US 20080007686A1

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2008/0007686 A1**

Chen et al. (43) **Pub. Date: Jan. 10, 2008**

(54) **LIQUID CRYSTAL PANEL WITH SEALANT HAVING CONDUCTIVE BEADS MIXED THEREIN AND METHOD FOR FABRICATING SAME**

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(21) Appl. No.: **11/825,936**

(22) Filed: **Jul. 9, 2007**

(30) **Foreign Application Priority Data**

Jul. 7, 2006 (TW) 95124897

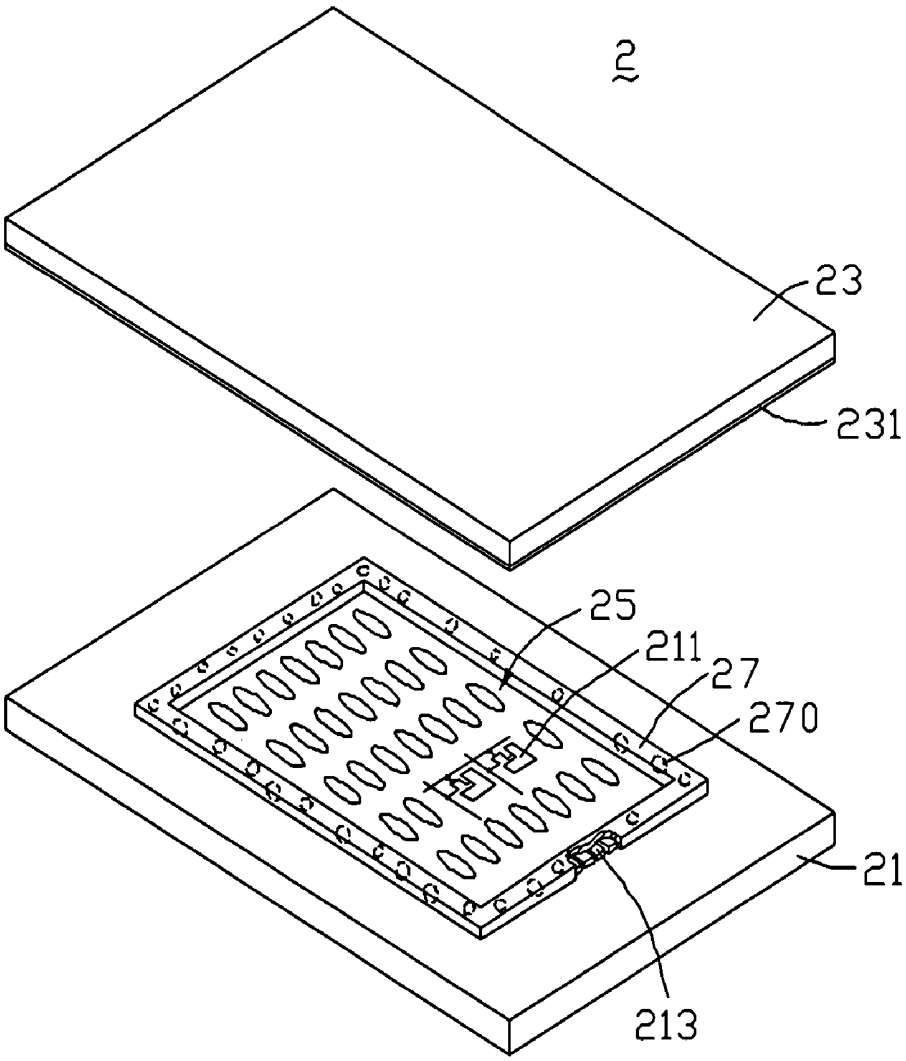
Publication Classification

(51) **Int. Cl.**
G02F 1/1339 (2006.01)

(52) **U.S. Cl.** **349/153**

(57) **ABSTRACT**

An exemplary liquid crystal panel (**2**) includes a first substrate (**21**), a second substrate (**23**) opposite to the first substrate, a liquid crystal layer (**25**) sandwiched between the first and second substrates, and a sealant (**27**) provided at the first substrate and attaching the first and second substrates together. The sealant has a plurality of conductive beads (**270**) mixed therein. The conductive beads electrically interconnect the first and second substrates. Because the conductive beads are mixed in the sealant, the conductive beads do not influence a uniformity of a height of the sealant. Therefore, the liquid crystal panel can provide a good quality display. Furthermore, the process of mixing the conductive beads in the sealant is simpler than a conventional process of applying conductive beads onto an outside of a sealant. Thus, the method for fabricating the liquid crystal panel is simplified.



