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(54) **LIQUID CRYSTAL DISPLAY PANEL**

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(52) **U.S. Cl.**

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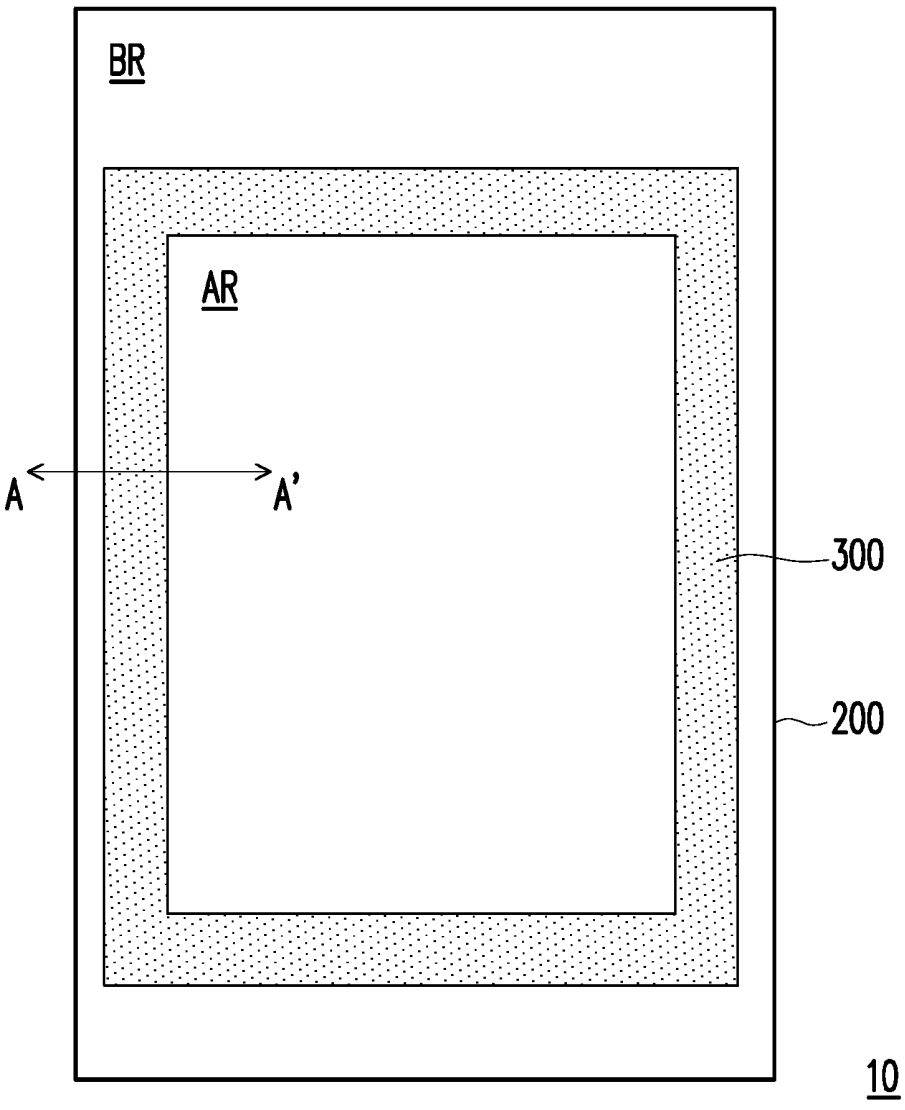
(57) **ABSTRACT**

A liquid crystal display panel including a pixel array substrate, an opposite substrate, a liquid crystal layer, a plurality of first bumps, a first inorganic transparent insulating layer and a sealant is provided. The opposite substrate faces the pixel array substrate. The liquid crystal layer is located between the pixel array substrate and the opposite substrate. The plurality of first bumps are located between the pixel array substrate and the opposite substrate. The first inorganic transparent insulating layer is located on the plurality of first bumps and completely covers the opposite substrate. The sealant surrounds the liquid crystal layer. The sealant covers the plurality of first bumps. The liquid crystal display panel of the disclosure effectively blocks the moisture infiltrating from the sealant.



