Push-through blister backing laminates providing a laser-scored outer layer and a metal substrate layer, and methods of making such laminates are disclosed. The laser-scored blister backing may allow for the use of a reduced amount of metal substrate as compared to blister backing that is not laser scored. The laser-scored push-through blister backing laminate may include a first, laser-scored outer layer, and a push-through metal layer such that the laminate functions as a push-through blister backing when it is applied to a blister film.
FIG. 6

1.5 mil Polyethylene
Adhesive
.75 mil Nylon
Adhesive
1.5 mil Foil
Adhesive
.48 mil PET

Score
LASER-SCORED PUSH-THROUGH BLISTER BACKING AND METHODS OF MAKING SAME

FIELD OF INVENTION

[0001] The present invention relates to packaging. In particular, the present invention relates to laser-scored push-through blister backing and methods of making such backing.

BACKGROUND

[0002] Blister packages are commonly used to package ingestible products, such as food and medicines, where it is convenient to package the product as an individual portion. The individually packaged item may be dispensed from the blister packing as needed, leaving additional portions still packaged. Such blister packages are also used for non-consumable products, such as toys, hardware products, and almost any product imaginable.

[0003] Blister packages are generally characterized as having a portion of the package being shaped as a bubble or “blister” that functions to hold the product of interest. The blister package typically comprises a sheet of translucent material such a polyvinyl chloride (PVC), cyclic olefin copolymers (COC), polystyrene, or similar materials that can be thermoformed into the required shape. For example, blister packaging for a medicine in the form of a pill might have a series of bubbles each shaped to hold individual pills.

[0004] To complete the blister package, a backing layer comprising a heat sealable web is sealed to the surface of the blister film to cover the formed cavity and the product contained within. This heat sealable web is commonly referred to as “blister backing.”

[0005] There are many different configurations of blister backing laminates but generally, they all fall into one of two categories: “peelable” or “push-through.” Peelable blister backing materials are generally designed to be removed from the package by peeling the backing from the blister to expose the product contained within. Push-through blister backing is designed to fracture when hand pressure is applied to the product cavity to push the product through the backing material. Push-through blister backing may use foil as the backing layer, since foil is able to protect the product in the blister from the environment, but still can be ruptured by pushing the product through the foil. Still, foil may be expensive as compared to other materials used for typical laminates, such as paper or plastic. Additionally, at a certain thickness, foil can have sharp edges that may cause cuts or other injury when the backing is being handled.

[0006] There is also a hybrid blister backing laminate available that may combine the attributes of both peelable and push through backing. This third type of blister backing may be referred to as “peel-push,” and involves peeling off one portion of a laminate backing (such as a paper/plastic film layer) and pushing the product through an underlying foil layer. One advantage of “peel-push” blister backing is that it can allow for a reduction in the foil layer thickness as compared to standard foil-based push-through blister backing.

[0007] Both peelable and peel-push blister backing may have the advantage of not requiring metal foil, or of requiring reduced amounts of foil as compared to push-through blister backing. Still, peeling the outer layer from a blister backing can be difficult, as for example, when the container is small, or the individual using the packaging has limited manual dexterity. Thus, for many applications, push-through blister backing is preferred for its convenience.

[0008] Although blister packaging provides numerous advantages and savings with respect to the packaged product, blister packaging individual items may require increased amounts of packaging materials as compared to packaging items in bulk. Also, where the packaging is used for ingestible items, the materials used for such backing (e.g., paper, plastic and/or foil) must be of sufficiently high quality to protect the product from the environment and if necessary, maintain the product in sterile condition. Thus, manufacturers are continually looking for ways to reduce the amount of raw materials used for blister backing.

[0009] What is needed is blister backing that has the convenience of push-through backing, but requiring less foil and other raw materials. Also, what is needed is a method to provide easy access push-through blister backing that provides a container having high integrity, but that is convenient to open.

SUMMARY OF THE INVENTION

[0010] The present invention comprises laser-scored push-through blister backing and methods of making such blister backing. In one embodiment, the present invention comprises a push-through blister backing laminate comprising a first outer layer and a second metal substrate layer, wherein the outer layer is at least partially scored with a laser such that the laminate functions as a push-through blister backing when it is applied to a blister film.

[0011] The present invention may also comprise methods of making a push-through blister backing comprising reduced amounts of metal substrate. In one embodiment, the present invention comprises forming a blister backing laminate comprising a first outer layer and a second metal substrate layer, and using a laser to at least partially score the outer layer of the laminate such that the laminate functions as a push-through blister backing when it is applied to a blister film.

[0012] In yet another embodiment, the present invention comprises an article of manufacture comprising a push-through blister packaging. In one embodiment, the blister package comprises a blister backing laminate applied to a blister film, the blister backing laminate comprising a first outer layer and a second metal substrate layer, wherein the outer layer is at least partially scored with a laser such the laminate functions as a push-through blister backing.

[0013] Various embodiments of the present invention may provide certain advantages. In an embodiment, the push-through blister backing of the present invention may require less metal foil than a push-through blister backing that does not comprise a laser-scored outer layer. The blister backing of the present invention may maintain the high level of structural integrity typical of peel-push foil-based blister backing while providing convenience of the push-through format. For example, the push-through backing of the present invention may be suitable for consumables such as food items and medicines, as well for as non-consumable items such as medical disposables, toys, hardware parts, and the like.
The present invention may be better understood by reference to the description and figures that follow. It is to be understood that the invention is not limited in its application to the specific details as set forth in the following description, figures, and claims, but is capable of other embodiments and of being practiced or carried out in various ways.

BRIEF DESCRIPTION OF THE FIGURES

FIG. 1 shows a layer of blister backing that is not laser scored in accordance with the prior art.

FIG. 2 shows a laser-scored blister backing that is at least partly scored through a first outer layer and a second print layer in accordance with an example embodiment of the present invention.

FIG. 3 shows a laser-scored blister backing that is at least partly scored through a first outer layer, a second printing layer, and a third adhesive layer in accordance with an example embodiment of the present invention.

FIG. 4 shows a bird's eye view of several types of laser-scored patterns that may be used for blister backing in accordance with example embodiments of the present invention.

FIG. 5 shows a means of providing continuous score lines on a blister backing web in accordance with two example embodiments (Panels 5A and 5B, respectively) of the present invention.

FIG. 6 shows an optical micrograph of a laser-scored blister backing laminate in accordance with an example embodiment of the present invention wherein a first outer layer of polyethylene terephthalate (PET) film and a second layer of adhesive bonding agent are scored down to the surface of a third layer of foil.

FIG. 7 shows an optical micrograph of a laser-scored blister backing laminate in accordance with an example embodiment of the present invention wherein a laminate comprising a first outer layer of polyethylene terephthalate (PET) film, a second layer of low density polyethylene (LDPE) adhesive bonding agent, and a third layer of aluminum foil is scored down to, but not through, the second, adhesive layer.

