US 20070284280A1

(19) United States
(12) **Patent Application Publication**
Young
(10) **Pub. No.: US 2007/0284280 A1**
(43) **Pub. Date: Dec. 13, 2007**

(54) **CHILD-RESISTANT BLISTER PACKAGE**

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(21) Appl. No.: **11/451,095**

(22) Filed: **Jun. 12, 2006**

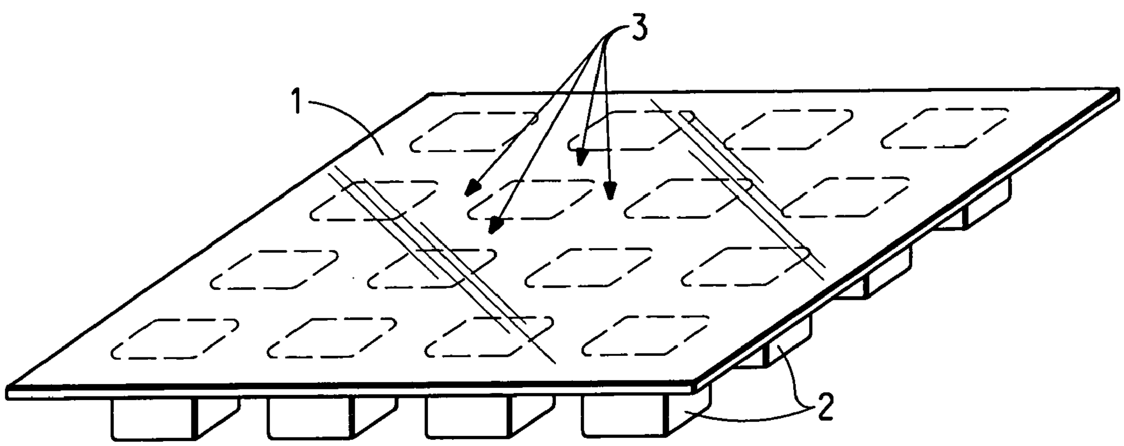
Publication Classification

(51) **Int. Cl.**
B65D 83/04 (2006.01)

(52) **U.S. Cl.** **206/538**

(57) **ABSTRACT**

An improved child-resistant blister package is provided in which the lidding component includes a tear-resistant nonwoven layer and a barrier layer. The nonwoven layer can be a melt-spun continuous filament nonwoven web. The lidding component used in peel off-push through blister packages of the invention contains fewer layers, can be processed at higher blister package sealing temperatures and has improved puncture resistance compared to lidding components used in child-resistant packages known in the art. In addition, in peel off-push through and peel-open package designs of the present invention, the lidding peels more cleanly from the blister component compared to packages known in the art which have a tendency to tear during peeling.



