US008030838B2

(12) **United States Patent**
Kwak et al.

(10) **Patent No.: US 8,030,838 B2**
(45) **Date of Patent: Oct. 4, 2011**

(54) ORGANIC LIGHT EMITTING DISPLAY APPARATUS

(75) Inventors: **Won-Kyu Kwak**, Suwon-si (KR); **Yong-Seog Kim**, Suwon-si (KR)

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

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 281 days.

(21) Appl. No.: **12/288,938**

(22) Filed: **Oct. 23, 2008**

(65) **Prior Publication Data**

US 2009/0128023 A1 May 21, 2009

(30) **Foreign Application Priority Data**

Nov. 16, 2007 (KR) 10-2007-0117368

(51) **Int. Cl.**
H01L 51/52 (2006.01)
H01L 51/50 (2006.01)

(52) **U.S. Cl.** **313/503**; 313/500; 313/504; 313/509; 313/506

(58) **Field of Classification Search** 313/500–512
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

7,279,708	B2 *	10/2007	Kwak et al.	257/72
2004/0195964	A1 *	10/2004	Yamazaki et al.	313/504
2005/0008894	A1	1/2005	Hiruma et al.	
2006/0113900	A1	6/2006	Oh	
2007/0007554	A1	1/2007	Lee	
2009/0058280	A1 *	3/2009	Jo et al.	313/504

FOREIGN PATENT DOCUMENTS

EP	1 513 196	A	3/2005
KR	10-2005-0113517	A	12/2005
KR	10-2006-0059722	A	6/2006
KR	10-2006-0067049	A	6/2006
KR	10-2007-0035884	A	4/2007

OTHER PUBLICATIONS

Notice of Allowance issued on Nov. 29, 2008 in Korean Publication No. 10-2007-0117368.

Extended European Search Report for EP 08169186.7 dated Mar. 9, 2009.

* cited by examiner

Primary Examiner — Mariceli Santiago

(74) *Attorney, Agent, or Firm* — Knobbe Martens Olson & Bear LLP

(57) ABSTRACT

An organic light emitting display apparatus that can prevent corrosion during manufacturing is disclosed. The apparatus can have a remarkably enhanced yield. The apparatus includes: a substrate having a display area, a thin film transistor disposed inside the display area, an electrode power supply line disposed outside the display area, a pixel electrode disposed inside the display area of the substrate and electrically connected to the thin film transistor, an auxiliary conductive layer contacting the electrode power supply line at a side of the electrode power supply line, a pixel defining layer exposing the pixel electrode covering the auxiliary conductive layer and exposing the electrode power supply line. The apparatus also includes an intermediate layer disposed on the pixel electrode and comprising an emitting layer, and a counter electrode disposed on the intermediate layer and extending outside the display area of the substrate to contact the electrode power supply line.

