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Lih et al.

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(54) **ACTIVE MATRIX ORGANIC LIGHT EMITTING DIODE DISPLAY AND FABRICATION METHOD OF THE SAME**

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(30) **Foreign Application Priority Data**

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(51) **Int. Cl.**[7] **H05B 33/00**
(52) **U.S. Cl.** **313/498**; 313/512
(58) **Field of Search** 313/498, 500, 313/505, 512, 504; 428/917; 315/169.3; 362/310, 800

(56) **References Cited**

U.S. PATENT DOCUMENTS

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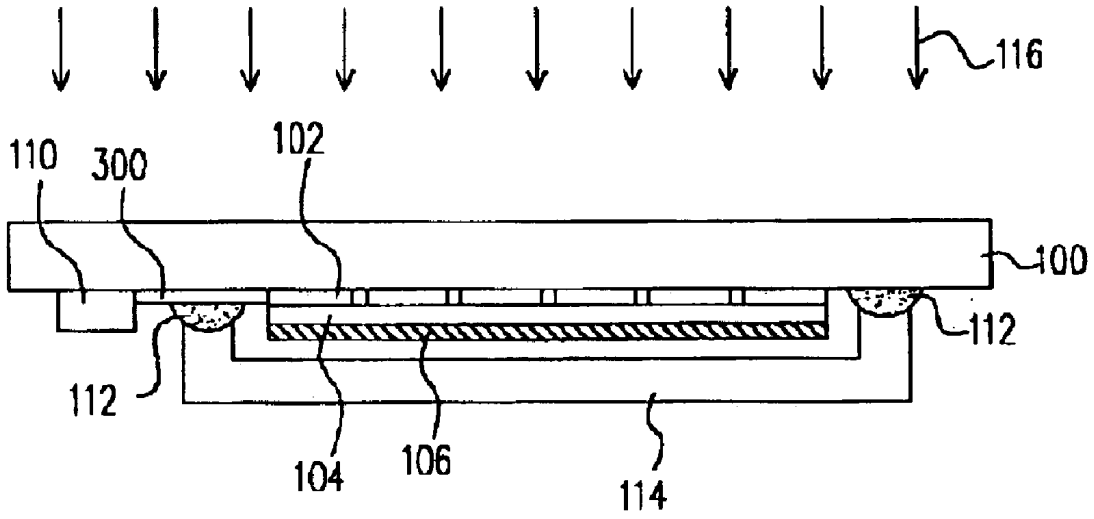
(57) **ABSTRACT**

An active matrix organic light emitting diode display and a fabrication method of the same. A substrate having a display area and a non-display area is provided. A plurality of pixel structures is formed in the display area, and a plurality of transparent conductive lines to electrically connect the pixel structures are formed on the substrate. The transparent conductive lines extend from the display area to the non-display area. A photosensitive glue is formed at a periphery of the display area, and a cap is formed to cover the display area. The cap is adhered to the substrate using the photosensitive glue. A radiation step is performed on a rear surface of the substrate to cure the photosensitive glue. A driving chip electrically connected to the pixel structures via the transparent conductive lines is formed in the non-display area.