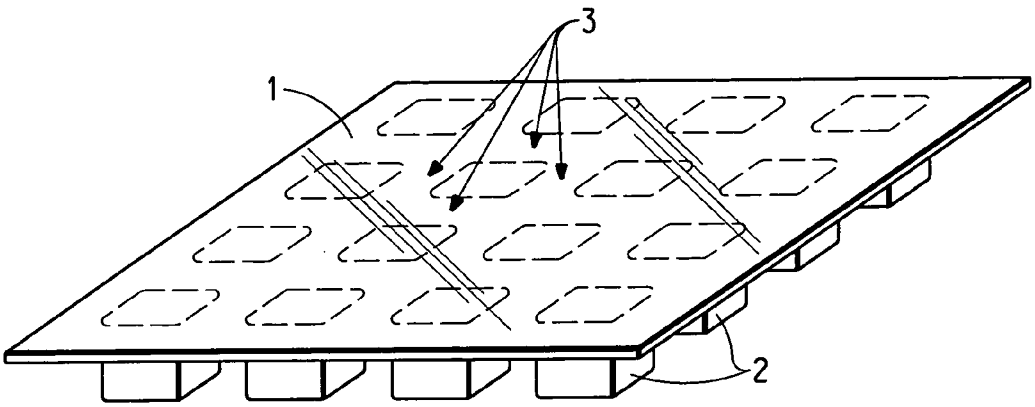


FIG. 1

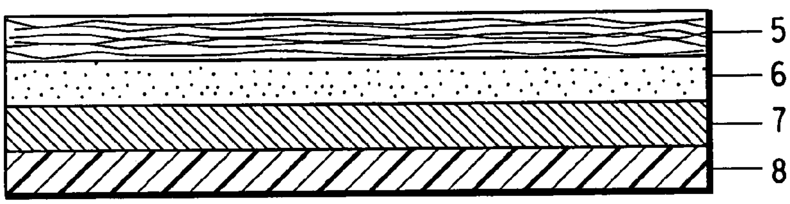


FIG. 2A

FIG. 2B

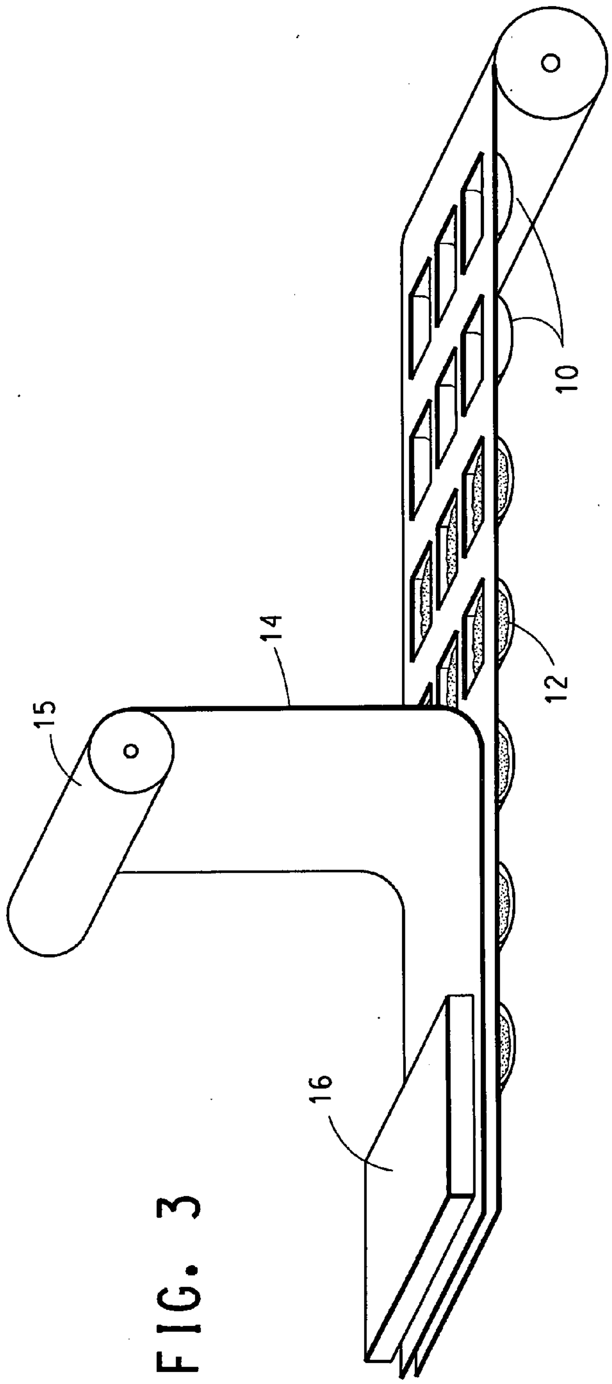


FIG. 3

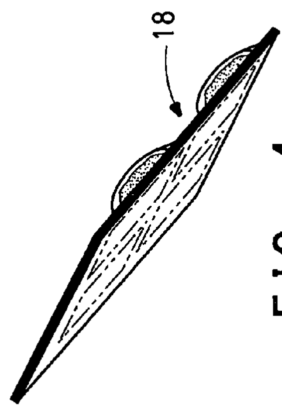


FIG. 4

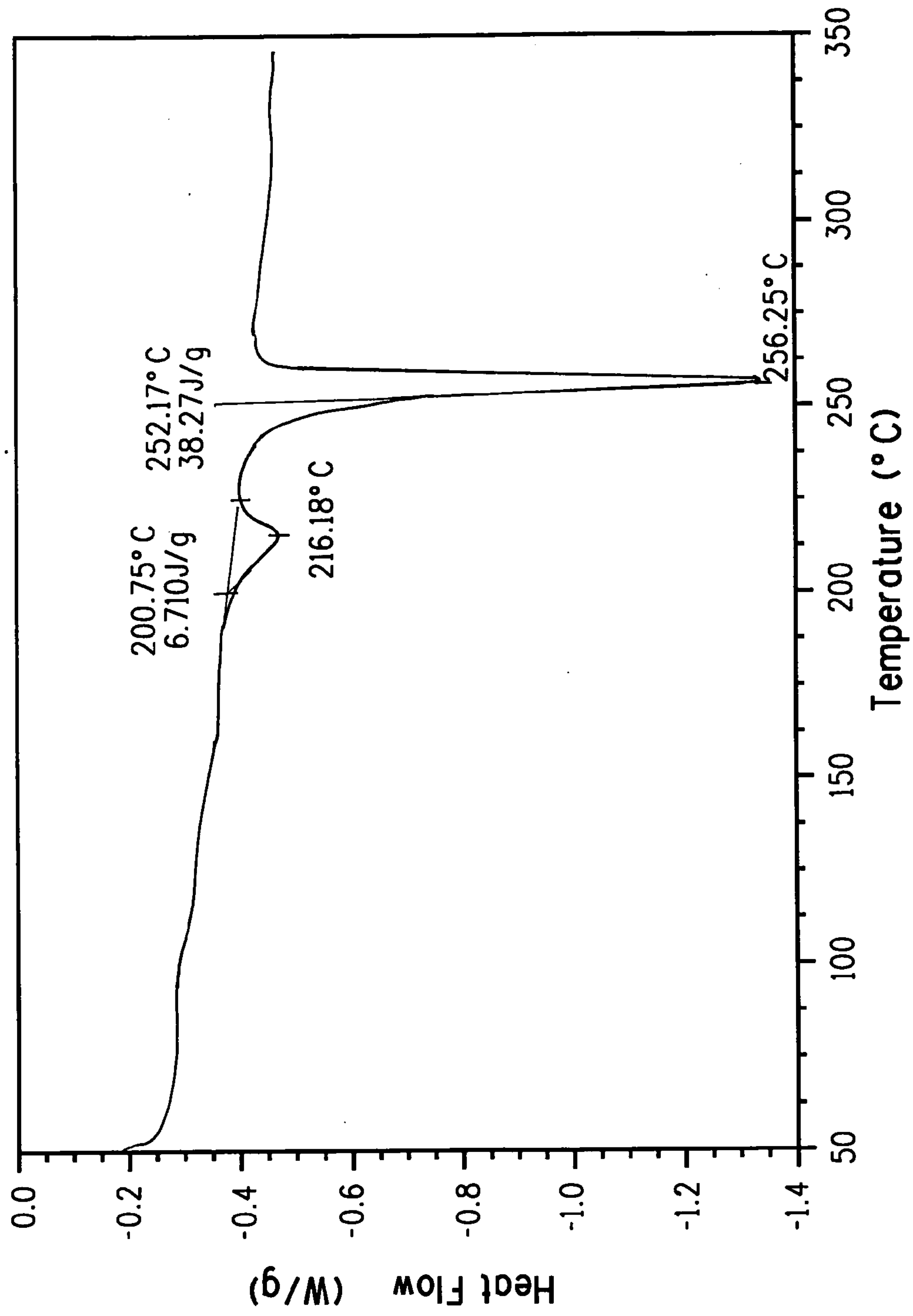

Heat Flow (W/g)
0.0
-0.2
-0.4
-0.6
-0.8
-1.0
-1.2
-1.4
Temperature (°C)
50
100
150
200
250
300
350
200.75°C
6.710J/g
216.18°C
252.17°C
38.27J/g
256.25°C

FIG. 5

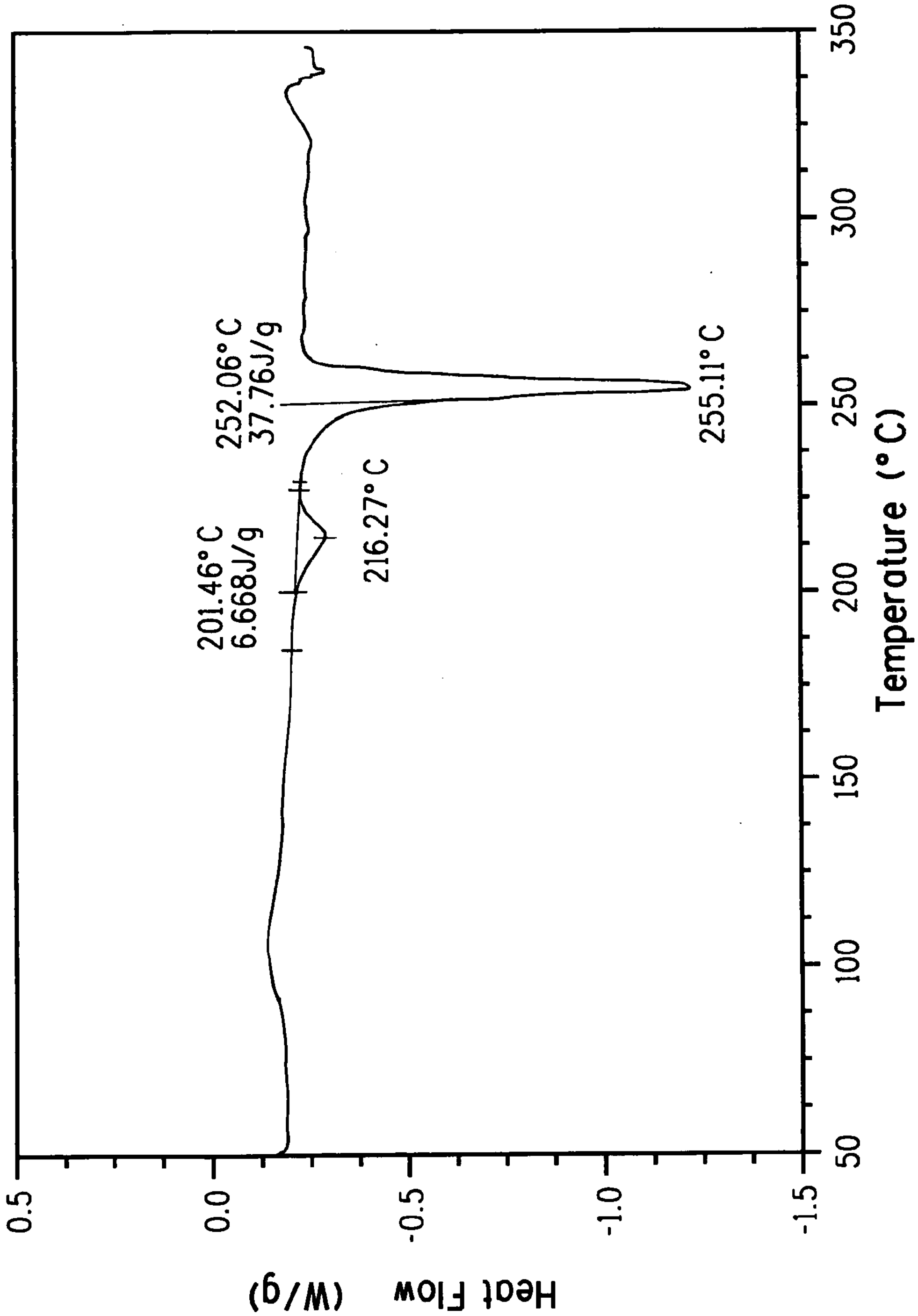

252.06° C
37.76J/g
255.11° C
201.46° C
6.668J/g
216.27° C
Temperature (°C)
Heat Flow (W/g)
0.5
0.0
-0.5
-1.0
-1.5
50
100
150
200
250
300
350

