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(57) **ABSTRACT**

A liquid crystal display including: a first substrate on which a first electrode and a first orientation layer are formed; a second substrate facing the first substrate and including a second electrode and a second orientation layer; a sealant formed along edges of the first substrate and the second substrate; and a liquid crystal layer between the first electrode and the second electrode; wherein holes are formed in the first and second orientation layers and the sealant is bonded to the first and second substrates through both side holes. Since a contact area between the sealant and the substrates is increased and a bonding force is improved, a stable sealing state can be maintained with a small area and a size of a non-pixel region is reduced so that a small-sized liquid crystal display can be achieved.

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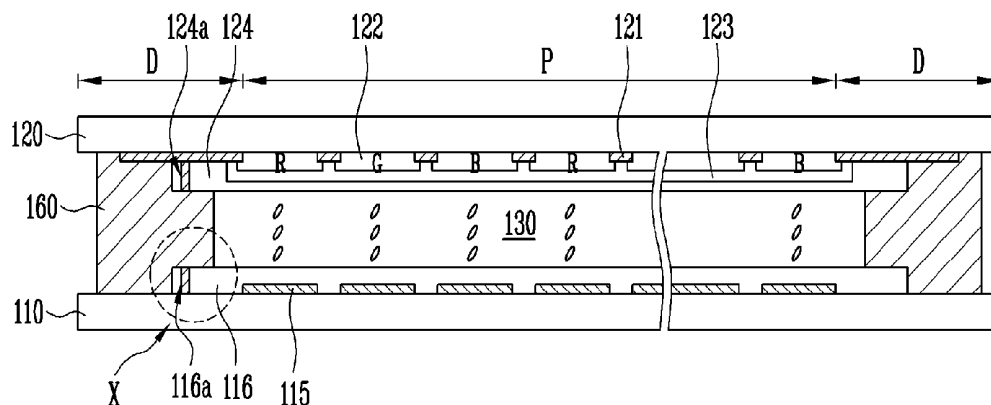


