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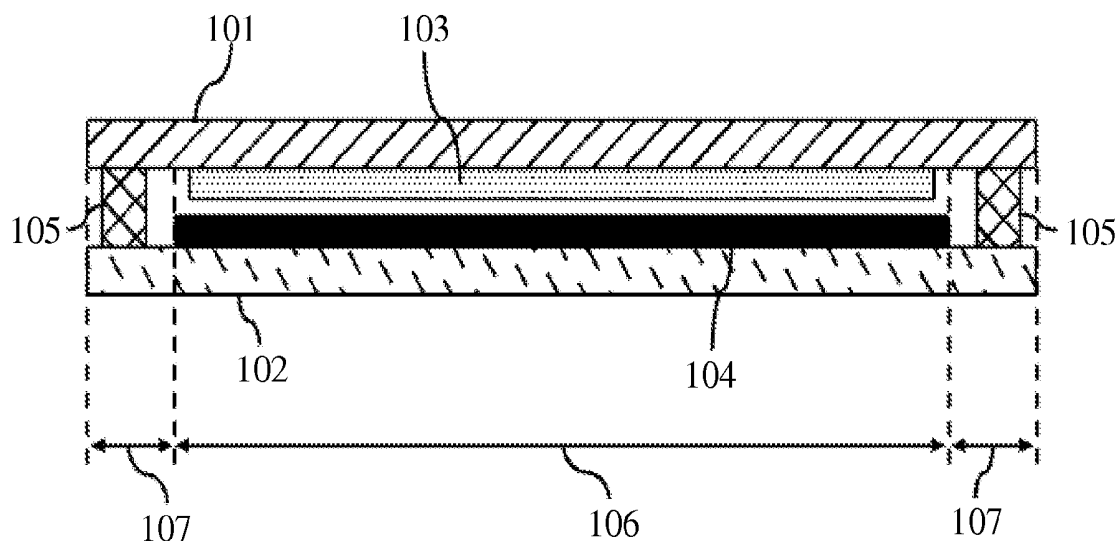
(19) **United States**(12) **Patent Application Publication**
YU(10) **Pub. No.: US 2016/0020432 A1**(43) **Pub. Date: Jan. 21, 2016**(54) **DISPLAY PANEL AND METHOD FOR
MANUFACTURING THE SAME****Publication Classification**(71) Applicant: **SHENZHEN CHINA STAR
OPTOELECTRONICS
TECHNOLOGY CO., LTD.,**
Guangdong (CN)(51) **Int. Cl.****H01L 51/56** (2006.01)**H01L 27/32** (2006.01)(52) **U.S. Cl.**CPC **H01L 51/56** (2013.01); **H01L 27/3272**
(2013.01)(72) Inventor: **Wei YU**, Guangdong (CN)(21) Appl. No.: **14/406,580**(57) **ABSTRACT**(22) PCT Filed: **Aug. 4, 2014**(86) PCT No.: **PCT/CN2014/083620**

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A display panel and a method for manufacturing the same are provided. The display panel comprises a substrate, an OLED device, a cover, at least one shielding element, and a sealant. The substrate has a first surface, and the OLED device is disposed on the first surface. The cover has a second surface, and the substrate and the cover are assembled into one piece, and the first surface and the second surface face each other. The shielding element is disposed on the second surface, and the sealant is disposed between the substrate and the cover.



