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(54) **Organic light emitting display device and method of manufacturing the same**

Organische lichtemittierende Anzeigevorrichtung und Verfahren zu deren Herstellung

Dispositif d' affichage électroluminescent organique et son procédé de fabrication

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Description

BACKGROUND

Field of the Invention

[0001] The present invention relates to an organic light emitting display device and a method of manufacturing the same.

Discussion of the Related Art

[0002] As a type of new flat panel display device, organic light emitting display devices are self-emitting display devices, and have a better viewing angle and contrast ratio than liquid crystal display (LCD) devices. Also, since the organic light emitting display devices do not need a separate backlight, it is possible to lighten and thin the organic light emitting display devices, and the organic light emitting display devices have excellent power consumption compared to LCD devices and the other flat panel display devices. Furthermore, the organic light emitting display devices are driven with a low direct current (DC) voltage, have a fast response time, and are low in manufacturing cost.

[0003] In organic light emitting display devices, an electron and a hole are respectively injected from a cathode and an anode into an emitting material layer, and, when an exciton in which the injected electron and hole are combined is shifted from an excited state to a base state, light is emitted. In this case, the types of organic light emitting display devices are categorized into a top emission type, a bottom emission type, and a dual emission type according to an emission direction of light, and categorized into a passive matrix type and an active matrix type according to a driving type.

[0004] Specifically, the organic light emitting display devices includes a first electrode (anode), a hole transporting layer, an emitting material layer including a red organic emission pattern, a green organic emission pattern, and a blue organic emission pattern, an electron transporting layer, and a second electrode (cathode), which are formed in each of a red pixel area (Rp), a green pixel area (Rg), and a blue pixel area (Rb).

[0005] In the organic light emitting display devices having the configuration, when a voltage is applied to the first and second electrodes, a hole moves to the emitting material layer through the hole transporting layer, an electron moves to the emitting material layer through the electron transporting layer, and the hole and the electron are combined in the emitting material layer, thereby emitting light.

[0006] In the organic light emitting display devices, a fine metal mask (FMM) process is used for patterning the emitting material layer between two electrodes disposed on a substrate.

[0007] However, due to limitations of mask manufacturing technology, it is difficult to apply the FMM process to a large size and high resolution. That is, when the organic light emitting display device is applied to a large area, a mask sags due to the weight thereof, and thus, it is difficult to form a desired pattern. Also, the spread of organic materials increases due to a separated distance between the mask and a deposition portion, and therefore, it is difficult to realize high resolution.

[0008] For this reason, various methods of manufacturing a high-resolution organic light emitting display device are required.

SUMMARY

[0009] US 2005280355 A1 describes an organic light emitting display device having a substrate with first, second and third pixel regions. A first electrode layer is formed in each of the first, second and third pixel regions on the substrate. A hole injection layer is formed over an entire surface of the substrate on the first electrode layers. A first hole transport layer is formed on the first electrode layers in the first, second and third pixel region. A second hole transport layer is formed on the first hole transport layer in any two adjacent pixel regions among the first, second and third pixel regions. A third hole transport layer is formed on the second hole transport layer in any one of the two adjacent pixel region. A first, second and third organic emission layers are formed on the first, second and third hole transport layer. A second electrode layer is formed on the first, second and third organic emission layers.

[0010] US 2012018712 A1 describes an organic electroluminescent display that includes a plurality of organic electroluminescent devices for red, green, and blue subpixels, each including a first electrode on a light output side, a second electrode opposite the first electrode, and an organic compound layer including a light-emitting layer therebetween.

[0011] WO 2006/078005 A1 describes a light emitting device in which light emitting layers are stacked between electrodes, each distance between each light emitting layer and an electrode being approximately oddly multiplied 1/4 wavelength by controlling a thickness of a layer provided therebetween to enhance luminous output efficiency.

[0012] Documents US20110297977 and CN102593150 disclose OLED displays having hole transport layers with different thicknesses in order to generate a resonance cavity.

[0013] In the organic light emitting display devices, a fine metal mask (FMM) process is used for patterning the emitting material layer between two electrodes disposed on a substrate.

[0014] However, due to limitations of mask manufacturing technology, it is difficult to apply the FMM process to a large size and high resolution. That is, when the organic light emitting display device is applied to a large area, a mask sags due to the weight thereof, and thus, it is difficult to form a desired pattern. Also, the spread of organic materials increases due to a separated distance between the mask and a deposition portion, and therefore, it is difficult to realize high resolution.

[0015] For this reason, various methods of manufacturing a high-resolution organic light emitting display device are required.

SUMMARY

[0016] The invention is indicated in the independent claims. Further embodiments are indicated in the dependent claims.

[0017] Accordingly, the present invention is directed to an organic light emitting display device and a method of manufacturing the same that substantially obviate one or more problems due to limitations and disadvantages of the related art.

[0018] An aspect of the present invention is directed to an high-resolution organic light emitting display device for realizing excellent light output efficiency, maintaining color characteristic, simplifying a process, and saving the manufacturing cost.

[0019] Additional advantages and features of the invention will be set forth in part in the description which follows and in part will become apparent to those having ordinary skill in the art upon examination of the following or may be learned from practice of the invention. The objectives and other advantages of the invention may be realized and attained by the structure particularly pointed out in the written description and claims hereof as well as the appended drawings.

[0020] To achieve these and other advantages and in accordance with the present invention there is provided an organic light emitting display device in accordance with claim 1.

[0021] In another aspect of the present invention, there is provided a method of manufacturing an organic light emitting display device in accordance with claim 6.

[0022] It is to be understood that both the foregoing general description and the following detailed description of the present invention are exemplary and explanatory and are intended to provide further explanation of the invention as claimed.

BRIEF DESCRIPTION OF THE DRAWINGS

[0023] The accompanying drawings, which are included to provide a further understanding of the invention and are incorporated in and constitute a part of this application, illustrate embodiments of the invention and together with the description serve to explain the principle of the invention. In the drawings:

FIG. 1 is a sectional view schematically illustrating an organic light emitting display device according to an embodiment of the present invention;

FIG. 2 is a view showing comparison of emission spectrums of respective organic light emitting display devices according to a comparative example and an embodiment; and

FIGS. 3 to 5 are views showing comparison of efficient characteristics (cd/A) with respect to luminance (cd/m^2) of respective organic light emitting display devices according to a comparative example and an embodiment.

