US007936121B2

(12) United States Patent
Kim

(10) Patent No.: **US 7,936,121 B2**

(45) Date of Patent: **May 3, 2011**

(54) **ORGANIC LIGHT EMITTING DISPLAY DEVICE**

(75) Inventor: **Hyeong-gwon Kim**, Suwon-si (KR)

(73) Assignee: **Samsung Mobile Display Co., Ltd.**, Yongin, Gyunggi-do (KR)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 328 days.

(21) Appl. No.: **12/117,647**

(22) Filed: **May 8, 2008**

(65) **Prior Publication Data**

US 2008/0278070 A1 Nov. 13, 2008

(30) **Foreign Application Priority Data**

May 10, 2007 (KR) 10-2007-0045554

(51) **Int. Cl.**
H01L 51/50 (2006.01)

(52) **U.S. Cl.** **313/504**; 257/100; 428/690

(58) **Field of Classification Search** 313/504; 257/100; 428/690

See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

6,888,237 B1 *	5/2005	Guenther	....	257/704
2002/0057052 A1 *	5/2002	Kobayashi	....	313/504
2004/0124765 A1 *	7/2004	Iwase	....	313/504
2004/0234813 A1 *	11/2004	Lee et al.	....	428/690

FOREIGN PATENT DOCUMENTS

JP	1997-330792	12/1997
JP	2003-150316	5/2003
JP	2004-145878	5/2004
KR	20-0218684	1/2001
KR	10 2003-0055856	7/2003
KR	10 2004-0031512	4/2004
KR	1020060077898 A	7/2006
KR	10-2006-0114595	11/2006
KR	10 2006-0114596	11/2006

OTHER PUBLICATIONS

Notice of Allowance for KR 9-5-2008-019633501, dated Apr. 10, 2008.

* cited by examiner

Primary Examiner — Nimeshkumar D Patel
Assistant Examiner — Mary Ellen Bowman
(74) *Attorney, Agent, or Firm* — Knobbe, Martens, Olson & Bear, LLP

(57) **ABSTRACT**

An organic light emitting display device having a touch panel function comprises at least one organic light emitting diode and an encapsulating thin film for encapsulating the organic light emitting diode; and an external input device formed on the display panel for generating an electric signal in response to a touch operation applied from the exterior thereof. The external input device includes an upper substrate and a spacing member. The external input device has a third electrode formed on the display panel and a fourth electrode formed on the upper substrate to intersect the third electrode. The spacing member forms a predetermined spacing between the third electrode and the fourth electrode.

16 Claims, 11 Drawing Sheets

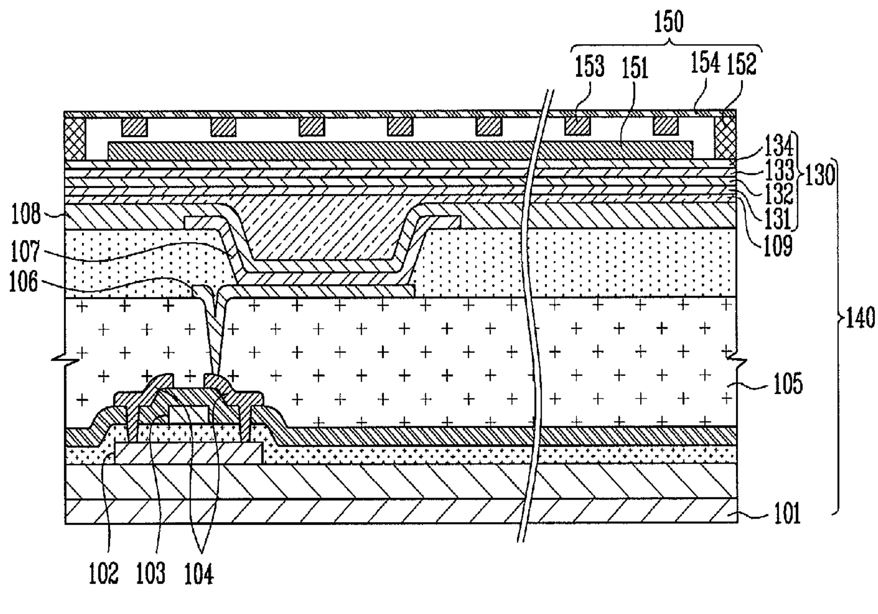


FIG. 1

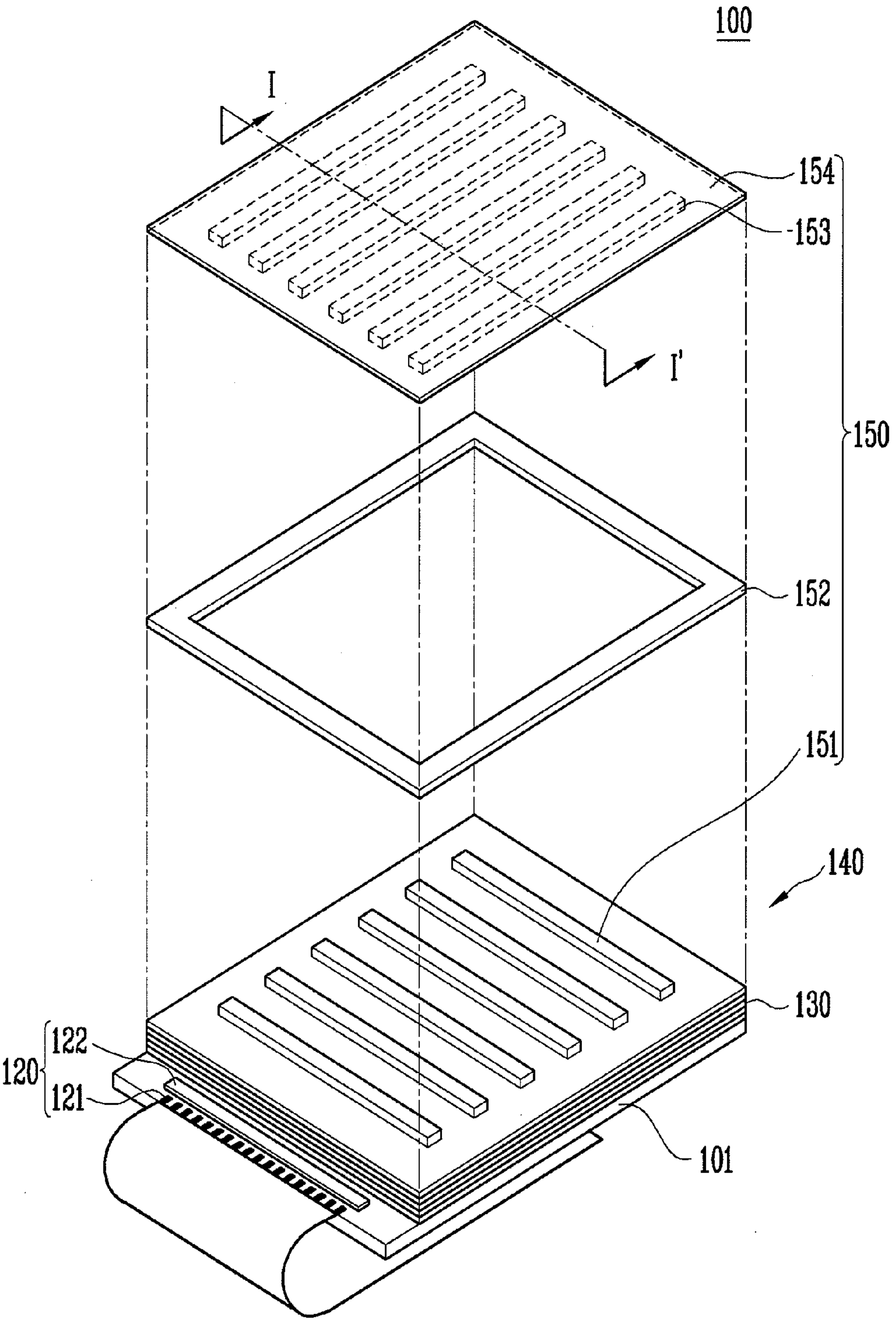


FIG. 2

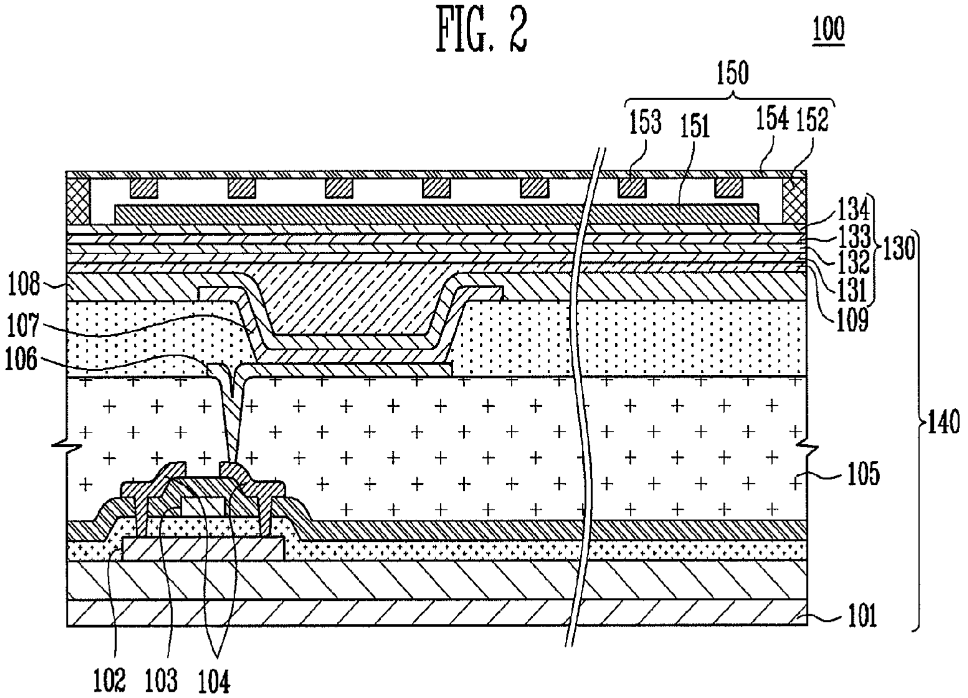

100
150
153
151
154
152
134
133
132
131
130
108
107
106
109
140
105
101
102
103
104

