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(54) **Organic light emitting display**

(57) An organic light emitting display is capable of reducing or preventing IR drop in a cathode electrode. An organic light emitting display includes a first substrate (100) and a second substrate (200). The first substrate (100) has a plurality of pixels (110) located thereon, each of the pixels comprising an organic light emitting diode. A cathode electrode includes a transparent material and may be located on substantially an entire area of the pixels. The second substrate (200) may have a mesh-type auxiliary electrode (210) located thereon at a side facing the pixels, the mesh-type auxiliary electrode (210) corresponding to non-emission regions between the pixels and being electrically connected to the cathode electrode.

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Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention relates to an organic light emitting display, and more particularly, to an organic light emitting display in which IR drop (i.e., voltage drop) in a cathode electrode is prevented or reduced.

2. Description of the Related Art

[0002] Recently, various flat panel displays (FPDs) that are light and thin in comparison to cathode ray tubes (CRTs) have been developed. Among the FPDs, organic light emitting displays using organic compounds as phosphor to have excellent brightness and color purity are in the spotlight.

[0003] Since the organic light emitting displays are thin and light and capable of being driven with low power consumption, they are suitable for portable displays in addition to applications in larger FPDs.

[0004] The organic light emitting displays are typically classified as a top emission organic light emitting display or a bottom emission organic light emitting display according to light emission directions. Further, a dual-side emission organic light emitting display has combined features of the top emission organic light emitting display and the bottom emission organic light emitting display.

[0005] A conventional bottom emission organic light emitting display has disadvantages of a low aperture ratio because thin film transistors for driving OLEDs cannot be positioned at light emitting regions.

[0006] On the contrary, the top emission organic light emitting display can achieve a desired aperture ratio regardless of whether or not the thin film transistors are located under the OLEDs.

[0007] However, in the top emission organic light emitting display, as light generated from an emission layer of the OLED is emitted out through a cathode electrode, the cathode electrode is required to be transparent. Therefore, the cathode electrode is made of a transparent conductive material such as ITO, or MgAg having a sufficiently small thickness to be transparent.

[0008] However, the transparent conductive material such as ITO has a high resistance, and

[0009] MgAg can only have a limited thickness. Thus, the resistance of the cathode electrode is high so that a relatively high IR drop (i.e., voltage drop) occurs. Particularly, as a display panel becomes larger, the IR drop in the cathode electrode is greatly increased so that image quality and display characteristics may not be uniform.

SUMMARY OF THE INVENTION

[0010] Accordingly, it is an object of the present invention to provide an organic light emitting display in which IR drop in a cathode electrode can be reduced or prevented.

[0011] In order to achieve the foregoing and/or other objects of the present invention, in one aspect of the present invention, an organic light emitting display comprises: a first substrate having a plurality of pixels located thereon, each of the pixels comprising an organic light emitting diode, wherein a cathode electrode of the organic light emitting diode comprising a transparent material is located on substantially an entire area of the pixels; and a second substrate having a mesh type auxiliary electrode located thereon at a side facing the pixels, the mesh-type auxiliary electrode corresponding to non-emission regions between the pixels and electrically connected to the cathode electrode. The auxiliary electrode may comprise a conductive black matrix material. Preferably, the auxiliary electrode comprises at least one material selected from the group consisting of chrome (Cr), a chrome alloy, molybdenum (Mo), a molybdenum alloy, a chrome oxide (CrOx), a molybdenum oxide (MoOx), and combinations thereof. Preferably, the auxiliary electrode comprises a material with a lower specific resistance than a material for the cathode electrode.

[0012] The organic light emitting display may further comprise a transparent conductive layer formed on substantially an entire area of the auxiliary electrode and contacting the cathode electrode to electrically connect the auxiliary electrode to the cathode electrode. The transparent conductive layer may comprise indium tin oxide (ITO). Preferably, the transparent conductive layer contacts the cathode electrode at the non-emission regions between the pixels. The organic light emitting diode may comprise a light emission layer for emitting a red light, a green light, or a blue light. Alternatively, the organic light emitting diode may comprise a light emission layer for emitting a white light, and the organic light emitting display may further comprise red color filters, green color filters, and blue color filters respectively located at openings of the auxiliary electrode to correspond to the pixels. The organic light emitting display may further comprise a transparent conductive layer formed on the auxiliary electrode and the color filters and contacting the cathode electrode to electrically connect the auxiliary electrode to the cathode electrode.

