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(54) **ORGANIC LIGHT EMITTING DISPLAY
DEVICE AND METHOD FOR FABRICATING
THE SAME**

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H01L 51/52 (2006.01)

(52) **U.S. Cl.**
CPC **H01L 27/3246** (2013.01); **H01L 27/3253**
(2013.01); **H01L 27/3279** (2013.01); **H01L**
51/5228 (2013.01); **H01L 51/5234** (2013.01)

(58) **Field of Classification Search**

None

See application file for complete search history.

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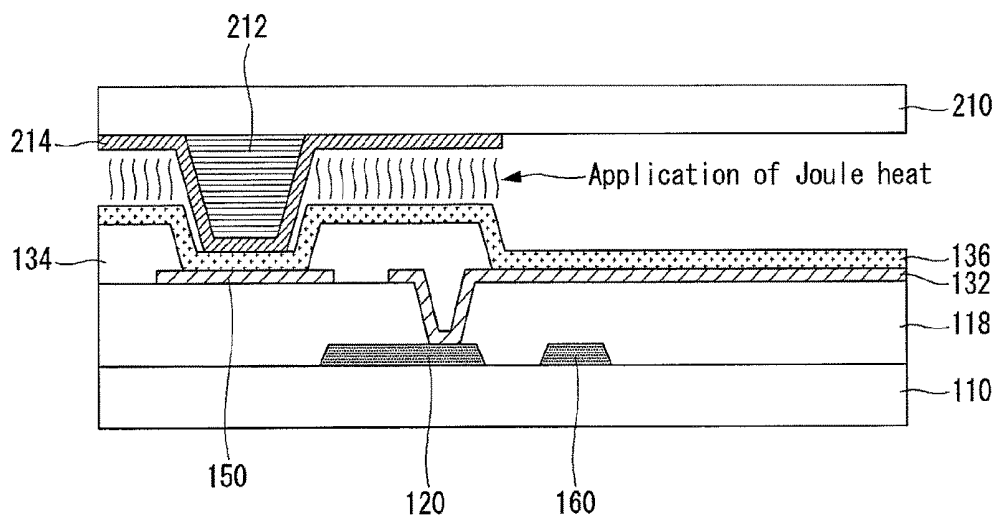
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& Birch, LLP

(57) **ABSTRACT**

An organic light emitting display device, and a method for manufacturing the organic light emitting display device are discussed. The organic light emitting display device according to one embodiment includes a substrate; a first auxiliary electrode formed on the substrate and in a non-light emitting region; a bank layer formed on the substrate and having an opening exposing the first auxiliary electrode; an organic light emitting layer formed on the bank layer; an upper electrode formed on the organic light emitting layer and the first auxiliary electrode; and a second auxiliary electrode formed on the upper electrode. The first auxiliary electrode and the second auxiliary electrode come into contact with the upper electrode in the opening exposing the first auxiliary electrode.

