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(54) **COLOR FILTER SUBSTRATE AND LIQUID CRYSTAL DISPLAY PANEL MADE THEREFROM**

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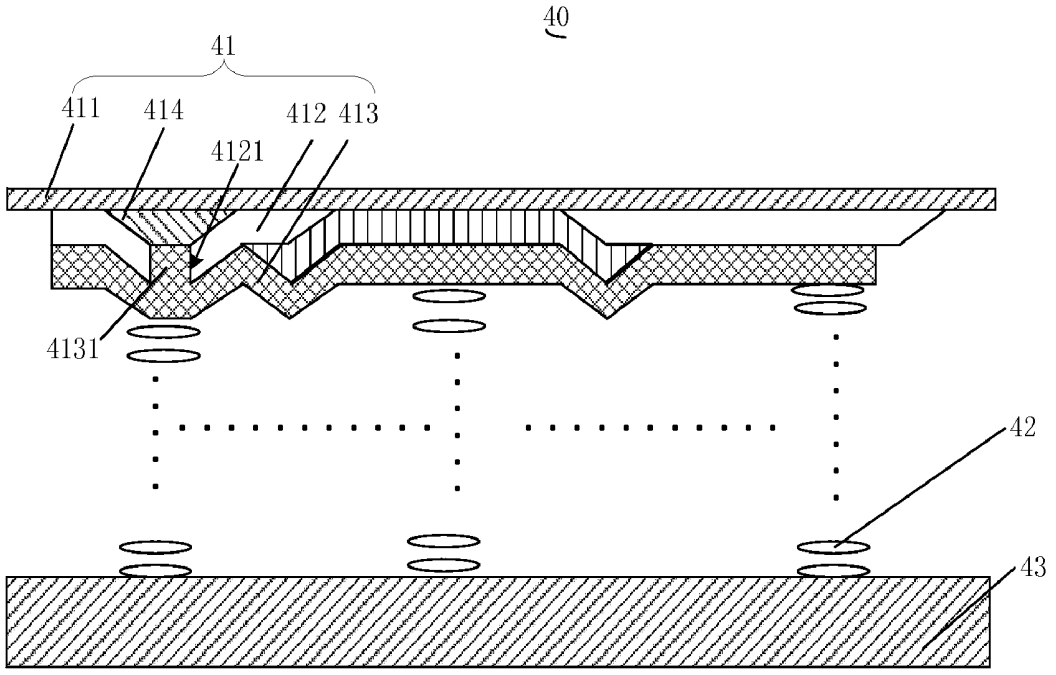
USPC **349/106**; 359/891

(57) **ABSTRACT**

The present invention discloses a color filter substrate and a liquid crystal panel. The color filter substrate includes a substrate a transparent conductive film, a black array, and an auxiliary conductive layer. Wherein the black array is arranged on the substrate and the transparent conductive film is disposed on the black array. Wherein the auxiliary conductive layer is disposed over a surface of the substrate facing the black array, and has at least portions arranged between the substrate and the black array. By these arrangements, the present invention can effectively reduce the brightness interference of the liquid crystal panel, while increasing the adhesion of the auxiliary conductive layer in addition, this arrangement can effectively avoid the damage to the transparent conductive film by the auxiliary conductive layer.



