



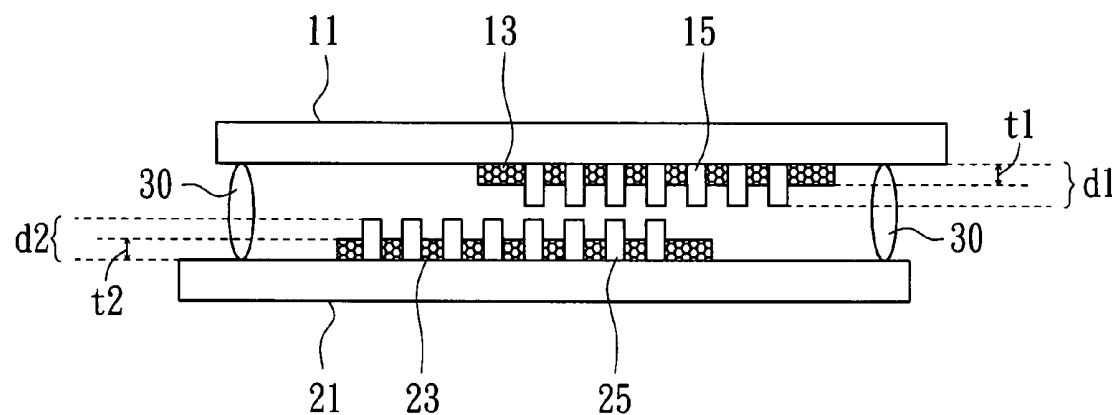
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(19) **United States**(12) **Patent Application Publication**
Lee(10) **Pub. No.: US 2007/0057629 A1**(43) **Pub. Date: Mar. 15, 2007**(54) **DOUBLE SIDED AMOLED DISPLAY AND
FABRICATING METHOD THEREOF****Publication Classification**(75) Inventor: **Chung-Chun Lee**, Lunbei Township
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ATLANTA, GA 30339-5948 (US)(57) **ABSTRACT**

A double sided display comprises a first substrate, a first organic light-emitting device (OLED) disposed on the first substrate, a first spacer, a second substrate, a second OLED disposed on the second substrate and a second spacer. The first and second spacers are disposed on the first and second substrates, and close to the first and second OLEDs, respectively. A height of the first spacer is larger than a thickness of the first OLED. A height of the second spacer is larger than a thickness of the second OLED. During assembly, the first substrate is disposed opposite to the second substrate, and the first spacer is disposed opposite to the second spacer. Also, the exact positions of the first and second spacers are determined for preventing the direct touch between the first and second OLEDs while the double sided display is deformed.

(73) Assignee: **AU Optronics Corp.**(21) Appl. No.: **11/371,856**(22) Filed: **Mar. 9, 2006**(30) **Foreign Application Priority Data**