FIG. 1

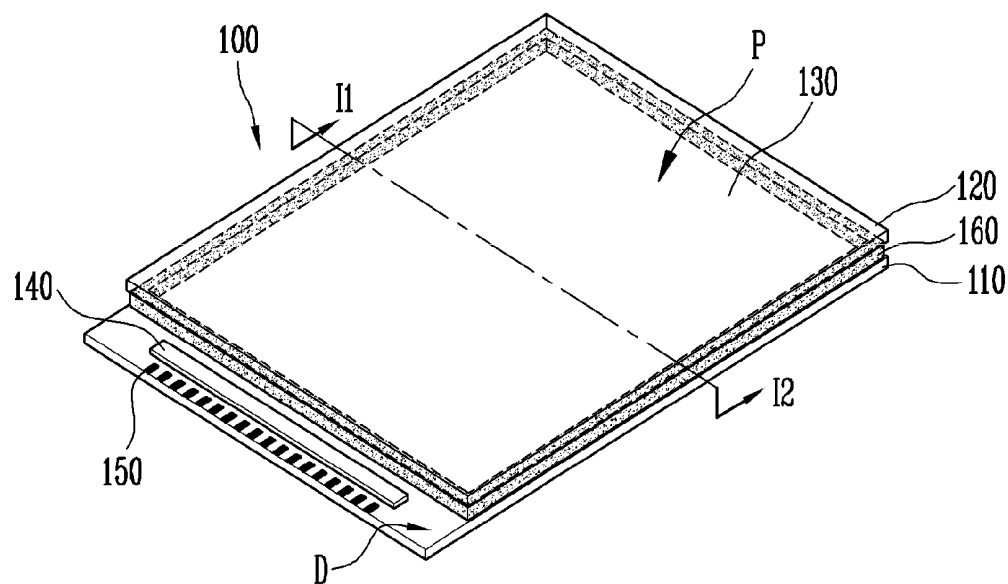


FIG. 2

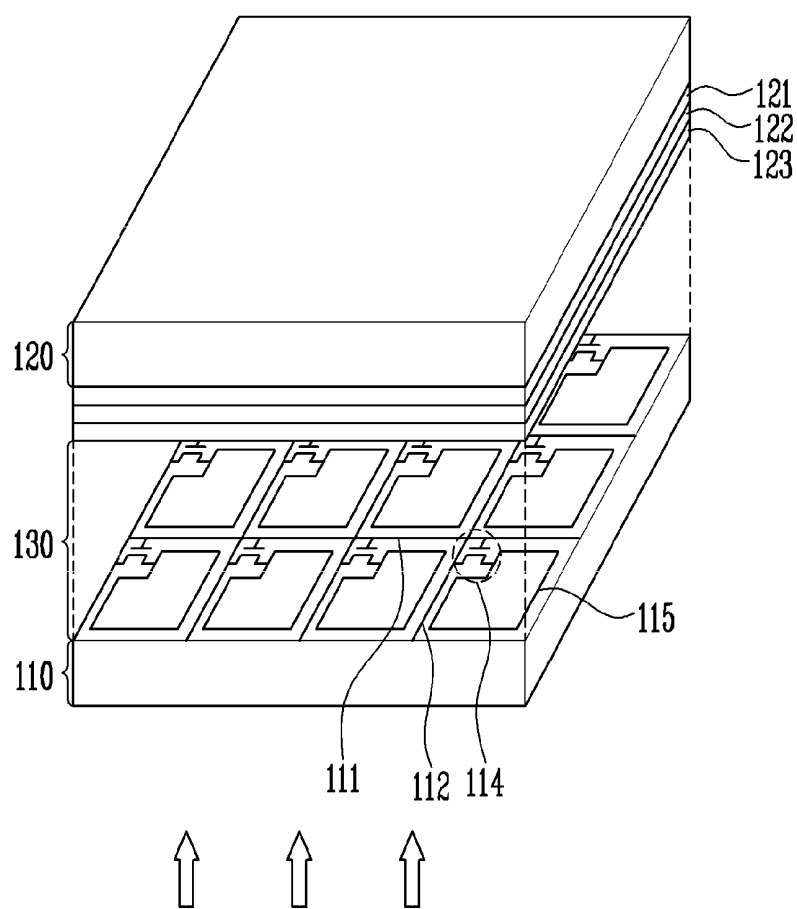


FIG. 3

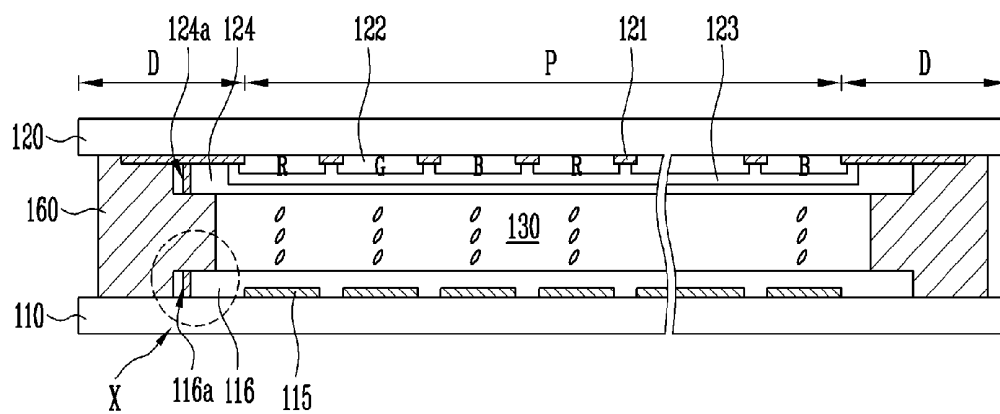


FIG. 4

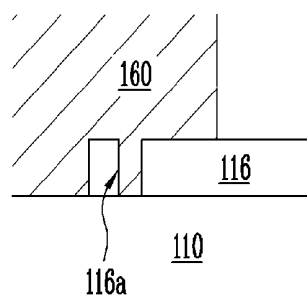


FIG. 5

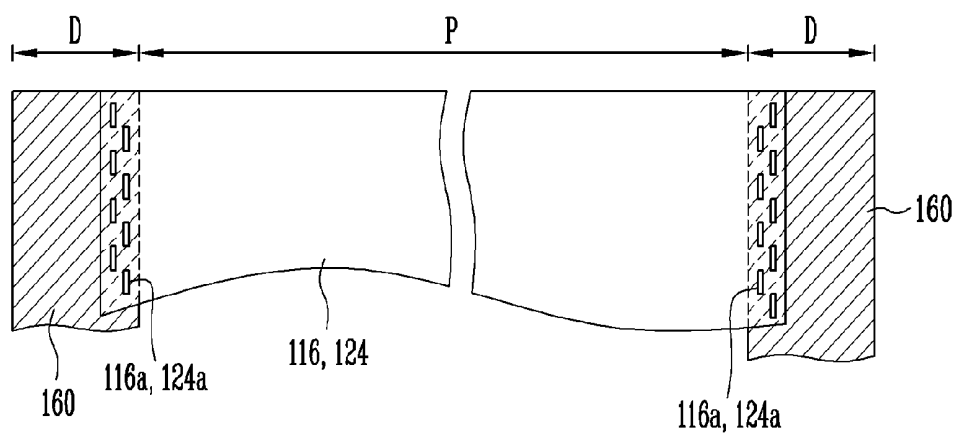
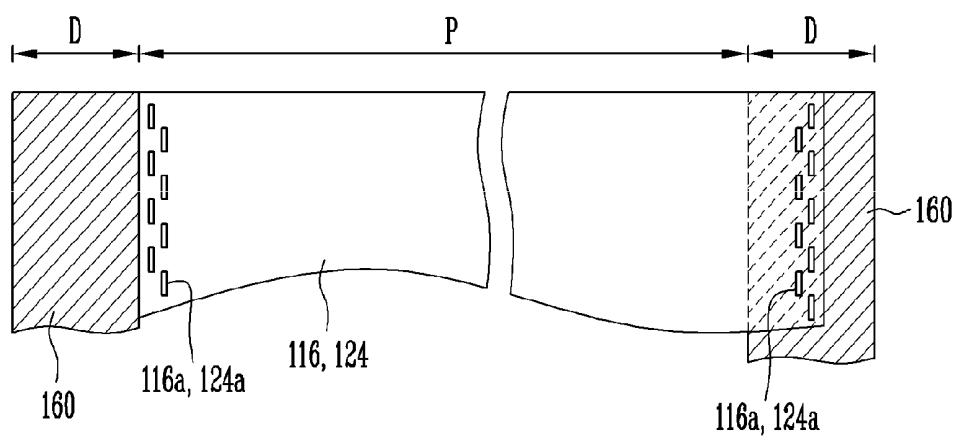


FIG. 6



LIQUID CRYSTAL DISPLAY

CROSS-REFERENCE TO RELATED APPLICATION

[0001] This application claims the benefit of Korean Patent Application No. 10-2010-0021262, filed Mar. 10, 2010, in the Korean Intellectual Property Office, the disclosure of which is incorporated herein by reference.

BACKGROUND

[0002] 1. Field

[0003] Aspects of the present invention relate to a liquid crystal display device, and a liquid crystal display device for improving bonding force between sealant and a substrate.

[0004] 2. Description of the Related Art

[0005] A liquid crystal display (LCD) using an electro-optic property of a liquid crystal to display an image or text is widely used in view of an excellent color reproduction, low power consumption, and because the LCD can be manufactured to be thin. The LCD includes a display panel displaying an image and text, a drive integrated circuit (IC) driving the display panel, and a backlight unit providing light to the display panel.

[0006] The display panel includes a lower substrate on which a pixel electrode is formed, an upper substrate on which a common electrode is formed, a liquid crystal layer disposed between the pixel electrode and the common electrode. The liquid crystal layer is sealed by a sealant formed along an edge between the lower substrate and the upper substrate to seal a space between the pixel electrode and the common electrode. The sealant is formed in a non-pixel region around the pixel region. Recently, displays have become smaller according to user requirements. However, there are problems when reducing a size of the pixel region, so, research on minimizing a size of the non-pixel region is conducted in order to reduce the display size.

SUMMARY

[0007] Aspects of the present invention provide a liquid crystal display being minimized by reducing a size of a non-pixel region.

[0008] Aspects of the present invention provide a liquid crystal display for maintaining a stable sealing state with a small area by improving a bonding force between a sealant and a substrate.

[0009] According to aspects of the present invention, there is provided a liquid crystal display includes: a first substrate on which a first electrode and a first orientation layer are formed; a second substrate facing the first substrate and including a second electrode and a second orientation layer; a sealant formed along edges of the first substrate and the second substrate; and a liquid crystal layer between the first electrode and the second electrode; wherein holes are formed in the first and second orientation layers and the sealant is bonded to the first and second substrates through both side holes.