[0013] In another aspect of the present invention, an organic light emitting display comprises: a first substrate; a second substrate facing the first substrate with a gap therebetween; a plurality of organic light emitting diodes (OLEDs) on the first substrate, the OLEDs sharing a common electrode comprising a substantially transparent material, each of the OLEDs comprising a pixel electrode and a light emission layer between the pixel electrode and the common electrode; a plurality of thin film transistors on the first substrate and electrically connected to the OLEDs; and an auxiliary electrode formed on the second substrate at non-emission regions between the OLEDs and electrically connected to the common electrode to reduce a resistance across the common electrode.

[0014] The auxiliary electrode may be a mesh-type electrode having openings corresponding to the OLEDs. The organic light emitting display may further comprise a plurality of color filters at the openings of the mesh-type electrode. The organic light emitting display may further comprise a transparent conductive layer formed between the auxiliary electrode and the common electrode and electrically connected to the auxiliary electrode and the common electrode.

[0015] According to one embodiment of the present invention, an organic light emitting display including a first substrate and a second substrate is provided. The first substrate has a plurality of pixels located thereon, each of the pixels including an organic light emitting diode, wherein a cathode electrode of the organic light emitting diode including a transparent material is located on substantially an entire area of the pixels. The second substrate has a mesh type auxiliary electrode located thereon at a side facing the pixels, the mesh-type auxiliary electrode corresponding to non-emission regions between the pixels and electrically connected to the cathode electrode.

[0016] Here, the auxiliary electrode may include a conductive black matrix material.

[0017] The auxiliary electrode may include a material with a lower specific resistance than a material for the cathode electrode.

[0018] The organic light emitting display further includes a transparent conductive layer formed on substantially an entire area of the auxiliary electrode and contacting the cathode electrode to electrically connect the auxiliary electrode to the cathode electrode. The transparent conductive layer contacts the cathode electrodes at the non-emission regions between the pixels.

[0019] Accordingly, in organic light emitting displays according to embodiments of the present invention, since an auxiliary electrode, electrically connected to a cathode electrode on a lower substrate and having resistance lower than the cathode electrode, is on an upper substrate, IR drop in the cathode electrode can be reduced or prevented.

BRIEF DESCRIPTION OF THE DRAWINGS

[0020] The accompanying drawings, together with the specification, illustrate exemplary embodiments of the present invention, and, together with the description, serve to explain the principles of the present invention.

FIG. 1 is an exploded perspective view illustrating an organic light emitting display according to an embodiment of the present invention;

FIG. 2 is a sectional view illustrating main parts of the organic light emitting display as shown in FIG. 1; and

FIG. 3 is a sectional view illustrating main parts of an organic light emitting display according to another embodiment of the present invention.

DETAILED DESCRIPTION

[0021] Hereinafter, certain exemplary embodiments of the present invention will be described with reference to the accompanying drawings. Here, when a first element is described as being coupled to a second element, the first element may be directly coupled to the second element or may be indirectly coupled to the second element via a third element. Further, some of the elements that are not essential to a complete understanding of the invention are omitted for clarity. Also, like reference numerals refer to like elements throughout.

[0022] Hereinafter, exemplary embodiments of the present invention will be described in detail with reference to the accompanying drawings, namely, FIGs. 1 to 3.

[0023] FIG. 1 is an exploded perspective view illustrating an organic light emitting display according to an embodiment of the present invention, and FIG. 2 is a sectional view illustrating main parts of the organic light emitting display as shown in FIG. 1.

[0024] Referring to FIG. 1, an organic light emitting display according to an embodiment of the present invention includes a lower substrate 100 on which a plurality of pixels 110 respectively including organic light emitting diodes (OLEDs) are formed, an upper substrate 200 on which a mesh-type auxiliary electrode 210 is located at the side facing the pixels 110. A transparent conductive layer 220 is formed on substantially an entire area of the auxiliary electrode 210 at the side facing the pixels 110. While the auxiliary electrode 210 is primarily described herein as a single electrode formed as a mesh as shown in FIG. 1, the auxiliary electrode can also be viewed as a plurality of auxiliary electrodes that are electrically connected together in a form of a mesh.

