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(54) TOP-EMITTING ORGANIC ELECTROLUMINESCENT DISPLAY PANEL, MANUFACTURING METHOD THEREOF AND DISPLAY DEVICE

(57) The present invention discloses a top-emitting organic electroluminescent display panel, a manufacturing method thereof and a display device; the top-emitting organic electroluminescent display panel comprises: a substrate, a layer of white organic light emitting diodes and a thin film encapsulation layer arranged on the substrate in sequence; wherein the thin film encapsulation layer comprises at least two inorganic thin film layers and at least one organic thin film layer; wherein one of the at least one organic thin film layer is a color filter layer comprising filters of at least three different colors for full color display, the color filter layer being arranged between the at least two inorganic thin film layers. Since one of the organic thin film layers in the thin film encapsulation layer is a color filter layer, the color filter layer does not have to be arranged above the thin film encapsulation layer separately; in this way, it can not only reduce the film layer number of the display panel, simplify the film layer structure, reduce the process flows and reduce the manufacturing cost, but also can shorten the light path from the light emitting layer to the color filter layer, thereby improving the luminous efficiency and the display effect.

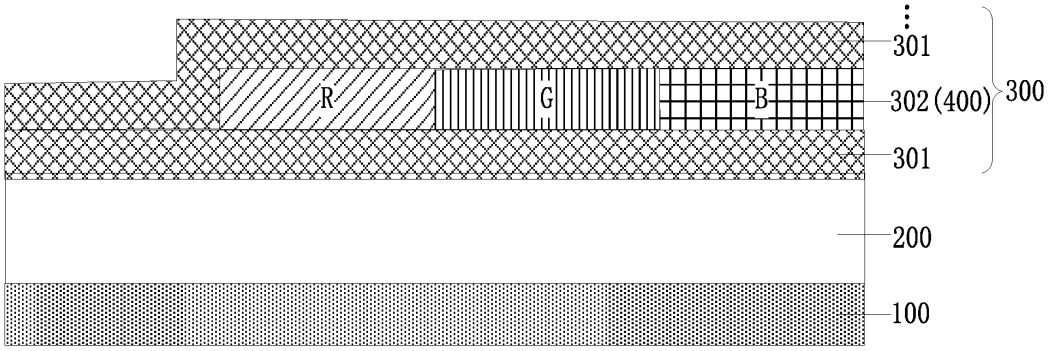

Fig. 2a

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Description

FIELD OF THE INVENTION

[0001] The present invention relates to the field of display technology, particularly to a top-emitting organic electroluminescent display panel, a manufacturing method thereof and a display device.

BACKGROUND OF THE INVENTION

[0002] At present, the organic electroluminescent display and organic light emitting diode (OLED) have become the mainstream of the display field gradually due to their excellent performance of low power consumption, high color saturation, wide visual angle, small thickness, and flexibility. The OLED can be classified into bottom-emitting type and top-emitting type according to the light emission manner; the light emission in the bottom-emitting OLED comes from the side of the substrate, while the light emission in the top-emitting OLED comes from the top.

[0003] In order to realize full color of the large-size OLED panel, top-emitting white organic light emitting diodes (WOLED) and a color filter layer are generally superposed. In the prior art, when the top-emitting OLED panel is manufactured, as shown in Fig. 1, a layer of white organic light emitting diodes 02 is formed on a substrate 01 firstly, then a thin film encapsulation layer 03 is formed with the thin film encapsulation technology; the thin film encapsulation layer 03 is a multi-layer film structure of at least three layers constituted by mutual alternation of an inorganic thin film layer 031 and an organic thin film layer 032, for blocking permeation of external moisture and oxygen; wherein the inorganic thin film layer 031 has a relatively high compactness and is the main water and oxygen barrier layer, however, the inorganic thin film layer 031 has a relatively low elasticity, and a large inner stress, which is easily affected by the external force so as to generate cracks or to be stripped from the OLED device; hence, it should cooperate with the organic thin film layer 032, which is formed by using the methods such as monomer deposition or polymer coating as a buffer layer. The organic thin film layer 032 has a relatively high elasticity, which can effectively prevent the inorganic thin film layer 031 from cracking; after the thin film encapsulation layer 03 is formed with the thin film encapsulation technology, a color filter layer 04 comprising filters of at least three colors should also be formed on the thin film encapsulation layer 03; the color filter layer 04 is used for realizing filtering of various colors. However, the OLED panel formed in this way has a relatively thick film layer; the manufacturing process is relatively complex; moreover, the light path is increased, the luminous efficiency is reduced, and the display effect of the OLED panel is influenced.

[0004] Therefore, how to simplify the film layer structure of the OLED panel, reduce the manufacturing processes, shorten the light path and improve the luminous efficiency is a technical problem that needs to be solved by the skilled person in the art urgently.

SUMMARY OF THE INVENTION

[0005] In view of this, the embodiments of the present invention provide a top-emitting organic electroluminescent display panel, a manufacturing method thereof and a display device, which can simplify the film layer structure of the OLED panel, reduce the manfucturing process, shorten the light path from the light emitting layer to the color filter layer, and improve the luminous efficiency.

[0006] Therefore, an embodiment of the present invention provides a top-emitting organic electroluminescent display panel, comprising: a substrate, a layer of white organic light emitting diodes and a thin film encapsulation layer arranged on the substrate in sequence; wherein the thin film encapsulation layer comprises at least two inorganic thin film layers and at least one organic thin film layer;

wherein one of the at least one organic thin film layer is a color filter layer comprising filters of at least three different colors for full color display, the color filter layer being arranged between the at least two inorganic thin film layers.

[0007] In a possible implementation, in the above top-emitting organic electroluminescent display panel provided by the embodiment of the present invention, the inorganic thin film layer and the organic thin film layer are arranged alternately.

[0008] In a possible implementation, in the above top-emitting organic electroluminescent display panel provided by the embodiment of the present invention, the thickness of the inorganic thin film layer is 30nm to 2000nm; the thickness of the color filter layer is 30nm to 3000nm.

[0009] In a possible implementation, in the above top-emitting organic electroluminescent display panel provided by the embodiment of the present invention, the material of the color filter layer is resin.

[0010] In a possible implementation, in the above top-emitting organic electroluminescent display panel provided by the embodiment of the present invention, it further comprises: a buffer layer arranged between the color filter layer and the inorganic thin film layer adjacent below.

