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(19) **United States**(12) **Patent Application Publication**
Lee(10) **Pub. No.: US 2006/0262265 A1**(43) **Pub. Date: Nov. 23, 2006**(54) **LIQUID CRYSTAL DISPLAY PANEL AND
METHOD OF FABRICATING THEREOF****Publication Classification**(51) **Int. Cl.****G02F 1/1339** (2006.01)(52) **U.S. Cl.** **349/155**(76) **Inventor: Min Jic Lee, Dong-gu (KR)**

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(57)

ABSTRACT

A liquid crystal display panel and a fabricating method thereof for preventing a generation of stains caused by a cell gap difference between an active area and an outside area are disclosed. In the liquid crystal display panel, an adhesive is placed between an upper substrate and a lower substrate that are closed in such a manner as to join an upper substrate from a lower substrate. A liquid crystal layer is provided at a closed area defined by the adhesive by a dropping system. A first pattern spacer is positioned at an active area between the upper substrate and the lower substrate. A second pattern spacer is provided such that an outside area thereof enclosing said active area has a different arrangement density from the first pattern spacer and is provided at the same plane as the first pattern spacer.

(21) **Appl. No.: 11/304,534**(22) **Filed: Dec. 16, 2005**(30) **Foreign Application Priority Data**

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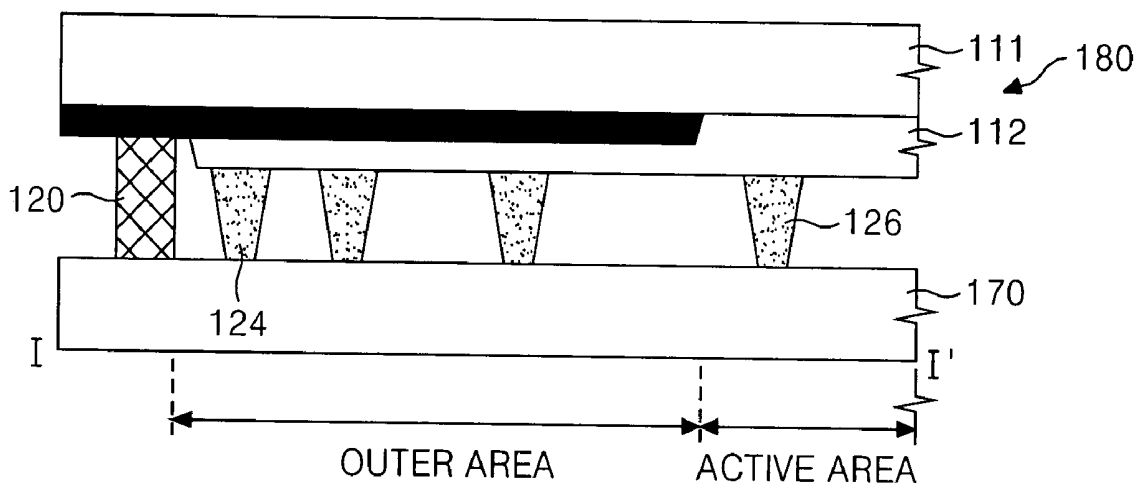