[0025] Each of the pixels 110, as illustrated in FIG. 2, includes a thin film transistor 112 and an OLEO 116 wh ich are formed on the lower substrate 100.

[0026] Each of the thin film transistors 112 includes a semiconductor layer 112a formed on a buffer layer 111, which is on the lower substrate 100, a gate electrode 112b formed on the semiconductor layer 112a, where an insulating layer 113 is interposed between the gate electrode 112b and the semiconductor layer 112a, and source/drain electrodes 112c formed on the gate electrode 112b, where an interlayer insulating layer 114 is interposed between the source/drain electrodes 112c and the gate electrode 112b.

[0027] The source/drain electrodes 112c are electrically connected to the semiconductor layer 112a.

[0028] An insulating planarization layer 115 is formed on the thin film transistor 112. An OLED 116 connected to the thin film transistor 112 through a via-hole is formed on the planarization layer 115.

[0029] The OLED 116 is formed on the planarization layer 115. The OLED 116 includes an anode electrode

116a electrically connected to the thin film transistor 112 through the via-hole formed in the planarization layer 115, a light emission layer 116b formed on the anode electrode 116a at an area exposed by a pixel definition layer 117 which is formed on the planarization layer 115 to overlap with an upper portion of an edge of the anode electrode 116a, and a cathode electrode 116c formed on the light emission layer 116b and made of transparent material. The cathode electrode layer 116c is formed over substantially an entire upper side of the pixels 110.

[0030] Here, the light emission layer 116b may be formed in the form of a red light emission layer R, a green light emission layer G, or a blue light emission layer B, independently deposited using a fine metal mask (FMM). According to the kind of the light emission layer 116b, the pixels 110 may be classified as a red pixel 110R, a green pixel 110G, or a blue pixel 110B.

[0031] Each of the pixels 110 includes the cathode electrode 116c made of a transparent material to emit light toward the cathode electrode 116c. Accordingly, the organic light emitting display may be implemented as a top emission (or a dual-side emission) organic light emitting display. In the described embodiment, the cathode electrode is a common electrode shared by all of the pixels. However, each pixel can also be viewed as having its own cathode electrode that is electrically connected to cathode electrodes of other pixels.

[0032] Since the cathode electrode 116c should transmit light in a top emission or dual-side emission organic light emitting display, the cathode electrode 116c is made of a transparent conductive layer. To this end, the cathode electrode 116c is made of a transparent conductive material such as ITO, or MgAg having a thickness that is small enough to be transparent. Here, the thickness of MgAg is determined within a range of guaranteeing transparency greater than a predetermined transparency with respect to light. The term transparency or transparent in the present application refers to translucency greater than a desired transparency (e.g., predetermined transparency) or substantial transparency, as well as a transparency of 100%.

[0033] In non-emission regions 120 between the pixels 110, spacers 118 are provided to maintain a gap (e.g., a predetermined gap) between the first substrate 100 and the second substrate 200.

[0034] Each of the spacers 118 is formed between the pixel definition layer 117 of the non-emission region 120 and the cathode electrode 116c. In other words, the cathode electrode 116c is formed in a region including an upper portion of the spacer 118 of the non-emission region 120, that is, is positioned on the top of the lower substrate 100. The auxiliary electrode 210 is formed at a side of the upper substrate 200 facing the pixels 110 to correspond to the non-emission region 120 between the pixels 110 in the form of a mesh, and is electrically connected to the cathode electrode 116c of the lower substrate 100 by a transparent conductive layer 220.

[0035] The auxiliary electrode 210 may function as a black matrix containing conductive black matrix material. The conductive black matrix material may be at least one selected from the group consisting of chrome (Cr), chrome alloys, molybdenum (Mo), molybdenum alloys, oxides thereof (CrOx, MoOx), and combinations thereof. For example, the auxiliary electrode 210 may be formed of a single chrome layer, or may include a dual chrome layer/chrome oxide layer or a dual molybdenum layer/molybdenum oxide layer for effective light interception.

