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SHI et al.(10) **Pub. No.: US 2016/0343784 A1**(43) **Pub. Date: Nov. 24, 2016**(54) **OLED DISPLAY SUBSTRATE AND
MANUFACTURE METHOD THEREOF****Publication Classification**(71) Applicant: **SHENZHEN CHINA STAR
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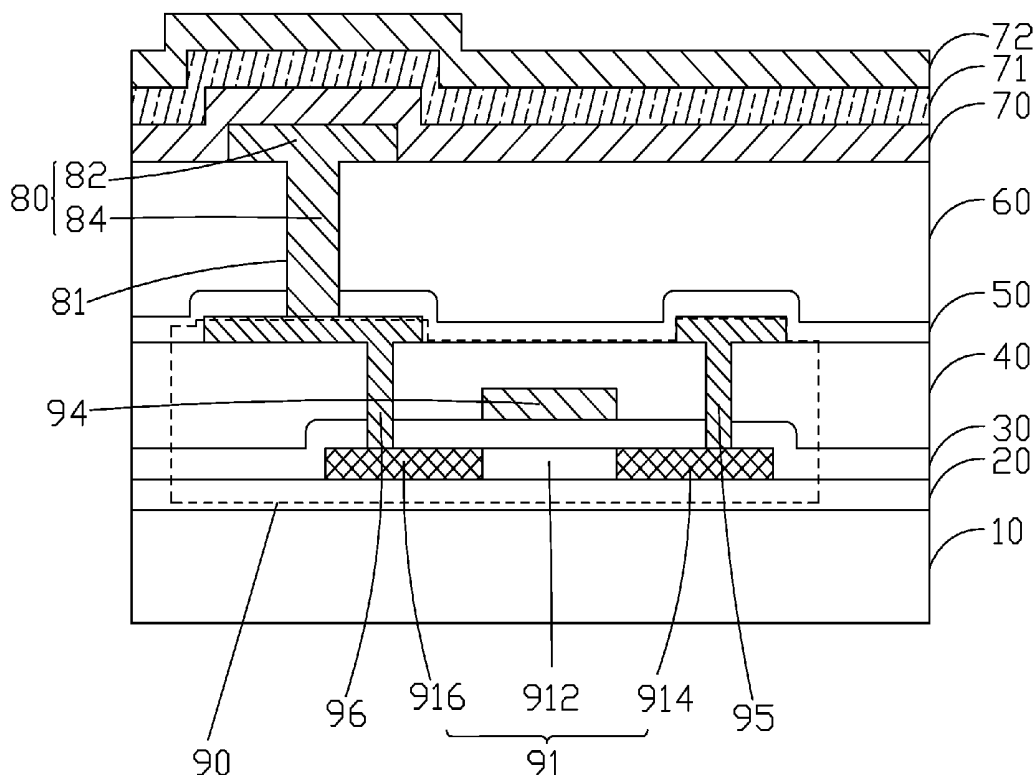
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(57)

ABSTRACT

The present invention provides an OLED display substrate and a manufacture method thereof. The OLED display substrate comprises a substrate (10), a TFT (90) located on the substrate (10), a passivation layer (50) located on the TFT (90), a flat layer (60) located on the passivation layer (50), a connecting electrode (80) being located on the flat layer (60) and contacting the TFT (90), an anode (70) being located on the flat layer (60) and covering the connecting electrode (80), an organic emitting layer (71) located on the anode (70) and a cathode (72) located on the organic emitting layer (71); the connecting electrode (80) contacts the TFT (90) via the contact hole (81) penetrating the flat layer (60) and the passivation layer (50); the anode (70) is electrically connected to the TFT (90) via the connecting electrode (80); the short circuit between the cathode and anode of the OLED display substrate can be prevented for avoiding the current concentration and ensuring the normal illumination of the OLED.



