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(54) PACKAGE FILM AND MANUFACTURING METHOD THEREOF, AND PACKAGING METHOD FOR OLED PANEL

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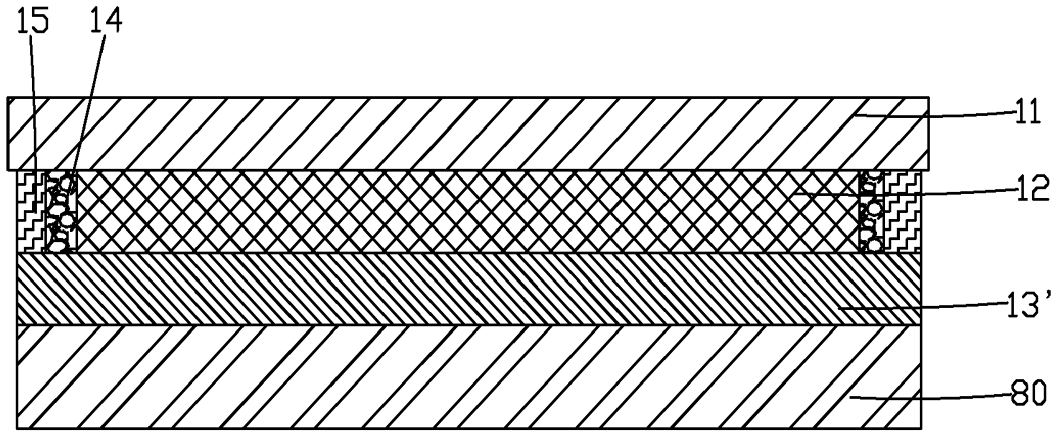
(57) **ABSTRACT**

A highly reliable flexible light-emitting device is provided. The light-emitting device includes a first flexible substrate, a second flexible substrate, a light-emitting element between the first flexible substrate and the second flexible substrate, a first bonding layer; and a second bonding layer in a frame shape surrounding the first bonding layer. The first bonding layer and the second bonding layer are between the second flexible substrate and the light-emitting element. The light-emitting element includes layer containing a light-emitting organic compound between the pair of electrodes. The second bonding layer has a higher gas barrier property than the first bonding layer.



