



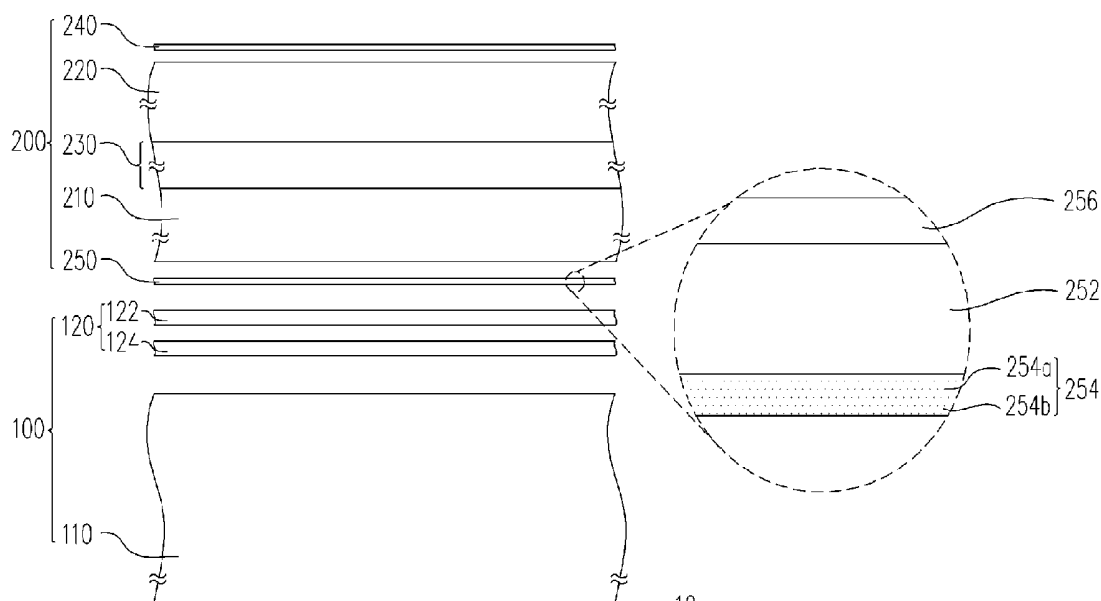
US 20060098138A1

(19) **United States**(12) **Patent Application Publication** (10) **Pub. No.: US 2006/0098138 A1**
Hu et al. (43) **Pub. Date: May 11, 2006**(54) **LIQUID CRYSTAL DISPLAY PANEL AND
LIQUID CRYSTAL DISPLAY MODULE**(52) **U.S. Cl.** **349/96**(76) Inventors: **Cheng-Chung Hu**, Taoyuan County
(TW); **Hsien-Chang Hsiao**, Nantou
County (TW)(57) **ABSTRACT**

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**JIANQ CHYUN INTELLECTUAL PROPERTY
OFFICE
7 FLOOR-1, NO. 100
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TAIPEI 100 (TW)**(21) Appl. No.: **10/904,402**(22) Filed: **Nov. 9, 2004****Publication Classification**(51) **Int. Cl.**
G02F 1/1335 (2006.01)

A liquid crystal display (LCD) panel and module is provided. The LCD panel comprises a thin film transistor (TFT) array substrate, a color filter substrate, a liquid crystal layer, an upper polarizing plate and a lower polarizing plate. The color filter substrate is disposed over the TFT array substrate, and the liquid crystal layer is disposed between the TFT array substrate and the color filter substrate. In addition, the upper polarizing plate is disposed over the color filter substrate. Moreover, the lower polarizing plate is disposed over the TFT array substrate, and the lower polarizing plate includes, for example, a polarizer and a light scattering layer disposed over a surface of the polarizer.



