



US009559332B2

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

(10) **Patent No.:** **US 9,559,332 B2**
(45) **Date of Patent:** **Jan. 31, 2017**

(54) **ORGANIC ELECTROLUMINESCENCE
DISPLAY PANEL STRUCTURED TO
REDUCE OR PREVENT OUTGASSING
FROM AN ORGANIC MATERIAL, AND
DISPLAY DEVICE INCLUDING THE SAME**

(58) **Field of Classification Search**
CPC H01L 51/5253
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

2005/0077816 A1* 4/2005 Yamada H01L 51/5228
313/503
2006/0022587 A1* 2/2006 Jeong H01L 27/3246
313/504

FOREIGN PATENT DOCUMENTS

KR	10-2001-0112623	12/2001
KR	10-2005-0074208	7/2005
KR	10-2005-0122893	12/2005
KR	1020050122893	* 12/2005
KR	10-2010-0131800	12/2010
KR	1020100131800	* 12/2010

* cited by examiner

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(57) **ABSTRACT**

An organic electroluminescence (EL) display panel includes a substrate, a thin film transistor on the substrate, an overcoat layer on the thin film transistor and containing an organic material, a first electrode on the overcoat layer, an organic light emitting layer on the first electrode, a second electrode on the organic light emitting layer, and a barrier layer between the overcoat layer and the first electrode and including a first region formed of a single layer and a second region formed of a multilayer.

16 Claims, 10 Drawing Sheets

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(*) Notice: Subject to any disclaimer, the term of this
patent is extended or adjusted under 35
U.S.C. 154(b) by 473 days.

(21) Appl. No.: **13/943,685**

(22) Filed: **Jul. 16, 2013**

(65) **Prior Publication Data**

US 2014/0078120 A1 Mar. 20, 2014

(30) **Foreign Application Priority Data**

Sep. 14, 2012 (KR) 10-2012-0102278

(51) **Int. Cl.**

H01L 51/52 (2006.01)

G09G 3/30 (2006.01)

H01L 27/32 (2006.01)

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

CPC **H01L 51/5253** (2013.01); **G09G 3/30**
(2013.01); **H01L 27/3258** (2013.01)