[0010] According to another aspect of the present invention, at least some of the orientation layer is disposed between the sealant and the substrate and the holes are formed in the first orientation layer and the second orientation layer between the sealant and the first substrate and the second substrate so that the sealant is bonded to the first substrate and the second substrate through the holes. Since a contact area

between the sealant and the first substrate and the second substrate is increased and the bonding force is improved, a stable sealing state can be maintained with a small area. The size of the non-pixel region is effectively reduced so that a small liquid crystal display can be achieved.

[0011] Additional aspects and/or advantages of the invention will be set forth in part in the description which follows and, in part, will be obvious from the description, or may be learned by practice of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

[0012] These and/or other aspects and advantages of the invention will become apparent and more readily appreciated from the following description of the embodiments, taken in conjunction with the accompanying drawings of which:

[0013] FIG. 1 is a perspective view illustrating a liquid crystal display according to an embodiment of the present invention;

[0014] FIG. 2 is a schematic perspective view illustrating a pixel region P of FIG. 1;

[0015] FIG. 3 is a sectional view taken along the line I1-I2 of FIG. 1;

[0016] FIG. 4 is an enlarged sectional view of an "X" portion of FIG. 3; and

[0017] FIGS. 5 and 6 are layout views illustrating an orientation layer and a sealant of FIG. 3.

DETAILED DESCRIPTION

[0018] Reference will now be made in detail to the present embodiments of the present invention, examples of which are illustrated in the accompanying drawings, wherein like reference numerals refer to the like elements throughout. The embodiments are described below in order to explain the present invention by referring to the figures.

[0019] It is to be understood that where is stated herein that a first element is said to be disposed or formed "on" or "in" or "connected to" a second element, the first element can directly contact the second element, or can be separated from the second element by one or more other elements located therebetween. In contrast, when an element is referred to as being disposed or formed "directly on" or "directly connected to" another element, there are no intervening elements present.

[0020] FIG. 1 is a perspective view illustrating a liquid crystal display according to an embodiment of the present invention. FIG. 2 is a schematic perspective view illustrating a pixel region P of FIG. 1. Referring to FIGS. 1 and 2, a liquid crystal display (LCD) 100 includes a lower substrate 110 and an upper substrate 120 that are disposed to face each other, and a liquid crystal layer 130 disposed between the lower substrate 110 and the upper substrate 120.

[0021] The lower substrate 110 includes a pixel region P and a non-pixel region D around the pixel region P. A plurality of gate lines 111 and data lines 112 are arranged in the form of matrix on the lower substrate 110 in the pixel region P. Pixels are defined by the gate lines 111 and the data lines 112 intersecting each other. Thin film transistors 114 control signals supplied to the respective pixels and pixel electrodes 115 connected to the thin film transistors 114. The thin film transistors 114 are made of a transparent material and are formed at portions where the gate lines 111 intersect the data lines 112. A pad unit 150 receiving a signal from the outside and a drive IC 140 driving the liquid crystal are mounted on the

lower substrate **110** in the non-pixel region D. The drive IC **140** processes an electric signal provided from the outside through the pad unit **150** and provides the processed signal to the gate lines **111** and the data lines **112**. A black matrix **121** preventing interference caused by light leakage and light of the respective pixels, a color filter **122** whose red color R, green color G, and blue color B are repeated corresponding to the respective pixels, and a common electrode **123** made of a transparent material, are formed on the upper substrate **120**.

[0022] The lower substrate **110** and the upper substrate **120** are disposed to face each other and are bonded to each other by a sealant **160**. A liquid crystal layer **130** is injected into a space sealed between the lower substrate **110** and the upper substrate **120**. The liquid crystal layer **130** is disposed in the space between one of the pixel electrodes **115** and the common electrode **123** and is sealed by a sealant **160** along edges of the lower substrate **110** and the upper substrate **120**. The sealant **160** is made of resin such as epoxy, phenol, and is formed in the non-pixel region to surround the pixel region P. However, aspects of the present invention are not limited thereto, and the sealant **160** may be formed of other suitable materials.

[0023] Although not illustrated in the drawings, polarizers (not shown) are installed at the rear sides of the lower substrate **110**, the upper substrate **120** and a back light unit (not shown) as a light source is disposed at the rear side of the lower substrate **110**. Therefore, light provided from the back light (not shown) enters the liquid crystal layer **130**, is modulated by the liquid crystal oriented by voltages applied to the pixel electrode **115** and the common electrode **123**, and is emitted to the outside through the upper substrate **120** to display text and an image.