FIG. 3

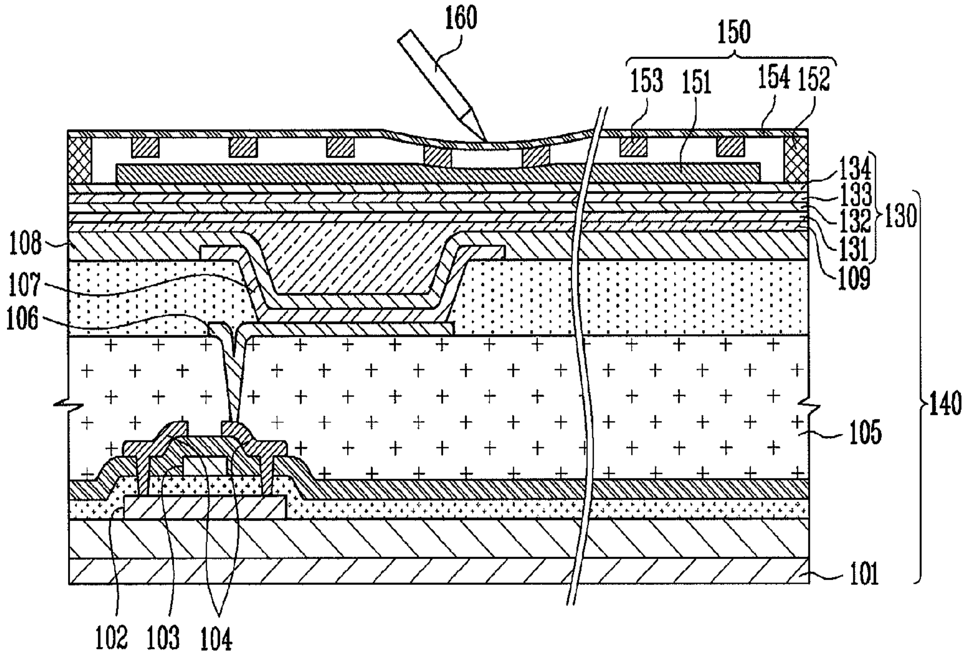

160
150
153
151
154
152
134
133
132
131
130
108
107
106
109
140
105
101
102
103
104

