



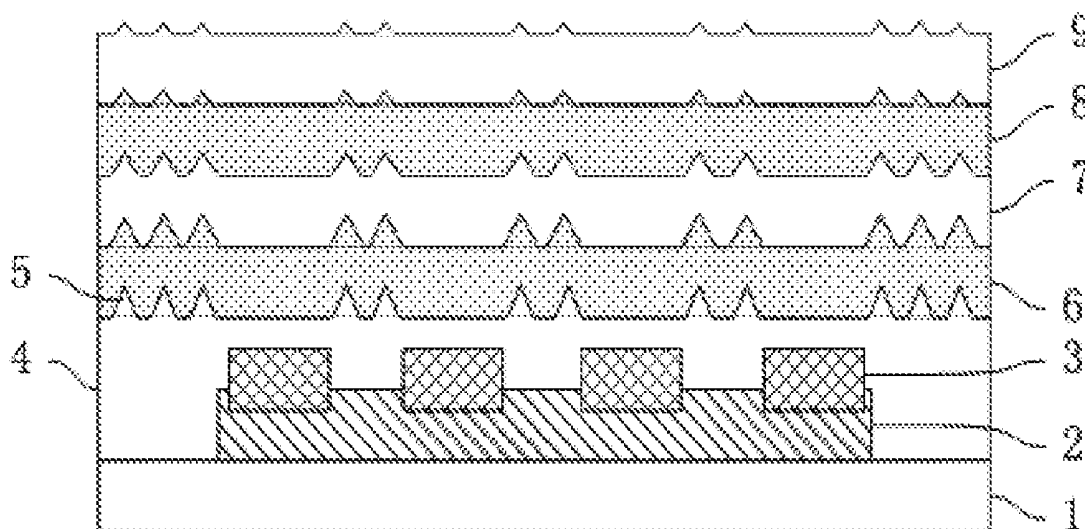
US 20190326551A1

(19) **United States**(12) **Patent Application Publication**
HUANG(10) **Pub. No.: US 2019/0326551 A1**(43) **Pub. Date: Oct. 24, 2019**(54) **ORGANIC LIGHT EMITTING DIODE
DISPLAY DEVICE AND MANUFACTURING
METHOD THEREOF**(71) Applicant: **SHENZHEN CHINA STAR
OPTOELECTRONICS
TECHNOLOGY CO., LTD.,**
Shenzhen (CN)(72) Inventor: **Hui HUANG, Shenzhen (CN)**(21) Appl. No.: **16/112,025**(22) Filed: **Aug. 24, 2018****Related U.S. Application Data**(63) Continuation of application No. PCT/CN2018/
092351, filed on Jun. 22, 2018.(30) **Foreign Application Priority Data**

Apr. 23, 2018 (CN) 201810365397.2

Publication Classification(51) **Int. Cl.**
H01L 51/52 (2006.01)
H01L 27/32 (2006.01)
H01L 51/56 (2006.01)
(52) **U.S. Cl.**
CPC **H01L 51/5253** (2013.01); **H01L 51/56**
(2013.01); **H01L 27/3246** (2013.01)(57) **ABSTRACT**

Provided is an organic light emitting diode display device and a manufacturing method thereof. The method includes: preparing a thin film transistor layer on a glass substrate; preparing a plurality of organic light emitting diode elements on a thin film transistor layer; preparing a barrier layer and a buffer layer on the thin film transistor layer, wherein the barrier layer covers the plurality of organic light emitting diode elements; preparing a plurality of island structures on the barrier layer or on the buffer layer, wherein the plurality of island structures are located a non-light emitting region on the barrier layer or the buffer layer. The path of water vapor entering the OLED display device can be prolonged to enhance the absorption of water vapor and to enhance the packaging result of the OLED display device.



