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(54) **DISPLAY PANEL AND DISPLAY DEVICE**

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G02F 1/1335 (2006.01)

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(2013.01); **G02F 1/1341** (2013.01)

(58) **Field of Classification Search**

CPC combination set(s) only.

See application file for complete search history.

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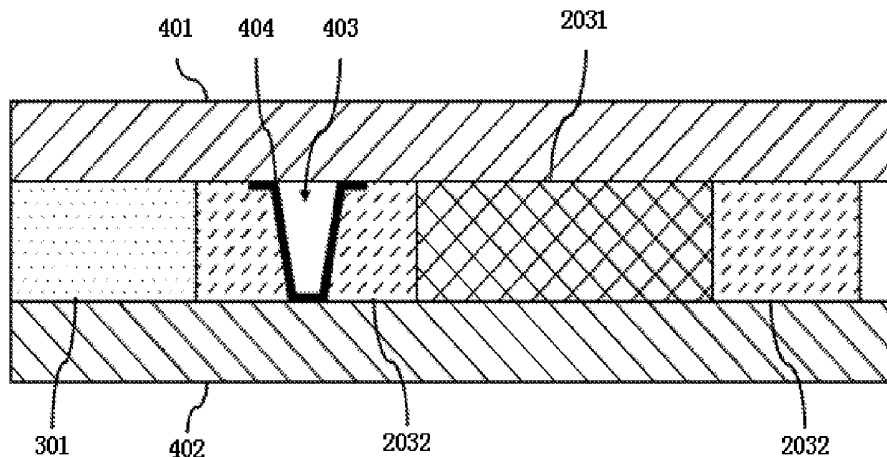
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(57) **ABSTRACT**

A display panel and a display device are provided. The display panel has a color filter substrate, a thin film transistor array substrate, a liquid crystal layer, and a sealing element. The sealing element is disposed on a non-active area of a liquid crystal cell. The sealing element has at least four sealing sections having beginnings and ends connected to each other. The sealing sections have at least one sealant segment and at least one color resist segment. The at least one sealant segment and the at least one color resist segment are integrated with each other. A narrow frame of the display panel is achieved.

16 Claims, 10 Drawing Sheets



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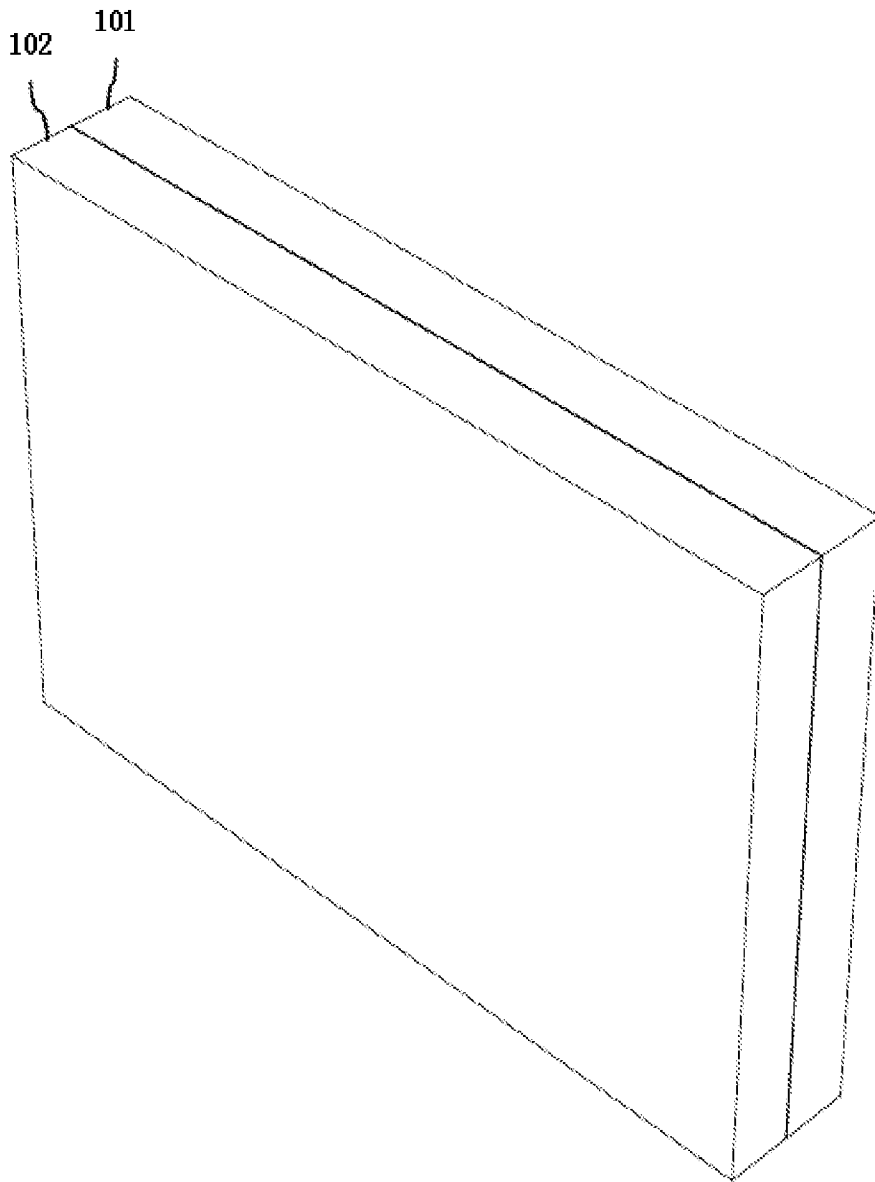