19 Claims, 5 Drawing Sheets

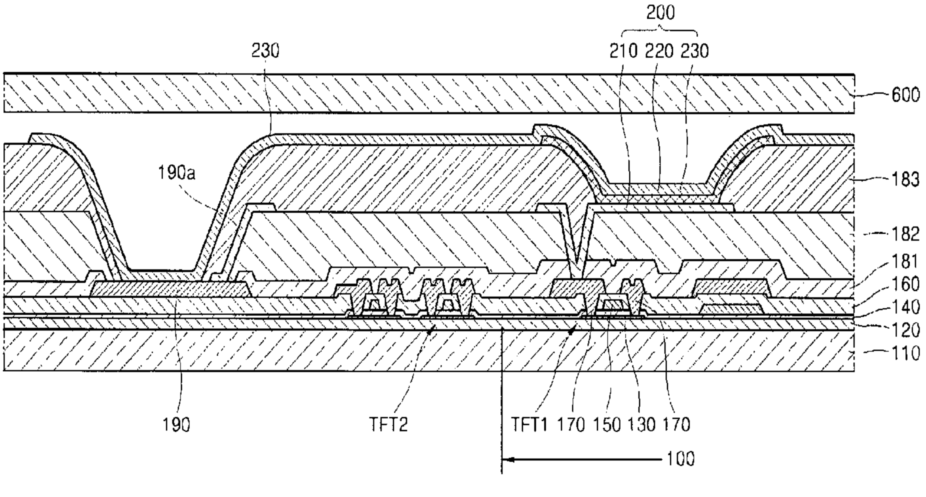


FIG. 1

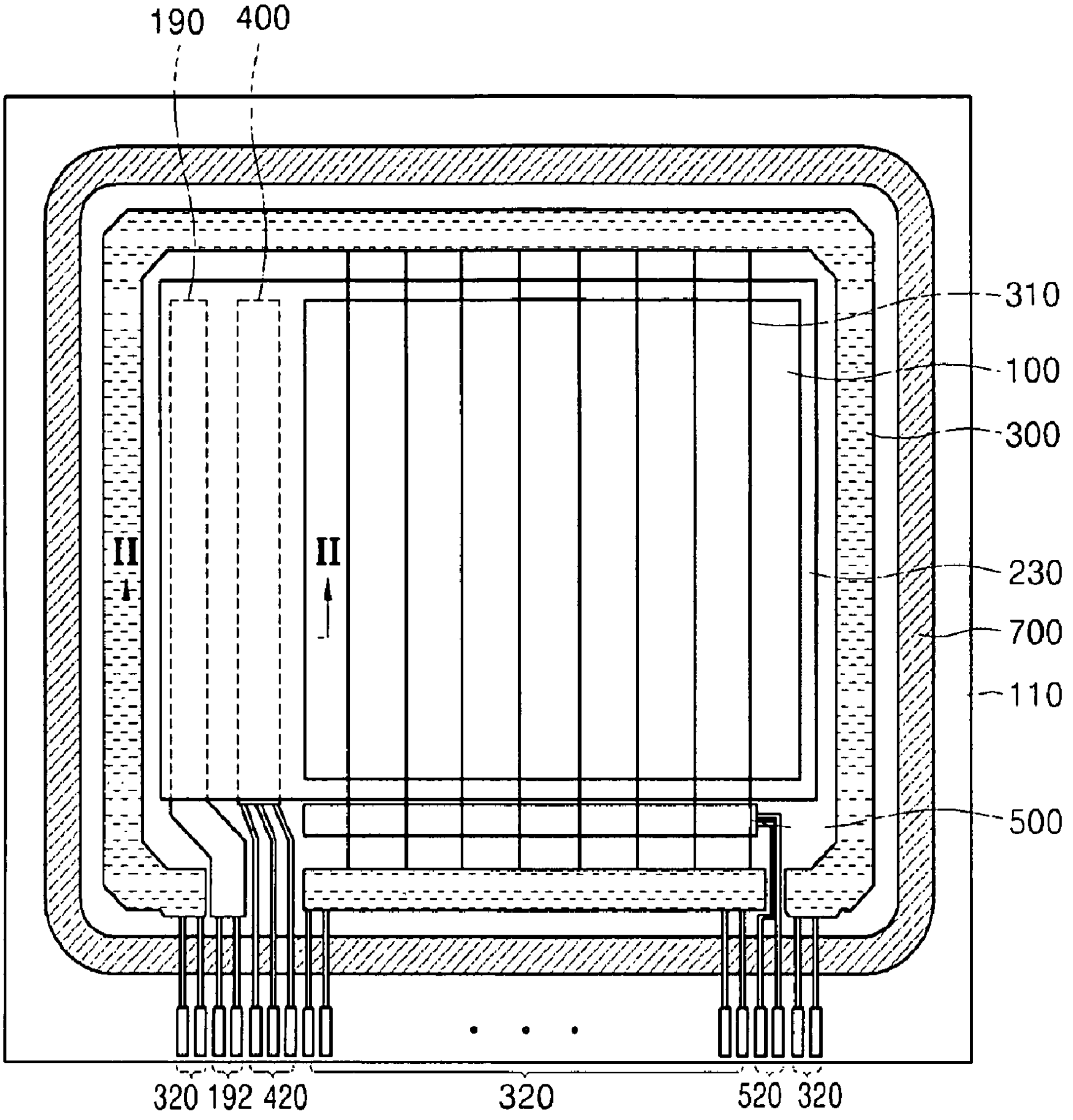


FIG. 2

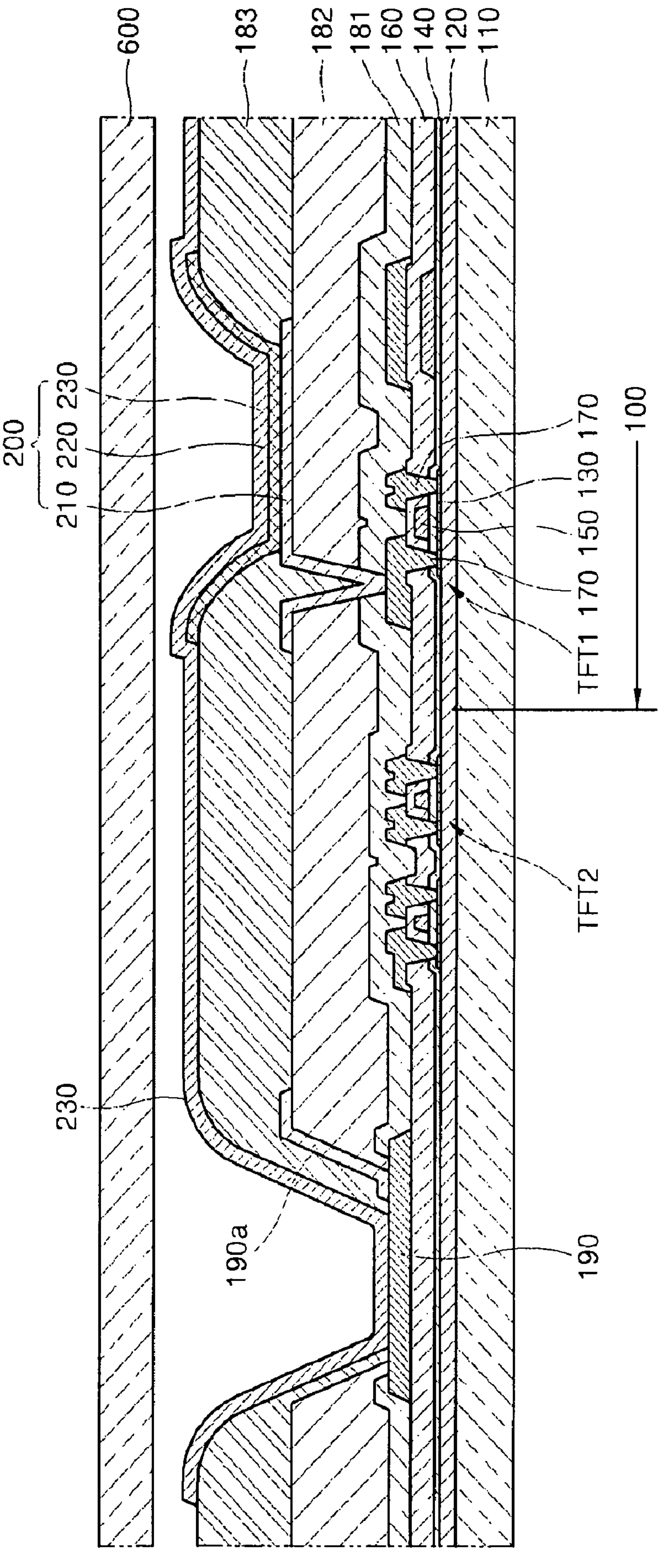

600
183
182
181
160
140
120
110
200
210
220
230
170
130
150
170
TFT1
