



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
18.06.2014 Bulletin 2014/25

(51) Int Cl.:
H01L 51/52 (2006.01) H01L 27/32 (2006.01)

(21) Application number: **13195595.7**

(22) Date of filing: **04.12.2013**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME

- **Yoo, Seongyeol**
Beijing Beijing 100176 (CN)
- **Choi, Seungjin**
Beijing Beijing 100176 (CN)
- **Kim, Heecheol**
Beijing Beijing 100176 (CN)

(30) Priority: **12.12.2012 CN 201210537562**

(74) Representative: **Brötz, Helmut et al**
Rieder & Partner
Patentanwälte - Rechtsanwalt
Corneliusstrasse 45
42329 Wuppertal (DE)

(71) Applicant: **Boe Technology Group Co. Ltd.**
Beijing 100015 (CN)

(72) Inventors:
• **Song, Youngsuk**
Beijing Beijing 100176 (CN)

(54) **Array substrate and fabrication method thereof, display device**

(57) Embodiments of the invention disclose an array substrate and a fabrication method thereof, and a display device. The array substrate comprises a plurality of pixel units disposed on a base substrate. Each pixel unit comprises a thin-film transistor region and a display region (A) other than the thin-film transistor region. A thin-film transistor structure is formed in the thin-film transistor region, and an organic light-emitting diode driven by the thin-film transistor structure is disposed in the display region. The organic light-emitting diode comprises a transparent first electrode (11), a light-emitting layer (13), and

a second electrode (14) for reflecting light that are sequentially formed in a direction away from the base substrate. A transfective layer (8) is formed in the display region. A color filter film (9) is formed in the display region and is disposed between the second electrode (14) of the organic light-emitting diode and the transfective layer (8). The second electrode of the organic light-emitting diode and the transfective layer form a microcavity structure. The color filter films in the pixel units of different colors have different thicknesses.

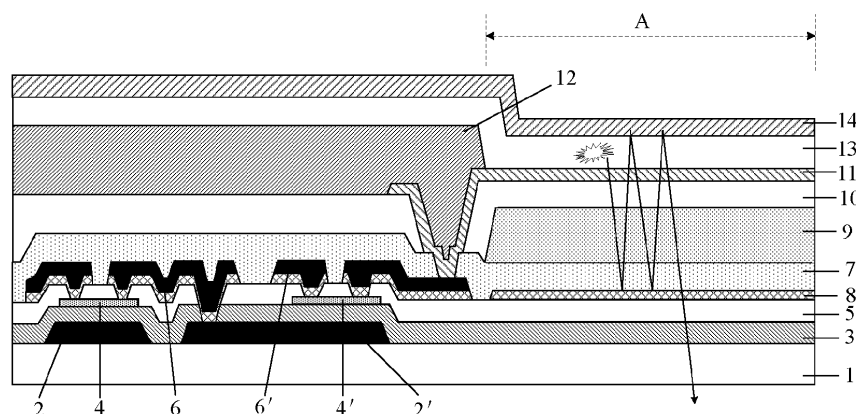


FIG. 5

Description

TECHNICAL FIELD

[0001] Embodiments of the invention relate to an array substrate and a fabrication method thereof, and a display device.

BACKGROUND

[0002] Organic Light-Emitting Diode (OLED) has the advantages of simple process, low cost, capable of adjusting color of the emitted light in the visible region, easy for mass production, good flexibility and the like, and thus an OLED display device using the OLED is regarded as one of the most promising display technologies in the future. White OLED (WOLED) has a power efficiency over 60 lm/W and a lifetime of 20,000 hours or more, which greatly promotes the development of the WOLED display device.

[0003] FIG. 1(a) is a schematic diagram illustrating a conventional WOLED without a microcavity structure. As illustrated in FIG. 1(a), the WOLED adopts an organic light-emitting layer 102 formed by light-emitting materials of three primary colors of red, green and blue, so that the organic light-emitting layer 102 emits white light. The organic light-emitting layer 102 is disposed between a cathode 101 and an anode 103, and the white light emitted from the light-emitting layer 102 exits on the anode side after reflected by the cathode 101.

[0004] In order to improve light extraction efficiency of the WOLED and increase brightness of the WOLED display device, a transfective layer 103' is provided on the anode side, so as to form a microcavity structure between the cathode 101 and the transfective layer 103', as shown in FIG. 1(b). The microcavity structure is a structure with a thickness of micrometers formed between the reflecting layer and the transfective layer. The microcavity structure enhances the intensity of light based on the following principle. Light from the light-emitting layer is repeatedly reflected between the reflecting layer and the transfective layer, light with particular wavelength among the light ultimately emitted from the transfective layer will be enhanced due to the resonance effect, and the wavelength of the enhanced light is relevant to the thickness of the microcavity. In the WOLED display device, different pixel units are used to emit light of different colors, thus the microcavities in different pixel units should have different thicknesses so that light of different wavelengths can be enhanced in the different pixel units.

[0005] FIG. 2 is a structural schematic diagram illustrating an array substrate of the conventional WOLED display device with the microcavity structure, and FIG. 3 is a structural schematic diagram illustrating another array substrate of the conventional WOLED display device with the microcavity structure. As shown in FIGS. 2 and 3, a color filter film is disposed outside the microcavity structure, color filter films of different colors belong to

different pixel units, and microcavity structures corresponding to the color filter films of different colors have different thicknesses.

[0006] FIG. 4 is a schematic diagram illustrating a comparison between a brightness of a WOLED with the microcavity structure and a brightness of a WOLED without the microcavity structure, wherein the dotted line corresponds to the brightness of the WOLED without the microcavity structure, and the solid line corresponds to the brightness of the WOLED with the microcavity structure. As illustrated in FIG. 4, by using the microcavity structure, the brightness of the blue light is increased by about 1.6 times, the brightness of the green light is increased by 2.5 times, and the brightness of the red light is increased by about 2.2 times.

[0007] Although the conventional microcavity structure enhances the intensity of the light, it can be seen from FIGS. 2 and 3 that the conventional microcavity structures have relatively complex hierarchy structures, it is required that the microcavity structures in the regions corresponding to the color filter films of different colors to have different thicknesses, and thus the fabrication process is relatively complex.

