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(54) ORGANIC ELECTROLUMINESCENT DISPLAY DEVICE AND METHOD OF FABRICATING THE SAME

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(57) **ABSTRACT**

An organic electroluminescent display device includes first and second substrates bonded together, the first and second substrates having a plurality of pixel regions, a plurality of driving elements on an inner surface of the first substrate within each of the plurality of pixel regions, a plurality of connection electrodes contacting the driving elements, a black matrix on an inner surface of the second substrate at a boundary of each of the plurality of pixel regions, a color filter layer including red, green, and blue color filters on the inner surface of the second substrate, each of the red, green, and blue color filters corresponding to each of the plurality of pixel regions, a first electrode on the black matrix and the color filter layer, an organic electroluminescent layer on the first electrode, and at least one second electrode on the organic electroluminescent layer, wherein the at least one second electrode contacts the connection electrodes.

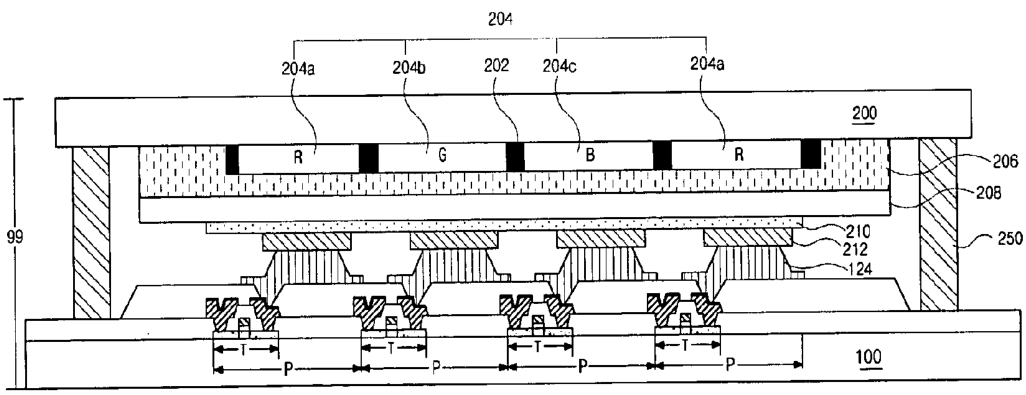


FIG. 1
RELATED ART

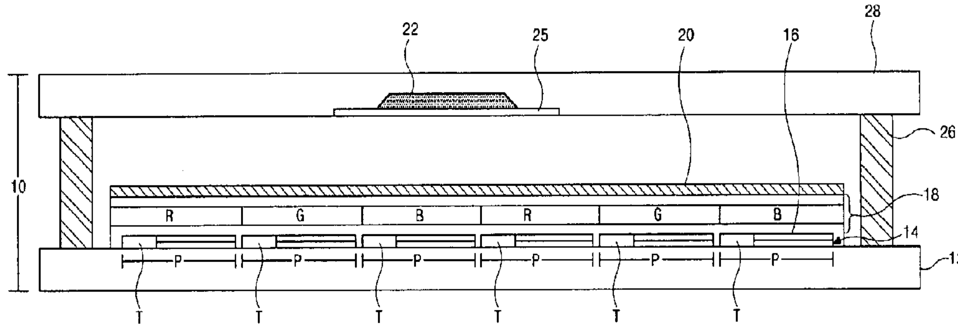