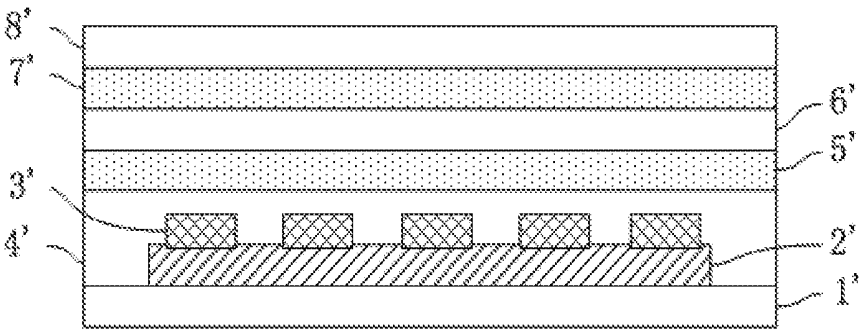


FIG. 1

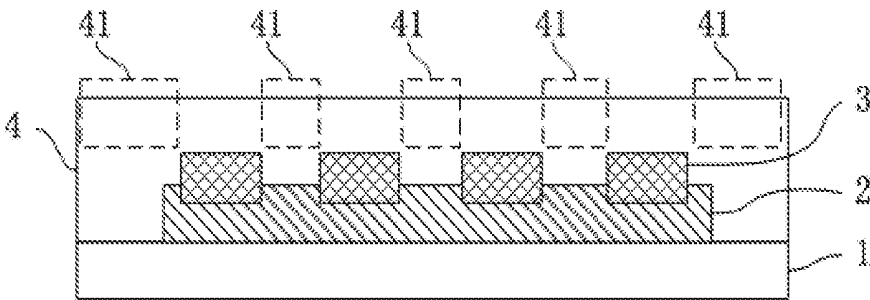


FIG. 2

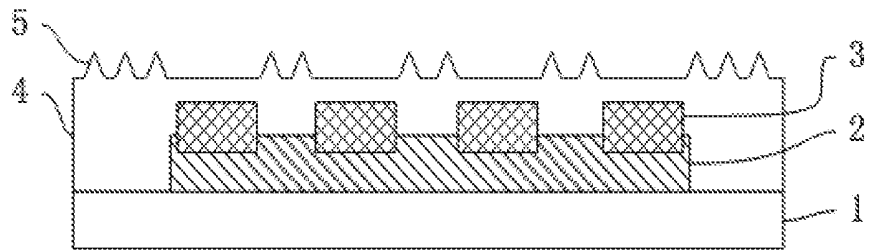


FIG. 3

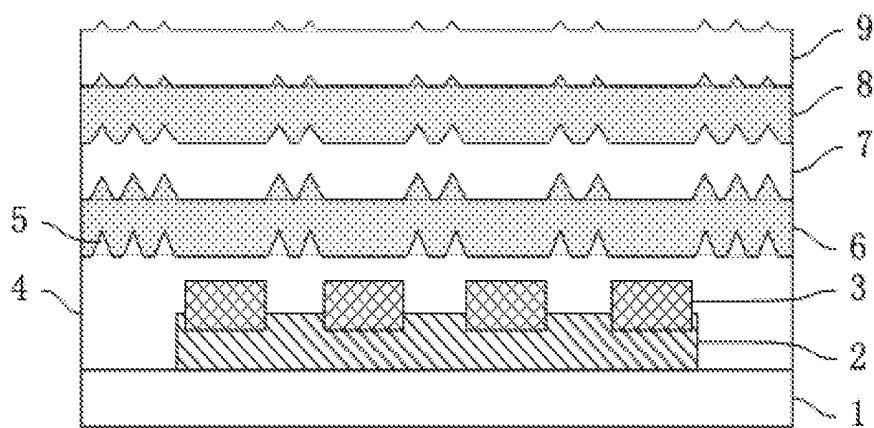


FIG. 4

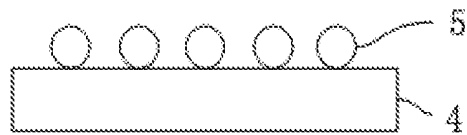


FIG. 5

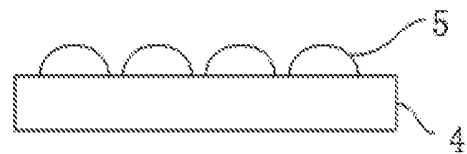


FIG. 6

**ORGANIC LIGHT EMITTING DIODE
DISPLAY DEVICE AND MANUFACTURING
METHOD THEREOF**

**CROSS-REFERENCE TO RELATED
APPLICATION**

[0001] This application is a continuing application of PCT Patent Application No. PCT/CN2018/092351 entitled "Organic light emitting diode display device and manufacturing method thereof", filed on Jun. 22, 2018, which claims priority to Chinese Patent Application No. 201810365397.2, filed on Apr. 23, 2018, both of which are hereby incorporated in its entirety by reference.