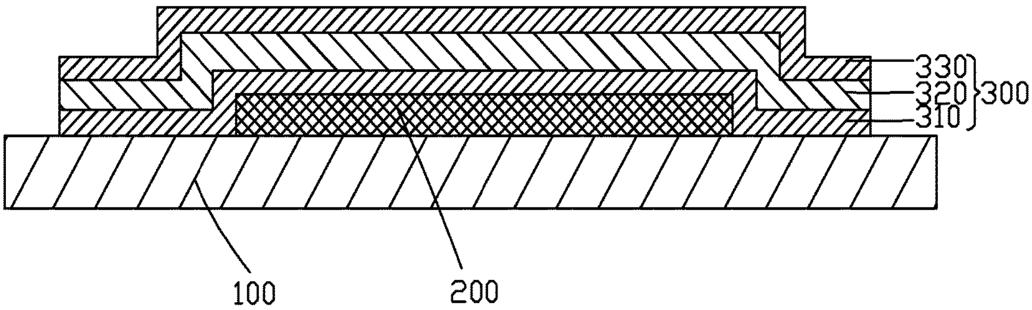


Fig. 1

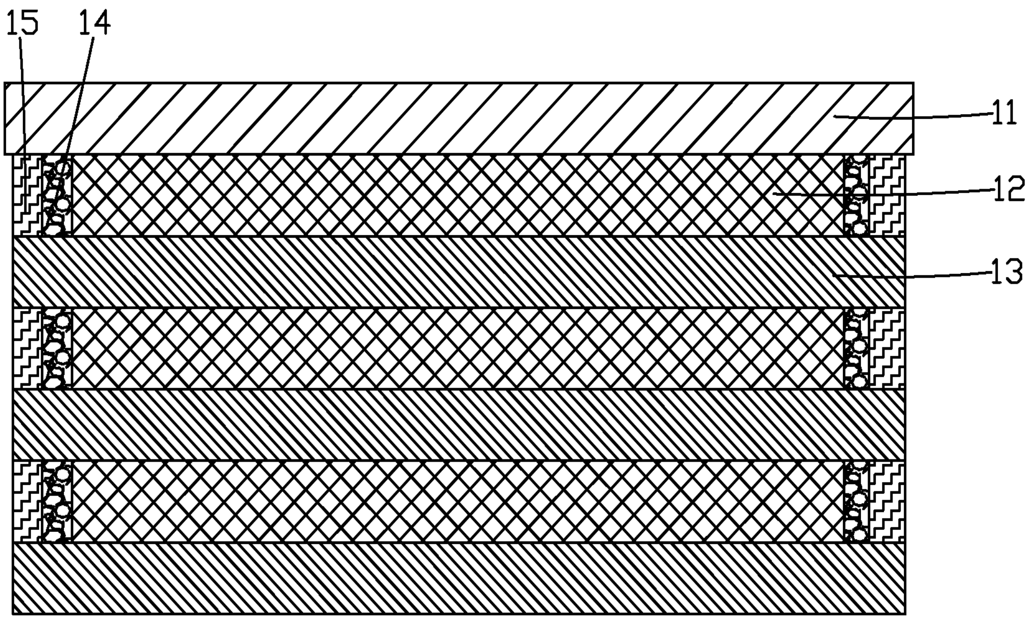


Fig. 2

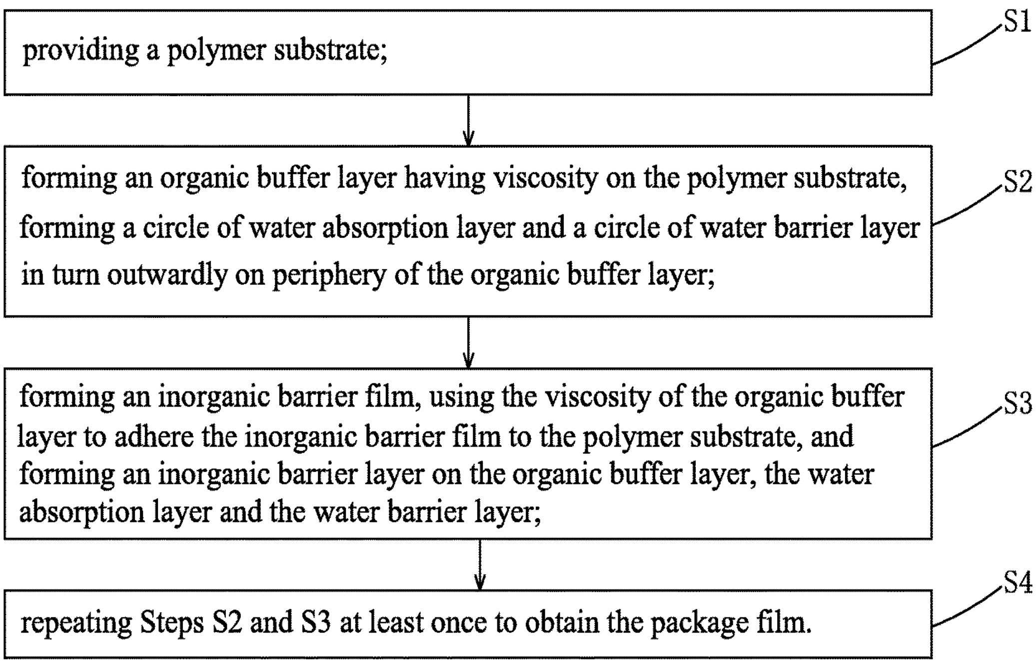

providing a polymer substrate;
S1
forming an organic buffer layer having viscosity on the polymer substrate, forming a circle of water absorption layer and a circle of water barrier layer in turn outwardly on periphery of the organic buffer layer;
S2
forming an inorganic barrier film, using the viscosity of the organic buffer layer to adhere the inorganic barrier film to the polymer substrate, and forming an inorganic barrier layer on the organic buffer layer, the water absorption layer and the water barrier layer;
S3
repeating Steps S2 and S3 at least once to obtain the package film.
S4