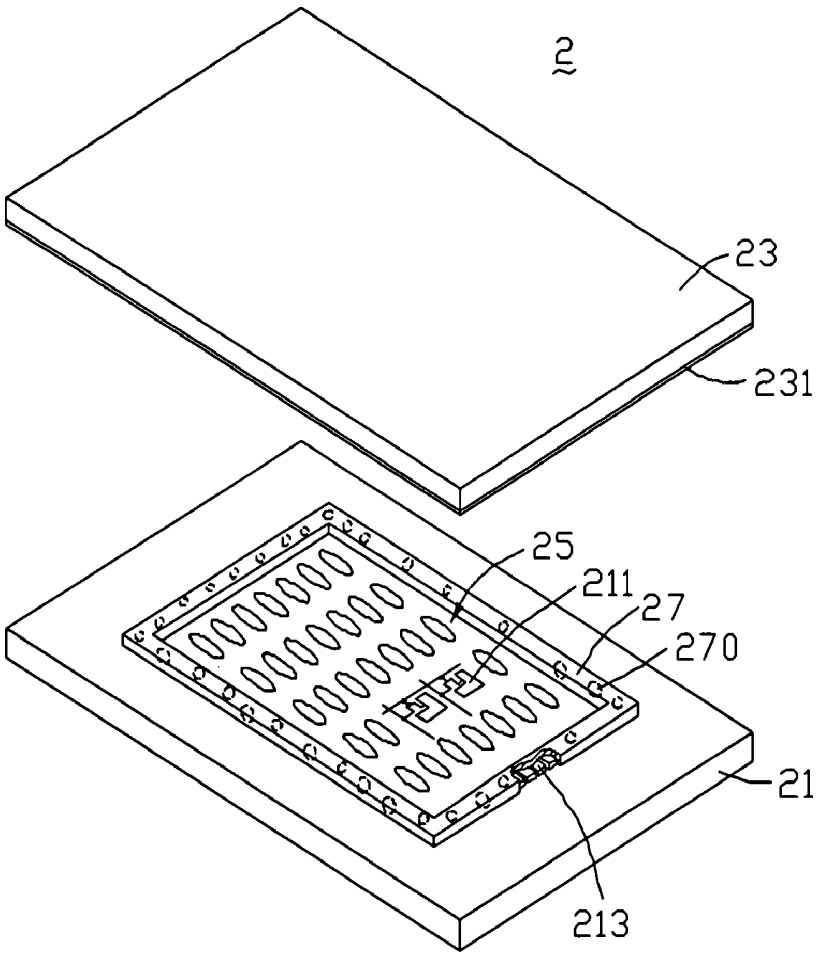


FIG. 1

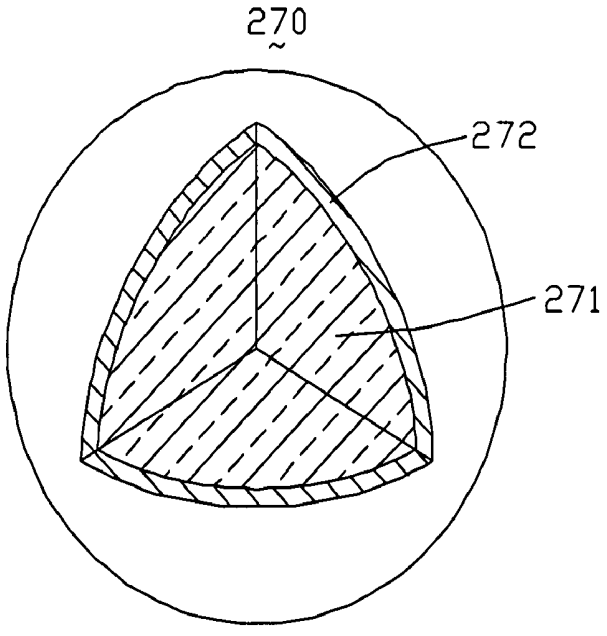


FIG. 2

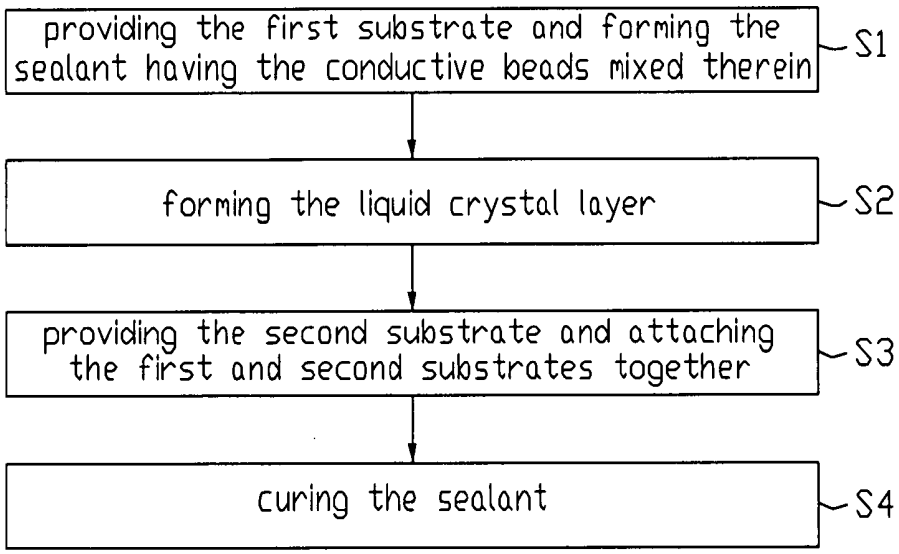

providing the first substrate and forming the sealant having the conductive beads mixed therein
S1
forming the liquid crystal layer
S2
providing the second substrate and attaching the first and second substrates together
S3
curing the sealant
S4

