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(71) Applicant *(for all designated States except US)*: **ALCOA INC.** [US/US]; Alcoa Corporate Center, 201 Isabella Street, Pittsburgh, Pennsylvania 15212-5858 (US).

(72) Inventor: **STEVENSON, James A.**; 1928 Ardmore Boulevard, Pittsburgh, Pennsylvania 15221 (US).

(74) Agents: **CILLO, Daniel P.** et al.; Eckert Seamans Cherin & Mellott, LLC, Alcoa Technical Center, 100 Technical Drive, Alcoa Center, Pennsylvania 15069-0001 (US).

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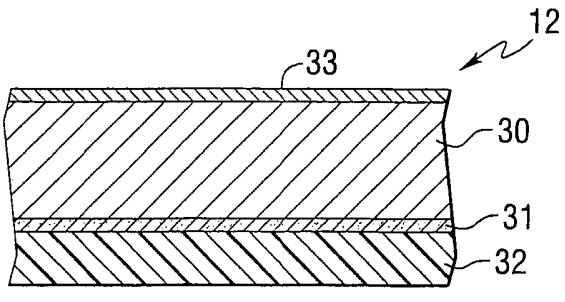
(54) Title: LIDSTOCK MATERIAL HAVING IMPROVED SEALABILITY AND PEELABILITY TO WIDE CLASSES OF MATERIALS



(57) Abstract: A material that can be used as a lid (12) on a container (14, 40), the lid containing a solid substrate (30) and a peelable and heat sealable film (32) which contains a mixture of at least aliphatic-aromatic copolyester, inorganic filler, butene-1 polymer and ethylene-vinyl acetate copolymer, where the substrate (30) is preferably made of aluminum.

WO 2005/123515 A2

LIDSTOCK MATERIAL HAVING IMPROVED SEALABILITY AND PEELABILITY TO WIDE CLASSES OF MATERIALS

Field of the Invention

[0001] The present invention relates to a lidstock material suitable for making lids to be sealed over plastic containers such as pharmaceutical blisters.

Background of the Invention

[0002] Many products are placed in containers covered by a lidstock material and such products can range from yogurt to disposable contact lenses. Such lidstocks must be sealable to a very wide class of materials, peelable and resistant to both hot and cold temperatures.

[0003] Many pharmaceuticals and disposable contact lenses are packaged in blister packages consisting of 2 pieces: a base and a lid. The base is an injection molded plastic shaped to include a bowl-shaped or rectangular recess for receiving the contents. In the case of contact lenses, each blister pack generally contains a contact lens and enough solution to prevent drying and to maintain the contact lens ready for use.

[0004] The lid covering the base is heat sealed over the recess containing the contents of the blister package. The lid must be easily peelable from the base in order to provide easy access without spilling the contents. Also the lid must be seal compatible with a wide variety of materials. These containers are described, for example, in U.S. Patent Specification Nos. 4,691,820; 4,810,541; 5,061,532; 5,626,929 and 5,958,531. (Martinez, Newman et al., Yamada, Stevenson and Stevenson, respectively) as well as in U.S. Serial No. 10/388,001 filed on March 12, 2003 (Docket No. 02-1312, Stevenson) and "Excitement In Plastics" Packaging Digest, Sept. 2003 pp. 13-15, at http://www.packagingdigest.com/articles200309/48.html Martinez U.S. 4,691,820 suggests a polypropylene base and cover of polypropylene film/aluminum foil laminate. Yamada in U.S. 5,061,532 suggests a thermoplastic rim and a lid made of the same material as the rim. Stevenson in U.S. 5,626,929 suggests a lidstock material containing a mixture of butene-1 and ethylene copolymer, an ethylene homopolymer or copolymer, an inorganic filler and optionally a propylene homopolymer or copolymer laminated to a metal or polymer substrate. Stevenson in U.S. 5,958,531 suggests a lidstock material containing a mixture of ethylene-carboxylic acid copolymer, polybutylene and an inorganic filler laminated to a metal or polymer substrate. Packaging Digest describes a lidstock containing a type ethylene acid copolymer which replaces adhesive-mounted versions

having high peel strengths making them somewhat difficult to open with an extrusion mounted version.