Fig. 3

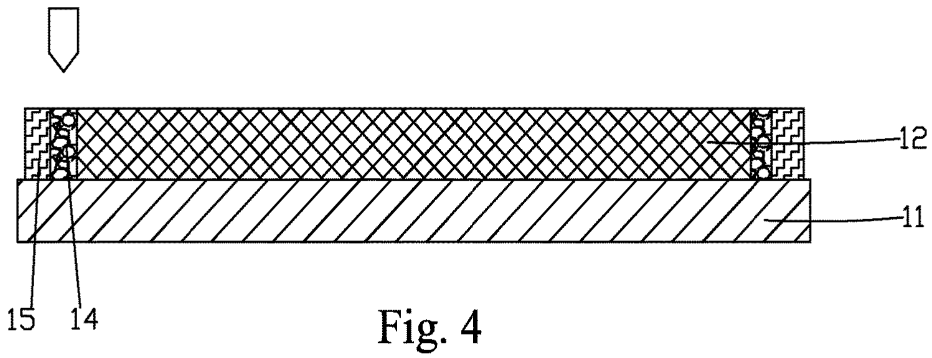


Fig. 4

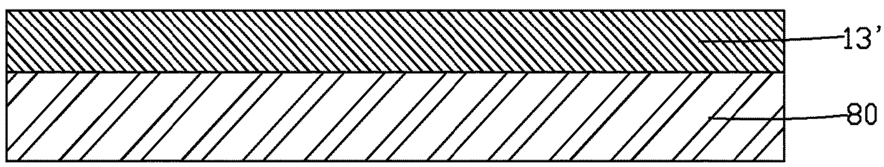


Fig. 5

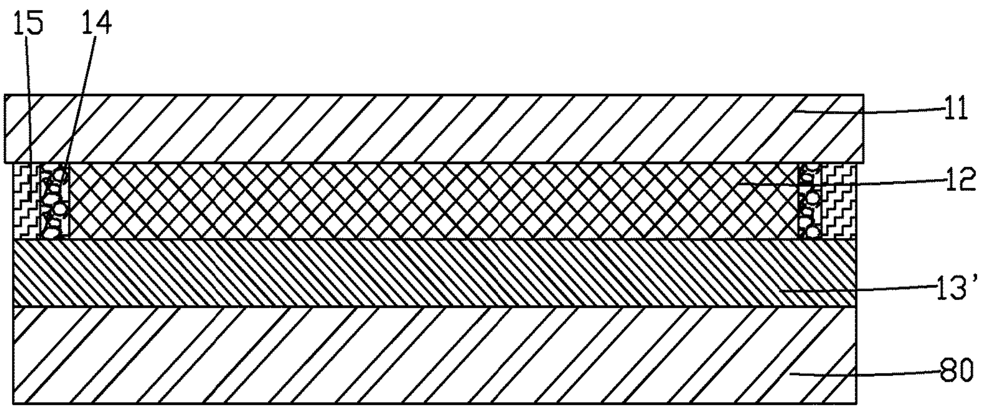


Fig. 6

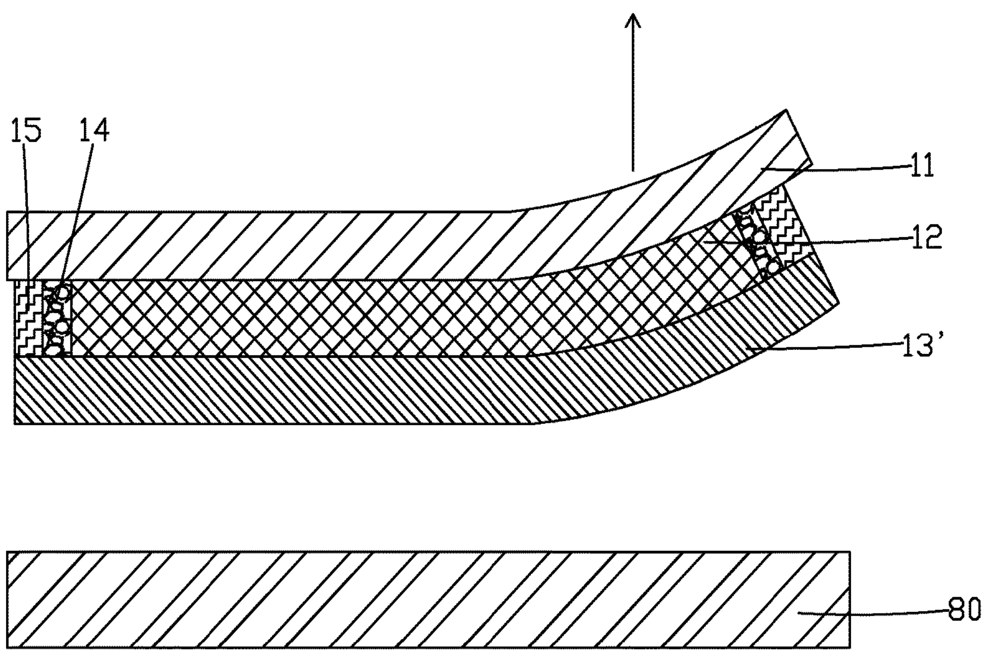


Fig. 7

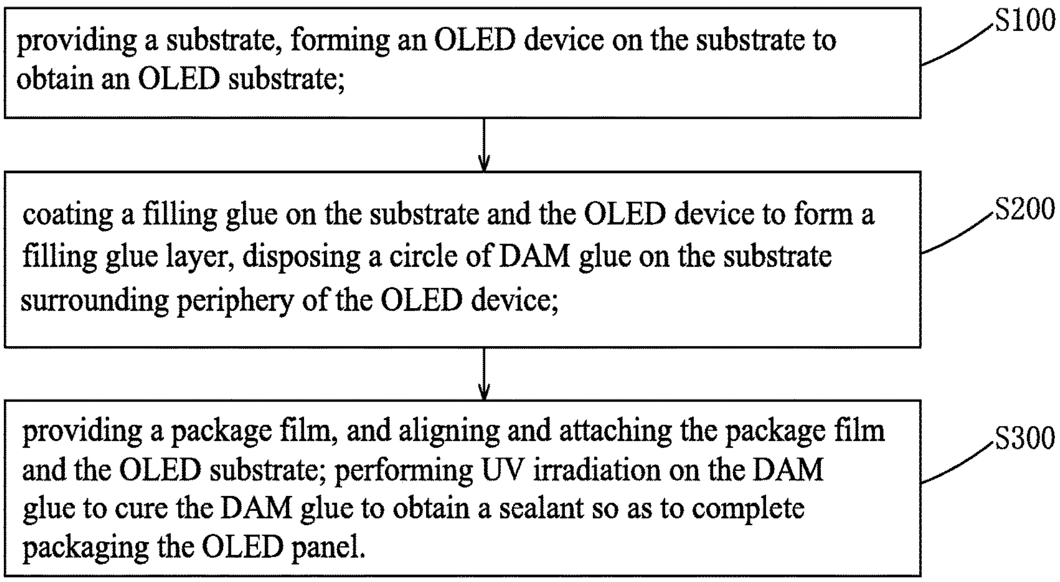

providing a substrate, forming an OLED device on the substrate to obtain an OLED substrate;
S100
coating a filling glue on the substrate and the OLED device to form a filling glue layer, disposing a circle of DAM glue on the substrate surrounding periphery of the OLED device;
S200
providing a package film, and aligning and attaching the package film and the OLED substrate; performing UV irradiation on the DAM glue to cure the DAM glue to obtain a sealant so as to complete packaging the OLED panel.
S300

Fig. 8

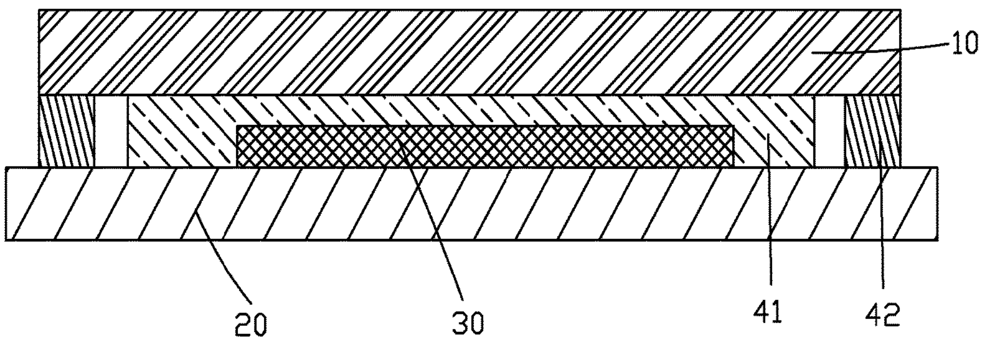

10
20
30
41
42

Fig. 9

S100' providing a substrate, forming an OLED device on the substrate to obtain an OLED substrate

↓

S200' forming a layer of double-sided glue layer on the substrate and the OLED device

↓

S300' providing a package film, and aligning and attaching the package film and the OLED substrate; the package film being adhered to the OLED substrate by the double-sided glue layer, so as to complete packaging the OLED panel