100
TFT2
230
190a
190

FIG. 3

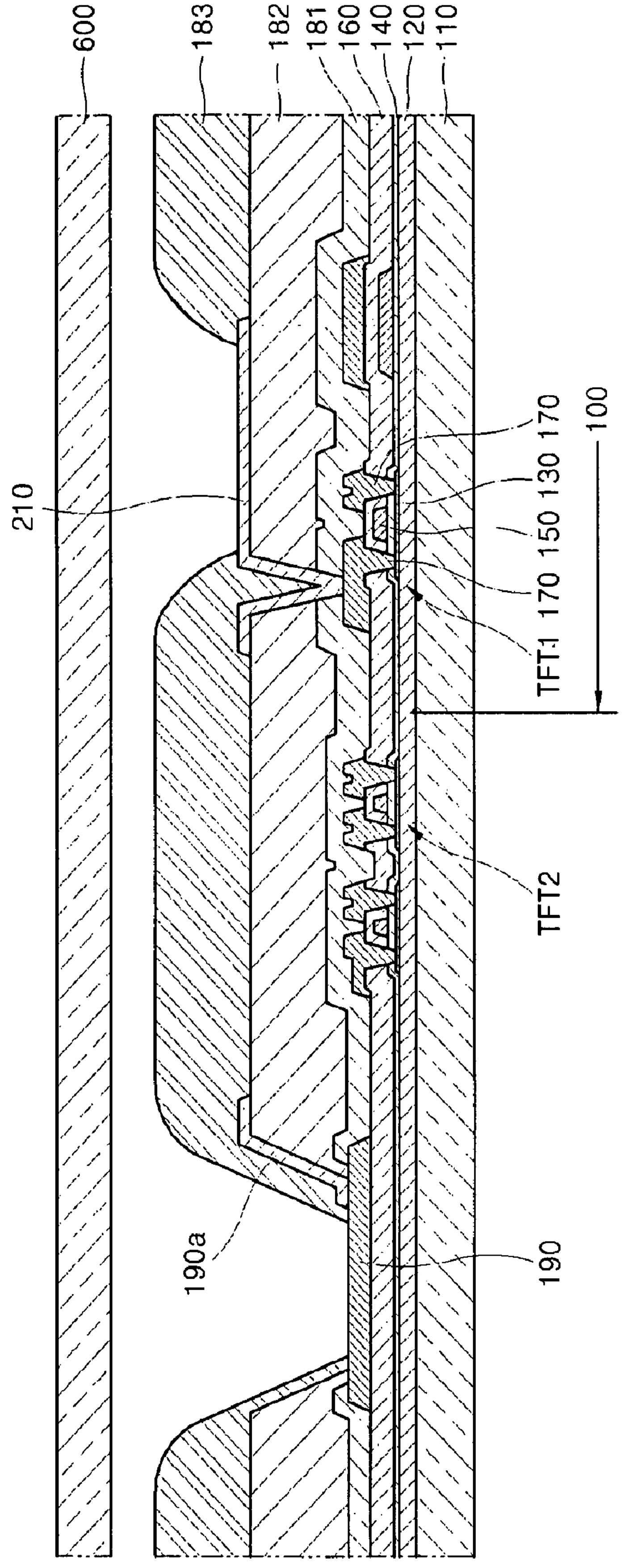

600
183
182
181
160
140
120
110
210
170
130
150
170
TFT1
100
TFT2
190a
190

FIG. 4

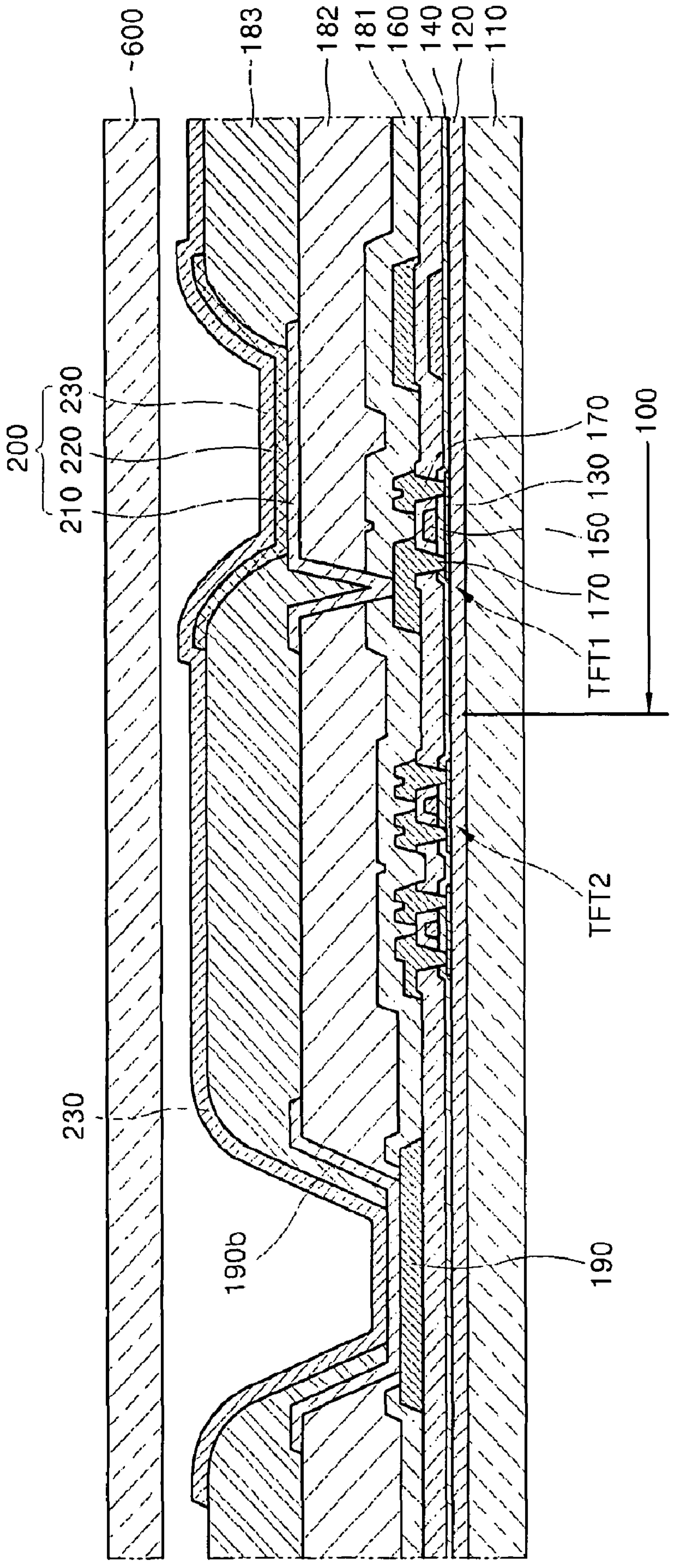
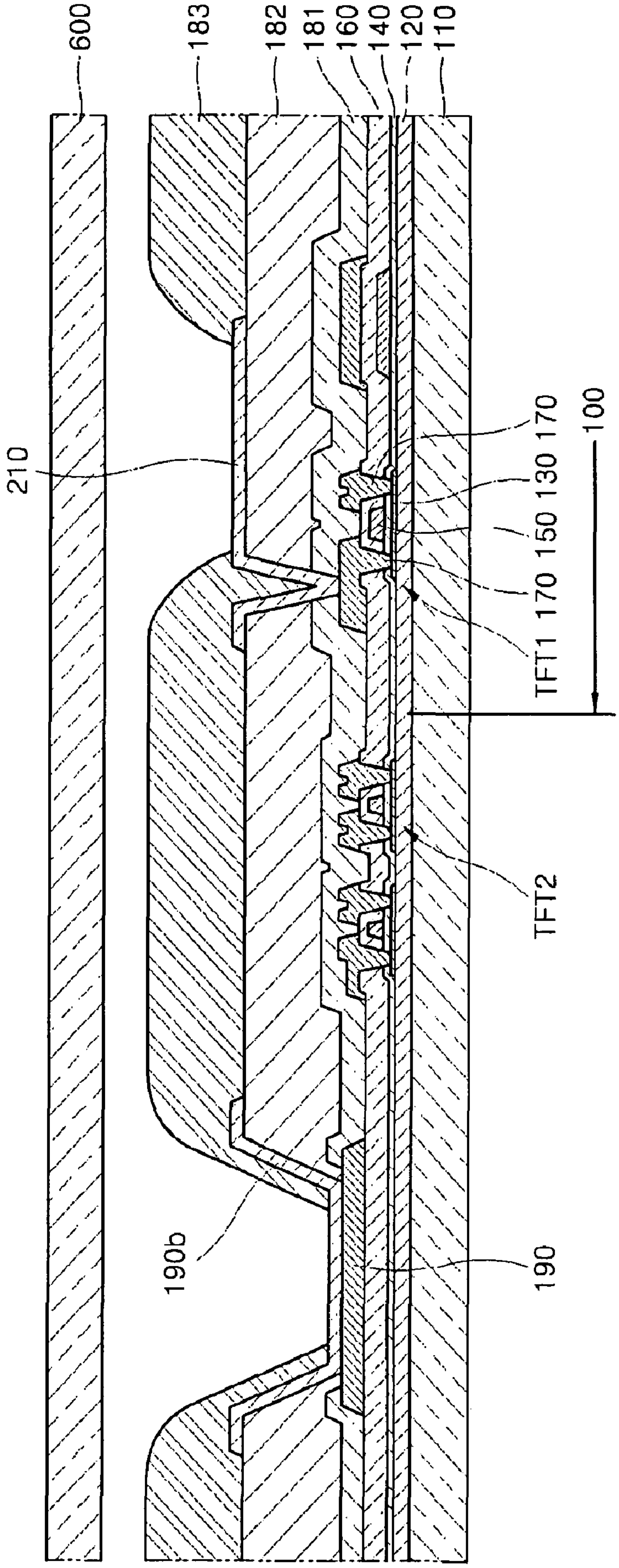