FIG. 4A

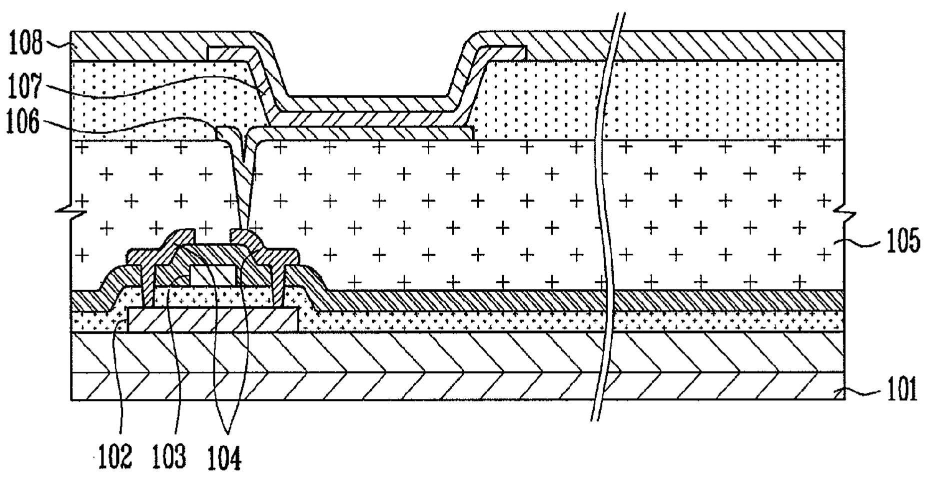

108
107
106
105
101
102 103 104

FIG. 4B

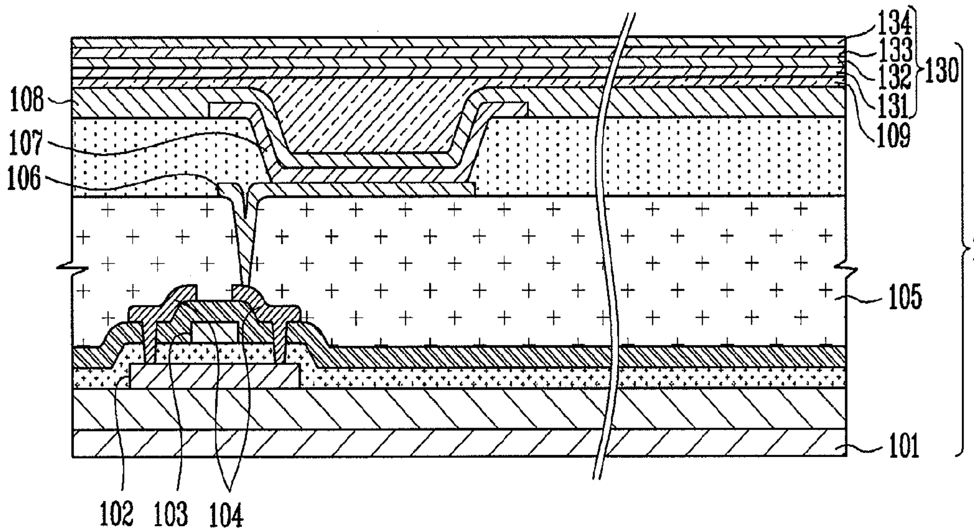

134
133
132
131
130
109
108
107
106
140
105
101
102 103 104

FIG. 4C

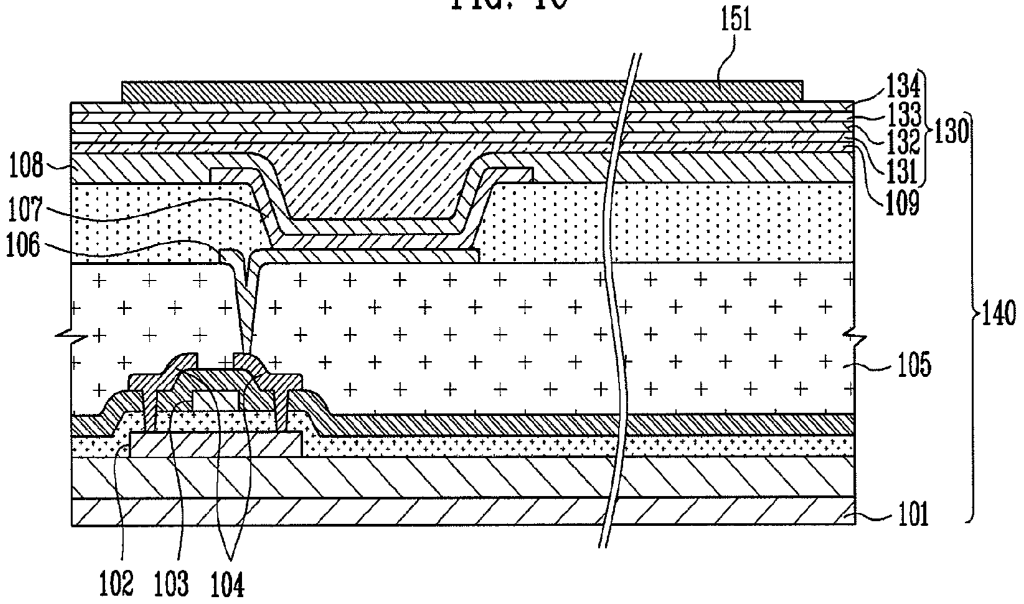

151
134
133
132
131
130
109
108
107
106
140
105
101
102
103
104

FIG. 4D

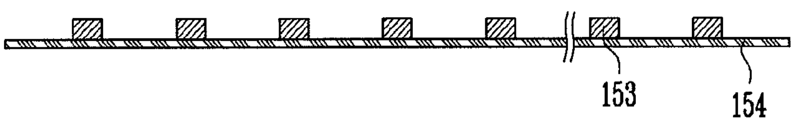

153
154

FIG. 4E