Fig. 10

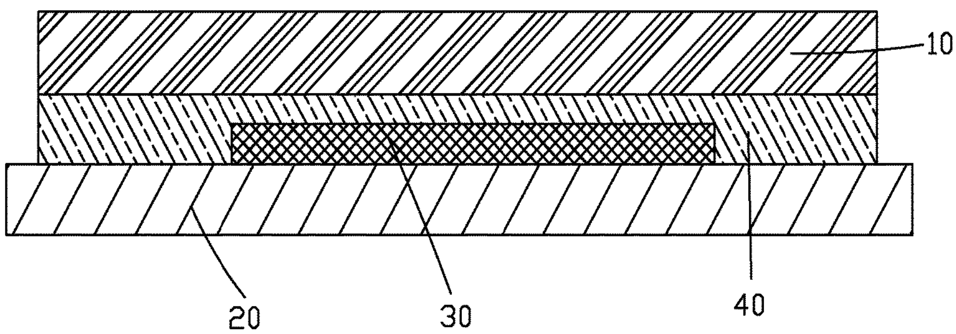


Fig. 11

PACKAGE FILM AND MANUFACTURING METHOD THEREOF, AND PACKAGING METHOD FOR OLED PANEL

BACKGROUND OF THE INVENTION

[0001] 1. Field of the Invention

[0002] The present invention relates to the field of panel display techniques, and in particular to a package film and manufacturing method thereof, and packaging method for OLED.

2. The Related Arts

[0003] The organic light-emitting display (OLED) devices have the advantages of active-luminous, low driving voltage, high emission efficiency, fast response, high contrast and clarity, near 180° viewing angle, wide temperature range, ability to realize flexible and large-size full-color display, and so on, are considered the emerging applications technology for the next generation display devices.

[0004] Unlike the conventional liquid crystal display (LCD) technology, the OLED display technology does not need backlight and uses ultra-thin organic material coating and glass substrate. The organic material emits light when a current flows through. However, because the organic material is easy to react with water or oxygen, the OLED display, as a display device based on the organic material, poses high requirements on the packaging. Thus, the encapsulation of OLED devices to improve the internal seal of the device, for insulation from the external environment as far as possible, is essential for stable emission for OLED devices.

[0005] The current OLED device package mainly uses packaging glue on a rigid packaging substrate (such as, glass or metal), but this approach is not applicable to flexible devices. Therefore, there are technical solutions by stacking thin films to encapsulate the OLED device. The thin film encapsulation usually forms two barrier layers of inorganic materials with good water barrier property over the OLED device on the substrate. A buffer layer of organic material with good flexible and durable property is formed between the two barrier layers. Specifically, refer to FIG. **1** for an OLED display packaged in thin film, comprising: a substrate **100**, an OLED device **200** disposed on the substrate **100**, a thin film package layer **300** formed on the OLED device **200**, wherein the thin film package layer **300** comprises: a first inorganic barrier layer **310**, an organic buffer layer **320** formed on the first inorganic barrier layer **310**, and a second inorganic barrier layer **330** formed on the organic buffer layer **320**.

[0006] Another thin film packaging technology is atomic layer deposition (ALD). The thin film prepared by using ALD technology has a high film density and less defects; but the entire production process requires a vacuum environment, and the film growth rate is very slow. In addition, the flexibility of the inorganic film is poor, and a low temperature must be used when depositing the thin film on the OLED to reduce the damage to the light-emitting material.

[0007] For flexible OLED device packaging, the commercialization requirements for the device life span and stability are: the water vapor transmission rate of less than 10^{-6} $g/m^2/day$, and the oxygen permeability of less than 10^5 $cc/m^2/day$ (1 atm). Therefore, the packaging process plays an important role in the production of OLED devices, and is one of the key factors affecting product yield. The issue of how to use convenient and efficient means to prepare flexible OLED packaging film has become a near-term research focus. A metal film packaging can achieve lower water vapor transmission rate, but the opaque property of metal regarding light also limits application scope.

SUMMARY OF THE INVENTION

[0008] The object of the present invention is to provide a package film, with the inorganic barrier layer selected from one or more of the graphene film, the mica film, and the carbon nanotube film, thereby achieving high transmittance, high barrier properties, and high flexibility of the package film, and reducing the oxygen permeability of the device as well as reducing the thickness of the package film, making the device thinner, and to meet the flexible OLED panel packaging requirements.

[0009] Another object of the present invention is to provide a manufacturing method of package film, able to manufacture package film with high transmittance, high barrier properties, and high flexibility of the package film, and reducing the oxygen permeability of the device as well as reducing the thickness of the package film, making the device thinner, and to meet the flexible OLED panel packaging requirements.

[0010] Yet another object of the present invention is to provide a packaging method for OLED panel, by using the above package film, capable of reducing the oxygen permeability of the device as well as reducing the thickness of the package film, making the device thinner, and to meet the flexible OLED panel packaging requirements.

[0011] To achieve the above object, the present invention provides a package film, comprising: a polymer substrate, at least two organic buffer layers, and at least two inorganic barrier layers;

[0012] wherein a single layer of the organic buffer layer and a single layer of the inorganic barrier layer being alternately stacked on the polymer substrate;

[0013] each organic buffer layer disposed in turn outwardly with a circle of water absorption layer and a circle of water barrier layer on periphery;

[0014] the inorganic barrier layer being formed with one or more materials selected from graphene film, mica sheet film, and carbon nanotube film; the organic buffer layer being formed with a material having a viscosity, and the inorganic barrier layer being adhered to the polymer substrate through the viscosity of the organic buffer layer.

[0015] According to a preferred embodiment of the present invention, the organic buffer layer is formed with a solid film or glue;

[0016] the solid film is a pyrolytic tape, or a PSA type film, and the glue comprises one or more of PMMA, PS, PDMS, and PVA.

[0017] According to a preferred embodiment of the present invention, the water absorption layer is made of calcium oxide; and

[0018] the water barrier layer is made of PDMS glue, or DAM glue.

[0019] According to a preferred embodiment of the present invention, the polymer substrate is made of PI, PEN, PET, PBT, PMMA, PS, COP, or FRT.

