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Yu et al.

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(54) **METHOD OF MANUFACTURING ORGANIC
LIGHT EMITTING DISPLAY PANEL**

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See application file for complete search history.

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(57) **ABSTRACT**

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(52) **U.S. Cl.**

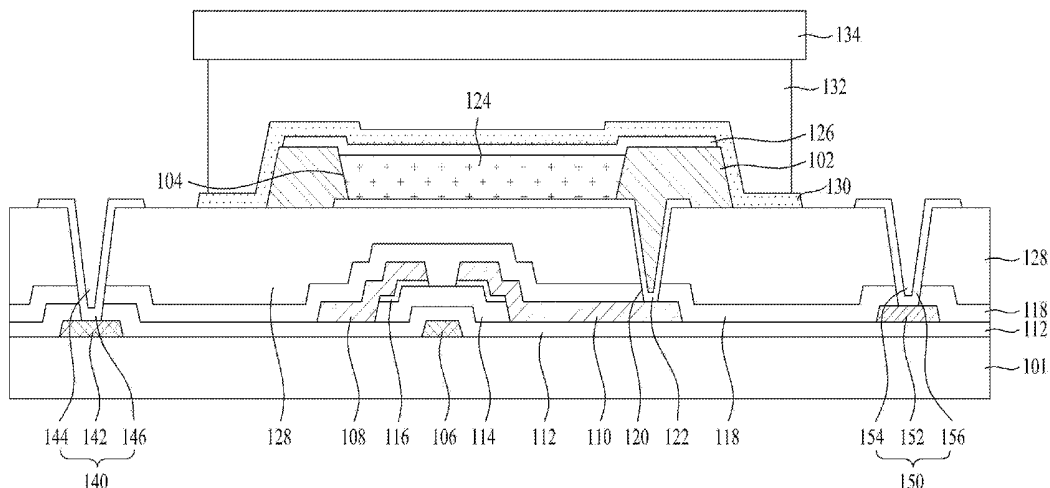
CPC **H01L 51/56** (2013.01); **H01L 51/524** (2013.01); **H01L 27/3276** (2013.01); **H01L 51/5253** (2013.01); **H01L 2251/566** (2013.01)

(58) **Field of Classification Search**

CPC ... H01L 51/56; H01L 51/525; H01L 51/0001; H01L 51/0024; H01L 51/50; H01L 51/5044; H01L 51/5203; H01L 51/5237; H01L 51/524
USPC 257/E51.018, E51.02–E51.022, 257/E23.116, E23.123, E23.124, E23.127, 257/E23.129, E23.132–E23.133;

A method of manufacturing an organic light emitting display panel forming a protective insulating film in a luminescent region without causing defects in a pattern is disclosed. The method of manufacturing an organic light emitting display panel includes forming a substrate having a luminescent region and a pad region, simultaneously forming a light emitting cell in the luminescent region and an organic pattern in the pad region, forming a protective insulating film over the substrate, bonding the substrate provided with the protective insulating film and the sealing substrate using an adhesive film formed in a region corresponding to the luminescent region, cutting the bonded substrate provided with the protective insulating film and the sealing substrate into a plurality of unit panels to expose the pad region, and removing the protective insulating film and the organic pattern in the exposed pad region.