FIELD OF THE INVENTION

[0002] The present invention relates to a display field, and more particularly to an organic light emitting diode display device and a manufacturing method thereof.

BACKGROUND OF THE INVENTION

[0003] In the current field of lighting and display, due to the properties of the OLED (Organic Light-Emitting Diode), such as low start-up voltage, lightness, thinness and self-luminescence, more and more OLEDs are widely studied for the development of lighting products and panel industry to meet the requirements of low energy consumption, light weight and surface light sources. At present, due to the properties of flexibility, thinness, and self-luminescence of the OLED flexible display panel, more and more OLED flexible display products are created.

[0004] At present, the structure of the OLED display device is performed by using a thin film package as shown in FIG. 1. The numbers 1', 2', 3', 4', 5', 6', 7' and 8' respectively indicate the glass substrate and the TFT (Thin Film Transistor) layer, the pixel layer, the first barrier layer, the first buffer layer, the second barrier layer, the second buffer layer and the third barrier layer. However, since the thin film barrier layer and the buffer layer are thin, there is a stress between the layers. Therefore, the ability of the barrier layer and the buffer layer for blocking water and oxygen does not achieve the desired effect. The water-oxygen permeability is high, and the barrier layer and the buffer layer are more likely to break and cause the package to fail.

SUMMARY OF THE INVENTION

[0005] For solving the aforesaid technical problems, the present invention provides an organic light emitting diode display device and a manufacturing method thereof, which can reduce the permeability of water and oxygen for lowering the risk of breakage of the barrier layer and the buffer layer, and improving the service life of the OLED display device.

[0006] The present invention provides a manufacturing method of an organic light emitting diode display device, comprising:

[0007] preparing a thin film transistor layer on a glass substrate;

[0008] preparing a plurality of organic light emitting diode elements on a thin film transistor layer;

[0009] preparing a barrier layer and a buffer layer on the thin film transistor layer, wherein the barrier layer covers the plurality of organic light emitting diode elements;

[0010] preparing a plurality of island structures on the barrier layer or on the buffer layer, wherein the plurality of island structures are located a non-light emitting region on the barrier layer or the buffer layer.

[0011] Preferably, preparing the plurality of island structures on the barrier layer or on the buffer layer specifically comprises:

[0012] patterning the barrier layer or the buffer layer by one of photolithography, transferring and laser etching to obtain the plurality of island structures, or preparing the plurality of island structures on the barrier layer or the buffer layer by inkjet printing.

[0013] Preferably, as the plurality of island structures are prepared on the barrier layer or the buffer layer by inkjet printing, a material of the island structures is an inorganic nanomaterial.

[0014] Preferably, a shape of the island structure is one of a pyramid shape, a lens shape and a particle shape.

[0015] Preferably, preparing the barrier layer and the buffer layer on the thin film transistor layer specifically comprises:

[0016] sequentially preparing a first barrier layer, a first buffer layer, a second barrier layer, a second buffer layer and a third barrier layer on the thin film transistor layer,

[0017] Preferably, preparing the plurality of island structures on the barrier layer or on the buffer layer specifically comprises:

[0018] preparing the plurality of island structures on any one of the first barrier layer, the first buffer layer, the second barrier layer, the second buffer layer and the third barrier layer.

