethylene and 1-butene, copolymers of ethylene and 1-hexene, copolymers of ethylene and 1-octene and combinations thereof. Such metallocene polymers are available from Exxon-Mobil Chemical Company of Baytown, Texas under the registered trademark EXXPOL for polypropylene based polymers and EXACT for polyethylene based polymers. DuPont Dow Elastomers, L.L.C. of Wilmington, Del. has polymers commercially available under the registered trademark ENGAGE. Metallocene polymers are also available under the registered trademark AFFINITY from Dow Chemical Company of Midland Mich. Suitable metallocene polymers for use in the present invention include, for example, ENGAGE EG8200 and AFFINITY XUS8380.011.

[0073] Elastomeric polymers including polypropylene, alone or in combination with other elastomeric polymers or less elastic materials, are also suitable for forming the elastomeric film. For example, the elastomeric film may be formed from an elastomeric homopolymer of polypropylene, an elastomeric copolymer of polypropylene, or a combination thereof.

[0074] A polyolefin may be used alone to form an extensible film or may be blended with an elastomeric polymer to improve the processability of the film composition. The polyolefin may be one which, when subjected to an appropriate combination of elevated temperature and elevated pressure conditions, is extrudable, alone or in blended form. Useful polyolefin materials include, for example, polyethylene, polypropylene and polybutene, including ethylene copolymers, propylene copolymers and butene copolymers. A particularly useful polyethylene may be obtained from U.S. I. Chemical Company under the registered trademark PETROTHEENE NA601. Two or more of the polyolefins may be utilized. Extrudable blends of elastomeric polymers and polyolefins are disclosed in, for example, U.S. Pat. No. 4,663,220 to Wisneski et al., hereby incorporated by reference.

[0075] The elastomeric film may also be a multilayer material in that it may include two or more coherent webs or sheets. Additionally, the elastomeric film may be a multilayer material in which one or more of the layers contain a mixture of elastic and nonelastic fibers or particulates. An example of the latter type of elastic web is disclosed in U.S. Pat. No. 4,209,563 to Sisson, incorporated herein by reference, in which elastomeric and nonelastomeric fibers are commingled to form a single coherent web of randomly dispersed fibers.

[0076] Exemplary elastomeric films for use in the present invention include blends of (poly)poly(ethylenebutylene)/poly(styrene) block copolymers, metallocene-derived polymers and polyolefins. For example, the elastomeric film may be formed from a blend of from about 15 percent to about 75 percent of a metallocene-derived polyolefin, from about 10 percent to about 60 percent (polystyrene/polyethylenebutylene)/poly(styrene) block copolymers, and from 0 to about 15 percent of a low density polyethylene.

[0077] In another aspect, the elastomeric sheet 14 may be an elastomeric foam material. One suitable elastomeric foam material is an elastomeric polyurethane foam.

[0078] The elastomeric sheet 14 may be formed by any number of conventionally known processes, including but not limited to, flat die extrusion, blown film (tubular) processes, casting, melt blowing and the like. Desirably, the elastomeric sheet 14 is a cast film that has been formed on a chill roll and substantially cooled prior to lamination to the extensible nonwoven material 12. This provides additional undesirable bonding between the extensible nonwoven material 12 and the elastomeric sheet 14 that can decrease the retraction force/extension force ratio of the extensible laminate 10. Suitably, the elastomeric sheet 14 may have a basis weight of about 5 to about 100 grams per square meter, more suitably about 25 to about 60 grams per square meter.

[0079] As noted above, the extensible nonwoven material 12 is selectively attached to the elastomeric sheet 14 by a plurality of intermittent adhesive bonds 20. The use of inelastic and/or elastic adhesives is suitable for this invention. An example of a suitable adhesive is a meltdown adhesive containing from about 54.5 percent to about 57.5 percent by weight petroleum hydrocarbon resins; from about 18.5 percent to about 21.5 percent by weight of a mixture of several mineral oils; from about 22.5 percent to about 27.5 percent by weight of styrene-butadiene-styrene block copolymers; from about 0.1 percent to about 0.9 percent by weight polyethylene and ethylene vinyl acetate; and from about 0.2 percent to about 1.8 percent by weight of an antioxidant and stabilizers. A specific example of a suitable adhesive for use in the present invention is NS34-5610, available from National Starch and Chemical Company of Bridgewater, N.J.