FIG. 2
RELATED ART

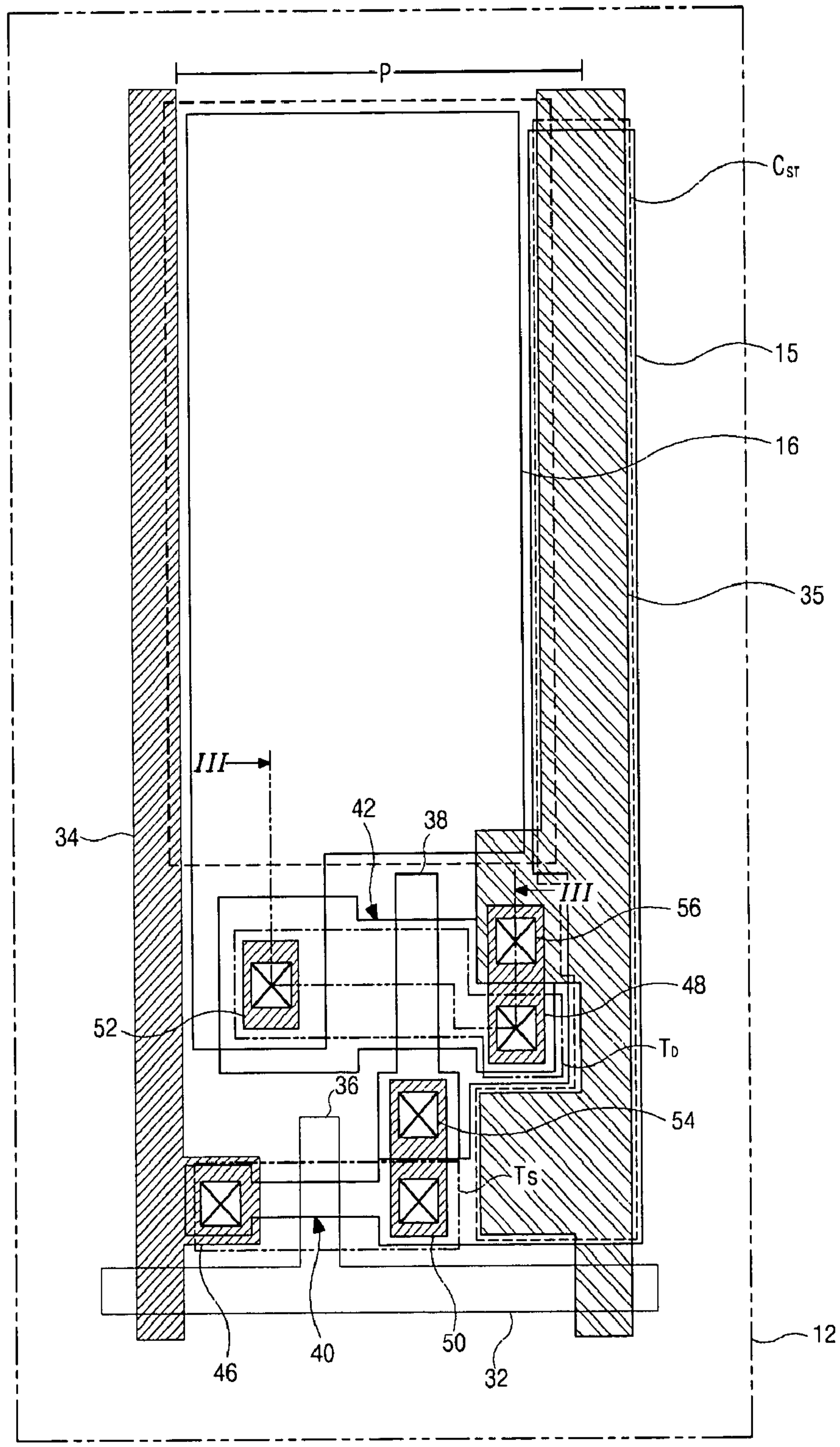


FIG. 3
RELATED ART

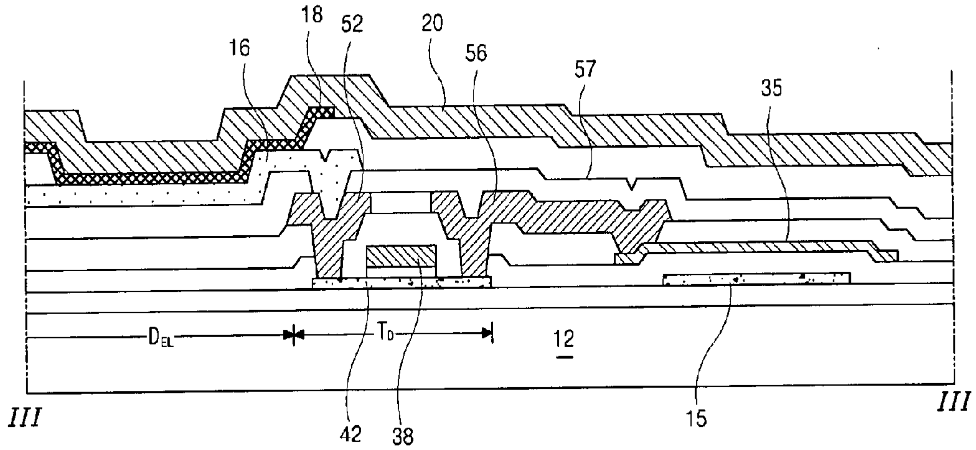


FIG. 4

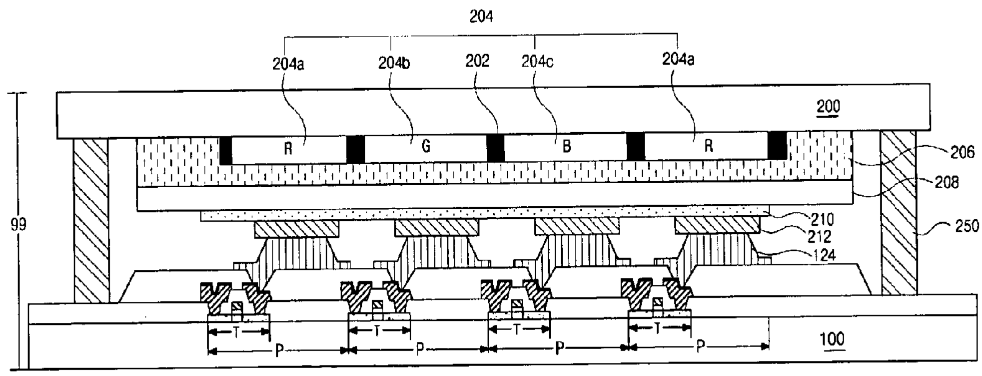


FIG. 5A

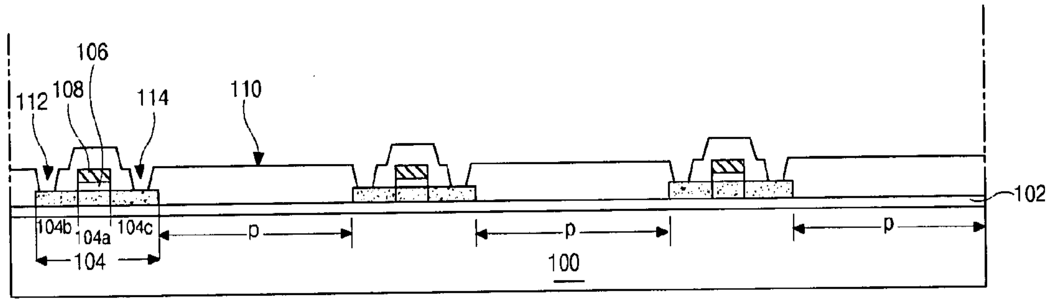

106
112
108
114
110
102
104b
104a
104c
104
p
p
p
100

FIG. 5B

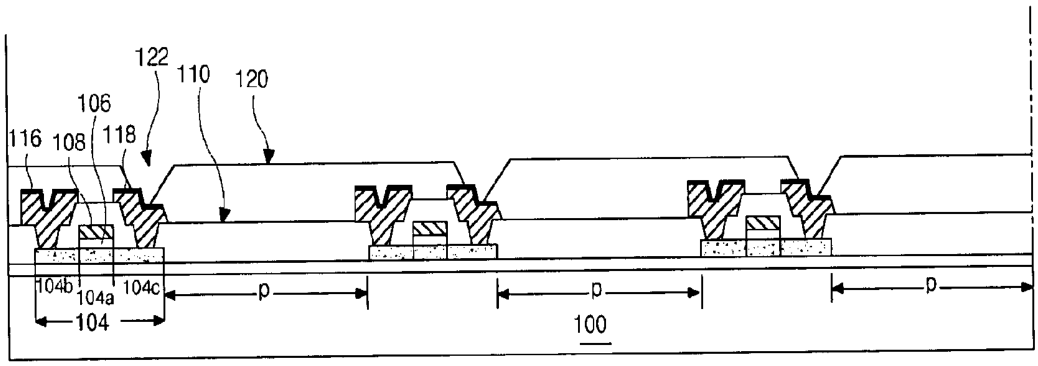

122
110
120
106
116
108
118
104b
104a
104c
104
p
p
p
100

FIG. 5C

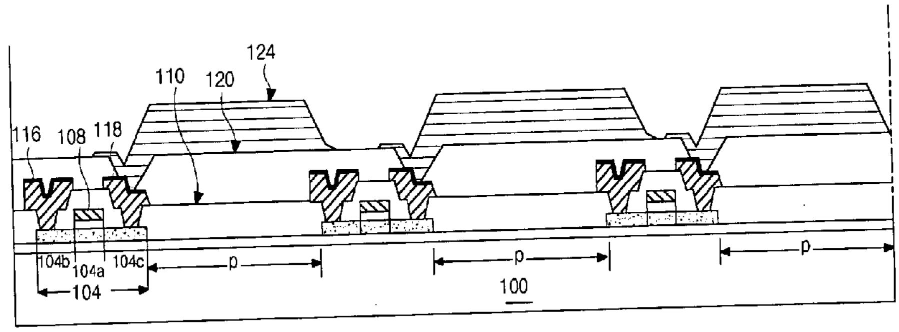


FIG. 6A

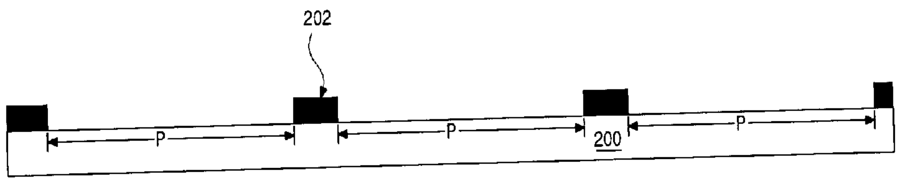


FIG. 6B

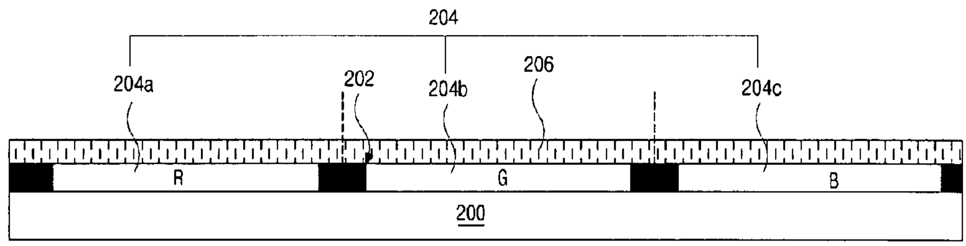

204
204a
202
204b
206
204c
R
G
B
200

FIG. 6C

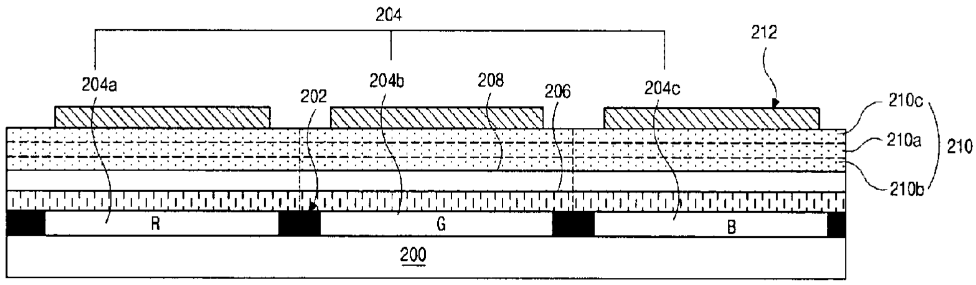

204
212
204a
202
204b
208
206
204c
210c
210a
210
210b
R
G
B
200

FIG. 7

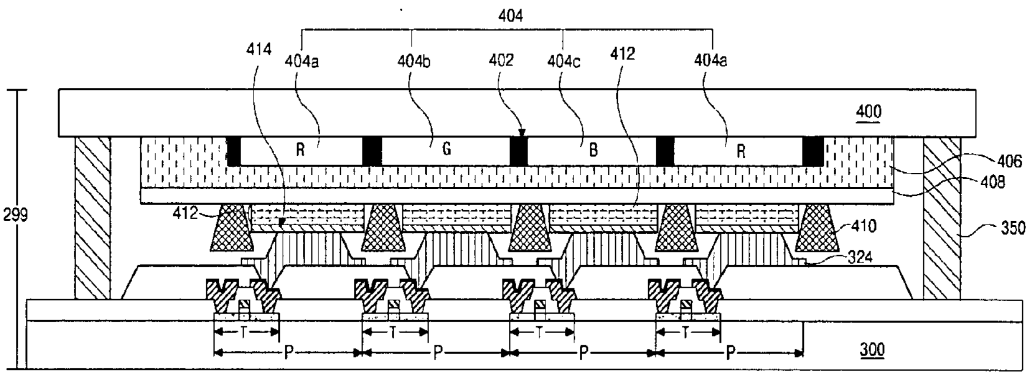

404
414
404a
404b
402
404c
412
404a
400
R
G
B
R
406
408
299
412
410
350
324
T
P
300

FIG. 8A

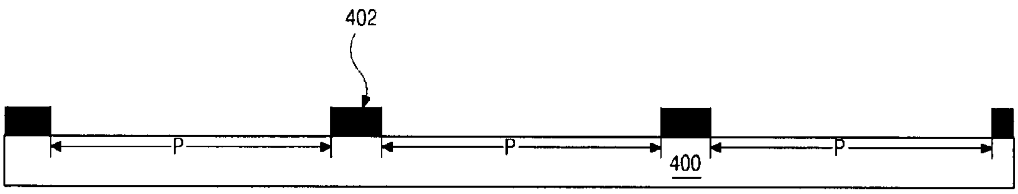

402
P
P
P
400

FIG. 8B

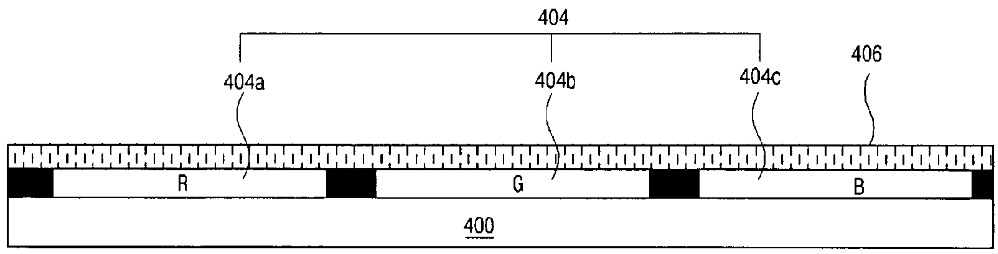

404
404a
404b
404c
406
R
G
B
400

FIG. 8C

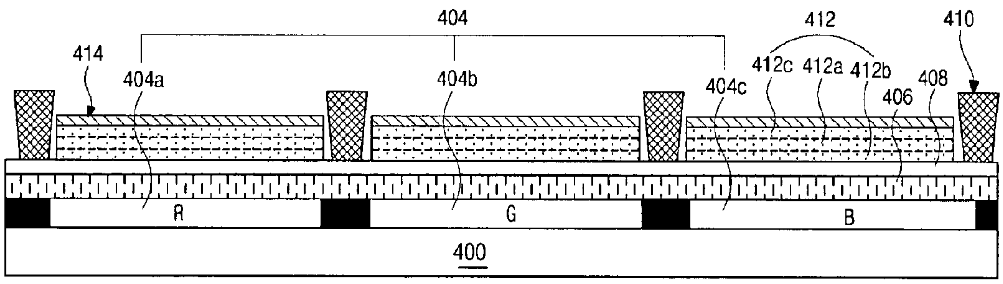

404
412
410
414
404a
404b
404c
412c
412a
412b
406
408
R
G
B
400

FIG. 9

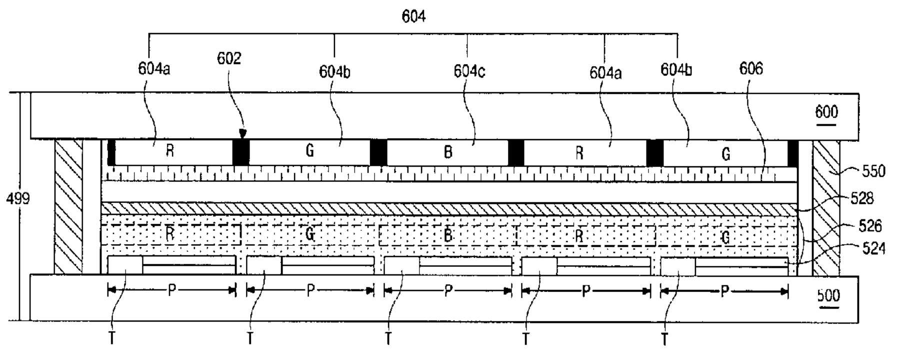

604
604a
602
604b
604c
604a
604b
606
600
550
528
526
524
499
R
G
B
R
G
R
G
B
R
G
P
P
P
P
P
500
T
T
T
T
T