SUMMARY

[0008] According to one aspect of the invention, there is provided an array substrate. The array substrate comprises a plurality of pixel units disposed on a base substrate. Each pixel unit comprises a thin-film transistor region and a display region other than the thin-film transistor region. A thin-film transistor structure is formed in the thin-film transistor region, and an organic light-emitting diode driven by the thin-film transistor structure is disposed in the display region. The organic light-emitting diode comprises a transparent first electrode, a light-emitting layer, and a second electrode for reflecting light that are sequentially formed in a direction away from the base substrate. A transfective layer is formed in the display region. A color filter film is formed in the display region and is disposed between the second electrode of the organic light-emitting diode and the transfective layer. The second electrode of the organic light-emitting diode and the transfective layer form a microcavity structure. The color filter films in the pixel units of different colors have different thicknesses.

[0009] For example, the thin-film transistor structure comprises: a first gate electrode and a second gate electrode formed on the base substrate; a gate insulating layer formed on the first gate electrode and the second gate electrode; a first active layer and a second active layer formed on the gate insulating layer; an insulating layer formed on the first active layer and the second active layer; a first source electrode and a first drain electrode formed on the insulating layer and corresponding to the first active layer, and a second source electrode and a second drain electrode formed on the insulating layer and corresponding to the second active layer. The

first gate electrode, the gate insulating layer, the first active layer, the insulating layer, the first source electrode and the first drain electrode form a switching thin-film transistor. The second gate electrode, the gate insulating layer, the second active layer, the insulating layer, the second source electrode and the second drain electrode form a driving thin-film transistor. The first drain electrode is connected to the second gate electrode, and the second drain electrode of the driving thin-film transistor is connected to the first electrode of the organic light-emitting diode.

[0010] For example, a passivation layer is formed on the thin-film transistor structure, and the passivation layer is further formed in the display region, the organic light-emitting diode is formed above the passivation layer, and the first electrode is connected to the second drain electrode through a via hole of the passivation layer.

[0011] For example, the insulating layer is further formed in the display region, and the transfective layer is formed between the insulating layer and the passivation layer.

[0012] For example, the color filter film is formed on the passivation layer and the first electrode of the organic light-emitting diode is disposed on the color filter film.

[0013] For example, a resin layer is further formed on the color filter film, the first electrode of the organic light-emitting diode is disposed on the resin layer, and the first electrode is connected to the second drain electrode through a via hole extending through the resin layer and the passivation layer.

[0014] For example, a portion of the transfective layer is formed below the first source electrode, the first drain electrode, the second source electrode and the second drain electrode of the thin-film transistor structure, and a pattern of the portion of the transfective layer is same as patterns of the first source electrode, the first drain electrode, the second source electrode and the second drain electrode.

[0015] For example, the pixel unit further comprises a pixel define layer disposed on the first electrode.

[0016] For example, the transfective layer is formed of any one of silver, aluminum, molybdenum, copper, titanium and chromium, or an alloy of two or more of the foregoing metals, and the transfective layer has a transmittance of 50%~95%.

[0017] For example, the transfective layer has a thickness of 10Å~200Å.

[0018] For example, the color filter film has a thickness of 1000Å~40000Å.

[0019] For example, the color filter films in the pixel units of different colors are red, green and blue; or red, green, blue and yellow; or red, green, blue and white.

[0020] For example, the first electrode is an anode, and the second electrode is a cathode.

[0021] For example, the first electrode is a cathode, and the second electrode is an anode.

[0022] For example, the second electrode is made of a reflective material, or the second electrode is coated

with a reflecting layer.

[0023] According to another aspect of the invention, there is provided a display device. The display device comprises the array substrate as described above.

[0024] According to yet another aspect of the invention, there is provided an array substrate fabrication method. The array substrate comprises a plurality of pixel units disposed on a base substrate, and each pixel unit comprises a thin-film transistor region and a display region other than the thin-film transistor region. The method comprises: forming a thin-film transistor structure, a transfective layer and a passivation layer on the base substrate; forming a color filter film in the display region of each pixel unit, so that the color filter films in the pixel units of different colors have different thicknesses; and forming an organic light-emitting diode in the display region of each pixel unit so that the color filter film is disposed between the organic light-emitting diode and the transfective layer.

[0025] For example, forming the thin-film transistor structure, the transfective layer and the passivation layer on the base substrate comprises: forming gate electrodes, a gate insulating layer, active layers, an insulating layer and a via hole of the insulating layer on the base substrate; forming a transfective film and a source-drain metal film, and forming a transfective layer and source and drain electrodes of thin-film transistor structure by a patterning process; and forming a passivation layer.

[0026] For example, forming the color filter film in the display region of each pixel unit comprises: forming the color filter films in the pixel units of different colors by multiple patterning processes and each patterning process forms the color filter film in the pixel unit of one color, so that the color filter films in the pixel units of different colors have different thicknesses.

[0027] For example, forming the organic light-emitting diode in the display region of each pixel unit comprises: forming a via hole of the passivation layer by a patterning process; forming a transparent conductive film and forming a first electrode of the organic light-emitting diode by a patterning process on the transparent conductive film, so that the first electrode is connected to the thin-film transistor structure through the via hole; forming an insulating film and forming a pixel define layer by a patterning process on the insulating film, so that the organic light-emitting diode to be formed is defined in the display region; forming an organic light-emitting layer and forming a second electrode for reflecting light, so that the organic light-emitting diode is formed.

[0028] For example, after forming the color filter film and before forming the organic light-emitting diode, the method further comprises forming a resin layer.

[0029] For example, forming the organic light-emitting diode in the display region of each pixel unit comprises: forming a via hole extending through the passivation layer and the resin layer by a patterning process; forming a transparent conductive film and forming a first electrode of the organic light-emitting diode by a patterning process

on the transparent conductive film, so that the first electrode is connected to the thin-film transistor structure through the via hole; forming an insulating film and forming a pixel define layer by a patterning process on the insulating film, so that the organic light-emitting diode to be formed is defined in the display region; forming an organic light-emitting layer and forming a second electrode for reflecting light, so that the organic light-emitting diode is formed.

[0030] For example, the transfective layer is formed of any one of silver, aluminum, molybdenum, copper, titanium and chromium, or an alloy of two or more of the foregoing metals, and the transfective layer has a transmittance of 5%~95%.