[0020] According to a preferred embodiment of the present invention, the water absorption layer and the water barrier layer are formed by nozzle printing.

[0021] According to a preferred embodiment of the present invention, the organic buffer layer has a thickness of 500-9000 nm;

[0022] the inorganic barrier layer has a thickness of 100-5000 nm;

[0023] the water absorption layer has a thickness of 100-5000 nm;

[0024] the water barrier layer has a thickness the same as the thickness of the water absorption layer.

[0025] The present invention also provides a manufacturing method of package film, comprising the steps of:

[0026] Step **S1**: providing a polymer substrate;

[0027] Step **S2**: forming an organic buffer layer having viscosity on the polymer substrate, forming a circle of water absorption layer and a circle of water barrier layer in turn outwardly on periphery of the organic buffer layer;

[0028] Step **S3**: forming an inorganic barrier film, using the viscosity of the organic buffer layer to adhere the inorganic barrier film to the polymer substrate, and forming an inorganic barrier layer on the organic buffer layer, the water absorption layer and the water barrier layer;

[0029] Step **S4**: repeating Steps **S2** and **S3** at least once to obtain the package film.

[0030] According to a preferred embodiment of the present invention, in Step **S2**, the organic buffer layer is formed with a solid film, the solid film is a pyrolytic tape, or a PSA type film, and the organic buffer layer is formed by direct adherence of a film; or,

[0031] the organic buffer layer is formed with a liquid glue, the glue comprises one or more of PMMA, PS, PDMS, and PVA, the organic buffer layer is formed by a coating process, and the coating process is a jet dispensing process, a spin coating process, a screen printing process, or an ink-jet printing process.

[0032] The present invention also provides a packaging method for OLED panel, comprising the steps of:

[0033] Step **S100**: providing a substrate, forming an OLED device on the substrate to obtain an OLED substrate;

[0034] Step **S200**: coating a filling glue on the substrate and the OLED device to form a filling glue layer, disposing a circle of DAM glue on the substrate surrounding periphery of the OLED device; or, forming a layer of double-sided glue layer on the substrate and the OLED device;

[0035] Step **S300**: providing the above package film, and aligning and attaching the package film and the OLED substrate, at this point, the polymer substrate of the package film being at uppermost layer of the OLED device, and the inorganic barrier layer at lowermost layer being separated from the OLED device by the filling glue layer or the double-sided glue layer;

[0036] then, performing UV irradiation on the DAM glue surrounding the periphery of the OLED device to cure the DAM glue to obtain a sealant, or the package film being adhered to the OLED substrate by the double-sided glue layer, so as to complete packaging the OLED panel.

[0037] Compared to the known techniques, the present invention provides the following advantages. The package film of the present invention comprises a polymer substrate, at least two organic buffer layers, and at least two inorganic barrier layers; with a single layer of the organic buffer layer and a single layer of the inorganic barrier layer being alternately stacked on the polymer substrate; each organic barrier layer being disposed in turn outwardly with a circle of water absorption layer and a circle of water barrier layer on periphery; the inorganic barrier layer being formed with one or more materials selected from graphene film, mica sheet film, and carbon nanotube film; the organic buffer layer being formed with a material having a viscosity, and the inorganic barrier layer being adhered to the polymer substrate through the viscosity of the organic buffer layer; the present invention utilizes the excellent optical properties and high density of a graphene film, a mica film, and carbon nanotubes film to achieve an excellent-performance package film with transmittance, high barrier, and high flexibility, reduces the device oxygen permeability as well as reduce the package film thickness, to make the device thinner, and to meet the packaging requirements for flexible OLED panel; moreover, by disposing a circle of water absorption layer and a circle of water barrier layer in each organic buffer layer at periphery to enhance the structure of the package film from the lateral side to further improve water and oxygen barrier ability. The manufacturing method of package film of the present invention is, able to manufacture package film with high transmittance, high barrier properties, and high flexibility of the package film, and reducing the oxygen permeability of the device as well as reducing the thickness of the package film, making the device thinner, and to meet the flexible OLED panel packaging requirements. The packaging method for OLED pane of the present invention is, by using the above package film, capable of reducing the oxygen permeability of the device as well as reducing the thickness of the package film, making the device thinner, and to meet the flexible OLED panel packaging requirements to overcome the disadvantages of the conventional thin film packaging and further protects the device.

BRIEF DESCRIPTION OF THE DRAWINGS

[0038] To make the technical solution of the embodiments according to the present invention, a brief description of the drawings that are necessary for the illustration of the embodiments will be given as follows. Apparently, the drawings described below show only example embodiments of the present invention and for those having ordinary skills in the art, other drawings may be easily obtained from these drawings without paying any creative effort. In the drawings:

[0039] FIG. **1** is a schematic view showing a the structure of an OLED display with known thin film packaging technology;

[0040] FIG. **2** is a schematic view showing the structure of a package film provided by an embodiment of the present invention;

[0041] FIG. **3** is a schematic views showing a flowchart of manufacturing method of package film provided by an embodiment of the present invention;

[0042] FIG. **4** is a schematic view showing Step 2 of the manufacturing method of package film provided by an embodiment of the present invention;

[0043] FIGS. **5-7** are view showing Step 3 of the manufacturing method of package film provided by a preferred embodiment of the present invention;

[0044] FIG. **8** is a schematic views showing a flowchart of packaging method for OLED panel provided by an embodiment of the present invention;

[0045] FIG. **9** is a schematic view of Step **S300** of FIG. **8**;

[0046] FIG. **10** a schematic views showing a flowchart of packaging method for OLED panel provided by another embodiment of the present invention;

[0047] FIG. 11 is a schematic view of Step S300' of FIG. 10.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0048] To further explain the technique means and effect of the present invention, the following uses preferred embodiments and drawings for detailed description.