DETAILED DESCRIPTION OF THE INVENTION

[0024] Hereinafter, embodiments of the present invention will be described in detail with reference to the accompanying drawings. Like reference numerals refer to like elements throughout. In the following description, when the detailed description of the relevant known function or configuration is determined to unnecessarily obscure the important point of the present invention, the detailed description is not provided.

[0025] FIG. 1 is a sectional view schematically illustrating an organic light emitting display device according to an embodiment of the present invention.

[0026] As illustrated in FIG. 1, the organic light emitting display device includes a first electrode (anode) 110, a hole injection layer 120, a first hole transporting layer 130, a second hole transporting layer 132, a third hole transporting layer 134, a fourth hole transporting layer 136, an emitting material layer 140 including first to third emission common layers 142, 144 and 146, an electron transporting layer 150, a second electrode (cathode) 160, and a capping layer 170 that are stacked on a substrate (not shown) in which a red pixel Rp, a green pixel area Gp, and a blue pixel area Bp are defined.

[0027] Although not shown, in the organic light emitting display device, a plurality of gate lines and a plurality of data lines, which define a plurality of pixel areas Rp, Gp, and Bp by intersections therebetween, and a plurality of power lines that are extended in parallel to respective corresponding lines among the gate lines and the data lines are disposed on the substrate (not shown). A switching thin film transistor (TFT) connected to a corresponding gate line and data line and a driving TFT connected to the switching TFT are disposed in each of the pixel areas Rp, Gp, and Bp. Here, the driving TFT is connected to the first electrode 110.

[0028] In an embodiment, the organic light emitting display device includes an organic layer between the first electrode 110 and the second electrode 160 facing the first electrode 110. The organic layer includes the hole injection layer 120, the first hole transporting layer 130, the second hole transporting layer 132, the third hole transporting layer 134, the fourth hole transporting layer 136, the emitting material layer 140 including the first to third emission common layers 142, 144 and 146, and the electron transporting layer 150. Here, the first emission common layer 142 may be formed of a red organic material, the second emission common layer 144 may be formed of a green organic material, and the third emission common layer 146 may be formed of a blue organic material.

[0029] The first electrode 110 is formed in a plate shape in the red pixel area Rp, the green pixel area Gp, and the blue pixel area Bp, on the substrate (not shown). The first electrode 110 is a reflective electrode, and for example, may have a multilayer structure that includes a transparent conductive material layer (having a high work function) such as indium tin oxide (ITO) and a reflective material layer such as Ag or an Ag alloy.

[0030] The hole injection layer 120 and the first hole transporting layer 130 are formed on the first electrode 110 in respective positions corresponding to the red pixel area Rp, the green pixel area Gp, and the blue pixel area Bp. The first hole transporting layer 130 may be called a common layer, and the hole injection layer 120 may not be provided. A thickness of the hole injection layer 120 and first hole transporting layer 130 may be about 100 Å to about 600 Å, but may be adjusted in consideration of hole injection characteristic and hole transport characteristic.

[0031] The second hole transporting layer 132 is formed on the first hole transporting layer 130 in a position corresponding to the red pixel area Rp. That is, the second hole transporting layer 132 is formed between the first hole transporting layer 130 and the first emission common layer 142. A thickness of the second hole transporting layer 132 may be about 100 Å to about 1100 Å, but may be adjusted in consideration of hole transport characteristic.

[0032] The third hole transporting layer 134 is formed on the first emission common layer 142 in a position corresponding to the green pixel area Gp. That is, the third hole transporting layer 134 is formed between the first emission common layer 142 and the second emission common layer 144. A thickness of the third hole transporting layer 134 may be about 100 Å to about 750 Å, but may be adjusted in consideration of hole transport characteristic.

[0033] The fourth hole transporting layer 136 is formed on the second emission common layer 144 in a position corresponding to the blue pixel area Bp. That is, the fourth hole transporting layer 136 is formed between the second emission common layer 144 and the third emission common layer 146. A thickness of the fourth hole transporting layer 136 may be about 100 Å to about 400 Å, but may be adjusted in consideration of hole transport characteristic.

[0034] The thickness of the third transporting layer 134 is less than that of the second hole transporting layer 132 and greater than that of the fourth hole transporting layer 136.

[0035] The emitting material layer 140 is formed in respective positions corresponding to the red pixel area Rp, the green pixel area Gp, and the blue pixel area Bp. That is, an emitting material layer 140 is formed as a common layer in each pixel area, and thus, the emitting material layer 140 may be formed even without an FMM.

[0036] The first emission common layer 142 is formed on the second hole transporting layer 132 and the first hole transporting layer 130 that is disposed in respective positions corresponding to the green and blue pixel areas Gp and Bp. The second emission common layer 144 is formed on the third hole transporting layer 134 and the first emission common layer 142 that is disposed in respective positions corresponding to the red and blue pixel areas Rp and Bp. The third emission common layer 146 is formed on the fourth hole transporting layer 136 and the second emission common layer 144 that is disposed in respective positions corresponding to the red and green pixel areas Rp and Gp.

[0037] The first to third emission common layers 142, 144 and 146 may be formed to have the same thickness. For example, the thickness of each of the first to third emission common layers 142, 144 and 146 may be about 100 Å to about 400 Å, but may be adjusted in consideration of emission characteristic.

[0038] The electron transporting layer 150 is formed on the third emission common layer 146 in respective positions corresponding to the red pixel area Rp, the green pixel area Gp, and thus may be called a common layer. A thickness of the electron transporting layer 150 may be about 250 Å to about 350 Å, but may be adjusted in consideration of electron transport characteristic. The electron transporting layer 150 may act as an electron transport and injection layer, but an electron injection layer may be separately formed on the electron transporting layer 150.

[0039] The second electrode 160 is formed on the electron transporting layer 150. For example, the second electrode 160 is formed of an alloy (Mg : Ag) of Mg and Ag, and has semi-transmissive characteristic. That is, light emitted from the emitting material layer 140 is transferred to the outside through the second electrode 160, in which case some of the light is again transferred to the first electrode 110 because the second electrode 160 has semi-transmissive characteristic.

[0040] Therefore, repetitive reflection is performed between the first electrode 110 (acting as a reflective electrode) and the second electrode 160. This is called the micro-cavity effect. That is, light is repeatedly reflected in a cavity between an anode (which is the first electrode 110) and a cathode that is the second electrode 160, thereby increasing light efficiency.