FIG. 8 shows a schematic representation of methods for preparing laser-scored blister backing in accordance with various example embodiments of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

Embodiments of the present invention comprises "push-through" blister backing laminates that use a laser-scored outer layer and methods of making such backing. The present invention may be embodied in a variety of ways. In one embodiment, the present invention comprises a push-through blister backing laminate comprising a first outer layer and a second metal substrate layer, wherein the outer layer is at least partially scored with a laser such that the laminate functions as a push-through blister backing when it is applied to a blister film.

In another embodiment, the present invention may comprise an article of manufacture that includes a "push-through" blister backing laminate. The blister backing laminate may comprise a reduced amount of metal substrate as compared to laminates that are not laser-scored. Thus, in one embodiment, the present invention may comprise an article of manufacture comprising a push-through blister packaging, wherein the packaging comprises a blister backing laminate applied to a blister film, the blister backing laminate comprising a first outer layer and a second metal substrate layer, wherein the outer layer is at least partially scored with a laser such the laminate functions as a push-through blister backing.

The present invention may also comprise methods for producing a push-through blister backing. The method may comprise adding an outer layer that is at least partially scored with a laser to a push-through backing. For example, in one embodiment, the method comprises forming a blister backing laminate comprising a first outer layer and a second metal substrate layer, and using a laser to at least partially score the outer layer of the laminate such that the laminate functions as a push-through blister backing when it is applied to a blister film.

The laminate further may further include a layer of adhesive bonding agent between the first outer layer and the metal substrate layer. Also, a sealant may be used for adhering the blister backing to a blister film. For example, a heat-sensitive sealant may be applied to the surface of the metal layer that is opposite to the outer layer for attaching the backing to a blister film.

The laminate may be scored to various depths to facilitate the manufacture of blister backing having different strengths. In one embodiment, the laminate may be scored such that the depth of the outer layer is scored only in part. Alternatively and/or additionally, the laminate may be scored such that at least one score substantially cuts through the entire depth of the outer layer. Or, the laminate may be scored such that at least one score cuts substantially through the outer layer and at least part of a second layer of adhesive bonding (and any intervening print layers) that is positioned between the outer layer and the metal substrate layer. In another embodiment, the laminate may be scored such that at least one score cuts substantially through the entire depth of the outer layer and any adhesive bonding layer that is positioned between the outer layer and the metal substrate layer down to the metal layer. In one embodiment, any print layers adjacent to the upper surface of outer film may be at least partially scored. Also, any print layers adjacent to the lower surface of outer film may be at least partially scored. In an additional embodiment, any print layers adjacent to the upper surface of the metal layer may be substantially scored.

A variety of materials may be used for the outer layer of the laminate. In an embodiment, the outer layer may comprise a polymer film. In an embodiment, the exterior layer may comprise polyethylene terephthalate (PET). Other materials for the outer layer can be almost any polymer film used in the art of packaging including, such as, but not limited to, polybutylene terephthalate (PBT), copolymers of PET or of PBT (CoPET or CoPBT), vinylidene chloride copolymers, polyethylene (PE), polypropylene (PP), propylene ethylene copolymer (PPE), polyethylene naphthalate (PEN), nylon, or a nylon derivative such as nylon-MXD6.

In another embodiment, a metallized film, such as a metallized oriented film, may be used as at least part of the
outer layer. In one embodiment, a metallized polyethylene terephthalate (MPET) or metallized oriented polypropylene (MOPP) may be used. Alternatively, films (e.g., PET) coated with silicon oxide and/or aluminum oxide, such as those commercially available from Mitsui Plastics (White Plains, N.Y.) or Toppan Printing Company (Japan), respectively, may be used.

In another embodiment, a cellulosic material may be used as the outer layer. For example, in an embodiment, paper may be used as the outer layer. In yet another embodiment, the cellulosic material may comprise a coarse paper product such as cardboard, or cellulosic film.

The blister backing may comprise at least one layer of printing as is known in the art of preparing multi-laminate layers. The location of the printing may be varied depending upon the type of packaging being produced. For example, there may be a layer of printing on the inner surface of the metal substrate (e.g., between the metal substrate layer and the sealant layer). Alternatively, the backing may comprise a layer of printing on the inner surface of the outer layer (e.g., between the outer layer and the adhesive bonding layer). Or, the layer of printing may be on the upper surface of the metal layer (e.g., between the metal substrate layer and the adhesive bonding layer). In yet another embodiment, there may be printing on the upper (outer) surface of the outer layer. Finally, various combinations of printing layers as described above may be used.

In one embodiment, the metal substrate layer may comprise aluminum foil. Or, metals such as an iron or steel foil or a noble metal foil may be used for some applications. The use of a laser-scored exterior film may allow for a reduction in the thickness of the metal layer. Thus, in various embodiments of the present invention, the foil may comprise a thickness of about 0.0002 inches (5.08 µm) to about 0.002 inches (50.8 µm), or a thickness of about 0.00025 inches (6.35 µm) to about 0.001 inches (25.4 µm), or a thickness of about 0.0003 inches (7.62 µm) to about 0.0008 inches (20.3 µm). Thus, in one embodiment, laser-scoring of the outer film layer may comprise a reduction in the amount of foil used in the blister backing of over 80%. Alternatively, laser-scoring of the outer film layer may comprise a reduction in the amount of foil used in the blister backing of over 50%. In yet another embodiment, laser-scoring of the outer film layer may comprise a reduction in the amount of foil used in the blister backing of over 20%.

In an embodiment, the laser used to score the film comprises a CO₂ laser. As is known in the art, the wavelength for a CO₂ laser may range from about 9 µm to about 11 µm, with the most common wavelength being 10.6 µm. The power used for the laser may depend on the required size of the score as well as the speed that the laser is moving relative to the substrate to be scored. The power may range from a few watts to over 2,000 watts. In one embodiment, the laser comprises a power in the range of about 100 to about 800 watts. In another embodiment, the laser comprises a power in the range of about 200 to about 400 watts.

As used herein, a score is a notch or line cut into at least part of the surface the structure of interest, wherein the notch or line may comprise a predetermined shape, size, or path. To form a score, the laser beam may be focused on the outer layer of the laminate to be scored, and the laminate and the laser beam moved relative to one another. In one embodiment, the laser beam is moved and the laminate to be scored is held stationary. Or, the laminate may be moved, and the laser beam held stationary. Or, both the laser beam and the laminate may be moved, as for example, where non-linear score patterns, such as serpentine lines, are created.

The size of the score line may depend on the focal width of the laser beam as well as the speed that the blister backing is moved. It is possible to create score lines that vary in both length and/or width and in overall shape. In an embodiment, the score may comprise a line or linear shape. Or, the score may have a relatively equivalent length and width to comprise a substantially square or circular shape.