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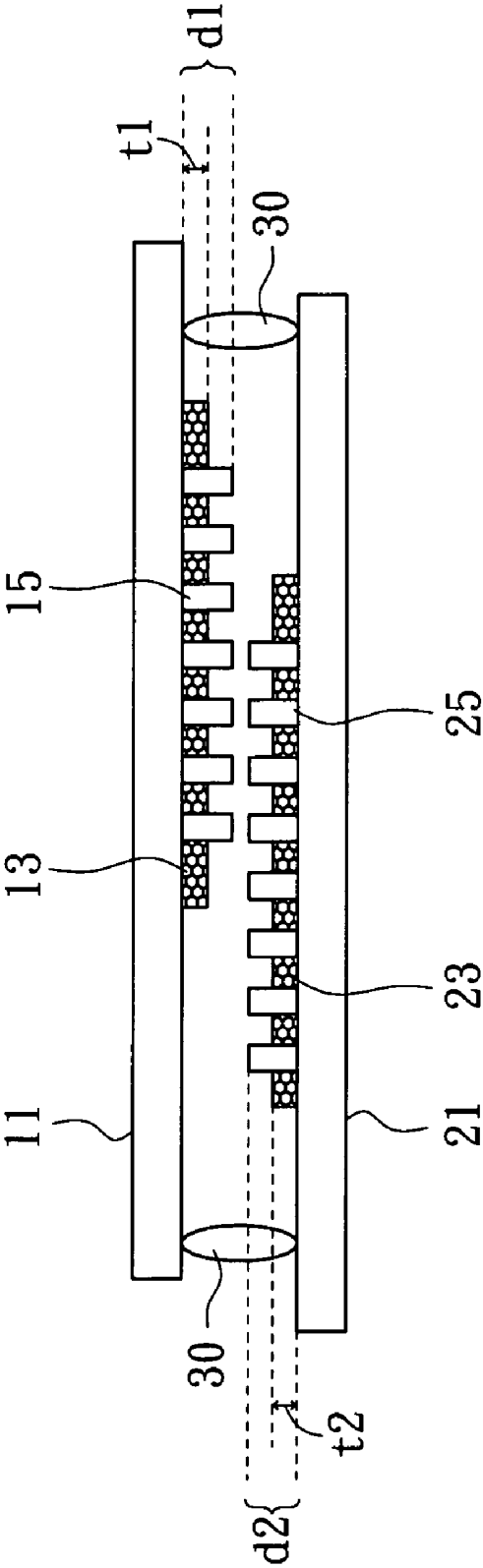


FIG. 1

DOUBLE SIDED AMOLED DISPLAY AND FABRICATING METHOD THEREOF

[0001] This application claims the benefit of Taiwan application Serial No. 094131234, filed Sep. 9, 2005, the subject matter of which is incorporated herein by reference.

BACKGROUND OF THE INVENTION

[0002] 1. Field of the Invention

[0003] The invention relates in general to a double sided display and fabricating method thereof, and more particularly to the double sided AMOLED display constructed for preventing the direct touch between the organic light-emitting devices (OLEDs) and fabricating method thereof.

[0004] 2. Description of the Related Art

[0005] With the increasing demand of the electronic products, especially the products with portability, the displays having great functions such as quick response, high resolution and vivid image have been developed. Besides the operational functions, it is one of major trends to develop an electronic product with lighter weight, smaller size, and even thinner form. Also, a double sided-type display is commonly applied for providing the user a more integrated electronic product.

[0006] Conventionally, a double sided-type display is constructed by integrating two liquid crystal displays (LCDs). For example, two LCDs can be assembled back-to-back to provide a double sided-type display. This conventional display disadvantageously possesses a bulky appearance (ex. about 8 mm to 10 mm in thick). Also, it increases the cost that the LCDs of the double sided-type display have to be fabricated individually before proceeding the assembling step. Thus, assembling the LCDs is not a proper design for making the double sided-type display. Regarding to a dual electroluminescent display (and denoted as "double sided display hereinafter"), it can be easily constructed by interposing two organic light-emitting devices (OLEDs) between two substrates (i.e. an upper substrate and a lower substrate). The resulting assembly of the double sided displayer not only possesses dual-panel function but also satisfy the requirements of lightweight, small size (thinner body in particular) and easy to carry.

[0007] However, the OLEDs disposed on the substrates of the double sided display may direct touch each other, while the substrates are deformed (e.g. bended) resulting from an external force unduly exerted on the display or the weight of the substrates itself. The OLEDs improperly touching each other may leave scratches on the cathodes of the OLEDs or cause current leakage during the operation, so as to degrade the image quality of the double sided display.

SUMMARY OF THE INVENTION

[0008] It is therefore an object of the present invention to provide an double sided display and fabricating method thereof for preventing the electroluminescent devices from direct touch by arranging the particular spacers at the predetermined positions; thus, the operational lifetime of the display is prolonged.