FIG. 6

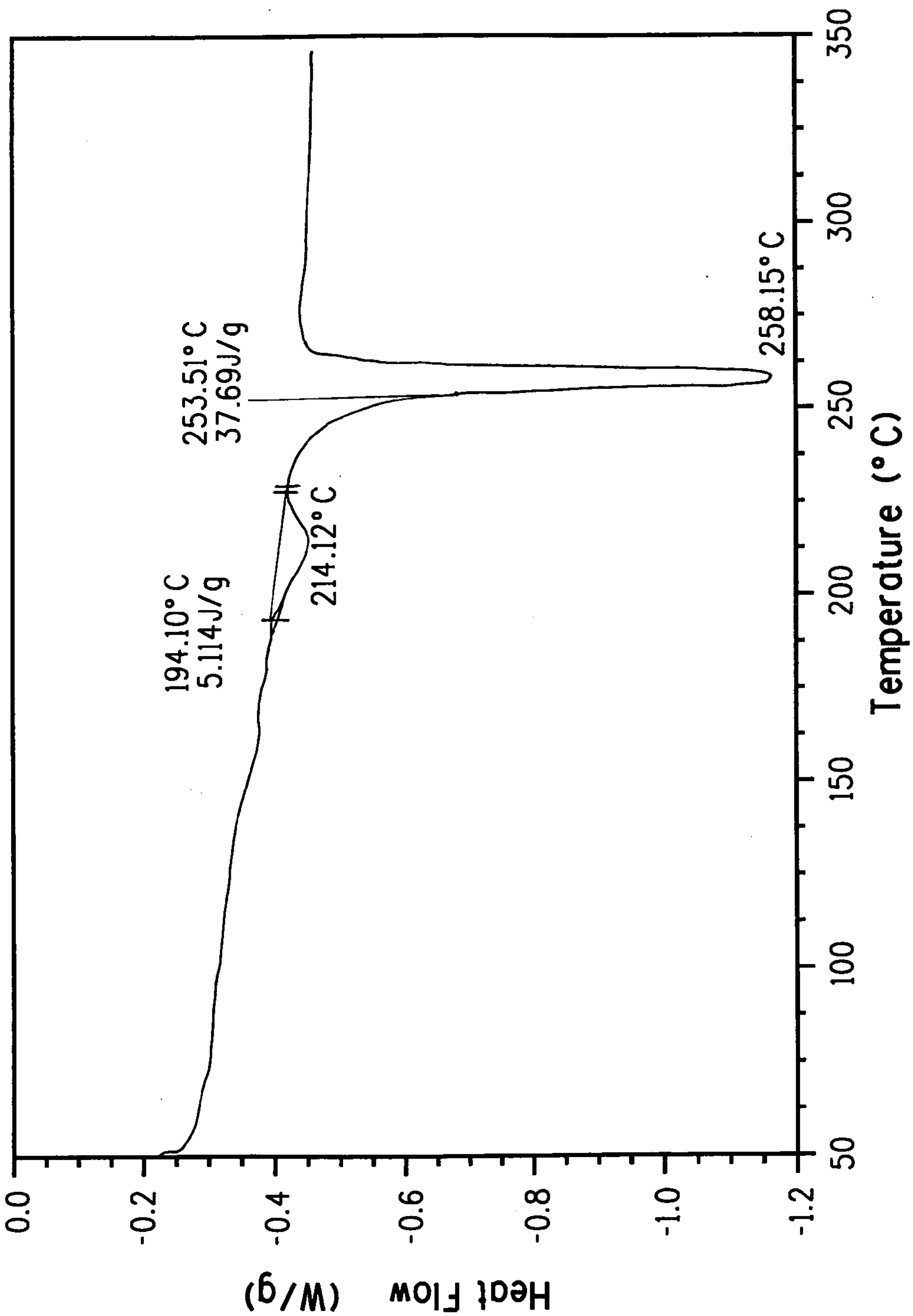
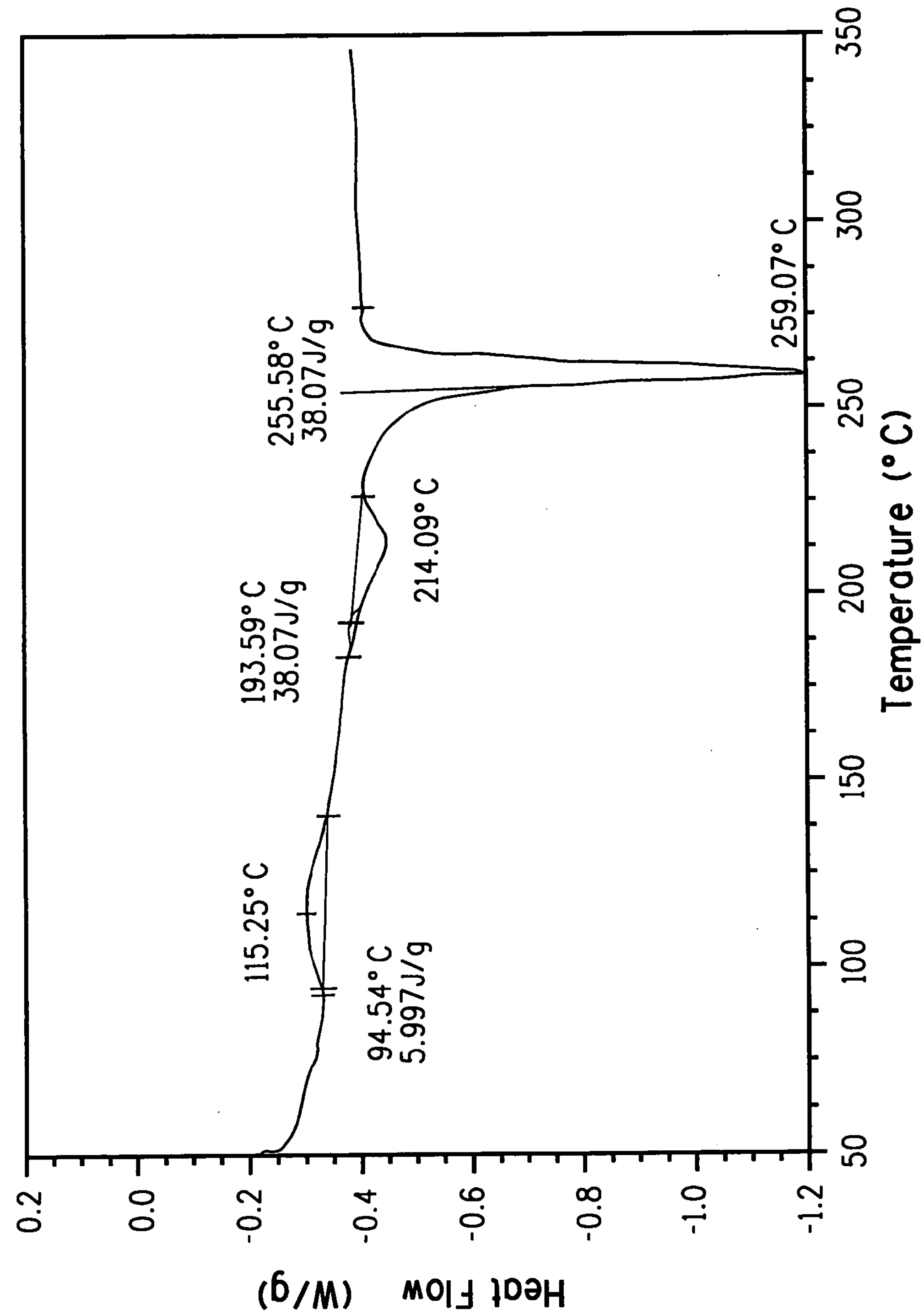

Heat Flow (W/g)
0.0
-0.2
-0.4
-0.6
-0.8
-1.0
-1.2
Temperature (°C)
50
100
150
200
250
300
350
194.10°C
5.114J/g
214.12°C
253.51°C
37.69J/g
258.15°C

FIG. 7



Heat Flow (W/g)
0.2
0.0
-0.2
-0.4
-0.6
-0.8
-1.0
-1.2
Temperature (°C)
50
100
150
200
250
300
350
115.25°C
94.54°C
5.997J/g
193.59°C
38.07J/g
214.09°C
255.58°C
38.07J/g
259.07°C

FIG. 8

CHILD-RESISTANT BLISTER PACKAGE

BACKGROUND OF THE INVENTION

[0001] 1. Field of the Invention

[0002] The present invention relates to improved child-resistant blister packaging. More particularly, this invention relates to blister packaging that includes a lidding component that comprises at least one nonwoven layer of melt-spun continuous filament nonwoven sheets.

[0003] 2. Description of the Related Art

[0004] Blister packages are known in the art, for example as packaging for pharmaceuticals and other materials. Blister packages include a blister component having at least one cavity formed therein into which the medicine or other packaged material is placed prior to being sealed to a lidding or top web component. Blister components known in the art include soft-tempered aluminum foils, hard-tempered aluminum foils, multi-layer cold formable foils, and thermoformed films. Lidding components known in the art include films, and combinations of films, paper, and/or foil. The lidding component generally has a heat-seal layer applied to one side thereof which is used to heat seal the lidding component to the blister component during the manufacture of the blister package. When used for packaging pharmaceuticals and other materials that are oxygen- and/or moisture-sensitive, the blister package should have sufficient barrier properties to ensure a reasonable shelf-life for the packaged materials. When used for packaging pharmaceuticals or other materials that may be harmful to children, a blister package should also be child-resistant so that a child cannot open the package, bite through it, or otherwise damage the packaging in a way that exposes the packaged pharmaceutical or other packaged material. At the same time, it is generally desirable that an adult can open the blister package without undue effort.

[0005] Examples of blister packages known in the art include peel-open, tear-open, push-through, and peel off-push through packages. In a peel-open package, the lidding component is peeled away from the blister component to reveal the packaged material. In a tear-open package, the lidding and blister components contain a notch or perforation that extends from an edge of the package in the direction of the cavity. The notch can be made in an external edge of a package, or, for packages comprising multiple blisters separated by perforations, the notch is preferably contained internal to the package such that when an individual blister is separated at the perforations from the rest of the blisters in the package, the notch in the separated blister is on an exposed edge thereof. The package is then torn at the notch and the tear is propagated until the contents of the package are capable of being removed. In a push-through package, the packaged material is pushed through the lidding component by applying finger pressure to the exterior of the blister cavity. In a peel off-push through package, the lidding component is a multi-layer laminate that generally includes an outer paper layer bonded by an intermediate adhesive layer to a film layer (e.g. polyester film), with the film layer also being bonded by a peelable adhesive layer to a foil layer on the side of the film opposite that which is bonded to the paper layer. The foil layer generally has a heat-seal layer coated or otherwise applied to the side of the foil opposite the film which provides a non-peelable seal when heat-sealed to the blister component. To open the package, the lidding is peeled between the film and the foil layers, leaving the foil layer attached to the blister component. After peeling off the combined paper and film lidding layers, the packaged material is pushed through the lidding layer(s) that remains attached to the blister component. Generally, the peelable adhesive layer remains adhered to the film layer during peeling such that only the foil layer remains attached to the blister component after peeling. An example of a peel off-push through blister package is described in Brunda, U.S. Pat. No. 3,899,080. The blister package comprises a peelable outer layer, for example film, cardboard, or paper that is adhered by a peelable adhesive to a rupturable layer such as paper, selected plastics, or metal foil.

[0006] One challenge in the manufacture of blister packaging is to make a package that is child resistant that can also be opened by an adult without undue difficulty. Certain child-resistant blister packages known in the art include peel-open packages that comprise a laminated paper-film lidding component adhered to a plastic blister component by a peelable sealant. Further child-resistance is obtained using peel off-push through packages, which comprise the multi-layer lidding material described above. One disadvantage of current peel off-push through packages is that paper-film-foil laminates used in the lidding do not generally peel cleanly in one piece and often tear at the perforation, making it difficult to initiate a new peel. Some paper-film laminates and paper-film-foil laminates also have poor puncture resistance and can be chewed through by a child. Another disadvantage of using paper-film laminates or paper-film-foil laminates in the lidding component is that it is not unusual to have problems with moisture being sealed in the blister when moisture that is retained in the paper forms steam at the high temperatures used in the heat-sealing process.

[0007] Poore, British patent GB 2151581 describes push-through strip packaging described as child-resistant that includes first and second planar sheet materials with the packaged elements enclosed therebetween. Neither of the planar sheet materials contains pre-formed blisters, but rather the necessary accommodation of the packaged elements is afforded by stretching of the material of each sheet as they are sealed together. The first sheet is a laminate of a paper or a foil with a tear-resistant biaxially oriented plastic material together with an adhesive layer that is preferably a heat-sealable adhesive layer. The second sheet preferably has a push through force of at least about 70 N and comprises a laminate of paper or metal foil and a layer of plastic or other material that can provide adhesive properties, preferably a heat-sealable adhesive. The package permits the removal of individual elements through the second sheet by application of finger pressure.