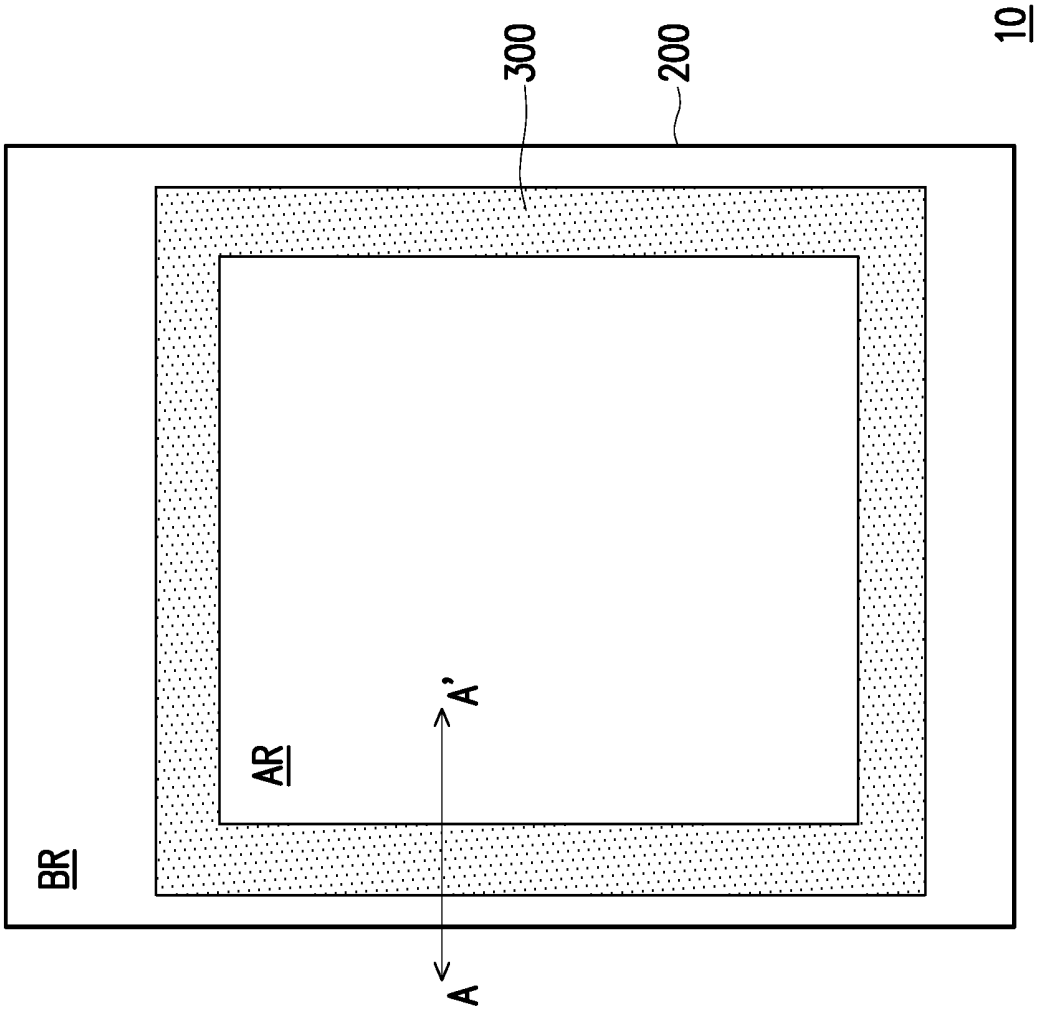


FIG. 1

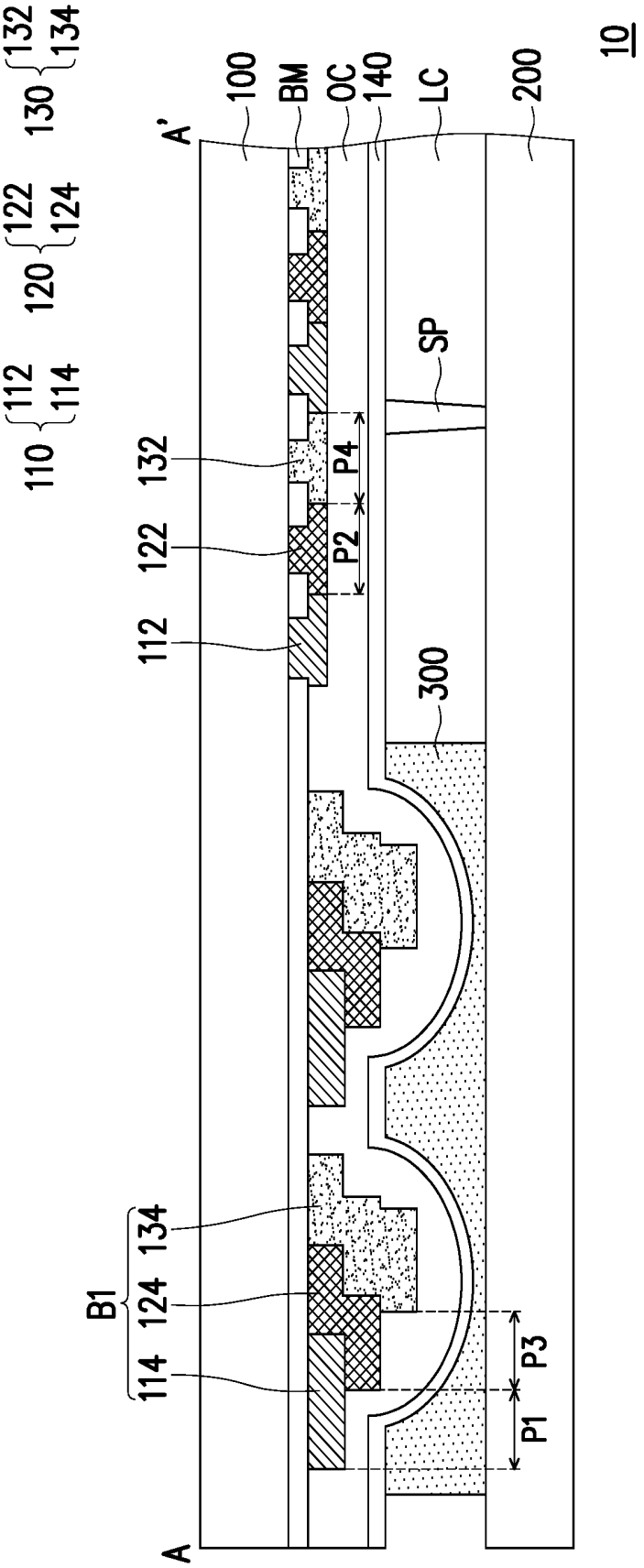

10
100
BM
OC
140
LC
200
A'
A
110
112
114
120
122
124
130
132
134
B1
SP
300
P1
P2
P3
P4

FIG. 2

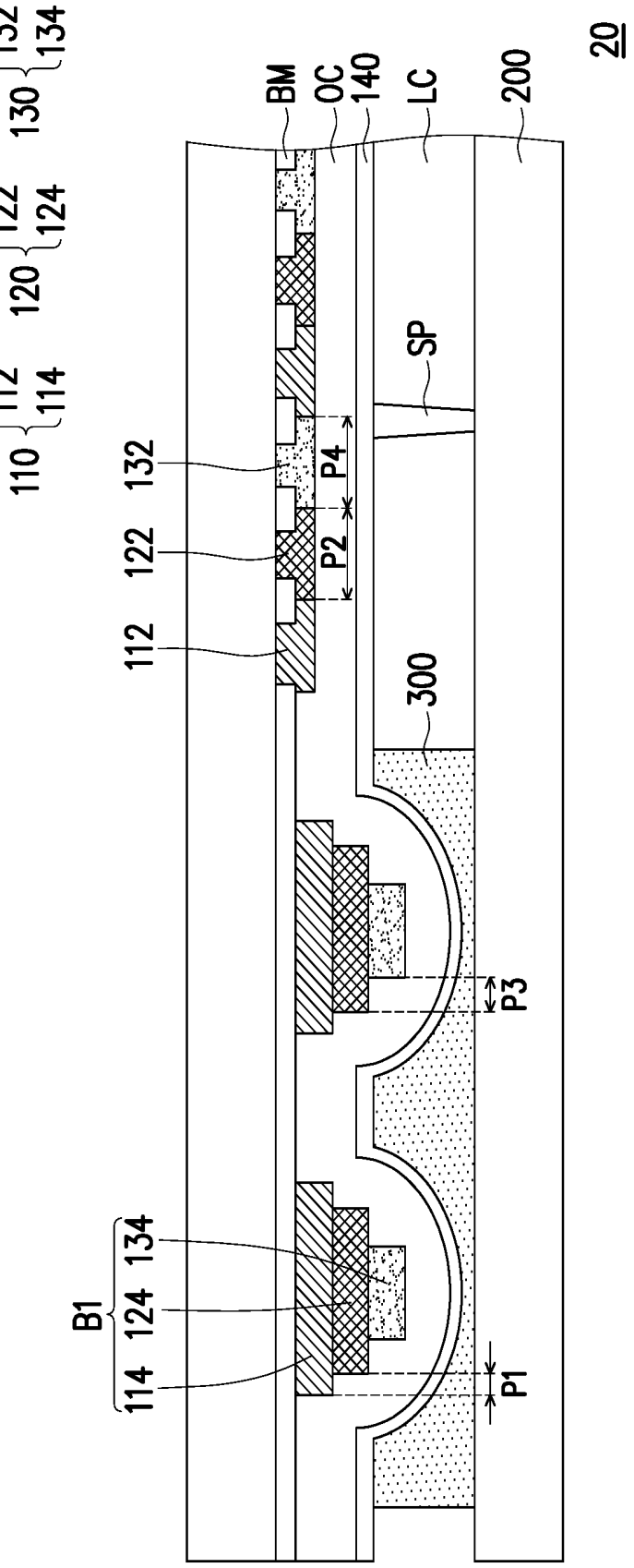

20
BM
OC
140
LC
200
130
132
134
120
122
124
110
112
114
SP
P4
P2
132
122
112
300
P3
B1
134
124
114
P1

FIG. 3

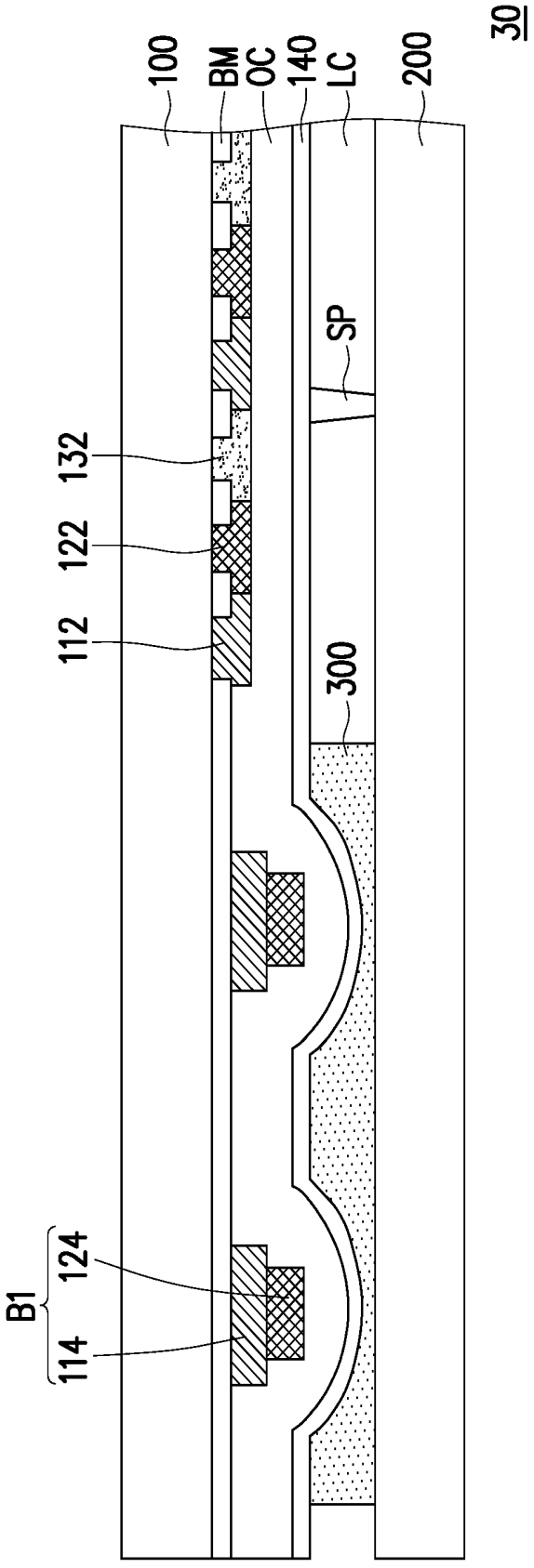


FIG. 4

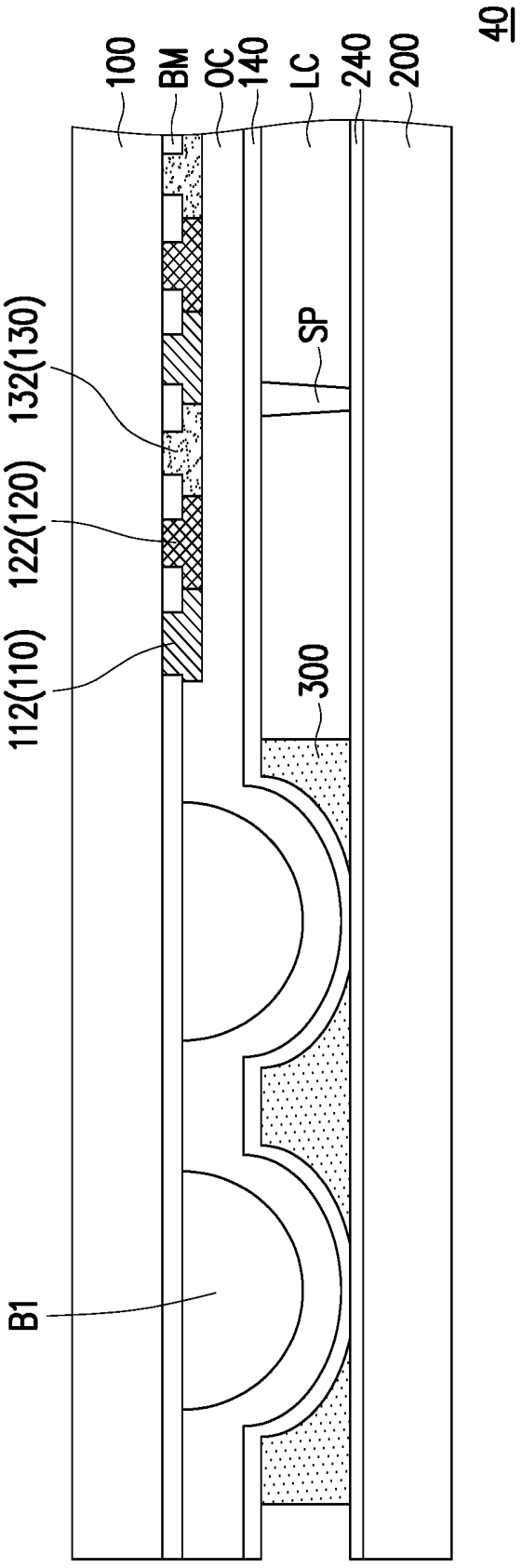


FIG. 5

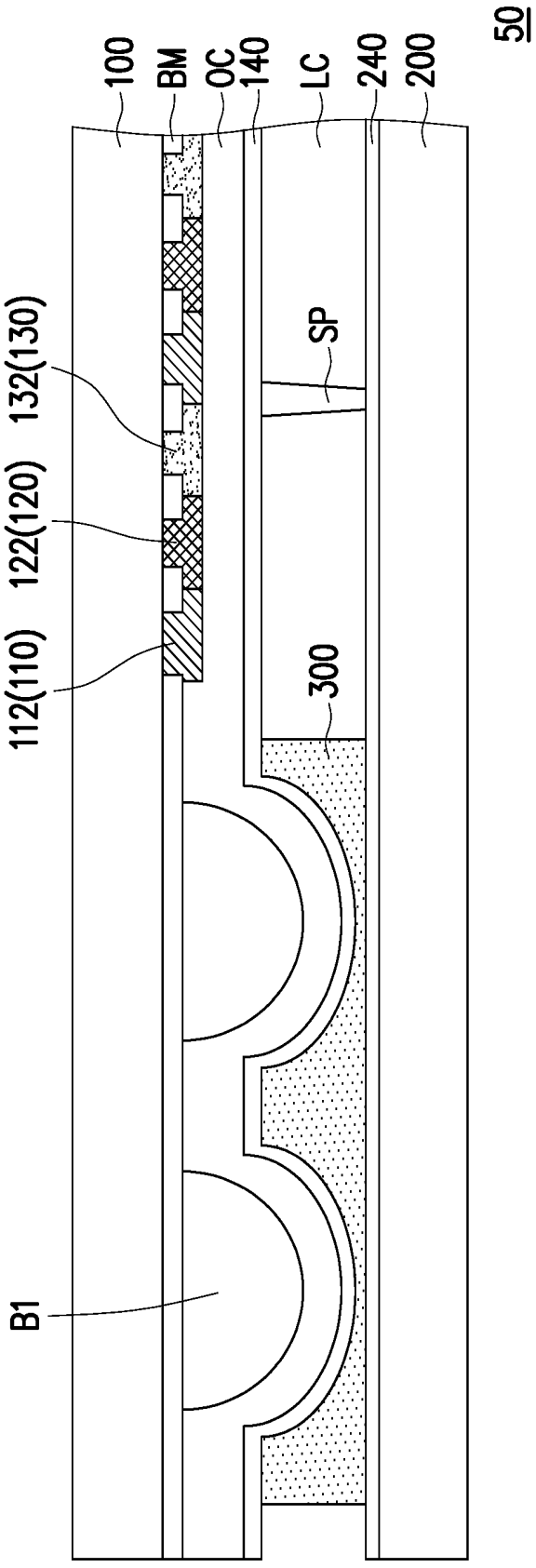


FIG. 6

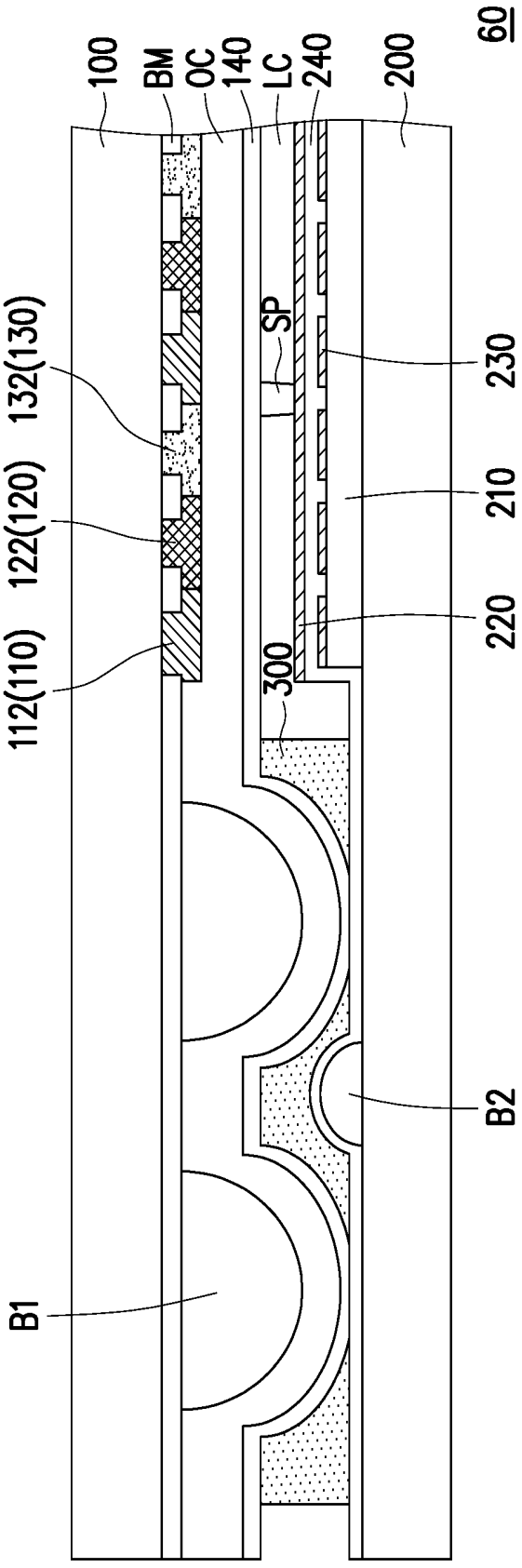

60
100
BM
OC
140
LC
240
200
SP
230
132(130)
122(120)
210
112(110)
220
300
B2
B1

FIG. 7

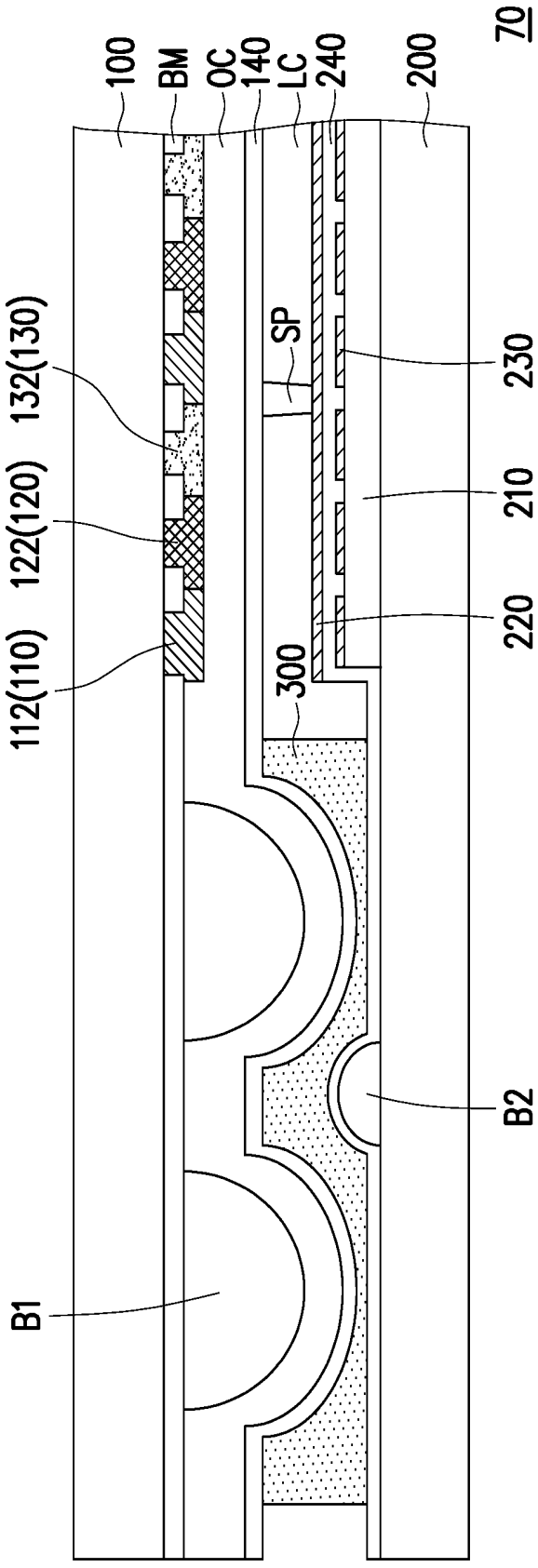

70
100
BM
OC
140
LC
240
200
SP
230
210
220
300
132(130)
122(120)
112(110)
B1
B2

FIG. 8

LIQUID CRYSTAL DISPLAY PANEL

CROSS-REFERENCE TO RELATED APPLICATION

[0001] This application claims the priority benefit of China application serial no. 201810959779.8, filed on Aug. 20, 2018. The entirety of the above-mentioned patent application is hereby incorporated by reference herein and made a part of this specification.

BACKGROUND OF THE INVENTION

Field of the Invention

[0002] The disclosure relates to a liquid crystal display panel having a sealant covering a first bump.

Description of Related Art

[0003] In general, the liquid crystal display includes an upper substrate, a lower substrate and a liquid crystal located between the upper and lower substrates. The sealant is applied to bond the upper and lower substrates and to prevent the liquid crystal layer from contacting with the external environment, serving as a defense of the liquid crystal display that blocks moisture.

[0004] However, as the common sealant is made of a polymer material, in the environment of high temperature and high humidity, moisture still has the opportunity to pass through the sealant and cause damage to the liquid crystal layer. In addition, the market share of the display with a narrow frame is gradually increasing for having a greater screen-to-body ratio. However, since the display with a narrow frame has a rather small space between the display region and the edge of the substrate, the space for coating the sealant is also small, which affects the adhesion of the upper and lower substrates and the performance of the sealant to prevent the moisture from infiltrating.