[0019] The present invention further provides a manufacturing method of an organic light emitting diode display device, comprising:

[0020] preparing a thin film transistor layer on a glass substrate;

[0021] preparing a plurality of organic light emitting diode elements on a thin film transistor layer;

[0022] preparing a barrier layer and a buffer layer on the thin film transistor layer, wherein the barrier layer covers the plurality of organic light emitting diode elements;

[0023] preparing a plurality of island structures on the barrier layer or on the buffer layer, wherein the plurality of island structures are located a non-light emitting region on the barrier layer or the buffer layer; wherein a shape of the island structure is one of a pyramid shape, a lens shape and a particle shape;

[0024] preparing the plurality of island structures on the barrier layer or on the buffer layer specifically comprises:

[0025] patterning the barrier layer or the buffer layer by one of photolithography, transferring and laser etching to obtain the plurality of island structures, or preparing the plurality of island structures on the barrier layer or the buffer layer by inkjet printing.

[0026] Preferably, as the plurality of island structures are prepared on the barrier layer or the buffer layer by inkjet printing, a material of the island structures is an inorganic nanomaterial.

[0027] Preferably, preparing the barrier layer and the buffer layer on the thin film transistor layer specifically comprises:

[0028] sequentially preparing a first barrier layer, a first buffer layer, a second barrier layer, a second buffer layer and a third barrier layer on the thin film transistor layer.

[0029] Preferably, preparing the plurality of island structures on the barrier layer or on the buffer layer specifically comprises:

[0030] preparing the plurality of island structures on any one of the first barrier layer, the first buffer layer, the second barrier layer, the second buffer layer and the third barrier layer.

[0031] The present invention further provides an organic light emitting diode display device, comprising: a glass substrate, a thin film transistor layer located on the glass substrate, a plurality of organic light emitting diode elements located on the thin film transistor layer, a barrier layer and a buffer layer located on the thin film transistor layer, wherein the barrier layer covers the plurality of organic light emitting diode elements;

[0032] wherein a plurality of island structures is arranged on the barrier layer or on the buffer layer, and the plurality of island structures are located in a non-light emitting region on the barrier layer or the buffer layer.

[0033] Preferably, a shape of the island structure is one of a pyramid shape, a lens shape and a particle shape.

[0034] Preferably, a material of the island structures is the same as a material of the barrier layer or the buffer layer, or the material of the island structures is an inorganic nanomaterial.

[0035] Preferably, the barrier layer comprises a first barrier layer, a second barrier layer, and a third barrier layer, and the buffer layer comprises a first buffer layer and a second buffer layer;

[0036] the first barrier layer, the first buffer layer, the second barrier layer, the second buffer layer and the third barrier layer are sequentially stacked in a direction away from the thin film transistor layer.

[0037] The implementation of the present invention possesses results: by preparing the plurality of island structures on the barrier layer or the buffer layer according to the present invention, the path of water vapor entering the OLED display device will be prolonged to enhance the absorption of water vapor and to reduce the water vapor-oxygen permeability for enhancing the packaging result of the OLED display device. Meanwhile, the stress of the OLED display device can be enhanced, and the film damage caused by the stress of the display device can be effectively reduced.

BRIEF DESCRIPTION OF THE DRAWINGS

[0038] In order to more clearly illustrate the embodiments of the present invention or prior art, the following figures will be described in the embodiments are briefly introduced. It is obvious that the drawings are merely some embodiments of the present invention, those of ordinary skill in this field can obtain other figures according to these figures without paying the premise.

[0039] FIG. 1 is a structural diagram of an organic light emitting diode display device in the prior art of the present invention.

[0040] FIG. 2 is a structure diagram of a thin film transistor layer, organic light emitting diode display elements and a first barrier layer prepared on a glass substrate according to the present invention.

[0041] FIG. 3 is a diagram of a plurality of island structures prepared on a first barrier layer according to the present invention.

[0042] FIG. 4 is a structure diagram of an organic light emitting diode display device according to the present invention.

[0043] FIG. 5 is a diagram of particle shape island structures according to the present invention.

