The invention relates to a single-layered or multilayered, biaxially-oriented film which contains 70 to 100% by weight of polymer consisting of at least one type of aliphatic polyhydroxy carboxylic acid, and which is used in the form of an inner liner of a cigarette package.
CIGARETTE PACKAGE PROVIDED WITH INTERNAL ENVELOPS MADE FROM POLYMER FILM

[0001] The invention concerns a cigarette packaging comprising at least one outer packaging and an inner wrapping for cigarettes. The invention furthermore concerns an inner liner. [0002] Cigarette packagings are conventionally constructed in such a way that the packaging contents, namely a collection of cigarettes, are surrounded by an inner wrapping. In the prior art, this inner wrapping consists of a cut sheet of aluminium foil, an aluminium-paper lamination or a piece of metallised paper. This inner wrapping is often imprinted or embossed. Earlier cut sheets are today conventionally replaced by inner wrappings made of paper. The inner wrapping is often imprinted or metallised, if necessary in combination with embossment, on the outside.

[0003] When manufacturing the packaging, the cigarettes are wrapped in this inner wrapping, the so-called inner liner, and the wrapped collection of cigarettes is folded by the packaging machine with the outer packaging, for example a flip-top lid packaging or a paper label. [0004] The inner liner can consist of printed paper, metallised paper or other lamellar materials. These materials are pulled onto the packaging machine off a roll and cut to the appropriate length. If necessary, selected perforations are made in order to produce a target cut-off point which makes possible a selected tearing open of the inner liner upon first opening of the packaging.

[0005] Paper and metal films are particularly advantageous because of the folding properties and the tearing properties. In this type of use, the strips of material must feature good folding properties (dead-fold) which ensure that the cigarettes being wrapped are wrapped up fine enough to remain as a bundle up until the point at which the outer packaging is put in place. Furthermore, the tearing behaviour performs an important role, in that a controlled opening of the liner is ensured. Finally, the cuts must feature a good flatness, in order that the handling is not hindered by the strips of material furling up.

[0006] This set of properties is well fulfilled by paper and metallised papers. Film made of thermoplastic polymers have inherently poor folding properties and therefore are generally not suitable material for this usage. Moreover, plastic films in the form of small cuts tend to curl up, i.e. these cuts roll up along or across the length of the film strip all by themselves.

[0007] As plastic films nevertheless often have advantages over paper both from the point of view of environmental aspects and in terms of cost, the substitution of paper in various uses is a request constantly put to the film manufacturer.

[0008] So underlying the invention was the task of making available a film suitable for use as the inner liner of cigarette packaging, and which met the demands of this usage.

[0009] This task is solved by the use of a single-layered or multilayered, biaxially-oriented film as the inner liner of a cigarette packaging, such that the film contains 70 to 100% by weight of a polymer made of at least one aliphatic hydroxyl carboxylic acid.

[0010] The invention comes into use particular for flip packs and soft packaging. The inner liner made of polyhydroxy carboxylic acid film, preferably PSA film, is particularly suitable for flip packs. These cartons conventionally consist of thin card. A piece of the carton serves to pick up the contents of the packaging, namely a collection of cigarettes which is surrounded on all sides by the folded inner wrapping made of polyhydroxy carboxylic acid or PSA. There is a lid disposed on a back side of the carton, which is connected to the carton over a fold line. Further details of the embodiment of flip packs are known and described e.g. in DE 43 33 462, a description to which explicit reference is made here.

[0011] The collection of cigarettes, the contents of the packaging, is surrounded on all sides by the inner wrapping according to the invention. The unit so arising as the packaging contents is a block of cigarettes. According to the invention, a film made of polyhydroxy carboxylic acid, preferably a PLA film, is introduced to the cigarette wrapping in order to manufacture such a block of cigarettes.

[0012] The film is cut to the suitable width for this purpose and pulled onto the packaging machine off a roll as a reel and cut to the appropriate length. The shape of the cut depends on the type of folding coming into use. For example, the tailored film cut is laid around the collection of cigarettes according to the principle of side folding. Connected to a continuous, closed bottom side are a front side and a back side. An upper end wall is likewise formed by folding, such that interior pointed corners and trapezoid pointed edges are formed.