[0036] Moreover, even if the auxiliary electrode 210 does not completely function as a black matrix, since it is formed in the non-emission region 120, it does not necessarily have to be transparent. Thus, the thickness of the auxiliary electrode 210 is less restricted than that of the cathode electrode 116c. Therefore, the auxiliary electrode 210 may be formed with a thickness relatively greater than that of the cathode electrode 116c. When the cathode electrode 116c is formed as a transparent electrode made of ITO, for example, the auxiliary electrode 210 may be made of one of a variety of materials having a specific resistance lower than the material for the cathode electrode 116c. That is, the auxiliary electrode 210 has a resistance lower than that of the cathode electrode 116c and is electrically connected thereto so as to prevent or reduce IR drop in the cathode electrode 116c.

[0037] The transparent conductive layer 220 is formed on substantially an entire area of the auxiliary electrode 210 and contacts the cathode electrode 116c at the non-emission regions 120 between the pixels 110 to electrically connect the auxiliary electrode 210 to the cathode electrode 116c.

[0038] The transparent conductive layer 220 performs a function of preventing or reducing IR drop in the cathode electrode 116c together with the auxiliary electrode 210, and may be made of indium tin oxide (ITO) such that light can be transmitted therethrough. In other embodiments of the present invention, the transparent conductive layer 220 may not be provided, and the auxiliary electrode 210 may directly contact the cathode electrode 116c when the transparent conductive layer 220 is not used.

[0039] As described above, according to embodiments of the present invention, the auxiliary electrode 210 and/or the transparent conductive layer 220 to be electrically connected to the cathode electrode 116c on the lower substrate 100 are formed on the upper substrate 200. Then, the two substrates 100 and 200 are bonded to each other. Accordingly, IR drop in the cathode electrode 116c can be prevented or reduced.

[0040] FIG. 3 is a sectional view illustrating main parts of an organic light emitting display according to another embodiment of the present invention. In FIG. 3, same reference numerals are assigned to the same elements as those in FIG. 2, and their description will be omitted.

[0041] Referring to FIG. 3, in an organic light emitting display according to another embodiment of the present invention, each of OLEDs 116' or a red pixel 110R', a green pixel 110G', and a blue pixel 110B' includes white light emitting layer W. Between the auxiliary electrode 210 of the upper substrate 200, color filters 230 corresponding to the pixels 110R', 110G', and 110B' are provided. Here, color filters are located at openings of the mesh-type auxiliary electrode 210. That is, red color filters R C/F, green color filters G C/F, and blue color filters B C/F are formed on the red pixels 110R', the green pixels 110G', and the blue pixels 110B', respectively.

[0042] Using the color filters, the organic light emitting display displays an image with full colors.

[0043] Although not shown in the drawings, when unit pixels include a red pixel, a green pixel, a blue pixel, and a white pixel to display an image with full colors, the white pixel may not include a color filter or may include a filter for adjusting the amount of transmitted light.

[0044] This way, in another embodiment, the transparent conductive layer 220 is formed on substantially an entire area of the auxiliary electrode 210 and color filters 230 and contacts the cathode electrode 116c to electrically connect the auxiliary electrode 210 to the cathode electrode 116c.

Claims

1. An organic light emitting display comprising:

> a first substrate (100) having a plurality of pixels (110) located thereon, each of the pixels (110) comprising an organic light emitting diode (116);
> a cathode electrode (116c) comprising a transparent material; and
> a second substrate (200) having an auxiliary electrode (210) located thereon at a side facing the pixels (110), the auxiliary electrode (210) corresponding to non-emission regions (120) between the pixels (110) and electrically connected to the cathode electrode (116c).

2. The organic light emitting display as claimed in claim 1, wherein the cathode electrode (116c) is located on substantially an entire area of the pixels (110).

3. The organic light emitting display as claimed in any one of the preceding claims, wherein the auxiliary electrode (210) is a mesh-type auxiliary electrode having openings corresponding to the organic light emitting diodes (116).

4. The organic light emitting display as claimed in any one of the preceding claims, wherein the auxiliary electrode (210) comprises a conductive black matrix material.

5. The organic light emitting display as claimed in any one of the preceding claims, wherein the auxiliary electrode (210) comprises at least one material selected from the group consisting of chrome (Cr), a chrome alloy, molybdenum (Mo), a molybdenum alloy, a chrome oxide (CrOx), a molybdenum oxide (MoOx), and combinations thereof.

6. The organic light emitting display as claimed in any one of the preceding claims, wherein the auxiliary electrode (210) comprises a material with a lower specific resistance than a material for the cathode electrode (116c).

