Appendix 3

Case 2

[Claims]

Appendix 3

[Claim 1]

A composite film comprising linear low-density polyethylene comprising;

a layer A comprising linear low-density polyethylene comprising 0.3 ~ 2.0wt% of inert particles each having 3 ~ 15μm of average particle size, wherein the density of the linear low-density polyethylene is defined to be 0.88 ~ 0.91g per cubic centimeter, wherein said linear low-density polyethylene has 1 ~ 3 of the ratio between the weight average molecular weight and the number average molecular weight; and

a layer B comprising linear low-density polyethylene comprising 0.3 ~ 1.5wt% of inert particles each having 2 ~ 7μm of average particle size, wherein the density of the linear low-density polyethylene is defined to be more than 0.905g per cubic centimeter, wherein said density is higher than that of said linear low-density polyethylene available for composing the above layer A.

[Claim 2]

A composite film comprising linear low-density polyethylene according to Claim 1, wherein the thickness ratio between said layers A and B is defined in a range from 0.01 up to 2.

[Claim 3]

A composite film comprising linear low-density polyethylene according to Claim 1 or 2, wherein said inert particles contained in said layer A comprise cross-linked organic high-polymers.

Appendix 3

Case 2

[Description]

Appendix 3

[Description]

COMPOSITE FILM COMPRISING LINEAR LOW-DENSITY POLYETHYLENE

[Technical Field]

[0001]

The present invention relates to a composite film comprising linear low-density polyethylene featuring excellent adhesion under low temperature and an anti-blocking effect as well as distinguished rigidity.

[Background Art]

[0002]

Due to handling convenience and satisfactory productivity, packaging of various commodities via automatic packaging machines has been applied to extensive fields. The packaging capability of modern automatic packaging machines has been enhanced with faster speed and higher efficiency in recent years. Reflecting this progress, there is an increasing demand for securing stable adhesion under low temperature. In terms of film products available for automatic packaging uses, polyethylene films have been used extensively. In particular, due to satisfactory adhesion under low temperature and shock-proof characteristics, non-elongated film made from linear low-density polyethylene is quite useful for packaging various commodities including foodstuff and beverages. However, in order to provide high adhesion under low temperature for the above non-elongated polyethylene film, it is required to use some resinous material having a low melting point. On the other hand, by using such a resinous material having a low melting point, the stability for forming a film and the rigidity required for the secondary production process are respectively lowered. In other words, the required adhesion under low temperature is contradictory to the required film-forming stability and the required rigidity for the secondary production process, and because of this, the above bilateral requirements have not yet been able to satisfy the growing demand prevailing in the market. Further, by using a resinous material having a low melting point, the film sliding characteristics is degraded, and as well, it causes a blocking phenomenon to be generated, thus further degrading the rigidity required for the secondary production process as well as degrading the opening characteristics of completed packages as a practical problem that still remains to be solved today.

[Summary of Invention]

[Technical Problem]

[0003]

Hence, the object of the present invention is to fully solve the above problems by providing a novel composite film comprising linear low-density polyethylene incorporating excellent adhesion under low temperature, with satisfactory anti-blocking characteristics, and stable rigidity.

[Solution to Problem]

[0004]

To fully achieve the above object, after following up on overall research, the inventors of the present invention eventually successfully achieved the present invention. More specifically, the present invention relates to a novel composite film comprising linear low-density polyethylene, wherein the inventive composite film comprises the following:

a layer A comprising linear low-density polyethylene having a density comprising 0.3 ~ 2.0wt% of inert particles each having 3 ~ 15µm of average particle size, wherein said density is defined to be 0.88 ~ 0.91g per cubic centimeter, wherein said linear low-density polyethylene has 1 ~ 3 of the ratio between the weight average molecular weight and the number average molecular weight; and

a layer B comprising linear low-density polyethylene having a density comprising 0.3 ~ 1.5wt% of inert particles each having 2 ~ 7µm of average particle size, wherein said density is defined to be more than 0.905g per cubic centimeter, wherein said density is higher than that of said linear low-density polyethylene available for composing the above layer A.