6 Claims, 2 Drawing Sheets



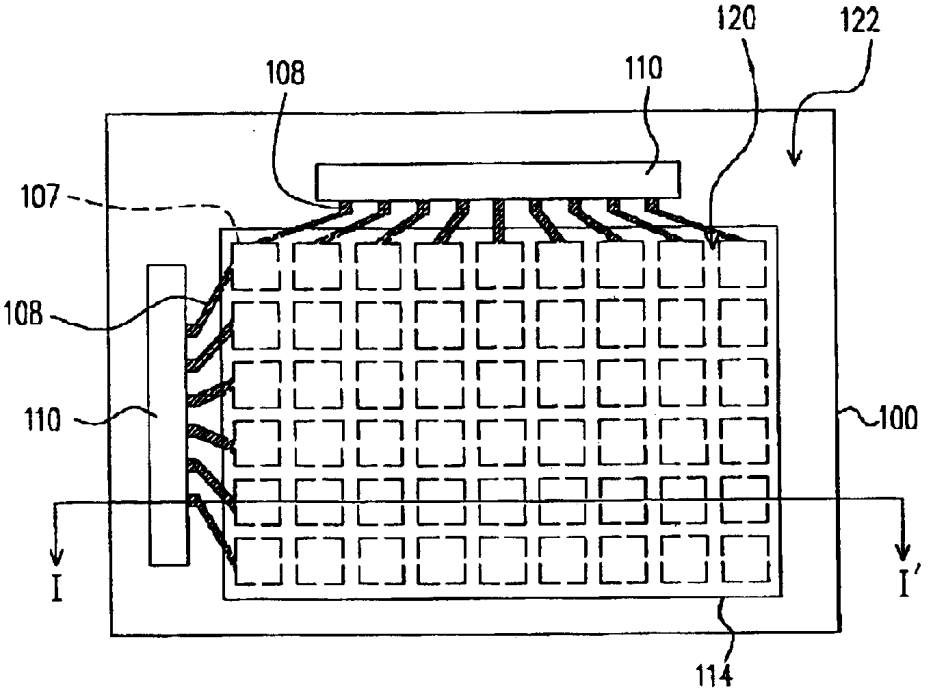


FIG. 1 (PRIOR ART)

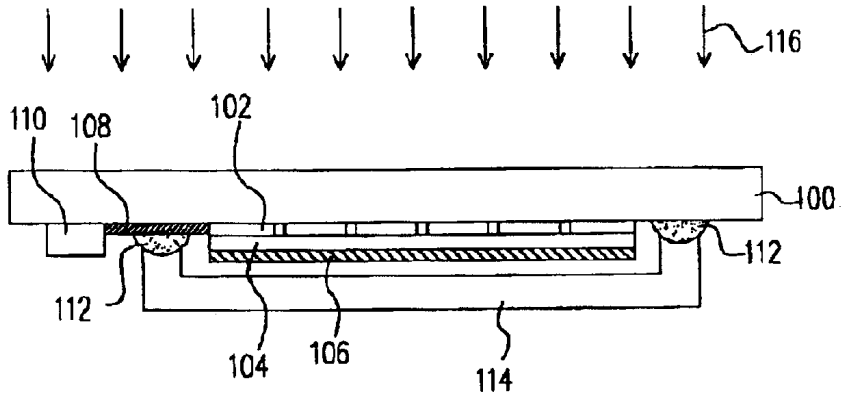


FIG. 2 (PRIOR ART)