20 Claims, 9 Drawing Sheets



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FIG. 1

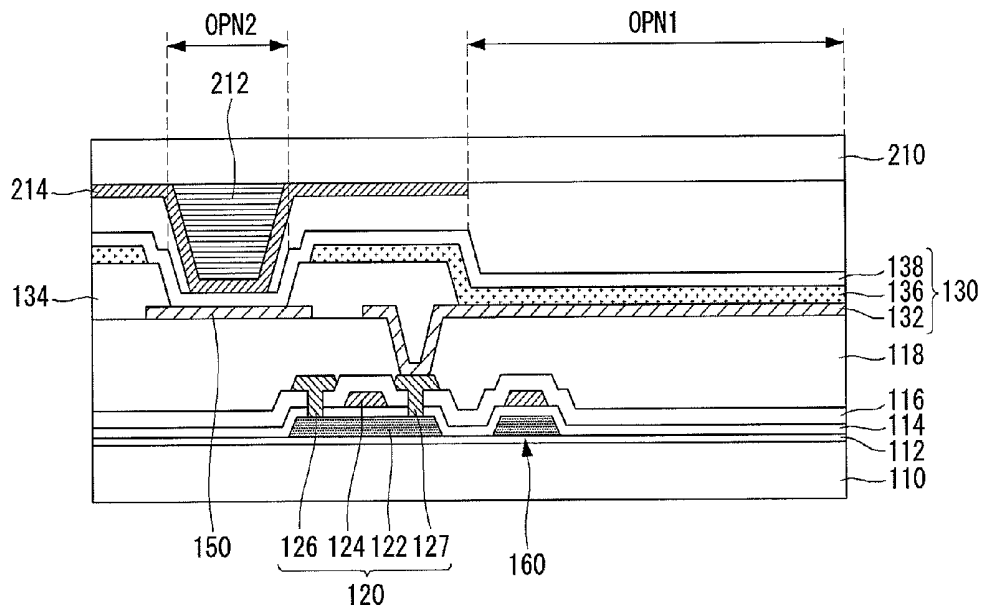


FIG. 2A

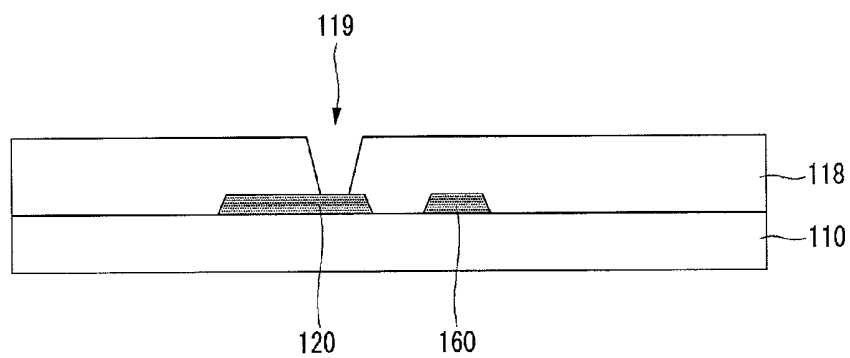


FIG. 2B

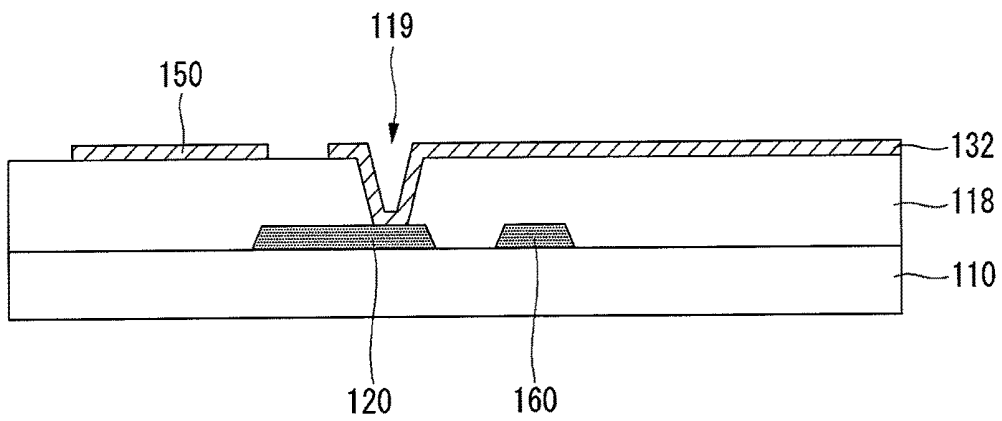


FIG. 2C

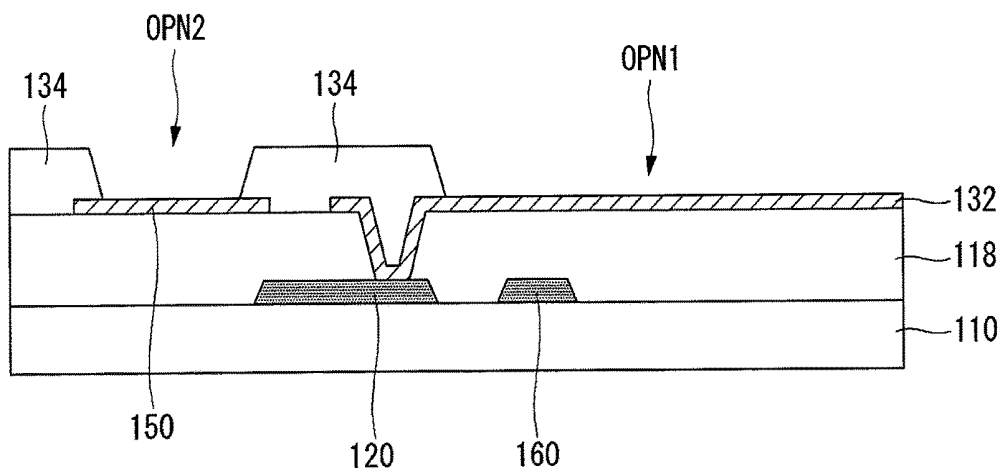


FIG. 2D

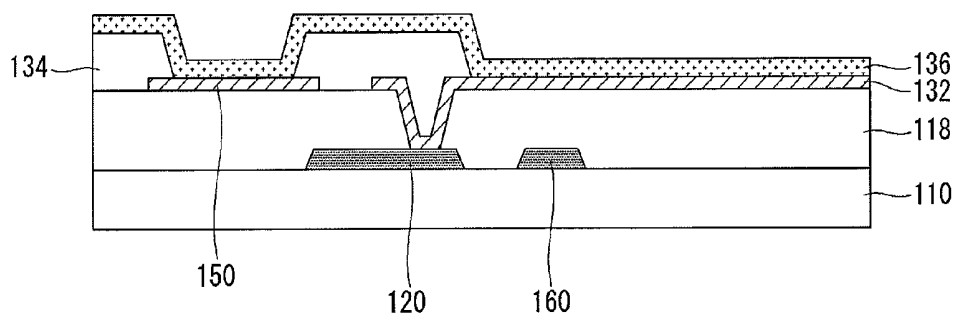


FIG. 2E

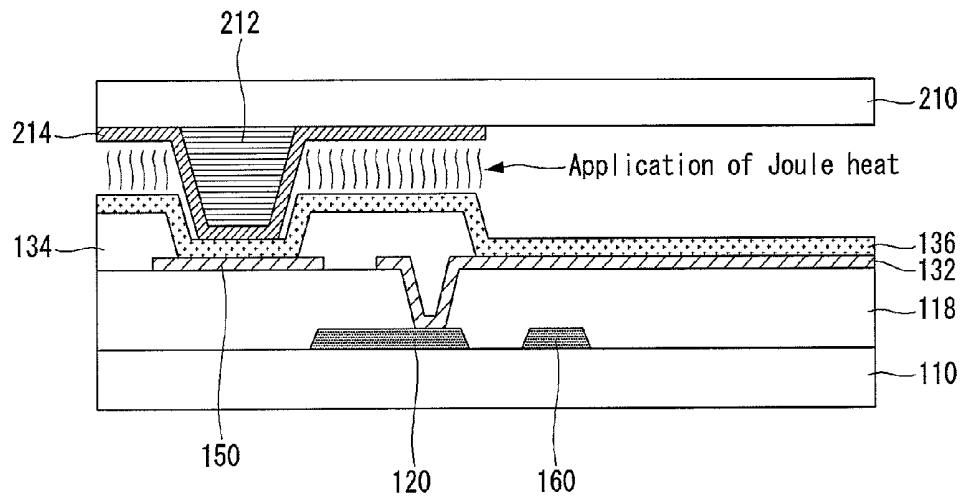


FIG. 2F