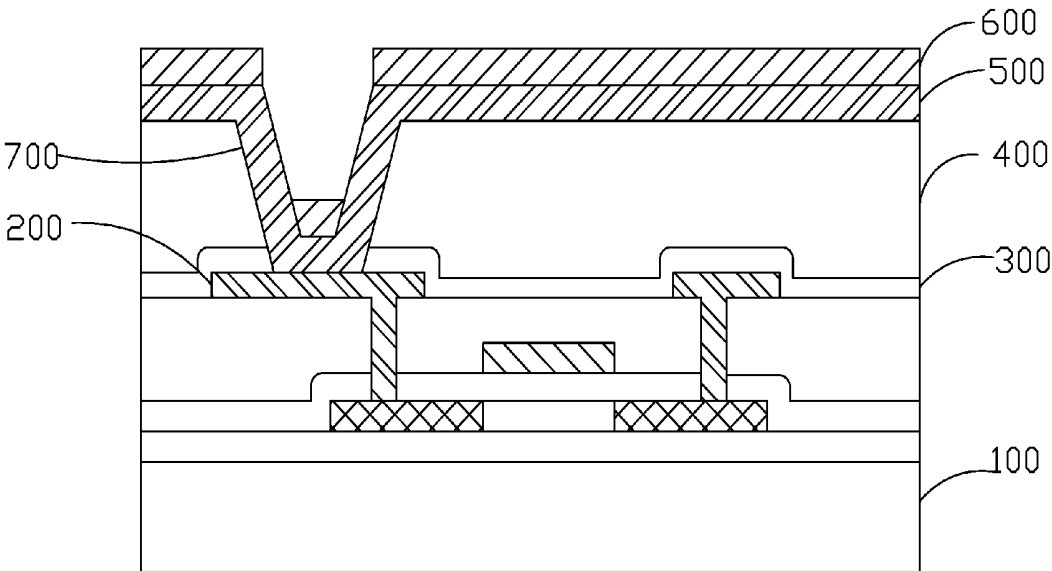


Fig. 1

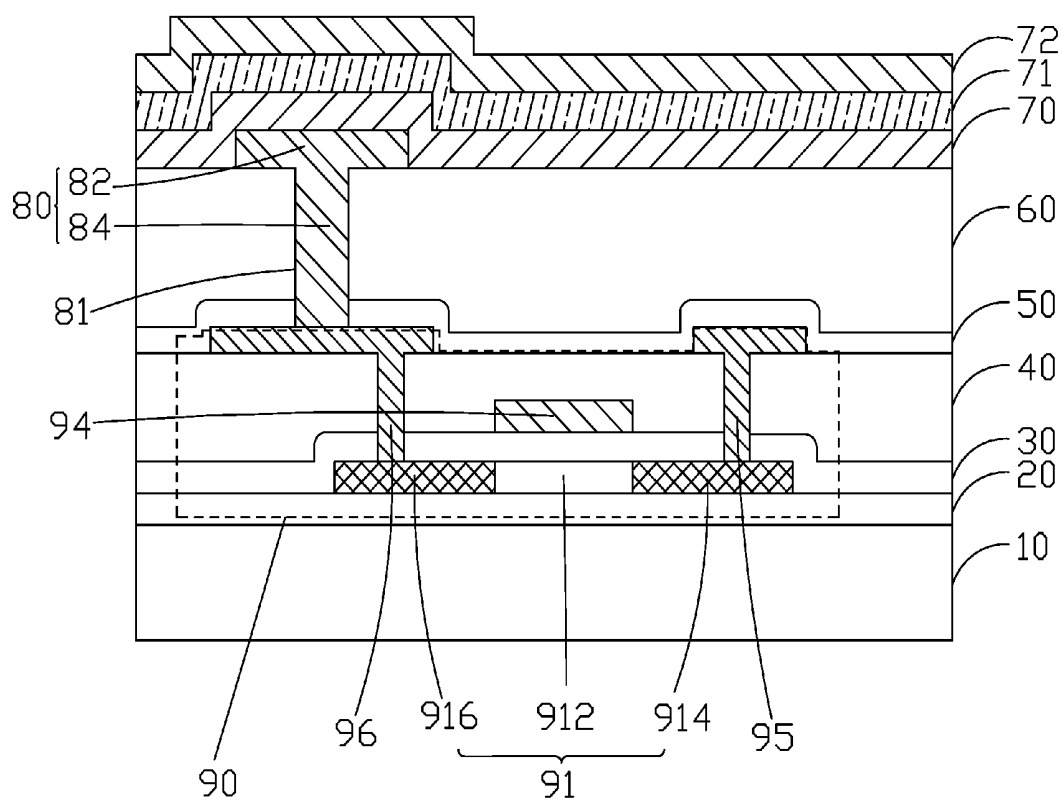


Fig. 2

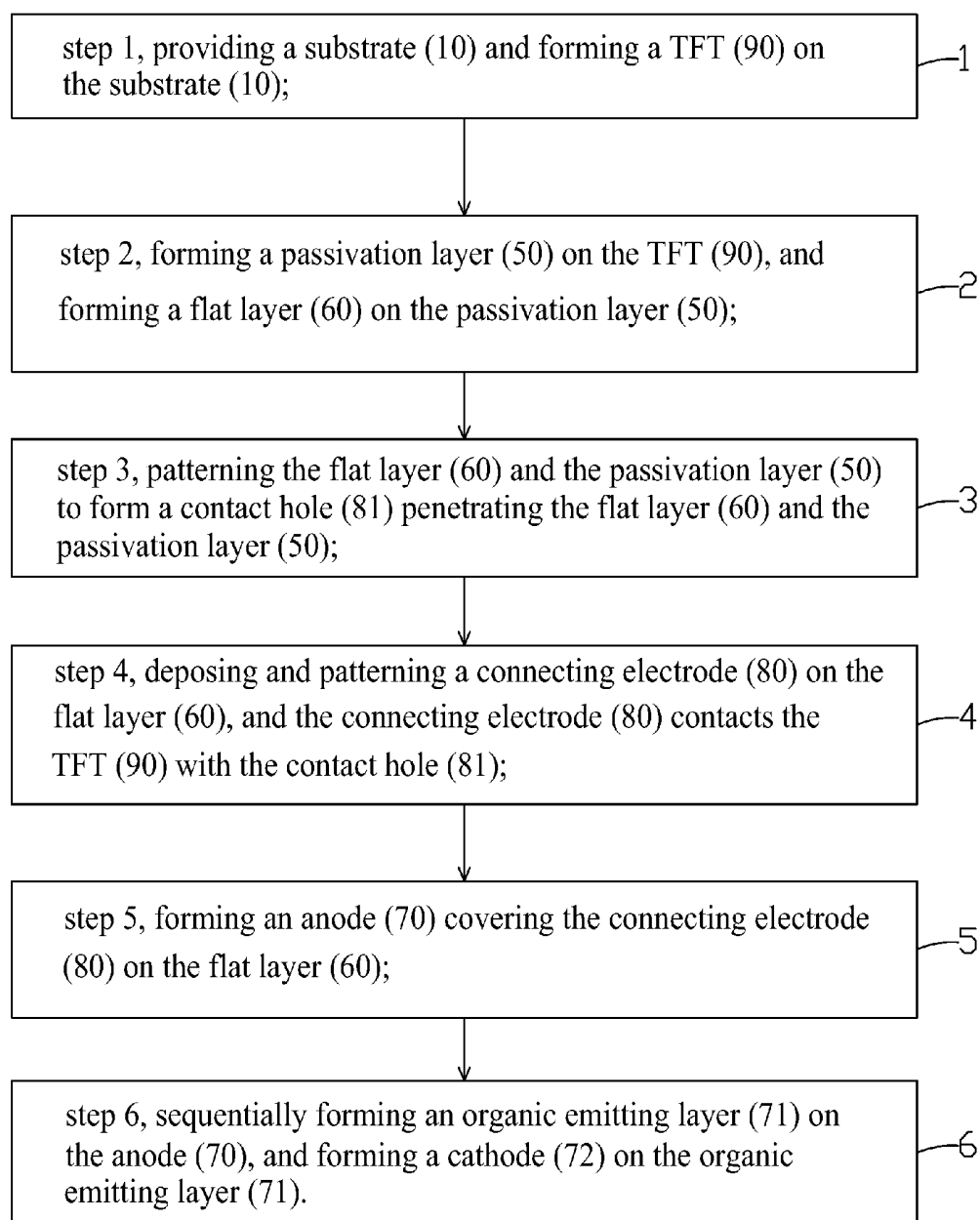


Fig. 3

OLED DISPLAY SUBSTRATE AND MANUFACTURE METHOD THEREOF

FIELD OF THE INVENTION

[0001] The present invention relates to a display technology field, and more particularly to an OLED display substrate and a manufacture method thereof.

BACKGROUND OF THE INVENTION

[0002] At present, the practical applied display devices mainly comprise Cathode Ray Tube (CRT), Liquid Crystal Display (LCD), Vacuum fluorescent devices (VFD), Plasma Display Panel (PDP), Organic Light-Emitting Device (OLED), Field Emission Display (FED) and Light-Emitting Device (LED). LCD, OLED, etc, have been gradually replaced the CRT displays.

[0003] Organic Light Emitting Diode (OLED) is a flat panel display technology which has great prospects for development. It does not only possess extremely excellent display performance but also properties of self-illumination, simple structure, ultra thin, fast response speed, wide view angle, low power consumption and capability of realizing flexible display, and therefore is considered as "dream display". It has been favored by respective big display makers and has become the main selection of the third generation display element.

[0004] Compared with the LCD display devices, the OLED display devices possess advantages of being thinner, lighter, wide view angle, active lighting, continuous adjustable light color, low cost, fast response, low power consumption, low driving voltage, wide usage temperature range, simple production process and high illuminating efficiency and possible flexible display, and the investment for the production equipments is far smaller than the LCD. The OLED has earned the great attention of the industry and the scientific community due to its incomparable advantages and beautiful application prospect than other displays.