[0011] In a possible implementation, in the above top-emitting organic electroluminescent display panel provided by the embodiment of the present invention, the thickness of the buffer layer is 5nm to 1000nm.

[0012] In a possible implementation, in the above top-emitting organic electroluminescent display panel provided by the embodiment of the present invention, the material of the buffer layer is one of TiO_2, SiNx or SiOx or a combination thereof.

[0013] In a possible implementation, in the above top-emitting organic electroluminescent display panel provided by the embodiment of the present invention, a black

matrix is arranged between any two adjacent filters in the color filter layer.

[0014] In a possible implementation, in the above top-emitting organic electroluminescent display panel provided by the embodiment of the present invention, the thickness of the black matrix is less than or equal to the thickness of the color filter layer.

[0015] In a possible implementation, in the above top-emitting organic electroluminescent display panel provided by the embodiment of the present invention, the color filter layer further comprises a white light transmission area.

[0016] In a possible implementation, in the above top-emitting organic electroluminescent display panel provided by the embodiment of the present invention, a planarization layer is arranged in the white light transmission area of the color filter layer.

[0017] In a possible implementation, in the above top-emitting organic electroluminescent display panel provided by the embodiment of the present invention, the thickness of the planarization layer is less than or equal to the thickness of the color filter layer.

[0018] In a possible implementation, in the above top-emitting organic electroluminescent display panel provided by the embodiment of the present invention, the material of the inorganic thin film layer in the inorganic thin film layers that is closest to the substrate is one of Al_2O_3, SiNx or SiOx or a combination thereof.

[0019] In a possible implementation, in the above top-emitting organic electroluminescent display panel provided by the embodiment of the present invention, the material of other inorganic thin film layers in the inorganic thin film layers except for the inorganic thin film layer that is closest to the substrate is one of Al_2O_3, TiO_2, SiNx or SiOx or a combination thereof.

[0020] The embodiment of the present invention further provides a method of manufacturing the above top-emitting organic electroluminescent display panel provided by the embodiment of the present invention, comprising: forming a layer of white organic light emitting diodes on a substrate; forming at least two inorganic thin film layers and at least one organic thin film layer on the substrate on which the layer of white organic light emitting diodes is formed; wherein one of the at least one organic thin film layer is a color filter layer comprising filters of at least three different colors for full color display, the color filter layer being arranged between the at least two inorganic thin film layers.

[0021] In a possible implementation, the method of manufacturing the above top-emitting organic electroluminescent display panel provided by the embodiment of the present invention, after forming the color filter layer, further comprises: performing postbaking process to the color filter layer.

[0022] The embodiment of the present invention further provides a display device comprising the above top-emitting organic electroluminescent display panel provided by the embodiment of the present invention.

[0023] The beneficial effects of the embodiment of the present invention include:

[0024] The embodiments of the present invention provide a top-emitting organic electroluminescent display panel, a manufacturing method thereof and a display device; the top-emitting organic electroluminescent display panel comprising: a substrate, a layer of white organic light emitting diodes and a thin film encapsulation layer arranged on the substrate in sequence; wherein the thin film encapsulation layer comprises at least two inorganic thin film layers and at least one organic thin film layer; wherein one of the at least one organic thin film layer is a color filter layer comprising filters of at least three different colors for full color display, the color filter layer being arranged between the at least two inorganic thin film layers. Since one of the organic thin film layers in the thin film encapsulation layer is a color filter layer, the color filter layer does not have to be arranged above the thin film encapsulation layer separately; in this way, it can not only reduce the film layer number of the display panel, simplify the film layer structure, reduce the process flows and reduce the manufacturing cost, but also can shorten the light path from the light emitting layer to the color filter layer, thereby improving the luminous efficiency and the display effect.

BRIEF DESCRIPTION OF THE DRAWINGS

[0025]

Fig. 1 is a structural schematic diagram of a top-emitting organic electroluminescent display panel in the prior art;

Fig. 2a to Fig. 2d are respectively structural schematic diagrams of a top-emitting organic electroluminescent display panel provided by the embodiment of the present invention;

Fig. 3 is a flow chart of a method of manufacturing a top-emitting organic electroluminescent display panel provided by the embodiment of the present invention;

Fig. 4a to Fig. 4f are respectively structural schematic diagrams after performing respective steps of the method for manufacturing a top-emitting organic electroluminescent display panel provided by the embodiment of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

[0026] The specific implementations of the top-emitting organic electroluminescent display panel, the manufacturing method thereof and the display device provided by the embodiment of the present invention will be explained in detail below with reference to the drawings.

[0027] Wherein the thickness and the shape of the film

layers in the drawings do not reflect the real proportion of the top-emitting organic electroluminescent display panel, which only aim to explain the contents of the present invention schematically.

[0028] An embodiment of the present invention provides a top-emitting organic electroluminescent display panel, as shown in Fig. 2a to Fig. 2d, comprising: a substrate 100, a layer of white organic light emitting diodes 200 and a thin film encapsulation layer 300 arranged on the substrate 100 in sequence; wherein the thin film encapsulation layer 300 comprises at least two inorganic thin film layers 301 and at least one organic thin film layer 302;

wherein one of the at least one organic thin film layer 302 is a color filter layer 400 comprising filters of at least three different colors for full color display, the color filter layer 400 being arranged between the at least two inorganic thin film layers 301, 301.

[0029] In the above top-emitting organic electroluminescent display panel provided by the embodiment of the present invention, since one of the organic thin film layers in the thin film encapsulation layer is a color filter layer comprising filters of at least three different colors for full color display, the color filter layer does not have to be arranged above the thin film encapsulation layer separately; in this way, it can not only reduce the film layer number of the display panel, simplify the film layer structure, reduce the process flows and reduce the manufacturing cost, but also can shorten the light path from the light emitting layer to the color filter layer, thereby improving the luminous efficiency and the display effect.

[0030] In a specific implementation, in the above top-emitting organic electroluminescent display panel provided by the embodiment of the present invention, the inorganic thin film layer 301 and the organic thin film layer 302 are arranged alternately, thereby further blocking external moisture and oxygen permeation.

[0031] In a specific implementation, in the above top-emitting organic electroluminescent display panel provided by the embodiment of the present invention, the thickness of the inorganic thin film layer 301 can be set as 30nm to 2000nm; the thickness of the color filter layer 400 can be set as 30nm to 3000nm. Specifically, the specific thickness of the inorganic thin film layer 301 and the color filter layer 400 can be selected based on specific conditions, which will not be limited here.