FIG. 1
RELATED ART

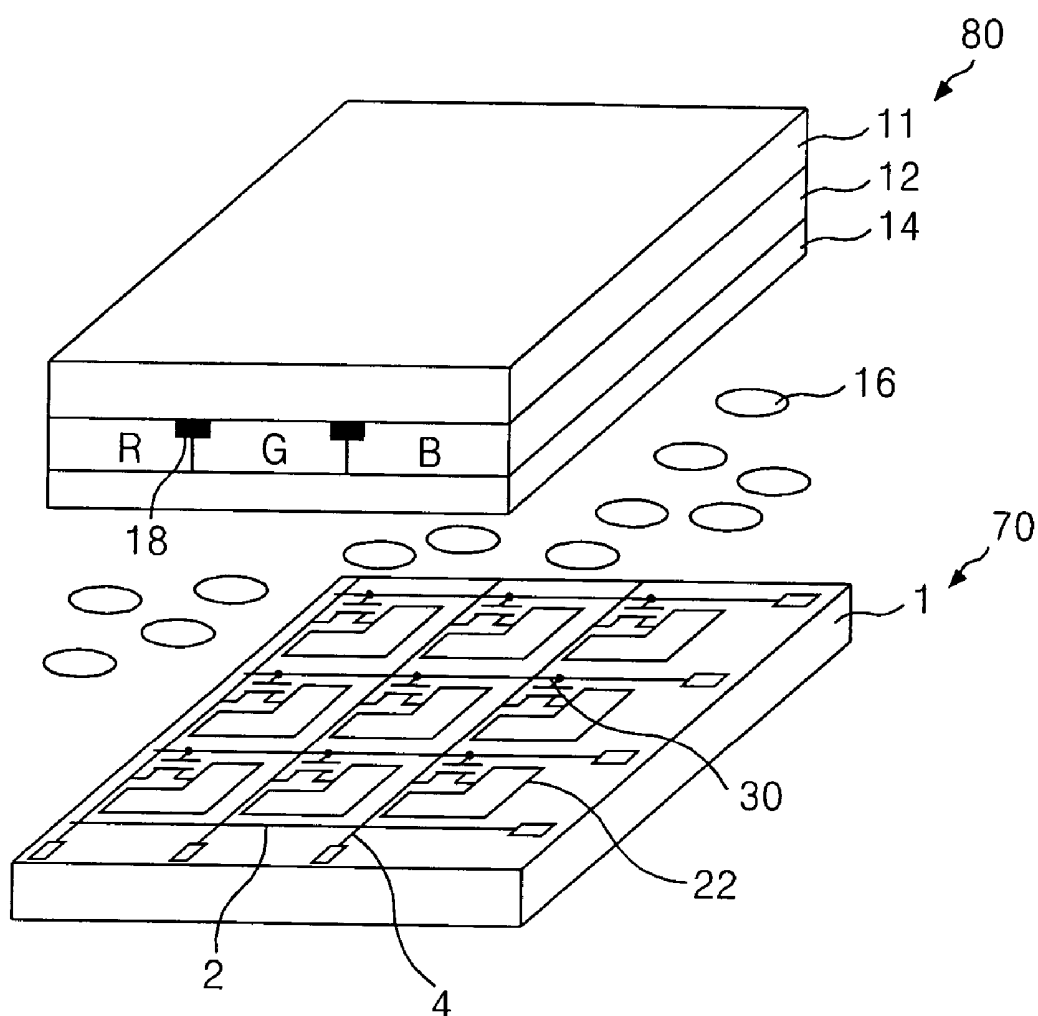


FIG. 2
RELATED ART

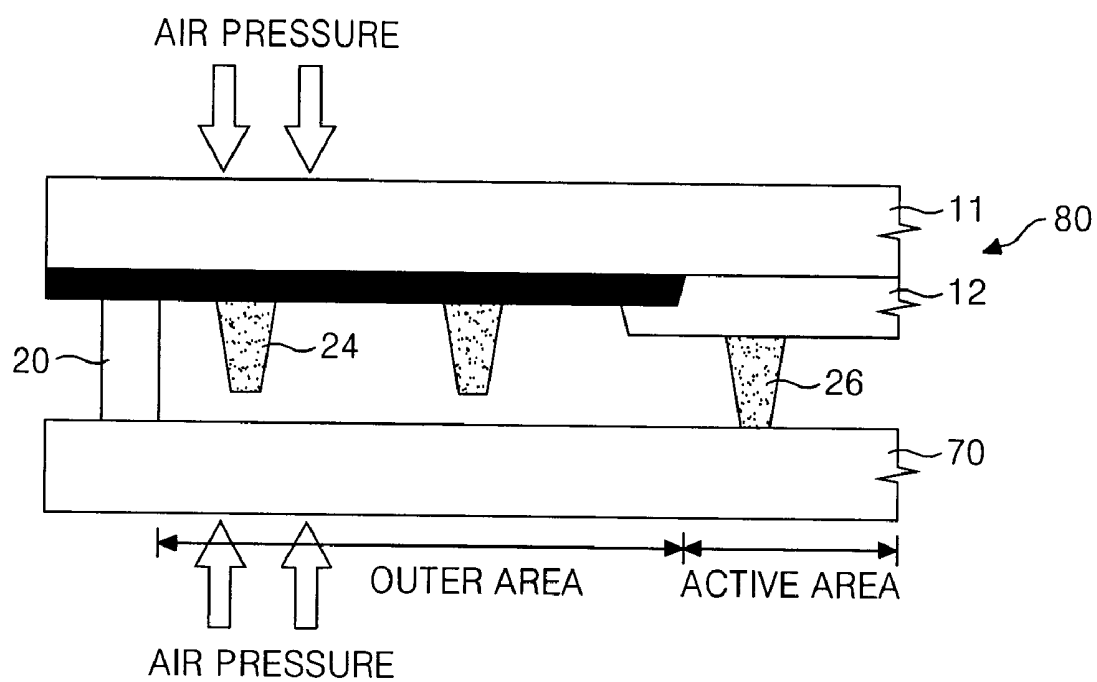