[0024] FIG. 3 is a sectional view taken along the line I-I' of FIG. 1. FIG. 4 is an enlarged sectional view of an "X" portion of FIG. 3. The embodiments of the present invention will be described in detail with reference to FIGS. 3 and 4. The liquid crystal layer **130** is disposed between an orientation layer **116** formed on the pixel electrode **115** and an orientation layer **124** formed on the common electrode **123**.

[0025] The orientation layers **116** and **124** are rubbed such that a pretilt angle and an orientation of liquid crystal molecules are adjusted after coating. Since the pretilt angle and the orientation of liquid crystal molecules are adjusted, defects, such as light leakage, occur in the orientation layers **116** and **124** when the orientation layers **116** and **124** are not formed in the pixel region P. Therefore, the orientation layers **116** and **124** are coated to be wider than the pixel region P. In other words, the orientation layers **116** and **124** are coated to include a whole of the pixel region P and some of the non-pixel region D by considering the process margin.

[0026] However, since the orientation layers **116** and **124** have weak bonding force in bonding to the sealant **160**, a contact area between the sealant **160** and the substrates **110** and **120** must be increased in consideration of the weak bonding force and therefore there is a limit on how much to reduce a size of the non-pixel region D. Therefore, the embodiments of the present invention coat and rub the orientation layers **116** and **124** and form holes **116a** and **124a** in the orientation layers **116** and **124** coated in the non-pixel region D. That, as illustrated in FIG. 4, the sealant **160** contacts the substrates **110** and **120** through the holes **116a** and **124a** formed on the orientation layers **116** and **124** so that the contact area between the sealant **160** and the substrates **110** and **120** is increased and the bonding force can be improved.

[0027] Since the size of the non-pixel region D is determined by a wire, an area occupied by the pad unit **150** and the drive IC **140**, the process margin when coating the orientation layers **116** and **124**, the contact area between the sealant **160** and the substrates **110** and **120**, and a cutting margin separating a unit display panel are reduced and the size of the non-pixel region D can be effectively reduced. Thus, a stable sealing state can be maintained with a small area due to the improved bonding force between the sealant **160** and the substrates **110** and **120**.

[0028] FIGS. 5 and 6 are layout views illustrating the orientation layers **116** and **124** and the sealant **160**. The holes **116a** and **124a** of the orientation layers **116** and **124** are rectangular or circular and are arranged alternately. However, aspects of the present invention are not limited thereto, and the holes **116a** and **124a** may have other suitable shapes and be arranged in other suitable manners. The size of the holes **116a** and **124a** is smaller than the size of a unit pixel and an area occupied by overall holes **116a** and **124a** is 20 to 50% of a contact area with the sealant **160**. For example, when the orientation layers **116** and **124** are 700 nm, defects may be prevented during the patterning when the holes **116a** and **124a** are a few micrometers to a few tens of micrometers. Although FIGS. 5 and 6 illustrate a regular arrangement of the holes **116a** and **124a**, the holes **116a** and **124a** are arranged irregularly to prevent light leakage from concentrating on a specific pixel.

[0029] FIG. 5 illustrates the orientation layers **116** and **124** formed in the whole of the pixel region P and some of the non-pixel region D. In this case, the sealant **160** contacts the substrates **110** and **120** through the holes **116a** and **124a** of orientation layers **116** and **124**. FIG. 6 illustrates the holes **116a** and **124a** of the orientation layers **116** and **124** positioned in the pixel region P, rather than the non-pixel region D, due to a process error. However, since the holes **116a** and **124a** are arranged alternately and are smaller than the size of a unit pixel, the orientation of the liquid crystal layer **130** is not affected. That is, since another hole is not disposed around one of the holes **116a** and **124a**, the liquid crystal molecules are oriented by the orientation layers **116** and **124** around the holes **116a** and **124a**.

[0030] Although a few embodiments of the present invention have been shown and described, it would be appreciated by those skilled in the art that changes may be made in this embodiment without departing from the principles and spirit of the invention, the scope of which is defined in the claims and their equivalents.

What is claimed is:

1. A liquid crystal display comprising:

- a first substrate on which a first electrode and a first orientation layer are formed;
- a second substrate facing the first substrate and including a second electrode and a second orientation layer;
- a sealant formed along edges of the first substrate and the second substrate; and
- a liquid crystal layer between the first electrode and the second electrode;

wherein holes are formed in the first and second orientation layers and the sealant is bonded to the first and second substrates through both side holes.