[0032] In a specific implementation, in the above top-emitting organic electroluminescent display panel provided by the embodiment of the present invention, the material of the color filter layer 400 can be resin. The resin material is an organic material, which can not only have the function of color filtering, but also can effectively prevent the inorganic thin film layer 301 from cracking due to its relatively high elasticity.

[0033] In a specific implementation, in the above top-emitting organic electroluminescent display panel provided by the embodiment of the present invention, in order to avoid the inorganic thin film layer formed in the process of manufacturing the color filter layer from being damaged or cracking, as shown in Fig. 2b, the top-emitting organic electroluminescent display panel can comprise: a buffer layer 500 arranged between the color filter layer 400 and the inorganic thin film layer 301 adjacent below. Thus it can have the function of buffering in the process of forming the color filter layer 400, and ensure that the inorganic thin film layer 301 adjacent below will not be damaged.

[0034] In a specific implementation, in the above top-emitting organic electroluminescent display panel provided by the embodiment of the present invention, the thickness of the buffer layer 500 can be set as 5nm to 1000nm. Specifically, the specific thickness of the buffer layer 500 can be selected based on specific conditions, which will not be limited here.

[0035] In a specific implementation, in the above top-emitting organic electroluminescent display panel provided by the embodiment of the present invention, the material of the buffer layer 500 can be one of TiO_2, SiNx or SiOx or a combination thereof. Specifically, selecting the material of the above buffer layer 500 reasonably can further realize the buffering function, the specific material of the buffer layer 500 can be selected based on specific conditions, which will not be limited here.

[0036] In a specific implementation, in the above top-emitting organic electroluminescent display panel provided by the embodiment of the present invention, in order to avoid color mixing phenomenon, as shown in Fig. 2c, a black matrix 600 can be arranged between any two adjacent filters in the color filter layer 400. The black matrix 600 can block the light which is in the light beam emitted from the light emitting area of the white organic light emitting diodes corresponding to the filters and towards the edges of the filter, so as to prevent occurrence of the color mixing phenomenon.

[0037] In a specific implementation, in the above top-emitting organic electroluminescent display panel provided by the embodiment of the present invention, the thickness of the black matrix 600 can be less than or equal to the thickness of the color filter layer 400. Specifically, the specific thickness of the black matrix 600 can be selected based on specific conditions, which will not be limited here.

[0038] In a specific implementation, in the above top-emitting organic electroluminescent display panel provided by the embodiment of the present invention, in order to realize RGBW color imaging, as shown in Fig. 2d, the color filter layer 400 may further comprises a white light transmission area W, thus the color saturation can be improved.

[0039] In a specific implementation, in the above top-emitting organic electroluminescent display panel provided by the embodiment of the present invention, in order to further enable the inorganic thin film layer 301 on the color filter layer 400 to be connected with the color filter layer 400 better, as shown in Fig. 2d, a planarization layer 700 can be arranged in the white light transmission

area W of the color filter layer 400. In order to improve the luminous efficiency of the WOLED, as shown in Fig. 2a to Fig. 2c, the planarization layer 700 may also not be arranged. The planarization layer can be selected based on specific conditions, which will not be limited here.

[0040] In a specific implementation, in the above top-emitting organic electroluminescent display panel provided by the embodiment of the present invention, the thickness of the planarization layer 700 can be less than or equal to the thickness of the color filter layer 400. Specifically, the specific thickness of the planarization layer 700 can be selected based on specific conditions, which will not be limited here.

[0041] In a specific implementation, in the above top-emitting organic electroluminescent display panel provided by the embodiment of the present invention, the material of the inorganic thin film layer in the inorganic thin film layers 301 that is closest to the substrate is one of Al_2O_3, SiN_x or SiO_x or a combination thereof; the material of other inorganic thin film layers except for the inorganic thin film layer that is closest to the substrate is one of Al_2O_3, TiO_2, SiN_x or SiO_x or a combination thereof. Specifically, selecting the materials of the above inorganic thin film layers 301 reasonably can be further used for blocking external moisture and oxygen permeation. The specific materials of the inorganic thin film layers 301 can be selected based on specific conditions, which will not be limited here.

[0042] In a specific implementation, the top-emitting organic electroluminescent display panel provided by the embodiment of the present invention may generally also have other structures such as anode, adhesive, protective layer; these specific structures may have various implementations, which will not be limited here.

[0043] Based on the same inventive concept, the embodiment of the present invention further provides a method of manufacturing the above top-emitting organic electroluminescent display panel provided by the embodiment of the present invention, since the principle of the method for solving problems is similar with the preceding top-emitting organic electroluminescent display panel, the implementation of the method can make reference to the implementation of the top-emitting organic electroluminescent display panel, which will not be repeated here.

[0044] In a specific implementation, the method of manufacturing a top-emitting organic electroluminescent display panel provided by the embodiment of the present invention, as shown in Fig. 3, specifically comprises the steps of:

S301, forming a layer of white organic light emitting diodes on a substrate;

S302, forming at least two inorganic thin film layers and at least one organic thin film layer on the substrate on which the layer of white organic light emitting diodes is formed; wherein one of the at least one organic thin film layer is a color filter layer comprising filters of at least three different colors for full color display, the color filter layer being arranged between the at least two inorganic thin film layers.

[0045] In a specific implementation, in the method of manufacturing the above top-emitting organic electroluminescent display panel provided by the embodiment of the present invention, in order to further remove moisture, and enhance the adhesion between the color filter layer and the inorganic thin film layer, after forming the color filter layer in step 302, it may further comprise: performing postbaking process to the color filter layer. It needs to be noted that the postbaking process can be performed immediately after the color filter layer is formed, and can also be performed after the whole encapsulation thin film layer is formed. Since the condition of the postbaking process ($\leq$100°C) is same as that of the thermal aging process, an additional thermal aging process after the OLED manufacture can be omitted, it only needs to perform the above mentioned postbaking process, so as to simplify the manfuacturing process.

