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(54) **ORGANIC LIGHT-EMITTING DISPLAY APPARATUS AND METHOD OF MANUFACTURING THE SAME**

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H01L 51/52 (2006.01)

(52) **U.S. Cl.**
CPC ***H01L 27/322*** (2013.01); ***H01L 27/3211*** (2013.01); ***H01L 51/5275*** (2013.01); ***H01L 51/5284*** (2013.01); *H01L 27/3244* (2013.01); *H01L 51/524* (2013.01); *H01L 2251/5315* (2013.01)

(58) **Field of Classification Search**
CPC combination set(s) only.
See application file for complete search history.

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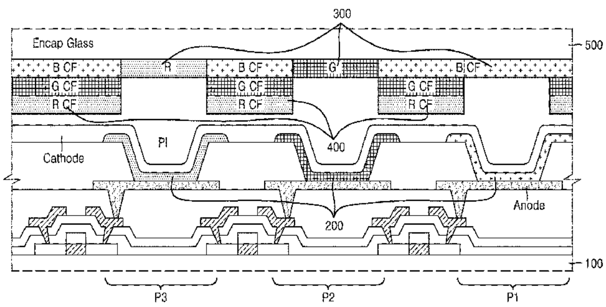
(57) **ABSTRACT**

An organic light-emitting display apparatus includes: an organic light-emitting device including a plurality of sub-pixels respectively emitting lights of different colors; a color filter formed on the organic light-emitting device in a region corresponding to each of the sub-pixels; a spacer color filter formed in the color filter between red, green, and blue color filters at locations corresponding to non-emitting areas; and a substrate provided on the color filter to encapsulate the organic light-emitting device.

16 Claims, 8 Drawing Sheets



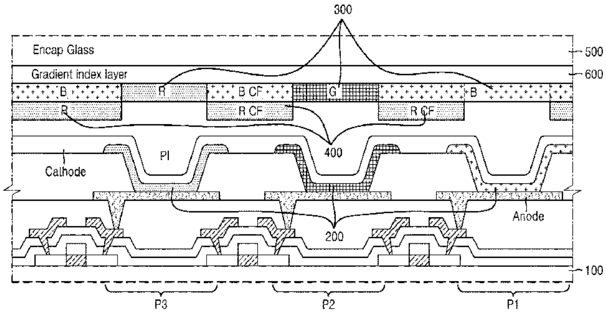


FIG. 1

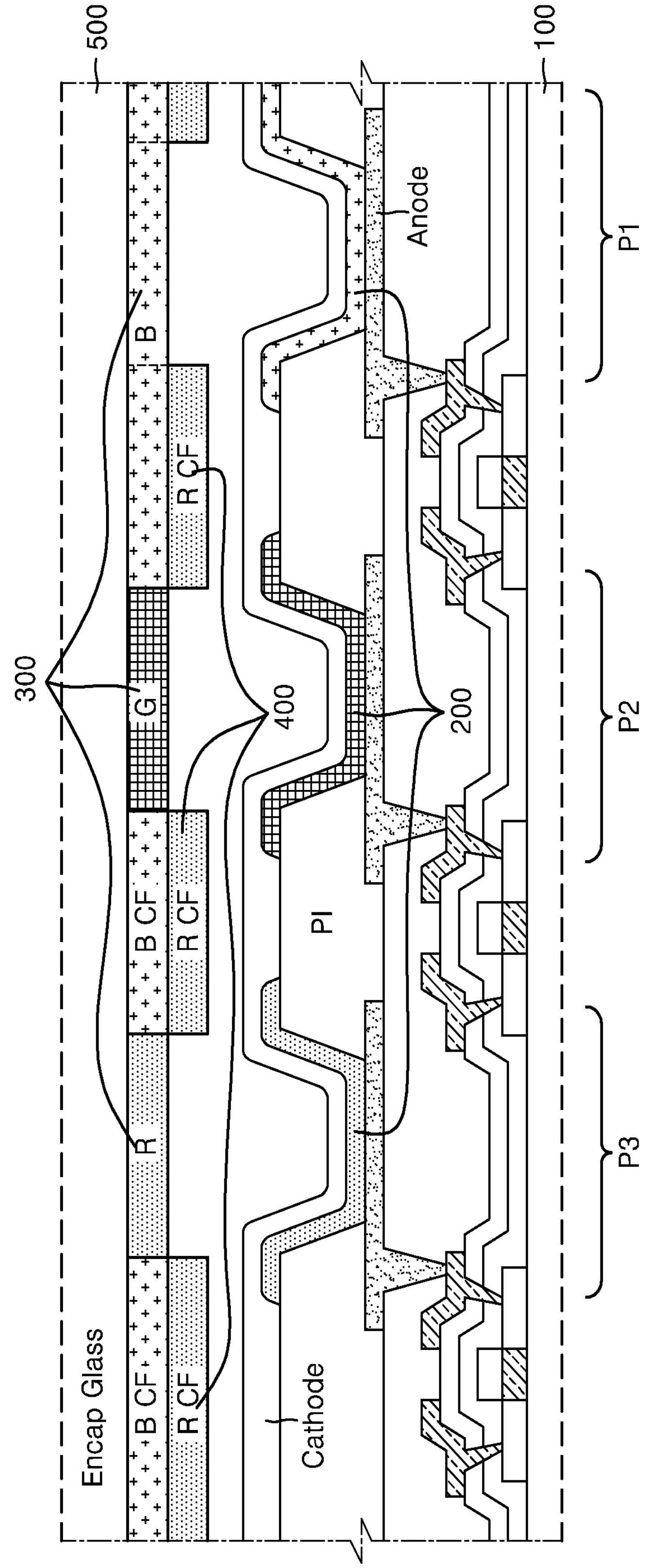
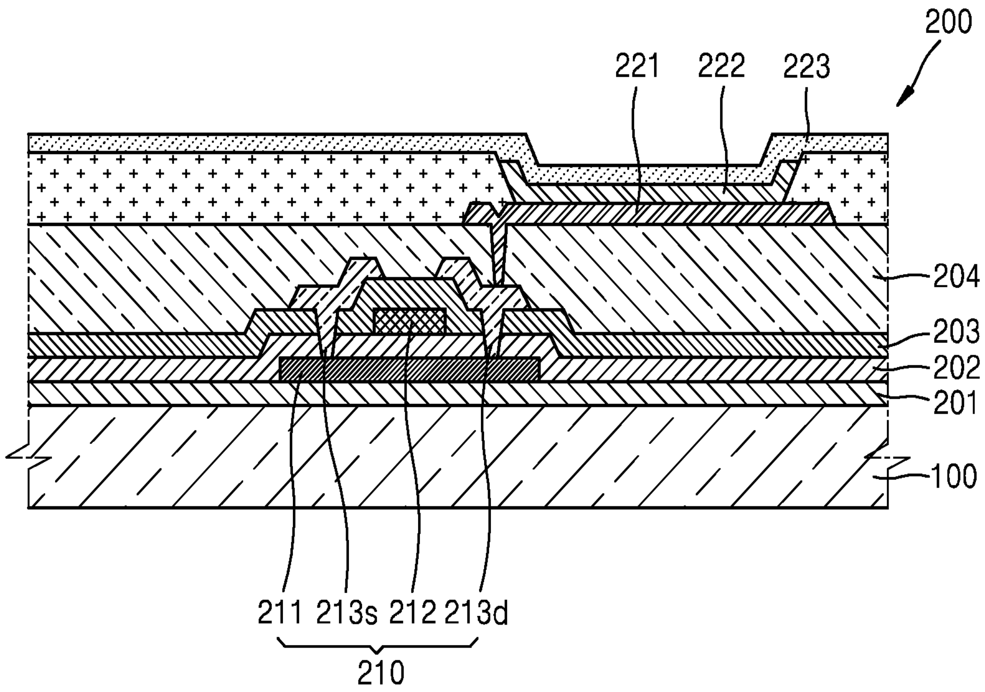