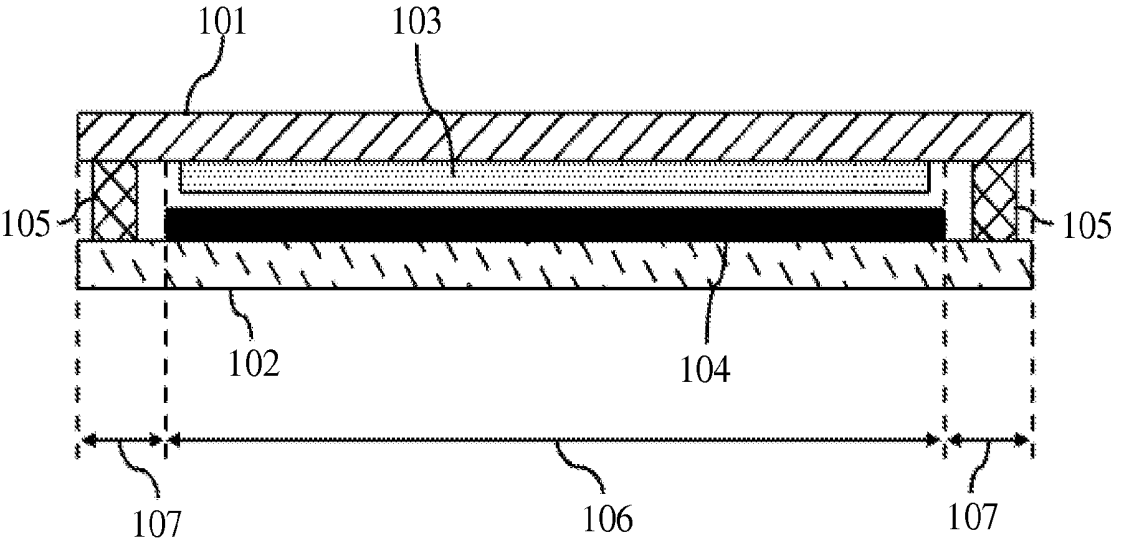


Fig.1

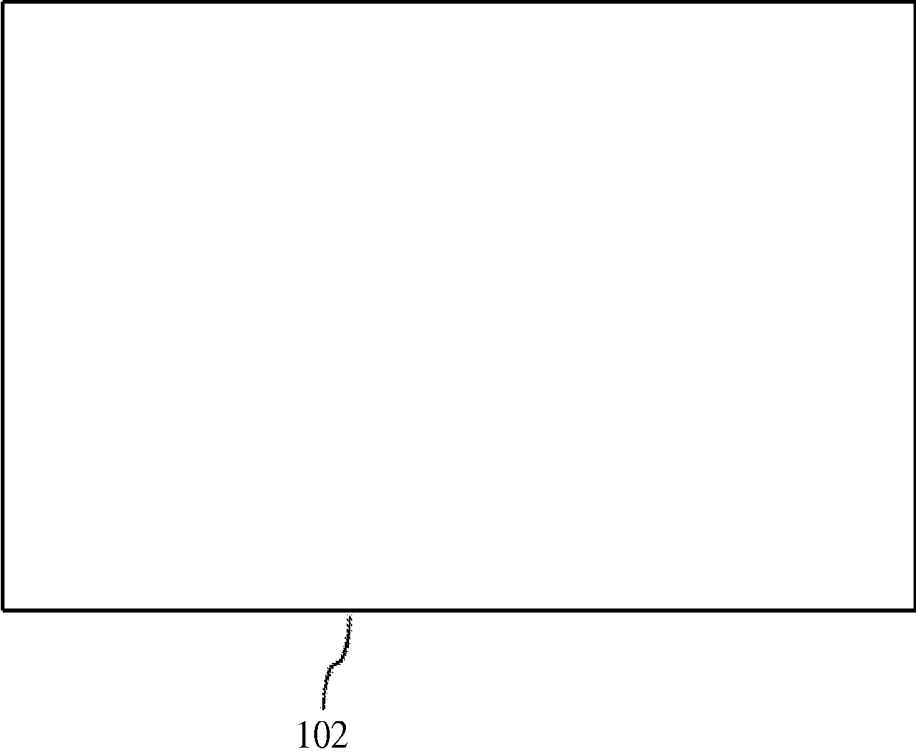


Fig.2

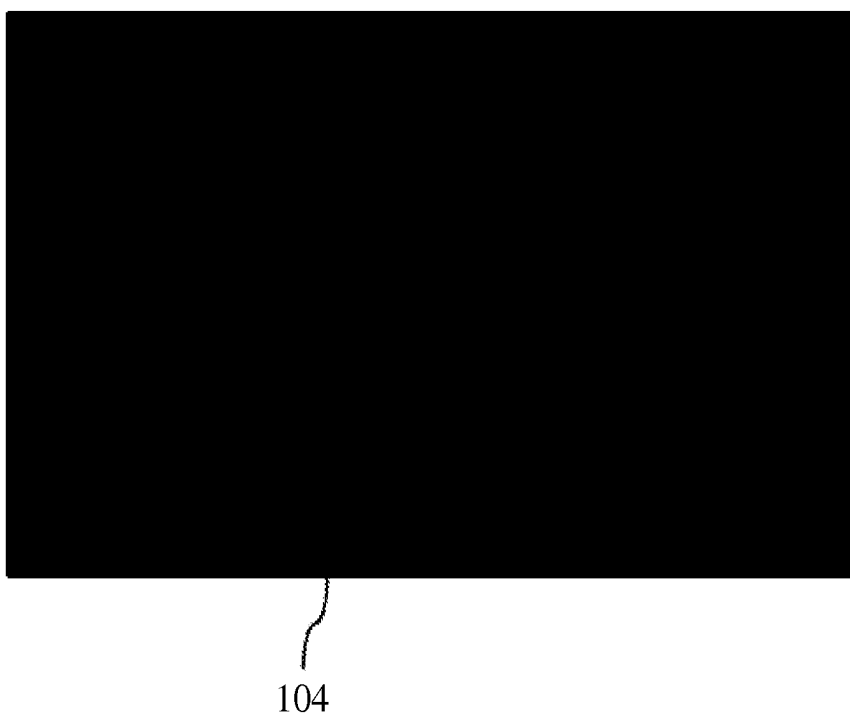


Fig.3

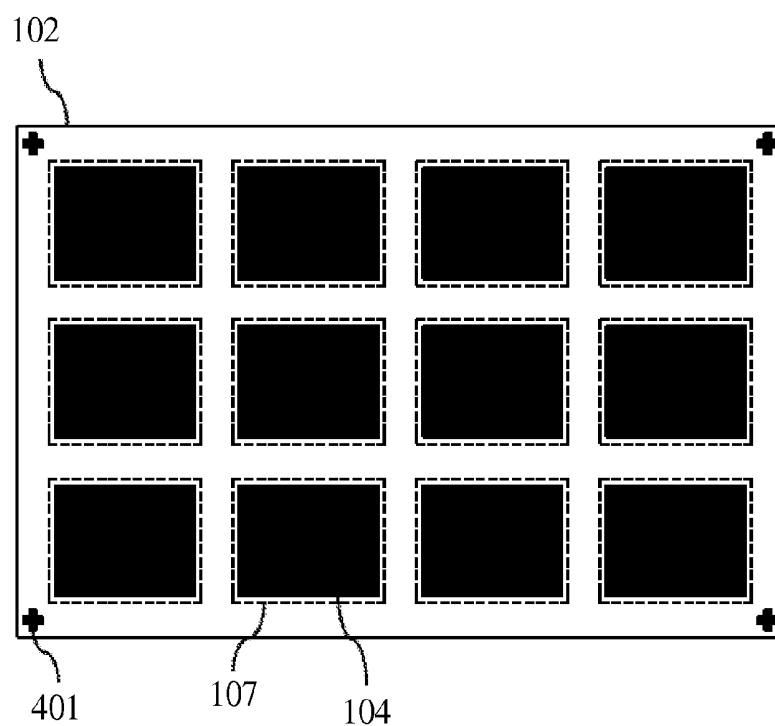


Fig.4

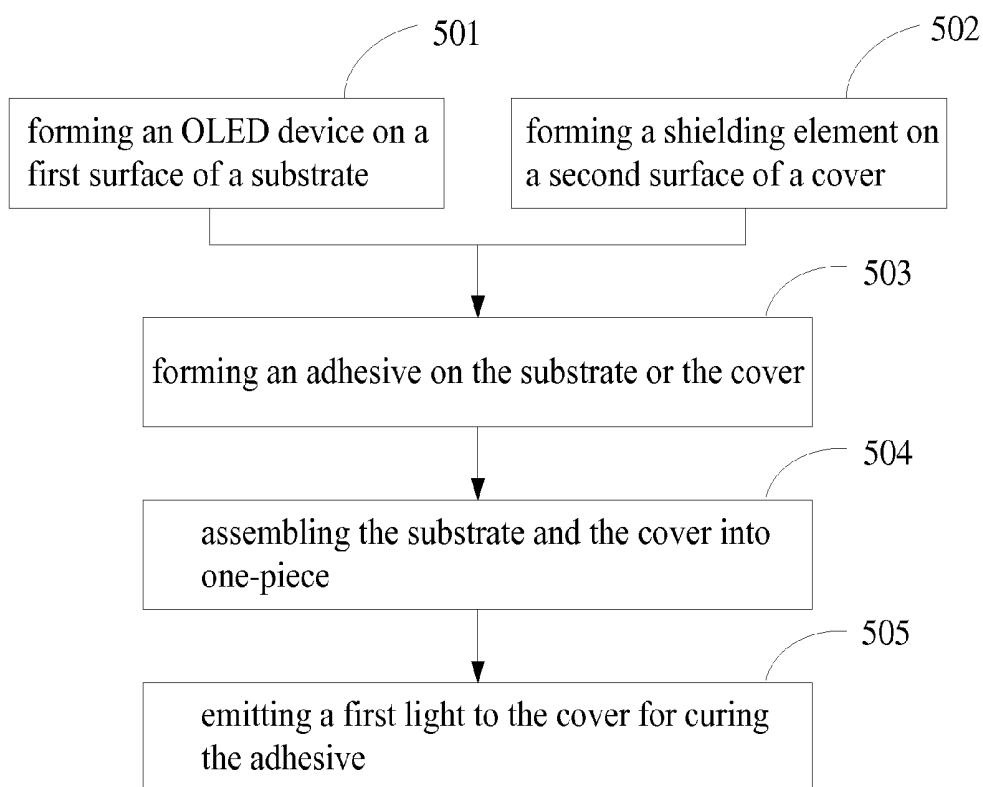


Fig.5

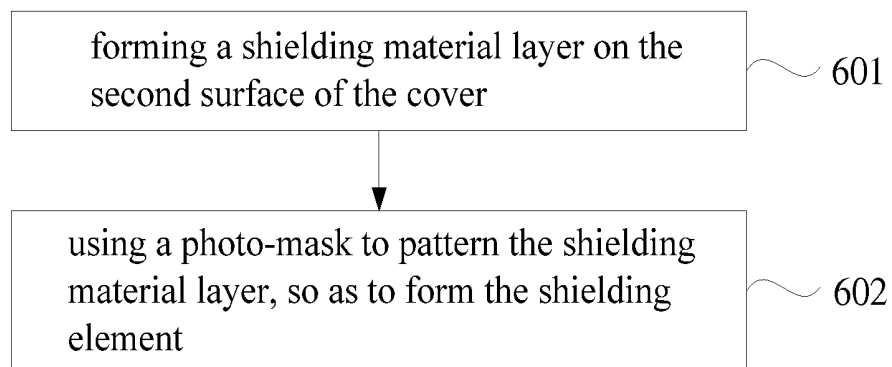


Fig.6

DISPLAY PANEL AND METHOD FOR MANUFACTURING THE SAME

FIELD OF THE INVENTION

[0001] The present invention relates to a display technology, and more particularly to a display panel and a method for manufacturing the same.

BACKGROUND OF THE INVENTION

[0002] In a conventional package process for an organic light emitting diode (OLED) display panel, a UV-curing adhesive is coated around a glass cover, and then the glass cover and a substrate are assembled into one piece. In this manner, a sealed space is formed between the glass cover, the substrate and the UV-curing adhesive, and an organic film is positioned in the sealed space.

[0003] When using a UV lamp to emit UV rays for curing the UV-curing adhesive, the organic film is damaged by the UV rays. Therefore, when emitting the UV rays to assemble the glass cover, the substrate, the UV-curing adhesive, and the organic film, a UV mask is required to shield an OLED lighting area (corresponding to the organic film), exposing only the UV-curing adhesive for curing.

