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(54) Title: MULTILAYER POLYESTER FILM FOR READY MEALS

(57) Abstract: Coextruded, biaxially oriented multilayer films comprising a base layer comprising a polyester having an intrinsic viscosity greater than 0.75 dl/g and a heat-sealable layer directly adhered to said base layer, said heat-sealable layer comprising an amorphous polyester having a melting temperature not higher than the melting temperature of the polyester of the base layer and a thermoplastic resin characterized in that the heat-sealable layer comprises a further polyester resin are described. Also packages comprising a container, a food product and the above coextruded, biaxially oriented multilayer film are described. The packages are particularly suitable for "ready-meals" to be used in conventional oven at high temperatures.

MULTILAYER POLYESTER FILM FOR READY MEALS

DESCRIPTION

Technical Field

[0001] The present invention relates to a coextruded, biaxially oriented, polyester film having a base layer and a heat-sealable layer useful for ready-meals packaging. The invention further relates to the use of the multilayer polyester film as a lidding film in food packaging operations.

Background Art

[0002] Biaxially oriented polyester films are commonly used as lidding films, in particular for ovenable containers. Packaging systems comprising a rigid heat stable container having a thin flexible thermoplastic film sealed on it are commonly used for the packaging of the so-called “ready-meals”, that is food products which only require heating to be ready for consumption. Ready-meals are suitable for heating in a conventional oven and/or in a microwave. Dual-ovenable ready-meal packages are suitable for both microwave and conventional ovens.

[0003] The film heat-sealed to the edge of the tray containing the ready-meal product seals the packaging and protects the ready-meal food from the external environment. The film can be removed from the tray shortly before heating or shortly after heating.

[0004] Sometimes, ready-meals packaging products undergo a heat treatment, such as sterilization or pasteurization, to increase their shelf-life.

[0005] Therefore, the films for ready meals should confer to the packaging good hermeticity and clean peelability also under high temperatures, and good resistance to heat treatments.

[0006] Various polyester films for ready-meals are known to confer hermeticity, peelability, and/or heat resistance.

[0007] EP1471096, EP1471097 and EP1475228 describe coextruded, heat-sealable and peelable polyester films having a base layer and a heat-sealable top

layer consisting of binary blends of a polyester and a polyester incompatible polymer.

[0008] EP 2 030 782 describes coextruded, heat-sealable and peelable polyester films having a base layer and a heat-sealable top layer consisting of ethylene-acrylate copolymer optionally in admixture with polyester. These films have good sealability but they are not suitable for dual-ovenable ready meal packaging products.

[0009] WO 2007/093495 describes coextruded, biaxially oriented heat-shrinkable films comprising a base layer comprising a polyester having an intrinsic viscosity greater than 0.75 dl/g and a first outer heat-sealable layer directly adhered to said base layer, said heat-sealable layer comprising an amorphous polyester or a crystalline polyester having a melting temperature not higher than the melting temperature of the polyester of the base layer. These films have good sealability and peelability and are particularly useful for ready meal packaging for their resistance to heat treatment, such as pasteurization or regeneration in microwave or conventional oven. However, when regeneration in conventional oven at high temperatures, generally higher than 140°C, is required, these films often show some drawbacks and the appearance of the packaging after such a drastic heat treatment is not acceptable.

[0010] We have now found that the problem of the resistance to high temperature treatments can be solved by including a further polyester in the composition of the heat-sealable layer.

Summary of invention

[0011] Therefore, a first object of the present invention is a coextruded, biaxially oriented multilayer film comprising a base layer comprising a polyester having an intrinsic viscosity greater than 0.75 dl/g and a heat-sealable layer directly adhered to said base layer, said heat-sealable layer comprising an amorphous polyester having a melting temperature not higher than the melting temperature of the polyester of the base layer and a thermoplastic resin characterized in that the heat-sealable layer comprises a further polyester resin.

[0012] The films object of the present invention are claimed in WO 2007/093495 but no specific examples or combinations of components including a film

comprising the mixture amorphous polyester/thermoplastic resin/further polyester resin according to the present invention is described or mentioned in the prior art document.