200b

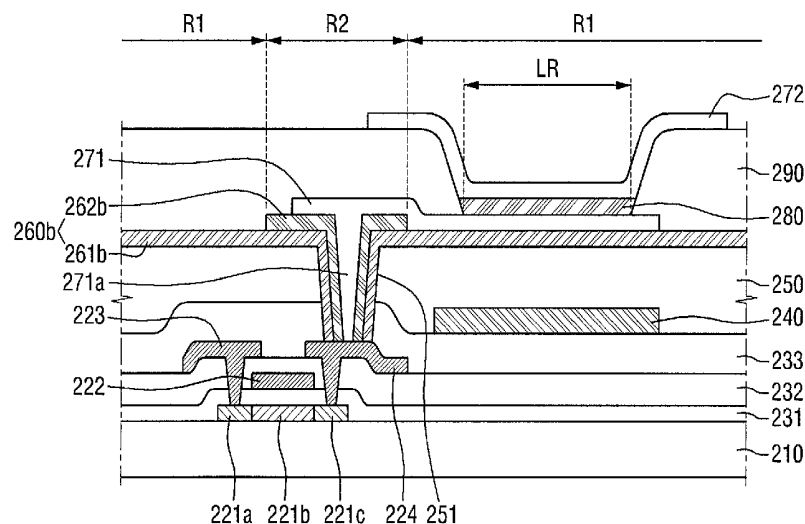


FIG.1

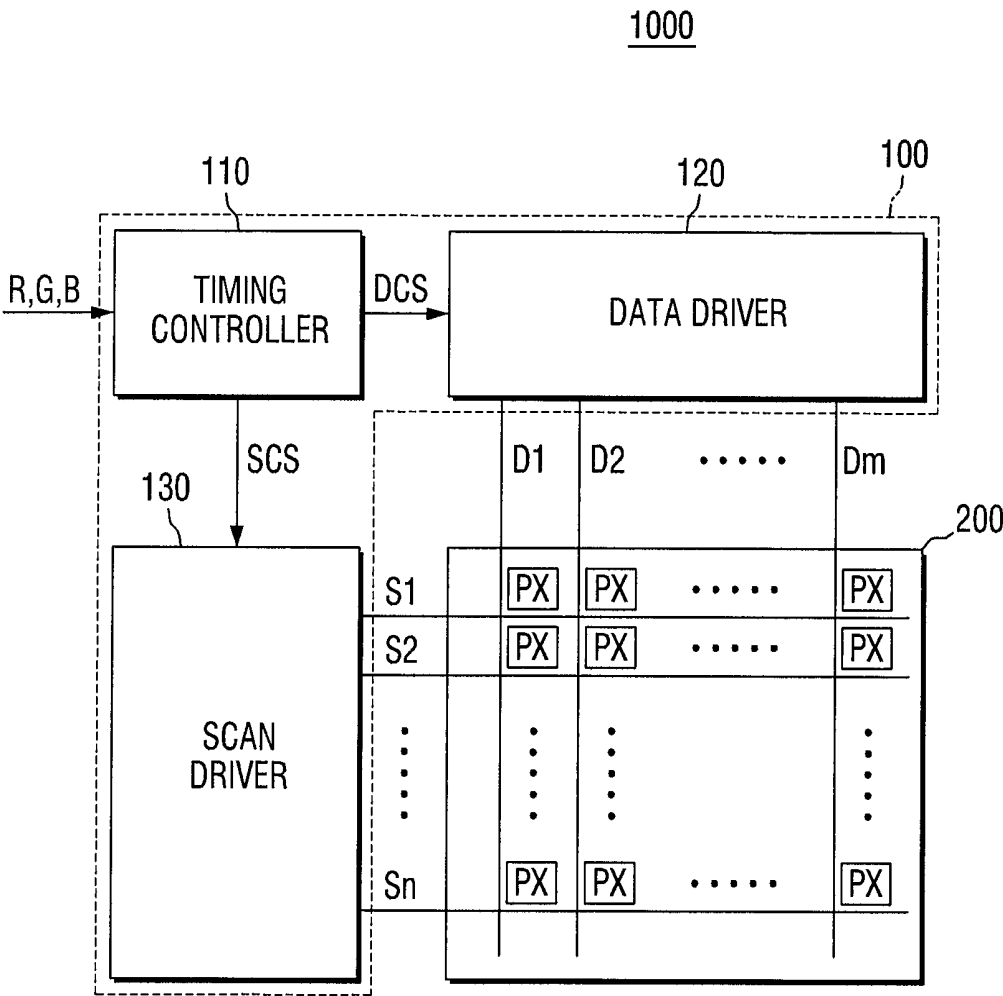


FIG. 3

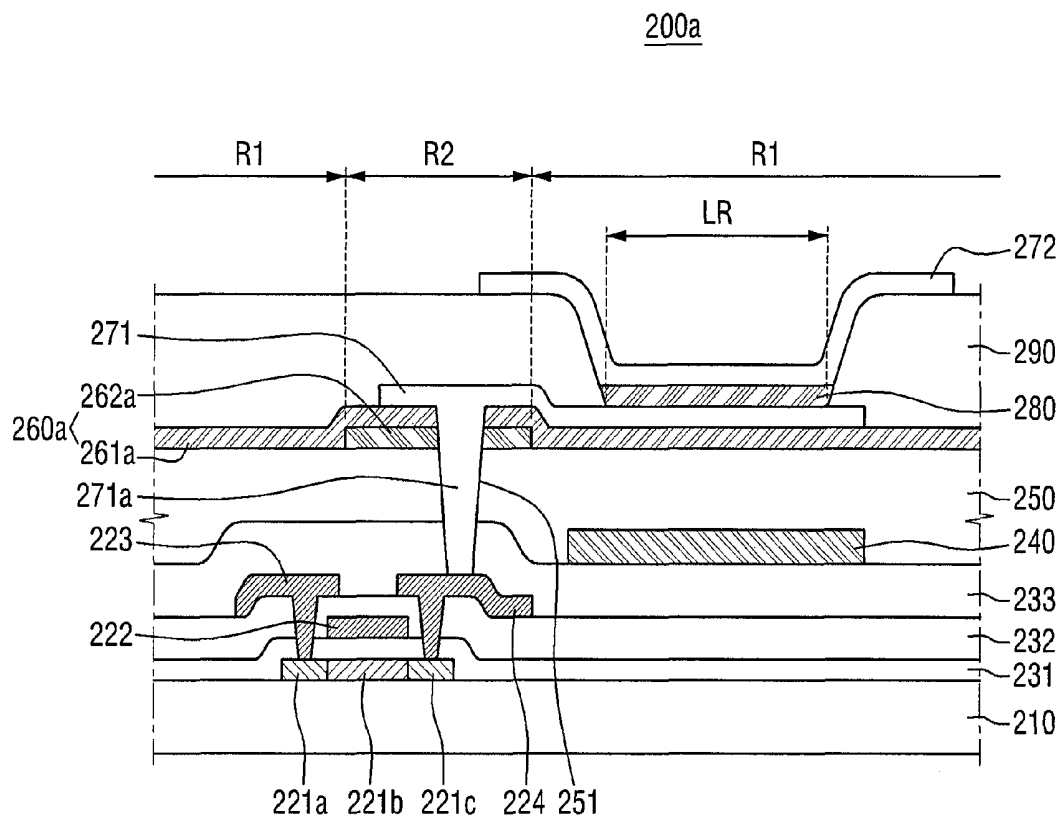


FIG. 4

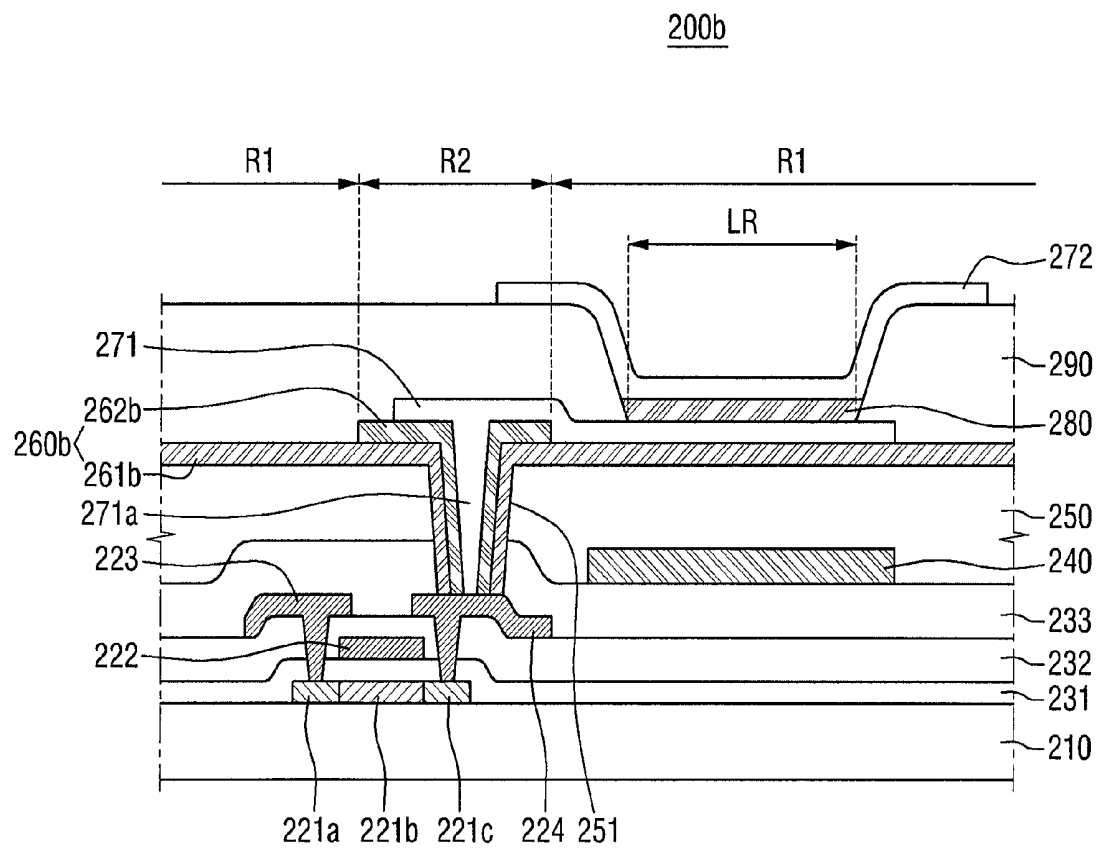
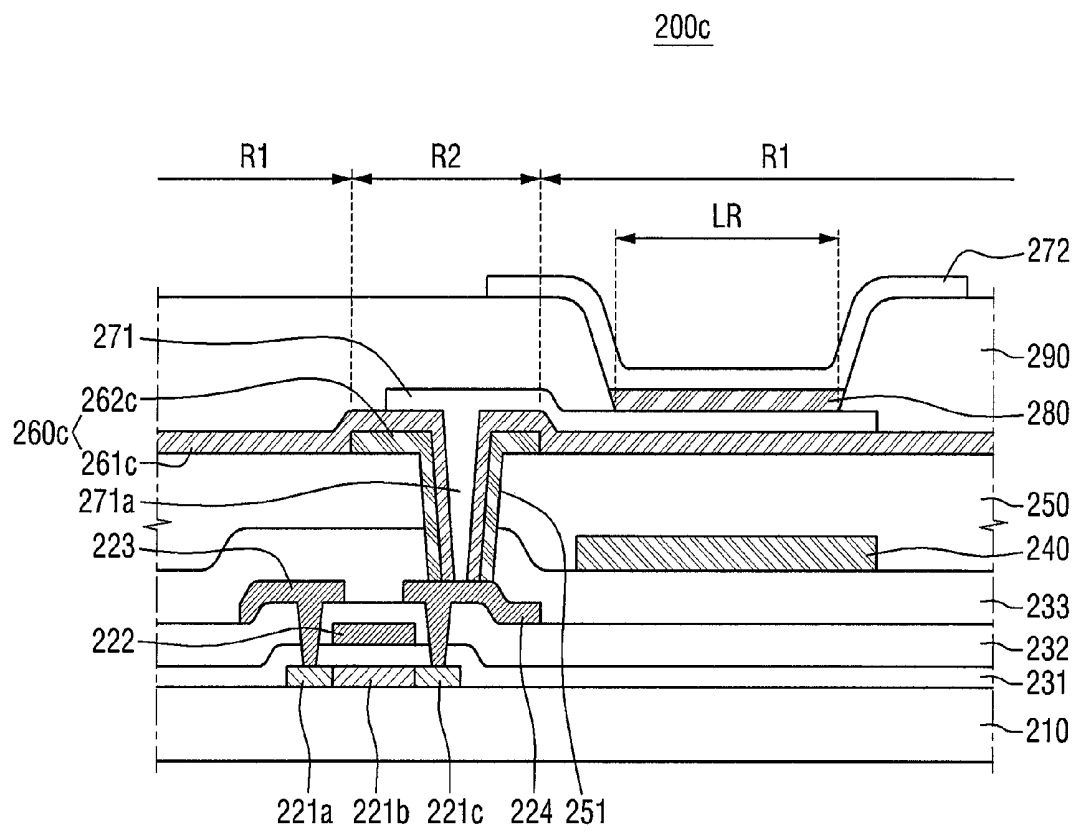


