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(54) **TOUCH SCREEN PANEL AND MANUFACTURING METHOD THEREOF**

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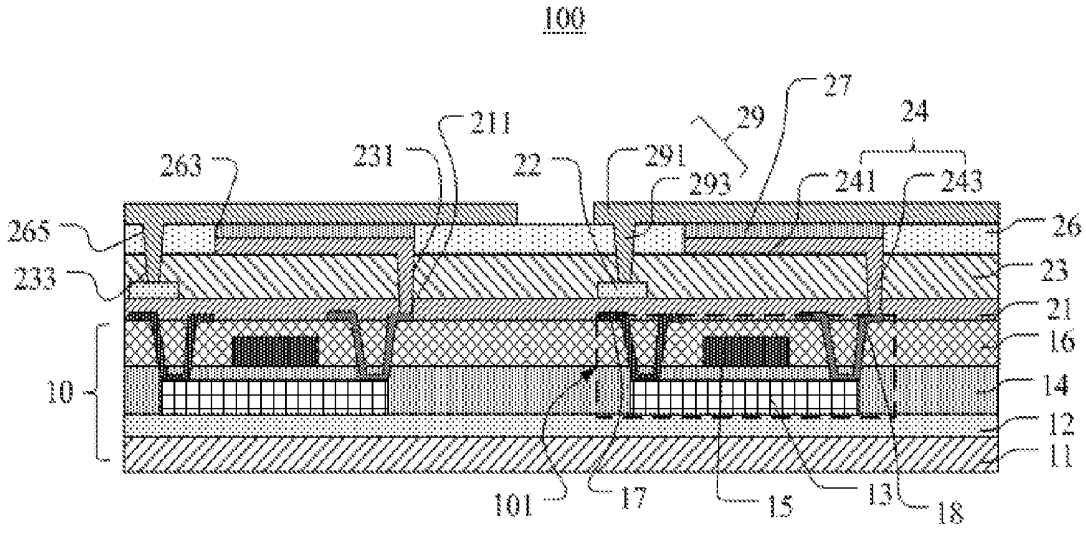
(57) **ABSTRACT**

A touch screen panel and a method of manufacturing touch screen panel are provided. The touch screen panel includes a TFT array substrate; a first protecting layer positioned on the TFT array substrate; a plurality of metal traces interval positioned on the first protecting layer; a second protecting layer covering the metal traces and the first protecting layer; and an anode, a pixel defining layer, a light-emitting layer and a plurality of interval positioned cathodes are sequentially positioned on the second protecting layer, the cathodes are used to be touch electrode layer, each of the cathodes is electrically connecting to the correspondingly metal trace. Because the invention does not need to position another touch screen electrode/panel, reduces the element, which decreases thickness of the OLED touch screen panel, it beneficial to light weight development.



