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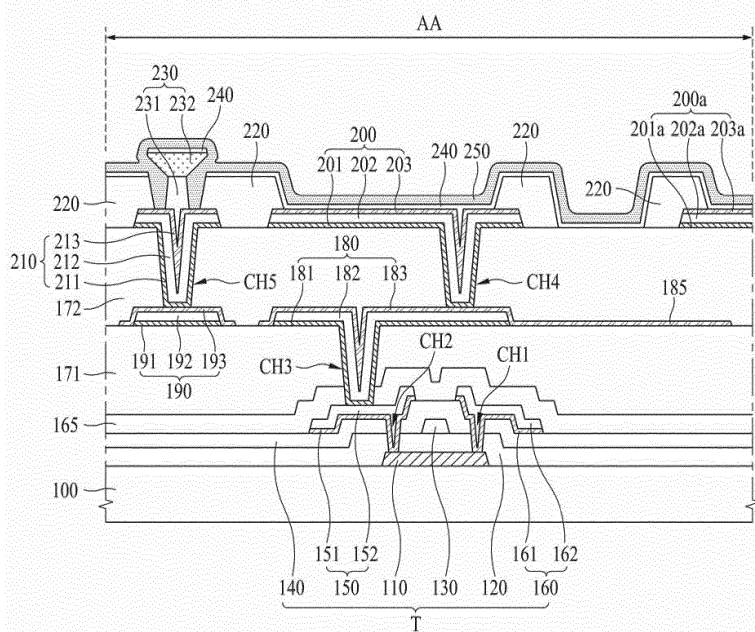
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(54) **ORGANIC LIGHT EMITTING DISPLAY DEVICE AND METHOD OF MANUFACTURING THE SAME**

(57) An organic light emitting display device is disclosed, which comprises an anode electrode (200) provided in a light emitting area on a substrate (100) provided with a plurality of pixels, each of which includes a light emitting area and a transmissive area; an organic light emitting layer (240) provided on the anode electrode; a cathode electrode (250) provided on the organic light

emitting layer; an auxiliary electrode (210, 190) connected with the cathode electrode; and a connection electrode (185) connected with the anode electrode and provided in the transmissive area of the substrate, wherein the connection electrode is made of a transparent material.

FIG. 4



Description

BACKGROUND OF THE INVENTION

Field of the Invention

[0001] The present invention relates to an organic light emitting display device, and more particularly, to a top emission type organic light emitting display device and a method of manufacturing the same.

Discussion of the Related Art

[0002] An organic light emitting display (OLED) device is a self light emitting display device, and has low power consumption, a fast response speed, high light emission efficiency, high luminance and a broad viewing angle.

[0003] The organic light emitting display (OLED) device is categorized into a top emission type and a bottom emission type depending on a direction to which light emitted through an organic light emitting diode is transmitted. In the bottom emission type organic light emitting display device, since a circuit element is disposed between a light emitting layer and an image display surface, a problem occurs in that an aperture ratio is deteriorated due to the circuit element. On the other hand, the top emission type organic light emitting display device has an advantage in that an aperture ratio is improved because a circuit element is not disposed between a light emitting layer and an image display surface.

[0004] FIG. 1 is a brief cross-sectional view illustrating a top emission type organic light emitting display device of the related art.

[0005] As shown in FIG. 1, a thin film transistor layer T, a passivation layer 20, a first planarization layer 31, a second planarization layer 32, a first anode electrode 40, a second anode electrode 60, a first auxiliary electrode 50, a second auxiliary electrode 70, a bank 80, a partition wall 92, an organic light emitting layer 94, and a cathode electrode 96 are formed in an active area AA on a substrate 10.

[0006] The thin film transistor layer T includes an active layer 11, a gate insulating film 12, a gate electrode 13, an interlayer dielectric 14, a source electrode 15, and a drain electrode 16.

[0007] The first anode electrode 40 and the first auxiliary electrode 50 are formed on the first planarization layer 31, and the second anode electrode 60 and the second auxiliary electrode 70 are formed on the second planarization layer 32. The first auxiliary electrode 50 serves to reduce resistance of the cathode electrode 96 together with the second auxiliary electrode 70.

[0008] The bank 80 is formed on the second anode electrode 60 and the second auxiliary electrode 70 to define a pixel area, the organic light emitting layer 94 is formed within the pixel area defined by the bank 80, and the cathode electrode 96 is formed on the organic light emitting layer 94.

[0009] The partition wall 92 is formed on the second auxiliary electrode 70. The partition wall 92 is spaced apart from the bank 80 at a predetermined distance, and the second auxiliary electrode 70 is connected with the cathode electrode 96 through the spaced area between the partition wall 92 and the bank 80 to reduce resistance of the cathode electrode 96.

[0010] In case of the top emission type, light emitted from the organic light emitting layer 94 moves by passing through the cathode electrode 96. Therefore, the cathode electrode 96 is formed using a transparent conductive material, whereby a problem occurs in that a resistance of the cathode electrode 96 increases. In order to reduce resistance of the cathode electrode 96, the cathode electrode 96 is connected with the first auxiliary electrode 50 and the second auxiliary electrode 70.

[0011] Particularly, the organic light emitting display device of the related art shown in FIG. 1 includes two auxiliary electrodes of the first auxiliary electrode 50 and the second auxiliary electrode 70, which are connected with each other to reduce resistance of the cathode electrode 96.

[0012] Specifically, since the second auxiliary electrode 70 is formed on the same layer as the second anode electrode 60, if a width of the second auxiliary electrode 70 increases to reduce resistance of the cathode electrode 96, a width of the second anode electrode 60 should be reduced. In this case, a problem occurs in that the pixel area of the display device is reduced. Therefore, there is limitation in increasing the width of the second auxiliary electrode 70.

[0013] Therefore, according to the related art, to solve the problem, the first auxiliary electrode 50 is additionally formed below the second auxiliary electrode 70, whereby resistance of the cathode electrode 96 is reduced even while the pixel area is not being reduced.

[0014] The aforementioned top emission type transparent organic light emitting display device of the related art has problems as follows.

[0015] An array test is intended to check whether there is any electrical defect in electrodes formed on the substrate 10, and is a test type that a signal is applied to an electrode formed in each layer and charges of the second anode electrode 60 are recognized through an image in each pixel.

[0016] Specifically, the transparent organic light emitting display device includes a transmissive portion and a light emitting portion, and since the maximum transmissive portion should be provided to improve transmittance, all elements of the light emitting portion are vertically deposited as shown in FIG. 1 to obtain an area of the transmissive portion.

[0017] Therefore, for the array test for the organic light emitting display device in which the thin film transistor layer T, the first anode electrode 40, and the second anode electrode 60 are vertically deposited as shown in FIG. 1, if a signal is applied to the second anode electrode 60 and it is tested through an image in each pixel whether

there is any defect in the second anode electrode 60, the defect of the second anode electrode 60 could not have been tested exactly due to interference caused by the thin film transistor layer T and the first anode electrode 40, which are deposited below the second anode electrode 60.

[0018] Particularly, since a low potential voltage V_{ss} signal is applied to the first auxiliary electrode 50 formed in the light emitting portion of each pixel, the result of the array test for all pixels is represented by the same image, whereby a problem occurs in that it is not possible to check there is any defect of the second anode electrode 60 in a specific pixel.

SUMMARY

[0019] Accordingly, the present invention is directed to an organic light emitting display device and a method of manufacturing the same, which substantially obviate one or more problems due to limitations and disadvantages of the related art.

[0020] An advantage of embodiments of the present invention is to provide a top emission type organic light emitting display device and a method of manufacturing the same, in which a defect of each pixel is tested exactly, and if it is determined that an anode electrode of a specific pixel has a defect, the defect may be repaired simply.

[0021] Additional advantages and features of embodiments of the present invention will be set forth in part in the description which follows and in part will become apparent to those having ordinary skill in the art upon examination of the following or may be learned from practice of the invention. The objectives and other advantages of embodiments of the present invention may be realized and attained by the structure particularly pointed out in the written description and claims hereof as well as the appended drawings.

[0022] To achieve these objects and other advantages and in accordance with the purpose of the invention, as embodied and broadly described herein, an organic light emitting display device comprises an anode electrode provided in a light emitting area on a substrate provided with a plurality of pixels, each of which includes a light emitting area and a transmissive area; an organic light emitting layer provided on the anode electrode; a cathode electrode provided on the organic light emitting layer; an auxiliary electrode connected with the cathode electrode; and a connection electrode connected with the anode electrode and provided in the transmissive area, wherein the connection electrode is made of a transparent material.

[0023] In another aspect, an organic light emitting display device according to one embodiment of the present invention is manufactured through the steps of forming a first anode electrode and a first auxiliary electrode spaced apart from the first anode electrode in a light emitting area on a substrate provided with a plurality of pixels, each of which includes a light emitting area and a trans-

missive area; forming a planarization layer on the first anode electrode and the first auxiliary electrode and respectively forming contact holes, which externally expose the first anode electrode and the first auxiliary electrode, by removing a predetermined area of the planarization layer; forming a second anode electrode and a second auxiliary electrode on the planarization layer, the second anode electrode being connected with the first anode electrode and the second auxiliary electrode being connected with the first auxiliary electrode; and forming a connection electrode connected with the first anode electrode in the transmissive area during a process of forming the first anode electrode and the first auxiliary electrode.

[0024] It is to be understood that both the foregoing general description and the following detailed description of the present invention are exemplary and explanatory and are intended to provide further explanation of the invention as claimed.

BRIEF DESCRIPTION OF THE DRAWINGS

[0025] The accompanying drawings, which are included to provide a further understanding of the invention and are incorporated in and constitute a part of this application, illustrate embodiment(s) of the invention and together with the description serve to explain the principle of the invention. In the drawings:

FIG. 1 is a brief cross-sectional view illustrating a top emission type organic light emitting display device of the related art;

FIG. 2 is a plane view illustrating an organic light emitting display device according to one embodiment of the present invention;

FIG. 3 is an enlarged view illustrating one sub pixel and an auxiliary electrode in an organic light emitting display device shown in FIG. 2;

FIG. 4 is a cross-sectional view illustrating an organic light emitting display device according to one embodiment of the present invention, which is taken along line "I-I" shown in FIG. 3; and

FIGS. 5a to 5h are cross-sectional views illustrating process steps of a method of manufacturing an organic light emitting display device according to one embodiment of the present invention.

DETAILED DESCRIPTION

[0026] Advantages and features of the present invention, and implementation methods thereof will be clarified through following embodiments described with reference to the accompanying drawings. The present invention may, however, be embodied in different forms and should not be construed as limited to the embodiments set forth herein. Rather, these embodiments are provided so that this disclosure will be thorough and complete, and will fully convey the scope of the present invention to those

skilled in the art. Further, the present invention is only defined by scopes of claims.

[0027] A shape, a size, a ratio, an angle, and a number disclosed in the drawings for describing embodiments of the present invention are merely an example, and thus, the present invention is not limited to the illustrated details. Like reference numerals refer to like elements throughout. In the following description, when the detailed description of the relevant known function or configuration is determined to unnecessarily obscure the important point of the present invention, the detailed description will be omitted. In a case where 'comprise', 'have', and 'include' described in the present specification are used, another part may be added unless 'only' is used. The terms of a singular form may include plural forms unless referred to the contrary.

[0028] In construing an element, the element is construed as including an error range although there is no explicit description.

[0029] In describing a position relationship, for example, when the position relationship is described as 'up-on-', 'above-', 'below-', and 'next to-', one or more portions may be arranged between two other portions unless 'just' or 'direct' is used.

[0030] In describing a time relationship, for example, when the temporal order is described as 'after-', 'subsequent-', 'next-', and 'before-', a case which is not continuous may be included unless 'just' or 'direct' is used.

[0031] It will be understood that, although the terms "first", "second", etc. may be used herein to describe various elements, these elements should not be limited by these terms. These terms are only used to distinguish one element from another element. Therefore, a first element could be termed a second element, and, similarly, a second element could be termed a first element, without departing from the scope of the present invention.

[0032] Features of various embodiments of the present invention may be partially or overall coupled to or combined with each other, and may be variously inter-operated with each other and driven technically as those skilled in the art can sufficiently understand. The embodiments of the present invention may be carried out independently from each other, or may be carried out together in co-dependent relationship.

[0033] Hereinafter, the preferred embodiments of the present invention will be described in detail with reference to the accompanying drawings.

[0034] FIG. 2 is a plane view illustrating an organic light emitting display device according to one embodiment of the present invention.

[0035] FIG. 3 is an enlarged view illustrating one sub pixel and an auxiliary electrode in an organic light emitting display device shown in FIG. 2.

[0036] As shown in FIGS. 2 and 3, the organic light emitting display device according to one embodiment of the present invention includes a plurality of pixels on a substrate, wherein each pixel includes a transmissive area, and a light emitting area provided with four sub pixels.