[0005] The OLED can be categorized into two major types according to the driving methods, which are the Passive Matrix OLED and the Active Matrix OLED, i.e. the direct addressing and the Thin Film Transistor (TFT) matrix addressing.

[0006] As shown in FIG. 1, the present Active Matrix OLED display substrate comprises a substrate **100**, a TFT located on the substrate **100**, a passivation layer **300** located on the TFT layer, a flat layer **400** located on the passivation layer **300**, an anode **500** located on the flat layer **400**, an organic emitting layer **600** located on the anode **500** and a cathode (not shown) located on the organic emitting layer **600**. A electrode hole **700** is above a drain **200** of the TFT and penetrates the flat layer **400** and the passivation layer **300** to expose a partial surface of the drain **200**. The anode **500** is recessed at the electrode hole **700** to contact the drain **200** for receiving driving signals and controlling the lighting of the OLED. However, as manufacturing the organic emitting layer **600** on the anode **500**, the organic emitting layer **600** on the recessed part of the anode **500** can be too thin or even cannot form thereon. If the manufacture of the cathode on the organic emitting layer **600** is proceeded, the short circuit between the cathode and the anode can happen very easily. The current concentration passing the short circuit can stop the current flow through the organic emitting layer **600** and cause issue incapable of lighting of the OLED.

SUMMARY OF THE INVENTION

[0007] An objective of the present invention is to provide an OLED display substrate capable of preventing the short circuit between the cathode and anode of the OLED display substrate to avoid the current concentration and ensuring the normal illumination of the OLED. Another objective of the present invention is to provide a manufacture method of an OLED display substrate, and the manufacture method is simple, the obtained OLED display substrate can prevent the short circuit between the cathode and anode of the OLED display substrate to avoid the current concentration and ensure the normal illumination of the OLED.

[0008] For realizing the aforesaid objectives, the present invention provides an OLED display substrate, comprising a substrate, a TFT located on the substrate, a passivation layer located on the TFT, a flat layer located on the passivation layer, a connecting electrode being located on the flat layer and contacting the TFT, an anode being located on the flat layer and covering the connecting electrode, an organic emitting layer located on the anode and a cathode located on the organic emitting layer;

[0009] the connecting electrode contacts the TFT with a contact hole penetrating the flat layer and the passivation layer;

[0010] the anode is electrically connected to the TFT via the connecting electrode.

[0011] The connecting electrode comprises a projecting part and a filling part; the projecting part is higher than the flat layer and covered by the anode to be electrically connected with the anode; the filling part fills in the contact hole and contacts the TFT to be electrically connected with the TFT.

[0012] Material of the connecting electrode is a stack combination of one or more of molybdenum, aluminum, titanium and copper.

[0013] The TFT comprises a buffer layer located on the substrate, a channel area and a semiconductor layer located in a source area and a drain area respectively at two sides of the channel area on the buffer layer, a gate isolation layer located on the semiconductor layer, a gate located above the channel area and on the gate isolation layer, an interlayer insulation layer on the gate, a source located in the source area and penetrating the gate isolation layer and the interlayer insulation layer and a drain located in the drain area and penetrating the gate isolation layer and the interlayer insulation layer.

[0014] The contact hole exposes a partial surface of the drain, and the filling part of the connecting electrode contacts the drain of the TFT via the contact hole, and electrically connected to the drain of the TFT.

[0015] The present invention further provides a manufacture method of an OLED display substrate, comprising steps of:

[0016] step 1, providing a substrate and forming a TFT on the substrate;

[0017] step 2, forming a passivation layer on the TFT, and forming a flat layer on the passivation layer;

[0018] step 3, patterning the flat layer and the passivation layer to form a contact hole penetrating the flat layer and the passivation layer;

[0019] step 4, depositing and patterning a connecting electrode on the flat layer, and the connecting electrode contacts the TFT with the contact hole;

[0020] step 5, forming an anode covering the connecting electrode on the flat layer;

[0021] step 6, sequentially forming an organic emitting layer on the anode, and forming a cathode on the organic emitting layer.

[0022] The step 1 comprises:

[0023] step 11, depositing a buffer layer on the substrate, and forming a channel area and a semiconductor layer located in a source area and a drain area respectively at two sides of the channel area on the buffer layer;

[0024] step 12, forming a gate isolation layer on the semiconductor layer, and forming a gate above the channel area and on the gate isolation layer, and depositing an interlayer insulation film on the gate and the gate isolation layer;

[0025] step 13, patterning the interlayer insulation film and the gate isolation layer to form via holes penetrating the interlayer insulation film and the gate isolation layer in positions corresponding to the source area and the drain area; forming a source and a drain on the interlayer insulation film, and the source and the drain respectively contact the source area and the drain area with the via holes.