500
100
Anode
P1
B
R CF
300
G
400
200
P2
B CF
R CF
PI
R
P3
Encap Glass
B CF
R CF
Cathode

FIG. 2



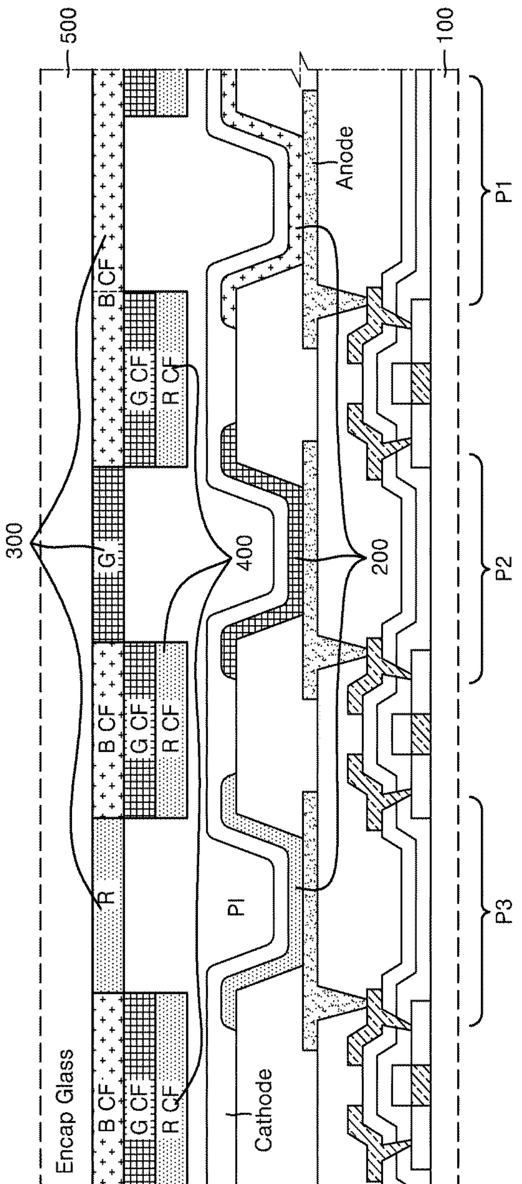

500
100
Encap Glass
B CF
G CF
R CF
B CF
G CF
R CF
B CF
G CF
R CF
R
G
300
400
200
Cathode
PI
Anode
P1
P2
P3

FIG. 3

FIG. 4

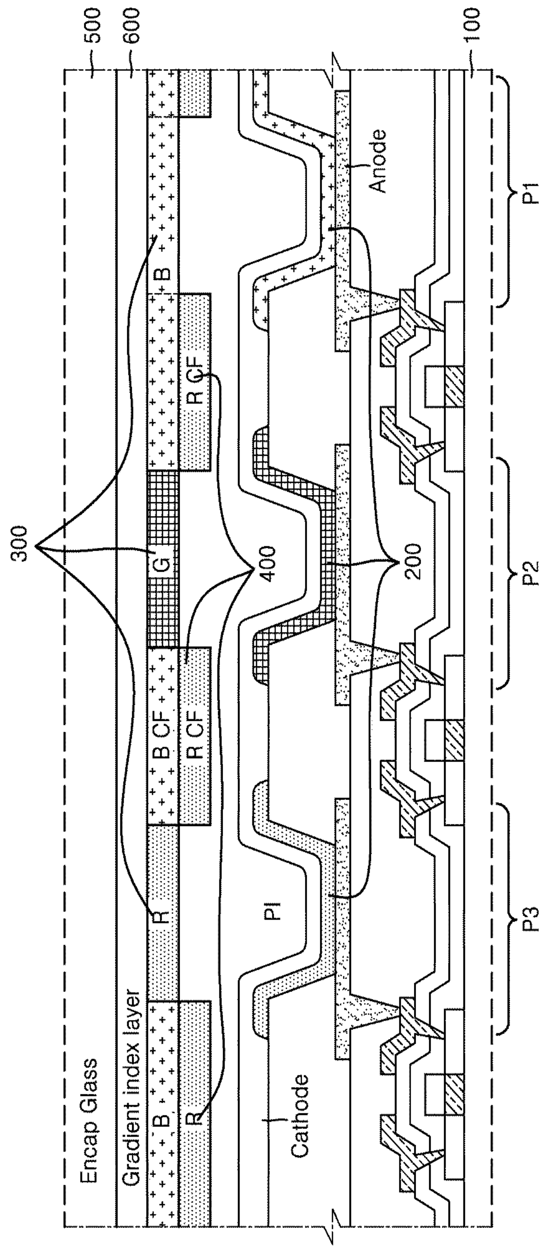

500
600
100
Encap Glass
Gradient index layer
B
R
R
B CF
R CF
G
B
R CF
300
400
200
PI
Cathode
Anode
P1
P2
P3