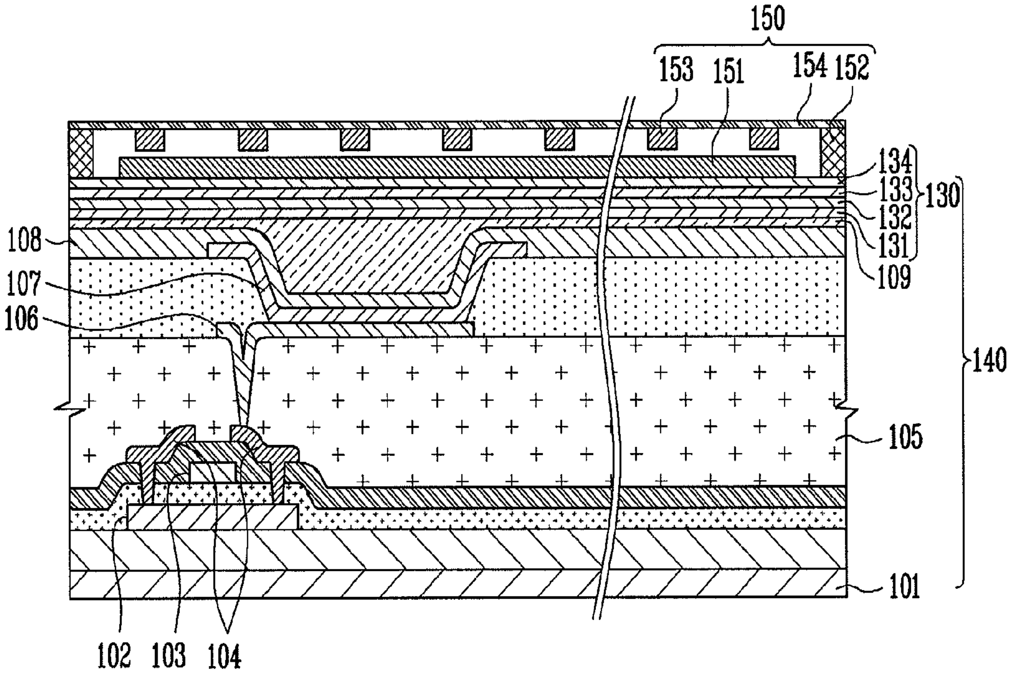

150
153
151
154
152
134
133
132
131
130
109
108
107
106
140
105
101
102
103
104

FIG. 5

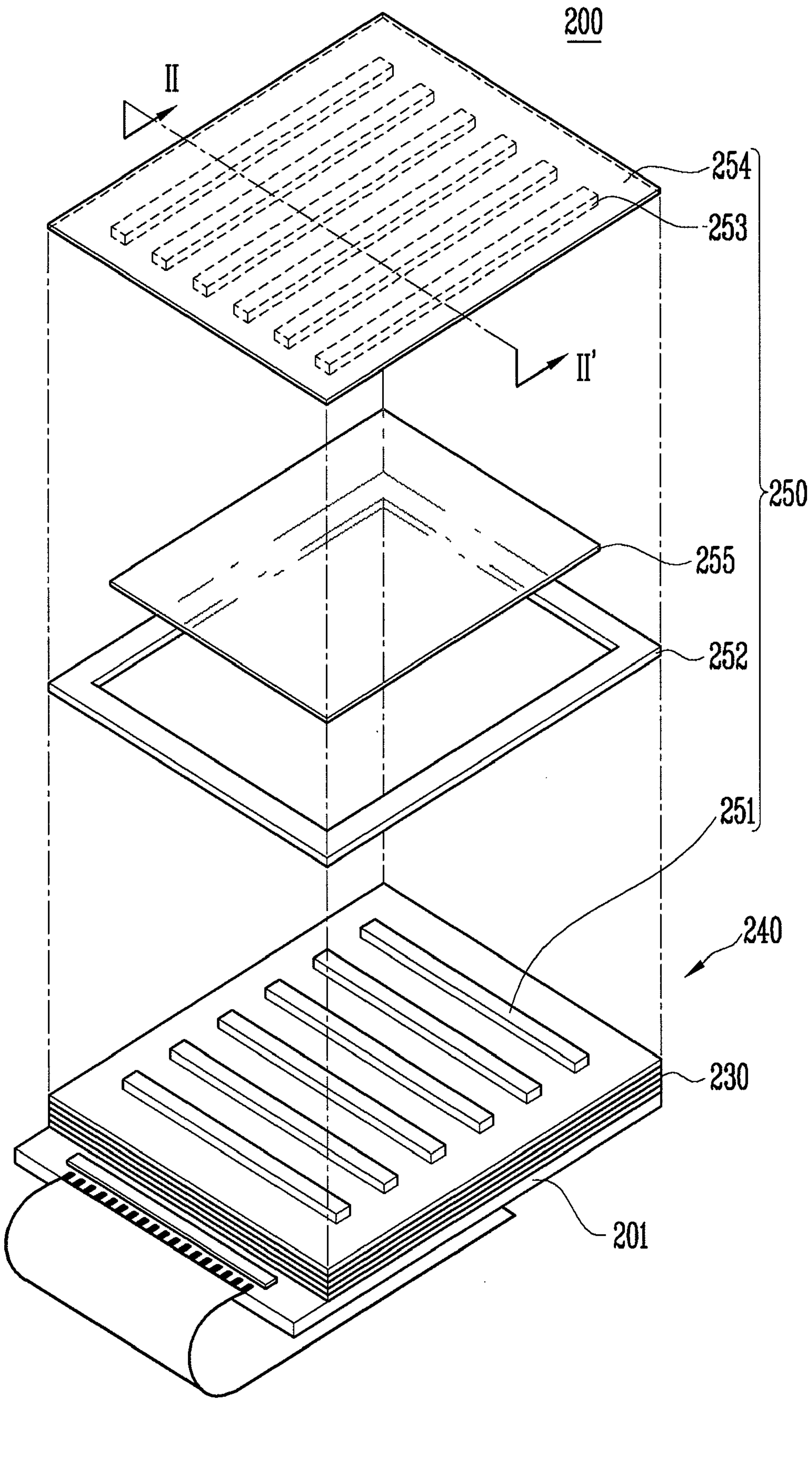


FIG. 6

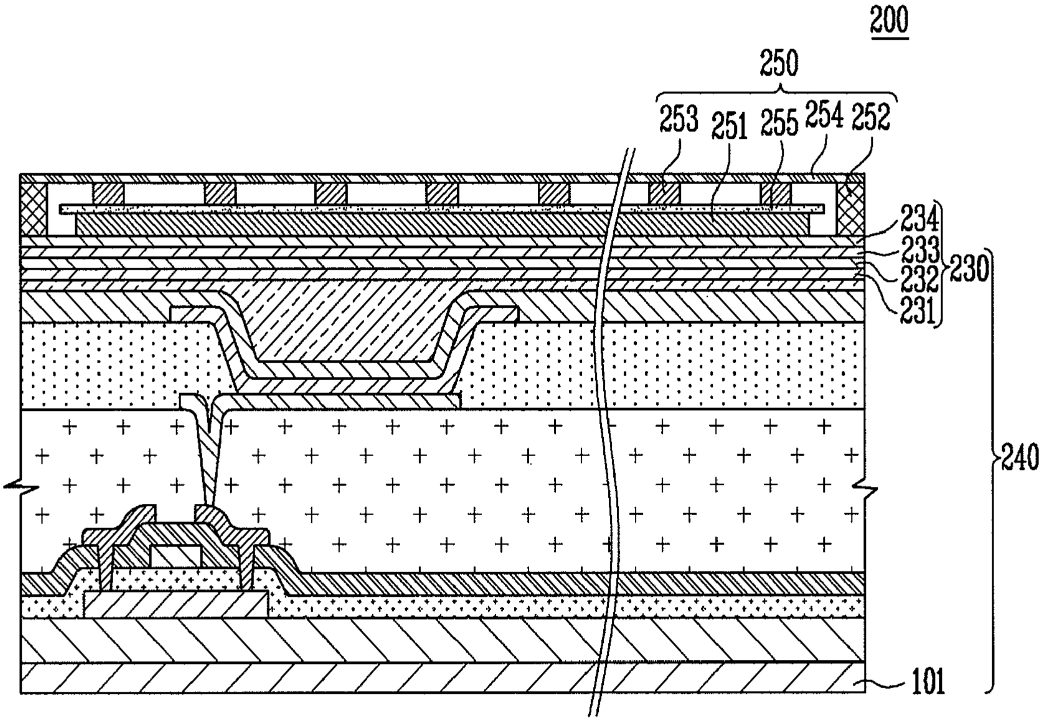


FIG. 7

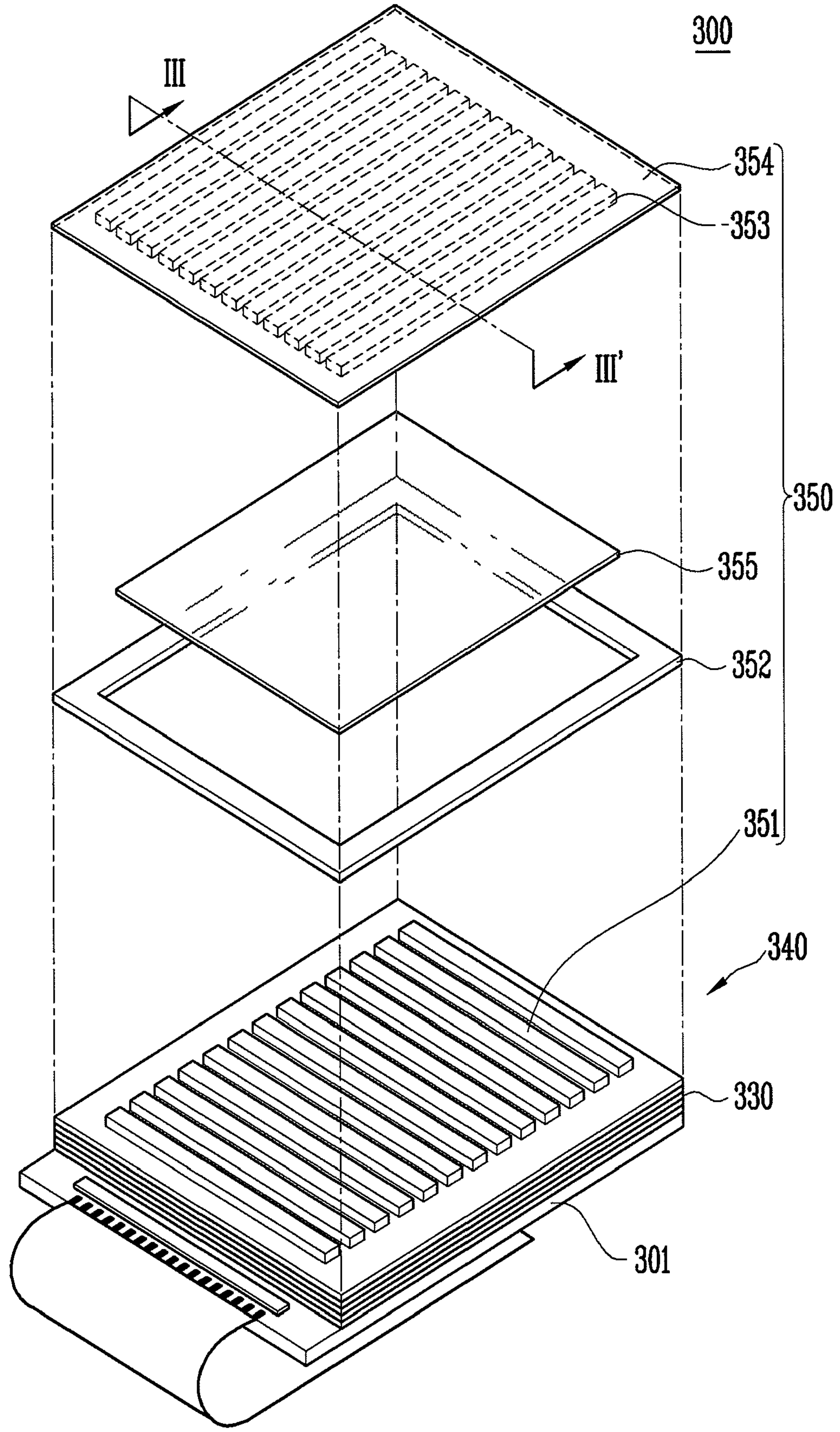


FIG. 8

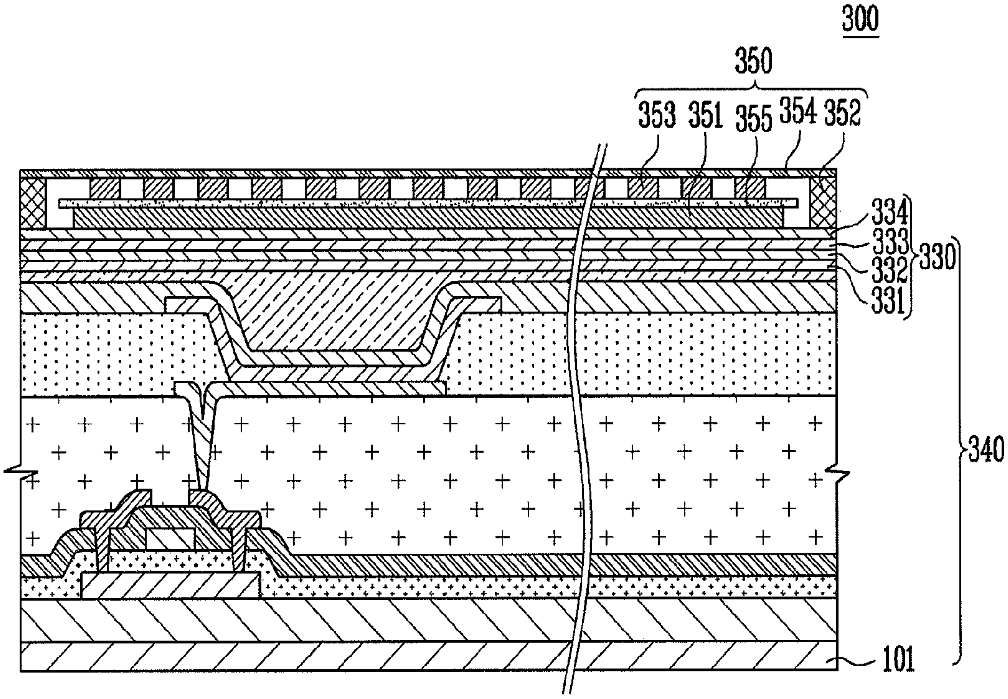


FIG. 9

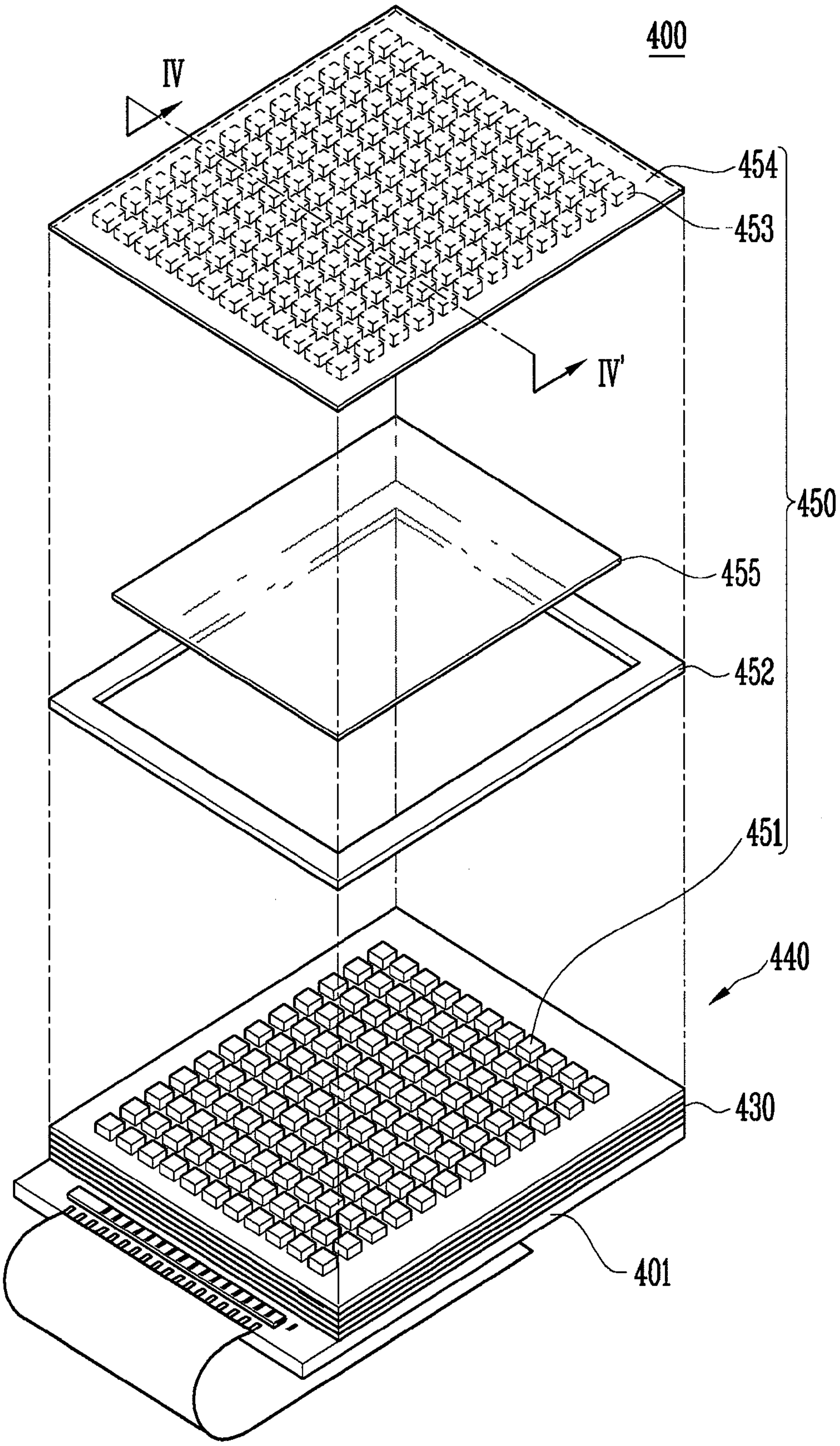
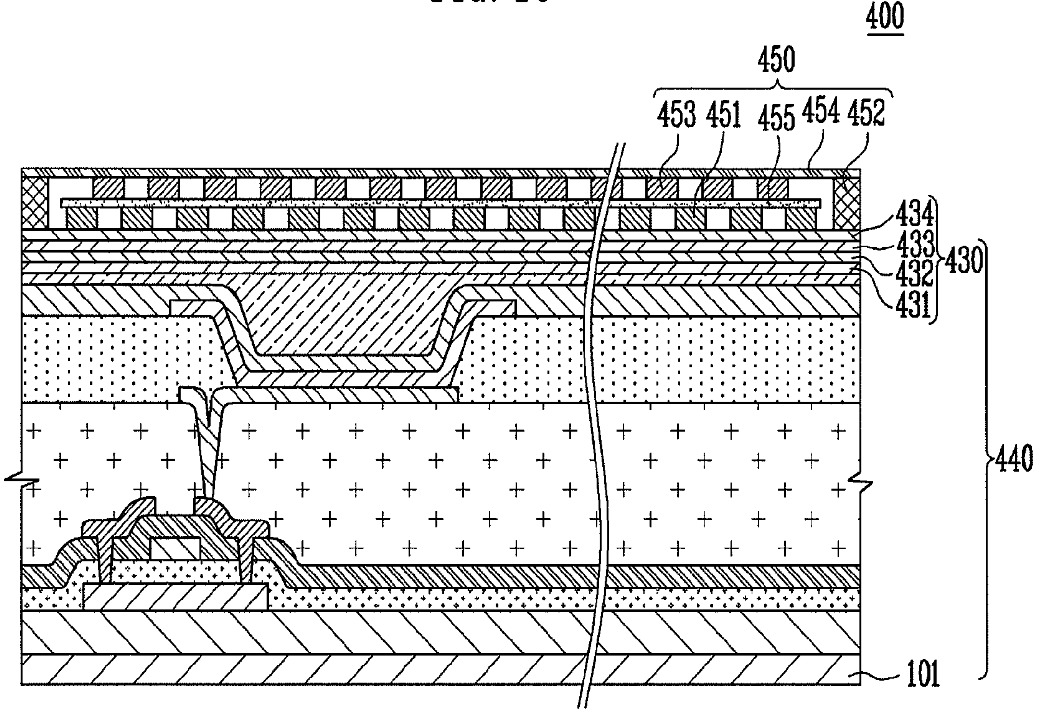