FIG. 5



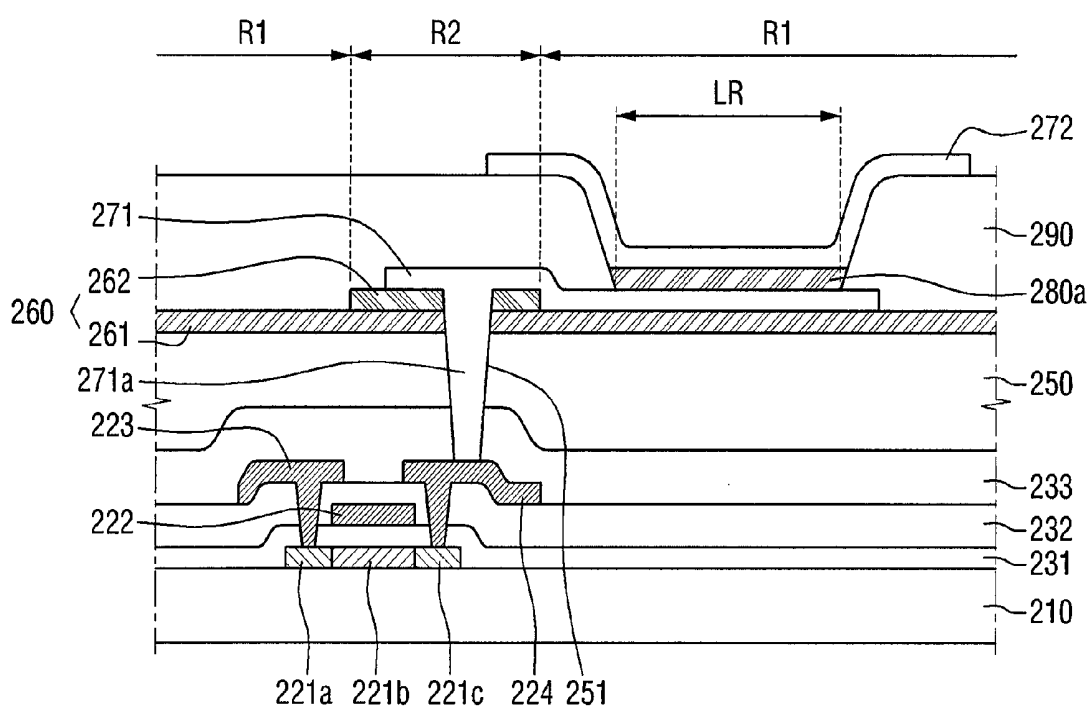


FIG. 7

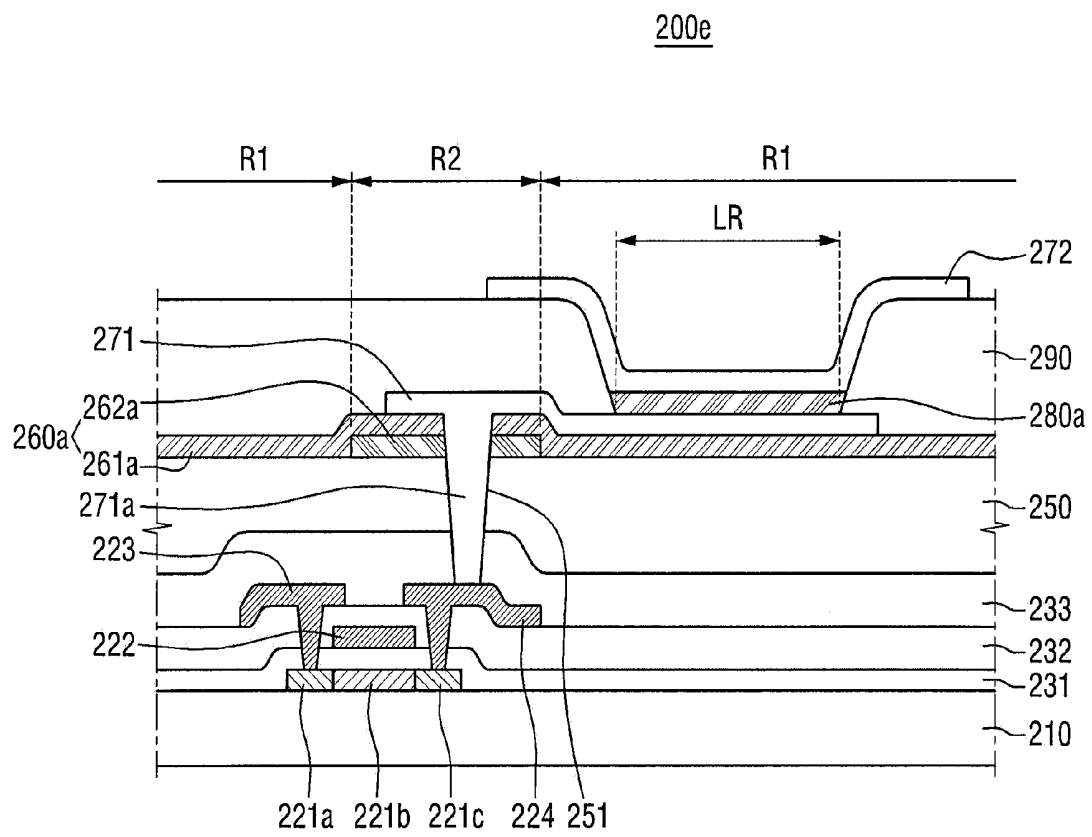


FIG.9

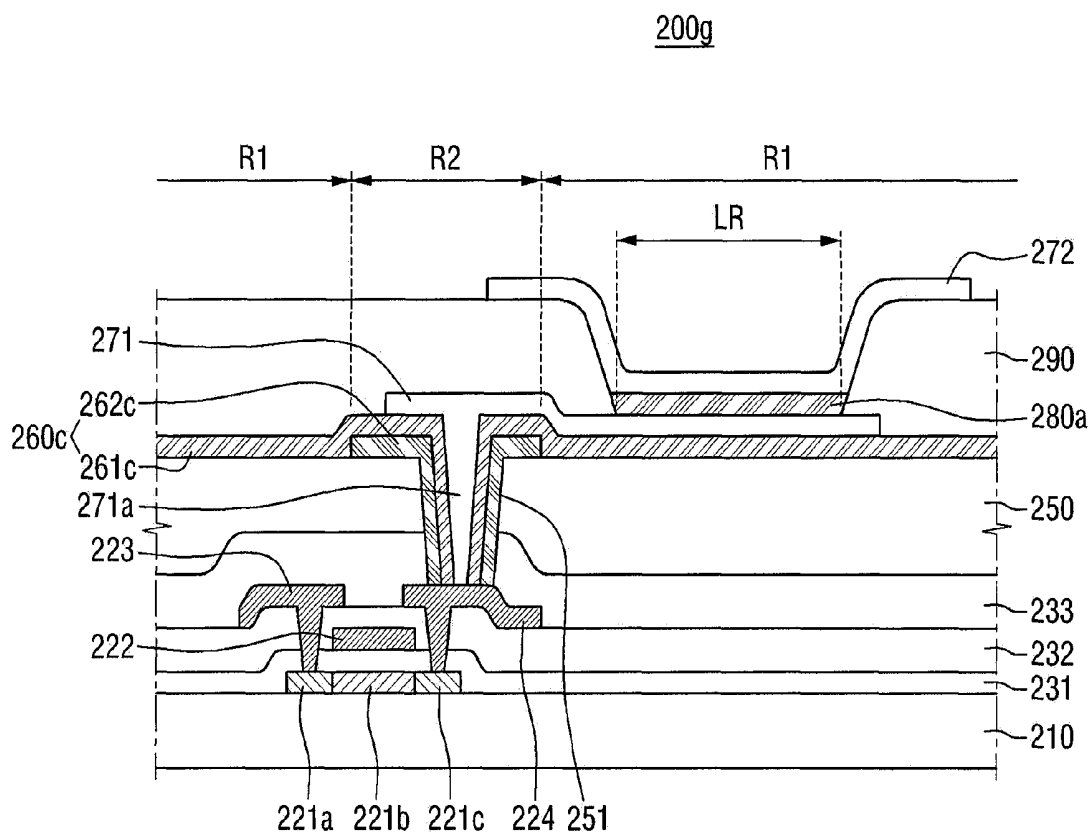
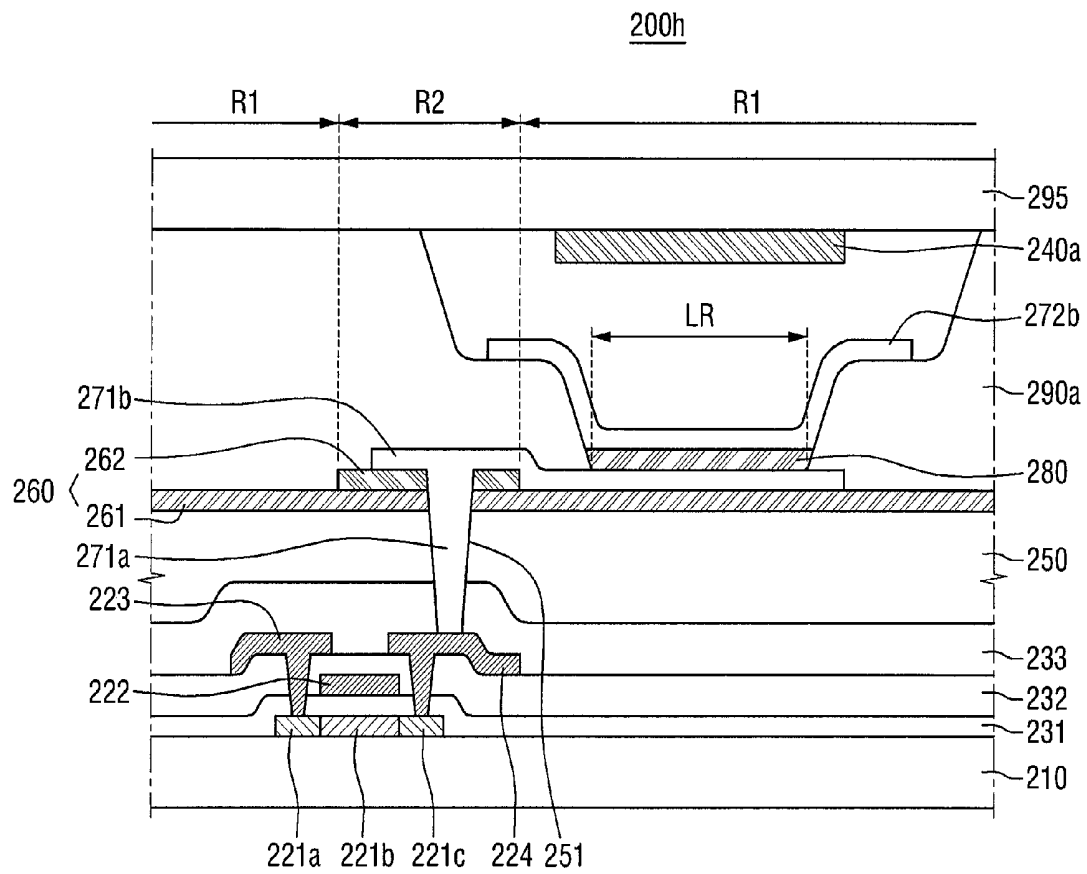


FIG. 10



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**ORGANIC ELECTROLUMINESCENCE
DISPLAY PANEL STRUCTURED TO
REDUCE OR PREVENT OUTGASSING
FROM AN ORGANIC MATERIAL, AND
DISPLAY DEVICE INCLUDING THE SAME**

**CROSS-REFERENCE TO RELATED
APPLICATION**

This application claims priority to and the benefit of Korean Patent Application No. 10-2012-0102278 filed on Sep. 14, 2012 in the Korean Intellectual Property Office, the disclosure of which is incorporated herein by reference in its entirety.

BACKGROUND

1. Field

The present invention relates to an organic electroluminescence (EL) display panel and a display device including the same.

2. Description of the Related Art

As portable display devices (such as notebooks, mobile phones and portable media players (PMPs)) as well as display devices for homes (such as TVs and monitors) become lighter and thinner, various flat panel display devices are being used. A flat panel display device includes a display panel which displays images. Flat panel display devices may be referred to as liquid crystal display devices, organic electroluminescence (EL) display devices, and electrophoretic display devices according to the type of the display panel.

An organic EL display device includes an organic EL display panel. The organic EL display panel includes an organic light emitting layer which is disposed between a first electrode and a second electrode and emits light corresponding to a current flowing therethrough. The organic EL display panel includes a thin film transistor connected to the first electrode or the second electrode and controls the current flowing through the organic light emitting layer using the thin film transistor. An overcoat layer may be disposed between the thin film transistor and the first or second electrode connected to the thin film transistor in order to planarize a top surface of the thin film transistor.

The organic light emitting layer may emit red light, blue light, or green light according to the type of the organic EL display panel. Otherwise, the organic light emitting layer may emit white light. If the organic light emitting layer emits the white light, the organic EL display panel may further include a color filter.

SUMMARY

Aspects of embodiments according to the present invention provide an organic electroluminescence (EL) display panel (i.e., an organic light emitting display panel) structured to reduce or prevent outgassing from an organic material and a display device including the organic EL display panel.

Aspects of embodiments according to the present invention also provide an organic EL display panel structured to reduce or prevent outgassing from an organic material and degradation of color reproducibility due to resonance, and a display device including the organic EL display panel.

However, aspects of the present invention are not limited to the aspects and embodiments set forth herein. The above and other aspects of the present invention will become more

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apparent to one of ordinary skill in the art to which the present invention pertains by referencing the detailed description of embodiments according to the present invention given below.