[0009] The present invention achieves the objects by providing a double sided display, comprising a first substrate; a first organic light-emitting device (OLED) formed on the

first substrate; at least one first spacer disposed on the first substrate and close to the first OLED; a second substrate substantially opposite to the first substrate; a second OLED, formed on the second substrate and disposed opposite to the first OLED; and at least one second spacer disposed on the second substrate and close to the second OLED, and the first spacer is substantially in alignment with the second spacer. Also, a height of the first spacer is larger than a thickness of the first OLED, and a height of the second spacer is larger than a thickness of the second OLED.

[0010] The present invention achieves the objects by providing a method for fabricating a double sided display, comprising:

[0011] providing a first substrate;

[0012] forming a first organic light-emitting device (OLED) on the first substrate;

[0013] disposing at least one first spacer on the first substrate and close to the first OLED, wherein a height of the first spacer is larger than a thickness of the first OLED;

[0014] providing a second substrate;

[0015] forming a second OLED on the second substrate;

[0016] disposing at least one second spacer on the second substrate and close to the second OLED, wherein a height of the second spacer is larger than a thickness of the second OLED; and

[0017] assembling the first substrate and the second substrate, and the first OLED substantially corresponding to the second OLED, and at least one first spacer is substantially in alignment with the second spacer.

[0018] Other objects, features, and advantages of the present invention will become apparent from the following detailed description of the preferred but non-limiting embodiment. The following description is made with reference to the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0019] FIG. 1 schematically illustrates a double sided display according to the preferred embodiment of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

[0020] In the present embodiment of the invention, a double sided display and fabricating method thereof are disclosed. It is noted that the embodiment disclosed herein is used for illustrating the present invention, but not for limiting the scope of the present invention. Additionally, the drawings used for illustrating the embodiments of the present invention only show the major characteristic parts in order to avoid obscuring the present invention. Accordingly, the specification and the drawings are to be regard as an illustrative sense rather than a restrictive sense.

[0021] FIG. 1 schematically illustrates a double sided display according to the preferred embodiment of the present invention. The double sided display comprises a first substrate 11, a first organic light-emitting device (OLED) 13 disposed on the first substrate 11, at least a first spacer 15, a second substrate 21, a second OLED 23 disposed on the

second substrate **21** and at least a second spacer **25**. The second substrate **21** is substantially opposite to the first substrate **11**. The first spacer **15** is disposed on the first substrate **11** and close to the first OLED **13**, and the second spacer **25** is disposed on the second substrate **21** and close to the second OLED **23**. The positions of the first spacer **15** and the second spacers **25** are associated; for example, the first spacer **15** is in alignment with the second spacers **25**. Also, in the practical application, both of the first spacer **15** and the second spacers **25** preferably contain a photoactive polymer. Examples of the photoactive polymer include epoxy resin, polyimide, phenolic resin, acryl resin and the like.

[0022] Noted that the height **d1** of the first spacer **15** is larger than the thickness **t1** of the first OLED **13**, and the height **d2** of the second spacer **25** is larger than the thickness **t2** of the second OLED **23**. Besides, it is known that the associated positions of the first spacer **15** and the second spacers **25** may include several conditions, such as the first spacer **15** and the second spacers **25** being arranged symmetrically, or the portions of the first spacer **15** and the second spacers **25** being overlapped. When the first substrate **11** and the second substrates **21** are deformed (e.g. bended) resulting from an external force unduly exerted thereon or the weight of the substrates itself, the first spacer **15** and the second spacers **25** will touch each other first for protecting the first OLED **13** and the second OLED **23** from damage.

[0023] In other word, the positions of the first spacer **15** and the second spacer **25** are optionally determined for preventing the direct touch between the first OLED **13** and second OLED **23** while the double sided display is deformed. In the practical fabrication, if one of the first spacer **15** and the second spacers **25** is settled, the position of the other spacer is limited consequently.