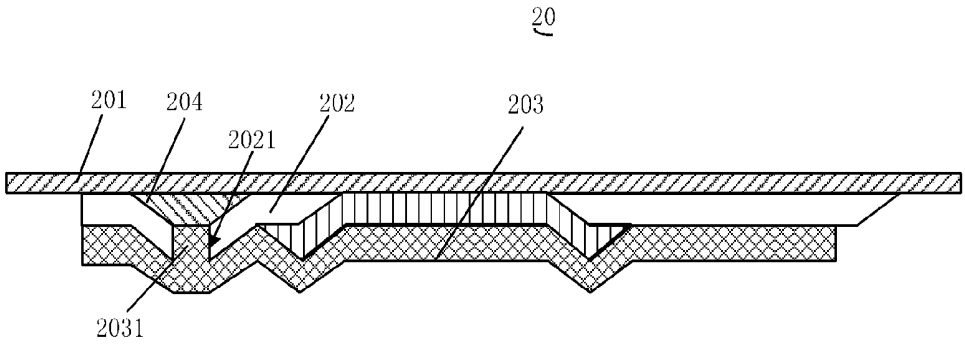


FIG. 1

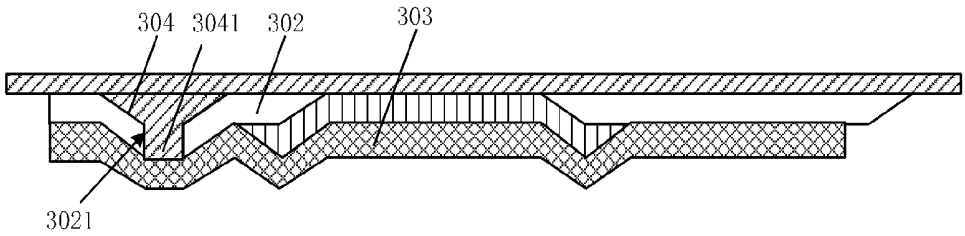


FIG.2

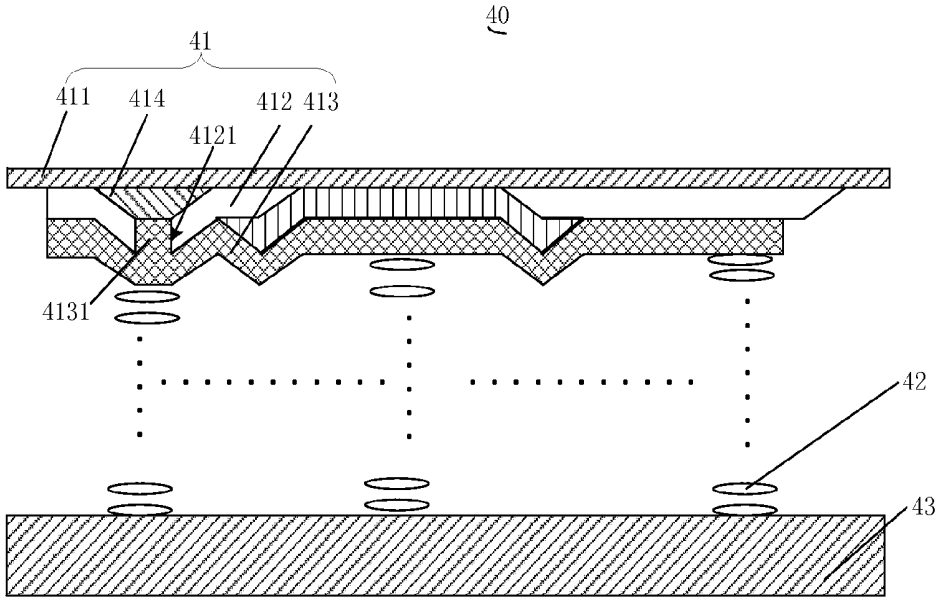


FIG. 3

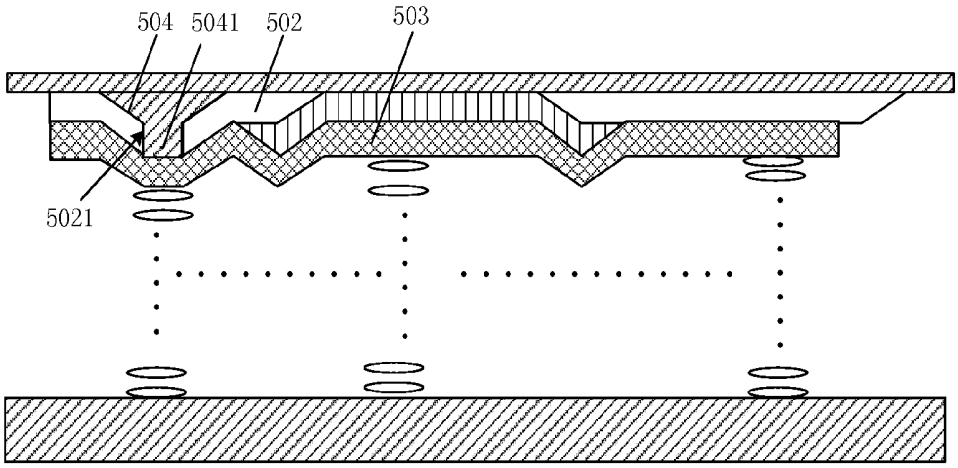


FIG. 4

COLOR FILTER SUBSTRATE AND LIQUID CRYSTAL DISPLAY PANEL MADE THEREFROM

FIELD OF THE INVENTION

[0001] The present invention relates to a technical field of liquid crystal display, and more particularly, to a color filter substrate and a liquid crystal display panel made therefrom.

DESCRIPTION OF PRIOR ART

[0002] With the development of the display technology, the liquid crystal display has become the main trend as it is featured with high displaying quality, low energy consumption, radiation, and high performance.

[0003] The liquid crystal panel is a key component of the liquid crystal display, and the panel generally includes an array substrate, a color filter substrate, and a liquid crystal stuffed between the array substrate and the color substrate. The color filter substrate is arranged with a transparent conductive film, and the array substrate is also provided with a pixel transparent conductive film, the brightness and dimmer of the pixel is jointly controlled by the transparent conductive film of the color filter substrate and the pixel transparent conductive film of the array substrate. However, the resistance of the transparent conductive film of the color filter substrate is too large such that it creates an unbalance of the brightness. Furthermore, an issue of brightness interference will also be created.

SUMMARY OF THE INVENTION

[0004] It is an object of the present invention to provide a color filter substrate and a liquid crystal panel so as to resolve the technical problem encountered by the prior art. While the present invention can effectively reduce the brightness interference of the liquid crystal panel, while increasing the adhesion of the auxiliary conductive layer. In addition, this arrangement can effectively avoid the damage to the transparent conductive film by the auxiliary conductive layer.

[0005] In order to resolve the technical problems, the present invention provides a solution by introducing a color filter substrate including a substrate, a transparent conductive film, a black array, and an auxiliary conductive layer; wherein the black array is arranged between the substrate and the transparent conductive film wherein the auxiliary conductive layer is disposed over a surface of the substrate facing the black array, and the auxiliary conductive layer is created by sputter deposition of metal across the surface of the substrate; wherein the black array is defined with through holes; and wherein the transparent conductive film is provided with embossments disposed within the holes of the black array therefore creating, an ohm contact.