[0013] The films object of the present invention are particularly resistant to heat treatments at temperatures higher than 140°C and also show a better appearance (transparency and glossiness) compared with the already known films. These improved characteristics make them particularly suitable for the packaging of ready meals.

[0014] A further object of the present invention is a package comprising a container, preferably a tray, a food product, preferably a ready-meal product, and a lid formed of a coextruded, biaxially oriented, heat-sealable film comprising the mixture amorphous polyester/thermoplastic resin/further polyester resin sealed onto said container.

[0015] As used herein, the term "polyester" refers to both homo- and co-polyesters, wherein homo-polyester are defined as polymers obtained from the condensation of one dicarboxylic acid with one diol and co-polyesters are defined as polymers obtained from the condensation of one or more dicarboxylic acids with one or more diols.

[0016] The base layer of the film comprises a polyester having an intrinsic viscosity greater than 0.75 dl/g. Preferably, the base layer of the film comprises a polyester having an intrinsic viscosity of at least 0.80 dl/g.

[0017] As used herein, the intrinsic viscosity is defined as the limiting value of the reduced viscosity at infinite dilution of the polymer and is determined using a capillary viscometer. A suitable method for the determination of the intrinsic viscosity is for instance ASTM method D4603-03.

[0018] Examples of suitable polyesters are polyesters of ethylene glycol and terephthalic acid such poly(ethylene terephthalate) (PET). Preference is given to polyesters which contain ethylene units and include, based on the dicarboxylate units, at least 90 mol%, more preferably at least 95 mol%, of terephthalate units. The remaining monomer units are selected from other dicarboxylic acids or diols. Suitable other dicarboxylic acids are aromatic, cycloaliphatic and aliphatic dicarboxylic acids. Preferred examples of aromatic dicarboxylic acids are

isophthalic acid, phthalic acid, 2,5-, 2,6- or 2,7-naphthalenedicarboxylic acid. Preferred examples of cycloaliphatic dicarboxylic acids are cyclohexanedicarboxylic acids, in particular cyclohexane-1,4-dicarboxylic acid. Preferred examples of aliphatic dicarboxylic acids are C3-C19 alkanedioic acids, in particular succinic acid, sebacic acid, adipic acid, azelaic acid, suberic acid and pimelic acid.

[0019] Suitable other diols are aliphatic and cycloaliphatic diols. Specific examples of aliphatic diols are ethylene glycol, diethylene glycol, triethylene glycol, propylene glycol, 1,3-butane diol, 1,4-butane diol, 1,5-pentane diol, 2,2-dimethyl-1,3-propane diol, neopentyl glycol and 1,6-hexane diol. Specific examples of cycloaliphatic diols are 1,4-cyclohexanedimethanol and 1,4-cyclohexane diol, and optionally heteroatom-containing diols having one or more rings.

[0020] Mixtures or blends of homo- and/or co-polyesters can be used for the base layer provided that the polyester having an intrinsic viscosity greater than 0.75 dl/g represents the major proportion of the base layer. Preferably the base layer comprises at least 50%, 60%, 70%, 80%, 85%, 90% or 95% by weight of a polyester having an intrinsic viscosity greater than 0.75 dl/g, based on the total weight of the base layer. Preferably the polyester in the base layer is a PET having an intrinsic viscosity of at least 0.80 dl/g.

[0021] Any homo- and/or co-polyester can be blended with the polyester resin having an intrinsic viscosity greater than 0.75 dl/g. For example, the base layer can comprise at least 50%, 60%, 70%, 80%, 85%, 90% or 95% by weight of a polyester having an intrinsic viscosity greater than 0.75 dl/g and not more than 50%, 40%, 30%, 20%, 15% or 5% of an amorphous polyester resin.

[0022] Suitable amorphous polyester resins for use in the base layer are co-polyesters of terephthalic acid with an aliphatic diol and a cycloaliphatic diol, preferably ethylene glycol and 1,4-cyclohexanedimethanol. A specific example is PETG Eastar® 6763 sold by Eastman.