FIG. 5

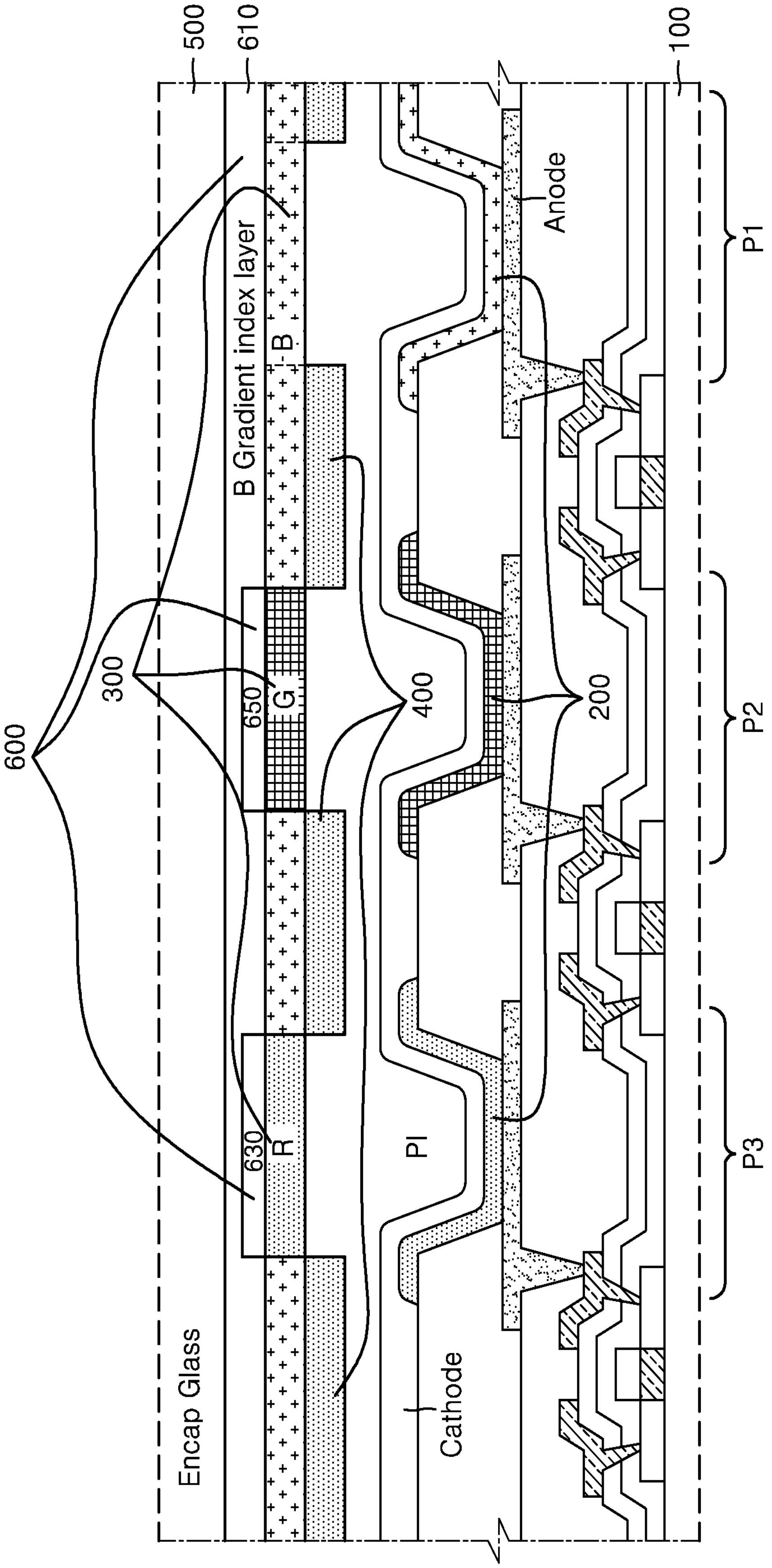

500
610
100
Encap Glass
B Gradient index layer
B
G
R
650
630
600
300
400
200
PI
Cathode
Anode
P1
P2
P3