Preferably, the thickness ratio between layer A and layer B of the novel composite film comprising linear low-density polyethylene is defined in a range from 0.01 up to 2.

Specifically, the above-mentioned inert particles contained in layer A individually comprise cross-linked organic high-polymers.

[Advantageous Effects of Invention]

Appendix 3

[0005]

The composite film comprising linear low-density polyethylene embodied by the present invention is characterized by excellent transparency, stable adhesion under low temperature, excellent anti-blocking characteristics, and durable rigidity, and accordingly, the composite film can stably be applied to a bag forming process at a high forming rate under low temperature and is further compatible with secondary processes, and thereby, the inventive composite film is effectively applicable to practical uses such as automatic packaging or sealant, for example.

[Description of Embodiments]

[0006]

Insofar as the linear low-density polyethylene available for composing layer A of the inventive composite film has 0.88 ~ 0.91g per cubic centimeter of density and 1 ~ 3 of the ratio between the weight average molecular weight and the number average molecular weight, there is no specific restriction on the film composition. Desirably, the above density shall range from 0.885 up to 0.905g per cubic centimeter, more desirably, the practical density thereof shall be in a range from 0.890 up to 0.905g per cubic centimeter. If the above density were less than 0.88g per cubic centimeter, the anti-blocking characteristics would be lowered, and thus, this is not desirable. Conversely, if the density exceeds 0.91g per cubic centimeter, adhesion under low temperature will be degraded, and thus, this is also undesirable.

The ratio between the weight average molecular weight and the number average molecular weight constitutes a gauge for rating the distribution of molecular weight. Although it is ideal that the distribution of molecular weight per dispersion shall be rated to be 1, up to 3 of the distribution rate is allowable. It is desired that the distribution rate shall be less than 2.5, and further, less than 2.3 of the distribution rate is preferable. If the ratio between the weight average molecular weight and the number average molecular weight exceeds 3, resinous viscosity intensifies itself to cause the resin handling operation to become inconvenient and to also cause the anti blocking characteristics of the produced film to be degraded. Accordingly, improper resinous viscosity is not desirable.

[0007]

Insofar as the above-referred physical characteristics are satisfied, there is no restriction on the composition of the linear low-density polyethylene available for composing layer A. Normally, practically applicable copolymer ingredients include the following: α-olefin having 3 ~12 units for the carbon number, including for example, propylene, butene-1, pentene-1, hexane-1, octene-1, 4-methyl-pentene-1, decene-1, dodecene-1, or the like. Of these, since a quality film having excellent shock-proof characteristics can be secured, use of a copolymer combined with high-quality α-olefin having a carbon number more than that of hexane-1 is preferable.

[0008]

Although there is no specific restriction on the method of producing the linear low-density polyethylene available for composing layer A, it is preferred that a method of producing the inventive linear low-density polyethylene by applying a bis-cyclopentadienyl metallic compound such as synge-site catalyst including metallocene catalyst shall be introduced.

[0009]

In order to improve the extrusion molding characteristics of dissolved linear low-density polyethylene having a narrow distribution of molecular weight, it is also possible to adopt such a system for introducing long-chained divergence controlled by the length and the number.

[0010]