[0005] U.S. Patent Specification Nos. 4,665,130; 4,886,849; and 4,916,190 (Hwo, Hwo et al., and Hwo respectively) relate to use of butene-1 polymers or copolymers with other materials such as propylene and polyethylene to provide film and sheet with peelability and also moldable articles such as containers. Other patents in this area include U.S. Patent Specification Nos. 4,876,156; 5,066,543; and 5,106,917 (Hwo, Hwo and Lee et al. respectively).

[0006] Lidstock materials suitable for covering openings in packages for contact lenses and foods are known in the prior art. However, there are still needs in this area. The prior art lidstock materials generally suffer from one or more serious disadvantages making them less than entirely suitable for their intended purpose, including compatibility with an extensive class of substrate or blister package sealing lids, for example compatibility with polystyrene ("PS"), polypropylene ("PP"), polyethylene ("PE") and with all three of polyvinyl chloride ("PVC"), polyethylene terephthalate ("PET"), and polyvinylidene chloride ("PVDC").

[0007] Recently, biodegradable polyesters have been developed for packaging, such as sandwich wrap, produce and meat trays, seedling bags, lawn and garden bags, and hot/cold cups, and the like; featuring aromatic-aliphatic copolyesters, as described in "Biodegradable Polyesters: Packaging Goes Green" Plastics Technology pp. 1-8, found at http://www.plasticstechnology.com/articles/200209 fa.3.html, June 6, 2003 and "Next Generation of Biodegradable Plastic Introduced by Eastman", Analytica & Chemie. DE News, p. 1 of 1, found at http://www.chemie.de/customers/analytica/news/details.php3?cmid=9487 & lang=en, June 6, 2003. These polyester resins appear to be further described in U.S. Patent Specification Nos. 5,292,783; 5,446,079; and 6,342,304B1 (all Buchanan et al.) for possible use as fibers, molded objects and films. Also, Mueller, in U.S. Patent Specification No. 6,503,549B1, teaches polyethylene terephthalate (PET) tray typed packages with lidding films directly sealable to the tray where the films include glycol-modified polyethylene terephthalate sealant layers.

[0008] A principal objective of the present invention is to provide a lidstock material for lids having excellent burst strength, good cohesive peel properties, acceptable heat resistance and excellent compatibility with all of PVC, PET and PVDC, as well as with PS, PP and PE.

[0009] Additional objectives and advantages of the present invention will become apparent from the following detailed description of some preferred embodiments.

Summary of the Invention

[0010] The above needs are solved and objects accomplished by providing, in accordance with the present invention, a peelable and heat sealable material suitable bonding to a wide variety of substrates, comprising a solid substrate joined to a film comprising aliphatic-aromatic copolyester, particulate inorganic filler, butene-1 polymer, and ethylene-vinyl acetate copolymer. The invention also consists essentially of and consists of such components. The copolyester can include a biodegradable component. The particle size of the filler is very important and ranges from 0.5 micrometer (micron) to 10.0 micrometer. Preferably the film contains from about 25 wt. % to about 50 wt. % copolyester, preferably a butene-1 homopolymer, and from about 15 wt. % to about 30 wt. % filler with the remainder containing at least 5 wt. % of both butene-1 polymer and ethylene-vinyl acetate copolymer.

[0011] The substrate can be, for example, metal foil, plastic or paper but the preferred substrate is aluminum foil. The preferred range is from about 10 wt. % to about 30 wt. % of butene-1 polymer and about 10 wt. % to about 30 wt. % ethylene-vinyl acetate copolymer. The above composition/substrate provides excellent bonding sealing and cohesive peeling to all of PVC, PET and PVDC as well as more easily bondable packaging such as PS, PP and PE.

[0012] Plastic and metal substrates are easily bonded to films of this material. These materials are particularly useful as a "peelable" "heat sealable" "lidstock material" for containers.

[0013] As used herein, the term "lidstock material" refers to a metal, polymer, or paper substrate laminated with a heat seal layer or film. Lidstock material of the present invention is made into container lids by cutting the material into desired shapes such as circles or rectangles. As used herein, the term "heat sealable" refers to the ability to form a bond between a plastic container and its lid when heat and pressure are applied locally for a sufficient time. The bond is gas-tight and preferably has sufficient burst strength to resist separation of the lid from the container body, even when the sealed container is retorted at an elevated temperature.

[0014] As used herein, the term "peelable" refers to the ability of a sealed lid to separate and to release from sealed engagement with a container body while both the lid and

the body substantially retain their integrity. Such separation and release are achieved by manually applying a separating force to an outer edge portion of the lid.