[0031] For example, the transfective layer has a thickness of 10Å~200Å.

[0032] For example, the color filter film has a thickness of 1000Å~40000Å.

BRIEF DESCRIPTION OF THE DRAWINGS

[0033] In order to clearly illustrate the technical solution of the embodiments of the invention, the drawings of the embodiments will be briefly described in the following; it is obvious that the described drawings are only related to some embodiments of the invention and thus are not limitative of the invention.

FIG. 1(a) is a schematic diagram illustrating a conventional WOLED without a microcavity structure; FIG. 1(b) is a schematic diagram illustrating a conventional WOLED with a microcavity structure; FIG. 2 is a structural schematic diagram illustrating an array substrate of a conventional WOLED display device with a microcavity structure; FIG. 3 is a structural schematic diagram illustrating another array substrate of a conventional WOLED display device with a microcavity structure; FIG. 4 is a schematic diagram illustrating a comparison between a brightness of a WOLED with a microcavity structure and a brightness of a WOLED without a microcavity structure; FIG. 5 is a structural schematic diagram illustrating an array substrate according to an embodiment of the invention; FIG. 6 is a schematic diagram illustrating forming a thin-film transistor structure and a transfective layer on a substrate in an array substrate fabrication method according to an embodiment of the invention; FIG. 7 is a schematic diagram illustrating forming a passivation layer in the array substrate fabrication method according to the embodiment of the invention; FIG. 8 is a schematic diagram illustrating forming a color filter film in the array substrate fabrication method according to the embodiment of the invention; FIG. 9 is a schematic diagram illustrating forming a resin layer in the array substrate fabrication method

according to the embodiment of the invention; FIG. 10 is a schematic diagram illustrating forming an anode in the array substrate fabrication method according to the embodiment of the invention; and FIG. 11 is a schematic diagram illustrating forming a pixel define layer in the array substrate fabrication method according to the embodiment of the invention.

DETAILED DESCRIPTION

[0034] In order to make objects, technical details and advantages of the embodiments of the invention apparent, the technical solutions of the embodiment will be described in a clearly and fully understandable way in connection with the drawings related to the embodiments of the invention. It is obvious that the described embodiments are just a part but not all of the embodiments of the invention. Based on the described embodiments herein, those skilled in the art can obtain other embodiment(s), without any inventive work, which should be within the scope of the invention.

[0035] An array substrate according to an embodiment of the invention comprises: a plurality of gate lines, a plurality of data lines and a plurality of pixel units formed by the plurality of gate lines and the plurality of data lines intersecting with each other on a base substrate 1. FIG. 5 is a structural schematic diagram illustrating the array substrate according to the embodiment of the invention, in which only one pixel unit is shown as an example. As illustrated in FIG. 5, each pixel unit comprises: a thin-film transistor region and a display region A other than the thin-film transistor region. A thin-film transistor structure is formed in the thin-film transistor region, and an organic light-emitting diode driven by the thin-film transistor structure is formed in the display region A. Each pixel unit further comprises a color filter film 9 disposed in the display region A of the pixel unit. The organic light-emitting diode comprises a transparent first electrode 11, a light-emitting layer 13, and a second electrode 14 for reflecting light that are sequentially formed in a direction away from the base substrate 1.

[0036] In order to achieve a microcavity structure, the pixel unit of the array substrate further comprises a transfective layer 8. The transfective layer 8 is disposed in the display region A of the pixel unit. The color filter film 9 is disposed between the second electrode 14 of the organic light-emitting diode and the transfective layer 8. The color filter films 9 in the pixel units of different colors have different thicknesses. A portion of the transfective layer 8 may be disposed in a source-drain electrodes region of the thin-film transistor structure (in the case that the portion of the transfective layer 8 is disposed in the source-drain region, the transfective layer 8 may be formed by a same patterning process as the source and drain electrodes). The second electrode 14 of the organic light-emitting diode and the transfective layer 8 form a microcavity structure. The color filter film 9 is disposed inside

the microcavity structure, and specifically, it is disposed between the second electrode 14 of the organic light-emitting diode and the transfective layer 8. Since the color filter films 9 in the pixel units of different colors have different thicknesses, the thicknesses of the microcavity structures in the pixel units of different colors can be adjusted by controlling the thicknesses of the color filter films 9 in the pixel units of different colors. Because the color filter films in the pixel units of different colors are formed in different steps, their thickness can easily be controlled respectively. Accordingly, it is unnecessary to respectively produce additional layers for pixel units of different colors so that the pixel units of different colors have the microcavity structures of different thicknesses. As a result, the fabrication process of the array substrate according to the embodiment of the invention can be simplified and the cost can be reduced.

[0037] As shown in FIG. 5, the thin-film transistor structure in the thin-film transistor region comprises: a first gate electrode 2 and a second gate electrode 2' formed on the base substrate 1; a gate insulating layer 3 formed on the first gate electrode 2 and the second gate electrode 2'; a first active layer 4 and a second active layer 4' formed on the gate insulating layer 3; an insulating layer 5 formed on the first active layer 4 and the second active layer 4'; a first source-drain electrodes layer 6 (including a first source electrode and a first drain electrode) and a second source-drain electrodes layer 6' (including a second source electrode and a second drain electrode) formed on the insulating layer 5. The first gate electrode 2, the gate insulating layer 3, the first active layer 4, the insulating layer 5 and the first source-drain electrodes layer 6 form a switching thin-film transistor. The second gate electrode 2', the gate insulating layer 3, the second active layer 4', the insulating layer 5 and the second source-drain electrodes layer 6' form a driving thin-film transistor. The first drain electrode is connected with the second gate electrode, and the second drain electrode of the driving thin-film transistor is connected with the first electrode of the organic light light-emitting diode.

[0038] A passivation layer 7 is formed on the thin-film transistor structure, and specifically, the passivation layer 7 is formed on the first source-drain electrodes layer 6 and the second source-drain electrodes layer 6'. Depending on the fabrication processes, the portion of the transfective layer may be under the first source-drain electrodes layer 6 and the second source-drain electrodes layer 6', and a pattern of the portion of the transfective layer is same as patterns of the first source-drain electrodes layer 6 and the second source-drain electrodes layer 6'. When the portion of the transfective layer is disposed under the first source-drain electrodes layer 6 and the second source-drain electrodes layer 6', the transfective layer is required to be made of conductive material.

