(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 3 447 815 A1

(12) EUROPEAN PATENT APPLICATION
published in accordance with Art. 153(4) EPC

(43) Date of publication:
27.02.2019 Bulletin 2019/09

(21) Application number: **16869394.3**

(22) Date of filing: **11.10.2016**

(51) Int Cl.:
H01L 51/52 *(2006.01)*

(86) International application number:
PCT/CN2016/101747

(87) International publication number:
WO 2017/181620 (26.10.2017 Gazette 2017/43)

(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
Designated Validation States:
MA MD

(30) Priority: **22.04.2016 CN 201610255474**

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(54) OLED AND MANUFACTURING METHOD THEREFOR AND OLED DISPLAY DEVICE

(57) An OLED, a method for manufacturing the same, and an OLED display device are provided. The method for manufacturing the OLED includes: forming an anode, a cathode layer and an intermediate layer interposed between the anode and the cathode layer in a pixel defining layer; forming a patterned first organic material layer on the cathode layer, the first organic material layer being formed in a pixel light emitting region of the OLED; forming a patterned second organic material layer on the first organic material layer using a material different from that of the first organic material layer, wherein a projection of the first organic material layer in a direction perpendicular to a major plane of the OLED overlaps with a projection of the second organic material layer in the direction; and forming an auxiliary electrode on the cathode layer on which the patterned first organic material layer and the patterned second organic material layer are formed, wherein a projection of the auxiliary electrode in the direction perpendicular to the major plane of the OLED does not overlap with the projections of the first organic material layer and the second organic material layer in the direction.

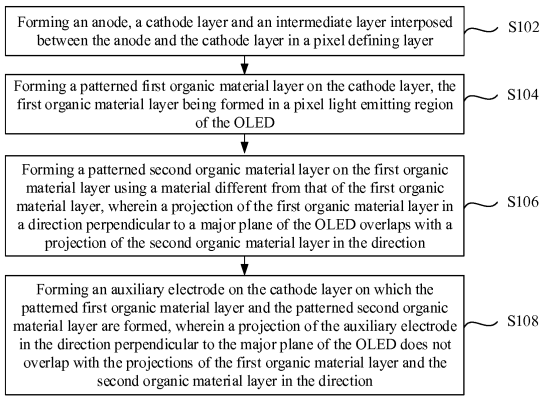

Fig. 1

EP 3 447 815 A1

Description

CROSS REFERENCE

[0001] The present application is based upon and claims priority to Chinese Patent Application No. 201610255474.X, filed on April 22, 2016, and the entire contents thereof are incorporated herein by reference.

TECHNICAL FIELD

[0002] Embodiments of the present disclosure relate to an organic light emitting diode (OLED), a method for manufacturing the same, and an OLED display device.

BACKGROUND

[0003] Current active organic light emitting diode (OLED) devices are typically controlled by thin film transistors (TFTs). Therefore, if an OLED device of the bottom emission structure emits light in the form of a bottom exit, the light emitted from the bottom is blocked by the TFTs and the metal wire circuits formed on the substrate when passing through the substrate, so that the area of the actual light emission is limited, resulting in a reduced ratio of light emitting area, which is the so-called aperture rate. In addition, in order to improve the brightness difference between pixels, many of the currently studied OLEDs employ pixel structures with compensation circuit in which pixel circuits such as 2T1C or higher are used. In this case, the aperture ratio of the OLED device of the bottom emission structure is further reduced. The top emitting OLED device has a great advantage over the bottom emitting OLED device, which increases the aperture ratio and extends the life of the device. For large-sized top emitting OLED devices, the cathode structure is critical.

[0004] Generally, the cathode of an OLED device may be prepared in two ways. In the first method with simpler process, a metal such as a magnesium-silver alloy is generally used as a cathode. However, due to the need for transparency, the metal needs to be formed to be very thin, which will result in a larger resistance, serious resistive voltage drop (IR drop), and poor uniformity of the OLED panel, which in turn affects the application of this process in large sized panels. In the second method, a transparent metal oxide such as indium zinc oxide (IZO) is used as the cathode. As the transparent metal oxide film material has a relatively high transparency, the resistance can meet the performance requirements of the device even when the thickness is large. However, since the transparent metal oxide material needs to be prepared by a sputtering process, the energy used at the time of sputtering is large, and the OLED device is liable to be damaged, thereby affecting the performances such as implantation efficiency and lifetime of the OLED device.

SUMMARY

[0005] Embodiments of the present disclosure provide a novel OLED, a method for manufacturing the same, and an OLED display device, which may effectively reduce the IR drop and improve uniformity of the OLED panel. Particularly, the embodiments of the present disclosure are applicable in the top emitting OLED and the manufacturing method thereof.