[0004] However, different UV masks are required for display panels of different sizes. Moreover, the conventional package process for the OLED display panel is performed in a N₂ gas chamber, and it will take more than 6 hours from opening the N₂ gas chamber for replacing the UV mask to return to a qualified N₂ environment for packaging. Therefore, the process for replacing the UV mask is very time-consuming.

[0005] As a result, it is necessary to provide a new technology to solve the problems existing in the conventional technologies as described above.

SUMMARY OF THE INVENTION

[0006] The present invention provides a display panel and a method for manufacturing the same, so as to simplify the manufacturing process and to save production time.

[0007] A primary object of the present invention is to provide a display panel, comprising: a substrate having a first surface; an organic light emitting diode (OLED) device disposed on the first surface of the substrate; a cover having a second surface, wherein the substrate and the cover are assembled into one piece, and the first surface and the second surface face each other; at least one shielding element disposed on the second surface of the cover; and a sealant disposed between the substrate and the cover. The first surface of the substrate has a display area and at least two non-display areas, and the at least two non-display areas are positioned at more than two sides of the display area, and the OLED device is disposed in the display area, and the shielding element is disposed on the second surface and corresponding to the display area, and the sealant is disposed in the non-display areas. The OLED device includes a cathode layer, an organic material layer, and an anode layer; the organic material layer is disposed between the cathode layer and the anode layer, and the OLED device is configured to display images when a voltage is applied to the organic material layer between the cathode layer and the anode layer.

[0008] In the above-mentioned display panel, the sealant is formed by using a first light to cure an adhesive in the display area.

[0009] In the above-mentioned display panel, the shielding element is configured to shield the OLED device from the first light when using the first light to cure the sealant.

[0010] In the above-mentioned display panel, the OLED device has a first projection on the first surface, and the shielding element has a second projection on the first surface, and the second projection overlaps the first projection.

[0011] In the above-mentioned display panel, the sealant has a third projection on the first surface without overlapping with the second projection.

[0012] In the above-mentioned display panel, the at least one shielding element is formed by using a photo-mask to pattern a shielding material layer on the second surface of the cover.