Fig.1

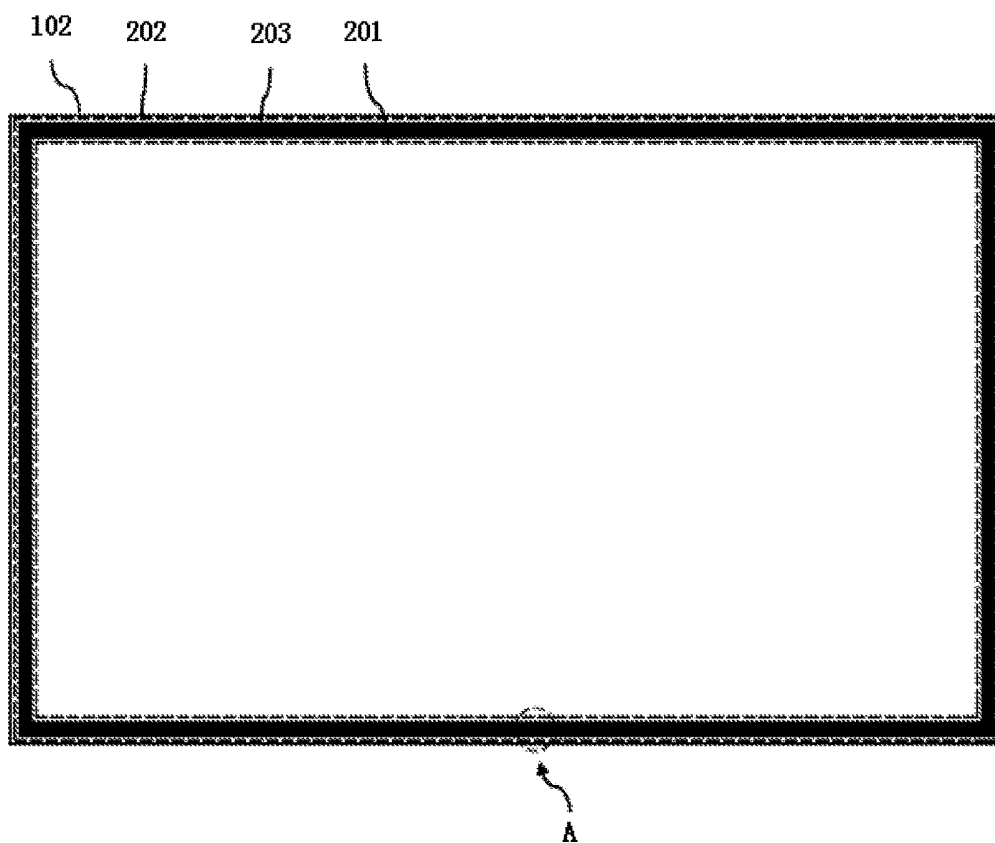


Fig.2

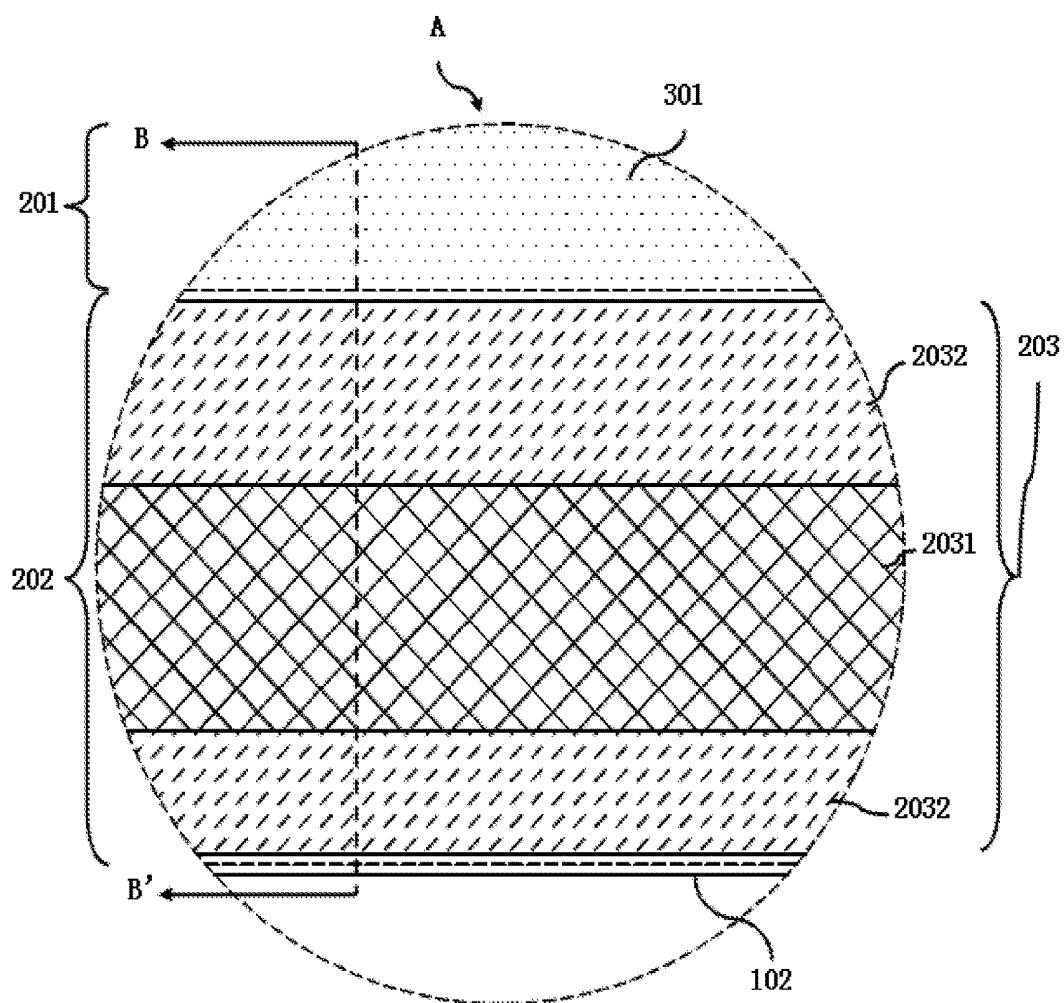


Fig.3

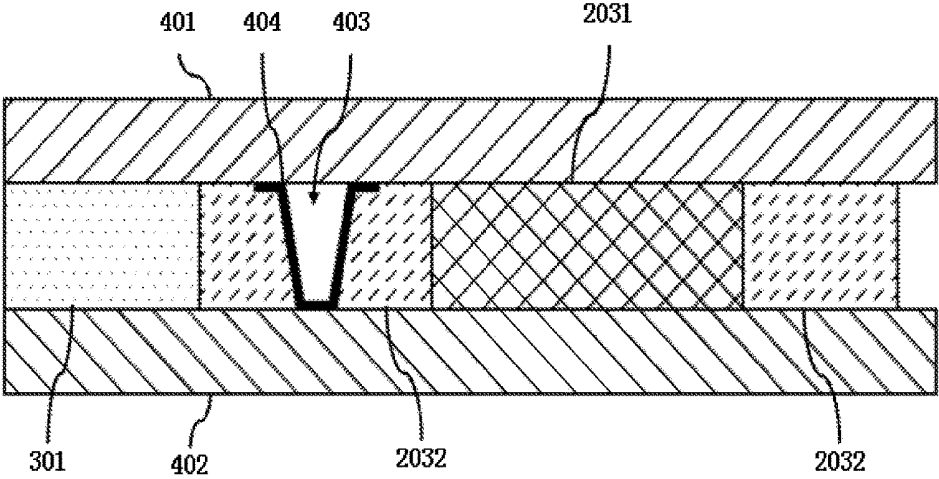


Fig.4

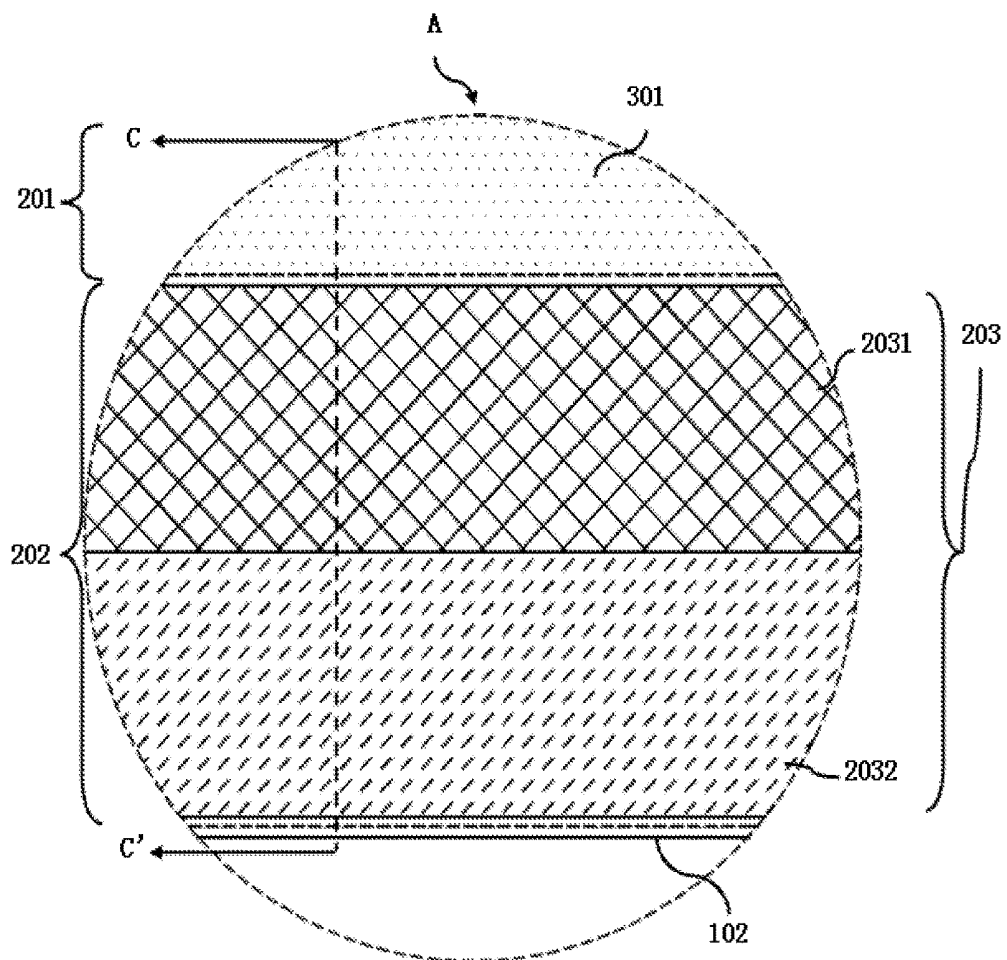


Fig.5

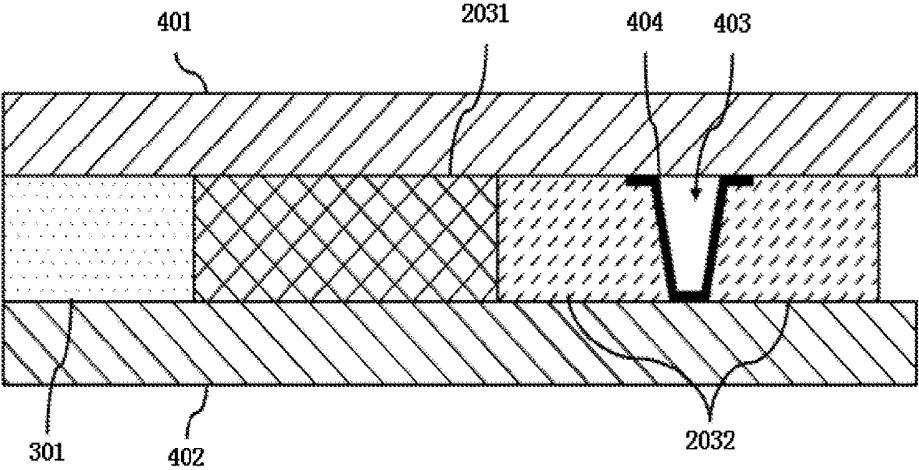


Fig.6

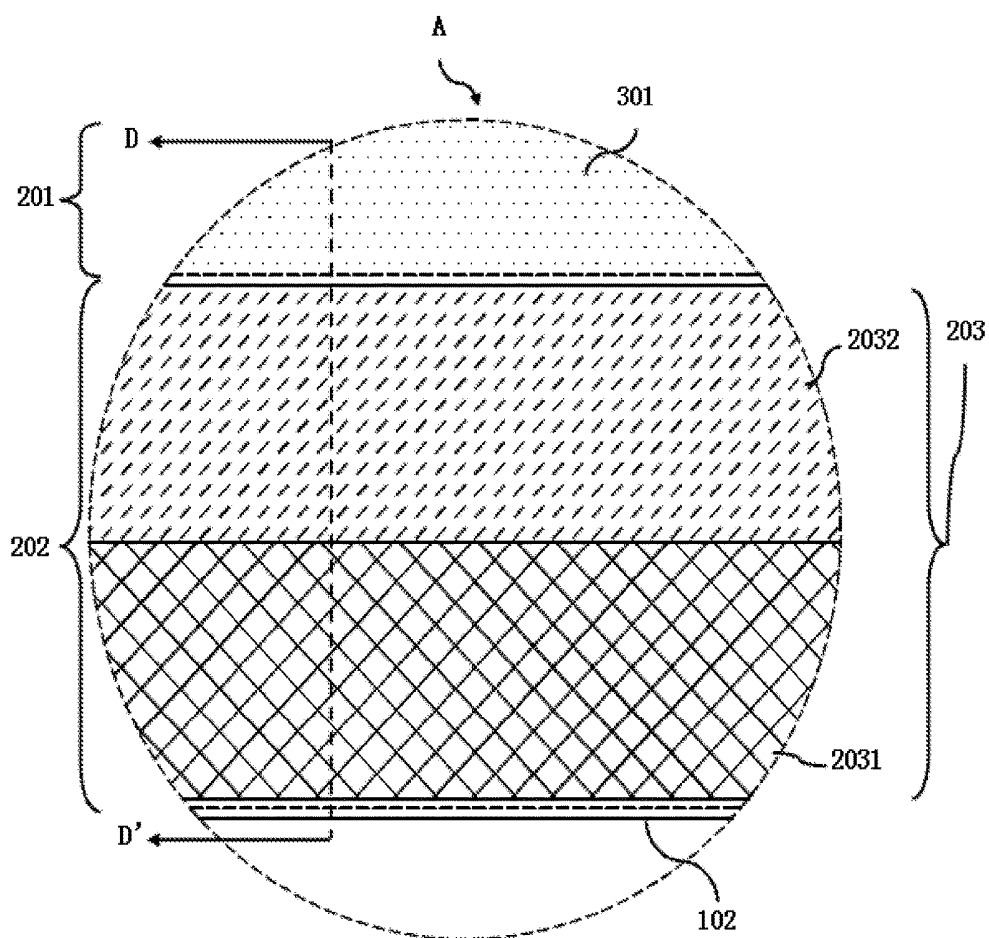


Fig.7

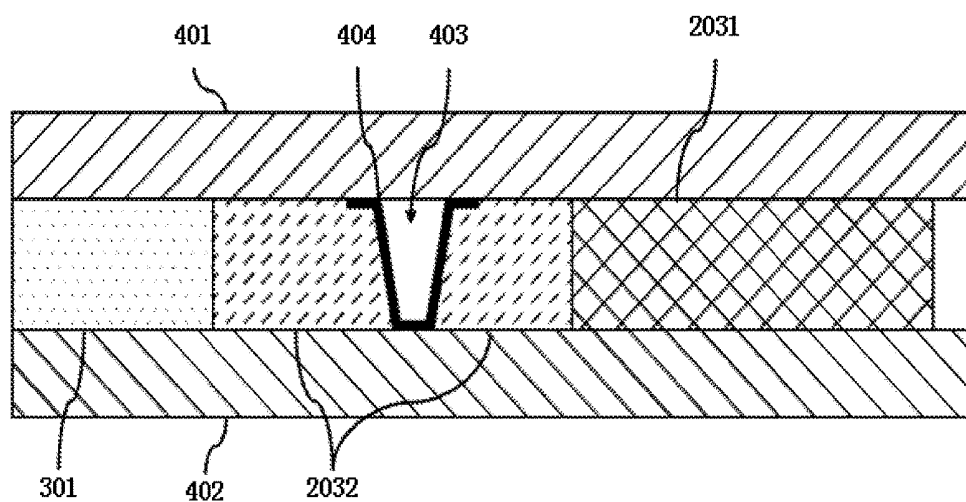


Fig.8

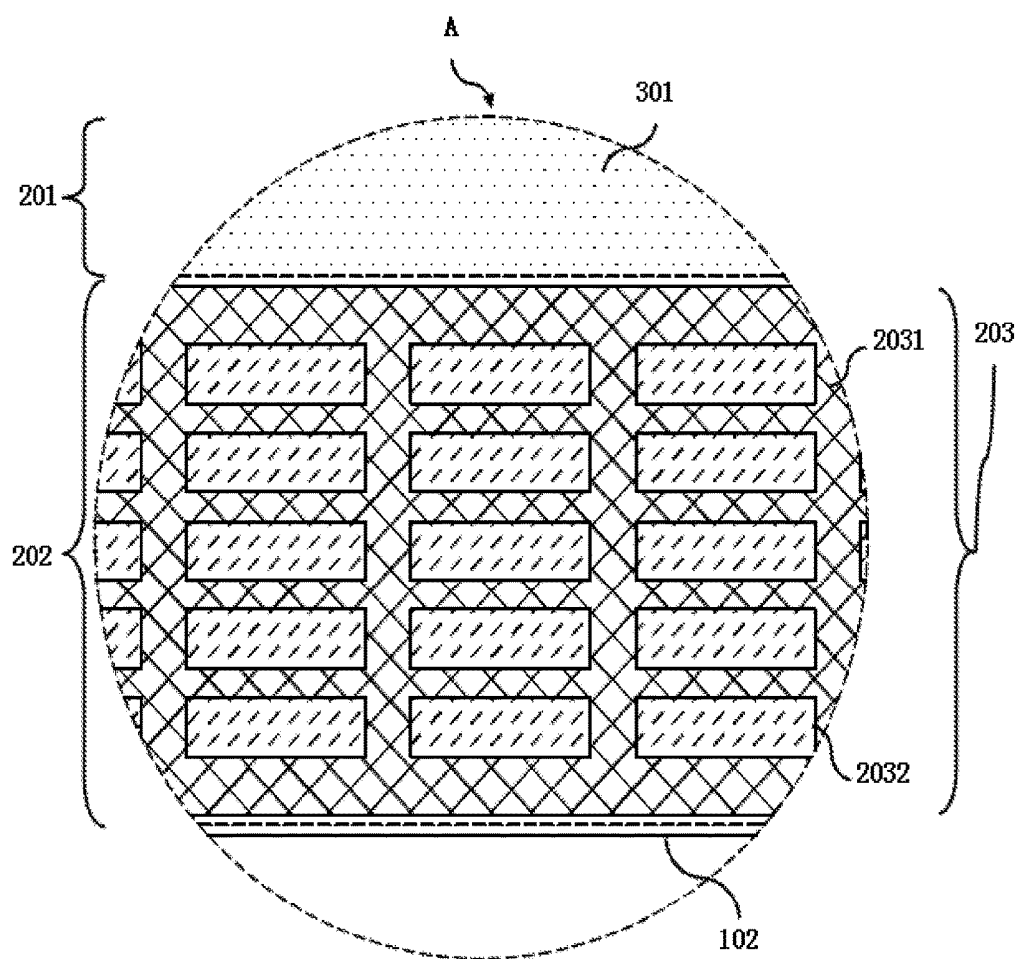


Fig.9

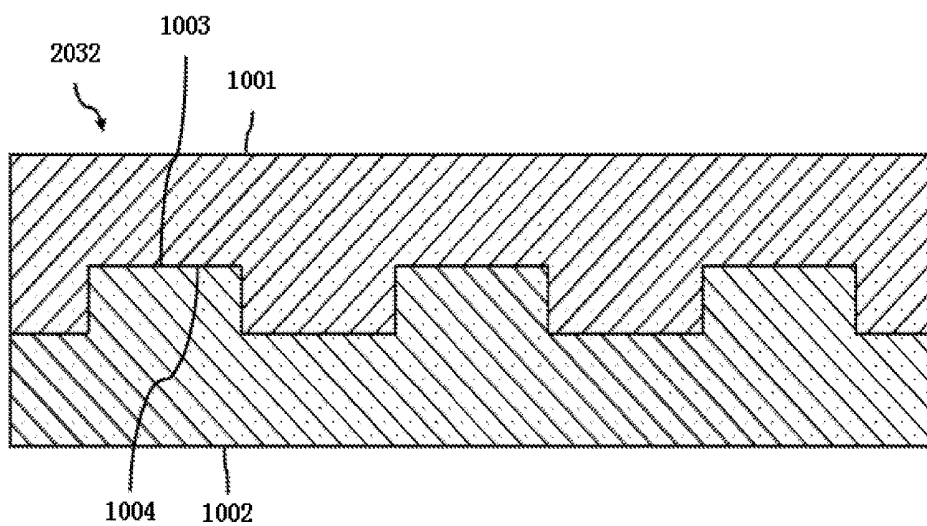


Fig.10

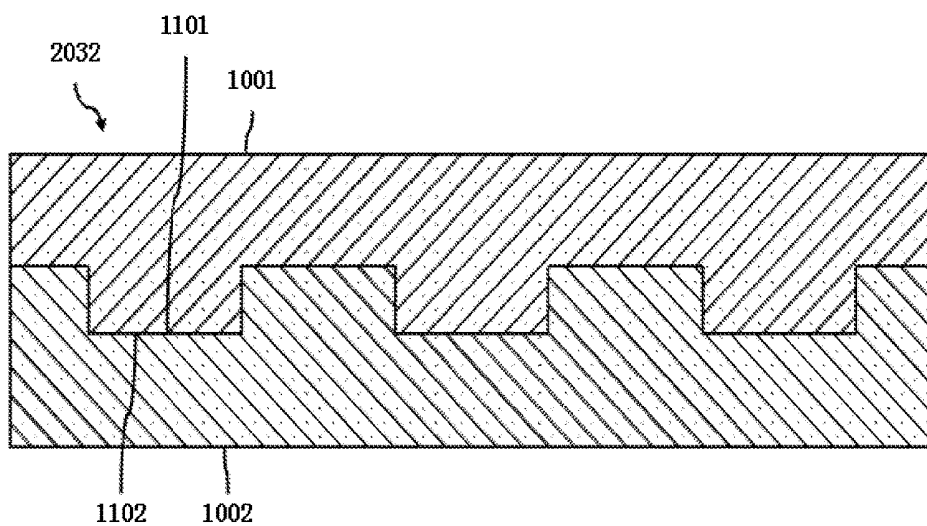


Fig.11

DISPLAY PANEL AND DISPLAY DEVICE**CROSS REFERENCE TO RELATED APPLICATIONS**

This application is a U.S. National Phase application submitted under 35 U.S.C. § 371 of Patent Cooperation Treaty Application serial No. PCT/CN2014/092334, filed on Nov. 27, 2014, which claims the priority of China Patent Application serial No. 201410667636.1, filed on Nov. 20, 2014, the disclosures of which are incorporated herein by reference.

FIELD OF THE INVENTION

The present invention relates to display technologies, and more particularly to a display panel and a display device.

BACKGROUND OF THE INVENTION

Traditional display panels generally have sealants disposed at the edges of the display panels. The sealant is used for sealing the display panel for preventing the liquid crystal molecules from leaking.