600
183
182
181
160
140
120
110
200
210
220
230
170
130
150
170
170
100
TFT1
TFT2
230
190b
190

FIG. 5


600
183
182
181
160
140
120
110
210
170
130
150
170
100
TFT1
TFT2
190b
190

ORGANIC LIGHT EMITTING DISPLAY APPARATUS

CROSS-REFERENCE TO RELATED PATENT APPLICATION

This application claims the benefit of Korean Patent Application No. 10-2007-00117368, filed on Nov. 16, 2007, in the Korean Intellectual Property Office, the disclosure of which is incorporated herein in its entirety by reference.

BACKGROUND

1. Field

The present invention relates to an organic light emitting display apparatus, and more particularly, to an organic light emitting display apparatus that resists corrosion during a manufacturing process thereof, and the organic light emitting display apparatus can have a remarkably increased yield.

2. Description of the Related Technology

Generally, organic light emitting display apparatuses refer to display apparatuses including organic light emitting devices. The organic light emitting devices include a pixel electrode, a counter electrode disposed opposite the pixel electrode, and an intermediate layer interposed between the pixel electrode and the counter electrode and including a light emitting layer.

An organic light emitting display apparatus can be classified as an active matrix display or a passive matrix display according to a driving method of the organic light emitting devices. In an active matrix display apparatus, a thin film transistor (TFT) of each of a plurality of sub-pixels controls the emission of light from the sub-pixel. In a passive matrix display apparatus, a plurality of electrodes arranged in a matrix shape controls the emission of light from a plurality of sub-pixels. In the case of the active matrix display apparatus, counter electrodes of a plurality of sub-pixels are generally formed as one body and contact an electrode power supply line positioned outside a display area.

The electrode power supply line is covered by an insulating layer that exposes at least a part of the electrode power supply line. The counter electrode contacts the exposed part of the electrode power supply line. However, before forming the counter electrode to contact the electrode power supply line during the manufacturing thereof, a process of exposing a part of the electrode power supply line outside the insulating layer is performed. Thus, the surface of the electrode power supply line is oxidized during the exposing process. As a result, contact resistance is increased in the subsequently-formed structure in which the electrode power supply line contacts with counter electrode.

SUMMARY OF CERTAIN INVENTIVE ASPECTS

One aspect is an organic light emitting display apparatus including a substrate having a display area, a thin film transistor (TFT) disposed inside the display area of the substrate, an electrode power supply line disposed outside the display area of the substrate, a pixel electrode disposed inside the display area of the substrate and electrically connected to the thin film transistor, an auxiliary conductive layer contacting the electrode power supply line, a pixel defining layer exposing the pixel electrode, covering the auxiliary conductive layer, and exposing the electrode power supply line, an intermediate layer disposed on the pixel electrode and including an emitting layer, and a counter electrode disposed on the intermediate layer and extending outside the display area of the substrate to contact the electrode power supply line.

Another aspect is an organic light emitting display apparatus, including a substrate, a conductive layer disposed on the substrate, an insulating layer covering a portion of the conductive layer so as to expose another portion of the conductive layer, and a terminal unit extending from the conductive layer toward an edge of the substrate, where the terminal unit and the conductive layer that is exposed by the insulating layer are formed of the same material.

BRIEF DESCRIPTION OF THE DRAWINGS

The above and other features and advantages will become more apparent through description of exemplary embodiments with reference to the attached drawings in which:

FIG. **1** is a schematic plan view of an organic light emitting display apparatus according to an embodiment;

FIG. **2** is a schematic cross-sectional view taken along line II-II of FIG. **1**, according to an embodiment;

FIG. **3** is a schematic cross-sectional view for describing a process of manufacturing the organic light emitting display apparatus of FIG. **2**, according to an embodiment;

FIG. **4** is a schematic cross-sectional view of a portion of an organic light emitting display apparatus; and

FIG. **5** is a schematic cross-sectional view for describing a process of manufacturing the organic light emitting display apparatus of FIG. **4**.