[0013] In the above-mentioned display panel, the cover includes marks on the second surface, and the marks are configured to position the cover and the substrate when assembling the cover and the substrate into one-piece.

[0014] In the above-mentioned display panel, the shielding elements and the marks are formed in one photo-mask process.

[0015] Another object of the present invention is to provide a display panel, comprising: a substrate having a first surface; an OLED device disposed on the first surface of the substrate; a cover having a second surface, wherein the substrate and the cover are assembled into one piece, and the first surface and the second surface face each other; at least one shielding element disposed on the second surface of the cover; and a sealant disposed between the substrate and the cover.

[0016] In the above-mentioned display panel, the first surface of the substrate has a display area and at least two non-display areas, and the at least two non-display areas are positioned at more than two sides of the display area, and the OLED device is disposed in the display area, and the shielding element is disposed on the second surface and corresponding to the display area, and the sealant is disposed in the non-display areas.

[0017] In the above-mentioned display panel, the sealant is formed by using a first light to cure an adhesive in the display area.

[0018] In the above-mentioned display panel, the shielding element is configured to shield the OLED device from the first light when using the first light to cure the sealant.

[0019] In the above-mentioned display panel, the OLED device has a first projection on the first surface, and the shielding element has a second projection on the first surface, and the second projection overlaps the first projection.

[0020] In the above-mentioned display panel, the sealant has a third projection on the first surface without overlapping with the second projection.

[0021] In the above-mentioned display panel, the at least one shielding element is formed by using a photo-mask to pattern a shielding material layer on the second surface of the cover.

[0022] In the above-mentioned display panel, the cover includes marks on the second surface, and the marks are configured to position the cover and the substrate when assembling the cover and the substrate into one-piece.

[0023] In the above-mentioned display panel, the shielding elements and the marks are formed in one photo-mask process.

[0024] Still another object of the present invention is to provide a method for manufacturing the above-mentioned display panel, comprising: forming the OLED device on the

first surface of the substrate; forming the shielding element on the second surface of the cover; forming an adhesive on the substrate or the cover; assembling the substrate having the OLED device and the cover having the shielding elements into one-piece, wherein the shielding elements, the OLED device, and the adhesive are positioned between the substrate and the cover; and emitting a first light to a display area and non-display areas in the substrate and the cover, so as to cure the adhesive.

[0025] In the above-mentioned method for manufacturing the display panel, the step of forming the shielding element on the second surface of the cover comprises: forming a shielding material layer on the second surface of the cover; and using a photo-mask to pattern the shielding material layer, so as to form the shielding elements.

[0026] In the above-mentioned method for manufacturing the display panel, the step of emitting the first light to the display area and the non-display areas in the substrate and the cover comprises: using the shielding elements to shield the display area from the first light, so as to prevent the OLED device from being emitted by the first light.

[0027] In comparison with the conventional technology, with the use of the present invention, the UV mask is not required and the process for replacing the UV mask can be omitted without opening the N₂ gas chamber, thereby saving the time (at least 6 hours) required for replacing the qualified N₂ gas environment, as well as solving the position error problem between the UV mask and the glass substrate (the substrate or the cover).

[0028] The structure and the technical means adopted by the present invention to achieve the above and other objects can be best understood by referring to the following detailed description of the preferred embodiments and the accompanying drawings.

DESCRIPTION OF THE DRAWINGS

[0029] FIG. 1 is a schematic diagram showing a display panel according to an embodiment of the present invention;

[0030] FIG. 2 is a schematic diagram showing the cover without being assembled to the substrate;

[0031] FIG. 3 is a schematic diagram showing a shielding material layer on the cover;

[0032] FIG. 4 is a schematic diagram showing shielding elements on the cover by patterning the shielding material layer;

[0033] FIG. 5 is a flowchart showing a method for manufacturing the display panel according to an embodiment of the present invention; and

[0034] FIG. 6 is a flowchart showing steps for forming the shielding elements on the second surface of the cover.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0035] The following embodiments are referring to the accompanying drawings for exemplifying specific implementable embodiments of the present invention.

[0036] FIG. 1 is a schematic diagram showing a display panel according to an embodiment of the present invention.

[0037] The display panel comprises a substrate 101, a cover 102, an OLED device 103, at least one shielding element 104, and at least one sealant 105.

[0038] The substrate 101 can be a transparent substrate (such as a glass substrate) and has a first surface, and the

OLED device 103 is disposed on the first surface of the substrate 101. The OLED device 103 includes a cathode layer, an organic material layer, and an anode layer; the organic material layer is disposed between the cathode layer and the anode layer. The OLED device 103 is configured to display images when a voltage is applied to the organic material layer between the cathode layer and the anode layer, and the images can be shown from the transparent substrate.