[0006] Wherein the metal includes one of copper, aluminum, molybdenum, zinc or silver or any alloy thereof.

[0007] In order to resolve the technical problems, the present invention provides a solution by introducing a color filter substrate including a substrate, a transparent conductive film, a black array, and an auxiliary conductive layer; wherein the black array is arranged between the substrate and the transparent conductive film wherein the auxiliary conductive layer is disposed over a surface of the substrate facing the black array, and having at least portions arranged between the substrate and the black array; and wherein the auxiliary conductive layer is electrically in contact with the transparent conductive film.

[0008] Wherein the black array is defined with holes, and the transparent conductive film is provided with embossments which are disposed within the holes so as to create an ohm contact to the auxiliary conductive layer.

[0009] Wherein the black array is defined with holes, and the auxiliary conductive layer is provided with embossments which are disposed within the holes so as to create an ohm contact to the transparent conductive film.

[0010] Wherein the auxiliary conductive layer is made from metal.

[0011] Wherein the metal includes one of copper, aluminum, molybdenum, zinc or silver or any alloy thereof.

[0012] In order to resolve the technical problems, the present invention provides a solution by introducing a liquid crystal panel including an array substrate, a liquid crystal layer, and a color filter substrate; wherein the color filter substrate includes a substrate, a transparent conductive film, a black array, and an auxiliary conductive layer; wherein the black array is arranged between the substrate and the transparent conductive film; wherein the auxiliary conductive layer is disposed over a surface of the substrate facing the black array, and having at least portions arranged between the substrate and the black array, wherein the auxiliary conductive layer is electrically in contact with the transparent conductive film; and wherein the auxiliary conductive layer is electrically in contact with the transparent conductive film.