FIG. 6

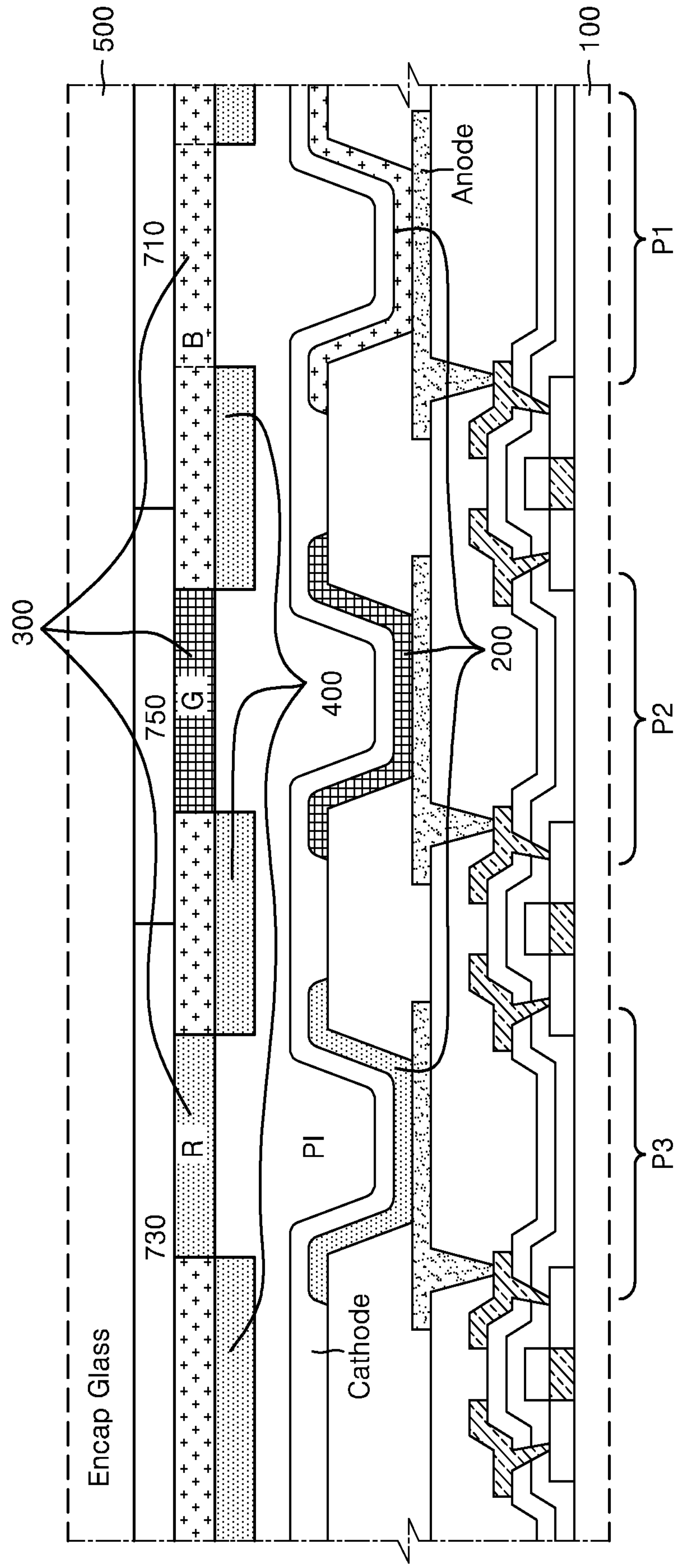

500
100
Anode
P1
710
B
300
G
750
400
200
P2
PI
R
730
Cathode
Encap Glass
P3

FIG. 7A

FIG. 7B

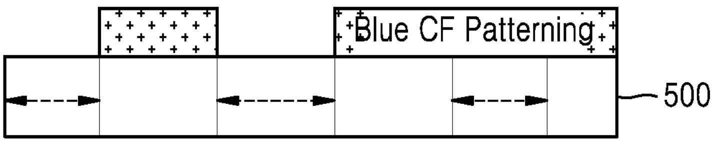


FIG. 7C

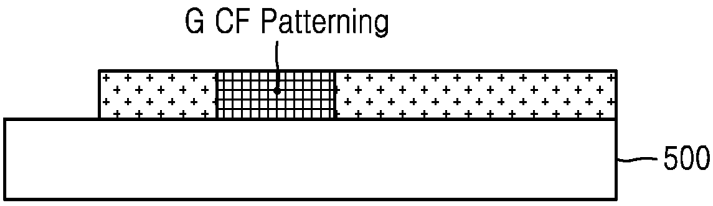


FIG. 7D

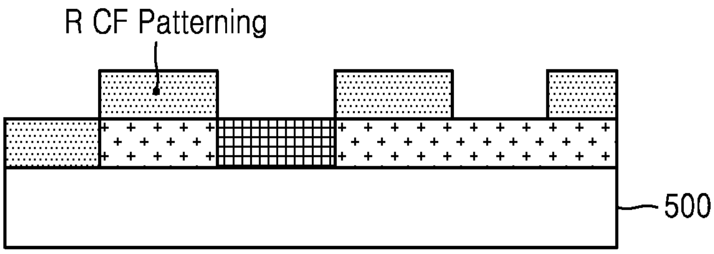


FIG. 8A

FIG. 8B

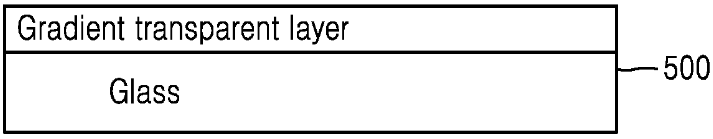


FIG. 8C

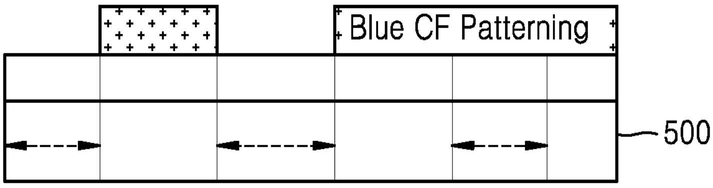


FIG. 8D

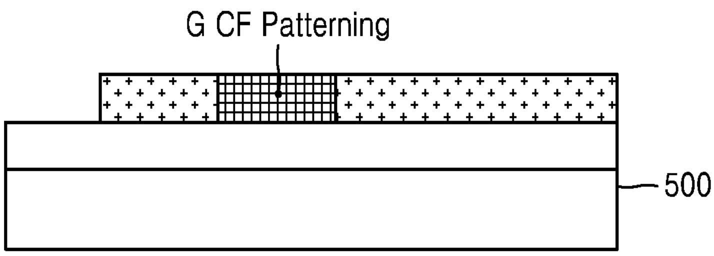
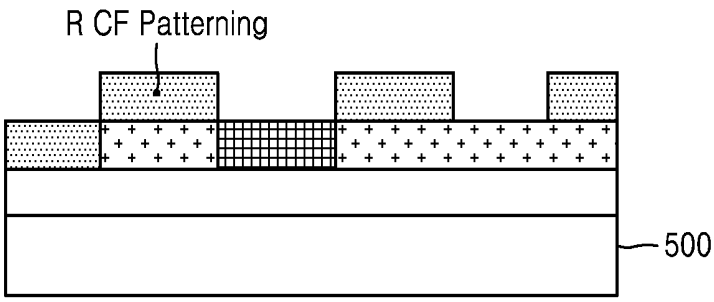


FIG. 8E



ORGANIC LIGHT-EMITTING DISPLAY APPARATUS AND METHOD OF MANUFACTURING THE SAME

CROSS REFERENCE TO RELATED APPLICATION

This application claims priority from and the benefit of Korean Patent Application No. 10-2014-0121267, filed on Sep. 12, 2014, which is hereby incorporated by reference for all purposes as if fully set forth herein.

BACKGROUND

Field

Exemplary embodiments of the present invention relate to an organic light-emitting display apparatus and a method of manufacturing the same.

Discussion of the Background

Organic light-emitting display apparatuses are self-emitting display apparatuses that typically do not include a separate light source. Accordingly, the organic light-emitting display apparatuses may be driven at a low voltage, may be lightweight and thin, and may have wide viewing angles, good contrast features, and fast response speeds. Accordingly, organic light-emitting display apparatuses have been highlighted as the next-generation display apparatuses.

However, when light is incident from an external light source on an organic-light emitting display apparatus, reflection occurs due to a refractive index difference between stacked layers in the organic-light emitting display apparatus. Thus, a reduction of the reflection of external light and maximization of the absorption thereof may enhance overall customer experience of the organic-light emitting display apparatuses.

SUMMARY

Exemplary embodiments of the present invention include an organic light-emitting display apparatus and a method of manufacturing the same.

Additional aspects will be set forth in part in the following description and, in part, will be apparent from the description, or may be learned by practice of the presented embodiments.

Exemplary embodiments of the present invention provide an organic light-emitting display apparatus including: an organic light-emitting device including a plurality of sub-pixels respectively emitting lights of different colors; a color filter formed on the organic light-emitting device in a region corresponding to each of the sub-pixels; a spacer color filter formed in the color filter between red, green, and blue color filters at locations corresponding to non-emitting areas; and a substrate provided on the color filter to encapsulate the organic light-emitting device.

An exemplary embodiment of the present invention also discloses an organic light-emitting display apparatus including: an organic light-emitting device including a plurality of sub-pixels respectively emitting lights of different colors; a color filter formed on the organic light-emitting device and located in a region corresponding to each of the sub-pixels; a spacer color filter formed in the color filter between red, green, and blue color filters at locations corresponding to non-emitting areas; a substrate provided on the color filter to encapsulate the organic light-emitting device; and an intermediate layer provided between the color filter and the substrate and having a refractive index between a refractive index of the color filter and a refractive index of the substrate.