FIG. 10A

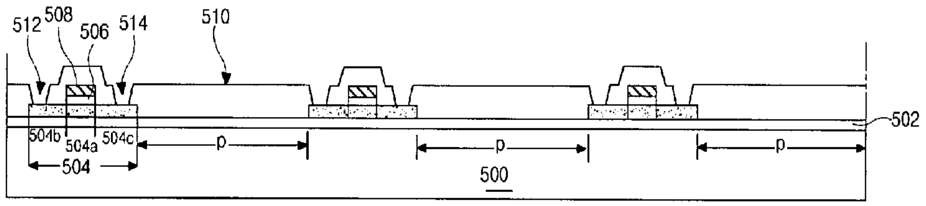

512
508
506
514
510
502
504b
504a
504c
504
p
p
p
500

FIG. 10B

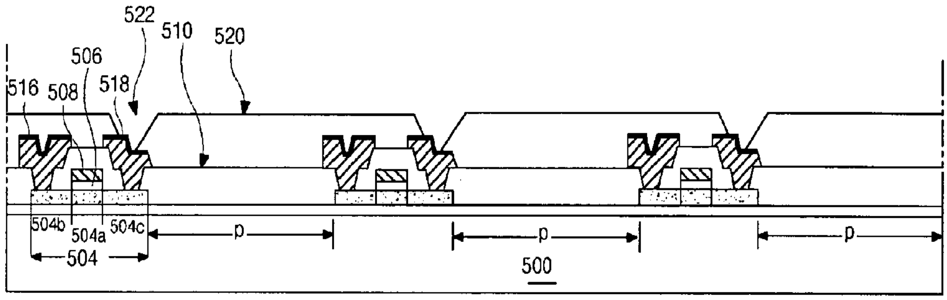


FIG. 10C

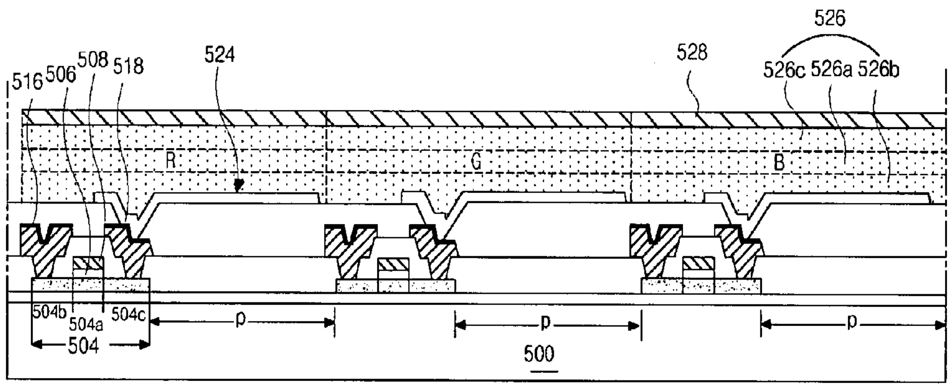


FIG. 11A

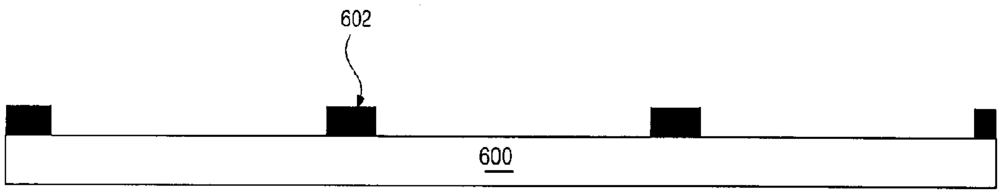


FIG. 11B

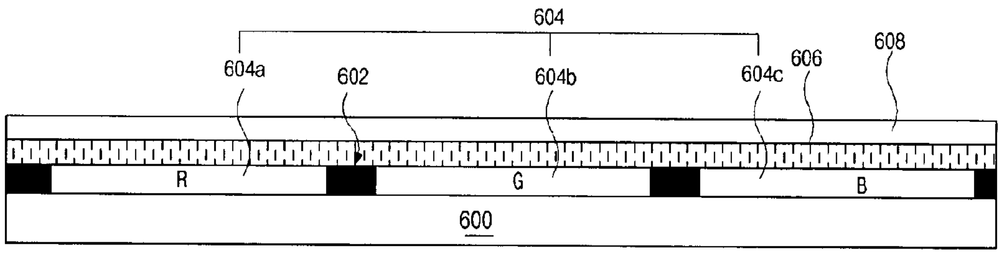


FIG. 12

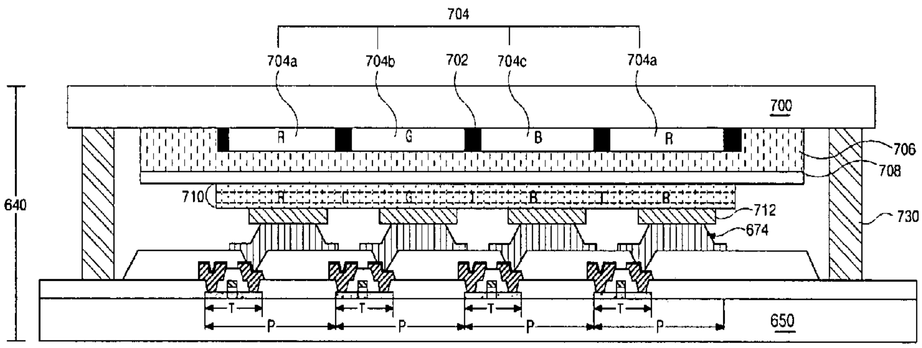


FIG. 13A

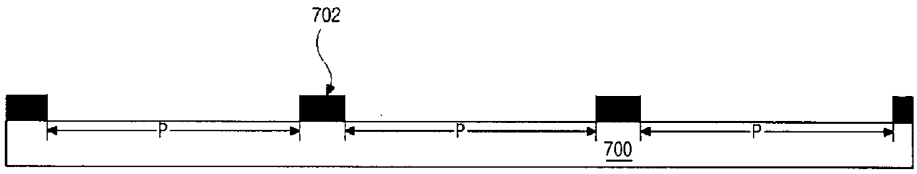


FIG. 13B

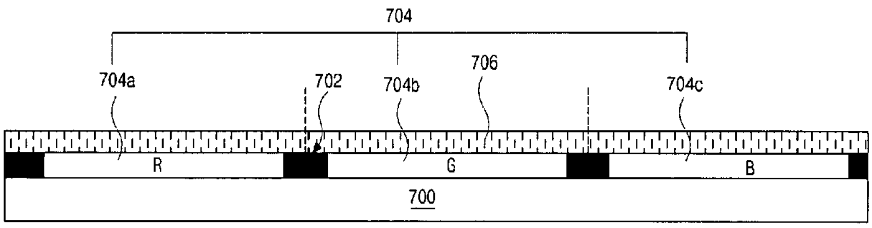


FIG. 13C

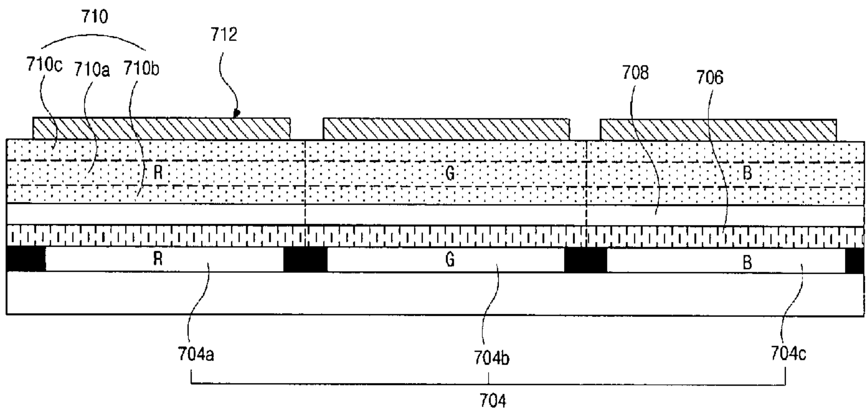


FIG. 14

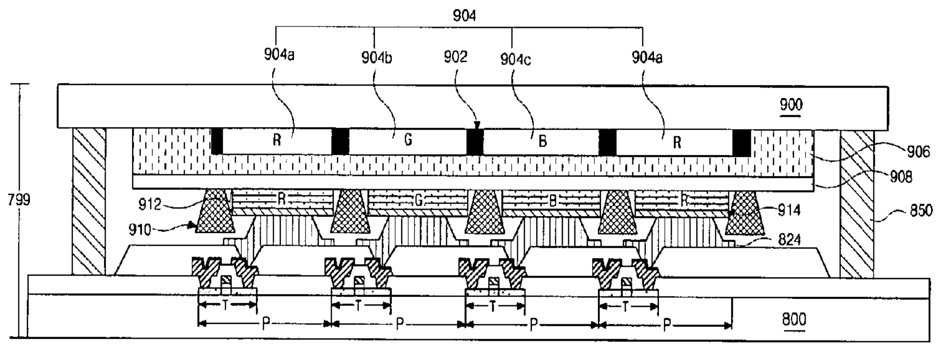


FIG. 15A

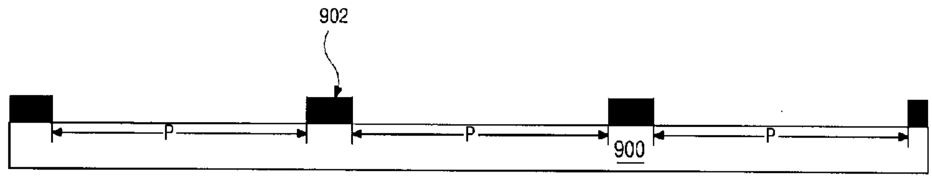


FIG. 15B

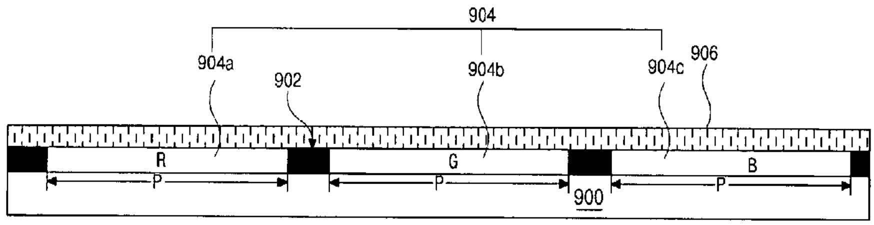
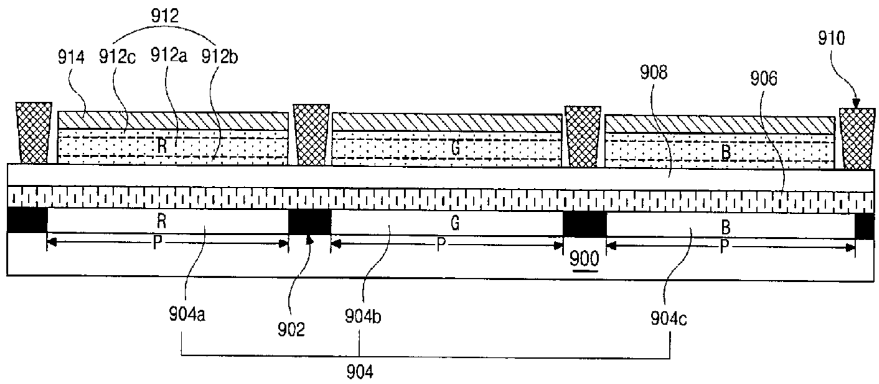


FIG. 15C



ORGANIC ELECTROLUMINESCENT DISPLAY DEVICE AND METHOD OF FABRICATING THE SAME

[0001] The present invention claims the benefit of Korean Patent Application No. 2002-49288 filed in Korea on Aug. 20, 2002, which is hereby incorporated by reference.