[0006] According to a first aspect of the embodiment of the present disclosure, there is provided a method for manufacturing an OLED, the method including:

forming an anode, a cathode layer and an intermediate layer interposed between the anode and the cathode layer in a pixel defining layer;

forming a patterned first organic material layer on the cathode layer, the first organic material layer being formed in a pixel light emitting region of the OLED;

forming a patterned second organic material layer on the first organic material layer using a material different from that of the first organic material layer, wherein a projection of the first organic material layer in a direction perpendicular to a major plane of the OLED overlaps with a projection of the second organic material layer in the direction; and

forming an auxiliary electrode on the cathode layer on which the patterned first organic material layer and the patterned second organic material layer are formed, wherein a projection of the auxiliary electrode in the direction perpendicular to the major plane of the OLED does not overlap with the projections of the first organic material layer and the second organic material layer in the direction.

[0007] According to the aspect, the anode, the cathode layer and the intermediate layer interposed between the anode and the cathode layer are formed in the pixel defining layer; the patterned first and second organic material layers are formed on the cathode layer within the pixel light emitting region of the OLED, wherein the projection of the first organic material layer in the direction perpendicular to the major plane of the OLED overlaps with the projection of the second organic material layer in the direction; and the auxiliary electrode is formed on the cathode layer on which the first and second organic material layers are formed, wherein the projection of the auxiliary electrode in the direction perpendicular to the major plane of the OLED does not overlay with the projections of the first organic material layer and the second organic material layer in the direction. Accordingly, the material forming the auxiliary electrode is attached to the cathode layer outside the pixel light emitting region. In this way, the auxiliary electrode may be connected to the cathode layer without affecting the light exiting from the pixel light emitting region, thereby effectively reducing the IR drop of the OLED and improving the uniformity of

the OLED panel.

[0008] According to an exemplary embodiment of the present disclosure, the forming a patterned first organic material layer on the cathode layer of the OLED includes: vapor depositing the first organic material layer on the cathode layer of the OLED using a fine metal mask (FMM). According to the embodiment, by vapor depositing the first organic material layer using the FMM, it is possible to improve the fineness and positioning accuracy of the pattern of first organic material layer and effectively form the first organic material layer in the light emitting region of the OLED, thereby improving the brightness and uniformity of the OLED panel.

[0009] According to an exemplary embodiment of the present disclosure, the forming a patterned second organic material layer on the first organic material layer includes: vapor depositing the second organic material layer on the first organic material layer using a fine metal mask or an opened mask. When the second organic material layer is vapor deposited using the FMM, it is possible to improve the fineness and positioning accuracy of the pattern of second organic material layer and effectively form the second organic material layer in the pixel light emitting region of the OLED, thereby improving the brightness and uniformity of the OLED panel. On the other hand, it is possible to use the second organic material layer whose material is not attachable to the material of the cathode layer. Accordingly, the second organic material layer and the first organic material layer may be automatically aligned in the direction perpendicular to the major surface of the OLED, allowing the second organic material layer to be vapor deposited using an opened mask, which has a simple manufacturing process and a low cost.

[0010] According to an exemplary embodiment of the present disclosure, the forming an auxiliary electrode on the cathode layer on which the patterned first organic material layer and the patterned second organic material layer are formed includes: vapor depositing a material for the auxiliary electrode on the cathode layer on which the patterned first organic material layer and the patterned second organic material layer are formed using an opened mask. Although the FMM may be used to form a fine pattern of the auxiliary electrode, the material such as metal or its alloy forming the auxiliary electrode may be easily attached to the FMM, which has a poor mass productivity. According to the embodiment, the FMM is used to deposit the first organic material layer that will not be attached to the FMM and the opened mask is used to deposit the material of the auxiliary electrode, thereby simplifying the manufacturing process and lowering the cost while insuring an accurate position of the deposited auxiliary electrode, and further improving mass productivity.

[0011] According to an exemplary embodiment of the present disclosure, the first organic material layer includes an organic small molecular material having a refractive index greater than or equal to 1.8. According to the exemplary embodiment, the first organic material layer may function as a light extracting layer. The organic small molecular material having a relative higher refractive index greater than or equal to 1.8 is convenient for vapor deposition on one hand and may facilitate the extraction of light on the other hand.

[0012] According to an exemplary embodiment of the present disclosure, the second organic material layer includes a small molecular silicone material. According to the embodiment, the small molecular silicone material may improve a non-sticking property between the materials of the second organic material layer and the auxiliary electrode, thereby improving the positioning accuracy of the auxiliary electrode.

[0013] According to an exemplary embodiment of the present disclosure, the auxiliary electrode includes Ag, Al or an alloy containing at least one of Ag and Al. The Ag, Al and the alloy containing at least one of Ag and Al may have a lower deposition temperature, which is easily implementable during the manufacturing process. Accordingly, it is possible to reduce the manufacturing difficulty and cost by forming the auxiliary electrode using Ag, Al or the alloy thereof.