12 Claims, 15 Drawing Sheets



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FIG. 1

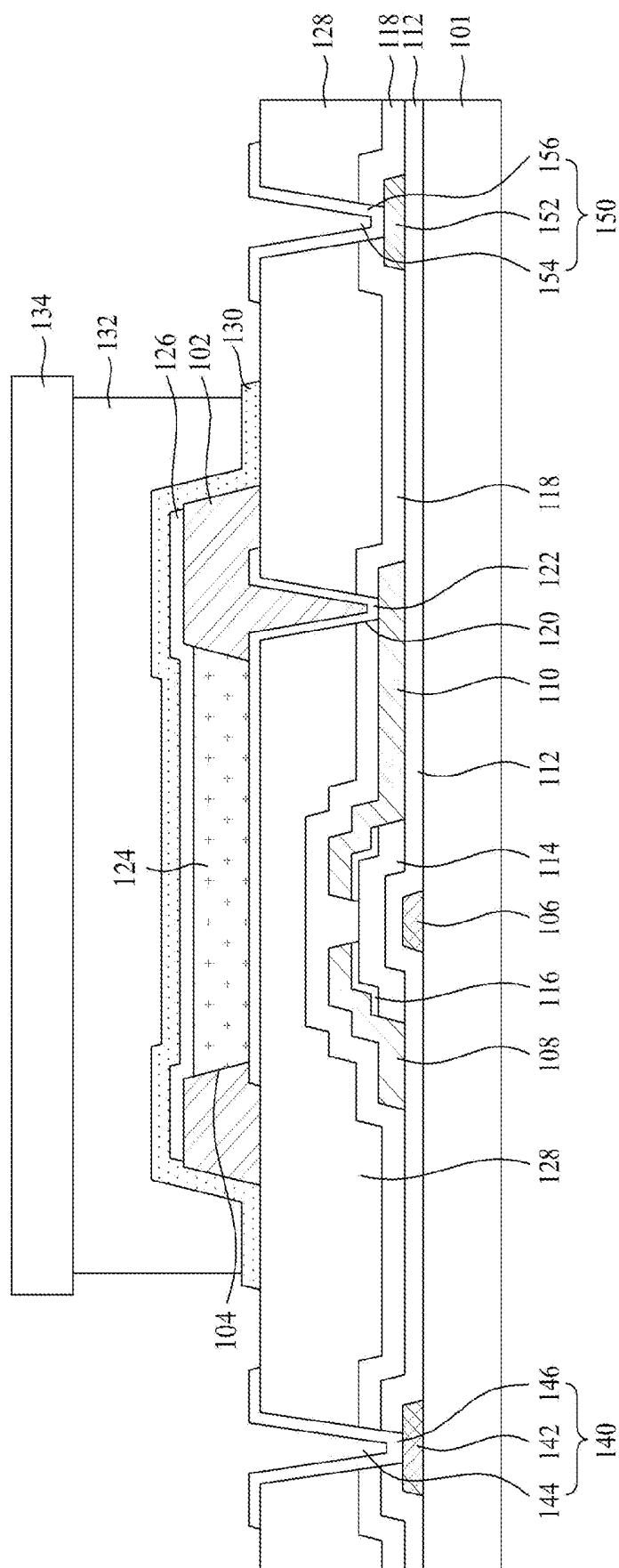


FIG. 2A

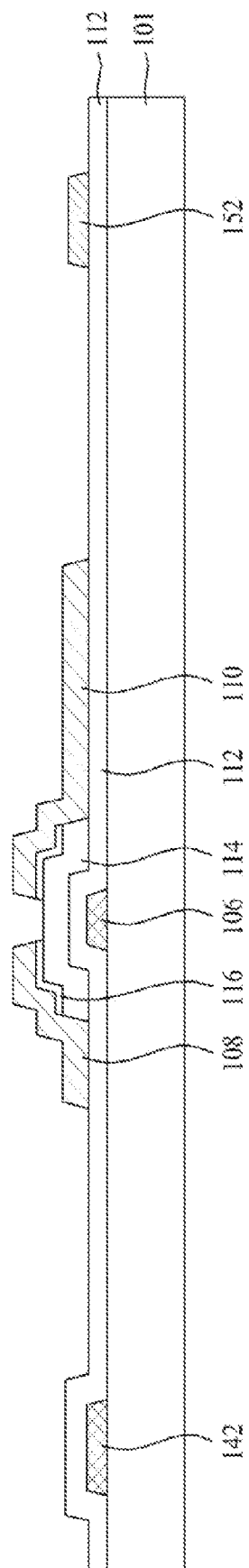


FIG. 2B

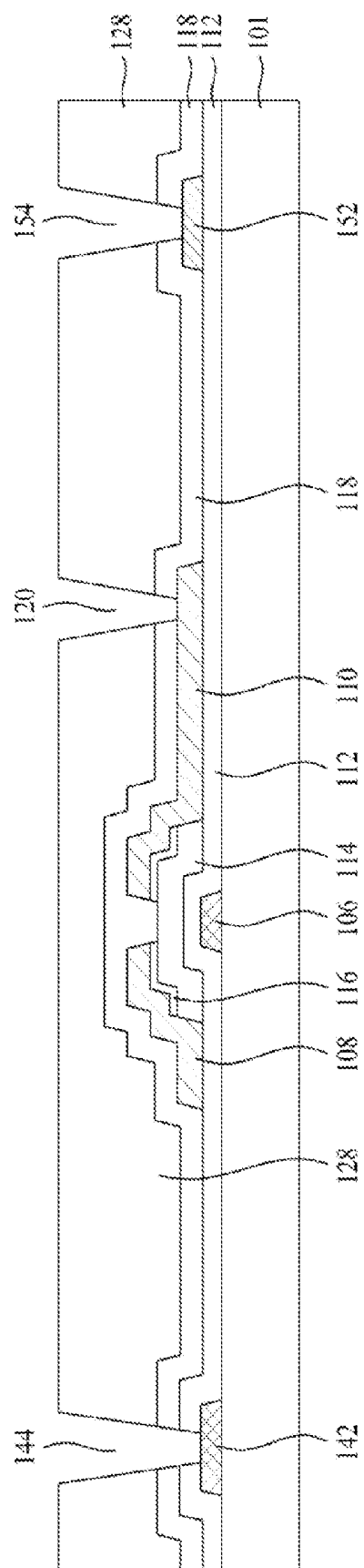