SUMMARY OF THE INVENTION

[0005] The disclosure relates to a liquid crystal display panel having a sealant covering a first bump.

[0006] According to an embodiment of the disclosure, a liquid crystal display panel includes a pixel array substrate, an opposite substrate, a liquid crystal layer, a first bump, a first inorganic transparent insulating layer and a sealant. The opposite substrate faces the pixel array substrate. The liquid crystal layer is located between the pixel array substrate and the opposite substrate. The first bump is located between the pixel array substrate and the opposite substrate. The first inorganic transparent insulating layer is located on the first bump and completely covers the opposite substrate. The sealant surrounds the liquid crystal layer. The sealant covers the first bump.

[0007] In an embodiment of the disclosure, the first bump is located on the opposite substrate and the first bump protrudes from the opposite substrate toward the pixel array substrate.

[0008] In an embodiment of the disclosure, the liquid crystal display panel further includes a second bump and a second inorganic transparent insulating layer. The second bump is located on the pixel array substrate, and the second bump protrudes from the pixel array substrate toward the opposite substrate, wherein the sealant covers the second bump. The second inorganic transparent insulating layer is located on the second bump.

[0009] In an embodiment of the disclosure, the liquid crystal display panel further includes a second inorganic transparent insulating layer located on the pixel array substrate.

[0010] In an embodiment of the disclosure, the liquid crystal display panel further includes a pixel electrode and a common electrode, located on the pixel array substrate, wherein the second inorganic transparent insulating layer is located between the pixel electrode and the common electrode.

[0011] In an embodiment of the disclosure, the first inorganic transparent insulating layer contacts the second inorganic transparent insulating layer.

[0012] In an embodiment of the disclosure, the first inorganic transparent insulating layer does not contact the second inorganic transparent insulating layer.

[0013] In an embodiment of the disclosure, the liquid crystal display panel further includes a first color resist, located on the opposite substrate and including a plurality of first sub-pixel filter patterns and a first isolation structure; a second color resist, located on the opposite substrate and including a plurality of second sub-pixel filter patterns and a second isolation structure, wherein the first bump includes the first isolation structure and the second isolation structure stacked on each other; and a third color resist, located on the opposite substrate and including a plurality of third sub-pixel filter patterns.

[0014] In an embodiment of the disclosure, the third color resist further includes a third isolation structure, wherein the first bump includes the first isolation structure, the second isolation structure and the third isolation structure stacked on each other.

[0015] In an embodiment of the disclosure, a distance between an end of the first isolation structure and a corresponding end of the corresponding second isolation structure is equal to a distance between an end of each of the first sub-pixel filter patterns and a corresponding end of a corresponding second sub-pixel filter pattern, and a distance between an end of each of the second isolation structures and a corresponding end of the corresponding third isolation structure is equal to a distance between an end of each of the plurality of second sub-pixel filter patterns and a corresponding end of a corresponding third sub-pixel filter pattern.

[0016] In an embodiment of the disclosure, the first inorganic transparent insulating layer includes silicon nitride or silicon oxide.

[0017] Based on the above, by having the first inorganic transparent insulating layer located on the first bump, and having the sealant covering the first bump, not only the moisture is effectively blocked from infiltrating from the sealant, but also the bonding area of the sealant increases and the adhesion of the sealant is improved.

[0018] In order to make the aforementioned and other features and advantages of the disclosure more comprehensible, several embodiments accompanied with figures are described in detail below.

BRIEF DESCRIPTION OF THE DRAWINGS

[0019] The accompanying drawings are included to provide a further understanding of the disclosure, and are

incorporated in and constitute a part of this specification. The drawings illustrate exemplary embodiments of the disclosure and, together with the description, serve to explain the principles of the disclosure.

[0020] FIG. **1** is a schematic top view of a liquid crystal display panel according to an embodiment of the disclosure.

[0021] FIG. **2** is a schematic cross-sectional view along the line AA' of FIG. **1**.

[0022] FIG. **3** is a schematic cross-sectional view of a liquid crystal display panel according to an embodiment of the disclosure.

[0023] FIG. **4** is a schematic cross-sectional view of a liquid crystal display panel according to an embodiment of the disclosure.

[0024] FIG. **5** is a schematic cross-sectional view of a liquid crystal display panel according to an embodiment of the disclosure.

[0025] FIG. **6** is a schematic cross-sectional view of a liquid crystal display panel according to an embodiment of the disclosure.

[0026] FIG. **7** is a schematic cross-sectional view of a liquid crystal display panel according to an embodiment of the disclosure.

[0027] FIG. **8** is a schematic cross-sectional view of a liquid crystal display panel according to an embodiment of the disclosure.

DESCRIPTION OF THE EMBODIMENTS

[0028] Descriptions of the disclosure are given with reference to the exemplary embodiments illustrated by the figures. Wherever possible, the same reference numerals are used in the figures and the description to refer to the same or similar parts.

[0029] FIG. **1** is a schematic top view of a liquid crystal display panel according to an embodiment of the disclosure, and FIG. **2** is a schematic cross-sectional view along the line AA' of FIG. **1**. FIG. **1** illustrates a pixel array substrate **200** and a sealant **300**, and other components are omitted.

[0030] Referring to FIG. **1** and FIG. **2**, a liquid crystal display panel **10** includes a pixel array substrate **200**, an opposite substrate **100**, a liquid crystal layer LC, a plurality of first bumps B**1**, a first inorganic transparent insulating layer **140** and a sealant **300**. The opposite substrate **100** faces the pixel array substrate **200**. The liquid crystal display panel **10** has an active region AR and a peripheral region BR surrounding the active region AR. The liquid crystal layer LC is located between the pixel array substrate **200** and the opposite substrate **100** and is located in the active region AR. The sealant **300** surrounds the liquid crystal layer LC. In this embodiment, the liquid crystal display panel **10** optionally includes a spacer SP. The spacer SP is located between the pixel array substrate **100** and the opposite substrate **300**, for example, and may be adapted to control a thickness of the liquid crystal layer LC.

[0031] In this embodiment, the opposite substrate **100** is a color filter element substrate. The opposite substrate **100** has a black matrix BM, a first color resist **110**, a second color resist **120**, a third color resist **130** and an over coating layer OC. The black matrix BM, the first color resist **110**, the second color resist **120** and the third color resist **130** are located on the opposite substrate **100**. The first color resist **110**, the second color resist **120** and the third color resist **130** are color resists of different colors. The first color resist **110**, the second color resist **120** and the third color resist **130** are, for example, a red color resist, a green color resist, and a blue color resist, respectively.

[0032] The first color resist **110** includes a plurality of first sub-pixel filter patterns **112** and at least one first isolation structure **114**. The second color resist **120** includes a plurality of second sub-pixel filter patterns **122** and at least one second isolation structure **124**. The third color resist **130** includes a plurality of third sub-pixel filter patterns **132** and at least one third isolation structure **134**. The first sub-pixel filter pattern **112**, the second sub-pixel filter pattern **122** and the third sub-pixel filter pattern **132** are, for example, located in the active region AR of the liquid crystal display panel **10**. The first isolation structure **114**, the second isolation structure **124** and the third isolation structure **134** are, for example, located in the peripheral region BR of the liquid crystal display panel **10**.