[0046] The method of manufacturing a top-emitting organic electroluminescent display panel provided by the embodiment of the present invention as shown in Fig. 2d will be explained in detail below with a specific example, specifically comprising the steps of:

1. forming a layer of white organic light emitting diodes on a substrate; in a specific implementation, as shown in Fig. 4a, a layer of white organic light emitting diodes 200 (WOLED) is formed on the substrate 100;

2. forming an inorganic thin film layer and a buffer layer in sequence on the substrate on which a layer of white organic light emitting diodes is formed;
in a specific implementation, as shown in Fig. 4b, an Al_2O_3 single layer thin film is formed firstly with atomic layer deposition (ALD) as the inorganic thin film layer 301, and then a TiO_2 single layer thin film is formed as the buffer layer 500, the water vapor transmission rate (WVTR) level of the inorganic thin film layer can reach a level below 10^{-6};

3. forming a pattern of the color filter layer on the buffer layer;
in a specific implementation, as shown in Fig. 4c, a color filter layer 400 comprising filters of three colors of red (R), green (G), and blue (B) is formed with the filter manufacturing process;

4. forming a black matrix between any two adjacent filters in the color filter layer;
in a specific implementation, as shown in Fig. 4d, a black matrix 600 is formed between the red filter R and the green filter G as well as between the green filter G and the blue filter B; here, the thickness of

the black matrix 600 is equal to the thickness of the color filter layer 400;

5. forming a planarization layer in a white light transmission area of the color filter layer;
in a specific implementation, as shown in Fig. 4e, a planarization layer 700 is formed in the white light transmission area of the color filter layer 400; here, the thickness of the planarization layer 700 is equal to the thickness of the color filter layer 400;

6. performing postbaking process to the color filter layer;
in a specific implementation, when postbaking process is performed to the color filter layer 400, the temepature does not exeed 100□, so as to avoid damage to the WOLED;

7. forming an inorganic thin film layer on the color filter layer;
in a specific implementation, as shown in Fig. 4f, an organic thin film layer 301 is formed on the color filter layer 400.

[0047] Thus, the above top-emitting organic electroluminescent display panel provided by the embodiment of the present invention is manufactured with the above steps 1 to 7 provided by the specific example.

[0048] Based on the same inventive concept, the embodiment of the present invention further provides a display device comprising the above top-emitting organic electroluminescent display panel provided by the embodiment of the present invention, the display device may be any product or component with the display function such as: a mobile phone, a tablet computer, a television, a display, a laptop, a digital photo frame, a navigator, etc. Other essential components of the display device should all be possessed as understood by the ordinary skilled person in the art, which will not be repeated here, and should not be taken as limitations to the present invention either. The implementation of the display device can make reference to the embodiments of the above top-emitting organic electroluminescent display panel, which will not be repeated here.

[0049] The embodiment of the present invention provides a top-emitting organic electroluminescent display panel, a manufacturing method thereof and a display device; the top-emitting organic electroluminescent display panel comprising: a substrate, a layer of white organic light emitting diodes and a thin film encapsulation layer arranged on the substrate in sequence; wherein the thin film encapsulation layer comprises at least two inorganic thin film layers and at least one organic thin film layer; wherein one of the at least one organic thin film layer is a color filter layer comprising filters of at least three different colors for full color display, the color filter layer being arranged between the at least two inorganic thin film layers. Since one of the organic thin film layers in the thin film encapsulation layer is a color filter layer, the color filter layer does not have to be arranged above the thin film encapsulation layer separately; in this way, it can not only reduce the film layer number of the display panel, simplify the film layer structure, reduce the process flows and reduce the manufacturing cost, but also can shorten the light path from the light emitting layer to the color filter layer, thereby improving the luminous efficiency and the display effect.

[0050] Apparently, the skilled person in the art can make various modifications and variations to the present invention without departing from the spirit and scope of the present invention. In this way, provided that these modifications and variations of the present invention belong to the scopes of the claims of the present invention and the equivalent technologies thereof, the present invention also intends to cover these modifications and variations.

Claims

1. A top-emitting organic electroluminescent display panel, comprising:

   a substrate, a layer of white organic light emitting diodes and a thin film encapsulation layer arranged on the substrate in sequence; wherein the thin film encapsulation layer comprises at least two inorganic thin film layers and at least one organic thin film layer; **characterized in that**:

   wherein one of the at least one organic thin film layer is a color filter layer comprising filters of at least three different colors for full color display, the color filter layer being arranged between the at least two inorganic thin film layers.

2. The top-emitting organic electroluminescent display panel as claimed in claim 1, **characterized in that** the inorganic thin film layer and the organic thin film layer are arranged alternately.

3. The top-emitting organic electroluminescent display panel as claimed in claim 1, **characterized in that** the thickness of the inorganic thin film layer is 30nm to 2000nm; the thickness of the color filter layer is 30nm to 3000nm.

4. The top-emitting organic electroluminescent display panel as claimed in claim 1, **characterized in that** the material of the color filter layer is resin.

5. The top-emitting organic electroluminescent display panel as claimed in claim 1, **characterized in that** further comprising: a buffer layer arranged between

the color filter layer and the inorganic thin film layer adjacent below.

6. The top-emitting organic electroluminescent display panel as claimed in claim 5, **characterized in that** the thickness of the buffer layer is 5nm to 1000nm.

7. The top-emitting organic electroluminescent display panel as claimed in claim 6, **characterized in that** the material of the buffer layer is one of TiO_2, SiNx or SiOx or a combination thereof.

8. The top-emitting organic electroluminescent display panel as claimed in claim 1, **characterized in that** a black matrix is arranged between any two adjacent filters in the color filter layer.

9. The top-emitting organic electroluminescent display panel as claimed in claim 8, **characterized in that** the thickness of the black matrix is less than or equal to the thickness of the color filter layer.

10. The top-emitting organic electroluminescent display panel as claimed in claim 1, **characterized in that** the color filter layer further comprises a white light transmission area.

11. The top-emitting organic electroluminescent display panel as claimed in claim 10, **characterized in that** a planarization layer is arranged in the white light transmission area of the color filter layer.

12. The top-emitting organic electroluminescent display panel as claimed in claim 11, **characterized in that** the thickness of the planarization layer is less than or equal to the thickness of the color filter layer.

13. The top-emitting organic electroluminescent display panel as claimed in any one of claims 1 to 12, **characterized in that** the material of the inorganic thin film layer in the inorganic thin film layers that is closest to the substrate is one of Al_2O_3, SiN_x or SiO_x or a combination thereof.

14. The top-emitting organic electroluminescent display panel as claimed in any one of claims 1 to 12, **characterized in that** the material of other inorganic thin film layers in the inorganic thin film layers except for the inorganic thin film layer that is closest to the substrate is one of Al_2O_3, TiO_2, SiN_x or SiO_x or a combination thereof.