BACKGROUND OF THE INVENTION

[0002] 1. Field of the Invention

[0003] The present invention relates to a display device and a method of fabricating a display device, and more particularly, to an organic electroluminescent display device and a method of fabricating an organic electroluminescent display device.

[0004] 2. Discussion of the Related Art

[0005] In general, organic electroluminescent display (OELD) devices have an electron supply electrode, which is commonly referred to as a cathode, and a hole supply electrode, which is commonly referred to as an anode. The electrons and the holes are supplied to an electroluminescent layer from the cathode and anode, respectively, wherein each pair of the electrons and holes form an exciton. The OELD devices emit light when energy levels of the excitons are reduced from an excited state to a ground state. Accordingly, since OELD devices do not require additional light sources, such as a backlight device as in liquid crystal display (LCD) devices, both volume and weight of the OELD devices may be reduced. In addition, the OELD devices have low power consumption, high luminance, fast response time, and low weight. Presently, the OELD devices are commonly implemented in mobile telecommunication terminals, car navigation systems (CNSs), personal digital assistants (PDAs), camcorders, and palm computers. In addition, since manufacturing processes for the OELD devices are relatively simple as compared to LCD devices, manufacturing costs can be reduced.

[0006] The OELD devices may be classified into passive matrix-type OELD devices and active matrix-type OELD devices. Although the passive matrix-type OELD devices have simple structures and manufacturing processes are simple, they have high power consumption and are not suitable for large-sized display devices, and their aperture ratios decrease as a total number of electrical lines increase. On the other hand, the active matrix-type OELD devices have high light-emitting efficiency and high image display quality.

[0007] **FIG. 1** is cross sectional view of an OELD device according to the related art. In **FIG. 1**, an OELD device **10** has a transparent first substrate **12**, a thin film transistor array part **14**, a first electrode **16**, an organic electroluminescent layer **18**, and a second electrode **20**, wherein the thin film transistor array part **14** is formed on the transparent first substrate **12**. In addition, a second substrate **28** has a moisture absorbent desiccant **22**. The first electrode **16**, the organic electroluminescent layer **18**, and the second electrode **20** are formed over the thin film transistor array part **14**. The electroluminescent layer **18** emits red (R), green (G), and blue (B) colored light, and it is commonly formed by patterning organic material within each pixel region "P" for the R, G, and B colored light.

[0008] The OELD **10** is completed by bonding the first and second substrates **12** and **28** together by disposing a sealant **26** between the first and second substrates **12** and **28**. The moisture absorbent desiccant **22** on the second substrate **28** removes any moisture and oxygen that may have infiltrated into an interior of the OELD **10**. The moisture absorbent desiccant **22** is formed by etching away a portion of the second substrate **28**, filling the etched portion of the second substrate **28** with moisture absorbent desiccant material, and affixing the moisture absorbent desiccant material with a tape **25**.

[0009] **FIG. 2** is a plan view of a thin film transistor array part of an OELD device according to the related art. In **FIG. 2**, each of a plurality of pixel regions "P" defined on a substrate **12** includes a switching element "T_S," a driving element "T_D," and a storage capacitor "C_{ST}." The switching element "T_s" and the driving element "T_D" may be formed by combinations of more than two thin film transistors (TFTs), and the substrate **12** is formed of a transparent material, such as glass and plastic. In addition, a gate line **32** is formed along a first direction, and a data line **34** is formed along a second direction perpendicular to the first direction, wherein the data line **34** perpendicularly crosses the gate line **32** with an insulating layer provided therebetween. A power line **35** is formed along the second direction, and is spaced apart from the data line **34**. The TFT used for the switching element "T_S" has a switching gate electrode **36**, a switching active layer **40**, a switching source electrode **46**, and a switching drain electrode **50**. The TFT used for the driving element "T_D" has a driving gate electrode **38**, a driving active layer **42**, a driving source electrode **48**, and a driving drain electrode **52**. Accordingly, the switching gate electrode **36** is electrically connected to the gate line **32**, and the switching source electrode **46** is electrically connected to the data line **34**. The switching drain electrode **50** is electrically connected to the driving gate electrode **38** through a contact hole **54**, and the driving source electrode **48** is electrically connected to the power line **35** through a contact hole **56**. The driving drain electrode **52** is electrically connected to a first electrode **16** within the pixel region "P," wherein the power line **35** and a first capacitor electrode **15**, which is formed of polycrystalline silicon, form a storage capacitor "C_{ST}."

[0010] **FIG. 3** is a cross sectional view along III-III of **FIG. 2** according to the related art. In **FIG. 3**, the OELD device has a driving thin film transistor (TFT) "T_D" and an organic electroluminescent (EL) diode "D_{EL}." The driving TFT "T_D" has a driving gate electrode **38**, a driving active layer **42**, a driving source electrode **56**, and a driving drain electrode **52**. In addition, a first electrode **16** is formed over the driving TFT "T_D" and is connected to the driving drain electrode **52** with an insulating layer therebetween. The organic EL diode "D_{EL}" includes the first electrode **16**, an organic electroluminescent (EL) layer **18**, and a second electrode **20**. The organic EL layer **18** is formed on the first electrode **16** for emitting light of a particular color wavelength, and the second electrode **20** is formed on the organic EL layer **18**. A storage capacitor "C_{ST}" is connected in parallel to the driving TFT "T_D," and includes first and second capacitor electrodes **15** and **35**. The driving source electrode **56** contacts the second capacitor electrode **35**, i.e., a power line, and the first capacitor electrode **15** is formed of polycrystalline silicon material under the second capacitor electrode **35**. The second electrode **20** is formed on the substrate **12** upon which the driving TFT "T_D," the storage capacitor "C_{ST}," and the organic electroluminescent layer **18** are formed. Adjacent pixel regions may be divided by a sidewall.

[**0011**] OELD devices are classified into bottom emission-type OELD devices and top emission-type OELD devices according to a transparency of the first and second electrodes **16** and **20** of the organic EL diode "D_{EL}." While the bottom emission-type OELD devices have high image stability and variable fabrication processing due to encapsulation, they are not adequate for implementation in devices that require high image resolution due to limitations of increased aperture ratio. On the other hand, since top emission-type OELD devices emit light upward through the substrate, the light can be emitted without influencing the TFT array part that is positioned under the organic EL layer. Accordingly, design of the TFT may be simplified and aperture ratio can be increased, thereby increasing operational life span of the OELD device. However, since a cathode is commonly formed over the organic EL layer in the top emission-type OELD devices, material selection and light transmittance are limited and light transmission efficiency is lowered. If a thin film-type passivation layer is formed to prevent a reduction of the light transmittance, the thin film-type passivation layer may fail to prevent infiltration of exterior air into the device.

SUMMARY OF THE INVENTION

[**0012**] Accordingly, the present invention is directed to an organic electroluminescent display device and a method of fabricating an organic electroluminescent display device that substantially obviate one or more of the problems due to limitations and disadvantages of the related art.

[**0013**] An object of the present invention is to provide a dual panel-type organic electroluminescent display device having an array element substrate and an organic electroluminescent diode substrate.

[**0014**] Another object of the present invention is to provide a method of fabricating a dual panel-type organic electroluminescent display device having an array element substrate and an organic electroluminescent diode substrate.

[**0015**] Another object of the present invention is to provide an organic electroluminescent display device that has improved production yield, high color purity, high aperture ratio, high image resolution, and high reliability.

[**0016**] Another object of the present invention is to provide a method of fabricating an organic electroluminescent display device that has improved production yield, high color purity, high aperture ratio, high image resolution, and high reliability.

[**0017**] Additional features and advantages of the invention will be set forth in the description which follows, and in part will be apparent from the description, or may be learned by practice of the invention. The objectives and other advantages of the invention will be realized and attained by the structure particularly pointed out in the written description and claims hereof as well as the appended drawings.

[**0018**] To achieve these and other advantages and in accordance with the purpose of the present invention, as embodied and broadly described, an organic electroluminescent display device includes first and second substrates bonded together, the first and second substrates having a plurality of pixel regions, a plurality of driving elements on an inner surface of the first substrate within each of the plurality of pixel regions, a plurality of connection electrodes contacting the driving elements, a black matrix on an inner surface of the second substrate at a boundary of each of the plurality of pixel regions, a color filter layer including red, green, and blue color filters on the inner surface of the second substrate, each of the red, green, and blue color filters corresponding to each of the plurality of pixel regions, a first electrode on the black matrix and the color filter layer, an organic electroluminescent layer on the first electrode, and at least one second electrode on the organic electroluminescent layer, wherein the at least one second electrode contacts the connection electrodes.

[**0019**] In another aspect, a method of fabricating an organic electroluminescent display device includes forming a plurality of driving elements on a first substrate having a plurality of pixel regions, forming a connection pattern contacting the driving elements, forming black matrix on a second substrate having the plurality of pixel regions, the black matrix being formed along a boundary of each of the plurality of pixel regions, forming a color filter layer including red, green, and blue color filters on a second substrate, each of the red, green, and blue color filters corresponding to each of the plurality of pixel regions, forming a first electrode on the black matrix and the color filter layer, forming an organic electroluminescent layer on the first electrode, forming at least one second electrode on the organic electroluminescent layer, and bonding the first and second substrates together, wherein the connection pattern contacts the at least one second electrode.