The score line may be continuous or discontinuous in nature. A continuous score line may be almost any length required. Examples of continuous score lines may include a line that spans the length or width of the blister surface. Also, a circle, or other shapes, positioned over the blister opening may comprise a continuous (uninterrupted) score. As used herein, a discontinuous score line is a score line that includes non-scored regions between the scored regions. In one embodiment, the score line is at least partly discontinuous. The distance between scored regions in a discontinuous score line may range from about 5 µm to about 5,000 µm. Alternatively, the distance between scored regions in a score line may range from about 100 µm to about 1,000 µm, or from about 20 µm to about 500 µm.

Depending upon the size (e.g., relative length and width) of the score line, and the application for which the blister backing is to be used, there may be a predetermined number of holes used per inch in a score. In one embodiment, there may be from about 2 to 500 holes per inch in the score. Alternatively from about 20 to 200 holes per inch may be present in a score.

Similarly, the width of the score line may be varied depending upon the application for which the blister backing is to be used. For example, a wider score line may be used for thicker materials, or where easy opening of the blister backing is desired. Conversely, narrow (or small) score lines may be used for some applications. In alternate example embodiments, the score may have a width that is in the range of from about 5 µm to about 500 µm, or from about 50 µm to about 250 µm, or from about 75 µm to about 150 µm.

It may be important to score the film in such a way as to facilitate opening of individual blister units that are present as part of a package having multiple blisters. Thus, it may be important to score the blister backing so that the score lines are positioned to allow an item positioned in the blister to be pushed through a specific blister backing without causing items in other blisters to be pushed out of their blisters. In one embodiment, the portion of the backing that is laser-scored may be positioned over the opening of the blister. Positioning of the score lines relative to an underlying blister may be facilitated by scoring the blister backing after it has been positioned with respect to the blister. Thus, in an embodiment, the backing is adhered to a blister prior to scoring.

Alternatively, it may be more efficient to make the backing in sheets that may be laser scored at various predetermined intervals and to then position the blister on the backing sheets. Thus, in one embodiment, the backing is scored by a laser prior to adhering the backing to a blister.
In yet another embodiment, continuous score lines may be made along the length (or width) of the blister backing and then the blister backing applied to a multi-blisters pack so that the lines are at least partly positioned over the blisters. In using a blister backing comprising continuous score lines, there may be sections of the score that are not positioned over the blister opening, but that overlap other regions of the blister pack (e.g., such as the walls and dividing sections between blister openings). As the score lines that are not positioned over the blister opening do not provide access to the blister, they should not compromise the integrity of the package. By using unidirectional continuous scoring, the score lines may be positioned on the blister package in a one directional format.

The blister backing may be scored prior to modifications such as pre-cutting of the film to fit the blister backing. Alternatively, the blister backing may be cut to the correct width or length or otherwise sized prior to scoring.

Production of Blister Backing Laminates for Laser-Scoring

Thus, embodiments of the present invention comprise a “push-through” blister backing material that may provide improved openability while maintaining a high level of structural integrity, and methods of making such blister backing. Embodiments of the push-through blister backing of the present invention may require less aluminum foil than push-through blister backing that is not laser-scored.

Conventional push-through blister backing may include two basic layers: a foil-based substrate and a sealant. In some cases, a paper/foil substrate comprising thin gauge foil laminate may be used as a “push-through” backing. The foil substrate may provide a barrier, as for example, to moisture and oxygen, to protect the product. Also, the blister backing may be printed on either side of the foil using conventional printing technologies. Sealant may be applied to the foil to adhere the backing to the blister.

For a push-through blister backing, the foil may be selected to have a thickness that will fracture easily under hand pressure when the product is pushed through the backing. For push-through backing, the foil layer may typically range from about 0.0008 inch (0.8 mils; 20.3 μm) to about 0.001 inch (1.0 mils; 25.4 μm) in thickness. The foil may be annealed foil (i.e., “soft” foil) or unannealed foil (i.e., “hard” foil).

The sealant layer may function primarily to adhere the foil substrate layer to the blister surface. The sealant layer may be applied to the foil surface as a liquid coating. The sealant may comprise a polymer or a polymer blend that will bond to the blister film when exposed to adequate heat.

In contrast to the prior art, the present invention comprises a push-through blister backing laminate comprising a laser-scored outer layer. In one embodiment, the laminate may comprise: (a) a first, outer layer; (b) a second layer of adhesive bonding agent; (c) a third, metal layer; and (d) a fourth layer of sealant for bonding the blister backing to a blister film. To allow the blister backing to function as push-through backing, the first outer layer may be at least partially scored with a laser. In an embodiment, the outer layer may comprise a film and/or a cellulosic substrate. In some cases, a metallized film may be used as the outer layer.

The use of laser scoring is known in the art of packaging. For example, U.S. Pat. No. 5,001,325, U.S. Pat. No. 6,207,925, European Patent Application EP 0 357 841 A1, and Japanese Patent Application 06184641 describe a method and/or apparatus for providing score lines in packaging material by local evaporation with a laser beam, where the laser beam and packaging material are moved relative to one another. Also, U.S. Pat. No. 5,630,308 describes the use of at least two substantially parallel and linear laser scores for tear control of packaging, and U.S. Pat. No. 4,549,065 describes the use of non-linear laser score lines that enable a crack-and-peel feature to be introduced into laminate backing. Also, U.S. Pat. Nos. 6,427,420 and 5,229,180 describe a method for scoring the inner side of a laminate packaging film, where the laser score provides a precut line to enable tearing the package along that line. Laser scoring is also used for marking packaging materials as described in U.S. Pat. No. 6,054,090, and U.S. patent applications 2001/0036537 A1 and 2002/0153639 A1.

Laser scoring has also been applied to blister packaging. For example, U.S. Patent application 2003/0102247, and Japanese patent applications 00352863 and 003514417, describe non-metal based blister back packaging having laser-scored film. Also, U.S. Pat. Nos. 6,212,858 and 5,820,953 describe the use of laser scoring to allow for breakage of individual blister bubbles from a pack, and U.S. Pat. No. 6,516,949 describes laser scoring of the blister portion of a blister packaging as a means to create a tag that is bonded to the backing. Still, these prior applications of laser scoring do not use a laser scored exterior plastic film as a means to reduce the amount of aluminum foil or other substrate layers used for push-through blister backing.

A schematic representation of a cross-sectional view of a conventional push-through blister backing laminate of the prior art is shown as FIG. 1. It may be seen that a push-through blister backing 2 may comprise an optional exterior print layer 4, a layer of metal foil 6, an optional interior layer of print 4, and a sealant layer 10. The sealant 10 may be used to adhere the blister backing to the blister(s) 12 (i.e., blister film) which may comprise a receptacle for the article (e.g., a single pill or the like) of interest 14. FIG. 1 is not necessarily to scale, and in many cases, the blister 12 will be substantially thicker than the backing laminate 2. As used herein, a blister film comprises a sheet or package being shaped as a bubble or “blister” that functions to hold a product of interest. The blister film may comprise a translucent material such as polystyrene, cyclic olefin copolymers (COC), polyethylene, or similar materials that can be thermoformed or otherwise shaped into the required format.