FIG. 2C

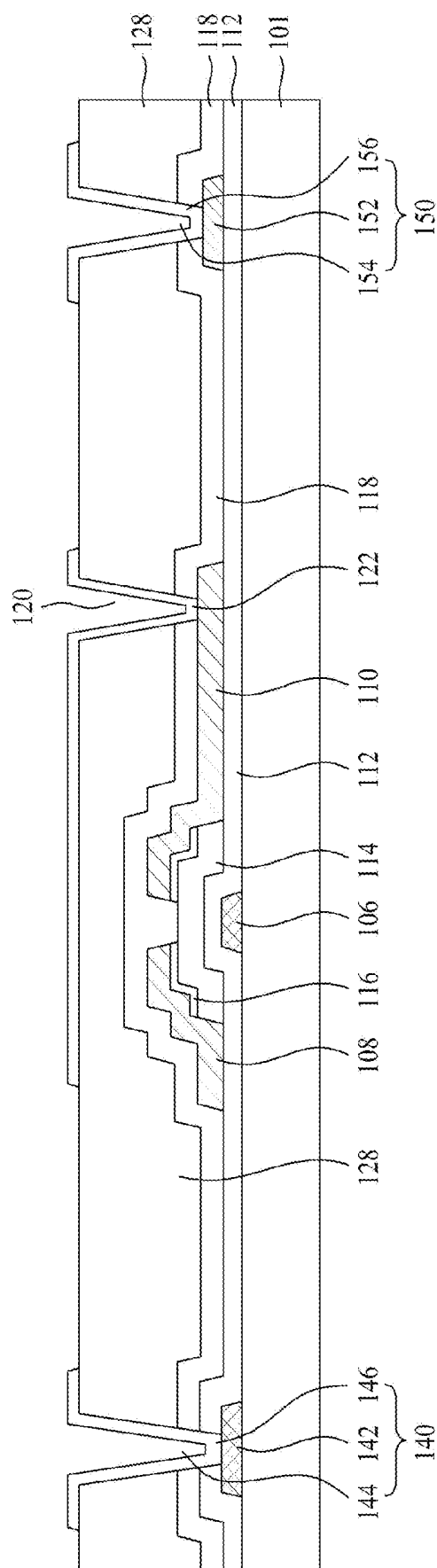


FIG. 2E

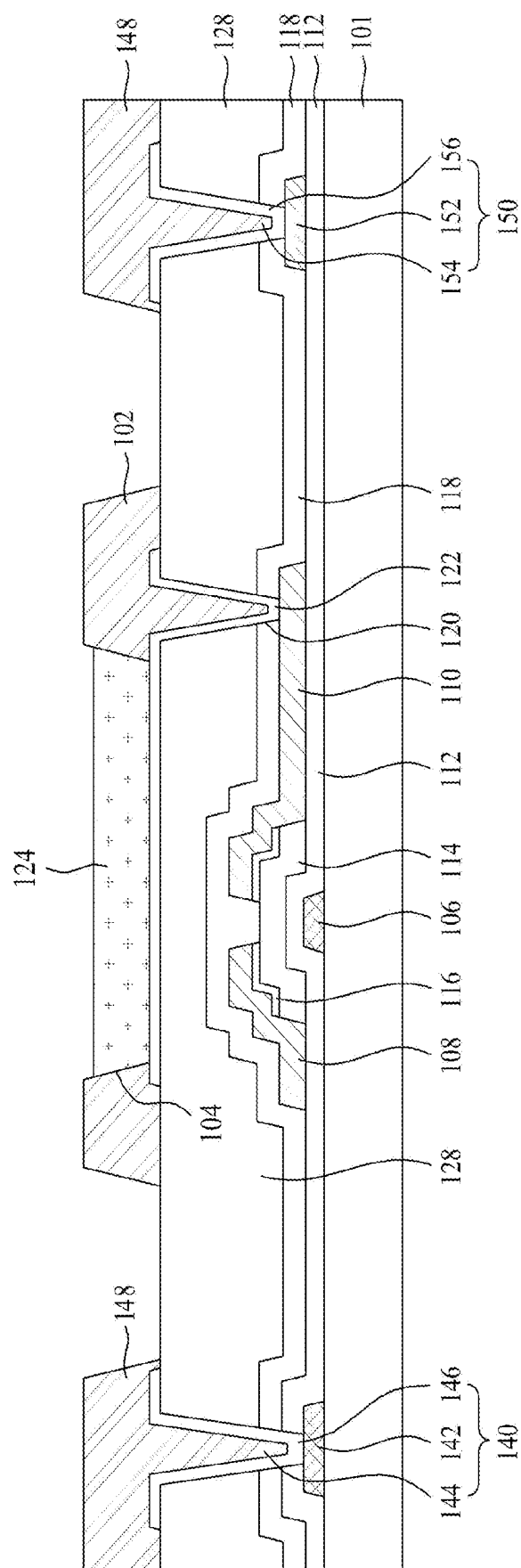


FIG. 2G

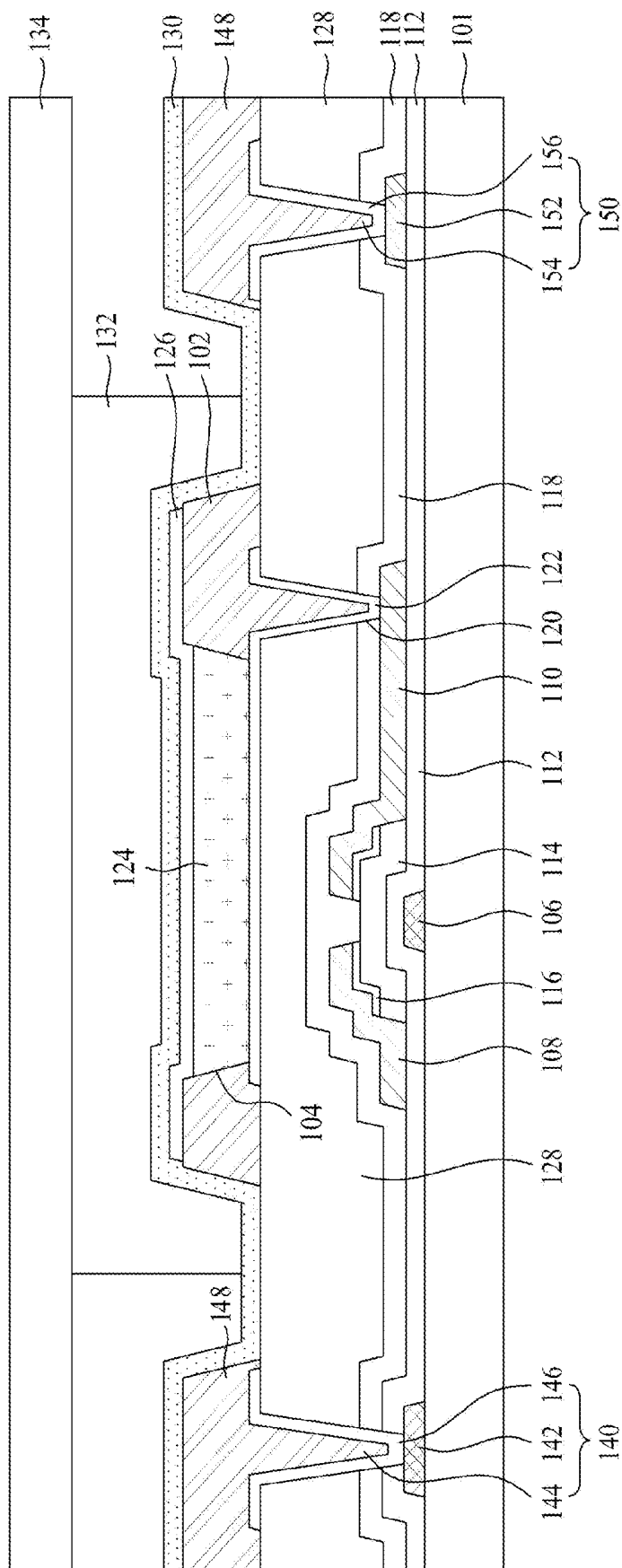


FIG. 2H

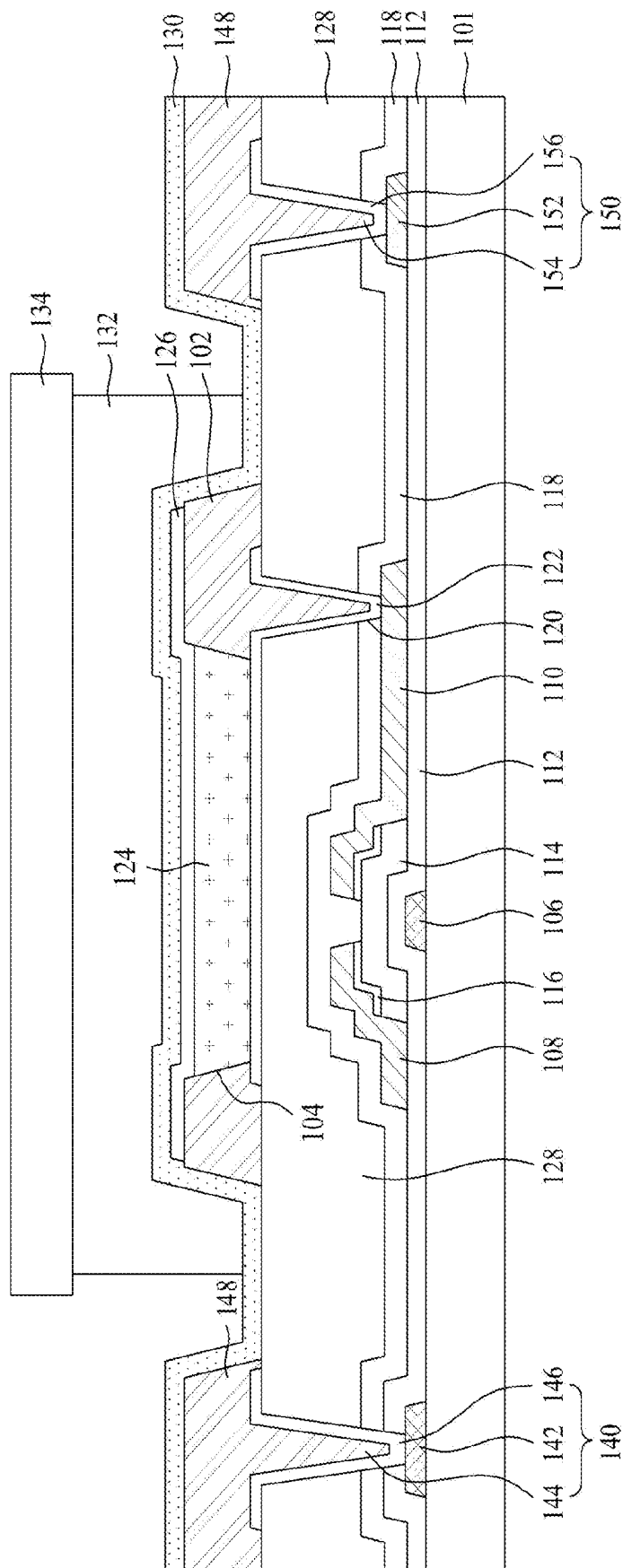
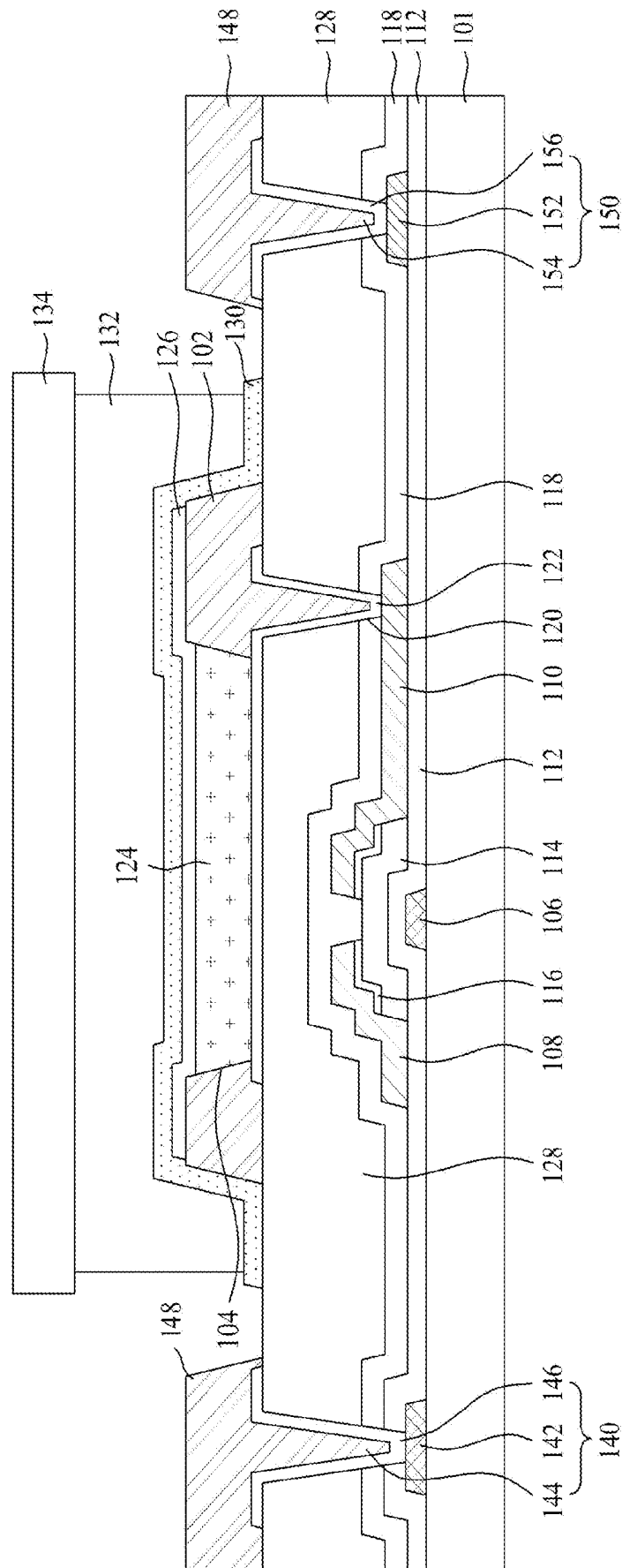