[0024] Moreover, the configuration of the first spacer **15** and the second spacer **25** has no limitation. In a practical application, the first spacer **15** and the second spacer **25** could be shaped as the strips, and the positions thereof are partially overlapped or symmetrically arranged. The height **d1** of the first spacer **15** and the height **d2** of the second spacer **25** are preferably about 0.1 μm to 50 μm . In the other application, several spherical objects could be distributed on the first substrate **11** and the second substrate **21**, functioning as the first spacers **15** and the second spacers **25**. Also, the positions of the first spherical spacers **15** and the second spherical spacers **25** are preferably symmetrical. If the display is deformed, the first spherical spacers **15** and the second spherical spacers **25** can touch each other for protecting the OLED from direct contact. The average first diameter of the first spherical spacers **15** and the average second diameter of the second spherical spacers **25** are preferably about 0.1 μm to 50 μm .

[0025] Additionally, the organic electroluminescent layer of the first OLED **13** and second OLED **23** may contain materials forming molecule-based light-emitting diodes substantially comprising the dyestuffs or pigments, or materials forming polymer-based light emitting. The light-emitting materials used in the first OLED **13** and second OLED **23** are not limited herein. Also, the image data received by the first OLED **13** and the second OLED **23** at a given time could be substantially identical or different. Besides, the first OLED **13** and the second OLED **23** of the embodiment

could be both driven by the passive matrix method (i.e. the double sided display denoted as a passive matrix organic light-emitting display (PMOLED)), or both driven by the active matrix method (i.e. the double sided display denoted as a active matrix organic light-emitting display (AMOLED)), or respectively driven by the passive and active matrix methods, depending on the requirements of the applications.

[0026] A method of fabricating the double sided display as shown in FIG. 1 is disclosed as follows. First, a first substrate **11** and a second substrate **21** are provided. The material of the first substrate **11** and the second substrate **21** could be glass or plastics with good transparency. A first light-emitting device (OLED) **13** is further formed on the first substrate **11**. A first protective layer (not shown) can be optionally formed on the first OLED **13** for the purpose of protection. Then, a first spacer **15** is disposed on the first substrate **11** and close to the first OLED **13**. The height **d1** (e.g. the thickness or the diameter) of the first spacer **15** is larger than the thickness **t1** of the first OLED **13**. Similarly, a second OLED **23** is formed on the second substrate **21**. A second protective layer (not shown) can be optionally formed on the second OLED **23** for the purpose of protection. The second spacer **25** is then disposed on the second substrate **21** and close to the second OLED **23**. The height **d2** (e.g. the thickness or the diameter) of the second spacer **25** is larger than the thickness **t2** of the second OLED **23**. To make a complete assembly, the first substrate **11** and the second substrate **21** are opposite placed together by providing a sealing adhesive **30** on one of the first substrate **11** and the second substrate **21**. Alternatively, the first and second protective layers can be optionally formed before the fabrication of the first and second, respectively.

[0027] Furthermore, a first polarized film (not shown) can be optionally attached to the first substrate **11**. Noted that the first polarized film and the first OLED **13** are positioned at the different sides of the first substrate **11**. Similarly, a second polarized film (not shown) can be optionally attached to the second substrate **21**. Noted that the second polarized film and the second OLED **23** are positioned at the different sides of the second substrate **21**.

[0028] According to the aforementioned description, the double sided display and fabricating method thereof use the spacers disposed at the associated positions of the first (i.e. upper) and second (i.e. lower) substrates, to make sure the gap (space between the substrates) varied within an acceptable range. When the substrates are deformed (e.g. bended) resulting from an external force unduly exerted on the display or the weight of the substrates itself, it has no direct touch between the OLEDs due to the arrangement of the spacers. Therefore, the convention problems such as scratches on the cathodes of the OLEDs or current leakage can be solved, and the operational lifetime of the double sided display is prolonged.

[0029] While the invention has been described by way of example and in terms of the preferred embodiment, it is to be understood that the invention is not limited thereto. On the contrary, it is intended to cover various modifications and similar arrangements and procedures, and the scope of the appended claims therefore should be accorded the broadest interpretation so as to encompass all such modifications and similar arrangements and procedures.