[0033] In this embodiment, the first color resist **110**, the second color resist **120** and the third color resist **130** are defined by a same photo mask. Therefore, a distance P**1** between an end of the first isolation structure **114** (for example, the left end) and a corresponding end of the corresponding second isolation structure **124** (for example, the left end) is equal to a distance P**2** between an end of each of the plurality of first sub-pixel filter patterns **112** (for example, the left end) and a corresponding end of a corresponding second sub-pixel filter pattern **122** (for example, the left end), and a distance P**3** between an end of each of the plurality of the second isolation structures **124** (for example, the left end) and a corresponding end of the corresponding third isolation structure **134** (for example, the left end) is equal to a distance P**4** between an end of each of the plurality of second sub-pixel filter patterns **122** (for example, the left end) and a corresponding end of a corresponding third sub-pixel filter pattern **132** (for example, the left end).

[0034] In this embodiment, a vertical projection area of each of the plurality of the first isolation structures **114** on the opposite substrate **100** is equal to a vertical projection area of each of the plurality of the second isolation structures **124** on the opposite substrate **100** and a vertical projection area of each of the plurality of the third isolation structures **134** on the opposite substrate **100**. A vertical projection area of each of the plurality of the first sub-pixel filter patterns **112** on the opposite substrate **100** is equal to a vertical projection area of each of the plurality of the second sub-pixel filter patterns **122** on the opposite substrate **100** and a vertical projection area of each of the plurality of the third sub-pixel filter patterns **132** on the opposite substrate **100**.

[0035] In this embodiment, the vertical projection area of each of the plurality of the first sub-pixel filter patterns **114** on the opposite substrate **100** is greater than the vertical projection area of each of the plurality of the first sub-pixel filter patterns **112** on the opposite substrate **100** and may be 1.5 times greater than the same, for example. In this embodiment, the vertical projection area of each of the plurality of the second isolation structures **124** on the opposite substrate **100** is greater than the vertical projection area of each of the plurality of the second sub-pixel filter patterns **122** on the opposite substrate **100** and may be 1.5 times greater than the same, for example. In this embodiment, the vertical projection area of each of the plurality of the third isolation structures **134** on the opposite substrate **100** is greater than the vertical projection area of each of the plurality of the

third sub-pixel filter patterns **132** on the opposite substrate **100** and may be 1.5 times greater than the same, for example.

[0036] At least one first bump B**1** is located between the pixel array substrate **200** and the opposite substrate **100**. In this embodiment, two first bumps B**1** are taken as an example, but the disclosure is not limited thereto. Each first bump B**1** includes the first isolation structure **114**, the second isolation structure **124** and the third isolation structure **134** stacked on each other. The flatness of the top of the first bump B**1** may vary due to the width of the first isolation structure **114**, the second isolation structure **124** and the third isolation structure **134**.

[0037] The first inorganic transparent insulating layer **140** is located on the first bump B**1**. The first inorganic transparent insulating layer **140** completely covers the opposite substrate **100**, for example, substantially covers the entire lower surface of the opposite substrate **100** or the entire inner surface of the opposite substrate **100**. The first inorganic transparent insulating layer **140** includes silicon nitride or silicon oxide. In this embodiment, the first inorganic transparent insulating layer **140** and the first bump B**1** further have an over coating layer OC in between. The over coating layer OC covers the first color resist **110**, the second color resist **120** and the third color resist **130**, but the disclosure is not limited thereto. In some embodiments, the thickness of the over coating layer OC affects the shape of the first inorganic transparent insulating layer **140** at the first bump B**1**. The thinner the over coating layer OC is, the more prominent the reliefs formed by the first inorganic transparent insulating layer **140** at the first bump B**1** are.

[0038] The pixel array substrate **200** includes, for example, a plurality of scan lines, a plurality of data lines, a plurality of active elements, and a plurality of pixel electrodes thereon. In some embodiments, the pixel array substrate **200** further includes a common electrode thereon, but the disclosure is not limited thereto. In some embodiments, the opposite substrate **100** includes a common electrode thereon.

[0039] The sealant **300** is located between the pixel array substrate **200** and the opposite substrate **100**, and may be adapted to seal the liquid crystal layer LC. In this embodiment, the sealant **300** covers the first bump B**1**. The first inorganic transparent insulating layer **140** on a surface of the first bump B**1** may block the moisture. As such, the first bump B**1** and the first inorganic transparent insulating layer **140** lengthens the moving path required for the moisture to pass through the sealant **300** and thereby makes it more difficult for the moisture to pass through the sealant **300**. Hence, the moisture is effectively blocked from infiltrating from the sealant **300**. In addition, the first bump B**1** increases a bonding area of the sealant **300** and improves the adhesion of the sealant **300**.

[0040] Based on the above, by having the first inorganic transparent insulating layer **140** located on the first bump B**1**, and having the sealant **300** covering the first bump B**1**, not only the moisture is effectively blocked from infiltrating from the sealant **300**, but also the bonding area of the sealant **300** increases and the adhesion of the sealant **300** is improved.

[0041] FIG. **3** is a schematic cross-sectional view of a liquid crystal display panel according to an embodiment of the disclosure. It should be noted that the reference numerals and a part of the contents in the embodiments of FIG. **1** to FIG. **2** are also used to describe the embodiments of FIG. **3**, in which the same or similar reference numerals are used to represent identical or similar elements, and thus descriptions of the same technical contents are omitted. Please refer to the descriptions of the previous embodiment for the omitted contents, which will not be repeated hereinafter.

[0042] The main difference between a liquid crystal display panel **20** of FIG. **3** and the liquid crystal display panel **10** of FIG. **1** lies in: the first color resist **110**, the second color resist **120** and the third color resist **130** of the liquid crystal display panel **20** are defined by different photo masks.

[0043] Referring to FIG. **3**, a distance P**1** between an end of the first isolation structure **114** (for example, the left end) and a corresponding end of the corresponding second isolation structure **124** (for example, the left end) is different from a distance P**2** between an end of each of the plurality of first sub-pixel filter patterns **112** (for example, the left end) and a corresponding end of a corresponding second sub-pixel filter pattern **122** (for example, the left end), and a distance P**3** between an end of each of the plurality of the second isolation structures **124** (for example, the left end) and a corresponding end of the corresponding third isolation structure **134** (for example, the left end) is different from a distance P**4** between an end of each of the plurality of second sub-pixel filter patterns **122** (for example, the left end) and a corresponding end of a corresponding third sub-pixel filter pattern **132** (for example, the left end).

[0044] In this embodiment, a vertical projection area of each of the plurality of the first isolation structures **114** on the opposite substrate **100** is different from a vertical projection area of each of the plurality of the second isolation structures **124** on the opposite substrate **100** and a vertical projection area of each of the plurality of the third isolation structures **134** on the opposite substrate **100**. The vertical projection area of each of the plurality of the second isolation structures **124** on the opposite substrate **100** is different from the vertical projection area of each of the plurality of the third isolation structures **134** on the opposite substrate **100**, but the disclosure is not limited thereto.

[0045] The width of the first bump B**1** may be freely designed, and the first isolation structure **114**, the second isolation structure **124** and the third isolation structure **134** are reduced in size sequentially in the order of fabrication. The greater the differences between the widths of the first isolation structure **114**, the second isolation structure **124** and the third isolation structure **134** are, the flatter the top of the first bump B**1** fabricated is. The smaller the differences between the widths of the first isolation structure **114**, the second isolation structure **124** and the third isolation structure **134** are, the steeper the top of the first bump B**1** fabricated is.