FIG. 3

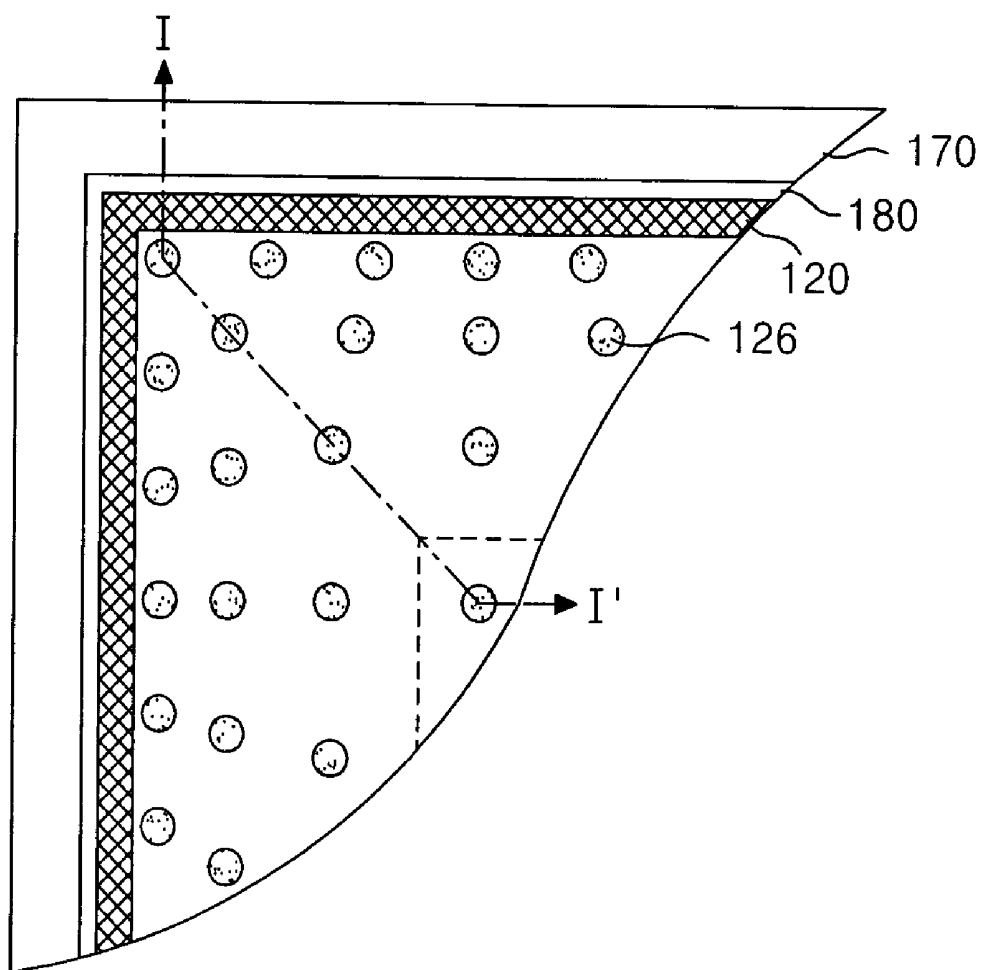


FIG. 5A

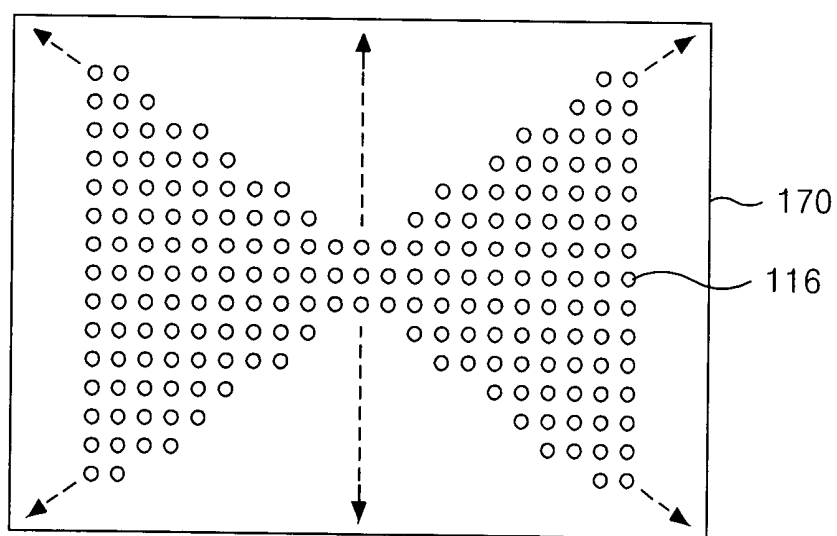