[0013] In a further embodiment, the inner wrapping of the upper area can be provided with a draw-off strap, a so-called flap. For this purpose a perforated line or some other kind of weakening line is made over the full width of the cut. Upon first opening of the package, the draw-off strap is detached by catching the outer pointed edge.

[0014] The cut is generally separated from the strips of material in such a way that the cut lies in the longitudinal direction. The strips of material can be provided with printing surfaces if necessary, which advantageously are arranged with a gap between them in the direction running along the length of material. The cross cuts for dividing the cuts are carried across the film lengthwise. The exact positioning of the dividing line can be carried out with a print mark control because of the printer's imprints.

[0015] Alternatively, the cut can be constructed in such a way that the width of the strip of film corresponds to the length of the cut. With this arrangement, the cuts are aligned normal to the length of the strip of material. In these cases, the strip of material is provided with an alternating strips of print on both sides, in particular of varying widths.

[0016] Cuts and techniques for folding the inner liner, units for imprinting cuts and further details and known in the prior art and described e.g. in DE 201 20 977 or DE 43 33 462 or DE 25 11 241, to which explicit reference is made here.

[0017] The packaging with inner liner constructed in the way described are generally additionally provided with an outer wrapping made of film, in particular polypropylene film or cellophane.

[0018] According to the invention, the inner liner is made of a biaxially-oriented film, which can feature one or several layers. The main constituent of the film is a polymer made of at least one aliphatic hydroxyl carboxylic acid. In general, the film contains at least 70-100% by weight of a polymer made of at least one aliphatic hydroxyl carboxylic acid. Embodiments made of 80-99% by weight, preferably 85-95% by weight of the named polymers, in each case relative to the weight of the film, are preferred.

[0019] Surprisingly, a film made of polyhydroxy carboxylic acid, preferably PLA is excellent for use as inner liner. It was
found that the film fixes in place the cigarette bundle sufficiently after the impaction. The film shows now disruptions during handling on the packaging machine. I found that the cuts have surprisingly little furling, sometimes none at all, and so avoid the problems of other thermoplastic films. Moreover, films are particularly advantageous because of the good stable workability given even in fluctuating climatic conditions. It was shown, the in comparison the paper, fluctuating temperatures or a fluctuating humidity hardly affects the film and its properties and has no effects on its use as inner liner and can always be handled equally well.

Both single-layered and multilayered films made of aliphatic polyhydroxycarboxylic acid are suitable for use according to the invention. Multilayered films are generally constructed out of a thick base layer which features the largest layer thickness and makes up 60 to 100% of the total thickness of the film. This base layer is provided with (a) top layer(s), preferably on both sides but only on one side if necessary. In further embodiments, additional intermediate layers or coatings of the outer surface of the multilayered film are possible, through which four or five-layered, coated or uncoated, films are obtained. The thickness of the top layer generally lies in a range from 0.5 to 10 μm, preferably 0.5-6 μm, in particular 1 to 3 μm. The total thickness of the film according to the invention lies in a range from 20 to 100 μm, preferably 25 to 80 μm, in particular 30 to 60 μm. The top layer is the layers with form the outer layers of the film. Intermediate layers are by naturally attached between the base layer and the top layers. Following embodiments to the layers of the film count analogously in the same way for single-layered embodiments of the film.

Surprisingly, films with a minimum thickness of 20 μm are particularly advantageous for use as inner liner according to the invention. If the thickness of the film lies under 20 μm, then congections occur on the machine. It was found that surprisingly thin films function even better in the use according to the invention. When the film thickness is too large, the film shows too large reset forces, so that the wrapped cigarettes slip out of the bundle before the outer flip pack can be applied. Therefore a maximum thickness of 100 μm should not be exceeded.