[0044] FIG. 6 is a diagram of lens shape island structures according to the present invention.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

[0045] The present invention provides a method for preparing an OLED (Organic Light-Emitting Diode) display device. The method comprises;

[0046] as shown in FIG. 2, preparing a TFT (thin film transistor) layer 2 on a glass substrate 1;

[0047] preparing a plurality of organic light emitting diode elements 3 on a thin film transistor layer 2;

[0048] preparing a barrier layer and a buffer layer on the thin film transistor layer 2, wherein the barrier layer covers the plurality of organic light emitting diode elements 3;

[0049] preparing a plurality of island structures on the barrier layer or on the buffer layer, wherein the plurality of island structures are located a non-light emitting region on the barrier layer or the buffer layer. For instance, as shown in FIG. 3, the plurality of island structures 5 are prepared on a first barrier layer 4 on the thin film transistor layer 2. As shown in FIG. 2, the non-light emitting region 41 is a region on the barrier layer outside a region directly above the organic light emitting diode display elements 3 as shown in the dashed frame area in FIG. 2; correspondingly, the light emitting region is a region on the barrier layer directly above the organic light emitting diode display elements 3. The light emitting region is a pixel region corresponding to the organic light emitting diode display device.

[0050] Furthermore, preparing the plurality of island structures on the barrier layer or on the buffer layer specifically comprises:

[0051] patterning the barrier layer or the buffer layer by one of photolithography, transferring and laser etching to obtain the plurality of island structures 5, or preparing the plurality of island structures 5 on the barrier layer or the buffer layer by inkjet printing. Specifically, photolithography is performed by coating photoresist, exposing and developing, and laser etching is directly etching by laser irradiation in positions where etching is required.

[0052] Furthermore, as the plurality of island structures 5 are prepared on the barrier layer or the buffer layer by inkjet printing, a material of the island structures 5 is an inorganic nanomaterial.

[0053] As shown in FIG. 4, preparing the barrier layer and the buffer layer on the thin film transistor layer 2 specifically comprises:

[0054] sequentially preparing a first barrier layer 4, a first buffer layer 6, a second barrier layer 7, a second buffer layer 8 and a third barrier layer 9 on the thin film transistor layer 2.

[0055] Furthermore, preparing the plurality of island structures on the barrier layer or on the buffer layer specifically comprises:

[0056] preparing the plurality of island structures 5 on any one of the first barrier layer 4, the first buffer layer 6, the second barrier layer 7, the second buffer layer 8 and the third barrier layer 9. In FIG. 3, the plurality of island structures 5 is prepared on the first barrier layer 4. In other embodiments,

the plurality of island structures **5** can be prepared on the first buffer layer **6** or on the second barrier layer **7**.

[0057] Since the first barrier layer **4**, the first buffer layer **6**, the second barrier layer **7**, the second buffer layer **8** and the third barrier layer **9** are generally prepared by chemical vapor deposition, thus as the plurality of island structures **5** is prepared on the first barrier layer **4**, the first buffer layer **6**, the second barrier layer **7**, the second buffer layer **8** and the third barrier layer **9** are all convex upwards corresponding to the island structures **5**.

[0058] When water vapor enters the organic light emitting diode display device, and as the water vapor passes through the positions where the first buffer layer **6**, the second barrier layer **7**, the second buffer layer **8**, and the third barrier layer **9** are convex upwards corresponding to the island structures **5**, and passes through the island structures **5**, the path of water vapor entering the OLED display device will be prolonged to enhance the absorption of water vapor and to reduce the water vapor-oxygen permeability for enhancing the packaging result of the OLED display device. Meanwhile, the stress of the OLED display device can be enhanced, and the film damage caused by the stress of the display device can be effectively reduced, and the island structures **5** prepared in the non-light emitting region **41** will not adversely affect the light-emitting result (such as total reflection, light absorption, etc.).

[0059] A shape of the island structure **5** is one of a pyramid shape, a lens shape and a particle shape. As shown in FIG. 3, the shape of the island structure **5** is the pyramid shape. As shown in FIG. 5, the shape of the island structure **5** can be the particle shape. As shown in FIG. 6, the shape of the island structure **5** can be the lens shape. The island structures **5** of the particle shape can be prepared by inkjet printing. When the island structures **5** of the particle shape are prepared by inkjet printing, the material of the island structures **5** is selected to use an inorganic nanomaterial, such as one of magnesium oxide, zinc oxide and titanium dioxide. When the inorganic nanomaterial is used, the process is simple and the cost is low. The pyramid shape island structures **5** or the lens shape island structures **5** can be prepared by photolithography, transferring, or laser etching.