FIG. 10



ORGANIC LIGHT EMITTING DISPLAY DEVICE

CROSS-REFERENCE TO RELATED APPLICATIONS

This application claims the benefit of Korean Patent Application No. 10-2007-0045554, filed on May 10, 2007 in the Korean Intellectual Property Office, the entire disclosure of which is incorporated herein by reference.

BACKGROUND

1. Technical Field

The present disclosure relates to an organic light emitting display device, more particularly to an organic light emitting display device having touch-panel functionality.

2. Discussion of Related Art

Recently, organic light emitting display devices have been widely used, and have relatively simple construction. Further, organic light emitting display devices can display text and graphics using an external input device. In general, an organic light emitting display device includes a first electrode, a second electrode, and at least one organic layer having an emission layer interposed between the first electrode and the second electrode. The first electrode is formed on a substrate and functions as an anode injecting holes. The organic layer is formed on the first electrode. The second electrode is formed on the organic layer facing the first electrode, and functions as a cathode injecting electrons.

Meanwhile, when an organic light emitting display device is exposed to moisture or oxygen, the emission layer may be damaged. So to protect an organic light emitting diode of the organic light emitting display device, an encapsulating substrate is provided on the substrate. The encapsulating substrate can be formed in a cavity or plate pattern, and can be made of glass or metal.

Furthermore, recently, an organic light emitting display device including a touch panel has been suggested. The touch panel is mounted on the organic light emitting display device and can perform various user interface functions for a screen operation in a display. In general, the touch panel includes an upper substrate, a lower substrate, and a spacing member. The upper substrate has an upper electrode. The lower substrate has a lower electrode. The spacing member spaces the upper substrate and the lower substrate apart from each other by a predetermined distance.

The following is an operation principle of the touch panel. By pressing the upper substrate using an input means such as a pen or a finger, the upper electrode formed on the upper substrate and the lower electrode formed on the lower substrate are electrically conducted therebetween. Accordingly, an electric signal is detected based on a resistance value of a contacted position, and a function of the touch panel is achieved using the detected electric signal.

However, when the touch panel manufactured as described above is adhered to the display panel, a process of adhering the touch panel to the display panel using an adhesive paste is added.

Furthermore, the organic light emitting display device has a problem that it becomes thicker due to an encapsulating substrate encapsulating an organic light emitting diode and a touch panel.

SUMMARY OF THE INVENTION

Accordingly, one aspect provides an organic light emitting display device, which may make a display panel being integrated with a touch panel by directly forming the touch panel on the display panel.

It is a second object to provide an organic light emitting display device, which reduces a thickness by forming an encapsulating substrate encapsulating an organic light emitting diode with an encapsulating thin film.

It is a third object to provide an organic light emitting display device, which may improve the mechanical reliability of an encapsulating thin film by forming a protection film as the highest layer of a touch panel.

Some embodiments provide an integrated display and touch input device comprising a display, for example, an organic light emitting display, on which a set of third electrodes of the touch input device is disposed on an upper surface of the display and a set of fourth electrodes of the touch input device are disposed on an upper substrate. A spacing member defines a space between the third and fourth electrodes. In some embodiments, the third and fourth electrodes are configured such that an external pressure on the upper substrate results in contact between the third and fourth electrodes, which generates a signal that is converted into a location on the display device. Embodiments of the integrated display and touch input device are thinner and/or easier to manufacture.

The foregoing and/or other aspects are achieved by providing an organic light emitting display device, comprising: a display panel including a substrate having at least one organic light emitting diode and an encapsulating thin film for encapsulating the organic light emitting diode; and an external input device formed on the display panel for generating an electric signal in response to a touch operation applied from an exterior, wherein the external input device includes an upper substrate and a spacing member, the upper substrate having a third electrode formed on the display panel and a fourth electrode formed to intersect the third electrode, and the spacing member forming a predetermined spacing between the third electrode and the fourth electrode.

Preferably, the upper substrate may be a transparent film, and the transparent film may comprise at least one of Indium Tin Oxide (ITO), IZO (Indium Zinc Oxide), Indium Zinc Tin Oxide (IZTO), ICO (Indium Cesium Oxide), and IWO (Indium Tungsten Oxide). More preferably, the third electrode may be formed in a dot or stripe shape, and the fourth electrode may be formed in a dot or stripe shape. Most preferably, a plurality of third electrodes and a plurality of fourth electrodes may be spaced from each other. The organic light emitting display device may further include a pressure conductive member disposed between the third electrode and the fourth electrode. Also, the pressure conductive member may be formed at a front surface of the third electrode, the pressure conductive member may be elastically transformed under external pressure, and the pressure conductive member may be a composite material made by dispersing conductive fine-particle metal in silicon rubber.

Further, the encapsulating thin film may include at least one organic layer and at least one inorganic layer, which are alternately stacked, the organic layer may be one selected from the group consisting of epoxy, acrylate, and urethane acrylate, and the inorganic layer may be one selected from the group consisting of Al_XO_Y and Si_XO_Y. The organic light emitting display device may further include a protection film disposed between the substrate including the organic light emitting diode and the encapsulating thin film. The protection film may be an inorganic layer.

The spacing member may be interposed between the display panel and a touch panel, and the spacing member may be a frit.

Some embodiments provide an organic light emitting display device, comprising: a display panel comprising a substrate comprising at least one organic light emitting diode, and an encapsulating thin film encapsulating the organic light emitting diode; and an external input device disposed on the display panel operable for generating an electric signal in response to external pressure, wherein the external input device comprises an upper substrate, a spacing member, a third electrode disposed on the display panel, and a fourth electrode disposed on the upper substrate to intersect the third electrode, wherein the spacing member defines a predetermined spacing between the third electrode and the fourth electrode.

In some embodiments, the upper substrate comprises a transparent film. In some embodiments, the transparent film comprises at least one of Indium Tin Oxide (ITO), IZO (Indium Zinc Oxide), Indium Zinc Tin Oxide (IZTO), ICO (Indium Cesium Oxide), and IWO (Indium Tungsten Oxide).

In some embodiments, the third electrode is a dot or a stripe. In some embodiments, the fourth electrode is a dot or a stripe. Some embodiments comprise a plurality of third electrodes and a plurality of fourth electrodes spaced from each other.