[0039] The cover 102 has a second surface, and the substrate 101 and the cover 102 can be assembled into one piece, and the first surface of the substrate 101 is opposite the second surface of the cover 102. That is, the first surface and the second surface face each other. The at least one shielding element 104 is disposed on the second surface of the cover 102, and the sealant 105 is disposed between the substrate 101 and the cover 102 for sealing a space formed between the substrate 101 and the cover 102. In particular, the sealant 105 is configured to seal the OLED device 103 between the substrate 101 and the cover 102.

[0040] In this embodiment, the first surface of the substrate 101 has a display area 106 and at least two non-display areas 107, and the at least two non-display areas 107 are positioned at more than two sides of the display area 106. The OLED device 103 is disposed in the display area 106, and the shielding element 104 is disposed on the second surface and corresponding to the display area 106, and the sealant 105 is disposed in the non-display areas 107.

[0041] In this embodiment, the sealant 105 is formed by using a first light (such as a UV light) to cure an adhesive in the display area 106.

[0042] In this embodiment, the shielding element 104 is configured to shield the OLED device 103 from the first light when using the first light to cure the sealant 105.

[0043] In this embodiment, the OLED device 103 has a first projection on the first surface, and the shielding element 104 has a second projection on the first surface, and the second projection can completely overlap or cover the first projection. That is, in a direction perpendicular to the first surface, the shielding element 104 can completely cover or shield the OLED device 103. The sealant 105 has a third projection on the first surface without overlapping with the second projection. That is, in the direction perpendicular to the first surface, the sealant 105 (the adhesive) is not shielded by the shielding element 104.

[0044] Referring to FIG. 2 through FIG. 4, FIG. 2 is a schematic diagram showing the cover 102 without being assembled to substrate, FIG. 3 is a schematic diagram showing a shielding material layer on the cover 102, and FIG. 4 is a schematic diagram showing shielding elements on the cover 102 by patterning the shielding material layer.

[0045] In this embodiment, the shielding elements 104 are formed by using a photo-mask to pattern the shielding material layer (such as a black matrix layer) on the second surface of the cover 102.

[0046] More specifically, as shown in FIG. 2, the cover 102 is provided. As shown in FIG. 3, the shielding material layer is formed on the second surface of the cover 102 by coating, depositing and/or sputtering. Thereafter, the photo-mask is used to pattern the shielding material layer, so as to form at least one first predetermined pattern and at least one second predetermined pattern. Herein, the first predetermined pattern corresponds to the shape and area of the shielding elements 104, and the second predetermined pattern corresponds to the shape and area of marks 401 of the cover 102. The marks 401

are configured to position the cover **102** and the substrate **101** when assembling the cover **102** and the substrate **101** into one piece. Thereafter, in addition to the first predetermined pattern and second predetermined pattern, the other portions of the shielding material layer are removed from the cover **102**, so as to form the shielding elements **104**.

[0047] In other words, the shielding elements **104** and the marks **401** for positioning the cover **102** and the substrate **101** can be formed by the same photo-mask (in one photo-mask process).

[0048] In addition, after assembling the substrate **101** having the OLED device **103** and the cover **102** having the shielding elements **104**, and curing the sealant, the cover **102** and the substrate **101** can be cut or diced into a plurality of display panels, as shown in FIG. 1.

[0049] In that manner, the adhesive of the sealant can be cured without an additional UV mask, thereby solving a position error problem between the UV mask and the cover **102**, as well as solving a mask replacing problem when replacing the UV mask in the N₂ gas chamber. In that manner, the first light can be directly emitted to the cover **102** for curing the adhesive of the sealant without the additional UV mask, thereby reducing the process time and steps for manufacturing the display panel. Furthermore, it is not required to replace the qualified N₂ gas environment for packaging after changing the UV mask from a N₂ gas chamber, thereby saving the process time (at least 6 hours) required for manufacturing the display panel.

[0050] Referring to FIGS. 5 and 6, FIG. 5 is a flowchart showing a method for manufacturing the display panel according to an embodiment of the present invention, and FIG. 6 is a flowchart showing steps for forming the shielding elements **104** on the second surface of the cover **102**.

[0051] In this embodiment, the method for manufacturing the display panel comprises the following steps.

[0052] In a step **501**, the OLED device **103** is formed on the first surface of the substrate **101**.

[0053] In a step **502**, the shielding element **104** is formed on the second surface of the cover **102**.

[0054] In a step **503**, an adhesive is formed on the substrate **101** or the cover **102**.