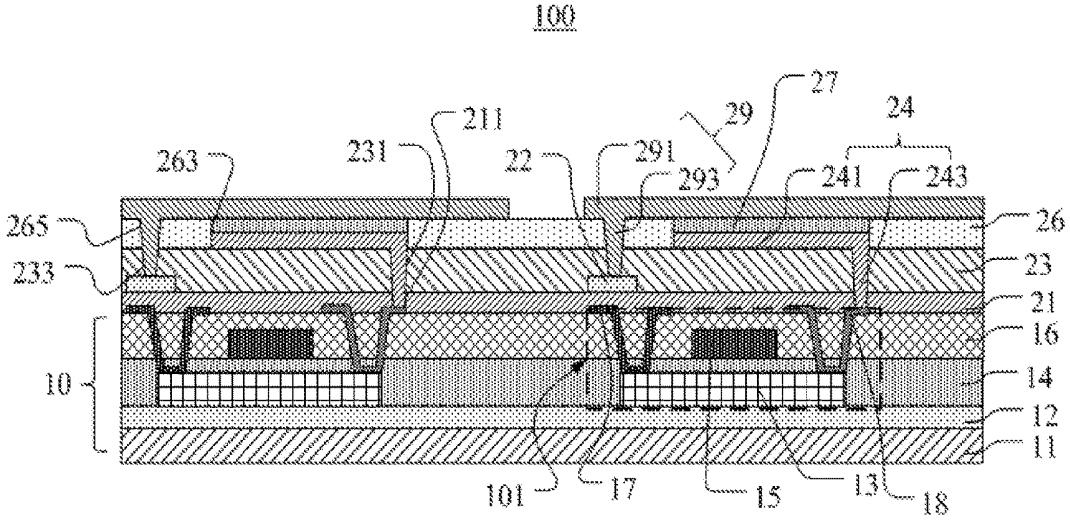

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FIG. 1

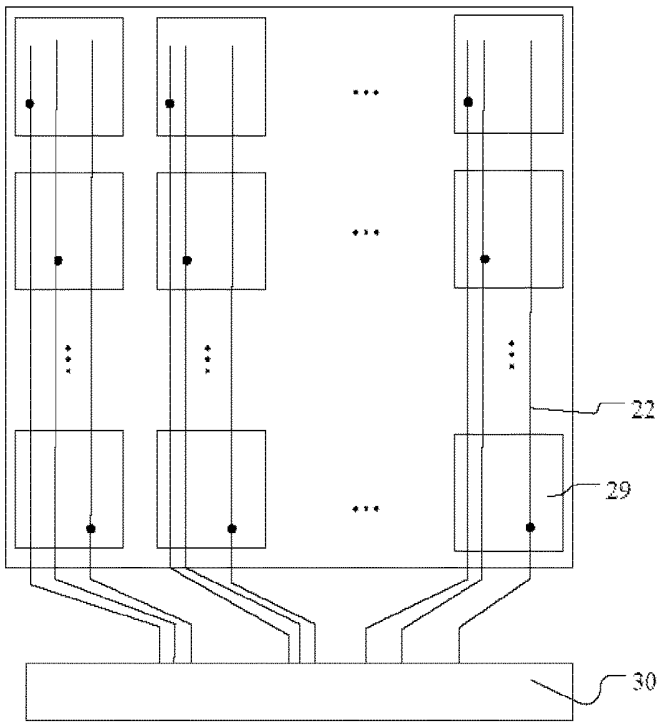
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FIG. 2