[0015] The lidstock material of the invention preferably a substrate laminated with a film comprising a polymer mixture of this invention. The substrate can be an aluminum foil having a thickness of about 0.25 mil to 3.0 mils (0.00025 inch to 0.003 inch (6.35 to 76.2 micrometers)). Aluminum foil provides an excellent barrier against penetration of gases and moisture. Aluminum foil also protects the package contents from ultraviolet light and has an aesthetically pleasing appearance. A particularly preferred aluminum foil substrate has a thickness of about 2 mils (0.002 inch-50.8 micrometers). Other preferred suitable materials for the substrate include biaxially oriented polyethylene terephthalate (PET), polyvinyl chloride (PVC), polyvinylidene chloride (PVDC), nylon, paper, and combinations thereof.

[0016] The substrate is preferably coated with a print primer. The print primer facilitates application of printed labeling on the substrate. A particularly preferred print primer has a coating weight of about 0.4 to 0.9 pound per 3000 square feet (0.6-1.4 g./sq meter).

[0017] The peelable and heat sealable film has a total weight of about 17 lb per 3000 square feet (27 g/sq meter). The filler enhances peelablity of the coating by assisting the seal failure upon peeling from adhesive failure at the container-coating layer interface to cohesive failure in the coating layer itself. The filler preferably is selected from at least one of talc, silica or alumina and comprises at least about 15 wt. % of the coating, preferably about 15 wt. % to 30 wt. %, more preferably about 20 wt. % to 30 wt. %. The filler is preferably a powder having an average particle size of about 0.5-10 micrometers (microns). Talc having an average particle size of about 12 0.5 to 10 micrometers is particularly preferred. The talc or other filler is preferably provided with a surface coating comprising about 0.5 wt. % to about 5 wt.% of the filler, preferably about 1 wt. %. A carboxylic acid surface coating is particularly preferred. The surface coating contributes to talc dispersion and adhesion within the polymer. The carboxylic acid in the surface coating may be a mono or dicarboxylic acid or a mixture of such acids. Some preferred acids include stearic acid and isostearic acid, which is a liquid mixture of mostly C_{18} saturated fatty acids having the general formula $C_{17}H_{35}COOH$. Other saturated C_{10}-C_{20} carboxylic acids or mixtures thereof may also be useful.

[0018] A particularly preferred butene-1 polymer is sold by Basell Polyolefins under the Tradename "PB 1710 M" and has a density of 0.908; a melt flow rate of 1.0 min by ASTM D 1238; and a melting point of 241° F (116° C).

Brief Description of the Drawings

[0019] Figure 1 is a top plan view of one embodiment of a container, here a blister pack, which might be made with the present invention;

[0020] Figure 2 is a side elevational view of the blister pack of Figure 1 with the lid partially peeled back;

[0021] Figure 3 is an enlarged fragmentary, cross-sectional view of the lid of the blister pack shown in Figure 2; and

[0022] Figure 4 is a perspective view of a food container which might be made with the present invention.

Detailed Description of Preferred Embodiments

[0023] In Figures 1 and 2 there is shown one type of many varieties of containers that are useful with the lidstock material of this invention; a blister pack 10 made in accordance with the present invention, with a lid 12 partially peeled back to reveal its contents. While the present invention will be described with a blister pack this is in no way to be taken as limiting. The pack 10 comprises an injection molded plastic container body 14 heat sealed to the lid 12. The body 14 defines a bowl-shaped recess 16 having a diameter of about 2 cm. and a depth of about 0.5 cm. A flange 18 extending around the recess 16 includes a tapered curled lip 20 spaced apart from the recess 16.

[0024] The recess 16 here houses a contact lens 22 and a saline solution 24. The recess 16 is circumscribed by a seal area 26 which is part of the flange 18. The lid 12 is preferably attached to the body 14 by heat sealing in the seal area 26. Other suitable means for attaching the lid 12 to the body 14 include induction sealing and sonic welding. The total interior volume defined by the recess 16 and the lid 12 is preferably less than 1 milliliter. The body 14 is preferably made from a plastic material which can be shaped by injection molding or thermoforming. The plastic material for the body is preferably polypropylene but may also be other plastic materials having similar properties, such as polyethylene, polyethylene-polypropylene mixtures, polyethylene-polypropylene copolymers, polybutylene, polyesters (e.g. PET), polycarbonates, and other thermoplastics. Plastics having low vapor transmission rates are most preferred. Plastics such as PVC, PET and PVDC are also bondable with the lidstock material of this invention.