FIG. 3

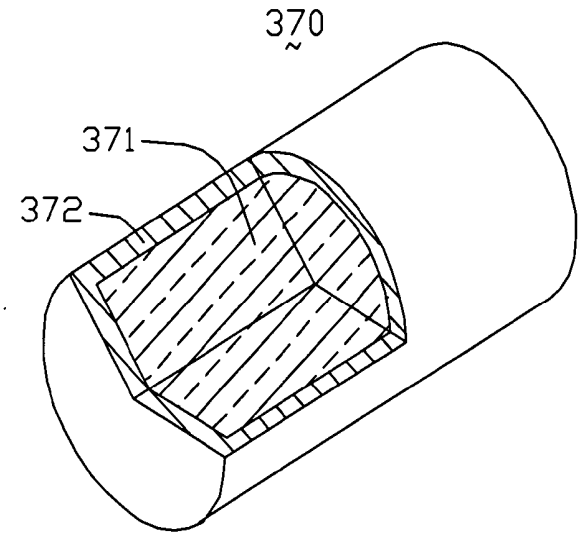

370
371
372

FIG. 4

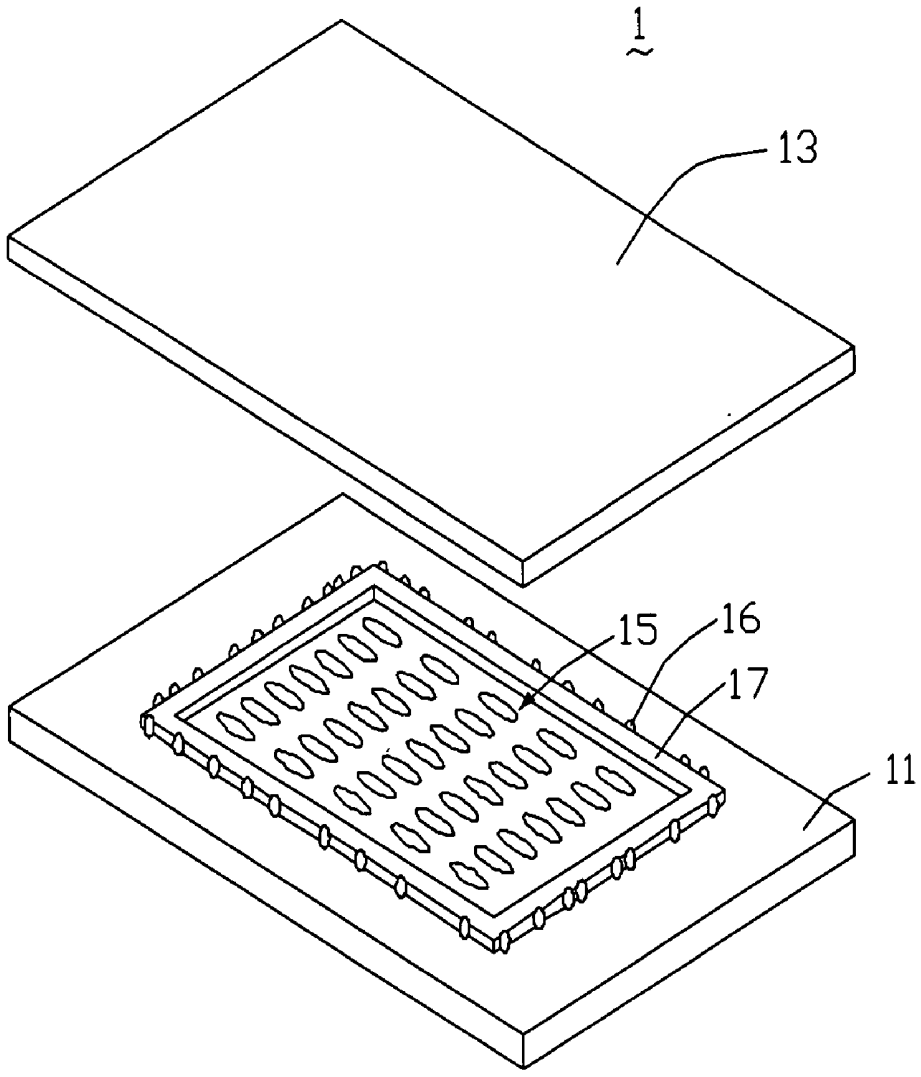


FIG. 5
(RELATED ART)

LIQUID CRYSTAL PANEL WITH SEALANT HAVING CONDUCTIVE BEADS MIXED THEREIN AND METHOD FOR FABRICATING SAME

FIELD OF THE INVENTION

[0001] The present invention relates to liquid crystal panels and methods for fabricating these panels; and particularly to a liquid crystal panel including a sealant having conductive beads mixed therein, and a method for fabricating such liquid crystal panel.

GENERAL BACKGROUND

[0002] A liquid crystal display (LCD) is capable of displaying a clear and sharp image through thousands or even millions of pixels that make up the complete image. The liquid crystal display has thus been applied to various electronic equipment in which messages or pictures need to be displayed, such as mobile phones and notebook computers. The liquid crystal display generally includes a liquid crystal panel for displaying images, and a backlight for illuminating the liquid crystal panel.

[0003] Referring to FIG. **5**, a typical liquid crystal panel **1** includes a thin film transistor (TFT) substrate **11**, a color filter (CF) substrate **13** opposite to the TFT substrate **11**, a liquid crystal layer **15** sandwiched between the two substrates **11**, **13**, conductive adhesive **16**, and a sealant **17**.

[0004] The sealant **17** is applied at a periphery of the TFT substrate **1**, and is sandwiched between the two substrates **11**, **13**. The two substrates **11**, **13** and the sealant **17** cooperatively define a space for accommodating the liquid crystal layer **15**. The conductive adhesive **16** is applied at an outside of the sealant **17**, and electrically connects the two substrates **11**, **13**. The conductive adhesive **16** is generally applied in the form of discrete beads. The beads include at least one silver-based compound, which includes silver ions. The silver-based compound can for example be silver nitrate ($AgNO_3$).