FIG. 2I



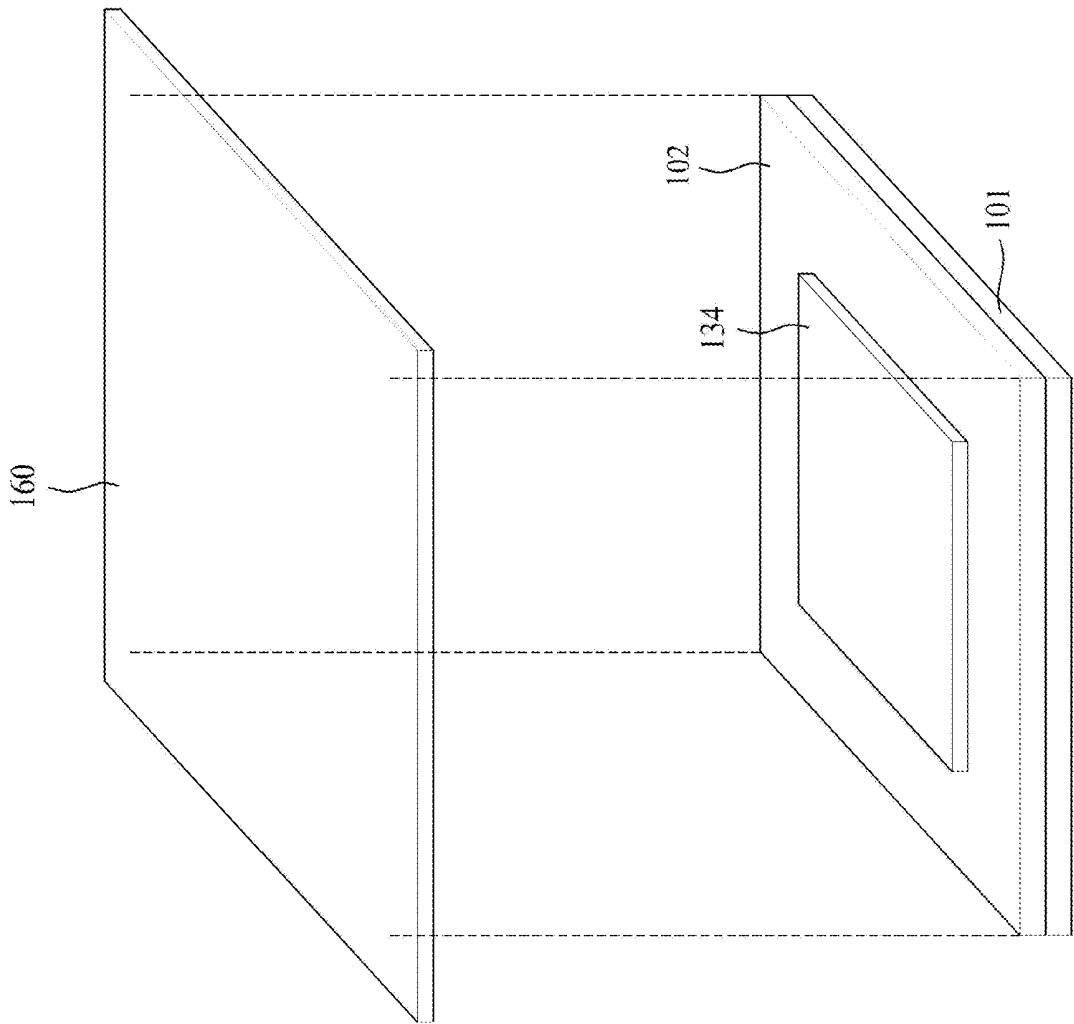


FIG. 3A

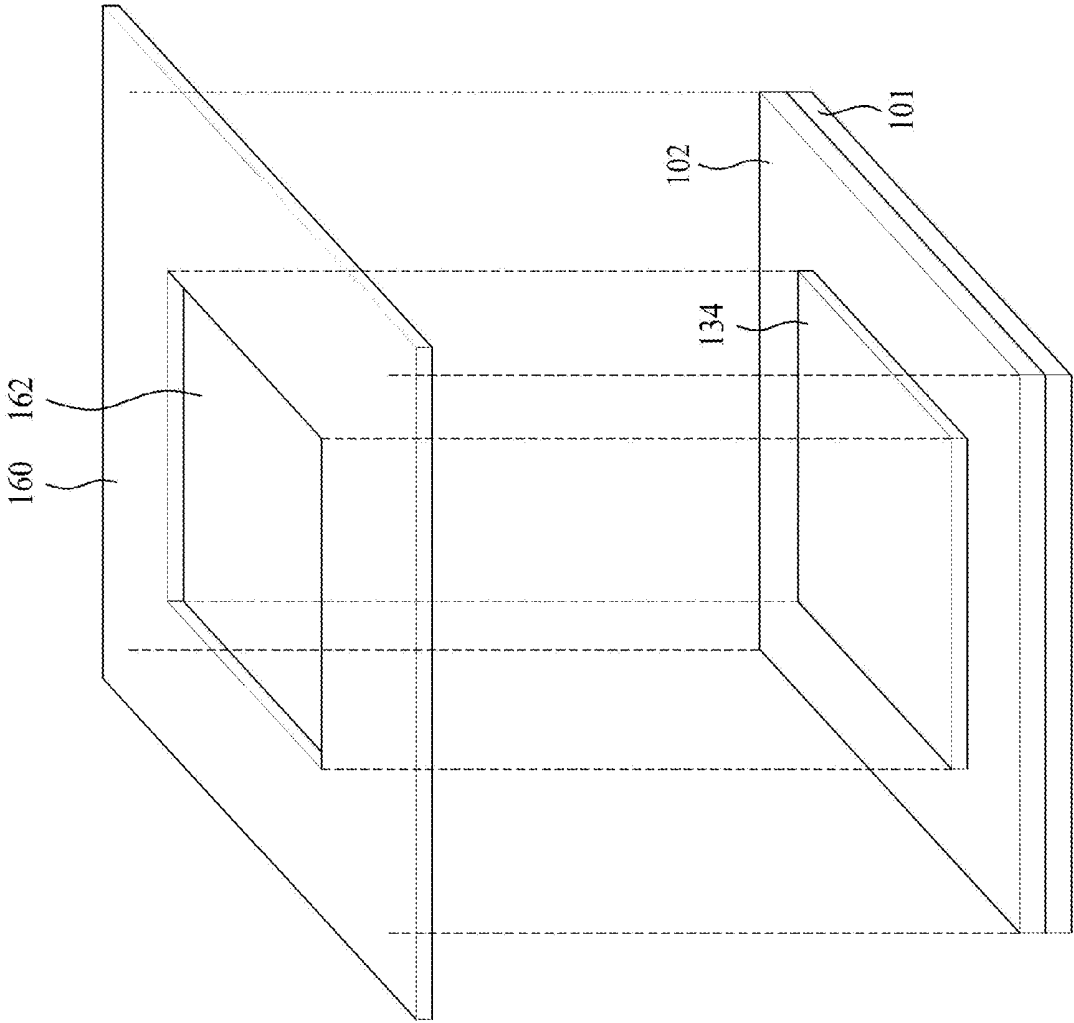


FIG. 3B

FIG. 4B

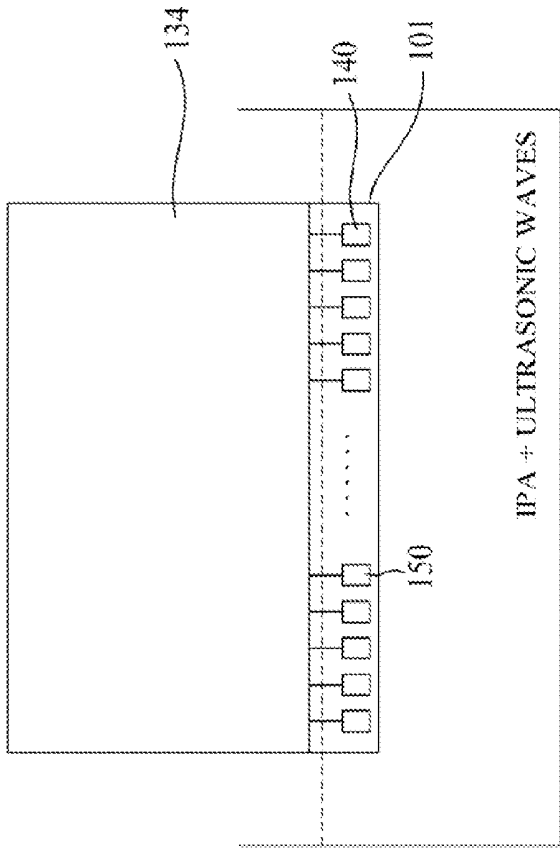


FIG. 4A

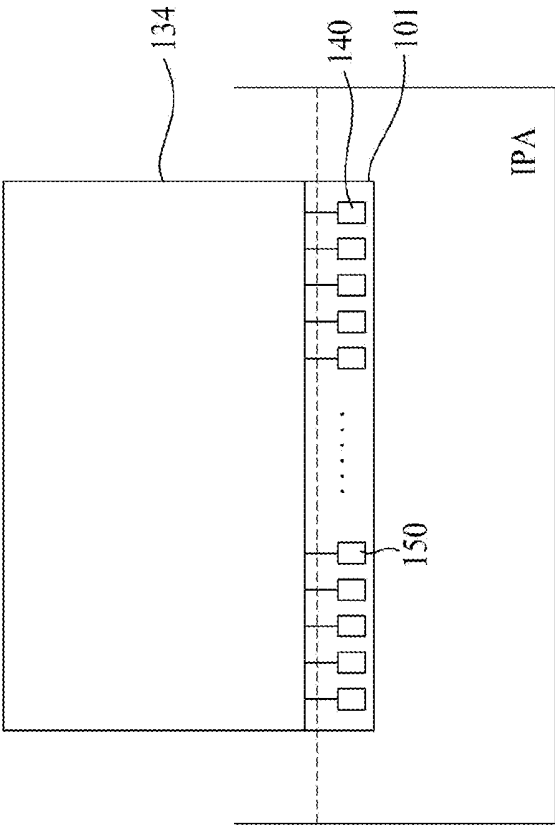


FIG. 5

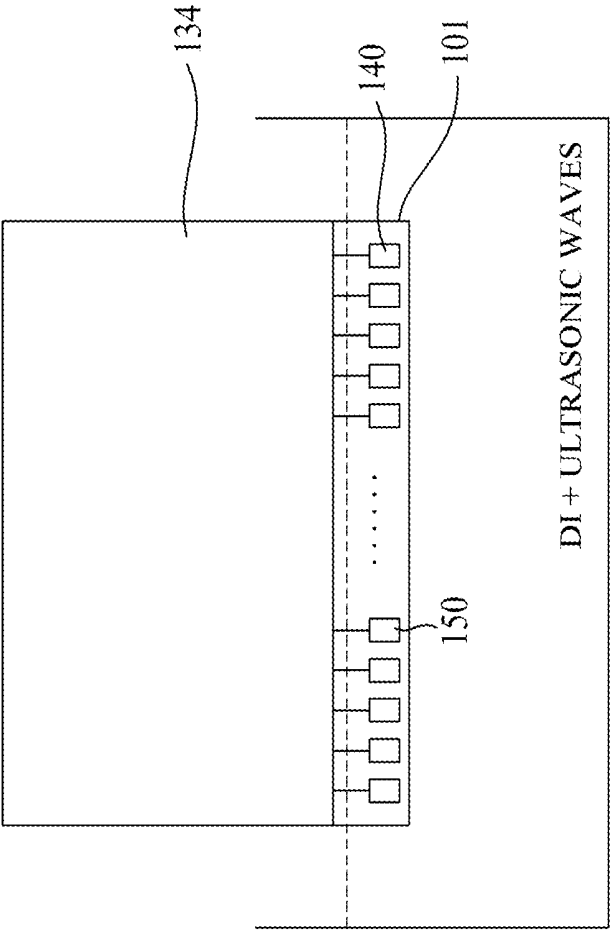


FIG. 6A

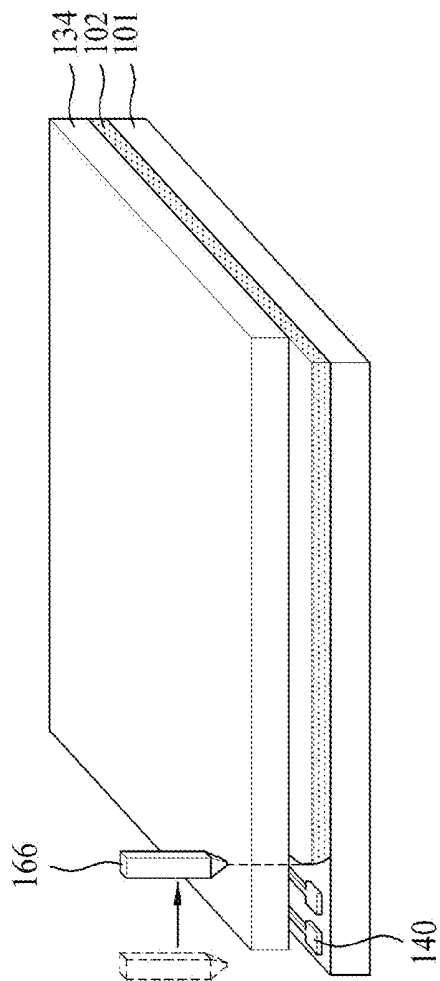
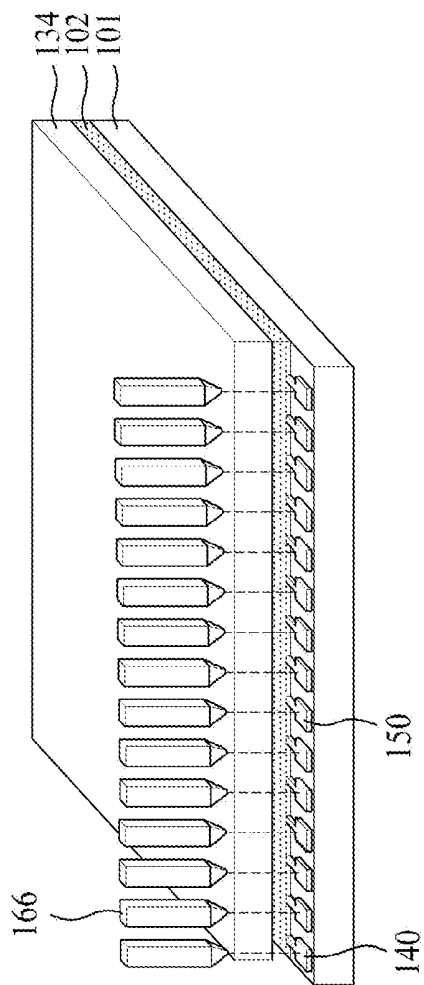


FIG. 6B



METHOD OF MANUFACTURING ORGANIC LIGHT EMITTING DISPLAY PANEL

CROSS REFERENCE TO RELATED APPLICATIONS

This application claims the benefit of Korean Patent Application No. 10-2012-0054091, filed on May 22, 2012, which is hereby incorporated by reference in its entirety.

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a method of manufacturing an organic light emitting display panel capable of forming a protective insulating film in a luminescent region without causing defects in a pattern.

2. Discussion of the Related Art

In recent years, a variety of flat panel display devices having reduced weight and volume, which are drawbacks of cathode ray tubes (CRTs), have been introduced. Examples of flat panel display devices include liquid crystal displays (LCDs), field emission displays (FEDs), plasma display panels (PDPs), and organic electroluminescent displays (ELDs).

Among these display devices, organic electro-luminescent display is a self-emitting device having advantages such as rapid response, high luminous efficacy, high luminance, and wide viewing angle. In conventional organic electro-luminescent displays, a plurality of thin film patterns is formed on a substrate using a mask frame assembly.

A mask frame assembly includes transmission units respectively corresponding to a plurality of thin film patterns, a deposition mask having a blocking unit formed between the transmission units, and a mask frame fixing the deposition mask.

The deposition mask is damaged by plasma generated during a deposition process and deformed due to reduced strength by heat generated during the deposition process. In this regard, a deformed blocking unit of the deposition mask cannot keep the surface flat, thereby causing gaps. Thus, alignment accuracy between the deposition mask and the substrate decreases during the deposition process, resulting in deposition defects by which a thin film is deposited on a substrate corresponding to the blocking unit. Particularly, a protective insulating film that should be formed only in the luminescent region using the deposition mask may also be formed in a pad region corresponding to the blocking unit of the deposition mask due to deformation of the deposition mask.

SUMMARY OF THE INVENTION

Accordingly, the present invention is directed to a method of manufacturing an organic light emitting display device that substantially obviates one or more problems due to limitations and disadvantages of the related art.

An object of the present invention is to provide a method of manufacturing an organic light emitting display panel capable of forming a protective insulating film in a luminescent region without causing pattern defects.

Additional advantages, objects, and features of the invention will be set forth in part in the description which follows and in part will become apparent to those having ordinary skill in the art upon examination of the following or may be learned from practice of the invention. The objectives and other advantages of the invention may be realized and

attained by the structure particularly pointed out in the written description and claims hereof as well as the appended drawings.