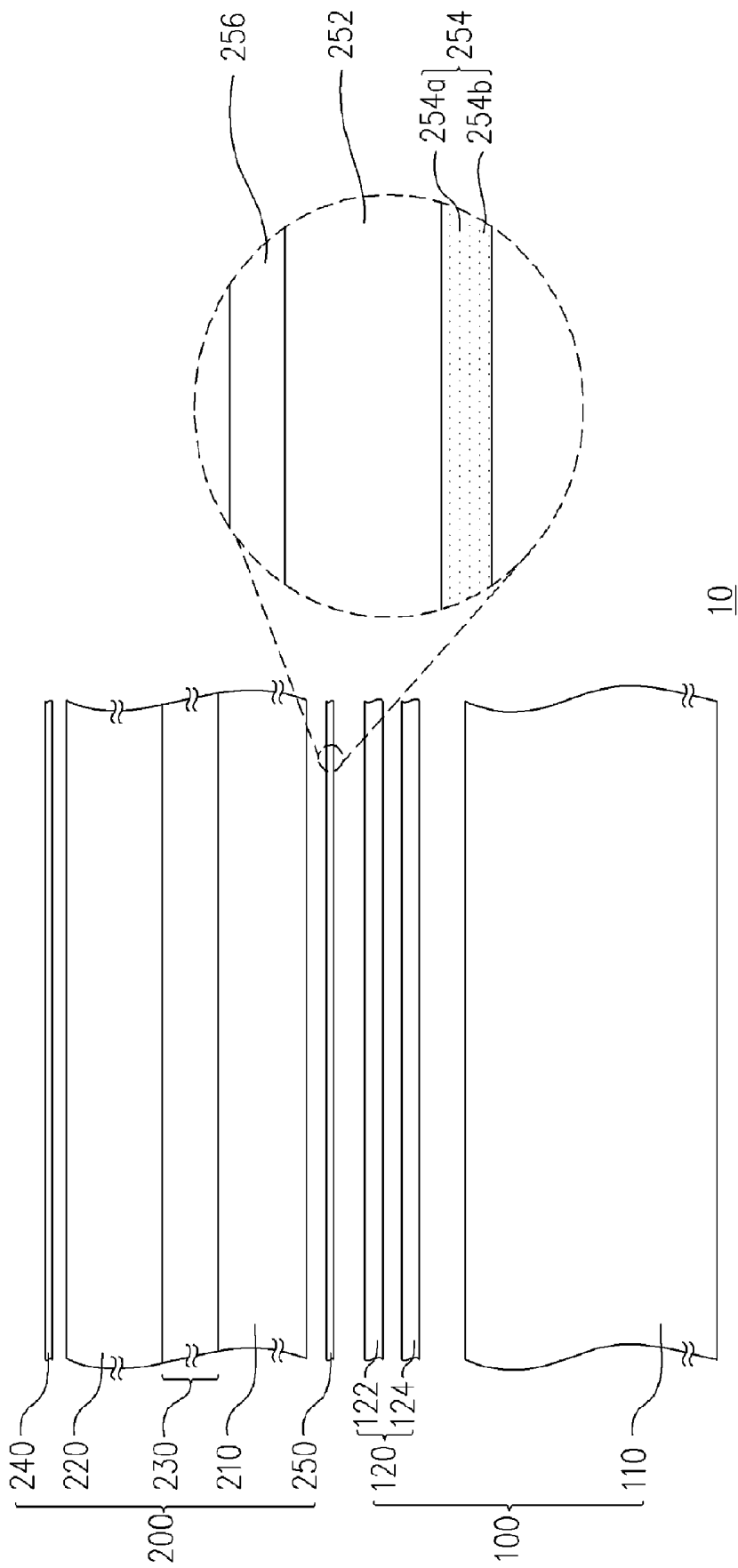


FIG. 1

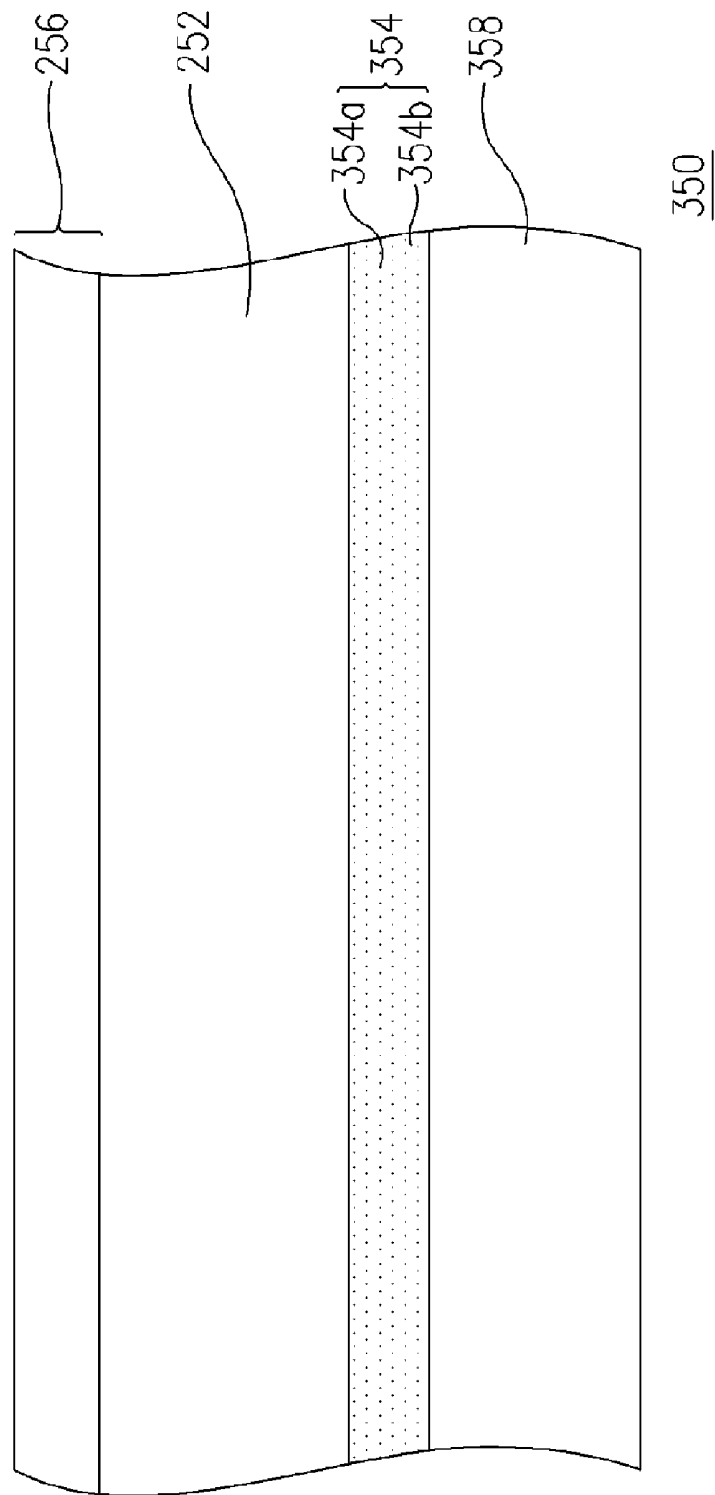


FIG. 2A

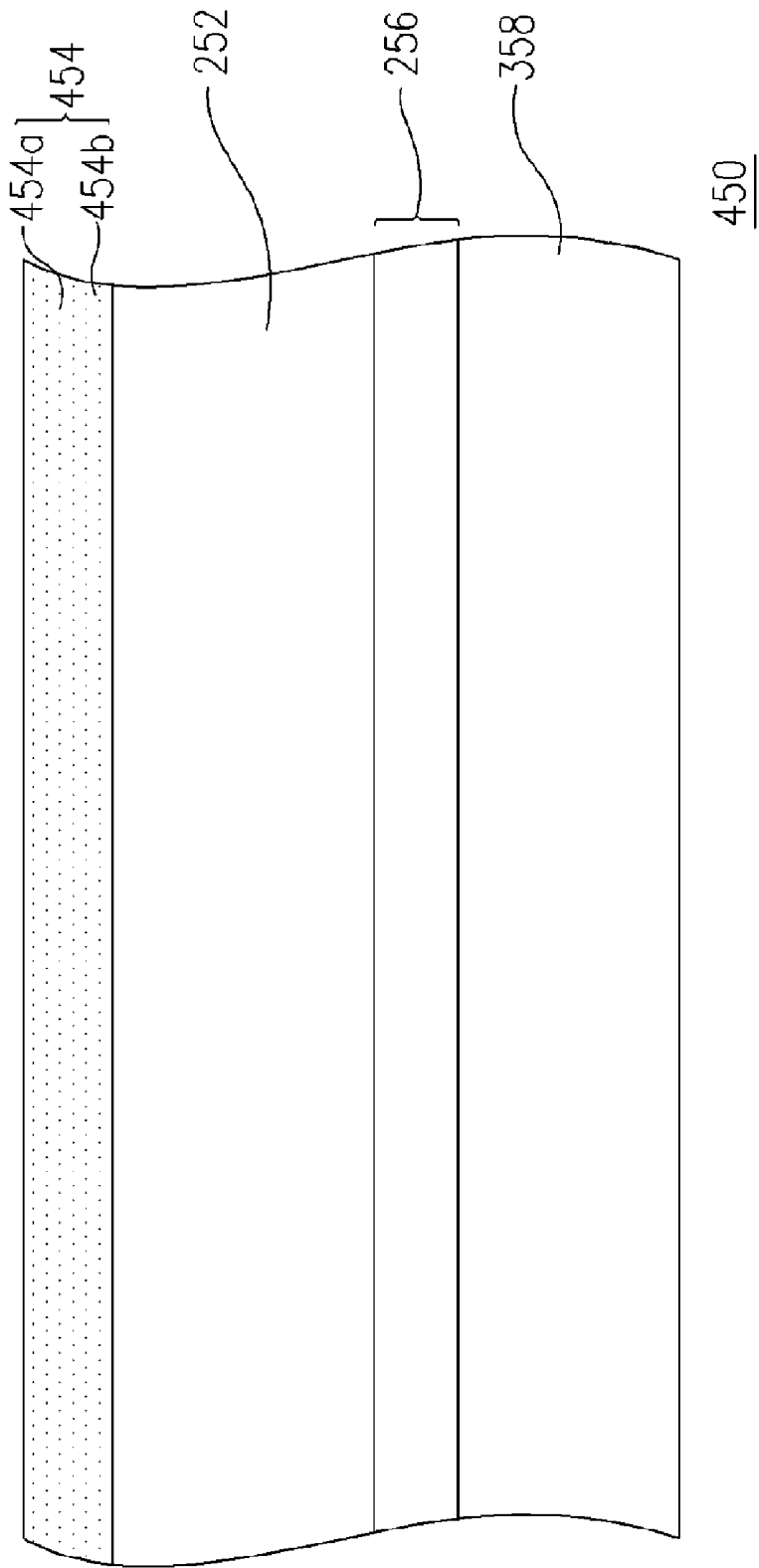


FIG. 2B

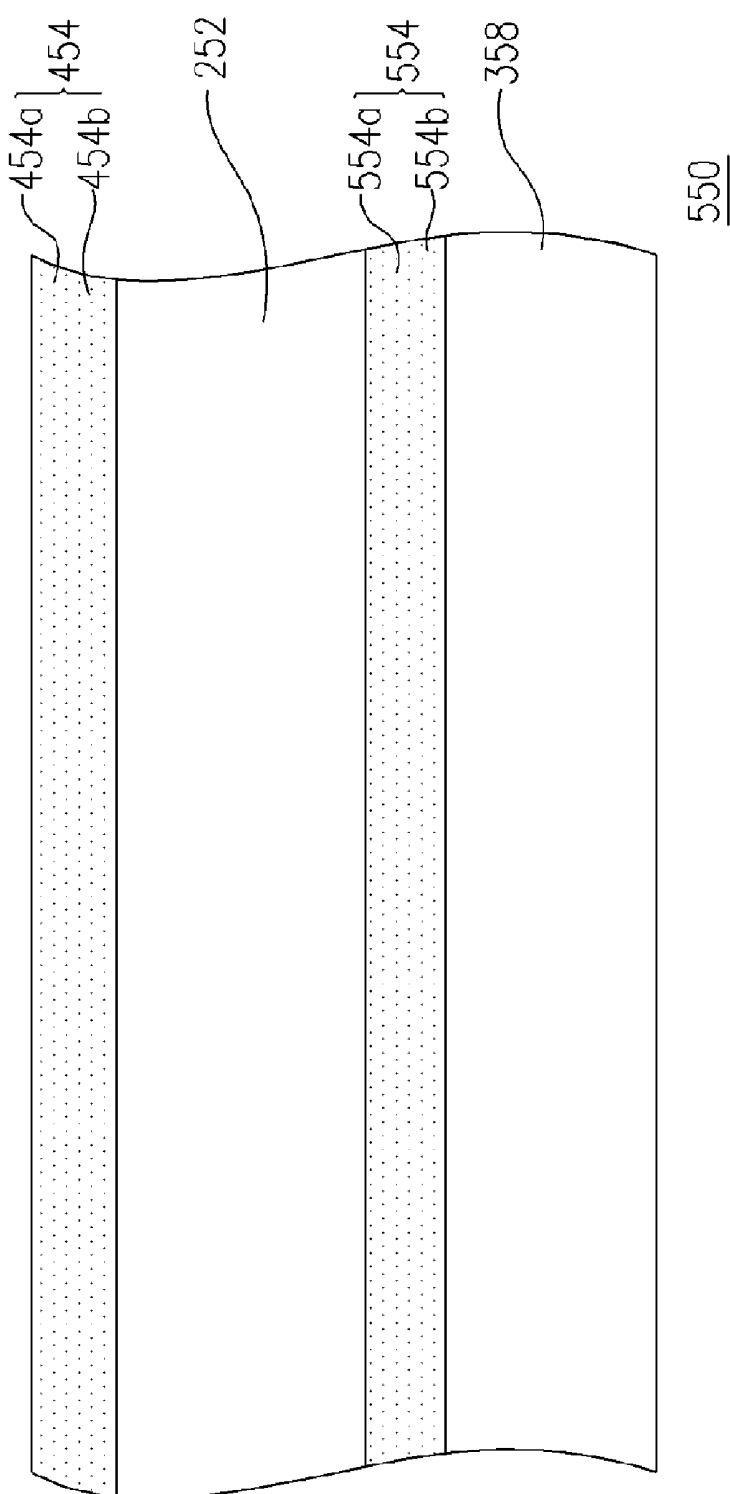