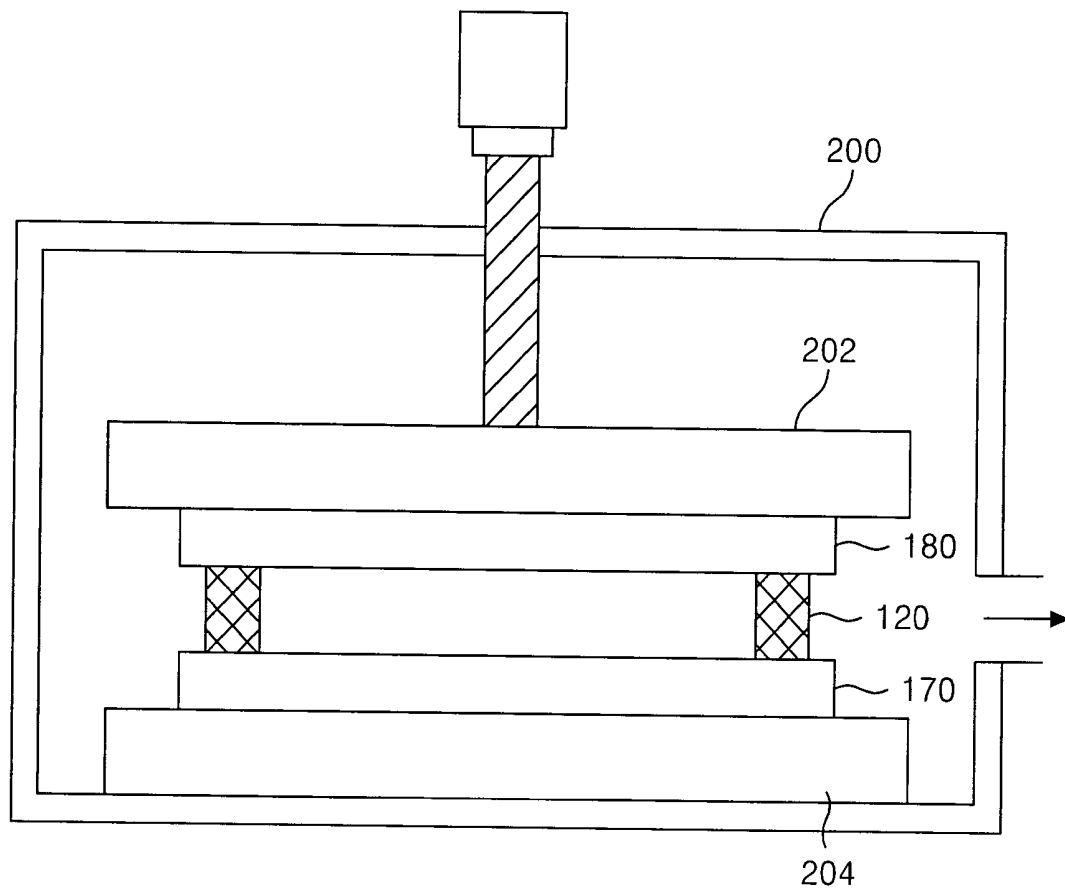
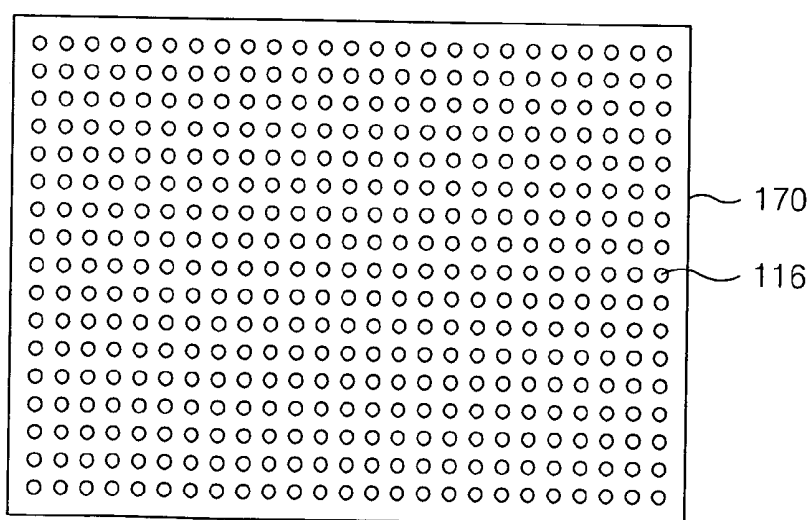
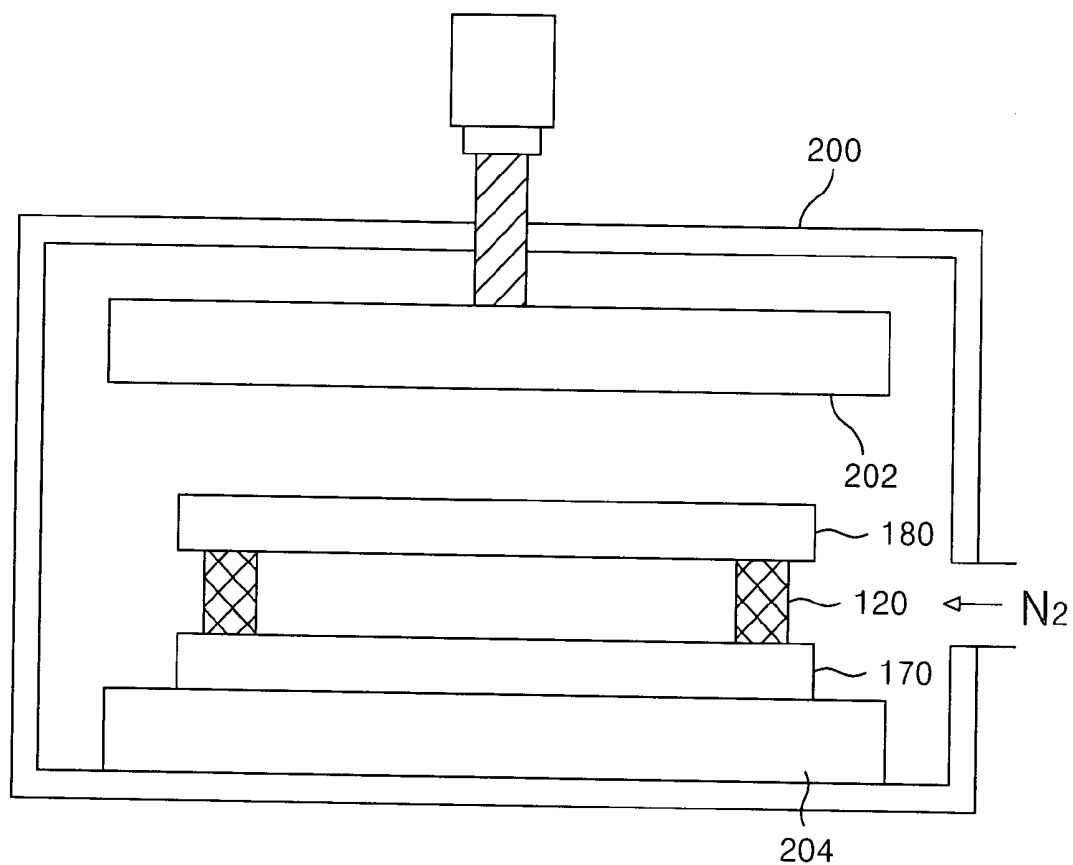