To achieve these objects and other advantages and in accordance with the purpose of the invention, as embodied and broadly described herein, a method of manufacturing an organic light emitting display panel includes forming a substrate having a luminescent region and a pad region, simultaneously forming a light emitting cell in the luminescent region and an organic pattern in the pad region, forming a protective insulating film over the substrate, bonding the substrate provided with the protective insulating film and the sealing substrate using an adhesive film formed in a region corresponding to the luminescent region, cutting the bonded substrate provided with the protective insulating film and the sealing substrate into a plurality of unit panels to expose the pad region, and removing the protective insulating film and the organic pattern in the exposed pad region.

The forming of the light emitting cell in the luminescent region and the organic pattern may include simultaneously forming at least one of an organic light emitting layer of the light emitting cell and a bank insulating film defining the organic light emitting layer and the organic pattern using the same material. The organic pattern may be separated from the at least one of the organic light emitting layer and the bank insulating film simultaneously formed.

The removing of the protective insulating film and the organic pattern in the exposed pad region may include adhering an adhesive tape to the substrate, removing the protective insulating film disposed in the pad region and adhered to the adhesive tape by peeling off the adhesive tape, and removing the organic pattern of the pad region by immersing the entire substrate from which the protective insulating film is removed or the pad region in an etchant, which may include isopropyl alcohol. The removing of the protective insulating film and the organic pattern in the exposed pad region may further include irradiating ultrasonic waves to the pad region immersed in the etchant including isopropyl alcohol.

The removing of the protective insulating film and the organic pattern in the exposed pad region may include adhering an adhesive tape to the substrate, removing the protective insulating film disposed in the pad region and adhered to the adhesive tape by peeling off the adhesive tape, immersing the entire substrate from which the protective insulating film is removed or the pad region in deionized water, and removing the organic pattern of the pad region by irradiating ultrasonic waves to the pad region immersed in deionized water.

The removing of the protective insulating film and the organic pattern in the exposed pad region may include adhering an adhesive tape to the substrate, removing the protective insulating film disposed in the pad region and adhered to the adhesive tape by peeling off the adhesive tape, removing the protective insulating film in the pad region to which the adhesive tape is adhered by peeling-off the adhesive tape, and evaporating the organic pattern by irradiating the organic pattern of the pad region exposed by the removal of the protective insulating film. The exposed pad region may be irradiated with a laser beam.

The evaporating of the organic pattern by irradiating the organic pattern of the pad region may include evaporating the organic pattern using energy of the laser beams absorbed by pad electrodes having octagonal or circular shapes and formed in the pad region to remove the organic pattern.

The adhesive tape may be adhered to the substrate to protrude from at least one of a plurality of sides of the substrate.

The removing of the protective insulating film and the organic pattern in the exposed pad region may include

immersing the entire substrate or the pad region in an etchant including isopropyl alcohol or deionized water after the cutting process, and simultaneously removing the organic pattern of the pad region by irradiating ultrasonic waves to the pad region immersed in the etchant including isopropyl alcohol or deionized water and the protective insulating film formed on the organic pattern.