15. A method of manufacturing a top-emitting organic electroluminescent display panel as claimed in any one of claims 1 to 14, **characterized in that**, comprising:

forming a layer of white organic light emitting diodes on a substrate;

forming at least two inorganic thin film layers and at least one organic thin film layer on the substrate on which the layer of white organic light emitting diodes is formed; wherein one of the at least one organic thin film layer is a color filter layer comprising filters of at least three different colors for full color display, the color filter layer being arranged between the at least two inorganic thin film layers.

16. The method as claimed in claim 15, **characterized in that**, after forming the color filter layer, further comprising: performing postbaking process to the color filter layer.

17. A display device, **characterized in that**, comprising a top-emitting organic electroluminescent display panel as claimed in any one of claims 1 to 14.

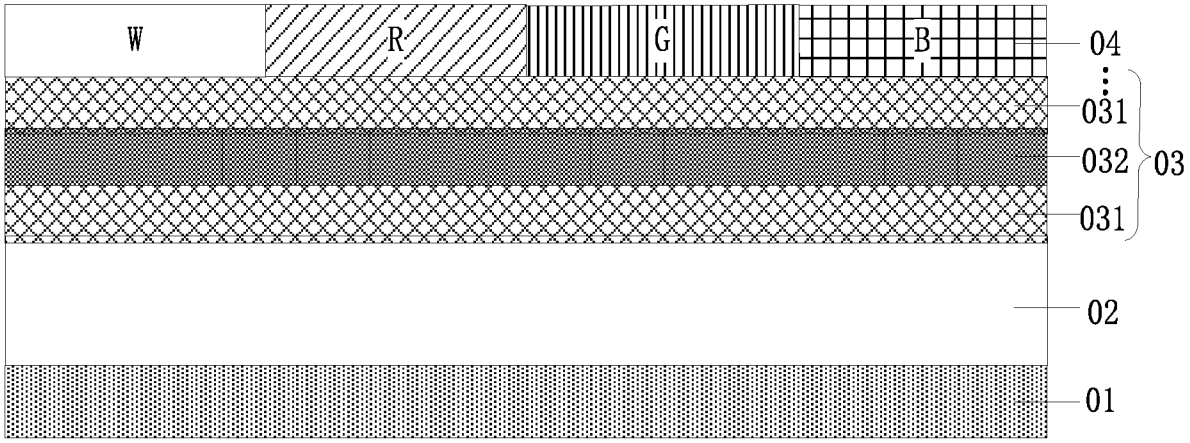

Fig. 1

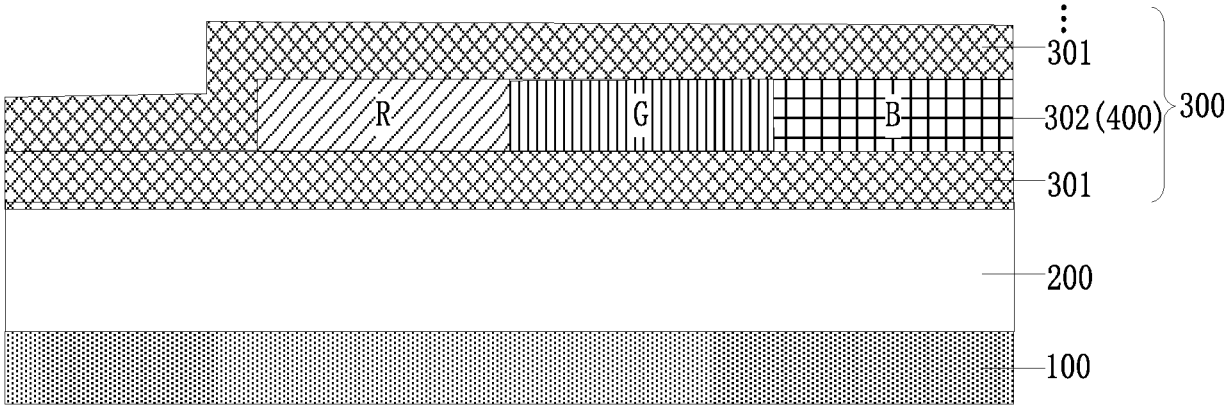

Fig. 2a

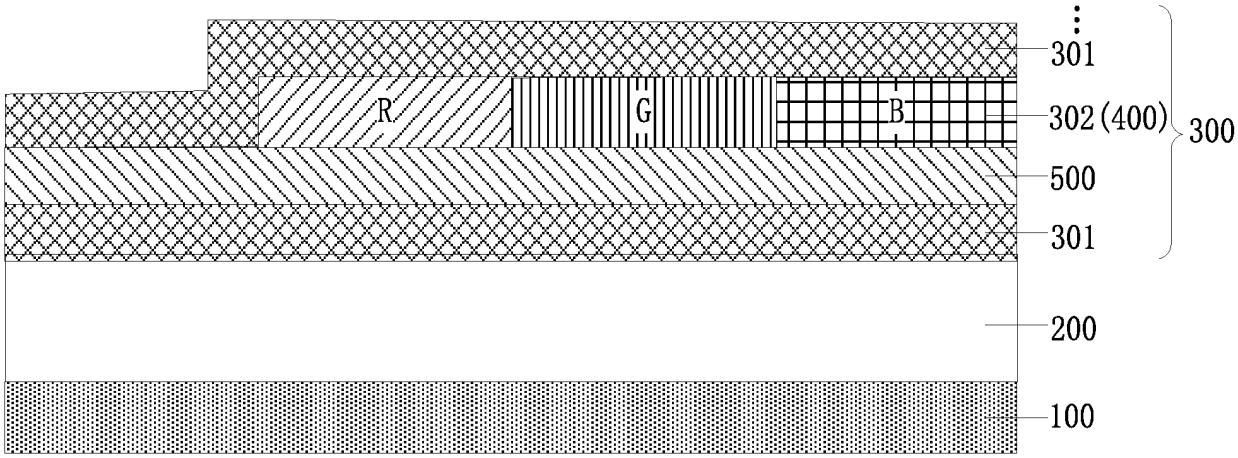
301
R
G
B
302 (400)
300
500
301
200
100

Fig. 2b

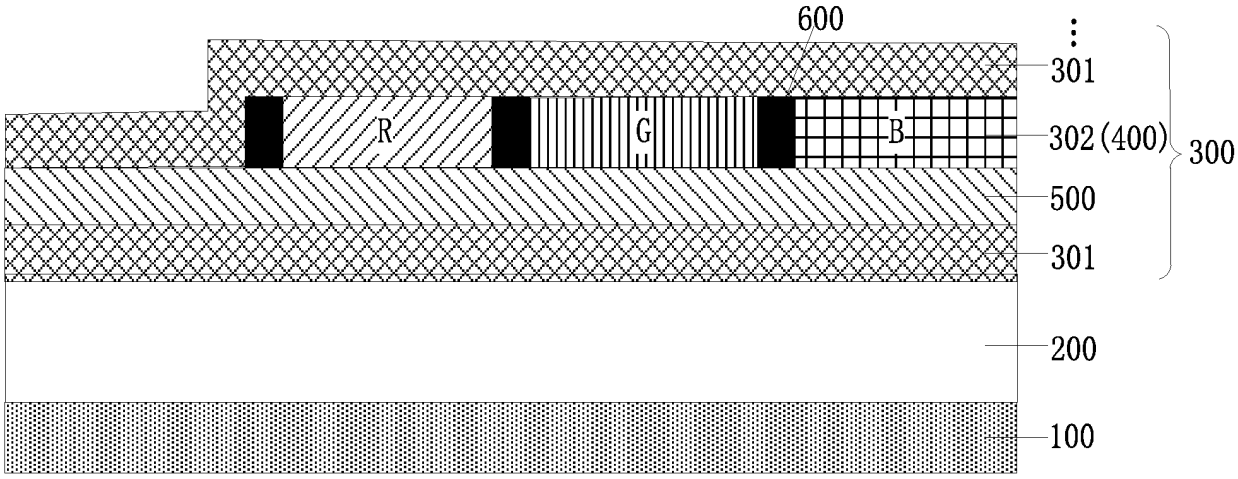
600
301
R
G
B
302 (400)
300
500
301
200
100

