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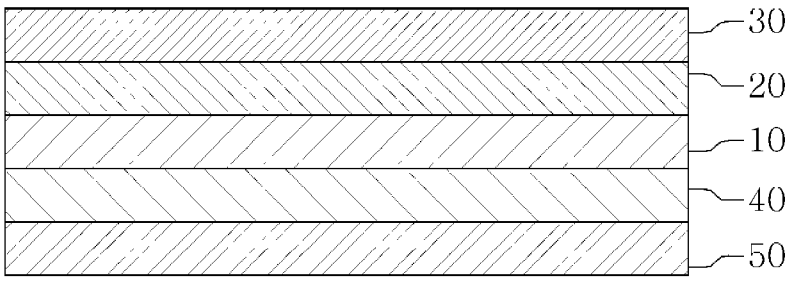
(54) Title: LAMINATED FILM HAVING CARBON LAYER

[Fig. 2]



(57) Abstract: Disclosed is a laminated film including a carbon layer to prevent a fracture or a crack of a layer or a film adjacent to the carbon layer in the laminated film. The carbon layer provides an elasticity and thus prevents the fracture or the crack of a layer or a film adjacent to the carbon layer in the laminated film.

Description

Title of Invention: LAMINATED FILM HAVING CARBON LAYER

Technical Field

[1] This disclosure relates to a laminated film having a carbon layer.

Background Art

[2] In general, laminated films with gas barrier property are used as insulating or packaging materials. Fig. 1 schematically shows a structure of a laminated film according to the related art.

[3] Referring to Fig. 1, a laminated film has a metal layer 1 as a gas barrier layer for blocking passage of gas in order to be used for vacuum insulating or packaging materials. The laminated film has a laminated structure with surface protective layers 2 formed above and below the metal layer 1. An aluminum (Al) foil or an aluminum-deposited film is used as the metal layer 1. The surface protective layer 2 is formed by attaching, for example, a polyethylene terephthalate (PET) film using an adhesive.

[4] With a superior gas barrier property of the metal layer 1, the laminated film is capable of maintaining vacuum for a long period of time, and thus is useful as vacuum insulating materials or food packaging materials.

[5] However, according to the inventors' view, the laminated film according to the related art is problematic in that a fracture or a crack occurs in the metal layer 1 during its manufacturing or handling. Specifically, the metal layer 1 usually lacks flexibility and is susceptible to surface scratches by an external force. This phenomenon gets worse in case of thin films such as aluminum foil. When attaching the surface protective layer 2 such as a PET film to the metal layer 1 or during transfer to the each process or handling, the metal layer 1 is easily fractured or cracked. As a consequence, the laminated film according to the related art has poor a gas barrier property and a high defect ratio.

Disclosure of Invention

Technical Problem

[6] This disclosure is to provide a laminated film capable of preventing a fracture or a crack of a metal layer (e.g. aluminum foil, etc.), a deposit film, a plastic film, etc. which are vulnerable to the fracture or the crack during its manufacturing or handling.

Solution to Problem

[7] In embodiments of the invention, provided is a laminated film including a carbon layer to prevent a fracture or a crack of a layer or a film adjacent to the carbon layer in the laminated film.

[8] In an embodiment, provided is a laminated film including a metal layer and a carbon layer formed on one side or both sides of the metal layer to prevent a fracture or a crack of the metal layer.

[9] In another embodiment, provided is a laminated film including a deposit film wherein at least one selected from a group consisting of a metal, an inorganic material and an organic material is deposited, and a carbon layer formed on the deposit film to prevent a fracture or a crack of the deposit film.

[10] In another embodiment, provided is a laminated film including a plastic film, and a carbon layer formed on one side or both sides of the plastic film to prevent a fracture or a crack of the plastic film.

[11] The carbon layer may include at least one selected from a group consisting of graphene, graphite, carbon black, carbon nanotube and carbon nanofiber.

Advantageous Effects of Invention

[12] According to the embodiments of the invention, a carbon layer may provide an elasticity to the metal layer, the deposit film, the plastic film, etc. Accordingly, a fracture or a crack of the metal layer, the deposit film, the plastic film, etc. may be prevented and a high barrier property may be achieved.