FIG. 2C

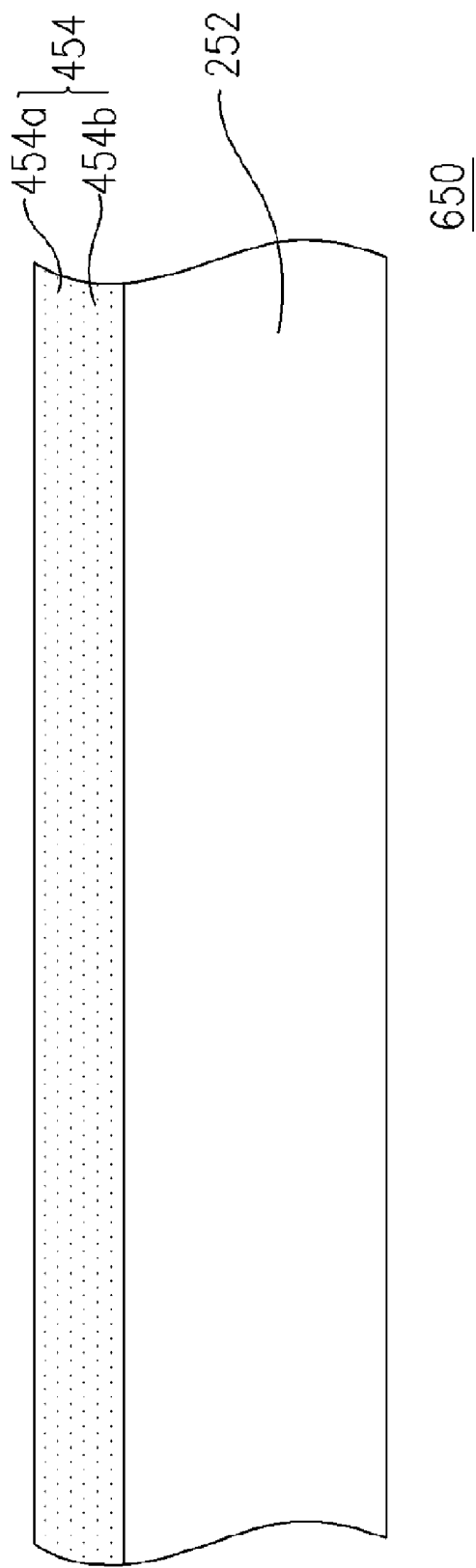


FIG. 2D

LIQUID CRYSTAL DISPLAY PANEL AND LIQUID CRYSTAL DISPLAY MODULE

BACKGROUND OF THE INVENTION

[0001] 1. Field of the Invention

[0002] The present invention generally relates to a display panel. More particularly, the present invention relates to a liquid crystal display panel and a liquid crystal display module.