FIG. 5B



LIQUID CRYSTAL DISPLAY PANEL AND METHOD OF FABRICATING THEREOF

[0001] This application claims the benefit of Korean Patent Application No. P2005-41839 filed in Korea on May 18, 2005, which is hereby incorporated by reference for all purposes as if fully set forth herein.

BACKGROUND OF THE INVENTION

[0002] 1. Field of the Invention

[0003] The present invention relates to a liquid crystal display panel, and more particularly to a liquid crystal display panel and a fabricating method thereof that are adaptive for preventing a generation of stains caused by a cell gap difference between an active area and an outside area.

[0004] 2. Description of the Related Art

[0005] A liquid crystal display device controls light transmittance of a liquid crystal using an electric field in order to display a picture. As illustrated in **FIG. 1**, the liquid crystal display device includes a thin film transistor substrate **70** and a color filter substrate **80** that are opposed to each other with having a liquid crystal layer **16** therebetween.

[0006] In the color filter substrate **80**, a color filter array including a black matrix **18** for preventing light leakage, a color filter **12** for implementing a color, a common electrode **14** forming a vertical electric field along with a pixel electrode **22** and an upper alignment film coated thereon to align the liquid crystal is provided on an upper substrate **11**.

[0007] In the thin film transistor substrate **70**, a thin film transistor array including a gate line **2** and a data line **4** crossing each other, a thin film transistor **30** formed at an intersection thereof, a pixel electrode **22** connected to the thin film transistor **30** and a lower alignment film coated thereon to align the liquid crystal is provided on a lower substrate **1**.

[0008] In a related art liquid crystal display device, the liquid crystal layer **16** is provided between the thin film transistor substrate **70** and the color filter substrate **80** by a dropping system. More specifically, the liquid crystal is dropped into a closed area defined by an adhesive coated onto any at least one of the thin film transistor substrate **70** and the color filter substrate **80** to thereby provide the liquid crystal layer **16**. Then, the thin film transistor substrate **70** and color filter substrates **80** undergo a vacuum joining with having the liquid crystal layer **16** therebetween, thereby completing the liquid crystal display panel.