Brief Description of Drawings

[13] Fig. 1 schematically shows a structure of a laminated film according to the related art.

[14] Fig. 2 schematically shows a structure of a laminated film according to an example embodiment.

[15] Fig. 3 schematically shows a structure of a laminated film according to another example embodiment.

[16] Fig. 4 schematically shows a structure of a laminated film according to another example embodiment.

[17] <Description of Numerals>

[18] 1: metal layer 2: surface protective layer

[19] 10: metal layer 20: carbon layer

[20] 30: carbon protective layer 40: metal protective layer

[21] 50: sealing layer 100: deposit film

[22] 110: substrate 120: deposit layer

[23] 200: plastic film

Mode for the Invention

[24] Example embodiments now will be described more fully hereinafter with reference to the accompanying drawings, in which example embodiments are shown. The present disclosure may, however, be embodied in many different forms and should not be

construed as limited to the example embodiments set forth therein. Rather, these example embodiments are provided so that the present disclosure will be thorough and complete, and will fully convey the scope of the present disclosure to those skilled in the art. In the description, details of well-known features and techniques may be omitted to avoid unnecessarily obscuring the presented embodiments.

[25] The terminology used herein is for the purpose of describing particular embodiments only and is not intended to be limiting of the present disclosure. As used herein, the singular forms "a", "an, "the" are intended to include the plural forms as well, unless the context clearly indicates otherwise. Furthermore, the use of the terms a, an, etc. does not denote a limitation of quantity, but rather denotes the presence of at least one of the referenced item.

[26] It will be further understood that the terms "comprises" and/or "comprising" or "includes" and/or "including" when used in this specification, specify the presence of stated features, regions, integers, steps, operations, elements, and/or components, but do not preclude the presence or addition of one or more other features, regions, integers, steps, operations, elements, components, and/or groups thereof.

[27] In embodiments, a laminated film includes a carbon layer to prevent a fracture or a crack of a layer or a film adjacent to the carbon layer in the laminated film.

[28] Fig. 2 schematically shows a structure of a laminated film according to an example embodiment.

[29] Referring to Fig. 2, a laminated film according to an example embodiment comprises a metal layer 10 and a carbon layer 20 existing on one side or both sides of the metal layer 10. Although the carbon layer 20 is formed only on one side of the metal layer 10 in Fig. 2, the carbon layer 20 may also be formed on both sides of the metal layer 10.

[30] In another embodiment, it is preferable that as well as the carbon layer 20 existing on one side of the metal layer 10, the laminated film may further comprise a metal protective layer 40 existing on the other side of the metal layer 10 to protect the metal layer 10. In addition, it is preferable that the laminated film may further comprise a carbon protective layer 30 existing on the carbon layer 20 to protect the carbon layer 20.

[31] That is, the laminated film may have a laminated structure comprising the carbon layer 20 formed on one side of the metal layer 10, the metal protective layer 40 formed on the other side of the metal layer 10 and the carbon protective layer 30 formed on the carbon layer 20 as shown in Fig. 2.

[32] Herein, it is preferable that the metal layer 10 has a gas barrier property. Specifically, the metal layer 10 may be a metal thin film such as metal foil or a metal deposit layer where a metal is deposited. The metal of the metal layer 10 may be for example, but

not limited to, a single or more metals selected from a group consisting of aluminum (Al), copper (Cu), nickel (Ni), tin (Sn), zinc (Zn), indium (In), silver (Ag), tungsten (W) and iron (Fe), etc. or an alloy of two or more of them (e.g. stainless steel, etc.). Specifically, it is preferable that aluminum (Al) or aluminum (Al) alloy is used since they are advantageous in terms of weight, cost, etc. More specifically, it is preferable that the metal layer 10 is an aluminum thin film such as aluminum foil or an aluminum alloy foil.