Embodiments of the present invention may comprise using a laser-scored film as a layer for conventional push-through blister backing. By using a laser-scored outer film, the amount of foil used for the backing may be reduced. For example, in one embodiment, the push-through blister backing of the present invention may comprise the following structure: (a) an exterior film and/or cellulosic material; (b) an adhesive bonding agent; (c) an aluminum foil layer; and (d) a sealant layer to bond the blister backing to the blister, where the outer film is scored to facilitate opening of the package. In general, a push-through structure of the present invention may comprise the four basic layers described
above. Additionally, optional layers of printing may be included as is used in conventional foil blister backing.  

**[0053]** Schematic representations of example embodiments of the push-through blister backing of the present invention are shown as FIGS. 2 and 3. As shown in FIGS. 2 and 3, the blister backing of the present invention may comprise an outer print layer 4, an exterior layer of film and/or cellulosic substrate 16, optionally another layer of print 4, a layer of adhesive bonding agent 18; a layer of metal foil 19; another optional layer of print 4, and sealant 10.

**[0054]** A blister backing comprising the layers described above would generally not function as a push-through blister material because the tensile and burst strength of the exterior film layer 16 may prevent pushing the product 14 through the foil layer 19. In order to overcome this limitation, so that the package may function as a push-through blister, the exterior film layer may be cut through, or scored 22, down to the bonding layer 18 (FIG. 2) or down to the metal layer 19 (FIG. 3). In one embodiment, there may be some variation to the depth of individual score lines (e.g., FIGS. 2 and 3). Scoring of the exterior film may be done by a variety of methods known in the art. For example, as described herein, the film may be scored using a CO2 laser.

**[0055]** In one embodiment, the blister pack may comprise individual units, or “blisters” 12 that function to hold an item of interest 14 in its own unique package. The blisters of the package may be formed by embossing a relatively thick sheet suitable for containing the tablets or other item of interest. For example, the blisters may be formed by embossing a sheet of a durable, generally transparent plastic or other polymeric film that is about 0.004 inches to 0.02 inches (100 μm to 500 μm) thick. Blisters of varying thickness may be used depending upon the application and size of the blister, with thicker blisters generally preferred for larger sized blisters or blisters requiring increased durability (i.e., to be child resistant), and thinner blisters preferred for smaller containers. For example, U.S. Pat. No. 5,785,180 describes blister packaging comprising blisters 15 mm in thickness.

**[0056]** Typical materials used for blister film include a variety of polymers and copolymers such as low density polyethylene or an olefinic copolymers. As such, the selection, formulation, use and specifications will be apparent to one skilled in the art of designing and manufacturing blister packaging. Materials used may include polyvinylchloride (PVC), fluoropolymers, cyclic polyolefin, polyamides, polyethylene, polypropylene, polystyrene, polyacetal, polybutylene terephthalate, polyethylene terephthalate, nylons, and polyester. Blisters can also be produced from cold-formable foil laminate such as polyamide/adhesive/foil/adhesive/vinyl laminates commercially available from Huesek Foil (Walt, N.J.) and Alcan Packaging (Shelbyville, Ky.).

**[0057]** The blister 12 may be substantially transparent and flexible polymeric material shaped and sized to contain a single item 14. Or, the blister may be non-transparent, as for example, where a foil laminate is used as the blister. Relative to the blister, the covering sheet 20 may be a relatively thin sheet, such as a 10 μm to 50 μm thick laminated sheet.

**[0058]** Still referring to FIGS. 2 and 3, almost any type of plastic and/or cellulosic material may be used according to the present invention for the outer layer 16. As such, the selection, formulation, use and specifications will be apparent to one skilled in the art of designing and manufacturing laminates for use as blister backing materials.

**[0059]** For example, in one embodiment, the outer layer 16 may comprise a cellulosic substrate such as paper, cardboard, or the like. In one embodiment, calendared bleach paper having a basis weight of from about 20 to about 30 pounds per ream (StoraEnso; Stevens Point, Wis.) may be used.

**[0060]** Alternatively and/or additionally, a plastic film layer may be employed as the outer layer 16. Plastics that may be employed as the outer layer of the blister backing may comprise a polyolefin, polyester, polyamide, polycarbonate, polystyrene, or a substituted polystyrene. Thus, suitable materials for the outer layer may comprise polyethylene terephthalate (PET), polybutylene terephthalate (PBT), copolymers of PET or of PBT (CoPET or CoPBT), polyethylene (PE), polypropylene (PP), propylene ethylene copolymer (PEE), nylon, such as nylon-MXD6 (Mitsubishi Gas Chemical Company, Inc.), or polymethylpentene-TPX (Mitsui Chemicals America).

**[0061]** The films used for the blister backing outer layer may comprise a monolayer or a multilayer film. Also, oriented polymeric films (e.g., oriented PET films) may be preferred in some embodiments. In certain embodiments, oriented films may provide desired mechanical properties, such as temperature stability, lay flat properties, chemical resistance, and printability, as compared to unoriented films. The films may also be stretch-oriented, and in some embodiments biaxially stretch-oriented, in order to improve their mechanical properties. Alternatively, it may be advantageous in some cases to provide a film with an unbalanced biaxial orientation. For instance, it may be desirable to provide a greater orientation to the polymeric film in the direction in which the laser scoring is applied so as to reduce the possibility of cross or uneven tears in the overwrap film.

**[0062]** Although oriented PET may be preferred, other oriented film materials, such as oriented polypropylene (OPP), oriented polyamide (OPA), and oriented polyethylene (OPE), or co-extruded films can be used. Alternatively, the covering sheet 16 may comprise oriented polyethylene-2,6 naphthalate containing a polyethylene-2,6 naphthalate resin as a principal component. For example, PET films suitable for use in the present invention are commercially available from a number of sources, such as Mitsubishi Polyester Film (Greer, S.C.), DuPont de Nemours & Company (Wilmington, Del.), and SKC America (Covington, Ga.).

**[0063]** Where improved barrier properties are required, or a foil like appearance is desired, it may also be possible to use a metallized film, such as a metallized oriented film, as at least part of the first outer layer 16. In an embodiment, the metallized film may comprise metallized polyethylene terephthalate (MPET). Vacuum metallization may be performed by a number of companies, including Camvac Intl., Inc. (Morristown, Tenn.), and Vacuum Corporation (Wayne, N.J.). The films may be metallized with a shiny, highly reflective surface or with a satin-like, low-reflectance surface depending on whether the polyester film substrate has a glossy or a matte finish prior to metallizing. A variety of metals may be used for metallization. In one embodiment,
the metal used may be aluminium. The metal may be applied at a thickness as is required to increase the integrity or to highlight the appearance of the outer film. For example, the metallization may comprise a thickness that will provide an optical density of about 1.5 to 3.0. After metallizing, the film may be wound onto rolls in preparation for further processing and/or printing.