An exemplary embodiment of the present invention also discloses a method of manufacturing an organic light-emitting display apparatus including: forming an organic light-emitting device including a plurality of sub-pixels respectively emitting lights of different colors; preparing a substrate for encapsulating the organic light-emitting device; and forming a color filter located on the organic light-emitting device on the substrate in a region corresponding to each of the sub-pixels, wherein the forming of the color filter sequentially includes: patterning a blue color filter in a region corresponding to a blue sub-pixel and a region corresponding to a non-emitting area; patterning a green color filter in a region corresponding to a green sub-pixel; and patterning a red color filter in a region corresponding to a red sub-pixel and a region corresponding to the non-emitting area.

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

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

FIG. **1** is a cross-sectional diagram of an organic light-emitting display apparatus according to an exemplary embodiment of the present invention.

FIG. **2** is a cross-sectional diagram of an organic light-emitting device corresponding to one sub-pixel region in the organic light-emitting display apparatus of FIG. **1**.

FIG. **3** is a cross-sectional diagram of an organic light-emitting display apparatus according to an exemplary embodiment of the present invention.

FIG. **4** is a cross-sectional diagram of an organic light-emitting display apparatus according to an exemplary embodiment of the present invention.

FIG. **5** is a cross-sectional diagram of an organic light-emitting display apparatus according to an exemplary embodiment of the present invention.

FIG. **6** is a cross-sectional diagram of an organic light-emitting display apparatus according to an exemplary embodiment of the present invention.

FIGS. **7**A, **7**B, **7**C, and **7**D are cross-sectional diagrams describing a method of forming an upper substrate and a color filter in a method of manufacturing an organic light-emitting display apparatus, according to an exemplary embodiment of the present invention.

FIGS. **8**A, **8**B, **8**C, **8**D, and **8**E are cross-sectional diagrams describing a method of manufacturing an organic light-emitting display apparatus, according to an exemplary embodiment of the present invention.

DETAILED DESCRIPTION OF THE ILLUSTRATED EMBODIMENTS

The present invention may allow various kinds of change or modification and various changes in form, and specific embodiments will be illustrated in drawings and described in detail in the specification. However, it should be understood that the specific embodiments do not limit the present invention to a specific disclosing form but include every modified, equivalent, or replaced one within the spirit and technical scope of the present invention.

Reference will now be made in detail to embodiments, examples of which are illustrated in the accompanying drawings, wherein like reference numerals refer to like elements throughout. In this regard, the present embodiments may have different forms and should not be construed as being limited to the descriptions set forth herein. Accordingly, the embodiments are merely described below, by referring to the figures, to explain aspects of the present description. As used herein, expressions such as "at least one of," when preceding a list of elements, modify the entire list of elements and do not modify the individual elements of the list.

It will be understood that although the terms "first", "second", etc. may be used herein to describe various components, these components should not be limited by these terms. These components are only used to distinguish one component from another.

The terminology in the application has been used only to describe specific embodiments and does not limit the present invention. In the application, it should be understood that terms, such as 'include' and 'have', are used to indicate the existence of an implemented feature, number, step, operation, element, part, or a combination thereof without excluding in advance the possibility of the existence or addition of one or more other features, numbers, steps, operations, elements, parts, or combinations thereof.

The present invention will now be described more fully with reference to the accompanying drawings, in which exemplary embodiments of the invention are shown.

FIG. **1** is a cross-sectional diagram of an organic light-emitting display apparatus according to an embodiment, and FIG. **2** is a cross-sectional diagram of an organic light-emitting device corresponding to one sub-pixel region in the organic light-emitting display apparatus of FIG. **1**.

Referring to FIG. **1**, the organic light-emitting display apparatus may include a substrate **100**, an organic light-emitting device **200** formed on the substrate **100**, a color filter **300**, and an upper substrate **500**.

The substrate **100** may be formed of a plastic having excellent heat resistance and durability. However, exemplary embodiments are not limited thereto, and the substrate **100** may be formed of various materials such as a metal, glass, and the like.

The organic light-emitting device **200** is formed on the substrate **100** and may include first, second, and third sub-pixels, P**1**, P**2**, and P**3**, respectively, emitting lights of different colors. For example, the organic light-emitting device **200** may include the first sub-pixel P**1** emitting blue light, the second sub-pixel P**2** emitting green light, and the third sub-pixel P**3** emitting red light.

Referring to FIG. **2**, the organic light-emitting device **200** may include a buffer layer **201** formed on the substrate **100** to block foreign substances/humidity from entering therein, a thin-film transistor **210** disposed on the buffer layer **201**, a first electrode **221** electrically connected to the thin-film transistor **210**, a second electrode **223** disposed opposite the first electrode **221**, and an intermediate layer **222** interposed between the first and second electrodes **221** and **223** and including an organic emission layer.

The thin-film transistor **210** may include an active layer **211**, a gate electrode **212**, a source electrode **212***s*, and a drain electrode **212***d*. A first insulating layer is interposed between the gate electrode **212** and the active layer **211** to insulate the gate electrode **212** from the active layer **211**. The active layer **211** may include a channel region formed in the center thereof and a source region and a drain region arranged on each side of the channel region, respectively. The active layer **211** may include amorphous silicon, crystalline silicon, or an oxide semiconductor, but is not limited thereto.

The source region and the drain region formed at both sides with respect to the channel region may be formed using the gate electrode **212** as a self-aligned mask and doping high-density impurities. Although FIG. **2** illustrates that the thin-film transistor **210** is of a top gate type, exemplary embodiments are not limited thereto. Thus, the thin-film transistor **210** may be of a top gate type.

The source and drain electrodes **212***s* and **212***d* are provided on the gate electrode **212** with a second insulating layer **203** interposed therebetween. The source and drain electrodes **212***s* and **212***d* are electrically connected to the source and drain regions of the active layer **211**, respectively. A third insulating layer **204** may be formed on the source and drain electrodes **212***s* and **212***d*.

Any one of the source and drain electrodes **212***s* and **212***d* may be electrically connected to the first electrode **221**. The intermediate layer **222**, which includes an organic emission layer, and the second electrode **223** may be formed on the first electrode **221**.

As shown in FIG. **1**, each of the first, second, and third sub-pixels P**1**, P**2**, and P**3** includes the structure shown in FIG. **2**, and the organic emission layers included in the intermediate layers **222** of the first, second, and third sub-pixels P**1**, P**2**, and P**3**, respectively, include organic materials for emitting red, green, and blue lights. Each organic emission layer emitting red, green, and/or blue light may include a low- or high-molecular organic material. Depending on an organic emission layer, the intermediate layer **222** may further include at least one selected from the group that includes a hole transport layer, a hole injection layer, an electron transport layer, and an electron injection layer.

Referring back to FIG. **1**, the organic light-emitting display apparatus according to an exemplary embodiment of the present invention may have a color filter **300** located on the organic light-emitting device **200** in a region corresponding to the first, second, and third sub-pixels P**1**, P**2**, and P**3**.