In order to produce the inventive linear low-density polyethylene available for composing layer A, it is allowable to solely apply the above-cited ingredients having specific physical characteristics within the above-defined range. Alternatively, it is also allowable to apply more than two kinds of the above ingredients in mixture such that the weighted average value can be held within the above-defined range. It is desired that the above-specified ingredients shall solely be used for composing the linear low-density polyethylene in particular. To embody the present invention, it is essential that layer A shall contain 0.3wt% ~ 2.0wt% of inert particles each having 3 ~ 15μm of average particle size. If the average particle size were less than 3μm, the sliding characteristics and anti-blocking characteristics would respectively be degraded, and thus, it is not desirable. Desirably, the average particle size shall range from 5μm up to 12μm. Conversely, if the average particle size exceeds 15μm, the external appearance of the inventive composite film will be degraded, and thus, this is also undesirable. Likewise, if the content of inert particles were less than 3wt%, the sliding characteristics and anti-blocking characteristics would be lowered, and thus, it is also undesirable. Conversely, if the content of inert particles exceeds 2wt%, the external appearance of the composite film will also be degraded, and thus, this is also undesirable. It is preferred that the content of inert particles shall range from 0.5wt% up to 1.5wt%. Available inert particles may be of one kind or plural kinds having different average particle sizes in combination with each other. Practically, it is a preferred aspect of the present invention to combine more than two kinds of inert particles having different average particle sizes. Further, available inert particles may be of an organic substance or an inorganic substance or a composite substance of these. Insofar as inorganic inert particles are insoluble and inert concerning the linear low-density polyethylene, there is no specific restriction on the kind. Concretely, applicable inorganic inert particles may comprise those metallic oxides including silica, alumina, zirconia, and titanium oxide, those composite oxides including kaolin, zeolite, cericide, and cepiolite, sulfuric acid including calcium sulfate, or barium sulfate, phosphate including calcium phosphide, or zirconium phosphide, and carbonate such as calcium carbonate. These inorganic inert particles may be of natural product or synthesized product. There is no restriction on the form of particles. In terms of the molecular composition of organic inert particles applied to the composite film of the present invention, insofar as the molecules are totally irresolvable at a temperature applied to the molding of the dissolved linear low-density polyethylene and insofar as the molecules are durably resistant to all of the applied temperature, there is no restriction on the molecular composition thereof. Available molecular composition may be generated via an additive polymerization or via a polycondensation process or a reactive additive polymerization process. Further, polymer available for composing the above inert particles may be devoid of cross-linkage or of cross-linked composition. However, from the standpoint of heat-resistant requirements, application of the cross-linked composition is recommended.

[0011]

Although there is no restriction on the method of converting polymer into fine particles, it is suggested that a method of directly converting polymer into fine particles in the way of polymerization via emulsion polymerization or suspension polymerization provides a favorable effect. When introducing this polymerization method, it is allowable to introduce such a means for copolymerizing a small amount of polarized monomer comprising a specific composition capable of providing a self-emulsifying property. To compose the cross-linked high-polymer particles, any of the following materials may be applied, which, for example, include copolymer comprising acrylic monomers such as acrylic acid, methacrylic acid, acrylic acid ester, and methacrylic acid ester, styrene monomer such as styrene, acrylic substitutive styrene, and any of those cross-linked monomers such as di-vinyl benzene, di-vinyl sulphone, ethylene glycol di-methacrylate, tri-methylol-propane-trimethyl-acrylate, penta-elystol-tetramethyl acrylate, or the like. Of the above-cited materials, it is particularly desired that a copolymer comprising an acrylic monomer and/or styrene monomer and a cross-linked monomer is used. Although the practical form of the above-cited inert particles is not specifically restricted, it is desired that a substantially spherical form or an elliptic form be used. Although it is possible to solely use inorganic inert particles or organic inert particles, for the sake of securing a proper balance between the appearance and the anti-blocking property, a combined use of organic and inorganic inert particles having different average particle sizes is particularly recommended as a preferred embodiment of the present invention. In terms of the linear low-density polyethylene available for composing layer B, insofar as the density exceeds 0.911g per cubic centimeter, there is no restriction on the density thereof. Desirably, the density shall be in a range from 0.915g up to 0.938g per cubic centimeter, more desirably in a range from 0.917g up to 0.930g per cubic centimeter. If the density were less than 0.911g per cubic centimeter, it would degrade the film rigidity, further degrading the compatibility with the secondary film process, and thus, it is by no means desirable.

[0012]

In terms of the linear low-density polyethylene available for composing layer B, there is no specific restriction on the method of forming said polyethylene insofar as the above-specified requirements are fully satisfied. Practically applicable copolymer ingredients include α-olefin normally having 3 ~ 12 of the carbon number, for example, propylene, butene-1, pentene-1, hexane-1, octene-1, 4-methyl-pentene -1, decene-1, dodecene-1, or the like. In order to secure shock-proof characteristics, it is desired that high-quality α-olefin having a carbon number greater than that of hexane-1 shall preferentially be used.