The film, as well as the individual layers of the film if necessary, contain(s) 70 to around 100% by weight preferably 80 to 98% by weight of a polymer made of at least one of the aliphatic hydroxyarylactic acids, hereinafter also called PHA or polyhydroxy carboxylic acids. This means homopolymers or mix polymers, which are made up of polymerizable units of aliphatic hydroxyarylactic acids. Among the PHA suitable for the present invention, poly lactic acids are particularly suitable. These are hereinafter called PLA (poly lactic acid). Here too, both homopolymers which are made up only of lactic acid units, and also mix polymerisers which predominantly contain lactic acid units (>50%) bonded with other aliphatic hydroxylactic acid units, are meant by the term PSA.

As monomers of the aliphatic polyhydroxyarylactic acids (PHA), aliphatic mono-, di- or trihydroxyarylactic acids, or their dimer cyclic esters, are suitable, among which lactic acid in its D- or L-form is preferred. These kinds of polymers are known in the prior art and are commercially available. The manufacture of poly lactic acids is likewise described in the prior art and takes place over catalytic ring-opening polymerisation of lactide (1,4-dioxane-3,6-dimethyl 2,5-dione), the dimerised cyclic ester of the lactic acid, hence PSA is often also called polylactide. The manufacture of PSA is described in the following publications: U.S. Pat. No. 5,208,297, U.S. Pat. No. 5,247,058 or U.S. Pat. No. 5,357,035.

Poly lactic acids made up exclusively of lactic acid units are preferred. In this connection PSA homopolymers containing 80-100% by weight L-lactic acid units, corresponding to 0 to 20% by weight D-lactic acid units, are particularly preferred. Even higher concentrations of D-lactic acid units can be contained as comonomers in order to decrease the crystallinity. If necessary, the poly lactic acid can additionally feature various aliphatic polyhydroxyarylactic acid units as comonomers from the lactic acid, for example glycolic acid units, 3-hydroxy propanoic acid units, 2,2-dimethyl-3-hydroxypropanoic acid units or higher homologues of the hydroxyarylactic acids with up to 5 carbon atoms.

Preferred are lactic acid polymers (PLA) with a melting point of 110 to 170°C, preferably from 125 to 165°C, and a melt flow index (DIN measurement 53 735 at 21.6 N load and 190°C) of 1 to 50 g/10 min, preferably from 1 to 50 g/10 min. The molecular weight of the PLA lies in a range of at least 10 000 to 500 000 (counting mean), preferably 50 000 to 300 000 (counting mean). The glass transition temperature lies in the 1g lies in a range from 40 to 100°C, preferably 40 to 80°C.

The individual layers of the film each contain 70 to around 100% by weight of the previously described polymers, preferably 80 to 98% by weight, as well as additional additives if necessary, like neutralising agents, stabilisers, lubricants, static inhibitors and fillers. They are advantageously added to the polymer or the polymer mixture before melting on. Phosphorous bonds, like phosphoric acids or phosphoric acid esters, for example, are introduced as stabilisers. The individual layers can basically feature the same composition as regards polymers and additives. In general, the composition of the base layer is different from the composition of the remaining layers. In particular, additives like anti-blocking agents or lubricants are added to the top layers, whereas fillers or pigments are preferably introduced into the base layer. Construction and composition of the individual layers of the film can nevertheless vary within wide boundaries.

It was found that transparent and white embodiments without vacuoles are especially well suited for this use. It is known about polypropylene films that opaque PP films with vacuoles in the base layer feature better folding properties than transparent PP films. The vacuole-free PLA films surprisingly also show very good folding properties in this use in comparison to vacuolated embodiments. In the sense of the present invention, transparent films are to be understood as those with a light permeability according to ASTM-D 1003-77 lies over 75%, preferably over 95%. White PLA films are coloured white by the addition of white pigment, but have no vacuoles either. These embodiments generally contain TiO₂ in a quantity of 1-12% by weight in at least one layer, if necessary several. Basically, TiO₂ can be added in these quantities to one or both top layers or also to one or both intermediate layers.

The addition of opaque or white-opaque embodiments of the film is basically also possible. These films contain vacuole-initiating fillers in the base layer, for example cycloolefin copolymer (opaque films) and, if necessary, additional pigments (white-opaque films). In this case, too, TiO₂
is also preferred as pigment and is introduced in a quantity of up to 10% by weight, preferably 1 to 8% by weight, in each case relative to the base layer.