For the purpose of promoting display quality, the sealant is generally designed to be very narrow in the traditional technical solution in order to comply with the requirement of a narrower frame.

However, considering the sealing property of the display panel, the tendency to narrow down the sealant is limited because the display panel cannot be sealed effectively by the excessively narrow width of the sealant. Therefore, the width of the sealant cannot be further narrowed, and the display quality of the display panel cannot be further promoted.

Furthermore, the traditional sealant generally has spacers disposed therein. The spacers are formed by main materials, such as melamine resin and polystyrene resin, which have a compressive ratio higher than that of the photo spacers disposed within the active area. Therefore, compression is more serious within the regions of the sealant, which results in less cell gaps in the regions where the sealant is disposed than that in the active area, so that mura occurs in the regions where the sealant is disposed.

It is therefore necessary to provide a new technical solution to solve the problems existing in the conventional technology as described above.

SUMMARY OF THE INVENTION

An object of the present invention is to provide a display panel and a display device so as to achieve a narrow frame for the display panel.

To solve the above problem, the present invention provides a technical solution as follows:

A display panel, comprising a color filter substrate; a thin film transistor array substrate stacked on the color filter substrate to integrate therewith; a liquid crystal layer disposed between the thin film transistor array substrate and the color filter substrate; and a sealing element disposed between the thin film transistor array substrate and the color filter substrate; wherein the sealing element surrounds the liquid crystal layer, and is used for sealing a liquid crystal cell formed by the thin film transistor array substrate and the color filter substrate; the liquid crystal cell includes an active area and a non-active area, the non-active area disposed outside of the active area, the sealing element disposed on

the non-active area; the sealing element includes at least four sealing sections having beginnings and ends connected to each other, so as to form a sealing frame; and the sealing sections comprise at least one sealant segment, and at least one color resist segment; wherein the at least one sealant segment and the at least one color resist segment are integrated with each other, the color resist segment further has a via hole passing through the color resist segment and a protective layer on the thin film transistor array substrate in a first direction, the first direction is perpendicular to the color filter substrate; the via hole has a conductive layer disposed on a side wall of the via hole, the conductive layer is connected to a common electrode on the color filter substrate and a common line on the thin film transistor array substrate; and the color resist segment comprises a first color resist material layer, and a second color resist material layer; wherein the first color resist material layer and the second color resist material layer are integrated by stacking each other in the first direction; and a second surface of the second color resist material layer is stacked on a first surface of the first color resist material layer.

In the abovementioned display panel, the sealant segment is a sealant strip; the color resist segment is a color resist strip; and the sealant strip and the color resist strip are disposed side by side.