DETAILED DESCRIPTION OF CERTAIN INVENTIVE EMBODIMENTS

Embodiments will now be described in detail with reference to the attached drawings.

FIG. **1** is a schematic plan view of an organic light emitting display apparatus according to an embodiment. FIG. **2** is a schematic cross-sectional view taken along line II-II of FIG. **1**, according to an embodiment. FIG. **3** is a schematic cross-sectional view for describing a process of manufacturing the organic light emitting display apparatus.

Referring to FIGS. **1** through **3**, the organic light emitting display apparatus shown includes a substrate **110**. The substrate **110** may be formed of various materials such as glass, a metal, plastic or the like. The substrate **110** has a display area **100** where display devices are disposed for displaying images. The display area **100** includes an organic light emitting device **200** including a pixel electrode **210** (see FIG. **2**), a counter electrode **230** (see FIG. **2**) disposed opposite the pixel electrode **210**, and an intermediate layer **220** including at least an emitting layer interposed between the pixel electrode **210** and the counter electrode **230**.

In addition to the organic light emitting device **200** of the display area **100**, a vertical circuit driving unit **400** and a horizontal circuit driving unit **500** that are disposed outside the display area **100**, a power wiring unit **300** to which a plurality of power supply lines **310** supplying power to the display area **100** are electrically connected, an electrode power supply line **190** supplying power to the counter electrode **230**, and terminal units **192**, **320**, **420**, and **520** transmitting electrical signals applied to the above components from external devices are formed on the substrate **100**. A sealant **700** may be applied on edges of the substrate **110**, so that a sealing element **600** (see FIG. **2**) seals the display area **100**. Alternatively, the sealant **700** and the sealing element **600** may not be formed, or a passivation layer may be formed on the entire surface of the substrate **110**. The terminal units **192**, **320**, **420**, and **520** are not covered and are exposed by spaces in insulating layers to be described later so as to be connected to other electrical components such as a flexible printing circuit substrate, an IC chip, or the like.

Structures of the display area **100** and the organic light emitting device **200** will now be described in detail with reference to FIG. **2**.

A first thin film transistor TFT**1** is disposed in the display area **100** on the substrate **110**. The electrode power supply line **190** is disposed outside the display area **100** on the substrate **110**. A second TFT TFT**2** included in the vertical circuit driving unit **400** may be disposed outside the display area **100** on the substrate **110**. The structure and components of the organic light emitting device **200** will now be described in more detail.

A buffer layer **120**, which may be formed of SiO_2, etc., is disposed on the substrate **110**. A semiconductor layer **130** is disposed on the buffer layer **120**. The semiconductor layer **130** may be an amorphous silicon layer, a polycrystalline silicon layer, or formed of an organic semiconductor material. Although not shown in FIG. **2**, the semiconductor layer **130** may include source and drain areas doped with a dopant and a channel area.

A gate electrode **150** is formed above the semiconductor layer **130**, and source and drain electrodes **170** electrically communicate with each other according to a signal applied to the gate electrode **150**. The gate electrode **150** may be formed of a material such as MoW, Ag, Cu, Al, or the like, in consideration of, for example, adherence to an adjacent layer, planarizing, and machining of a surface of a layer stacked on the gate electrode **150**. In the some embodiments, a gate insulating layer **140** formed of SiO_2 is interposed between the semiconductor layer **130** and the gate electrode **150** in order to provide insulation between the semiconductor layer **130** and the gate electrode **150**.

An interlayer insulating layer **160** is formed on the gate electrode **150** and may be formed of a material such as silicon oxide, silicon nitride, or the like as a single layer or a multi-layer structure. The source and drain electrodes **170** are formed on the interlayer insulating layer **160**. The source and drain electrodes **170** are electrically connected to the semiconductor layer **130** through contact holes which are formed in the interlayer insulating layer **160** and the gate insulating layer **140**, respectively. The source and drain electrodes **170** may be formed of a material such as Ti, MoW, Ag, Cu, Al, or the like in consideration of conductivity. The source and drain electrodes **170** may be formed as a single layer or a multi-layer structure and, for example, may have a structure in which a Ti layer and an Al layer are stacked.

The electrode power supply line **190** is disposed outside the display area **100**. Referring to FIG. **2**, the electrode power supply line **190** is disposed on the interlayer insulating layer **160** on which the source and drain electrodes **170** of the first TFT TFT**1** are disposed. That is, the electrode power supply line **190** may be simultaneously formed together with the source and drain electrodes **170** of the first TFT TFT**1**. However, the present invention is not limited thereto. That is, the electrode power supply line **190** may be formed on a layer on which the gate electrode **150** of the first TFT TFT**1** is formed or may be formed irrespective of positions of electrodes of the first TFT TFT**1**. For convenience of explanation, however, the electrode power supply line **190** is formed on the interlayer insulating layer **160** on which the source and drain electrodes **170** are disposed.

The electrode power supply line **190** may be formed of various materials. The electrode power supply line **190** supplies an electrical signal to the counter electrode **230** of the organic light emitting device **200** as will be described later and thus is formed of a material having low resistivity and high conductivity such as Ti, MoW, Ag, Cu, Al or the like. The electrode power supply line **190** may be formed as a single layer or a multi-layer structure and, for example, may have a structure in which a Ti layer and an Al layer are stacked. As described above, the source and drain electrodes **170** and the electrode power supply line **190** may be formed of the same material or may be simultaneously formed together. When the source and drain electrodes **170** and the electrode power supply line **190** are simultaneously formed together, the source and drain electrodes **170** and the electrode power supply line **190** may have the same structure.

The electrode power supply line **190** supplies power to the counter electrode **230** as will be described later. The terminal unit **192** is extended from the electrode power supply line **190** toward an edge of the substrate **110**. Power is supplied to the electrode power supply line **190** through the terminal unit **192** and is supplied to the counter electrode **230** through the electrode power supply line **190**. The terminal unit **192** and the electrode power supply line **190** may be simultaneously formed together, and accordingly, may be formed of the same material. When the terminal unit **192** and the electrode power supply line **190** are simultaneously formed together, structures thereof are the same or similar. In some embodiments, the terminal unit **192** and/or the electrode power supply line **190** may include a layer formed of Al in consideration of conductivity.