[0008] Gerber published European Patent Application 0959020 describes a peel off-push through type blister package that includes a cover sheet containing a metal foil-free push-through penetrable plastic layer, a peelable release adhesive, and a non-penetrable cover layer. The cover layer is peeled off the release adhesive in a first step and the packaged material is pushed through the metal foil-free penetrable plastic layer. Suitable cover layers include mono-films, film laminates containing thermoplastics, papers or layered materials of thermoplastic paper. Suitable papers include cellulose papers, security papers, and papers made of synthetic fibers.

[0009] Carter, U.S. Pat. No. 4,947,620 describes a blister pack suitable for steam sterilization that includes a lidding material of Tyvek® nonwoven material that is coated with an adhesive only on the areas of the lidding that are bonded to the blister component. The Tyvek® nonwoven material is breathable and therefore such packaging is not suitable for packaging pharmaceuticals and other materials that are oxygen or moisture sensitive.

[0010] There remains a need for improved child-resistant blister packaging that protects materials packaged therein from moisture and/or oxygen that is also economical to manufacture and can be processed at elevated sealing temperatures.

BRIEF SUMMARY OF THE INVENTION

[0011] The present invention is directed to a blister package comprising a blister component having an inner surface and an outer surface and a multi-layer lidding component having an inner surface and an outer surface, wherein selected portions of the inner surfaces of the blister component and lidding component are adhered together to form at least one cavity therebetween, the blister component comprising a first barrier layer selected from the group consisting of polymeric films, coated polymeric films, metal foils, and film-foil laminates, and the lidding component comprising a second barrier layer and a nonwoven layer comprising at least one melt-spun continuous filament nonwoven sheet with at least one polymer located along at least some a portion of the surface of the filament having a melt onset temperature greater than about 198° C. and essentially no cold crystallization peak between about 75° C. and about 125° C.

BRIEF DESCRIPTION OF THE DRAWINGS

[0012] FIG. **1** is a schematic elevation view of a blister package.

[0013] FIG. **2***a* is a schematic cross-sectional view of a lidding material useful in blister packages of the present invention.

[0014] FIG. **2***b* is a schematic cross-sectional view of a second embodiment of a lidding material useful in blister packages of the present invention.

[0015] FIG. **3** is a schematic diagram of a process suitable for preparing a blister package of the present invention.

[0016] FIG. **4** is a portion of the product made by the process of FIG. **3**, showing multiple blister packages.

[0017] FIG. **5** is a graph of the DSC curve for Example 1.

[0018] FIG. **6** is a graph of the DSC curve for Comparative Example A.

[0019] FIG. **7** is a graph of the DSC curve for Comparative Example B.

[0020] FIG. **8** is a graph of the DSC curve for Comparative Example C.

DETAILED DESCRIPTION OF THE INVENTION

[0021] The present invention relates to an improved child-resistant blister package that comprises a multi-layer lidding component and a blister component. The multi-layer lidding component includes at least one barrier layer and at least one nonwoven layer melt-spun continuous filament nonwoven sheet. Examples of these types of blister packages are disclosed in U.S. Patent Application No. US2005/0139505 and incorporated herein by reference in its entirety. The present invention further relates to a nonwoven sheet that is particularly suited toward elevated sealing temperatures for use in blister packages sealing temperatures. The blister packages of the present invention include peel-open, tear-open, and peel off-push through packages. The use of a melt-spun continuous filament nonwoven sheet in the lidding results in a blister package that is difficult or impossible to open by pushing the packaged item through the lidding or by chewing through the lidding, thus improving the degree of child resistance compared to packages known in the art.

[0022] The term "copolymer" as used herein includes random, block, alternating, and graft copolymers prepared by polymerizing two or more comonomers and thus includes dipolymers, terpolymers, etc.

[0023] The term "polyethylene" (PE) as used herein is intended to encompass not only homopolymers of ethylene, but also copolymers wherein at least 85% of the recurring units are ethylene units, and includes "linear low density polyethylenes" (LLDPE) which are linear ethylene/α-olefin copolymers having a density of less than about 0.955 g/cm^3, and "high density polyethylenes" (HDPE), which are polyethylene homopolymers having a density of at least about 0.94 g/cm^3.

[0024] The term "polyester" as used herein is intended to embrace polymers wherein at least 85% of the recurring units are condensation products of dicarboxylic acids and dihydroxy alcohols with linkages created by formation of ester units. Examples of polyesters include poly(ethylene terephthalate) (PET), which is a condensation product of ethylene glycol and terephthalic acid, and poly(1,3-propylene terephthalate), which is a condensation product of 1,3-propanediol and terephthalic acid and poly(ethylene naphthalate).

[0025] The term "polyamide" as used herein is intended to embrace polymers containing recurring amide (—CONH—) groups. One class of polyamides is prepared by copolymerizing one or more dicarboxylic acids with one or more diamines. Examples of polyamides suitable for use in the present invention include poly(hexamethylene adipamide) (nylon 6,6) and polycaprolactam (nylon 6).

[0026] The term "barrier layer" as used herein refers to a sheet layer, including films and coatings that restrict the permeation of oxygen and/or water vapor into a blister package that comprises the sheet layer. Barrier layers suitable for use in the present invention preferably have a moisture vapor transmission rate (MVTR) of less than 6 g/m^2/124 hr measured according to ASTM F1249 under the conditions of 38° C. and 90% Relative Humidity and/or an oxygen transmission rate of less than 28 cm^3/m^2/124 hr measured according to ASTM D3985 under the conditions of 23° C., 100% oxygen, and 100% Relative Humidity.

[0027] The terms "nonwoven fabric", "nonwoven sheet", "nonwoven layer", and "nonwoven web" as used herein refer to a structure of individual fibers, filaments, or threads that are positioned in a random manner to form a planar material without an identifiable pattern, as opposed to a knitted or woven fabric. Examples of nonwoven fabrics include meltblown webs, spunbond nonwoven webs, flash spun webs, carded webs, spunlaced webs, and composite sheets comprising more than one nonwoven web.

[0028] The term "machine direction" (MD) is used herein to refer to the direction in which a nonwoven web is produced (e.g. the direction of travel of the supporting surface upon which the fibers are laid down during formation of the nonwoven web). The term "cross direction" (XD) refers to the direction generally perpendicular to the machine direction in the plane of the web.

[0029] The term "spunbond fibers" as used herein means fibers that are melt-spun by extruding molten thermoplastic polymer material as fibers from a plurality of fine, usually circular, capillaries of a spinneret with the diameter of the extruded fibers then being rapidly reduced by drawing and then quenching the fibers.

[0030] The term "meltblown fibers" as used herein, means fibers that are melt-spun by meltblowing, which comprises extruding a melt-processable polymer through a plurality of capillaries as molten streams into a high velocity gas (e.g. air) stream.

[0031] The term "spunbond-meltblown-spunbond nonwoven fabric" ("SMS") as used herein refers to a multi-layer composite sheet comprising a web of meltblown fibers sandwiched between and bonded to two spunbond layers. Additional spunbond and/or meltblown layers can be incorporated in the composite sheet, for example spunbond-meltblown-meltblown-spunbond webs ("SMMS"), etc.

[0032] The term "multiple component fiber" as used herein refers to a fiber that is composed of at least two distinct polymeric components that have been spun together to form a single fiber. At least two polymeric components are arranged in distinct substantially constantly positioned zones across the cross-section of the multiple component fibers, the zones extending substantially continuously along the length of the fibers.

[0033] The term "bicomponent fiber" is used herein to refer to a multiple component fiber that is made from two distinct polymer components, such as sheath-core fibers that comprises a first polymeric component forming the sheath, and a second polymeric component forming the core; and side-by-side fibers, in which the first polymeric component forms at least one segment that is adjacent at least one segment formed of the second polymeric component, each segment being substantially continuous along the length of the fiber with both polymeric components being exposed on the fiber surface. Multiple component fibers are distinguished from fibers that are extruded from a single homogeneous or heterogeneous blend of polymeric materials.

[0034] The term "multiple component nonwoven web" as used herein refers to a nonwoven web comprising multiple component fibers. The term "bicomponent web" as used herein refers to a nonwoven web comprising bicomponent fibers. A multiple component web can comprise single component and/or polymer blend fibers in addition to multiple component fibers.

[0035] As used herein, the term "film" includes layers that are extruded directly onto one of the other layers in the lidding or blister components, as well as films that are formed in a separate film-forming step and then laminated to one or more other layers.

[0036] The term "full-surface bonded nonwoven fabric" as used herein refers to a nonwoven fabric that has been bonded by applying heat and pressure to the nonwoven fabric between two substantially smooth bonding surfaces. A full-surface bonded nonwoven fabric is bonded over substantially 100% of its outer surfaces by fiber-to-fiber bonds. The use of smooth bonding surfaces results in each side of the full-surface bonded nonwoven fabric being substantially uniformly bonded. Full surface bonded nonwoven fabrics are described in U.S. Patent Application No. US2005/0130545 and incorporated herein by reference in its entirety.

[0037] The term "melt onset temperature" as used herein refers to the part of the polymer melting curve which is measured from the tangent to the first part of the DSC melting peak and the extrapolated baseline before melting.

[0038] The abbreviation "DSC" as used herein refers to Differential Scanning Calorimeter or Differential Scanning Calorimetry, depending on grammatical context.

[0039] The term "cold crystallization peak" as used herein refers to crystallization of an amorphous or semi-crystalline polymeric material upon heating as can be measured from a graph using a DSC.

[0040] FIG. **1** illustrates a schematic elevation view of a blister package according to the present invention. Lidding component **1** is heat-sealed to a blister component comprising a plurality of cavities **2**. The lidding and blister components are heat-sealed in the shoulder areas **3** that separate the individual cavities. The shoulder areas generally include perforations (not shown) between the individual blisters or groups of individual blisters.