[0046] Based on the above, by having the first inorganic transparent insulating layer **140** located on the plurality of first bumps B**1**, and having the sealant **300** covering the plurality of first bumps B**1**, not only the moisture is effectively blocked from infiltrating from the sealant **300**, but also the bonding area of the sealant **300** increases and the adhesion of the sealant **300** is improved.

[0047] FIG. **4** is a schematic cross-sectional view of a liquid crystal display panel according to an embodiment of the disclosure. It should be noted that the reference numerals and a part of the contents in the embodiments of FIG. **3** are also used to describe the embodiments of FIG. **4**, in which the same or similar reference numerals are used to represent

identical or similar elements, and thus descriptions of the same technical contents are omitted. Please refer to the descriptions of the previous embodiment for the omitted contents, which will not be repeated hereinafter.

[0048] The main difference between a liquid crystal display panel **30** of FIG. **4** and the liquid crystal display panel **20** of FIG. **2** lies in: each first bump B**1** includes one of the first isolation structures **114** and one of the second isolation structures **124** stacked on each other.

[0049] The first color resist **110** includes a plurality of first sub-pixel filter patterns **112** and at least one first isolation structure **114**, the second color resist **120** includes a plurality of second sub-pixel filter patterns **122** and at least one second isolation structure **124**, and the third color resist **130** includes a plurality of third sub-pixel filter patterns **132**. The first bump B**1** includes a first isolation structure **114** and a second isolation structure **124** stacked on each other. In this embodiment, the first color resist **110** includes a plurality of first sub-pixel filter patterns **112** and a plurality of first isolation structures **114**, the second color resist **120** includes a plurality of second sub-pixel filter patterns **122** and a plurality of second isolation structures **124**, but the disclosure is not limited thereto.

[0050] In other embodiments, the first color resist **110** includes a plurality of first sub-pixel filter patterns **112** and at least one first isolation structure **114**, the second color resist **120** includes a plurality of second sub-pixel filter patterns **122**, and the third color resist **130** includes a plurality of third sub-pixel filter patterns **132** and at least one third isolation structure **134**. The first bump B**1** includes a first isolation structure **114** and a third isolation structure **134** stacked on each other.

[0051] In other embodiments, the first color resist **110** includes a plurality of first sub-pixel filter patterns **112**, the second color resist **120** includes a plurality of second sub-pixel filter patterns **122** and at least one second isolation structure **124**, and the third color resist **130** includes a plurality of third sub-pixel filter patterns **132** and at least one third isolation structure **134**. The first bump B**1** includes a second isolation structure **124** and a third isolation structure **134** stacked on each other.

[0052] In this embodiment, the first color resist **110**, the second color resist **120** and the third color resist **130** are defined by different photo masks, for example, but the disclosure is not limited thereto. In other embodiments, the first color resist **110** and the second color resist **120** are defined by a same photo mask, as the third color resist **130** is defined by a different photo mask. In other embodiments, the second color resist **120** and the third color resist **130** are defined by a same photo mask, as the first color resist **110** is defined by a different photo mask. In other embodiments, the first color resist **110** and the third color resist **130** are defined by a same photo mask, as the second color resist **120** is defined by a different photo mask.

[0053] By having each first bump B**1** including two of the first isolation structure **114**, the second isolation structure **124** and the third isolation structure **134**, the thickness of the liquid crystal layer LC may be smaller.

[0054] Based on the above, by having the first inorganic transparent insulating layer **140** located on the first bump B**1**, and having the sealant **300** covering the first bump B**1**, not only the moisture is effectively blocked from infiltrating from the sealant **300**, but also the bonding area of the sealant **300** increases and the adhesion of the sealant **300** is improved.

[0055] FIG. **5** is a schematic cross-sectional view of a liquid crystal display panel according to an embodiment of the disclosure. It should be noted that the reference numerals and a part of the contents in the embodiments of FIG. **1** to FIG. **2** are also used to describe the embodiments of FIG. **5**, in which the same or similar reference numerals are used to represent identical or similar elements, and thus descriptions of the same technical contents are omitted. Please refer to the descriptions of the previous embodiment for the omitted contents, which will not be repeated hereinafter.

[0056] The main difference between a liquid crystal display panel **40** of FIG. **5** and the liquid crystal display panel **10** of FIG. **1** lies in: the liquid crystal display panel **40** further includes a second inorganic transparent insulating layer **240**.

[0057] In this embodiment, the first bump B**1** may be the same as the first bump B**1** of any of the foregoing embodiments. For example, the first bump B**1** includes at least two of the first isolation structure **114**, the second isolation structure **124** and the third isolation structure **134** of the foregoing embodiments, but the disclosure is not limited thereto. The first bump B**1** may also be made of other materials.

[0058] In this embodiment, the second inorganic transparent insulating layer **240** is located on the pixel array substrate **200**. In some embodiments, the second inorganic transparent insulating layer **240** completely covers the pixel array substrate **200**, for example, substantially covers the entire upper surface of the pixel array substrate **200** or the entire inner surface of the pixel array substrate **200**, but the disclosure is not limited thereto. The first inorganic transparent insulating layer **140** is in contact with the second inorganic transparent insulating layer **240**, blocking the path of the moisture to infiltrate into the liquid crystal display panel **40**.

[0059] FIG. **6** is a schematic cross-sectional view of a liquid crystal display panel according to an embodiment of the disclosure. It should be noted that the reference numerals and a part of the contents in the embodiments of FIG. **5** are also used to describe the embodiments of FIG. **6**, in which the same or similar reference numerals are used to represent identical or similar elements, and thus descriptions of the same technical contents are omitted. Please refer to the descriptions of the previous embodiment for the omitted contents, which will not be repeated hereinafter.

[0060] The main difference between a liquid crystal display panel **50** of FIG. **6** and the liquid crystal display panel **40** of FIG. **5** lies in: The first inorganic transparent insulating layer **140** of the liquid crystal display panel **50** does not contact the second inorganic transparent insulating layer **240**.

[0061] In this embodiment, since the first inorganic transparent insulating layer **140** does not contact the second inorganic transparent insulating layer **240**, a contact area between the sealant **300** and the second inorganic transparent insulating layer **240** on the pixel array substrate **200** and a contact area between the sealant **300** and the first inorganic transparent insulating layer **140** on the opposite substrate **100** are larger.

[0062] FIG. **7** is a schematic cross-sectional view of a liquid crystal display panel according to an embodiment of

the disclosure. It should be noted that the reference numerals and a part of the contents in the embodiments of FIG. **5** are also used to describe the embodiments of FIG. **7**, in which the same or similar reference numerals are used to represent identical or similar elements, and thus descriptions of the same technical contents are omitted. Please refer to the descriptions of the previous embodiment for the omitted contents, which will not be repeated hereinafter.

[0063] The main difference between a liquid crystal display panel **60** of FIG. **7** and the liquid crystal display panel **40** of FIG. **5** lies in: the liquid crystal display panel **60** further includes a plurality of second bumps B**2**.

[0064] In this embodiment, an active region AR of the liquid crystal display panel **60** (as shown in FIG. **1**) has an insulating layer **210**, and a peripheral region BR (as shown in FIG. **1**) has a plurality of second bumps B**2**. The insulating layer **210** is located on the pixel array substrate **200**. The second bumps B**2** are located on the pixel array substrate **200**. The second bumps B**2** and the insulating layer **210** are formed by the same material and are formed together, for example.