[0023] Particularly preferred base layer in the films object of the present invention comprise 60% of a polyester resin having an intrinsic viscosity greater than 0.75 dl/g and 40% of an amorphous polyester resin.

[0024] The characterizing feature of the multilayer film according to the present invention is the composition of the heat-sealable layer.

[0025] The heat-sealable layer comprises at least a first amorphous polyester resin, at least a thermoplastic resin and at least a further polyester resin. Said further polyester resin is different from the first amorphous polyester.

[0026] Suitable amorphous polyester resins are those deriving from an aliphatic diol and a cycloaliphatic diol with one or more dicarboxylic acids, preferably an aromatic dicarboxylic acid. Preferred amorphous polyesters are co-polyesters of terephthalic acid with an aliphatic diol and a cycloaliphatic diol, particularly ethylene glycol and 1,4-dicyclohexanedimethanol. The preferred molar ratios of the cycloaliphatic diol to the aliphatic diol are in the range from 10:90 to 60:40, preferably in the range from 20:80 to 40:60, more preferably from 30:70 to 35:65. A specific example of particularly preferred amorphous polyester is PETG Eastar® 6763, sold by Eastman, which comprises a co-polyester of terephthalic acid, about 33 mole % 1,4-cyclohexanedimethanol and about 67 mole % ethylene glycol.

[0027] In a particularly preferred embodiment, the amorphous polyester resin in the heat-sealable layer is the same polyester resin used in the base layer.

[0028] Suitable further polyesters are those deriving from one or more aliphatic diols, preferably ethylene glycol and / or cyclohexandimethanols, and an aromatic dicarboxylic acid, preferably terephthalic acid. Suitable further polyesters are preferably characterized by an intrinsic viscosity of at least 0.75 dl/g or higher and / or by a glass transition temperature Tg not higher than 80°C and/or a melting point higher than 240°C. A suitable method for the determination of the intrinsic viscosity is for instance ASTM method D4603-03. A suitable method for the determination of the glass transition temperature is for instance ASTM method D-3418. A suitable method for the determination of the melting point is for instance ASTM method D3418.

[0029] Polyethylene terephthalate (PET) is preferred. A specific example of PET is Eastapak Copolyester 9921, sold by Eastman.

[0030] Suitable thermoplastic resins are polyamides, polystyrenes, in particular styrene-butadiene block copolymers, ionomers, ethylene/unsaturated carboxylic acid copolymers, such as ethylene/(meth)acrylic acid copolymers,

ethylene/unsaturated esters copolymers, such as ethylene/vinyl acetate copolymers, ethylene/propylene copolymers and ethylene/cyclic olefin copolymers, such as ethylene/norbornene copolymers. Ethylene/(meth)acrylic acid copolymers are preferred. A specific example of particularly preferred thermoplastic resin is Primacor 3440, sold by Dow, which is an ethylene/acrylic acid copolymer with a co-monomer content acrylic acid 9.7%.

[0031] The amount of the first amorphous polyester in the heat-sealable layer of the multilayer film according to the present invention is generally from 25% to 70% by weight with respect to the total weight of the heat-sealable layer, preferably from 40 to 60% by weight. Specific preferred amounts are about 40%, and about 60% by weight.

[0032] The amount of the further polyester in the heat-sealable layer of the multilayer film according to the present invention is generally from 20% to 60% by weight with respect to the total weight of the heat-sealable layer, preferably from 25 to 50%. Specific preferred amounts are about 25%, about 45%, and about 60% by weight.

[0033] The amount of thermoplastic resin in the heat-sealable layer of the multilayer film according to the present invention is generally from 10% to 20% by weight with respect to the total weight of the heat-sealable layer, preferably about 15% by weight.

[0034] In a preferred embodiment the heat-sealable layer of the multilayer film of the present invention comprises from about 25 to 70% by weight of the amorphous polyester, from 10 to 20 % by weight of the thermoplastic resin and from 20% to 60% by weight of the further polyester.