A display panel, comprising a color filter substrate; a thin film transistor array substrate stacked on the color filter substrate to integrate therewith; a liquid crystal layer disposed between the thin film transistor array substrate and the color filter substrate; and a sealing element disposed between the thin film transistor array substrate and the color filter substrate, wherein the sealing element surrounds the liquid crystal layer, and is used for sealing a liquid crystal cell formed by the thin film transistor array substrate and the color filter substrate; wherein the liquid crystal cell includes an active area and a non-active area, the non-active area disposed outside of the active area, the sealing element disposed on the non-active area; the sealing element includes at least four sealing sections having beginnings and ends connected to each other so as to form a sealing frame; and the sealing sections comprise at least one sealant segment, and at least one color resist segment; wherein the at least one sealant segment and the at least one color resist segment are integrated with each other.

In the abovementioned display panel, the sealant segment is a sealant strip; the color resist segment is a color resist strip; the sealant strip and the color resist strip are disposed side by side; and the color resist strip and the sealant strip are used together for supporting the thin film transistor array substrate and the color filter substrate, and for sealing the liquid crystal cell.

In the abovementioned display panel, the sealant strip is disposed between two color resist strips.

In the abovementioned display panel, the sealant strip is disposed next to the color resist strip at a side near the liquid crystal layer.

In the abovementioned display panel, the sealant segment includes at least one mesh, and the color resist segment includes at least one color resist block, wherein the color resist block is filled in the mesh.

In the abovementioned display panel, the color resist segment further has a via hole passing through the color resist segment and a protective layer on the thin film transistor array substrate in a first direction, the first direction is perpendicular to the color filter substrate; and the via hole has a conductive layer disposed on a side wall of the via hole, the conductive layer is connected to a common elec-

trode on the color filter substrate and a common line on the thin film transistor array substrate.

In the abovementioned display panel, the color resist segment comprises a first color resist material layer, and a second color resist material layer; the first color resist material layer and the second color resist material layer are integrated by stacking each other in the first direction; and a second surface of the second color resist material layer is stacked on a first surface of the first color resist material layer.

In the abovementioned display panel, the first surface of the first color resist material layer has a first recess, the second surface of the second color resist material layer has a first protrusion, and the first recess on the first surface is disposed at a position corresponding with where the first protrusion is disposed on the second surface.

In the abovementioned display panel, the first surface of the first color resist material layer has a second protrusion, the second surface of the second color resist material layer has a second recess, and the second protrusion on the first surface is disposed at a position corresponding with where the second recess is disposed on the second surface.

A display device, comprising a backlight module; and a display panel stacked on the backlight module to integrate therewith; wherein the display panel comprises a color filter substrate; a thin film transistor array substrate stacked on the color filter substrate to integrate therewith; a liquid crystal layer disposed between the thin film transistor array substrate and the color filter substrate; and a sealing element disposed between the thin film transistor array substrate and the color filter substrate, wherein the sealing element surrounds the liquid crystal layer, and is used for sealing a liquid crystal cell formed by the thin film transistor array substrate and the color filter substrate; wherein the liquid crystal cell includes an active area and a non-active area, the non-active area disposed outside of the active area, the sealing element disposed on the non-active area; the sealing element includes at least four sealing sections having beginnings and ends connected to each other so as to form a sealing frame; and the sealing sections comprise at least one sealant segment, and at least one color resist segment; wherein the at least one sealant segment and the at least one color resist segment are integrated with each other.

In the abovementioned display device, the sealant segment is a sealant strip; the color resist segment is a color resist strip; the sealant strip and the color resist strip are disposed side by side; and the color resist strip and the sealant strip are used together for supporting the thin film transistor array substrate and the color filter substrate, and for sealing the liquid crystal cell.

In the abovementioned display device, the sealant strip is disposed between two color resist strips.

In the abovementioned display device, the sealant strip is disposed next to the color resist strip at a side near the liquid crystal layer.

In the abovementioned display device, the sealant segment includes at least one mesh, and the color resist segment includes at least one color resist block, wherein the color resist block is filled in the mesh.

In the abovementioned display device, the color resist segment further has a via hole passing through the color resist segment and a protective layer on the thin film transistor array substrate in a first direction, the first direction is perpendicular to the color filter substrate; and the via hole has a conductive layer disposed on a side wall of the via hole, the conductive layer is connected to a common elec-

trode on the color filter substrate and a common line on the thin film transistor array substrate.

In the abovementioned display device, the color resist segment comprises a first color resist material layer, and a second color resist material layer; the first color resist material layer and the second color resist material layer are integrated by stacking each other in the first direction; and a second surface of the second color resist material layer is stacked on a first surface of the first color resist material layer.

In the abovementioned display device, the first surface of the first color resist material layer has a first recess, the second surface of the second color resist material layer has a first protrusion, and the first recess on the first surface is disposed at a position corresponding with where the first protrusion is disposed on the second surface.

In the abovementioned display device, the first surface of the first color resist material layer has a second protrusion, the second surface of the second color resist material layer has a second recess, and the second protrusion on the first surface is disposed at a position corresponding with where the second recess is disposed on the second surface.

Compared with the prior art, a narrow frame of the display panel can be realized by present invention without losing structural strength and the sealing property of the sealing element.

The following embodiments are referring to the accompanying drawings for exemplifying specific implementable embodiments of the present invention, and for making the technical solution and the benefits of the present invention easily understood.

DESCRIPTION OF THE DRAWINGS

FIG. 1 is a schematic view of a display device according to the present invention.

FIG. 2 is a schematic view of the display panel illustrated in FIG. 1.

FIG. 3 is a partially enlarged top view of region A in FIG. 2 according to a first embodiment of the present invention.

FIG. 4 is a cross-sectional view taken along a line B-B' in FIG. 3.

FIG. 5 is a partially enlarged top view of region A in FIG. 2 according to a second embodiment of the present invention.

FIG. 6 is a cross-sectional view taken along a line C-C' in FIG. 5.

FIG. 7 is a partially enlarged top view of region A in FIG. 2 according to a third embodiment of the present invention.

FIG. 8 is a cross-sectional view taken along a line C-C' in FIG. 7.

FIG. 9 is a partially enlarged top view of region A in FIG. 2 according to a fourth embodiment of the present invention.

FIG. 10 is a schematic view of the color resist segment illustrated in FIGS. 3~9 according to a first example of the color resist segment.

FIG. 11 is a schematic view of the color resist segment illustrated in FIGS. 3~9 according to a second example of the color resist segment.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The word "embodiment" means "example", "instance", or "illustration" in the specification. Furthermore, if there is no specific description in the invention, singular terms such as "a", "one", and "the" include the plural number.