[0041] In this case, light respectively emitted from the first to third emission common layers 142, 144 and 146 has different wavelengths, and thus, a thickness "d" of a cavity defined as a distance between the first and second electrodes 110 and 160 is differently set. That is, the thickness "d" of the green pixel area Gp is less than that of the red pixel area Rp that emits red light having the longest wavelength, and greater than that of the blue pixel area Bp that emits blue light having the shortest wavelength.

[0042] In the present invention, therefore, distances between the first and second electrodes 110 and 160 are differently formed by adjusting the respective thicknesses of the second to fourth hole transporting layers 132, 134 and 136. That is, the thickness of the third hole transporting layer 134 is less than that of the second hole transporting layer 132, and greater than that of the fourth hole transporting layer 136.

[0043] The capping layer 170 increases a light extraction effect, and may be formed of one of materials of the first to fourth hole transporting layers 130, 132, 134 and 136, a material of the electron transporting layer 150, and host materials of the red, green, and blue emission common layers 142, 144 and 146. Alternatively, the capping layer 170 may not be provided.

[0044] As described above, the organic light emitting display device according to an embodiment of the present invention maintains light output efficiency and color characteristic, and simultaneously realizes a high-quality image.

[0045] However, the FMM having an opening is used in correspondence with each pixel area, forming a material pattern in each of the pixel areas Rp, Gp and Bp. In this case, a process using the FMM is needed in a separate chamber, for forming the second to fourth hole transporting layers 132, 134 and 136 having different thicknesses.

[0046] First, the first electrode 110 is formed, and then, the hole injection layer 120 and the first hole transporting layer 130 are formed without the FMM in a first chamber. In the hole injection layer 120, a P-type dopant, for example, boron (B) may be doped into the material of the first hole transporting layer 130.

[0047] Subsequently, the second hole transporting layer 132 is formed in the red pixel area Rp by using a first FMM in a second chamber. In the second hole transporting layer 132, a P-type dopant, for example, boron (B) may be doped into the material of the first hole transporting layer 130.

[0048] Subsequently, the first emission common layer 142 is formed of a red organic material without the FMM in a third chamber.

[0049] Subsequently, the third hole transporting layer 134 is formed in the green pixel area Gp by using a second FMM in a fourth chamber. In the third hole transporting layer 134, a P-type dopant, for example, boron (B) may be doped into the material of the first hole transporting layer 130.

[0050] Subsequently, the second emission common layer 144 is formed of a red organic material without the FMM in a fifth chamber.

[0051] Subsequently, the fourth hole transporting layer 136 is formed in the blue pixel area Bp by using a third FMM in a sixth chamber. In the fourth hole transporting layer 136, a P-type dopant, for example, boron (B) may be doped into the material of the first hole transporting layer 130.

[0052] Subsequently, the third emission common layer 146 is formed of a blue organic material without the FMM in a seventh chamber.

[0053] Finally, the electron transporting layer 150, the second electrode 160, and the capping layer 170 are sequentially formed without the FMM in eighth to tenth chambers, respectively.

[0054] That is, a process may be performed using only three FMMs in a total of ten chambers, for implementing the micro-cavity structure.

[0055] As described above, the organic light emitting display device according to an embodiment of the present invention can solve problems due to a defective mask, simplify a process, and save the manufacturing cost.

[0056] FIG. 2 and Table 1 show comparison of emission spectrums of respective organic light emitting display devices according to a comparative example and an embodiment.

[Table 1]

Division		Result		
		Intensity	CIE_x	CIE_y
Red (R)	Comparative example	1	0.658	0.340
	Embodiment	0.98	0.659	0.339
Green (G)	Comparative example	1	0.257	0.710
	Embodiment	1.02	0.259	0.709

(continued)

Division		Result		
		Intensity	CIE_x	CIE_y
Blue (B)	Comparative example	1	0.138	0.056
	Embodiment	0.99	0.139	0.056

[0057] As shown in FIG. 2 and Table 1, it can be seen that the comparative example and an embodiment hardly have a color characteristic difference in emission spectrums in respective pixel areas Rp, Gp and Bp.

[0058] Here, the comparative example (illustrated as a dotted line) denotes a case in which a red emission layer, a green emission layer, and a blue emission layer are stacked as a single layer in each pixel area, and an embodiment (illustrated as a solid line) denotes a structure according to an embodiment of the present invention. That is, the structure is a structure in which the red, green, and blue emission layers are all included in each pixel area, in which case the red, green, and blue emission layers are sequentially stacked trebly in the red pixel area Rp, the green and blue emission layers are sequentially stacked doubly in the green pixel area Gp, and the red and green emission layers are sequentially stacked doubly in the blue pixel area Bp.

[0059] In this case, an energy band gap of the green emission layer is greater than that of the red emission layer, and less than that of the blue emission layer. That is, an electron and a hole are first combined to emit light in a layer having a broad energy band gap, and then, when an electron and a hole are again combined in a layer having an energy band gap narrower than the broad energy band gap, light may be emitted. However, an electron and a hole are first combined to emit light in a layer having a narrow energy band gap, and then, when an electron and a hole are again combined in a layer having an energy band gap broader than the narrow energy band gap, light cannot be emitted.

[0060] Therefore, as in the red pixel area Rp of FIG. 1, in a structure in which the red, green, and blue emission layers are sequentially stacked between the first and second electrodes 110 and 160, an electron and a hole are combined to emit light in the red emission layer, and then, light is not emitted from the green and blue emission layers.

[0061] Moreover, as in the green pixel area Gp of FIG. 1, in a structure in which the green and blue emission layers are sequentially stacked between the first and second electrodes 110 and 160, an electron and a hole are combined to emit light in the green emission layer, and then, light is not emitted from the blue emission layer having a broad energy band gap.

[0062] FIGS. 3 to 5 are views showing comparison of efficient characteristics (cd/A) with respect to luminance (cd/m^2) of respective organic light emitting display devices according to a comparative example and an embodiment. Here, FIG. 3 shows comparison of efficient characteristics (cd/A) with respect to luminance (cd/m^2) in the red pixel area, FIG. 4 shows comparison of efficient characteristics (cd/A) with respect to luminance (cd/m^2) in the green pixel area, and FIG. 5 shows comparison of efficient characteristics (cd/A) with respect to luminance (cd/m^2) in the blue pixel area.

[0063] As shown in FIGS. 3 to 5, it can be seen that the comparative example and an embodiment hardly have an efficient characteristic difference in each of the pixel areas Rp, Gp and Bp.

[0064] Therefore, the emitting material layer is stacked as the red, green, or blue emission common layer, but the organic light emitting display device according to an embodiment of the present invention can maintain color characteristic and realize a high-quality image.