[0003] 2. Description of Related Art

[0004] Recently, a variety of factories have invested great efforts on the development of display device as the market demand of display device has grown rapidly. Conventionally, since the cathode ray tube (CRT) is fully developed and has good display quality, the CRT has been adopted in a variety of application. However, the CRT has the disadvantages of high power consumption, heavy weight, large size and harmful radiation and therefore cannot meet the requirement of environmental protection requirement. Accordingly, the thin film transistor liquid crystal display (TFT-LCD) has been developed and has become the major trend of the display device due to the advantages of high definition, small size, thinness, low power consumption, radiation free, etc.

[0005] The conventional TFT-LCD module mainly includes a liquid crystal display (LCD) panel and a back light module. The liquid crystal display panel constitutes a TFT array substrate, a color filter substrate and a liquid crystal layer disposed between the two substrates. The back light module is adopted as a surface light source of the LCD panel for displaying image from the TFT-LCD module. In addition, an upper polarizing plate and a lower polarizing plate are usually disposed over the two opposite surfaces of the LCD panel to enhance the display quality of the TFT-LCD module. Moreover, a plurality of optical films is disposed between the LCD panel and the surface light source of the back light module to enhance the brightness of the TFT-LCD module.

[0006] Accordingly, in order to enhance the display contrast of the LCD panel and to make the appearance of the LCD panel more shiny, the upper polarizing plate of the LCD panel is generally constructed by glare type polarizing plate, and the lower polarizing plate of the LCD panel is generally constructed by conventional polarizing plate. However, after a light from the surface light source of the back light module passes through the optical films and the LCD panel, generally a plurality of mutually parallelized moire are generated in the display area of the LCD panel. It is noted that, since the moire may be observed by human eyes, the displaying quality of the LCD panel is reduced.

SUMMARY OF THE INVENTION

[0007] Accordingly, the present invention is directed to liquid crystal display (LCD) panel for reducing the generation of moire in the display area of the LCD panel and thereby enhance the displaying quality of the LCD panel.

[0008] In addition, the present invention is also directed to a liquid crystal display (LCD) module for reducing the generation of moire in the display area of the LCD module and thereby enhance the displaying quality of the LCD module.

[0009] According to one embodiment of the present invention, a liquid crystal display panel comprising, for example but not limited to, a thin film transistor (TFT) array substrate, a color filter substrate, a liquid crystal layer, an upper polarizing plate and a lower polarizing plate is provided. The color filter substrate is disposed over the TFT array substrate. The liquid crystal layer is disposed between the TFT array substrate and the color filter substrate. In addition, the upper polarizing plate is disposed over the color filter substrate. Moreover, the lower polarizing plate is disposed over the TFT array substrate. The lower polarizing plate comprises, for example but not limited to, a polarizer and a light scattering layer disposed over a surface of the polarizer.

[0010] According to one embodiment of the present invention, a liquid crystal display module comprising, for example but not limited to, a back light module and a liquid crystal display panel is provided. The liquid crystal display panel is disposed over the back light module. In addition, the back light module comprises, for example, an optical film (or an optical sheet) and a back light source. Moreover, the liquid crystal display panel comprises, for example but not limited to, a thin film transistor (TFT) array substrate, a color filter substrate, a liquid crystal layer, an upper polarizing plate and a lower polarizing plate. The color filter substrate is disposed over the TFT array substrate, and the liquid crystal layer is disposed between the TFT array substrate and the color filter substrate. The upper polarizing plate is disposed over the color filter substrate, and the lower polarizing plate is disposed over the TFT array substrate. Furthermore, the lower polarizing plate comprises, for example but not limited to, a polarizer and a light scattering layer disposed over a surface of the polarizer.

[0011] Accordingly, a lower polarizing plate with light scattering layer is provided in the liquid crystal display panel and liquid crystal display module of the present invention. Therefore, the generation of moire in the display area can be effectively reduced by the light scattering layer, and thus the displaying quality of the liquid crystal display panel and liquid crystal display module is enhanced.

BRIEF DESCRIPTION OF THE DRAWINGS

[0012] The accompanying drawings are included to provide a further understanding of the present invention, and are incorporated in and constitute a part of this specification. The drawings illustrate embodiments of the present invention and, together with the description, serve to explain the principles of the present invention.

[0013] **FIG. 1** is a schematic cross-sectional view illustrating a liquid crystal display module according to one embodiment of the present invention.

