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(54) **LIQUID CRYSTAL DISPLAY DEVICE**

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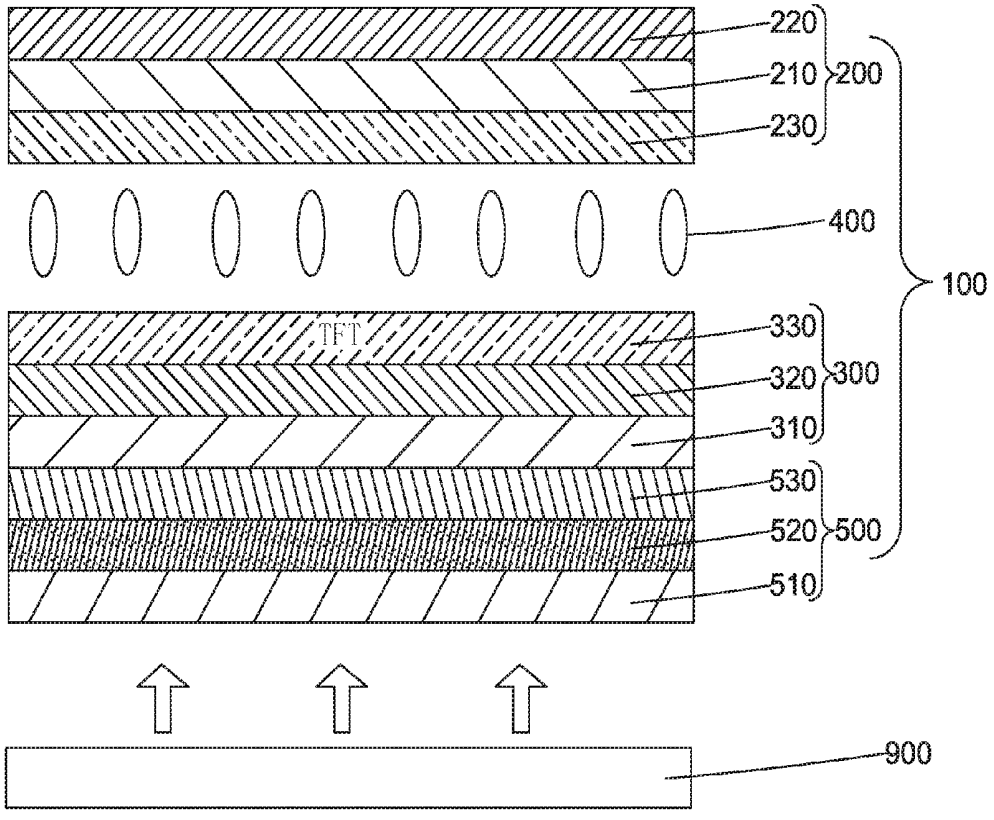
(57) **ABSTRACT**

The present invention provides a liquid crystal display device, which includes a liquid crystal panel including a first substrate and a second substrate respectively arranged at upper and lower sides and opposite to each other, a liquid crystal layer, and a third substrate that is arranged on one side of the first substrate that is distant from the liquid crystal layer or one side of the second substrate that is distant from the liquid crystal layer, wherein the first substrate comprises a first backing plate and an upper polarizer arranged on the first backing plate; the second substrate comprises a second backing plate and a lower polarizer arranged on the second backing plate; and the third substrate comprises a third backing plate and a quantum dot color filter plate arranged on the third backing plate. The present invention is structured to have the quantum dot color filter plate arranged on the third backing plate that is different from the backing plates that carry the upper and lower polarizers thereon so that the quantum dots do not alter the state of polarization of light in the interior of the panel and no complicated polarizer internalization operation is necessary, while ensuring preservation of the advantages of the quantum dot color filter plate, providing the liquid crystal display device with a wider color gamut and higher brightness, and the manufacturing process is made simple.