[**0020**] In another aspect, an organic electroluminescent display device includes first and second substrates bonded together, the first and second substrates having a plurality of pixel regions, a plurality of driving elements on an inner surface of the first substrate within each of the plurality of pixel regions, a first electrode connected to the driving elements, an organic electroluminescent layer on the first electrode, at least one second electrode on the organic electroluminescent layer, a black matrix on an inner surface of the second substrate along a boundary of each of the plurality of pixel regions, and a color filter layer including red, green, and blue color filters on the inner surface of the second substrate, each of the red, green, and blue color filters corresponding to each of the plurality of pixel regions.

[**0021**] In another aspect, a method of fabricating an organic electroluminescent display device includes forming a plurality of driving elements on a first substrate having a plurality of pixel regions, forming a first electrode connected to the driving elements, forming an organic electroluminescent layer on the first electrode, forming a second electrode on the organic electroluminescent layer, forming a black matrix on a second substrate having the plurality of pixel regions, the black matrix being formed along a boundary of each of the plurality of pixel regions, forming a color filter layer including red, green, and blue color filters on the second substrate, each of the red, green, and blue color filters corresponding to each of the plurality of pixel regions, and bonding the first and second substrates together, wherein the color filter layer faces the second electrode.

[0022] In another aspect, an organic electroluminescent display device includes a plurality of driving elements on an inner surface of a first substrate within each of a plurality of pixel regions, a plurality of connection electrodes contacting the driving elements, a black matrix on an inner surface of the second substrate at a boundary of each of the plurality of pixel regions, a color filter layer including red, green, and blue color filters on the inner surface of the second substrate, each of the red, green, and blue color filters corresponding to each of the plurality of pixel regions, a first electrode on the black matrix and the color filter layer, an organic electroluminescent layer on the first electrode, and a plurality of second electrodes on the organic electroluminescent layer, wherein each of the second electrodes contact one of the connection electrodes.

[0023] In another aspect, an organic electroluminescent display device includes a plurality of driving elements on an inner surface of a first substrate within each of a plurality of pixel regions, a plurality of connection electrodes contacting the driving elements, a black matrix on an inner surface of the second substrate at a boundary of each of the plurality of pixel regions, a color filter layer including red, green, and blue color filters on the inner surface of the second substrate, each of the red, green, and blue color filters corresponding to each of the plurality of pixel regions, a first electrode on the black matrix and the color filter layer, a plurality of sidewalls on the first electrode corresponding to the black matrix, a plurality of organic electroluminescent layer segments on the first electrode between the sidewalls, each of the organic electroluminescent segments include a hole-transporting layer and an electron-transporting layer, and a plurality of second electrodes each on one of the organic electroluminescent layer segments, wherein each of the second electrodes contact one of the connection electrodes.

[0024] In another aspect, an organic electroluminescent display device includes a plurality of driving elements on an inner surface of a first substrate within each of a plurality of pixel regions, a plurality of first electrodes contacting each of the driving elements, a black matrix on an inner surface of the second substrate at a boundary of each of the plurality of pixel regions, a color filter layer including red, green, and blue color filters on the inner surface of the second substrate, each of the red, green, and blue color filters corresponding to each of the plurality of pixel regions, a planarization layer on the black matrix and the color filter layer, a second electrode on the planarization layer, and an organic electroluminescent layer on the second electrode, wherein the organic electroluminescent layer contacts each of the first plurality of electrodes.

[0025] It is to be understood that both the foregoing general description and the following detailed description are exemplary and explanatory and are intended to provide further explanation of the invention as claimed.

BRIEF DESCRIPTION OF THE DRAWINGS

[0026] The accompanying drawings, which are included to provide a further understanding of the invention and are incorporated in and constitute a part of this specification, illustrate embodiments of the invention and together with the description serve to explain the principle of the invention. In the drawings:

[0027] **FIG. 1** is cross sectional view of an OELD device according to the related art;

[0028] **FIG. 2** is a plan view of a thin film transistor array part of an OELD device according to the related art;

[0029] **FIG. 3** is a cross sectional view along III-III of **FIG. 2** according to the related art;

[0030] **FIG. 4** is a schematic cross sectional view of an exemplary OELD device according to the present invention;

[0031] **FIGS. 5A** to **5**C are schematic cross sectional views of an exemplary method of fabricating a first substrate of an OELD device according to the present invention;

[0032] **FIGS. 6A** to **6**C are schematic cross sectional views of an exemplary method of fabricating a second substrate of an OELD device according to the present invention;

[0033] **FIG. 7** is a schematic cross sectional view of another exemplary OELD device according to the present invention;

[0034] **FIGS. 8A** to **8**C are schematic cross sectional views of an exemplary method of fabricating a second substrate of an OELD device according to the present invention;

[0035] **FIG. 9** is a schematic cross sectional view of another exemplary OELD device according to the present invention;

[0036] **FIGS. 10A** to **10**C are schematic cross sectional views of an exemplary method of fabricating a first substrate of an OELD device according to the present invention;

[0037] **FIGS. 11A and 11B** are schematic cross sectional views of an exemplary method of fabricating a second substrate of an OELD device according to the present invention;

[0038] **FIG. 12** is a schematic cross sectional view of another exemplary OELD device according to the present invention;

[0039] **FIGS. 13A** to **13**C are schematic cross sectional views of an exemplary method of fabricating a second substrate of an OELD device according to the present invention;

[0040] **FIG. 14** is a schematic cross sectional view of another exemplary OELD device according to the present invention; and

[0041] **FIGS. 15A** to **15**C are schematic cross sectional views of an exemplary method of fabricating a second substrate of an OELD device according to the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0042] Reference will now be made in detail to the preferred embodiments of the present invention, examples of which are illustrated in the accompanying drawings.

[0043] **FIG. 4** is a schematic cross sectional view of an exemplary OELD device according to the present invention. In **FIG. 4**, an OELD device **99** may include first and second substrates **100** and **200** bonded together with a sealant material **250**, wherein the first and second substrates **100** and **200** may include a plurality of pixel regions "P." In addition, switching and driving thin film transistors (TFTs) "T" and array lines (not shown) may be formed on an inner surface of the first substrate **100** in each of the pixel regions "P," wherein connection electrodes **124** may contact the driving TFTs "T." Although not shown, the array lines may include a gate line, a data line, a power line, and a common line.

[**0044**] A black matrix **202** and a color filter layer **204** may be formed on an inner surface of the second substrate **200**, wherein the black matrix **202** may be disposed along a boundary of each pixel region "P" and the color filter layer **204** may include red (R), green (G), and blue (B) sub color filters **204***a*, **204***b* and **204***c* corresponding to each of the pixel regions "P." In addition, a planarization layer (i.e., overcoat layer) **206** may be formed on the black matrix **202** and the color filter layer **204**, and a first electrode **208** may be formed on the planarization layer **206**. An organic electroluminescent (EL) layer **210** may be formed on the first electrode **208**, and second electrodes **212** may be formed on the organic EL layer **210** at each of the pixel regions "P" to contact the connection electrodes **124** after bonding of the first and second substrates **100** and **200**.

[**0045**] The organic EL layer **210** may emit white colored light, i.e., light including wavelengths corresponding to red, green, and blue colors. Accordingly, the organic EL layer **210** may be formed as one body within the R, G, and B pixel regions "P," while the second electrodes **212** may be separately formed within each of the pixel regions "P" using a shadow mask. Since the light emitted from the organic EL layer **210** may be transmitted through the color filter layer **204**, images having high color purity may be obtained. Moreover, a high aperture ratio may be obtained since the OELD device **99** is a top emission-type OELD device. In addition, since the organic EL diode "D_{EL}" is formed over the second substrate **200**, production yields may be improved.

[**0046**] **FIGS. 5A** to **5**C are schematic cross sectional views of an exemplary method of fabricating a first substrate of an OELD device according to the present invention. In **FIG. 5A, a** first insulating layer (i.e., buffer layer) **102** may be formed on a first substrate **100** having a plurality of pixel regions "P" by depositing inorganic insulating material(s), such as silicon nitride (SiN_x) and silicon oxide (SiO_x). Then, an amorphous silicon (i.e., a-Si:H) layer (not shown) may be formed on the first insulating layer **102**, and crystallized to become a polycrystalline silicon layer (not shown). Accordingly, an active layer **104** including a channel region **104***a*, and source and drain regions **104***b* and **104***c* formed at both sides of the channel region **104***a* may be obtained by patterning the polycrystalline silicon layer. In addition, a dehydrogenation process may be performed before the crystallization process, wherein the crystallization process may be performed using heat and/or light.

[**0047**] A second insulating layer (i.e., gate insulating layer) **106** may be formed on the active layer **104** by depositing inorganic insulating material(s), such as silicon nitride (SiN_x) and silicon oxide (SiO_x). The second insulating layer **106** may be formed on an entire surface of the first substrate **100** without any subsequent etch process, or may be etched to have the same shape as a gate electrode **108**. After forming the gate electrode **108** on the second insulating layer **106** over the active layer **104**, the source and drain regions **104***b* and **104***c* of the active layer **104** may be doped with impurities, such as boron (B) or phosphorous (P).

[**0048**] A third insulating layer (i.e., interlayer insulating layer) **110** having first and second contact holes **112** and **114** may be formed on the gate electrode **108**. Accordingly, the first and second contact holes **112** and **114** may expose portions of the source and drain regions **104***b* and **104***c* of the active layer **104**, respectively.

[**0049**] The gate electrode **108** may include at least one of aluminum (Al), an aluminum (Al) alloy, copper (Cu), tungsten (W), tantalum (Ta), and molybdenum (Mo), and the third insulating layer **110** may include inorganic insulating material(s), such as silicon nitride (SiN_x) and silicon oxide (SiO_x).

[**0050**] In **FIG. 5**B, source and drain electrodes **116** and **118** may be formed on the third insulating layer **110** by depositing and patterning at least one conductive metallic material, such as aluminum (Al), an aluminum (Al) alloy, copper (Cu), tungsten (W), tantalum (Ta), and molybdenum (Mo). Accordingly, the source and drain electrodes **116** and **118** may be connected to the source and drain regions **104***b* and **104***c* of the active layer **104**, respectively.

[**0051**] A fourth insulating layer (i.e., passivation layer) **120** may be formed on the source and drain electrodes **116** and **118** by depositing one of inorganic insulating material(s), such as silicon nitride (SiN_x) and silicon oxide (SiO_x) and organic insulating material(s), such as benzocyclobutene (BCB) and an acrylic resin. Accordingly, the fourth insulating layer **120** may have a drain contact hole **122** exposing the drain electrode **118**.