[0014] **FIG. 2A, FIG. 2B, FIG. 2C** and **FIG. 2D** are schematic cross-section views illustrating lower polarizing plates according to another embodiments of the present invention.

DESCRIPTION OF THE EMBODIMENTS

[0015] The present invention will be described fully hereinafter with reference to the accompanying drawings, in which preferred embodiments of the present invention are illustrated. The present invention may, however, be embodied in many different forms and should not be construed as

limited to the embodiments set forth herein; rather, these embodiments are provided so that this disclosure will be thorough and complete, and will fully convey the scope of the invention to those skilled in the art. Like numbers refer to like elements in the accompanying drawings throughout.

[0016] **FIG. 1** is a schematic cross-section view illustrating a liquid crystal display module according to one embodiment of the present invention. Referring to **FIG. 1**, the liquid crystal display (LCD) module **10** comprises, for example but not limited to, a back light module **100** and a liquid crystal display (LCD) panel **200**. The LCD panel **200** is disposed over the back light module **100**. In addition, the back light module **100** comprises, for example, a back light source **110** and an optical film (or optical sheet) **120**. In one embodiment of the present invention, the optical film **120** comprises, for example but not limited to, a light collecting sheet **122** and a diffusion sheet **124**. The light collecting sheet **122** comprises, for example but not limited to, a prism sheet. Furthermore, the back light source **110** comprises, for example but not limited to, a side type back light source or a direct type back light source.

[0017] Moreover, the LCD panel **200** comprises, for example but not limited to, a thin film transistor (TFT) array substrate **210**, a color filter substrate **220**, a liquid crystal layer **230**, an upper polarizing plate **240** and a lower polarizing plate **250**. The color filter substrate **220** is disposed over the TFT array substrate **210**. The liquid crystal layer **230** is disposed between the TFT array substrate **210** and the color filter substrate **220**. Furthermore, the upper polarizing plate **240** is disposed over a surface of the color filter substrate **220**, and the lower polarizing plate **250** is disposed over a surface of the TFT array substrate **210**.

[0018] Referring to the enlarged area of **FIG. 1**, the lower polarizing plate **250** comprises, for example but not limited to, a polarizer **252** and a light scattering layer **254**. The light scattering layer **254** is constructed by, for example but not limited to, a transparent resin **254b** and a plurality of light scattering particles **254a** distributed in transparent resin **254b**. In addition, the transparent resin **254b** comprises, for example but not limited to, ultraviolet (UV) light hardening resin or other light hardening resin. Moreover, the refractive indices of the light scattering particle **254a** and the transparent resin **254b** are, for example, different. The light scattering particle **254a** comprises, for example but not limited to, transparent particles only with a single refractive index. Alternatively, the light scattering particle **254a** may comprise transparent particles with a plurality of different refractive indices. Furthermore, the lower polarizing plate **250** is, for example but not limited to, adhered over the TFT array substrate **210** via an adhesion layer **256**. However, in another embodiment of the present invention, the lower polarizing plate **250** may be disposed over the TFT array substrate **210** by using another method except for by using the adhesion layer **256**.

[0019] Referring to **FIG. 1**, in the present invention, the light scattering particles **254a** disposed in the light scattering layer **254** of the lower polarizing plate **250** is provided for scattering the light from the surface light source of the back light source **110**. Therefore, in comparison with the conventional technology, after the light from the surface light source of the back light source **110** passes through the optical film sheet **120**, it is difficult to generate moire in the

LCD panel **200**. Therefore, the user will not observe moire in the display area of the LCD panel **200**. In the present invention, the upper polarizing plate **240** comprises conventional polarizing plate or any applicable polarizing plate. In one embodiment of the present invention, in order to make the appearances of the LCD panel **200** and the LCD module **10** more shiny and to enhance the display contrasts of the LCD panel **200** and the LCD module **10**, the upper polarizing plate **240** comprises, for example, glare type polarizing plate. Furthermore, the surface treatment of the glare type polarizing plate comprises hardening and antireflection treatment.

[0020] It is noted that in the embodiment described above, the lower polarizing plate of the LCD panel and the LCD module comprises the polarizing plate having the light scattering layer. Therefore, the generation of moire in the LCD module is effectively reduced. Hereinafter, a lower polarizing plate of the LCD panel and the LCD module for achieving the effect reducing the generation of moire will be described.

[0021] **FIG. 2A** is schematic cross-section view illustrating a lower polarizing plate according to another embodiment of the present invention. Referring to **FIG. 2A**, the lower polarizing plate **350** is also adhered over a surface of the thin film transistor (TFT) array substrate **210** (as illustrated in **FIG. 1**). In the present embodiment, the lower polarizing plate **350** comprises, for example but not limited to, a polarizer **252**, a light scattering layer **354** and an optical film **358**. The light scattering layer **354** is adhered over a surface of the polarizer **252**. The light scattering layer **354** is constructed by, for example but not limited to, an adhesion material **354b** and a plurality of light scattering particles **354a** distributed in the adhesion material **354b**. The optical film **358** is adhered over a surface of the polarizer **252** via the adhesion material **354b** of the light scattering layer **354**. In one embodiment of the present invention, the optical film **358** comprises, for example but not limited to, a brightness enhancement film (BEF) or a dual brightness enhanced film (DBEF). In addition, an adhesion layer **256** may be further coated on another surface of the polarizer **252** to adhere the lower polarizing plate **350** over the surface of the TFT array substrate **210** (similar to that illustrated in **FIG. 1**).