An upper substrate **500** for encapsulating the organic light-emitting device **200** may be provided on the color filter **300**. The upper substrate **500** may be formed of glass, but is not limited thereto, and the upper substrate **500** may be formed of various materials such as metal, plastic, and the like.

The color filter **300** may include a blue color filter B located in a region corresponding to the first sub-pixel P**1**, a green color filter G located in a region corresponding to the second sub-pixel P**2**, and a red color filter R located in a region corresponding to the third sub-pixel P**3**.

The color filter **300** may be located in a region corresponding to the first, second, and third sub-pixels, P**1**, P**2**, and P**3**, and a spacer color filter **400** may be formed between the red, green, and blue color filters R, G, and B. That is, the spacer color filter **400** may be formed at a location corresponding to a non-emitting area between the first, second, and third sub-pixels P**1**, P**2**, and P**3**.

By forming the spacer color filter **400** at the location corresponding to the non-emitting area, i.e., between the red, green, and blue color filters R, G, and B, only a small amount amount of external light incident onto the color filter **300** may be reflected, and thus, improving the visibility of the display and also definition of an image displayed.

The spacer color filter **400** may be light-shielding. That is, the spacer color filter **400** may be formed in the non-emitting area, and may include a black matrix for absorbing visible light to reduce contrast due to downward reflection of external light. The downward reflection refers to reflection toward an electrode or a wiring layer of the organic light-emitting device **200** or a lower substrate **100** below the organic light-emitting device **200**.

As shown in FIG. **1**, the spacer color filter **400** may be formed by stacking a first layer and a second layer, wherein the first layer may be the blue color filter B. Alternatively, the spacer color filter **400** may only include the first layer, but the present embodiment is not limited thereto.

The blue color filter B may have a refractive index that is almost the same as or the same as that of the upper substrate **500**, in comparison to that of the green or red color filter G or R. Therefore, the blue color filter B may be stacked and formed as the first layer of the spacer color filter **400**.

Light from the outside may be incident on the color filter **300** by passing through the upper substrate **500**. In this case, a portion of light incident at the location corresponding to the non-emitting area may be reflected again to the outside, and other portion thereof may be absorbed inside the organic light-emitting display apparatus.

When a refractive index difference between stacked layers at an interface is high, total reflection occurs. That is, when a refractive index difference between neighboring layers is large, it is highly probable that light incident from the outside is totally reflected to the outside.

Therefore, when a refractive index difference between layers through which light incident from the outside passes is small, the probability that light incident from the outside is totally reflected to the outside is low, thereby maximizing the absorption of the incident external light within the organic light-emitting display apparatus.

Accordingly, by stacking the blue color filter B as the first layer of the spacer color filter **400**, the organic light-emitting display apparatus of an exemplary embodiment of the present invention may minimize a difference in a refractive index with respect to the upper substrate **500**.

That is, light absorbed from the outside sequentially passes through the upper substrate **500** and the blue color filter B. Thus, such a minimized surface reflection allows the organic light-emitting display apparatus to absorb the external incident light.

Thus, a manufacturing process may be simplified by forming the spacer color filter **400** to have light-shielding properties between the red, green, and blue color filters R, G, and B, without separately preparing a light-shielding part.

A process of forming the spacer color filter **400** will be described in detail along with a method of manufacturing an organic light-emitting display apparatus according to an exemplary embodiment of the present invention.

According to the an exemplary embodiment, the spacer color filter **400** may be formed together with the color filter **300** without patterning a separate light-shielding part, thus reducing manufacturing time and costs.

As shown in FIG. **1**, the spacer color filter **400** may have the blue color filter B as the first layer, and the red color filter R may be stacked on the blue color filter B.

Since the spacer color filter **400** includes the first and second layers, the region corresponding to the non-emitting area may be formed so as to protrude further than the region of the color filter **300**.

Therefore, the spacer color filter **400** may have characteristics of a spacer in the organic light-emitting display apparatus according to the present embodiment.

That is, by stacking the blue color filter B as the first layer on the upper substrate **500** and then stacking the red color filter R thereon as the second layer, an inter-layer refractive index difference may be not only minimized, but also increasing the efficiency of absorbing external light through the first and second layers. By forming the spacer color filter **400** so as to protrude more than the color filter **300**, the spacer color filter **400** may be a spacer for maintaining a gap between the upper substrate **500** and the lower substrate **100**.

FIG. **3** is a cross-sectional diagram of an organic light-emitting display apparatus according to an exemplary embodiment of the present invention.

The spacer color filter **400** in the organic light-emitting display apparatus according to the present embodiment may be formed by stacking first, second, and third layers, as shown in FIG. **3**.

The spacer color filter **400** formed at the location corresponding to the mon-emitting area may include the blue color filter B as the first layer, the green color filter G as the second layer, and the red color filter as the third layer, which are sequentially stacked. However, the spacer color filter **400** is not limited to the three stacked layers, and the order of stacking the red, green, and blue color filters R, G, and B is also not limited.

FIG. **4** is a cross-sectional diagram of an organic light-emitting display apparatus according to an exemplary embodiment of the present invention.

The organic light-emitting display apparatus according to an exemplary embodiment may further include an intermediate layer (gradient index layer) **600** provided between the color filter **300** and the upper substrate **500**.

The intermediate layer **600** may be an intermediate refractive layer between the refractive index of the color filter **300** and the refractive index of the upper substrate **500**. The intermediate layer **600** may be a transparent layer since external incident light passes through the color filter **300** after passing through the intermediate layer **600**.

The organic light-emitting display apparatus according to exemplary embodiments may include the intermediate layer **600** to prevent reflection of light incident from the outside when the refractive index of the color filter **300** is different from the refractive index of the upper substrate **500**.

A refractive index of the intermediate layer **600** may have an intermediate value between the refractive index of the color filter **300** and the refractive index of the upper substrate **500**, and thus, an inter-layer refractive index difference may be lowered, thereby minimizing surface reflection.

Light incident from the outside may be absorbed by the organic light-emitting display apparatus by sequentially passing through the upper substrate **500**, the intermediate layer **600**, and the color filter **300**.

Like the organic light-emitting display apparatuses according to the embodiments described above, the organic light-emitting display apparatus according to the present embodiment may also include the spacer color filter **400**, as shown in FIG. **4**.

As shown in FIG. **4**, the spacer color filter **400** may be formed by stacking the first layer and the second layer. However, the present embodiment is not limited thereto, and the spacer color filter **400** may be formed by stacking the first layer, the second layer, and the third layer as described above.

Since the refractive index of the blue color filter B is almost the same as that of the upper substrate **500**, the first layer may be formed by stacking the blue color filter B on the upper substrate **500**. As shown in FIG. **4**, the second layer may be formed by stacking the red color filter R on the blue color filter B.