[0049] Referring to FIG. 2, the present invention provides a package film, comprising: a polymer substrate 11, at least two organic buffer layers 12, and at least two inorganic barrier layers 13;

[0050] wherein a single layer of the organic buffer layer 12 and a single layer of the inorganic barrier layer 13 being alternately stacked on the polymer substrate 11;

[0051] each organic buffer layer 12 disposed in turn outwardly with a circle of water absorption layer 14 and a circle of water barrier layer 15 on periphery;

[0052] the inorganic barrier layer 13 being formed with one or more materials selected from graphene film, mica sheet film, and carbon nanotube film; the organic buffer layer 12 being formed with a material having a viscosity, and the inorganic barrier layer 13 being adhered to the polymer substrate 11 through the viscosity of the organic buffer layer 12.

[0053] Specifically, the organic buffer layer 12 is formed with a solid film or glue; wherein the solid film is a pyrolytic tape, or a pressure sensitive (PSA) type film, and the glue comprises one or more of polymers, such as, polymethylmethacrylate (PMMA), polystyrene (PS), polydimethylsiloxane (PDMS), and poly Vinyl alcohol (PVA).

[0054] Specifically, the water absorption layer 14 is mainly made of calcium oxide, with water absorption capacity reaching 5-10%.

[0055] Specifically, the water barrier layer 15 is made of an organic polymer having a high transmittance and having hydrophobicity, such as PDMS glue or DAM glue (cofferdam glue available in the market).

[0056] Specifically, the polymer substrate 11 has a transmittance of >98% for visible light; the polymer substrate 11 is made of hydrocarbons, esters, or amide polymers, such as polyimide (PI), polyethylene naphthalate (PEN), poly (terephthalic acid), ethylene glycol (PET), polybutylene terephthalate (PBT), PMMA, PS, cycloolefin polymer (COP), or thermoplastic composite (FRT).

[0057] Specifically, the water absorption layer 14 and the water barrier layer 15 are formed by nozzle printing.

[0058] Specifically, the organic buffer layer 12 has a thickness of 500-9000 nm.

[0059] Specifically, the inorganic barrier layer 13 has a thickness of 100-5000 nm.

[0060] Specifically, the water absorption layer 14 has a thickness of 100-5000 nm.

[0061] Specifically, the water barrier layer 15 has a thickness of 100-5000 nm, the same as the thickness of the water absorption layer 14.

[0062] Specifically, the package film comprises 2-5 organic buffer layers 12 and 2-5 inorganic barrier layers 13.

[0063] The present invention utilizes the excellent optical properties and high density of a graphene film, a mica film, and carbon nanotubes film for use as the inorganic barrier layer 13 to achieve an excellent-performance package film with transmittance, high barrier, and high flexibility, reduces the device oxygen oxygen permeability as well as reduce the package film thickness, to make the device thinner, and to meet the packaging requirements for flexible OLED panel; moreover, by disposing a circle of water absorption layer 14 and a circle of water barrier layer 15 in each organic buffer layer 12 at periphery to enhance the structure of the package film from the lateral side to further improve water and oxygen barrier ability.

[0064] In a preferred embodiment of the package film of the present invention, the package film comprises three organic buffer layers 12 and three inorganic barrier layer 13; among the three inorganic barrier layers 13, the middle layer is a mica film and the other two layers are graphene films.

[0065] Based on the above package film, referring to FIG. 3, the present invention also a manufacturing method of OLED panel, comprising the steps of:

[0066] Step S1: providing a polymer substrate 11.

[0067] Specifically, the polymer substrate 11 has a transmittance of >98% for visible light; the polymer substrate 11 is made of hydrocarbons, esters, or amide polymers, such as polyimide (PI), polyethylene naphthalate (PEN), poly (terephthalic acid), ethylene glycol (PET), polybutylene terephthalate (PBT), PMMA, PS, cycloolefin polymer (COP), or thermoplastic composite (FRT).

[0068] Step S2: as shown in FIG. 4, forming an organic buffer layer 12 having viscosity on the polymer substrate 11, forming a circle of water absorption layer 14 and a circle of water barrier layer 15 in turn outwardly on periphery of the organic buffer layer 12.

[0069] Specifically, the organic buffer layer 12 is formed with a solid film the solid film is a pyrolytic tape, or a pressure sensitive (PSA) type film, and the organic buffer layer 12 is formed by direct adherence of a film; or

[0070] the organic buffer layer is formed with a liquid glue, the glue comprises one or more of polymethylmethacrylate (PMMA), polystyrene (PS), polydimethylsiloxane (PDMS), and poly Vinyl alcohol (PVA), the organic buffer layer 12 is formed by a coating process, and the coating process is a jet dispensing process, a spin coating process, a screen printing process, or an ink-jet printing process.

[0071] Specifically, the water absorption layer 14 is mainly made of calcium oxide, with water absorption capacity reaching 5-10%.

[0072] Specifically, the water barrier layer 15 is made of an organic polymer having a high transmittance and having hydrophobicity, such as PDMS glue or DAM glue.

[0073] Specifically, the water absorption layer 14 and the water barrier layer 15 are formed by nozzle printing.

[0074] Specifically, the organic buffer layer 12 has a thickness of 500-9000 nm.

[0075] Specifically, the water absorption layer 14 has a thickness of 100-5000 nm.

[0076] Specifically, the water barrier layer 15 has a thickness of 100-5000 nm, the same as the thickness of the water absorption layer 14.

[0077] Specifically, Step S2 further comprises performing pre-curing on the organic buffer layer 12, specifically, by UV curing or thermal curing, and further comprises performing pre-curing on the water absorption layer 14 and water barrier layer 15, specifically, by UV curing or thermal curing. The preferred pre-curing process is the thermal curing process.

[0078] Step S3: forming an inorganic barrier film, using the viscosity of the organic buffer layer 12 to adhere the inorganic barrier film to the polymer substrate 10, and forming an inorganic barrier layer 13 on the organic buffer layer **12**, the water absorption layer **14** and the water barrier layer **15**; Specifically, the inorganic barrier layer **13** has a thickness of 100-5000 nm.