[0013]

In terms of the method for producing the linear low-density polyethylene available for composing layer B, there is no specific restriction on the applicable method. The objective polyethylene may be produced by applying the same method as was practiced for the production of the above-cited polyethylene available for composing layer A. For example, it may be produced by applying a Ziegler catalyst. For the sake of cost saving, it is desired that this method be used.

[0014]

In order to produce the linear low-density polyethylene available for composing layer B, any of the above copolymer ingredients having the above-defined characteristics may solely be used. Alternatively, more than 2 kinds of the above copolymer ingredients may be combined with each other such that weighted average value can reach the above-defined range.

[0015]

Distribution of molecular weight of the linear low-density polyethylene available for composing layer B is not specifically restricted. As was practiced for the linear low-density polyethylene available for layer A, it is allowable to apply the ratio 1~3 between the weight average molecular weight and the number average molecular weight. Alternatively, it is also allowable to apply more than 3 of the ratio between the weight average molecular weight and the number average molecular weight.

[0016]

In the present invention, the weight average molecular weight and the number average molecular weight were respectively measured by applying gel-permeation chromatography. To embody the present invention, it is essential that layer B shall contain 0.3wt% up to 1.5wt% of inert particles each having 2μm ~ 7μm of average particle size. If the average particle size were less than 2μm, the sliding characteristics and anti-blocking characteristics would respectively be lowered, and thus, this is not desirable. Conversely, if the average particle size exceeds 7μm, it will degrade the film appearance, and thus, this is also undesirable. It is desired that the average particle size shall be in a range from 3μm up to 6μm. If the content of inert particles were less than 0.3wt%, the sliding characteristics and anti-blocking characteristics would also be degraded, and thus, this is also undesirable. Conversely, if the content of inert particles exceeds 1.5wt%, it will degrade the film appearance, and thus, this is also undesirable. Preferably, the content of inert particles shall range from 0.5wt% up to 1wt%. The inert fine particles contained in layer A are preferably used as the suitable ones. To embody the present invention, it is recommended to apply those copolymer ingredients contained in layer A cited earlier, or otherwise, different kinds of copolymer ingredients may also be applied. Further, it is particularly desired that inert particles having a substantially spherical form shall be used for composing layer A.

[0017]

It is desired that the melt index of the linear low-density polyethylene for composing the above-cited layers A

Appendix 3

and B shall be in a range defined as 1 ~ 5g rated at 190℃ for 10 minutes, preferably in a range from 0.5 ~ 4g rated at 190℃ for 10 minutes. If the melt index were less than 0.1g rated at 190℃ for 10 minutes, the thermal adhesive strength would be saturated, and yet, molten resinous viscosity would be raised, and then, load applied to the motor of the extrusion machine would tend to increase. Conversely, if the melt index exceeds 5g rated at 190℃ for 10 minutes, thermal adhesive strength tends to be lowered.

[0018]

It is essential for the composite film embodied by the present invention that layer A and layer B are laminated. In order to provide proper thermal adhesion at low temperature, at least either of the outermost layers shall comprise layer A, desirably comprise a double-layer composition consisting of layer A and layer B, more desirably the inventive composite film shall comprise a triple-layer composition consisting of layer A, layer B, and layer A.

[0019]

It is possible to secure the composite film comprising linear low-density polyethylene related to the present invention by practicing a co-extrusion molding process. The composite film can be molded according to a normal molding method. For example, an inflation molding process using a circular die or a T-die molding process using a T-die is introduced. When applying the T-die molding process, it is desired that the draft rate shall be selected from any rate ranging from 1 to 10, whereas the resin temperature shall be selected from a range between 190℃ and 300℃.

[0020]

It is desired that the thickness ratio between layer A and layer B shall range from 0.01 up to 2, more desirably from 0.02 up to 1. In the case of a composite film comprising more than 3 layers, the thickness of layers A and B is calculated as an aggregated thickness. If the thickness ratio between layers A and B were less than 0.01, thermal adhesion at low temperature would tend to degrade. Conversely, if the above thickness ratio exceeds 2, the film rigidity tends to be lowered, causing the compatibility with the secondary process to be degraded.