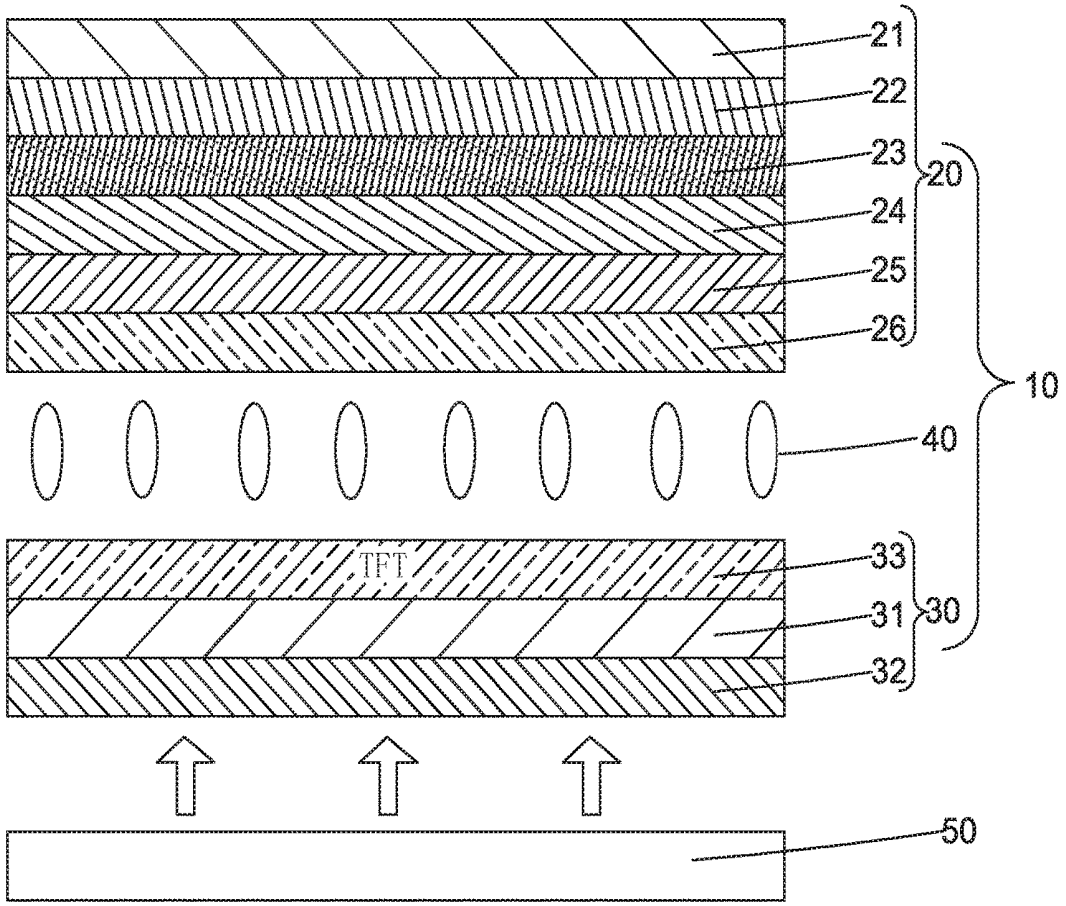


Fig. 1

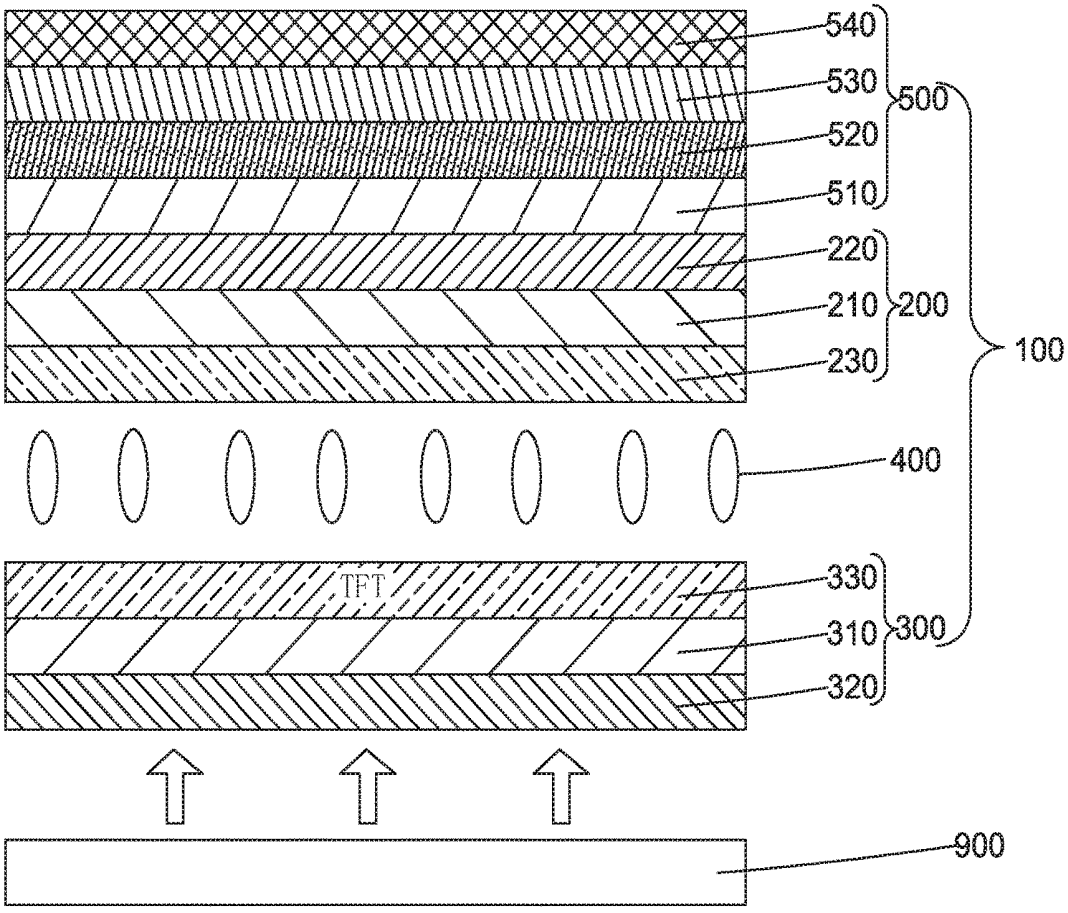

540
530
520
510
500
220
210
230
200
100
400
TFT
330
310
320
300
900

Fig. 2

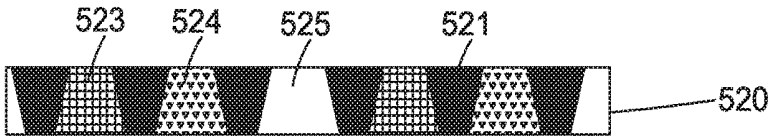

523
524
525
521
520

Fig. 3

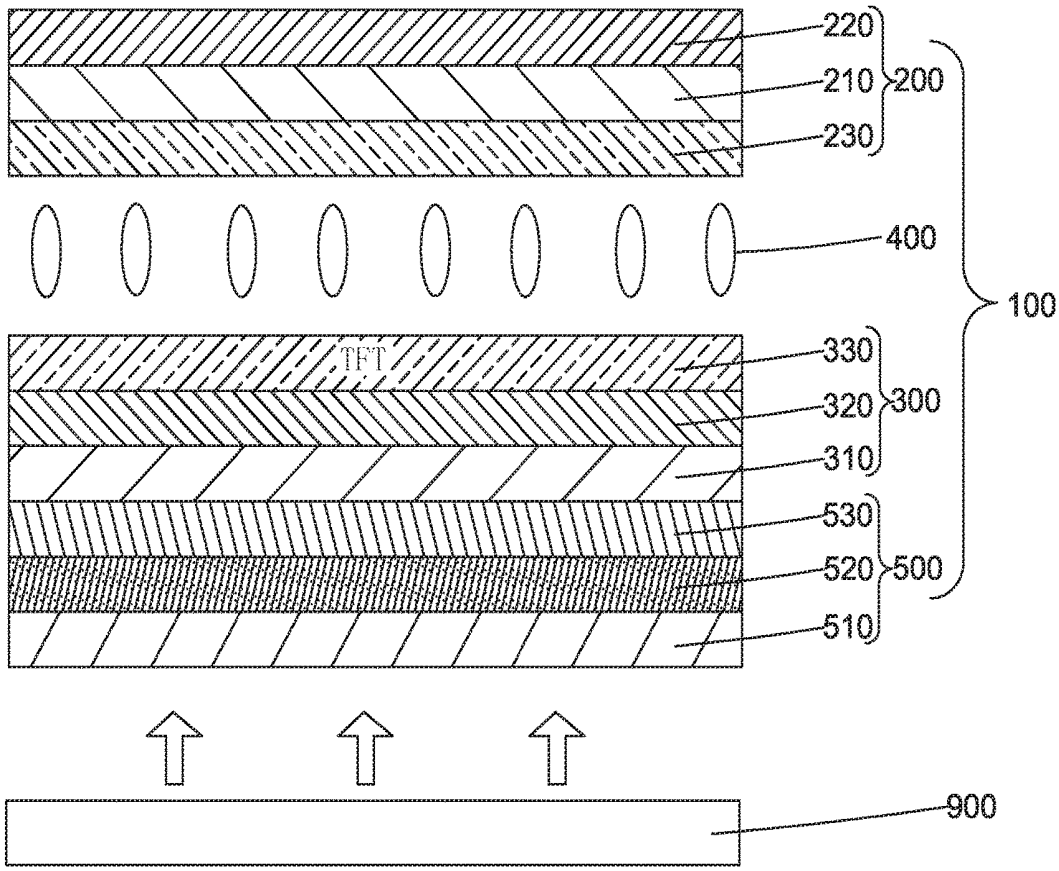

220
210
200
230
400
100
TFT
330
320
300
310
530
520
500
510
900

Fig. 4

LIQUID CRYSTAL DISPLAY DEVICE

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention relates to the field of display technology, and more particular to a liquid crystal display device.

2. The Related Arts

[0002] The development of science and technology and the progress of human society make people increasingly rely on exchange and transmission of information. As a major carrier, as well as a physical basis, for exchange and transmission of information, a display device is now a hot spot and highland that scientists who devote themselves to study and research in the field of photoelectronics must capture.