Fig. 2c

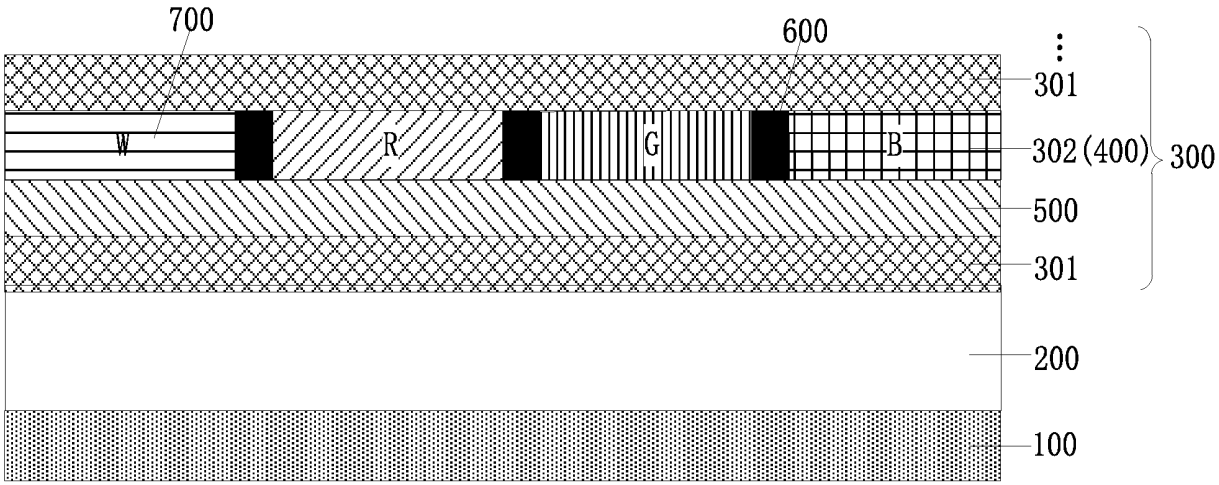

Fig. 2d

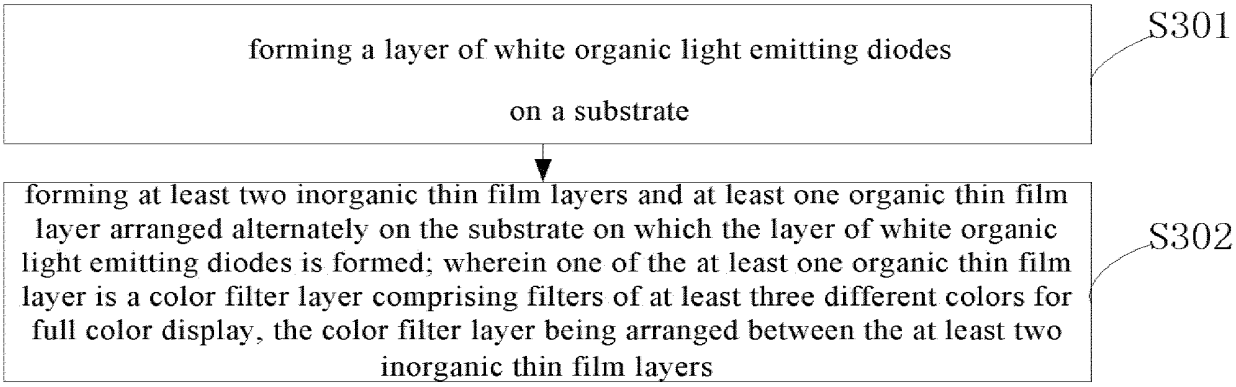

Fig. 3

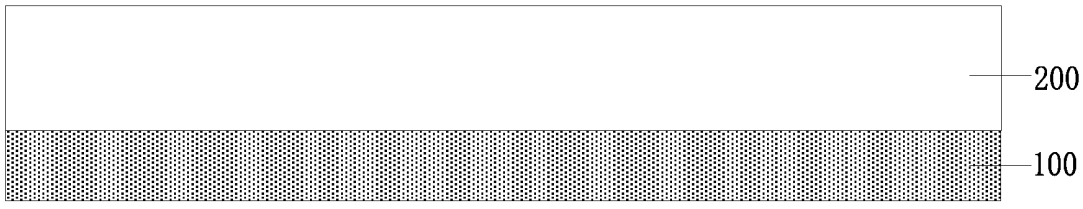

Fig. 4a

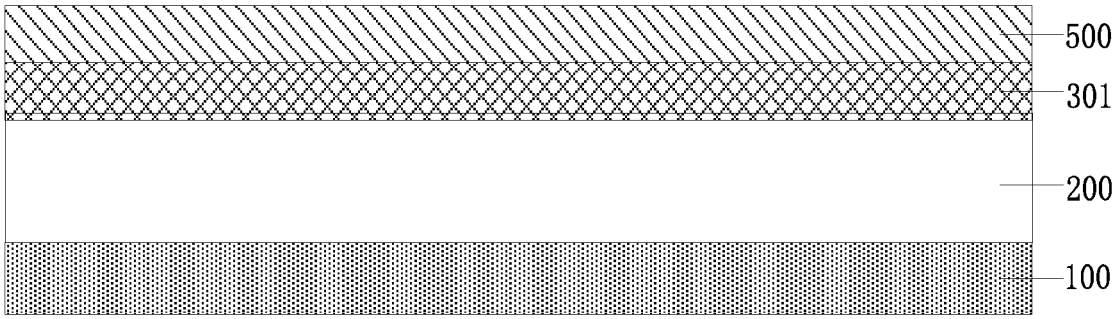

Fig. 4b