It is to be understood that both the foregoing general description and the following detailed description of the present invention are exemplary and explanatory and are intended to provide further explanation of the invention as claimed.

BRIEF DESCRIPTION OF THE DRAWINGS

The accompanying drawings, which are included to provide a further understanding of the invention and are incorporated in and constitute a part of this application, illustrate embodiment(s) of the invention and together with the description serve to explain the principle of the invention. In the drawings:

FIG. 1 is a cross-sectional view illustrating an organic light emitting display panel according to the present invention;

FIGS. 2A to 2J are cross-sectional views for describing a method of manufacturing the organic light emitting display panel of FIG. 1;

FIGS. 3A and 3B are perspective views illustrating examples of adhesive films used in a peel-off process of removing a protective insulating film described with reference to FIG. 2I;

FIGS. 4A and 4B are diagrams for describing an example of a method of removing an organic pattern described with reference to FIG. 2J;

FIG. 5 is a diagram for describing another example of the method of removing the organic pattern described with reference to FIG. 2J; and

FIGS. 6A and 6B are diagrams for describing another example of the method of removing the organic pattern described with reference to FIG. 2J.

DETAILED DESCRIPTION OF THE INVENTION

Reference will now be made in detail to the preferred embodiments of the present invention, examples of which are illustrated in the accompanying drawings. Wherever possible, the same reference numbers will be used throughout the drawings to refer to the same or like parts.

FIG. 1 is a cross-sectional view illustrating an organic light emitting display panel according to the present invention.

The organic light emitting display panel illustrated in FIG. 1 includes a light emitting substrate and a sealing substrate **134** adhered to the light emitting substrate via an adhesive film **132**.

The light emitting substrate includes a plurality of thin film transistors formed in a luminescent region of the substrate, light emitting cells connected to the thin film transistors, and a protective insulating film **130** formed to protect the light emitting cells.

Each of the thin film transistors includes a gate electrode **106**, a drain electrode **110** connected to a first electrode **122** of a light emitting cell, a source electrode **108** facing the drain electrode **110**, an active layer **114** overlapping the gate electrode **106** while interposing the gate insulating layer **112** therebetween to form a channel between the source electrode **108** and the drain electrode **110**, and an ohmic contact layer **116** formed on the active layer **114** except for the channel

region for ohmic contact between the active layer **114** and each of the source electrode **108** and the drain electrode **110**.

An inorganic passivation layer **118** formed of an inorganic insulating material and an organic passivation layer **128** formed of an organic insulating material are sequentially laminated on the thin film transistor. The organic passivation layer **128** is formed to planarize the substrate **101** provided with the thin film transistor thereon. The inorganic passivation layer **118** is formed to improve stability of interfaces between the organic passivation layer **128** and each of the gate insulating layers **112** and the source and drain electrodes **108** and **110**.

The light emitting cell includes a first electrode **122** formed on the organic passivation layer **128**, an organic light emitting layer **124** formed on the first electrode **122**, and a second electrode **126** formed on the organic light emitting layer **124**.

The organic light emitting layer **124** includes a hole-related layer, a light emitting layer, and an electron-related layer sequentially formed on the first electrode **122** or in reverse order. The organic light emitting layer **124** is formed in a bank hole **104** defined by a bank insulating film **102** that partitions each luminescent region.

The first electrode **122** is electrically connected to the drain electrode **110** of the thin film transistor via a pixel contact hole **120** that penetrates the inorganic passivation layer **118** and the organic passivation layer **128**. The first electrode **122** may have its structure formed by laminating an opaque conductive material such as aluminum (Al) and a transparent conductive material such as indium tin oxide (ITO). Alternatively, the first electrode **122** may be formed of an acid-resistant and corrosion-resistant opaque metal.

The second electrode **126** is formed on the organic light emitting layer **124**. The second electrode **126** is formed of a transparent conductive material such as ITO. Thus, light generated in the organic light emitting layer **124** is emitted upward through the second electrode **126**.

The protective insulating film **130** is disposed between the light emitting cell and the adhesive film **132** to prevent the light emitting cell, particularly, the organic light emitting layer **124**, from being damaged by moisture or oxygen or to prevent deterioration of light emitting characteristics thereof. Particularly, the protective insulating film **130** is formed to be in contact with the adhesive film **132** to block infiltration of moisture, hydrogen, and oxygen via side and front surfaces of the organic light emitting display panel. The protective insulating film **130** is formed as an inorganic insulating film using materials such as SiN_x , SiO_x , or the like.

Meanwhile, a gate pad **140** and a data pad **150** are formed in a pad region of the substrate **101** exposed by the sealing substrate **134**.

The gate pad **140** is connected to a gate driving integrated circuit (IC) and a gate line to provide a driving signal from the gate driving IC to the gate line. To this end, the gate pad **140** includes a gate pad lower electrode **142** extending from the gate line and a gate pad upper electrode **146** disposed on the gate pad lower electrode **142** and connected to the gate pad lower electrode **142**. In this regard, the gate pad upper electrode **146** is connected to the gate pad lower electrode **142** via a gate contact hole **144** that penetrates the gate insulating film **112**, the inorganic passivation film **118**, and the organic passivation film **128**.

The data pad **150** is connected to a data driving IC and a data line to provide a driving signal from the data driving IC to the data line. To this end, the data pad **150** includes a data pad lower electrode **152** extending from the data line and a data pad upper electrode **156** disposed on the data pad lower electrode **152** and connected to the data pad lower electrode

152. In this regard, the data pad upper electrode 156 is connected to the data pad lower electrode 152 via a data contact hole 154 that penetrates the organic passivation film 128 and the inorganic passivation film 118.

The sealing substrate 134 is bonded to the light emitting substrate provided with the thin film transistor, the light emitting cell, and the protective insulating film 130 via the adhesive film 132, which may be disposed on the bottom surface of the sealing substrate 134 or the top surface of the protective insulating film 130 to seal the light emitting cell. Accordingly, the sealing substrate 134 forms a seal that prevents external moisture or oxygen from entering the light emitting substrate. In addition, since the adhesive film 132 is disposed between the bottom surface of the sealing substrate 134 and the top surface of the protective insulating film 130 that protects the organic light emitting layer 124, the space between the light emitting substrate and the sealing substrate 134 is filled with the adhesive film 132. Accordingly, the adhesive film 132 absorbs external impact, resulting in improved rigidity of the organic light emitting display panel according to the present invention.

FIGS. 2A to 2J are cross-sectional views for describing a method of manufacturing the organic light emitting display panel of FIG. 1.

Referring to FIG. 2A, a gate pattern including the gate electrode 106 and the gate pad lower electrode 142, the gate insulating film 112, semiconductor patterns 114 and 116, and a data pattern including the source and drain electrodes 108 and 110 and the data pad lower electrode 152 are sequentially formed on the substrate 101.

Particularly, a gate metal layer is formed on the substrate 101 by a deposition method such as sputtering. In this regard, the gate metal layer is formed using a metal such as an aluminum-based metal (Al and AlNd), copper (Cu), titanium (Ti), molybdenum (Mo), and tungsten (W). Then, the gate metal layer is patterned by photolithography and etching to form the gate pattern including the gate electrode 106 and the gate pad lower electrode 142.

Then, an inorganic insulating material such as silicon oxide (SiO_x) or silicon nitride (SiN_x) may be formed over the substrate 101 provided with the gate pattern to form the gate insulating film 112. Then, an amorphous silicon layer and an amorphous silicon layer doped with an impurity (n^+ or p^+) are sequentially formed on the substrate 101 provided with the gate insulating film 112. Then, the amorphous silicon layer and the amorphous silicon layer doped with an impurity (n^+ or p^+) are patterned by photolithography and etching to form the semiconductor patterns including the active layer 114 and the ohmic contact layer 116.

Then, a data metal layer is formed on the substrate 101 provided with the semiconductor patterns by deposition such as sputtering. In this regard, the data metal layer may be formed of titanium (Ti), tungsten (W), an aluminum (Al)-based metal, molybdenum (Mo), copper (Cu), or the like. Then, the data metal layer is patterned by photolithography and etching to form the data pattern including the source and drain electrodes 108 and 110 and the data pad lower electrode 152. Then, a portion of the ohmic contact layer 116 disposed between the source electrode 108 and the drain electrode 110 is removed using the source electrode 108 and the drain electrode 110 as masks to expose the active layer 114.

Since the semiconductor patterns 114 and 116 and the data pattern are independently formed as described above, two masks are required therefor. Besides, the semiconductor patterns 114 and 116 and the data pattern may be formed by use

of a diffraction mask or semi-transmissive mask or via a single mask process using a diffraction mask, i.e., may be simultaneously formed.

Referring to FIG. 2B, the inorganic passivation film 118 and the organic passivation film 128 having the pixel contact hole 120, the gate contact hole 144, and the data contact hole 154 are formed on the substrate 101 provided with the data pattern.