[33] Further, though not specifically limited, the metal layer 10 may have a thickness of 1㎛ to 300㎛. When the thickness of the metal layer 10 is smaller than 1㎛, the gas barrier property and support strength may be insufficient. If the thickness of the metal layer 10 exceeds 300㎛, it is not preferable in terms of cost and flexibility may be poor. Preferably, the thickness of the metal layer 10 may be 5㎛ to 200㎛.

[34] In an example embodiment, when the metal layer 10 is a metal thin film, an adhesive may be used to enhance an adhesion to the metal protective layer 40.

[35] In case that the metal layer 10 is a metal deposit layer, the metal deposit layer may be formed by depositing metal on the metal protective layer 40 through a commonly employed deposition method. Herein, the metal protective layer 40 serves as a substrate.

[36] The metal protective layer 40 may be any one capable of protecting the metal layer 10. Preferably, the metal protective layer 40 may be one having an adequate support strength. The metal protective layer 40 may be selected from, for example, paper, nonwoven fabric, plastic film, etc. In an example, the metal protective layer 40 may be a plastic film, for example, a film comprising at least one resin selected from a group consisting of polyester resin and polyolefin resin. Specifically, the metal protective layer 40 may be, but not limited to, a film comprising at least one resin selected from a group consisting of polyethylene terephthalate (PET), polybutylene terephthalate (PBT), polyethylene naphthalate (PEN), polybutylene naphthalate (PBN), polyethylene (PE) and polypropylene (PP). The thickness of the metal protective layer 40 is not particularly limited and may be any thickness as long as the metal layer 10 is able to be protected and the flexibility of the laminated film is not negatively affected.

[37] The carbon layer 20 is coated on the metal layer 10 to prevent a fracture or a crack of the metal layer 10. In general, the metal layer 10 lacks flexibility and is vulnerable to surface scratches by an external force. Therefore, a fracture or a crack may occur in the metal layer 10 during, for example, the attachment of the metal protective layer 40 or handling thereof. Especially, when a thin film such as aluminum foil is used as the metal layer 10, the fracture or the crack may severely occur. In embodiments of the invention, the carbon layer 20 may provide an elasticity to the metal layer 10 and, thus prevent the fracture or crack of the metal layer 10.

[38] The carbon layer 20 is made of carbon materials which are capable of preventing the fracture or the crack by providing an elasticity to the adjacent layer or film such as the metal layer 10. The carbon layer 20 may further comprise a binder.

[39] Preferablely, the carbon layer 20 may comprise one or more carbon materials selected from a group consisting of graphene, graphite, carbon black, carbon nanotube (CNT) and carbon nanofiber (CNF). The carbon layer 20 may be formed by depositing or coating the carbon materials on the adjacent layer or film such as the metal layer 10. Herein, the coating may be performed, for example, by any coating method selected from Spray coating, Gravure coating, Micro Gravure coating, Kiss Gravure coating, Comma Knife coating, Roll coating, Meyer Bar coating, Slot Die coating and Reverser coating, but is not limited thereto.

[40] When the carbon layer 20 is formed, for example, by the coating methods, the carbon layer 20 may be formed by coating a carbon composition comprising a carbon material and a binder. The carbon material may be a particulate carbon material. The carbon material may have a particle size of, for example, 0.3nm to 300㎛.

[41] The binder is used to bind the carbon material particles and enhance an adhesion between the carbon layer 20 and the adjacent layer or film such as the metal layer 10. The binder is not particularly limited so long as it has an adhesive force. The binder may be a synthetic resin or a natural resin. For example, a polymer compound having one or more functional group selected from acryl, urethane, epoxy, amide, hydroxyl and silane groups or the like may be used alone or in combination. Specifically, the binder may be, but not limited to, at least one selected from a group consisting of polyacryl, polyacrylate, polyurethane, polyepoxy, polyamide, polyester, ethylene vinyl acetate, polysiloxane and copolymers thereof. Preferably, the binder may be an elastomer. The elastomer is an elastic polymer and has an adhesivity so that the elastomer may provide an elasticity to the carbon layer 20 and also serve as the binder. The elastomer is not limited to specific one so long as the elastomer has both adhesivity and elasticity. For example, the elastomer may be selected from a group consisting of silicone rubber, urethane rubber, urea rubber, butadiene rubber, etc.