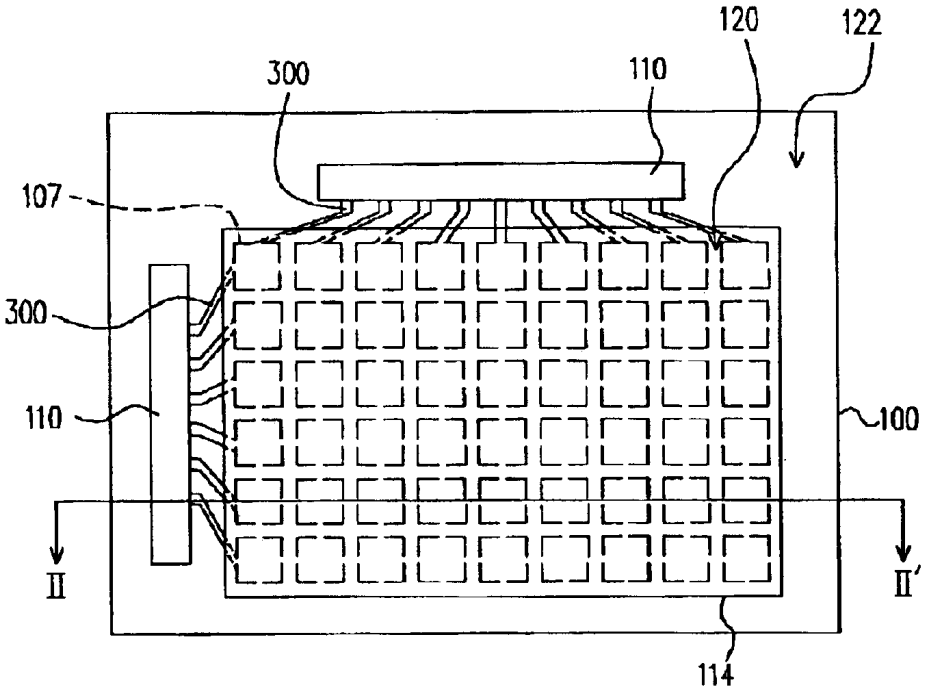

120
122
300
110
107
300
110
100
II
II'
114

FIG. 3

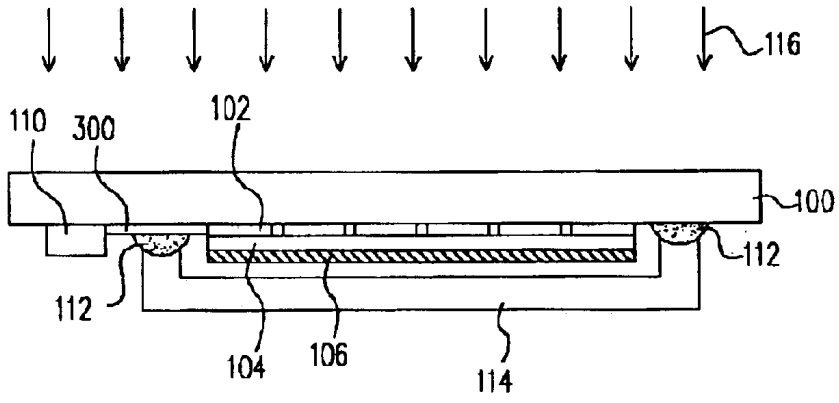

116
110
300
102
100
112
112
104
106
114

FIG. 4

ACTIVE MATRIX ORGANIC LIGHT EMITTING DIODE DISPLAY AND FABRICATION METHOD OF THE SAME

CROSS REFERENCE TO RELATED APPLICATIONS

This application claims the priority benefit of Taiwan application serial no. 91133680, filed Nov. 19, 2002.

BACKGROUND OF INVENTION

1. Field of the Invention

The invention relates in general to a flat panel display and a fabrication method thereof, and more particularly, to an active matrix organic light emitting diode (AMOLED) and a fabrication method thereof.

2. Related Art of the Invention

The organic light emitting diode is a semiconductor device with high conversion efficiency by converting electric energy into optical energy. The common application includes indicators, display panel and light emitting device for optical pickup head. Having the properties such as viewing-angle independency, simple process, low cost, high response speed, broad application temperature range and full color, the organic light emitting diode meet with the requirement of modern display and becomes a very popular research topic.

Following the intensive research, the active matrix organic light emitting diode having an organic light emitting layer and a cathode layer formed on a substrate having a thin-film transistor array formed thereon has been developed. The active matrix organic light emitting diode display is driven by the thin-film transistor. The fabrication of the conventional active matrix organic light emitting diode display is introduced as follows.

FIG. **1** shows a top view of a conventional active matrix organic light emitting diode display. FIG. **2** shows a cross sectional view along line I-I" of FIG. **1**.

Referring to FIGS. **1** and **2**, a substrate **100** on which a display area **120** and a non-display area **122** are formed is provided. The display area **120** of the substrate **100** further comprises a plurality of pixel structures **107** arranged as an array thereon. Each of the pixel structures **107** comprises an active device (thin-film transistor), an anode layer **102**, a luminescent layer **104** and a cathode layer **106**.

Each pixel structure **107** is controlled by a scan line (not shown) and a data line (not shown). The scan lines and data lines located in the display area **120** extends towards the non-display area **122** to form a plurality of fan-outs **108** extending externally. The fan-outs **108** are used to electrically connect the driving chip subsequently formed in the non-display area **122**.

An ultra-violet (UV) glue **112** is formed at a perimeter of the display area **120** on the substrate **100**, while a cap **114** is disposed over the substrate **100**. The substrate **100** and the cap **114** are then adhered via the UV glue **112**. An UV radiation **116** is performed to cure the UV glue **112**, so as to seal the display area **122** within the substrate **100** and the cap **114**. A driving chip **110** is then formed on the non-display area **122** of the substrate **100**. The driving chip **110** is electrically connected to the pixel structures **107** via the fan-outs **108**.

In the conventional process, the fan-outs **108** electrically connecting the pixel structures **107** and the driving chip **110** is made of the same metal material of the scan lines and the data lines. A part of the UV glue **112** is blocked by the fan-outs **108** and unable to absorb the UV radiation **116**. Consequently, this part of UV glue **112** is not cured properly to result in negative effect of the package. That is, moisture is easily to penetrate through the part of UV glue **112**, which is cured incompletely to damage the internal device of the display.

SUMMARY OF INVENTION

The present invention provides an active matrix organic light emitting diode display and a fabrication method thereof to improve the incomplete packaging problem caused in the conventional structure formed by the conventional fabrication method.

The method of fabricating an active matrix organic light emitting diode comprises the following steps. A substrate having a display area and a non-display area thereon is provided. A plurality of pixel structures is formed in the display area. Each pixel structure comprises an active device (thin-film transistor), an anode layer, a luminescent layer and a cathode layer. A plurality of transparent conductive lines is formed in the non-display area for providing electrical connection to the pixel structures. The transparent conductive lines can be defined by the step of forming the anode. The material for forming the transparent conductive lines includes indium tin oxide or indium zinc oxide. A photosensitive glue is applied at a perimeter of the display area on the substrate. A cap is disposed over the display area of the substrate and adhered to the substrate to cover the display area via the photosensitive glue. A radiation step is performed to cure the photosensitive glue. A driving chip is then formed on the non-display area and electrically connected to the pixel structures via the transparent conductive lines.

