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(54) **LIQUID CRYSTAL DISPLAY PANEL AND MANUFACTURING METHOD THEREOF**

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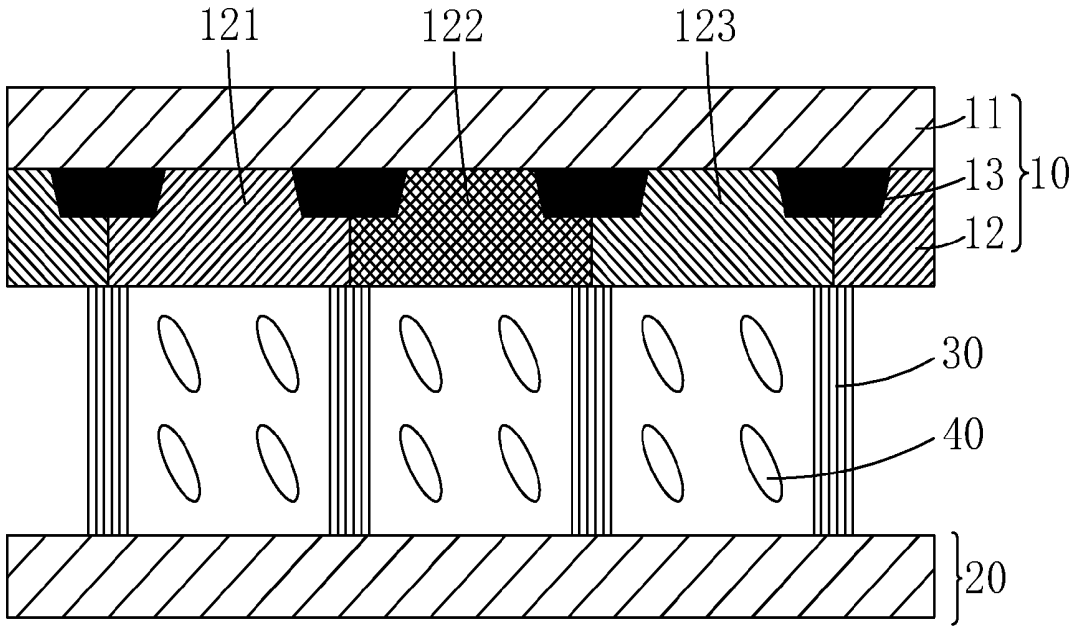
(57) **ABSTRACT**

The present invention provides a liquid crystal display panel and a manufacturing method thereof, in which aligned carbon nanotube arrays are provided to replace photo spacers that are used in the prior art and takes advantage of the excellent mechanic property and excellent stability of the aligned carbon nanotubes to significantly enhance the performance and service life of a liquid crystal display panel. The manufacturing method of the liquid crystal display panel of the present invention grows aligned carbon nanotubes on one substrate of a liquid crystal display panel to obtain spacers formed of aligned carbon nanotube arrays, so as to take advantage of the excellent mechanic property and excellent stability of the aligned carbon nanotubes to significantly enhance the performance and service life of a liquid crystal display panel.