[0039] In addition, the insulating layer 5 and the passivation layer 7 in the thin-film transistor region are further formed in the display region A. The organic light-emitting

diode is formed above the passivation layer 7, and the first electrode 11 is connected to the second drain electrode through a via hole of the passivation layer 7.

[0040] The transfective layer 8 is formed between the insulating layer 5 and the passivation layer 7, the color filter film 9 is formed on the passivation layer 7, and the first electrode 11 of the organic light-emitting diode is formed on the color filter film 9. The organic light-emitting diode is disposed above the transfective layer 8 and the color filter film 9, and is defined in the display region A by a pixel define layer (PDL) 12. In addition, the first electrode 11 is an anode, the second electrode 14 is a cathode (alternatively, the first electrode 11 is the cathode, and the second electrode 14 is the anode), and the first electrode 11 is connected to the second drain electrode through the via hole of the passivation layer 7. The second electrode 14 may be a reflecting electrode made of a reflective material, or the second electrode 14 is coated with a reflecting layer to form the reflecting electrode.

[0041] As for the switching thin-film transistor, the gate electrode (the first gate electrode 2) thereof is connected to the gate line, the source electrode (the first source electrode) thereof is connected to the data line, and the drain electrode (the first drain electrode) thereof is connected to the gate electrode (the second gate electrode 2') of the driving thin-film transistor. As for the driving thin-film transistor, the source electrode (the second source electrode) thereof is connected to a power supply voltage, and the drain electrode (the second drain electrode) thereof is connected to the first electrode 11 of the organic light-emitting diode. The white light from the organic light-emitting layer 13 exits from the base substrate 1 after transmitting through the first electrode 11 and the respective layers under the first electrode 11, as shown in FIG. 5. When the white light from the organic light-emitting layer 13 irradiates on the transfective layer 8, a portion of the white light transmits and the other portion of the white light is reflected. Such reflected light is further reflected by the second electrode 14. In the process that the reflected light is repeatedly reflected between the transfective layer 8 and the second electrode 14, the light having a wavelength corresponding to the color of the pixel unit among the light ultimately emitted from the transfective layer 8 will be enhanced due to the resonance effect, so that the brightness of the resultant OLED display device is increased.

[0042] In order to increase the thickness of the microcavity structure and to further increase the brightness, a resin layer 10 is further formed between the color filter film 9 and the first electrode 11. In this case, the first electrode 11 is connected to the second drain electrode through a via hole that extending through the passivation layer 7 and the resin layer 10.

[0043] For example, the transfective layer 8 is formed of any one of silver, aluminum, molybdenum, copper, titanium and chromium, or an alloy of two or more of the foregoing metals. For example, the transfective layer 8 has a transmittance of 5%~95% and a thickness of

10Å~200Å. For example, the color filter film 9 has a thickness of 1000Å~40000Å. The color filter films 9 in the pixel units of different colors may be red, green and blue; or red, green, blue and yellow; or red, green, blue and white.

[0044] An embodiment of the invention further provides a method of fabricating an array substrate. The method may comprise the following steps.

[0045] Step 1: forming a thin-film transistor structure, a transfective layer 8 and a passivation layer 7 on a base substrate 1.

[0046] As shown in FIG. 6, gate electrodes (a first gate electrode 2 and a second gate electrode 2'), a gate insulating layer, active layers (a first active layer 4 and a second active layer 4'), an insulating layer 5 and a via hole in the insulating layer 5 are formed on the base substrate.

[0047] Next, a transfective film and a source-drain metal film are formed, and the transfective layer 8 and the source-drain electrodes (a first source-drain electrodes layer 6 and a second source-drain electrodes layer 6') of the thin-film transistor structure are formed by a single patterning process (the patterning process generally comprises photoresist coating, exposure, development, etching, photoresist stripping and the like). For example, the transfective film is formed of any one of silver, aluminum, molybdenum, copper, titanium and chromium, or an alloy of two or more of the foregoing metals. For example, the transfective film has a transmittance of 5%~95% and a thickness of 10Å~200Å. Since the transfective layer 8, the first source-drain electrodes layer 6 and the second source-drain electrodes layer 6' are formed simultaneously by a single patterning process, a portion of the transfective layer is provided under the first source-drain electrodes layer 6 and the second source-drain electrodes layer 6', and a pattern of the portion of the transfective layer is same as patterns of the first source-drain electrodes layer 6 and the second source-drain electrodes layer 6'. The resultant structure is shown in FIG. 6, in which one pixel unit is illustrated as an example. As shown in Fig. 6, a region in which the thin-film transistor structure is provided is a thin-film transistor region, and a region other than the thin-film transistor region is a display region A. The thin-film transistor structure comprises a switching thin-film transistor and a driving thin-film transistor. The first gate electrode 2, the gate insulating layer 3, the first active layer 4, the insulating layer 5 and the first source-drain electrodes layer 6 (including a first source electrode and first drain electrode) form the switching thin-film transistor. The second gate electrode 2', the gate insulating layer 3, the second active layer 4', the insulating layer 5 and the second source-drain electrodes layer 6' (including a second source electrode and second drain electrode) form the driving thin-film transistor.

[0048] Then, the passivation layer 7 is formed. The substrate after the passivation layer 7 is formed is shown in FIG. 7.

[0049] Step 2: forming a color filter film 9 in the display

region A of each pixel unit so that the color filter films 9 in the pixel units of different colors have different thicknesses. For example, the step is performed as follows.