[0003] Quantum dots (QDs) are generally extremely tiny organic nanometer crystals that are not visually observable and are mostly nanometer materials having a three-dimensional configuration made of elements of II-VI groups or III-V groups. Due to the quantum confinement effect, transportation of electrons and holes in the interior is constrained and a continuous energy band is converted into a discrete energy level structure. Once receiving excitation of external energy, such as light or electricity, the quantum dots give off a color light and the color of the light is determined by the constituent materials, size and shape of the quantum dots. Different sizes of quantum dots provide different extents of quantum confinement for electrons and holes so that the discrete energy level structures are different. Generally, the smaller the particles are, the longer the wavelength that will be absorbed would be; and the larger the particles are, the shorter the wavelength that will be absorbed would be. Regular quantum dots absorb blue light that has a relatively short wavelength and will be excited to give off color light of a longer wavelength. Such a characteristic allows the quantum dots to change the color of light emitting from a light source.

[0004] An advantage of quantum dots is that through adjustment of the size of the quantum dots, it is possible to realize emissive wavelength covering both infrared band and entire visible light band, and the band of the emissive light band can be made narrow and shows high degree of color saturation. The quantum dots have a high quantum dot conversion efficiency and the material shows stable property; the manufacturing method is simple, allowing for preparation from solutions and ensuring rich resources.