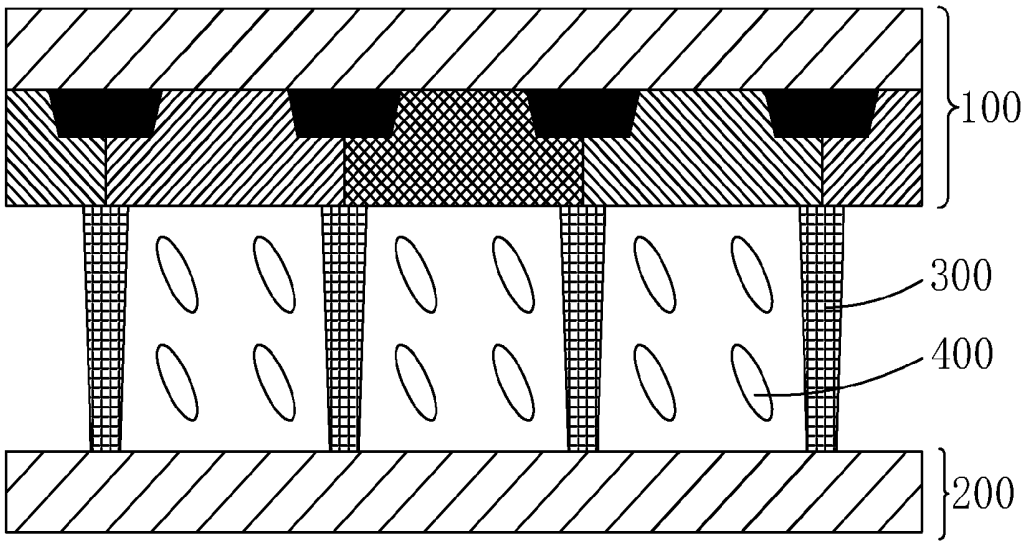


Fig. 1

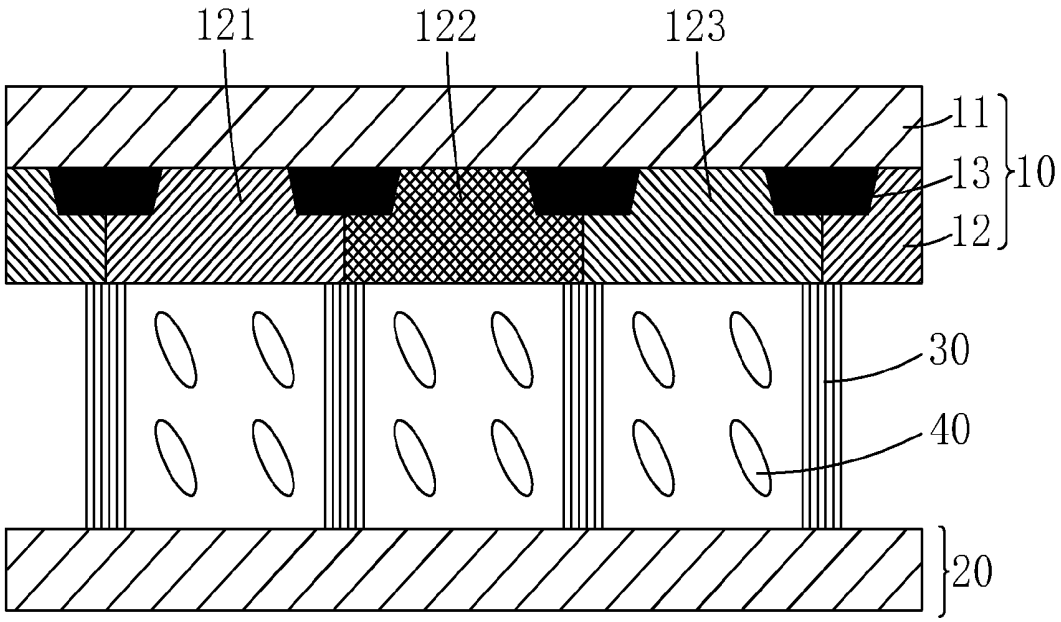


Fig. 2

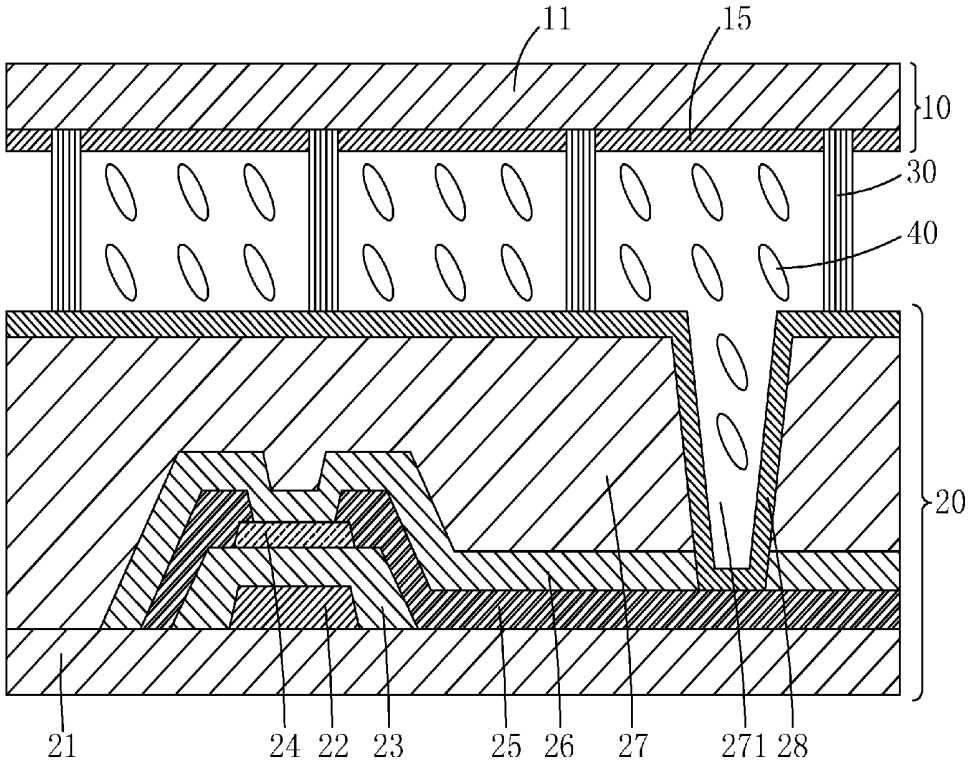


Fig. 3

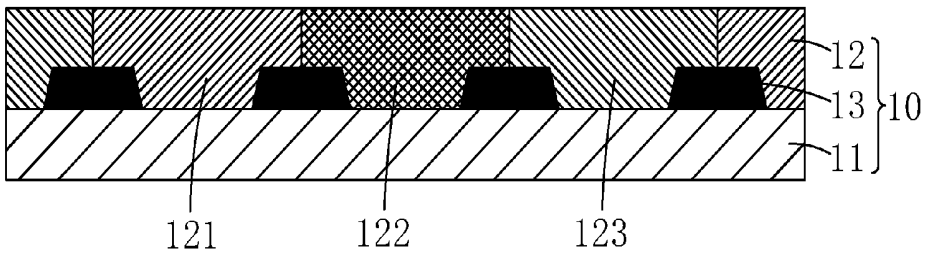


Fig. 4

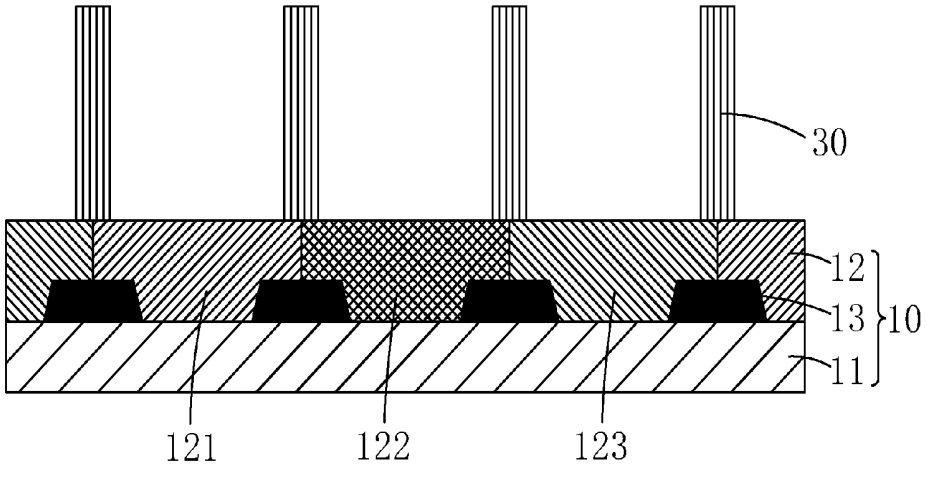


Fig. 5

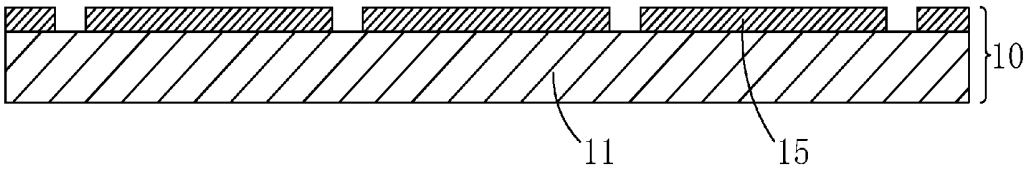


Fig. 6

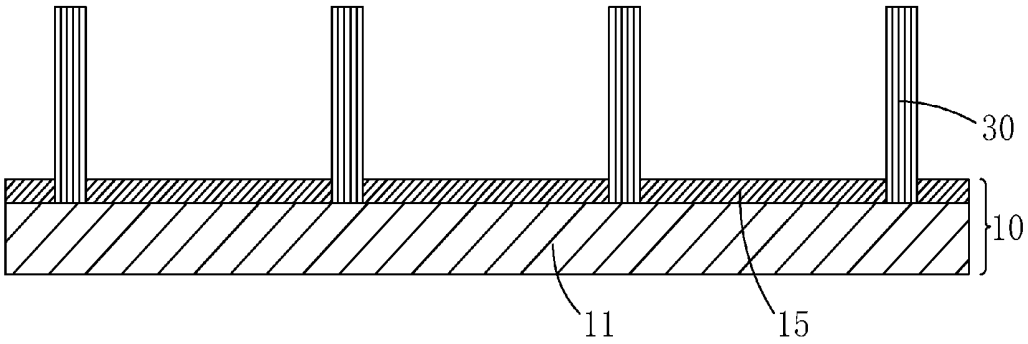


Fig. 7

LIQUID CRYSTAL DISPLAY PANEL AND MANUFACTURING METHOD THEREOF

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention relates to the field of display technology, and in particular to a liquid crystal display panel and a manufacturing method thereof.

2. The Related Arts

[0002] With the progress of the display technology, flat panel display devices, such as liquid crystal displays (LCDs), due to a variety of advantages, such as high image quality, low power consumption, thin device body, and wide application, have been widely used in various consumer electronic products, such as mobile phones, televisions, personal digital assistants (PDAs), digital cameras, notebook computers, and desktop computers, making them the main stream of display devices.