[0029] If necessary, the film can be coated in order to optimise further properties of the film. Typical coatings are adhesion-enhancing, slip-improving or dehiscence-operating coatings. If necessary, these additional coatings can be applied over in-line coating by means of aqueous or non-aqueous dispersions before lateral stretching or off-line.

[0030] In a further embodiment, the films are metallised as inner liner before use. Upon use as inner-liner, the metallised side forms the visible side. In a further embodiment, the film can be metallised on both sides. This embodiment has the additional advantage that direct contact between the cigarettes and the film is avoided, so that no detractors to the taste of the cigarettes because of the film are possible, or rather they are extensively prevented.

[0031] In a further embodiment, the metallised or non-metallised film can be additionally provided with an embossment which on the one hand has a decorative character, and which contributes towards a further improved flatness. Surprisingly, after metallisation and imprinting the films can be handled just as well as the paper inner-liner used until now. What is more, the embossed metallised films come very close to the topical appearance of metallised papers.

[0032] The PCH film is manufactured according to the coextrusion procedure known in itself. Within the scope of this procedure, the melt(s) corresponding to the layers of the film are coextruded through a flat die; the multilayered film so obtained is pulled off for hardening on one or several roller(s), the film is subsequently biaxially stretched (oriented), the biaxially-stretched film is heat set and, if necessary, corona- or flame-treated on the surface layer intended for treatment.

[0033] The biaxial stretching is generally carried out sequentially. In so doing, stretching preferably happens first in the longitudinal direction (i.e. in the machine direction, =MD direction) and subsequently in the lateral direction (i.e. at a right angle to the machine direction, =TD direction). This leads to an orientation of the molecular chains. The stretching in the longitudinal direction preferably takes place with the help of one or two rollers running at different speeds, corresponding to the desired stretch ratio. For the lateral stretching, a corresponding clip frame is commonly used. Further description of the film manufacture is carried out according to the example of a thin film extrusion with subsequent sequential stretching.

[0034] The melt(s) are pressed through a flat die (sheet die), and the film pressed out is pulled off on one or several outfeed rollers at a temperature of 10 to 100 °C, preferably 20 to 80 °C, such that it cools off and hardens.

[0035] The film so obtained is then stretched along and across the direction of extrusion. The longitudinal stretching will preferably be carried out at a roller temperature of the stretch roller of 40 to 130 °C, preferably 50 to 100 °C, advantageously with the help of two rollers running at different speeds, corresponding to the desired stretch ratio; the lateral stretching preferably at a temperature of 50 to 130 °C, preferably 60 to 120 °C, with the help of a corresponding clip frame. The longitudinal stretch ratios can vary within a range of 1.5 to 8. In the manufacture of films with a base layer containing vacuole-initiating fillers a high longitudinal stretch ratio of 3 to 6 is preferred, whereas films with a transparent base layer are preferably stretched within a range of 1.5 to 3.5. The lateral stretch ratios lay in the range from 3 to 10, preferably 4 to 7.

[0036] Attached to the stretching of the film is its heat setting (heat treatment), where the film is held converging around 0.1 to 10 s long at a temperature of 60 to 150 °C (convergence up to 25%). Subsequently the film is wound up in the conventional manner with a batcher.

[0037] The following measured values were used to characterise the raw materials and the films:

[0038] The invention will hereinafter be explained on the basis of the following execution examples:

EXAMPLE 1

[0039] A transparent, three-layered PLA film with a thickness of around 30 μm was manufactured by extrusion and subsequent incremental orientation in the longitudinal and lateral directions. The base layer consisted of almost 100% by weight polyactic acid with a melting point of around 160 °C. The layer additionally contained stabilisers and neutralising agents in conventional quantities. Both sealable top layers were fundamentally made up of an amorphous polyactic acids such that this polyactic acid features an L/D ratio of around 40/60. In addition, the top layers each contained 0.1% by weight SiO₂-based particles as anti-blocking agents. The thickness of the top layers each came to 2.5 μm.