[0009] After the vacuum joining of the thin film transistor substrate **70** and color filter substrates **80**, the exterior of the liquid crystal display panel returns to atmospheric pressure with the liquid crystal layer **16** being not filled uniformly until the outside area encloses the active area. Then, the outside area of the liquid crystal display panel, that is, an area adjacent to the adhesive **20** becomes a vacuum to receive high pressure from the exterior thereof, thereby causing a twisting of the substrate. Further, as illustrated **FIG. 2**, the color filter **12** is not provided at the outside area. In this case, a main pattern spacer **26** positioned at the active area is in contact with the thin film transistor substrate **70**, whereas a dummy pattern spacer **24** positioned at the outside area is not in contact with the thin film transistor substrate

70. Thus, a problem such that a twisting of the substrate differentiates a cell gap of the active area from that of the outside area, causing stains.

SUMMARY OF THE INVENTION

[0010] Accordingly, it is an advantage of the present invention to provide a liquid crystal display panel and a fabricating method thereof that are adaptive for preventing stains caused by a cell gap difference between an active area and an outside area.

[0011] In order to achieve these and other advantages of the invention, the liquid crystal display panel according to the present invention includes: an adhesive formed in such a manner to have a closing type between an upper substrate and a lower substrate and unites the upper substrate and the lower substrate; a liquid crystal layer is formed in a dropping type at the closed area arranged by the adhesive; a first pattern spacer positioned at the active area of between the upper substrate and the lower substrate; a second pattern spacer formed differently an arrangement density in comparison to the first pattern spacer positioned at the outside area enclosing the active area and is formed on the same plane along with the first pattern spacer.

[0012] In the liquid crystal display panel, said second pattern spacer has a higher arrangement density than the first pattern spacer as it goes around said adhesive.

[0013] The liquid crystal display panel further comprises a black matrix provided on the upper substrate and a color filter provided at the active area and the outside area on the black matrix.

[0014] The liquid crystal display panel further comprises a smoothing layer provided at the active area and the outside area to cover the color filter.

[0015] In the liquid crystal display panel, said first and second pattern spacers are provided on the color filter.

[0016] In the liquid crystal display panel, said first and second pattern spacers are provided on the smoothing layer.

[0017] The second pattern spacer is having a higher arrangement density as approaching to the adhesive in comparison to the first pattern spacer.

[0018] The liquid crystal display panel includes: the black matrix formed on the upper substrate; a color filter formed at the active area and outside area of the black matrix.

[0019] The liquid crystal display panel includes: a flattening layer formed at the active area and outside area for covering the color filter.

[0020] The first and second pattern spacers are formed on the color filter.

[0021] The first and second pattern spacers are formed on the flattening layer.

[0022] A method of fabricating the liquid crystal display panel according to the present invention includes: preparing a first substrate; preparing a second substrate facing the first substrate including a second pattern spacer formed differently an arrangement density in comparison to a first pattern spacer positioned at the outside area enclosing the active area and formed on the same plane along with the first pattern spacer; forming an adhesive in a closing type on at

least one of the first substrate and second substrates; dropping a liquid crystal at the closed area arranged by the adhesive; uniting the first and second substrates together employing the adhesive with the liquid crystal therebetween.

[0023] In the method, the step of preparing the second substrate includes simultaneously forming the first pattern spacer and the second pattern spacer with a higher arrangement density than the first pattern spacer as it goes around the adhesive on the second substrate.

[0024] The method further includes the steps of forming a black matrix on any one of the first substrate and second substrates; and forming the color filter at the active area and the outside area on the black matrix.

[0025] The method further comprises the step of forming a smoothing layer at the active area and the outside area to cover the color filter.

[0026] In the method, said first and second pattern spacers are formed on the color filter.

[0027] In the method, said first and second pattern spacers are formed on the smoothing layer.

[0028] In the method, said first and second pattern spacers are formed by a photolithography.

[0029] The step of preparing the second substrate includes: forming simultaneously a first pattern spacer, and a second pattern spacer having a higher arrangement density in comparison to the first pattern spacer as approaching to the first pattern spacer and the adhesive on the second substrate.

[0030] The method further comprises the step of forming a black matrix on any one of the first substrate and second substrates; forming a color filter at the active area and the outside area of the black matrix.

[0031] The method further comprises the step of forming a flattening layer formed at the active area and the outside area for covering the color filter.

[0032] The first and second pattern spacers are formed by a photolithography process.

BRIEF DESCRIPTION OF THE DRAWINGS

[0033] These and other objects of the invention will be apparent from the following detailed description of the embodiments of the present invention with reference to the accompanying drawings, in which:

[0034] **FIG. 1** is a perspective view illustrating a structure of a related art liquid crystal display panel;

[0035] **FIG. 2** is a detailed section view of a spacer of the related art liquid crystal display panel;

[0036] **FIG. 3** is a plan view illustrating a structure of a liquid crystal display panel according to an embodiment of the present invention;

[0037] **FIG. 4** is a section view of the liquid crystal display panel taken along the I-I' line in **FIG. 3**; and

[0038] **FIG. 5a** and **FIG. 5b** are a section view and a plan view for explaining a method of fabricating the liquid crystal display panel according to the embodiment of the present invention, respectively.