[0013] Wherein the black array is defined with holes, and the transparent conductive film is provided with embossments which are disposed within the holes so as to create an ohm contact to the auxiliary conductive layer.

[0014] Wherein the black array is defined with holes, and the auxiliary conductive layer is provided with embossments which are disposed within the holes so as to create an ohm contact to the transparent conductive film.

[0015] Wherein the auxiliary conductive layer is made from metal.

[0016] Wherein the metal includes one of copper, aluminum, molybdenum, zinc or silver or any alloy thereof.

[0017] The present invention can be concluded with the following advantages. As compared to the existing prior art, an auxiliary conductive layer is formed on a surface of the substrate of the color filter film facing the black array so as to avoid corrosion from the auxiliary conductive layer to the transparent conductive film when the auxiliary conductive layer is created. Since the transparent conductive film is comparatively thin, and it can be easily damaged during the corrosive activities. On the other hand, the material used to make the substrate is silicon oxide, while the auxiliary conductive layer is metallic material. The bonding between the metallic material and the silicon oxide is even stronger, and this will help the formation of the auxiliary conductive layer over the substrate, and also increase the adhesion of the auxiliary conductive layer. As the auxiliary conductive layer and the transparent conductive film are electrically interconnected, and the original common electrode configured singly by the transparent conductive film will be transformed to be configured by both the auxiliary conductive layer and the transparent conductive film. As a result, the resistance of the common electrode can be effectively lowered so as to even the brightness of the panel and reduce the brightness interference of the panel.

BRIEF DESCRIPTION OF DRAWINGS

[0018] FIG. **1** is a configurational illustration of a color filter substrate made in accordance with the present invention:

[0019] FIG. **2** is a configurational illustration showing the establishment of an electrical interconnection between an auxiliary conductive layer and a transparent conductive film made in accordance with the color filter substrate of the present invention,

[0020] FIG. **3** is a configurational illustration of a liquid crystal panel made in accordance. with the present invention; and

[0021] FIG. **4** is a configurational illustration showing the establishment of an electrical interconnection between an auxiliary conductive layer and a transparent conductive film made in accordance with the liquid crystal panel of the present invention.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

[0022] Referring to FIG. **1**, which is a configurational illustration of a color filter substrate made in accordance with the present invention. As shown, the color filter substrate **20** includes a substrate **20**, a black array **202**, a transparent conductive film **203**, and an auxiliary conductive layer **204**.

[0023] The black array **202** is disposed between the substrate **201** and the transparent conductive film **203**. The auxiliary conductive layer **204** is formed on a surface of the substrate **201** facing toward a surface of the black array **202** and at least a portion thereof is arranged between the substrate **201** and the black array **202**, in a preferable embodiment of the present invention, the auxiliary conductive layer **204** is made form copper, aluminum, molybdenum, zinc or silver or any alloy thereof. The auxiliary conductive layer **204** is formed by deploying metallic layer over the substrate **201** by way of sputter deposition. Since the substrate **201** is main made from silicon oxide, and the bonding between the metal and the silicon oxide is comparably better. In comparison to have the auxiliary conductive layer **204** attached to the black array **202** or attached to the transparent conductive, film **204**, the attachment of the auxiliary conductive layer **204** attached to the substrate **201** demonstrates a stronger bonding performance such that the auxiliary conductive layer **204** will not easily peeled of therefrom On the other hand, if the auxiliary conductive layer **204** is going to deploy over the transparent conductive film **203** through sputter deposition, an etching solution is required. The etching solution will exert a corrosive action during, the deployment. Since the transparent conductive film **203** is comparably thinner, and it can be readily damaged by the etching solution. However, the thickness of the substrate **201** is much thicker, and the etching solution has less etching activity to the substrate **201**

[0024] On the other hand, if the metallic layer is deployed over the transparent conductive film **203** so as to create the auxiliary conductive layer **204** by means of sputter deposition, then the etching solution is needed, and which will inevitably create some corrosive activities over the transparent conductive film **203**. However, since the transparent conductive film **203** is comparably thinner, and it can be readily damaged by the etching solution, while the thickness of the substrate **201** is much thicker, and the etching solution has less etching influence to the substrate **201**.