[0080] The adhesive may be applied to the film side 16 of the extensible nonwoven material 12 by any method known in the art including, but not limited to, melt blowing processes, spraying, intermittent slot coating, combing and/or patterned gravure roll printing. Alternatively or additionally, the adhesive may be applied to at least a portion of a surface of the elastomeric sheet 14. Desirably, the adhesive is applied in a molten or liquid state. Suitably, adhesives applied in the molten state should not thermally degrade and/or melt the extensible nonwoven material 12. Alternatively, the adhesive may be applied as individual strands, filaments or threads having a diameter that is not detectable to the human eye. Such adhesives may be applied in a manner that is detectable to the human eye. Such adhesives may be applied in a manner that is detectable to the human eye.

[0081] The amount of adhesive applied to the film side 16 of extensible nonwoven material 12 and/or to the elastomeric sheet 14 may be varied depending upon the type of adhesive, application method, application pattern, desired bond coverage, elastomeric film type and extensible nonwoven material type. For example, the adhesive may be applied by a melt blowing process at an add-on level of from about 2 grams per square meter to about grams per square meter to achieve a bond coverage of from about 10 percent to about 70 percent of the interface plane 22 between the extensible nonwoven material sheet 12 and the elastomeric film 14.

[0082] Desirably, the adhesive is applied in a random and/or discontinuous pattern. Most desirably, the adhesive is applied in a pattern that is discontinuous in the cross direction 26. Most desirably, as depicted in FIG. 1, the adhesive is applied in a pattern that is discontinuous in both the cross direction 26 and the machine direction 28.

[0083] Referring to FIG. 2, one suitable discontinuous pattern of adhesive application includes a plurality of indi-
individual dots 30. Desirably, the dots have a diameter of from about 1 millimeter to about 2 millimeters and an area of about 0.8 square millimeters to about 3.1 square millimeters. More desirably, as shown in FIG. 2, the dots are arranged in a checkerboard pattern on the film side 16 of extensible nonwoven material 12. Suitably, the dots 30 are spaced apart from each other by a distance “d” of from about 5 millimeters to about 8 millimeters measured center to center and provide a cell size of about 25 square millimeters to about 64 square millimeters. Such a pattern may provide a bond coverage of about 1.25 to about 12.5 percent (calculated as [dot area/cell size]),

[0084] Advantageously, if the adhesive is inelastic, the intermittent adhesive bonds may cover from about 10 percent to about 50 percent of the interfacing plane 22 between the extensible nonwoven material sheet 12 and the elastomeric film 14. More advantageously, the inelastic intermittent adhesive bonds 20 may cover from about 10 percent to about 40 percent of the interfacing plane 22. Desirably, at least about 50 percent to about 90 percent of the interfacing plane 22 is free of inelastic intermittent adhesive bonds 20.

[0085] Suitably, if the adhesive is elastomeric, the intermittent adhesive bonds 20 may cover from about 10 percent to about 70 percent of the interfacing plane 22. More suitably, the elastomeric intermittent adhesive bonds 20 may cover from about 10 percent to about 65 percent of the interfacing plane 22. Most suitably, the elastomeric intermittent adhesive bonds 20 may cover from about 10 percent to about 50 percent of the interfacing plane 22. Desirably, at least about 30 percent to about 70 percent of the interfacing plane is free of elastomeric intermittent adhesive bonds.

[0086] As shown in FIG. 1, the extensible nonwoven material sheet 12 is further selectively attached to the elastomeric sheet 14 by a plurality of thermal point bonds 24. The thermal point bonds 24 may be formed through the use of heat and pressure to force portions of the extensible nonwoven material sheet 12 into areas of the elastomeric sheet 14 such that the portions of extensible nonwoven material sheet 12 are encapsulated by areas of the elastomeric sheet 14.

[0087] Such thermal point bonds are formed, generally, by passing the two sheets of material through a nip between a pair of heated laminating rolls. At least one of the laminating rolls is engraved such that it has a pattern of protrusions or pins that form the point bonds as the sheets are pressed between the rolls. The other laminating roll may be smooth or it may also be patterned. If the second roll is patterned, the pattern may match the first roll pattern such that the thermal point bonds on each side of the laminate overlay one another. Alternatively, the patterns may be offset such that the two sides of the laminate display different bonding patterns. The two rolls could also have spiral patterns with opposite pitch such that the bonding occurs only where the two spirals meet.