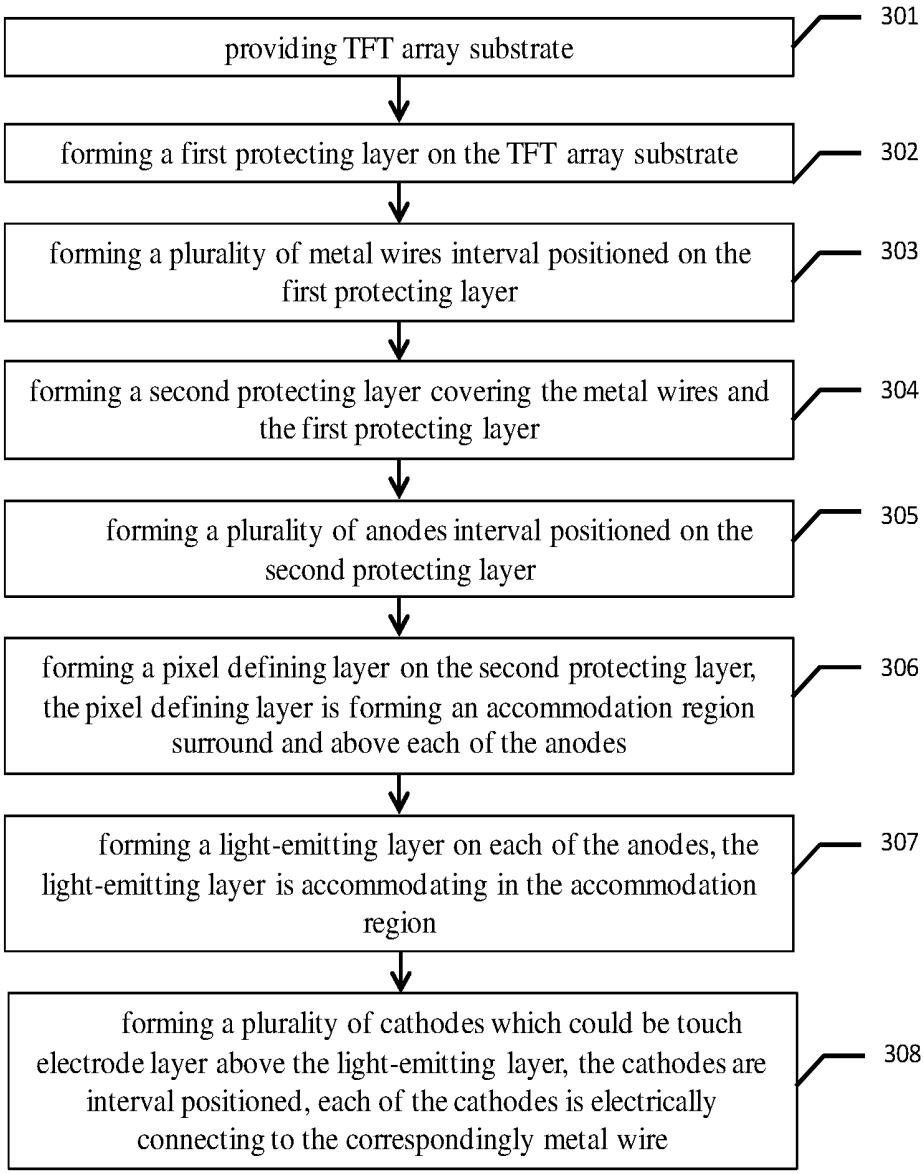
providing TFT array substrate
301
forming a first protecting layer on the TFT array substrate
302
forming a plurality of metal wires interval positioned on the first protecting layer
303
forming a second protecting layer covering the metal wires and the first protecting layer
304
forming a plurality of anodes interval positioned on the second protecting layer
305
forming a pixel defining layer on the second protecting layer, the pixel defining layer is forming an accommodation region surround and above each of the anodes
306
forming a light-emitting layer on each of the anodes, the light-emitting layer is accommodating in the accommodation region
307
forming a plurality of cathodes which could be touch electrode layer above the light-emitting layer, the cathodes are interval positioned, each of the cathodes is electrically connecting to the correspondingly metal wire
308

FIG. 3

TOUCH SCREEN PANEL AND MANUFACTURING METHOD THEREOF

RELATED APPLICATIONS

[0001] The present application is a National Phase of International Application Number PCT/2017/116833, filed Dec. 18, 2017, and claims the priority of China Application No. 201711188931.9, filed Nov. 22, 2017.

FIELD OF THE DISCLOSURE

[0002] The disclosure relates to a display technical field, and more particularly to a touch screen panel and a method of manufacturing touch screen panel.

BACKGROUND

[0003] The Organic light-emitting diodes (OLED) has numerous of advantages such as low driving voltage, fast response speed, high effectiveness of emitting, wide view angle, wide working temperature, so that it is beneficial to thin-light, low power consumption and curving design of display element. Currently, the existing touch panel product structure base on OLED which needs to respectively manufacturing OLED display panel and touch panel, and pasting these two panels by gel materials to form an entire touch screen device. This structure will increases entire thickness of the OLED device, and not beneficial to light-thin development of product.

SUMMARY

[0004] A technical problem to be solved by the disclosure is to provide a touch screen panel and a method of manufacturing touch screen panel.

[0005] An objective of the disclosure is achieved by following embodiments. In particular, a touch screen panel includes a TFT array substrate; a first protecting layer positioned on the TFT array substrate; a plurality of metal traces interval positioned on the first protecting layer; a second protecting layer covering the metal traces and the first protecting layer; and an anode, a pixel defining layer, a light-emitting layer and a plurality of interval positioned cathodes are sequentially positioned on the second protecting layer, the cathodes are used to be touch electrode layer, each of the cathodes is electrically connecting to the correspondingly metal traces.

[0006] In an embodiment, the first protecting layer is passivation layer and made by inorganic materials; the second protecting layer is planarization layer and made by organic materials.

[0007] In an embodiment, the first protecting layer is planarization layer and made by organic materials; the second protecting layer is passivation layer and made by inorganic materials.