[0037] The four sub pixels may be comprised of, but not limited to, sub pixels that emit red (R) light, white (W) light, blue (B) light, and green (G) light. Hereinafter, each of the four sub pixels will be described in detail.

5 **[0038]** The light emitting area of each of the sub pixels is provided with a thin film transistor T, a first anode electrode 180, a first auxiliary electrode 190, a second anode electrode 200, and a cathode electrode 250.

10 **[0039]** The thin film transistor T is formed in a pixel area of each sub pixel. The thin film transistor T supplies a data signal from a data line (not shown) to the first anode electrode 180 in response to a gate signal from a gate line (not shown).

15 **[0040]** The first anode electrode 180 is formed within the pixel area. The first anode electrode 180 is connected with a source electrode (not shown) of the thin film transistor T through a contact hole, and receives the data signal from the thin film transistor T.

20 **[0041]** The first auxiliary electrode 190 is formed to be spaced apart from the first anode electrode 180 in the light emitting area. The first auxiliary electrode 190 is connected to the cathode electrode 250 together with the second auxiliary electrode 210 which will be described later, and lowers resistance of the cathode electrode 250.

25 The first auxiliary electrode 190 may be formed of the same material and thickness as those of the first anode electrode 180 on the same layer as the first anode electrode 180. In this case, it is advantageous that the first auxiliary electrode 190 and the first anode electrode 180 may be formed through the same process at the same time.

30 **[0042]** The second anode electrode 200 is formed within the light emitting area of each sub pixel. The second anode electrode 200 is connected with the first anode electrode 180 through the contact hole, and receives the data signal from the first anode electrode 180.

35 **[0043]** The cathode electrode 250 is formed in an entire area including the light emitting area, the transmissive area, and an area between the transmissive areas. The cathode electrode 250 is connected to a driving power supply (not shown) and supplied with a driving power source.

40 **[0044]** A connection electrode 185 which is connected to the first anode electrode 180, and the cathode electrode 250, are formed in the transmissive area of each of the sub pixels. The cathode electrode 250 is extended from the light emitting area of each of the sub-pixels as described above, and thus its repeated description will be omitted.

50 **[0045]** The first anode electrode 180 may include a first lower anode electrode (not shown), a first upper anode electrode (not shown), and a first cover anode electrode 183. The first anode electrode 180 comprised of a plurality of layers including all of the first lower anode electrode (not shown), the first upper anode electrode (not shown) and the first cover anode electrode 183 is formed in the light emitting area of each of the sub pixels, and the connection electrode 185 connected with the first cov-

er anode electrode 183 of the first anode electrode 180 is formed in the transmissive area of each pixel as shown in FIGS. 2 and 3. In this case, it is advantageous that the connection electrode 185 may be formed through the same process as that of the first cover anode electrode 183 simultaneously with the first cover anode electrode 183.

[0046] In one embodiment of the present invention, when it is tested whether there is any defect in the second anode electrode 200, through an array test for the organic light emitting display device, the signal applied to the second anode electrode 200 is recognized through the connection electrode 185 formed in the transmissive area, whereby interference caused by the signals of the thin film transistor T, the first anode electrode 180 and the first auxiliary electrode 190, which are formed below the second anode electrode 200, may be removed to perform only the test for the defect of the second anode electrode 200.

[0047] That is, according to the related art, the signal applied to the second anode electrode 200 is recognized in the light emitting area where the thin film transistor T, the first anode electrode 180, the first auxiliary electrode 190, and the second anode electrode 190 are vertically deposited, so as to perform the test for the defect of the second anode electrode 200. Therefore, it is difficult to exactly test the defect of the second anode electrode 200 due to interference caused by the signals of the thin film transistor T, the first anode electrode 180 and the first auxiliary electrode 190. However, in the embodiment of

the present invention, the signal applied to the second anode electrode 200 is recognized in the transmissive area where the thin film transistor T, the first anode electrode 180 and the first auxiliary electrode 190 are not deposited, whereby the defect of the second anode electrode 200 may exactly be tested.

[0048] Particularly, the connection electrode 185 according to one embodiment of the present invention may be made of a transparent conductive material such as ITO. Therefore, in one embodiment of the present invention, the connection electrode 185 is formed of a transparent conductive material in the transmissive area so as not to affect transmittance of each pixel.

[0049] As described above, in the organic light emitting display device according to one embodiment of the present invention, the connection electrode 185 made of a transparent conductive material such as ITO is formed to be extended from the first cover anode electrode 183 in the transmissive area, and the signal of the second anode electrode 200 is recognized through the connection electrode 185, whereby the defect of the second anode electrode 200 may be tested even without affecting transmittance of each pixel.

[0050] Particularly, in the transmissive area of each of the sub pixels, the connection electrode 185 is formed to overlap (O) a second anode electrode of a corresponding one of sub pixels of another adjacent pixel. Therefore, when a defect occurs in the second anode electrode 200

of a specific sub pixel, the defect pixel may simply be repaired through welding the connection electrode 185 of the specific sub pixel to the second anode electrode of another adjacent sub pixel.

[0051] At this time, the corresponding sub pixel means a sub pixel that emits the same light as red (R) light, white (W) light, blue (B) light, or green (G) light, which is emitted from the sub pixel that includes the second anode electrode 200 where a defect occurs.

[0052] That is, in one embodiment of the present invention, the connection electrode 185 of the specific pixel is formed to overlap (O) the second anode electrode of another sub pixel, and when a defect occurs in the second anode electrode of the specific pixel, the connection electrode 185 of the specific pixel and the second anode electrode of another adjacent sub pixel are subjected to welding through a laser, whereby the defect pixel may simply be repaired. However, since welding of the connection electrode 185 and the second anode electrode of another

sub pixel is not limited to laser welding, various welding methods, which are not mentioned, may be used.

[0053] The first auxiliary electrode 190, the second auxiliary electrode 210, the partition wall 230 and the cathode electrode 250 are formed between the plurality of pixels, specifically between the transmissive areas of the plurality of pixels. The first auxiliary electrode 190 and the cathode electrode 250 are formed to be extended from the light emitting area of each pixel as described above, and thus their repeated description will be omitted.

[0054] The second auxiliary electrode 210 is formed to be spaced apart from the second anode electrode 200 on the first auxiliary electrode 190. The second auxiliary electrode 210 is connected to the first auxiliary electrode 190 through the contact hole, and is connected to the cathode electrode 250 together with the first auxiliary electrode 190 to lower resistance of the cathode electrode 250. The second auxiliary electrode 210 may be formed of the same material and thickness as those of the second anode electrode 200 on the same layer as the second anode electrode 200. In this case, it is advantageous that the second auxiliary electrode 210 may be formed through the same process as that of the second anode electrode 200 simultaneously with the second anode electrode 200.

[0055] The partition wall 230 is formed on the second auxiliary electrode 210. The partition wall 230 is spaced apart from a bank (not shown) at a predetermined distance, and the second auxiliary electrode 210 and the cathode electrode 250 are electrically connected with each other through the spaced area between the partition wall 230 and the bank.

[0056] In one embodiment of the present invention, the first auxiliary electrodes 190 of the respective sub pixels that emit red (R) light, white (W) light, blue (B) light, and green (G) light are formed in a single body as shown. However, since the present invention is not limited to this example, the first auxiliary electrodes 190 of the respec-

tive sub pixels may be formed to be spaced apart from each other. In this case, the first auxiliary electrodes 190 of the respective sub pixels may be formed to be connected with the second auxiliary electrodes 210 which exist separately for each sub pixel.

[0057] Hereinafter, a deposition structure of the organic light emitting display device according to one embodiment of the present invention, which may perform a test for a defect of the second anode electrode 200 by removing interference caused by the signals of the thin film transistor T, the first anode electrode 180 and the first auxiliary electrode 190 and repair a pixel where the defect occurs, will be described in detail.

[0058] FIG. 4 is a cross-sectional view illustrating an organic light emitting display device according to one embodiment of the present invention, which is taken along line "I-I" shown in FIG. 3.

[0059] As shown in FIG. 4, the organic light emitting display device according to one embodiment of the present invention includes an active area AA and a pad area (not shown), which are provided on a substrate 100.

[0060] A thin film transistor layer T, a passivation layer 165, a first planarization layer 171, a second planarization layer 172, a first anode electrode 180, a second anode electrode 200, a first auxiliary electrode 190, a second auxiliary electrode 210, a connection electrode 185, a bank 220, a partition wall 230, an organic light emitting layer 240, and a cathode electrode 250 are formed in the active area AA on the substrate 100.

[0061] The thin film transistor layer T includes an active layer 110, a gate insulating film 120, a gate electrode 130, an interlayer dielectric 140, a source electrode 150, and a drain electrode 160.

[0062] The active layer 110 is formed to be overlapped with the gate electrode 130 on the substrate 100. The active layer 110 may be made of a silicon based semiconductor material or an oxide based semiconductor material. Although not shown, a light shielding film may additionally be formed between the substrate 100 and the active layer 110. In this case, external light entering the display device through a lower surface of the substrate 100 is shielded by the light shielding film, whereby a problem that the active layer 110 is damaged by the external light may be avoided.

[0063] The gate insulating film 120 is formed on the active layer 110. The gate insulating film 120 serves to insulate the active layer 110 from the gate electrode 130. The gate insulating film 120 may be made of, but not limited to, an inorganic insulating material, for example, a silicon oxide (SiOX) film, a silicon nitride (SiNX) film, or their multi-layer. The gate insulating film 120 may be formed to be extended to the entire active area AA that includes a transmissive area.

[0064] The gate electrode 130 is formed on the gate insulating film 120. The gate electrode 130 is formed to overlap the active layer 110 by interposing the gate insulating film therebetween. The gate electrode 130 may be made of, but not limited to, a single layer or multi-

layer, which is comprised of any one of Mo, Al, Cr, Au, Ti, Ni, Nd and Cu or their alloy.

[0065] The interlayer dielectric 140 is formed on the gate electrode 130. The interlayer dielectric 140 may be made of, but not limited to, the same inorganic insulating material as that of the gate insulating film 120, for example, a silicon oxide (SiOX) film, a silicon nitride (SiNX) film, or their multi-layer. The interlayer dielectric 140 may be formed to be extended to the entire active area AA that includes a transmissive area.

[0066] The source electrode 150 and the drain electrode 160 are formed to face each other on the interlayer dielectric 140. A first contact hole CH1, which exposes one end area of the active layer 110, and a second contact hole CH2, which exposes the other end area of the active layer 110, are provided in the aforementioned gate insulating film 120 and the interlayer dielectric 140. The source electrode 150 is connected with the other end area of the active layer 110 through the second contact hole CH2, and the drain electrode 160 is connected with the one end area of the active layer 110 through the first contact hole CH1.

[0067] The source electrode 150 may include a lower source electrode 151 and an upper source electrode 152.

[0068] The lower source electrode 151 may be formed between the interlayer dielectric 140 and the upper source electrode 152 to enhance adhesion between the interlayer dielectric 140 and the upper source electrode 152. Also, the lower source electrode 151 may prevent a lower surface of the upper source electrode 152 from being corroded by protecting the lower surface of the upper source electrode 152. Therefore, oxidation of the lower source electrode 151 may be smaller than that of the upper source electrode 152. That is, the lower source electrode 151 may be made of a material of which corrosion resistance is stronger than that of the upper source electrode 152. In this way, the lower source electrode 151 serves as an adhesion enhancement layer or an anti-corrosion layer, and may be made of, but not limited to, an alloy (MoTi) of Mo and Ti.

[0069] The upper source electrode 152 is formed on the lower source electrode 151. The upper source electrode 152 may be made of, but not limited to, Cu which is a metal having low resistance. The upper source electrode 152 may be made of a metal of which resistance is relatively lower than that of the lower source electrode 151. In order to reduce resistance of the source electrode 150, it may be preferable that the upper source electrode 152 is formed to be thicker than the lower source electrode 151.

[0070] The drain electrode 160 may include a lower drain electrode 161 and an upper drain electrode 162 similarly to the aforementioned source electrode 150.

[0071] The lower drain electrode 161 may be formed between the interlayer dielectric 140 and the upper drain electrode 162 to enhance adhesion between the interlayer dielectric 140 and the upper drain electrode 162. Also, the lower drain electrode 161 may prevent a lower

surface of the upper drain electrode 162 from being corroded. Therefore, oxidation of the lower drain electrode 161 may be smaller than that of the upper drain electrode 162. That is, the lower drain electrode 161 may be made of a material of which corrosion resistance is stronger than that of the upper drain electrode 162. In the same manner as the aforementioned lower source electrode 151, the lower drain electrode 161 may be made of, but not limited to, an alloy (MoTi) of Mo and Ti.