[0041] The blister component is formed from a forming web that comprises at least one barrier layer, for example a polymeric film, coated polymeric film, or metal foil. Forming webs suitable for forming the blister component are known in the art. For example, the blister component can be prepared by thermoforming cavities into a barrier film. Alternately, the blister component can be formed from a soft-tempered or a hard-tempered foil such as an aluminum foil layer. Films and foils suitable for forming the blister component generally have a thickness between about 5.0 mils (0.125 mm) and 15 mils (0.38 mm) for child-resistant packaging. For example, a typical film thickness is about 10 mils (0.25 mm). The blister component can be formed from a multi-layer sheet structure, for example a multi-layer film or a film-foil laminate.

[0042] FIG. **2***a* is a cross-sectional view of an embodiment of a lidding component suitable for use in peel-open, tear-open, and peel off-push through blister packages of the present invention. Nonwoven layer **5**, which comprises at least one melt-spun continuous filament sheet, is bonded to barrier layer **7** by intervening adhesive tie layer **6**. Heat-seal layer **8** is adhered to the barrier layer on the side of the barrier layer opposite the tie layer. A blister package is formed by heat-sealing the lidding component to the blister component with heat-seal layer **8** facing the blister component such that nonwoven layer **5** forms one of the outer surfaces of the blister package. Tie layer **6** can form a peelable seal (e.g. in a peel off-push through package) or a non-peelable seal (e.g. in a peel-open or tear-open package) between the nonwoven layer and the barrier layer, depending on the desired method for opening the blister package. A seal or bond is considered non-peelable if the layers bonded by the non-peelable seal are not readily opened by an adult by hand-peeling. Generally, a seal having a peel strength between about 3 to 4 lb/in (5.1 to 7.2 newton/centimeter) is preferred for a peelable seal. Peel strengths less than about 3 lb/in are generally peeled too easily to be useful in child-resistant packages. Seals having a peel strength greater than about 4 lb/inch are generally considered to be non-peelable or permanent seals. Peel strength can be measured according to ASTM F 88-0, which is hereby incorporated by reference, using the unsupported method of clamping the sample described therein. Similarly, heat-seal layer **8** can form a peelable seal (e.g. in a peel-open package) or a non-peelable seal (e.g. in a peel off-push through or tear-open package) between the barrier layer and the blister component. Examples of lidding constructions according to FIG. **2***a* include: (a) melt-spun continuous filament nonwoven sheet/adhesive tie layer/metal foil/heat-seal layer and (b) melt-spun continuous filament nonwoven sheet/adhesive tie layer/barrier film (metalized or unmetalized, coated or uncoated)/heat-seal layer. The barrier film can be a film that is laminated to the nonwoven sheet or can be a layer that is co-extruded with the adhesive tie layer onto the nonwoven sheet.

[0043] Barrier layers suitable for use in the lidding component shown in FIG. **2***a* include foil sheets such as aluminum foil and laminated structures comprising a foil layer such as film-foil laminates, as well as mono-layer, multi-layer, and coated polymeric films, and metalized polymeric films.

[0044] Examples of other materials useful as either the barrier layers suitable for use in the lidding component, or as the blister component include poly(vinyl chloride) (PVC) used as a mono-layer film, PVC film coated with poly (vinylidene chloride) (PVdC), PVC film laminated with poly(chlorotrifluoroethylene) (PCTFE) film such as Aclar® PCTFE film available from Honeywell, Inc. (Morris Township, N.J.), cyclo-olefin-copolymer (COC) used as part of a laminated or co-extruded structure, cold-formable foil such as PVC/aluminum/nylon laminated structures, mono-layer aluminum foil, polypropylene (PP) used as a mono-layer film, poly(ethylene terephthalate) (PET) used as a mono-layer film, and poly(ethylene terephthalate) copolymers that have been modified with 1,4-cyclohexanedimethanol, available from Eastman Chemicals (Kingsport, Tenn.) as PETG copolymers, used as a mono-layer film.

[0045] In one embodiment the barrier layer comprises a polymeric film comprising a polymeric coating. For example, the barrier layer can comprise a PVdC-coated polyester film such as PVdC-coated Mylar® polyester films e.g. M30 and M34 films, available from DuPont Teijin Films). In another embodiment, the barrier layer comprises a polymeric film that has been coated with a ceramic material. Ceramic materials suitable for coating polymeric films include oxides, nitrides, or carbides of silicon, aluminum, magnesium, chromium, lanthanum, titanium, boron, zirconium, or mixtures thereof. Methods for depositing ceramic coatings onto a substrate are known in the art, such as by deposition from the vapor or gaseous phase under vacuum onto a film layer in thicknesses of about 5 to 500 nanometers (nm). Suitable ceramic-coated films include films made of a thermoplastic material, such as polyolefin films having a thickness of 23 to 100 micrometers or polyester films having a thickness of 12 to 80 micrometers, that have been coated with at least one 5 to 500 nm thick layer of SiO_x, where x is a number ranging from 1.1 to 2, or with Al_yO_z, where the ratio y/z is a number ranging from 0.2 to 1.5. Alternately, the barrier layer can comprise a metalized film prepared using processes known in the art such as vacuum deposition or sputter coating. In one embodiment, the barrier layer is a metalized polyester film, for example a poly(ethylene terephthalate) film, that has a layer of aluminum metal coated thereon; preferably the metal layer is about 10 Angstroms to 1000 Angstroms thick and the film is preferably at least 12 micrometers thick. Metalized polyester films are known in the art and include aluminum-coated polyester films such as Mylar® MC2 aluminum-coated polyester film (available from DuPont Teijin Films). When the barrier layer of the lidding component comprises a ceramic-coated or a metalized polymeric film, the film can be ceramic-coated or metalized on one or both sides. The polymeric film is preferably ceramic-coated or metalized on one side thereof and the lidding is preferably constructed such that the metalized or ceramic-coated side of the film contacts adhesive tie layer **6** to avoid flaking off of the metalized or ceramic layer onto the packaged material when the package is opened. Metalized and ceramic-coated films generally have better barrier properties than unmetalized and uncoated films and therefore are preferred when higher barrier is required than can be achieved with an un-metalized or uncoated film.

[0046] FIG. **2***b* is a cross-sectional view of a second embodiment of a lidding component suitable for use in peel-open and tear-open blister packages of the present invention. The lidding component includes nonwoven layer **5'** and heat-seal layer **8'**. In this embodiment, the heat-seal layer is selected such that it is a barrier layer as well as being heat-sealable, thus eliminating the need for separate barrier and heat-seal layers. The nonwoven layer comprises at least one melt-spun continuous filament nonwoven sheet. When the heat-sealable barrier layer is applied as a coating on the nonwoven layer, it completely coats the nonwoven layer to provide the desired barrier properties in the blister package. For example, PVdC at a basis weight ranging from 5 g/m^2 to 120 g/m^2 coated on a nonwoven layer provides sufficient barrier properties as well as functioning as a heat-seal layer. Depending on the selection of the heat-sealable barrier layer and the blister component, the heat seal can be peelable or non-peelable. When it is desired to form a peel-open package, the heat-sealable barrier layer and the blister component are selected such that the heat seal is peelable. When it is desired to form a tear-open package, the heat seal is preferably non-peelable. In one embodiment of the present invention according to FIG. **2***b*, a tear-open package is formed using a PVdC blister component and a PVdC heat sealable barrier layer (heat seal is non-peelable). In another embodiment of the present invention according to FIG. **2***b*, a peel-open package is formed using a PVC blister component and a PVdC heat-sealable barrier layer, where the PVdC formulation is selected to form a peelable seal with the PVC blister. The lidding shown in FIG. **2***b* optionally includes a non-peelable tie layer (not shown) between the nonwoven layer and heat-seal/barrier layer. For example the tie layer can be a polyester-based polyurethane composition such as Adcote® polyurethane adhesives available from Rohm & Haas (Philadelphia, Pa.).

[0047] Melt-spun continuous filament nonwoven sheets suitable for use in the nonwoven layer in the lidding component include spunbond nonwoven webs and composite nonwoven fabrics that comprise at least one spunbond nonwoven web. Spunbond webs suitable for use in the lidding component of the blister package of the present invention can be prepared using spunbonding methods known in the art. Alternately, the melt-spun continuous filament nonwoven sheet can be formed from previously collected continuous filaments that are laid down on a collecting surface, for example as in the process described in Davies et al. U.S. Pat. No. 3,595,731. Polymers suitable for forming the melt-spun continuous filament nonwoven sheet include polyesters such as poly(ethylene terephthalate) and poly(1,3-propylene terephthalate), polyamides such as nylon 6,6 and nylon 6, and copolymers thereof.

[0048] The melt-spun continuous filaments of the continuous filament nonwoven sheet can be spun from a single polymer or from a homogeneous or heterogeneous blend of two or more polymers. A homogeneous blend is defined as the mixing of two or more polymers where the final composition does not have separate polymer regions throughout the filament. A heterogeneous blend is defined as the mixing of two or more polymers where there are separate polymer regions throughout the filament. Alternatively, the melt-spun continuous filament nonwoven sheet can comprise a multiple component spunbond nonwoven web. Multiple component spunbond webs preferably comprise a polymeric component that has a melting point that is lower than the melting point(s) of the other polymeric component(s) to facilitate thermal bonding of the web. Examples of suitable multiple component fiber cross-sections include bicomponent fibers such as those having side-by-side or sheath-core cross-sections. In one embodiment of the present invention, the melt-spun continuous filament multiple component nonwoven sheet comprises multiple component sheath-core spunbond fibers having a substantially concentric cross-section wherein the melting point of the sheath component is at least 10° C., preferably at least 20° C., less than the melting point of the core component. In one embodiment, the melt-spun continuous filaments comprise a polyester copolymer sheath and a polyester core. For example, the sheath can comprise a poly(ethylene terephthalate) copolymer and the core can comprise poly(ethylene terephthalate). Poly(ethylene terephthalate) copolymers suitable for use as the sheath component include amorphous and semi-crystalline poly(ethylene terephthalate) copolymers. For example, poly(ethylene terephthalate) copolymers in which between about 5 and 30 mole percent based on the diacid component is formed from di-methyl isophthalic acid, as well as poly (ethylene terephthalate) copolymers in which between about 5 and 60 mole percent based on the glycol component is formed from 1,4-cyclohexanedimethanol are suitable for use as the lowest-melting component in the multiple component fibers. Poly(ethylene terephthalate) copolymers that have been modified with 1,4-cyclohexanedimethanol are available from Eastman Chemicals (Kingsport, Tenn.) as PETG copolymers. Poly(ethylene terephthalate) copolymers that have been modified with di-methyl isophthalic acid are available from E. I. du Pont de Nemours and Company (Wilmington, Del.), (DuPont) as Crystar® polyester copolymers.