[0021]

Although the total thickness of the composite film comprising linear low-density polyethylene of the present invention is not specifically restricted, normally, the total thickness shall range from 5μm up to 100μm, desirably in a range from 10μm up to 50μm.

[0022]

Further, due to excellent heat-resistant and tenacious properties, it is possible to use the inventive composite film comprising linear low-density polyethylene by laminating with a nylon film. It should be understood that the laminate comprising the inventive composite film and a nylon film also constitutes a scope of the present invention.

In this case, it is so arranged that at least either of the outermost layers of the laminate film shall essentially comprise the above-cited layer A. Although there is no specific restriction on the thickness of the film to be laminated with the inventive composite film comprising linear low-density polyethylene, normally, 5µm ~ 100µm of thickness is desired, more desirably the thickness of the laminate film shall range from 10µm up to 50µm.

[0023]

It is allowable for the inventive composite film comprising linear low-density polyethylene that any of the following additives such as a thermal stabilizer, an oxidation inhibitor, an anti-static agent, a clouding inhibitor, a neutralizer, a smoothing agent, a nucleus forming agent, a coloring agent, other additives, and inorganic fillers, may be combined therewith as required within a scope free from deteriorating essential objects of the present invention.

[0024]

[Examples]

By referring to practical examples, essentials of the present invention are further described below. It should be understood, however, that the practical scope of the present invention is not solely limited to the practical examples described hereinafter, but any modification of the essentials of the present invention within a scope free from deviation from said essentials is also included in the technical scope of the present invention. Measuring methods are described below.

[0025]

(1) Cloudy value

In accordance with the JIS-K6714 specification, cloudy values were measured by applying a haze tester J, a product of Toyo Seiki Co., Ltd.

(2) Anti-blocking characteristics

In accordance with the ASTM-D1893-67 specification, the anti-blocking characteristics were measured by facing the film layer A onto a measuring instrument.

(3) Dynamic frictional coefficient

In accordance with the JIS-K7215-1987 specification, the sliding property on the surfaces of layers A and B of the composite film were measured.

(4) Sealing startup temperature

Using a thermally sloping heat sealing machine manufactured by Toyo Seiki Co., Ltd., film layers A and B were thermally sealed by applying 1kg per square centimeter of pressure for one second. Next, strength of the sealed composite film was measured. In the case of an original film, the sealing startup temperature was measured at a temperature when the strength of the original film reached 500g per 15mm. In the case of a composite film laminated with a biaxially elongated nylon film having 15µm of thickness, the sealing startup temperature was measured when the above pressure reached 2kg per 15mm. The sealing startup temperature was measured by facing the surface of layer A onto a measuring instrument.

(5) The Young’s modulus

In accordance with the ASTM-D882 specification, Young’s modulus of the above composite film was measured.

(6) Bag forming speed

Using a filling and packaging machine, i.e. a half-fold three-directional filling machine, model KS324, a product of Komatsu Seisakusho, a packaging bag (50mm X 70mm) was filled with hot water heated at 80℃, which was then thermally sealed at 110℃ via a sealing bar. The sealed bag was then placed under 100kg of load. Next, bag forming speed was measured in a condition where the bag forming is possible without causing the bag to incur rupture or water leakage. Likewise, the bag forming speed was also measured against a laminate comprising the composite film and a biaxially elongated nylon film having 15μm of thickness, where the surface of the above layer B of the composite film was laminated with the above-cited nylon film.