[0025] The auxiliary conductive layer **204** and the transparent conductive film **203** are electrically interconnected, and wherein the auxiliary transparent layer **204** has a stronger conductivity as it has lower resistance. Accordingly, the original common electrode configured singly by the transparent conductive film **203** will be transformed to be configured by both the auxiliary conductive layer **204** and the transparent conductive film **203**. As a result, the resistance of the common electrode can be effectively lowered so as to even the brightness of the panel and reduce the brightness interference of the panel. It should be noted that accordingly to the preferred embodiment of the present invention, even the auxiliary conductive layer **204** is arranged within an area under the shadow of the black array **202**, it can be arranged such that it is located outside of the shadow of the black array **202**. It can be arranged that it is disposed outside of the shadow of the black array **202** as long as the electrical interconnection between the auxiliary conductive layer **204** and the transparent conductive film **203** is established so as to fulfill the purpose of lowering the resistance.

[0026] According to one of the embodiments, the black array **202** is defined with holes **2021**, and the transparent conductive film **203** is provided with embossments **2031** which passing through the holes **2021** so as to create an ohm contact with the auxiliary conductive layer **204**. By this arrangement, electrical interconnection between the auxiliary conductive layer **204** and the transparent conductive film **203** is established.

[0027] According to another embodiment of the present invention such as shown in FIG. **2**, the black array **202** is also defined with holes **3021**, while the auxiliary conductive layer **304** is formed with embossments **3041** which are disposed within the holes **3021** so as to establish an ohm contact with respect to the transparent conductive, film **303**, and the electrical interconnection between the auxiliary conductive layer **304** and the transparent conductive film **303** is established.

[0028] In the current embodiment, the auxiliary conductive layer **204** is formed on the surface of the substrate **201** of the color filter substrate **20** facing toward the black array **202** so as to prevent the damage to the transparent conductive film **203** when the auxiliary conductive layer **204** is formed over the transparent conductive film **203** because of the etching activity Since the transparent conductive film **203** is much thinner and is vulnerably to be damaged under the etching activity. By way of the present invention, the transparent conductive film **203** is well protected. On the other hand, the substrate **201** is generally made from silicon oxide and the auxiliary conductive layer **204** has a better bonding with the silicon oxide. As compared to the bonding between the auxiliary conductive layer **204** and the black array **202** or to the transparent conductive layer **203**, the bonding between the auxiliary conductive layer **203** and the substrate **201** is much stronger, and thereby increasing the bonding adhesion of the auxiliary conductive layer **204** to the substrate **201**. The auxiliary conductive layer **204** is electrically interconnected with the transparent conductive film **203** such that the common electrode originally solely configured by the transparent conductive film **203** is not changed to be configured by both the auxiliary conductive layer **204** and the transparent conductive film **203**. By way of this arrangement, the resistance of the common electrode is effectively reduced, and the brightness of the display becomes even more homogeneous, and the brightness interference is also reduced

[0029] Referring to FIG. **3**, which is a configurational illustration of a liquid crystal panel made in accordance with the present invention. As shown in FIG. **3**, the liquid crystal

display panel **40** includes a color filter film **41**, a liquid crystal layer **42**, and an array substrate **43**. The color filter substrate **41** includes a substrate **411**, a black array **412**, a transparent conductive film **413**, and an auxiliary conductive layer **414**.

[0030] The black array **412** is disposed between the substrate **411** and the transparent conductive film **413**. The auxiliary conductive layer **4144** is formed on a surface of the substrate **411** facing toward a surface of the black array **412** and at least a portion thereof is arranged between the substrate **411** and the black array **412**. In a preferable embodiment of the present invention, the auxiliary conductive layer **414** is made form copper, aluminum, molybdenum, zinc or silver or any alloy thereof. The auxiliary conductive layer **414** is formed by deploying metallic layer over the substrate **411** by way of sputter deposition. Since the substrate **411** is main made from silicon oxide, and the bonding between the metal and the silicon oxide is comparably better. In comparison to have the auxiliary conductive layer **414** attached to the black array **412** or attached to the transparent conductive film **414**, the attachment of the auxiliary conductive layer **414** attached to the substrate **411** demonstrates a stronger bonding performance such that the auxiliary conductive layer **414** will not easily peeled of therefrom. On the other hand, if the auxiliary conductive layer **414** is going to deploy over the transparent conductive film **413** through sputter deposition, an etching solution is required. The etching solution will exert a corrosive action during the deployment. Since the transparent conductive film **413** is comparably thinner, and it can be readily damaged by the etching solution. However, the thickness of the substrate **411** is much thicker, and the etching solution has less etching influence to the substrate **411**.