[0064] In certain embodiments, the outer layer may comprise a mixture of films and/or cardboard. Various polymeric films may be bonded to each other using extrusion or adhesive lamination techniques. For example, cardboard may be bonded to polyolefin with various adhesives such as low density polyethylene or any wet bond adhesive typically used in the art. Similarly, polyesters may be bonded to polyolefins, or biaxially oriented nylon may be bonded to polyolefins such as BOPP by means of a polyurethane thermost coat adhesive such as Tyc® Polyurethane Adhesive from Lofof® Company (Henkel Adhesives, Cary, N.C.).

[0065] Depending upon the material used, and the nature of the packaging being made, the outer layer may comprise a variety of thicknesses. In various embodiments, the thickness of the outer layer may range from about 0.0002 inches to about 0.025 inches (5.08 µm to 635 µm), or from about 0.0002 inches to about 0.005 inches (5.08 µm to 127 µm), or from about 0.0003 inches to about 0.001 inches (7.62 µm to 25.4 µm). In one embodiment, the film may comprise 48 gauge (0.000048 inch; 0.48 mils; 12.2 µm) polyethylene terephthalate.

[0066] Referring again to FIGS. 2 and 3, the outer layer may include a coloring agent or may be printed in some manner. Or, a counterproof may be deposited for color as is known in the art. For example, a paper layer may be printed using standard printing techniques known in the art. Where the outer layer comprises a polymer film, or a metallized film, the film may be printed on either the metallized or non-metallized surface of the layer. Depending upon the ink formulations used, it may be necessary to prime coat the surface of the base layer with an adhesion promoting material, such as polyethylene imine (PEI). In one embodiment, transparent, metallic filled and/or opaque printing inks may be applied by conventional printing techniques, such as rotogravure or flexographic processes. For metallized films, transparent printing inks that permit the reflectivity of the metallized surface to be apparent through the printing ink may be used.

[0067] Again referring to FIGS. 2 and 3, an adhesive bonding agent may be used to adhere the outer film layer to the underlying metal layer. Adhesives comprise compounds that can bond together two materials by surface attachment. The selection of the specific adhesive may depend upon factors such as the various components of the blister backing that are to be bonded together, the equipment used to carry out the application of the backing to the blister, the desired sealing and opening properties, and other like factors. For example, where the metal layer is aluminium foil, and the outer layer consists primarily of a polyolefin such as high density polyethylene, the adhesive layer may be a urethane or polyurethane adhesive. Typical adhesive materials may be either thermoplastic or thermost coat materials, depending upon the materials to be bonded. Thermoplastic adhesives may comprise vinyl, polyester, acrylic, and polyethylene polymers. Example adhesives used may include the following: polyethylene (PE) homopolymers, such as low density PE (LDPE), medium density PE (MDPE), linear low density PE (LLDPE), and high density PE (HDPE); PE copolymers, such as ethylene-acrylic acid copolymers (EAA) (commercially available as PRIMACOR®, Dow Chemical Company); ethylene methacrylic acid copolymer (EMMA; commercially available as Nucrel® from DuPont Packaging Products, Wilmington, Del.); polypropylene (PP); PP copolymers; and maleic anhydride grafted polymers (commercially available as ADMER® from Mitsui Chemicals America, Inc., Purchase N.Y.; or Bynel® from DuPont Packaging Products, Wilmington, Del.). Also, ionomers such as Surlyn® (DuPont Printing Products, Wilmington, Del.) may be used as adhesives.

[0068] Adhesives can be applied to the laminate using a variety of techniques, such as wet or dry bond lamination, extrusion lamination, or thermal lamination. In one embodiment, the adhesive may be applied to a substrate in a fluid form, and then the adhesive allowed to set to achieve a desirably high cohesive strength. The transition from fluid to solid may be accomplished by the heating of a thermoplastic, the release of a solvent or carrier, a chemical reaction such as cross-linking, or other suitable mechanism. Typically, wet or dry bond adhesives form layers on the laminate backing that are at least about 0.0005 inch (1.27 µm) thick and usually have a thickness of less than about 0.0005 inch (12.7 µm), and often less than about 0.0001 inch (25.4 µm). Extrusion adhesive layers are typically at least 0.00025 inches (0.635 µm) thick and usually have a thickness of less than 0.001 inches (25.4 µm), or in other embodiments, less than 0.0008 inches (20.3 µm).

[0069] Again referring to FIGS. 2 and 3, the blister back laminate comprises a metal substrate as one of the layers. The metal substrate layer may also be printed using techniques such as rotogravure or flexographic processes known in the art. In one embodiment, the metal substrate may comprise aluminium foil. For example, direct or continuous cast aluminium foil available in a variety of thicknesses is commercially available from suppliers in the art (Alcoa; Alcan; and RRJ Packaging, Winston-Salem, N.C.). Or, metals such as an iron or steel foil or a noble metal foil may be used for some applications. The foil may comprise a thickness of about 0.0002 inches to about 0.002 inches (5.08 µm to 50.8 µm). In yet another embodiment, the foil may comprise a thickness of about 0.00025 inches (0.35 µm) to about 0.001 inches (25.4 µm). Or, in yet another embodiment, the foil may comprise a thickness of about 0.0003 inches (7.6 µm) to about 0.008 inches (20.32 µm).

[0070] The laminated blister backing may comprise a layer of sealant to adhere the blister backing to the blister container. In one embodiment, the sealant comprises a heat seal coating. A heat seal coating may comprise a sealant selected to melt at a temperature lower than the melting temperatures of other components of the blister back package. Upon melting, the heat sealant maintains adherence to the rest of the backing, but also adheres to the surface material of the blister. As the heat sealant hardens, it provides bonding, and hence a seal, between the blister and the blister backing.

[0071] The selection of the specific sealant material may depend upon the composition of the layer of the blister backing to which the sealant material is laminated, the
composition and properties of the surface of the blister to which the sealant is expected to bond, the equipment used to carry out the sealing process, the desired sealing and opening properties, and other factors related to the blister packaging being made. Thus, various sealant materials used commercially for producing laminates may be employed in the laser-scored laminates of the present invention. Such coatings may be selected from materials such as vinyls, acrylics, or polyolefins, which may be applied using common methods such as spraying, dipping, curtain coating, roller coating, and the like.