[0003] Most of the liquid crystal display devices that are currently available in the market are backlighting LCDs, which comprise a liquid crystal display panel and a backlight module. The working principle of the liquid crystal display panel is that liquid crystal molecules are arranged between two parallel glass substrates with a number of vertical and horizontal tiny electrical wires arranged between the two glass substrates and the liquid crystal molecules are controlled to rotate according to whether electricity is applied or not so as to refract out light from the backlight module to generate an image.

[0004] FIG. **1** is a schematic view illustrating the structure of a conventional liquid crystal display panel. The liquid crystal display panel comprises an upper substrate **100** and a lower substrate that are arranged opposite to each other, a liquid crystal layer **400** arranged between the upper substrate **100** and the lower substrate **200**, and a plurality of photo spacers **300** arranged between the upper substrate **100** and the lower substrate **200**. The photo spacers **300** are made of a photoresist material. Due to instability of property, the photoresist material reacts easily with other substances and shows poor mechanic performance. Thus, when the photo spacers **300** react with other substances of the liquid crystal display panel or undergoes deformation, the performance and displaying effect of the liquid crystal display panel are easily affected.

[0005] Carbon nanotube (CNT) is formed by wrapping a single layer or multiple layers of graphite sheet, having a diameter of some tens of nanometers and a length of several to tens micrometer. The carbon nanotube has extremely stable property, is resistant to high temperature, is extremely hard to react with other substances, has excellent mechanic property, and shows excellent elastic property of compression and restorability. Compared to disorderly stacked carbon nanotube clusters, aligned carbon nanotubes show similar growth directions and may easily form a carbon nanotube array. Thus, the conventionally used photo spacers can be substituted by formation of aligned carbon nanotube arrays by growing aligned carbon nanotubes on one substrate of a liquid crystal display panel at the locations originally designated for the spacers and the performance and service life of the liquid crystal display panel can be effectively enhanced with the excellent mechanic property and excellent stability of the aligned carbon nanotubes.

SUMMARY OF THE INVENTION

[0006] An object of the present invention is to provide a liquid crystal display panel, which comprises aligned carbon nanotube array to substitute photo spacers used in the prior art and takes advantage of the excellent mechanic property and the excellent stability of the aligned carbon nanotubes to significantly improve the performance and service life of the liquid crystal display panel.

[0007] Another object of the present invention is to provide a manufacturing method of a liquid crystal display panel, which comprises growing aligned carbon nanotubes on one substrate of a liquid crystal display panel at locations designated for spacers so as to obtain spacers formed of aligned carbon nanotube arrays and takes advantage of the excellent mechanic property and the excellent stability of the aligned carbon nanotubes to significantly improve the performance and service life of the liquid crystal display panel.

[0008] To achieve the above objects, the present invention provides a liquid crystal display panel, which comprises an upper substrate and a lower substrate arranged opposite to each other, a liquid crystal layer arranged between the upper substrate and the lower substrate, and a plurality of spacers arranged between the upper substrate and the lower substrate, wherein the spacers are each formed of an aligned carbon nanotube array comprising multiple aligned carbon nanotubes that are arranged parallel to each other.

[0009] The aligned carbon nanotubes are single-walled carton nanotubes or a multi-walled carbon nanotubes.

[0010] The upper substrate comprises a first base plate, a black matrix arranged on the first base plate, and a color resist layer arranged on the black matrix and the first base plate. The color resist layer has a surface that is a flat and smooth surface. The lower substrate is a thin-film transistor array substrate.

[0011] The upper substrate comprises a first base plate and a patternized common electrode arranged on the first base plate. The plurality of spacers is arranged to contact portions of the first base plate that are not covered by the common electrode. The surface of the first base plate that is in contact with the plurality of spacers is a flat and smooth surface. The lower substrate comprises a second base plate and a gate electrode, a gate insulation layer, an active layer, source/drain electrodes, a passivation layer, a color resist layer, and a pixel electrode that are arranged, in sequence from bottom to top, on the second base plate

[0012] The present invention also provides a manufacturing method of a liquid crystal display panel, which comprises the following steps:

[0013] (1) providing a upper substrate, wherein the upper substrate comprises a first base plate, a black matrix arranged on the first base plate, and a color resist layer arranged on the black matrix and the first base plate, the color resist layer having a surface that is a flat and smooth surface; and the surface of the color resist layer is provided with a plurality of locations for spacers;

[0014] (2) growing aligned carbon nanotubes on the color resist layer at the plurality of locations for spacers such that in each of the locations for spacers, an aligned carbon nanotube array that comprises multiple parallel aligned carbon nanotubes is formed so as to form a plurality of spacers; and

[0015] (3) providing a lower substrate, wherein the lower substrate is a thin-film transistor array substrate; and dripping liquid crystal molecules on a surface of the upper substrate that comprises the plurality of spacers formed thereon or a surface of the lower substrate to form a liquid crystal layer and aligning and laminating the upper substrate and the lower substrate together to form a liquid crystal display panel.