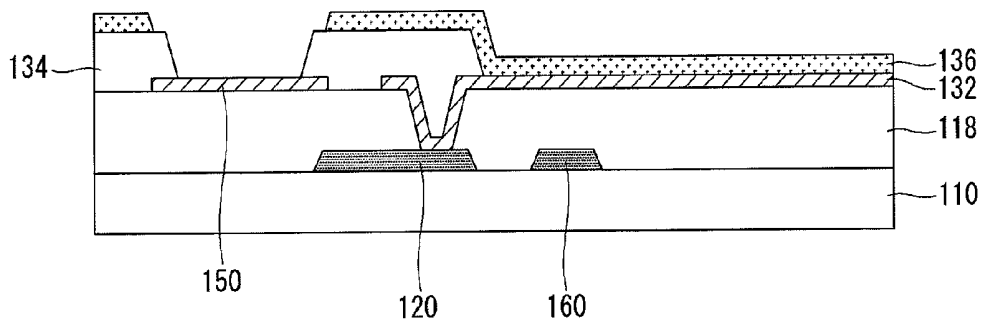


FIG. 2G

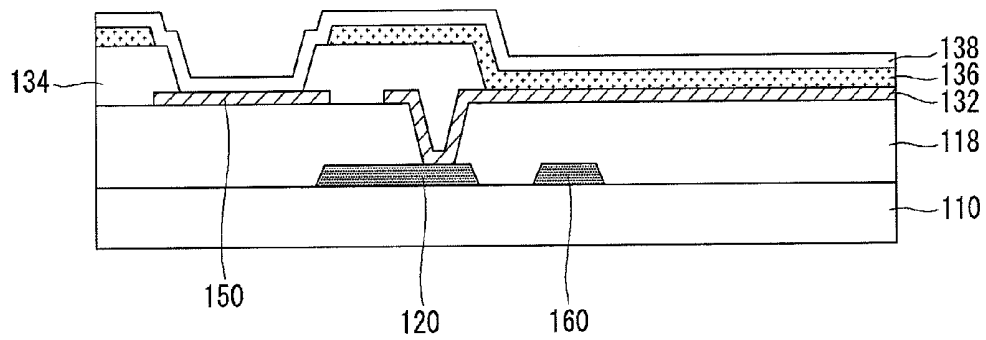


FIG. 2H

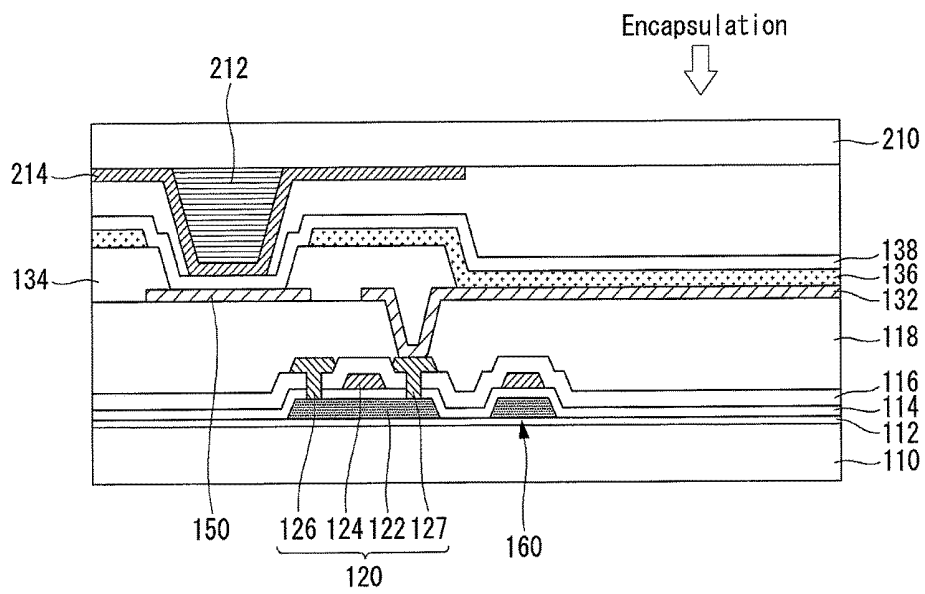


FIG. 3A

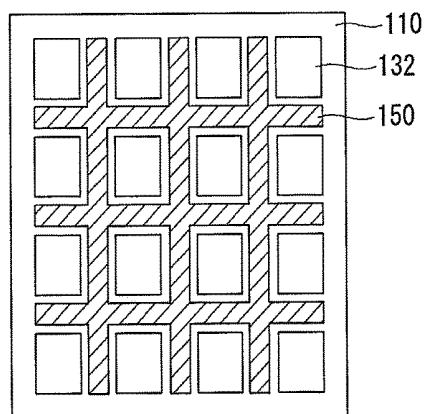


FIG. 3B

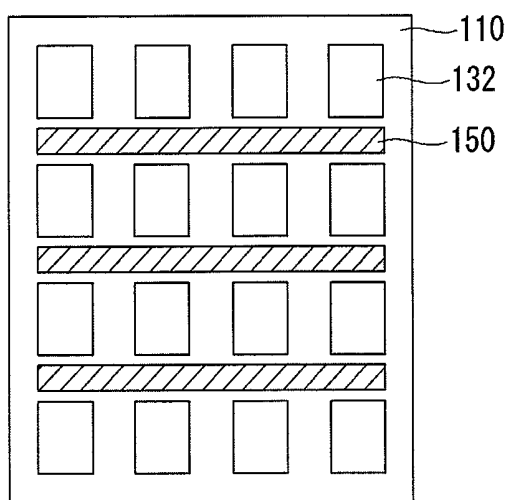


FIG. 3C

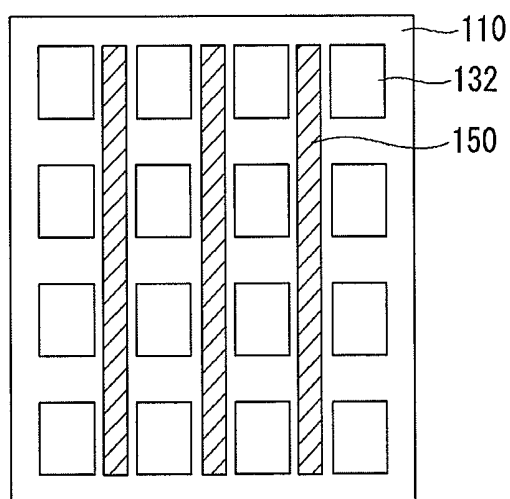


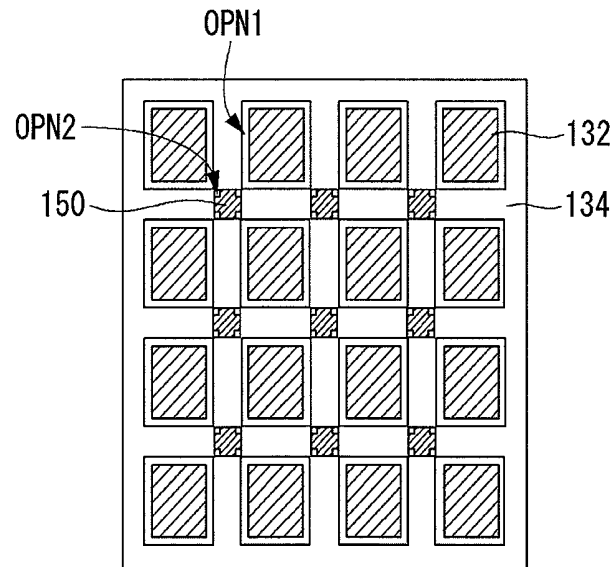
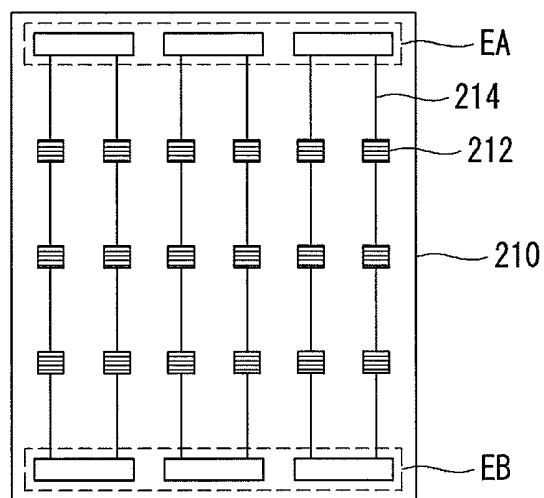
FIG. 4**FIG. 5**