[0014] According to a second aspect of the embodiment of the present disclosure, there is provided an OLED including:

an anode, a cathode layer and an intermediate layer interposed between the anode and the cathode layer in a pixel defining layer;

a patterned first organic material layer on the cathode layer, the first organic material layer being formed in a pixel light emitting region of the OLED;

a patterned second organic material layer on the first organic material layer, a material of the second organic material layer being different from that of the first organic material layer, wherein a projection of the first organic material layer in a direction perpendicular to a major plane of the OLED overlaps with a projection of the second organic material layer in the direction; and

an auxiliary electrode on the cathode layer on which the patterned first organic material layer and the patterned second organic material layer are formed, wherein a projection of the auxiliary electrode in the direction perpendicular to the major plane of the OLED does not overlap with the projections of the first organic material layer and the second organic material layer in the direction.

[0015] According to the aspect, the first and second organic materials within the pixel light emitting region and the auxiliary electrode outside the pixel light emitting region are formed on the cathode layer of the OLED. Accordingly, the auxiliary electrode may be connected to the cathode layer without affecting the light exiting from the pixel light emitting region, thereby effectively reducing the IR drop of the OLED and improving the uniformity of

the OLED panel.

[0016] According to a third aspect of the embodiment of the present disclosure, there is provided an organic light emitting diode (OLED) display device, including a plurality of OLEDs manufactured using the method according to the first aspect or the OLEDs according to the second aspect.

[0017] As can be seen from the above technical solutions, according to the embodiments of the present disclosure, by forming the first and second organic materials within the pixel light emitting region on the cathode layer of the OLED, and forming the auxiliary electrode on the resulted structure, it is possible to utilize the non-sticking property of the materials of the auxiliary electrode and the second organic material, such that the projection of the auxiliary electrode in the direction perpendicular to the major plane of the OLED does not overlap with the projections of the first organic material layer and the second organic material layer in the direction, thereby keeping the auxiliary electrode outside the pixel light emitting region. In this way, the auxiliary electrode may be connected to the cathode layer without affecting the light exiting from the pixel light emitting region, thereby effectively reducing the IR drop of the OLED and improving the uniformity of the OLED panel.

BRIEF DESCRIPTION OF THE DRAWINGS

[0018] In order to more clearly illustrate the technical solutions of the embodiments of the present disclosure, drawings of the embodiments of the present disclosure will be briefly described below. It will be apparent that the drawings in the following description refer only to some embodiments of the present disclosure, and are not intended to limit the present disclosure.

Fig. 1 is a flow chart of a method for manufacturing an OLED according to an embodiment of the present disclosure;

Fig. 2 is a schematic cross sectional view of the anode, the cathode layer and the intermediate layer forming the OLED according to an embodiment of the present disclosure;

Fig. 3 is a schematic cross sectional view of forming the first organic material layer on the cathode layer of the OLED according to an embodiment of the present disclosure;

Fig. 4 is a schematic cross sectional view of forming the second organic material layer on the first organic material layer according to an embodiment of the present disclosure; and

Fig. 5 is a schematic cross sectional view of forming the auxiliary electrode on the cathode layer on which the first and second organic material layers are formed according to an embodiment of the present disclosure.

DETAILED DESCRIPTION

[0019] In order to make the objectives, technical solutions and advantages of the embodiments of the present disclosure more clear, the technical solutions of the embodiments of the present disclosure will be described clearly and completely in conjunction with the accompanying drawings of the embodiments of the present disclosure. It is obvious that the described embodiments are part of the embodiments rather than all embodiments of the present disclosure. All other embodiments obtained by one of ordinary skill in the art based on the described embodiments of the present disclosure without the need for creative work are within the scope of the present disclosure.

[0020] In the description of the embodiments of the present disclosure, it is to be noted that the directional or positional relationships indicated by the terms "upper", "lower", "top", "bottom" or the like are based on the directional or positional relationships shown in the drawings, which are provided only for the purpose of facilitating the description and simplification of the description and is not intended or implied that the device or element referred to must have a specific orientation, constructed or operated in a particular orientation. Accordingly, it should not be construed as a limitation of this disclosure.

[0021] In addition, in the description of the embodiments of the present disclosure, unless otherwise indicated, the term "a plurality of' means two or more.

[0022] According to exemplary embodiments of the present disclosure, an OLED and a method for manufacturing the same, and an OLED display device are provided.

[0023] Fig. 1 is a flow chart of a method for manufacturing an OLED according to an embodiment of the present disclosure. As illustrated in Fig. 1, the method for manufacturing the OLED includes the steps that follow.

[0024] In step S102, an anode, a cathode layer and an intermediate layer interposed between the anode and the cathode layer are formed in a pixel defining layer.

[0025] In step S104, a patterned first organic material layer is formed on the cathode layer of the OLED, wherein the first organic material layer is formed in a pixel light emitting region of the OLED.