A first insulating layer **181** is formed above the first TFT TFT**1** to operate as a passivation layer so as to protect the first TFT TFT**1**. The first insulating layer **181** may be formed of various materials, i.e., an inorganic material, such as silicon oxide, silicon nitride, or silicon oxynitride, which can provide a high level of protection for the first TFT TFT**1**. The first insulating layer **181** is formed as a single layer in FIG. **2**; however, the it is not limited thereto and the first insulating layer **181** may be formed as a multi-layer structure. The first insulating layer **181** is formed so as to expose at least a part of the electrode power supply line **190**. FIG. **2** illustrates a structure in which the first insulating layer **181** covers edge portions of the electrode power supply line **190**.

A second insulating layer **182** functions as a planarizing layer on the first insulating layer **181**. The second insulating layer **182** may be formed of an organic material, e.g., acryl, BCB, photoacryl, or the like. The second insulating layer **182** is illustrated as a single layer in FIG. **2**. However, the it is not limited thereto and the second insulating layer **182** may be formed as a multi-layer structure. The second insulating layer **182** is formed so as to expose at least a part of the electrode power supply line **190**.

The organic light emitting device **200** is disposed on the second insulating layer **182** and includes the pixel electrode **210**, the counter electrode **230**, and the intermediate layer **220** interposed between the pixel electrode **210** and the counter electrode **230**. The organic light emitting device **200** will now be described in detail.

In the display area **100**, openings are formed in the first and second insulating layers **181** and **182** to expose at least one of the source and drain electrodes **170** of the first TFT TFT**1**. The pixel electrode **210** is disposed on the display area **100** of the substrate **110**, i.e., on the second insulating layer **182** and contacts at least one of the source and drain electrodes **170** through the openings so as to be electrically connected to the first TFT TFT**1**. The pixel electrode **210** may be a transparent electrode or a reflective electrode. If the pixel electrode **210** is a transparent electrode, the pixel electrode **210** may be formed of, for example, indium tin oxide (ITO), indium zinc oxide (IZO), ZnO, or In_2O_3. If the pixel electrode **210** is a reflective electrode, the pixel electrode **210** may, for example include a reflective layer formed of Ag, Mg, Al, Pt, Pd, Au, Ni, Nd, Ir, Cr, or a combination thereof, and a layer formed of ITO, IZO, ZnO, or In_2O_3. However, the pixel electrode **210** is not limited thereto, and the pixel electrode **210** may be formed of various materials, and also, may be formed as a single layer or a multi-layer structure.

A third insulating layer **183** is disposed on the second insulating layer **182**. In other words, the third insulating layer **183** is formed so as to cover the second insulating layer **182**. The third insulating layer **183** operates as a pixel defining layer by having openings corresponding to a plurality of sub-pixels, which expose at least a part of the pixel electrode **210**. For example, a central portion or the whole portion of the pixel electrode **210** may be exposed. Referring to FIG. **2**, the third insulating layer **183** increases a distance between the end of the pixel electrode **210** and the counter electrode **230**. This is beneficial in preventing arcing between the pixel electrode **210** and the counter electrode **230**. The third insulating layer **183** is disposed on the second insulating layer **182**, and also may be disposed outside the display area **100** as illustrated in FIG. **2**. That is, the third insulating layer **183** may be disposed both over and outside the display area **100** of the substrate **110**. Also, the third insulating layer **183** of FIG. **2** exposes at least a part of the electrode power supply line **190**.

An auxiliary conductive layer **190***a* is disposed so as to contact the electrode power supply line **190** at a side of the electrode power supply line **190**. The auxiliary conductive layer **190***a* contacts the electrode power supply line **190** so as to establish a lower conductive path and reduce IR drop through the electrode power supply line **190**. The auxiliary conductive layer **190***a* may be disposed outside the display area **100** of the substrate **110**. Referring to FIG. **2**, a part of the auxiliary conductive layer **190***a* may be disposed on the same layer on which the pixel electrode **210** is disposed. In FIG. **2**, the auxiliary conductive layer **190***a* is disposed on the second insulating layer **182** and the electrode power supply line **190**. In this case, the auxiliary conductive layer **190***a* may be formed of the same material as that of the pixel electrode **210**. The auxiliary conductive layer **190***a* and the pixel electrode **210** may be simultaneously formed together. In this case, the auxiliary conductive layer **190***a* and the pixel electrode **210** may have the same structure. The auxiliary conductive layer **190***a* is covered by the third insulating layer **183**, and accordingly, the auxiliary conductive layer **190***a* is not exposed outside the third insulating layer **183**.

The intermediate layer **220** of the organic light emitting device **200** may be formed of a low or high molecular weight material. When the intermediate layer **220** is formed of a low molecular weight material, it may be preferable to have at least one of a hole injection layer (HIL), a hole transport layer (HTL), an emission layer (EML), an electron transport layer (ETL), an electron injection layer (EIL), and the like stacked in a single structure or a multi-layer structure to form the intermediate layer **220**. Alternatively, the intermediate layer **220** may be formed of an organic material such as copper phthalocyanine (CuPc), N,N'-Di(naphthalene-1-yl)-N,N'-diphenyl-benzidine (NPB), tris-8-hydroxyquinoline aluminum (Alq3), or the like. These layers may be formed, for example, using a vacuum deposition method.

When the intermediate layer **220** is formed of a high molecular weight material, the intermediate layer **200** it may be preferable to have a structure in which an HTL and an EML are stacked. The HTL may be formed of PEDOT, and the EML may be formed of Poly-Phenylenevinylene (PPV)-family and Polyfluorene-family high molecular weight materials using a screen printing method, an inkjet printing method, or the like. However, the intermediate layer **220** is not limited to this structure, and may have various other structures.

The counter electrode **230** may be disposed on the intermediate layer **220**, over the display area **100** as illustrated in FIG. **2**. The counter electrode **230** extends outside the display area **100** and contacts the electrode power supply line **190** disposed outside the display area **100** to receive power from the electrode power supply line **190**. That is, the counter electrode **230** extends outside the display area **100** of the substrate **110** over the third insulating layer **183** and the electrode power supply line **190** which is exposed by the third insulating layer **183**.

The counter electrode **230** may be a transparent or reflective electrode. If the counter electrode **230** is a transparent electrode, the counter electrode **230** may include a layer formed of a metal having a low work function, i.e., Li, Ca, LiF/Ca, LiF/Al, Al, Ag, Mg, or a combination thereof, and a transparent conductive layer formed of ITO, IZO, ZnO, or In_2O_3. If the counter electrode **230** is a reflective electrode, the counter electrode **230** may be formed of Li, Ca, LiF/Ca, LiF/Al, Al, Ag, Mg, or a combination thereof. However, the counter electrode **230** is not limited to these structures and materials, and thus, may be modified into various forms.