7. The organic light emitting display as claimed in any one of the preceding claims, further comprising a transparent conductive layer (220) formed between the auxiliary electrode (210) and the cathode electrode (116c) and contacting the auxiliary electrode (210) and the cathode electrode (116c) to electrically connect the auxiliary electrode (210) to the cathode electrode (116c).

8. The organic light emitting display as claimed in claim 7, wherein the transparent conductive layer (220) comprises indium tin oxide (ITO).

9. The organic light emitting display as claimed in any one of claims 7 or 8, wherein the transparent conductive layer (220) is formed on substantially an entire area of the auxiliary electrode (210) and/or the transparent conductive layer (220) contacts the cathode electrode (116c) at the non-emission regions (120) between the pixels (110).

10. The organic light emitting display as claimed in any one of the preceding claims, wherein each organic light emitting diode (116) comprises a light emission layer (116b) for emitting red light, green light, or blue light.

11. The organic light emitting display as claimed in any one of claims 1 to 9, wherein each organic light emitting diode (116) comprises a light emission layer (116b') for emitting white light.

12. The organic light emitting display as claimed in claim 11, further comprising red color filters (R C/F), green color filters (G C/F), and blue color filters (B C/F) respectively located at openings of the auxiliary electrode (210) to correspond to the pixels (110).

13. The organic light emitting display as claimed in claim 12 and any one of claims 7 to 9, wherein the transparent conductive layer (220) is formed on the auxiliary electrode (210) and the color filters (R C/F, G C/F, B C/F).

14. The organic light emitting display as claimed in any one of the preceding claims, wherein each of the organic light emitting diodes (116) comprises a pixel electrode (116a) and a light emission layer (116b, 116b') between the pixel electrode (116a) and the cathode electrode (116c).

15. The organic light emitting display as claimed in any one of the preceding claims, wherein each of the pixels (110) comprises a thin film transistor (112) electrically connected to the organic light emitting diode (116) of the pixel (110).