[0088] In the alternative, the thermal point bonds 24 may be formed using ultrasonic bonding or welding techniques. Generally, this type of thermal point bond is formed by passing the two sheets of material through a nip between an ultrasonic bonding horn and an ultrasonic bonding anvil. At least one of the horn and the anvil is engraved or patterned such that it has protrusions that form the thermal point bonds as the sheets are exposed to ultrasonic sound waves.

[0089] The thermal point bond coverage may be calculated by multiplying the pin density, expressed as pins per area, by the area of the pins. For example, a patterned roll including a plurality of pins having an area of 0.01 square centimeters per pin and having a pin density of 30 pins per square centimeter would provide a thermal point bond coverage of 0.30 or 30 percent.

[0090] The thermal point bonds 24 can be positioned in the interfacing plane between the intermittent adhesive bonds 20. Alternatively, as shown in FIG. 1, at least a portion of the thermal point bonds 24 can overlap at least a portion of the intermittent adhesive bonds 20. Suitably, the thermal point bonds 24 may cover from about 5 percent to about 50 percent of the interfacing plane. More suitably, the thermal point bonds 24 may cover from about 10 percent to about 40 percent of the interfacing plane 22. Advantageously, at least about 50 percent of the interfacing plane 22 is free from thermal point bonds 24.

[0091] In another embodiment, the intermittent adhesive bonds 20 and the thermal point bonds 24 may be positioned in the interfacing plane 22 as alternating stripes or bands of thermal point bonds and intermittent adhesive bonds as shown in FIG. 4. The stripes or bands may be oriented in the cross-direction, the machine direction, on a diagonal across the interfacing plane, or other suitable pattern. The individual stripes or bands may have the same or different dimensions such as length and/or width. Additionally, the individual stripes or bands of bonds may be spaced apart from each other by a bond-free stripe or band in the interfacing plane 22. The stripes or bands may be configured in any suitable pattern to provide the desired bond coverage.

[0092] Referring to FIG. 1, the intermittent adhesive bonds 20 cover a greater percentage of the interfacing plane 22 than the thermal point bonds 24. At least about 30, suitably, at least about 50 percent of the interfacing plane is free of both inelastic intermittent adhesive bonds and thermal point bonds (when the adhesive is inelastic). More suitably, at least about 60 percent of the interfacing plane is free of both inelastic intermittent adhesive bonds and thermal point bonds. Desirably, at least about 30 percent of the interfacing plane is free of both elastomeric intermittent adhesive bonds and thermal point bonds. When a combination of elastic and inelastic adhesives are used, at least about 30 percent of the interfacing plane 22 should be free of all adhesive and thermal bonds.

[0093] In addition to contributing to the peel strength and the internal cohesion of the extensible laminate, the thermal point bonds 24 impart surface patterning to the fabric side 18 of the extensible nonwoven material 12 that is aesthetically desirable. The bond pattern can be applied either evenly or unevenly to the fabric side 18 of the extensible nonwoven material 12. An evenly applied bond pattern contributes to more consistent material property across the surface of the resulting extensible laminate, while an unevenly applied bond pattern can affect material properties such as the level of retractive force.

[0094] Many patterns for calender rolls have been developed. As will be understood by those skilled in the art, the
bond coverages are, of necessity, described in approximations or ranges since bond pins are normally tapered and wear down over time. As those skilled in the art will also recognize, references to “pins/square inch” or “bonds per square inch” are somewhat interchangeable since the pins will create the bonds in the substrate in essentially the same sizes and surface relationship as the pins on the roll. There are a number of discreet bond patterns which may be used. See, for example, U.S. Pat. No. 4,041,203 to Brock et al., which is incorporated by reference. One example of a pattern is the Hansen Penning’s or “H&P” pattern with about 200 bonds per square inch as taught in U.S. Pat. No. 3,855,046 to Hansen and Pennings. The H&P pattern has square point or pin bonding areas wherein each pin may have a side dimension of 0.038 inches (0.965 millimeters), for example, resulting in a pattern having a bond coverage of about 30 percent. Another typical point bonding pattern is the expanded Hansen and Penning’s or “EHP” pattern which produces a bond coverage of about 15 percent to about 18 percent which may have a square pin having a side dimension of 0.037 inches (0.94 millimeters), for example, and a pin density of about 100 pins per square inch. Other common patterns include a “Ramisch” diamond pattern with repeating diamonds having a bond coverage of from about 8 percent to about 14 percent and 52 pins per square inch and a “S” weave pattern as described in commonly assigned U.S. Pat. No. 5,964,742 to McCormack et al., which is incorpo- rated by reference. Additional patterns include, for example, cross directional lines, machine directional lines or other extensible patterns known in the art. One such extensible pattern suitable for use in the present invention, known as “wire weave”, has a bond coverage of from about 15 percent to about 20 percent and 302 pins per square inch. As shown in FIG. 3, the wire weave bond pattern 32 includes diamond-shaped pattern elements that create a pattern that looks like a window screen. Each pattern element can be defined by four elliptical point bonds 34.