Some embodiments further comprise a pressure conductive member disposed between the third electrode and the fourth electrode. In some embodiments, the pressure conductive member is disposed on a front surface of the third electrode. In some embodiments, the pressure conductive member elastically deforms under external pressure. In some embodiments, the pressure conductive member comprises a composite material comprising a conductive fine-particle metal dispersed in silicone rubber.

In some embodiments, the encapsulating thin film comprises at least one organic layer and at least one inorganic layer, which are alternately stacked. In some embodiments, the organic layer comprises at least one of epoxy, acrylate, and urethane acrylate. In some embodiments, the inorganic layer comprises at least one of Al_XO_Y and Si_XO_Y.

Some embodiments further comprise a protection film disposed between the substrate comprising the organic light emitting diode, and the encapsulating thin film. In some embodiments, the protection film comprises an inorganic layer.

In some embodiments, the spacing member is circumferentially disposed between the encapsulating thin film and the upper substrate. In some embodiments, the spacing member comprises a frit.

BRIEF DESCRIPTION OF THE DRAWINGS

These and/or other embodiments and features will become apparent and more readily appreciated from the following description of certain exemplary embodiments, taken in conjunction with the accompanying drawings of which:

FIG. **1** is a perspective exploded view schematically showing an organic light emitting display device according to a first embodiment;

FIG. **2** is a cross-sectional view of the organic light emitting display device taken along section line I-I' of FIG. **1**;

FIG. **3** is a cross-sectional view showing an operation state of an organic light emitting display device including a touch panel according to a first embodiment;

FIG. **4**A to FIG. **4**E are cross-sectional views illustrating a method of manufacturing an organic light emitting display device according to the first embodiment;

FIG. **5** is a perspective exploded view schematically showing an organic light emitting display device according to a second embodiment;

FIG. **6** is a cross-sectional view of the organic light emitting display device taken along section line II-II' of FIG. **5**;

FIG. **7** is a perspective exploded view schematically showing an organic light emitting display device according to a third embodiment;

FIG. **8** is a cross-sectional view of the organic light emitting display device taken along section line III-III' of FIG. **7**;

FIG. **9** is a perspective exploded view schematically showing an organic light emitting display device according to a fourth embodiment; and

FIG. **10** is a cross-sectional view of the organic light emitting display device taken along section line IV-IV' of FIG. **9**.

DETAILED DESCRIPTION OF CERTAIN EMBODIMENTS

Hereinafter, exemplary embodiments of an organic light emitting display device including a touch panel will be described with reference to the accompanying drawings. Here, when a first element is coupled to a second element, the first element may be not only directly coupled to the second element but also indirectly coupled through one or more other elements. Further, elements not needed for an understanding of the illustrated embodiments are omitted for clarity. Also, like reference numerals refer to like elements throughout.

FIG. **1** is an exploded perspective view schematically showing an organic light emitting display device according to a first embodiment. FIG. **2** is a cross-sectional view of the organic light emitting display device taken along section line I-I' of FIG. **1**.

With reference to FIG. **1** and FIG. **2**, the organic light emitting display device **100** includes a display panel **140** and an external input device **150**. The display panel **140** includes a substrate **101** having at least one organic light emitting diode and an encapsulating thin film **130** for encapsulating the organic light emitting diode. The external input device **150** is formed on the display panel **140**, and generates an electric signal in response to a touch operation applied from an exterior. Here, the external input device **150** includes a protection film **154** and a spacing member **152**. The protection film **154** has a third electrode **151** formed on the display panel **140** and a fourth electrode **153** formed to intersect the third electrode **151**. The spacing member **152** forms a predetermined space between the third electrode **151** and the fourth electrode **153**.

The display panel **140** comprises a pixel region and a non-pixel region. The pixel region includes at least one thin film transistor formed on the substrate **101**, and an organic light emitting diode electrically coupled to the thin film transistor. The non-pixel region includes a driving circuit **122** and a pad portion **121**.

A scan line, a data line, and an organic light emitting diode are formed on the pixel region of the display panel. The organic light emitting diode is coupled to each of the scan line and the data line, and constitutes a pixel.

A scan line, a data line, a power supply line for operating the organic light emitting diode, a scan driver, and a data driver are formed on the non-pixel region. The scan line and the data line extend from the scan line and the data line of the non-pixel region. The driving circuit **122**, namely, a scan driver and a data driver, process external signals through the pad portion **121**, and supply the processed signals to the scan line and the data line, respectively. The aforementioned driving circuit **122** may be mounted on a Flexible Printed Circuit Board (FPCB) electrically coupled to a display panel unit through the pad portion **121** or on the display panel in a form of an integrated circuit (IC) chip.

Hereinafter, a thin film transistor and organic light emitting diode formed on the substrate **101** will be described in detail with reference to FIG. **2**. The thin film transistor comprises a buffer layer comprising an oxide layer is formed on the substrate **101**. After a poly-silicon layer is formed on the buffer layer, it is patterned to form a semiconductor layer **102**. A gate insulating layer is formed on the buffer layer on which the semiconductor layer **102** is formed, and a gate electrode **103** is formed on the gate insulating layer. An interlayer insulation layer is formed on the gate electrode **103**, and source and drain electrodes **104** are formed on the interlayer insulation layer. Here, the source and drain electrodes **104** are coupled to source and drain regions of the semiconductor layer **102**, respectively. A planarization layer **105** is formed on the interlayer insulation layer on which the source and drain electrodes **104** are formed. An organic light emitting diode is formed on the planarization layer **105**, and electrically coupled to a thin film transistor. Here, the organic light emitting diode includes a first electrode **106**, an emission layer **107**, and a second electrode **108**. Referring to FIG. **1**, the pad portion **121** and the driving circuit **122** may be formed on the non-pixel region of the substrate **101**. A data line and a power line may be formed in the pad portion **121**. Here, the data line functions to supply signals to the organic light emitting diode, which is formed in the pixel region.

Meanwhile, an encapsulating thin film **130** is formed over a surface of the organic light emitting diode opposite from the substrate **101** and spaced apart from the second electrode **108** by a predetermined distance. Here, the encapsulating thin film **130** functions to protect the organic light emitting diode. The encapsulating thin film **130** is formed by alternately stacking at least one organic layer and one inorganic layer to prevent moisture and oxygen from penetrating into the organic light emitting diode. The encapsulating thin film **130** is from about 1 μm to about 10 μm thick, which can be reduced to approximately 1/30 of that of an encapsulating substrate having a thickness greater than 200 μm.

Furthermore, a protection film **109** is formed between the second substrate **108** and the encapsulating thin film **130**. The protection film **109** is formed covering an entire surface of the substrate **101** on which the organic light emitting diode is formed, which may be made of inorganic materials. The protection film **109** planarizes a contact surface between the substrate **101** on which the second electrode **108** and the encapsulating thin film **130**, and may adhere the substrate **101** to the encapsulating thin film **130**.

The encapsulating thin film **130** will be now explained in detail. A first organic layer **131**, a first inorganic layer **132**, a second organic layer **133**, and a second inorganic layer **134** are alternately stacked on the protection film **109** at least four times in a repeated manner, thereby efficiently reducing the penetration of moisture and oxygen from the exterior. The first and second organic layers **131** and **132** of the encapsulating thin film **130** prevent nano crack and/or micro crack defects from propagating continuously in the first and second inorganic layers **132** and **134**, which would otherwise extend a penetration path of the moisture and oxygen therethrough, thereby reducing moisture permeability and stress remaining in the first and second inorganic layers **132** and **134**. Each of the first and second organic layers **131** and **133** comprises at least one of epoxy, acrylate, and urethane acrylate. Each of the first and second inorganic layers **132** and **134** comprises at least one of Al_XO_Y and Si_XO_Y.

Moreover, an external input device **150** is provided on the display panel **140**. The external input device **150** digitally detects an input position of a pen or finger, and converts the input position into X and Y coordinates. The external input device **150** may be generally classified into a capacitive type and a resistive type. The external input device **150** may be generally classified into a touch panel, a tablet, and a digitizer. In an embodiment of the present invention, a touch panel **150** of a resistive-type external input device is shown.

The touch panel **150** includes a protection film **154** and a spacing member **152**. A plurality of third electrodes **151** spaced from each other is formed on the display panel **140** in a stripe pattern in a first direction. A plurality of fourth electrodes **153** is formed on the protection film **154** in a second direction that intersects the third electrodes **151**. The spacing member **152** spaces the third electrodes **151** and the fourth electrodes **153** apart from each other greater than a predetermined distance. In some embodiments, the first direction of the display panel **140** on which the third electrodes **151** are formed means a direction horizontal or perpendicular to one of four sides of the display panel **140**. The second direction in which the fourth electrodes **153** extend are about 90 degrees (vertically) from the direction of the third electrodes **151** in the illustrated embodiment.

The spacing member **152** is interposed between the display panel **140** and a touch panel **150**. The spacing member comprises an adhesive material, for example, a frit or an adhesive tape. The spacing member **152** can adhere the protection film **154** to the display panel **140**, spaced apart from each other by a predetermined distance. Here, the third electrodes **151** are formed on the display panel **140** and the fourth electrodes **153** are formed on the protection film **154**. As described above, as the third electrodes **151** are formed on the display panel **140** without forming a lower substrate for forming the third electrodes **151**. Consequently, manufacture of the display panel **140** may be integrated with manufacture of the touch panel **150**, and the number of processes may be reduced. Since a lower substrate is not needed for the touch panel **150** according to the present embodiment, a thickness of the touch panel **150** and a transmission path of light emitted from the organic light emitting diode may be reduced.