FIG. 6A

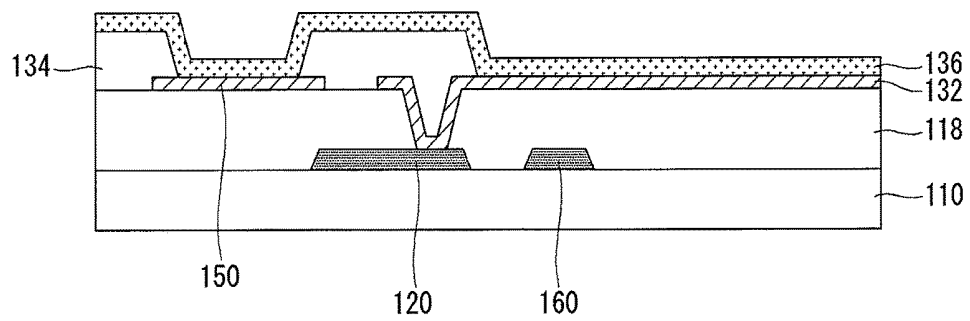


FIG. 6B

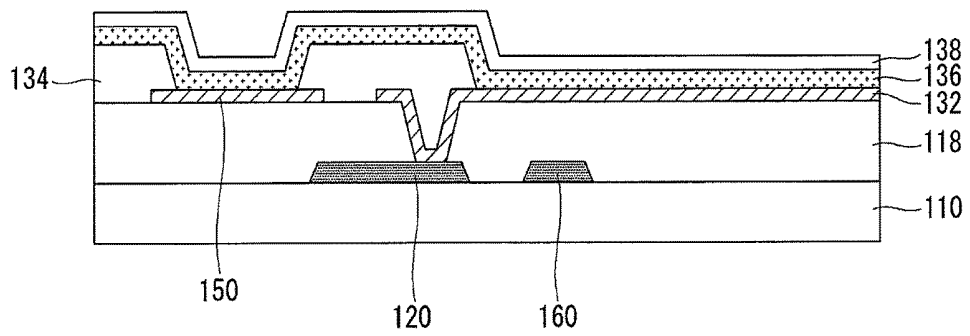


FIG. 6C

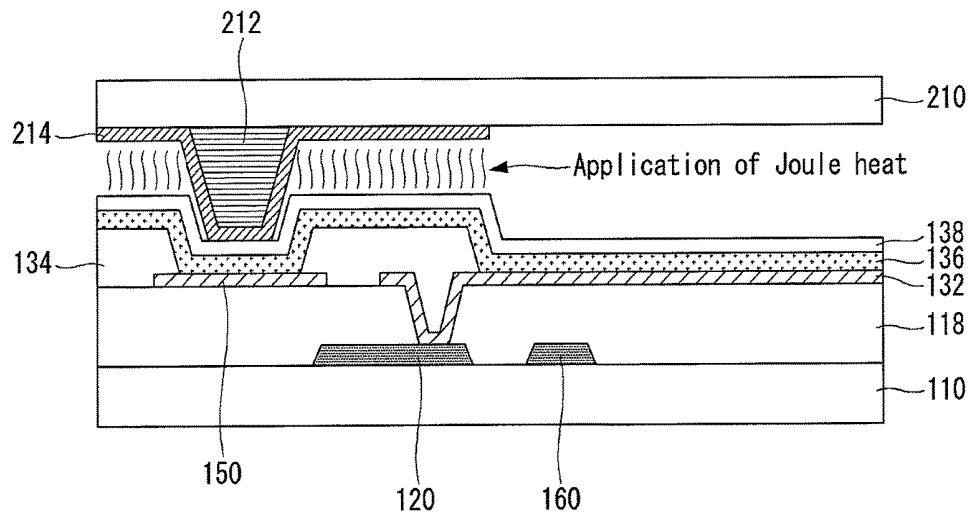
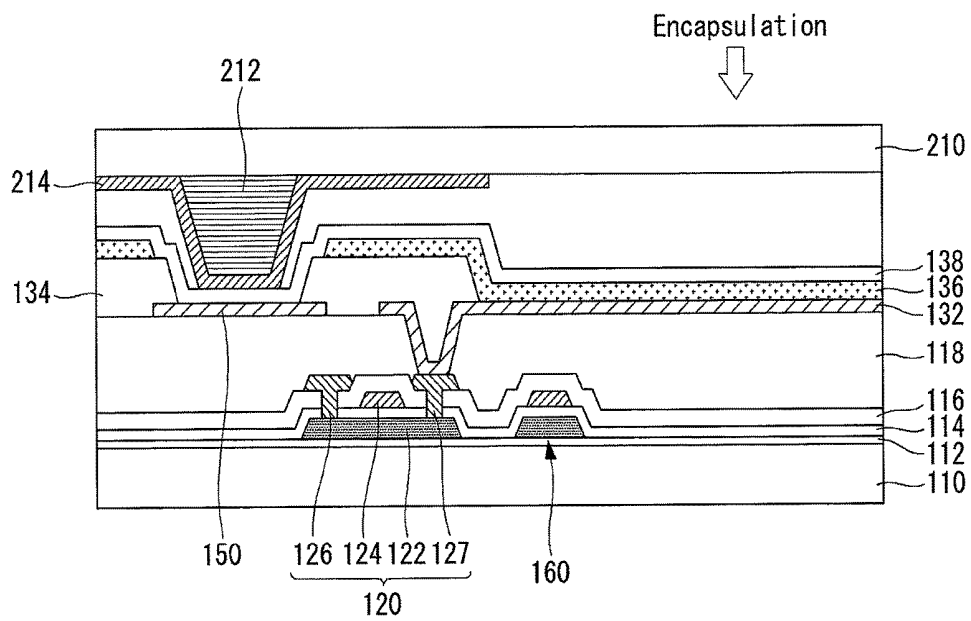


FIG. 6D



ORGANIC LIGHT EMITTING DISPLAY DEVICE AND METHOD FOR FABRICATING THE SAME

CROSS REFERENCE TO RELATED APPLICATIONS

This application claims the priority benefit of Korean Patent Application No. 10-2014-0119608 filed on Sep. 10, 2014, the contents of which are hereby incorporated by reference herein in their entirety.

BACKGROUND OF THE INVENTION

Field of the Disclosure

The present application relates to an organic light emitting display device and a method for fabricating the same.

Description of the Related Art

Organic light emitting display devices are self-luminous elements that cause an organic light emitting layer to emit light by the recombination of electrons and holes. Organic light emitting display devices have high brightness, low operating voltage, and ultra-thin design.