[**0052**] In **FIG. 5C, a** connection electrode **124** contacting the drain electrode **118** may be formed on the fourth insulating layer **120** in each of the pixel regions "P."

[**0053**] Although the driving TFT "T" may have a coplanar polysilicon structure, as shown in **FIGS. 4 and 5**A to **5**C, the driving TFT "T" may be made of amorphous silicon.

[**0054**] **FIGS. 6A** to **6**C are schematic cross sectional views of an exemplary method of fabricating a second substrate of an OELD device according to the present invention. In **FIG. 6A, a** black matrix **202** may be formed on a second substrate **200** having a plurality of pixel regions "P," wherein the black matrix **202** may be disposed along a boundary of each of the pixel regions "P."

[**0055**] In **FIG. 6B, a** color filter layer **204** including red, green, and blue sub color filters **204***a*, **204***b*, and **204***c* may be formed on the second substrate **200**. Although not shown, the color filter layer **204** may be formed to cover the black matrix **202**, wherein each sub color filter **204***a*, **204***b*, or **204***c* may be disposed within the pixel regions "P." A planarization layer (i.e., overcoat layer) **206** may be formed on the black matrix **202** and the color filter layer **204** by coating organic insulating material(s), such as benzocyclobutene (BCB) and an acrylic resin.

[**0056**] In **FIG. 6C, a** first electrode **208** may be formed on the planarization layer **206** and an organic electroluminescent (EL) layer **210** for emitting white colored light may be formed on the first electrode **208**. In addition, second electrodes **212** may be formed on the organic EL layer **210** within each of the pixel regions "P." The first electrode **208** may include transparent conductive metallic material(s), such as indium-tin-oxide (ITO) and indium-zinc-oxide (IZO).

[0057] The organic EL layer **210** may be formed of a single layer structure or of a multiple layer structure. In the multiple layer structure, the organic EL layer **210** may include a hole-transporting layer **210***b* formed on the first electrode **208**, an emission layer **210***a* formed on the hole-transporting layer **210***b*, and an electron-transporting layer **210***c* formed on the emission layer **210***a*. The organic EL layer **210** may be formed as a single layered structure across the R, G, and B pixel regions "P," or the organic EL layer **210** may be formed as multiple individual structures within each of the pixel regions "P" using a shadow mask. In addition, the second electrodes **212** may be formed of a single layer structure including at least one of aluminum (Al), calcium (Ca) and magnesium (Mg), or the second electrodes **212** may be formed of a multiple layer structure including lithium fluorine/aluminum (LiF/Al). Moreover, the second electrode **212** may be independently formed within each of the pixel regions "P" using a shadow mask.

[0058] Accordingly, an OELD device may be obtained by bonding the exemplary first and second substrates **100** and **200** fabricated through processes of **FIGS. 5A** to **6**C.

[0059] **FIG. 7** is a schematic cross sectional view of another exemplary OELD device according to the present invention. In **FIG. 7**, an OELD device **299** may include first and second substrates **300** and **400** bonded together with a sealant material **350**, wherein the first and second substrates **300** and **400** may include a plurality of pixel regions "P." In addition, switching and driving thin film transistors (TFTs) "T" and array lines (not shown) may be formed on an inner surface of the first substrate **300** within each of the pixel regions "P" and connection electrodes **324** may contact each of the driving TFTs "T." Although not shown, the array lines may include a gate line, a data line, a power line, and a common line.

[0060] In **FIG. 7, a** black matrix **402** and a color filter layer **404** may be formed on an inner surface of the second substrate **400**, wherein the color filter layer **404** may include red (R), green (G), and blue (B) sub color filters **404***a*, **404***b*, and **404***c* corresponding to each of the pixel regions "P," and the black matrix **402** may be disposed along a boundary of each of the pixel regions "P."

[0061] A planarization layer (i.e., overcoat layer) **406** may be formed on the black matrix **402** and the color filter layer **404**, and a first electrode **408** may be formed on the planarization layer **406**. In addition, a plurality of sidewalls **410** corresponding to the boundary of each of the pixel regions "P" may be formed on the first electrode **408**.

[0062] A plurality of organic electroluminescent (EL) layers **412** for emitting white colored light may separately formed on the first electrode **408** between the sidewalls **410** of each of the pixel regions "P." In addition, a plurality of second electrodes **414** may be separately formed on each of the organic EL layers **412** at each of the pixel regions "P." Since the organic EL layers **412** and the second electrodes **414** are separately formed in each of the pixel regions "P" between the sidewalls **410**, it may not be necessary to use a shadow mask. Accordingly, the second electrodes **414** contact the connection electrodes **224** after bonding the first and second substrates **300** and **400** together.

[0063] **FIGS. 8A** to **8**C are schematic cross sectional views of an exemplary method of fabricating a second substrate of an OELD device according to the present invention. Since a method of fabricating a first substrate according to **FIGS. 8A** to **8**C may be similar to the method of fabricating a first substrate according to **FIGS. 6A** to **6**C, only a method of fabricating a second substrate of an OELD device according to **FIGS. 8A** to **8**C will be illustrated.

[0064] In **FIG. 8A, a** black matrix **402** may be formed on a second substrate **400** having a plurality of pixel regions "P," wherein the black matrix **402** may be disposed along a boundary of each of the pixel regions "P."

[0065] In **FIG. 8B, a** color filter layer **404** including red, green, and blue sub-color filters **404***a*, **404***b* and **404***c* may be formed on the second substrate **400**. Although not shown, the color filter layer **404** may be formed to cover the black matrix **402**. Each of the sub-color filters **404***a*, **404***b*, or **404***c* may be disposed in each of the pixel regions "P." Then, a planarization layer (i.e., overcoat layer) **406** may be formed on the black matrix **402** and the color filter layer **404** by coating organic insulating material(s), such as benzocyclobutene (BCB) and an acrylic resin.

[0066] In **FIG. 8C, a** first electrode **408** may be formed on the planarization layer **406**, and a plurality of sidewalls **410** corresponding to the boundary of each of the pixel regions "P" may be formed on the first electrode **408**. The first electrode **408** may include transparent conductive metallic material(s), such as indium-tin-oxide (ITO) and indium-zinc-oxide (IZO), and the sidewalls **410** may include one of photoresist and transparent organic materials.

[0067] Then, a plurality of organic electroluminescent (EL) layers **412** that emit white light may be formed on the first electrode **408** between the sidewall **410***s* within each of the pixel regions "P." The organic EL layers **412** may include a single layer structure or a multiple layer structure. In case the multiple layer structure, the organic EL layers **412** may each include a hole-transporting layer **412***b* formed on the first electrode **408**, an emission layer **412***a* formed on the hole-transporting layer **412***b*, and an electron-transporting layer **412***c* formed on the emission layer **412***a*.

[0068] Next, a plurality of second electrodes **414** may be formed on each of the organic EL layers **412** between the sidewalls **410** within each of the pixel regions "P." The second electrodes **414** may be a single layer including at least one of aluminum (Al), calcium (Ca), and magnesium (Mg), or may be a double layer structure including lithium fluorine/aluminum (LiF/Al).

[0069] Then, an OELD device may be obtained by bonding the first and second substrates **300** and **400** together fabricated through processes of **FIGS. 8A** to **8**C.

[0070] **FIG. 9** is a schematic cross sectional view of another exemplary OELD device according to the present invention. In **FIG. 9**, an OELD device **499** may includes first and second substrates **500** and **600** bonded together with a sealant material **550**, wherein the first and second substrates **500** and **600** may have a plurality of pixel regions "P." In addition, switching and driving thin film transistors (TFTs) "T" and array lines (not shown) may be formed on an inner surface of the first substrate **500** within each of the pixel regions "P."

[0071] Next, a plurality of first electrodes **524** that contact the driving TFTs "T" may be formed within each of the pixel regions "P," and an organic electroluminescent (EL) layer **526** may be formed on each the first electrodes **524**, wherein the organic EL layer **526** emits red, green, and blue colored light within each of the pixel regions "P." Then, a second electrode **528** may be formed on the organic EL layer **526**, and may include opaque conductive material(s), such as aluminum (Al) and chromium (Cr). To obtain a top emission-type OELD device, the second electrode **528** may be formed to have a thickness of about several tens of angstroms for light transparency. Furthermore, an additional transparent electrode (not shown) may be formed on the second electrode **528**.

[**0072**] Then, a black matrix **602** and a color filter layer **604** may be formed on an inner surface of the second substrate **600**, wherein the black matrix **602** may be disposed along a boundary of each of the pixel regions "P" and the color filter layer **604** may include red (R), green (G), and blue (B) sub-color filters **604***a*, **604***b*, and **604***c* corresponding to each of the pixel regions "P." Next, a planarization layer (i.e., overcoat layer) **606** may be formed on the black matrix **602** and the color filter layer **604**.

[**0073**] The organic EL layer **526** may emit one of red, green, and blue colored light and may be separately formed within each of the pixel regions "P," and one of the sub-color filters **604***a*, **604***b*, or **604***c* corresponding to a specific color may be disposed over the organic EL layer **526**. Accordingly, high color purity may be obtained.

[**0074**] **FIGS. 10A** to **10**C are schematic cross sectional views of an exemplary method of fabricating a first substrate of an OELD device according to the present invention. In **FIG. 10A, a** first insulating layer (i.e., buffer layer) **502** may be formed on a first substrate **500** having a plurality of pixel regions "P" by depositing inorganic insulating material(s), such as silicon nitride (SiN_x) and silicon oxide (SiO_x).

[**0075**] Then, an amorphous silicon (i.e., a-Si:H) layer (not shown) may be formed on the first insulating layer **502**, and may be crystallized to become polycrystalline silicon (not shown). Next, an active layer **504** including a channel region **504***a*, and source and drain regions **504***b* and **504***c* may be formed at both sides of the channel region **504***a* by patterning the polycrystalline silicon layer. In addition, a dehydrogenation process may be performed before the crystallization process, wherein the crystallization process may be performed using heat or light.

[**0076**] Next, a second insulating layer (i.e., gate insulating layer) **506** may be formed on the active layer **504** by depositing inorganic insulating material(s), such as silicon nitride (SiN_x) and silicon oxide (SiO_x). The second insulating layer **506** may be formed on an entire surface of the first substrate **500** without any subsequent etch process, or may be etched to have the same shape as a gate electrode **508** after forming the gate electrode **508**. The gate electrode **508** may include conductive metallic material(s), such as aluminum (Al), an aluminum (Al) alloy, copper (Cu), tungsten (W), tantalum (Ta), and molybdenum (Mo). Then, the source and drain regions **504***b* and **504***c* of the active layer **504** may be doped with impurities, such as boron (B) or phosphorous (P).