[0060] The present invention further provides an organic light emitting diode display device. As shown in FIG. 4, the OLED display device comprises: a glass substrate **1**, a thin film transistor layer **2** located on the glass substrate **1**, a plurality of organic light emitting diode elements **3** located on the thin film transistor layer **2**, a barrier layer and a buffer layer located on the thin film transistor layer **2**, wherein the barrier layer covers the plurality of organic light emitting diode elements **3**.

[0061] The barrier layer comprises a first barrier layer **4**, a second barrier layer **7** and the third barrier layer **9**. The buffer layer comprises a first buffer layer **6** and a second buffer layer **8**.

[0062] The first barrier layer **4**, the first buffer layer **6**, the second barrier layer **7**, the second buffer layer **8** and the third barrier layer **9** are sequentially stacked in a direction away from the thin film transistor layer **2**.

[0063] A plurality of island structures **5** is arranged on the barrier layer or on the buffer layer, and the plurality of island structures **5** are located in a non-light emitting region **41** on the barrier layer or the buffer layer. For instance, the plurality of island structures **5** is arranged on the first barrier layer **4**.

[0064] Furthermore, a shape of the island structure **5** is one of a pyramid shape, a lens shape and a particle shape.

[0065] Furthermore, a material of the island structures **5** is the same as a material of the barrier layer or the buffer layer, or the material of the island structures **5** is an inorganic nanomaterial.

[0066] In conclusion, by preparing the plurality of island structures **5** on the barrier layer or the buffer layer according to the present invention, the path of water vapor entering the OLED display device will be prolonged to enhance the absorption of water vapor and to reduce the water vapor-oxygen permeability for enhancing the packaging result of the OLED display device. Meanwhile, the stress of the OLED display device can be enhanced, and the film damage caused by the stress of the display device can be effectively reduced, and the island structures **5** prepared in the non-light emitting region **41** will not adversely affect the light-emitting result (such as total reflection, light absorption, etc.).

[0067] The above content with the specific preferred embodiments of the present invention is further made to the detailed description, the specific embodiments of the present invention should not be considered limited to these descriptions. Those of ordinary skill in the art for the present invention, without departing from the spirit of the present invention, can make various simple deduction or replacement, should be deemed to belong to the scope of the present invention.

What is claimed is:

1. A manufacturing method of an organic light emitting diode display device, comprising:

preparing a thin film transistor layer on a glass substrate;
preparing a plurality of organic light emitting diode elements on a thin film transistor layer;

preparing a barrier layer and a buffer layer on the thin film transistor layer, wherein the barrier layer covers the plurality of organic light emitting diode elements;

preparing a plurality of island structures on the barrier layer or on the buffer layer, wherein the plurality of island structures are located a non-light emitting region on the barrier layer or the buffer layer.

2. The manufacturing method of the organic light emitting diode display device according to claim 1, wherein preparing the plurality of island structures on the barrier layer or on the buffer layer comprises:

patterning the barrier layer or the buffer layer by one of photolithography, transferring and laser etching to obtain the plurality of island structures, or preparing the plurality of island structures on the barrier layer or the buffer layer by inkjet printing.

3. The manufacturing method of the organic light emitting diode display device according to claim 2, wherein as the plurality of island structures are prepared on the barrier layer or the buffer layer by inkjet printing, a material of the island structures is an inorganic nanomaterial.

4. The manufacturing method of the organic light emitting diode display device according to claim 1, wherein a shape of the island structure is one of a pyramid shape, a lens shape and a particle shape.

5. The manufacturing method of the organic light emitting diode display device according to claim 1, wherein preparing the barrier layer and the buffer layer on the thin film transistor layer comprises:

sequentially preparing a first barrier layer, a first buffer layer, a second barrier layer, a second buffer layer and a third barrier layer on the thin film transistor layer.

6. The manufacturing method of the organic light emitting diode display device according to claim 5, wherein preparing the plurality of island structures on the barrier layer or on the buffer layer comprises:

preparing the plurality of island structures on any one of the first barrier layer, the first buffer layer, the second barrier layer, the second buffer layer and the third barrier layer.