An active-matrix organic light emitting display device (AMOLED) includes pixels arranged in a matrix to display an image. Each pixel includes an organic light emitting diode and a cell driver that independently drives the organic light emitting diode. The cell driver includes at least two thin film transistors and a storage capacitor to control the amount of light emission from the organic light emitting diode by controlling the amount of electric current fed to the organic light emitting diode in response to a data signal.

The organic light emitting diode includes an emissive layer of organic materials disposed between an upper electrode and a lower electrode. The organic light emitting diode emits light by energy generated when an exciton, which is a hole-electron pair formed by the combination of a hole fed from the lower electrode and an electron received from the upper electrode within the emissive layer, returns to the ground state.

The organic light emitting display devices include bottom emission devices and top emission devices depending on the direction that emitted light exits the device. For bottom emission devices, light emitted passes through the bottom of the substrate, i.e., from the organic light emitting layer toward the lower electrode. For top emission devices, light emitted passes through the top of the substrate, i.e., from the organic light emitting layer toward the upper electrode.

The upper electrode of a top emission organic light emitting display device is made thin enough to pass light through the upper electrode, which causes an increase in the resistance of the upper electrode. Organic light emitting display devices, in related art, include a larger screen and a larger area of the upper electrode, an increased resistance of the upper electrode, and a large voltage drop (IR drop). As a result, the large IR drop in the organic light emitting display devices of related art can result in a rise in power consumption and non-uniformity in the brightness of the display devices, and decreased reliability.

SUMMARY OF THE INVENTION

An object of the present invention is to provide an organic light emitting display device which can reduce power consumption and minimize non-uniformity in brightness by

decreasing the surface resistance of an upper electrode included in an organic light emitting diode, and a method for fabricating the same.

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 specification, illustrate embodiments of the invention and together with the description serve to explain the principles of the invention.

FIG. 1 is a view showing a cross-section of a pixel of an organic light emitting display device according to an embodiment of the present invention;

FIGS. 2A to 2H are views sequentially showing a method for fabricating an organic light emitting display device according to another embodiment of the present invention;

FIGS. 3A to 3C are views showing examples of formation of a first auxiliary electrode in an organic light emitting display device according to another embodiment of the present invention;

FIG. 4 is a view showing an organic light emitting display device according to another embodiment of the present invention including a lower electrode exposed through a first opening of a bank layer and a first auxiliary electrode exposed through a second opening of the bank layer;

FIG. 5 is a plane view showing an organic light emitting display device according to another embodiment of the present invention including a second auxiliary electrode and a protruding pattern that are formed on an encapsulation substrate; and

FIGS. 6A to 6D are views sequentially showing a method for fabricating an organic light emitting display device according to another embodiment of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

Hereinafter, implementations of this document will be described in detail with reference to the attached drawings.

FIG. 1 is a view illustrating a cross-section of a pixel of an organic light emitting display device according to an embodiment of the present invention. The organic light emitting display device according to the embodiment of the present invention includes a plurality of pixels isolated from each other by a bank layer 134. Each pixel includes an organic light emitting diode 130 and a cell driver that drives the organic light emitting diode 130. The organic light emitting display device according to the embodiment of the present invention includes a substrate 110 and an encapsulation substrate 210 to encapsulate pixels formed on the substrate 110. The organic light emitting display device according to the embodiment of the present invention further includes a first auxiliary electrode 150 that comes into contact with one side of an upper electrode 138 and a second auxiliary electrode 214 that comes into contact with the other side of the upper electrode 138, to reduce the surface resistance of the upper electrode 138 included in the organic light emitting diode 130.

The cell driver includes a switching transistor, a driving transistor 120, a storage capacitor 160, and signal lines for driving the transistors. The switching transistor is switched on in response to a scan signal from a gate line and applies a data signal from a data line to the gate terminal of the driving transistor 120. The driving transistor 120 controls the amount of current applied to the organic light emitting diode 130 according to a gate-source voltage. The storage

capacitor **160** maintains the gate-source voltage of the driving transistor **120** for a given period of time even if the supply of data signals is cut off by the turn-off of the switching transistor, causing a desired amount of electric current to flow into the organic light emitting diode **130**.

The driving transistor **120** includes a semiconductor layer **122** formed over a buffer layer **112** on the substrate **110**, and a gate electrode **124** overlapping a channel portion of the semiconductor layer **122**, with a gate insulating layer **114** interposed between the gate electrode **124** and the semiconductor layer **122**. Further, the driving transistor **120** includes a source electrode **126** and a drain electrode **127** that come into contact with the semiconductor layer **122** via contact holes penetrating an interlayer insulating layer **116** and the gate insulating layer **114**.

A lower electrode of the storage capacitor **160** is made of the same material as the semiconductor layer **122**, and an upper electrode of the storage capacitor **160** is made of the same material as the gate electrode **124**. The lower electrode of the storage capacitor **160** may be made of the same material as the gate electrode **124**, and the upper electrode of the storage capacitor **160** may be made of the same material as the source electrode **126** and drain electrode **127**.

One electrode (e.g., the source electrode **126** or the drain electrode **127**) of the driving transistor **120** is connected to a lower electrode **132** of the organic light emitting diode **130** via a contact hole penetrating a planarization film **118** to supply a driving current to the organic light emitting diode **130**. The lower electrode **132** is formed on the planarization film **118** to be connected to one electrode of the driving transistor **120**. The lower electrode **132** may be formed of Cr, Al, AlNd, MO, Cu, W, Au, Ni, Ag, or an alloy or oxide of these materials. Also, the lower electrode **132** may be composed of a multilayer of ITO/reflective layer/ITO so that a light emitted from an organic light emitting layer **136** is reflected upward. The lower electrode **132** is patterned corresponding to each pixel.

The organic light emitting diode **130** emits light of either red, green, or blue in response to a driving current to display predetermined image data. The organic light emitting diode **130** includes the lower electrode **132** and upper electrode **138** facing each other, and the organic light emitting layer **136** disposed between the electrodes **132** and **138**. The lower electrode **132** and the upper electrode **138** are insulated from each other, and apply voltages of different polarities to the organic light emitting layer **136**. The organic light emitting layer **136** receives a hole from the lower electrode **132** and an electron from the upper electrode **138** to form an exciton, a hole-electron pair, and emits light by an energy generated as the exciton returns to the ground state. The organic light emitting layer **136** includes a hole injection layer HIL, a hole transporting layer HTL, an emission layer EL, an electron transporting layer ETL, and an electron injection layer EIL. The organic light emitting layer **136** is formed in a light emitting region, but not in a non-light emitting region where the driving transistor **120** is formed.