[0026] The connecting electrode comprises a projecting part and a filling part; the projecting part is higher than the flat layer and covered by the anode to be electrically connected with the anode; the filling part fills in the contact hole and contacts the TFT to be electrically connected with the TFT.

[0027] In the step 3, the contact hole is formed at a position corresponding to the drain and exposes a partial surface of the drain.

[0028] Material of the connecting electrode is a stack combination of one or more of molybdenum, aluminum, titanium and copper.

[0029] The present invention further provides an OLED display substrate, comprising a substrate, a TFT located on the substrate, a passivation layer located on the TFT, a flat layer located on the passivation layer, a connecting electrode being located on the flat layer and contacting the TFT, an anode being located on the flat layer and covering the connecting electrode, an organic emitting layer located on the anode and a cathode located on the organic emitting layer;

[0030] the connecting electrode contacts the TFT with a contact hole penetrating the flat layer and the passivation layer;

[0031] the anode is electrically connected to the TFT via the connecting electrode;

[0032] wherein the connecting electrode comprises a projecting part and a filling part; the projecting part is higher than the flat layer and covered by the anode to be electrically connected with the anode; the filling part fills in the contact hole and contacts the TFT to be electrically connected with the TFT;

[0033] wherein material of the connecting electrode is a stack combination of one or more of molybdenum, aluminum, titanium and copper.

[0034] The benefits of the present invention are: the present invention provides an OLED display substrate and a manufacture method thereof. With the connecting electrode, the anode is electrically connected to the TFT via the connecting electrode, and it is different from prior art that the anode is electrically connected to the TFT via the recessed electrode hole and prevents the condition that the organic

emitting layer is extremely thin on the recesses part of the anode or even cannot form thereon. Thus, it can prevent the short circuit between the cathode and anode of the OLED display substrate after locating the cathode on the organic emitting layer for avoiding the current concentration and ensuring the normal illumination of the OLED; meanwhile, the addition of the connecting electrode can improve the contact resistance between the anode and the drain of the TFT to promote the performance of the OLED display substrate.

[0035] In order to better understand the characteristics and technical aspect of the invention, please refer to the following detailed description of the present invention is concerned with the diagrams, however, provide reference to the accompanying drawings and description only and is not intended to be limiting of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

[0036] The technical solution and the beneficial effects of the present invention are best understood from the following detailed description with reference to the accompanying figures and embodiments.

[0037] In drawings,

[0038] FIG. 1 is a sectional diagram of an OLED display substrate according to prior art;

[0039] FIG. 2 is a sectional diagram of an OLED display substrate according to the present invention;

[0040] FIG. 3 is a flowchart of a manufacture method of an OLED display substrate according to the present invention.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

[0041] For better explaining the technical solution and the effect of the present invention, the present invention will be further described in detail with the accompanying drawings and the specific embodiments.

[0042] Please refer to FIG. 2. The present invention first provides an OLED display substrate, comprising:

[0043] a substrate 10, and the substrate 10 is a transparent substrate, and preferably, the substrate 10 is a glass substrate;

[0044] a TFT 90 located on the substrate 10; specifically, the TFT 90 comprises: a buffer layer 20 located on the substrate 10, a channel area 912 and a semiconductor layer 91 located in a source area 912 and a drain area 914 respectively at two sides of the channel area 912 on the buffer layer 20, a gate isolation layer 30 located on the semiconductor layer 91, a gate 94 located above the channel area 912 and on the gate isolation layer 30, an interlayer insulation layer 40 on the gate 94, a source 95 located in the source area 914 and penetrating the gate isolation layer 30 and the interlayer insulation layer 40 and a drain 96 located in the drain area 916 and penetrating the gate isolation layer 30 and the interlayer insulation layer 40;

[0045] a passivation layer 50 located on the TFT 90, and the passivation layer 50 can utilize an insulative film containing silicon as the material, which preferably can be a silicon nitride film or a silicon oxide film;

[0046] a flat layer 60 located on the passivation layer 50, and material of the flat layer 60 can be selected from organic

resin films, such as a polyimide resin film, an acrylic resin film, etc. Alternatively, an inorganic film also can be the possible option;