FIG. **3** is a schematic cross-sectional view for describing a process of manufacturing the organic light emitting display apparatus according to one embodiment. FIG. **3** illustrates the organic light emitting display apparatus before forming the intermediate layer **220** and the counter electrode **230**.

As described above, the third insulating layer **183** has an opening exposing at least a part of the pixel electrode **210** and an opening exposing at least a part of the electrode power supply line **190**, and covers the auxiliary conductive layer **190***a*. In an embodiment of a process to form the third insulating layer **183**, an insulating layer is formed on the entire surface of the substrate **110**. Then, exposing, developing, and etching processes are performed on the insulating layer using photoresist. Finally, a washing process is performed on the insulating layer using deionized (DI) water. In these manufacturing steps, since the auxiliary conductive layer **190***a* is covered by the third insulating layer **183**, the electrode power supply line **190**, the terminal unit **192**, and the auxiliary conductive layer **190***a* are not damaged.

FIG. **4** is a schematic cross-sectional view of an embodiment of a portion of an organic light emitting display apparatus. FIG. **5** is a schematic cross-sectional view for describing a process of manufacturing the organic light emitting display apparatus of FIG. **4**. Referring to FIGS. **4** and **5**, an auxiliary conductive layer **190***b* is disposed on an electrode power supply line **190**, and a third insulating layer **183** is formed so as to expose the auxiliary conductive layer **190***b*. A counter electrode **230** contacts the auxiliary conductive layer **190***b* so as to be electrically connected to the electrode power supply line **190** via the auxiliary conductive layer **190***b*.

In the organic light emitting display apparatus illustrated in FIGS. **4** and **5**, the auxiliary conductive layer **190***b* is exposed in a process of forming the third insulating layer **183** and the subsequent processes. In this case, since a terminal unit connected to the electrode power supply line **190** is exposed outside the third insulating layer **183**, the auxiliary conductive layer **190***b* or the terminal unit may be damaged in the process of forming the third insulating layer **183** and the subsequent processes.

In more detail, a developing process of the third insulating layer **183** using photoresist and stripping and/or washing processes of the photoresist are performed using a wet process. In the above processes, the auxiliary conductive layer **190***b* and the terminal unit, which are respectively formed of different materials, are exposed by an alkali solution used in the wet process. At this time, a potential difference is generated between the auxiliary conductive layer **190***b* and the terminal unit due to a galvanic phenomenon, so that at least one of the auxiliary conductive layer **190***b* and the terminal unit is greatly damaged. For example, if a pixel electrode **210** includes a layer formed of ITO, and the auxiliary conductive layer **190***b* is formed of the same material as that of the pixel electrode **210** and thus also includes a layer formed of ITO, the terminal unit includes a layer formed of Al and the electrode power supply line **190** is formed of the same material as that of the terminal unit and thus also includes a layer formed of Al, the layer formed of Al is oxidized and the layer formed of ITO is reduced, thereby damaging the layer formed of Al. As a result, resistance of the Al layer is sharply increased due to oxidization of the Al layer, thereby causing defect of the organic light emitting display apparatus.

However, in the organic light emitting display apparatus according to the embodiment as shown in FIGS. **1** through **3**, since the auxiliary conductive layer **190***a* is covered by the third insulating layer **183** in the process of forming the third insulating layer **183** and the subsequent processes, the above-described problem does not occur. In more detail, even though the electrode power supply line **190** and the terminal unit **192** are exposed by the third insulating layer **183** in the process of forming the third insulating layer **183** and the subsequent processes, since the electrode power supply line **190** and the terminal unit **192** are formed of the same material, a galvanic phenomenon does not occur between the electrode power supply line **190** and the terminal unit **192**. That is because the galvanic phenomenon occurs between different materials. In particular, in the organic light emitting display apparatus, when the pixel electrode **210** includes a layer formed of ITO, the auxiliary conductive layer **190***a* may also include a layer formed of ITO, and the terminal unit **192** may include the same material as that of the electrode power supply line **190** and include a layer formed of Al. The problem in which the layer formed of Al is oxidized or the layer formed of ITO is reduced can be prevented. Furthermore, when the pixel electrode **210** is formed as a multi-layer structure having an uppermost layer formed of ITO, the auxiliary conductive layer **190***a* may be formed as a multi-layer structure also having an uppermost layer formed of ITO. In this case, the layer formed of ITO is not exposed outside the third insulating layer **183**.

Referring to FIGS. **4** and **5**, since the electrode power supply line **190** and the terminal unit are connected to each other and the auxiliary conductive layer **190***b* contacts the electrode power supply line **190**; a galvanic phenomenon can occur between the terminal unit and the auxiliary conductive layer **190***b*. Referring to FIGS. **1** through **3**, in the organic light emitting display apparatus, the pixel electrode **210** is exposed by the third insulating layer **183**; however, the pixel electrode **210** does not directly contact the terminal unit **192** or the electrode power supply line **190**. Accordingly, a galvanic phenomenon does not occur between the pixel electrode **210** and the terminal unit **192** or the electrode power supply line **190**.

The organic light emitting display apparatus is not limited to these specific exemplary embodiments. For example, the first insulating layer **181** operating as a passivation layer and the second insulating layer **182** operating as a planarizing layer are not necessarily formed separately and may be integrally formed as one body.

In the embodiment illustrated in FIGS. **1** to **3**, the electrode power supply line **190** is exposed by the third insulating layer **183**, the terminal unit **192** extending from the electrode power supply line **190** is exposed by the third insulating layer **183**, and the auxiliary conductive layer **190***a* is covered by the third insulating layer **183**. In this embodiment, because the electrode power supply line **190** and the terminal unit **192** are respectively formed of the same material, and the auxiliary conductive layer **190***a*, formed of different material, is covered by the third insulating layer **183** and is therefore not exposed outside the third insulating layer **183**, the electrode power supply line **190**, the auxiliary conductive layer **190***a*, or the terminal unit **192** is prevented from being damaged in a process of patterning the third insulating layer **183** and the subsequent processes. However, the present invention is not limited thereto.