[0022] In another embodiment of the present invention, the lower polarizing plate may be designed as shown in **FIG. 2B**. The lower polarizing plate **450** comprises, for example but not limited to, a polarizer **252**, a light scattering layer **454**, an optical film **358** and an adhesion layer **256**. The light scattering layer **454** is adhered over a surface of the polarizer **252**. The light scattering layer **454** is constructed by, for example but not limited to, an adhesion material **454b** and a plurality of light scattering particles **454a** distributed in the adhesion material **454b**. Moreover, the adhesion layer **256** is coated on another surface of the polarizer **252**. The optical film **358** is adhered over the polarizer **252** via the adhesion layer **256**. The lower polarizing plate **450** is, for example but not limited to, adhered over the surface of the TFT array substrate **210** via the adhesion material **454b** of the light scattering layer **454** (similar to that illustrated in **FIG. 1**).

[0023] In another embodiment of the present invention, the lower polarizing plate comprises two light scattering layers as shown in **FIG. 2C**. In the present embodiment, the lower polarizing plate **550** comprises, for example but not

limited to, a polarizer **252**, a light scattering layer **454**, a light scattering layer **554** and an optical film **358**. The light scattering layer **554** is adhered over a surface of the polarizer **252**. The light scattering layer **554** is constructed by, for example but not limited to, an adhesion material **554b** and a plurality of light scattering particles **554a** distributed in the adhesion material **554b**. The optical film **358** is adhered over the surface of the polarizer **252** via the adhesion material **554b** of the light scattering layer **554**. In addition, the light scattering layer **454** is adhered over another surface of the polarizer **252**. The light scattering layer **454** is constructed by, for example but not limited to, an adhesion material **454b** and a plurality of light scattering particles **454a** distributed in the adhesion material **454b**. The lower polarizing plate **550** is, for example but not limited to, adhered over the surface of the TFT array substrate **210** via the adhesion material **454b** of the light scattering layer **454** (similar to that illustrated in **FIG. 1**).

[0024] In another embodiment of the present invention, the lower polarizing plate may be designed as shown in **FIG. 2D**. In the present invention, the lower polarizing plate **650** comprises, for example but not limited to, a polarizer **252** and a light scattering layer **454**. The light scattering layer **454** is adhered over a surface of the polarizer **252**. The light scattering layer **454** is constructed by, for example but not limited to, an adhesion material **454b** and a plurality of light scattering particles **454a** distributed in the adhesion material **454b**. The lower polarizing plate **650** is, for example but not limited to, adhered over the surface of the TFT array substrate **210** via the adhesion material **454b** of the light scattering layer **454** (similar to that illustrated in **FIG. 1**).

[0025] Accordingly, the LCD panel and the LCD module of the present invention has the following advantages.

[0026] First, since the lower polarizing plate of the LCD panel and the LCD module of the present invention has a light scattering layer, the generation of moire in the LCD module can be effectively reduced. Therefore, the display quality of the LCD panel and the LCD module of the present invention is enhanced.

[0027] In addition, it is noted that the light scattering layer of the lower polarizing plate is constructed by, for example but not limited to, adhesion material and light scattering particles. Therefore, the light scattering layer may not only be provided for adhesion, but also may enhance the display quality of the LCD panel and the LCD module of the present invention.

[0028] Furthermore, in the LCD panel and the LCD module of the present invention, the lower polarizing plate further comprises optical film layer for enhancing the displaying quality. Moreover, the light scattering layer constructed by the adhesion material can be disposed between the optical film layer and the polarizer. In addition, the upper polarizing plate may also comprises glare type polarizing plate to make the appearance of the LCD panel and the LCD module more shiny.

[0029] The foregoing description of the preferred embodiment of the present invention has been presented for purposes of illustration and description. It is not intended to be exhaustive or to limit the invention to the precise form or to exemplary embodiments disclosed. Accordingly, the foregoing description should be regarded as illustrative rather

than restrictive. Obviously, many modifications and variations will be apparent to practitioners skilled in this art. The embodiments are chosen and described in order to best explain the principles of the invention and its best mode practical application, thereby to enable persons skilled in the art to understand the invention for various embodiments and with various modifications as are suited to the particular use or implementation contemplated. It is intended that the scope of the invention be defined by the claims appended hereto and their equivalents in which all terms are meant in their broadest reasonable sense unless otherwise indicated. It should be appreciated that variations may be made in the embodiments described by persons skilled in the art without departing from the scope of the present invention as defined by the following claims. Moreover, no element and component in the present disclosure is intended to be dedicated to the public regardless of whether the element or component is explicitly recited in the following claims.