Particularly, the inorganic passivation film 118 is formed by applying an inorganic insulating material such as silicon oxide (SiO_x) or silicon nitride (SiN_x) over the substrate 101 provided with the data pattern. Then, the organic passivation film 128 is formed by applying an organic insulating material such as an acrylic resin over the inorganic passivation film 118. Then, the inorganic passivation film 118 and the organic passivation film 128 are patterned by photolithography and etching to form the pixel contact hole 120, the gate contact hole 144, and the data contact hole 154. The pixel contact hole 120 penetrates the inorganic passivation film 118 and the organic passivation film 128 to expose the drain electrode 110. The data contact hole 154 penetrates the inorganic passivation film 118 and the organic passivation film 128 to expose the data pad lower electrode 152. The gate contact hole 144 penetrates the gate insulating film 112, the inorganic passivation film 118, and the organic passivation film 128 to expose the gate pad lower electrode 142.

Referring to FIG. 2C, the first electrode 122, the gate pad upper electrode 146, and the data pad upper electrode 156 are formed on the substrate 101 provided with the organic passivation film 128 with the respective holes.

Particularly, an opaque conductive layer having high reflectivity and high acid-resistance or a stack structure including an opaque conductive layer having high reflectivity and a transparent conductive layer having high acid-resistance may be formed on the substrate 101 provided with the organic passivation film 128 by deposition such as sputtering. Then, the conductive layers are patterned by photolithography and etching to form the first electrode 122, the gate pad upper electrode 146, and the data pad upper electrode 156.

Referring to FIG. 2D, the bank insulating film 102 having the bank hole 104 is formed on the substrate 101 provided with the first electrode 122. Simultaneously, an organic pattern 148 may be formed on the gate pad 140 and the data pad 150.

Particularly, the bank insulating film 102 having the bank hole 104 and the organic pattern 148 are simultaneously formed by forming an organic insulating material such as an acrylic resin over the substrate 101 provided with the first electrode 122 and patterning the organic insulating material by photolithography and etching or by photolithography only. The bank hole 104 penetrates the bank insulating film 102 of each pixel region to expose the first electrode 122. The bank insulating film 102 is formed to define light emitting cells realizing different colors. The organic pattern 148 is formed to cover the gate pad upper electrode 146 and the data pad upper electrode 156. In this regard, the bank insulating film 102 formed in the luminescent region is isolated from the organic pattern 148 formed to cover the gate pad upper electrode 146 and the data pad upper electrode 156.

Referring to FIG. 2E, the organic light emitting layer 124 is formed on the substrate 101 provided with the bank insulating film 102 and the organic pattern 148.

Particularly, the organic light emitting layer 124 including the electron-related layer, the light emitting layer, and the hole-related layer is formed on the portion of the first elec-

trode **122** exposed by the hole **104** within the bank insulating film **102** by thermal deposition, sputtering, or any combination thereof.

Referring to FIG. 2F, the second electrode **126** is formed on the substrate **101** provided with the organic light emitting layer **124**.

Particularly, the second electrode **126** is formed by coating the substrate **101** provided with the organic light emitting layer **124** with a transparent conductive film. The transparent conductive film may be formed of indium tin oxide (ITO), tin oxide (TO), indium zinc oxide (IZO), SnO₂, amorphous-indium tin oxide (a-ITO), or the like.

Referring to FIG. 2G, the protective insulating film **130** is formed over the substrate **101** provided with the second electrode **126** by depositing silicon oxide or silicon nitride over the entire surface thereof. In this regard, the protective insulating film **130** is deposited over the entire surface of the substrate **101** without using a deposition mask. Thus, the protective insulating film **130** is formed on the pad region including the gate pad **140** and the data pad **150** as well as the luminescent region. Then, the adhesive film **132** is applied to the top surface of the protective insulating film **130** or the bottom surface of the sealing substrate **134**. As shown, the adhesive film **132** may be disposed such that it substantially covers the luminescent region including the banks **102**. Accordingly, the light emitting substrate provided with the light emitting cell is bonded to the sealing substrate **134** via the adhesive film **132**.

Referring to FIG. 2H, the sealing substrate **134** and the light emitting substrate bonded to each other are divided into a plurality of light emitting panels. Particularly, the sealing substrate **134** and the light emitting substrate bonded to each other are cut along scribe lines into a plurality of light emitting panels. After the cutting process, the pad region including the gate pad **140** and the data pad **150** of each of the light emitting panels is exposed to the outside by the sealing substrate **134**.

Referring to FIG. 2I, a portion of the protective insulating film **130** where the gate pad **140** and the data pad **150** are disposed is removed by a peel-off process. Particularly, an adhesive tape **160** is attached to the substrate **101** to cover the protective insulating film **130** formed in the pad region and exposed by removing the corresponding sealing substrate **134** as illustrated in FIGS. 3A and 3B. In this regard, the adhesive tape **160** illustrated in FIG. 3A covers the bonded sealing substrate **134** and the substrate **101** provided with the light emitting cell and has a greater area than the substrate **101** provided with the light emitting cell. The adhesive tape **160** illustrated in FIG. 3B has an opening **162** that exposes the sealing substrate **134** and has a greater area than the substrate **101** exposed by the sealing substrate **134**. The adhesive tapes **160** of FIGS. 3A and 3B include a base film formed of polyethylene terephthalate (PET) or polyimide and an adhesive layer formed on the base film using at least one of silicone and acryl and has a peel strength of 50 gf/in or greater. In addition, the adhesive tapes **160** illustrated in FIGS. 3A and 3B have greater areas than the substrate **101** provided with the light emitting cell to protrude from at least one of the sides of the substrate **101** provided with the light emitting cell. Thus, the protruded portion of the adhesive tape **160** may be used to initiate the peel-off process, thereby facilitating the peel-off process.

During the peel-off process of the adhesive tape **160**, the protective insulating film **130** bonded to the adhesive tape **160** is separated from the organic pattern **148**. In this regard, the adhesive force between the protective insulating film **130** formed of an inorganic insulating material and the organic

pattern **148** formed of an organic insulating material is lower than the adhesive force between the organic passivation film **128** provided with the gate pad upper electrode **146** and the data pad upper electrode **156** and the organic pattern **148**, so that only the protective insulating film **130** is removed in the peel-off process.

Referring to FIG. 2J, the organic pattern **148** disposed on the gate pad **140** and the data pad **150** is removed by one of the processes illustrated in FIGS. 4A to 6B to expose the gate pad **140** and the data pad **150**.

Particularly, as illustrated in FIG. 4A, the pad region in which the gate pad **140** and the data pad **150** are formed or the entire organic light emitting display panel is immersed in an etchant for several to several tens of minutes, for example, for 6 to 15 minutes. In this regard, the etchant may be a solution including isopropyl alcohol (IPA). Accordingly, the organic pattern **148** disposed on the gate pad **140** and the data pad **150** is removed by etching using the sealing substrate **134** as a mask and the etchant, thereby exposing the gate pad upper electrode **146** and the data pad upper electrode **156**. Meanwhile, in addition to the method of removing the organic pattern **148** by use of the etchant, the organic pattern **148** may also be removed by immersing the pad region in an etchant and treating the pad region with ultrasonic waves at 40 kHz to 50 kHz and 50 W to 60 W to reduce processing time as illustrated in FIG. 4B.

Alternatively, as illustrated in FIG. 5, only the pad region including the gate pad **140** and the data pad **150** is immersed in deionized water (DI), or the entire organic light emitting display panel in which the sealing substrate and the light emitting substrate are bonded to each other is immersed in deionized water. Then, the pad region immersed in deionized water is treated with ultrasonic waves at 40 kHz to 50 kHz and 50 W to 60 W, so that the organic pattern **148** disposed on the gate pad **140** and the data pad **150** may be separated from the gate pad upper electrode **146** and the data pad upper electrode **156**. Meanwhile, the process of removing the organic pattern **148** using deionized water and ultrasonic waves is less harmful to the atmospheric environment and workers than the process of removing the organic pattern **148** using IPA as illustrated in FIG. 4A.

Meanwhile, when the pad region including the gate pad **140** and the data pad **150** is immersed in the etchant including IPA or deionized water and treated with ultrasonic waves after the cutting process illustrated in FIG. 2H, the organic pattern **148** is removed from the gate pad upper electrode **146** and the data pad upper electrode **156**, so that the protective insulating film **130** formed on the organic pattern **148** may also be removed. Accordingly, the protective insulating film **130** and the organic pattern **148** disposed on the gate pad **140** and the data pad **150** may be simultaneously removed using the etchant or deionized water and ultrasonic waves without performing the peel-off process for removing the protective insulating film **130** disposed on the gate pad **140** and the data pad **150**.