[0008] In an embodiment, a plurality of first holes are formed on the second protecting layer, a plurality of second holes are formed on the pixel defining layer, each of the first holes is connecting to one of the second hole, and each of the cathodes is electrically connecting with the correspondingly metal trace by one of the first hole and one of the second hole.

[0009] In an embodiment, a first connecting hole is formed on the first protecting layer, a second connecting hole is formed on the second protecting layer and connecting to the first connecting hole, the anode is electrically connecting to a drain electrode of the TFT array substrate according to the first connecting hole and the second connecting hole.

[0010] In an embodiment, the touch screen panel further comprising a controller, the controller is electrically connected by the metal trace and the cathode, the controller has touch and display driving controlling function.

[0011] In an embodiment, material of the metal trace is one of Cu, Ag, Al, Ti, Mo.

[0012] According to another aspect of the disclosure, the disclosure further provides a method of manufacturing touch screen panel. The method of manufacturing touch screen panel, comprising

[0013] providing TFT array substrate;

[0014] forming a first protecting layer on the TFT array substrate;

[0015] forming a plurality of metal traces interval positioned on the first protecting layer;

[0016] forming a second protecting layer covering the metal traces and the first protecting layer;

[0017] forming a plurality of anodes interval positioned on the second protecting layer;

[0018] forming a pixel defining layer on the second protecting layer, the pixel defining layer is forming an accommodation region surround and above each of the anodes;

[0019] forming a light-emitting layer on each of the anodes, the light-emitting layer is accommodating in the accommodation region;

[0020] forming a plurality of cathodes which could be touch electrode layer and positioned above the light-emitting layer, the cathodes are interval positioned, each of the cathodes is electrically connecting to the correspondingly metal trace.

[0021] In an embodiment, in the step of "forming a second protecting layer on the metal traces and the first protecting layer", which forming a plurality of first holes on the second protecting layer, and each of first holes is correspondingly positioned a metal trace; in the step of "forming a pixel defining layer on the second protecting layer, the pixel defining layer is forming an accommodation region surround and above each of the anodes", which forming a plurality of second holes on the pixel defining layer, each of the second hole is connecting with the first hole, each of the cathodes is electrically connecting to the correspondingly metal trace by the first hole and the second hole.

[0022] In an embodiment, the first protecting layer is passivation layer and made by inorganic materials; the second protecting layer is planarization layer and made by organic materials; or the first protecting layer is planarization layer and made by organic materials; the second protecting layer is passivation layer and made by inorganic materials.

[0023] In an embodiment, each of the cathodes comprises a cathode main body and a cathode connecting portion which extending by the cathode main body, the cathode main body is covering the light-emitting layer, the cathode connecting portion is electrically connecting with the correspondingly metal trace by pass through the first hole and the second hole.

[0024] In an embodiment, each of the anodes comprises an anode main body and an anode connecting portion which extending by the anode main body, the anode main body is accommodating in the pixel defining layer, the anode main body is positioned between the second protecting layer and the light-emitting layer, the anode connecting portion pass

through the second connecting hole and the first connecting hole for electrically connecting with the drain such that achieves to electrically connection between the anode and the drain.

[0025] The touch screen panel and the manufacturing method thereof, comprising a plurality of cathode are interval positioned, the cathode is used to be touch electrode layer. The cathode is electrically connecting to the metal trace by the controller electrically connecting with the metal trace, so that is does not need to position another touch electrode/panel, reduces the element, decreases thickness of the touch screen display, it beneficial to thin-light development. Further, controller has touch and display driving controlling function, greatly reduces thickness of entire device; at the same time, reduces number of electrical element, reduce manufacturing process, decreases cost.

BRIEF DESCRIPTION OF THE DRAWINGS

[0026] Accompanying drawings are for providing further understanding of embodiments of the disclosure. The drawings form a part of the disclosure and are for illustrating the principle of the embodiments of the disclosure along with the literal description. Apparently, the drawings in the description below are merely some embodiments of the disclosure, a person skilled in the art can obtain other drawings according to these drawings without creative efforts. In the figures:

[0027] FIG. **1** is a sectional view of a touch screen panel of the disclosure;

[0028] FIG. **2** is a connection schematic view between the cathode and controller of a touch screen panel shown in FIG. **1**; and

[0029] FIG. **3** is a manufacturing method flow chart of a touch screen panel of the disclosure.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

[0030] The specific structural and functional details disclosed herein are only representative and are intended for describing exemplary embodiments of the disclosure. However, the disclosure can be embodied in many forms of substitution, and should not be interpreted as merely limited to the embodiments described herein.