[0035] In a particularly preferred embodiment the heat sealable layer of the multilayer film of the present invention comprises from about 40 to 60% by weight of the first amorphous polyester, from 25 to 50% by weight of the further polyester and from 10 to 20 % by weight of the thermoplastic resin

[0036] Preferably said amorphous polyester is selected among those deriving from an aliphatic diol and a cycloaliphatic diol with one dicarboxylic aromatic acid, more preferably with terephthalic acid.

[0037] Specific examples of the blends of at least an amorphous polyester, at least a thermoplastic resin and at least a further polyester in the heat-sealable layer of the multilayer film according to the present invention are:

[0038] first amorphous polyester – 60% w/w thermoplastic resin – 15% w/w further polyester – 25% w/w

[0039] first amorphous polyester – 40% w/w thermoplastic resin – 15% w/w further polyester – 45% w/w

[0040] first amorphous polyester –25% w/w thermoplastic resin – 15% w/w further polyester – 60% w/w

[0041] The total thickness of the multilayer film according to the present invention can range within wide limits, generally from 3 to 100 μm, in particular from 5 to 80 μm, preferably from 10 to 70 μm, still more preferably from 15 to 50 μm. The thickness of the base layer represents at least 50%, preferably from 50 to 80% of the overall thickness of the final multilayer polyester film according to the present invention.

[0042] The thickness of the heat-sealable layer is generally between about 5% and about 40% of the base layer. The heat-sealable layer can have a thickness up to about 25 μm, preferably up to about 15 μm, more preferably between about 0.5 μm and 10 μm, and more preferably between about 0.5 μm and 7 μm.

[0043] In a preferred embodiment, the film of the present invention has a three-layer structure: a base layer, a heat-sealable layer and an outer layer on the opposite side of the base layer to the heat-sealable layer.

[0044] The outer layer can comprise any suitable thermoplastic resin, although a polyester resin in preferred. The polyester resin can be the same as the polyester resin of the base layer or a different one.

[0045] From a practical point of view the use of the same polyester resin in the base layer and in the outer layer is preferred.

[0046] One or more of the layers of the film according to the present invention can optionally contain one or more additives conventionally used in the manufacture of polymeric films. Examples of such additives are anti-fogs, pigments, lubricants, anti-oxidants, radical scavengers, UV absorbers, thermal stabilizers, anti-blocking

agents, surface active agents, slip aids, optical brighteners, gloss improvers, viscosity modifiers, etc.

[0047] In a preferred embodiment of the present invention slip and/or anti-blocking agents can be added to the outer layer. The additives can be added in the form of a concentrate in a polyester resin. The amount of the additives is generally from 0.2 to 5% by weight, preferably about 2%, of the total weight of the layer.

[0048] The film of the present invention preferably comprises at least one surface provided with anti-fogging properties. Typically, the anti-fogging surface is the surface of the heat-sealable layer, that is the surface directly facing the product in the container.

[0049] To obtain an anti-fogging surface anti-fogging agents may be compounded directly into the resins of the heat-sealable layer before extrusion of the film of the invention. Suitable anti-fogging agents are for instance non-ionic fluorinated surfactants, like alkylester fluorides, perfluoroalkyl ethyleneoxides, anionic fluorinated surfactants, like quaternary ammonium salt of perfluoroalkyl sulfonates, non-ionic surfactants like polyhydric alcohol fatty acid esters, higher fatty acid amines, higher fatty acid amides, and ethylene oxide adducts of higher fatty acid esters, amines or amides and the like, polyoxyethylene ether of a fatty alcohol, glycerol fatty acid ester, preferably polyhydric alcohol fatty acid ester and their ethoxylated derivatives, more preferably ethoxylated sorbitan derivatives with higher fatty acids such as those marketed under the trade name of Tweens or Polysorbates, preferably with fatty acids from C14 to C24, in particular ethoxylated sorbitan monooleate marketed as Tween 80. The amount of anti-fogging agent added to the heat-sealable layer is generally from 0.5 to 8%, from 1 to 5%, from 1 to 3%, preferably from 0.5% to 2.5% by weight of the heat-sealable layer.