[0026] In step S106, a patterned second organic material layer is formed on the first organic material, wherein the second organic material layer is formed of a material different from that of the first organic material layer, and a projection of the first organic material layer in a direction perpendicular to a major plane of the OLED overlaps with a projection of the second organic material layer in said direction.

[0027] In step S108, an auxiliary electrode is formed on the cathode layer on which the patterned first organic material layer and the patterned second organic material layer are formed, wherein a projection of the auxiliary electrode in a direction perpendicular to a major plane of

the OLED does not overlap with the projections of the first organic material layer and the second organic material layer in said direction.

[0028] Hereinafter, each step of the method for manufacturing the OLED and the resultant structure of each step will be described in detail with reference to Fig. 2 to Fig. 5.

[0029] As illustrated in Fig. 2, an anode 12, a cathode layer 16 and an intermediate layer 14 interposed between the anode 12 and the cathode layer 16 are formed in a pixel defining layer 10. The intermediate layer 14 may include organic layers such as a hole transport layer, an organic light emitting layer, an electron transport layer and the like.

[0030] Next, a first organic material layer 18 that is patterned is formed on the cathode layer 16 of the OLED. The first organic material layer 18 is formed in a pixel light emitting region of the OLED, and the first organic material is not formed in other regions of the OLED. During this period, the resulted structure is illustrated in Fig. 3.

[0031] The first organic material layer 18 may be formed by vapor depositing using a mask. In an exemplary embodiment of the present disclosure, the first organic material layer 18 may be vapor deposited on the cathode layer 16 using a fine metal mask (FMM), thereby improving the fineness and positioning accuracy of the pattern of first organic material layer 18 and effectively forming the first organic material layer 18 in the pixel light emitting region of the OLED.

[0032] The first organic material layer 18 may function as a light extracting layer. The light extracting layer is also referred to as a cathode cladding layer. The light extracting layer may have a thickness of $\lambda/4n$, wherein λ is a peak wavelength of the emitted light, and n is a refractive index of the light extracting layer. The transmittance of the light extracting layer increases as the refractive index of the light extracting layer increases. However, on the other hand, the microcavity effect decreases as the transmittance of the light extracting layer increases. Accordingly, one of the requirements for the light extracting layer is the refractive index matching, which is compromised between the transmittance and the microcavity effect, and such a light extracting layer may improve the efficiency of the device. According to an exemplary embodiment, the light extracting layer may include an organic small molecular material having a relative higher refractive index (e.g., a refractive index greater than or equal to 1.8). For example, the light extracting layer may include Alq3.

[0033] Next, as illustrated in Fig. 4, the patterned second organic material layer 20 is formed on the first organic material layer 18. The second organic material layer 20 includes a material different from that of the first organic material layer 18. In addition, a projection of the first organic material layer 18 in the direction perpendicular to the major plane of the OLED overlaps with that of the second organic material layer 20 in said direction. In an exemplary embodiment, the second organic material layer 20 may include an organic material that is attachable to the material of the first organic material layer 18 but is not attachable to the material of the cathode layer 16. Accordingly, the second organic material layer 20 and the first organic material layer 18 may be automatically aligned in the direction perpendicular to the major surface of the OLED.

[0034] In this embodiment, it should be noted that if one material is described herein to be "attachable" to another material, it means that there is a sticking property between the two materials. On the other hand, if one material is described herein to be "not attachable" to another material, it means that there is no sticking property between the two materials, or there is a non-sticking property between the two materials.

[0035] As illustrated in Fig. 4, since the second organic material layer 20 and the first organic material layer 18 are automatically aligned, the second organic material layer 20 is also formed in the pixel light emitting region of the OLED.

[0036] In an exemplary embodiment, the patterned second organic material layer 20 may also be formed on the first organic material layer 18 using the FMM, thereby improving the fineness and positioning accuracy of the pattern of second organic material layer 20 and effectively forming the second organic material layer 20 in the light emitting region of the OLED.

[0037] In another exemplary embodiment, the second organic material layer 20 is formed by a material that is attachable to the material of the first organic material layer 18 but is not attachable to the material of the cathode layer 16, i.e., the second organic material layer 20 and the first organic material layer 18 may be automatically aligned. Accordingly, it is possible to vapor deposit the second organic material layer 20 using an opened mask. In this case, since the fabrication of the opened mask itself is simple and easy, and the use of the opened mask for vapor deposition does not require high precision alignment as with the FMM, the manufacturing process is relatively simple and the manufacturing cost is low.

[0038] The second organic material layer 20 may include any material that is attachable to the organic material while not attachable to the cathode metal. In an exemplary embodiment, the second organic material layer 20 may include a small molecular silicone material, such as isocyanate-based silane, alkoxy silicon polyurethane, and the like. The small molecular silicone material has a good non-sticking property to the material of the auxiliary electrode that is to be formed on the cathode layer 16, thereby improving the positioning accuracy of the auxiliary electrode.