[0016] The aligned carbon nanotubes are single-walled carton nanotubes or a multi-walled carbon nanotubes.

[0017] The plurality of spacers is arranged at locations corresponding to the black matrix of the upper substrate.

[0018] The present invention further provides a manufacturing method of a liquid crystal display panel, which comprises the following steps:

[0019] (1) providing a upper substrate, wherein the upper substrate comprises a first base plate and a patternized common electrode formed on the first base plate, a surface of the first base plate that is in contact with the common electrode being a flat and smooth surface, portions of the first base plate that are covered by the common electrode forming a plurality of locations for spacers;

[0020] (2) growing aligned carbon nanotubes on the first base plate at the plurality of locations for spacers, wherein each of the locations for spacers comprises an aligned carbon nanotube array comprising multiple parallel aligned carbon nanotubes formed thereon so as to form a plurality of spacers; and

[0021] (3) providing a lower substrate, wherein the lower substrate comprises a second base plate and a gate electrode, a gate insulation layer, an active layer, source/drain electrodes, a passivation layer, a color resist layer, and a pixel electrode that are arranged, in sequence from bottom to top, on the second base plate;

[0022] wherein liquid crystal molecules are dripped on a surface of the upper substrate that comprises the plurality of spacers formed thereon or a surface of the lower substrate that comprises the pixel electrode formed thereon to form a liquid crystal layer and the upper substrate and the lower substrate are aligned and laminated together to form a liquid crystal display panel.

[0023] The aligned carbon nanotubes are single-walled carton nanotubes or a multi-walled carbon nanotubes.

[0024] The common electrode is formed of a material comprising a metal; the lower substrate further comprises a black matrix arranged above or under the color resist layer; and the plurality of spacers is arranged at locations corresponding to the black matrix.

[0025] The efficacy of the present invention is that the present invention provides a liquid crystal display panel, which comprises aligned carbon nanotube arrays to replace photo spacers that are used in the prior art and takes advantage of the excellent mechanic property and excellent stability of the aligned carbon nanotubes to significantly enhance the performance and service life of a liquid crystal display panel. The present invention also provides a manufacturing method of a liquid crystal display panel, which grows aligned carbon nanotubes on one substrate of a liquid crystal display panel to obtain spacers formed of aligned carbon nanotube arrays, so as to take advantage of the excellent mechanic property and excellent stability of the aligned carbon nanotubes to significantly enhance the performance and service life of a liquid crystal display panel.

[0026] For better understanding of the features and technical contents of the present invention, reference will be made to the following detailed description of the present invention and the attached drawings. However, the drawings are provided for the purposes of reference and illustration and are not intended to impose limitations to the present invention.

BRIEF DESCRIPTION OF THE DRAWINGS

[0027] The technical solution, as well as other beneficial advantages, of the present invention will be apparent from the following detailed description of embodiments of the present invention, with reference to the attached drawing. In the drawing:

[0028] FIG. **1** is a schematic view illustrating the structure of a conventional liquid crystal display panel;

[0029] FIG. **2** is a schematic view illustrating the structure of a liquid crystal display panel according to a second embodiment of the present invention;

[0030] FIG. **3** is a schematic view illustrating the structure of a liquid crystal display panel according to a first embodiment of the present invention;

[0031] FIG. **4** is a schematic view illustrating step 1 of a manufacturing method of a liquid crystal display panel according to a first embodiment of the present invention;

[0032] FIG. **5** is a schematic view illustrating step 2 of the manufacturing method of the liquid crystal display panel according to the first embodiment of the present invention;

[0033] FIG. **6** is a schematic view illustrating step 1 of a manufacturing method of a liquid crystal display panel according to a second embodiment of the present invention; and

[0034] FIG. **7** is a schematic view illustrating step 2 of the manufacturing method of the liquid crystal display panel according to the second embodiment of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0035] To further expound the technical solution adopted in the present invention and the advantages thereof, a detailed description is given to a preferred embodiment of the present invention and the attached drawings.

[0036] Referring to FIGS. **2-3**, the present invention provides a liquid crystal display panel, which comprises an upper substrate **10** and a lower substrate **20** that are arranged opposite to each other, a liquid crystal layer **40** arranged between the upper substrate **10** and the lower substrate **20**, and a plurality of spacers **30** arranged between the upper substrate **10** and the lower substrate **20**, wherein the spacers **30** are each formed of an aligned carbon nanotube array comprising multiple aligned carbon nanotubes that are arranged parallel to each other.

[0037] Specifically, the aligned carbon nanotubes are single-walled carbon nanotubes (SWNTs) or multi-walled carbon nanotubes (MWNTs).