[42] The carbon composition may comprise 10 to 500 parts by weight of the carbon material based on 100 parts by weight of the binder, although not being particularly limited thereto. When the content of the carbon material is less than 10 parts by weight, the adjacent layer or film such as the metal layer 10 may not be endowed with enough elasticity. When the content of the carbon material exceeds 500 parts by weight, coatability may be lowered due to a high viscosity and an interlayer adhesion may be insufficient due to relatively decreased content of the binder. Preferably, the carbon layer 20 may be formed by coating a carbon composition comprising 50 to 200 parts by weight of the carbon material based on 100 parts by weight of the binder. The

carbon composition may further comprise, in addition to the carbon material and the binder, one or more additives selected from, for example, curing agent, dispersant, solvent, antioxidant, defoamer, pigment, etc., if necessary. The additive may be used in an amount of 0.1 to 20 parts by weight based on 100 parts by weight of the binder.

[43] In a non-limiting example, the carbon layer 20 may have a thickness of, for example, 0.3nm to 300㎛. When the thickness of the carbon layer 20 is smaller than 0.3nm, enough elasticity may not be endowed. When it exceeds 300㎛, flexibility of the laminated film may be lowered. Specifically, the carbon layer 20 may have a thickness of 0.003㎛ to 100㎛, more specifically 0.05㎛ to 20㎛.

[44] In embodiments, as described above, it is preferable that the laminated film may have the carbon protective layer 30 formed on the carbon layer 20. Herein, it is more preferable if the carbon protective layer 30 may have a surface durability, a scratch resistance, a staining resistance, or the like. As in non-limiting examples, the carbon protective layer 30 may be formed by coating a resin composition or by attaching a flexible substrate using an adhesive. As in non-limiting examples, the flexible substrate may be selected from, for example, paper, nonwoven fabric, plastic film, etc. If the flexible substrate is a plastic film, it may comprise, for example, one or more resin selected from polyester resin and polyolefin resin. Specifically, the flexible substrate may be a film comprising one or more resin selected from a group consisting of polyethylene terephthalate (PET), polybutylene terephthalate (PBT), polyethylene naphthalate (PEN), polybutylene naphthalate (PBN), polyethylene (PE), polypropylene (PP), etc., but is not limited thereto. The thickness of the carbon protective layer 30 is not particularly limited as long as the carbon layer 20 can be protected and the flexibility of the laminated film is not negatively affected.

[45] In an embodiment, the laminated film may further comprise a sealing layer 50, if necessary. The sealing layer 50 is formed as the outermost layer on one side or both sides of the laminated film. In Fig. 2, the sealing layer 50 is formed on the lower side of the laminated film, i.e. on the metal protective layer 40. When the sealing layer 50 is formed, the laminated film may be useful for vacuum packaging materials or vacuum insulating materials. That is, the sealing layer 50 forms the outermost layer of the laminated film and is sealed by heat when packaged so as to provide vacuum. The sealing layer 50 may comprise any material that can be melt by heat and provide sealing (heat sealing). For example, the sealing layer 50 may comprise one or more selected from a group consisting of polyethylene (PE), polypropylene (PP), polyvinyl, silicone resin, urethane resin, acryl resin, ethylene vinyl acetate (EVA), rubber, etc. Preferably, the sealing layer 50 may comprise a low-melting resin such as one or more selected from polyethylene, polypropylene, ethylene vinyl acetate, butadiene rubber, ethylene propylene rubber, etc. or an ethylene-propylene-butadiene tri-block

copolymer.

[46] The laminated film according to the embodiments may be useful for products requiring a gas barrier property, for example, insulating materials, packaging materials, or the like. More specifically, the laminated film may be used for vacuum insulating materials or packaging materials for food, electronic components, medicine, etc. As described above, the laminated film may have a gas barrier property due to the metal layer 10, and the carbon layer 20 formed on the metal layer 10 may provide an elasticity to the metal layer 10. Accordingly, a fracture or a crack can be prevented during attachment of the metal protective layer 40 to the metal layer 10 or transfer of the metal layer 10 to each manufacturing process or handling of the metal layer 10, thereby realizing a high barrier property.