2. The liquid crystal display as claimed in claim 1, wherein the holes are arranged alternately.

3. The liquid crystal display as claimed in claim 1, wherein the holes are rectangular or circular.

4. The liquid crystal display as claimed in claim 1, wherein the holes are smaller than a size of a unit pixel of the liquid crystal display.

5. The liquid crystal display as claimed in claim 1, further comprising:

a thin film transistor connected to the first electrode; and
a first wire and a second wire connected to the thin film transistor and intersecting each other.

6. The liquid crystal display as claimed in claim 1, further comprising:

black matrices formed on the second substrate; and
a color filter formed between the black matrices.

7. The liquid crystal display as claimed in claim 2, wherein the holes are disposed along the edges of the first substrate and the second substrate.

8. The liquid crystal display as claimed in claim 1, wherein the first orientation layer and second orientation layer are coated and rubbed to adjust a pre-tilt angle and orientation of liquid crystal molecules of the liquid crystal layer.

9. The liquid crystal display as claimed in claim 1, wherein the holes formed in the first orientation layer and the second orientation layer occupy 20% to 50% of a contact area between the sealant and the first substrate and the second substrate.

10. A liquid crystal display having a first substrate including a first electrode, a second substrate including a second electrode and a liquid crystal layer disposed between the first electrode and the second electrode, the liquid crystal display comprising:

a first orientation layer having first holes disposed along a periphery of the first orientation layer, the first orientation layer being disposed on the first substrate;

a second orientation layer having second holes disposed along a periphery of the second orientation layer, the second orientation layer being disposed on the second substrate; and

a sealant disposed between the first substrate and the second substrate along a periphery of the first substrate and the second substrate;

wherein the sealant contacts the first substrate and the second substrate through the first holes and the second holes.

11. The liquid crystal display as claimed in claim 10, wherein the first holes are disposed in a first line and the second holes are disposed in a second line parallel to the first line.

12. The liquid crystal display as claimed in claim 11, wherein the first holes and the second holes are not adjacent to each other in a direction perpendicular to the direction in which the first line and the second line extend in parallel.

13. The liquid crystal display as claimed in claim 10, wherein the holes are rectangular or circular.

14. The liquid crystal display as claimed in claim 10, wherein the holes are smaller than a size of a unit pixel of the liquid crystal display.

15. The liquid crystal display as claimed in claim 10, further comprising:

a thin film transistor connected to the first electrode; and
a first wire and a second wire connected to the thin film transistor and intersecting each other.

16. The liquid crystal display as claimed in claim 10, further comprising:

black matrices formed on the second substrate; and
a color filter formed between the black matrices.

17. The liquid crystal display as claimed in claim 10, wherein the holes are disposed along the edges of the first substrate and the second substrate.

18. The liquid crystal display as claimed in claim 10, wherein the first orientation layer and second orientation layer are coated and rubbed to adjust a pre-tilt angle and orientation of liquid crystal molecules of the liquid crystal layer.

19. The liquid crystal display as claimed in claim 10, wherein the holes formed in the first orientation layer and the second orientation layer occupy 20% to 50% of a contact area between the sealant and the first substrate and the second substrate.

* * * * *

专利名称(译)	液晶显示器		
公开(公告)号	US20110222015A1	公开(公告)日	2011-09-15
申请号	US13/005224	申请日	2011-01-12
[标]申请(专利权)人(译)	三星显示有限公司		
申请(专利权)人(译)	三星移动显示器有限公司.		
当前申请(专利权)人(译)	三星DISPLAY CO. , LTD.		
[标]发明人	KANG MYUNG KOO		
发明人	KANG, MYUNG-KOO		
IPC分类号	G02F1/1339		
CPC分类号	G02F1/1339 G02F1/133784		
优先权	1020100021262 2010-03-10 KR		
外部链接	Espacenet USPTO		

摘要(译)

一种液晶显示器，包括：第一基板，在第一基板上形成第一电极和第一取向层；第二基板，面向第一基板并包括第二电极和第二取向层；沿第一基板和第二基板的边缘形成的密封剂；以及第一电极和第二电极之间的液晶层；其中，在第一和第二取向层中形成孔，并且密封剂通过两个侧孔结合到第一和第二子电离。由于密封剂和基板之间的接触面积增加并且结合力得到改善，因此可以以小面积保持稳定的密封状态并且减小非像素区域的尺寸，从而使得小尺寸的液晶显示器可以实现。