FIG. 1

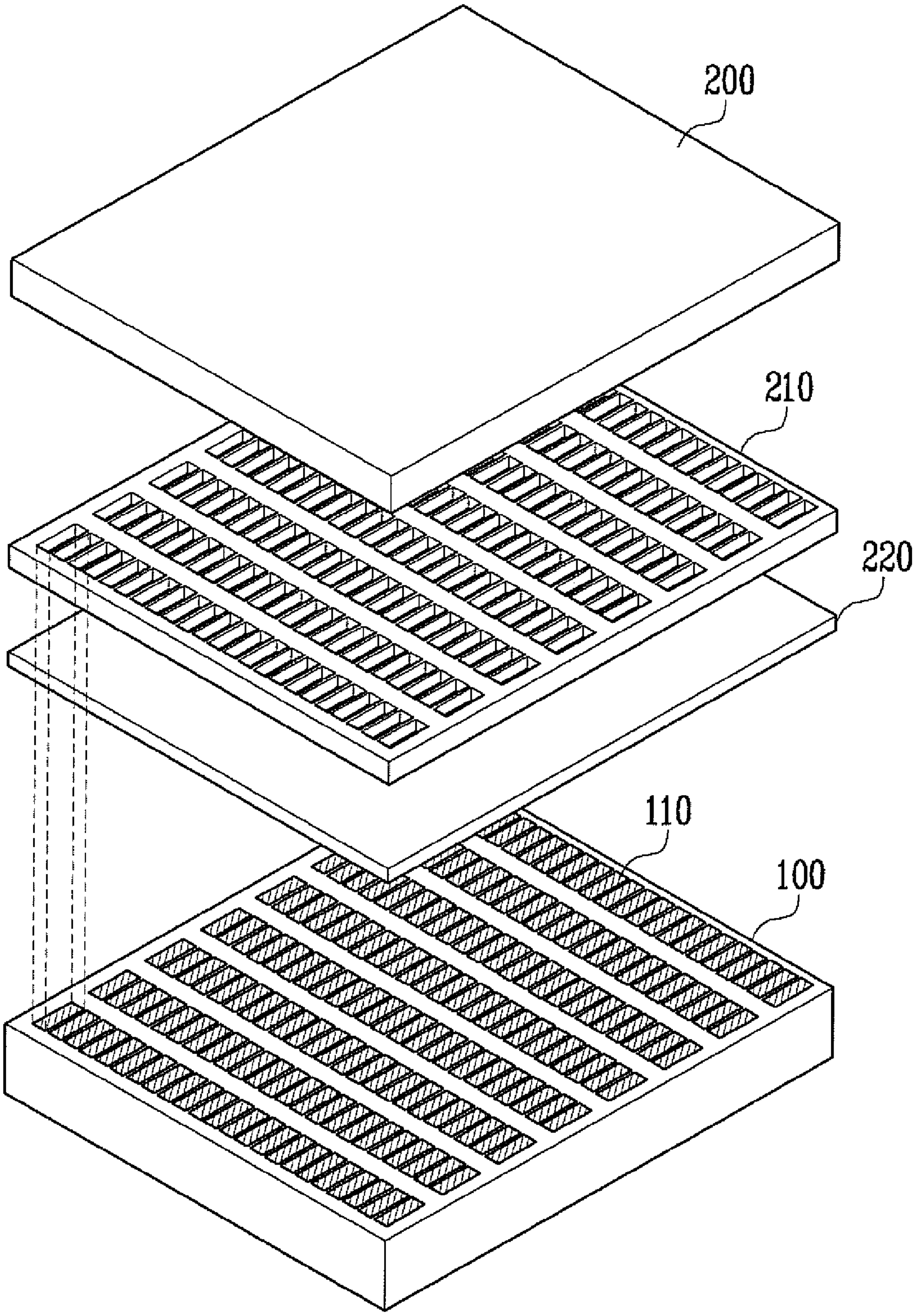


FIG. 2

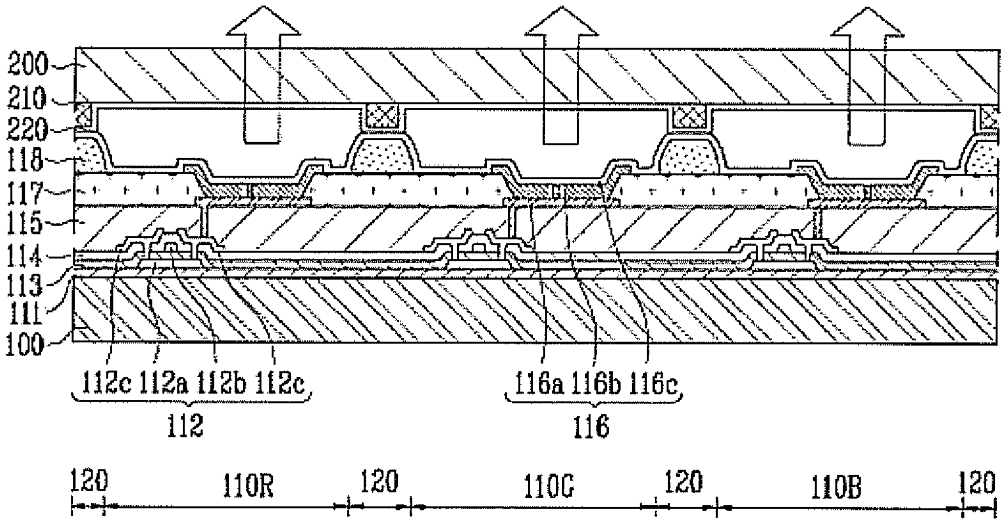
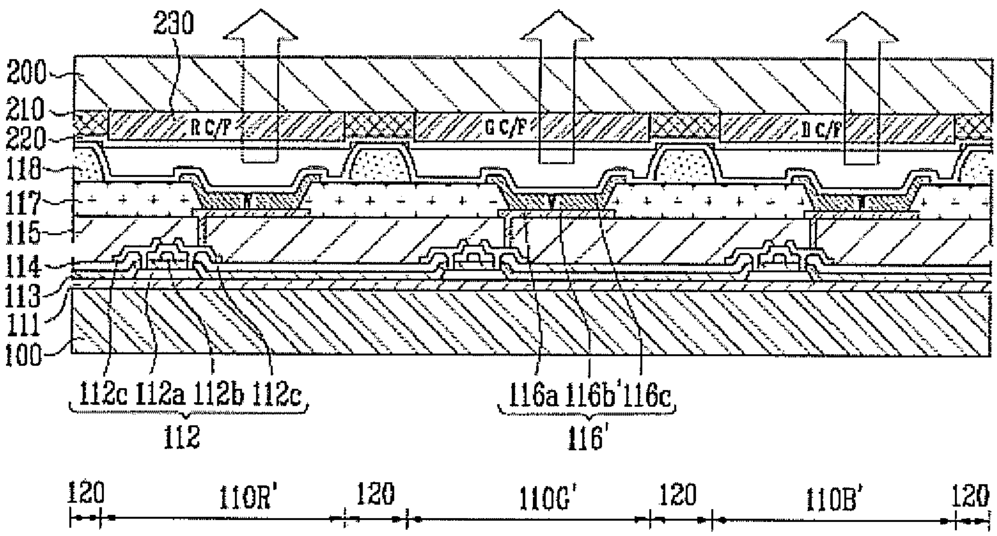