In one embodiment according to the present invention, an organic electroluminescence (EL) display panel is provided. The organic EL display panel includes: a substrate; a thin film transistor on the substrate; an overcoat layer on the thin film transistor and including an organic material; a first electrode on the overcoat layer; an organic light emitting layer on the first electrode; a second electrode on the organic light emitting layer; and a barrier layer between the overcoat layer and the first electrode, and including a first region including a single layer and a second region including a multilayer.

The first electrode may include a transparent electrode, and the second electrode may include a reflective electrode.

The display panel may further include a pixel defining layer on the barrier layer, wherein the first region is disposed under a light emitting region in which the light emitting layer is exposed by the pixel defining layer.

The second region may not be located under the light emitting region.

The display panel may further include a color filter located under the light emitting region and the barrier layer.

The overcoat layer may have a contact hole which overlaps the first electrode, and the second region may be located adjacently to the contact hole.

The second region may be located on an inner surface of a wall of the contact hole.

The first electrode may include a reflective electrode, and the second electrode may include a transparent electrode.

The display panel may further include a color filter located above the organic light emitting layer to overlap the organic light emitting layer.

The barrier layer may include: a first barrier layer at the first region and the second region; and a second barrier layer at the second region and including a different material from the first barrier layer.

In another embodiment according to the present invention, a display device includes: an organic EL display panel; and a driver configured to drive the organic EL display panel. The organic EL display panel includes: a substrate; a thin film transistor on the substrate; an overcoat layer on the thin film transistor and including an organic material; a first electrode on the overcoat layer; an organic light emitting layer on the first electrode; a second electrode on the organic light emitting layer; and a barrier layer between the overcoat layer and the first electrode, and including a first region including a single layer and a second region including a multilayer.

The first electrode may include a transparent electrode, and the second electrode may include a reflective electrode.

The organic EL display panel may further include a pixel defining layer on the barrier layer, wherein the first region may be located under a light emitting region in which the light emitting layer is exposed by the pixel defining layer.

The second region may not be located under the light emitting region.

The organic EL display panel may further include a color filter located under the light emitting region and the barrier layer.

The overcoat layer may have a contact hole which overlaps the first electrode, and the second region may be located adjacently to the contact hole.

The second region may be located on an inner surface of a wall of the contact hole.

The first electrode may include a reflective electrode, and the second electrode may include a transparent electrode.

The organic EL display panel may further include a color filter located above the organic light emitting layer to overlap the organic light emitting layer.

The barrier layer may include: a first barrier layer at the first region and the second region; and a second barrier layer at the second region and including a different material from the first barrier layer.

BRIEF DESCRIPTION OF THE DRAWINGS

The above and other aspects and features of the present invention will become more apparent by describing in detail exemplary embodiments thereof with reference to the attached drawings, in which:

FIG. 1 is a block diagram of a display device according to an embodiment of the present invention;

FIG. 2 is a cross-sectional view of an organic electroluminescence (EL) display panel according to an embodiment of the present invention;

FIG. 3 is a cross-sectional view of an organic EL display panel according to another embodiment of the present invention;

FIG. 4 is a cross-sectional view of an organic EL display panel according to another embodiment of the present invention;

FIG. 5 is a cross-sectional view of an organic EL display panel according to another embodiment of the present invention;

FIG. 6 is a cross-sectional view of an organic EL display panel according to another embodiment of the present invention;

FIG. 7 is a cross-sectional view of an organic EL display panel according to another embodiment of the present invention;

FIG. 8 is a cross-sectional view of an organic EL display panel according to another embodiment of the present invention;

FIG. 9 is a cross-sectional view of an organic EL display panel according to another embodiment of the present invention; and

FIG. 10 is a cross-sectional view of an organic EL display panel according to another embodiment of the present invention.

DETAILED DESCRIPTION

Features and aspects of the present invention and methods of accomplishing the same may be understood more readily by reference to the following detailed description of example embodiments and the accompanying drawings. The present invention may, however, be embodied in many different forms and should not be construed as being limited to the embodiments set forth herein. Rather, these embodiments are provided so that this disclosure will be thorough and complete and will fully convey the concept of the invention to those skilled in the art, and the scope of the present invention will be defined by the appended claims and their equivalents. Thus, in some embodiments, well-known structures and devices are not shown in order not to obscure the description of the embodiments with unnecessary detail. Like reference numerals refer to like elements throughout. In the drawings, the thickness of layers and regions may be exaggerated for clarity.

It will be understood that when an element or layer is referred to as being "on" or "connected to" another element

or layer, it can be directly on or connected to the other element or layer or intervening elements or layers may be present. When an element is referred to as being "directly on" or "directly connected to" another element or layer, there may be no intervening elements or layers present. As used herein, the term "and/or" includes any and all combinations of one or more of the associated listed items.

It will be understood that, although the terms first, second, etc. may be used herein to describe various elements, these elements should not be limited by these terms. These terms are used to distinguish one element from another element. Thus, for example, a first element, a first component or a first section discussed below could be termed a second element, a second component or a second section without departing from the teachings of the present invention.

Spatially relative terms, such as "below," "beneath," "lower," "above," "upper," and the like, may be used herein for ease of description to describe one element or feature's relationship to another element(s) or feature(s) as illustrated in the figures. It will be understood that the spatially relative terms are intended to encompass different orientations of the device in use or operation in addition to the orientation depicted in the figures.

Embodiments described herein will be described in reference to plan views and/or cross-sectional views by way of ideal schematic views of the embodiments of the present invention. Accordingly, the example views may be modified depending on manufacturing technologies and/or tolerances. Therefore, the embodiments of the present invention are not limited to those shown in the views, but include modifications in configuration formed on the basis of manufacturing processes. Therefore, regions that are illustrated as examples in figures have schematic properties and shapes of regions corresponding to specific shapes of regions of elements by way of example, and do not limit aspects of the present invention.

An overcoat layer and/or the color filter in an organic EL device (e.g., an organic light emitting display device) may contain an organic material. In the process of depositing the first electrode or the second electrode at a high temperature, outgassing may occur from the organic material. The outgassing increases surface resistance of the first or second electrode, thereby deteriorating characteristics of a device while contracting (i.e., reducing the size of) a pixel and shortening the life of the organic light emitting layer.

Hereinafter, embodiments of the present invention will be described in further detail with reference to the accompanying drawings.

FIG. 1 is a block diagram of a display device 1000 according to an embodiment of the present invention.

Referring to FIG. 1, the display device 1000 includes a driver 100 and an organic electroluminescence (EL) display panel 200.

The driver 100 may drive the organic EL display panel 200. The driver 100 may receive image data R, G, B, generate scan signals S1 through Sn and data signals D1 through Dm, which correspond to the received image data R, G, B, to drive the organic EL display panel 200, and provide the scan signals S1 through Sn and the data signals D1 through Dm to the organic EL display panel 200.

The driver 100 may include a timing controller 110, a data driver 120, and a scan driver 130. The timing controller 110, the data driver 120 and the scan driver 130 may be formed as a single integrated circuit. However, the present invention is not limited thereto, and they can also be formed as discrete (or separate) integrated circuits.

The timing controller **110** may receive the image data R, G, B and generate a scan driver control signal SCS and a data driver control signal DCS which correspond to the image data R, G, B.