[0095] In another embodiment, as shown in FIG. 5, an extensible laminate 10 includes a first sheet of an extensible nonwoven material 12 having a film side 16 and a fabric side 18, a second sheet of extensible nonwoven material 36 having a film side 38 and fabric side 40, and a sheet of an elastomeric material 14 having a first surface 17 and a second surface 37 positioned between sheets 12 and 36 of extensible nonwoven material. A first adhesive is applied to at least a portion of the film side 16 of the first sheet of extensible nonwoven material 12 and/or at least a portion of a first surface 17 of the elastomeric sheet 14 (not shown) such that the first sheet of extensible nonwoven material 12 is selectively attached to the elastomeric sheet 14 by a plurality of intermittent adhesive bonds 20. A second adhesive is applied to at least a portion of the film side 38 of the second sheet of neck nonwoven material 36 and/or at least a portion of a second surface 37 of the elastomeric sheet 14 (not shown) such that the second sheet of extensible nonwoven material 36 is selectively attached to the elastomeric sheet 14 by a plurality of intermittent adhesive bonds 20. The first sheet of extensible nonwoven material 12 and the second sheet of neck nonwoven material 36 are further selectively attached to the elastomeric sheet 14 by a plurality of thermal point bonds 24 and 24’. The intermittent adhesive bonds 20 and 20’ cover a greater percentage of an interfacial plane 42 between the first sheet of extensible nonwoven material 12 and the second sheet of extensible nonwoven material 36 than the thermal point bonds 24 and 24’.

[0096] The first sheet of extensible nonwoven material 12 and the second sheet of extensible nonwoven material 36 may be the same material or may be different materials. For example, the first sheet 12 may be a spunbond web while the second sheet 36 may be a spunbonded web, a meltblown web, a bonded coated web or a multi-layer composite thereof. Furthermore, the first sheet 12 may be an extensible nonwoven material having one basis weight and the second sheet 36 may be an extensible nonwoven material having the same or a different basis weight.

[0097] Similarly, the first and second adhesives may be the same or different. For example, the first and second adhesives may be a meltblown adhesive such as described above. Alternatively, the first adhesive may be a meltblown adhesive while the second adhesive may be a hot melt spray adhesive such as, for example, a styrene-isoprene-styrene based adhesive available under the trade designation Findlay 2525A from Ato-Findley Adhesives, Inc., of Wauwatosa, Wis. Additionally, the first and second adhesives may be applied in the same or different discontinuous and/or random patterns.

[0098] A further embodiment is shown in FIG. 6. An extensible laminate 10 includes a first sheet of an extensible nonwoven material 12 having a film side 16 and a fabric side 18, a second sheet of an extensible nonwoven material 36, and a sheet of an elastomeric material 14 having a first surface 17. The elastomeric sheet 14 is positioned between the first sheet 12 and the second sheet 36 of extensible nonwoven material. An adhesive is applied to at least a portion of the film side 16 of the first sheet of extensible nonwoven material 12 and/or at least a portion of the first surface 17 of the elastomeric sheet 14 (not shown) such that the first sheet of extensible nonwoven material 12 is selectively attached to the elastomeric sheet 14 by a plurality of intermittent adhesive bonds 20. The second sheet of extensible nonwoven material 36 is selectively attached to the elastomeric sheet 14 by a plurality of thermal point bonds 24. The intermittent adhesive bonds 20 cover a greater percentage of an interfacial plane 42 between the first sheet of extensible nonwoven material 12 and the second sheet of extensible nonwoven material 36 than the thermal point bonds 24.