[0040] The manufacturing conditions in the individual procedural steps were:

[0041] Extrusion: temperatures 170-220 °C.

[0042] Temperature of the outfeed roller: 60 °C.

[0043] Longitudinal stretching: temperature: 68 °C.

[0044] Longitudinal stretch ratio: 2.0

[0045] Lateral stretching: temperature 88 °C.

[0046] Lateral stretch ratio (effective): 5.5

[0047] Fixation: temperature 75 °C.

[0048] Convergence: 5%

EXAMPLE 2

[0049] A film was manufactured as is described in example 1. In contrast to example 1, no top layer was attached. For the rest, the composition and the manufacturing conditions were unchanged. A transparent film, but a single-layered film with a thickness of 25 μm, was again manufactured.

EXAMPLE 3

[0050] By extrusion and subsequent incremental orientation in the longitudinal and lateral directions, an opaque, single-layered PLA film with a thickness of 30 μm was manufactured. This layer was around 95% by weight made up of a polyactic acid with a melting point of 135 °C and a melt flow index of around 3 g/10 min and a glass transition temperature of 60 °C and around 5% by weight C6O (Tecona Topas 6013) with a Tg of 140 °C. The layer additionally contains stabilisers and neutralising agent in conventional quantities. The manufacturing conditions in the individual procedural steps were:

[0051] Extrusion: temperature 170-220 °C.

[0052] Temperature of the outfeed roller: 60 °C.

[0053] Longitudinal stretching: temperature: 68 °C.

[0054] Longitudinal stretch ratio: 4.0

[0055] Lateral stretching: temperature: 88 °C.

[0056] Lateral stretch ratio (effective): 5.5

[0057] Setting: temperature: 75 °C.

[0058] Convergence: 5%
In this way, an opaque film with characteristic pearl-escence shine and a reduced density of around 0.75 \( \text{g/cm}^2 \) is obtained.

The films were introduced on a commercial cigarette packaging machine as inner liner and could be used without huge problems. The non-vacuolated films according to example 1 and 2 showed themselves to be especially advantageous. In contrast, biaxially orientated polypropylene films could not be adopted in this usage. Because of strong reset forces of the material, the individual cigarettes could not be packaged.

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1-16. (canceled)

17. An inner liner for a cigarette packaging which comprises a single-layered or multilayered, biaxially-oriented film which contains 70 to 100\% by weight of polymer of at least one aliphatic polyhydroxyacrylic acid.

18. The inner liner according to claim 17, wherein the film is transparent.

19. The inner liner according to claim 17, wherein the film is white.

20. The inner liner according to claim 17, wherein the film has an opaque, vacuolated base layer.

21. The inner liner according to claim 17, wherein the film is metallized on one surface.

22. The inner liner according to claim 17, wherein the film is metallized on both sides.

23. The inner liner according to claim 17, wherein the film is embossed.

24. The inner liner according to claim 21, wherein the metallized surface of the film is embossed.

25. The inner liner according to claim 17, wherein the film contains 80 to \(<98\% \text{ by weight of a polymer of aliphatic polyhydroxyacrylic acid in the base layer.} \)

26. The inner liner according to claim 17, wherein film features top layers on both sides, and the top layers contain 70 to \(<100\% \text{ by weight of a polymer of aliphatic polyacrylic acid.} \)

27. The inner liner according to claim 17, wherein the aliphatic polyhydroxyacrylic acid is a polyacrylic acid.

28. The inner liner according to claim 17, wherein the film has a total thickness of 20 to 100 \( \mu \text{m} \).

29. The inner liner according to claim 17, wherein the top layer has thickness of 0.5 to 6 \( \mu \text{m} \).

30. The inner liner according to claim 17, wherein the top layer is sealable.

31. A cigarette packaging which comprises the inner liner according to claim 17

32. The cigarette packaging as claimed in claim 31, wherein that cigarette packaging is a flip pack.

33. The cigarette packaging as claimed in claim 31, wherein that cigarette packaging is a soft packaging.

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