The data driver **120** may receive the data driver control signal DCS and generate the data signals D1 through Dm corresponding to the data driver control signal DCS. The data signals D1 through Dm may include information about gray levels of an image to be displayed on the organic EL display panel **200**.

The scan driver **130** may receive the scan driver control signal SCS and generate the scan signals S1 through Sn corresponding to the scan driver control signal SCS. The scan signals S1 through Sn may control times at which the data signals D1 through Dm are transmitted to a plurality of pixels PX of the organic EL display panel **200**, respectively.

The organic EL display panel **200** may receive the data signals D1 through Dm and the scan signals S1 through Sn, and may display an image corresponding to the data signals D1 through Dm and the scan signals S1 through Sn. The organic EL display panel **200** may include a plurality of pixels PX. The pixels PX may be arranged in a matrix. The pixels PX may be illuminated at gray levels corresponding to the data signals D1 through Dm, and the scan signals S1 through Sn may control the times at which the data signals D1 through Dm are transmitted to the pixels PX, respectively.

The organic EL display panel **200** will now be described in more detail with reference to FIG. 2. FIG. 2 is a cross-sectional view of an organic EL display panel **200** according to an embodiment of the present invention. More specifically, FIG. 2 is a cross-sectional view of one pixel PX of the organic EL display panel **200** and an area around the pixel PX.

Referring to FIG. 2, the organic EL display panel **200** includes a thin film transistor, an overcoat layer **250**, a first electrode **271**, an organic light emitting layer **280**, a second electrode **272**, and a barrier layer **260**.

A substrate **210** may be made of a transparent material. For example, the substrate **210** may be made of, but is not limited to, glass, polyethylene terephthalate (PET), polycarbonate (PC), polyethersulfone (PES), polyimide (PI), or polymethylmethacrylate (PMMA).

The thin film transistor may be disposed on the substrate **210**. The thin film transistor may include a semiconductor layer **221a** through **221c**, a gate electrode **222**, a source electrode **223**, and a drain electrode **224**.

The semiconductor layer **221a** through **221c** may include a source region **221a**, a channel region **221b**, and a drain region **221c**. The source region **221a** may be connected to the source electrode **223**, and the drain region **221c** may be connected to the drain electrode **224**. The channel region **221b** may be disposed between the source region **221a** and the drain region **221c**. A channel may be formed in the channel region **221b** by a voltage applied to the gate electrode **222**. When the channel is formed in the channel region **221b**, the source region **221a** and the drain region **221c** may be electrically connected to each other. Although not shown in the drawing, the organic EL display panel **200** may further include a buffer layer between the substrate **210** and the semiconductor layer **221a** through **221c** to prevent the introduction of foreign matter from the substrate **210**.

The gate electrode **222** may be disposed on the semiconductor layer **221a** through **221c**. The gate electrode **222** may overlap the channel region **221b**. One of the scan signals S1 through Sn may be transmitted to the gate electrode **222**, and a voltage corresponding to the transmitted scan signal may

be applied to the gate electrode **222**, thereby controlling the thin film transistor to be turned on or off. The organic EL display panel **200** may further include a gate insulating film **231** between the gate electrode **222** and the semiconductor layer **221a** through **221c**. The gate insulating film **231** may insulate the gate electrode **222** from the semiconductor layer **221a** through **221c**. The organic EL display panel **200** may further include an interlayer insulating film **232** on the gate electrode **222**.

The source electrode **223** and the drain electrode **224** may be connected to the source region **221a** and the drain region **221c**, respectively. The source electrode **223** and the drain electrode **224** may respectively be connected to the source region **221a** and the drain region **221c** by contact holes formed in the gate insulating film **231** and the interlayer insulating film **232**.

The arrangement of the elements **221a** through **221c** and **222** through **224** of the thin film transistor shown in FIG. 2 is provided as merely an embodiment. Those with ordinary skill in the art would appreciate that the arrangement of the elements **221a** through **221c** and **222** through **224** of the thin film transistor can be modified variously according to embodiments.

The overcoat layer **250** may be disposed on the thin film transistor. The overcoat layer **250** may have a flat top surface such that other elements can be easily placed on the overcoat layer **250**. The overcoat layer **250** may contain an organic material. The overcoat layer **250** may include a contact hole **251**. The first electrode **271** may be connected to an element disposed under the overcoat layer **250** by the contact hole **251**. For example, the first electrode **271** may be connected to the drain electrode **224** by the contact hole **251**. When the first electrode **271** is deposited at a high temperature, outgassing may occur from the organic material contained in the overcoat layer **250**. The outgassing increases surface resistance of the first electrode **271**, thereby degrading characteristics of a device while contracting the pixel PX and shortening the life of the organic light emitting layer **280**. The contact hole **251** may function as a major path through which an outgas is released. The barrier layer **260** included in the organic EL display panel **200** can reduce negative effects brought about by the outgassing. Since the barrier layer **260** is formed around the contact hole **251** which is a major path for the release of the outgas, it can block the outgassing more effectively.

The first electrode **271** may be disposed on the overcoat layer **250**. The first electrode **271** may include a connecting portion **271a** which extends downward to be connected to the drain electrode **224**. The connecting portion **271a** may be disposed in the contact hole **251**. The first electrode **271** may be made of a transparent conductive material such as indium tin oxide (ITO), indium zinc oxide (IZO), ZnO, or SnO₂. The first electrode **271** may be formed by high-temperature deposition, and outgassing may occur in the process of depositing the first electrode **271** at a high temperature.

The organic light emitting layer **280** may be disposed on the first electrode **271**. The organic light emitting layer **280** may emit light at a gray level corresponding to a potential difference between the first electrode **271** and the second electrode **272** or a current flowing through the organic light emitting layer **280**. The organic light emitting layer **280** may emit white light. However, the present invention is not limited thereto. Light generated by the organic light emitting layer **280** may be emitted toward the bottom of the substrate **210**.

The second electrode **272** may be disposed on the organic light emitting layer **280**. The second electrode **272** may be

made of a reflective conductive material. The second electrode **272** may reflect light coming from the organic light emitting layer **280** in a downward direction.

The barrier layer **260** may be disposed between the overcoat layer **250** and the first electrode **271**. The barrier layer **260** may be made of SiOx or SiNx. The barrier layer **260** hinders an outgas generated by the organic material of the overcoat layer **250** from being released upward from the overcoat layer **250**. Therefore, the barrier layer **260** can reduce effects caused by outgassing.

The barrier layer **260** may include a first region R1 formed of a single layer and a second region R2 formed of a multilayer (i.e., multiple layers, or two or more layers stacked together). In FIG. 2, the second region R is a double layer. However, this is merely an example, and the second region R2 can also be formed of a triple or quadruple layer. The second region R2 may be disposed adjacent to a major path for the release of an outgas. For example, the second region R2 may be disposed around the contact hole **251**. If the second region R2 formed of a multilayer is disposed adjacent to the major path for the release of the outgas, it can better block the outgas. Thus, the second region R2 can more effectively hinder the outgas from being released upward from the overcoat layer **250**. In addition, since only part of the barrier layer **260** is composed of multiple layers, a thickness of the organic EL display panel **200** can be reduced compared with cases in which the entire barrier layer **260** is composed of multiple layers.