[0072] The upper drain electrode 162 is formed on the lower drain electrode 161. The upper drain electrode 162 may be made of, but not limited to, Cu in the same manner as the aforementioned upper source electrode 152. It may be preferable that the upper drain electrode 162 is formed to be thicker than the lower drain electrode 161 to reduce resistance of the drain electrode 160.

[0073] The upper drain electrode 162 may be formed of the same material and thickness as those of the upper source electrode 152, and the lower drain electrode 161 may be formed of the same material and thickness as those of the lower source electrode 151. In this case, it is advantageous that the drain electrode 160 and the source electrode 150 may be formed through the same process at the same time.

[0074] The structure of the aforementioned thin film transistor layer T is not limited to the shown structure, and various modifications may be made in the structure of the thin film transistor layer T by the structure known to the person skilled in the art. For example, although a top gate structure is shown in which the gate electrode 130 is formed above the active layer 110, the thin film transistor layer T may be formed of a bottom gate structure in which the gate electrode 130 is formed below the active layer 110.

[0075] The passivation layer 165 is formed on the thin film transistor layer T, more specifically on the source electrode 150 and the drain electrode 160. The passivation layer 165 serves to protect the thin film transistor layer T, and may be made of, but not limited to, an inorganic insulating material, for example, a silicon oxide (Si-OX) film or a silicon nitride (SiNX) film. The passivation layer 165 may be formed to be extended to the entire active area AA that includes a transmissive area.

[0076] The first planarization layer 171 is formed on the passivation layer 165. The first planarization layer 171 serves to planarize an upper portion of the substrate 100 provided with the thin film transistor T. The first planarization layer 171 may be made of, but not limited to, an organic insulating material such as acryl resin, epoxy resin, phenolic resin, polyamides resin and polyimide resin. The first planarization layer 171 may be formed to be extended to the entire active area AA that includes a transmissive area.

[0077] The first anode electrode 180 and the first auxiliary electrode 190 are formed on the first planarization layer 171. That is, the first anode electrode 180 and the first auxiliary electrode 190 are formed on the same layer. The aforementioned passivation layer 165 and the afore-

mentioned first planarization layer 171 are provided with a third contact hole CH3 that exposes the source electrode 150, and the source electrode 150 is connected with the first anode electrode 180 through the third contact hole CH3.

[0078] The first anode electrode 180 may include a first lower anode electrode 181, a first upper anode electrode 182, and a first cover anode electrode 183.

[0079] The first lower anode electrode 181 may be formed between the first planarization layer 171 and the first upper anode electrode 182 to enhance adhesion between the first planarization layer 171 and the first upper anode electrode 182. Also, the first lower anode electrode 181 may prevent a lower surface of the first upper anode electrode 182 from being corroded by protecting the lower surface of the first upper anode electrode 182. Therefore, oxidation of the first lower anode electrode 181 may be smaller than that of the first upper anode electrode 182. That is, the first lower anode electrode 181 may be made of a material of which corrosion resistance is stronger than that of the first upper anode electrode 182. Also, the first lower anode electrode 181 may prevent the upper surface of the upper source electrode 152 from being corroded by protecting the upper surface of the upper source electrode 152. Therefore, oxidation of the first lower anode electrode 181 may be smaller than that of the upper source electrode 152. That is, the first lower anode electrode 181 may be made of a material of which corrosion resistance is stronger than that of the upper source electrode 152. In this way, since the first lower anode electrode 181 may prevent the upper surface of the upper source electrode 152 from being corroded, the source electrode 150 may be formed in the aforementioned double layer structure. The first lower anode electrode 181 serves as an adhesion enhancement layer or an anti-corrosion layer, and may be made of, but not limited to, an alloy (MoTi) of Mo and Ti.

[0080] The first upper anode electrode 182 is formed between the first lower anode electrode 181 and the first cover anode electrode 183. The first upper anode electrode 182 may be made of, but not limited to, Cu which is a metal having low resistance. The first upper anode electrode 182 may be made of a metal of which resistance is relatively lower than that of each of the first lower anode electrode 181 and the first cover anode electrode 183. In order to reduce resistance of the first anode electrode 180, it may be preferable that the first upper anode electrode 182 is formed to be thicker than each of the first lower anode electrode 181 and the first cover anode electrode 183.

[0081] The first cover anode electrode 183 is formed on the first upper anode electrode 182. The first cover anode electrode 183 prevents the first upper anode electrode 182 from being corroded by being formed to cover the upper surface and side of the first upper anode electrode 182. Therefore, oxidation of the first cover anode electrode 183 may be smaller than that of the first upper anode electrode 182. That is, the first cover anode elec-

trode 183 may be made of a material of which corrosion resistance is stronger than that of the first upper anode electrode 182.

[0082] The first cover anode electrode 183 may be formed to cover the side of the first lower anode electrode 181. At this time, oxidation of the first cover anode electrode 183 may be smaller than that of the first lower anode electrode 181. That is, the first cover anode electrode 183 may be made of a material of which corrosion resistance is stronger than that of the first lower anode electrode 181. The first cover anode electrode 183 may be made of, but not limited to, a transparent conductive material such as ITO.

[0083] The first auxiliary electrode 190 may include a first lower auxiliary electrode 191, a first upper auxiliary electrode 192, and a first cover auxiliary electrode 193 similarly to the aforementioned first anode electrode 180.

[0084] The first lower auxiliary electrode 191 may be formed between the first planarization layer 171 and the first upper auxiliary electrode 192 to enhance adhesion between the first planarization layer 171 and the first upper auxiliary electrode 192. Also, the first lower auxiliary electrode 191 may prevent a lower surface of the first upper auxiliary electrode 192 from being corroded. Therefore, oxidation of the first lower auxiliary electrode 191 may be smaller than that of the first upper auxiliary electrode 192. That is, the first lower auxiliary electrode 191 may be made of a material of which corrosion resistance is stronger than that of the first upper auxiliary electrode 192. In this way, the first lower auxiliary electrode 191 may be made of, but not limited to, an alloy (MoTi) of Mo and Ti in the same manner as the aforementioned first lower anode electrode 181.

[0085] The first upper auxiliary electrode 192 is formed between the first lower auxiliary electrode 191 and the first cover auxiliary electrode 193, and may be made of, but not limited to, Cu in the same manner as the aforementioned first upper anode electrode 182. Preferably, the first upper auxiliary electrode 192 which has relatively low resistance is formed to be thicker than each of the first lower auxiliary electrode 191 and the first cover auxiliary electrode 193, each of which has relatively high resistance, whereby entire resistance of the first auxiliary electrode 190 may be reduced.

[0086] The first cover auxiliary electrode 193 is formed on the first upper auxiliary electrode 192. The first cover auxiliary electrode 193 prevents the first upper auxiliary electrode 192 from being corroded by being formed to cover the upper surface and side of the first upper auxiliary electrode 192. Therefore, oxidation of the first cover auxiliary electrode 193 may be smaller than that of the first upper auxiliary electrode 192. That is, the first cover auxiliary electrode 193 may be made of a material of which corrosion resistance is stronger than that of the first upper auxiliary electrode 192.

[0087] The first cover auxiliary electrode 193 may be formed to cover the side of the first lower auxiliary electrode 191. Also, oxidation of the first cover auxiliary electrode

trode 193 may be smaller than that of the first lower auxiliary electrode 191. That is, the first cover auxiliary electrode 193 may be made of a material of which corrosion resistance is stronger than that of the first lower auxiliary electrode 191. The first cover auxiliary electrode 193 may be made of, but not limited to, a transparent conductive material such as ITO.

[0088] The first cover auxiliary electrode 193 may be formed of the same material and thickness as those of the first cover anode electrode 183, and the first upper auxiliary electrode 192 may be formed of the same material and thickness as those of the first upper anode electrode 182, and the first lower auxiliary electrode 191 may be formed of the same material and thickness as those of the first lower anode electrode 181. In this case, it is advantageous that the first auxiliary electrode 190 and the first anode electrode 180 may be formed through the same process at the same time.

[0089] The connection electrode 185 is connected with the first anode electrode 180, and is formed to be extended to the transmissive area. In more detail, the connection electrode 185 is formed to be connected with the first cover anode electrode 183 of the first anode electrode 180.

[0090] Since the first cover anode electrode 183 is connected with the second anode electrode 200, the connection electrode 185 may recognize the signal applied to the second anode electrode 200.

[0091] Therefore, in one embodiment of the present invention, when it is tested whether there is any defect in the second anode electrode 200, through an array test for the organic light emitting display device, the signal applied to the second anode electrode 200 is recognized through the first cover anode electrode 183 formed in the transmissive area, whereby interference caused by the signals of the thin film transistor T and the first anode electrode 180, which are formed below the second anode electrode 200, may be removed to perform the test for the defect of the second anode electrode 200.

[0092] Also, the connection electrode 185 may be made of a transparent conductive material such as ITO in the same manner as the first cover anode electrode 183 and the first cover auxiliary electrode 193 and may be formed at the same thickness as that of each of them. In this case, it is advantageous that the first cover anode electrode 183 and the first cover auxiliary electrode 193 may be formed through the same process at the same time.

[0093] As described above, in the organic light emitting display device according to one embodiment of the present invention, the connection electrode 185 made of a transparent conductive material such as ITO is formed in the transmissive area, and the signal of the second anode electrode 200 is recognized through the connection electrode 185, whereby the defect of the second anode electrode 200 may be tested even without affecting transmittance of each pixel.

[0094] Also, the connection electrode 185 is formed to

overlap a second anode electrode 200a of a corresponding one of sub pixels of another adjacent sub pixel. Therefore, if a defect occurs in a second anode electrode 200 of a specific sub pixel as a result of a test for the defect, the connection electrode 185 of the specific sub pixel and the second anode electrode 200a of another sub pixel are subjected to welding through a laser, whereby the defect pixel may simply be repaired. The corresponding sub pixel means a sub pixel that emits the same light as red (R), white (W), blue (B), or green (G) light emitted from the sub pixel that includes the second anode electrode 200 where the defect occurs.

[0095] The second planarization layer 172 is formed on the first auxiliary electrode 190, the first anode electrode 180, and the connection electrode 185. The second planarization layer 172 serves to planarize the upper portion of the substrate 100 together with the aforementioned first planarization layer 171. The second planarization layer 172 may be made of, but not limited to, an organic insulating material such as acryl resin, epoxy resin, phenolic resin, polyamide resin and polyimide resin. The second planarization layer 172 may be formed to be extended to the entire active area AA that includes a transmissive area.

[0096] The second planarization layer 172 is provided with a fourth contact hole CH4 and a fifth contact hole CH5. The first anode electrode 180 is exposed by the fourth contact hole CH4, and the first auxiliary electrode 190 is exposed by the fifth contact hole CH5.

[0097] The second anode electrode 200 is formed on the second planarization layer 172. The second anode electrode 200 is connected with the first anode electrode 180 through the fourth contact hole CH4. The second anode electrode 200 serves to upwardly reflect light emitted from the organic light emitting layer 240, and thus is made of a material with excellent reflectance. The second anode electrode 200 may include a second lower anode electrode 201, a second center anode electrode 202 and a second upper anode electrode 203.

[0098] The second lower anode electrode 201 is formed between the first anode electrode 180 and the second center anode electrode 202. The second lower anode electrode 201 may prevent a lower surface of the second center anode electrode 202 from being corroded by protecting the lower surface of the second center anode electrode 202. Therefore, oxidation of the second lower anode electrode 201 may be smaller than that of the second center anode electrode 202. That is, the second lower anode electrode 201 may be made of a material of which corrosion resistance is stronger than that of the second center anode electrode 202. In this way, the second lower anode electrode 201 may be made of, but not limited to, a transparent conductive material such as ITO.

[0099] The second center anode electrode 202 is formed between the second lower anode electrode 201 and the second upper anode electrode 203. The second center anode electrode 202 is made of a material with

resistance lower than that of the second lower anode electrode 201 and the second upper anode electrode 203 and reflectance more excellent than that of them, and may be made of, but not limited to, Ag, for example. Preferably, the second center anode electrode 202 which has relatively low resistance is formed to be thicker than each of the second lower anode electrode 201 and the second upper anode electrode 203, each of which has relatively high resistance, whereby entire resistance of the second anode electrode 200 may be reduced.

[0100] The second upper anode electrode 203 may be formed on the second center anode electrode 202 to prevent an upper surface of the second center anode electrode 202 from being corroded. Therefore, oxidation of the second upper anode electrode 203 may be smaller than that of the second center anode electrode 202. That is, the second upper anode electrode 203 may be made of a material of which corrosion resistance is stronger than that of the second center anode electrode 202. In this way, the second upper anode electrode 203 may be made of, but not limited to, a transparent conductive material such as ITO.