[0039] Next, as illustrated in Fig. 5, the auxiliary electrode 22 is formed on the cathode layer 16 on which the patterned first and second organic material layers 18 and 20 are formed, wherein the projection of the auxiliary electrode 22 in the direction perpendicular to the major plane of the OLED does not overlap with the projections

of the first organic material layer 18 and the second organic material layer 20 in the direction. In an exemplary embodiment, the auxiliary electrode 22 may include a material that is not attachable to the material of the second organic material layer 20 while is attachable to the material of the cathode layer 16, such that the auxiliary electrode 22 is positioned on the cathode layer 16 outside the pixel light emitting region.

[0040] In an exemplary embodiment, the material of the auxiliary electrode may be vapor deposited using an opened mask on the cathode layer 16 on which the first organic material layer 18 and the second organic material layer 20 are formed. Since the material of the auxiliary electrode 22 is attachable to the material of the cathode layer 16 while is not attachable to the material of the second organic material layer 20, it is possible to simply use an opened mask to form the auxiliary electrode 22 on the cathode layer 16 in a region outside the first organic material layer 18 and the second organic material layer 20, that is, the region of the cathode layer 16 outside the pixel light emitting region.

[0041] The auxiliary electrode 22 may include any material that is able to be used as an electrode. Preferably, Ag, Al and the alloy containing at least one of Ag and Al may have a lower deposition temperature, which is easily implementable during the manufacturing process. Accordingly, it is possible to reduce the manufacturing difficulty and cost by forming the auxiliary electrode using Ag, Al or the alloy thereof.

[0042] According to an embodiment of the present disclosure, it is also possible to expect an OLED display device including a plurality of the above OLEDs.

[0043] Exemplary embodiments of the present disclosure are described hereinabove. The first and second organic materials are formed on the cathode layer of the OLED within the pixel light emitting region, and due to the properties of the second organic material, the second organic material may be well attached to the first organic material, while metal material will not be attached to the second organic material. Accordingly, the fine auxiliary electrode may be formed outside the pixel light emitting region, such that the auxiliary electrode may be connected to the cathode layer without affecting the light exiting from the pixel light emitting region, thereby effectively reducing the IR drop of the OLED and improving the uniformity of the OLED panel.

[0044] In the description of the present disclosure, various specific details have been described. However, it will be appreciated that embodiments of the present disclosure may be implemented without these specific details. In some embodiment, known methods, structures and technologies are not illustrated in detail so as not to obscure the understanding of the specification.

[0045] It should be noted that the above embodiments are merely illustrative of the technical solutions of the present disclosure and are not to be construed as limiting the present disclosure. Although the present disclosure has been described in detail with reference to the foregoing embodiments, one of ordinary skill in the art will understand that various modifications, combinations, or equivalents of some of the technical features described therein are possible to the technical solutions according to the above embodiments, all without departing from the spirit and scope of the embodiments of the present disclosure.

Claims

1. A method for manufacturing an organic light emitting diode (OLED), comprising:

   forming an anode, a cathode layer and an intermediate layer interposed between the anode and the cathode layer in a pixel defining layer;
   forming a patterned first organic material layer on the cathode layer, the first organic material layer being formed in a pixel light emitting region of the OLED;
   forming a patterned second organic material layer on the first organic material layer using a material different from that of the first organic material layer, wherein a projection of the first organic material layer in a direction perpendicular to a major plane of the OLED overlaps with a projection of the second organic material layer in the direction; and
   forming an auxiliary electrode on the cathode layer on which the patterned first organic material layer and the patterned second organic material layer are formed, wherein a projection of the auxiliary electrode in the direction perpendicular to the major plane of the OLED does not overlap with the projections of the first organic material layer and the second organic material layer in the direction.

2. The method according to claim 1, wherein the forming a patterned first organic material layer on the cathode layer comprises: vapor depositing the first organic material layer on the cathode layer using a fine metal mask.

3. The method according to claim 1 or 2, wherein the forming a patterned second organic material layer on the first organic material layer comprises: vapor depositing the second organic material layer on the first organic material layer using a fine metal mask or an opened mask.

4. The method according to any one of claims 1 to 3, wherein the forming an auxiliary electrode on the cathode layer on which the patterned first organic material layer and the patterned second organic material layer are formed comprises: vapor depositing a material for the auxiliary electrode on the cathode

layer on which the patterned first organic material layer and the patterned second organic material layer are formed using an opened mask.

5. The method according to any one of claims 1 to 4, wherein the first organic material layer comprises an organic small molecular material having a refractive index greater than or equal to 1.8.

6. The method according to any one of claims 1 to 5, wherein the second organic material layer comprises a small molecular silicone material.

7. The method according to any one of claims 1 to 6, wherein the auxiliary electrode comprises Ag, Al or an alloy containing at least one of Ag and Al.