[0079] Step S**4**: repeating Steps S**2** and S**3** at least once to obtain the package film.

[0080] Specifically, Steps S**2** and S**3** are repeated 1-4 times in Step S**4** to obtain the package film.

[0081] In a preferred embodiment of the manufacturing method of package film of the present invention, the polymer substrate **11** provided in Step S**1** is a PET material film.

[0082] The organic buffer layer **12** formed in Step S**2** is made of a PDMS glue, and Step S**2** specifically comprises: coating a PDMS prepolymerization solution to the polymer substrate **11** to form an organic buffer layer **12**, forming a circle of water barrier layer **15** surrounding the organic buffer layer **12**, and forming a circle of water absorption layer **14** between the organic buffer layer **12** and the water barrier layer **15**, and then performing pre-curing on the organic buffer layer **12**, the water absorption layer **14**, and the water barrier layer **15** to cure the PDMS prepolymerized solution. At this point, he organic buffer layer **12** is a transparent elastomer with a certain viscosity on the surface.

[0083] The inorganic barrier layer **13** formed in Step S**3** is a graphene film, and the specific process of the step S**3** is as follows:

[0084] (1). As shown in FIG. **5**, preparation of graphene film **13'**: use a metal nickel plate **80** as the substrate, clean and put into the tube furnace, flow a mixture of methane and hydrogen mixed gas with flow rate of 1.1:1-1.5:1 between methane and hydrogen, use argon for the protection with flow rate of 100-200 sccm; when the temperature reaches 900-1000° C., open the methane and hydrogen flow valve, start the reaction, set the reaction time is 90-120 s, take out of the sample after the end of the cooling, a graphene film **13'** is formed on the metal nickel plate **80**.

[0085] (2). As shown in FIG. **6**, attach the polymer substrate **11** after Step S**2** to the metal nickel plate **80** so that the viscous organic buffer layer **12** is brought into a tight contact with the graphene film **13'**, and the entire process is carried out under a nitrogen atmosphere.

[0086] (3). As shown in FIG. **7**, the polymer substrate **11** is rapidly removed from the metal nickel plate **80**, and the graphene film **13'** is adhered to the polymer substrate **11** through the organic buffer layer **12** to obtain an inorganic barrier layer **13**.

[0087] The manufacturing method of package film of the present invention is simple to operate, able to manufacture package film with high transmittance, high barrier properties, and high flexibility of the package film, and reducing the oxygen permeability of the device as well as reducing the thickness of the package film, making the device thinner, and to meet the flexible OLED panel packaging requirements.

[0088] The package film of the present invention can also easily realize a hybrid packaging structure, such as combining the dam-and-fill packaging, or face sealant packaging. A shown, the applicability of this package film has wide adaptability and numerous options. Therefore, based on the above package film, referring to FIG. **8**, the present invention also provides a packaging method of OLED panel, which combines the above package film with a dam-and-fill packaging to encapsulate an OLED panel, comprising the steps of:

[0089] Step S**100**: providing a substrate **20**, forming an OLED device **30** on the substrate to obtain an OLED substrate.

[0090] Step S**200**: coating a filling glue on the substrate **20** and the OLED device **30** to form a filling glue layer **41**, disposing a circle of DAM glue on the substrate **20** surrounding periphery of the OLED device **30**.

[0091] Step S**300**: as shown in FIG. **9**, providing the above package film **10**, and aligning and attaching the package film **10** and the OLED substrate, at this point, the polymer substrate **11** of the package film **10** being at uppermost layer of the OLED device **30**, and the inorganic barrier layer **13** at lowermost layer being separated from the OLED device **30** by the filling glue layer; then, performing UV irradiation on the DAM glue surrounding the periphery of the OLED device **30** to cure the DAM glue to obtain a sealant **42**, so as to complete packaging the OLED panel. Wherein, the structure of the package film **10** is described as above, and will not be repeated here.

[0092] Refer to FIG. **10**, the present invention also provides another packaging method of OLED panel, which combines the above package film with a face sealant packaging to encapsulate an OLED panel, comprising the steps of:

[0093] Step S**100'**: providing a substrate **20**, forming an OLED device **30** on the substrate to obtain an OLED substrate.

[0094] Step S**200'**: forming a layer of double-sided glue layer on the substrate **20** and the OLED device **30**.

[0095] Step S**300'**: as shown in FIG. **11**, providing the above package film **10**, and aligning and attaching the package film **10** and the OLED substrate, at this point, the polymer substrate **11** of the package film **10** being at uppermost layer of the OLED device **30**, and the inorganic barrier layer **13** at lowermost layer being separated from the OLED device **30** by the double-sided glue layer; then, the package film being adhered to the OLED substrate by the double-sided glue layer, so as to complete packaging the OLED panel. Wherein, the structure of the package film **10** is described as above, and will not be repeated here.

[0096] In summary, the package film of the present invention comprises a polymer substrate, at least two organic buffer layers, and at least two inorganic barrier layers; with a single layer of the organic buffer layer and a single layer of the inorganic barrier layer being alternately stacked on the polymer substrate; each organic barrier layer being disposed in turn outwardly with a circle of water absorption layer and a circle of water barrier layer on periphery; the inorganic barrier layer being formed with one or more materials selected from graphene film, mica sheet film, and carbon nanotube film; the organic buffer layer being formed with a material having a viscosity, and the inorganic barrier layer being adhered to the polymer substrate through the viscosity of the organic buffer layer; the present invention utilizes the excellent optical properties and high density of a graphene film, a mica film, and carbon nanotubes film to achieve an excellent-performance package film with transmittance, high barrier, and high flexibility, reduces the device oxygen permeability as well as reduce the package film thickness, to make the device thinner, and to meet the packaging requirements for flexible OLED panel; moreover, by disposing a circle of water absorption layer and a circle of water barrier layer in each organic buffer layer at periphery to enhance the structure of the package film from the lateral side to further improve water and oxygen barrier ability. The manufacturing method of package film of the present invention is, able to manufacture package film with high transmittance, high barrier properties, and high flexibility of the package film, and reducing the oxygen permeability of the device as well as reducing the thickness of the package film, making the device thinner, and to meet the flexible OLED panel packaging requirements. The packaging method for OLED pane of the present invention is, by using the above package film, capable of reducing the oxygen permeability of the device as well as reducing the thickness of the package film, making the device thinner, and to meet the flexible OLED panel packaging requirements to overcome the disadvantages of the conventional thin film packaging and further protects the device.