The active matrix organic light emitting diode provided by the present invention comprises a substrate, a driving chip, a plurality of transparent conductive lines, a cap and a photosensitive glue. The substrate has a display area and a non-display area, and a plurality of pixel structures formed in the display area. Each of the pixel structure comprises an active device (thin-film transistor), an anode layer, a luminescent layer and a cathode layer. The driving chip is formed in the non-display area of the substrate. The transparent conductive lines are disposed on the substrate and extend from the display area towards the non-display area to provide electric connection between the driving chip and the pixel electrodes. The material for forming the transparent conductive lines includes indium tin oxide and indium zinc oxide. In addition, the cap is located above the display area of the substrate to encapsulate the pixel structures.

The present invention uses transparent conductive lines to provide electric connection between the pixel structures and the driving chip instead of using the fan-outs described above. Therefore, the problem of incomplete curing the UV glue is resolved in the present invention.

As the display area is sealed within the cap and the completely cured photosensitive glue, the internal device of the display will not be damaged by the moisture penetration.

The present invention thus improves the defect of the conventional structure and process, such that the reliability of the display is enhanced.

BRIEF DESCRIPTION OF DRAWINGS

These, as well as other features of the present invention, will become more apparent upon reference to the drawings wherein:

FIG. **1** shows a top view of a conventional active matrix organic light emitting diode display;

FIG. **2** shows a cross sectional view along the line I-I' as shown in FIG. **1**;

FIG. **3** shows a top view of an active matrix organic light emitting diode display according to the present invention; and

FIG. **4** shows a cross sectional view along the line II-II" as shown in FIG. **3**.

DETAILED DESCRIPTION

FIG. **3** shows a top view of an active matrix organic light emitting diode provided by the present invention, and FIG. **4** shows a cross sectional view along line II-II' as shown in FIG. **3**.

Referring to FIGS. **3** and **4**, a substrate **100** is provided. The substrate **100** comprises a display area **120** and a non-display area **122**. A plurality of pixel structures **107** is formed in the display area **120**. Each of the pixel structures **107** comprises an active device (thin-film transistor), an anode layer **102**, a luminescent layer **104** and a cathode layer **106**.

While forming the anode layer **102** of the pixel structures **107**, a plurality of transparent conductive lines **300** are simultaneously defined in the non-display area **120** extending from two edges of the display area **120** to the non-display area **122** for forming a plurality of fan-outs. In this embodiment, the length of the transparent conductive lines **300** is about 2 mm to about 4 mm for providing electrical connection between a driving chip formed subsequently in the non-display area and the pixel structures **107**. Therefore, the signals generated by the driving chip can be delivered to the pixel structures **107**.

As the transparent conductive lines **300** are defined simultaneously with the anode layer **102**, the material for forming the transparent conductive lines **300** is thus the same as that of the anode layer **102**. The material includes indium tin oxide or indium zinc oxide.

A photosensitive glue **112** is formed at a perimeter of the display area **120** on the substrate **100**. An encapsulate cap **114** is disposed over the substrate **100** and adhered thereto via the photosensitive glue **112** for covering the display area **120**. The material for forming the cap **114** includes impermeable metal or glass. The photosensitive glue **112** includes an UV glue, for example.

An UV radiation **116** is then performed to cure the photosensitive glue **112**. Meanwhile, as the transparent conductive lines **112** extending from the display area **120** to the non-display area **122** are transparent, the UV radiation **116** can be absorbed by every part of the photosensitive glue **112**, which can thus be completely cured. As a result, an improved package and isolation effect can be obtained by the cured photosensitive glue **112**.

A driving chip **110** is then formed in the non-display area **122** of the substrate. The electrical connection between the driving chip **110** and the pixel structures **107** is achieved via the conductive transparent lines **108**.

Therefore, the active matrix organic light emitting diode display provided by the present invention comprises a substrate **100**, a driving chip **110**, a plurality of transparent conductive lines **300**, an encapsulating cap **114** and a photosensitive glue **112**.