8. An organic light emitting diode (OLED) comprising:

an anode, a cathode layer and an intermediate layer interposed between the anode and the cathode layer in a pixel defining layer;
a patterned first organic material layer on the cathode layer, the first organic material layer being formed in a pixel light emitting region of the OLED;
a patterned second organic material layer on the first organic material layer, a material of the second organic material layer being different from that of the first organic material layer, wherein a projection of the first organic material layer in a direction perpendicular to a major plane of the OLED overlaps with a projection of the second organic material layer in the direction; and
an auxiliary electrode on the cathode layer on which the patterned first organic material layer and the patterned second organic material layer are formed, wherein a projection of the auxiliary electrode in the direction perpendicular to the major plane of the OLED does not overlap with the projections of the first organic material layer and the second organic material layer in the direction.

9. The OLED according to claim 8, wherein the first organic material layer comprises an organic small molecular material having a refractive index greater than or equal to 1.8.

10. The OLED according to claim 8 or 9, wherein the second organic material layer comprises a small molecular silicone material.

11. The OLED according to any one of claims 8 to 10, wherein the auxiliary electrode comprises Ag, Al or an alloy containing at least one of Ag and Al.

12. An organic light emitting diode (OLED) display device, comprising the OLED according to any one of claims 8 to 11.

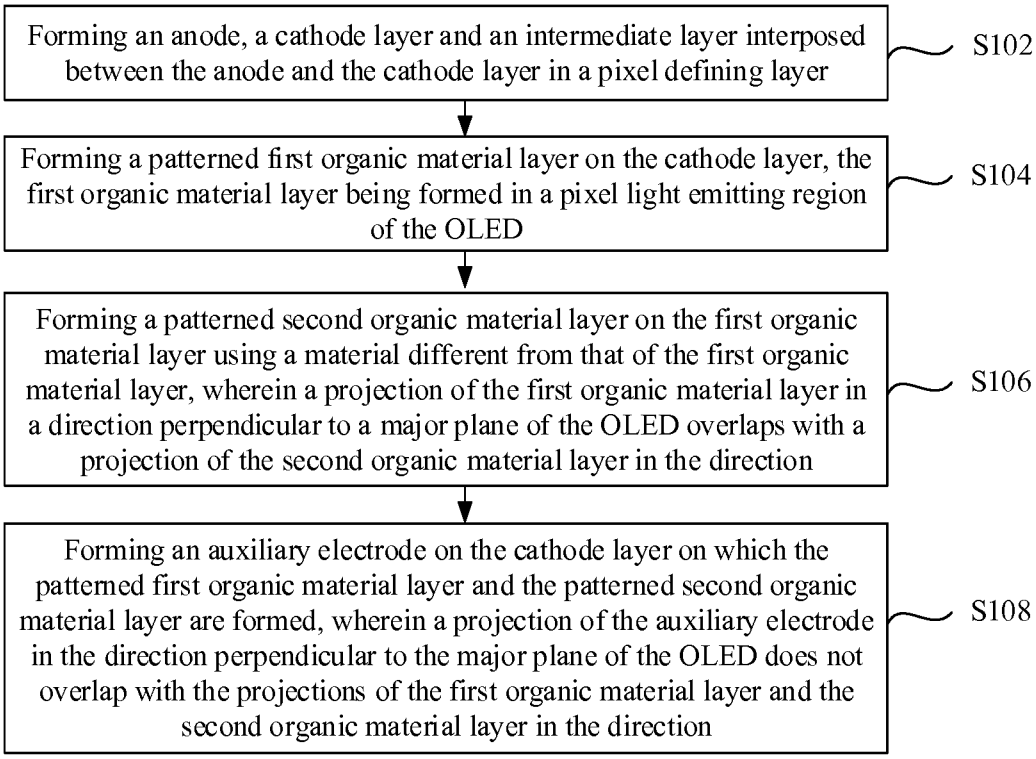
Forming an anode, a cathode layer and an intermediate layer interposed between the anode and the cathode layer in a pixel defining layer
S102
Forming a patterned first organic material layer on the cathode layer, the first organic material layer being formed in a pixel light emitting region of the OLED
S104
Forming a patterned second organic material layer on the first organic material layer using a material different from that of the first organic material layer, wherein a projection of the first organic material layer in a direction perpendicular to a major plane of the OLED overlaps with a projection of the second organic material layer in the direction
S106
Forming an auxiliary electrode on the cathode layer on which the patterned first organic material layer and the patterned second organic material layer are formed, wherein a projection of the auxiliary electrode in the direction perpendicular to the major plane of the OLED does not overlap with the projections of the first organic material layer and the second organic material layer in the direction
S108