[0097] It should be noted that in the present disclosure the terms, such as, first, second are only for distinguishing an entity or operation from another entity or operation, and does not imply any specific relation or order between the entities or operations. Also, the terms "comprises", "include", and other similar variations, do not exclude the inclusion of other non-listed elements. Without further restrictions, the expression "comprises a . . . " does not exclude other identical elements from presence besides the listed elements.

[0098] Embodiments of the present invention have been described, but not intending to impose any unduly constraint to the appended claims. Any modification of equivalent structure or equivalent process made according to the disclosure and drawings of the present invention, or any application thereof, directly or indirectly, to other related fields of technique, is considered encompassed in the scope of protection defined by the clams of the present invention.

What is claimed is:

1. A package film, comprising: a polymer substrate, at least two organic buffer layers, and at least two inorganic barrier layers;

wherein a single layer of the organic buffer layer and a single layer of the inorganic barrier layer being alternately stacked on the polymer substrate;

each organic buffer layer disposed in turn outwardly with a circle of water absorption layer and a circle of water barrier layer on periphery;

the inorganic barrier layer being formed with one or more materials selected from graphene film, mica sheet film, and carbon nanotube film; the organic buffer layer being formed with a material having a viscosity, and the inorganic barrier layer being adhered to the polymer substrate through the viscosity of the organic buffer layer.

2. The package film as claimed in claim **1**, wherein the organic buffer layer is formed with a solid film or glue;

the solid film is a pyrolytic tape, or a PSA type film, and the glue comprises one or more of PMMA, PS, PDMS, and PVA.

3. The package film as claimed in claim **1**, wherein the water absorption layer is made of calcium oxide; and

the water barrier layer is made of PDMS glue, or DAM glue.

4. The package film as claimed in claim **1**, wherein the polymer substrate is made of PI, PEN, PET, PBT, PMMA, PS, COP, or FRT.

5. The package film as claimed in claim **1**, wherein the water absorption layer and the water barrier layer are formed by nozzle printing.

6. The package film as claimed in claim **1**, wherein the organic buffer layer has a thickness of 500-9000 nm;

the inorganic barrier layer has a thickness of 100-5000 nm;

the water absorption layer has a thickness of 100-5000 nm;

the water barrier layer has a thickness the same as the thickness of the water absorption layer.

7. A manufacturing method of package film, comprising the steps of:

Step S**1**: providing a polymer substrate;

Step S**2**: forming an organic buffer layer having viscosity on the polymer substrate, forming a circle of water absorption layer and a circle of water barrier layer in turn outwardly on periphery of the organic buffer layer;

Step S**3**: forming an inorganic barrier film, using the viscosity of the organic buffer layer to adhere the inorganic barrier film to the polymer substrate, and forming an inorganic barrier layer on the organic buffer layer, the water absorption layer and the water barrier layer;

Step S**4**: repeating Steps S**2** and S**3** at least once to obtain the package film.

8. The manufacturing method of package film as claimed in claim **7**, wherein in Step S**2**, the organic buffer layer is formed with a solid film, the solid film is a pyrolytic tape, or a PSA type film, and the organic buffer layer is formed by direct adherence of a film; or,

the organic buffer layer is formed with a liquid glue, the glue comprises one or more of PMMA, PS, PDMS, and PVA, the organic buffer layer is formed by a coating process, and the coating process is a jet dispensing process, a spin coating process, a screen printing process, or an ink-jet printing process.

9. A packaging method for OLED panel, comprising the steps of:

Step S**100**: providing a substrate, forming an OLED device on the substrate to obtain an OLED substrate;

Step S**200**: coating a filling glue on the substrate and the OLED device to form a filling glue layer, disposing a circle of DAM glue on the substrate surrounding periphery of the OLED device; or,

forming a layer of double-sided glue layer on the substrate and the OLED device;

S**300**: providing the package film as claimed in claim **1**, and aligning and attaching the package film and the OLED substrate, at this point, the polymer substrate of the package film being at uppermost layer of the OLED device, and the inorganic barrier layer at lowermost layer being separated from the OLED device by the filling glue layer or the double-sided glue layer;

then, performing UV irradiation on the DAM glue surrounding the periphery of the OLED device to cure the DAM glue to obtain a sealant, or the package film being adhered to the OLED substrate by the double-sided glue layer, so as to complete packaging the OLED panel.

* * * * *

patsnap

专利名称(译)	封装膜及其制造方法，以及OLED面板的封装方法
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[标]申请(专利权)人(译)	深圳市华星光电技术有限公司
[标]发明人	LI WENJIE LI JINCHUAN
发明人	LI, WENJIE LI, JINCHUAN
IPC分类号	H01L51/52 H01L51/56 H01L51/00 H01L27/32 C23C16/26
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摘要(译)

提供一种高度可靠的柔性发光装置。该发光装置包括第一柔性基板，第二柔性基板，位于第一柔性基板和第二柔性基板之间的发光元件，第一粘接层;以及围绕第一粘合层的框架形状的第二粘合层。第一粘合层和第二粘合层位于第二柔性基板和发光元件之间。发光元件包括在一对电极之间含有发光有机化合物的层。第二粘合层具有比第一粘合层更高的阻气性。