[0047] a connecting electrode 80 being located on the flat layer 60 and contacting the TFT 90, and the connecting electrode 80 contacts the TFT 90 with a contact hole 81 penetrating the flat layer 60 and the passivation layer 50; material of the connecting electrode 80 is metal with well conductivity and preferably, is a stack combination of one or more of molybdenum, aluminum, titanium and copper;

[0048] an anode 70 being located on the flat layer 60 and covering the connecting electrode 80, and the anode 70 is electrically connected to the TFT 90 via the connecting electrode 80; the anode 70 is a transparent conductive film, such as an Indium Tin Oxide (ITO) conductive film, an Indium Zinc Oxide (IZO) conductive film, etc.;

[0049] an organic emitting layer 71 located on the anode 70, and the organic emitting layer 71 generally comprises a Hole Injection Layer (HIL), a Hole Transporting Layer (HTL), an emitting material layer (EML), an Electron Transport Layer (ETL) and an Electron Injection Layer (EIL);

[0050] and a cathode 72 located on the organic emitting layer 71.

[0051] Furthermore, the connecting electrode 80 comprises a projecting part 82 and a filling part 84; the projecting part 82 is higher than the flat layer 60 and covered by the anode 70 to be electrically connected with the anode 70; the filling part 84 fills in the contact hole 81 and contacts the TFT 90 to be electrically connected with the TFT 90. Accordingly, the anode 70 and the TFT 90 are connected via the connecting electrode 80.

[0052] In detail, the contact hole 81 exposes a partial surface of the drain 96, and the filling part 84 of the connecting electrode 80 contacts the drain of the TFT 90 via the contact hole 81, and electrically connected to the drain 96 of the TFT 90.

[0053] With the connecting electrode located 80 in the OLED display substrate of the present invention, the anode 70 is electrically connected to the TFT 90 via the connecting electrode 80, and it is different from prior art that the anode 70 is electrically connected to the TFT 90 via the recessed electrode hole and prevents the condition that the organic emitting layer is extremely thin on the recesses part of the anode or even cannot form thereon. The organic emitting layer 71 with continuous and even thickness on the anode 70 can be ensured. Thus, it can prevent the short circuit between the cathode 72 and the anode 70 of the OLED display substrate after locating the cathode 72 on the organic emitting layer 71 for avoiding the current concentration and ensuring the normal illumination of the OLED; meanwhile, the addition of the connecting electrode 80 can improve the contact resistance between the anode 70 and the drain 96 of the TFT 90 to promote the performance of the OLED display substrate.

[0054] Please refer to FIG. 3 in combination with FIG. 2. The present invention further provides a manufacture method of an OLED display substrate, comprising steps of:

[0055] step 1, providing a substrate 10 and forming a TFT 90 on the substrate 10.

[0056] Specifically, the step 1 comprises steps of:

[0057] step 11, depositing a buffer layer 20 on the substrate 10, and forming a channel area 912 and a semiconductor

layer 91 located in a source area 914 and a drain area 916 respectively at two sides of the channel area 912 on the buffer layer 20;

[0058] step 12, forming a gate isolation layer 30 on the semiconductor layer 91, and forming a gate 94 above the channel area 912 and on the gate isolation layer 30, and depositing an interlayer insulation film 40 on the gate 94 and the gate isolation layer 30;

[0059] step 13, patterning the interlayer insulation film 40 and the gate isolation layer 30 to form via holes penetrating the interlayer insulation film 40 and the gate isolation layer 30 in positions corresponding to the source area 914 and the drain area 916; forming a source 95 and a drain 96 on the interlayer insulation film 40, and the source 95 and the drain 96 respectively contact the source area 914 and the drain area 916 with the via holes.

[0060] step 2, forming a passivation layer 50 on the TFT 90, and forming a flat layer 60 on the passivation layer 50.

[0061] step 3, patterning the flat layer 60 and the passivation layer 50 to form a contact hole 81 penetrating the flat layer 60 and the passivation layer 50.

[0062] Specifically, the passivation layer 50 can utilize an insulative film containing silicon as the material, which preferably can be a silicon nitride film or a silicon oxide film; material of the flat layer 60 can be selected from organic resin films, such as a polyimide resin film, an acrylic resin film, etc., and alternatively, an inorganic film also can be the possible option;

[0063] The contact hole 81 is formed at a position corresponding to the drain 96 and exposes a partial surface of the drain 96.

[0064] step 4, depositing and patterning a connecting electrode 80 on the flat layer 60, and the connecting electrode 80 contacts the TFT 90 with the contact hole 81.

[0065] Specifically, material of the connecting electrode 80 is metal with well conductivity and preferably, is a stack combination of one or more of molybdenum, aluminum, titanium and copper.