[0026]

[Example 1]

Initially, in order to form layer A , linear low-density polyethylene copolymerized with octen-1 was produced by applying a metallocene catalyst, where the above polyethylene resinous material contained 0.05wt% of erucic acid amide and 0.3wt% of cross-linked polymethyl methacrylate particles each having 6μm and 10μm of average particle sizes, where the above polyethylene resinous material had density of 0.895g per cubic centimeter, 2.0 of the ratio between the weight average molecular weight and the number average molecular weight, and 2.0g of the melt index rated at 190℃ for 10 minutes. In order to form layer B, linear low-density polyethylene copolymerized with hexane-1 was produced by applying the Ziegler catalyst, where the above polyethylene resinous material contained 0.05wt% of erucic acid amide and 0.80wt% of spherical silica particles each having 4μm of average particle size, where the above polyethylene resinous material had 0.921g per cubic centimeter of density, 3.5 of the ratio between the weight average molecular weight and the number average molecular weight, and 2.0g of the melt index rated at 190℃ for 10 minutes. The former and the latter polyethylene resinous materials were respectively dissolved and extruded via discretely disposed extruding machines. Next, the dissolved materials were respectively fed to multi- manifold multi-layer T-dies, which were then jointly extruded at 260℃, and then cooled down via a chilling roll. The cooled polyethylene resinous materials were eventually formed into a novel composite film comprising linear low-density polyethylene, which was composed of the above layers A and B having a thickness ratio rated to be 5μm and 35μm, respectively.

[0027]

[Example 2]

Except for the density of the resinous material available for layer A defined at 0.902g per cubic centimeter, the density of the resinous material available for layer B defined at 0.924g per cubic centimeter, the melt index of the above materials available for layers A and B defined at 3.0, and the thickness ratio between layers A and B defined to be 10μm and 30μm, respectively adopted for the preceding example 1, a novel composite film was produced via those serial processes as implemented for the preceding example 1.

[0028]

[Example 3]

Except for the density of the resinous material available for layer A defined at 0.886g per cubic centimeter, the ratio between the weight average molecular weight and the number weight molecular weight defined at 2.0 applied to the resinous material available for layer B, the melt index of the resinous materials available for the layers A and B defined at 2.5, and the thickness ratio between the layers A and B defined to be 3μm and 37μm, respectively adopted for example 1, a novel composite film was produced via those serial processes as implemented for the above example 1.

[0029]

[Example 4]

Except for the process executed for implementing example 1, in which 0.3wt% of spherical zeolites having 4μm of average particle size and 0.5wt% of cross-linked polymethylmethacrylate particles having 8μm of average particle size were respectively added to inert particles present in the resinous material available for composing layer A, a novel composite film was produced via those serial processes as implemented for the above example 1.

[0030]

Comparative Example 1

Except for the introduction of linear low-density polyethylene copolymerized with octen-1 otherwise available for composing layer A, identical linear low-density polyethylene copolymerized with octen-1 was applied to the composition of layer B adopted for the above example 1, a composite film was produced via those serial processes as implemented for the above example 1.

[0031]

Comparative Example 2

Except for the introduction of linear low-density polyethylene copolymerized with hexane-1 otherwise available for composing layer B, identical linear low-density polyethylene copolymerized with hexane-1 was applied to the composition of layer A adopted for the above example 1, a composite film was produced via those serial processes as implemented for the above example 1.

[0032]

Comparative Example 3

Except for the application of linear low-density polyethylene copolymerized with octen-1 having a broad distribution of molecular weight rated at 3.5 of the ratio between the weight average molecular weight and the number average molecular weight as resinous material for composing layer A, respectively adopted for the above example 1, a composite film was produced via those serial processes as implemented for the above example 1.

[0033]

Comparative Example 4

Except for the density of resinous material arranged at 0.912g per cubic centimeter adopted for example 1, a composite film was produced via those serial processes as implemented for the above example 1.

[0034]

Comparative Example 5

Except for the re-arrangement of the density of resinous material for layer A to be 0.870g per cubic centimeter, the ratio between the weight average molecular weight and the number average molecular weight to be 2.3, the melt index thereof to be 3.0g rated at 190℃ for 10 minutes, the density of resinous material for layer B to be 0.924g per cubic centimeter, and the melt index thereof to be 3.0g rated at 190℃ for 10 minutes, respectively adopted for the above example 1, a composite film was produced via those serial processes as implemented for the above example 1.