What is claimed is:

1. A double sided display, comprising:
 - a first substrate;
 - a first organic light-emitting device (OLED) formed on the first substrate;
 - at least one first spacer disposed on the first substrate and close to the first OLED;
 - a second substrate substantially opposite to the first substrate;
 - a second OLED formed on the second substrate, wherein the first OLED is disposed opposite to the first OLED; and
 - at least one second spacer disposed on the second substrate and close to the second OLED, wherein at least one first spacer is substantially in alignment with at least one second spacer;

wherein a height of the first spacer is larger than a thickness of the first OLED, and a height of the second spacer is larger than a thickness of the second OLED.
2. The double sided display of claim 1, wherein the first spacer and the second spacer are strip-shaped.
3. The double sided display of claim 1, wherein the first spacer has a height of about 0.1 μm to 50 μm .
4. The double sided display of claim 1, wherein the second spacer has a height of about 0.1 μm to 50 μm .
5. The double sided display of claim 1, wherein at least one first spacer comprises a first spherical spacer, and at least one second spacer comprises a second spherical spacer disposed substantially in alignment with the first spherical spacer.
6. The double sided display of claim 5, wherein the first spherical spacer has a diameter of about 0.1 μm to 50 μm .
7. The double sided display of claim 5, wherein the second spherical spacer has a diameter of about 0.1 μm to 50 μm .
8. The double sided display of claim 1, wherein at least one of the first spacer and the second spacer comprises a photoactive polymer.
9. The double sided display of claim 1, wherein at least one of the first OLED and the second OLED comprises a small molecule-based OLED.
10. The double sided display of claim 1, wherein at least one of the first OLED and the second OLED comprise a polymer-based OLED.
11. The double sided display of claim 1, wherein image data received by the first OLED is substantially different from image data received by the second OLED at the same time.
12. The double sided display of claim 1, wherein image data received by the first OLED is substantially identical to image data received by the second OLED at the same time.
13. The double sided display of claim 1, wherein at least one of the first OLED and the second OLED is driven by an active matrix method.
14. The double sided display of claim 1, wherein at least one of the first OLED and the second OLED is driven by a passive matrix method.
15. A method for fabricating a double sided display, comprising:
 - providing a first substrate;
 - forming a first organic light-emitting device (OLED) on the first substrate;
 - disposing at least one first spacer on the first substrate and close to the first OLED, wherein a height of the first spacer is larger than a thickness of the first OLED;
 - providing a second substrate;
 - forming a second OLED on the second substrate;
 - disposing at least one second spacer on the second substrate and close to the second OLED, wherein a height of the second spacer is larger than a thickness of the second OLED; and
 - assembling the first substrate and the second substrate, and the first OLED substantially corresponding to the second OLED, wherein at least one first spacer is substantially in alignment with at least one second spacer.

* * * * *

专利名称(译)	双面AMOLED显示器及其制造方法		
公开(公告)号	US20070057629A1	公开(公告)日	2007-03-15
申请号	US11/371856	申请日	2006-03-09
[标]申请(专利权)人(译)	友达光电股份有限公司		
申请(专利权)人(译)	友达光电.		
当前申请(专利权)人(译)	友达光电.		
[标]发明人	LEE CHUNG CHUN		
发明人	LEE, CHUNG-CHUN		
IPC分类号	H01L51/00		
CPC分类号	H01L25/048 H01L51/525 H01L27/3286 H01L27/3267 H01L2924/0002		
优先权	094131234 2005-09-09 TW		
其他公开文献	US7710030		
外部链接	Espacenet USPTO		

摘要(译)

双面显示器包括第一基板，设置在第一基板上的第一有机发光装置（OLED），第一间隔物，第二基板，设置在第二基板上的第二OLED和第二间隔物。第一和第二间隔物设置在第一和第二基板上，并分别靠近第一和第二OLED。第一间隔物的高度大于第一OLED的厚度。第二间隔物的高度大于第二OLED的厚度。在组装期间，第一基板与第二基板相对设置，第一间隔物与第二间隔物相对设置。而且，确定第一和第二间隔物的确切位置，以防止在双面显示器变形时第一和第二OLED之间的直接接触。