[0005] Heretofore, a liquid crystal display (LCD) provides colors by means of a color filter (CF) layer. A conventional color filter layer is formed by subjecting color resist materials to a series of photolithographic operations. The color resist materials are made by dissolving and distributing a polymer, a monomer, a photo initiator, and a pigment in a solvent. Recently, manufacturers, such as Samsung Electronics Co., Ltd., proposed an idea of using a quantum dot color filter (QDCF) made of quantum dot materials to replace the conventional color filter plate.

[0006] Making a QDCF with QD nanometer materials requires solvents and ligands used in combination and certain progress has been made in this field. For example, some patent documents have been available concerning fabrication of color filter plates with quantum dots. However, the quantum dot color filter plates proposed in these patent documents are arranged inside liquid crystal cells. Since the principles based on which colors are generated are different between the quantum dots and the commonly used pigments of the color filter plates, where light emission of the quantum dots is achieved through excitation by light to cause a change of the energy band structure of the quantum dot so as to emit a specific wavelength of light, if the common way that a polarizer (POL) is attached to an outside surface of a glass backing a liquid crystal display is still adopted, then backlight that passes through a lower polarizer generates linear polarization light polarized at a specific direction and when the linear polarization light is applied to excite quantum dots, the polarized light in the specific direction would change the polarization condition thereof (such as de-polarization or variation of polarization direction). This makes a light path and brightness become uncontrollable.

[0007] To prevent the above problems, a polarizer structure must be added between the QDCF and a liquid crystal layer. As shown in FIG. **1**, which is a schematic view illustrating a structure of a conventional liquid crystal display device, the liquid crystal display device comprises a liquid crystal panel **10** and a backlight module **50** arranged under the liquid crystal panel **10**. The liquid crystal panel **10** comprises a first substrate **20** and a second structure **30** that are respectively arranged at upper and lower sides and opposite to each other and a liquid crystal layer **40** arranged between the first substrate **20** and the second substrate **30**. The first substrate **20** comprises a first backing plate **21** and an optic film **22**, a quantum dot color filter layer **23**, a planarization layer **24**, an upper polarizer **25**, and an electrode layer **26** that are arranged, in sequence, on a side of the first backing plate **21** that is adjacent to the liquid crystal layer **40**; and the second substrate **30** comprises a second backing plate **31**, a thin-film transistor (TFT) layer **32** arranged on a side of the second backing plate **31** that is adjacent to the liquid crystal layer **40**, and a lower polarizer **33** arranged on a side of the second backing plate **31** that is distant from the liquid crystal layer **40**, wherein due to high sensitivity of the QD materials to moisture and oxygen, the planarization layer **24** is provided between the upper polarizer **25** and the quantum dot color filter layer **23** to provide protection to the quantum dot color filter layer **23**.

[0008] However, for the liquid crystal display device shown in FIG. **1**, an important issue is the internalization of the polarizers. Internalization of polarizers can be achieved with several solutions, one example being a solution in which a nanometer grating polarizer is internally arranged. However, internally arranged polarizers of this kind provides contrast that is lower than polarization achieved with the conventional PVA polarizer and requires a more complicated process of manufacturing and expensive equipment for fabrication of large sizes.

[0009] In view of the above problems, it is desired to provide a novel structure for liquid crystal display devices, which requires no complicated polarizer internalization process, while still ensuring the advantages of QDCF.

SUMMARY OF THE INVENTION

[0010] An objective of the present invention is to provide a liquid crystal display device, in which a quantum dot color filter plate is arranged on a third backing plate other than the

backing plates on which upper and lower polarizers are mounted so as to avoid a complicated polarizer internalization process, making the manufacturing process simple.