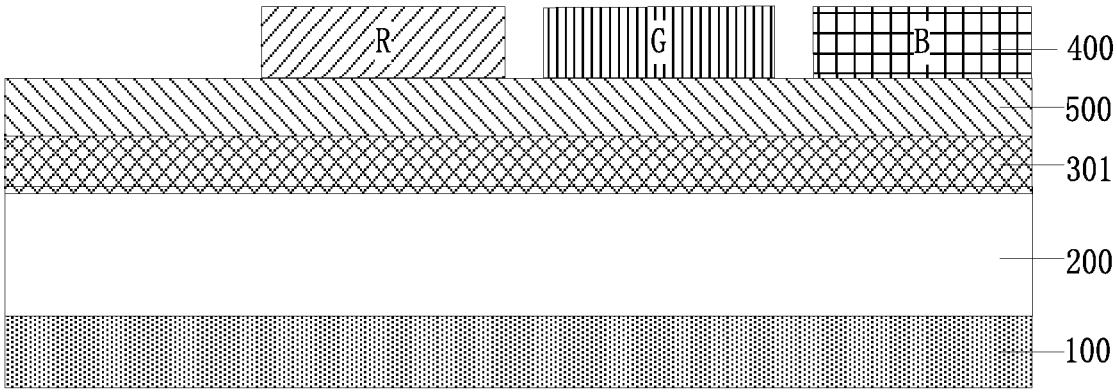

Fig. 4c

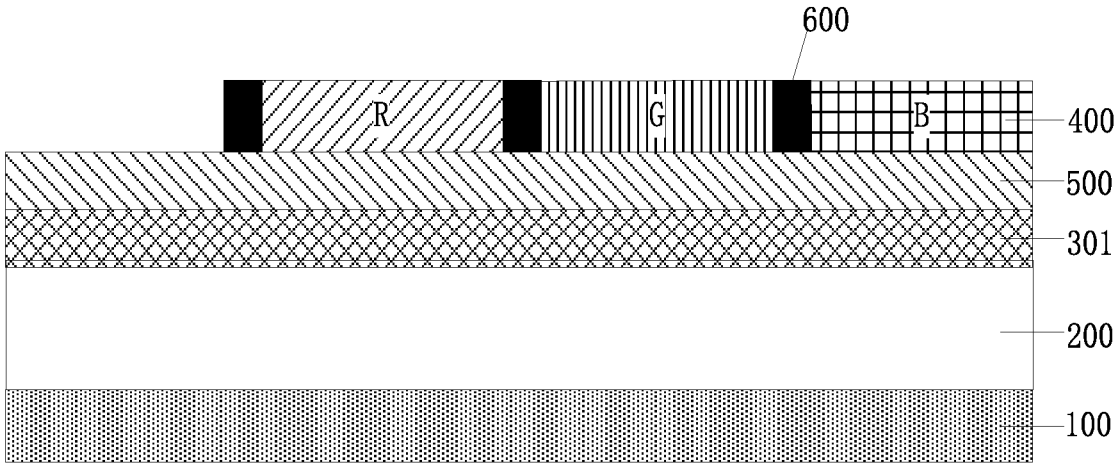

Fig. 4d

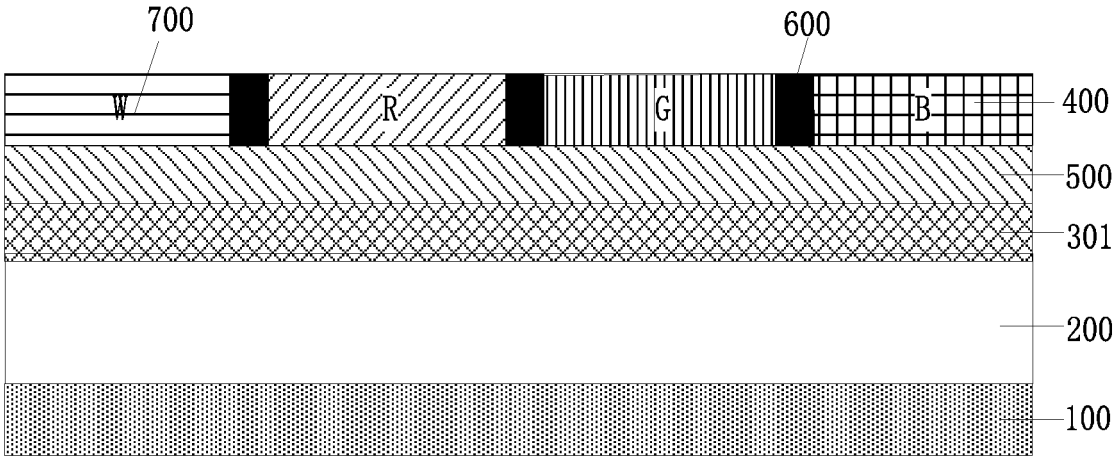
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Fig. 4e