Fig. 1

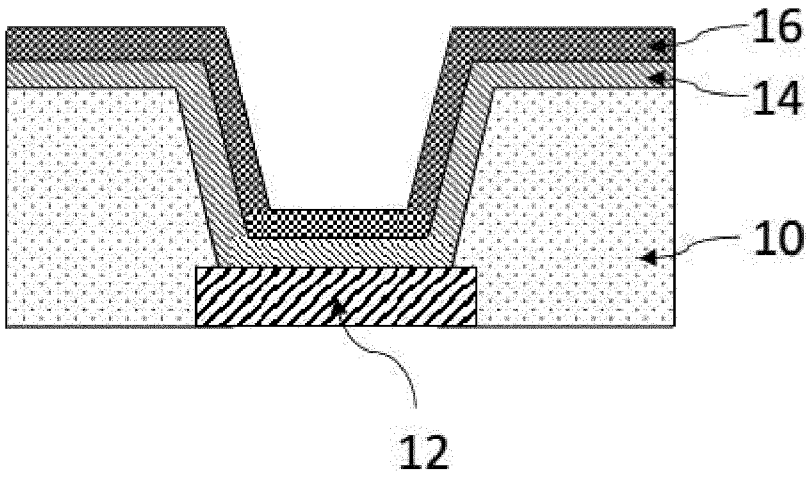
16
14
10
12

Fig. 2

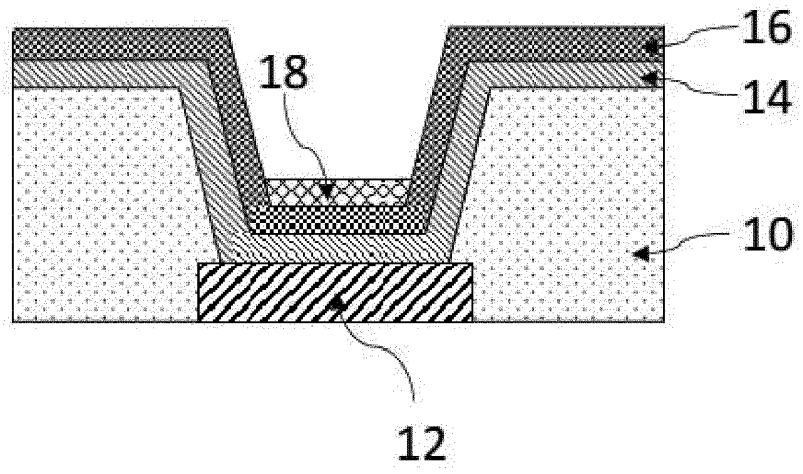

Fig. 3

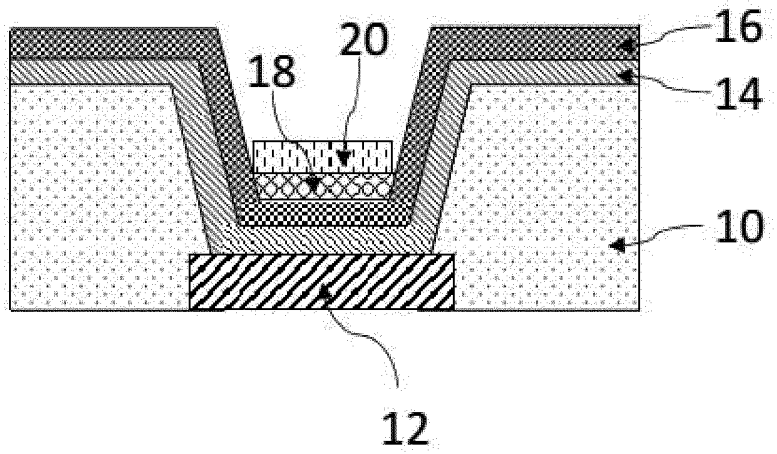

Fig. 4

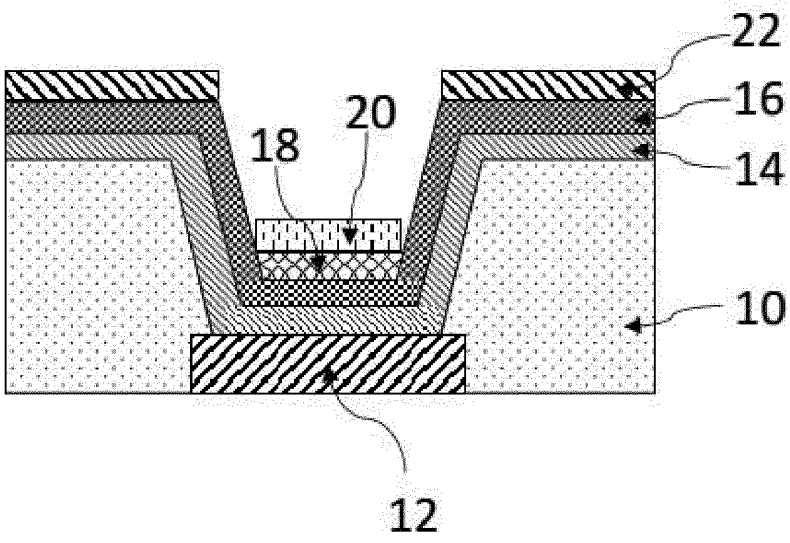

Fig. 5

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2016/101747

A. CLASSIFICATION OF SUBJECT MATTER

H01L 51/52(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)