[0050] The color filter films 9 are formed by multiple patterning processes and each patterning process forms the color filter film in the pixel unit of one color, so that the color filter films in the pixel units of different colors have different thicknesses. For example, the array substrate has the pixel units of three colors of R, G, and B. In this case, the color filter films 9 may be formed by three patterning processes, and the color filter films 9 in the pixel units of RGB three colors have different thicknesses. For example, the color filter film 9 in the red pixel unit is formed by a first patterning process, the color filter film 9 in the green pixel unit is formed by a second patterning process, and the color filter film 9 in the blue pixel unit is formed by a third patterning process, and the color filter film 9 in the red pixel unit, the color filter film 9 in the green pixel unit and the color filter film 9 in the blue pixel unit have thicknesses different from one another. For example, the color filter film 9 has a thickness of 1000Å~40000Å. The above-described thickness range of the color filter film is large and the color filter film is provided inside the microcavity structure, thus the thicknesses of the microcavity structures in the pixel units of different colors can be adjusted by controlling the thicknesses of the color filter films 9 in the pixel units of different colors so that the microcavity structures in the pixel units of different colors can enhance the lights of the pixel units of different colors. Because the color filter films in the pixel units of different colors are formed in different steps, their thickness can easily be controlled respectively. Accordingly, it is unnecessary to respectively produce additional layers for pixel units of different colors so that the pixel units of different colors have the microcavity structures of different thicknesses. As a result, the fabrication process of the array substrate according to the embodiment of the invention can be simplified and the cost can be reduced.

[0051] Step 3: forming an organic light-emitting diode in the display region A of each pixel unit, so that the color filter film 9 is formed between the organic light-emitting diode and the transfective layer 8.

[0052] As shown in FIG. 9, a via hole of the passivation layer 7 is formed by a patterning process. In order to increase the thickness of the microcavity structure and to further increase the brightness, a resin layer 10 is further formed on the passivation layer 7. In this case, the via hole extends through the passivation layer 7 and the resin layer 10.

[0053] As shown in FIG. 10, a transparent conductive film is formed, and a first electrode 11 of the organic light-emitting diode is formed by a patterning process on the transparent conductive film. The first electrode 11 is connected to the thin-film transistor structure through the via hole, and specifically, the first electrode 11 is connected to the drain electrode of the driving thin-film transistor through the via hole.

[0054] As shown in FIG. 11, an insulating film is formed

and a pixel define layer 12 is formed by a patterning process on the insulating film, so that the organic light-emitting diode to be formed is defined in the display region A;

[0055] An organic light-emitting layer 13 and a second electrode 14 are formed so that the organic light-emitting diode is formed. The resultant array substrate is shown in FIG. 5. The second electrode 14 is a reflecting electrode, and it may be made of a reflective material. Alternatively, a reflecting layer is formed before the formation of the second electrode 14, and the second electrode 14 is then formed on the reflecting layer. Alternatively, the second electrode 14 is first formed and then a reflecting layer is formed on the second electrode 14.

[0056] An embodiment of the invention further provides a display device, and the display device comprises the above array substrate. The display device may be any product or component having a display function such as an e-paper, an OLED panel, an OLED display, an OLED television, a digital photo frame, a mobile phone, a pad and the like.

[0057] The foregoing embodiments merely are exemplary embodiments of the invention, and not intended to define the scope of the invention, and the scope of the invention is determined by the appended claims.

Claims

1. An array substrate, comprising a plurality of pixel units disposed on a base substrate, wherein, each pixel unit comprises a thin-film transistor region and a display region other than the thin-film transistor region; a thin-film transistor structure is formed in the thin-film transistor region, and an organic light-emitting diode driven by the thin-film transistor structure is disposed in the display region; the organic light-emitting diode comprises a transparent first electrode, a light-emitting layer, and a second electrode for reflecting light that are sequentially formed in a direction away from the base substrate; a transfective layer is formed in the display region; a color filter film is formed in the display region and is disposed between the second electrode of the organic light-emitting diode and the transfective layer; the second electrode of the organic light-emitting diode and the transfective layer form a microcavity structure; and the color filter films in the pixel units of different colors have different thicknesses.
2. The array substrate according to claim 1, wherein the thin-film transistor structure comprises: a first gate electrode and a second gate electrode formed on the base substrate; a gate insulating layer formed on the first gate electrode and the second gate electrode; a first active layer and a second active layer

formed on the gate insulating layer; an insulating layer formed on the first active layer and the second active layer; a first source electrode and a first drain electrode formed on the insulating layer and corresponding to the first active layer, and a second source electrode and a second drain electrode formed on the insulating layer and corresponding to the second active layer;

the first gate electrode, the gate insulating layer, the first active layer, the insulating layer, the first source electrode and the first drain electrode form a switching thin-film transistor;

the second gate electrode, the gate insulating layer, the second active layer, the insulating layer, the second source electrode and the second drain electrode form a driving thin-film transistor;

the first drain electrode is connected to the second gate electrode, and the second drain electrode of the driving thin-film transistor is connected to the first electrode of the organic light-emitting diode.

3. The array substrate according to claim 2, wherein a passivation layer is formed on the thin-film transistor structure, and the passivation layer is further formed in the display region, the organic light-emitting diode is formed above the passivation layer, and the first electrode is connected to the second drain electrode through a via hole of the passivation layer.

4. The array substrate according to claim 3, wherein the insulating layer is further formed in the display region, and the transfective layer is formed between the insulating layer and the passivation layer.

5. The array substrate according to claim 3, wherein the color filter film is formed on the passivation layer and the first electrode of the organic light-emitting diode is disposed on the color filter film.

6. The array substrate according to claim 5, wherein a resin layer is further formed on the color filter film, the first electrode of the organic light-emitting diode is disposed on the resin layer, and the first electrode is connected to the second drain electrode through a via hole extending through the resin layer and the passivation layer.

7. The array substrate according to claim 2, wherein a portion of the transfective layer is formed below the first source electrode, the first drain electrode, the second source electrode and the second drain electrode of the thin-film transistor structure, and a pattern of the portion of the transfective layer is same as patterns of the first source electrode, the first drain electrode, the second source electrode and the second drain electrode.

8. The array substrate according to claim 1, wherein

the pixel unit further comprises a pixel define layer disposed on the first electrode.