[47] Hereinafter, another embodiments of the invention will be described referring to Figs. 3 and 4.

[48] Referring to Fig. 3, a laminated film according to another embodiment comprises a deposit film 100 and a carbon layer 20 existing on the deposit film 100. The deposit film 100 comprises a substrate 110 and a deposit layer 120 deposited on the substrate 110.

[49] The substrate 110 may be any one capable of supporting the deposit layer 120 and may be selected from, for example, a glass substrate, a ceramic substrate, a plastic film, or the like. Preferably, the substrate 110 may be a flexible plastic film comprising, for example, one or more resin selected from polyolefin resin, polyester resin, polyamide resin, polyimide resin, etc. Specifically, the substrate 110 may be a film comprising one or more resin selected from a group consisting of polyethylene terephthalate (PET), polybutylene terephthalate (PBT), polyethylene naphthalate (PEN), polybutylene naphthalate (PBN), polyethylene (PE), polypropylene (PP), polyamide (PA) and polyimide (PI), but is not limited thereto.

[50] The deposit layer 120 is formed by depositing one or more selected from a metal, an inorganic material and an organic material on the substrate 110. The metal used in the deposit layer 120 may be the same one used in the metal layer 10. Specifically, the deposit layer 120 may be formed by depositing a single or more metals selected from a group consisting of aluminum (Al), copper (Cu), nickel (Ni), tin (Sn), zinc (Zn), indium (In), silver (Ag), tungsten (W) and iron (Fe) or an alloy of two or more of them (e.g. stainless steel). The inorganic material used in the deposit layer 120 may be selected from, for example, oxides such as silicon oxide (SiO_2), tin oxide (SnO_2), indium oxide (In_2O_3) zinc oxide (ZnO), or the like. The organic material used in the deposit layer 120 may be one or more resin selected from polyolefin resin, polyester resin, polyamide resin, polyimide resin, etc. Specifically, the organic material may be one or more selected from a group consisting of polyethylene terephthalate (PET),

polybutylene terephthalate (PBT), polyethylene naphthalate (PEN), polybutylene naphthalate (PBN), polyethylene (PE), polypropylene (PP), polyamide (PA), polyimide (PI), etc. The deposit layer 120 may comprise two or more layers selected from a group consisting of a metal deposit layer, an inorganic material deposit layer and an organic material deposit layer. In another embodiment, the deposit layer 120 may comprise a hybrid layer of a metal, an inorganic material and an organic material. For example, the deposit layer 120 may comprise an inorganic-organic hybrid layer.

[51] The carbon layer 20 may prevent a fracture or a crack of the deposit film 100 by providing an elasticity to the deposit film 100. Since the deposit layer 120 of the deposit film 100 may lack flexibility and be vulnerable scratches by external force as described above with regard to the metal layer 10, a fracture or a crack may occur. The carbon layer 20 may prevent this fracture or crack. As shown in Fig. 3, the carbon layer 20 is formed on the deposit layer 120 of the deposit film 100. The materials, coating method, etc. of the carbon layer 20 are the same as described above. Also, as shown in Fig. 3, it is preferable that a carbon protective layer 30 may be formed on the carbon layer 20 to protect the carbon layer 20. The materials, forming method, etc. of the carbon protective layer 30 are the same as described above.

[52] Referring to Fig. 4, a laminated film according to another embodiment comprises a plastic film 200 and a carbon layer 20 existing on the plastic film 200.

[53] Preferably, the plastic film 200 may be a flexible plastic film. For example, it may be a film comprising one or more resin selected from polyolefin resin, polyester resin, polyamide resin, polyimide resin, etc. Specifically, the plastic film 200 may be a film comprising one or more resin selected from a group consisting of polyethylene terephthalate (PET), polybutylene terephthalate (PBT), polyethylene naphthalate (PEN), polybutylene naphthalate (PBN), polyethylene (PE), polypropylene (PP), polyamide (PA) and polyimide (PI), but is not limited thereto.