[0050] Alternatively, the anti-fogging agent may be in the form of a coating applied onto the heat-sealable outer layer. Conventional techniques can be used for the application of the anti-fogging agent to the heat-sealable layer, like gravure coating, reverse kiss coating, fountain bar coating, spraying.

[0051] The application of the anti-fogging agent may be carried out either by an in-line method involving application during the manufacture of the heat-shrinkable

polyester film or by an off-line coating method involving application after the manufacture of the heat-shrinkable polyester film.

[0052] Suitable anti-fogging agents for this application are non-ionic surfactants like polyhydric alcohol fatty acid esters, higher fatty acid amines, higher fatty acid amides, polyoxyethylene ethers of higher fatty alcohols, and ethylene oxide adducts of higher fatty acid esters, amines or amides. Among these, polyhydric alcohol fatty acid esters and their polyethoxylated derivatives, polyoxyethylene ethers of higher fatty alcohols and glycerin fatty acid esters are preferred, ethoxylated sorbitan derivatives with higher fatty acids such as those marketed under the trade name of Tweens or Polysorbates, preferably with fatty acids from C14 to C24, are more preferred, in particular ethoxylated sorbitan monooleate marketed as Tween 80 is even more preferred.The amount of the anti-fogging agent coating is not particular limited, but it may be 0.1 to 8 ml/m^2, 0.5 to 7 ml/m^2, 0.5 to 5 ml/m^2.

[0053] The multilayer film according to the present invention can be prepared according to known process for the preparation of biaxially oriented films, in particular according to the processes described in the already mentioned WO 2007/093495.

[0054] In a preferred practical embodiment, a three-layer film according to the present invention can be manufactured on tenterframe LISIM® line, according to the following methodology and conditions.

[0055] The three layers are coextruded through a three-layer feedblock and then distributed through a flat die, typically having a multimanifold system. The melt out of the die is quenched onto a chill roll; electrostatic pinning is used to favour the intimate contact between melt and chill roll. The so formed cast is then biaxially oriented. The stretching is done sequentially, first in machine direction (MD) and then in transverse direction (TD), or simultaneously, preferably simultaneously, at ratios of at least 3:1 in both MD and TD, and at temperature from 90°C to 106°C, preferably from 95°C to 100°C (preheating zones) and from 88°C to 104°C, preferably from 92°C to 100°C (stretching zones). Before oven exit, the film is generally annealed at temperature from 160°C to 230°C, according to the shrink

level required. The bioriented film is finally cooled, edge trimmed and wound into mill logs.

[0056] Typically the films of the present invention have no or negligible shrink (lower than 10%) at temperatures below 140°C.

[0057] The invention further provides a package comprising a container, a product placed in the container and a lid formed from the coextruded biaxially oriented polyester film of the invention sealed onto the container.

[0058] Typically the surface of the container in contact with the product, i.e. the surface involved in the formation of the seal with the lidding film, comprises a polyester resin. For instance the container can be made of a cardboard coated with a polyester or it can be integrally made of a polyester resin. Examples of suitable containers for the package of the invention are CPET, APET or APET/CPET containers. Such container can be either foamed or not-foamed.

[0059] The package is produces by techniques well-known to those skilled in the art. Once the food to be packaged has been introduced into the container, the multilayer film according to the present invention is sealed onto the container by means of temperature and/or pressure using conventional techniques and equipment. The film is placed on the container such that the heat-sealable layer is in contact with the surface of the container and the base layer or the optional outer layer is the outermost surface of the film. Sealing is generally carried out by means of a heated frame at temperatures of from 140°C to 200°C at a pressure from 2 bar to 10 bar. Sealing times are generally in the order of 0.3-2.0 seconds. The heat generated by the sealing frame, regardless of the short sealing times, promotes the shrinkage of the films in both directions without distortion of the container to give a taut hermetically sealed lid.

[0060] The package is particularly suitable for ready prepared foods (ready meals) which are warmed in a microwave or in a conventional oven. The peculiar characteristics of the multilayer film according to the present invention make the packages sealed with it particularly suitable for heat treatment at high temperatures, generally higher than 140°C, in conventional oven. The multilayer film according to the present invention allows to achieve heat resistance together

with good hermeticity and clean peelability of the package significantly improved in comparison with the known packages.