[**0077**] A third insulating layer (i.e., interlayer insulating layer) **510** having first and second contact holes **512** and **514** may be formed on the gate electrode **508**, wherein the first and second contact holes **512** and **514** may expose the source and drain regions **504***b* and **504***c* of the active layer **504**, respectively. The third insulating layer **510** may include inorganic insulating material(s), such as silicon nitride (SiN_x) and silicon oxide (SiO_x).

[**0078**] In **FIG. 10**B, source and drain electrodes **516** and **518** may be formed on the third insulating layer **510** by depositing and patterning conductive metallic material(s), such as aluminum (Al), an aluminum (Al) alloy, copper (Cu), tungsten (W), tantalum (Ta), and molybdenum (Mo). Accordingly, the source and drain electrodes **516** and **518** may be connected to the source and drain regions **504***b* and **504***c* of the active layer **504**, respectively.

[**0079**] A fourth insulating layer (i.e., passivation layer) **520** may be formed on the source and drain electrodes **516** and **518** by depositing inorganic insulating material(s), such as silicon nitride (SiN_x) and silicon oxide (SiO_x), and/or organic insulating material(s), such as benzocyclobutene (BCB) and an acrylic resin. In addition, the fourth insulating layer **520** may have a drain contact hole **522** to expose the drain electrode **118**.

[**0080**] In **FIG. 10C, a** first electrode **524** connected to the drain electrode **518** is formed on the fourth insulating layer **520**, wherein the first electrode **524** may include transparent conductive material(s) having high work function, such as indium-tin-oxide (ITO) and indium-zinc-oxide (IZO). Then, an organic electroluminescent (EL) layer **526** emitting red, green, and blue colored lights within each of the pixel regions "P" may be formed on the first electrode **524**. The organic EL layer **526** may be formed of a single layer structure or a multiple layer structure. In case the multiple layer structure, the organic EL layer **526** may include a hole-transporting layer **526***b* formed on the first electrode **524**, an emission layer **526***a* formed on the hole-transporting layer **526***b*, and an electron-transporting layer **526***c* formed on the emission layer **526***a*.

[**0081**] Next, a second electrode **528** may be formed on the organic EL layer **526**. The second electrode **528** may include opaque conductive material(s), such as aluminum (Al) and chromium (Cr) formed to have a thickness of about several tens of angstroms for light transparency. Moreover, an additional transparent electrode (not shown) may be formed on the second electrode **528** to improve hardness of the second electrode **528**.

[**0082**] **FIGS. 11A and 11B** are schematic cross sectional views of an exemplary method of fabricating a second substrate of an OELD device according to the present invention. In **FIG. 11A, a** black matrix **602** may formed on a second substrate **600** having a plurality of pixel regions, wherein the black matrix **602** may be disposed along a boundary of each of the pixel regions.

[**0083**] In **FIG. 11B, a** color filter layer **604** including red, green, and blue sub-color filters **604***a*, **604***b*, and **604***c* may be formed on the second substrate **600**, wherein each of the sub-color filters **604***a*, **604***b*, or **604***c* may be disposed within the pixel region. Although not shown, the color filter layer **604** may be formed to cover the black matrix **602**.

[**0084**] Then, a planarization layer (i.e., overcoat layer) **606** may be formed on the black matrix **602** and the color filter layer **604** by coating organic insulating material(s), such as benzocyclobutene (BCB) and an acrylic resin. Next, a passivation layer **608** may be formed on the planarization layer **606**.

[**0085**] Next, an OELD device may be obtained by bonding the first and second substrates **500** and **600** together fabricated through processes of **FIGS. 10A** to **10**C, **11**A, and 11B.

[**0086**] **FIG. 12** is a schematic cross sectional view of another exemplary OELD device according to the present invention. In **FIG. 12**, an OELD device **640** may include first and second substrates **650** and **700** bonded together with a sealant material **730**, wherein the first and second substrates **650** and **700** may include a plurality of pixel regions "P." In addition, switching and driving thin film transistors (TFTs) "T" and array lines (not shown) may be formed on an inner surface of the first substrate **650** within each of the pixel regions "P," wherein a plurality of connection electrodes **674** contacts each of the driving TFTs "T." Although not shown, the array lines may include a gate line, a data line, a power line, and a common line.

[**0087**] Next, a black matrix **702** and a color filter layer **704** may be formed on an inner surface of the second substrate **700**, wherein the black matrix **702** may be disposed along a boundary of each of the pixel regions "P" and the color filter layer **704** may include red (R), green (G), and blue (B) sub-color filters **704***a*, **704***b*, and **704***c* corresponding to each of the pixel regions "P." Then, a planarization layer (i.e., overcoat layer) **706** may be formed on the black matrix **702** and the color filter layer **704**, and a first electrode **708** may be formed on the planarization layer **706**.

[**0088**] Next, an organic electroluminescent (EL) layer **710** may be formed on the first electrode **708** using a shadow mask to emit one of red, green, and blue colored light corresponding to the sub-color filter **704***a*, **704***b*, or **704***c* within each of the pixel regions "P." Then, a plurality of second electrodes **712** may be separately formed on the organic EL layer **710** within each of the pixel regions "P," wherein each of the second electrodes **712** may contact each of the connection electrodes **674** after bonding the first and second substrates **650** and **700** together.

[**0089**] **FIGS. 13A** to **13**C are schematic cross sectional views of an exemplary method of fabricating a second substrate of an OELD device according to the present invention. In **FIG. 13A, a** black matrix **702** may be formed on a second substrate **700** having a plurality of pixel regions "P," wherein the black matrix **702** may be disposed along a boundary of each of the pixel regions "P."

[**0090**] In **FIG. 13B, a** color filter layer **704** including red, green, and blue sub-color filters **704***a*, **704***b*, and **704***c* may be formed on the second substrate **700**, wherein each of the sub-color filters **704***a*, **704***b*, or **704***c* may be disposed within each of the pixel regions "P." Although not shown, the color filter layer **704** may be formed to cover the black matrix **702**.

[**0091**] Next, a planarization layer (i.e., overcoat layer) **706** may be formed on the black matrix **702** and the color filter layer **704** by coating organic insulating material(s), such as benzocyclobutene (BCB) and an acrylic resin.

[**0092**] In **FIG. 13C, a** first electrode **708** may be formed on the planarization layer **706**, and an organic electroluminescent (EL) layer **710** may be formed on the first electrode **708** within each of the pixel regions "P." The organic EL layer **710** may be formed using a shadow mask to emit one of red, green, and blue colored lights corresponding to one of the sub-color filters **704***a*, **704***b*, or **704***c*. The first electrode **708** may include transparent conductive metallic material(s), such as indium-tin-oxide (ITO) and indium-zinc-oxide (IZO). In addition, the organic EL layer **710** may be formed of a single layer structure or a multiple layer structure. In the multiple layer structure, the organic EL layer **710** may include a hole-transporting layer **710***b* formed on the first electrode **708**, an emission layer **710***a* formed on the hole-transporting layer **710***b*, and an electron-transporting layer **710***c* formed on the emission layer **710***a*.

[**0093**] Next, a plurality of second electrodes **712** may be formed on the organic EL layer **710** within each of the pixel regions "P." The second electrode **712** may include a single layer structure including at least one of aluminum (Al), calcium (Ca), and magnesium (Mg) or may be a double layer structure including lithium fluorine/aluminum (LiF/Al).

[**0094**] Accordingly, an OELD device may be obtained by bonding the first and second substrates **650** and **700** together fabricated through processes of **FIGS. 13A** to **13**C.

[**0095**] **FIG. 14** is a schematic cross sectional view of another exemplary OELD device according to the present invention. In **FIG. 14**, an OELD device **799** may include first and second substrates **800** and **900** bonded together with a sealant material **850**, wherein the first and second substrates **800** and **900** may include a plurality of pixel regions "P." In addition, switching and driving thin film transistors (TFTs) "T" and array lines (not shown) may be formed on an inner surface of the first substrate **800** within each of the pixel regions "P," wherein a plurality of connection electrode **824** may contact each of the driving TFTs "T." Although not shown, the array lines may include a gate line, a data line, a power line, and a common line.

[**0096**] A black matrix **902** and a color filter layer **904** may be formed on an inner surface of the second substrate **900**, wherein the black matrix **902** is disposed at a boundary of each pixel region "P," and the color filter layer **904** may include red (R), green (G), and blue (B) sub-color filters **904***a*, **904***b*, and **904***c* corresponding to each of the pixel regions "P." In addition, a planarization layer (i.e, overcoat layer) **906** may be formed on the black matrix **902** and the color filter layer **904**, and a first electrode **908** may be formed on the planarization layer **906**.

[**0097**] A plurality of sidewalls **910** each corresponding to the boundary of each of the pixel regions "P" may be formed on the first electrode **908**, and a plurality of organic electroluminescent (EL) layers **912** emitting white light may be separately formed on the first electrode **908** between the sidewalls **910** within each of the pixel regions "P." In addition, a plurality of second electrodes **914** may be separately formed on each of the organic EL layers **912** within each of the pixel regions "P." Since the organic EL layers **912** and the second electrodes **914** may be separately formed within each of the pixel regions "P" between each of the sidewalls **910**, it may not be necessary to use a shadow mask.

[**0098**] Accordingly, the second electrodes **914** may contact the connection electrodes **824** when the first and second substrates **800** and **900** are bonded together.

[0099] **FIGS. 15A** to **15**C are schematic cross sectional views of an exemplary method of fabricating a second substrate of an OELD device according to the present invention. In **FIG. 15A, a** black matrix **902** may be formed on a second substrate **900** having a plurality of pixel regions "P," wherein the black matrix **902** may be disposed along a boundary of each of the pixel regions "P."

[0100] In **FIG. 15B, a** color filter layer **904** including red, green, and blue sub-color filters **904***a*, **904***b*, and **904***c* may be formed on the second substrate **900**, wherein one of the sub-color filters **904***a*, **904***b*, or **904***c* may be disposed within each of the pixel regions "P." Although not shown, the color filter layer **904** can be formed to cover the black matrix **902**. Next, a planarization layer (an overcoat layer) **906** may be formed on the black matrix **902** and the color filter layer **904** by coating organic insulating material(s), such as benzocyclobutene (BCB) and an acrylic resin.