Refer to FIG. 1, which is a schematic view of a display device of the present invention.

The display device of the present invention comprises a backlight module **101**, and a display panel **102** stacked on the backlight module **101** which integrate with each other. The display panel **102** can be a TFT-LCD (Thin Film Transistor Liquid Crystal Display) display panel.

Refer to FIGS. 2-4. FIG. 2 is a schematic view of the display panel **102** illustrated in FIG. 1, FIG. 3 is a partially enlarged top view of region A in FIG. 2 according to a first embodiment of the present invention, and FIG. 4 is a cross-sectional view taken along a line B-B' in FIG. 3.

The display panel **102** in the present invention includes a color filter substrate **401**, a thin film transistor array substrate **402**, a liquid crystal layer **301**, and a sealing element **203**.

The thin film transistor array substrate **402** is stacked on the color filter substrate **401** so that they integrate with each other. The liquid crystal layer **301** is disposed between the thin film transistor array substrate **402** and the color filter substrate **401**. The sealing element **203** is disposed between the thin film transistor array substrate **402** and the color filter substrate **401**. The sealing element **203** is formed into a rectangle, and surrounds the liquid crystal layer **301**. The sealing element **203** is used for sealing a liquid crystal cell formed by the thin film transistor array substrate **402** and the color filter substrate **401**.

The liquid crystal cell includes an active area **201** and a non-active area **202**. The non-active area **202** is disposed outside of the active area **201**. The sealing element **203** is disposed on the non-active area **202**. The non-active area **202** surrounds the active area **201**.

The sealing element **203** includes at least four sealing sections having beginnings and ends connected to each other, so as to form a sealing frame. The sealing sections comprise at least one sealant segment, and at least one color resist segment. The at least one sealant segment and the at least one color resist segment are integrated with each other.

In this embodiment, the sealant segment is a sealant strip **2031**; the color resist segment is a color resist strip **2032**; and the sealant strip **2031** and the color resist strip **2032** are disposed side by side. The sealant strip **2031** is disposed between two of the color resist strips **2032**. The color resist strip **2032** and the sealant strip **2031** are used together for supporting the thin film transistor array substrate **402** and the color filter substrate **401**, and for sealing the liquid crystal cell.

In this embodiment, the sealing element **203** has a width (a total width of the color resist strip **2032** and the sealant strip **2031**) ranged from 200 μm to 4000 μm .

In this embodiment, the color resist segment further has a via hole **403** passing through the color resist segment and a protective layer on the thin film transistor array substrate **402** in a first direction. The first direction is perpendicular to the color filter substrate. The via hole **403** has a conductive layer **404** disposed on a side wall thereof. The conductive layer **404** is connected to a common electrode on the color filter substrate **401** and a common line on the thin film transistor array substrate **402**.

In the above technical solution, since the sealing sections have the color resist strip **2032** and the sealant strip **2031**, the color resist strip **2032** can be used for supporting the thin film transistor array substrate **402** and the color filter substrate **401**, so that the spacers in the sealant can be removed. Therefore, a narrow frame of the display panel **102** can be realized without losing structural strength and the sealing property of the sealing element **203**. That is, the structural

strength and the sealing property of the sealing element **203** can be kept when the sealing element **203** has a narrowed width.

Furthermore, since the sealing sections include the color resist strip **2032** having a compressive strength higher than that of the conventional spacers, so that it is beneficial for reducing the difference in the gap of the liquid crystal cell between the regions corresponding to the sealing sections (the nonactive area **202**) and the active area **201**, so that mura occurring in the surroundings of the sealing element **203** (the nonactive area **202**) can be prevented.

Moreover, since the color resist strip **2032** includes the via hole **403** and the conductive layer **404**, the gold balls (Au balls) can be removed from the sealant so that the costs can be saved.

Refer to FIG. 5 and FIG. 6. FIG. 5 is a partially enlarged top view of region A in FIG. 2 according to a second embodiment of the present invention, and FIG. 6 is a cross-sectional view taken along a line C-C' in FIG. 5. This embodiment is similar to the first embodiment mentioned above, with the difference being as follows:

The sealant strip **2031** is disposed next to the color resist strip **2032** at a side near the liquid crystal layer **301**.

Refer to FIG. 7 and FIG. 8. FIG. 7 is a partially enlarged top view of region A in FIG. 2 according to a third embodiment of the present invention, and FIG. 8 is a cross-sectional view taken along a line C-C' in FIG. 7. This embodiment is similar to the first or the second embodiment, with the difference being as follows:

The sealant strip **2031** is disposed next to the color resist strip **2032** at a side away from the liquid crystal layer **301**; that is, the color resist strip **2032** is disposed between the liquid crystal layer **301** and the sealant strip **2031**.

Refer to FIG. 9, which is a partially enlarged top view of region A in FIG. 2 according to a fourth embodiment of the present invention. This embodiment is similar to any of the first, the second, and the third embodiments, with the difference being as follows:

The sealant segment includes at least one mesh, and the color resist segment includes at least one color resist block, wherein the color resist block is filled in the mesh.

The above technical solutions are beneficial for enhancing the structural strength of the sealing sections, so as to stably support the thin film transistor array substrate **402** and the color filter substrate **401**.

Refer to FIG. 10, which is a schematic view of the color resist segment illustrated in FIGS. 3-9 according to a first example of the color resist segment.

The color resist segment comprises a first color resist material layer **1001** and a second color resist material layer **1002**. The first color resist material layer **1001** and the second color resist material layer **1002** are integrated by stacking on each other in the first direction; and a second surface of the second color resist material layer **1002** is stacked on a first surface of the first color resist material layer **1001**.

The first surface of the first color resist material layer **1001** has a first recess **1003**, the second surface of the second color resist material layer **1002** has a first protrusion **1004**, and the first recess **1003** on the first surface is disposed at a position corresponding with where the first protrusion **1004** is disposed on the second surface.

Alternatively, as shown in FIG. 11, the first surface of the first color resist material layer **1001** has a second protrusion **1101**, the second surface of the second color resist material layer **1002** has a second recess **1102**, and the second

protrusion **1101** on the first surface is disposed at a position corresponding with where the second recess **1102** is disposed on the second surface.

Through the above technical solutions, since the color resist segment has a higher structural strength, it is beneficial for stably supporting the thin film transistor array substrate **402** and the color filter substrate **401**.