[0031] Please refer to the FIG. **1**. A touch screen panel **100** is provided by this disclosure. In this embodiment, the touch screen panel **100** is OLED touch screen panel.

[0032] The touch screen panel **100**, comprising a TFT array substrate **10**; a first protecting layer **21** positioned on the TFT array substrate **10**; a plurality of metal traces **22** (only illustrates two metal traces in FIG. **1**) interval positioned on the first protecting layer **21**; a second protecting layer **23** is covering the metal traces **22** and the first protecting layer **21**; and an anode **24**, a pixel defining layer **26**, a light-emitting layer **27** and a plurality of interval positioned cathodes **29** are sequentially positioned on the second protecting layer **23**, the cathodes **29** are also used to be touch electrode layer, each of the cathodes **29** is electrically connecting to the correspondingly metal trace **22**.

[0033] Specifically, the TFT array substrate **10** includes substrate **11**, buffer layer **12** and a plurality of TFT transistor **101** (only illustrates two transistors in FIG. **1**). In this embodiment, material of the substrate **11** is polyimide (PI) or glass. The buffer layer **12** is covering the substrate **11**. Each of the TFT transistors **101** includes an active layer **13**, a grid insulating layer **14**, a grid electrode **15**, a dielectric layer **16**, a source electrode **17** and a drain electrode **18**. The active layer **13** is pasting on the buffer layer **12**. The grid insulating layer **14** is covering the buffer layer **12** and the active layer **13**. The gird electrode **15** is positioned on the grid insulating layer **14**. The dielectric layer **16** is covering the grid electrode **15** and the grid insulating layer **14**. The source electrode **17** is positioned on the dielectric layer **16** and connecting with the active layer **13**. The drain electrode **18** is spaced by the source electrode **17** and positioned on the dielectric layer **16**, and the drain electrode **18** is connecting with the active layer **13**. Each of the drain electrodes **18** of the TFT transistors **101** is electrically connecting with one anode **24**.

[0034] The first protecting **21** is covering the source electrode **17**, the drain electrode **18** and the dielectric layer **16**. The first protecting layer **21** is passivation layer, and made by inorganic materials. Preferably, material of the first protecting layer **21** could be SiN_x or SiO_2. A plurality of first connecting hole **211** are formed on the first protecting layer **21**. Each of the first connecting holes **211** is correspondingly positioned to one of the drain electrode **18**.

[0035] A plurality metal traces **22** are interval positioned on a side of the first protecting layer **21** which far away the dielectric layer **16**. The material of the metal traces **22** is a metal or alloy material which has better property of conductivities, such as at least one of Cu, Ag, Al, Ti, Mo.

[0036] The second protecting layer **23** is covering the first protecting **21** and the metal traces **22**. The first protecting layer **21** is positioned between the second protecting layer **23** and the dielectric layer **16**. The second protecting layer **23** is planarization layer, and made by organic materials. A plurality of second connecting hole **231** are formed on the second protecting layer **23**. Each of the second connecting holes **231** is correspondingly connecting with one of the first connecting hole **211**. The second protecting layer **23** is forming a first hole **233** that corresponding to each of metal traces **22**. It is noted that, each of the first connecting hole **211** and the correspondingly second connecting hole **231** only needs to connect each other.

[0037] A plurality of anode **24** are interval positioned on a side of the second protecting layer **23** which far away the first protecting layer **21**. Each of the anodes **24** is electrically connecting with the correspondingly drain electrode **18** by one of the first connecting hole **211** and one of the second connecting hole **231**.

[0038] Further, each of the anodes **24** comprises an anode main body **241** and an anode connecting portion **243** which extending by the anode main body **241**. The anode main body **241** is positioned on the second protecting layer **23**. Each of the anodes connecting portions **243** pass through one of the first connecting hole **211** and one of the second connecting hole **231** such that achieves to the anode **24** is electrically connecting with the drain electrode **18**.