[0038] Due to the property and stability of the aligned carbon nanotubes, being resistant to high temperature and hard to react with other substances, and also showing excellent mechanic performance and possessing excellent elastic property of compressibility and restorability, the aligned carbon nanotube array can effectively support the

upper and lower substrates **10**, **20** and maintain thickness and uniformity of a gap between the upper and lower substrates **10**, **20**.

[0039] FIG. **2** illustrates a first embodiment of the liquid crystal display panel of the present invention. In the first embodiment, the upper substrate **10** comprises a first base plate **11**, a black matrix **13** arranged on the first base plate **11**, and a color resist layer **12** arranged on the black matrix **13** and the first base plate **11**. The color resist layer **12** has a surface that is a flat and smooth surface. The lower substrate **20** is a thin-film transistor array substrate.

[0040] Specifically, the first base plate **11** is a transparent plate, and preferably a glass plate.

[0041] Specifically, the plurality of spacers **30** is arranged at locations corresponding to the black matrix **13** of the upper substrate **10**.

[0042] Specifically, the color resist layer **12** comprises a plurality of red photoresist blocks **121**, a plurality of blue photoresist blocks **122**, and a plurality of green photoresist blocks **123**.

[0043] FIG. **3** illustrates a second embodiment of the liquid crystal display panel of the present invention. In the second embodiment, the upper substrate **10** comprises a first base plate **11** and a patternized common electrode **15** arranged on the first base plate **11**. The plurality of spacers **30** is arranged to contact portions of the first base plate **11** that are not covered by the common electrode **15**. The surface of the first base plate **11** that is in contact with the plurality of spacers **30** is a flat and smooth surface. The lower substrate **20** comprises a second base plate **21** and a gate electrode **22**, a gate insulation layer **23**, an active layer **24**, source/drain electrodes **25**, a passivation layer **26**, a color resist layer **27**, and a pixel electrode **28** that are arranged, in sequence from bottom to top, on the second base plate **21**, wherein the color resist layer **27** comprises a via **271** formed therein such that the pixel electrode **28** is in contact with the source/drain electrodes **25** through the via **271**.

[0044] Specifically, the first base plate **11** is a transparent plate, and preferably a glass plate.

[0045] Specifically, the lower substrate **20** further comprises a black matrix arranged above or under the color resist layer **27** and the plurality of spacers **30** is arranged at locations corresponding to the black matrix.

[0046] Specifically, the color resist layer **27** comprises a plurality of red photoresist blocks, a plurality of blue photoresist blocks, and a plurality of green photoresist blocks. The black matrix is arranged to correspond to an interface between adjacent photoresist blocks.

[0047] Referring to FIGS. **4-5**, in combination with FIG. **2**, the present invention also provides a manufacturing method of a liquid crystal display panel, which comprises the following steps:

[0048] Step 1: as shown in FIG. **4**, providing an upper substrate **10**, wherein the upper substrate **10** comprises a first base plate **11**, a black matrix **13** arranged on the first base plate **11**, and a color resist layer **12** arranged on the black matrix **13** and the first base plate **11**, the color resist layer **12** having a surface that is a flat and smooth surface; and the surface of the color resist layer **12** is provided with a plurality of locations for spacers.

[0049] Specifically, the first base plate **11** is a transparent plate, and preferably a glass plate.

[0050] Specifically, the color resist layer **12** comprises a plurality of red photoresist blocks **121**, a plurality of blue photoresist blocks **122**, and a plurality of green photoresist blocks **123**.

[0051] Step 2: as shown in FIG. **5**, growing aligned carbon nanotubes on the color resist layer **12** at the plurality of locations for spacers such that in each of the locations for spacers, an aligned carbon nanotube array that comprises multiple parallel aligned carbon nanotubes is formed so as to form a plurality of spacers **30**.

[0052] Specifically, the aligned carbon nanotubes are single-walled carbon nanotubes (SWNTs) or multi-walled carbon nanotubes (MWNTs).

[0053] Specifically, the plurality of spacers **30** is arranged at locations corresponding to the black matrix **13** of the upper substrate **10**.

[0054] Specifically, in Step 2, a process involving using laser to engrave a base, a plasma enhanced chemical vapor deposition, or metal organic pyrolysis, which are commonly used regular techniques in this field, is applied to grow the aligned carbon nanotubes on the substrate **10**.

[0055] Step 3: as shown in FIG. **2**, providing a lower substrate **20**, wherein the lower substrate **20** is a thin-film transistor array substrate; and dripping liquid crystal molecules on a surface of the upper substrate **10** that comprises the plurality of spacers **30** formed thereon or a surface of the lower substrate **20** to form a liquid crystal layer **40** and aligning and laminating the upper substrate **10** and the lower substrate **20** together to form a liquid crystal display panel.