[0031] The auxiliary conductive layer **414** and the transparent conductive film **413** are electrically interconnected, and wherein the auxiliary transparent layer **414** has a stronger conductivity as it has lower resistance. Accordingly, the original common electrode configured singly by the transparent conductive film **413** will be transformed to be configured by both the auxiliary conductive layer **414** and the transparent conductive film **413**. As a result, the resistance of the common electrode can be effectively lowered so as to even the brightness of the panel and reduce the brightness interference of the panel. It should be noted that accordingly to the preferred embodiment of the present invention, even the auxiliary conductive layer **414** is arranged within an area under the shadow of the black array **412**, it can be arranged such that it is located outside of the shadow of the black array **412**. It can be arranged that it is disposed outside of the shadow of the black array **412** as long as the electrical interconnection between the auxiliary conductive layer **414** and the transparent conductive film **413** is established so as to fulfill the purpose of lowering the resistance.

[0032] According to one of the embodiments, the black array **412** is defined with holes **4121**, and the transparent conductive film **413** is provided with embossments **4131** which passing through the holes **4121** so as to create an ohm contact with the auxiliary conductive layer **414**. By this arrangement, electrical interconnection between the auxiliary conductive layer **414** and the transparent conductive film **413** is established.

[0033] According to another embodiment of the present invention such as shown in FIG. **4**, the black array **502** is also defined with holes **5021**, while the auxiliary conductive layer **504** is formed with embossments **5041** which are disposed within the holes **5021** so as to establish an ohm contact with respect to the transparent conductive film **503**, and the electrical interconnection between the auxiliary conductive layer **504** and the transparent conductive film **503** is established

[0034] The liquid crystal layer **42** is arranged between the transparent conductive film **503** and the array substrate **43**.

[0035] in the current embodiment, the auxiliary conductive layer **414** is formed on the surface of the substrate **411** of the color filter substrate **41** of the liquid crystal panel **40** facing toward the black array **412** so as to prevent the damage to the transparent conductive film **413** when the auxiliary conductive layer **414** is formed over the transparent conductive film **413** because of the etching activity. Since the transparent conductive film **413** is much thinner and is vulnerably to be damaged under the etching activity. By way of the present invention, the transparent conductive film **413** is well protected. On the other hand, the substrate **411** is generally made from silicon oxide and the auxiliary conductive layer **414** has a better bonding with the silicon oxide. As compared to the bonding between the auxiliary conductive layer **414** and the black array **412** or to the transparent conductive layer **413**, the bonding between the auxiliary conductive layer **413** and the substrate **411** is much stronger, and thereby increasing the bonding adhesion of the auxiliary conductive layer **414** to the substrate **411**. The auxiliary conductive layer **414** is electrically interconnected with the transparent conductive film **413** such that the common electrode originally solely configured by the transparent conductive film **413** is not changed to be configured by both the auxiliary conductive layer **414** and the transparent conductive film **413**. By way of this arrangement, the resistance of the common electrode is effectively reduced, and the brightness of the display becomes even more homogeneous, and the brightness interference is also reduced.

[0036] Embodiments of the present invention have been described, but not intending to impose any unduly constraint to the appended claims. Any modification of equivalent structure or equivalent process made according to the disclosure and drawings of the present invention, or any application thereof, directly or indirectly, to other related fields of technique, is considered encompassed in the scope of protection defined by the claims of the present invention.