[0011] To achieve the above objective, the present invention provides a liquid crystal display device, which comprises a liquid crystal panel and a backlight module arranged under the liquid crystal panel;

[0012] wherein the liquid crystal panel comprises a first substrate and a second substrate respectively arranged on upper and lower sides and opposite to each other, a liquid crystal layer arranged between the first substrate and the second substrate, and a third substrate arranged on a side of the first substrate that is distant from the liquid crystal layer or a side of the second substrate that is distant from the liquid crystal layer;

[0013] the first substrate comprises a first backing plate and an upper polarizer arranged on the first backing plate;

[0014] the second substrate comprises a second backing plate and a lower polarizer arranged on the second backing plate; and

[0015] the third substrate comprises a third backing plate and a quantum dot color filter plate arranged on the third backing plate.

[0016] The third substrate further comprises an optic film layer arranged on the quantum dot color filter plate and providing a function of wave filtration.

[0017] The third substrate is arranged on the side of the first substrate that is distant from the liquid crystal layer;

[0018] the third substrate further comprises an encapsulation layer arranged on the optic film layer; and

[0019] the third backing plate, the quantum dot color filter plate, the optic film layer, and the encapsulation layer of the third substrate are arranged, in sequence, on the side of the first substrate that is distant from the liquid crystal layer.

[0020] The third substrate arranged on the side of the second substrate that is distant from the liquid crystal layer; and

[0021] the optic film layer, the quantum dot color filter plate, and the third backing plate of the third substrate are arranged, in sequence, on the side of the second substrate that is distant from the liquid crystal layer.

[0022] The third substrate is attached to the side of the first substrate that is distant from the liquid crystal layer by coating adhesive on a circumferential edge or an entire surface of the first substrate; or, alternatively,

[0023] the third substrate is attached to the side of the second substrate that is distant from the liquid crystal layer by coating adhesive on a circumferential edge or an entire surface of the second substrate.

[0024] The upper polarizer is arranged on a side of the first backing plate that is distant from or adjacent to the liquid crystal layer; and

[0025] the lower polarizer is arranged on a side of the second backing plate that is distant from or adjacent to the liquid crystal layer.

[0026] The quantum dot color filter plate comprises a pixel separation layer and a red pixel unit, a green pixel unit, and a blue pixel unit that are separated from each other by the pixel separation layer.

[0027] The backlight module comprises a blue fluorescent light source and the red pixel unit and the green pixel unit are respectively formed of a red quantum dot ink material and a green quantum dot ink material through inkjet printing and the blue pixel unit is formed of a material comprising a transparent organic material.

[0028] The optic film layer is formed through patterning and functions to remove blue fluorescent light that emits from the backlight module and is not converted after transmission through the red pixel unit and the green pixel unit.

[0029] The first backing plate, the second backing plate, and the third backing plate each comprise a glass plate, a polyimide (PI) plate, or a polyethylene terephthalate (PET) plate.

[0030] The present invention also provides a liquid crystal display device, which comprises a liquid crystal panel and a backlight module arranged under the liquid crystal panel;

[0031] wherein the liquid crystal panel comprises a first substrate and a second substrate respectively arranged on upper and lower sides and opposite to each other, a liquid crystal layer arranged between the first substrate and the second substrate, and a third substrate arranged on a side of the first substrate that is distant from the liquid crystal layer or a side of the second substrate that is distant from the liquid crystal layer;

[0032] the first substrate comprises a first backing plate and an upper polarizer arranged on the first backing plate;

[0033] the second substrate comprises a second backing plate and a lower polarizer arranged on the second backing plate; and

[0034] the third substrate comprises a third backing plate and a quantum dot color filter plate arranged on the third backing plate;

[0035] wherein the third substrate further comprises an optic film layer arranged on the quantum dot color filter plate and providing a function of wave filtration; and

[0036] wherein the first backing plate, the second backing plate, and the third backing plate each comprise a glass plate, a polyimide (PI) plate, or a polyethylene terephthalate (PET) plate.