200
210
220
118
117
115
114
113
111
100
112c 112a 112b 112c
112
116a 116b 116c
116
120
110R
120
110G
120
110B
120

FIG. 3


230
200
210
220
118
117
115
114
113
111
100
R C/F
G C/F
B C/F
112c 112a 112b 112c
112
116a 116b' 116c
116'
120
110R'
120
110G'
120
110B'
120

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EUROPEAN SEARCH REPORT

Application Number
EP 09 17 3041

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 2007/108899 A1 (JUNG JAE-HOON [KR] ET AL) 17 May 2007 (2007-05-17) * paragraphs [0058] - [0059], [0072], [0074], [0076] - [0079]; figure 2 * * paragraphs [0097], [0098]; figure 5 *	1-10, 14-15	INV. H01L27/32 H01L51/52
X	US 2006/124950 A1 (PARK JIN-WOO [KR] ET AL) 15 June 2006 (2006-06-15) * paragraphs [0021], [0037], [0038]; figure 1 * * paragraphs [0044], [0046]; figures 2,3 * * paragraphs [0047], [0049]; figure 4 * * paragraph [0069]; figure 6 *	1-9, 11-15	
X	US 2006/158095 A1 (IMAMURA YOICHI [JP]) 20 July 2006 (2006-07-20) * paragraphs [0120], [0121], [0129], [0130], [0133]; figure 4 * * paragraph [0146] - paragraph [0148]; figures 8A-8E * * paragraphs [0034], [0035], [0036] * * paragraphs [0158], [0171], [0179], [0185] *	1-7, 9-10, 14-15	TECHNICAL FIELDS SEARCHED (IPC) H01L
X	US 2006/273712 A1 (YAEGASHI HIROYUKI [JP]) 7 December 2006 (2006-12-07) * figure 8; example 6 * * paragraphs [0047], [0091] * * paragraph [0097] * * paragraph [0089]; figure 4 *	1-6,10, 14-15	

1 The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	25 January 2010	Pusch, Catharina

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 09 17 3041

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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25-01-2010

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

专利名称(译)	有机发光显示器		
公开(公告)号	EP2178124A1	公开(公告)日	2010-04-21
申请号	EP2009173041	申请日	2009-10-14
[标]申请(专利权)人(译)	三星显示有限公司		
申请(专利权)人(译)	三星移动显示器有限公司.		
当前申请(专利权)人(译)	三星DISPLAY CO.，LTD.		
[标]发明人	KWAK WON KYU		
发明人	KWAK, WON-KYU		
IPC分类号	H01L27/32 H01L51/52		
CPC分类号	H01L51/5234 H01L27/322 H01L51/5036 H01L51/5228 H01L51/524 H01L51/525 H01L51/5284		
优先权	1020080101947 2008-10-17 KR		
外部链接	Espacenet		

摘要(译)

有机发光显示器能够减少或防止阴极中的IR降。有机发光显示器包括第一基板（100）和第二基板（200）。第一基板（100）具有位于其上的多个像素（110），每个像素包括有机发光二极管。阴极电极包括透明材料，并且可以位于像素的基本上整个区域上。第二基板（200）可以在面向像素的一侧上具有位于其上的网状辅助电极（210），网状辅助电极（210）对应于像素之间的非发射区域并且电连接到像素。阴极电极。

FIG. 1