[0039] The pixel defining layer **26** is covering the second protecting layer **23**. The pixel defining layer **26** is forming an accommodation region **263** surround and above each of the anodes **24**. The second protecting layer **23** is positioned between the first protecting layer **21** and the pixel defining layer **26**. The pixel defining layer **26** is forming a plurality of second holes **265**. Each of the second holes **265** is correspondingly positioned and connecting with one of the

first hole **233**. The accommodation region **263** is located above the anode main body **241**.

[0040] The light-emitting layer **27** is accommodated in the accommodation region **263**. The light-emitting layer **27** is positioned a surface of the anode main body **241** which far away the second protecting layer **23**. The anode main body **241** is positioned between the light-emitting layer **27** and the second protecting layer **23**.

[0041] A plurality of the cathodes **29** is interval positioned on the light-emitting layer **27**. The cathode **29** is also used to be touch electrode layer. The light-emitting layer **27** is positioned between the anode **24** and the cathode **29**. Each of the cathode **29** is connecting with the correspondingly metal traces **22** by one of the first hole **233** and one of the second hole **265**, such that achieved to electrically connecting between the cathode **26** and the metal traces **22**.

[0042] Further, each of the cathodes **29** comprises a cathode main body **291** and a cathode connecting portion **293** which bending toward and extending to the metal traces **22** by the cathode main body **291**. The cathode main body **291** is positioned on the light-emitting layer **27**. The light-emitting layer **27** is positioned between the anode main body **241** and the cathode main body **291**. The cathode connecting portion **293** is electrically connecting with the correspondingly metal trace **22** by pass through the first hole **233** and the second hole **235**. Therefore, it achieves to electrically connect between the cathode **29** and the metal trace **22**.

[0043] In another embodiment, the first protecting layer **21** is planarization layer, and made by organic materials; the second protecting layer **23** is passivation layer, and made by inorganic materials. Preferably, material of the first protecting layer **21** could be SiN_x or SiO_2.

[0044] Because of the cathode **29** is used to be touch electrode layer and the cathode **29** is electrically connecting with the metal trace **22**, it does not need to another touch screen panel, reduces the elements such that decreases thickness of the OLED touch screen panel, it beneficial to light weight and thinner development. In addition, it also enhance open ratio of the emitting pixel of the touch screen panel **100**, because of the cathodes **29** are not positioned on entirely surface of the touch screen panel **100**.

[0045] Further, please refer to FIG. **2**. The touch screen panel **100** further comprises a controller **30**. The controller **30** is electrically connected by the metal trace **22** and the cathode **29**. The controller **30** has touch and display driving controlling function, which integrating two chips has touch and display driving controlling function respectively into one controller. Because the touch and display are using same controller **30**, greatly reduces thickness of whole touch screen panel; and also reduces number of the electrically element, reduces manufacturing step, decreases cost.

[0046] The touch screen panel **100** could be applied to devices has display function such as liquid crystal television, smart phone, digital camera, tablet, wearing watch, notebook and so on.

[0047] In this embodiment, the buffer layer **12**, a grid insulating layer **14** and dielectric layer **16** are made by inorganic materials such as SiN_x or SiO_2.

[0048] It could be noted that, the buffer layer **12** could be omitted.

[0049] A method of manufacturing touch screen panel is also provided by this disclosure. Please refer to FIG. **3**, the method comprises the following steps.

[0050] **301**, providing TFT array substrate.

[0051] Specifically, the TFT array substrate includes substrate, buffer layer and a plurality of TFT transistor. In this embodiment, material of the substrate is glass. The buffer layer is covering the substrate. Each of the TFT transistors includes an active layer, a grid insulating layer, a grid electrode, a dielectric layer, a source electrode and a drain electrode. The active layer is pasting on the buffer layer. The grid insulating layer is covering the buffer layer and the active layer. The gird electrode is positioned on the grid insulating layer. The dielectric layer is covering the grid electrode and the grid insulating layer. The source is positioned on the dielectric layer and connecting with the active layer. The drain electrode is spaced by the source electrode and positioned on the dielectric layer, and the drain electrode is connecting with the active layer.