[0056] Referring to FIGS. **6-7**, in combination with FIG. **3**, the present invention also provides another manufacturing method of a liquid crystal display panel, which comprises the following steps:

[0057] Step 1: as shown in FIG. **6**, providing an upper substrate **10**, wherein the upper substrate **10** comprises a first base plate **11** and a patternized common electrode **15** formed on the first base plate **11**, a surface of the first base plate **11** that is in contact with the common electrode **15** being a flat and smooth surface, portions of the first base plate **11** that are covered by the common electrode **15** forming a plurality of locations for spacers.

[0058] Specifically, the first base plate **11** is a transparent plate, and preferably a glass plate.

[0059] Specifically, the common electrode **15** is formed of a material comprising a metal, preferably a metal having good contact surface, such as gold (Au), and to prevent the common electrode **15** that is made of a metal from affecting light transmission rate of a liquid crystal panel, the thickness of the common electrode **15** can be made reduced, such as 10-20 nm.

[0060] Step 1 uses the patternized common electrode **15** to define the plurality of locations for spacers on the first base plate **11** and also makes use of the principle that carbon nanotube does not grow on a metal surface to make the aligned carbon nanotubes growing on the plurality of locations for spacers so as to form spacers made up of aligned carbon nanotube arrays.

[0061] Step 2: as shown in FIG. **7**, growing aligned carbon nanotubes on the first base plate **11** at the plurality of locations for spacers, wherein each of the locations for spacers comprises an aligned carbon nanotube array comprising multiple parallel aligned carbon nanotubes formed thereon so as to form a plurality of spacers **30**.

[0062] Specifically, the aligned carbon nanotubes are single-walled carbon nanotubes (SWNTs) or multi-walled carbon nanotubes (MWNTs).

[0063] Specifically, in Step 2, a process involving using laser to engrave a base, a plasma enhanced chemical vapor deposition, or metal organic pyrolysis, which are commonly used regular techniques in this field, is applied to grow the aligned carbon nanotubes on the substrate **10**.

[0064] Step 3: as shown in FIG. **3**, providing a lower substrate **20**, wherein the lower substrate **20** comprises a second base plate **21** and a gate electrode **22**, a gate insulation layer **23**, an active layer **24**, source/drain electrodes **25**, a passivation layer **26**, a color resist layer **27**, and a pixel electrode **28** that are arranged, in sequence from bottom to top, on the second base plate **21**, wherein the color resist layer **27** comprises a via **271** formed therein such that the pixel electrode **28** is in contact with the source/drain electrodes **25** through the via **271**.

[0065] Liquid crystal molecules are dripped on a surface of the upper substrate **10** that comprises the plurality of spacers **30** formed thereon or a surface of the lower substrate **20** that comprises the pixel electrode **28** formed thereon to form a liquid crystal layer **40** and the upper substrate **10** and the lower substrate **20** are aligned and laminated together to form a liquid crystal display panel.

[0066] Specifically, the lower substrate **20** further comprises a black matrix arranged above or under the color resist layer **27** and the plurality of spacers **30** is arranged at locations corresponding to the black matrix.

[0067] Specifically, the color resist layer **27** comprises a plurality of red photoresist blocks, a plurality of blue photoresist blocks, and a plurality of green photoresist blocks. The black matrix is arranged to correspond to an interface between adjacent photoresist blocks.

[0068] In summary, the present invention provides a liquid crystal display panel, which comprises aligned carbon nanotube arrays to replace photo spacers that are used in the prior art and takes advantage of the excellent mechanic property and excellent stability of the aligned carbon nanotubes to significantly enhance the performance and service life of a liquid crystal display panel. The present invention also provides a manufacturing method of a liquid crystal display panel, which grows aligned carbon nanotubes on one substrate of a liquid crystal display panel to obtain spacers formed of aligned carbon nanotube arrays, so as to take advantage of the excellent mechanic property and excellent stability of the aligned carbon nanotubes to significantly enhance the performance and service life of a liquid crystal display panel.

[0069] Based on the description given above, those having ordinary skills of the art may easily contemplate various changes and modifications of the technical solution and technical ideas of the present invention and all these changes and modifications are considered within the protection scope of right for the present invention.

What is claimed is:

1. A liquid crystal display panel, comprising an upper substrate and a lower substrate arranged opposite to each other, a liquid crystal layer arranged between the upper substrate and the lower substrate, and a plurality of spacers arranged between the upper substrate and the lower substrate, wherein the spacers are each formed of an aligned carbon nanotube array comprising multiple aligned carbon nanotubes that are arranged parallel to each other.

2. The liquid crystal display panel as claimed in claim **1**, wherein the aligned carbon nanotubes are single-walled carton nanotubes or a multi-walled carbon nanotubes.

3. The liquid crystal display panel as claimed in claim **1**, wherein the upper substrate comprises a first base plate, a black matrix arranged on the first base plate, and a color resist layer arranged on the black matrix and the first base plate, the color resist layer having a surface that is a flat and smooth surface, the lower substrate being a thin-film transistor array substrate.