[54] The carbon layer 20 may be formed on one side or on both sides of the plastic film 200. In general, the plastic film 200 may be easily fractured during handling when it lacks surface elasticity and has a small thickness. Most of the plastic film 200 cracks easily by an external force due to a poor scratch resistance. The carbon layer 20 may prevent the fracture or crack of the plastic film 200 by providing an elasticity to the plastic film 200. The materials, coating method, etc. of the carbon layer 20 are the same as described above. As shown in Fig. 4, a carbon protective layer 30 for protecting the carbon layer 20 may be formed on the carbon layer 20. The materials, forming method, etc. of the carbon protective layer 30 are the same as described above.

[55] Although not shown in Figs. 3 and 4, the laminated films illustrated in Figs. 3 and 4 may also have a sealing layer 50 as the outermost layer. The materials of the sealing layer 50 is the same as described above.

[56] The laminated films illustrated in Figs. 3 and 4 may be useful for products requiring a gas barrier property, for example, vacuum insulating materials, packaging materials (for food, electronic components, etc.), or the like. As described, since the carbon layer 20 provides an elasticity to the deposit film 100 or the plastic film 200, a fracture or a crack may be prevented, thereby realizing a high barrier property.

[57] While the embodiments have been shown and described, it will be understood by those skilled in the art that various changes in form and details may be made thereto without departing from the spirit and scope of the present disclosure as defined by the appended claims. In addition, many modifications can be made to adapt a particular situation or material to the teachings of the present disclosure without departing from the essential scope thereof.

Industrial Applicability

[58] This disclosure relates to a laminated film including a carbon layer to prevent a fracture or a crack of a layer or a film adjacent to the carbon layer in the laminated film.

Claims

[Claim 1] A laminated film comprising a carbon layer to prevent a fracture or a crack of a layer or a film adjacent to the carbon layer in the laminated film.

[Claim 2] The laminated film according to claim 1, wherein the laminated film comprises a metal layer and the carbon layer existing on one side or both sides of the metal layer.

[Claim 3] The laminated film according to claim 1, wherein the laminated film comprises a deposit film wherein at least one selected from a group consisting of a metal, an inorganic material and an organic material is deposited on a substrate, and the carbon layer existing on the deposit film.

[Claim 4] The laminated film according to claim 1, wherein the laminated film comprises a plastic film and the carbon layer existing on one side or both sides of the plastic film.

[Claim 5] The laminated film according to claim 1, wherein the laminated film comprises:
a metal layer;
the carbon layer existing on one side of the metal layer;
a metal protective layer existing on the other side of the metal layer; and
a carbon protective layer existing on the carbon layer.

[Claim 6] The laminated film according to any one of claims 1 to 4, wherein the laminated film further comprises a carbon protective layer existing on the carbon layer.

[Claim 7] The laminated film according to any one of claims 1 to 5, wherein the laminated film further comprises a sealing layer as the outermost layer.

[Claim 8] The laminated film according to any one of claims 1 to 5, wherein the carbon layer comprises at least one selected from a group consisting of graphene, graphite, carbon black, carbon nanotube and carbon nanofiber.

[Claim 9] The laminated film according to claim 5, wherein the metal layer is a metal thin film or a metal deposit layer.

[Claim 10] The laminated film according to any one of Claims 1 to 5, wherein the carbon layer is formed by depositing a carbon material or by coating a carbon composition comprising a carbon material and a binder.