[0035]

Comparative Example 6

Except for the introduction of cross-linked polymethyl-methacrylate particles having 6μm and 10μm of average particle sizes to be added to the resinous material available for composing layer A by 0.1wt%, respectively adopted for the above example 1, a composite film was produced via those serial processes as implemented for the above example 1.

[0036]

Comparative Example 7

Except for the introduction of cross-linked polymethyl-methacrylate particles having 6μm and 10μm of average particle sizes to be added to the resinous material available for composing layer A by 1.5wt%, respectively adopted for the above example 1, a composite film was produced as implemented for the above example 1.

[0037]

Comparative Example 8

Except for changing the amount of inert cross-linked polymethyl- methacrylate particles having 2μm of average particle size to be added to resinous material for composing layer A into 0.6wt% adopted for the above example 1, a composite film was produced as implemented for the above example 1.

[0038]

Comparative Example 9

Except for changing the amount of inert cross-linked polymethyl- metacrylate particles having 18μm of average particle size to be added to resinous material for composing layer A into 0.6wt% adopted for the above example 1, a composite film was produced as implemented for the above example 1.

[0039]

Comparative Example 10

Except for changing the amount of spherical silica to be added to resinous material for composing layer B into 0.2wt% adopted for the above example 1, a composite film was produced as implemented for the above example 1.

[0040]

Comparative Example 11

Except for changing the amount of spherical silica to be added to resinous material for composing layer B into 2.0wt% adopted for the above example 1, a composite film was produced as implemented for the above example 1.

[0041]

Comparative Example 12

Except for changing the amount of spherical silica to be added to resinous material for composing layer B into 1.5wt% adopted for the above example 1, a composite film was produced as implemented for the above example 1.

[0042]

Comparative Example 13

Except for changing the amount of spherical silica to be added to resinous material for composing layer B into 10wt% adopted for the above example 1, a composite film was produced as implemented for the above example 1.

[0043]

Appendix 3

After completing experimental production of composite films (original films) and the laminated film products comprising the original films adhered with biaxially elongated nylon films produced via the above-cited practical examples 1 ~ 4 and comparative examples 1 ~ 13, cloudy values, the anti-blocking property, Young’s modulus, the sealing startup temperature, and the bag forming speed, were respectively measured. The results are shown in Table 1. The laminated film products individually comprise a laminate film produced by laminating the surface of layer B of the original film with a biaxially elongated nylon film. The composite films comprising linear low-density polyethylene produced via the above practical examples 1 ~ 4 respectively proved to be satisfactory in terms of the appearance and adhesion under low temperature. Further, these inventive composite films proved to be compatible with a bag forming process at a fast rate under low temperature, and yet, excellent in the anti-blocking property and also in the rigidity, and further compatible with the secondary processes, thereby proving to be extremely compatible with practical uses for producing automatic packaging films or sealants. In terms of the composite films produced via the comparative example 1, despite their satisfactory adhesion under low temperature and the anti-blocking property, they proved to still be insufficient in the rigidity and sliding characteristics, thereby proving to be inferior to the ones produced via the practical examples in terms of the secondary processing compatibility. In consequence, they proved to be of low quality for application to the automatic packaging film or the sealant. Next, in terms of the composite films produced via the comparative example 2, despite their satisfactory rigidity and anti-blocking property, they proved to have generated a high temperature at the sealing startup point. Further, they proved to be inferior to the ones produced via the practical examples in terms of the adhesion under low temperature, and yet, being slow in the bag forming rate under low temperature, and further proved to be of low quality for application to the automatic packaging film or the sealant. The original film produced via the comparative example 3 proved to be extremely poor in the anti-blocking property and sliding characteristics, thereby causing a blocking action between rolled films to prevent films from being rewound smoothly. Hence, the original film produced via the comparative example 3 was evaluated to be unacceptable for practical uses. The composite films produced via the comparative example 4 proved to have generated a high temperature at the sealing startup point, and yet, they proved to be inferior in the adhesion under low temperature, and further proved to be slow in the bag forming rate at low temperature, thereby they proved to be of low quality for application to the automatic packaging film or the sealant. Like the one produced via the comparative example 3, the composite films produced via the comparative example 5 proved to be extremely poor in the anti-blocking property and sliding characteristics, and thus, they were evaluated to be unacceptable for practical uses. Likewise, the composite film produced via the comparative example 6 proved to be poor in the anti-blocking property and sliding characteristics, thereby evaluated to be unacceptable for practical uses. The composite films produced via the comparative example 7 proved to be satisfactory in terms of the adhesion under low temperature and the anti-blocking property. However, due to a high cloudy value and insufficient transparency, they were also evaluated to be unacceptable for practical uses. In terms of the composite films produced via the comparative example 8, despite satisfactory appearance and the adhesion under low temperature, they also proved to be insufficient in the anti-blocking property and sliding characteristics, thereby they were also evaluated to be unacceptable for practical uses. The composite films produced via the comparative example 9 proved to be of high cloudy value and insufficient in the transparency, thereby they were also rejected from practical uses. In terms of the composite films produced via the comparative example 10, despite satisfactory appearance, satisfactory adhesion under low temperature, and satisfactory anti-blocking property, due to poor sliding characteristics, they were evaluated to be unsuitable for the secondary processes. The composite films produced via the comparative example 11 proved to be of high cloudy value