For example, in one embodiment, the heat seal coating may comprise a water dispersion of a vinyl resin. The vinyl resin may be ion-linked and acid-modified ethylene interpolymer known as ionomer resins. Wax and other modifiers may be included to further extend the range of performance properties. Thus, the heat-sealing layer may be made of a thermoplastic resin, such as a polyvinyl acetate (PVA) resin, a polyvinyl butyral resin, a polyvinyl chloride resin, a polyamide resin, a polyester resin, a polyol resin, a polyacrylic resin, a cellulose ester resin, or a polyethylene resin, a copolymer of some of those resins, or a mixture of some of those resins. For example, thermoplastic materials suitable for use as a heat seal layer may include condensation polymers formed from ethylene glycol and terephthalic acid (PET); copolymers of ethylene and vinyl acetate; vinyl esters formed from a free radical addition reaction of vinyl acetate and various vinyl monomers, acrylate esters, vinyl chloride, vinylidene chloride, dibutyl and other dialkyl maleates, and other commercially available comonomers; polymers derived from the polymerization of a carboxylic acid monomer and ethylene reacted with sodium, potassium or zinc (ionomer); or a dispersion of modified polypropylene in a high boiling aliphatic hydrocarbon. In one example embodiment, polymers such as blend of ethylene vinyl acetate and polybutylene that are formulated to produce peelsable seals may be used.

The heat seal layers may be clear. Alternatively, the sealant may be translucent or opaque. In one embodiment, thermoplastic materials having optimum hot tack characteristics and minimum sealing temperatures in the range of about 150°F to about 300°F are used. The application weight of the heat seal polymers may range from about 2 to 6 pounds per 3,000 square feet of base layer.

Thus, depending upon the materials used for each layer, the overall thickness of the blister backing laminate of the present invention may range from 0.0005 inches to 0.02 inches (12.7 μm to 508 μm). In other embodiments, the overall thickness of the blister backing laminate may range from about 0.0005 inches to 0.01 inches (12.7 μm to 254 μm) or from 0.0007 inches to 0.004 inches (17.8 μm to 101.6 μm).

The laminate blister backing of the present invention (e.g., FIG. 2) can be produced by first providing a continuous thermoplastic film (e.g., a PET film) of a desired thickness (e.g., from wound roll using a typical press unwind unit) as the upper, exterior layer. Optionally, a 100% solids, solvent-based or water-based overcoating may be applied to the outer PET surface. In an embodiment, the film may be printed on either side or both sides using standard rotogravure or flexographic techniques.

Next, a 100% solids, water-based, or solvent-based adhesive formulation may be applied to the under side of the PET film surface and/or the upper side of the aluminum foil. The foil may be printed with ink and dried prior to application of the sealant. Or, the foil may be printed on the upper side which is not coated with sealant. The coated film may be passed through an oven to remove the solvent if necessary, and the two layers (foil and film) adhered together using laminating techniques standard in the art. The sealant solution may then be applied to the surface of the foil opposite of the film layer, and the entire laminate may then be passed through an oven to remove the sealant solvent, cooled, and rewound into a roll.

At this point, the resultant lamination may be unwound at any time and slit to desired widths for application to the blister material by heat sealing as is known in the art. The slit laminate may further be subdivided into pieces of the desired size and shape. As such, the laminated material may be provided by the manufacturer as so-called “one-component laminate” type of process, and is capable of being used to provide blister backing of the desired size and shape without the necessity of being subjected to further lamination-type processing steps.

Once the laminate has been formed, the upper layer may be scored using a laser. As is known in the art, a laser emits a concentrated beam of light made up of light waves all of which are substantially coherent (i.e., in phase and all having the same wavelength) and thus, provides a highly focused beam. Lasers may be named according to the particular material which is used to generate the beam; generally, lasers will emit a characteristic wavelength depending on the type of beam. Lasers suitable for industrial use include gaseous lasers such as carbon dioxide or helium-neon; solid-state light pumped lasers such as ruby, neodymium-yttrium aluminum garnet (Nd:YAG), or glass; semi-conductor lasers such as gallium arsenide; as well as plastic lasers, and lasers using conjugated organic molecules such as benzene, toluene or naphthalene. The laser used will depend on the substrate targeted. In an embodiment, for scoring plastic or paper, a CO₂ laser is used. In other embodiments, a Nd:YAG laser may be employed. The laser beam may be pulsed or continuous in nature. For CO₂ lasers, generally a continuous beam is used. References describing laser scoring of packaging laminates include U.S. Pat. Nos. 3,009,582; 3,626,143; 4,549,063; 5,001,325; 5,010,231; 5,630,308; 5,820,953; 6,054,090; and 6,207,295 providing general descriptions of laser scoring, as well as U.S. Pat. No. 6,054,090, and U.S. Patent Application 2002/015639 (describing marking packaging with CO₂ or Nd:YAG lasers), and U.S. Patent Application 2003/010247 describing the use of argon and YAG lasers. The disclosure of each of these patents and patent applications is incorporated by reference in their entirety herein.

The wavelength of the laser beam can be any wavelength is such that it will be selectively absorbed by the material used for the film. The frequency of the radiation and other laser and beam characteristics such as the output power of the laser and size of the beam, can be any combination which will provide a beam of radiant energy of sufficient intensity to effect scoring of the film layer. For CO₂ lasers, the wavelength generally ranges from about 9 μm to about 11 μm. In most embodiments, the wavelength of the CO₂ laser is about 10.6 μm. For Nd:YAG lasers, a wavelength of about 1.06 μm is emitted. As is known in the art, other lasers each have their own unique wavelengths.
Beam intensity may be determined by beam power and the diameter of the score. If spot diameter is held constant, intensity may be determined by the power of the laser beam. Thus, exposure time may be based on the total amount of energy required to produce the desired score line. In one embodiment, exposure time may be determined by the relative rate of movement between the laser beam and the blister backing.

Laser beams may be focused or unfocused. In one embodiment of the present invention, the laser beams are focused. For example, a CO₂ laser beam may be focused to a spot about 100 μm or less. The diameter of the spot to which the laser beam is focused can be of any suitable dimension depending on the thickness of the layer to be scored and the type of score desired. Although beams of short wavelengths can be focused to sizes less than 1 micron in diameter, the spot size for a carbon dioxide laser having a wavelength of 10.6 μm is not well focused for the present invention since the beam diameter may range from about 20 μm to 500 μm, or in other embodiments, from about 50 μm to 400 μm, or from about 80 μm to 150 μm, depending on beam mode structure and lens focal length.

The output power of the laser can conceivably be of any wattage. For example, CO₂ lasers may comprise a power that ranges from a few watts to megawatts. High wattages may be preferred when it is desired that the laser emit a plurality of beams. Multiple beams can be produced by any of the known means such as beam splitting by partial reflectors. Generally, the beam power used is varied depending on the thickness of the film layer or laminate being irradiated and the relative motion between the beam and the target blister backing. For an outer film layer of about 0.0005 inches to about 0.004 inches (12.7 μm to 101.6 μm) in thickness, it may be advantageous to use beams of about 100 to 600 watts. In some embodiments, beams of about 200 to 600 watts, or from 200 to 400 watts may be employed.