[0055] In a step **504**, the substrate **101** having the OLED device **103** and the cover **102** having the shielding elements **104** are assembled into one piece, wherein the shielding elements **104**, the OLED device **103**, and the adhesive are positioned between the substrate **101** and the cover **102**.

[0056] In a step **505**, the first light is emitted to the display area **106** and the non-display areas **107** in the substrate **101** and the cover **102**, so as to cure the adhesive of the sealant.

[0057] Herein, the step **501** and the step **502** can be performed regardless of the order. That is, the step **501** and the step **502** can be performed simultaneously or sequentially.

[0058] In addition, after assembling the substrate **101** having the OLED device **103** and the cover **102** having the shielding elements **104**, and curing the sealant, the cover **102** and the substrate **101** can be cut or diced into a plurality of display panels, as shown in FIG. 1.

[0059] In this embodiment, the step of forming the shielding element **104** on the second surface of the cover **102** (i.e. the step **502**) comprises the following steps.

[0060] In a step **601**, the shielding material layer is formed on the second surface of the cover **102**.

[0061] In a step **602**, the photo-mask is used to pattern the shielding material layer, so as to form the shielding elements **104**.

[0062] More specifically, as shown in FIG. 2, the cover **102** is provided. As shown in FIG. 3, the shielding material layer is formed on the second surface of the cover **102** by coating, depositing and/or sputtering. Thereafter, the photo-mask is used to pattern the shielding material layer, so as to form the at least one first predetermined pattern and the at least one second predetermined pattern. Herein, the first predetermined pattern corresponds to the shape and area of the shielding elements **104**, and the second predetermined pattern corresponds to the shape and area of marks **401** of the cover **102**. The marks **401** are configured to position the cover **102** and the substrate **101** when assembling the cover **102** and the substrate **101** into one piece. Thereafter, in addition to the first predetermined pattern and second predetermined pattern, the other portions of the shielding material layer are removed from the cover **102**, so as to form the shielding elements **104**.

[0063] The shielding elements **104** and the marks **401** can be formed in one photo-mask process, wherein the marks **401** are configured to position the cover **102** and the substrate **101**.

[0064] In this embodiment, when emitting the first light to the display area **106** and the non-display areas **107** in the substrate **101** and the cover **102**, the shielding elements **104** are used to shield or cover the display area **106** from the first light, so as to prevent the OLED device **103** from being emitted by the first light.

[0065] In that manner, the adhesive of the sealant can be cured without an additional UV mask, thereby solving a position error problem between the UV mask and the cover **102**, as well as solving a mask replacing problem when replacing the UV mask in the N₂ chamber. In that manner, the first light can be directly emitted to the cover **102** for curing the adhesive of the sealant without the additional UV mask, thereby reducing the process time and steps for manufacturing the display panel. Furthermore, it is not required to replace the qualified N₂ gas environment for packaging after changing the UV mask from a N₂ gas chamber, thereby saving the process time (at least 6 hours) required for manufacturing the display panel.

[0066] In the present invention, the shielding elements **104** and the marks **401** on the package cover **102** can be formed in one photo-mask process, wherein the shielding elements **104** are configured to replace the UV mask for shielding UV rays.

[0067] After assembling the substrate **101** having the OLED device **103** and the cover **102** having the shielding elements **104** into one piece, the shielding elements **104** can shield or cover the OLED device **103** (the organic material layer or organic film), and the adhesive of the at least one sealant **105** around the OLED device **103** can be exposed to be cured by the UV rays. For the display panels of different sizes, the shielding elements **104** of corresponding sizes can be formed. Therefore, the UV mask is not required and the process for replace the UV mask can be omitted without opening the N₂ gas chamber, thereby saving the time (at least 6 hours) required for replacing the qualified N₂ gas environment, as well as solving the position error problem between the UV mask and the glass substrate (the substrate **101** or the cover **102**).

[0068] The present invention has been described with preferred embodiments thereof and it is understood that many changes and modifications to the described embodiments can

be carried out without departing from the scope and the spirit of the invention that is intended to be limited only by the appended claims.