[0025] Referring now to Figure 3, the lid 12 is made from lidstock material comprising substrate 30, preferably aluminum foil, having a polyurethane adhesive layer 31 joining a film

32 to the substrate 30. An exterior side of the substrate 30 displays graphic matter (not shown) printed over a print primer 33. The substrate 30 has a thickness of about 2 mils. (0.002 inch-50.8 micrometers). The print primer 33 has a weight of about 0.4 to 0.9 pounds per 3000 square feet. The film 32 has a thickness of about 25 micrometers (1 mil.), corresponding to a weight of about 17 pounds per 3000 square feet. The lid 12 includes only a single layer of the film 32.

[0026] Figure 4 shows another type container that might use the lidstock material of this invention. The container 40 has a cavity 42 within the body for containing food such as prepared cake, frosting, pudding, yogurt, cream cheese, or apple sauce, juice, coffee and the like with a lip/flange 44 extending radially outward from the body 46 and a lid 12 made from lidstock material having the same configuration as Figure 3.

[0027] The preferred blister pack 10 shown in Figures 1 to 3 has a lid 12 heat sealed to an injection molded polypropylene body 14. The film 32 on the lid 12 may have the compositions as follows:

Film Composition

Component	Range wt. %	Preferred Range wt. %
Aliphatic-Aromatic Copolyester	25 to 50	20 to 40
Particulate Inorganic Filler	15 to 30	20 to 30
Butene-1 polymer	> 5	10 to 30
Ethylene-Vinyl Acetate Copolymer	> 5	10 to 30

Preferably, the copolyester is a mixture of aliphatic-aromatic copolyester and a biodegradable component selected from the group consisting of cellulose, cellulose monoacetate, starch and mixtures thereof making up from 0.5 wt. % to 10 wt. %, based on the weight of the copolyester. The preferred range of copolyester is from about 20 wt. % to 40 wt. %. Preferably the inorganic filler is selected from the group consisting of talc, silica, alumina, alumina trihydrate, and mixtures thereof.

[0028] Having described the presently preferred embodiments, it is to be understood that the invention may be otherwise embodied within the scope of the appended claims.

What is claimed is:

1. A peelable and heat sealable material suitable for bonding to a wide variety of substrates, comprising a solid substrate joined to a film, the film comprising:

a.) aliphatic-aromatic copolyester;

b.) particulate inorganic filler;

c.) butene-1 polymer; and

d.) ethylene-vinylacetate copolymer.

2. The material of claim 1, wherein said substrate material is a lidstock material and comprises at least one material selected from metal foil, plastic, and paper.

3. The material of claim 1, wherein said substrate comprises aluminum foil.

4. The material of claim 1, wherein said inorganic filler comprises talc, silica, or alumina.

5. The material of claim 1, wherein said material is bondable to all of PVC, PET and PVDC.

6. The material of claim 1, wherein said film comprises about 25 wt. % to about 50 wt. % of aliphatic-aromatic copolyester.

7. The material of claim 1, wherein said film comprises at least about 5 wt. % of both butene-1 polymer and ethylene-vinyl acetate copolymer.

8. The material of claim 1, wherein said film comprises from about 10 wt. % to about 30 wt. % of butene-1 polymer and from about 10 wt. % to about 30 wt. % of ethylene-vinyl acetate copolymer.

9. The lidstock material of claim 1, wherein said film comprises about 20-30 wt. % of the inorganic filler.

10. The lidstock material of claim 1, wherein said filler has a particle size of from about 0.5 micrometer to 10 micrometer and contains from about 0.5 wt. % to 5 wt. %, based on the weight of the filler, of a carboxylic acid.

11. The material of claim 1, wherein said material is bondable to PS, PP and PE as well as PVC, PET and PVDC.

12. The material of claim 9, wherein said filler is selected from the group consisting of talc, alumina, silica and mixtures thereof talc having an average particle size of from 0.5 micrometers to 10 micrometers.