For example, in an organic light emitting display apparatus including a substrate, a conductive layer disposed on the substrate, an insulating layer covering a part of the conductive layer so as to expose the conductive layer, and a terminal unit extended from the conductive layer toward an edge of the substrate, when the conductive layer and the terminal unit are respectively formed of different material, a galvanic phenomenon may occur between the conductive layer and the terminal unit in a process of patterning the insulating layer and the subsequent processes. Accordingly, the conductive layer, which is exposed by the insulating layer, and the terminal unit are formed of the same material so as to prevent a galvanic phenomenon. Also, an auxiliary conductive layer may be disposed at a side of the conductive layer so as to contact the conductive layer. In this case, the auxiliary conductive layer may be formed of a different material from the conductive layer or the terminal unit. When the auxiliary conductive layer is exposed outside the insulating layer, a galvanic phenomenon may occur between the auxiliary conductive layer and the conductive layer or between the auxiliary conductive layer and the terminal unit. Accordingly, the auxiliary conductive layer may be covered by the insulating layer so as to prevent the galvanic phenomenon from occurring between the auxiliary conductive layer and the conductive layer or between the auxiliary conductive layer and the terminal unit.

In particular, when the terminal unit and the conductive layer are simultaneously formed together and have the same structure; the conductive layer may include a layer formed of Al; and the auxiliary conductive layer may include a layer formed of ITO, the effect of the present invention is remarkable. The present invention can be applied to any case in which the auxiliary conductive layer and the conductive layer are respectively formed of different materials.

According to the organic light emitting display apparatus of the present invention, process yield can be dramatically increased by preventing corrosion during a manufacturing process thereof.

While the present invention has been particularly shown and described with reference to exemplary embodiments thereof, it will be understood by one of ordinary skill in the art that various changes in form and details may be made therein without departing from the spirit and scope of the present invention.

What is claimed is:

1. An organic light emitting display apparatus comprising:
a substrate having a display area;
a thin film transistor (TFT) disposed inside the display area of the substrate;
an electrode power supply line disposed outside the display area of the substrate;
a pixel electrode disposed inside the display area of the substrate and electrically connected to the thin film transistor;

an auxiliary conductive layer contacting the electrode power supply line;

a pixel defining layer exposing the pixel electrode, completely covering the auxiliary conductive layer, and exposing the electrode power supply line;

an intermediate layer disposed on the pixel electrode and including an emitting layer; and

a counter electrode disposed on the intermediate layer and extending outside the display area of the substrate to contact the electrode power supply line.

2. The organic light emitting display apparatus of claim **1**, wherein the auxiliary conductive layer is disposed outside the display area of the substrate.

3. The organic light emitting display apparatus of claim **1**, wherein the auxiliary conductive layer is formed of the same material as that of the pixel electrode.

4. The organic light emitting display apparatus of claim **3**, wherein the pixel electrode comprises a layer formed of ITO.

5. The organic light emitting display apparatus of claim **4**, wherein the pixel electrode comprises a multi-layer structure having an uppermost layer formed of ITO.

6. The organic light emitting display apparatus of claim **3**, wherein the auxiliary conductive layer is formed in the same processing steps as the pixel electrode.

7. The organic light emitting display apparatus of claim **1**, wherein a part of the auxiliary conductive layer is disposed on the same layer as the pixel electrode.

8. The organic light emitting display apparatus of claim **1**, wherein the pixel defining layer is disposed over the display area of the substrate and outside the display area.

9. The organic light emitting display apparatus of claim **1**, further comprising a planarizing layer covering the thin film transistor and an edge of the electrode power supply line,

wherein the pixel electrode is disposed on the planarizing layer, the auxiliary conductive layer is disposed over the planarizing layer and the electrode power supply line, and the pixel defining layer is disposed so as to cover the planarizing layer.

10. The organic light emitting display apparatus of claim **1**, wherein the counter electrode extends outside the display area of the substrate over the electrode power supply line exposed by the pixel defining layer.

11. The organic light emitting display apparatus of claim **1**, wherein the thin film transistor comprises source and drain electrodes and a gate electrode, and the electrode power supply line is formed of the same material as that of the source and drain electrodes.

12. The organic light emitting display apparatus of claim **11**, wherein the electrode power supply line comprises a layer formed of aluminum.

13. The organic light emitting display apparatus of claim **11**, wherein the electrode power supply line is formed in the same processing steps as the source and drain electrodes.

14. The organic light emitting display apparatus of claim **11**, wherein the electrode power supply line is disposed on the same layer as the source and drain electrodes.

15. The organic light emitting display apparatus of claim **1**, further comprising a terminal unit extending from the electrode power supply line toward an edge of the substrate.

16. The organic light emitting display apparatus of claim **15**, wherein the terminal unit is formed of the same material as that of the electrode power supply line.

17. The organic light emitting display apparatus of claim **16**, wherein the terminal unit comprises a layer formed of aluminum.

18. The organic light emitting display apparatus of claim **16**, wherein the terminal unit and the electrode power supply line are formed in the same processing steps.

19. The organic light emitting display apparatus of claim **16**, wherein the terminal unit and the auxiliary conductive layer are respectively formed of different materials.

* * * * *

专利名称(译)	有机发光显示装置		
公开(公告)号	US8030838	公开(公告)日	2011-10-04
申请号	US12/288938	申请日	2008-10-23
[标]申请(专利权)人(译)	KWAK WON KYU 金永SEOG		
申请(专利权)人(译)	KWAK WON-KYU KIM YONG-SEOG		
当前申请(专利权)人(译)	三星移动显示器有限公司.		
[标]发明人	KWAK WON KYU KIM YONG SEOG		
发明人	KWAK, WON-KYU KIM, YONG-SEOG		
IPC分类号	H01L51/52 H01L51/50		
CPC分类号	H01L27/3246 H01L27/3279 H01L2924/0002 H01L2924/00		
优先权	1020070117368 2007-11-16 KR		
其他公开文献	US20090128023A1		
外部链接	Espacenet USPTO		

摘要(译)

公开了一种能够防止制造期间腐蚀的有机发光显示装置。该装置可以具有显着提高的产量。该装置包括：具有显示区域的基板，设置在显示区域内的薄膜晶体管，设置在显示区域外部的电极电源线，设置在基板的显示区域内并电连接到薄膜的像素电极晶体管，在电极电源线一侧接触电极电源线的辅助导电层，暴露覆盖辅助导电层的像素电极并暴露电极电源线的像素限定层。该装置还包括：中间层，设置在像素电极上并包括发光层;以及对电极，设置在中间层上并延伸到基板的显示区域外部以接触电极电源线。