What is claimed is:

1. A display panel, comprising:
a substrate having a first surface;
an organic light emitting diode (OLED) device disposed on the first surface of the substrate;
a cover having a second surface, wherein the substrate and the cover are assembled into one piece, and the first surface and the second surface face each other;
at least one shielding element disposed on the second surface of the cover; and
a sealant disposed between the substrate and the cover;
wherein the first surface of the substrate has a display area and at least two non-display areas, and the at least two non-display areas are positioned at more than two sides of the display area, and the OLED device is disposed in the display area, and the shielding element is disposed on the second surface and corresponding to the display area, and the sealant is disposed in the non-display areas;
wherein the OLED device includes a cathode layer, an organic material layer and an anode layer, and the organic material layer is disposed between the cathode layer and the anode layer, and the OLED device is configured to display images when a voltage is applied to the organic material layer between the cathode layer and the anode layer.
2. The display panel according to claim 1, wherein the sealant is formed by using a first light to cure an adhesive in the display area.
3. The display panel according to claim 2, wherein the shielding element is configured to shield the OLED device from the first light when using the first light to cure the sealant.
4. The display panel according to claim 3, wherein the OLED device has a first projection on the first surface, and the shielding element has a second projection on the first surface, and the second projection overlaps the first projection.
5. The display panel according to claim 4, wherein the sealant has a third projection on the first surface without overlapping with the second projection.
6. The display panel according to claim 1, wherein the at least one shielding element is formed by using a photo-mask to pattern a shielding material layer on the second surface of the cover.
7. The display panel according to claim 6, wherein the cover includes marks on the second surface, and the marks are configured to position the cover and the substrate when assembling the cover and the substrate into one piece.
8. The display panel according to claim 7, wherein the shielding elements and the marks are formed in one photo-mask process.
9. A display panel, comprising:
a substrate having a first surface;
an OLED device disposed on the first surface of the substrate;
a cover having a second surface, wherein the substrate and the cover are assembled into one piece, and the first surface and the second surface face each other;
at least one shielding element disposed on the second surface of the cover; and
a sealant disposed between the substrate and the cover.
10. The display panel according to claim 9, wherein the first surface of the substrate has a display area and at least two non-display areas, and the at least two non-display areas are positioned at more than two sides of the display area, and the OLED device is disposed in the display area, and the shielding element is disposed on the second surface and corresponding to the display area, and the sealant is disposed in the non-display areas.
11. The display panel according to claim 10, wherein the sealant is formed by using a first light to cure an adhesive in the display area.
12. The display panel according to claim 11, wherein the shielding element is configured to shield the OLED device from the first light when using the first light to cure the sealant.
13. The display panel according to claim 12, wherein the OLED device has a first projection on the first surface, and the shielding element has a second projection on the first surface, and the second projection overlaps the first projection.
14. The display panel according to claim 13, wherein the sealant has a third projection on the first surface without overlapping with the second projection.
15. The display panel according to claim 10, wherein the at least one shielding element is formed by using a photo-mask to pattern a shielding material layer on the second surface of the cover.
16. The display panel according to claim 15, wherein the cover includes marks on the second surface, and the marks are configured to position the cover and the substrate when assembling the cover and the substrate into one piece.
17. The display panel according to claim 16, wherein the shielding elements and the marks are formed in one photo-mask process.
18. A method for manufacturing the display panel according to claim 9, comprising:
forming the OLED device on the first surface of the substrate;
forming the shielding element on the second surface of the cover;
forming an adhesive on the substrate or the cover;
assembling the substrate having the OLED device and the cover having the shielding elements into one piece, wherein the shielding elements, the OLED device, and the adhesive are positioned between the substrate and the cover; and
emitting a first light to a display area and non-display areas in the substrate and the cover, so as to cure the adhesive.
19. The method for manufacturing the display panel according to claim 18, wherein the step of forming the shielding element on the second surface of the cover comprises:
forming a shielding material layer on the second surface of the cover; and
using a photo-mask to pattern the shielding material layer, so as to form the shielding elements.
20. The method for manufacturing the display panel according to claim 18, wherein the step of emitting the first light to the display area and the non-display areas in the substrate and the cover comprises:
using the shielding elements to shield the display area from the first light, so as to prevent the OLED device from being emitted by the first light.

专利名称(译)	显示面板及其制造方法		
公开(公告)号	US20160020432A1	公开(公告)日	2016-01-21
申请号	US14/406580	申请日	2014-08-04
[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	YU WEI		
发明人	YU, WEI		
IPC分类号	H01L51/56 H01L27/32		
CPC分类号	H01L27/3272 H01L51/56 H01L51/5246		
优先权	201410340495.2 2014-07-17 CN		
外部链接	Espacenet USPTO		

摘要(译)

提供了一种显示面板及其制造方法。显示面板包括基板，OLED器件，盖，至少一个屏蔽元件和密封剂。基板具有第一表面，并且OLED器件设置在第一表面上。盖体具有一第二表面，且基板与盖体组装成一体，且第一表面与第二表面彼此相对。遮蔽元件设置于第二表面，密封胶设置于基板与盖板之间。