DETAILED DESCRIPTION OF THE ILLUSTRATED EMBODIMENTS

[0039] Examples of embodiments of the present invention will now be described with reference to the drawings. Hereinafter, the exemplary embodiment of the present invention will be described in detail with reference to **FIG. 3** to **FIG. 5b**.

[0040] **FIG. 3** is a plan view illustrating a structure of the liquid crystal display panel according to an embodiment of the present invention, and **FIG. 4** is a section view of the liquid crystal display panel taken along the I-I' line in **FIG. 3**.

[0041] Referring to **FIG. 3** and **FIG. 4**, the liquid crystal display panel includes pattern spacers **124** and **126**, and a thin film transistor substrate **170** and a color filter substrate **180** opposed to each other with having the pattern spacers **124** and **126** therebetween.

[0042] In the thin film transistor substrate **170**, a thin film transistor array including a gate line and a data line crossing each other, a thin film transistor formed at an intersection thereof, a pixel electrode **22** connected to the thin film transistor and a lower alignment film coated thereon to align the liquid crystal is provided on a lower substrate.

[0043] In the color filter substrate **180**, a color filter array including a black matrix **118** for preventing light leakage, a color filter **112** for implementing a color, a common electrode (not illustrated) forming a vertical electric field along with a pixel electrode and an upper alignment film coated thereon to align the liquid crystal is provided on an upper substrate **111**. Further, in the color filter substrate **180**, a smoothing layer (not illustrated) for smoothing the upper substrate **111** stepped by the color filter may be provided on the upper substrate **111**.

[0044] At least one of the color filter **112** and the smoothing layer is extended to the active area as well as the outside area. The main pattern spacer **126** and the dummy pattern spacer **124** are formed on any one of the color filter **112** and the smoothing layer extended into the outside area. As mentioned above, the pattern spacer **126** and the dummy pattern spacer **124** compensate for the step coverage between them on the same plane.

[0045] The pattern spacer includes the main pattern spacer **126** positioned at the active area and the dummy pattern spacer **124** positioned at the outside area.

[0046] The main pattern spacer **126** plays a role to keep the cell gap between the thin film transistor substrate **170** and the color filter substrate **180**. The main pattern spacer **126** is formed by patterning an organic insulating material such as acrylic group resin by the photolithography and the etching process.

[0047] The dummy pattern spacer **124** is formed from the same material and on the same plane as the main pattern spacer **126**. The dummy pattern spacer **124** has a different arrangement density from the main pattern spacer **126**. In other words, the dummy pattern spacer **124** has a constant arrangement density irrespectively of its position, whereas the dummy pattern spacer **126** has a higher arrangement density as it goes around an adhesive **120**. Thus, when the interior of the panel is a vacuum state after the joining process, the outside area can stand an external pressure by

the dummy pattern spacer **124** having a high arrangement density. Accordingly, it becomes possible to prevent a twisting of the substrate. Also, the active area and the outside area have the same cell gap, so that it becomes possible to prevent cell gap badness.

[0048] **FIG. 5a** and **FIG. 5b** are views illustrating a method of fabricating the liquid crystal display panel having the main pattern spacer and the dummy pattern spacer according to the present invention.

[0049] As illustrated **FIG. 5a**, the color filter substrate **180** and the thin film transistor substrate **170** are loaded on upper/lower stages **202** and **204**. The adhesive is coated onto the thin film transistor substrate **170** loaded on the lower stage **204** in a closed manner. The liquid crystal **116** is dropped into the closed area defined by the adhesive. In this case, since the liquid crystal **116** has spreads in the vertical direction farther than it spreads in the diagonal direction; it is dropped lengthwise onto the edge of the substrate. In other words, as it goes from the middle area of the substrate into each side area thereof, a dropped area of the liquid crystal **116** is more enlarged. After the liquid crystal **116** is dropped, the upper stage **202** is fallen. Thus, while two substrates **180** and **170** are being pressurized by the upper stage **202**, the color filter substrate **180** and the thin film transistor substrate **170** are joined to each other.

[0050] Thereafter, as illustrated **FIG. 5b**, the upper stage **202** is raised to separate the upper stage **202** from the joined two substrates **180** and **170**. Then, in order to raise a vacuum chamber **200** to atmospheric pressure and to uniformly pressurize the joined color filter substrate and thin film transistor substrate **180** and **170**, a gas such as N_2 is applied to the vacuum chamber **200**. If the gas is applied, then an area between the color filter substrate **180** and the thin film transistor substrate joined by the adhesive becomes a vacuum state while the vacuum chamber becomes the atmosphere state. Accordingly, a uniform pressure is applied such that the color filter substrate **180** and the thin film transistor substrate **170** converted into the vacuum state by the atmosphere pressure can keep a uniform gap. In this case, as illustrated **FIG. 5a** and **FIG. 5b**, the liquid crystal **116** is uniformly spread out into the closed area caused by the adhesive **120**.