[0065] In the specification, a top emission type of organic light emitting display device including a plurality of organic light emitting diodes (OLEDs) has been exemplified, but the spirit and scope of the present invention are not limited thereto. The present invention may be applied to organic light emitting display devices having various types such as a bottom emission type, a dual emission type, a tandem type, etc.

[0066] According to the present invention, although the red, green, and blue emission layers are formed as the common layers in the red, green, and blue pixel areas, light output efficiency is excellent, and color characteristic is maintained. Also, it is not required to form a separate emitting material layer in each pixel area, and thus, the emitting material layer is formed without using an FMM. Accordingly, color mixture is prevented, limitations due to a defective mask are overcome, a process is simplified, and the manufacturing cost is saved.

[0067] Therefore, the organic light emitting display device according to the present invention can realize high resolution.

[0068] It will be apparent to those skilled in the art that various modifications and variations can be made in the present invention without departing from the scope of the inventions. Thus, it is intended that the present invention covers the modifications and variations of this invention provided they come within the scope of the appended claims.

Claims

1. An organic light emitting display device, comprising:

a substrate, red, green, and blue pixel areas (Rp, Gp, Bp) being defined in the substrate;
a first electrode (110) disposed at each of the red, green, and blue pixel areas (Rp, Gp, Bp) on the substrate;
a first hole transporting layer (130) disposed at each of the red, green, and blue pixel areas (Rp, Gp, Bp) on the first electrode (110);
first to third emission common layers (142; 144; 146) on the first hole transporting layer (130) at each of the red, green, and blue pixel areas (Rp, Gp, Bp), wherein the second emission common layer (144) is over the first emission common layer (142), and wherein the third emission common layer (146) is over the second emission common layer (144);
an electron transporting layer (150) on the third emission common layer (146) and a second electrode layer (160) on the electron transporting layer (150) both being disposed at each of the red, green, and blue pixel areas (Rp, Gp, Bp), wherein the organic light emitting display further comprises:

a second hole transporting layer (132) disposed at the red pixel area (Rp) between the first hole transporting layer (130) and the first emission common layer (142);
a third hole transporting layer (134) disposed at the green pixel area (Gp) between the first and second emission common layers (142; 144), the thickness of the third hole transporting layer (134) being less than the thickness of the second hole transporting layer (132); and
a fourth hole transporting layer (136) disposed at the blue pixel area (Bp) between the second and third emission common layers (144; 146), the thickness of the fourth hole transporting layer (136) being less than the thickness of the third hole transporting layer (134).

2. The organic light emitting display device of claim 1, further comprising a hole injection layer (120) formed between the first electrode (110) and the first hole transporting layer (130).

3. The organic light emitting display device of claim 1, wherein each of the second to fourth hole transporting layers (132; 134; 136) comprise a P-type dopant into a material for forming the first hole transport layer (130).

4. The organic light emitting display device of claim 1, wherein the first electrode (110) is a reflective electrode comprising an Ag alloy.

5. The organic light emitting display device of claim 1, wherein,

the first electrode (110) is a reflective electrode, and
the second electrode (160) has semi-transmissive characteristic.

6. A method of manufacturing an organic light emitting display device, comprising:

forming a first electrode (110) over a substrate in which red, green, and blue pixel areas (Rp; Gp; Bp) are defined;
forming a first hole transporting layer (130) on the first electrode (110) at each of the red, green, and blue pixel areas (Rp; Gp; Bp);
forming a second hole transporting layer (132) on the first hole transporting layer (130) at the red pixel area (Rp);
forming a first emission common layer (142) on the second hole transporting layer (132) at the red pixel area (Rp) and on the first hole transporting layer (130) at the green and blue pixel areas (Gp; Bp), at the same time;
forming a third hole transporting layer (134) on the first emission common layer (142) at the green pixel area (Gp), the thickness of the third hole transporting layer (134) being less than the thickness of the second hole transporting layer (132);
forming a second emission common layer (144) on the third hole transporting layer (134) at the green pixel area (Gp) and on the first emission common layer (142) at the red and blue pixel areas (Rp; Bp), at the same time;
forming a fourth hole transporting layer (136) on the second emission common layer (144) at the blue pixel area (Bp), the thickness of the fourth hole transporting layer (136) being less than the thickness of the third hole transporting layer (134);
forming a third emission common layer (146) on the fourth hole transporting layer (136) at the blue pixel area (Bp) and on the second emission common layer (144) at the red and green pixel areas (Rp; Gp), at the same time;
forming an electron transporting layer (150) on the third emission common layer (146); and

forming a second electrode layer (160) on the electron transporting layer (150) at each of the red, green, and blue pixel areas (Rp; Gp; Bp).

7. The method of claim 6, further comprising forming, before the forming of a first hole transporting layer (130), a hole injection layer (120) on the first electrode (110).

8. The method of claim 6, wherein the first electrode (110) is a reflective electrode comprising an Ag alloy.

9. The method of claim 6, wherein each of the second to fourth hole transporting layers (132; 134; 136) is formed by doping a P-type dopant into a material for forming the first hole transport layer (130).

10. The method of claim 6, wherein,

the first electrode (110) is a reflective electrode, and
the second electrode (160) has semi-transmissive characteristic.

Patentansprüche

1. Organische lichtemittierende Anzeigevorrichtung, die Folgendes umfasst:

ein Substrat, in dem rote, grüne und blaue Bildpunktbereiche (Rp, Gp, Bp) definiert sind;
eine erste Elektrode (110), die bei den roten, grünen und blauen Bildpunktbereichen (Rp, Gp, Bp) auf dem Substrat angeordnet ist;
eine erste Lochtransportschicht (130), die bei den roten, grünen und blauen Bildpunktbereichen (Rp, Gp, Bp) auf der ersten Elektrode (110) angeordnet ist;
erste bis dritte gemeinsame Emissionsschichten (142; 144; 146) auf der ersten Lochtransportschicht (130) bei den roten, grünen und blauen Bildpunktbereichen (Rp, Gp, Bp), wobei die zweite gemeinsame Emissionsschicht (144) über der ersten gemeinsamen Emissionsschicht (142) liegt und die dritte gemeinsame Emissionsschicht (146) über der zweiten gemeinsamen Emissionsschicht (144) liegt;
eine Elektronentransportschicht (150) auf der dritten gemeinsamen Emissionsschicht (146) und eine zweite Elektrodenschicht (160) auf der Elektronentransportschicht (150), die beide bei den roten, grünen und blauen Bildpunktbereichen (Rp, Gp, Bp) angeordnet sind,
wobei die organische lichtemittierende Anzeige ferner Folgendes umfasst:

eine zweite Lochtransportschicht (132), die bei den roten Bildpunktbereichen (Rp) zwischen der ersten Lochtransportschicht (130) und der ersten gemeinsamen Emissionsschicht (142) angeordnet ist;
eine dritte Lochtransportschicht (134), die bei den grünen Bildpunktbereichen (Gp) zwischen der ersten und der zweiten gemeinsamen Emissionsschicht (142; 144) angeordnet ist, wobei die Dicke der dritten Lochtransportschicht (134) geringer als die Dicke der zweiten Lochtransportschicht (132) ist; und
eine vierte Lochtransportschicht (136), die bei den blauen Bildpunktbereichen (Bp) zwischen der zweiten und der dritten gemeinsamen Emissionsschicht (144; 146) angeordnet ist, wobei die Dicke der vierten Lochtransportschicht (136) geringer als die Dicke der dritten Lochtransportschicht (134) ist.

2. Organische lichtemittierende Anzeigevorrichtung nach Anspruch 1, die ferner eine Lochinjektionsschicht (120) umfasst, die zwischen der ersten Elektrode (110) und der ersten Lochtransportschicht (130) gebildet ist.

3. Organische lichtemittierende Anzeigevorrichtung nach Anspruch 1, wobei jede der zweiten bis vierten Lochtransportschichten (132; 134; 136) einen Dotierstoff vom P-Typ in einem Material zum Bilden der ersten Lochtransportschicht (130) umfasst.

4. Organische lichtemittierende Anzeigevorrichtung nach Anspruch 1, wobei die erste Elektrode (110) eine reflektierende Elektrode ist, die eine Ag-Legierung umfasst.

5. Organische lichtemittierende Anzeigevorrichtung nach Anspruch 1, wobei

die erste Elektrode (110) eine reflektierende Elektrode ist, und
die zweite Elektrode (160) halbdurchlässige Eigenschaften besitzt.

6. Verfahren zum Herstellen einer organischen lichtemittierenden Anzeigevorrichtung, die Folgendes umfasst:

Bilden einer ersten Elektrode (110) über einem Substrat, in dem rote, grüne und blaue Bildpunktbereiche (Rp; Gp; Bp) definiert sind;
Bilden einer ersten Lochtransportschicht (130) auf der ersten Elektrode (110) bei den roten, grünen und blauen Bildpunktbereichen (Rp; Gp; Bp);
Bilden einer zweiten Lochtransportschicht (132) auf der ersten Lochtransportschicht (130) bei dem roten Bildpunktbereich (Rp);
gleichzeitig Bilden einer ersten gemeinsamen Emissionsschicht (142) auf der zweiten Lochtransportschicht (132) bei den roten Bildpunktbereichen (Rp) und auf der ersten Lochtransportschicht (130) bei den grünen und den blauen Bildpunktbereichen (Gp; Bp);
Bilden einer dritten Lochtransportschicht (134) auf der ersten gemeinsamen Emissionsschicht (142) bei den grünen Bildpunktbereichen (Gp), wobei die Dicke der dritten Lochtransportschicht (134) geringer als die Dicke der zweiten Lochtransportschicht (132) ist;
gleichzeitig Bilden einer zweiten gemeinsamen Emissionsschicht (144) auf der dritten Lochtransportschicht (134) bei den grünen Bildpunktbereichen (Gp) und auf der ersten gemeinsamen Emissionsschicht (142) bei den roten und blauen Bildpunktbereichen (Rp; Bp);
Bilden einer vierten Lochtransportschicht (136) auf der zweiten gemeinsamen Emissionsschicht (144) bei den blauen Bildpunktbereichen (Bp), wobei die Dicke der vierten Lochtransportschicht (136) geringer als die Dicke der dritten Lochtransportschicht (134) ist;
Bilden einer dritten gemeinsamen Emissionsschicht (146) auf der vierten Lochtransportschicht (136) bei den blauen Bildpunktbereichen (Bp) und auf der zweiten gemeinsamen Emissionsschicht (144) gleichzeitig bei den roten und grünen Bildpunktbereichen (Rp; Gp);
Bilden einer Elektronentransportschicht (150) auf der dritten gemeinsamen Emissionsschicht (146); und
Bilden einer zweiten Elektrodenschicht (160) auf der Elektronentransportschicht (150) bei den roten, grünen und blauen Bildpunktbereichen (Rp; Gp; Bp).

7. Verfahren nach Anspruch 6, das ferner vor dem Bilden einer ersten Lochtransportschicht (130) das Bilden einer Lochinjektionsschicht (120) auf der ersten Elektrode (110) umfasst.

8. Verfahren nach Anspruch 6, wobei die erste Elektrode (110) eine reflektierende Elektrode ist, die eine Ag-Legierung umfasst.

9. Verfahren nach Anspruch 6, wobei jede der zweiten bis vierten Lochtransportschichten (132; 134; 136) durch Dotieren eines Dotierstoffs vom P-Typ in einem Material zum Bilden der ersten Lochtransportschicht (130) gebildet wird.

10. Verfahren nach Anspruch 6, wobei

die erste Elektrode (110) eine reflektierende Elektrode ist, und
die zweite Elektrode (160) halbdurchlässige Eigenschaften besitzt.

Revendications

1. Dispositif d'affichage électroluminescent organique, comprenant :

un substrat dans lequel des zones de pixels rouge, vert et bleu (Rp, Gp, Bp) sont définies ;
une première électrode (110) disposée à chacune des zones de pixels rouge, vert et bleu (Rp, Gp, Bp) sur le substrat ;
une première couche de transport de trous (130) disposée à chacune des zones de pixels rouge, vert et bleu (Rp, Gp, Bp) sur la première électrode (110) ;
des première à troisième couches communes d'émission (142 ; 144 ; 146) sur la première couche de transport de trous (130) à chacune des zones de pixels rouge, vert et bleu (Rp, Gp, Bp), dans lequel la deuxième couche commune d'émission (144) est sur la première couche commune d'émission (142), et dans lequel la troisième couche commune d'émission (146) est sur la deuxième couche commune d'émission (144) ;
une couche de transport d'électrons (150) sur la troisième couche commune d'émission (146) et une deuxième couche d'électrodes (160) sur la couche de transport d'électrons (150), qui sont toutes les deux disposées à chacune des zones de pixels rouge, vert et bleu (Rp, Gp, Bp),

dans lequel l'affichage électroluminescent organique comprend en outre :

une deuxième couche de transport de trous (132) disposée à la première zone de pixel rouge (Rp) entre la première couche de transport de trous (130) et la première couche commune d'émission (142) ;
une troisième couche de transport de trous (134) disposée à la zone de pixel vert (Gp) entre les première et deuxième couches communes d'émission (142 ; 144), l'épaisseur de la troisième couche de transport de trous (134) étant inférieure à l'épaisseur de la deuxième couche de transport de trous (132) ; et
une quatrième couche de transport de trous (136) disposée à la zone de pixel bleu (Bp) entre les deuxième et troisième couches communes d'émission (144 ; 146), l'épaisseur de la quatrième couche de transport de trous (136) étant inférieure à l'épaisseur de la troisième couche de transport de trous (134).