What is claimed is:

1. A liquid crystal display (LCD) panel, comprising:
 - a thin film transistor (TFT) array substrate;
 - a color filter substrate, disposed over the TFT array substrate;
 - a liquid crystal layer, disposed between the TFT array substrate and the color filter substrate;
 - an upper polarizing plate, disposed over the color filter substrate; and
 - a lower polarizing plate, disposed over the TFT array substrate, wherein the lower polarizing plate comprises a polarizer and a first light scattering layer disposed over a surface of the polarizer.
2. The LCD panel of claim 1, further comprising an adhesion layer, disposed between the lower polarizing plate and the TFT array substrate.
3. The LCD panel of claim 2, wherein the first light scattering layer comprises a transparent resin and a plurality of light scattering particles distributed in the transparent resin.
4. The LCD panel of claim 1, wherein the first light scattering layer is disposed between the TFT array substrate and the polarizer, and the first light scattering layer comprises an adhesion material and a plurality of light scattering particles distributed in the adhesion material.
5. The LCD panel of claim 1, wherein the first light scattering layer comprises an adhesion material and a plurality of light scattering particles distributed in the adhesion material, and the lower polarizing plate further comprises:
 - an optical film and an adhesion layer, wherein the adhesion layer is coated on another surface of the polarizer, and the optical film is adhered over the adhesion layer.
6. The LCD panel of claim 1, wherein the first light scattering layer comprises an adhesion material and a plurality of light scattering particles distributed in the adhesion material, and the lower polarizing plate further comprises:
 - an optical film, wherein the first light scattering layer is disposed between the optical film and the polarizer.
7. The LCD panel of claim 6, further comprising an adhesion layer, disposed between the polarizing plate and the TFT array substrate.

8. The LCD panel of claim 7, further comprises:
a plurality of scattering particles, distributed in the adhesion layer.
9. The LCD panel of claim 6, wherein the optical film comprises a brightness enhancement film (BEF) or a dual brightness enhanced film (DBEF).
10. The LCD panel of claim 1, wherein the upper polarizing plate comprises glare type polarizing plate.
11. A liquid crystal display (LCD) module, comprises
a back light module, comprising at least an optical film and a back light source;
a liquid crystal display (LCD) panel, disposed over the back light module, wherein the LCD panel comprising:
a thin film transistor (TFT) array substrate;
a color filter substrate, disposed over the TFT array substrate;
a liquid crystal layer, disposed between the TFT array substrate and the color filter substrate;
an upper polarizing plate, disposed over the color filter substrate; and
a lower polarizing plate, disposed over the TFT array substrate, wherein the lower polarizing plate comprises:
a polarizer a first light scattering layer disposed over a surface of the polarizer.
12. The LCD module of claim 11, further comprising an adhesion layer disposed between the lower polarizing plate and the TFT array substrate.
13. The LCD module of claim 12, wherein the first light scattering layer comprises a transparent resin and a plurality of light scattering particles distributed in the transparent resin.
14. The LCD module of claim 11, wherein the first light scattering layer is disposed between the TFT array substrate and the polarizer, and the first light scattering layer comprises an adhesion material and a plurality of light scattering particles distributed in the adhesion material.
15. The LCD module of claim 11, wherein the first light scattering layer comprises an adhesion material and a plurality of light scattering particles distributed in the adhesion material, and the lower polarizing plate further comprises:
an optical film and an adhesion layer, wherein the adhesion layer is coated on another surface of the polarizer, and the optical film is adhered over the adhesion layer.
16. The LCD module of claim 11, wherein the first light scattering layer comprises an adhesion material and a plurality of light scattering particles distributed in the adhesion material, and the lower polarizing plate further comprises:
an optical film, wherein the first light scattering layer is disposed between the optical film and the polarizer.
17. The LCD module of claim 16, further comprising an adhesion layer disposed between the lower polarizing plate and the TFT array substrate.
18. The LCD module of claim 17, further comprising a plurality of scattering particles distributed in the adhesion layer.
19. The LCD module of claim 16, wherein the optical film comprises a brightness enhancement film (BEF) or a dual brightness enhanced film (DBEF).
20. The LCD module of claim 11, wherein the upper polarizing plate comprises glare type polarizing plate.
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专利名称(译)	液晶显示面板和液晶显示模块		
公开(公告)号	US20060098138A1	公开(公告)日	2006-05-11
申请号	US10/904402	申请日	2004-11-09
[标]申请(专利权)人(译)	胡诚CHUNG 萧HSIEN常		
申请(专利权)人(译)	胡成CHUNG 萧献常		
当前申请(专利权)人(译)	中华映管股份有限公司.		
[标]发明人	HU CHENG CHUNG HSIAO HSIEN CHANG		
发明人	HU, CHENG-CHUNG HSIAO, HSIEN-CHANG		
IPC分类号	G02F1/1335		
CPC分类号	G02F1/133504 G02F1/133528		
其他公开文献	US7411641		
外部链接	Espacenet USPTO		

摘要(译)

提供液晶显示 (LCD) 面板和模块。 LCD 面板包括薄膜晶体管 (TFT) 阵列基板, 滤色器基板, 液晶层, 上偏振板和下偏振板。滤色器基板设置在 TFT 阵列基板上方, 液晶层设置在 TFT 阵列基板和滤色器基板之间。另外, 上偏振片设置在滤色器基板上方。此外, 下偏振片设置在 TFT 阵列基板上, 下偏振片包括例如偏振器和设置在偏振器表面上的光散射层。