1. A color filter substrate including a substrate, a transparent conductive film, a black array, and an auxiliary conductive layer;

wherein the black array is arranged between the substrate and the transparent conductive film;

wherein the auxiliary conductive layer is disposed over a surface of the substrate facing the black array, and the auxiliary conductive layer is created by sputter deposition of metal across the surface of the substrate;

wherein the black array is defined with through holes; and

wherein the transparent conductive film is provided with embossments disposed within the holes of the black array therefore creating an ohm contact.

2. The color filter substrate as recited in claim **1**, wherein the metal includes one of copper, aluminum, molybdenum, zinc or silver or any alloy thereof.

3. A color filter substrate including a substrate, a. transparent conductive film, a black array, and an auxiliary conductive layer;

wherein the black array is arranged between the substrate and the transparent conductive film;

wherein the auxiliary conductive layer is disposed over a surface of the substrate facing the black array, and having at least portions arranged between the substrate and the black array; and

wherein the auxiliary conductive layer is electrically in contact with the transparent conductive film.

4. The color filter substrate as recited in claim **3**, wherein the black array is defined with holes, and the transparent conductive film is provided with embossments which are disposed within the holes so as to create an ohm contact to the auxiliary conductive layer.

5. The color filter substrate as recited in claim **3**, wherein the black array is defined with holes, and the auxiliary conductive layer is provided with embossments which are disposed within the holes so as to create an ohm contact to the transparent conductive film.

6. The color filter substrate as recited in claims **3**, wherein the auxiliary conductive layer made from metal.

7. The color filter substrate as recited in claim **6**, the metal includes one of aluminum, molybdenum, zinc or silver or any alloy thereof.

8. A liquid crystal panel including an array substrate, a liquid crystal layer, and a color substrate;

wherein the color filter substrate includes a substrate, a transparent conductive film, a black array, and an auxiliary conductive layer;

wherein the black array is arranged between the substrate and the transparent film;

wherein the auxiliary conductive layer is disposed over a surface of the substrate the black array, and having at least portions arranged between the substrate and the black array, wherein the auxiliary conductive layer is electrically in contact with the transparent conductive film; and

wherein the auxiliary conductive layer is electrically in contact with the transparent conductive film.

9. The liquid crystal panel as recited in claim **8**, wherein the black array is defined with holes, and the transparent conductive film is provided with embossments which are within the holes so as to create an ohm contact to the auxiliary conductive layer.

10. The color filter substrate as recited in claim **8**, wherein the black array is defined with holes, and the auxiliary conductive layer is provided with embossments which are disposed within the holes so as to create an ohm contact to the transparent conductive film.

11. The liquid crystal panel as recited in claims **8**, wherein the auxiliary conductive layer made from metal.

12. The liquid crystal panel as recited in claim **11**, wherein the metal includes one of aluminum, molybdenum, zinc or silver or any alloy thereof.

* * * * *

专利名称(译)	彩色滤光片和液晶显示面板		
公开(公告)号	US20140347610A1	公开(公告)日	2014-11-27
申请号	US13/985289	申请日	2013-06-28
[标]申请(专利权)人(译)	韩冰 LO SHIH HSUN 廖ZUOMIN		
申请(专利权)人(译)	韩，BING LO，施勋 廖ZUOMIN		
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	HAN BING LO SHIH HSUN LIAO ZUOMIN		
发明人	HAN, BING LO, SHIH-HSUN LIAO, ZUOMIN		
IPC分类号	G02F1/1335 G02B5/20		
CPC分类号	G02B5/201 G02F1/133512 G02F1/133514 G02F1/1343 G02F2201/121		
优先权	201310198398.X 2013-05-24 CN		
其他公开文献	US9519179		
外部链接	Espacenet USPTO		

摘要(译)

本发明公开了一种彩色滤光片基板和液晶面板。滤色器基板包括基板，透明导电膜，黑色阵列和辅助导电层。其中，黑色阵列设置在基板上，透明导电膜设置在黑色阵列上。其中，辅助导电层设置在面向黑色阵列的基板表面上，并且至少部分设置在基板和黑色阵列之间。通过这些布置，本发明可以有效地降低液晶面板的亮度干扰，同时增加辅助导电层的附着力，这种布置可以有效地避免辅助导电层对透明导电膜的损害。