[0099] The extensible laminate 10 of the invention can be incorporated into any suitable absorbent article. Examples of absorbent articles that may include an extensible laminate 10 include absorbent garments such as training pants, diapers, diaper pants, feminine hygiene products, swimwear, incontinence products, other personal care or health care garments, including medical garments, or the like. As used herein, the term “incontinence products” includes absorbent underwear for children, absorbent garments for children or young adults with special needs such as autistic children or others with bladder/bowel control problems as a result of physical disabilities, as well as absorbent garments for incontinent older adults.

[9100] A process for making an extensible laminate 10 is shown in FIG. 7. The process includes the steps of: providing an extensible nonwoven web 12 having a film side 16 and a fabric side 18; and providing an elastomeric web 14. An adhesive 44 is applied in a discontinuous pattern to at
least a portion of the film side 16 of the extensible nonwoven web 12. Alternatively or additionally, an adhesive may be applied to a first surface 17 of the elastomeric web 14 (not shown). The extensible nonwoven material web 12 is selectively attached to the elastomeric web 14 by a plurality of intermittent adhesive bonds (not shown). The intermittent adhesive bonds 20 are formed by passing the web through a first nip 46 between a first smooth nip roll 48 and a second smooth nip roll 50. The extensible nonwoven material web 12 is also selectively attached to the elastomeric web 14 by a plurality of thermal point bonds 24 (not shown). The thermal point bonds 24 are formed by passing the extensible nonwoven material web 12 and the elastomeric web 14 through a second nip 52 between a smooth anvil roll 54 and a heated, patterned calender roll 56. Desirably, the fabric side 18 of the extensible nonwoven material web 12 is oriented toward the heated, patterned calender roll 56 such that the thermal point bonds 24 create an aesthetically desirable pattern on the extensible nonwoven surface of the extensible laminate 10.

[0101] The heated, patterned calender roll 56 has a plurality of spaced apart protrusions or pins 58 on its surface. The protrusions 58 are commonly known as embossing points. The protrusions 58 contact the fabric side 18 of the extensible nonwoven material web 12 and selectively force the elastomeric film web 14 into the fiber structure of the film side 16 of the extensible nonwoven web 12 thereby encapsulating and bonding portions of the extensible nonwoven web 12 to the elastomeric film web 14 at a plurality of thermal bond-points 24. In areas between the thermal point bonds 24 and the intermittent adhesive bonds 20, the extensible nonwoven web 12 and the elastomeric web 14 are not bonded to each other and can move independently with respect to each other. The structure which exists the second nip 52 is now an extensible laminate 10 of the present invention and can be wound on a take up roll for storage or transport for further processing. The heated, patterned calender roll 56 contacts the fabric side 18 of the extensible nonwoven web 12 so as to prevent the elastomeric web 14 from adhering to the protrusions 58. There may be, however, some circumstances where it may be desirable for the heated, patterned calender roll 52 to contact the elastomeric web 14.

[0102] The temperature to which the patterned calender roll 56 is heated depends upon the properties of the elastomeric web 14 and/or the extensible nonwoven web 12, but is usually in the range of from about 100° to about 275°F. (about 38° to about 135°C.). The bonding characteristics are determined, in part, by a number of factors, including but not limited to, the composition of the webs 12 and 14, the presence of wetting agents, the temperature of the elastomeric sheet 14 and the extensible nonwoven material 12 at the thermal bond points 24, the temperatures of the heated smooth anvil roll 54 and the heated, patterned calender roll 56, and the like. Additionally, the design and construction of the protrusions 58 will have an impact on the bonding. Such factors include, but are not limited to, the height, geometry, density, width, and pattern of the protrusions 58, the size of the second nip 52, and the like.

[0103] Optionally, the elastomeric web 14 can be formed in-line during production. For example, the first smooth nip roll 48 may be a chill roll whereon an elastomeric polymer or polymer blend could be extruded to form a cast elastomeric film web prior to adhesive lamination to the extensible nonwoven web.

[0104] It is to be understood that more than two layers of material can be laminated together to form an extensible laminate of the present invention, such as but not limited to, a spunbond-elastomer-spunbond laminate, a spunbond-elastomer-meltblown laminate, and the like. FIGS. 8 and 9 show alternative embodiments of processes for forming the extensible laminates of the present invention.