For example, a carbon dioxide laser, commercially available as a Lumonics Laser UPA 1500 (GSI Lumonics) may be used. Such carbon dioxide flowing gas lasers have a power range of up to 2200 watts and can emit a continuous single-mode beam having a wavelength of 10.6 microns, and a frequency of about 60 Hz. In one embodiment, the beam may be focused to a spot diameter of about 100 μm by an appropriately sized focal length lens.

In an embodiment, the laser beam used for producing scored laminates may be a continuous CO₂ laser beam of a wavelength of 10.6 μm. The output capacity per unit area of the laser may selectively be determined taking into consideration the speed of processing the laminate. The sheet for forming the laminate may be irradiated with the laser beam by fixing the laser beam and moving the laminate to form straight scores. Alternatively, the laminate may be scanned with the laser beam to form the cutting grooves in a desired pattern.

The laser-produced score may comprise one or more layers of a laminate or film. A variety of shapes may be used as the scoring pattern. In one embodiment, the scoring pattern may be centered on the cavity containing the product. For example, a single line, positioned along the length or the width of the blister sheet may be used as the laser scoring pattern for an individual blister unit. Alternatively, a plurality of lines intersecting in the center to form a star-like design may be used. In another embodiment, the scoring may comprise a circle or similar shape that is large enough for the item of interest to be pushed through. Or, the scoring may comprise a partial circle (or similar shape) such that when the item is pushed from the blister through the backing, the backing remains attached so as to be discarded with the empty blister. FIG. 4 shows a bird's eye view looking directly down at individual blisters 12 having the upper outer surface 16 scored 22 using various non-limiting shapes.

Referring now to FIG. 5, in one embodiment, scoring may comprise forming continuous score lines 22 that extend the entire length or width of a laminate roll 20. The laminate may then be attached to a sheet of blisters 30 so that the score line(s) are positioned at least partially over the individual blister openings 12. In this way, positioning of the laminate may only require aligning of the laminate and blister sheet in one direction (i.e., along the y-axis), since the score line is continuous along the other direction (i.e., the x axis). The score line that is positioned over the portion of the blister that does not comprise an opening would not be expected to compromise the integrity of the packaging, since the seal between the underlying foil and blister substantially prevents access to the item 14 held in the blister. In one embodiment, a single score may be used (e.g., FIG. 5A). Alternatively, multiple score lines per blister opening may be used (e.g., FIG. 5B).

Example photographs of scored laminate structures are shown in FIGS. 6 and 7. As shown in FIG. 6, in one embodiment, the laser score may substantially cut through an upper layer of PET film (shown as the bottom layer in the orientation shown in FIG. 6) and a second layer of adhesive to stop at a third layer of foil. Or, as shown in FIG. 7, the laser score may substantially cut through an upper layer of PET to stop at a second layer of low density polyethylene (LDPE) adhesive, prior to reaching a third foil layer.

FIG. 8 shows schematic representation of various embodiments for the manufacture of laser-scored blister backing. As shown in FIG. 8, scoring of the blister backing laminate may take place at various points in the manufacture of the blister backing. In one embodiment, the scoring of the laminate 110 may performed following production of the laminate 100, but prior to sealing the laminate on the blister 140 and prior to cutting (or slitting) the laminate to size 120. Or, the laminate may be formed 100 and slit to size 120, scored 130, and then applied to the blisters 140. Or, the laminate may be formed 100 and slit to size 120, applied to the blister 140, and then the scoring performed 150.

EXAMPLE

Testing of laminated structures using a commercial carbon dioxide micro-laser (Lumonics Laser UPA 1500, GSI Lumonics) was performed. As described below, the results of the study indicate that polyester film having an underlying layer of foil or low density polyethylene (LDPE) may be scored to a predetermined depth using a CO₂ laser.

Two trial laminates were scored using a continuous CO₂ laser beam. The composition of the two laminates used is provided in Table 1. Thus, the first laminate (from outer layer to innermost layers) was as follows: 0.00048 inch PET (polyester film grade Melinex 813, DuPont Packaging), polyurethane adhesive (Adcote 518, Rohm & Haas Com-
pany); 0.0015 inch foil (1235 CC aluminum foil, RJR Packaging); adhesive; 0.00075 inch nylon (polyamide film N-201, Enhance Packaging Technologies); adhesive (polyurethane adhesive, grade 7975, Henkel Adhesives), and 0.00015 inch polyethylene sealant (grade 151492, New England Extrusion). The second laminate (from outer layer to innermost layers) was as follows: 0.00048 inch PET (polyester film, grade SP65, SKC America); 0.0005 inch LDPE (density 0.92; grade 500M41, Dow Chemical Company); 0.000285 inch foil (1235 CC aluminum foil, RJR Packaging), and 0.0001 inch ionomer sealant (Surlyn® 1652SB, density=0.94, Dupont Packaging).

### TABLE 1

<table>
<thead>
<tr>
<th>Layer</th>
<th>Laminate 1</th>
<th>Laminate 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>PET (0.48 mil)</td>
<td>PET (0.48 mil)</td>
</tr>
<tr>
<td>2</td>
<td>Polyurethane Adhesive</td>
<td>LDPE (0.5 mil)</td>
</tr>
<tr>
<td>3</td>
<td>Foil (1.5 mil)</td>
<td>Foil (0.285 mil)</td>
</tr>
<tr>
<td>4</td>
<td>Polyurethane Adhesive</td>
<td>Ionomer Sealant (1.0 mil)</td>
</tr>
<tr>
<td>5</td>
<td>Polyethylene N-201 (0.75 mil)</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Polyurethane Adhesive</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>PE Sealant (1.5 mil)</td>
<td></td>
</tr>
</tbody>
</table>

[0093] It will be understood that each of the elements described above, or two or more together, may also find utility in applications different from the types described. As used herein, the singular forms "a", "an" and "the" include plural references unless the context clearly dictates otherwise. The invention is not intended to be limited to the details shown, since various modifications and substitutions can be made without departing in any way from the spirit of the present invention. As such, further modifications and equivalents of the invention disclosed herein may occur to persons skilled in the art using no more than routine experimentation, and all such modifications and equivalents are believed to be within the spirit and scope of the invention as described herein.

That which is claimed is:

1. A blister backing laminate comprising a first outer layer and a second metal substrate layer, wherein the outer layer is at least partially scored with a laser such that the laminate functions as a push-through blister backing.

2. The blister backing of claim 1, further comprising a layer of adhesive bonding agent between the first outer layer and the metal substrate layer and a layer of sealant for adhering the blister backing to a blister film.

3. The blister backing of claim 2, wherein the outer layer is scored through only part of the depth of the outer layer.

4. The blister backing of claim 2, wherein at least one score cuts substantially through the entire depth of the outer layer.