Meanwhile, since a protection film **154** forms an upper substrate at the highest layer of the touch panel **150**, the total thickness of the touch panel **150** may be thinner. Namely, thickness of the protection film **154** is from about 1/10 to 1/2 of the thickness of a typical upper substrate, which is formed of plastic or glass, thereby reducing the thickness of the touch panel **150**.

In addition, the protection film **154** is formed of a transparent film having high hardness in order to protect the encapsulating thin film **130**. That is, the highest layer of the touch panel **150** is formed of materials having high hardness, thereby preventing the encapsulating thin film **130** from being damaged due to external pressure.

The protection film **154** comprises at least one of Indium Tin Oxide (ITO), IZO (Indium Zinc Oxide), Indium Zinc Tin Oxide (IZTO), ICO (Indium Cesium Oxide), IWO (Indium Tungsten Oxide) to provide the desired hardness of the encapsulating thin film **130**. For example, the protection film **154** may be formed by materials having hardness of about 10,000 to 1,000,000 times higher than the hardness of the encapsulating thin film **130**. As illustrate earlier, the protection film **154** is formed from materials harder than the encapsulating thin film **130**, thereby preventing the encapsulating thin film **130** from being damaged by external shock or pressure.

FIG. **3** is a cross-sectional view showing an operation state of an organic light emitting display device including a touch panel according to a first embodiment. Referring to FIG. **3**, the following is the explanation of an operation state of the organic light emitting display device including the touch panel according to the first embodiment. By pressing the protection film **154** on which the fourth electrode **153** is disposed using an input means such as a pen **160** or a finger (not shown), the fourth electrode **153** contacts with the third electrode **154**. As described above, the touch operation presses the protection film **154**, thereby electrically contacting the fourth electrode **153** with the third electrode **151**. Accordingly, an electric signal is detected based on a resistance value of a contacted position, which is transmitted to an internal or external integrated circuit (IC) through a connector that leads to an embodiment of the touch panel.

FIG. **4**A to FIG. **4**E are cross-sectional views illustrating a method of manufacturing an organic light emitting display device according to the first embodiment.

With reference to FIG. **4**A, a buffer layer is formed on the substrate **101**. A thin film transistor is formed on the buffer layer. Here, the thin film transistor includes a semiconductor layer **102**, a gate electrode **103**, and source/drain electrodes **104**. The semiconductor layer **102** is formed on the buffer layer in a predetermined pattern. The semiconductor layer **102** is coated to a thickness of approximately 300 to 2000 Å with silicon or a material selected from organic materials by a chemical vapor deposition (CVD), and is patterned in a predetermined shape. A gate insulating layer is formed on an entire surface of the semiconductor layer **102**. On the gate insulating layer, a gate electrode **103** is formed at an upper portion corresponding to a channel region of the semiconductor layer **102**. Conductive metal is deposited on the gate insulating layer to a thickness of about 200 to 3000 Å, and is patterned in a predetermined shape. Here, examples of suitable conductive metals include aluminum (Al), MoW, molybdenum (Mo), copper (Cu), silver (Ag), aluminum alloy, and/or silver alloy. An interlayer insulation layer is formed on the gate insulating layer in the same manner as the gate insulating layer.

The source/drain electrodes **104** are formed on the interlayer insulation layer, and are electrically coupled to source and drain regions of the semiconductor layer **102** through contact holes formed in the gate insulating layer and the interlayer insulation layer. A planarization layer **105** is formed on the source/drain electrodes **104**. The planarization layer **105** comprises at least one of acryl, polyimide, and benzocyclobutene (BCB). An organic light emitting diode is formed on the planarization layer **105**. Here, the organic light emitting diode includes a first electrode, an emission layer **107**, and a second electrode **108**.

With reference to FIG. **4**B, a passivation layer **109** is formed on the second electrode **108**. The passivation layer **109** may be formed of inorganic materials, and planarizes the substrate **101** on which the second electrode **108** is formed. An encapsulating thin film **103** is formed on the passivation layer **109**. The encapsulating thin film **130** is formed by alternately stacking at least one organic layer and at least one inorganic layer. The encapsulating thin film **130** comprises a first organic layer **131**, a first inorganic layer, a second organic layer **133**, and a second inorganic layer **134**. The encapsulating thin film **130** may be formed by at least one of ion beam assisted sputtering, electron-beam deposition, plasma enhanced chemical vapor deposition (PECVD), radio frequency (RF) sputtering, and atomic layer deposition.

Referring to FIG. **4**C, a third electrode **151** is formed on the encapsulating thin film **130**. A plurality of third electrodes **151** is formed in a first direction on the encapsulating thin film **130** in stripes spaced apart from each other by a predetermined distance.

The third electrode **151** may be formed of a transparent conductive material, for example, at least one of Indium Tin Oxide (ITO), IZO (Indium Zinc Oxide), Indium Zinc Tin Oxide (IZTO), ICO (Indium Cesium Oxide), and IWO (Indium Tungsten Oxide).

With reference to FIG. **4**D, a fourth electrode **153** is formed on the protection film **154**. Plural electrodes are formed in a second direction crossing the first direction in which the third electrode **151** is formed. And, the fourth electrode **153** may be formed of the same material as the third electrode **151**.

With reference to FIG. **4**E, a periphery of the protection film **154** or a periphery of the encapsulating thin film **130** is coated with a spacing member, namely, a sealant **152**, thereby adhering the protection film **154** on which the fourth electrode **154** is disposed to the encapsulating thin film **130** on which the third electrode **152** is formed. As a result, the organic light emitting display device **100** integrated with the touch panel **150** can be provided.

FIG. **5** is a perspective exploded view schematically showing an organic light emitting display device according to a second embodiment. FIG. **6** is a cross-sectional view of the organic light emitting display device taken along section line II-II' of FIG. **5**.

With reference to FIG. **5** and FIG. **6**, the organic light emitting display device **200** includes a display panel **240** and an external input device **250**. The display panel **240** includes a substrate **201** having at least one organic light emitting diode and an encapsulating thin film **230** for encapsulating the organic light emitting diode. The external input device **250** is formed on the display panel **240**, and generates an electric signal in response to a touch operation applied from the exterior thereof. Here, the external input device **250** includes a protection film **254** and a spacing member **252**. The external input device **250** has a third electrode **251** formed on the display panel **240** and a fourth electrode **253** formed on the protection film **254** to intersect the third electrode **251**. The spacing member **252** forms a predetermined spacing between the third electrode **251** and the fourth electrode **254**.

The encapsulating thin film **230** may be formed by alternately stacking a first organic layer **231**, a first inorganic layer **232**, a second organic layer **233**, and a second inorganic layer **234**. The second embodiment is substantially similar to the first embodiment, further comprising a pressure conductive member **255** provided between the third electrode **251** and the fourth electrode **253**.

The pressure conductive member **255** is formed between the third electrode **252** and the fourth electrode **253**, namely, over an entire surface of the third electrode **251**, thereby adhering the protection film **254** including the fourth electrode **253** to the encapsulating substrate **230**. Here, the third electrode **251** is formed on the encapsulating substrate **230**. Further, the pressure conductive member **255** can be formed at a peripheral region of the third electrode **252** and a peripheral region of the fourth electrode **253**. Here, if the protection film **254** sags, the fourth electrode **253** contacts with the third electrode **251**. In order to prevent the fourth electrode **253** from contacting with the third electrode **251**, transparent insulation materials are formed between a plurality of third electrodes **251** or a plurality of fourth electrodes **253**, which allows the fourth electrode **253** to be spaced apart from the third electrode **251**. As explained earlier, the pressure conductive member **255** is interposed between the third electrode **251** and the fourth electrode **254** in order to enhance the mechanical reliability of the touch panel **250**. The pressure conductive member **255** has an elasticity such that when a shock or force from an upper portion of the touch panel **205** is applied thereto, the pressure conductive member **255** returns to the original state when the applied shock or force is removed. The pressure conductive member **255** has transparency and adhesion. In some embodiments, the pressure conductive member **255** comprises a composite material obtained by dispersing a conductive, fine-particle metal in silicone rubber. Embodiments of the pressure conductive **255** member are coated with a conductive fine-particle metal in a form of a thin film or manufactured in a form of a film. By pressing the pressure conductive member **255** using an input means such as a pen or a finger to apply force to the pressure conductive member **255**, the third electrode **251** and the fourth electrode **253** are electrically coupled. Accordingly, an electric signal is detected based on a resistance value of a contacted position, and is transmitted to an IC through a connector. The IC calculates and processes the detected voltage into coordinates.