[0105] FIG. 8 shows a process for making an extensible laminate of the present invention including two layers of extensible nonwoven material. The process includes the steps of providing a first web of an extensible nonwoven material 12 having a film side 16 and a fabric side 18; applying an adhesive 44 to a material web pattern at least a portion of the film side 16 of the first extensible nonwoven material web 12; providing a web of an elastomeric material 14; and selectively attaching the first extensible nonwoven web 12 to the elastomeric web 14 by a plurality of intermittent adhesive bonds 20 (not shown). The intermittent adhesive bonds 20 are formed by passing webs 12 and 14 through a first nip 46 between a first smooth nip roll 48 and a second smooth nip roll 50. A second web of an extensible nonwoven material 36 having a film side 38 and a fabric side 40 is provided. The second extensible nonwoven web 36 is selectively attached to the elastomeric web 14 by a plurality of thermal point bonds 24 (not shown). The thermal point bonds 24 are formed by passing the first extensible nonwoven web, the elastomeric web and the second extensible nonwoven web through the second nip 52 between smooth anvil roll 54 and the heated, patterned calender roll 56, wherein the heated, patterned calender roll is positioned adjacent the fabric side 40 of the second extensible nonwoven web 36.

[0106] Optionally, the process can include the additional steps of applying an adhesive in a discontinuous pattern to the film side 38 of the second extensible nonwoven web 36, selectively attaching the second extensible nonwoven web 36 to the elastomeric web 14 by a plurality of intermittent adhesive bonds 20 and/or selectively attaching the first extensible nonwoven web 12 to the elastomeric web 14 by a plurality of thermal point bonds 24. Furthermore, adhesive may be applied to at least a portion of a first surface 17 and/or a second surface 37 of the elastomeric web 14.

[0107] FIG. 9 shows an additional process for forming an extensible laminate including two webs of extensible nonwoven material. The process includes the steps of: providing a first extensible nonwoven material web 12; applying an adhesive 44 in a discontinuous pattern to the film side 16 of the first extensible nonwoven web 12; providing an elastomeric web 14; and selectively attaching the first extensible nonwoven material web 12 to the elastomeric web 14 by a plurality of intermittent adhesive bonds 20 (not shown) to form a first composite 60. The intermittent adhesive bonds 20 are formed by passing the first extensible nonwoven web 12 having the film side 16 oriented toward the elastomeric web 14 and the elastomeric web 14 through a first nip 46 between a first smooth nip roll 48 and a second smooth nip roll 50. The process further includes providing a second extensible nonwoven material web 36 having a film side 38 and a fabric side 40; applying an adhesive 44 in a discon-
tinuous pattern to the film side 38 of the second extensible nonwoven web 36, and selectively attaching the second extensible nonwoven web 36 to the elastomeric web 14 by a plurality of intermittent adhesive bonds 20 (not shown) to form a second composite 62. The intermittent adhesive bonds 20 are formed by passing the first composite 60 and the second extensible nonwoven web 36 having the film side 38 oriented toward the elastomeric web 14 of first composite 60 through a second nip 64 between the second nip roll 50 and a third nip roll 66. The process also includes selectively attaching the first extensible nonwoven web 12 to the elastomeric web 14 by a plurality of thermal point bonds 24 (not shown) and selectively attaching the second extensible nonwoven web to the elastomeric web 14 by a plurality of thermal point bonds 24 (not shown). The thermal point bonds 24 attaching the first extensible nonwoven web 12 to the elastomeric web 14 are formed by passing a first composite 62 through a nip 52 between a first smooth anvil roll 54 positioned adjacent the second extensible nonwoven web 36 and a first heated, patterned calender roll 56 positioned adjacent the first extensible nonwoven web 12. The thermal point bonds 24 attaching the second extensible nonwoven web 36 to the elastomeric web 14 are formed by passing the second composite 62 through a nip 68 between a second smooth anvil roll 70 positioned adjacent the first extensible nonwoven web 12 and a second heated, patterned calender roll 72 positioned adjacent the second extensible nonwoven web 36.

[0108] Alternatively, in FIGS. 7, 8, and 9, the smooth anvil rolls 52 and/or 70 may be ultrasonic bonding anvils and the heated, patterned calender rolls 56 and/or 72 may be patterned ultrasonic bonding horns.