### TABLE 2

<table>
<thead>
<tr>
<th>Trial</th>
<th>Material</th>
<th>Speed* (fpm)</th>
<th>Watts</th>
<th>Holes/in (expected)</th>
<th>Holes/in (actual)</th>
<th>Hole-hole Distance (μm)</th>
<th>Length (μm)</th>
<th>Width (μm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>800</td>
<td>400</td>
<td>*</td>
<td>60.95</td>
<td>416.73</td>
<td>118.24</td>
<td>104.59</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>600</td>
<td>75</td>
<td>80.22</td>
<td>316.65</td>
<td>133.98</td>
<td>103.39</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>1</td>
<td>400</td>
<td>100</td>
<td>117.62</td>
<td>215.59</td>
<td>130.28</td>
<td>104.39</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>1</td>
<td>300</td>
<td>120</td>
<td>156.89</td>
<td>161.90</td>
<td>129.33</td>
<td>98.86</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>2</td>
<td>300</td>
<td>120</td>
<td>153.37</td>
<td>165.62</td>
<td>131.84</td>
<td>89.15</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>2</td>
<td>300</td>
<td>120</td>
<td>157.98</td>
<td>160.78</td>
<td>130.73</td>
<td>79.92</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>2</td>
<td>300</td>
<td>120</td>
<td>155.71</td>
<td>163.12</td>
<td>110.18</td>
<td>72.09</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>2</td>
<td>350</td>
<td>110</td>
<td>135.22</td>
<td>187.84</td>
<td>103.59</td>
<td>71.63</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>2</td>
<td>350</td>
<td>110</td>
<td>136.09</td>
<td>186.64</td>
<td>104.95</td>
<td>79.45</td>
<td></td>
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<tr>
<td>10</td>
<td>2</td>
<td>350</td>
<td>110</td>
<td>136.11</td>
<td>186.61</td>
<td>124.77</td>
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<tr>
<td>11</td>
<td>2</td>
<td>400</td>
<td>100</td>
<td>130.66</td>
<td>214.05</td>
<td>81.29</td>
<td>60.32</td>
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</tr>
<tr>
<td>12</td>
<td>2</td>
<td>400</td>
<td>100</td>
<td>133.49</td>
<td>214.36</td>
<td>113.16</td>
<td>90.54</td>
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<tr>
<td>13</td>
<td>2</td>
<td>400</td>
<td>85</td>
<td>95.79</td>
<td>265.17</td>
<td>130.27</td>
<td>105.79</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>2</td>
<td>400</td>
<td>75</td>
<td>80.57</td>
<td>315.24</td>
<td>119.18</td>
<td>97.18</td>
<td></td>
</tr>
</tbody>
</table>

*Speed for the laminate moving relative to the laser beam is given in feet per minute (fpm).

[0092] It was found that at the settings employed, the CO₂ laser could score substantially through the outer PET layer (FIG. 7) or the PET layer and the adhesive layer (FIG. 6), but did not score the underlying foil layer on either structure. This was true for all line speeds and power settings used. It was also found that there may be a weak correlation between the power setting of the laser and the width of the hole (r²=0.86). There was no apparent correlation between the power settings and the length of the hole (r²=0.48) or the spacing of the holes (r²=0.19). As expected, there was a strong correlation between line speed and hole spacing (r²=0.97). There was no apparent correlation between line speed and length (r²=0.03) or width (r²=0.25) of the holes.

5. The blister backing of claim 2, wherein at least one score cuts substantially through the outer layer and at least part of the adhesive bonding layer.

6. The blister backing of claim 2, wherein at least one score cuts substantially through the entire depth of the outer layer and the bonding layer down to the metal layer.

7. The blister backing of claim 1, wherein the outer layer comprises a polymer film.

8. The blister backing of claim 1, wherein the outer layer comprises polyethylene terephthalate (PET).

9. The blister backing of claim 1, wherein the outer layer comprises a cellulosic substrate.
10. The blister backing of claim 1, wherein the metal layer comprises aluminum foil.
11. The blister backing of claim 10, wherein the foil comprises a thickness of about 0.0002 inches to about 0.002 inches.
12. The blister backing of claim 10, wherein the foil comprises a thickness of about 0.00025 inches to about 0.001 inches.
13. The blister backing of claim 10, wherein the foil comprises a thickness of about 0.0003 inches to about 0.0008 inches.
14. The blister backing of claim 1, wherein the laminate comprises at least one layer of printing.
15. The blister backing of claim 1, wherein the laser comprises a CO₂ laser.
16. The blister backing of claim 1, wherein the laminate is adhered to a blister film.
17. The blister backing of claim 16, wherein the portion of the laminate that is laser scored is positioned over the opening of the blister.
18. A push-through blister packaging comprising a blister backing laminate applied to a blister film, the blister backing laminate comprising a first outer layer and a second metal substrate layer, wherein the outer layer is at least partially scored with a laser such that the laminate functions as a push-through blister backing.
19. A method for producing a push-through blister backing laminate comprising forming a blister backing laminate comprising a first outer layer and a second metal substrate layer, and using a laser to at least partially score the outer layer of the laminate such that the laminate functions as a push-through blister backing.
20. The method of claim 19, further comprising applying a layer of adhesive bonding agent between the first outer layer and the metal substrate layer and a layer of sealant to the surface of the metal substrate layer that is opposite of the outer layer for adhering the blister backing to a blister film.
21. The method of claim 20, wherein the outer layer is scored through only part of the depth of the outer layer.
22. The method of claim 20, wherein at least one score cuts substantially through the entire depth of the outer layer.
23. The method of claim 20, wherein at least one score cuts substantially through the outer layer and at least part of the adhesive bonding layer.
24. The method of claim 20, wherein at least one score cuts substantially through the entire depth of the outer layer and the bonding layer down to the metal layer.
25. The method of claim 19, wherein the outer layer comprises a polymer film.
26. The method of claim 25, wherein the polymer film comprises polyethylene terephthalate (PET).
27. The method of claim 19, wherein the outer layer comprises a cellulosic substrate.
28. The method of claim 19, wherein the metal layer comprises aluminum foil.
29. The method of claim 28, wherein the foil comprises a thickness of about 0.0002 inches to about 0.002 inches.
30. The method of claim 28, wherein the foil comprises a thickness of about 0.00025 inches to about 0.001 inches.
31. The method of claim 28, wherein the foil comprises a thickness of about 0.0003 inches to about 0.0008 inches.
32. The method of claim 19, wherein the laminate comprises at least one layer of printing.
33. The method of claim 19, wherein the laser comprises a CO₂ laser.
34. The method of claim 19, wherein the blister backing laminate is adhered to a blister film.
35. The method of claim 34, wherein the portion of the blister backing laminate that is laser scored is positioned over the opening of the blister.
36. The method of claim 34, wherein the blister backing laminate is scored by a laser prior to adhering the backing to a blister film.
37. The method of claim 34, wherein the blister backing laminate is scored by a laser after adhering the backing to a blister film.

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