The spacer color filter **400** may be formed by stacking the first, second, and third layers, wherein the first layer as the blue color filter B, the second layer as the green color layer G, and the third layer as the red color layer R are sequentially provided.

FIG. **5** is a cross-sectional diagram of an organic light-emitting display apparatus according to an exemplary embodiment of the present invention.

The organic light-emitting display apparatus according to an exemplary embodiment may include a blue intermediate layer **610** having a refractive index between an intermediate value of the refractive index of the blue color filter B and the refractive index of the upper substrate **500**.

A red intermediate layer pattern **630** formed in the blue intermediate layer **610** and located on the red color filter R may be further included in the organic light-emitting display apparatus.

Since the refractive index of the blue color filter B is almost the same with that of the upper substrate **500**, the blue intermediate layer **610** may be formed between the upper substrate **500** and the color filter **300**.

Thus, in a case where the blue intermediate layer **610** is formed, when light incident from the outside passes through the blue color filter B, an inter-layer refractive index difference is minimized, thereby enhancing the display efficiency.

To minimize a surface reflection of light passing through the red color filter R from outside the device, the red intermediate layer pattern **630** may also be formed as shown in FIG. **5**. The red intermediate layer pattern **630** may be located in the blue intermediate layer **610** and may be formed so as to have a refractive index with an intermediate value between the refractive index of the blue intermediate layer **610** and the refractive index of the red color filter R.

Therefore, light incident from the outside may pass through the red color filter R after sequentially passing through the upper substrate **500**, the blue intermediate layer **610**, and the red intermediate layer pattern **630**.

Therefore, since an inter-layer refractive index difference is minimized, even though light passes through a plurality of layers, an amount of reflected light may be minimized, and thus, an amount of light absorbed by the organic light-emitting display apparatus may be large.

Accordingly, external light absorption of the organic light-emitting display apparatus according to an exemplary embodiment of the present invention may be maximized.

As shown in FIG. **5**, a green intermediate layer pattern **650** may be further included in the blue intermediate layer **610**, specifically, in the green color filter G.

The green intermediate layer pattern **650** may be formed so as to have a refractive index between the refractive index of the blue intermediate layer **610** and the refractive index of the green color filter G.

In this case, outside light incident onto the green color filter G may sequentially pass through the upper substrate **500**, the blue intermediate layer **610**, and the green intermediate layer pattern **650**.

Like the red intermediate layer pattern **630**, since an inter-layer refractive index difference is minimized, the amount of light absorbed by the organic light-emitting display apparatus through the green color filter G may be maximized.

The organic light-emitting display apparatus according to exemplary embodiments of the present invention are not limited to the embodiment illustrated in FIG. **5** and may include only the red intermediate layer pattern **630** and the green intermediate layer pattern **650**, or both the red intermediate layer pattern **630** and the green intermediate layer pattern **650**.

FIG. **6** is a cross-sectional diagram of an organic light-emitting display apparatus according to an exemplary embodiment of the present invention.

The organic light-emitting display apparatus according to an exemplary embodiment may include an intermediate layer **710**, **730**, **750**. The intermediate layer **710**, **730**, **750** may include a blue intermediate layer **710**, a red intermediate layer **730**, and a green intermediate layer **750**.

That is, the blue, red, and green intermediate layers **710**, **730**, and **750** having different refractive indices may be formed depending on a location of the color filter **300**. That is, the blue, red, and green intermediate layers **710**, **730**, and **750** may be formed on the blue, red, and green color filters B, R, and G, respectively.

The blue intermediate layer **710** may be formed so as to have a refractive index between the refractive index of the blue color filter B and the refractive index of the upper substrate **500**.

Likewise, each of the red intermediate layer **730** and the green intermediate layer **750** may be formed so as to have a refractive index between the refractive index of the red or green color filter R or G and the refractive index of the upper substrate **500**.

In the organic light-emitting display apparatus according to an exemplary embodiment, when light incident from the outside passes through each of the red, green, and blue color filters R, G, and B, the light passes through the upper substrate **500** and the intermediate layer **700**. Thus, an inter-layer refractive index difference may be minimized, thereby maximizing efficiency of the internal absorption of external light.

FIGS. **7**A to **7**D are cross-sectional diagrams describing a method of forming an upper substrate and a color filter in a method of manufacturing an organic light-emitting display apparatus, according to an exemplary embodiment of the present invention.

According to the method of manufacturing an organic light-emitting display apparatus, first, the organic light-emitting device **200** including a plurality of sub-pixels for respectively emitting lights of different colors may be formed (not shown). The upper substrate **500** located at an upper part so as to encapsulate the organic light-emitting device **200** may be formed (not shown).

As discussed in further detail below, the color filter **300** located in a region corresponding to the plurality of sub-pixels may be formed on the upper substrate **500**. The color filter **300** may include the blue color filter B, the red color filter R, and the green color filter G.

Specifically, FIGS. **7**A to **7**D sequentially illustrate the forming of the color filter **300**.

First, as shown in FIGS. **7**A and **7**B, the blue color filter B may be patterned on the upper substrate **500**. The blue color filter B may be patterned not only in a region corresponding to a blue sub-pixel but also at a location corresponding to the non-emitting area. That is, the blue color filter B may be patterned in both a region between the region where the blue color filter B will be disposed and a region where the green color filter G will be disposed and in a region between the region where the green color filter G will be disposed and the region where the red color filter R will be disposed. As such an inter-layer refractive index difference is minimized when external incident light is absorbed, since the blue color filter B has almost the same refractive index as that of the upper substrate **500**, in comparison to the green color filter G and the red color filter R.

Next, as shown in FIG. **7**C, the green color filter G may be patterned in a region corresponding to a green sub-pixel.

Next, as shown in FIG. **7**D, the red color filter R may be patterned. The red color filter R may be patterned not only in a region corresponding to a red sub-pixel but also at a location corresponding to the non-emitting area.

That is, the red color filter R may be patterned as a second layer on the blue color filter B patterned as a first layer in the region between the blue color filter B and the green color filter G and the region between the green color filter G and the red color filter R.

In this case, since the patterned red color filter R protrudes more than the color filter **300** formed in an emitting area, the patterned red color filter R may increase the efficiency of internal absorption of external light and be a spacer maintaining a gap between the upper and lower substrates **500** and **100** (not shown).

The types and an order of color filters patterned at the location corresponding to the non-emitting area are not limited to the above. The method of manufacturing an organic light-emitting display apparatus illustrated in FIGS. **7**A to **7**D is merely one embodiment and is not limited thereto. For example, the green color filter G may also be patterned at the location corresponding to the non-emitting area.