[0051] As described above, according to the present invention, the dummy pattern spacer positioned at the outside area has a higher arrangement density than the main pattern spacer positioned at the active area. Accordingly, when the interior of the panel goes into a vacuum state after the joining process, the outside area can stand an external pressure with the aid of the dummy pattern spacer **124**. Accordingly, it becomes possible to prevent a twisting of the substrate. Furthermore, the active area and the outside area have the same cell gap, so that it becomes possible to prevent cell gap badness.

[0052] Although the present invention has been explained by the embodiments illustrated in the drawings described above, it should be understood to the ordinary skilled person in the art that the invention is not limited to the embodiments, but rather that various changes or modifications thereof are possible without departing from the spirit of the invention.

What is claimed is:

1. A liquid crystal display panel, comprising:
 - an adhesive between an upper substrate and a lower substrate joining an upper substrate with a lower substrate;
 - a liquid crystal layer provided at a closed area defined by the adhesive by a dropping system;
 - a first pattern spacer positioned at an active area between the upper substrate and the lower substrate; and
 - a second pattern spacer provided such that an outside area thereof enclosing said active area has a different arrangement density from the first pattern spacer and provided at the same plane as the first pattern spacer.
2. In the liquid crystal display panel as claimed in claim 1, wherein said second pattern spacer has a higher arrangement density than the first pattern spacer as it goes around said adhesive.
3. The liquid crystal display panel as claimed in claim 1, further comprising:
 - a black matrix provided on the upper substrate; and
 - a color filter provided at the active area and the outside area on the black matrix.
4. The liquid crystal display panel as claimed in claim 3, further comprising:
 - a smoothing layer provided at the active area and the outside area to cover the color filter.
5. In the liquid crystal display panel as claimed in claim 3, wherein said first and second pattern spacers are provided on the color filter.
6. In the liquid crystal display panel as claimed in claim 4, wherein said first and second pattern spacers are provided on the smoothing layer.
7. A method of fabricating a liquid crystal display panel, comprising:
 - preparing a first substrate;
 - preparing a second substrate opposed to the first substrate and having a first pattern spacer provided on an active area and a second pattern spacer provided at an outside area enclosing said active area in such a manner to have a different arrangement density from the first pattern spacer and provided on the same plane as the first pattern spacer;
 - forming an adhesive on any at least one of the first substrate and second substrates in a closed manner;
 - dropping a liquid crystal into the closed area defined by the adhesive; and
 - joining the first and second substrates to each other with the liquid crystal therebetween by the adhesive.
8. The method as claimed in claim 7, wherein said step of preparing the second substrate includes:
 - simultaneously forming the first pattern spacer and the second pattern spacer with a higher arrangement density than the first pattern spacer as it goes around the adhesive on the second substrate.
9. The method as claimed in claim 7, further comprising:
 - forming a black matrix on any one of the first substrate and second substrates; and

forming the color filter at the active area and the outside area on the black matrix.

10. The method as claimed in claim 9, further comprising:

forming a smoothing layer at the active area and the outside area to cover the color filter.

11. The method as claimed in claim 9, wherein said first and second pattern spacers are formed on the color filter.

12. The method as claimed in claim 10, wherein said first and second pattern spacers are formed on the smoothing layer.

13. The method as claimed in claim 7, said first and second pattern spacers are formed by a photolithography.

* * * * *

专利名称(译)	液晶显示面板及其制造方法		
公开(公告)号	US20060262265A1	公开(公告)日	2006-11-23
申请号	US11/304534	申请日	2005-12-16
[标]申请(专利权)人(译)	李民Ĵ		
申请(专利权)人(译)	李民Ĵ		
当前申请(专利权)人(译)	LG DISPLAY CO. , LTD.		
[标]发明人	LEE MIN JIC		
发明人	LEE, MIN JIC		
IPC分类号	G02F1/1339		
CPC分类号	G02F1/1339 G02F2001/133388 G02F1/13394		
优先权	1020050041839 2005-05-18 KR		
其他公开文献	US7630051		
外部链接	Espacenet USPTO		

摘要(译)

本发明公开了一种液晶显示面板及其制造方法，用于防止由有源区域和外部区域之间的单元间隙差异引起的污点的产生。在液晶显示面板中，粘合剂放置在上基板和下基板之间，所述粘合剂以从下基板接合上基板的方式封闭。通过滴落系统在由粘合剂限定的封闭区域处提供液晶层。第一图案间隔物位于上基板和下基板之间的有源区域。提供第二图案间隔物，使得包围所述有源区域的外部区域具有与第一图案间隔物不同的布置密度，并且设置在与第一图案间隔物相同的平面上。