13. A lid for a plastic container comprising the lidstock material of claim 2.

14. A container comprising a plastic body having an edge defining an opening and a flange extending radially outwardly of said opening, and a lid comprising the lidstock material of claim 2 heat sealed to said flange.

15. The container of claim 13, wherein said substrate comprises aluminum foil.

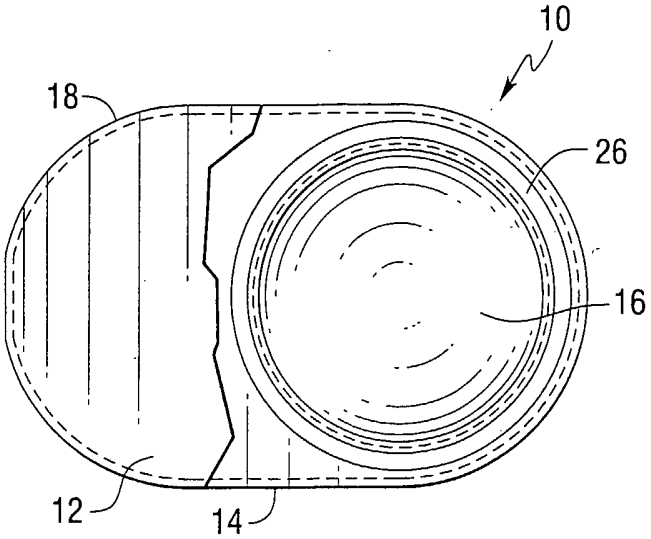


FIG. 1

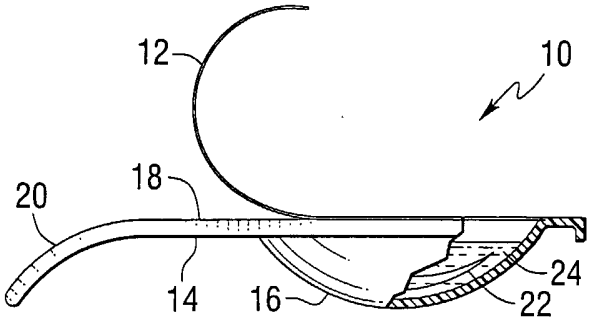


FIG. 2

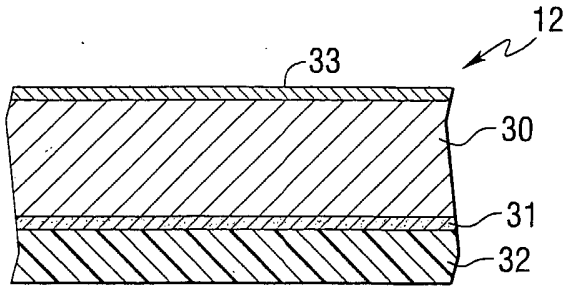


FIG. 3

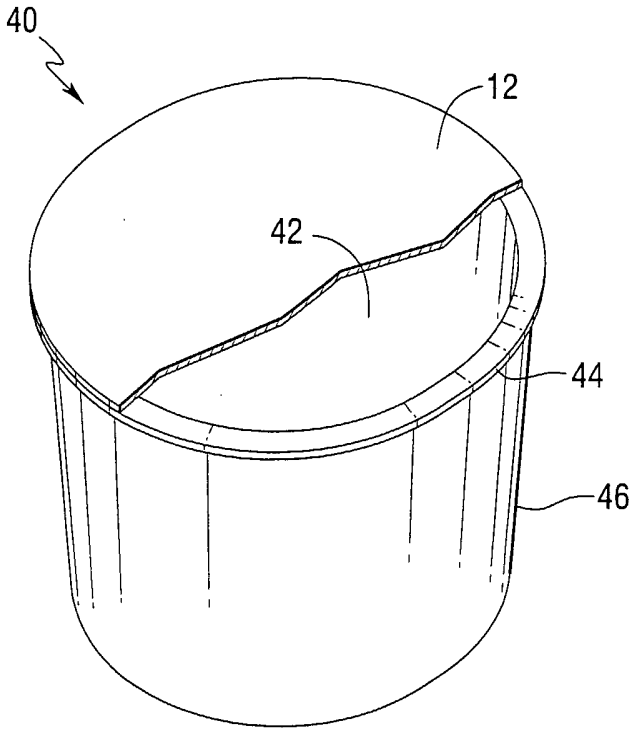


FIG. 4