The first region R1 may be disposed under a light emitting region LR in which light generated from the organic light emitting layer **280** can travel downward from the organic light emitting layer **280**. The second region R2 may not be disposed under the light emitting region LR. When the barrier layer **260** composed of multiple layers is disposed under the light emitting region LR, light emitted from the organic light emitting layer **280** is more likely to be reflected due to a difference in refractive index between the multiple layers than when the barrier layer **260** composed of a single layer is disposed under the light emitting region LR. The light reflected by the barrier layer **260** composed of the multiple layers can be reflected again by the second electrode **272**. In this process, resonance of light may occur between the second electrode **272** and the barrier layer **260** composed of the multiple layers. The resonance of the light between the second electrode **272** and the barrier layer **260** composed of the multiple layers may affect the wavelength of emitted light, thereby degrading color reproducibility of the display device **1000**. In the organic EL display panel **200**, however, the first region R1 having a single layer is disposed under the light emitting region LR. Thus, this can reduce or prevent the resonance between the second electrode **272** and the barrier layer **260** and the degradation of the color reproducibility of the display device **1000**.

The barrier layer **260** may include a first barrier layer **261** and a second barrier layer **262**. The first barrier layer **261** may be disposed on the entire top surface of the overcoat layer **250**. The second barrier layer **262** may be disposed on a selected region of the first barrier layer **261**. In this case, after the first barrier layer **261** is disposed on the entire top surface of the overcoat layer **250**, the second barrier layer **262** may be disposed on the selected region of the first barrier layer **261**, thereby completing the barrier layer **260**. A region in which the second barrier layer **262** overlaps the first barrier layer **261** may be defined as the second region R2. The first barrier layer **261** and the second barrier layer **262** may be made of different materials. For example, the first barrier layer **261** may be made of SiOx, and the second

barrier layer **262** may be made of SiNx. The opposite is also possible, and the present invention is not limited to either embodiment.

The organic EL display panel **200** may further include a protective film **233** disposed on the thin film transistor. The protective film **233** may protect the thin film transistor.

The organic EL display panel **200** may further include a color filter **240**. The color filter **240** may be disposed under the barrier layer **260** to be overlapped by the light emitting region LR. In FIG. 2, the color filter **240** is disposed on a top surface of the protective film **233**. However, the present invention is not limited thereto. The color filter **240** may have any one of, but is not limited to, red, green and blue colors. The color filter **240** may contain an organic material. The organic material contained in the color filter **240** may experience outgassing in the process of manufacturing the organic EL display panel **200**. The barrier layer **260** included in the organic EL display panel **200** can hinder an outgas emitted from the color filter **240** from travelling to above the barrier layer **260**.

The organic EL display panel **200** may further include a pixel defining layer **290**. The pixel defining layer **290** may be disposed on the barrier layer **260** and the first electrode **271**. The pixel defining layer **290** may define the area of each of the pixels PX included in the organic EL display panel **200**. The pixel defining layer **290** may form an aperture which exposes at least a part of the first electrode **271**. The organic light emitting layer **280** and the second electrode **272** may be disposed in the aperture of the pixel defining layer **290**. A region of the aperture (in which the pixel defining layer **290** is not disposed) which exposes the organic light emitting layer **280** may be defined as the light emitting region LR.

Another embodiment of the present invention will now be described with reference to FIG. 3. FIG. 3 is a cross-sectional view of an organic EL display panel **200a** according to another embodiment of the present invention.

Referring to FIG. 3, the organic EL display panel **200a** may include a barrier layer **260a**. The barrier layer **260a** may include a first barrier layer **261a** and a second barrier layer **262a**. The first barrier layer **261a** may be disposed on the second barrier layer **262a**. In this case, after the second barrier layer **262a** is disposed on a selected region of an overcoat layer **250**, the first barrier layer **261a** may be disposed on the overcoat layer **250** and the entire surface of the second barrier layer **262a**, thereby completing the barrier layer **260a**.

For simplicity, other elements substantially identical to those of FIG. 2 are indicated by like reference numerals, and thus their description will be omitted.

Another embodiment of the present invention will now be described with a reference to FIG. 4. FIG. 4 is a cross-sectional view of an organic EL display panel **200b** according to another embodiment of the present invention.

Referring to FIG. 4, the organic EL display panel **200b** may include a barrier layer **260b**. The barrier layer **260b** may be disposed on an inner surface of a wall (e.g., a cylindrical wall or one or more cuboidal walls) of a contact hole **251**. Specifically, after the contact hole **251** is formed in an overcoat layer **250**, the barrier layer **260b** may be formed on the inner surface of the wall of the contact hole **251**. The barrier layer **260b** disposed on the inner surface of the wall of the contact hole **251** can reduce or prevent the release of an outgas not only through a top surface of the overcoat layer **250** but also through the inner surface of the wall of the contact hole **251**.

The barrier layer **260b** may include a first barrier layer **261b** and a second barrier layer **262b**. The first barrier layer **261b** may be disposed on the entire top surface of the overcoat layer **250** and be adjacent to the inner surface of the wall of the contact hole **251**. The second barrier layer **262b** may be disposed on a selected region of the first barrier layer **261b**. After the first barrier layer **261b** is disposed, the second barrier layer **262b** may be disposed, thereby completing the barrier layer **260b**.

For simplicity, other elements substantially identical to those of FIG. 2 are indicated by like reference numerals, and thus their description will be omitted.

Another embodiment of the present invention will now be described with reference to FIG. 5. FIG. 5 is a cross-sectional view of an organic EL display panel **200c** according to another embodiment of the present invention.

Referring to FIG. 5, the organic EL display panel **200c** may include a barrier layer **260c**. The barrier layer **260c** may be disposed on an inner surface of a wall of a contact hole **251**. The barrier layer **260c** disposed on the inner surface of the wall of the contact hole **251** can reduce or prevent the release of an outgas not only through a top surface of an overcoat layer **250** but also through the inner surface of the wall of the contact hole **251**.

The barrier layer **260c** may include a first barrier layer **261c** and a second barrier layer **262c**. The second barrier layer **262c** may be disposed on a selected region of the top surface of the overcoat layer **250**. When the second barrier layer **262c** is disposed adjacent to the contact hole **251**, it may also be disposed in a region adjacent to the inner surface of the wall of the contact hole **251**. After the second barrier layer **262c** is disposed, the first barrier layer **261c** may be disposed on the entire top surface of the overcoat layer **250** and the second barrier layer **262c**.

For simplicity, other elements substantially identical to those of FIG. 2 are indicated by like reference numerals, and thus their description will be omitted.

Another embodiment of the present invention will now be described with reference to FIG. 6. FIG. 6 is a cross-sectional view of an organic EL display panel **200d** according to another embodiment of the present invention.

Referring to FIG. 6, the organic EL display panel **200d** may include an organic light emitting layer **280a**. The organic light emitting layer **280a** may emit light at a gray level corresponding to a potential difference between a first electrode **271** and a second electrode **272** or a current flowing through the organic light emitting layer **280a**. The organic light emitting layer **280a** may emit any one of red light, blue light, and green light. If the organic light emitting layer **280a** emits any one of the red light, the blue light and the green light, the color filter **240** of the organic EL display panel **200** shown in FIG. 2 may be omitted from the organic EL display panel **200d**.

For simplicity, other elements substantially identical to those of FIG. 2 are indicated by like reference numerals, and thus their description will be omitted.

Organic EL display panels according to other embodiments of the present invention will now be described with reference to FIGS. 7 through 9. FIG. 7 is a cross-sectional view of an organic EL display panel **200e** according to another embodiment of the present invention. FIG. 8 is a cross-sectional view of an organic EL display panel **200f** according to another embodiment of the present invention. FIG. 9 is a cross-sectional view of an organic EL display panel **200g** according to another embodiment of the present invention.