[0109] Although only a few exemplary embodiments of the present invention have been described in detail above, those skilled in the art will readily appreciate that many modifications are possible in the exemplary embodiments without materially departing from the novel teachings and advantages of this invention. Accordingly, all such modifications are intended to be included within the scope of this invention as defined in the following claims.

[0110] It should be noted that any patents or publications referred to herein are incorporated by reference in their entirety.

We claim:
1. An extensible laminate comprising:
   a sheet of an extensible nonwoven material having a film side and a fabric side;
   a sheet of an elastomeric film; and
   an adhesive applied to at least a portion of the film side of the extensible nonwoven material such that the sheet of extensible nonwoven material is selectively attached to the sheet of elastomeric film by a plurality of intermittent adhesive bonds,

   wherein the extensible nonwoven material sheet is further selectively attached to the sheet of elastomeric film by a plurality of thermal point bonds, and the intermittent adhesive bonds cover a greater percentage of an interfacial plane between the sheet of extensible nonwoven material and the sheet of elastomeric film than the thermal point bonds.

2. The extensible laminate of claim 1, wherein the sheet of extensible nonwoven material is substantially unattached to the sheet of elastomeric film in portions of the interfacial plane between the intermittent adhesive bonds and the thermal point bonds.

3. The extensible laminate of claim 1, wherein the intermittent adhesive bonds cover at least 5 percent more of the interfacial plane than the thermal point bonds.

4. The extensible laminate of claim 1, wherein the intermittent adhesive bonds cover at least 10 percent more of the interfacial plane than the thermal point bonds.

5. The extensible laminate of claim 1, wherein the intermittent adhesive bonds cover at least 20 percent more of the interfacial plane than the thermal point bonds.

6. The extensible laminate of claim 1, wherein the laminate has an elasticity measurement of greater than about 0.22 retraction force/extension force ratio.

7. The extensible laminate of claim 1, wherein the thermal point bonds are positioned in the interfacial plane between the intermittent adhesive bonds.

8. The extensible laminate of claim 1, wherein at least a portion of the thermal point bonds overlay at least a portion of the intermittent adhesive bonds.

9. The extensible laminate of claim 1, wherein the adhesive is an inelastic adhesive.

10. The extensible laminate of claim 9, wherein the intermittent adhesive bonds cover from about 5 percent to about 50 percent of the interfacial plane.

11. The extensible laminate of claim 1, wherein the adhesive is an elastomeric adhesive.

12. The extensible laminate of claim 11, wherein the intermittent adhesive bonds cover up to about 70 percent of the interfacial plane.

13. An absorbent article comprising the extensible laminate of claim 1.

14. An extensible laminate comprising:
   a first sheet of an extensible nonwoven material having a film side and a fabric side;
   a sheet of an elastomeric film; and
   a first adhesive applied in a discontinuous pattern to the film side of the first sheet of extensible nonwoven material such that the first sheet of extensible nonwoven material is selectively attached to the sheet of elastomeric film by a first plurality of intermittent adhesive bonds,

   wherein the first sheet of extensible nonwoven material is further selectively attached to the sheet of elastomeric film by a first plurality of thermal point bonds such that the intermittent adhesive bonds cover a greater percentage of an interfacial plane between the first sheet of extensible nonwoven material and the sheet of elastomeric film than the thermal point bonds and at least about 50 percent of the interfacial plane is free of intermittent adhesive bonds.

15. The extensible laminate of claim 14, wherein the laminate has an elasticity measurement greater than about 0.22 retraction force/extension force ratio.

16. The extensible laminate of claim 14, wherein at least about 50 percent of the interfacial plane is free of intermittent adhesive bonds and thermal point bonds.
17. The extensible laminate of claim 14, further comprising:
   a second sheet of an extensible nonwoven material having a film side and a fabric side; and
   a second adhesive applied in a discontinuous pattern to the film side of the second sheet of extensible nonwoven material such that the second sheet of extensible nonwoven material is selectively attached to the sheet of elastomeric film by a plurality of intermittent adhesive bonds,

wherein the first and second pluralities of intermittent adhesive bonds cover a greater percentage of an interfacial plane between the first and second sheets of extensible nonwoven material than the thermal point bonds.

18. The extensible laminate of claim 17, wherein the second sheet of extensible nonwoven material is further selectively attached to the sheet of elastomeric film by a second plurality of thermal point bonds such that the first and second pluralities of intermittent adhesive bonds cover a greater percentage of the interfacial plane between the first and second sheets of extensible nonwoven material than the first and second pluralities of thermal point bonds.