9. The array substrate according to claim 1, wherein the transfective layer is formed of any one of silver, aluminum, molybdenum, copper, titanium and chromium, or an alloy of two or more of the foregoing metals, and the transfective layer has a transmittance of 5%~95% and a thickness of 10Å~200Å. 5
10. The array substrate according to claim 1, wherein the color filter film has a thickness of 1000Å~40000Å. 10
11. The array substrate according to claim 1, wherein the color filter films in the pixel units of different colors are red, green and blue; or red, green, blue and yellow; or red, green, blue and white. 15
12. The array substrate according to claim 1, wherein the first electrode is an anode, and the second electrode is a cathode. 20
13. The array substrate according to claim 1, wherein the first electrode is a cathode, and the second electrode is an anode. 25
14. The array substrate according to claim 1, wherein the second electrode is made of a reflective material, or the second electrode is coated with a reflecting layer. 30
15. A display device, wherein the display device comprises the array substrate according to any one of claims 1-14. 35

40

45

50

55

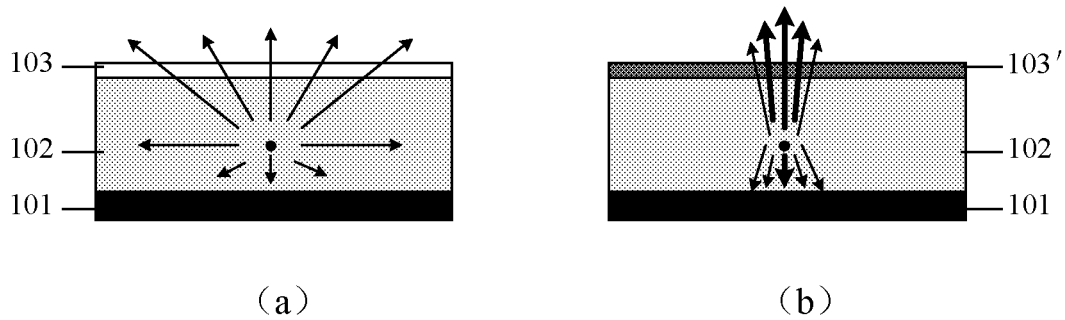


FIG. 1

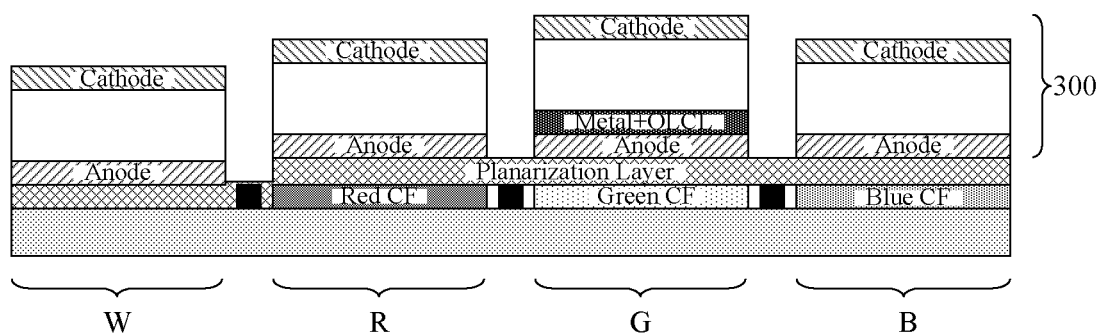


FIG. 2

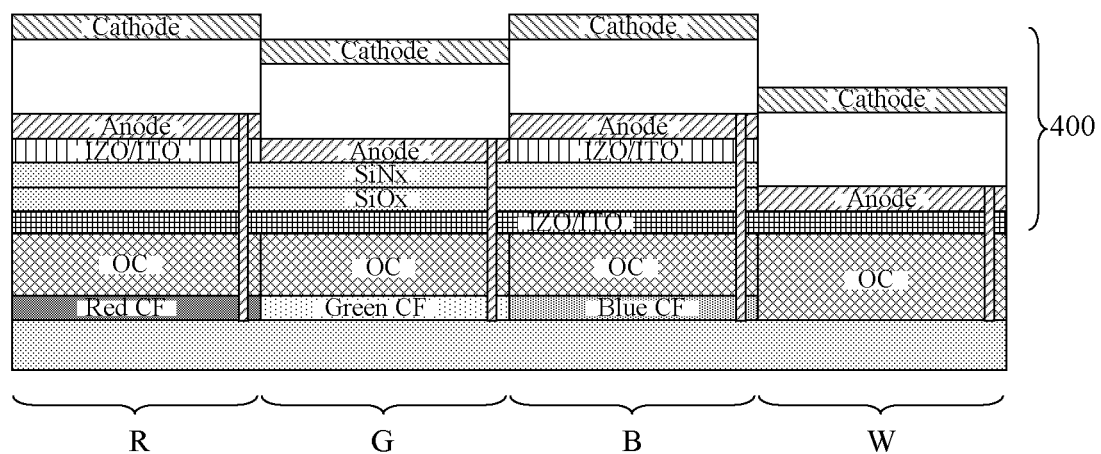


FIG. 3

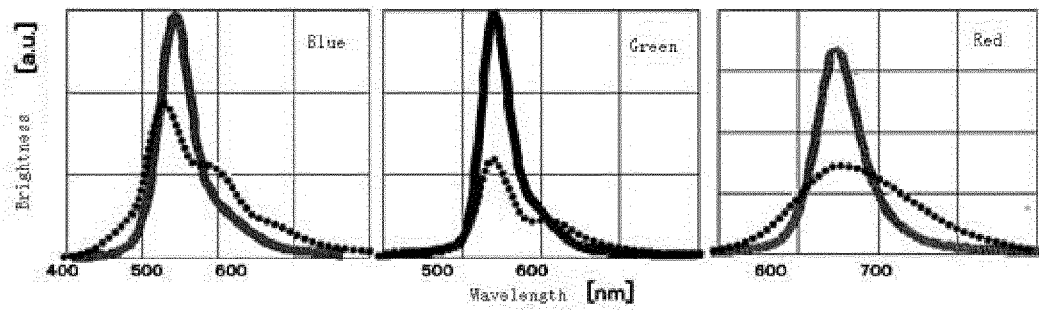


FIG. 4

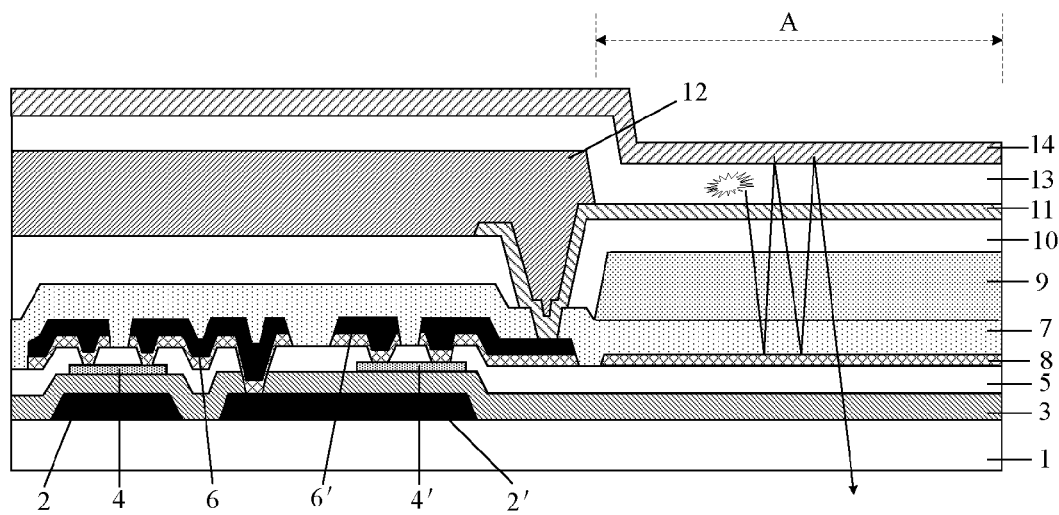


FIG. 5

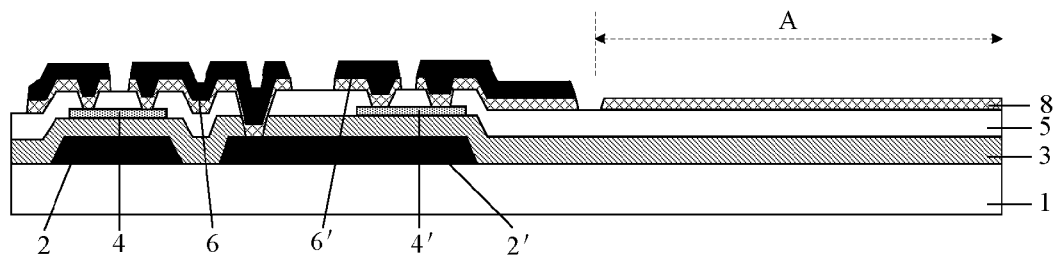


FIG. 6

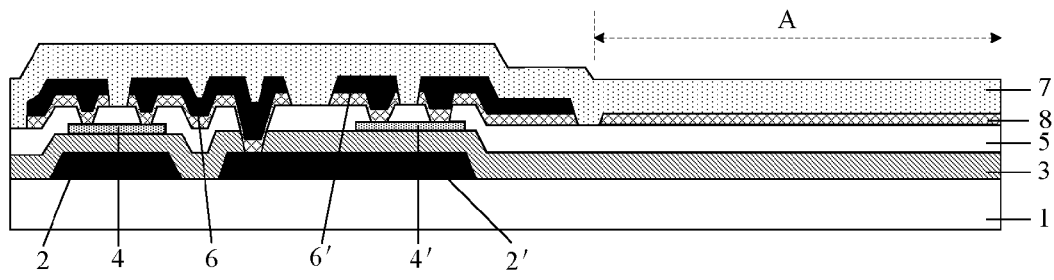


FIG. 7

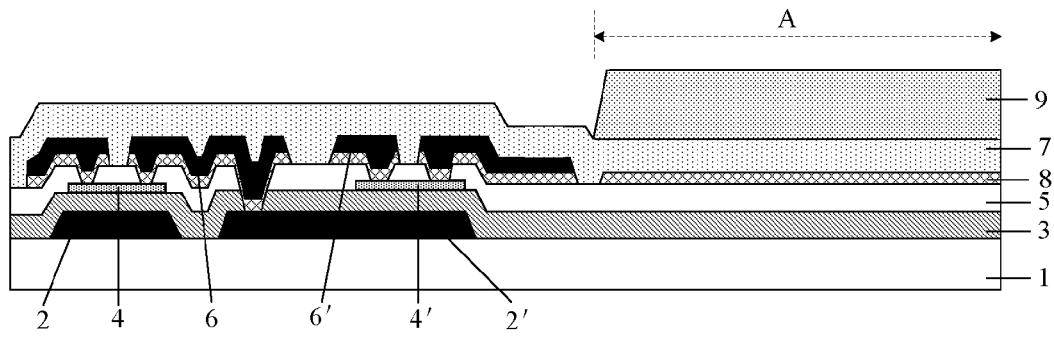


FIG. 8

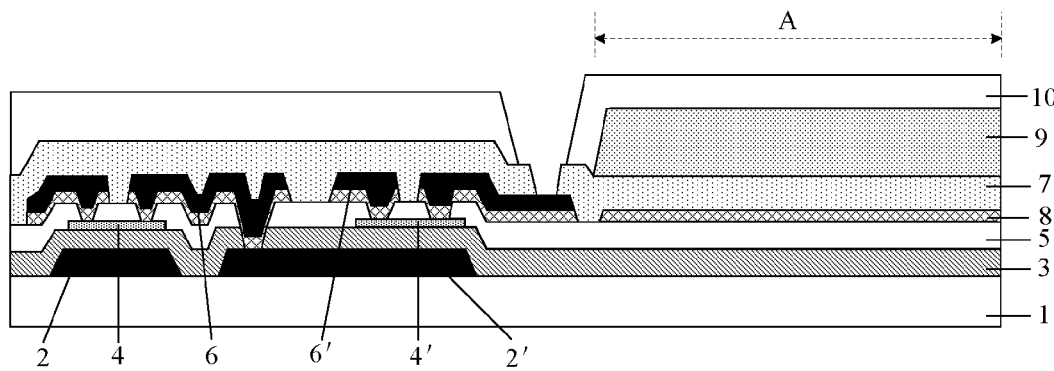


FIG. 9

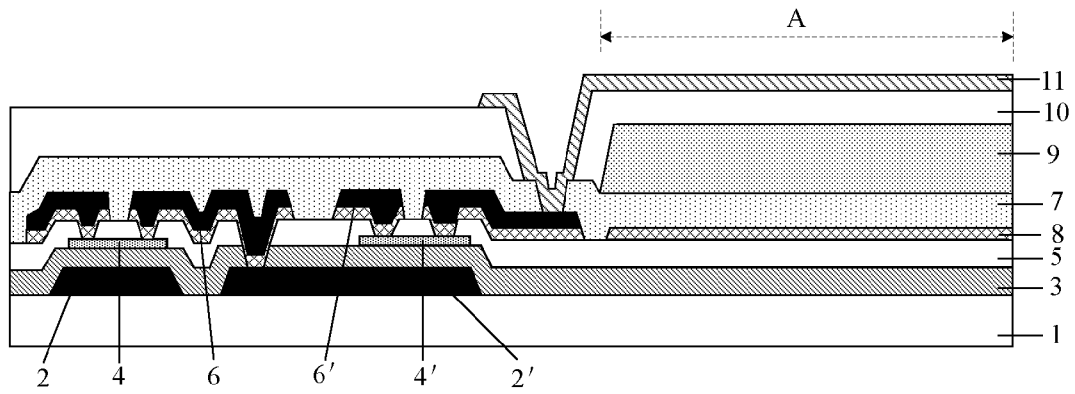


FIG. 10

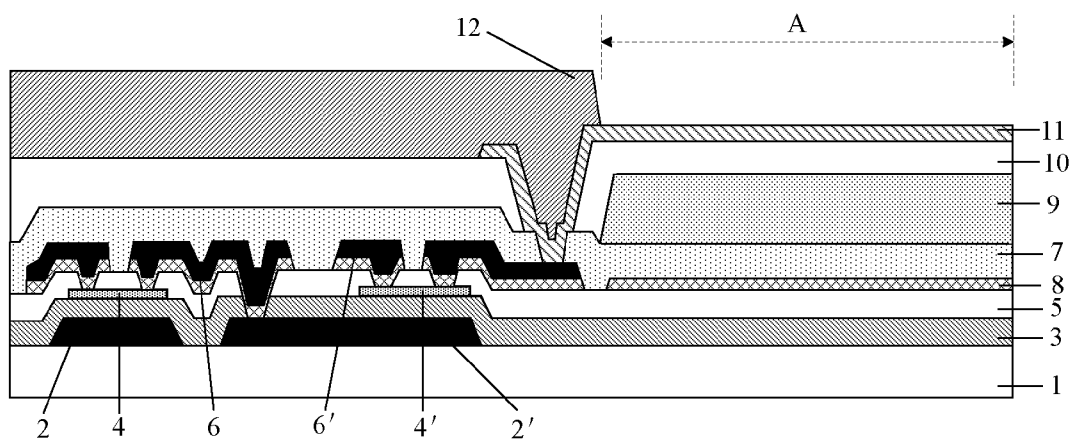


FIG. 11



EUROPEAN SEARCH REPORT

Application Number
EP 13 19 5595

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	JP 2010 010020 A (SEIKO EPSON CORP) 14 January 2010 (2010-01-14)	1,8-15	INV. H01L51/52 H01L27/32
Y	* paragraphs [0058], [0060], [0079] -	2,3,5	
A	[0084]; figure 5 *	6,7	

Y	US 2011/127533 A1 (CHUNG HYUN-JOONG [KR] ET AL) 2 June 2011 (2011-06-02)	2,3,5	H01L
A	* paragraphs [0026], [0029], [0032]; figure 1 *	4	

The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 27 February 2014	Examiner De Laere, Ann
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

1
EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 13 19 5595