[0066] The connecting electrode 80 comprises a projecting part 82 and a filling part 84; the projecting part 82 is higher than the flat layer 60, and the filling part 84 fills in the contact hole 81 and contacts drain 96 of the TFT 90 to be electrically connected with the drain 96 of the TFT 90.

[0067] step 5, forming an anode 70 covering the connecting electrode 80 on the flat layer 60.

[0068] Specifically, the anode 70 covers the projecting part 82 of the connecting electrode 80 to be electrically connected with the connecting electrode 80. Thus, the anode 70 and the TFT 90 are connected via the connecting electrode 80.

[0069] The anode 70 is a transparent conductive film, such as an ITO conductive film, an IZO conductive film, etc.

[0070] step 6, sequentially forming an organic emitting layer 71 on the anode 70, and forming a cathode 72 on the organic emitting layer 71.

[0071] Specifically, the organic emitting layer 71 generally comprises a Hole Injection Layer, a Hole Transporting Layer, an emitting material layer, an Electron Transport Layer and an Electron Injection Layer.

[0072] Thus, the manufacture of the OLED display substrate is accomplished.

[0073] With the OLED display substrate manufactured by the aforesaid method, it can prevent the short circuit between the cathode 72 and the anode 70 for avoiding the current

concentration and ensuring the normal illumination of the OLED; meanwhile, the contact resistance between the anode 70 and the drain 96 of the TFT 90 can be improved to promote the performance of the OLED display substrate.

[0074] In conclusion, the present invention provides an OLED display substrate and a manufacture method thereof. With the connecting electrode, the anode is electrically connected to the TFT via the connecting electrode, and it is different from prior art that the anode is electrically connected to the TFT via the recessed electrode hole and prevents the condition that the organic emitting layer is extremely thin on the recesses part of the anode or even cannot form thereon. Thus, it can prevent the short circuit between the cathode and anode of the OLED display substrate after locating the cathode on the organic emitting layer for avoiding the current concentration and ensuring the normal illumination of the OLED; meanwhile, the addition of the connecting electrode can improve the contact resistance between the anode and the drain of the TFT to promote the performance of the OLED display substrate.

[0075] Above are only specific embodiments of the present invention, the scope of the present invention is not limited to this, and to any persons who are skilled in the art, change or replacement which is easily derived should be covered by the protected scope of the invention. Thus, the protected scope of the invention should go by the subject claims.

What is claimed is:

1. An OLED display substrate, comprising a substrate, a TFT located on the substrate, a passivation layer located on the TFT, a flat layer located on the passivation layer, a connecting electrode being located on the flat layer and contacting the TFT, an anode being located on the flat layer and covering the connecting electrode, an organic emitting layer located on the anode and a cathode located on the organic emitting layer;

the connecting electrode contacts the TFT with a contact hole penetrating the flat layer and the passivation layer;
the anode is electrically connected to the TFT via the connecting electrode.

2. The OLED display substrate according to claim 1, wherein the connecting electrode comprises a projecting part and a filling part; the projecting part is higher than the flat layer and covered by the anode to be electrically connected with the anode; the filling part fills in the contact hole and contacts the TFT to be electrically connected with the TFT.

3. The OLED display substrate according to claim 1, wherein material of the connecting electrode is a stack combination of one or more of molybdenum, aluminum, titanium and copper.

4. The OLED display substrate according to claim 2, wherein the TFT comprises a buffer layer located on the substrate, a channel area and a semiconductor layer located in a source area and a drain area respectively at two sides of the channel area on the buffer layer, a gate isolation layer located on the semiconductor layer, a gate located above the channel area and on the gate isolation layer, an interlayer insulation layer on the gate, a source located in the source area and penetrating the gate isolation layer and the interlayer insulation layer and a drain located in the drain area and penetrating the gate isolation layer and the interlayer insulation layer.

5. The OLED display substrate according to claim 4, wherein the contact hole exposes a partial surface of the

drain, and the filling part of the connecting electrode contacts the drain of the TFT via the contact hole, and electrically connected to the drain of the TFT.

6. A manufacture method of an OLED display substrate, comprising steps of:

step 1, providing a substrate and forming a TFT on the substrate;

step 2, forming a passivation layer on the TFT, and forming a flat layer on the passivation layer;

step 3, patterning the flat layer and the passivation layer to form a contact hole penetrating the flat layer and the passivation layer;

step 4, depositing and patterning a connecting electrode on the flat layer, and the connecting electrode contacts the TFT with the contact hole;

step 5, forming an anode covering the connecting electrode on the flat layer;

step 6, sequentially forming an organic emitting layer on the anode, and forming a cathode on the organic emitting layer.