[0049] In melt spinning the continuous filament nonwoven sheet, the filaments develop certain levels of polymer crystalline character and amorphous character due to the filament spinning and subsequent web bonding conditions.

[0050] During melt spinning, the filaments can be prepared with strain induced crystallinity with varying levels of oriented and unoriented crystallinity. The presence of excess unoriented crystallinity lowers the melt onset temperature of the polymer. For filaments with at least one polymer located along at least a portion of the surface of the filament with a melt onset temperature less than about 198° C., the multi-layer lidding component can stick to the platen of the blister packaging machine. However, without being held to any particular theory, it has been found that by adjusting the pneumatic draw jet operating conditions during the melt spinning process, the unoriented crystallinity of the filament can be reduced, thereby raising the melt onset temperature above about 198° C. and thereby avoiding having the multi-layer lidding component sticking to the platen.

[0051] The web bonding process anneals the filaments by thermal crystallization of the unoriented amorphous regions, partially oriented amorphous regions and semi-crystalline regions. Crystallization of an amorphous or semi-crystalline material upon heating is termed "cold crystallization." The extent of cold crystallization can be measured on a graph using a DSC. If there is insufficient thermal crystallization during the web bonding process, cold crystallization does not sufficiently occur, which is indicated by the presence of a peak in the DSC graph. For filaments with at least one polymer located along at least a portion of the surface of the filament and wherein the polymer exhibits the presence of a cold crystallization peak between 75° C. and 125° C., the multi-layer lidding component can stick to the platen. However, it has been found that by using sufficient heat during the web bonding process, the cold crystallization process can take place so that the polymer will cause essentially no cold crystallization peak between 75° C. and 125° C. and thereby avoid the multi-layer lidding component's sticking to the platen. Without being held to any particular theory, it has been found that by sufficient reduction of the filament unoriented crystallinity and essentially eliminating the polymer cold crystallization peak, the multi-layer lidding component's sticking to the platen can be avoided and thereby allow the use of desirable high temperature materials in blister packages.

[0052] Composite nonwoven fabrics comprising a spunbond nonwoven web suitable for use in the lidding component include spunbond-meltblown (SM) composite nonwoven fabrics, SMS composite nonwoven fabrics, and composite nonwoven fabrics that include other combinations of spunbond and/or meltblown nonwoven webs such as SMMS composite webs, etc. The meltblown web(s) used to prepare the composite nonwoven fabrics can be single component or multiple component meltblown web(s) and can be prepared using methods known in the art.

[0053] A particularly suitable lidding component can be obtained by smooth-surface thermal bonding of a nonwoven web. This can be achieved by heating the web between two smooth bonding surfaces to a temperature sufficient to melt or soften the surfaces of the fibers on one or both sides of the nonwoven web such that fiber-to-fiber thermal fusion bonds are formed at the fiber cross-over points on one or both surfaces of the nonwoven web, as disclosed in U.S. Application No. US2005/0130545 and incorporated herein by reference in its entirety.

[0054] Thermal calendering processes using a variety of roll configurations are known in the art. The nonwoven layer can be calender bonded such that one side of the nonwoven layer is thermally bonded, with the thermally bonded side forming one of the outer surfaces of the final blister package. Alternately, the nonwoven layer can be calendered such that both sides of the nonwoven layer are thermally bonded. Examples of other calendering processes suitable for bonding the nonwoven layer include those disclosed in David, U.S. Pat. No. 3,532,589, Janis, U.S. Pat. No. 5,972,147, and Lim et al., U.S. Pat. No. 5,308,691, which are each incorporated herein by reference.

[0055] In one embodiment, the nonwoven layer comprises a full-surface bonded melt-spun multiple component continuous filament nonwoven fabric that has been thermally bonded on both sides in a smooth-calendering process.

Full-surface bonded melt-spun multiple component continuous filament nonwoven fabrics have an improved combination of tensile and tear strength for a given fabric thickness compared to comparable smooth-calendered single component melt-spun nonwoven fabrics. Suitable full-surface bonded melt-spun multiple component continuous filament nonwoven fabrics include full-surface bonded bicomponent spunbond webs such as a spunbond web comprising sheath/core fibers, wherein the melting point of the sheath is at least 10° C. less than the melting point of the core, that has been smooth-calendered and bonded on both sides. Suitable sheath components include polyester copolymers, poly(1,4-butylene terephthalate) (4GT), and poly(1,3-propylene terephthalate) (3GT), and polyamides such as polycaprolactam (nylon 6). Suitable core components include poly(ethylene terephthalate) and poly(hexamethylene adipamide) (nylon 6,6). For example, the full-surface bonded bicomponent spunbond web can comprise bicomponent fibers having a polyester copolymer sheath and a poly(ethylene terephthalate) core.

[0056] The lidding component comprising a nonwoven layer and a barrier layer preferably has a Spencer Puncture (measured according to ASTM D3420, modified for 9/16 in. diameter probe) of at least 0.5 Joules, and preferably at least 0.6 Joules and an Elmendorf Tear (measured according to ASTM D1424) in both the machine direction and the cross-direction of at least 2.0 N and preferably at least 2.5 N.

[0057] In one embodiment of the present invention the heat-seal layer comprises a peelable sealant, thus providing a peel-open blister package. Whether or not a particular heat-seal layer forms a peelable seal may depend on the nature of the layers to which it is sealed (e.g. the blister component and barrier layer for the embodiment shown in FIG. **2***a* or the blister component and the nonwoven layer for embodiments shown in FIG. **2***b*). In a peel-open configuration, the package is opened by peeling the multi-layer lidding component away from the blister component, with the peeling occurring between the heat-seal layer and the blister component. Peelable sealants suitable for use in the heat-seal layer of the packages of the present invention include poly(vinylidene chloride), or solvent-based sealants such as modified vinyl/acrylic sealants available from Watson Rhenania (Pittsburgh, Pa.) such as JVHS-157-LT1 sealant, as well as extrudable sealants, for example blends of polyolefin resins comprising primarily ethylene vinyl acetate or ethylene methyl acrylate copolymers, such as Appeel® resins, available from DuPont. The heat-seal layer can be applied to the barrier layer of the lidding component using methods known in the art including but not limited to roll coating, gravure coating, spray coating, and extrusion coating. In a peel-open package, a non-peelable adhesive tie layer is preferably used to join the nonwoven layer to the barrier layer so that the nonwoven and barrier layers are strongly bonded together, allowing the multi-layer lidding to be cleanly pulled away from the blister component without delamination occurring between the nonwoven and barrier layers. Non-peelable adhesive tie layers suitable for use in lidding used in a peel-open package of the present invention include solvent-based two-component dry-bond adhesive compositions such as polyester-based polyurethane adhesives, for example Adcote® polyurethane-based adhesives available from Rohm & Haas (Philadelphia, Pa.). In a dry-bond adhesive process, the adhesive is applied to either the barrier layer or the nonwoven layer or both, and the two layers are bonded together while the adhesive is "dry" or substantially free of solvent. If the starting adhesive composition comprises a solvent, it is dried prior to laminating the nonwoven layer to the barrier layer. Other adhesive compositions which provide a non-peelable tie layer include extrudable resins such as modified ethylene vinyl acetate, ethylene vinyl acetate, and ethylene methyl acrylate based resins, for example Bynel® and Nucrel® modified ethylene vinyl acetate and modified ethylene methyl acrylate resins, available from DuPont.

[0058] In another embodiment of a blister package of the present invention, the blister package is a peel off-push through package wherein the outer nonwoven layer is adhered to a frangible barrier layer by a peelable tie layer, and is peeled from the package to reveal the frangible barrier layer through which the packaged material is pushed. A layer is considered to be frangible if a packaged material can be removed by rupturing the layer by applying pressure to the exterior of the blister cavity. Peeling may occur between the nonwoven layer and the adhesive tie layer or between the adhesive tie layer and the barrier layer. The adhesive tie layer is preferably selected such that it remains adhered to the nonwoven layer and peels cleanly away from the barrier layer when the package is opened without tearing or otherwise rupturing the barrier layer. That is, the adhesive tie layer preferably has a high adherence to the nonwoven layer and a relatively lower adherence to the frangible barrier layer. If peeling occurs between the nonwoven layer and the adhesive tie layer, the adhesive tie layer should also be a frangible layer. For example, in a peel off-push through package comprising a lidding component according to FIG. **2***a*, the adhesive tie layer is a peelable layer such that the nonwoven layer can be peeled away from the barrier layer of the lidding component, and wherein the combined barrier layer/heat-seal layer (for peeling between the adhesive tie layer and the barrier layer) or combined adhesive tie layer/barrier layer/heat-seal layer (for peeling between the nonwoven layer and tie layer) is frangible. Examples of frangible barrier layers include metal foils (e.g. aluminum foil), frangible polymeric films [e.g. biaxially-oriented poly(chlorotrifluoroethylene) films], frangible metalized polymeric films, and frangible ceramic-coated polymeric films. The frangible layer(s) are selected such that once the nonwoven layer (or combined nonwoven/adhesive tie layer) is peeled away from the package, the pharmaceutical or other packaged material can be pushed through the frangible layer(s). The adhesive tie layer can be extruded or coated onto one or both of the nonwoven layer (e.g. melt-spun continuous filament polyester-based spunbond nonwoven) or frangible barrier layer and the nonwoven and barrier layer bonded together by the intermediate tie layer. Examples of suitable peelable tie layers include modified vinyl/acrylic compositions, such as JVHS-157-LT1 modified vinyl/acrylic adhesive available from Watson Rhenania (Pittsburgh, Pa.), or blends of polyolefin resins comprising primarily ethylene vinyl acetate or ethylene methyl acrylate copolymers, such as Appeel® polyolefin resins, available from DuPont, and solvent-based modified acrylic pressure sensitive adhesive, such as Adcote L74X105 from Rohm & Haas (Philadelphia, Pa.). The heat-seal layer in a peel off-push through package is selected such that it forms a non-peelable seal between the blister component and the barrier layer in the lidding. Examples of suitable permanent (non-peelable) sealants include modified vinyl/acrylic compositions such as JVHS-

157-2, or a modified polyester sealant such as GNS01-014, both available from Watson Rhenania (Pittsburgh, Pa.).