CNPAT, CNKI, WPI, EPODOC, IEEE: ZHANG, Can; GAO, Xue; auxiliary electrode, AlQ3, light extraction, light collection, infiltration, small organosilicon molecule, 8-hydroxyquinoline aluminum, isocyanate silane, alkoxy silicon polyurethane, refractive index, cathode, anode, BOE, pixel, positive, negative, light, collection, adhe+, bond+, deposit+, metal, silicon, organic, auxiliary, OLED

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
PX	CN 105789479 A (BOE TECHNOLOGY GROUP CO., LTD.), 20 July 2016 (20.07.2016), description, paragraphs [0031]-[0052], and figures 1-5	1-12
Y	CN 104157675 A (BOE TECHNOLOGY GROUP CO., LTD.), 19 November 2014 (19.11.2014), description, paragraphs [0030]-[0032] and [0042]-[0068], and figures 2-5	1-12
Y	CN 103219471 A (JILIN UNIVERSITY), 24 July 2013 (24.07.2013), description, paragraphs [0031]-[0047], and figure 1	1-12
Y	CN 102456713 A (SAMSUNG MOBILE DISPLAY CO., LTD.), 16 May 2012 (16.05.2012), description, paragraphs [0039]-[0053], and figures 3-4	1-12
A	US 2011175097 A1 (SAMSUNG MOBILE DISPLAY CO., LTD.), 21 July 2011 (21.07.2011), the whole document	1-12
A	JP 2008122956 A (HITACHI LTD.), 29 May 2008 (29.05.2008), the whole document	1-12

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

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Date of the actual completion of the international search	Date of mailing of the international search report
12December 2016 (12.12.2016)	**28December 2016 (28.12.2016)**
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 **ZHOU, Zhongtang** Telephone No.:(86-10) **53318981**

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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2016/101747

Patent Documents referred in the Report	Publication Date	Patent Family	Publication Date
CN 105789479 A	20 July 2016	None	
CN 104157675 A	19 November 2014	US 2016276619 A1	22 September 2016
		WO 2016019637 A1	11 February 2016
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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- CN 201610255474X **[0001]**

专利名称(译)	OLED及其制造方法和OLED显示装置		
公开(公告)号	EP3447815A1	公开(公告)日	2019-02-27
申请号	EP2016869394	申请日	2016-10-11
[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	ZHANG CAN GAO XUE		
发明人	ZHANG, CAN GAO, XUE		
IPC分类号	H01L51/52		
CPC分类号	H01L27/3246 H01L51/5228 H01L51/56 H01L2251/5315 H01L51/0011 H01L51/5262 H01L51/5056 H01L51/5072 H01L51/5206 H01L51/5234		
代理机构(译)	POTTER CLARKSON		
优先权	201610255474.X 2016-04-22 CN		
其他公开文献	EP3447815A4		
外部链接	Espacenet		

摘要(译)

提供OLED，其制造方法以及OLED显示装置。制造OLED的方法包括：在像素限定层中形成阳极，阴极层和介于阳极和阴极层之间的中间层;在阴极层上形成图案化的第一有机材料层，第一有机材料层形成在OLED的像素发光区域中;使用与第一有机材料层不同的材料在第一有机材料层上形成图案化的第二有机材料层，其中第一有机材料层在垂直于OLED的主平面的方向上的投影与投影重叠第二有机材料层的方向;在阴极层上形成辅助电极，在阴极层上形成图案化的第一有机材料层和图案化的第二有机材料层，其中辅助电极在垂直于OLED的主平面的方向上的投影不与第一有机材料层和第二有机材料层在该方向上的投影。

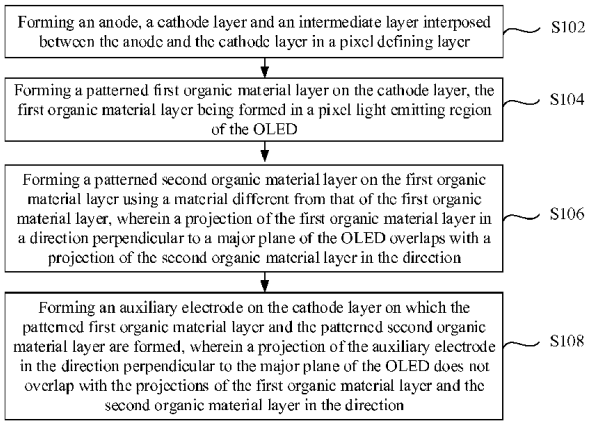

Fig. 1