[0005] A method of fabricating the liquid crystal panel **1** generally includes: applying the sealant **17** at a periphery of the TFT substrate **11**, thereby defining a space; distributing spacers (not shown) on the TFT substrate **11**, and filling liquid crystal material in the space; applying the conductive adhesive **16** to the outside of the sealant **17**; and in a vacuum environment, attaching the CF substrate **13** onto the TFT substrate **11** to form the liquid crystal panel **1**.

[0006] In the process of fabricating the liquid crystal panel **1**, a height of the sealant **17** is a factor that can influence the quality of the display provided by the liquid crystal panel **1** in use. In particular, when the sealant **17** has a uniform height, this helps ensure the liquid crystal material has a uniform thickness between the two substrates **11**, **13**. In turn, the liquid crystal material is able to uniformly and accurately generate images. However, because the conductive adhesive **16** is applied at the outside of the sealant **17**, the uniformity of the height of the sealant **17** may be diminished. Thereby, the display quality of the liquid crystal panel **1** may be impaired.

[0007] One way to overcome the above-described problems is to reduce the sizes of the beads of the conductive adhesive **16**. If this is done, a proportion of the silver-based compound mixed in the conductive adhesive **16** needs to be increased, in order to maintain good electrical conductivity of the conductive adhesive **16**. However, in general, it is difficult to properly mix a high proportion of the silver-based compound in the conductive adhesive **16**. Furthermore, when the conductive adhesive **16** has a high proportion of silver-based compound, the step of applying the conductive adhesive **16** on the TFT substrate **11** can be problematic.

[0008] Therefore, a new liquid crystal panel that can overcome the above-described problems is desired. A method for fabricating such a liquid crystal panel is also desired.

SUMMARY

[0009] In one preferred embodiment, a liquid crystal panel includes a first substrate, a second substrate opposite to the first substrate, a liquid crystal layer sandwiched between the first and second substrates, and a sealant provided at the first mother substrate and attaching the first and second substrates together. The sealant has a plurality of conductive beads mixed therein. The conductive beads electrically interconnect the first substrate and the second substrate.

[0010] In another preferred embodiment, a method for fabricating a liquid crystal panel includes: providing a first substrate; mixing a plurality of conductive beads into a sealant; applying the sealant having the plurality of conductive beads at a periphery of the first substrate, thereby defining an accommodating space; dropping liquid crystal material into the accommodating space, thereby forming a liquid crystal layer; providing a second substrate, and attaching the second substrate onto the first substrate such that at least a plurality of the plurality of conductive beads in the sealant electrically interconnect the first and second substrates; and curing the sealant.

[0011] Other novel features and advantages will become more apparent from the following detailed description when taken in conjunction with the accompanying drawings. In the drawings, all the views are schematic.

BRIEF DESCRIPTION OF THE DRAWINGS

[0012] FIG. **1** is an exploded, isometric, abbreviated view of a liquid crystal panel according to a first embodiment of the present invention, the liquid crystal panel including a sealant (partly cut away), the sealant including a plurality of conductive beads.

[0013] FIG. **2** is an enlarged, isometric view of one of the conductive beads of FIG. **1**, with part of the conductive bead cut out.

[0014] FIG. **3** is a flowchart summarizing an exemplary method for fabricating the liquid crystal panel of FIG. **1**.

[0015] FIG. **4** is an isometric view of one of conductive beads of a liquid crystal panel according to a second embodiment of the present invention, with part of the conductive bead cut out.

[0016] FIG. **5** is an exploded, isometric view of a conventional liquid crystal panel.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

[0017] Referring to FIG. **1**, a liquid crystal panel **2** according to a first embodiment of the present invention is shown. The liquid crystal panel **2** includes a first substrate **21**, a second substrate **23** opposite to the first substrate **21**, a liquid crystal layer **25** sandwiched between the first and second substrates **21**, **23**, and a sealant **27**.