[0059] When a tear-open package is desired, the adhesive tie layer and heat-seal layer of FIGS. **2***a* and **2***b* are selected such that non-peelable bonds/seals are formed between the barrier layer and the blister component and between the nonwoven layer and the barrier layer. This allows the package to be torn cleanly at a pre-formed notch in the package without peeling occurring between the various layers in the multi-layer lidding component.

[0060] The blister package of the present invention can be manufactured using methods known in the art. FIG. **3** illustrates a process that is suitable for forming a blister package of the present invention. The blister cavities **10** are generally thermoformed into a forming web in-line just prior to filling the cavities with the material **12** to be packaged. The lidding component **14** is unwound from roll **15** and brought into contact with the formed and filled blister component such that the heat-seal layer of the lidding component contacts the blister component. The lidding and blister components are heat sealed, typically using a heated platen **16** with or without a pattern. Generally, some areas are not sealed to provide a starting point for peeling off the lidding or selected layers of the lidding prior to removing the product. If the lidding component is not pre-printed, printing is generally done just before heat sealing (not shown). After heat-sealing, the individual blisters are generally perforated using methods known in the art (not shown) so that they can be removed at point of use. If the blister package is a tear-open package, notches are formed in the individual blisters during the perforation step. The notches are preferably contained internal to the package such that they are not exposed until the individual blister is removed at point of use. The notch can also be formed on one of the external edges of the blister package, however forming the notches internal to the package decreases the likelihood that a child will be able to tear open the package. Individual blister packages **18**, which can comprise multiple blisters (as shown in FIG. **4**) or a single blister, are then cut from the continuous sheet of sealed blisters. It is important that all materials maintain dimensional stability through the blister package process due to the platen registry, the print registry and the perforation registry.

[0061] The improved tear resistance provided by the continuous filament nonwoven layer in the lidding component of the packages of the present invention provides peel off-push through and peel-open packages wherein the lidding or nonwoven layer peels cleanly away from the package without tearing, whereas packages known in the art that utilize paper-film-foil laminates often do not provide a clean peel, thus making it difficult for even an adult to open the package. The present invention also reduces the number of processing steps required to manufacture the lidding compared to the prior art by replacing three layers (paper-adhesive-film) with a single nonwoven layer. Although the tear resistance of the lidding component of the packages of the present invention is improved compared to prior art lidding materials, they can also be used in tear-open packages wherein the tear is initiated by a pre-formed notch.

Test Methods

[0062] In the description above the following test methods are employed to determine various reported characteristics and properties. ASTM refers to the American Society for Testing and Materials.

[0063] Basis Weight is a measure of the mass per unit area of a fabric or sheet and is determined by ASTM D-3776, which is hereby incorporated by reference, and is reported in g/m^2.

[0064] Tensile Strength is a measure of the force required to break the material apart by pulling. For nonwoven fabrics and nonwoven/foil laminates, tensile strength is determined according to ASTM D5035, which is hereby incorporated by reference, and is reported in units of lb/in or N/cm. For nonwoven/film laminates, tensile strength was measured according to ASTM D882, which is hereby incorporated by reference, and is reported in units of N/cm.

[0065] Elongation is a measure of the extent a substrate with stretch before it breaks and is determined by ASTM D5035, which is hereby incorporated by reference. It is reported in %.

[0066] Elmendorf Tear is a measure of the force required to propagate an initiated tear from a cut or a nick. Elmendorf Tear is measured for nonwoven fabrics and nonwoven/foil laminates according to ASTM D1424, which is hereby incorporated by reference, and is reported in units of lb or N. Elmendorf Tear was measured for nonwoven/film laminates according to ASTM 1922, and is reported in units of Newtons.

[0067] Spencer Puncture is a measure of the ability of a substrate to resist puncture by impact. Spencer puncture is measured for nonwoven fabrics and nonwoven/foil laminates using a bullet-shaped probe and is determined by ASTM D3420 (modified for 9/16 inch diameter probe) with a pendulum capacity of 5.4 Joules, which is hereby incorporated by reference. It is reported in Joules.

[0068] Melt Onset Temperature and Cold Crystallization Peak are determined from a sample of the nonwoven that is placed in a sealed aluminum pan and a scan is run on a differential scanning calorimeter DSC (TA Instruments, New Castle, Pa.) using a thermal profile of from 0° C. to 300° C. at a rate of 10 degrees per minute. The melt onset temperature is determined by measuring the intersection of the tangent to the first part of the DSC melting peak and the extrapolated baseline before melting. The cold crystallization peak is determined by measuring the area of the exotherm between about 75° C. and about 125° C. during the upwards scan of the sample.

EXAMPLE 1

[0069] This example demonstrates preparation of a blister package comprising a lidding component according to FIG. **2***a*, wherein the nonwoven layer was a smooth-calendered full-surface bonded spunbond nonwoven web and the barrier layer in the lidding was a metal foil.

[0070] A spunbond bicomponent nonwoven web was prepared in which the fibers were continuous core/sheath fibers having a poly(ethylene terephthalate) (PET) core component and a co-polyester sheath component composed of 17 mole percent modified di-methyl isophthalate PET copolymer.

[0071] The nonwoven sheet of the invention may be produced using a high speed melt spinning process, such as the high speed spinning processes disclosed in U.S. Pat. Nos. 3,802,817, 5,545,371, and 5,885,909, which are hereby incorporated by reference. Two different polymers were put in the two separate extruders so as to produce bicomponent sheath-core fibers. A low melt 17% modified di-methyl isophthalate co-polyester with an intrinsic viscosity of 0.61 dl/g produced by DuPont as Crystar co-polyester (Merge

4442) was used in the sheath and poly (ethylene terephthalate) polyester with an intrinsic viscosity of 0.53 dl/g available from DuPont as Crystar polyester (Merge 3949) was used in the core. The sheath comprised about 30% of the fiber cross sections and the core comprised about 70% of the fiber cross sections. The total polymer throughput per spin pack capillary was 0.8 g/min. The filaments were cooled in a 15 inch (38.1 cm) long quenching zone with quenching air provided from two opposing quench boxes at a temperature of 12° C. and a velocity of 1 m/sec. The filaments passed into a pneumatic draw jet spaced 50 inches (127 cm) below the capillary openings of the spin pack. Samples were collected while the pneumatic draw jet supply air pressure was 33 psi (227.5 kilopascals).

[0072] The web was thermally bonded between two polished chrome rolls. The web was bonded at a temperature of 170° C., a nip pressure of 500 psi (3447.4 kilopascals), and a line speed of 75 ft/min. The bonded sheet was collected on a roll. A differential scanning calorimeter DSC was used to measure the heat flow versus time of the web. The plot of the data can be seen in FIG. **5**. The data shows a co-polyester melt onset temperature of 200.75° C. and essentially no cold crystallization peak between 75° C. and 125° C.

[0073] The thermally calendered bicomponent spunbond web was then laminated to a 0.93 mil (0.024 mm) thick soft-tempered aluminum foil obtained from Alcoa (Pittsburgh, Pa.) using Adcote 503A/Cat F solvent-based poly (ethylene terephthalate)-based polyurethane permanent adhesive tie layer obtained from Rohm & Haas (Philadelphia, Pa.). An Inta-Roto dry-bond coater/laminator (Model 'The Delaware') was used to perform the lamination. The Adcote 503A/Cat F was mixed at a ratio of 62 percent by weight 503A, 3.5 percent by weight CatF, and 34.5 percent by weight methyl ethyl ketone; and the adhesive was applied using a reverse gravure coating process. The bicomponent spunbond web was unwound from a primary unwind and the adhesive was applied to the bicomponent spunbond web using a reverse rotating gravure roll. Alternately, the adhesive can be applied to the barrier layer. The gravure roll was engraved with a 35 line per inch (13.8 line per cm) tri-helical pattern, where a continuous triangular channel in the helical pattern circumvents the gravure roll. The machine speed was 65 ft/min (19.8 m/min). Typical line speeds used in a reverse gravure coating process are usually between about 15 m/min to 305 m/min. The adhesive was applied at a dry coating weight of about 8 g/m^2. An adhesive tie layer dry coating weight between about 3 g/m^2 and 10 g/m^2 is generally used, with a dry coating weight between about 4 g/m^2 and 8 g/m^2 generally being preferred. A hot air impingement dryer was used to dry the coated spunbond web to remove the solvent present in the tie layer adhesive. Air heated to a temperature of 74° C. was forced through a slotted nozzle assembly onto the adhesive-coated surface of the spunbond web to evaporate the solvent.