The upper electrode **138** may be formed of a transparent conductive layer to emit light from the organic light emitting layer **136** included in the organic light emitting diode **130**. The transparent conductive layer may be made of indium tin oxide (ITO), tin oxide (TO), indium zinc oxide (IZO), indium tin zinc oxide (ITZO), or a combination of these materials. The upper electrode **138** is plate-shaped and formed over the entire surface of the substrate **110**. The organic light emitting diode **130** corresponds to each pixel by the bank layer **134** to produce light of either red, green, or blue.

The bank layer **134** has a first opening OPN1 and a second opening OPN2 to define a light emitting region and a non-light emitting region in each pixel, respectively. The bank layer **134** defines the light emitting region of each pixel through the first opening OPN1 that exposes part of the lower electrode. The region other than the light emitting region is the non-light emitting region. The bank layer **134** exposes the first auxiliary electrode **150** formed within the non-light emitting region through the second opening OPN2. The bank layer **134** may include an organic material such as polyimide or an inorganic material such as a silicon nitride film, a silicon oxide film, etc.

The first auxiliary electrode **150** serves to reduce the surface resistance of the upper electrode **138** constituting the organic light emitting diode **130**, and may be formed under the bank layer **134**. For example, the first auxiliary electrode **150** may lie in the same plane as the lower electrode **132** of the organic light emitting diode **130**, i.e., on the planarization film **118**.

The first auxiliary electrode **150** may be made of a conductive material, which has lower specific resistance and higher electric conductivity than the upper electrode **138**. For example, the first auxiliary electrode **150** may be formed of silver (Ag), copper (Cu), gold (Au), aluminum (Al), magnesium (Mg), neodymium (Nd), an alloy of these materials, or a lamination of these materials.

Forming the first auxiliary electrode **150** electrically connected to the upper electrode **138** and under the upper electrode **138** can reduce the surface resistance of the upper electrode **138**. As a result of reducing the surface of the upper electrode **138**, non-uniformity in brightness caused by a voltage drop across the upper electrode **138** can be suppressed to allow for low voltage driving, thereby making it easy to reduce power consumption.

To maximize the above-described effects, in related art, the width and thickness of the first auxiliary electrode **150** can be increased. However, the first auxiliary electrode **150** having the increased width can lead to a smaller light emitting region, making it difficult to attain a high aperture ratio for a high-resolution model. To increase the thickness of the first auxiliary electrode **150**, the first auxiliary electrode **150** needs to be formed separately from the lower electrode **132** of the organic light emitting diode **130** which is formed by an additional process.

In the embodiment of the present invention, the second auxiliary electrode **214** of the encapsulation substrate **210** is also brought into contact with the upper electrode **138**, to maximize the above-described effects without increasing the width and thickness of the first auxiliary electrode **150**. The encapsulation substrate **210** is attached to and faces the substrate **110** to encapsulate the pixels formed on the substrate **110**. A protruding pattern **212** and the second auxiliary electrode **214** are sequentially formed on the encapsulation substrate **210**. Due to the attachment of the encapsulation substrate **210** to the substrate **110**, a position of the protruding pattern **212** corresponds to a position of the second opening OPN2, and the second auxiliary electrode **214** comes into contact with the upper electrode **138** at the second opening OPN2.

The second auxiliary electrode **214** along with the first auxiliary electrode **150** serves to reduce the surface resistance of the upper electrode **138**. Moreover, the second auxiliary electrode **214** removes unnecessary parts of the organic light emitting layer **136** deposited on the first auxiliary electrode **150** in a process of formation of the light

emitting layers **136**. As a result, the upper electrode **138** comes into contact with the first auxiliary electrode **150** at the second opening OPN2.

To this end, the second auxiliary electrode **214** can be made of a metal or a metal oxide so as to generate Joule heat by a driving power. In particular, the second auxiliary electrode **214** generates Joule heat by the driving power to remove unnecessary parts of the organic light emitting layer **136** deposited on the first auxiliary electrode **150** in the process of formation of the organic light emitting layer **136**.

In the related art, physical methods such as laser patterning were once proposed to remove unnecessary parts of the organic light emitting layer **136** deposited on the first auxiliary electrode **150**. However, the methods in related art requiring additional equipment and processes are not desirable in terms of cost and time.

The embodiment of the present invention offers the advantage of requiring no additional equipment because the contact between the first auxiliary electrode **150** and the upper electrode **138** is induced by Joule heat. In particular, the existing encapsulation substrate **210** can be used to generate the Joule heat.

Next, FIGS. 2A to 2H are views sequentially showing a method for fabricating an organic light emitting display device according another embodiment of the present invention. Referring to FIG. 2A, the fabrication method of an organic light emitting display device according to the another embodiment of the present invention is illustrated. The fabrication method includes, for example, forming a driving transistor **120** and a storage capacitor **160** for each pixel on a substrate **110**. A switching transistor serving as a switch and a plurality of wires for supplying electric power and a driving signal to the diode can be formed on the substrate **110**. Subsequently, a planarization film **118** is formed, and then a contact hole **119** that exposes one electrode of the driving transistor **120** is formed by penetrating the planarization film **118**. The planarization film **118** may be made of an inorganic material such as a silicon nitride film, a silicon oxide film, or a lamination of the silicon oxide film and the silicon nitride film.

Referring to FIG. 2B, a lower electrode **132** connected to one electrode of the driving transistor **120** via the contact hole **119** is illustrated. The lower electrode **132** is formed on the planarization film **118**. Moreover, a first auxiliary electrode **150** can be formed on the planarization film **118** by the same process as the lower electrode **132**.

Specifically, the lower electrode **132** corresponding in position to a light emitting region and the first auxiliary electrode **150** corresponding in position to a non-light emitting region are formed by depositing a conductive material containing Cr, Al, AlNd, Mo, Cu, W, Au, Ni, Ag, or an alloy or oxide of these materials, by a deposition method such as sputtering, over the entire surface of the substrate **110** with the planarization film **118** formed on it, and then selectively removing the conductive material. The lower electrode **132** is patterned corresponding to each pixel (refer to FIGS. 3A to 3C). To facilitate reduction of the surface resistance of the upper electrode **138**, the first auxiliary electrode **150** can have a mesh pattern in the non-light emitting region (refer to FIG. 3A) or a stripe pattern in the non-light emitting region (refer to FIGS. 3A to 3C).

Referring to FIG. 2C an organic or inorganic material selectively formed on the substrate **110** with the lower electrode **132** and the first auxiliary electrode **150** formed on the substrate **110** is illustrated. As a result, a bank layer **134** having a first opening OPN1 and a second opening OPN2 is formed. The lower electrode **132** is exposed through the first

opening OPN1 of the bank layer **134**, and the first auxiliary electrode **150** is exposed through the second opening OPN2 of the bank layer **134** (refer to FIG. 4).