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

27-02-2014

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
JP 2010010020 A	14-01-2010	NONE	

US 2011127533 A1	02-06-2011	JP 5032634 B2	26-09-2012
		JP 2011119215 A	16-06-2011
		KR 20110060477 A	08-06-2011
		TW 201119028 A	01-06-2011
		US 2011127533 A1	02-06-2011

专利名称(译)	阵列基板及其制造方法，显示装置		
公开(公告)号	EP2744007A1	公开(公告)日	2014-06-18
申请号	EP2013195595	申请日	2013-12-04
[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)	京东方科技集团有限公司.		
当前申请(专利权)人(译)	京东方科技集团有限公司.		
[标]发明人	SONG YOUNGSUK YOO SEONGYEOL CHOI SEUNGJIN KIM HEECHEOL		
发明人	SONG, YOUNGSUK YOO, SEONGYEOL CHOI, SEUNGJIN KIM, HEECHEOL		
IPC分类号	H01L51/52 H01L27/32		
CPC分类号	H01L27/322 H01L27/3206 H01L27/3213 H01L27/3262 H01L51/5265		
优先权	201210537562.0 2012-12-12 CN		
外部链接	Espacenet		

摘要(译)

本发明实施例公开了一种阵列基板及其制作方法，显示装置。阵列基板包括设置在基础基板上的多个像素单元。每个像素单元包括薄膜晶体管区域和除薄膜晶体管区域之外的显示区域（A）。在薄膜晶体管区域中形成薄膜晶体管结构，并且由薄膜晶体管结构驱动的有机发光二极管设置在显示区域中。有机发光二极管包括透明的第一电极（11），发光层（13）和第二电极（14），用于反射在远离基础基板的方向上顺序形成的光。在显示区域中形成半透射反射层（8）。滤色膜（9）形成在显示区域中，并设置在有机发光二极管的第二电极（14）和半透半反层（8）之间。有机发光二极管的第二电极和半透半反层形成微腔结构。不同颜色的像素单元中的滤色膜具有不同的厚度。

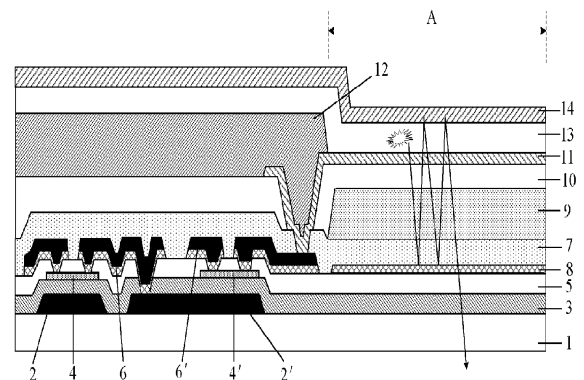


FIG. 5