[0061] The present invention will be now illustrated by some examples without limiting it.

[0062] The following multilayer films were prepared (percentage w/w):

Table 1

Film	Heat-sealable layer		Base layer		Outer layer	
A*	PETG	85%	CoPolyEst	60%	CoPolyEst	98%
(33 µm)	EAA	15%	PETG	40%	MB1	2%
	(4.5 µm)		(22.0 µm)		(6.5 µm)	
B*	PETG	85%	CoPolyEst	60%	CoPolyEst	98%
(17.5 µm)	EAA	15%	PETG	40%	MB1	2%
	(2.0 µm)		(13.5 µm)		(2.0 µm)	
C*	CoPolyEst	85%	CoPolyEst	60%	CoPolyEst	98%
(33 µm)	EAA	15%	PETG	40%	MB1	2%
	(4.5 µm)		(22.0 µm)		(6.5 µm)	
I	CoPolyEst	25%	CoPolyEst	60%	CoPolyEst	98%
(33 µm)	PETG	60%	PETG	40%	MB1	2%
	EAA	15%				
	(4.5 µm)		(22.0 µm)		(6.5 µm)	
II	CoPolyEst	25%	CoPolyEst	60%	CoPolyEst	98%
(22.5 µm)	PETG	60%	PETG	40%	MB1	2%
	EAA	15%				
	(2.6 µm)		(17.3 µm)		(2.6 µm)	
III	CoPolyEst	25%	CoPolyEst	60%	CoPolyEst	98%
(17.5 µm)	PETG	60%	PETG	40%	MB1	2%
	EAA	15%				
	(2.0 µm)		(13.5 µm)		(2.0 µm)	
IV	CoPolyEst	45%	CoPolyEst	60%	CoPolyEst	98%
(33 µm)	PETG	40%	PETG	40%	MB1	2%
	EAA	15%				
	(4.5 µm)		(22.0 µm)		(6.5 µm)	
V	CoPolyEst	45%	CoPolyEst	60%	CoPolyEst	98%
(22.5 µm)	PETG	40%	PETG	40%	MB1	2%

	EAA (2.6 µm)	15%		(17.3 µm)		(2.6 µm)
VI (33 µm)	CoPolyEst PETG EAA (2.5 µm)	25% 60% 15%	CoPolyEst2 PETG (24 µm)	60% 40%	CoPolyEst2 MB1 (6.5 µm)	98% 2%
VII (33 µm)	CoPolyEst PETG EAA (4.5 µm)	65% 20% 15%	CoPolyEst PETG (22.0 µm)	60% 40%	CoPolyEst MB1 (6.5 µm)	98% 2%
VIII (22.5 µm)	CoPolyEst PETG EAA (2.6 µm)	65% 20% 15%	CoPolyEst PETG (17.3 µm)	60% 40%	CoPolyEst MB1 (2.6 µm)	98% 2%

[0063] PETG (first amorphous polyester) Polyethylene Terephthalate/Glycol Eastman EASTAR PETG 6763, Density 1.27 g/cm3, Glass Transition 81°C Melt Flow Rate 200°C/05.00 kg, 2.8 g/10 min Viscosity Solution 0.75 mPA.sec

[0064] CoPolyEst (further polyester) Copolyester Eastman Chemical EASTAPAK COPOLYESTER 9921 Density 1.4000 g/cm3 Melting point 255.0°C

[0065] EAA (thermoplastic resin) Ethylene/Acrylic Acid Copolymer PRIMACOR 3440 Dow Co-monomer content Acrylic Acid 9.7%, Density 0.938 g/cm3, Melt Flow Rate 190°C/02.16 kg 10 g/10 min, Vicar softening point 76°C

[0066] CoPolyEst 2 Polyethylene Terephthalate/Glycol Indorama RAMAPET N180 Bulk Density 0.817 g/cm3, Density 1.4 g/cm3, Viscosity Solution 0.80 mPA.sec