2. Dispositif d'affichage électroluminescent organique selon la revendication 1, comprenant en outre une couche d'injection de trous (120) formée entre la première électrode (110) et la première couche de transport de trous (130).

3. Dispositif d'affichage électroluminescent organique selon la revendication 1, dans lequel chacune des deuxième à quatrième couches de transport de trous (132 ; 134 ; 136) comprend un dopant de type P dans un matériau pour former la première couche de transport de trous (130).

4. Dispositif d'affichage électroluminescent organique selon la revendication 1, dans lequel la première électrode (110) est une électrode réfléchissante comprenant un alliage d'Ag.

5. Dispositif d'affichage électroluminescent organique selon la revendication 1, dans lequel

la première électrode (110) est une électrode réfléchissante, et
la deuxième électrode (160) présente une caractéristique semi-transmissive.

6. Procédé de fabrication d'un dispositif d'affichage électroluminescent organique, comprenant :

la formation d'une première électrode (110) sur un substrat dans lequel des zones de pixels rouge, vert et bleu (Rp, Gp, Bp) sont définies ;
la formation d'une première couche de transport de trous (130) sur la première électrode (110) à chacune des zones de pixels rouge, vert et bleu (Rp, Gp, Bp) ;
la formation d'une deuxième couche de transport de trous (132) sur la première couche de transport de trous (130) à la zone de pixel rouge (Rp) ;
la formation d'une première couche commune d'émission (142) sur la deuxième couche de transport de trous (132) à la zone de pixel rouge (Rp) et sur la première couche de transport de trous (130) aux zones de pixels vert et bleu (Gp ; Bp) en même temps ;
la formation d'une troisième couche de transport de trous (134) sur la première couche commune d'émission (142) à la zone de pixel vert (Gp), l'épaisseur de la troisième couche de transport de trous (134) étant inférieure à l'épaisseur de la deuxième couche de transport de trous (132) ;
la formation d'une deuxième couche commune d'émission (144) sur la troisième couche de transport de trous (134) à la zone de pixel vert (Gp) et sur la première couche commune d'émission (142) aux zones de pixels rouge et bleu (Rp ; Bp) en même temps ;
la formation d'une quatrième couche de transport de trous (136) sur la deuxième couche commune d'émission (144) à la zone de pixel bleu (Bp), l'épaisseur de la quatrième couche de transport de trous (136) étant inférieure à l'épaisseur de la troisième couche de transport de trous (134) ;
la formation d'une troisième couche commune d'émission (146) sur la quatrième couche de transport de trous (136) à la zone de pixel bleu (Bp) et sur la deuxième couche commune d'émission (144) aux zones de pixels rouge et vert (Rp ; Gp) en même temps ;
la formation d'une couche de transport d'électrons (150) sur la troisième couche commune d'émission (146) ; et
la formation d'une deuxième couche d'électrodes (160) sur la couche de transport d'électrons (150) à chacune des zones de pixels rouge, vert et bleu (Rp ; Gp ; Bp).

7. Procédé selon la revendication 6, comprenant en outre la formation, avant la formation d'une première couche de transport de trous (130), d'une couche d'injection de trous (120) formée sur la première électrode (110).

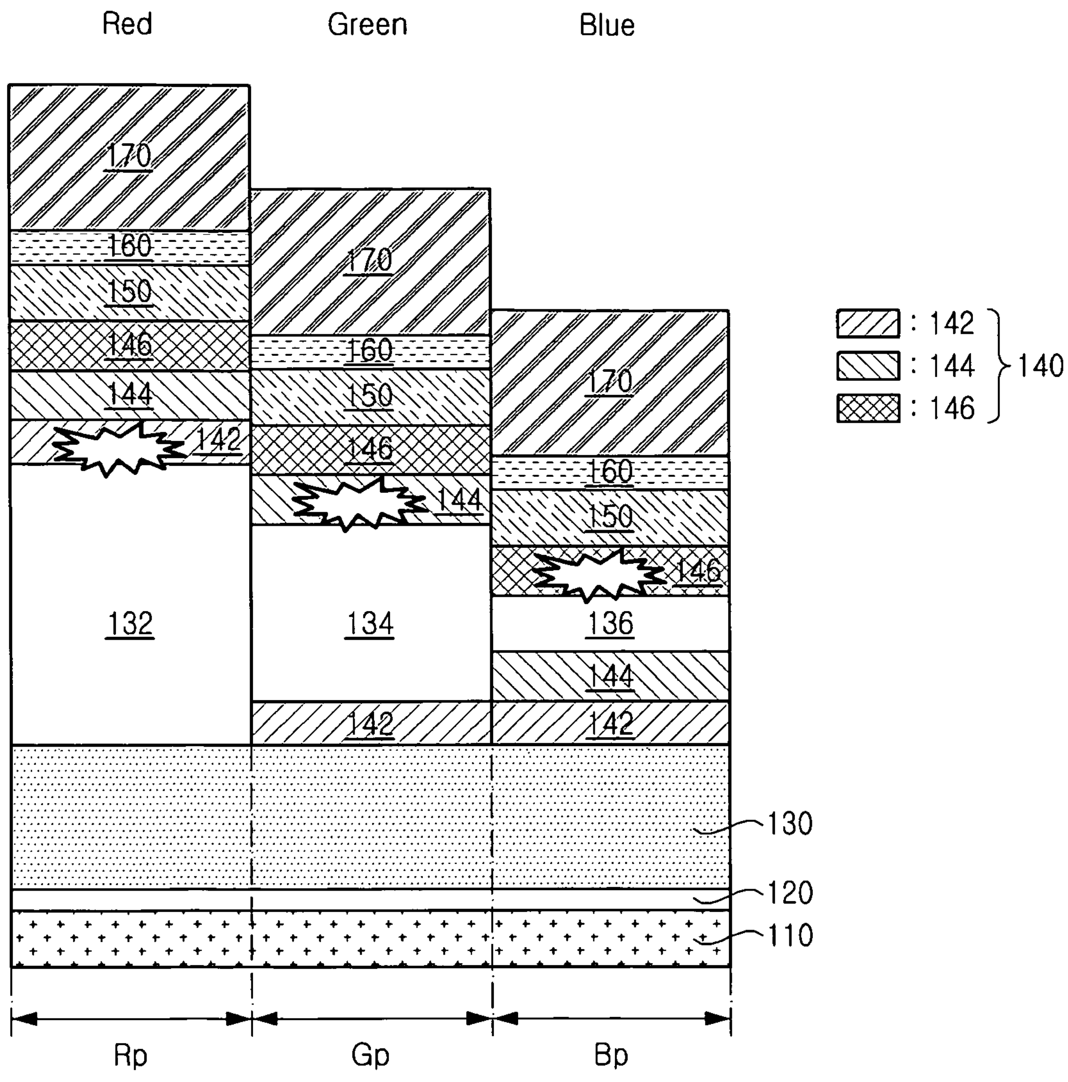
8. Procédé selon la revendication 6, dans lequel la première électrode (110) est une électrode réfléchissante comprenant un alliage d'Ag.