Alternatively, the organic pattern **148** disposed in the pad region exposed by the sealing substrate **134** is removed by irradiation, for example sequentially using a short wavelength diode laser irradiation device **166** illustrated in FIG. 6A or by batch irradiation of laser beams using a laser irradiation device **166** illustrated in FIG. 6B. Particularly, short wavelength linear laser beams or short wavelength spot laser beams are irradiated to the gate pad **140** of the pad region, energy of the laser beams is partially absorbed by the opaque material since at least one of the gate pad lower electrode **142** and the gate pad upper electrode **146** disposed under the organic pattern **148** is formed of an opaque material. Thus, the

organic pattern **148** formed of an organic material and disposed on the gate pad upper electrode **146** is evaporated by the absorbed energy and removed. In the same manner, when laser beams are irradiated to the data pad **150** of the pad region, energy of the laser beams is partially absorbed by the opaque material since at least one of the data pad lower electrode **152** and the data pad upper electrode **156** disposed under the organic pattern **148** is formed of an opaque material. Accordingly, the organic pattern **148** formed of an organic material and disposed on the data pad upper electrode **156** is evaporated by the absorbed energy and removed.

Meanwhile, when the organic pattern **148** is removed by the laser irradiation device **166**, laser beams are irradiated to regions of the organic pattern **148** corresponding to the centers of the pad electrodes **142**, **152**, **146**, and **156**. In this case, while portions of the organic pattern **148** formed on the central regions of the pad electrodes **142**, **152**, **146**, and **156**, each having a rectangular surface area, are easily removed, portions of the organic pattern **148** formed on corners of each of the pad electrodes **142**, **152**, **146**, and **156** farthest from the centers of the pad electrodes **142**, **152**, **146**, and **156** are not easily removed. In order to overcome this problem, the corners of each of the pad electrodes **142**, **152**, **146**, and **156** are rounded to form octagonal or circular shapes such that the distance between the center and a circumferential position of each of the pad electrodes **142**, **152**, **146**, and **156** may be identical or similar to each other. As a result, since each of the pad electrodes **142**, **152**, **146**, and **156** having an octagonal or circular shape has a uniform distance between the center and each of the sides or corners, laser beams are uniformly irradiated to the entire area of each of the pad electrodes **142**, **152**, **146**, and **156**. Thus, the organic pattern **148** disposed on each of the pad electrodes **142**, **152**, **146**, and **156** is completely removed.

Meanwhile, since a melting point of the organic pattern **148** is lower than melting points of the gate insulating film **112** and the inorganic passivation film **118**, which are formed of an inorganic insulating material, and melting points of the pad electrodes **142**, **152**, **146**, and **156**, the organic pattern **148** may be removed without damaging the gate insulating film **112**, the inorganic passivation film **118**, and the pad electrodes **142**, **152**, **146**, and **156** during laser irradiation.

Meanwhile, the organic pattern **148** and the bank insulating film **102** are simultaneously formed of the same material according to the illustrated embodiment. However, the organic pattern **148** may be simultaneously formed of the same material as that of at least one organic light emitting layer **124** among an organic light emitting layer realizing red light, an organic light emitting layer green light, and an organic light emitting layer realizing blue light.

According to the present invention, after an organic pattern **148** is formed in a pad region (e.g., **140**, **150**), and a protective insulating film **130** is deposited over the entire surface, the protective insulating film **130** and the organic pattern **148** are removed. Depending on the embodiment, the insulating film **130** and the organic pattern **148** may be sequentially or simultaneously removed. Accordingly, since the protective insulating film **130** according to the present invention may be formed without using a deposition mask, the protective insulating film **130** may be formed in the luminescent region (e.g., **124**) without causing defects associated with using the deposition mask. In addition, since the protective insulating film **130** is formed without using the deposition mask, a mask stocker, a vision aligner, and a mask frame, which are typically essential equipment for applying a protective film using the deposition mask, are not required, thereby reducing the manufacturing costs.

It will be apparent to those skilled in the art that various modifications and variations can be made in the present invention without departing from the spirit or scope of the inventions. Thus, it is intended that the present invention covers the modifications and variations of this invention provided they come within the scope of the appended claims and their equivalents.

What is claimed is:

1. A method of manufacturing an organic light emitting display panel, the method comprising:

- forming a substrate having a luminescent region and a pad region;
- forming a light emitting cell in the luminescent region and an organic pattern in the pad region;
- forming a protective insulating film over the luminescent region and the pad region of the substrate;
- bonding the substrate provided with the protective insulating film and a sealing substrate using an adhesive film formed in a region corresponding to the luminescent region;
- cutting the bonded substrate provided with the protective insulating film and the sealing substrate into a plurality of unit panels to expose the pad region; and
- subsequent to exposing the pad region, removing the protective insulating film and the organic pattern in the exposed pad region.

2. The method according to claim 1, wherein the forming of the light emitting cell and the organic pattern comprises simultaneously forming the organic pattern and at least one of an organic light emitting layer of the light emitting cell and a bank insulating film defining the organic light emitting layer using the same material, wherein the organic pattern is separated from the at least one of the simultaneously formed organic light emitting layer and bank insulating film.

3. The method according to claim 1, wherein the removing of the protective insulating film and the organic pattern in the exposed pad region comprises:

- adhering an adhesive tape to the substrate;
- removing the protective insulating film disposed in the pad region and adhered to the adhesive tape by peeling off the adhesive tape; and
- removing the organic pattern of the pad region by immersing the entire substrate from which the protective insulating film is removed or the pad region in an etchant.

4. The method according to claim 3, wherein the removing of the protective insulating film and the organic pattern in the exposed pad region further comprises irradiating ultrasonic waves to the pad region immersed in the etchant, the etchant comprising isopropyl alcohol.

5. The method according to claim 1, wherein the removing of the protective insulating film and the organic pattern in the exposed pad region comprises:

- adhering an adhesive tape to the substrate;
- removing the protective insulating film disposed in the pad region and adhered to the adhesive tape by peeling off the adhesive tape;
- immersing the entire substrate from which the protective insulating film is removed or the pad region in deionized water; and
- removing the organic pattern of the pad region by irradiating ultrasonic waves to the pad region immersed in deionized water.

6. The method according to claim 1, wherein the removing of the protective insulating film and the organic pattern in the exposed pad region comprises:

- adhering an adhesive tape to the substrate;

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removing the protective insulating film disposed in the pad region and adhered to the adhesive tape by peeling off the adhesive tape;

removing the protective insulating film in the pad region to which the adhesive tape is adhered by peeling-off the adhesive tape; and

evaporating the organic pattern by irradiating laser beams to the organic pattern of the pad region exposed by removal of the protective insulating film.

7. The method according to claim 6, wherein the evaporating of the organic pattern by irradiating laser beams to the organic pattern of the pad region comprises evaporating the organic pattern using energy of the laser beams absorbed by pad electrodes having octagonal or circular shapes and formed in the pad region to remove the organic pattern.

8. The method according to claim 3, wherein the adhesive tape is adhered to the substrate to protrude from at least one of a plurality of sides of the substrate.

9. The method according to claim 5, wherein the adhesive tape is adhered to the substrate to protrude from at least one of a plurality of sides of the substrate.

10. The method according to claim 6, wherein the adhesive tape is adhered to the substrate to protrude from at least one of a plurality of sides of the substrate.

11. The method according to claim 1, wherein the removing of the protective insulating film and the organic pattern in the exposed pad region comprises:

immersing the entire substrate or the pad region in an etchant comprising isopropyl alcohol or deionized water after the cutting process; and

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simultaneously removing the organic pattern of the pad region by irradiating ultrasonic waves to the pad region immersed in the etchant comprising isopropyl alcohol or deionized water and the protective insulating film formed on the organic pattern.

12. A method of manufacturing an organic light emitting display panel, the method comprising:

forming a substrate having a luminescent region and a pad region;

simultaneously forming an organic pattern in the pad region and at least one of an organic light emitting layer of a light emitting cell and a bank insulating film in the luminescent region, the bank insulating film defining the organic light emitting layer;

forming a protective insulating film over the luminescent region and the pad region of the substrate;

bonding the substrate provided with the protective insulating film and a sealing substrate using an adhesive film formed in a region corresponding to the luminescent region;

cutting the bonded substrate provided with the protective insulating film and the sealing substrate into a plurality of unit panels to expose the pad region; and

subsequent to exposing the pad region, removing the protective insulating film and the organic pattern in the exposed pad region.

* * * * *

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[标]申请(专利权)人(译)	乐金显示有限公司		
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摘要(译)

公开了一种制造有机发光显示板的方法，该有机发光显示板在发光区域中形成保护绝缘膜而不会引起图案中的缺陷。制造有机发光显示面板的方法包括形成具有发光区域和焊盘区域的基板，同时在发光区域中形成发光单元并在焊盘区域中形成有机图案，在基板上形成保护绝缘膜使用形成在与发光区域对应的区域中的粘合膜将设置有保护绝缘膜的基板与密封基板接合，将设置有保护绝缘膜和密封基板的接合基板切割成多个单元面板以暴露焊盘区域，并去除暴露焊盘区域中的保护绝缘膜和有机图案。