[0065] At least one of the second bumps B**2** protrudes from the pixel array substrate **200** toward the opposite substrate **100**, wherein the sealant **300** covers at least one of the second bumps B**2**. The second inorganic transparent insulating layer **240** is located on the second bumps B**2**. In this embodiment, the plurality of second bumps B**2** are covered by the sealant **300**, for example, but the disclosure is not limited thereto.

[0066] In this embodiment, the second bumps B**2** and the first bumps B**1** are disposed alternately, but the disclosure is not limited thereto. In other embodiments, the second bumps B**2** and the first bumps B**1** may be connected to one another.

[0067] In this embodiment, the active region AR of the liquid crystal display panel **60** has a pixel electrode **220** and a common electrode **230** therein. The pixel electrode **220** and the common electrode **230** are located on the pixel array substrate **200**, and the pixel electrode **220** and the common electrode **230** are, for example, located on the insulating layer **210**. The second inorganic transparent insulating layer **240** is located between the pixel electrode **220** and the common electrode **230**.

[0068] Based on the above, by having the first inorganic transparent insulating layer **140** located on the plurality of first bumps B**1**, having the second inorganic transparent insulating layer **240** located on the plurality of second bumps B**2**, and having the sealant **300** covering the plurality of first bumps B**1** and the plurality of second bumps B**2**, not only the moisture is effectively blocked from infiltrating from the sealant **300**, but also the bonding area of the sealant **300** increases and the adhesion of the sealant **300** is improved.

[0069] FIG. **8** is a schematic cross-sectional view of a liquid crystal display panel according to an embodiment of the disclosure. It should be noted that the reference numerals and a part of the contents in the embodiments of FIG. **7** are also used to describe the embodiments of FIG. **8**, in which the same or similar reference numerals are used to represent identical or similar elements, and thus descriptions of the same technical contents are omitted. Please refer to the descriptions of the previous embodiment for the omitted contents, which will not be repeated hereinafter.

[0070] The main difference between a liquid crystal display panel **70** of FIG. **8** and the liquid crystal display panel **60** of FIG. **7** lies in: The first inorganic transparent insulating layer **140** of the liquid crystal display panel **70** does not contact the second inorganic transparent insulating layer **240**.

[0071] In this embodiment, since the first inorganic transparent insulating layer **140** does not contact the second inorganic transparent insulating layer **240**, a contact area between the sealant **300** and the second inorganic transparent insulating layer **240** on the pixel array substrate **200** and a contact area between the sealant **300** and the first inorganic transparent insulating layer **140** on the opposite substrate **100** are larger.

[0072] In sum of the above, by having the first inorganic transparent insulating layer located on the first bump, and having the sealant covering the first bump, not only the moisture is effectively blocked from infiltrating from the sealant, but also the bonding area of the sealant increases and the adhesion of the sealant is improved. In some embodiments, the liquid crystal display panel further includes a second inorganic transparent insulating layer and a second bump. The second inorganic transparent insulating layer is located on the second bump, and the sealant covers the first bump and the second bump. As such, not only the moisture is more effectively blocked from infiltrating from the sealant, but also the bonding area of the sealant further increases and the adhesion of the sealant is improved.

[0073] It will be apparent to those skilled in the art that various modifications and variations can be made to the disclosed embodiments without departing from the scope or spirit of the disclosure. In view of the foregoing, it is intended that the disclosure covers modifications and variations provided that they fall within the scope of the following claims and their equivalents.

What is claimed is:

1. A liquid crystal display panel, comprising:
- a pixel array substrate;
- an opposite substrate, facing the pixel array substrate;
- a liquid crystal layer, located between the pixel array substrate and the opposite substrate;
- a first bump, located between the pixel array substrate and the opposite substrate;
- a first inorganic transparent insulating layer, located on the first bump and completely covering the opposite substrate; and
- a sealant, surrounding the liquid crystal layer, wherein the sealant covers the first bump.

2. The liquid crystal display panel according to claim **1**, wherein the first bump is located on the opposite substrate and the first bump protrudes from the opposite substrate toward the pixel array substrate.

3. The liquid crystal display panel according to claim **2**, further comprising:
- a second bump, located on the pixel array substrate, and the second bump protrudes from the pixel array substrate toward the opposite substrate, wherein the sealant covers the second bump; and
- a second inorganic transparent insulating layer located on the second bump.

4. The liquid crystal display panel according to claim **1**, further comprising:
- a second inorganic transparent insulating layer, located on the pixel array substrate.

5. The liquid crystal display panel according to claim **4**, further comprising:

a pixel electrode and a common electrode, located on the pixel array substrate, wherein the second inorganic transparent insulating layer is located between the pixel electrode and the common electrode.

6. The liquid crystal display panel according to claim **4**, wherein the first inorganic transparent insulating layer contacts the second inorganic transparent insulating layer.

7. The liquid crystal display panel according to claim **4**, wherein the first inorganic transparent insulating layer does not contact the second inorganic transparent insulating layer.

8. The liquid crystal display panel according to claim **1**, further comprising:

a first color resist, located on the opposite substrate and comprising a plurality of first sub-pixel filter patterns and a first isolation structure;

a second color resist, located on the opposite substrate and comprising a plurality of second sub-pixel filter patterns and a second isolation structure, wherein each of the first bump comprises the first isolation structure and the second isolation structure stacked on each other; and

a third color resist, located on the opposite substrate and comprises a plurality of third sub-pixel filter patterns.

9. The liquid crystal display panel according to claim **8**, wherein: the third color resist further comprises a third isolation structure, and the first bump comprises the first isolation structure, the second isolation structure and the third isolation structure stacked on one another.

10. The liquid crystal display panel according to claim **9**, wherein

a distance between an end of the first isolation structure and a corresponding end of the second isolation structure is equal to a distance between an end of each of the plurality of first sub-pixel filter patterns and a corresponding end of a corresponding second sub-pixel filter pattern, and

a distance between an end of the second isolation structure and a corresponding end of the third isolation structure is equal to a distance between an end of each of the plurality of second sub-pixel filter patterns and a corresponding end of a corresponding third sub-pixel filter pattern.

11. The liquid crystal display panel according to claim **1**, wherein the first inorganic transparent insulating layer comprises silicon nitride or silicon oxide.

* * * * *

专利名称(译)	液晶显示面板		
公开(公告)号	US20200057326A1	公开(公告)日	2020-02-20
申请号	US16/177457	申请日	2018-11-01
[标]申请(专利权)人(译)	中华映管股份有限公司		
申请(专利权)人(译)	中华映管股份有限公司.		
当前申请(专利权)人(译)	中华映管股份有限公司.		
[标]发明人	LAI MIN TA		
发明人	LAI, MIN-TA		
IPC分类号	G02F1/1339 G02F1/1343 G02F1/1335 G02F1/1333		
CPC分类号	G02F1/133345 G02F1/1343 G02F1/1339 G02F1/133514 G02F2201/50		
优先权	201810959779.8 2018-08-20 CN		
外部链接	Espacenet USPTO		

摘要(译)

提供一种液晶显示面板，其包括像素阵列基板，相对基板，液晶层，多个第一凸块，第一无机透明绝缘层和密封剂。 相对基板面对像素阵列基板。 液晶层位于像素阵列基板和相对基板之间。 多个第一凸块位于像素阵列基板和相对基板之间。 第一无机透明绝缘层位于多个第一凸块上并且完全覆盖相对的基板。 密封剂包围液晶层。 密封剂覆盖多个第一凸块。 本发明的液晶显示面板有效地阻挡了从密封剂渗入的水分。