Appendix 3

and insufficient in the transparency, thereby they were also rejected from practical uses. Like the one produced via the comparative example 10, the composite film produced via the comparative example 12 proved to be poor in the sliding characteristics and incompatible with the secondary processes. Like the one produced via the comparative example 11, the composite films produced via the comparative example 13 proved to be of high cloudy value and poor in the transparency, and thus, they were also evaluated to be unacceptable for practical uses.

Appendix 3

[0044]

[Table 1]

		Example				Comparative Example												
		1	2	3	4	1	2	3	4	5	6	7	8	9	10	11	12	13
Resinous material for composing layer A	Density (g/cm^3)	0.895	0.902	0.886	0.895	0.895	0.921	0.895	0.912	0.870	0.895	0.895	0.895	0.895	0.895	0.895	0.895	0.895
	Mw/Mn*	2.0	2.0	2.0	2.0	2.0	3.5	3.5	2.0	2.3	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
	Melt index (190°C) (g/min)	2.0	3.0	2.5	2.0	2.0	2.0	2.0	2.0	3.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Resinous material for composing layer B	Density (g/cm^3)	0.921	0.924	0.921	0.921	0.895	0.921	0.921	0.921	0.924	0.921	0.921	0.921	0.921	0.921	0.921	0.921	0.921
	Mw/Mn*	3.5	3.5	2.0	3.5	2.0	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
	Melt index (190°C) (g/min)	2.0	3.0	2.5	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Thickness ratio between layers A and B		0.143	0.333	0.081	0.143	.0.143	0.143	0.143	0.143	0.143	0.143	0.143	0.143	0.143	0.143	0.143	0.143	0.143
Original film	Cloudy value (%)	6.8	7.0	6.5	6.5	7.5	7.0	6.8	6.5	6.8	3.0	15.0	42	12.5	4.8	16.5	3.2	15.8
	Anti-blocking characteristics (g／20mm)	7	5	15	6	10	3	>2000	4	>2000	580	3	600	35	7	7	7	7
	Young's modulus (Kg／cm^2)	1600	200	1550	1600	400	1900	1500	1800	1300	1600	1600	1600	1600	1600	1600	1600	1600
	Sealing startup temperature (°C)	85	89	81	85	110	86	98	<80	85	90	85	90	85	85	85	85	85
Laminated film**	Sealing startup temperature (°C)	91	98	85	91	90	125	-	114	-	91	98	91	98	90	90	90	90
	Bag forming speed (bags／min)	145	126	155	145	145	<80	-	80	-	120	120	120	120	144	145	147	145
	Dynamic frictional coefficient	0.19	0.17	0.20	0.18	0.30	0.16	0.35	0.19	0.30	0.30	0.19	0.29	0.17	0.32	0.16	0.27	0.15

*Mw/Mn: Ratio between the weight average molecular weight and the number

** Adhered with biaxially elongated nylon films