The substrate **100** has a display area **120** and a non-display area **122**, where the display area **120** further comprises a plurality of pixel structures **107**, each including an active device (thin-film transistor), an anode layer **102**, a luminescent layer **104** and a cathode layer **106**. The driving chip **110** is located in the non-display area **122**. A plurality of transparent conductive lines **300** is formed on the substrate **100**. The transparent conductive lines **300** extend from the display area **120** towards the non-display area **122** to electrically connect the pixel structures **107** and the driving chip **110**. The material for forming the transparent conductive lines **300** includes indium tin oxide or indium zinc oxide.

The encapsulating cap **114** is located over the substrate **100** to cover the display area **120** of the substrate **100**. The photosensitive glue **112** is applied along a perimeter of the display area **120** on the substrate **100** to adhere the cap **114** and the substrate **100**.

It is appreciated that while forming the transparent conductive lines **300**, a power source line (not shown) may also be formed in the non-display area **122** of the substrate **160**. The power source line is electrically connected to the pixel structures **107** to provide source energy to the pixel structures **107** from an external power supply.

In addition, although the transparent conductive lines **300** (made of indium tin oxide or indium zinc oxide) for connecting the pixel structures **107** and the driving chip **110** has resistance relatively higher than that of metal, as the typical driving chip **110** hardly requires a large current, and the length of the transparent conductive lines **300** is only about 2 mm to about 4 mm (the distance between the pixel structures **107** and the driving chip **110**), the effect upon signal attenuation is very minor. Further, should signal is attenuated thereby, the attenuation can be compensated by increasing the signal voltage output from the driving chip **110**.

Accordingly, the present invention has the following advantages.

1. The present invention uses transparent conductive lines to provide electric connection between the pixel structures and the driving chip instead of using the fan-outs described above. Therefore, the problem of incomplete curing the UV glue is resolved in the present invention.

2. As the display area is sealed within the cap and the completely cured photosensitive glue, the internal device of the display will not be damaged by the moisture penetration.

3. The present invention thus improves the defect of the conventional structure and process, such that the reliability of the display is enhanced.

Other embodiments of the invention will appear to those skilled in the art from consideration of the specification and practice of the invention disclosed herein. It is intended that the specification and examples to be considered as exemplary only, with a true scope and spirit of the invention being indicated by the following claims.

What is claimed is:

1. An active matrix organic light emitting diode display, comprising:

a substrate, having a display area and a non-display area thereon and the display area further comprising a plurality of pixel structures thereon;

a driving chip, formed in the non-display area of the substrate;

a photosensitive glue, applied at a periphery of the display area on the substrate for adhering the cap with the substrate;

a plurality of transparent conductive lines disposed over the photosensitive glue; and

a sealing cap, over the substrate to cover the display area.

2. The display according to claim **1**, wherein material for forming the transparent conductive lines includes indium tin oxide or indium zinc oxide.

3. The display according to claim **1**, wherein the transparent conductive lines have a length between about 2 mm to about 4 mm.

4. The display according to claim **1**, wherein the photosensitive glue includes an ultra-violet glue.

5. The display according to claim **1**, wherein the cap includes a glass cap or a metal cap.

6. The display according to claim **1**, where in the plurality of transparent conductive lines extends from the display area to the non-display area to electrically connect the pixel structures and the driving chip.

* * * * *

专利名称(译)	有源矩阵有机发光二极管显示器及其制造方法		
公开(公告)号	US6737799	公开(公告)日	2004-05-18
申请号	US10/248336	申请日	2003-01-10
[标]申请(专利权)人(译)	LIH锦JOU SUNG CHIH冯		
申请(专利权)人(译)	LIH锦-JOU SUNG质枫		
当前申请(专利权)人(译)	友达光电股份有限公司		
[标]发明人	LIH JIIN JOU SUNG CHIH FENG		
发明人	LIH, JIIN-JOU SUNG, CHIH-FENG		
IPC分类号	H05B33/04 H01L27/32 H01L51/52 H05B33/00		
CPC分类号	H01L27/3244 H05B33/04 H01L51/5237 H01L51/5203 H01L51/524 H01L51/5243 H01L51/5246		
审查员(译)	帕特尔ASHOK		
优先权	091133680 2002-11-19 TW		
其他公开文献	US20040095062A1		
外部链接	Espacenet USPTO		

摘要(译)

一种有源矩阵有机发光二极管显示器及其制造方法。提供具有显示区域和非显示区域的基板。在显示区域中形成多个像素结构，并且在基板上形成用于电连接像素结构的多个透明导电线。透明导线从显示区域延伸到非显示区域。在显示区域的周边形成光敏胶，并形成盖以覆盖显示区域。使用光敏胶将盖子粘附到基板上。在基板的后表面上执行辐射步骤以固化光敏胶。经由透明导线电连接到像素结构的驱动芯片形成在非显示区域中。