[0018] The first substrate **21** is a thin film transistor (TFT) substrate, and includes a plurality of pixel electrodes **211** and a plurality of common electrodes **213**. The second substrate **23** is a color filter (CF) substrate, and includes a transparent conductive layer **231**. The sealant **27** is applied at a periphery of the first substrate **21**, and is sandwiched between the first and second substrates **21**, **23**. The two substrates **21**, **23** together with the sealant **27** cooperatively define a space therebetween, for accommodating the liquid crystal layer **25**. The sealant **27** can be ultraviolet-curable sealant or heat-curable sealant or a combination of these, and includes a plurality of generally spherical conductive beads **270** mixed therein.

[0019] Referring also to FIG. **2**, each of the conductive beads **270** includes a core **271**, and a conductive layer **272** substantially covering a surface of the core **271**. The core **271** is generally made from silicate, but can be made from other material such as fiberglass. The conductive layer **272** is made from at least one material selected from the group consisting of silver, tin, lead, gold, copper, nickel, and aluminum; and is formed by an electroplating method or a coating method.

[0020] The conductive beads **270** mixed in the sealant **27** can electrically connect the common electrode **213** of the first substrate **21** with the transparent conductive layer **231** of the second substrate **23**. Good electrical conductivity can be achieved by configuring a distribution density of the conductive beads **270** appropriately. Preferably, a proportion by weight of the conductive beads **270** relative to the sealant **27** is in the range from 0.5%~5%. For example, the proportion by weight of the conductive beads **270** relative to the sealant **27** can be 1%.

[0021] Referring to FIG. **3**, a method for fabricating the liquid crystal panel **2** includes: step S**1**, providing the first substrate **21** and forming the sealant **27** having the conductive beads **270** mixed therein; step S**2**, forming the liquid crystal layer **25**; step S**3**, providing the second substrate **23** and attaching the first and second substrates **21**, **23** together; and step S**4**, curing the sealant **27**.

[0022] In step S**1**, the first substrate **21** is provided. The conductive beads **270** are mixed into the sealant **27**. The sealant **27** having the conductive beads **270** is applied at a periphery of the first substrate **21** by a printing method or a coating method. Thereby, an accommodating space for receiving the liquid crystal layer **25** is defined. The accommodating space has a top opening.

[0023] In step S**2**, the liquid crystal layer **25** is formed. A plurality of spacers (not shown) are distributed in the accommodating space. Liquid crystal material (not shown) is then dropped into the accommodating space.

[0024] In step S**3**, the second substrate **23** is provided, and the first and second substrates **21**, **23** are attached together. The second substrate **23** is first loosely attached onto the first substrate **21**, and is then pressed. Thereby, the common electrode **213** of the first substrate **21** is electrically connected with the transparent conductive layer **231** of the second substrate **23** via the conductive beads **270** that are mixed in the sealant **27**.

[0025] In step S**4**, the sealant **270** is cured, thereby forming the liquid crystal panel **2**.

[0026] In summary, because the conductive beads **270** are mixed in the sealant **27**, the conductive beads **270** do not influence a uniformity of a height of the sealant **27**. Therefore, the liquid crystal panel **2** can provide a good quality display. Furthermore, the process of mixing the conductive beads **270** in the sealant **27** is simpler than a conventional process of applying conductive beads onto an outside of a sealant. Thus, the method for fabricating the liquid crystal panel **2** is simplified, and the liquid crystal panel **2** can have a reduced cost.

[0027] Referring to FIG. **4**, a conductive bead **370** of a liquid crystal panel according to a second embodiment of the present invention is similar to the conductive bead **270** of the first embodiment. However, the conductive bead **370** includes a generally cylindrical core **371**, and a conductive layer **372** substantially covering a surface of the core **371**. The core **371** is generally made from fiberglass, but can be made from other material such as silicate. The conductive layer **372** is made from at least one material selected from the group consisting of silver, tin, lead, gold, copper, nickel, and aluminum; and is formed by an electroplating method or a coating method.

[0028] It is believed that the present embodiments and their advantages will be understood from the foregoing description, and it will be apparent that various changes may be made thereto without departing from the spirit and scope of the invention or sacrificing all of its material advantages, the examples hereinbefore described merely being preferred or exemplary embodiments of the invention.

What is claimed is:

1. A liquid crystal panel comprising:
a first substrate;
a second substrate opposite to the first substrate;
a liquid crystal layer sandwiched between the first and second substrates; and
a sealant provided at the first substrate and attaching the first and second substrates together, the sealant having a plurality of conductive beads mixed therein, the conductive beads electrically interconnecting the first substrate and the second substrate.