[0101] The second auxiliary electrode 210 is formed on the second planarization layer 172 in the same manner as the second anode electrode 200. The second auxiliary electrode 210 is connected with the first auxiliary electrode 190 through the fifth contact hole CH5. The second auxiliary electrode 210 serves to lower resistance of the cathode electrode 250 together with the first auxiliary electrode 190.

[0102] The second auxiliary electrode 210 may include a second lower auxiliary electrode 211, a second center auxiliary electrode 212, and a second upper auxiliary electrode 213.

[0103] The second lower auxiliary electrode 211 is formed between the first auxiliary electrode 190 and the second center auxiliary electrode 212. The second lower auxiliary electrode 211 may prevent a lower surface of the second center auxiliary electrode 212 from being corroded by protecting the lower surface of the second center auxiliary electrode. Therefore, oxidation of the second lower auxiliary electrode 211 may be smaller than that of the second center auxiliary electrode 212. That is, the second lower auxiliary electrode 211 may be made of a material of which corrosion resistance is stronger than that of the second center auxiliary electrode 212. In this way, the second lower auxiliary electrode 211 may be made of, but not limited to, a transparent conductive material such as ITO.

[0104] The second center auxiliary electrode 212 is formed between the second lower auxiliary electrode 211 and the second upper auxiliary electrode 213. The second center auxiliary electrode 212 is made of a material with resistance lower than that of the second lower auxiliary electrode 211 and the second upper auxiliary electrode 213 and reflectance more excellent than that of them, and may be made of, but not limited to, Ag, for example. Preferably, the second center auxiliary elec-

trode 212 which has relatively low resistance is formed to be thicker than each of the second lower auxiliary electrode 211 and the second upper auxiliary electrode 213, each of which has relatively high resistance, whereby entire resistance of the second auxiliary electrode 210 may be reduced.

[0105] The second upper auxiliary electrode 213 may be formed on the second center auxiliary electrode 212 to prevent an upper surface of the second center auxiliary electrode 212 from being corroded. Therefore, oxidation of the second upper auxiliary electrode 213 may be smaller than that of the second center auxiliary electrode 212. That is, the second upper auxiliary electrode 213 may be made of a material of which corrosion resistance is stronger than that of the second center auxiliary electrode 212. In this way, the second upper auxiliary electrode 213 may be made of, but not limited to, a transparent conductive material such as ITO.

[0106] The second upper auxiliary electrode 213 may be formed of the same material and thickness as those of the second upper anode electrode 203, and the second center auxiliary electrode 212 may be formed of the same material and thickness as those of the second center anode electrode 202, and the second lower auxiliary electrode 211 may be formed of the same material and thickness as those of the second lower anode electrode 201. In this case, it is advantageous that the second auxiliary electrode 210 and the second anode electrode 200 may be formed through the same process at the same time.

[0107] According to one embodiment of the present invention, two auxiliary electrodes of the first auxiliary electrode 190 and the second auxiliary electrode 210, which are connected with each other to reduce resistance of the cathode electrode 250, may be formed to more easily control resistance properties of the auxiliary electrodes which are required.

[0108] In more detail, since the second auxiliary electrode 210 is formed on the same layer as the second anode electrode 200, if a width of the second auxiliary electrode 210 increases, a width of the second anode electrode 200 should be reduced. In this case, a problem occurs in that a pixel area of the display device is reduced. Therefore, there is limitation in increasing the width of the second auxiliary electrode 210. In this respect, according to one embodiment of the present invention, the first auxiliary electrode 190 connected with the second auxiliary electrode 210 may additionally be formed below the second auxiliary electrode 210 to effectively lower resistance of the cathode electrode 250 even without reducing the pixel area.

[0109] The first auxiliary electrode 190 is formed on the same layer as the first anode electrode 180, and serves to connect the source electrode 150 with the second anode electrode 200, whereby a width of the first anode electrode 180 may be reduced, and thus a width of the first auxiliary electrode 190 may increase. That is, the width of the first auxiliary electrode 190 may be

formed to be greater than that of the first anode electrode 180. Moreover, the width of the first auxiliary electrode 190 may increase such that the first auxiliary electrode 190 may be overlapped with the second anode electrode 200. As a result, resistance of the cathode electrode 250 may be lowered more effectively.

[0110] The bank 220 is formed on the second anode electrode 200 and the second auxiliary electrode 210.

[0111] The bank 220 is formed on one side and the other side of the second anode electrode 200 while exposing the upper surface of the second anode electrode 200. As the bank 220 is formed to expose the upper surface of the second anode electrode 200, an area where an image is displayed may be obtained. Also, as the bank 220 is formed on one side and the other side of the second anode electrode 200, the side of the second center anode electrode 202, which is vulnerable to corrosion, is prevented from being exposed to the outside, whereby the side of the second center anode electrode 202 may be prevented from being corroded.

[0112] The bank 220 is formed on one side and the other side of the second auxiliary electrode 210 while exposing the upper surface of the second auxiliary electrode 210. As the bank 220 is formed to expose the upper surface of the second auxiliary electrode 210, an electrical connection space between the second auxiliary electrode 210 and the cathode electrode 250 may be obtained. Also, as the bank 220 is formed on one side and the other side of the second auxiliary electrode 210, the side of the second center auxiliary electrode 212, which is vulnerable to corrosion, is prevented from being exposed to the outside, whereby the side of the second center auxiliary electrode 212 may be prevented from being corroded.

[0113] Also, the bank 220 is formed between the second anode electrode 200 and the second auxiliary electrode 210 to insulate the second electrode 200 and the second auxiliary electrode 210 from each other. The bank 220 may be made of, but not limited to, an organic insulating material such as polyimide resin, acryl resin, and BCB.

[0114] The partition wall 230 is formed on the second auxiliary electrode 210. The partition wall 230 is spaced apart from the bank 220 at a predetermined distance, and the second auxiliary electrode 210 is connected with the cathode electrode 250 through the spaced area between the partition wall 230 and the bank 220. The partition wall 230 may not be formed, whereby the second auxiliary electrode 210 may electrically be connected with the cathode electrode 250 without the partition wall 230. However, if the partition wall 230 is formed, it is advantageous that the organic light emitting layer 240 may be deposited more easily. This will be described in more detail as follows.

[0115] If the partition wall 230 is not formed, a mask pattern that covers the upper surface of the second auxiliary electrode 210 when the organic light emitting layer 240 is deposited is required such that the upper surface

of the second auxiliary electrode 210 is not covered by the organic light emitting layer 240. However, if the partition wall 230 is formed, its upper surface serves as eaves when the organic light emitting layer 240 is deposited, whereby the organic light emitting layer 240 is not deposited on an area below the eaves. In this case, a mask pattern that covers the upper surface of the second auxiliary electrode 210 is not required. That is, based on a front surface, if the upper surface of the partition wall 230 serving as the eaves is formed to cover the spaced area between the partition wall 230 and the bank 220, the organic light emitting layer 240 is not permeated into the spaced area between the partition wall 230 and the bank 220, whereby the second auxiliary electrode 210 may be exposed from the spaced area between the partition wall 230 and the bank 220. Particularly, since the organic light emitting layer 240 may be formed through a deposition process such as evaporation in which linearity of a deposition material is excellent, the organic light emitting layer 240 is not deposited on the spaced area between the partition wall 230 and the bank 220.

[0116] In order that the upper surface of the partition wall 230 serves as the eaves as described above, a width of the upper surface of the partition wall 230 is formed to be greater than that of the lower surface of the partition wall 230. The partition wall 230 may include a first partition wall 231 and a second partition wall 232. The first partition wall 231 is formed on the second auxiliary electrode 210, and may be formed of the same material as that of the bank 220 through the same process as that of the bank 220. The second partition wall 232 is formed on the first partition wall 231. A width of the upper surface of the second partition wall 232 is formed to be greater than that of the lower surface of the second partition wall 232. Particularly, as the second partition wall 232 may be formed such that the upper surface of the second partition wall 232 covers the spaced area between the partition wall 230 and the bank 220, the second partition wall 232 may serve as the eaves.

[0117] The organic light emitting layer 240 is formed on the second anode electrode 200. The organic light emitting layer 240 may include a hole injecting layer, a hole transporting layer, an emitting layer, an electron transporting layer, and an electron injecting layer. Various modifications known in the art may be made in the organic light emitting layer 240.

[0118] The organic light emitting layer 240 may be extended to the upper surface of the bank 220. However, the organic light emitting layer 240 is not extended to the upper surface of the second auxiliary electrode 210 while covering the upper surface of the second auxiliary electrode 210. This is because that it is difficult to electrically connect the second auxiliary electrode 210 with the cathode electrode 250 if the organic light emitting layer 240 covers the upper surface of the second auxiliary electrode 210. As described above, the organic light emitting layer 240 may be formed through a deposition process without a mask that covers the upper surface of the sec-

ond auxiliary electrode 210. In this case, the organic light emitting layer 240 may be formed even on the partition wall 230.

[0119] The cathode electrode 250 is formed on the organic light emitting layer 240. Since the cathode electrode 250 is formed on a surface to which light is emitted, the cathode electrode 250 is made of a transparent conductive material. Since the cathode electrode 250 is made of a transparent conductive material, its resistance is high. Therefore, the cathode electrode 250 is connected with the second auxiliary electrode 210 to reduce resistance. That is, the cathode electrode 250 is connected with the second auxiliary electrode 210 through the spaced area between the partition wall 230 and the bank 220. Since the cathode electrode 250 may be formed through a deposition process such as sputtering, in which linearity of a deposition material is not good, the cathode electrode 250 may be deposited on the spaced area between the partition wall 230 and the bank 220.

[0120] Although not shown, an encapsulation layer may additionally be formed on the cathode electrode 250 to prevent water permeation from occurring. Various materials known in the art may be used as the encapsulation layer. Also, although not shown, a color filter per pixel may additionally be formed on the cathode electrode 250, and in this case, white light may be emitted from the organic light emitting layer 240.

[0121] FIGS. 5a to 5h are cross-sectional views illustrating process steps of a method of manufacturing an organic light emitting display device according to one embodiment of the present invention, and relate to a method of manufacturing the aforementioned organic light emitting display device according to FIG. 4. The same reference numbers will be used throughout the drawings to refer to the same or like parts, and repeated description in material and structure of each element will be omitted.

[0122] First of all, as shown in FIG. 5a, an active layer 110, a gate insulating film 120, a gate electrode 130, an interlayer dielectric 140, a source electrode 150, and a drain electrode 160 are sequentially formed on a substrate 100.

[0123] In more detail, the active layer 110 is formed on the substrate 100, the gate insulating film 120 is formed on the active layer 110, the gate electrode 130 is formed on the gate insulating film 120, the interlayer dielectric 140 is formed on the gate electrode 130, and a first contact hole CH1 and a second contact hole CH2 are formed in the gate insulating film 120 and the interlayer dielectric 140. Afterwards, the drain electrode 160 connected with one end area of the active layer 110 through the first contact hole CH1 and the source electrode 150 connected with the other end area of the active layer 110 through the second contact hole CH2 are formed.

[0124] In this case, the active layer 110, the gate electrode 130, the source electrode 150 and the drain electrode 160 are formed in the light emitting area of the substrate 100, and the gate insulating film 120 and the interlayer dielectric 140 are formed to be extended to the en-

tire active area AA that includes a light emitting area and a transmissive area.

[0125] The source electrode 150 includes a lower source electrode 151 and an upper source electrode 152, and the drain electrode 160 includes a lower drain electrode 161 and an upper drain electrode 162. The source electrode 150 and the drain electrode 160 may be formed of the same material through the same patterning process at the same time.

[0126] Next, as shown in FIG. 5b, a passivation layer 165 is formed on the source electrode 150 and the drain electrode 160, and a first planarization layer 171 is formed on the passivation layer 165. The passivation layer 165 and the first planarization layer 171 are formed to be extended to the entire active area AA that includes a light emitting area and a transmissive area.

[0127] The passivation layer 165 and the first planarization layer 171 are formed to be extended to the entire active area AA that includes a light emitting area and a transmissive area.

[0128] The passivation layer 165 and the first planarization layer 171 are formed to be provided with a third contact hole CH3 in the active area AA, whereby the source electrode 150 is externally exposed through the third contact hole CH3.

[0129] Next, as shown in FIG. 5c, a first anode electrode 180 and a first auxiliary electrode 190 are formed to be spaced apart from each other on the first planarization layer 171 within the active area AA, and a connection electrode 185 is formed to be connected with the first anode electrode 180.

[0130] The first anode electrode 180 is formed to be connected with the source electrode 150 through the third contact hole CH3.

[0131] The first anode electrode 180 includes a first lower anode electrode 181, a first upper anode electrode 182, and a first cover anode electrode 183, and the first auxiliary electrode 190 includes a first lower auxiliary electrode 191, a first lower auxiliary electrode 192, and a first cover auxiliary electrode 193.