[0052] **302**, forming a first protecting layer on the TFT array substrate;

[0053] Further, a first connecting hole is forming on the first protecting layer, each of the first connecting holes is corresponding to a drain electrode of one of the TFT transistor.

[0054] **303**, forming a plurality of metal traces interval positioned on the first protecting layer.

[0055] **304**, forming a second protecting layer on the metal traces and the first protecting layer.

[0056] Further, a plurality of the first hole and a plurality of the second connecting hole are formed on the second protecting layer. Each of the first holes is correspondingly positioned to one metal trace, each of the second connecting holes is correspondingly positioned and connected to one of the first connecting hole.

[0057] Specifically, forming a plurality of preset pattern metal traces by mask photo process.

[0058] **305**, forming a plurality of anodes interval positioned on the second protecting layer.

[0059] Further, each of the anodes is electrically connecting to the correspondingly drain electrode by the first connecting hole and the second connecting hole.

[0060] Further, each of the anodes comprises an anode main body and an anode connecting portion which bending toward and extending to the metal traces by the anode main body. The anode main body is positioned on the second protecting layer. Each of the anodes connecting portions is electrically connecting to a drain electrode by pass through the second connecting hole and the first connecting hole.

[0061] **306**, forming a pixel defining layer on the second protecting layer, the pixel defining layer is forming an accommodation region surround and above each of the anodes.

[0062] Further, forming a plurality of the second hole on the pixel defining layer. Each of the second holes is connecting to one of the first hole.

[0063] **307**, forming a light-emitting layer on each of the anodes, the light-emitting layer is accommodating in the accommodation region.

[0064] **308**, depositing to form a plurality of cathodes which may used to be touch electrode layer above the light-emitting layer, the cathodes are interval positioned; each of the cathodes is electrically connecting to the correspondingly metal trace.

[0065] Each of the cathodes is electrically connecting to the correspondingly metal trace by the second hole and the first hole. Above the each of the light-emitting layers is forming one cathode.

[0066] Further, each of the cathodes comprises a cathode main body and a cathode connecting portion which bending toward and extending to the metal traces by the cathode main body. The cathode main body is electrically connecting to the metal trace by pass through the second hole and the first hole

[0067] The first protecting layer is passivation layer and made by inorganic materials; the second protecting layer is planarization layer and made by organic materials; Or the first protecting layer is planarization layer and made by organic materials; the second protecting layer is passivation layer and made by inorganic materials.

[0068] The touch screen panel and method of manufacture thereof are provided by this disclosure. The traditional OLED display device is patterning entire cathode to form a plurality of cathodes. Each of cathodes is electrically connecting by metal trace and controller, which is the cathode also used to be a touch electrode layer of OLED touch screen. So that it does not need to position another touch electrode, reduces element, and decreases thickness of the touch screen panel, it beneficial to light-thin development.

[0069] The foregoing contents are detailed description of the disclosure in conjunction with specific preferred embodiments and concrete embodiments of the disclosure are not limited to these description. For the person skilled in the art of the disclosure, without departing from the concept of the disclosure, simple deductions or substitutions can be made and should be included in the protection scope of the application.

What is claimed is:

1. A touch screen panel, comprising

a TFT array substrate;

a first protecting layer positioned on the TFT array substrate;

a plurality of metal traces interval positioned on the first protecting layer;

a second protecting layer covering the metal traces and the first protecting layer; and an anode, a pixel defining layer, a light-emitting layer and a plurality of interval positioned cathodes are sequentially positioned on the second protecting layer, the cathodes are used to be touch electrode layer, each of the cathodes is electrically connecting to the correspondingly metal trace.

2. The touch screen panel according to claim **1**, wherein the first protecting layer is passivation layer and made by inorganic materials; the second protecting layer is planarization layer and made by organic materials.

3. The touch screen panel according to claim **1**, wherein the first protecting layer is planarization layer and made by organic materials; the second protecting layer is passivation layer and made by inorganic materials.

4. The touch screen panel according to claim **1**, wherein a first hole is formed on the second protecting layer, a second hole is formed on the pixel defining layer and connecting with the first hole, the cathode is electrically connecting with the metal trace by the first hole and the second hole.