As mentioned above, as the pressure conductive member **255** is further formed between the third electrode **251** and the fourth electrode **254**. Further, a uniform spacer **252** can be formed between the protection film **254**, to which the fourth electrode **253** may be more uniformly adhered, and the display panel **240**, on which the third electrode **251** is formed. In addition, the pressure conductive member **255** is interposed between the third electrode **251** and the fourth electrode **253** to prevent an air layer from being formed between the third electrode **251** and the fourth electrode **253**, with the result that degradation in quality of images displayed by the display panel **240** can be reduced and/or prevented.

FIG. **7** is a perspective exploded view schematically showing an organic light emitting display device according to a third embodiment. FIG. **8** is a cross-sectional view of the organic light emitting display device taken along section line III-III' of FIG. **7**.

With reference to FIG. **7** and FIG. **8**, the organic light emitting display device **300** includes a display panel **340** and an external input device **350**. The display panel **340** includes a substrate **301** having at least one organic light emitting diode and an encapsulating thin film **330** for encapsulating the organic light emitting diode. The external input device **350** is formed on the display panel **340**, and generates an electric signal in response to a touch operation applied from the exterior thereof. Here, the external input device **350** includes a protection film **354** and a spacing member **352**. The external input device **350** has a third electrode **351** formed on the display panel **340** and a fourth electrode **353** formed to intersect the third electrode **351**. The spacing member **352** forms a predetermined spacer between the third electrode **351** and the fourth electrode **353**.

The encapsulating thin film **330** may be formed by alternately stacking a first organic layer **331**, a first inorganic layer **332**, a second organic layer **333**, and a second inorganic layer **334**. The third embodiment of the present invention is substantially to the second embodiment, with a greater number of third electrodes **351** formed on the encapsulating thin film **330**, and a greater number of fourth electrodes **353** formed on the protection film **354**. The increased number of third electrodes **351** is increased by reducing the spacing therebetween. The number of fourth electrodes **353** is also increased by reducing the spacing therebetween.

As described earlier, the more closely spaced third electrodes **351** and the fourth electrodes **353** in the third embodiment, increases the resolution and operating characteristics of the touch panel **350**.

FIG. **9** is a perspective exploded view schematically showing an organic light emitting display device according to a fourth embodiment. FIG. **10** is a cross-sectional view of the organic light emitting display device taken along section line IV-IV' of FIG. **9**.

With reference to FIG. **9** and FIG. **10**, the organic light emitting display device **400** includes a display panel **440** and an external input device **450**. The display panel **440** includes a substrate **401** having at least one organic light emitting diode and an encapsulating thin film **430** for encapsulating the organic light emitting diode. The external input device **450** is formed on the display panel **440**, and generates an electric signal in response to a touch operation applied from the exterior thereof. Here, the external input device **450** includes a protection film **454** and a spacing member **452**. The external input device **450** has a third electrode **451** formed on the display panel **440** and a fourth electrode **453** formed to intersect the third electrode **451**. The spacing member **452** forms a predetermined spacing between the third electrode **451** and the fourth electrode **453**.

The encapsulating thin film **430** may be formed by alternately stacking a first organic layer **431**, a first inorganic layer **432**, a second organic layer **433**, and a second inorganic layer **434**. The third embodiment of the present invention is substantially similar to the second embodiment, the third electrodes **451** and the fourth electrodes **453** are formed in a dot pattern. The third electrodes **451** and the fourth electrodes **453** are formed in a dot pattern, thereby improving the operation resolution and operating property of the touch panel **450**.

With accordance with certain embodiments, since a protection film is formed of a film having a high hardness as the highest layer, namely, an upper substrate of a touch panel, it can prevent an encapsulating thin film from being damaged. Because the upper substrate of the touch panel is formed by a film, the thickness of the touch panel is decreased, thereby reducing a total thickness of an organic light emitting display device. As third electrodes are directly formed on an encapsulating thin film without a lower substrate of the touch panel, an integrated organic light emitting display device may be provided, which can be thinner compared with a typical organic light emitting display device with a touch panel. Further, the number of components and the number of processes are reduced, thereby improving the productivity. In addition, the encapsulating thin film is formed as an encapsulating means, thereby reducing the thickness of the organic light emitting display device.

Although a organic light emitting diode display panel has be described in the embodiments, it would be appreciated by those skilled in the art that other embodiments are applicable to a Liquid Crystal Display (LCD), a Field Emission Display (FED), a Plasma Display Panel (PDP), an Electro Luminescent Display (ELD), a Vacuum Fluorescent Display (VFD), and the like.

Although certain embodiments have been shown and described, it would be appreciated by those skilled in the art that changes might be made without departing from the principles and spirit thereof, the scope of which is defined in the claims and their equivalents.

What is claimed is:

1. An organic light emitting display device, comprising:

a display panel comprising

a substrate comprising at least one organic light emitting diode that defines a recess,

an encapsulating thin film encapsulating the organic light emitting diode wherein the encapsulating thin film comprises at least one organic layer and at least one inorganic layer, which are alternately stacked;

a protective film interposed between the encapsulating thin film and the organic light emitting device wherein the protective film fills the recess and provides a planarized surface for the encapsulating thin film; and an external input device disposed on the encapsulating thin film operable for generating an electric signal in response to external pressure,

wherein the external input device comprises

a third electrode disposed on the encapsulating thin film,

an upper substrate having a fourth electrode to intersect the third electrode, the upper substrate disposed on the third electrode, and

a spacing member,

wherein the spacing member defines a predetermined spacing between the third electrode and the fourth electrode, and

a pressure conductive member disposed between the third and fourth electrode.

2. The organic light emitting display device as claimed in claim **1**, wherein the upper substrate comprises a transparent film.

3. The organic light emitting display device as claimed in claim **2**, wherein the transparent film comprises at least one of Indium Tin Oxide (ITO), IZO (Indium Zinc Oxide), Indium Zinc Tin Oxide (IZTO), ICO (Indium Cesium Oxide), and IWO (Indium Tungsten Oxide).

4. The organic light emitting display device as claimed in claim **1**, wherein the third electrode is a dot or a stripe.

5. The organic light emitting display device as claimed in claim **1**, wherein the fourth electrode is a dot or a stripe.

6. The organic light emitting display device as claimed in claim **1**, comprising a plurality of third electrodes and a plurality of fourth electrodes spaced from each other.

7. The organic light emitting display device as claimed in claim **1**, wherein the pressure conductive member is disposed on a front surface of the third electrode.

8. The organic light emitting display device as claimed in claim **1**, wherein the pressure conductive member elastically deforms under external pressure.

9. The organic light emitting display device as claimed in claim **1**, wherein the pressure conductive member comprises a composite material comprising a conductive fine-particle metal dispersed in silicone rubber.

10. The organic light emitting display device as claimed in claim **1**, wherein the organic layer comprises at least one of epoxy, acrylate, and urethane acrylate.

11. The organic light emitting display device as claimed in claim **1**, wherein the inorganic layer comprises at least one of Al_XO_Y and Si_XO_Y.

12. The organic light emitting display device as claimed in claim **1**, further comprising a protection film disposed between the substrate comprising the organic light emitting diode, and the encapsulating thin film.

13. The organic light emitting display device as claimed in claim **12**, wherein the protection film comprises an inorganic layer.

14. The organic light emitting display device as claimed in claim **1**, wherein the spacing member is circumferentially disposed between the encapsulating thin film and the upper substrate.

15. The organic light emitting display device as claimed in claim **14**, wherein the spacing member comprises a frit.

16. An organic light emitting display device comprising:

a display panel comprising

a substrate comprising at least one organic light emitting diode that defines a recess, and

an encapsulating thin film encapsulating the organic light emitting diode;

a protective film interposed between the encapsulating thin film and the organic light emitting device wherein the protective film fills the recess and provides a planarized surface for the encapsulating thin film; and

an external input device disposed on the display panel operable for generating an electric signal in response to external pressure,

wherein the external input device comprises

an upper substrate,

a spacing member,

a third electrode disposed on the display panel, and

a fourth electrode disposed on the upper substrate to intersect the third electrode, wherein the spacing member defines a predetermined spacing between the third electrode and the fourth electrode; and

a pressure conductive member disposed between the third electrode and the fourth electrode that electrically connects the third and fourth electrode in response to pressure on the display panel.

* * * * *

专利名称(译)	有机发光显示装置		
公开(公告)号	US7936121	公开(公告)日	2011-05-03
申请号	US12/117647	申请日	2008-05-08
申请(专利权)人(译)	三星SDI CO.，LTD.		
当前申请(专利权)人(译)	三星DISPLAY CO.，LTD.		
[标]发明人	KIM HYEONG GWON		
发明人	KIM, HYEONG-GWON		
IPC分类号	H01L51/50		
CPC分类号	G06F3/0412 H01L27/323 G06F3/045 H01L51/5253		
优先权	1020070045554 2007-05-10 KR		
其他公开文献	US20080278070A1		
外部链接	Espacenet USPTO		

摘要(译)

一种具有触摸板功能的有机发光显示装置，包括至少一个有机发光二极管和用于封装有机发光二极管的封装薄膜;外部输入装置形成在显示面板上，用于响应从其外部施加的触摸操作产生电信号。外部输入装置包括上基板和间隔构件。外部输入装置具有形成在显示面板上的第三电极和形成在上基板上以与第三电极交叉的第四电极。间隔构件在第三电极和第四电极之间形成预定间隔。