[0132] Particularly, although the first anode electrode 180 and the first auxiliary electrode 190 are formed in the light emitting area only to obtain transmittance of a pixel in one embodiment of the present invention, the connection electrode 185 may be connected with the first cover anode electrode 183 and formed in the transmissive area as shown in FIG. 5c.

[0133] Therefore, in one embodiment of the present invention, when a defect of a second anode electrode 200 formed through FIG. 5e is tested through an array test for an organic light emitting display device, a signal applied to the second anode electrode 200 is recognized through the connection electrode 185 formed in the transmissive area. Thus, the interference caused by signals of the thin film transistor T and the first anode electrode 180, which are formed below the second anode electrode 200, may be removed, and the defect test for the second anode electrode 200 may be performed. Also, since the

connection electrode 185 may be made of a transparent conductive material such as ITO, the connection electrode 185 may not affect transmittance of a pixel.

[0134] Since the connection electrode 185 may be formed through the same process as that of the first cover anode electrode 183 and the first cover auxiliary electrode 183 simultaneously with them, a separate mask process is not required additionally.

[0135] Next, as shown in FIG. 5d, a second planarization layer 172 is formed on the first anode electrode 180, the first auxiliary electrode 190 and the connection electrode 185, which are formed within the active area AA.

[0136] The second planarization layer 172 is formed to be provided with a fourth contact hole CH4 and a fifth contact hole CH5, whereby the first anode electrode 180 is externally exposed through the fourth contact hole CH4, and the first auxiliary electrode 190 is externally exposed through the fifth contact hole CH5.

[0137] Next, as shown in FIG. 5e, a second anode electrode 200 and a second auxiliary electrode 210 are formed to be spaced apart from each other on the second planarization layer 172.

[0138] The second anode electrode 200 includes a second lower anode electrode 201, a second center anode electrode 202, and a second upper anode electrode 203, and the second auxiliary electrode 210 includes a second lower auxiliary electrode 211, a second center auxiliary electrode 212, and a second upper auxiliary electrode 213.

[0139] The second anode electrode 200 and the second auxiliary electrode 210 may be formed of the same material through the same patterning process at the same time.

[0140] Particularly, in one embodiment of the present invention, as shown in FIG. 5e, the connection electrode 185 is formed to overlap a second anode electrode 200a of a corresponding one of sub pixels of another adjacent pixel. Therefore, if a defect occurs in the second anode electrode 200 of a specific sub pixel, the connection electrode 185 of the specific sub pixel and the second anode electrode 200a of another adjacent pixel are subjected to welding, whereby the defect pixel may be repaired simply.

[0141] Next, as shown in FIG. 5f, a bank 220 is formed on one side and the other side of the second anode electrode 200 while an upper surface of the second anode electrode 200 is being exposed. Also, the bank 220 is formed on one side and the other side of the second auxiliary electrode 210 while the upper surface of the second auxiliary electrode 210 is being exposed.

[0142] Also, a first partition wall 231 and a second partition wall 232 are sequentially formed on the exposed second auxiliary electrode 210. The first partition wall 231 may be formed of the same material as that of the bank 220 through the same patterning process as that of the bank 220 simultaneously with the bank 220. The partition wall 230 is formed to be spaced apart from the bank 220 at a predetermined distance, whereby a spaced

area is provided between the partition wall 230 and the bank 220.

[0143] In order that an upper surface of the partition wall 230 serves as eaves, a width of an upper surface of the second partition wall 232 is formed to be greater than that of a lower surface of the second partition wall 232. Particularly, based on a front surface, the upper surface of the second partition wall 232 covers the spaced area between the partition wall 230 and the bank 220, whereby an organic light emitting layer 240, which will be described later, is prevented from being deposited on the spaced area between the partition wall 230 and the bank 220 during a deposition process of the organic light emitting layer 240.

[0144] Next, as shown in FIG. 5g, the organic light emitting layer 240 is formed on the second anode electrode 200. The organic light emitting layer 240 is formed through a deposition process such as evaporation in which linearity of a deposition material is excellent, whereby the organic light emitting layer 240 may be deposited on the bank 220 and the partition wall 230 but is not deposited on the spaced area between the partition wall 230 and the bank 220. That is, since the upper surface of the partition wall 230 serves as eaves during deposition of the organic light emitting layer 240, even though the organic light emitting layer 240 may be deposited without a mask pattern that covers the upper surface of the second auxiliary electrode 210, the organic light emitting layer 240 may be prevented from being deposited on the spaced area between the partition wall 230 and the bank 220.

[0145] Next, as shown in FIG. 5h, a cathode electrode 250 is formed on the organic light emitting layer 240.

[0146] The cathode electrode 250 is formed to be connected with the second auxiliary electrode 210 through the spaced area between the partition wall 230 and the bank 220. The cathode electrode 250 may be formed through a deposition process such as sputtering in which linearity of a deposition material is not good, whereby the cathode electrode 250 may be deposited on the spaced area between the partition wall 230 and the bank 220.

[0147] According to the present invention described as above, the following advantages may be obtained as follows.

[0148] According to one embodiment of the present invention, the signal at the anode electrode is tested through the connection electrode connected with the anode electrode and formed in the transmissive area of the pixel, whereby the defect of the anode electrode may be tested exactly without interference caused by another electrode.

[0149] According to one embodiment of the present invention, the connection electrode made of a transparent conductive material is formed in the transmissive area of the pixel, whereby the defect of the anode electrode may be tested without affecting transmittance of each pixel.

[0150] According to one embodiment of the present

invention, since the connection electrode may be formed thorough the process of forming the anode electrode simultaneously with the anode electrode, the mask process may be prevented from increasing.

[0151] According to one embodiment of the present invention, when the defect occurs in an anode electrode of a specific pixel, another anode electrode of a corresponding one of sub pixels of another adjacent pixel and the connection electrode are subjected to welding, whereby the pixel where the defect occurs may be repaired simply.

[0152] It will be apparent to those skilled in the art that various modifications and variations can be made in the present invention without departing from the scope of the inventions. Thus, it is intended that the present invention covers the modifications and variations of this invention provided they come within the scope of the appended claims and their equivalents.

[0153] The following list of embodiments forms part of the description.

1. An organic light emitting display device comprising:

a substrate provided with a plurality of pixels, each of which includes a light emitting area and a transmissive area;
an anode electrode provided in the light emitting area;
an organic light emitting layer provided on the anode electrode;
a cathode electrode provided on the organic light emitting layer;
an auxiliary electrode connected with the cathode electrode; and
a connection electrode connected with the anode electrode and provided in the transmissive area.

2. The organic light emitting display device of embodiment 1, wherein the anode electrode includes a first anode electrode and a second anode electrode connected with the first anode electrode through a contact hole, and
wherein the connection electrode is provided to be connected with the first anode electrode on the same layer as the first anode electrode.

3. The organic light emitting display device of embodiment 2, wherein the first anode electrode includes a first lower anode electrode and a first upper anode electrode, and a first cover anode electrode, and
wherein the connection electrode is provided to be connected with the first cover anode electrode.

4. The organic light emitting display device of embodiment 1, wherein the connection electrode is

made of a transparent conductive material.

5. The organic light emitting display device of embodiment 1, wherein, when it is determined that the anode electrode has a defect, the connection electrode is provided to overlap an anode electrode of a corresponding one of sub pixels of an adjacent pixel so as to repair the anode electrode with the defect.

6. The organic light emitting display device of embodiment 1, further comprising a bank provided on one side and the other side of the auxiliary electrode, and a partition wall provided to be spaced apart from the bank on the auxiliary electrode, wherein the cathode electrode is connected with the auxiliary electrode through a spaced area between the bank and the partition wall.

7. A method of manufacturing an organic light emitting display device, the method comprising the steps of:

forming a first anode electrode and a first auxiliary electrode spaced apart from the first anode electrode, in a light emitting area on a substrate provided with a plurality of pixels, each of which includes a light emitting area and a transmissive area;

forming a planarization layer on the first anode electrode and the first auxiliary electrode and respectively forming contact holes, which externally expose the first anode electrode and the first auxiliary electrode, by removing a predetermined area of the planarization layer; and forming a second anode electrode and a second auxiliary electrode on the planarization layer, the second anode electrode being connected with the first anode electrode and the second auxiliary electrode being connected with the second auxiliary electrode, wherein a connection electrode connected with the first anode electrode is formed in the transmissive area during the process of forming the first anode electrode and the first auxiliary electrode.

8. The method of embodiment 7, wherein the step of forming the first anode electrode and the first auxiliary electrode includes the steps of:

forming a first lower anode electrode and a first lower auxiliary electrode; respectively forming a first upper anode electrode and a first upper auxiliary electrode on the first lower anode electrode and the first auxiliary electrode; and respectively forming a first cover anode elec-

trode and a first cover auxiliary electrode on the first upper anode electrode and the first upper auxiliary electrode, wherein the connection electrode is formed together with the first cover anode electrode and the first cover auxiliary electrode during the process of forming the first cover anode electrode and the first cover auxiliary electrode.

9. The method of embodiment 7, wherein, when it is determined that the second anode electrode has a defect, the connection electrode is provided to overlap a second anode electrode of a corresponding one of sub pixels of an adjacent pixel so as to repair the second anode electrode with the defect.

10. The method of embodiment 7, further comprising the steps of:

forming a bank provided on one side and the other side of the second auxiliary electrode and forming a partition wall provided on the second auxiliary electrode;

forming an organic light emitting layer on the second anode electrode; and

forming a cathode electrode connected with the second auxiliary electrode on the organic light emitting layer,

wherein the organic light emitting layer is not deposited on a spaced area between the bank and the partition wall, and the cathode electrode is deposited on the spaced area between the bank and the partition wall.

Claims

1. An organic light emitting display device comprising:

a substrate provided with a plurality of pixels, each of which includes a light emitting area and a transmissive area;

an anode electrode provided in the light emitting area;

an organic light emitting layer provided on the anode electrode;

a cathode electrode provided on the organic light emitting layer;

an auxiliary electrode connected with the cathode electrode; and

a connection electrode connected with the anode electrode and provided in the transmissive area.

2. The organic light emitting display device of claim 1, wherein the anode electrode includes a first anode electrode and a second anode electrode connected with the first anode electrode through a contact hole,

- and
wherein the connection electrode is provided to be connected with the first anode electrode on the same layer as the first anode electrode.
3. The organic light emitting display device of claim 2, wherein the first anode electrode includes a first lower anode electrode and a first upper anode electrode, and a first cover anode electrode, and wherein the connection electrode is provided to be connected with the first cover anode electrode.
 4. The organic light emitting display device of claim 3, wherein the first cover anode electrode is disposed to cover an upper surface and side of the first upper anode electrode.
 5. The organic light emitting display device of claim 3 or claim 4, wherein an oxidation of the first lower anode electrode and the first cover anode electrode is smaller than that of the first upper anode electrode, and wherein a resistance of the first upper anode electrode is lower than that of each of the first lower anode electrode and the first cover anode electrode.
 6. The organic light emitting display device of any preceding claim, wherein the auxiliary electrode includes a first auxiliary electrode and a second auxiliary electrode connected with the first auxiliary electrode through a contact hole.
 7. The organic light emitting display device of claim 6 when dependent on claim 2, wherein the first anode electrode and the first auxiliary electrode are disposed on the same layer, and wherein the second anode electrode and the second auxiliary electrode are disposed on the same layer.
 8. The organic light emitting display device of claim 6 when dependent on claim 2, or claim 7, wherein a width of the first auxiliary electrode is greater than that of the first anode electrode.
 9. The organic light emitting display device of claim 6 when dependent on claim 2, or claim 7 or claim 8, wherein the first auxiliary electrode is overlapped with the second anode electrode.
 10. The organic light emitting display device of claim 6 when dependent on claim 2, or any one of claims 7 to 9, wherein the first auxiliary electrode and the first anode electrode are formed of the same material, and wherein the second auxiliary electrode and the second anode electrode are formed of the same material.
 11. The organic light emitting display device of any one of claims 6 to 10, wherein the first auxiliary electrode includes a first lower auxiliary electrode and a first upper auxiliary electrode, and a first cover auxiliary electrode.
 12. The organic light emitting display device of claim 11, wherein the first cover auxiliary electrode is disposed to cover an upper surface and side of the first upper auxiliary electrode.
 13. The organic light emitting display device of claim 11 or claim 12, wherein an oxidation of the first lower auxiliary electrode and the first cover auxiliary electrode is smaller than that of the first upper auxiliary electrode, and wherein a resistance of the first upper auxiliary electrode is lower than that of each of the first lower auxiliary electrode and the first cover auxiliary electrode.
 14. The organic light emitting display device according to any preceding claim, wherein the connection electrode is made of a transparent conductive material.
 15. The organic light emitting display device according to any preceding claim, wherein the connection electrode overlaps an anode electrode of a corresponding one of sub pixels of an adjacent pixel.
 16. The organic light emitting display device of claim 15, wherein, an anode electrode that has a defect is connected to an anode electrode of a corresponding one of sub pixels of an adjacent pixel so as to repair the anode electrode with the defect.
 17. The organic light emitting display device according to any preceding claim, further comprising a bank provided on one side and the other side of the auxiliary electrode, and a partition wall provided to be spaced apart from the bank on the auxiliary electrode, wherein the cathode electrode is connected with the auxiliary electrode through a spaced area between the bank and the partition wall.
 18. A method of manufacturing an organic light emitting display device, the method comprising the steps of:
forming a first anode electrode and a first auxiliary electrode spaced apart from the first anode electrode, in a light emitting area on a substrate provided with a plurality of pixels, each of which includes a light emitting area and a transmissive area;
forming a planarization layer on the first anode electrode and the first auxiliary electrode and respectively forming contact holes, which externally expose the first anode electrode and the first auxiliary electrode, by removing a predetermined area of the planarization layer; and

forming a second anode electrode and a second auxiliary electrode on the planarization layer, the second anode electrode being connected with the first anode electrode and the second auxiliary electrode being connected with the second auxiliary electrode, 5
 wherein a connection electrode connected with the first anode electrode is formed in the transmissive area during the process of forming the first anode electrode and the first auxiliary electrode. 10