Moreover, although the present publication is illustrated and described by one or more embodiments, one skilled in the art will expect equivalent variations and modifications by understanding and reading based on the specification and the accompanying drawings. The present invention includes all such modifications and variations, and is limited only by the appended claims. Especially regarding various functions performed by the abovementioned components (such as elements, resources, etc.), the terms for describing these components mean that the specific functions (e.g. the functions of the components are equivalent) can be performed by any component (unless explicitly described), even though the structure is different from the structure disclosed in the specification for performing the same function. In addition, although the specific features correspond to only one of the embodiments in the present publication, the specific features can be expected to combine with one or more features in practice if it is advantageous to the specific features. Furthermore, in the specification, unless explicitly described to the contrary, the word “comprising”, “having”, and “containing” as well as their variations in the embodiments and claims will be understood to imply the inclusion of the stated elements, but not the exclusion of any other elements.

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 color filter substrate;

a thin film transistor array substrate stacked on the color filter substrate to integrate therewith;

a liquid crystal layer disposed between the thin film transistor array substrate and the color filter substrate; and

a sealing element disposed between the thin film transistor array substrate and the color filter substrate, wherein the sealing element surrounds the liquid crystal layer, and is used for sealing a liquid crystal cell formed by the thin film transistor array substrate and the color filter substrate;

wherein the liquid crystal cell includes an active area and a nonactive area, the nonactive area disposed outside of the active area, the sealing element disposed on the nonactive area;

the sealing element includes at least four sealing sections having beginnings and ends connected to each other so as to form a sealing frame; and

the sealing sections comprise at least one sealant segment, and at least one color resist segment;

wherein the at least one sealant segment and the at least one color resist segment are integrated with each other; the color resist segment further has a via hole passing through the color resist segment and a protective layer on the thin film transistor array substrate in a first direction, and the first direction is perpendicular to the color filter substrate; and

wherein the via hole has a conductive layer disposed on a side wall of the via hole, and the conductive layer is connected to a common electrode on the color filter substrate and a common line on the thin film transistor array substrate.

2. The display panel according to claim 1, wherein the sealant segment is a sealant strip; the color resist segment is a color resist strip; the sealant strip and the color resist strip are disposed side by side; and the color resist strip and the sealant strip are used together for supporting the thin film transistor array substrate and the color filter substrate, and for sealing the liquid crystal cell.

3. The display panel according to claim 2, wherein the sealant strip is disposed between two color resist strips.

4. The display panel according to claim 2, wherein the sealant strip is disposed next to the color resist strip at a side near the liquid crystal layer.

5. The display panel according to claim 1, wherein the sealant segment includes at least one mesh, and the color resist segment includes at least one color resist block, wherein the color resist block is filled in the mesh.

6. The display panel according to claim 1, wherein the color resist segment comprises a first color resist material layer, and a second color resist material layer; the first color resist material layer and the second color resist material layer are integrated by stacking each other in the first direction; and a second surface of the second color resist material layer is stacked on a first surface of the first color resist material layer.

7. The display panel according to claim 6, wherein the first surface of the first color resist material layer has a first recess, the second surface of the second color resist material layer has a first protrusion, and the first recess on the first surface is disposed at a position corresponding with where the first protrusion is disposed on the second surface.

8. The display panel according to claim 6, wherein the first surface of the first color resist material layer has a second protrusion, the second surface of the second color resist material layer has a second recess, and the second protrusion on the first surface is disposed at a position corresponding with where the second recess is disposed on the second surface.

9. A display device, comprising:

a backlight module; and

a display panel stacked on the backlight module to integrate therewith;

wherein the display panel comprises:

a color filter substrate;

a thin film transistor array substrate stacked on the color filter substrate to integrate therewith;

a liquid crystal layer disposed between the thin film transistor array substrate and the color filter substrate; and

a sealing element disposed between the thin film transistor array substrate and the color filter substrate, wherein the sealing element surrounds the liquid crystal layer, and is used for sealing a liquid crystal cell formed by the thin film transistor array substrate and the color filter substrate;

wherein the liquid crystal cell includes an active area and a nonactive area, the nonactive area disposed outside of the active area, the sealing element disposed on the nonactive area;

the sealing element includes at least four sealing sections having beginnings and ends connected to each other so as to form a sealing frame; and

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the sealing sections comprise at least one sealant segment, and at least one color resist segment;

wherein the at least one sealant segment and the at least one color resist segment are integrated with each other; the color resist segment further has a via hole passing through the color resist segment and a protective layer on the thin film transistor array substrate in a first direction, and the first direction is perpendicular to the color filter substrate; and

wherein the via hole has a conductive layer disposed on a side wall of the via hole, and the conductive layer is connected to a common electrode on the color filter substrate and a common line on the thin film transistor array substrate.

10. The display device according to claim 9, wherein the sealant segment is a sealant strip; the color resist segment is a color resist strip; the sealant strip and the color resist strip are disposed side by side; and the color resist strip and the sealant strip are used together for supporting the thin film transistor array substrate and the color filter substrate, and for sealing the liquid crystal cell.

11. The display device according to claim 10, wherein the sealant strip is disposed between two color resist strips.

12. The display device according to claim 10, wherein the sealant strip is disposed next to the color resist strip at a side near the liquid crystal layer.

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13. The display device according to claim 9, wherein the sealant segment includes at least one mesh, and the color resist segment includes at least one color resist block, wherein the color resist block is filled in the mesh.

14. The display device according to claim 9, wherein the color resist segment comprises a first color resist material layer, and a second color resist material layer; the first color resist material layer and the second color resist material layer are integrated by stacking each other in the first direction; and a second surface of the second color resist material layer is stacked on a first surface of the first color resist material layer.

15. The display device according to claim 14, wherein the first surface of the first color resist material layer has a first recess, the second surface of the second color resist material layer has a first protrusion, and the first recess on the first surface is disposed at a position corresponding with where the first protrusion is disposed on the second surface.

16. The display device according to claim 14, wherein the first surface of the first color resist material layer has a second protrusion, the second surface of the second color resist material layer has a second recess, and the second protrusion on the first surface is disposed at a position corresponding with where the second recess is disposed on the second surface.

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专利名称(译)	显示面板和显示设备		
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摘要(译)

提供一种显示面板和显示装置。显示面板具有滤色器基板，薄膜晶体管阵列基板，液晶层和密封元件。密封元件设置在液晶单元的非有源区域上。密封元件具有至少四个密封部分，所述密封部分具有彼此连接的起点和终点。密封部分具有至少一个密封剂区段和至少一个颜色抗蚀剂区段。至少一个密封剂区段和至少一个颜色抗蚀剂区段彼此一体化。实现了显示面板的窄框架。