9. Procédé selon la revendication 6, dans lequel chacune des deuxième à quatrième couches de transport de trous (132 ; 134 ; 136) est formée par le dopage d'un dopant de type P dans un matériau pour la formation de la première couche de transport de trous (130).

10. Procédé selon la revendication 6, dans lequel

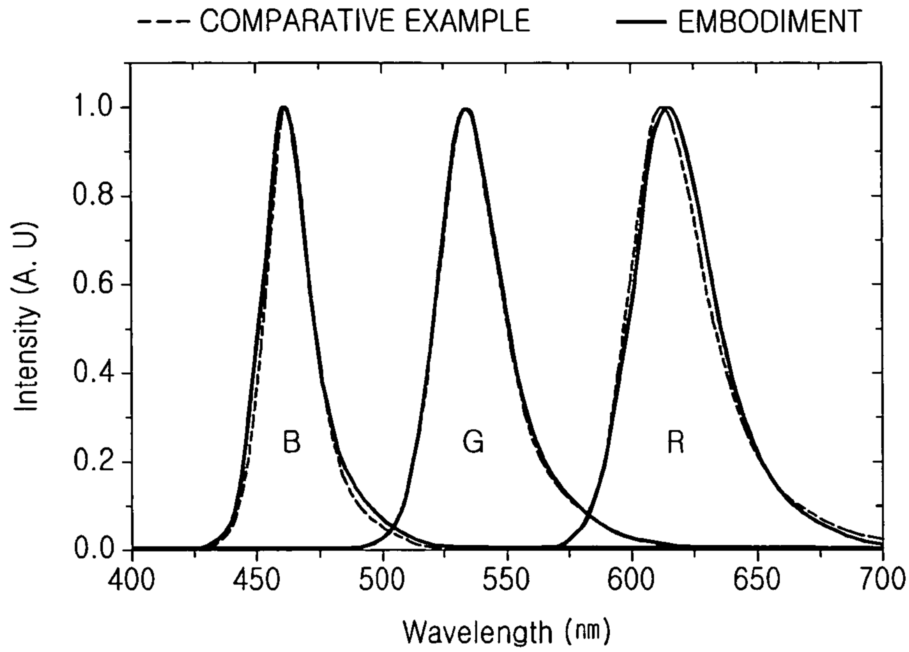
la première électrode (110) est une électrode réfléchissante, et
la deuxième électrode (160) présente une caractéristique semi-transmissive.

FIG. 1



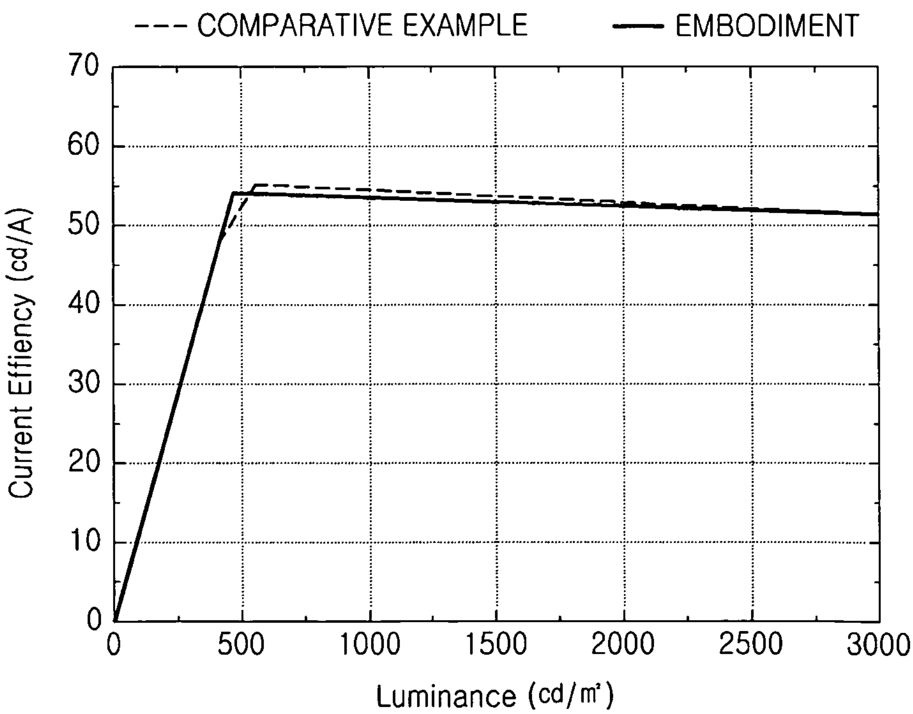
Red
Green
Blue
170
160
150
146
144
142
132
134
136
130
120
110
: 142
: 144
: 146
140
Rp
Gp
Bp