[0067] MB1 Masterbatch AntiBlock and Slip in Polyethylene Terephthalate/Glycol Amorphous Silica and Ester Wax SUKANO G dc S503 Sukano; Additives SiO2 6 %, Additives Wax 10% Apparent density 1.2 g/cm3, Bulk (Apparent) Density 0.8 g/cm3 Moisture Content 0.5% Vicat softening point 82°C

[0068] The performance at cooking in conventional oven for the ready meals packages sealed with the comparative films (A-C and VII-VIII) and with the films according to the present invention (I-VI) was evaluated as follows.

[0069] Each package was prepared by filling an ovenable foam tray with food surrogate up to 0.7 mm from the edge and sealing with the multilayer film to be tested:

[0070] - sealing temperature: 200°C

[0071] - sealing time: 0.5 seconds

[0072] - vacuum/gas: 0.450/0.570 bar

[0073] The trays were put closed in the conventional oven pre-heated at the test temperatures (180°C or 200°C) and kept inside the oven for 20 minutes after the temperature of the oven reached again the test value.

[0074] The trays were taken out of the oven and the following parameters were evaluated: by visual check:

[0075] - hermeticity (leaker rate <0.5% very good; 0.5-1.5% good; 1.5-3% acceptable; >3% not acceptable)

[0076] - tray appearance (deformation <0.5% very good; 0.5-1.5% good; 1.5-3% acceptable; >3% not acceptable)

[0077] - top lid appearance: very good (the lid appeared as it was originally), good (only a minor difference was present), acceptable (minor curling but peel tab graspable), not acceptable (brittle peel tab or not visible, burns, etc.)

[0078] - peelability after 1-2 minutes after removal from the oven: very good (easy and clean peel), good (easy and clean peel but some strength required), acceptable (easy and clean peel but minor fringes or tear), not acceptable (presence of tearing, delamination or fringes), n.d. not detectable (package open)

[0079] In addition free shrinks values at 140°C and 160°C were measured according to ASTM D2732 while the haze of each film was evaluated, according to ASTM D1003, to check the optical characteristics.

[0080] The results are reported in the following table.

Table 2

	Shrink % 140° C	Shrink % 160° C	Haze %	Hermeticity	Tray appearance	Top lid appearance	Peelability
A	5.5	12.0	26.0	Not acceptable	Good	Not acceptable	n.d.

						(shrunk)	
B	6.5	12.0	12.0	Not acceptable	Good	Not acceptable (shrunk)	n.d.
C	1.5	4.0	12.0	Not acceptable	Acceptable	Acceptable	Not acceptable (welded, does not open)
I	4	10.5	5.5	Very good	Good	Good	Acceptable
II	3.5	9.0	5.0	Very good	Good	Good	Good
III	2.5	7.5	5.0	Good	Acceptable	Good	Good
IV	3.0	7.5	6.0	Acceptable	Acceptable	Acceptable	Acceptable
V	4.0	10.0	4.5	Acceptable	Acceptable	Acceptable	Acceptable
VI	3	9	9	Good	Good	Good	Very good
VII	3.5	8.5	8.5	Good	Acceptable	Acceptable	Not acceptable
VIII	3.0	8.0	6.0	Good	Acceptable	Acceptable	Not acceptable

[0081] The multilayer films according to the present invention (I-VI) show resistance at high temperatures, good hermeticity, clean peelability and improved optics in comparison with the known films. Films VII and VIII do not show a satisfactory peelability.

CLAIMS

1. A coextruded, biaxially oriented multilayer film comprising a base layer comprising a polyester having an intrinsic viscosity measured according to ASTM method D4603-03 greater than 0.75 dl/g and a heat-sealable layer directly adhered to said base layer, said heat-sealable layer comprising

- from about 25% to 70% by weight of an amorphous polyester having a melting temperature not higher than the melting temperature of the polyester of the base layer, wherein said amorphous polyester is selected among those deriving from an aliphatic diol and a cycloaliphatic diol with one or more dicarboxylic acids,
- from 10% to 20 % by weight of a thermoplastic resin and
- from 20% to 60% by weight of a further polyester.