19. The method of claim 18, wherein the step of forming the first anode electrode and the first auxiliary electrode includes the steps of: 15

forming a first lower anode electrode and a first lower auxiliary electrode;
 respectively forming a first upper anode electrode and a first upper auxiliary electrode on the first lower anode electrode and the first lower auxiliary electrode; and 20
 respectively forming a first cover anode electrode and a first cover auxiliary electrode on the first upper anode electrode and the first upper auxiliary electrode, 25
 wherein the connection electrode is formed together with the first cover anode electrode and the first cover auxiliary electrode during the process of forming the first cover anode electrode and the first cover auxiliary electrode. 30

20. The method of claim 18 or claim 19, wherein, when it is determined that the second anode electrode has a defect, the connection electrode is provided to overlap a second anode electrode of a corresponding one of sub pixels of an adjacent pixel so as to repair the second anode electrode with the defect. 35

21. The method according to any one of claims 18 to 20, further comprising the steps of: 40

forming a bank provided on one side and the other side of the second auxiliary electrode and forming a partition wall provided on the second auxiliary electrode; 45
 forming an organic light emitting layer on the second anode electrode; and
 forming a cathode electrode connected with the second auxiliary electrode on the organic light emitting layer, 50
 wherein the organic light emitting layer is not deposited on a spaced area between the bank and the partition wall, and the cathode electrode is deposited on the spaced area between the bank and the partition wall. 55