In a case where the green color filter G is patterned at the location corresponding to the non-emitting area, the blue color filter B patterned as a first layer, the green color filter G as a second layer, and the red color filter R as a third layer may be stacked at the location corresponding to the non-emitting area. Accordingly, the blue, green, and red color filters B, G, and R at the location corresponding to the non-emitting area may protrude further than the color filter **300** at a location corresponding to the emitting area and may form a spacer.

FIGS. **8**A to **8**E are cross-sectional diagrams describing a method of manufacturing an organic light-emitting display apparatus, according to an exemplary embodiment. Steps similar to those described above with reference to FIG. **7**A are omitted in this description.

In the method of manufacturing an organic light-emitting display apparatus according to the exemplary embodiment, an intermediate layer may be first formed before forming the color filter **300** on the upper substrate **500** as shown in FIG. **8**B.

The intermediate layer may be formed so as to have a refractive index between the refractive index of the color filter **300** and the refractive index of the upper substrate **500**, thereby minimizing an inter-layer refractive index difference.

As described above, according to the one or more of the above embodiments, the reflection of external light may be reduced, and a manufacturing process may also be simplified.

It should be understood that the exemplary embodiments described therein should be considered in a descriptive sense only and not for purposes of limitation. Descriptions of features or aspects within each embodiment should typically be considered as available for other similar features or aspects in other embodiments.

While one or more embodiments of the present invention have been described with reference to the figures, it will be understood by those of ordinary skill in the art that various changes in form and details may be made therein without departing from the spirit and scope of the present invention as defined by the following claims.

What is claimed is:

1. An organic light-emitting display apparatus, comprising:

an organic light-emitting device comprising a plurality of sub-pixels, the sub-pixels configured to emit lights of different colors;

a color filter disposed on the organic light-emitting device in a region corresponding to an emitting area of each sub-pixel of the plurality of sub-pixels, the color filter comprising a red color filter and a green color filter;

a spacer color filter disposed in a non-light emitting area directly bound by the red color filter and the green color filter in the same plane, the spacer color filter comprising a material different from the red color filter and green color filter; and

a substrate disposed on the color filter and encapsulating the organic light-emitting device.

2. The organic light-emitting display apparatus of claim **1**, wherein the color filter further comprises a blue color filter and the spacer color filter comprises a first layer comprising the same material as the blue color filter.

3. The organic light-emitting display apparatus of claim **2**, wherein the spacer color filter further comprises a second layer stacked on the first layer, and the second layer comprises the same material as the red color filter.

4. The organic light-emitting display apparatus of claim **2**, wherein the spacer color filter further comprises second and third layers stacked on the first layer, wherein the second layer comprises the same material as the green color filter and the third layer comprises the same material as the red color filter.

5. The organic light-emitting display apparatus of claim **1**, further comprising an intermediate layer disposed between the color filter and the substrate and having a refractive index between a refractive index of the color filter and a refractive index of the substrate.

6. The organic light-emitting display apparatus of claim **5**, wherein the color filter further comprises a blue color filter and the spacer color filter comprises stacked first and second layers, the first layer comprising the same material as the blue color filter and the second layer comprising the same material as the red color filter.

7. The organic light-emitting display apparatus of claim **5**, wherein the color filter further comprises a blue color filter and the spacer color filter comprises sequentially stacked first, second, and third layers, the first layer comprising the same material as the blue color filter, the second layer comprising the same material as the green color filter, and the third layer comprising the same material as the red color filter.

8. The organic light-emitting display apparatus of claim **5**,

wherein the color filter further comprises a blue color filter and the intermediate layer has a refractive index between a refractive index of the blue color filter and a refractive index of the substrate, and

wherein a red intermediate layer pattern is disposed in the intermediate layer in an area corresponding to the red color filter.

9. The organic light-emitting display apparatus of claim **8**, wherein the red intermediate layer pattern has a refractive index between a refractive index of the red color filter and the refractive index of the substrate.

10. The organic light-emitting display apparatus of claim **5**, wherein the color filter further comprises a blue color filter and the intermediate layer has a refractive index between a refractive index of the blue color filter and a refractive index of the substrate, and

wherein a green intermediate layer pattern is disposed in the intermediate layer in an area corresponding to the green color filter.

11. The organic light-emitting display apparatus of claim **10**, wherein the green intermediate layer pattern has a refractive index between a refractive index of the green color filter and the refractive index of the substrate.

12. The organic light-emitting display apparatus of claim **5**,

wherein the color filter further comprises a blue color filter and the intermediate layer has a refractive index between a refractive index of the blue color filter and a refractive index of the substrate, and

wherein a red intermediate layer pattern is disposed in the intermediate layer in an area corresponding to the red color filter, and a green intermediate layer pattern is formed in the intermediate layer at an area corresponding to the green color filter.

13. The organic light-emitting display apparatus of claim **12**,

wherein the red intermediate layer pattern has a refractive index between a refractive index of the red color filter and the refractive index of the substrate, and

wherein the green intermediate layer pattern has a refractive index between a refractive index of the green color filter and the refractive index of the substrate.

14. The organic light-emitting display apparatus of claim **5**,

wherein the color filter further comprises a blue color filter and the intermediate layer comprises a green intermediate layer, a red intermediate layer, and a blue intermediate layer, and

wherein the green, red, and blue intermediate layers are disposed on the green, red, and blue color filters, respectively.

15. The organic light-emitting display apparatus of claim **14**,

wherein the green intermediate layer has a refractive index between a refractive index of the green color filter and the refractive index of the substrate, the red intermediate layer has a refractive index between a refractive index of the red color filter and the refractive index of the substrate, and the blue intermediate layer has a refractive index between a refractive index of the blue color filter and the refractive index of the substrate.

16. An organic light-emitting display apparatus, comprising:

an organic light-emitting device comprising a plurality of sub-pixels, the sub-pixels configured to emit lights of different colors;

a color filter disposed on the organic light-emitting device in a region corresponding to an emitting area of each sub-pixel of the plurality of sub-pixels, the color filter comprising a red color filter and a green color filter;

a spacer color filter disposed in a non-emitting area directly bound by the red color filter and the green color filter in the same plane, the spacer color filter comprising a material different from the red color filter and the green color filter;

a substrate disposed on the color filter and encapsulating the organic light-emitting device; and

an intermediate layer disposed between the color filter and the substrate and having a refractive index between a refractive index of the color filter and a refractive index of the substrate.

* * * * *

patsnap

专利名称(译)	有机发光显示装置及其制造方法		
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摘要(译)

一种有机发光显示装置，包括：有机发光装置，包括分别发出不同颜色的光的多个子像素;在与每个子像素对应的区域中的有机发光装置上形成的滤色器;在对应于非发光区域的位置处，在红色，绿色和蓝色滤色器之间的滤色器中形成间隔物滤色器;以及设置在滤色器上以封装有机发光器件的基板。