2. A film according to claim 1 wherein the amorphous polyester in the heat-sealable layer is selected among those deriving from an aliphatic diol and a cycloaliphatic diol with an aromatic dicarboxylic acid.

3. A film according to claim 2 wherein the amorphous polyester is a co-polyester of terephthalic acid with an aliphatic diol and a cycloaliphatic diol, particularly ethylene glycol and 1,4-dicyclohexanedimethanol.

4. A film according to claim 1 wherein the amorphous polyester resin in the heat-sealable layer is the same polyester resin used in the base layer.

5. A film according to claim 1 wherein the further polyester resin is selected among those deriving from one or more aliphatic diols, preferably selected from ethylene glycol and cyclohexandimethanols, and an aromatic dicarboxylic acid, preferably terephthalic acid.

6. A film according to claim 5 wherein the further polyester resin is polyethylene terephthalate.

7. A film according to claim 1 wherein the thermoplastic resins is selected among polyamides, polystyrenes, in particular styrene-butadiene block copolymers, ionomers, ethylene/unsaturated carboxylic acid copolymers, such as ethylene/(meth)acrylic acid copolymers, ethylene/unsaturated esters copolymers,

such as ethylene/vinyl acetate copolymers, ethylene/propylene copolymers and ethylene/cyclic olefin copolymers, such as ethylene/norbornene copolymers.

8. A film according to claim 7 wherein the thermoplastic resin is an ethylene/(meth)acrylic acid copolymer.

9. A film according to any preceding claims wherein in the heat-sealable layer of the multilayer film the amount of the first amorphous polyester is generally from 40 to 60 % by weight, the amount of the further polyester is generally from 25 to 50% by weight and the amount of thermoplastic resin is about 15% by weight, with respect to the total weight of the heat-sealable layer.

10. A film according to any preceding claims wherein the heat-sealable layer of the multilayer film further comprises an anti-fog agent.

11. A film according to any preceding claims wherein the heat-sealable layer of the multilayer film is coated with an anti-fog agent.

12. A film according to claims 10 or 11 wherein said anti-fog agent is a non-ionic surfactant, preferably a polyhydric alcohol fatty acid ester and its ethoxylated derivatives, more preferably an ethoxylated sorbitan ester with higher fatty acids.

13. A film according to any preceding claims comprising an outer layer on the opposite side of the base layer to the heat-sealable layer.

14. A package comprising a container, a food product, and a lid formed of a coextruded, biaxially oriented, heat-sealable film according to claims 1 to 13 sealed onto said container.

15. The package according to claim 14 for use in conventional oven at temperatures higher than 140°C.

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2012/059723

A. CLASSIFICATION OF SUBJECT MATTER
INV. B32B27/08 B32B27/36
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
B32B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 1 475 228 A2 (MITSUBISHI POLYESTER FILM GMBH [DE]) 10 November 2004 (2004-11-10) cited in the application paragraphs [0001] - [0140]; claims 1-24	1-15
X	EP 1 471 097 A1 (MITSUBISHI POLYESTER FILM GMBH [DE]) 27 October 2004 (2004-10-27) cited in the application paragraphs [0001] - [0136]; claims 1-24	1-15
X	EP 1 471 096 A1 (MITSUBISHI POLYESTER FILM GMBH [DE]) 27 October 2004 (2004-10-27) cited in the application paragraphs [0001] - [0134]; claims 1-24	1-15

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[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
16 August 2012	24/08/2012

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Ansorge, Markus

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2012/059723

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 2007/093495 A1 (CRYOVAC INC [US]; FORLONI ROBERTO [IT]) 23 August 2007 (2007-08-23) cited in the application paragraphs [0001] - [0093]; claims 1-14 -----	1-15
A	EP 2 030 782 A1 (MITSUBISHI POLYESTER FILM GMBH [DE]) 4 March 2009 (2009-03-04) cited in the application paragraphs [0001] - [0080]; claims 1-10 -----	1-15

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
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