Referring to FIG. 2D, an organic light emitting layer **136** formed over the bank layer **134**, the lower electrode **132**, and first auxiliary electrode **150** exposed by the bank layer **134** is illustrated. The first auxiliary electrode **150** is exposed by thermal deposition, etc., using a fine metal mask FMM.

Referring to FIG. 2E an encapsulation substrate **210** with a second auxiliary electrode **214** initially attached to the substrate **110** on which the organic light emitting layer **136** is formed is illustrated. A protruding pattern **212** is formed on the encapsulation substrate **210** (refer to FIG. 5), corresponding in position to each second opening OPN2. In addition, the second auxiliary electrode **214** is formed on the protruding pattern **212**. The protruding pattern **212** can be formed to contain a black resin to prevent light leakage at the time of encapsulation. Power supply terminals EA and EB are connected and apply a driving power of opposite polarities to the ends of the second auxiliary electrode **214**. Although the power supply terminals EA and EB can be connected commonly to all the second auxiliary electrodes **214**, the power supply terminals EA and EB can be divided into units corresponding to a predetermined number of second auxiliary electrodes **214** to prevent an IR drop.

The encapsulation substrate **210** and the substrate **110** in the another embodiment of the present invention are initially attached together so that the protruding pattern **212** corresponds to the second opening OPN2. With the encapsulation substrate **210** and the substrate **110** initially attached together, the second auxiliary electrode **214** comes into contact with unnecessary parts of the organic light emitting layer **136** formed on the first auxiliary electrode **150** at the second opening OPN2, due to the protruding pattern **212**.

Referring to FIG. 2F, the organic light emitting layer **136** disposed on the bank layer **134** and the lower electrode **132** is illustrated. The organic light emitting layer **136** is not disposed on the first auxiliary electrode **150**. In particular, the organic light emitting layer **136** that was formed on the first auxiliary electrode **150** at the second opening OPN2 is melted and removed by Joule heat generated by the application of driving power to the second auxiliary electrode **214** on the encapsulation substrate **210** (refer to FIG. 2E).

Referring to FIG. 2G, the upper electrode **138** formed by depositing, after the encapsulation substrate **210** is detached from the substrate **110** (refer to FIG. 2E), a transparent conductive material by a deposition method such as sputtering is illustrated. The transparent conductive material is deposited over the entire surface of the substrate **110** with the organic light emitting layer **136** partially removed from the second opening OPN2. As a result, one side of the upper electrode **138** comes into contact with the first auxiliary electrode **150** at the second opening OPN2. By the contact of the upper electrode **138** with the first auxiliary electrode **150**, the surface resistance of the upper electrode **138** is reduced.

Referring to FIG. 2H, the encapsulation substrate **210** and the substrate **110** being reattached together to encapsulate the substrate **110** are illustrated. With the encapsulation substrate **210** and the substrate **110** attached together, the protruding pattern **212** is formed to correspond to the second opening OPN2, so that the second auxiliary electrode **214** comes into contact with the other side of the upper electrode **138** at the second opening OPN2. In the reattaching step, the driving power applied to the second auxiliary electrode **214** of the encapsulation substrate **210** is cut off. As the upper electrode **138** comes into contact with the second auxiliary

electrode **214** as well as the first auxiliary electrode **150**, the surface resistance of the upper electrode **138** is further reduced.

Next, FIGS. **3A** to **3C** are views showing examples of formation of a first auxiliary electrode in an organic light emitting display device according another embodiment of the present invention.

Next, FIG. **4** is a view showing an organic light emitting display device according to another embodiment of the present invention. The organic light emitting display device includes a lower electrode **132** exposed through a first opening of a bank layer **134** and a first auxiliary electrode **150** exposed through a second opening of the bank layer **134**.

Next, FIG. **5** is a plane view showing an organic light emitting display device according to another embodiment of the present invention including a second auxiliary electrode and a protruding pattern that are formed on an encapsulation substrate.

Next, FIGS. **6A** to **6D** are views sequentially showing a method for fabricating an organic light emitting display device according another embodiment of the present invention. The method for fabricating an organic light emitting display device according to the another embodiment of the present invention employs the above-described process sequence shown in FIGS. **2A** to **2C** including forming a driving transistor **120** on a substrate **110** (refer to FIG. **2A**); forming a lower electrode **132** connected to one electrode of the driving transistor and forming a first auxiliary electrode **150** in a non-light emitting region so as to be separated from the lower electrode **132** (refer to FIG. **2B**); and forming a bank layer **134** having a first opening **OPN1** exposing the lower electrode **132** and a second opening **OPN2** exposing the first auxiliary electrode **150** (refer to FIG. **2C**).

Referring to FIGS. **6A** and **6B**, the organic light emitting layer **136** and the upper electrode **138** are sequentially formed over the bank layer **134** and the lower electrode **132** and the first auxiliary electrode **150** exposed by the bank layer **134**. The organic light emitting layer **136** and the upper electrode **138** can be formed by thermal deposition, etc., using a fine metal mask **FMM**.

Referring to FIG. **6C**, the encapsulation substrate **210** is formed on the substrate for the purpose of encapsulation; and the second auxiliary electrode **214** is formed on the encapsulation substrate **210** which is attached to the substrate **110** where the organic light emitting layer **136** and the upper electrode **138** are sequentially formed. A protruding pattern **212** is formed on the encapsulation substrate **210** (refer to FIG. **5**), corresponding in position to each second opening **OPN2**, and the second auxiliary electrode **214** is formed on the protruding pattern **212**. Because the encapsulation substrate **210** is attached to the substrate **110** in such a manner that the protruding pattern **212** corresponds to the second opening **OPN2**, the second auxiliary electrode **214** comes into contact with the upper electrode to attach together the encapsulation substrate **210** and the substrate **110**. In the another embodiment of the present invention, driving power is applied to the second auxiliary electrode **214** on the encapsulation substrate **210** to generate Joule heat.

Referring to FIG. **6D**, the upper electrode **138** is formed to come into contact with the first auxiliary electrodes **150**. The upper electrode **138** and the first auxiliary electrodes **150** are welded together at the second opening **OPN2** by melting and removing the organic light emitting layer **136** formed at the second opening **OPN2** by the Joule heat from the second auxiliary electrode **214**. The driving power for

generating Joule heat is cut off after the upper electrode **138** and the first auxiliary electrode **150** are welded together. Accordingly, the upper electrode **138** comes into contact with the second auxiliary electrode **214** as well as the first auxiliary electrode **150**, thereby further reducing the surface resistance of the upper electrode **138**.