FIG. 2



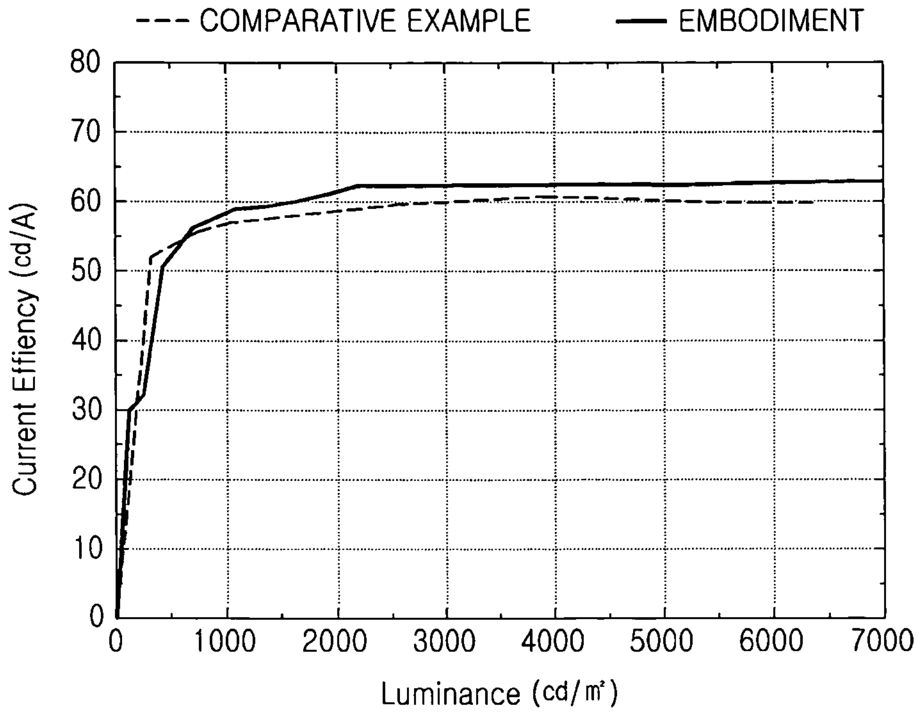
--- COMPARATIVE EXAMPLE
— EMBODIMENT
Intensity (A. U)
1.0
0.8
0.6
0.4
0.2
0.0
B
G
R
400
450
500
550
600
650
700
Wavelength (nm)

FIG. 3



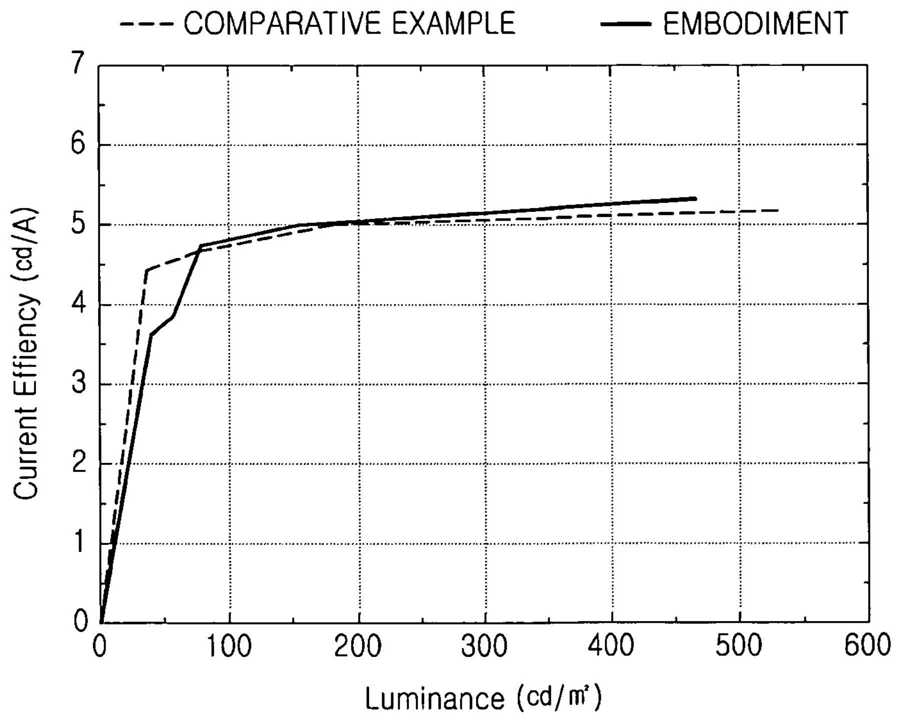
--- COMPARATIVE EXAMPLE
— EMBODIMENT
Current Effiency (cd/A)
70
60
50
40
30
20
10
0
0
500
1000
1500
2000
2500
3000
Luminance (cd/m²)

FIG. 4



--- COMPARATIVE EXAMPLE
— EMBODIMENT
Current Effiency (cd/A)
0
10
20
30
40
50
60
70
80
0
1000
2000
3000
4000
5000
6000
7000
Luminance (cd/m²)

FIG. 5



--- COMPARATIVE EXAMPLE
— EMBODIMENT
Current Effiency (cd/A)
0
1
2
3
4
5
6
7
0
100
200
300
400
500
600
Luminance (cd/m²)

REFERENCES CITED IN THE DESCRIPTION

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- CN 102593150 **[0012]**

专利名称(译)	有机发光显示装置及其制造方法		
公开(公告)号	EP2728638B1	公开(公告)日	2018-05-02
申请号	EP2012008085	申请日	2012-12-03
[标]申请(专利权)人(译)	乐金显示有限公司		
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当前申请(专利权)人(译)	LG DISPLAY CO. , LTD.		
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发明人	KIM, MI-NA KIM, KWANG HYUN PARK, JINHO		
IPC分类号	H01L51/50 H01L51/52 H01L27/32 H01L51/00 H01L51/56		
CPC分类号	H01L27/3211 H01L51/0001 H01L51/0021 H01L51/504 H01L51/506 H01L51/5064 H01L51/5072 H01L51/5088 H01L51/52 H01L51/5203 H01L51/5218 H01L51/5234 H01L51/5265 H01L51/5271 H01L51/56 H01L2251/558		
优先权	1020120121726 2012-10-31 KR		
其他公开文献	EP2728638A1		
外部链接	Espacenet		

摘要(译)

公开了一种有机发光显示装置。有机发光显示装置包括：基板，其中限定红色，绿色和蓝色像素区域;第一电极（110）和第一空穴传输层（130），其形成在基板上;第一至第三发射共用层（130）上的每个像素区域中形成的电子传输层（142,144,146）以及形成在第三发射公共层（146）上的电子传输层（150）和第二电极（160））。因此，防止了颜色混合，克服了由于有缺陷的掩模而造成的限制，简化了工艺并节省了制造成本。

FIG. 1