FIG. 1
RELATED ART

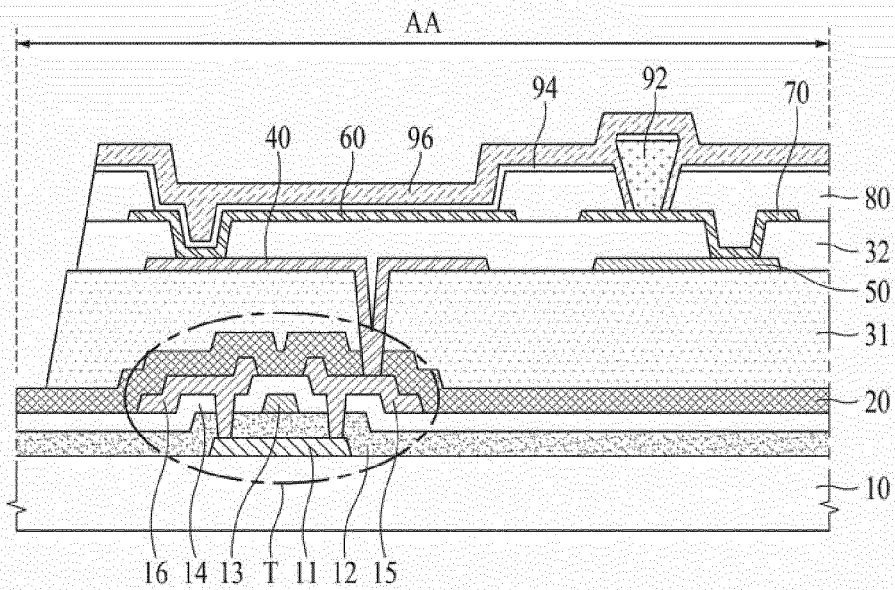


FIG. 2

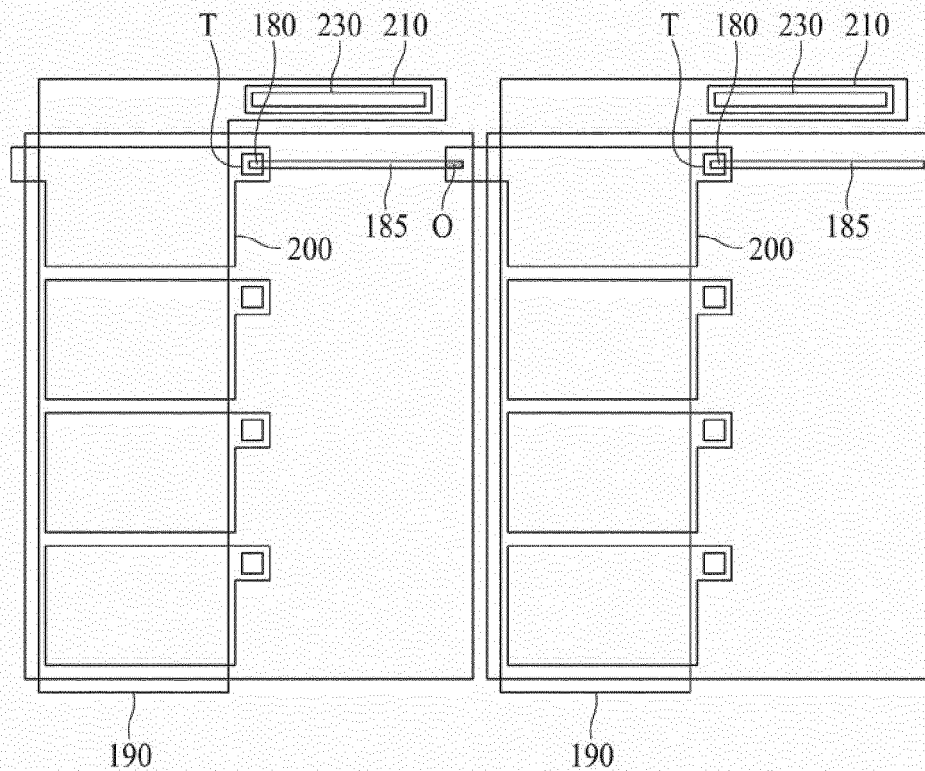


FIG. 3

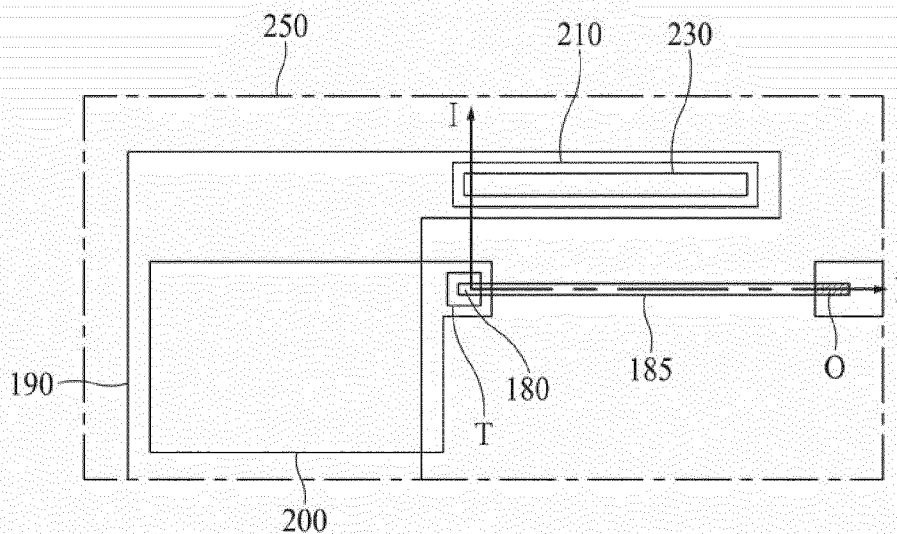


FIG. 4

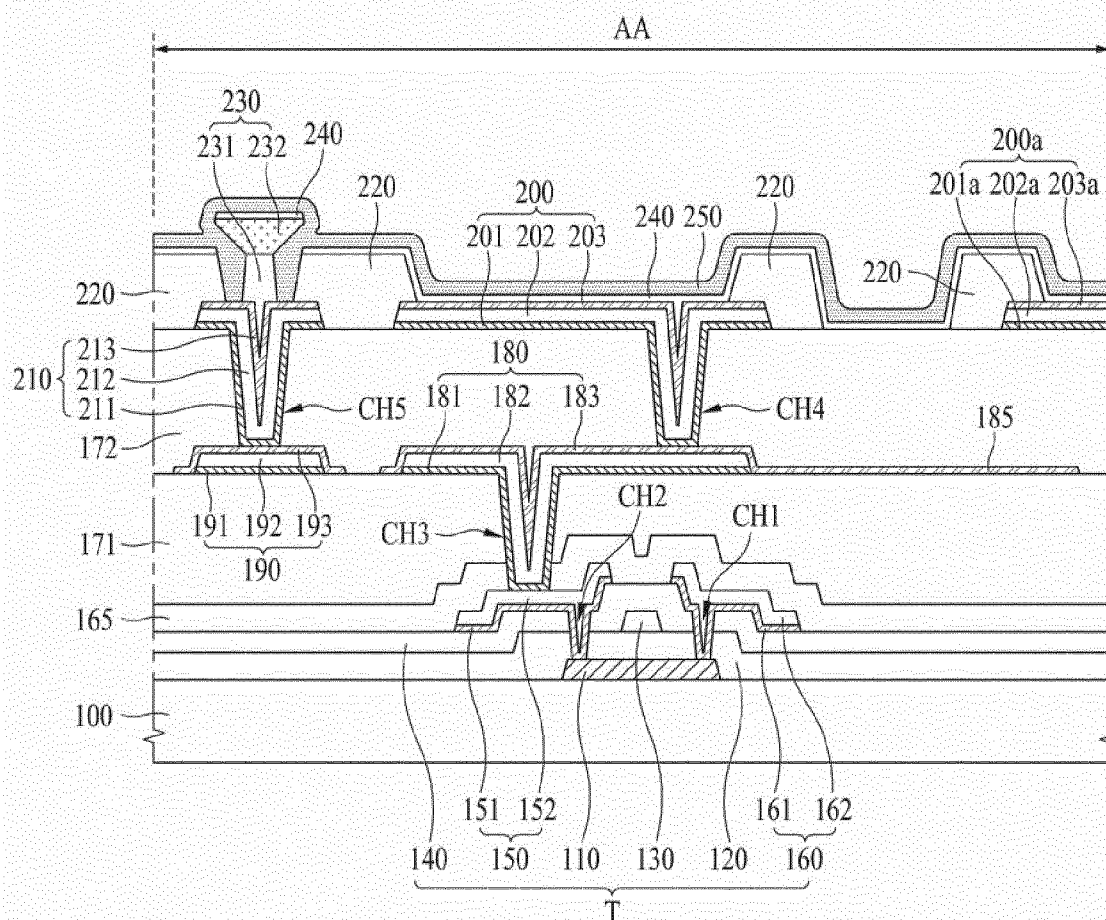


FIG. 5A

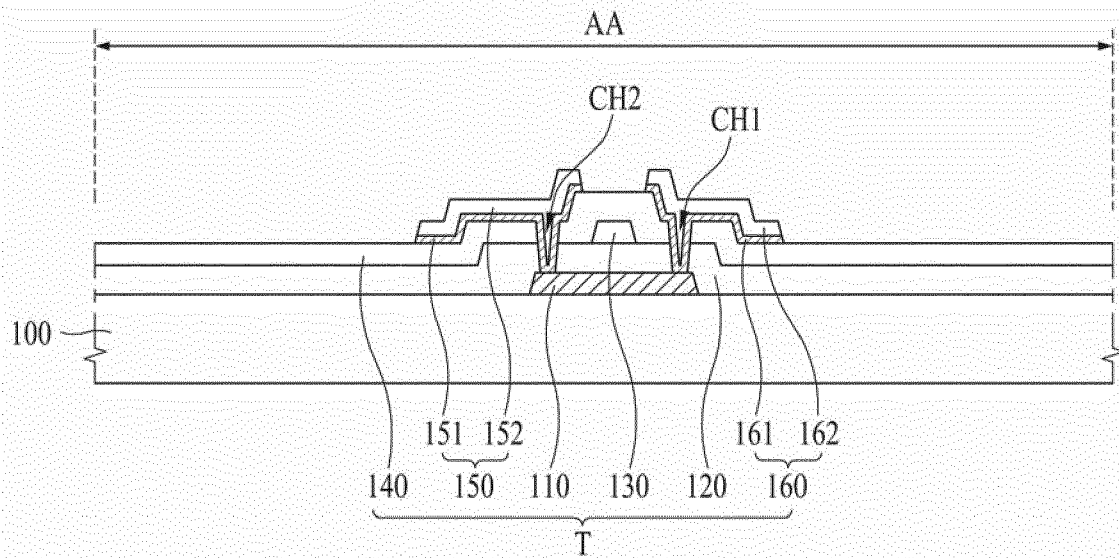


FIG. 5B

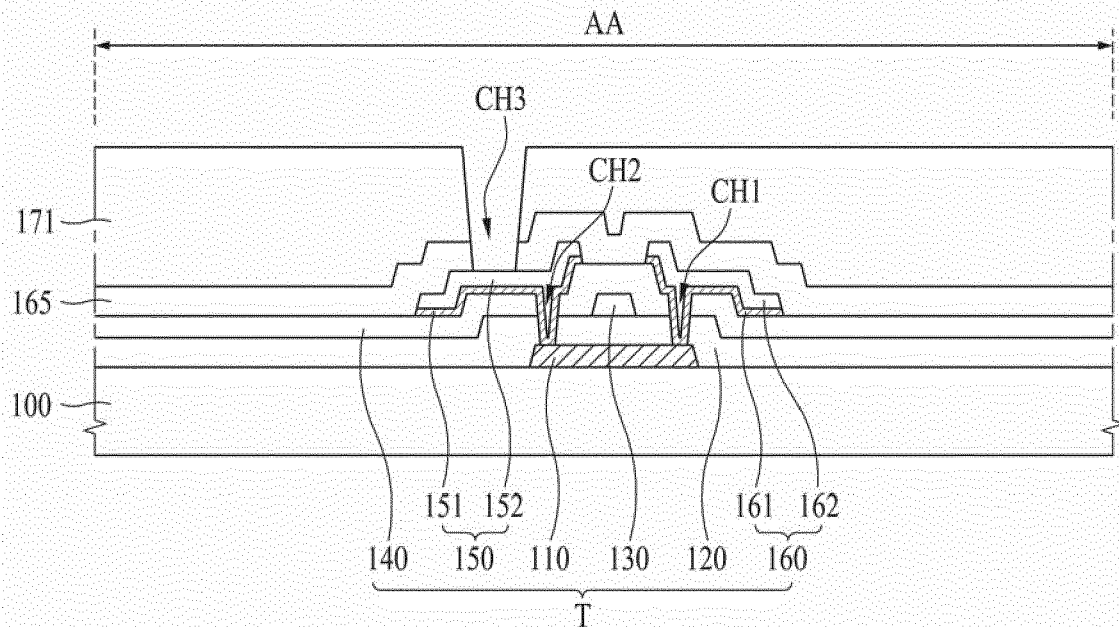


FIG. 5C

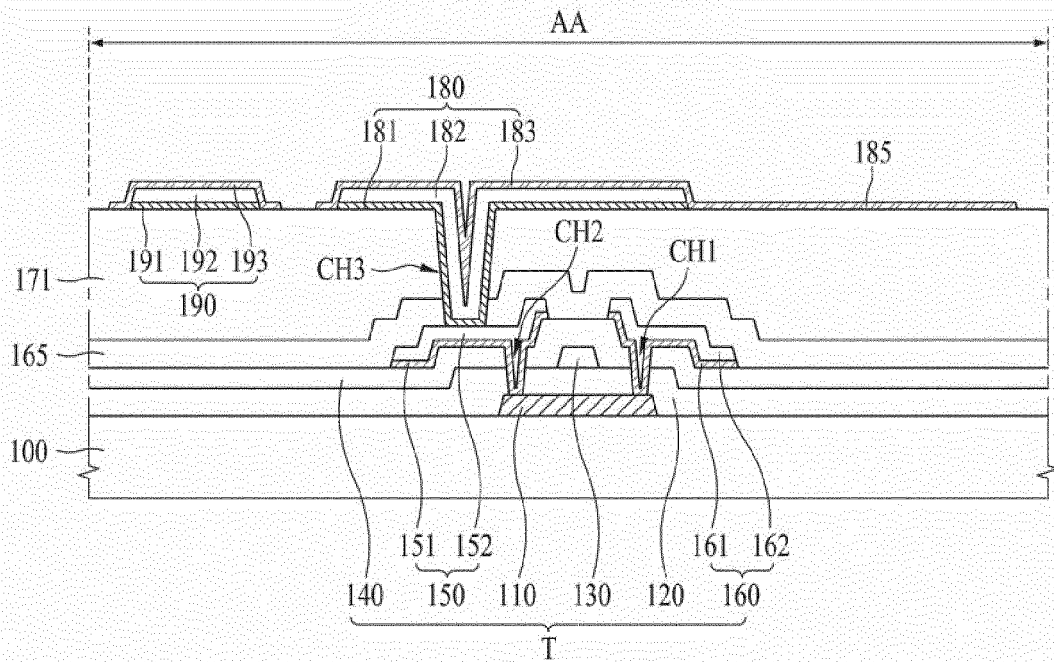


FIG. 5D

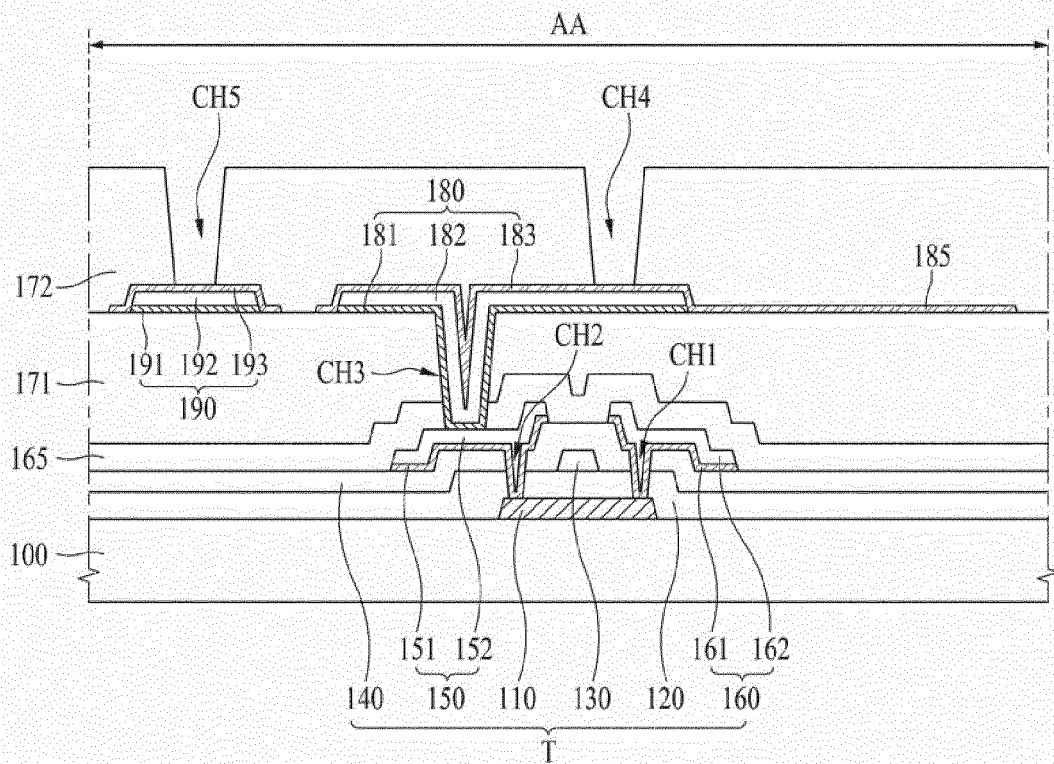


FIG. 5E

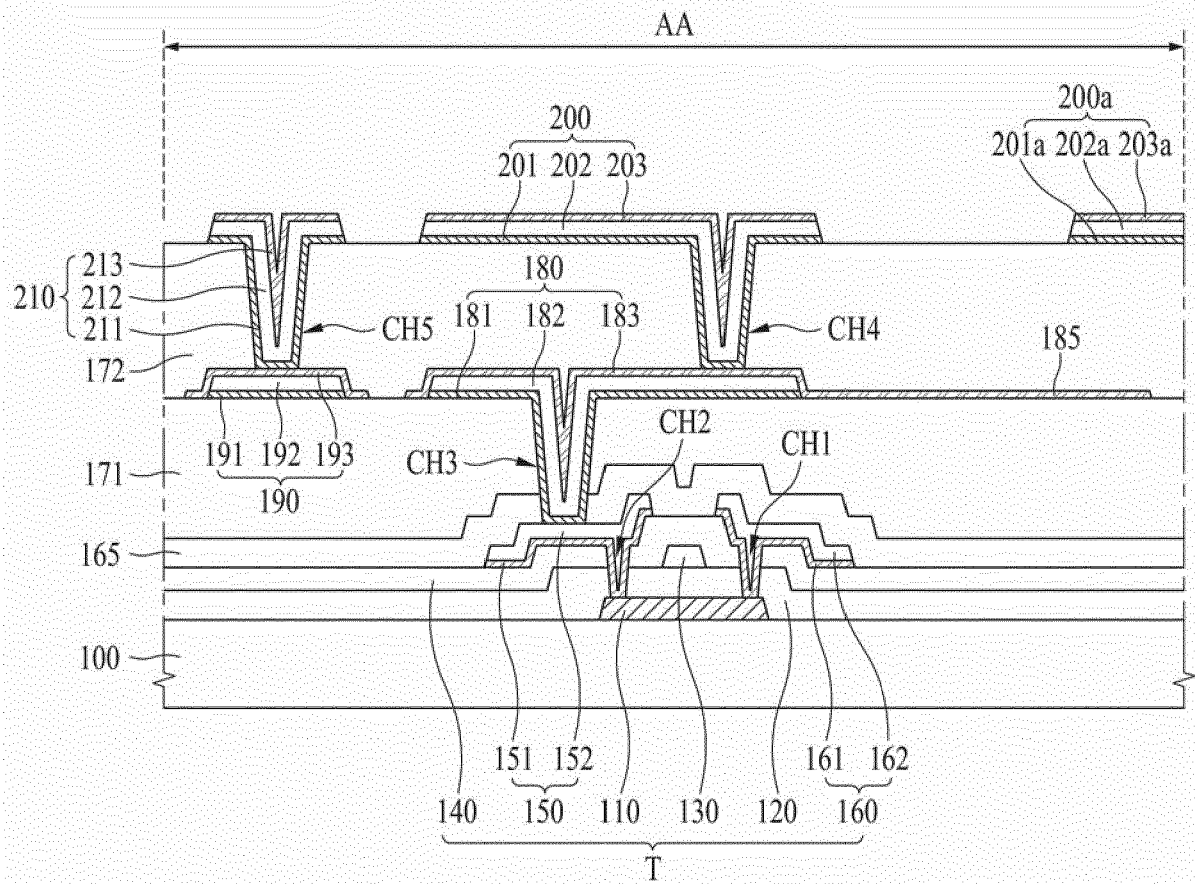


FIG. 5F

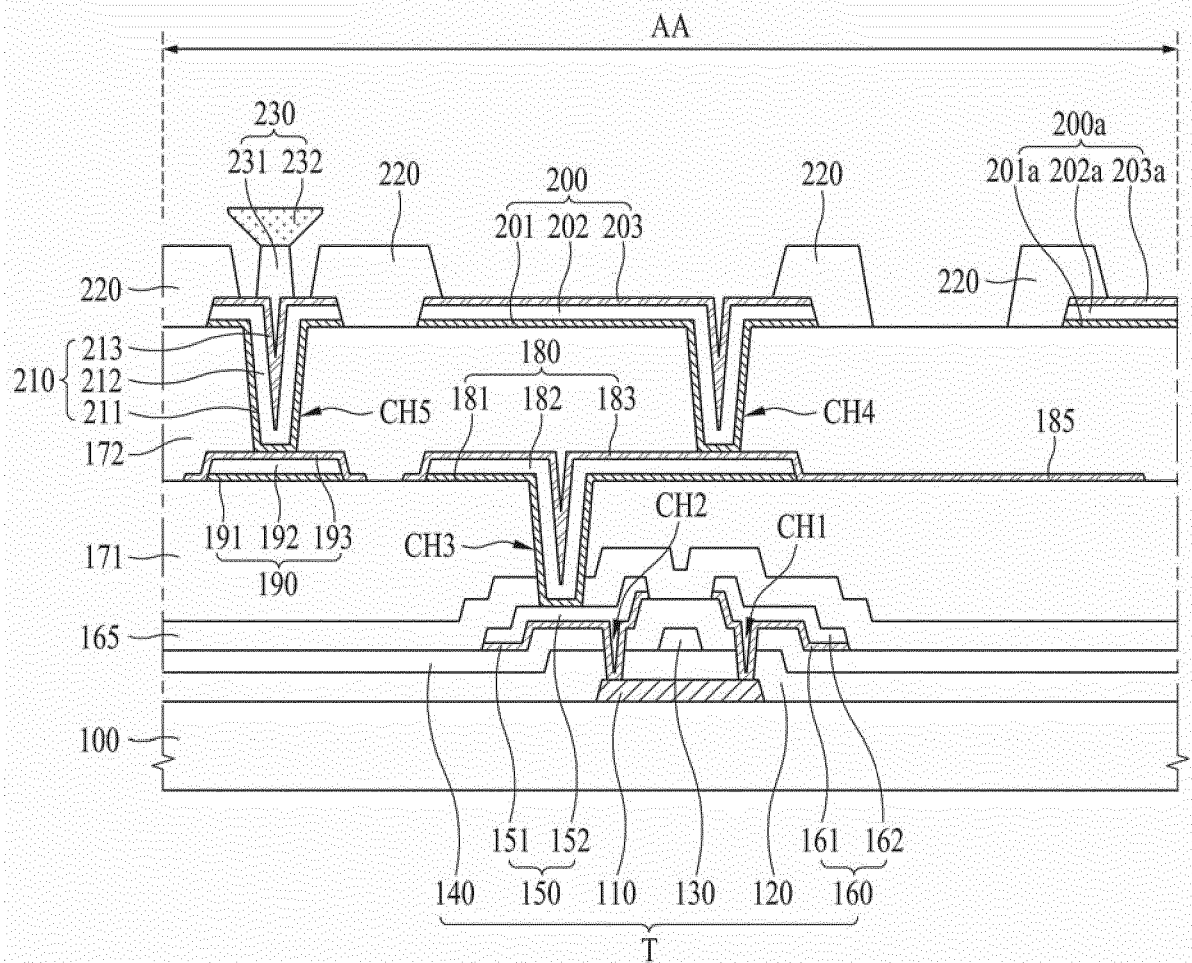


FIG. 5G

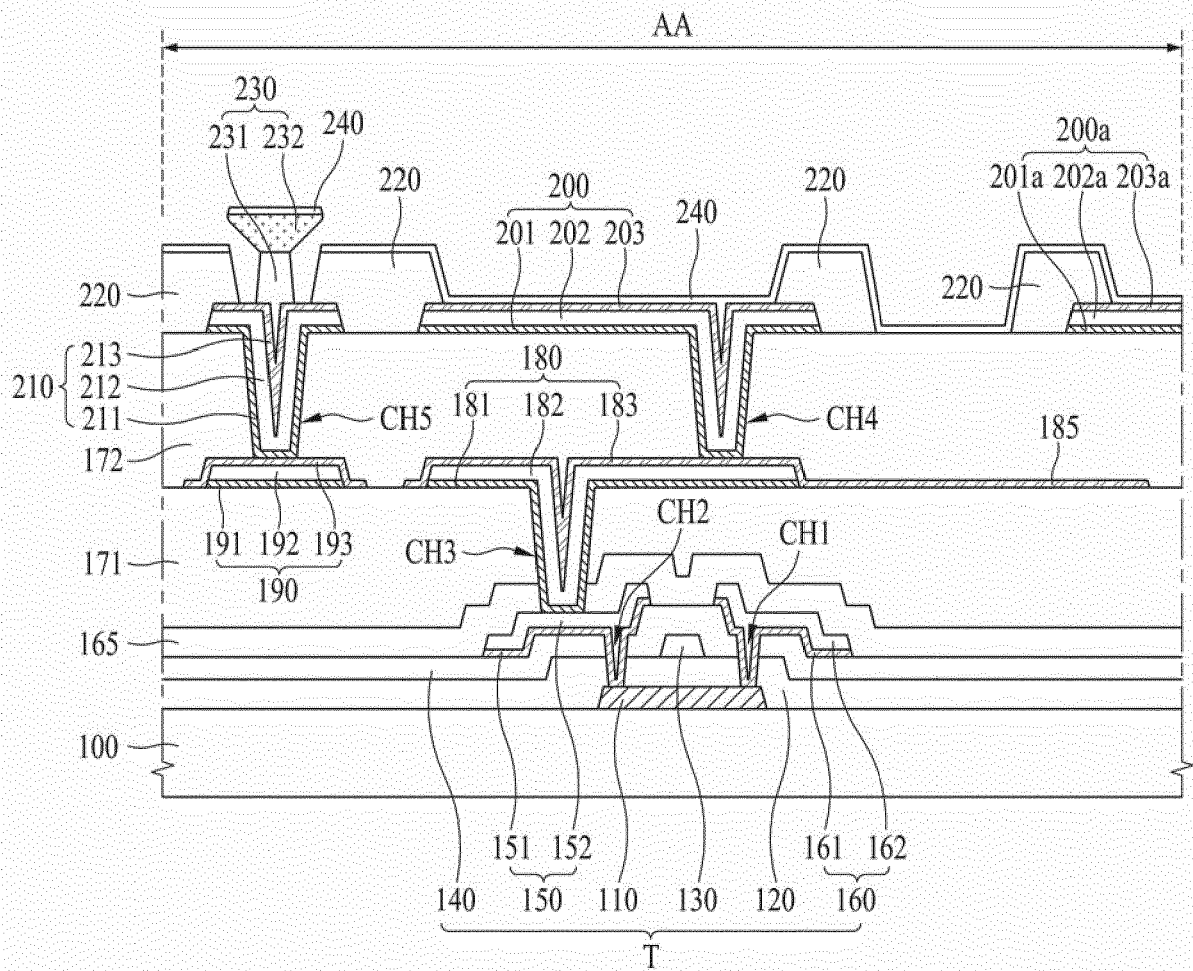
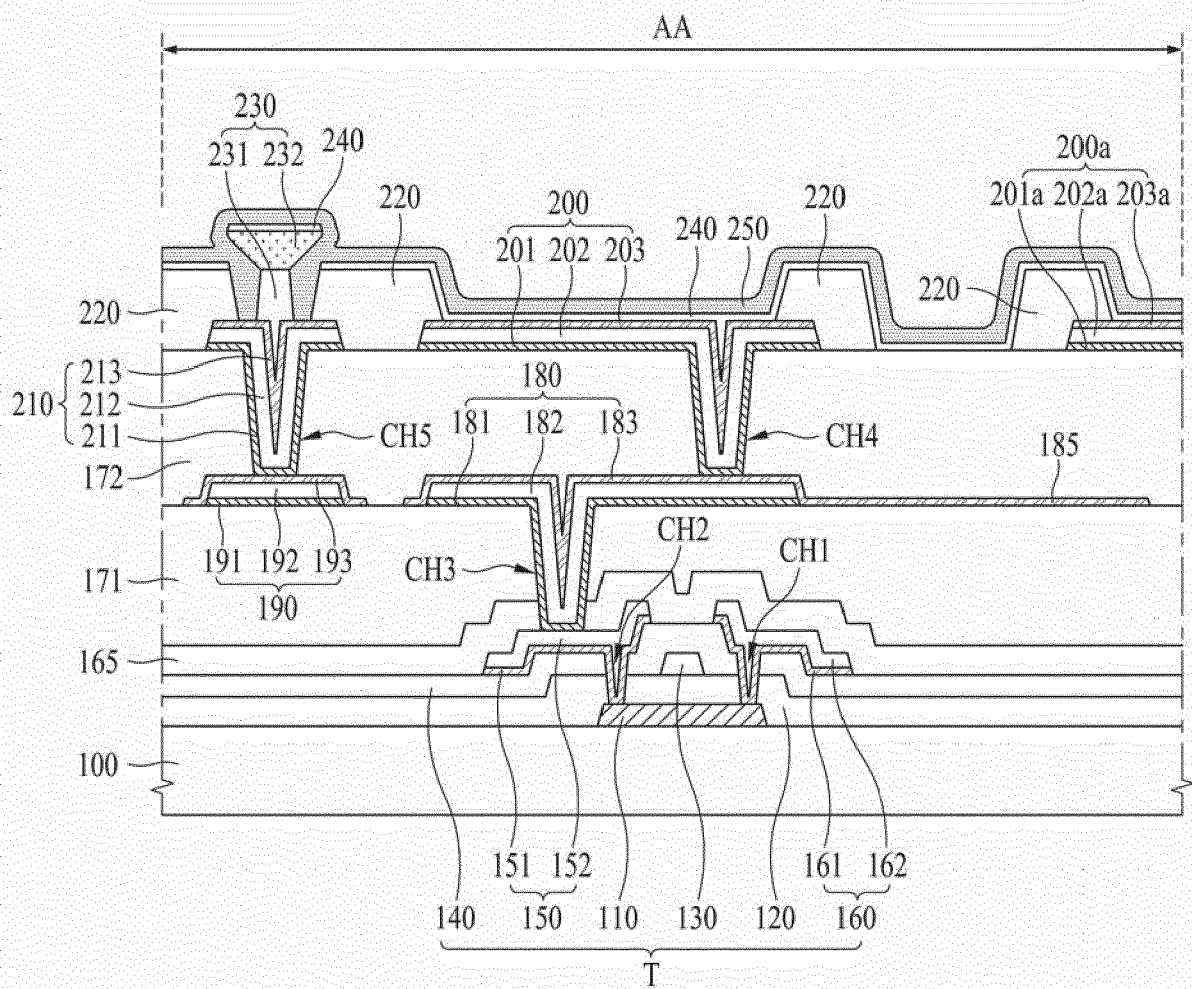


FIG. 5H





EUROPEAN SEARCH REPORT

Application Number
EP 16 19 8222

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Y	* paragraphs [0010], [0012], [0033] - [0037], [0044], [0050]; figure 8 *	1-7, 10-17 8,9, 18-21	H01L27/32 H01L51/00
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Y	US 2012/169683 A1 (HONG SANG-MIN [KR]) 5 July 2012 (2012-07-05) * paragraphs [0049] - [0053], [0060], [0061], [0093], [0096]; figures 7,8 *	1-7, 10-14,17	
Y	US 2015/097171 A1 (KIM BINN [KR] ET AL) 9 April 2015 (2015-04-09) * paragraphs [0006], [0008], [0012], [0013], [0039]; figure 1c *	1,2,6,7, 10	