[0101] In **FIG. 15C, a** first electrode **908** may be formed on the planarization layer **906**, and a plurality of sidewalls **910** corresponding to the boundary of each of the pixel regions "P" may be formed on the first electrode **908**, wherein the sidewalls **910** may include photoresist and/or transparent organic material(s). Next, a plurality of organic electroluminescent (EL) layers **912** emitting one of red, green, and blue colored light may be formed on the first electrode **908** between the sidewalls **910** within each of the pixel regions "P." The first electrode **908** may include transparent conductive metallic material(s), such as indium-tin-oxide (ITO) and indium-zinc-oxide (IZO), and the organic EL layers **912** may be formed of a single layer structure or a multiple layer structure. In the multiple layer structure, the organic EL layers **912** may include a hole-transporting layer **912***b* formed on the first electrode **908**, an emission layer **912***a* formed on the hole-transporting layer **912***b*, and an electron-transporting layer **912***c* formed on the emission layer **912***a*.

[0102] Then, a plurality of second electrodes **914** may be formed on each of the organic EL layers **912** within each of pixel regions "P." The second electrodes **914** may have a single layer structure including one of aluminum (Al), calcium (Ca), and magnesium (Mg), or may be a double layer structure including lithium fluorine/aluminum.

[0103] Accordingly, an OELD device may be obtained by bonding the first and second substrates **800** and **900** together fabricated through processes of **FIGS. 15A** to **15**C.

[0104] An OELD device according to the present invention has several advantages. First, since the OELD devices include both a color filter layer and an organic EL layer, color purity is improved. Second, since the OELD devices are top emission-type OELD devices, a thin film transistor may be easily designed, and high image resolution and high aperture ratio may be obtained regardless of lower array patterns. Third, since array patterns and an organic EL diode may be formed on respective substrates, production yield and a production management efficiency are improved, and a lifetime of the OELD devices is lengthened.

[0105] It will be apparent to those skilled in the art that various modifications and variations can be made in the organic electroluminescent display device and a method of fabricating an organic electroluminescent display device method of the present invention without departing from the spirit or scope of the invention. Thus, it is intended that the present invention cover the modifications and variations of this invention provided they come within the scope of the appended claims and their equivalents.

What is claimed is:

1. An organic electroluminescent display device, comprising:

first and second substrates bonded together, the first and second substrates having a plurality of pixel regions;

a plurality of driving elements on an inner surface of the first substrate within each of the plurality of pixel regions;

a plurality of connection electrodes contacting the driving elements;

a black matrix on an inner surface of the second substrate at a boundary of each of the plurality of pixel regions;

a color filter layer including red, green, and blue color filters on the inner surface of the second substrate, each of the red, green, and blue color filters corresponding to each of the plurality of pixel regions;

a first electrode on the black matrix and the color filter layer;

an organic electroluminescent layer on the first electrode; and

at least one second electrode on the organic electroluminescent layer,

wherein the at least one second electrode contacts the connection electrodes.

2. The device according to claim 1, wherein the organic electroluminescent layer includes an organic material emitting white light.

3. The device according to claim 1, wherein the organic electroluminescent layer includes an organic material emitting red, green, and blue colored light corresponding to each of the red, green, and blue color filters.

4. The device according to claim 1, further comprising a plurality of sidewalls on the first electrode corresponding to the black matrix.

5. The device according to claim 1, further comprising a planarization layer between the first electrode and the color filter layer, the planarization layer includes a transparent insulating material.

6. The device according to claim 1, wherein the first electrode includes one of a indium-tin-oxide (ITO) and indium-zinc-oxide (IZO).

7. The device according to claim 1, wherein the at least one second electrode includes at least one of aluminum (Al), calcium (Ca), magnesium (Mg), and lithium (Li).

8. The device according to claim 1, wherein the organic electroluminescent layer includes a hole-transporting layer and an electron-transporting layer.

9. The device according to claim 1, wherein the at least one second electrode includes a plurality of the second electrodes.

10. The device according to claim 9, wherein each of the plurality of second electrodes contact each of the connection electrodes.

11. The device according to claim 9, wherein each of the plurality of second electrodes include a double layered structure including lithium flourine and aluminum.

12. A method of fabricating an organic electroluminescent display device, comprising:

forming a plurality of driving elements on a first substrate having a plurality of pixel regions;

forming a connection pattern contacting the driving elements;

forming black matrix on a second substrate having the plurality of pixel regions, the black matrix being formed along a boundary of each of the plurality of pixel regions;

forming a color filter layer including red, green, and blue color filters on a second substrate, each of the red, green, and blue color filters corresponding to each of the plurality of pixel regions;

forming a first electrode on the black matrix and the color filter layer;

forming an organic electroluminescent layer on the first electrode;

forming at least one second electrode on the organic electroluminescent layer; and

bonding the first and second substrates together,

wherein the connection pattern contacts the at least one second electrode.

13. The method according to claim 12, wherein the organic electroluminescent layer includes an organic material emitting white light.

14. The method according to claim 12, wherein the organic electroluminescent layer includes an organic material emitting red, green, and blue colored lights corresponding to each of the red, green, and blue color filters.

15. The method according to claim 14, further comprising forming a plurality of sidewalls on the first electrode corresponding to the black matrix.

16. The method according to claim 14, further comprising forming a planarization layer between the first electrode and the color filter layer, the planarization layer includes a transparent insulating material.

17. The method according to claim 14, wherein the organic electroluminescent layer includes a hole-transporting layer and an electron-transporting layer.

18. An organic electroluminescent display device, comprising:

first and second substrates bonded together, the first and second substrates having a plurality of pixel regions;

a plurality of driving elements on an inner surface of the first substrate within each of the plurality of pixel regions;

a first electrode connected to the driving elements;

an organic electroluminescent layer on the first electrode;

at least one second electrode on the organic electroluminescent layer;

a black matrix on an inner surface of the second substrate along a boundary of each of the plurality of pixel regions; and

a color filter layer including red, green, and blue color filters on the inner surface of the second substrate, each of the red, green, and blue color filters corresponding to each of the plurality of pixel regions.

19. The device according to claim 18, wherein the organic electroluminescent layer includes an organic material emitting white light.

20. The device according to claim 18, wherein the organic electroluminescent layer includes an organic material emitting red, green, and blue colored light corresponding to each of the red, green, and blue color filters.

21. The device according to claim 18, further comprising a plurality of sidewalls on the first electrode corresponding to the black matrix.

22. The device according to claim 18, wherein the first electrode includes one of indium-tin-oxide (ITO) and indium-zinc-oxide (IZO).

23. The device according to claim 18, wherein the organic electroluminescent layer includes a hole-transporting layer and an electron-transporting layer.

24. The device according to claim 18, wherein the at least one second electrode includes at least one of aluminum (Al), calcium (Ca), magnesium (Mg), and lithium (Li).

25. The device according to claim 24, wherein the at least one second electrode includes a plurality of the second electrodes.

26. The device according to claim 25, wherein each of the plurality of second electrodes are connected to the organic electroluminescent layer.

27. A method of fabricating an organic electroluminescent display device, comprising:

forming a plurality of driving elements on a first substrate having a plurality of pixel regions;

forming a first electrode connected to the driving elements;

forming an organic electroluminescent layer on the first electrode;

forming a second electrode on the organic electroluminescent layer;

forming a black matrix on a second substrate having the plurality of pixel regions, the black matrix being formed along a boundary of each of the plurality of pixel regions;

forming a color filter layer including red, green, and blue color filters on the second substrate, each of the red, green, and blue color filters corresponding to each of the plurality of pixel regions; and

bonding the first and second substrates together,

wherein the color filter layer faces the second electrode.

28. The method according to claim 27, wherein the organic electroluminescent layer includes an organic material emitting white light.

29. The method according to claim 27, wherein the organic electroluminescent layer includes an organic material emitting red, green, and blue colored lights corresponding to each of red, green, and blue color filters.

30. The method according to claim 27, further comprising forming a plurality of sidewalls on the first electrode corresponding to the black matrix.

31. The method according to claim 27, wherein the organic electroluminescent layer includes a hole-transporting layer and an electron-transporting layer.

32. An organic electroluminescent display device, comprising:

a plurality of driving elements on an inner surface of a first substrate within each of a plurality of pixel regions;

a plurality of connection electrodes contacting the driving elements;

a black matrix on an inner surface of the second substrate at a boundary of each of the plurality of pixel regions;

a color filter layer including red, green, and blue color filters on the inner surface of the second substrate, each of the red, green, and blue color filters corresponding to each of the plurality of pixel regions;

a first electrode on the black matrix and the color filter layer;

an organic electroluminescent layer on the first electrode; and

a plurality of second electrodes on the organic electroluminescent layer,

wherein each of the second electrodes contact one of the connection electrodes.

33. An organic electroluminescent display device, comprising:

a plurality of driving elements on an inner surface of a first substrate within each of a plurality of pixel regions;

a plurality of connection electrodes contacting the driving elements;

a black matrix on an inner surface of the second substrate at a boundary of each of the plurality of pixel regions;

a color filter layer including red, green, and blue color filters on the inner surface of the second substrate, each of the red, green, and blue color filters corresponding to each of the plurality of pixel regions;

a first electrode on the black matrix and the color filter layer;

a plurality of sidewalls on the first electrode corresponding to the black matrix;

a plurality of organic electroluminescent layer segments on the first electrode between the sidewalls, each of the organic electroluminescent segments include a hole-transporting layer and an electron-transporting layer; and

a plurality of second electrodes each on one of the organic electroluminescent layer segments,

wherein each of the second electrodes contact one of the connection electrodes.

34. An organic electroluminescent display device, comprising:

a plurality of driving elements on an inner surface of a first substrate within each of a plurality of pixel regions;

a plurality of first electrodes contacting each of the driving elements;

a black matrix on an inner surface of the second substrate at a boundary of each of the plurality of pixel regions;

a color filter layer including red, green, and blue color filters on the inner surface of the second substrate, each of the red, green, and blue color filters corresponding to each of the plurality of pixel regions;

a planarization layer on the black matrix and the color filter layer;

a second electrode on the planarization layer; and

an organic electroluminescent layer on the second electrode,

wherein the organic electroluminescent layer contacts each of the first plurality of electrodes.

* * * * *

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专利名称(译)	有机电致发光显示装置及其制造方法

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摘要(译)

一种有机电致发光显示装置，包括结合在一起的第一和第二基板，所述第一和第二基板具有多个像素区域，所述多个像素区域中的每个像素区域内的所述第一基板的内表面上的多个驱动元件，多个接触驱动元件的连接电极，在多个像素区域中的每个像素区域的边界处的第二基板的内表面上的黑矩阵，在第二内表面上的包括红色，绿色和蓝色滤色器的滤色器层基板，红色，绿色和蓝色滤色器中的每一个对应于多个像素区域中的每一个，黑矩阵和滤色器层上的第一电极，第一电极上的有机电致发光层，以及至少一个第二电极在有机电致发光层上的电极，其中至少一个第二电极接触连接电极。