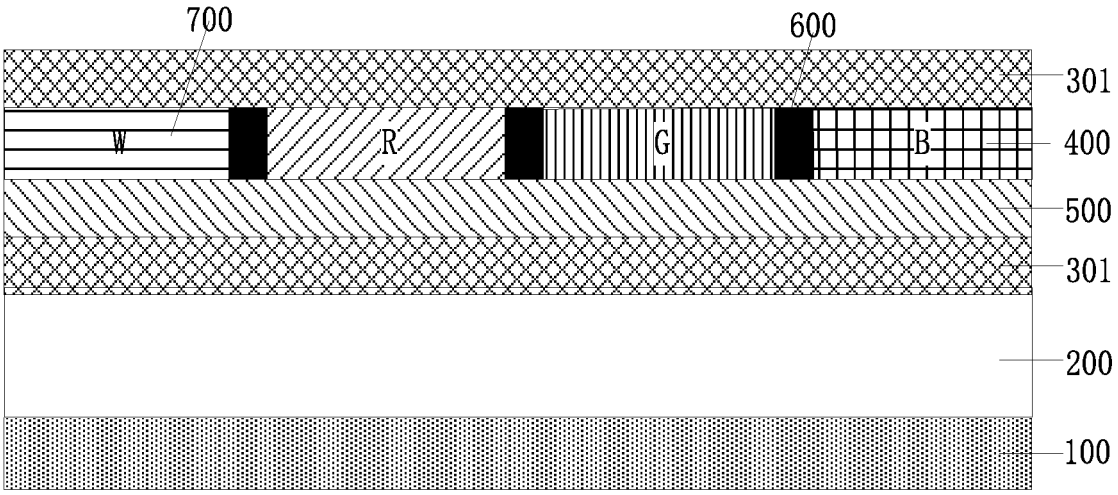
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Fig. 4f

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2015/089150

A. CLASSIFICATION OF SUBJECT MATTER

H01L 51/52 (2006.01) i; H01L 27/32 (2006.01) i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

H01L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPODOC, WPI, CNPAT, CNKI: white light, light-emitting, BOE, organ+, OLED, white, filter, CF, inorgan+, film, barrier

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
PX	CN 104701465 A (BOE TECHNOLOGY GROUP CO., LTD.), 10 June 2015 (10.06.2015), claims 1-16, description, paragraphs 0033-0068, and figures 1-4f	1-17
X	US 2008081105 A1 (SAMSUNG SDI CO., LTD.), 03 April 2008 (03.04.2008), description, paragraphs 0030-0038, and figure 1	1-17
X	CN 101447509 A (YUNNAN NORTH OLIGHTEK OPTO-ELECTRONIC TECHNOLOGY CO., LTD.), 03 June 2009 (03.06.2009), description, page 1, line 3 to page 5, line 20, and figure 1	1-17
X	US 2006232195 A1 (EASTMAN KODAK COMPANY), 19 October 2006 (19.10.2006), description, paragraph 0055, and figure 10	1-17
A	US 2006290276 A1 (EASTMAN KODAK COMPANY), 28 December 2006 (28.12.2006), the whole document	1-17

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
03 November 2015 (03.11.2015)	**12 November 2015 (12.11.2015)**
Name and mailing address of the ISA/CN: State Intellectual Property Office of the P. R. China No. 6, Xitucheng Road, Jimenqiao Haidian District, Beijing 100088, China Facsimile No.: (86-10) 62019451	Authorized officer **FANG, Dingyi** Telephone No.: (86-10) **62413896**

Form PCT/ISA/210 (second sheet) (July 2009)

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2015/089150

Patent Documents referred in the Report	Publication Date	Patent Family	Publication Date
CN 104701465 A	10 June 2015	None	
US 2008081105 A1	03 April 2008	US 2005062407 A1	24 March 2005
		US 7339315 B2	04 March 2008
		KR 20050029426 A	28 March 2005
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		JP 2009076475 A	09 April 2009
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		CN 101452948 B	01 June 2011
CN 101447509 A	03 June 2009	CN 101447509 B	22 September 2010
US 2006232195 A1	19 October 2006	WO 2006113319 A1	26 October 2006
		TW 200642527 A	01 December 2006
US 2006290276 A1	28 December 2006	WO 2007002097 A1	04 January 2007

Form PCT/ISA/210 (patent family annex) (July 2009)

专利名称(译)	顶部发光有机电致发光显示面板，其制造方法和显示装置		
公开(公告)号	EP3270434A1	公开(公告)日	2018-01-17
申请号	EP2015832669	申请日	2015-09-08
[标]申请(专利权)人(译)	京东方科技集团股份有限公司		
申请(专利权)人(译)	京东方科技集团股份有限公司.		
当前申请(专利权)人(译)	京东方科技集团股份有限公司.		
[标]发明人	LEE JOOHYEON HUANGFU LUJIANG PARK JINSAN		
发明人	LEE, JOOHYEON HUANGFU, LUJIANG PARK, JINSAN		
IPC分类号	H01L51/52 H01L27/32		
CPC分类号	H01L27/322 H01L51/5253 H01L51/5284 H01L51/56		
优先权	201510104824.8 2015-03-10 CN		
其他公开文献	EP3270434A4		
外部链接	Espacenet		

摘要(译)

本发明公开了一种顶部发光有机电致发光显示面板及其制造方法和显示装置;顶部发光有机电致发光显示面板包括：基板，白色有机发光二极管层和依次设置在基板上的薄膜封装层;其中薄膜封装层包括至少两个无机薄膜层和至少一个有机薄膜层;其中所述至少一个有机薄膜层中的一个是包括至少三种不同颜色的滤光器的滤色器层，用于全色显示，所述滤色器层设置在所述至少两个无机薄膜层之间。由于薄膜封装层中的一个有机薄膜层是滤色器层，所以滤色器层不必分别布置在薄膜封装层上方;这样，不仅可以减少显示面板的薄膜层数，简化薄膜层结构，减少工艺流程，降低制造成本，还可以缩短从发光层到滤色器的光路层，从而提高发光效率和显示效果。

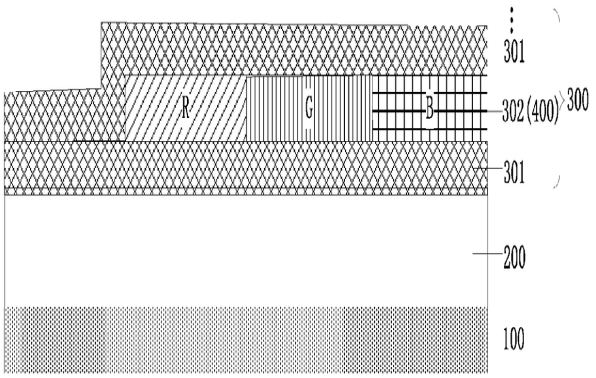

Fig. 2a