2. The liquid crystal panel as claimed in claim **1**, wherein the sealant comprises at least one of ultraviolet-curable sealant and heat-curable sealant.

3. The liquid crystal panel as claimed in claim **1**, wherein each of the conductive beads comprises a core and a conductive layer substantially covering a surface of the core.

4. The liquid crystal panel as claimed in claim **3**, wherein the core is made from silicate or fiberglass.

5. The liquid crystal panel as claimed in claim **3**, wherein the core is generally spherical or generally cylindrical.

6. The liquid crystal panel as claimed in claim **3**, wherein the conductive layer is made from at least one material selected from the group consisting of silver, tin, lead, gold, copper, nickel, and aluminum.

7. The liquid crystal panel as claimed in claim **1**, wherein a proportion by weight of the conductive beads relative to the sealant is in the range from 0.5%~5%.

8. The liquid crystal panel as claimed in claim **7**, wherein the proportion by weight of the conductive beads relative to the sealant is equal to 1%.

9. The liquid crystal panel as claimed in claim **1**, wherein the first substrate is a thin film transistor (TFT) substrate, and comprises a plurality of pixel electrodes and a plurality of common electrodes.

10. The liquid crystal panel as claimed in claim **9**, wherein the second substrate is a color filter (CF) substrate, and comprises a transparent conductive layer.

11. The liquid crystal panel as claimed in claim **10**, wherein the conductive beads electrically interconnect the common electrodes of the first substrate and the transparent conductive layer of the second substrate.

12. A method for fabricating a liquid crystal panel, the method comprising:

providing a first substrate;

mixing a plurality of conductive beads into a sealant;

applying the sealant having the plurality of conductive beads at a periphery of the first substrate, thereby defining an accommodating space;

dropping liquid crystal material into the accommodating space, thereby forming a liquid crystal layer;

providing a second substrate, and attaching the second substrate onto the first substrate such that at least a plurality of the plurality of conductive beads in the sealant electrically interconnect the first and second substrates; and

curing the sealant.

13. The method as claimed in claim **12**, wherein the sealant is applied at the first substrate by a coating method.

14. The method as claimed in claim **12**, wherein the sealant is applied at the first substrate by a printing method.

15. The method as claimed in claim **12**, further comprising distributing spacers in the accommodating space after the accommodating space is defined.

16. A liquid crystal panel comprising:

a first substrate;

a second substrate opposite to the first substrate;

a liquid crystal layer sandwiched between the first and second substrates; and

a sealant provided at the first substrate and attaching the first and second substrates together, the sealant containing conductive material thereof to electrically interconnect the first substrate and the second substrate.

* * * * *

专利名称(译)	具有混合有导电珠的密封剂的液晶面板及其制造方法		
公开(公告)号	US20080007686A1	公开(公告)日	2008-01-10
申请号	US11/825936	申请日	2007-07-09
[标]申请(专利权)人(译)	群创光电股份有限公司		
申请(专利权)人(译)	群创光电股份有限公司.		
当前申请(专利权)人(译)	群创光电		
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发明人	CHEN, CHI-JUNG HSIAO, KUN-HSING WU, JIA-YI		
IPC分类号	G02F1/1339		
CPC分类号	G02F1/1339 G02F2201/121 G02F1/1345		
优先权	095124897 2006-07-07 TW		
外部链接	Espacenet USPTO		

摘要(译)

示例性液晶面板（2）包括第一基板（21），与第一基板相对的第二基板（23），夹在第一基板和第二基板之间的液晶层（25），以及设置的密封剂（27）在第一基板上并将第一和第二基板连接在一起。密封剂具有混合在其中的多个导电珠（270）。导电珠将第一和第二基板电互连。因为导电珠在密封剂中混合，导电珠不会影响密封剂高度的均匀性。因此，液晶面板可以提供高质量的显示。此外，在密封剂中混合导电珠的过程比将导电珠施加到密封剂外部的传统过程更简单。因此，简化了制造液晶面板的方法。