In each of the organic EL display panels **200e** through **200g** of FIGS. 7 through 9, the organic light emitting layer **280** of each of the organic EL display panels **200a** through **200c** of FIGS. 3 through 5 is replaced with an organic light emitting layer **280a**, and the color filter **240** is omitted.

For simplicity, other elements of the organic EL display panels **200e** through **200g** are substantially identical to those with the same names in FIGS. 3 through 5, and thus their description will be omitted.

Another embodiment of the present invention will now be described with reference to FIG. 10. FIG. 10 is a cross-sectional view of an organic EL display panel **200h** according to another embodiment of the present invention.

Referring to FIG. 10, the organic EL display panel **200h** may include a first electrode **271a**, a second electrode **272b**, a pixel defining layer **290a**, an upper substrate **295**, and a color filter **240a**.

The first electrode **271b** may be made of a reflective conductor. When light emitted from an organic light emitting layer **280** reaches the first electrode **271b**, the first electrode **271b** reflects the light upward.

The second electrode **272b** may be made of a transparent conductive material. For example, the second electrode **272b** may be made of a material such as ITO, IZO, ZnO, or SnO₂.

A region of the pixel defining layer **290a** may protrude and thus function as a spacer which supports the upper substrate **295**.

The upper substrate **295** may be disposed on the pixel defining layer **290a** and may be made of a transparent material. For example, the upper substrate **295** may be made of, but is not limited to, glass, PET, PC, PES, PI or PMMA. Light generated from the organic light emitting layer **280** may pass through the color filter **240a** and the upper substrate **295** to come out of the upper substrate **295**.

The color filter **240a** may be, but is not limited to, a red filter, a blue filter, or a green filter. The color filter **240a** may be disposed above a light emitting region LR to overlap the light emitting region LR. In FIG. 10, the color filter **240a** is disposed in contact with a bottom surface of the upper substrate **295**. However, the present invention is not limited thereto, and the color filter **240a** may alternatively be disposed on a path of light emitted from the light emitting layer **280**.

For simplicity, other elements substantially identical to those of FIG. 2 are indicated by like reference numerals, and thus their description will be omitted.

According to some embodiments, the organic light emitting layer **280** may be replaced with the organic light emitting layer **280a**. In this case, the color filter **240a** may be omitted.

According to some other embodiments, a barrier layer **260** may be replaced with one of the barrier layers **260a** through **260c** of FIGS. 3 through 5.

Embodiments of the present invention provide at least one of the following features.

That is, a layer which blocks outgassing can be reinforced in a region of an organic EL display panel in which outgassing may occur actively.

In addition, the outgassing can be blocked effectively while the effects on color reproducibility of an image displayed on the organic EL display panel are reduced.

However, the effects of the present invention are not limited to the one set forth herein. The above and other effects of the present invention will become more apparent to one of ordinary skill in the art to which the present invention pertains by referencing the claims and their equivalents.

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What is claimed is:

1. An organic electroluminescence (EL) display panel comprising:

- a substrate;
 - a thin film transistor on the substrate;
 - an overcoat layer on the thin film transistor and comprising an organic material;
 - a first electrode on the overcoat layer;
 - an organic light emitting layer on the first electrode;
 - a second electrode on the organic light emitting layer;
 - a barrier layer between the overcoat layer and the first electrode, and comprising a first region comprising only a single layer for reducing resonance between the second electrode and the barrier layer, and a second region comprising a multilayer; and
 - a pixel defining layer on the barrier layer,
- wherein the second region is not located under a light emitting region in which the light emitting layer is exposed by the pixel defining layer,
- wherein resonance of the first region comprising only the single layer is smaller than resonance of the first region would be if the first region comprised a multilayer.

2. The display panel of claim 1, wherein the first electrode comprises a transparent electrode, and the second electrode comprises a reflective electrode.

3. The display panel of claim 2, wherein of the first region and the second region, only the first region is disposed under the light emitting region.

4. The display panel of claim 3, further comprising a color filter located under the light emitting region and the barrier layer.

5. The display panel of claim 1, wherein the overcoat layer has a contact hole which overlaps the first electrode, and the second region is located adjacently to the contact hole.

6. The display panel of claim 5, wherein the second region is located on an inner surface of a wall of the contact hole.

7. The display panel of claim 1, wherein the barrier layer comprises:

- the single layer at the first region and the second region; and
- the multilayer only at the second region and comprising a different material from the single layer.

8. The display panel of claim 1, wherein the second region comprises a triple or quadruple layer.

9. A display device comprising:
an organic electroluminescence (EL) display panel; and

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a driver configured to drive the organic EL display panel, wherein the organic EL display panel comprises:

- a substrate;
 - a thin film transistor on the substrate;
 - an overcoat layer on the thin film transistor and comprising an organic material;
 - a first electrode on the overcoat layer;
 - an organic light emitting layer on the first electrode;
 - a second electrode on the organic light emitting layer;
 - a barrier layer between the overcoat layer and the first electrode, and comprising a first region comprising only a single layer for reducing resonance between the second electrode and the barrier layer, and a second region comprising a multilayer; and
 - a pixel defining layer on the barrier layer,
- wherein the second region is not located under a light emitting region in which the light emitting layer is exposed by the pixel defining layer,
- wherein resonance of the first region comprising only the single layer is smaller than resonance of the first region would be if the first region comprised a multilayer.

10. The display device of claim 9, wherein the first electrode comprises a transparent electrode, and the second electrode comprises a reflective electrode.

11. The display device of claim 10, wherein of the first region and the second region, only the first region is located under the light emitting region.

12. The display device of claim 11, wherein the organic EL display panel further comprises a color filter located under the light emitting region and the barrier layer.

13. The display device of claim 9, wherein the overcoat layer has a contact hole which overlaps the first electrode, and the second region is located adjacently to the contact hole.

14. The display device of claim 13, wherein the second region is located on an inner surface of a wall of the contact hole.

15. The display device of claim 9, wherein the barrier layer comprises:

- the single layer at the first region and the second region; and
- the multilayer only at the second region and comprising a different material from the single layer.

16. The display device of claim 9, wherein the second region comprises a triple or quadruple layer.

* * * * *

专利名称(译)	有机电致发光显示板构造减少或防止有机材料的除气，以及包括该有机电致发光显示板的显示装置		
公开(公告)号	US9559332	公开(公告)日	2017-01-31
申请号	US13/943685	申请日	2013-07-16
[标]申请(专利权)人(译)	三星显示有限公司		
申请(专利权)人(译)	三星DISPLAY CO. , LTD.		
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IPC分类号	H01L51/52 H01L27/32 G09G3/30		
CPC分类号	H01L51/5253 G09G3/30 H01L27/3258 H01L51/442		
优先权	1020120102278 2012-09-14 KR		
其他公开文献	US20140078120A1		
外部链接	Espacenet USPTO		

摘要(译)

有机电致发光 (EL) 显示面板包括基板，在基板上的薄膜晶体管，在薄膜晶体管上的包含有机材料的覆盖层，在覆盖层上的第一电极，在第一电极，在有机发光层上的第二电极，以及在外涂层和第一电极之间的阻挡层，并且包括由单层形成的第一区域和由多层形成的第二区域。