[Claim 11] The laminated film according to claim 10, wherein the carbon material

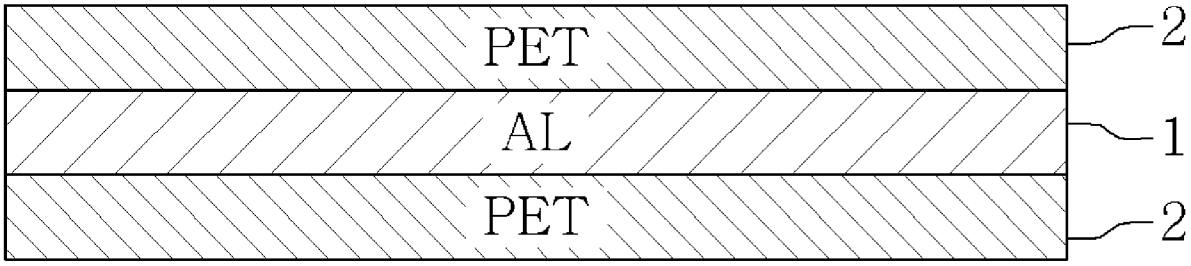
is at least one selected from a group consisting of graphene, graphite, carbon black, carbon nanotube and carbon nanofiber.

[Claim 12] The laminated film according to claim 10, wherein the binder is an elastomer.

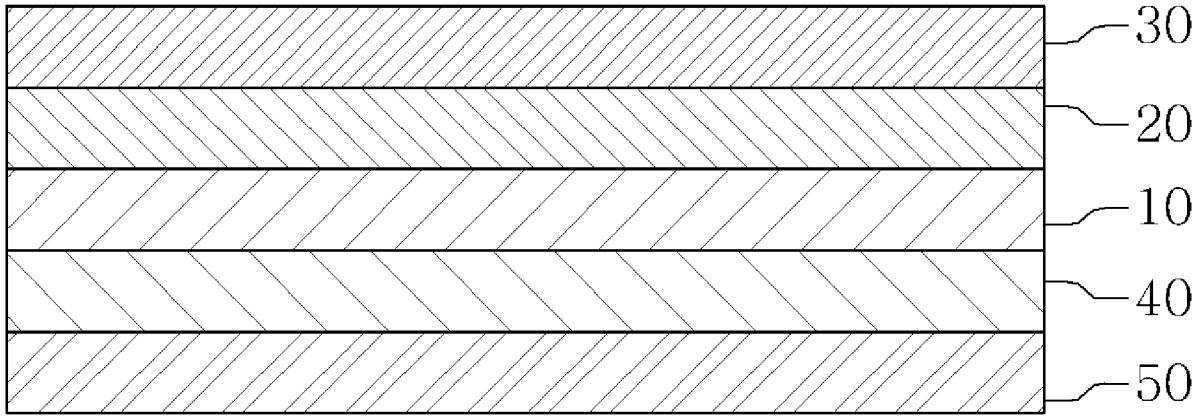
[Claim 13] The laminated film according to any one of claims 1 to 5, wherein the laminated film is used as an insulating material or a packaging material.

WO 2012/096482 PCT/KR2012/000195

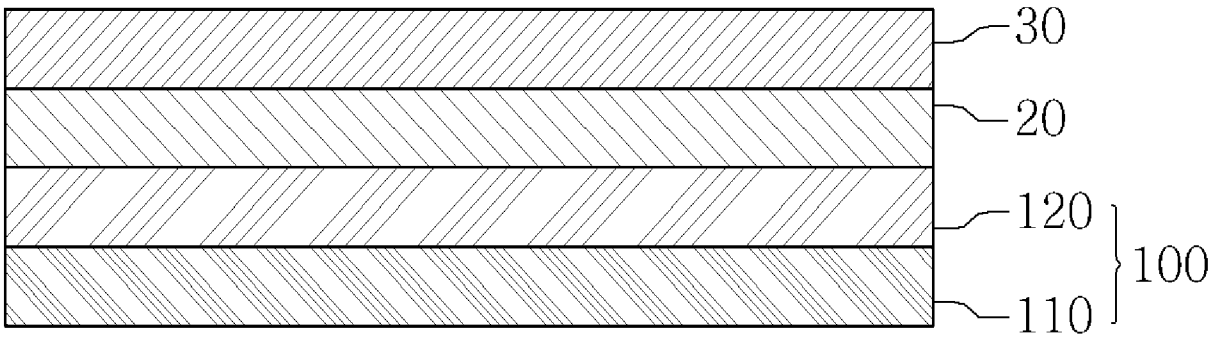
[Fig. 1]



[Fig. 2]



[Fig. 3]



[Fig. 4]