As described in detail above, embodiments of the present invention can reduce the surface resistance of the upper electrode due to the first auxiliary electrode coming into contact with the upper electrode of the organic light emitting diode. As a result, no additional equipment is required because the contact between the first auxiliary electrode and the upper electrode is induced by Joule heat, which can be generated by the encapsulation substrate. In particular, embodiments of the present invention can efficiently reduce the surface resistance of the upper electrode more efficiently by forming the second auxiliary electrode on the encapsulation substrate to generate Joule heat and bringing the second auxiliary electrode into contact with the upper electrode while the encapsulation substrate and the substrate are attached together for encapsulation.

According to embodiments of the present invention, a significant reduction in the surface resistance of the upper electrode can be achieved. This suppresses non-uniformity in brightness caused by a voltage drop across the upper electrode and allows for low voltage driving to more easily reduce power consumption.

Although preferred embodiments of the present invention are described above with reference to the accompanying drawings, it is understood that those skilled in the art can embody the technical configuration in other specific forms without changing the technical spirit and essential features of the present invention. Therefore, it should be understood that the embodiments described above are exemplary and not restrictive, and the scope of the present invention is defined by the appended claims rather than the above specific descriptions. It should be interpreted that all the changed and modified forms derived from the meaning, scope and equivalent concepts of the claims are included in the scope of the present invention.

What is claimed is:

1. An organic light emitting display device, comprising:
 - a substrate;
 - a first auxiliary electrode formed on the substrate and in a non-light emitting region;
 - a bank layer formed on the substrate and having an opening exposing the first auxiliary electrode;
 - an organic light emitting layer formed on the bank layer;
 - an upper electrode formed on the organic light emitting layer and the first auxiliary electrode;
 - a second auxiliary electrode that is disposed on an encapsulation substrate attached to and facing the substrate, wherein the first auxiliary electrode and the second auxiliary electrode come into contact with the upper electrode in the opening exposing the first auxiliary electrode.
2. The organic light emitting display device according to claim 1, further comprising:
 - a lower electrode formed on a same layer as the first auxiliary electrode and formed in a light emitting region, wherein the bank layer has another opening exposing the lower electrode.
3. The organic light emitting display device according to claim 1, wherein the opening exposing the first auxiliary electrode is in the non-light emitting region, and wherein the second auxiliary electrode is formed to contact the upper electrode in the opening exposing the

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first auxiliary electrode, and formed above the bank layer to overlap the organic light emitting layer.

4. The organic light emitting display device according to claim 1, further comprising:

a protruding pattern formed on the second auxiliary electrode in the opening exposing the first auxiliary electrode, the protruding pattern including black resin.

5. The organic light emitting display device according to claim 4, wherein, in a cross-sectional view, a maximum width of the protruding pattern is less than or equal to a width of the opening exposing the lower electrode.

6. The organic light emitting display device according to claim 4, wherein the second auxiliary electrode, the protruding pattern, and the bank layer are not in the light emitting region.

7. The organic light emitting display device according to claim 1, wherein the organic light emitting layer is not in the opening exposing the first auxiliary electrode.

8. The organic light emitting display device according to claim 1, further comprising:

a planarization film formed between the substrate and the first auxiliary electrode, wherein the bank layer is formed on the planarization film.

9. The organic light emitting display device according to claim 1, wherein the second auxiliary electrode includes a metal or metal oxide for generating Joule heat by a driving power.

10. The organic light emitting display device according to claim 1, further comprising:

a lower electrode formed in a same plane as the first auxiliary electrode,

wherein the first auxiliary electrode has a mesh pattern in the non-light emitting region including the opening exposing the first auxiliary electrode.

11. A method of forming an organic light emitting display device, comprising:

forming a first auxiliary electrode on a substrate, and in a non-light emitting region;

forming a bank layer on the substrate, the bank layer having an opening exposing the first auxiliary electrode;

forming an organic light emitting layer on the bank layer; forming an upper electrode on the organic light emitting layer and the first auxiliary electrode; and

forming a second auxiliary electrode that is disposed on an encapsulation substrate attached to and facing the substrate,

wherein the first auxiliary electrode and the second auxiliary electrode come into contact with the upper electrode in the opening exposing the first auxiliary electrode.

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12. The method according to claim 11, further comprising:

prior to the forming the upper electrode, initially attaching the encapsulation substrate with the second auxiliary electrode to the substrate to remove the organic light emitting layer at the opening by Joule heat from the second auxiliary electrode;

prior to the forming the upper electrode, detaching the encapsulation substrate from the substrate; and reattaching the encapsulation substrate to the substrate after the forming the upper electrode.

13. The method according to claim 12, wherein the initial attaching of the encapsulation substrate to the substrate includes applying a driving power to the second auxiliary electrode to generate Joule heat.

14. The method according to claim 13, wherein the driving power is cut off in the reattaching of the encapsulation substrate to the substrate.

15. The method according to claim 11, further comprising:

after the forming the upper electrode, attaching the encapsulation substrate with the second auxiliary electrode to the substrate; and

removing the organic light emitting layer at the opening by welding the upper electrode and the first auxiliary electrode together to remove the organic light emitting layer by Joule heat from the second auxiliary electrode in the opening exposing the first auxiliary electrode.

16. The method according to claim 15, wherein the attaching of the encapsulation substrate to the substrate includes applying a driving power to the second auxiliary electrode to generate Joule heat.

17. The method according to claim 16, wherein the driving power is cut off after the upper electrode and the first auxiliary electrode are welded together.

18. The method according to claim 11, further comprising:

forming a protruding pattern on the second auxiliary electrode in the opening exposing the first auxiliary electrode, the protruding pattern including black resin.

19. The method according to claim 11, wherein the second auxiliary electrode includes a metal or metal oxide for generating Joule heat by a driving power.

20. The method according to claim 11, further comprising:

forming a lower electrode in a same plane as the first auxiliary electrode,

wherein the first auxiliary electrode has a mesh pattern in the non-light emitting region including the opening exposing the first auxiliary electrode.

* * * *

专利名称(译)	有机发光显示装置及其制造方法		
公开(公告)号	US9799710	公开(公告)日	2017-10-24
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[标]申请(专利权)人(译)	乐金显示有限公司		
申请(专利权)人(译)	LG DISPLAY CO. , LTD.		
当前申请(专利权)人(译)	LG DISPLAY CO. , LTD.		
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摘要(译)

讨论了有机发光显示装置和制造有机发光显示装置的方法。根据一个实施方式的有机发光显示装置包括基板;第一辅助电极,形成在基板上和非发光区域中;形成在基板上并具有暴露第一辅助电极的开口的堤层;形成在堤层上的有机发光层;形成在有机发光层和第一辅助电极上的上电极;以及形成在上电极上的第二辅助电极。第一辅助电极和第二辅助电极在暴露第一辅助电极的开口中与上电极接触。