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

preparing a thin film transistor layer on a glass substrate; preparing a plurality of organic light emitting diode elements on a thin film transistor layer;

preparing a barrier layer and a buffer layer on the thin film transistor layer, wherein the barrier layer covers the plurality of organic light emitting diode elements;

preparing a plurality of island structures on the barrier layer or on the buffer layer, wherein the plurality of island structures are located a non-light emitting region on the barrier layer or the buffer layer; wherein a shape of the island structure is one of a pyramid shape, a lens shape and a particle shape;

preparing the plurality of island structures on the barrier layer or on the buffer layer specifically comprises:

patterning the barrier layer or the buffer layer by one of photolithography, transferring and laser etching to obtain the plurality of island structures, or preparing the plurality of island structures on the barrier layer or the buffer layer by inkjet printing.

8. The manufacturing method of the organic light emitting diode display device according to claim 7, wherein as the plurality of island structures are prepared on the barrier layer or the buffer layer by inkjet printing, a material of the island structures is an inorganic nanomaterial.

9. The manufacturing method of the organic light emitting diode display device according to claim 7, wherein preparing the barrier layer and the buffer layer on the thin film transistor layer comprises:

sequentially preparing a first barrier layer, a first buffer layer, a second barrier layer, a second buffer layer and a third barrier layer on the thin film transistor layer.

10. The manufacturing method of the organic light emitting diode display device according to claim 9, wherein preparing the plurality of island structures on the barrier layer or on the buffer layer comprises:

preparing the plurality of island structures on any one of the first barrier layer, the first buffer layer, the second barrier layer, the second buffer layer and the third barrier layer.

11. An organic light emitting diode display device, comprising: a glass substrate, a thin film transistor layer located on the glass substrate, a plurality of organic light emitting diode elements located on the thin film transistor layer, a barrier layer and a buffer layer located on the thin film transistor layer, wherein the barrier layer covers the plurality of organic light emitting diode elements;

wherein a plurality of island structures is arranged on the barrier layer or on the buffer layer, and the plurality of island structures are located in a non-light emitting region on the barrier layer or the buffer layer.

12. The organic light emitting diode display device according to claim 11, wherein a shape of the island structure is one of a pyramid shape, a lens shape and a particle shape.

13. The organic light emitting diode display device according to claim 11, wherein a material of the island structures is the same as a material of the barrier layer or the buffer layer, or the material of the island structures is an inorganic nanomaterial.

14. The organic light emitting diode display device according to claim 11, wherein the barrier layer comprises a first barrier layer, a second barrier layer, and a third barrier layer, and the buffer layer comprises a first buffer layer and a second buffer layer;

the first barrier layer, the first buffer layer, the second barrier layer, the second buffer layer and the third barrier layer are sequentially stacked in a direction away from the thin film transistor layer.

* * * * *

专利名称(译)	有机发光二极管显示装置及其制造方法		
公开(公告)号	US20190326551A1	公开(公告)日	2019-10-24
申请号	US16/112025	申请日	2018-08-24
[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.		
当前申请(专利权)人(译)	深圳市中国星光电科技有限公司.		
[标]发明人	HUANG HUI		
发明人	HUANG, HUI		
IPC分类号	H01L51/52 H01L27/32 H01L51/56		
CPC分类号	H01L51/56 H01L27/3246 H01L51/5253 H01L51/5256 H01L27/1244		
优先权	201810365397.2 2018-04-23 CN		
其他公开文献	US10600821		
外部链接	Espacenet USPTO		

摘要(译)

提供一种有机发光二极管显示装置及其制造方法。该方法包括：在玻璃基板上制备薄膜晶体管层；在薄膜晶体管层上制备多个有机发光二极管元件；在所述薄膜晶体管层上制备阻挡层和缓冲层，所述阻挡层覆盖所述多个有机发光二极管元件；在阻挡层或缓冲层上制备多个岛状结构，其中多个岛状结构位于阻挡层或缓冲层上的非发光区。可以延长水蒸气进入OLED显示装置的路径，以增强水蒸气的吸收并增强OLED显示装置的封装结果。