4. The liquid crystal display panel as claimed in claim **1**, wherein the upper substrate comprises a first base plate and a patternized common electrode arranged on the first base plate, the plurality of spacers being arranged to contact portions of the first base plate that are not covered by the common electrode, the surface of the first base plate that is in contact with the plurality of spacers being a flat and smooth surface, the lower substrate comprising a second base plate and a gate electrode, a gate insulation layer, an active layer, source/drain electrodes, a passivation layer, a color resist layer, and a pixel electrode that are arranged, in sequence from bottom to top, on the second base plate.

5. A manufacturing method of a liquid crystal display panel, comprising the following steps:

(1) providing a upper substrate, wherein the upper substrate comprises a first base plate, a black matrix arranged on the first base plate, and a color resist layer arranged on the black matrix and the first base plate, the color resist layer having a surface that is a flat and smooth surface; and the surface of the color resist layer is provided with a plurality of locations for spacers;

(2) growing aligned carbon nanotubes on the color resist layer at the plurality of locations for spacers such that in each of the locations for spacers, an aligned carbon nanotube array that comprises multiple parallel aligned carbon nanotubes is formed so as to form a plurality of spacers; and

(3) providing a lower substrate, wherein the lower substrate is a thin-film transistor array substrate; and dripping liquid crystal molecules on a surface of the upper substrate that comprises the plurality of spacers formed thereon or a surface of the lower substrate to form a liquid crystal layer and aligning and laminating the upper substrate and the lower substrate together to form a liquid crystal display panel.

6. The manufacturing method of the liquid crystal display panel as claimed in claim **5**, wherein the aligned carbon nanotubes are single-walled carton nanotubes or a multi-walled carbon nanotubes.

7. The manufacturing method of the liquid crystal display panel as claimed in claim **5**, wherein the plurality of spacers is arranged at locations corresponding to the black matrix of the upper substrate.

8. A manufacturing method of a liquid crystal display panel, comprising the following steps:

(1) providing a upper substrate, wherein the upper substrate comprises a first base plate and a patternized common electrode formed on the first base plate, a surface of the first base plate that is in contact with the common electrode being a flat and smooth surface, portions of the first base plate that are covered by the common electrode forming a plurality of locations for spacers;

(2) growing aligned carbon nanotubes on the first base plate at the plurality of locations for spacers, wherein each of the locations for spacers comprises an aligned carbon nanotube array comprising multiple parallel aligned carbon nanotubes formed thereon so as to form a plurality of spacers; and

(3) providing a lower substrate, wherein the lower substrate comprises a second base plate and a gate electrode, a gate insulation layer, an active layer, source/drain electrodes, a passivation layer, a color resist layer, and a pixel electrode that are arranged, in sequence from bottom to top, on the second base plate;

wherein liquid crystal molecules are dripped on a surface of the upper substrate that comprises the plurality of spacers formed thereon or a surface of the lower substrate that comprises the pixel electrode formed thereon to form a liquid crystal layer and the upper substrate and the lower substrate are aligned and laminated together to form a liquid crystal display panel.

9. The manufacturing method of the liquid crystal display panel as claimed in claim **8**, wherein the aligned carbon nanotubes are single-walled carton nanotubes or a multi-walled carbon nanotubes.

10. The manufacturing method of the liquid crystal display panel as claimed in claim **8**, wherein the common electrode is formed of a material comprising a metal; the lower substrate further comprises a black matrix arranged above or under the color resist layer; and the plurality of spacers is arranged at locations corresponding to the black matrix.

* * * * *

专利名称(译)	液晶显示面板及其制造方法		
公开(公告)号	US20180088384A1	公开(公告)日	2018-03-29
申请号	US15/031748	申请日	2016-04-08
[标]申请(专利权)人(译)	深圳市华星光电技术有限公司		
申请(专利权)人(译)	深圳市中国星光电科技有限公司.		
当前申请(专利权)人(译)	深圳市中国星光电科技有限公司.		
[标]发明人	GAN QIMING		
发明人	GAN, QIMING		
IPC分类号	G02F1/1339 G02F1/1335 G02F1/1343 G02F1/1368 G02F1/1341		
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优先权	201610136203.2 2016-03-10 CN		
外部链接	Espacenet USPTO		

摘要(译)

本发明提供一种液晶显示面板及其制造方法，其中提供对准的碳纳米管阵列以代替现有技术中使用的光隔离物，并利用对准的碳纳米管的优异机械性能和优异的稳定性。显着提高液晶显示面板的性能和使用寿命。本发明的液晶显示面板的制造方法在液晶显示面板的一个基板上生长排列的碳纳米管，以获得由排列的碳纳米管阵列形成的间隔物，从而利用优异的机械性能和优异的稳定性。对准的碳纳米管可显着提高液晶显示面板的性能和使用寿命。