19. An extensible laminate comprising:
   a first sheet of an extensible nonwoven material having a film side and a fabric side;
   a sheet of an elastomeric film;
   an adhesive applied in a discontinuous pattern to the film side of the first sheet of extensible nonwoven material such that the first sheet of extensible nonwoven material is selectively attached to the sheet of elastomeric film by a plurality of intermittent adhesive bonds; and
   a second sheet of extensible nonwoven material selectively attached to the sheet of elastomeric film by a plurality of thermal point bonds,

wherein the intermittent adhesive bonds cover a greater percentage of an interfacial plane between the first and second sheets of extensible nonwoven material than the thermal point bonds, at least about 50 percent of the interfacial plane is free of intermittent adhesive bonds and thermal point bonds and the laminate has an elasticity measurement of greater than about 0.22 retraction force/extension force ratio.

20. A process for making an extensible laminate comprising the steps of:
   providing a web of an extensible nonwoven material having a film side and a fabric side;
   providing a web of an elastomeric film;
   applying an adhesive in a discontinuous pattern to the film side of the web of extensible nonwoven material;
   selectively attaching the web of extensible nonwoven material to the web of elastomeric film by a plurality of intermittent adhesive bonds; and
   selectively attaching the web of extensible nonwoven material to the web of elastomeric film by a plurality of thermal point bonds,

whereby the intermittent adhesive bonds cover a greater percentage of an interfacial plane between the web of extensible nonwoven material and the web of elastomeric film than the thermal point bonds.

21. The process of claim 20, wherein the laminate has an elasticity measurement of greater than about 0.22 retraction force/extension force ratio.

22. The process of claim 20, wherein the intermittent adhesive bonds cover at least about 5 percent more of the interfacial plane than the thermal point bonds.

23. The process of claim 20, wherein the intermittent adhesive bonds cover at least about 10 percent more of the interfacial plane than the thermal point bonds.

24. The process of claim 20, wherein the intermittent adhesive bonds cover at least about 20 percent more of the interfacial plane than the thermal point bonds.

25. The process of claim 20, wherein the thermal point bonds are formed by passing the web of extensible nonwoven material and the web of elastomeric film through a nip between a smooth anvil roll and a heated, patterned calender roll.

26. The process of claim 20, wherein the thermal point bonds are formed by passing the web of extensible nonwoven material and the web of elastomeric film through a nip between an ultrasonic bonding anvil and a patterned ultrasonic bonding horn.

27. The process of claim 20, wherein the adhesive is applied as a plurality of individual dots.

28. The process of claim 27, wherein the individual dots have a diameter of from about 1 millimeter to about 2 millimeters.

29. The process of claim 28, wherein the individual dots form a checkerboard pattern.

30. The process of claim 29, wherein the individual dots are spaced apart from each other by a distance of from about 5 millimeters to about 8 millimeters measured center to center.

31. A process for making an extensible laminate comprising the steps of:
   providing a first web of an extensible nonwoven material having a film side and a fabric side;
   applying an adhesive in a discontinuous pattern to the film side of the first web of extensible nonwoven material;
   providing a web of an elastomeric film;
   selectively attaching the first extensible nonwoven material web to the elastomeric film web by a plurality of intermittent adhesive bonds;
   providing a second web of an extensible nonwoven material having a film side and a fabric side; and
   selectively attaching the second extensible nonwoven material web to the elastomeric film web by a plurality of thermal point bonds,

whereby the intermittent adhesive bonds cover a greater percentage of an interfacial plane between the first and second webs of extensible nonwoven material than the thermal point bonds.

32. The process of claim 31, further comprising the step of selectively attaching the first extensible nonwoven mate-
33. The process of claim 31, further comprising the steps of: applying and adhesive in a discontinuous pattern to the film side of the second extensible nonwoven material web; and selectively attaching the second web of extensible nonwoven material to the elastomeric film web by a plurality of intermittent adhesive bonds.

34. The process of claim 32, further comprising the steps of: applying and adhesive in a discontinuous pattern to the film side of the second extensible nonwoven material web; and selectively attaching the second web of extensible nonwoven material to the elastomeric film web by a plurality of intermittent adhesive bonds.