[0074] After drying, the adhesive-coated spunbond nonwoven web layer was laminated to the foil layer which was unwound from a roll and contacted with the adhesive-coated side of the spunbond web in a nip formed by two cylindrical calender rolls. One of the rolls was a rubber-covered roll and the second roll was a steel roll heated to 82° C. by internal water heating. The nonwoven web contacted the heated steel roll in the nip and the aluminum foil contacted the rubber-surfaced roll. The laminated substrate was then rewound on the rewinder.

[0075] A solvent-based peelable heat seal layer was then applied to the aluminum foil side of the above-described spunbond nonwoven/aluminum foil laminate using the reverse gravure coating process described above. The peelable heat seal composition used was a vinyl/acrylic solvent-based sealant (JVHS-157-LT1, supplied by Watson-Rhenania, Pittsburgh, Pa.). The heat-seal coating was applied at 5.2 g/m^2 to the nonwoven/foil laminate. Generally, heat seal coatings applied at a dry coating weight of between about 4.8 to 5.6 g/m^2 are preferred. After applying the sealant, the coated material was dried using the same hot air impingement dryer described above and an air temperature of 275° F. (135° C.) to remove the ethyl acetate solvent. After drying the laminate was rewound on the rewinder. The multi-layer laminate can be used directly as a lidding component to prepare a blister package or further processed by printing on the nonwoven surface of the laminate prior to forming a blister package. Properties of the lidding component are compared to a conventional paper-film-foil laminate that is used in the art as lidding in blister packages [CR-417, available from Hueck Foils (Wall, N.J.)] in the Table 1 below. The results demonstrate the significant improvement in Spencer Puncture of the lidding of the present invention compared to the prior art lidding material. The puncture resistance of the laminate prepared in Example 1 was about two times greater than the conventional lidding material. Blister packages prepared according to the present invention are expected to be much more difficult for a child to chew through than conventional blister packages.

[0076] Blister packages were prepared according to the process shown in FIG. **3** using an Uhlmann 1070 form-fill-seal blister packaging machine. The forming web used to form the blister component was 10 mil (0.254 mm) Pentapharm M570/01 poly(vinyl chloride) film supplied by Klockner Pentaplast of America (Gordonsville, Va.). The platen used to heat seal the lidding to the blister component was heated to a temperature of 200° C. to obtain a peel-open package. Numerous blister packages of the present invention were produced on the machine without any sticking of the nonwoven to the platen.

COMPARATIVE EXAMPLE A

[0077] Comparative Example A was prepared similarly to Example 1 except for the web thermal bonding temperature. The web was thermally bonded at a temperature of 120° C. instead of 170° C. Physical properties of the laminate lidding component are shown in Table 1. The DSC plot of the data can be seen in FIG. **6**. The data shows a co-polyester melt onset temperature of 201.46° C. and the presence of the cold crystallization peak between 75° C. and 125° C. Numerous blister packages were produced with sticking of the nonwoven to the platen of the blister packaging machine. The sticking problem is a result of the presence of the cold crystallization peak.

COMPARATIVE EXAMPLE B

[0078] Comparative Example B was prepared similarly to Example 1 except the for some changes in the pneumatic draw jet operating conditions. The filaments passed into a pneumatic draw jet spaced 45 (114 cm) instead of 50 inches (127 cm) below the capillary openings of the spin pack. Samples were collected while the pneumatic draw jet supply air pressure was 44.6 psi (307.5 kilopascals) instead of 33 psi (227.5 kilopascals). Physical properties of the laminate lidding component are shown in Table 1. The DSC plot of the data can be seen in FIG. **7**. The data shows a co-polyester melt onset temperature of 194.10° C. and essentially no cold crystallization peak between 75° C. and 125° C. Numerous blister packages were produced with sticking of the non-woven to the platen of the blister packaging machine. The sticking problem is a result of the co-polyester melt onset temperature being below 198° C.

COMPARATIVE EXAMPLE C

[0079] Comparative Example C was prepared similarly to Example 1 except the for some changes in the web thermal bonding temperature and in the pneumatic draw get operating conditions. The web was thermally bonded at a temperature of 120° C. instead of 170° C. The filaments passed into a pneumatic draw jet spaced 45 inches (114 cm) instead of 50 inches (127 cm) below the capillary openings of the spin pack. Samples were collected while the pneumatic draw jet supply air pressure was 44.6 psi (307.5 kilopascals) instead of 33 psi (227.5 kilopascals). Physical properties of the laminate lidding component are shown in Table 1. The DSC plot of the data can be seen in FIG. **8**. The data shows a co-polyester melt onset temperature of 193.59° C. and presence of the cold crystallization peak between 75° C. and 125° C. Numerous blister packages were produced with sticking of the nonwoven to the platen of the blister packaging machine. The sticking problem is a result of the melt onset temperature being below 198° C. of the presence of the cold crystallization peak.

TABLE 1

Properties of Nonwoven and Nonwoven/Foil Lidding Component

	Example 1	Comparative Example A	Comparative Example B	Comparative Example C	Conventional Lidding (paper/film/foil)
Basis Weight (g/m^2)	162.5	169.5	164.8	162.2	72.5
MD Tensile Strength (N/cm)	154.2	164.3	160.6	157.7	73.7
XD Tensile Strength (N/cm)	70.7	75.1	74.8	68.7	55.5
MD Elongation (% at 3_lbs)	0.2	0.125	0.110	0.120	0.1
XD Elongation (% at 3_lbs)	0.3	0.2	0.3	0.3	0.2
MD Elmendorf Tear (N) Lidding Component	3.43	3.70	3.56	3.74	1.11
XD Elmendorf Tear (N) Lidding Component	3.38	3.60	3.29	3.65	0.89
Spencer Puncture (J) Lidding Component	0.79	0.8609	0.74	0.75	0.39
*Co PET Melt Onset Temp (° C.)	200.75	201.46	194.10	193.59	
*Cold Crystallization Peak	Absent	Present	Absent	Present	

*These data were obtained from testing the nonwoven sheet without the foil.

What is claimed is:

1. A blister package comprising a blister component having an inner surface and an outer surface and a multi-layer lidding component having an inner surface and an outer surface, wherein selected portions of the inner surface of the blister component and inner surface of the lidding component are adhered together to form at least one cavity therebetween, the blister component comprising a first barrier layer selected from the group consisting of polymeric films, coated polymeric films, metal foils, and film-foil laminates, and the lidding component comprising a second barrier layer and a nonwoven layer comprising at least one melt-spun continuous filament nonwoven sheet with at least one polymer located along at least a portion of the surface of the filament having a melt onset temperature greater than about 198° C. and essentially no cold crystallization peak between about 75° C. and about 125° C.

2. A blister package according to claim **1**, wherein the second barrier layer comprises a sheet layer selected from the group consisting of polymeric films, coated polymeric films, metalized polymeric films, and metal foils.

3. A blister package according to claim **2**, wherein the lidding component further comprises an adhesive tie layer intermediate the second barrier layer and the nonwoven layer, and a heat-seal layer adhered to the side of the second barrier layer opposite the adhesive tie layer, such that the inner surface of the lidding component comprises the heat-seal layer and the outer surface of the lidding component comprises the nonwoven layer, and wherein the lidding and blister components are heat sealed to each other to form a seal therebetween.

4. A blister package according to claim **3**, wherein the heat-seal layer comprises a heat-sealable sealant selected from the group consisting of poly(vinylidene chloride), vinyl/acrylic compositions, blends of polyolefin resins comprising ethylene vinyl acetate copolymers, blends of polyolefin resins comprising ethylene methyl acrylate copolymers, and polyester-based compositions.

5. A blister package according to claim **3**, wherein the tie-layer comprises an adhesive composition selected from the group consisting of vinyl/acrylic compositions, blends of polyolefin resins comprising ethylene vinyl acetate copolymers, blends of polyolefin resins comprising ethylene methyl acrylate copolymers, ethylene vinyl acetate resins, ethylene methyl acrylate resins, and polyester-based polyurethanes.

6. A blister package according to claim **3**, wherein the second barrier layer is a frangible sheet layer selected from the group consisting of frangible polymeric films and frangible metal foils.

7. A blister package according to claim **1** or **3**, wherein the nonwoven layer comprises a full-surface bonded multiple component spunbond web.

8. A blister package according to claim **1** or **3**, wherein the nonwoven layer comprises at least one meltblown web sandwiched between first and second melt-spun continuous filament multiple component nonwoven sheets.

9. A blister package according to claim **8**, wherein the first and second melt-spun continuous filament multiple component nonwoven sheets are multiple component spunbond nonwoven webs.

10. A blister package according to claim **9**, wherein the at least one meltblown web is a multiple component meltblown web comprising bicomponent side-by-side meltblown fibers.

11. A blister package according to claim **9**, wherein the first and second multiple component spunbond nonwoven webs comprise sheath-core spunbond fibers wherein the core component comprises a polyester and the sheath component comprises a polyester copolymer.

12. A blister package according to claim **11**, wherein the core component comprises poly(ethylene terephthalate) and the polyester copolymer is selected from the group consisting of poly(ethylene terephthalate) copolymers that have been modified with 1,4-cyclohexanedimethanol and poly(ethylene terephthalate) copolymers that have been modified with di-methyl isophthalic acid.

13. A blister package according to claim **1**, wherein the second barrier layer is a heat-sealable barrier layer adhered to the nonwoven layer, the inner surface of the lidding component comprises the heat-sealable barrier layer, and the lidding and blister components are heat sealed together to form a seal therebetween.

14. A blister package according to claim **13**, wherein the heat-sealable barrier layer comprises poly(vinylidene chloride).

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