Y	US 2015/021564 A1 (HONG SANG-MOK [KR] ET AL) 22 January 2015 (2015-01-22) * paragraphs [0055], [0058]; figures 3,7 *	3-5, 11-13	
Y	US 2013/240914 A1 (JIN GUANG HAI [KR] ET AL) 19 September 2013 (2013-09-19) * paragraphs [0053] - [0057], [0061]; figures 1,2 *	1,15-17	TECHNICAL FIELDS SEARCHED (IPC) H01L
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 16 March 2017	Examiner Faou, Marylène
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			

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

EP 16 19 8222

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专利名称(译)	有机发光显示装置及其制造方法		
公开(公告)号	EP3168892A1	公开(公告)日	2017-05-17
申请号	EP2016198222	申请日	2016-11-10
[标]申请(专利权)人(译)	乐金显示有限公司		
申请(专利权)人(译)	LG DISPLAY CO. , LTD.		
当前申请(专利权)人(译)	LG DISPLAY CO. , LTD.		
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IPC分类号	H01L51/52 H01L27/32 H01L51/00		
CPC分类号	H01L27/3244 H01L51/5212 H01L51/56 H01L27/326 H01L27/3276 H01L51/0031 H01L51/5206 H01L51/5218 H01L51/5228 H01L2251/5315 H01L27/3246 H01L51/5215		
优先权	1020150157090 2015-11-10 KR		
外部链接	Espacenet		

摘要(译)

公开了一种有机发光显示装置，其包括设置在基板（100）上的发光区域中的阳极（200），所述基板设置有多像素，每个像素包括发光区域和透射区域；设置在阳极上的有机发光层（240）；阴极电极（250）设置在有机发光层上；辅助电极（210,190）与阴极连接；连接电极（185）与阳极连接并设置在基板的透射区域中，其中连接电极由透明材料制成。