5. The touch screen panel according to claim **4**, wherein each of the cathodes comprises a cathode main body and a cathode connecting portion which extending by the cathode main body, the cathode main body is covering the light-emitting layer, the cathode connecting portion pass through the first hole and the second hole and is electrically connecting with the correspondingly metal trace.

6. The touch screen panel according to claim **1**, wherein the a first connecting hole is formed on the first protecting layer, a second connecting hole is formed on the second protecting layer and connecting to the first connecting hole, the anode is electrically connecting to a drain electrode of the TFT array substrate according to the first connecting hole and the second connecting hole.

7. The touch screen panel according to claim **6**, wherein each of the anodes comprises an anode main body and an anode connecting portion which extending by the anode main body, the anode main body is accommodating in the pixel defining layer, the anode main body is positioned between the second protecting layer and the light-emitting layer, the anode connecting portion pass through the second connecting hole and the first connecting hole for electrically connecting with the drain electrode such that achieves to electrically connection between the anode and the drain electrode.

8. The touch screen panel according to claim **1**, wherein the touch screen panel further comprising a controller, the controller is electrically connected by the metal trace and the cathode, the controller has touch and display driving controlling function.

9. The touch screen panel according to claim **1**, wherein materials of the metal trace is at least one of Cu, Ag, Al, Ti, Mo.

10. A method of manufacturing touch screen panel, comprising

providing TFT array substrate;

forming a first protecting layer on the TFT array substrate;

forming a plurality of metal traces interval positioned on the first protecting layer;

forming a second protecting layer covering the metal traces and the first protecting layer;

forming a plurality of anodes interval positioned on the second protecting layer;

forming a pixel defining layer on the second protecting layer, the pixel defining layer is forming an accommodation region surround and above each of the anodes;

forming a light-emitting layer on each of the anodes, the light-emitting layer is accommodating in the accommodation region;

forming a plurality of cathodes which could be touch electrode layer above the light-emitting layer, the cathodes are interval positioned, each of the cathodes is electrically connecting to the correspondingly metal trace.

11. The method of manufacturing touch screen panel according to claim **10**, wherein in the step of "forming a second protecting layer on the metal traces and the first protecting layer", which forming a plurality of first holes on the second protecting layer, and each of first holes is correspondingly positioned a metal trace; in the step of "forming a pixel defining layer on the second protecting layer, the pixel defining layer is forming an accommodation region surround and above each of the anodes", which forming a plurality of second holes on the pixel defining layer, each of the second holes is connecting with the first hole, each of the cathodes is electrically connecting to the correspondingly metal trace by the first hole and the second hole.

12. The method of manufacturing touch screen panel according to claim **10**, wherein the first protecting layer is passivation layer and made by inorganic materials; the second protecting layer is planarization layer and made by organic materials;

or the first protecting layer is planarization layer and made by organic materials; the second protecting layer is passivation layer and made by inorganic materials.

* * * * *

专利名称(译)	触摸屏面板及其制造方法		
公开(公告)号	US20190157355A1	公开(公告)日	2019-05-23
申请号	US15/746599	申请日	2017-12-18
[标]发明人	YE JIAN		
发明人	YE, JIAN		
IPC分类号	H01L27/32 H01L51/52 H01L51/56 G06F3/041		
CPC分类号	H01L27/323 H01L27/3258 H01L27/3276 H01L27/3246 H01L27/3248 H01L51/5209 H01L51/56 G06F3/0412 G06F3/0416 H01L2227/323 H01L27/124 H01L27/1248 G06F2203/04103 H01L51/5225		
优先权	201711188931.9 2017-11-22 CN		
外部链接	Espacenet USPTO		

摘要(译)

提供了一种触摸屏面板和制造触摸屏面板的方法。触摸屏面板包括TFT阵列基板;第一保护层位于TFT阵列基板上;多个金属迹线间隔位于第一保护层上;第二保护层，覆盖金属迹线和第一保护层;阳极，像素限定层，发光层和多个间隔定位的阴极依次设置在第二保护层上，阴极用作触摸电极层，每个阴极电连接到相应的金属痕迹。因为本发明不需要定位另一个触摸屏电极/面板，减少了元件，这降低了OLED触摸屏面板的厚度，有利于轻量化的发展。