7. The manufacture method of the OLED display substrate according to claim 6, wherein the step 1 comprises:

step 11, depositing a buffer layer on the substrate, and forming a channel area and a semiconductor layer located in a source area and a drain area respectively at two sides of the channel area on the buffer layer;

step 12, forming a gate isolation layer on the semiconductor layer, and forming a gate above the channel area and on the gate isolation layer, and depositing an interlayer insulation film on the gate and the gate isolation layer;

step 13, patterning the interlayer insulation film and the gate isolation layer to form via holes penetrating the interlayer insulation film and the gate isolation layer in positions corresponding to the source area and the drain area; forming a source and a drain on the interlayer insulation film, and the source and the drain respectively contact the source area and the drain area with the via holes.

8. The manufacture method of the OLED display substrate according to claim 6, wherein the connecting electrode comprises a projecting part and a filling part; the projecting part is higher than the flat layer and covered by the anode to be electrically connected with the anode; the filling part fills in the contact hole and contacts the TFT to be electrically connected with the TFT.

9. The manufacture method of the OLED display substrate according to claim 7, wherein in the step 3, the contact hole is formed at a position corresponding to the drain and exposes a partial surface of the drain.

10. The manufacture method of the OLED display substrate according to claim 6, wherein material of the connecting electrode is a stack combination of one or more of molybdenum, aluminum, titanium and copper.

11. An OLED display substrate, comprising a substrate, a TFT located on the substrate, a passivation layer located on the TFT, a flat layer located on the passivation layer, a connecting electrode being located on the flat layer and contacting the TFT, an anode being located on the flat layer and covering the connecting electrode, an organic emitting layer located on the anode and a cathode located on the organic emitting layer;

the connecting electrode contacts the TFT with a contact hole penetrating the flat layer and the passivation layer;

the anode is electrically connected to the TFT via the connecting electrode;

wherein the connecting electrode comprises a projecting part and a filling part; the projecting part is higher than the flat layer and covered by the anode to be electrically connected with the anode; the filling part fills in the contact hole and contacts the TFT to be electrically connected with the TFT;

wherein material of the connecting electrode is a stack combination of one or more of molybdenum, aluminum, titanium and copper.

12. The OLED display substrate according to claim **11**, wherein the TFT comprises a buffer layer located on the substrate, a channel area and a semiconductor layer located in a source area and a drain area respectively at two sides of the channel area on the buffer layer, a gate isolation layer located on the semiconductor layer, a gate located above the channel area and on the gate isolation layer, an interlayer insulation layer on the gate, a source located in the source area and penetrating the gate isolation layer and the interlayer insulation layer and a drain located in the drain area and penetrating the gate isolation layer and the interlayer insulation layer.

13. The OLED display substrate according to claim **12**, wherein the contact hole exposes a partial surface of the drain, and the filling part of the connecting electrode contacts the drain of the TFT via the contact hole, and electrically connected to the drain of the TFT.

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专利名称(译)	OLED显示器基板及其制造方法		
公开(公告)号	US20160343784A1	公开(公告)日	2016-11-24
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[标]申请(专利权)人(译)	深圳市华星光电技术有限公司		
申请(专利权)人(译)	深圳市中国星光电科技有限公司.		
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[标]发明人	SHI LONGQIANG LIU YAWEI		
发明人	SHI, LONGQIANG LIU, YAWEI		
IPC分类号	H01L27/32 H01L51/56		
CPC分类号	H01L51/5212 H01L51/5209 H01L27/3248 H01L27/3262 H01L27/1248 H01L27/3258 H01L27/1218 H01L2227/323 H01L27/1259 H01L51/56 H01L51/5203 H01L27/326 H01L27/3276		
优先权	201410782725.0 2014-12-16 CN		
其他公开文献	US9705104		
外部链接	Espacenet USPTO		

摘要(译)

本发明提供一种OLED显示基板及其制造方法。OLED显示基板包括基板(10)，位于基板(10)上的TFT(90)，钝化层(50位于TFT(90)上，位于钝化层上的平坦层(60)50)，连接电极(80)位于平坦层(60)上并与TFT(90)接触，阳极(70)位于平坦层(60)并覆盖连接电极(80)，有机发光层(71)位于阳极(70)上，阴极(72)位于有机发光层上；连接电极(80)通过穿透平坦层的接触孔(81)接触TFT(90)和钝化层(50)；阳极(70)通过连接电极(80)电连接到TFT(90)；可以防止OLED显示基板的阴极和阳极之间的短路，以避免电流集中并确保正常照射OLED