[0037] The efficacy of the present invention is that the present invention provides a liquid crystal display device, which comprises a liquid crystal panel comprising a first substrate and a second substrate respectively arranged at upper and lower sides and opposite to each other, a liquid crystal layer, and a third substrate that is arranged on one side of the first substrate that is distant from the liquid crystal layer or one side of the second substrate that is distant from the liquid crystal layer, wherein the first substrate comprises a first backing plate and an upper polarizer arranged on the first backing plate; the second substrate comprises a second backing plate and a lower polarizer arranged on the second backing plate; and the third substrate comprises a third backing plate and a quantum dot color filter plate arranged on the third backing plate. The present invention is structured to have the quantum dot color filter plate arranged on the third backing plate that is different from the backing plates that carry the upper and lower polarizers thereon so that the quantum dots do not alter the state of polarization of light in the interior of the panel and no complicated polarizer internalization operation is necessary, while ensuring preservation of the advantages of the quantum dot color filter plate, providing the liquid crystal display device with a wider color gamut and higher brightness, and the manufacturing process is made simple.

BRIEF DESCRIPTION OF THE DRAWINGS

[0038] The technical solution, as well as other beneficial advantages, of the present invention will become apparent from the following detailed description of embodiments of the present invention, with reference to the attached drawings.

[0039] In the drawings:

[0040] FIG. **1** is a schematic view showing a structure of a conventional liquid crystal display device;

[0041] FIG. **2** is a schematic view showing a structure of a first embodiment of a liquid crystal display device according to the present invention;

[0042] FIG. **3** is a schematic view showing a structure of a quantum dot color filter plate included in the liquid crystal display device according to the present invention; and

[0043] FIG. **4** is a schematic view showing a structure of a second embodiment of the liquid crystal display device according to the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0044] To further expound the technical solution adopted in the present invention and the advantages thereof, a detailed description will be given with reference to the preferred embodiments of the present invention and the drawings thereof.

[0045] Referring to FIG. **2**, which is a schematic view showing a structure of a first embodiment of a liquid crystal display device according to the present invention, in the instant embodiment, the liquid crystal display device comprises a liquid crystal panel **100** and a backlight module **900** arranged under the liquid crystal panel **100**.

[0046] The liquid crystal panel **100** comprises a first substrate **200** and a second substrate **300** respectively arranged at upper and lower sides and opposite to each other, a liquid crystal layer **400** arranged between the first substrate **200** and the second substrate **300**, and a third substrate **500** arranged on one side of the first substrate **200** that is distant from the liquid crystal layer **400**.

[0047] The first substrate **200** comprises a first backing plate **210** and an upper polarizer **220** arranged on the first backing plate **210**.

[0048] The second substrate **300** comprises a second backing plate **310** and a lower polarizer **320** arranged on the second backing plate **310**.

[0049] The third substrate **500** comprises a third backing plate **510** and a quantum dot color filter plate **520** arranged on the third backing plate **510**.

[0050] Specifically, the third substrate **500** further comprises an optic film layer **530** arranged on the quantum dot color filter plate **520** and provides a function of wave filtration for removing excessive backlighting that emits from the backlight module **900** and is not converted by quantum dots contained in the quantum dot color filter plate **520**.

[0051] Specifically, in the instant embodiment, the third substrate **500** further comprises an encapsulation layer **540** arranged on the optic film layer **530**.

[0052] The third backing plate **510**, the quantum dot color filter plate **520**, the optic film layer **530**, and the encapsulation layer **540** of the third substrate **500** are arranged, in sequence, on the side of the first substrate **200** that is distant from the liquid crystal layer **400**.

[0053] Specifically, the third substrate **500** is attached to the side of the first substrate **200** that is distant from the liquid crystal layer **400** by adhesive that is coated on a circumferential edge or an entire surface of the first substrate **200**.

[0054] Specifically, the upper polarizer **220** can be an internally arranged polarization plate or can alternatively be an externally arranged polarization plate, and may be arranged on a side of the first backing plate **210** that is distant from the liquid crystal layer **400** or arranged on a side of the first backing plate **210** that is adjacent to the liquid crystal layer **400**. Preferably, the upper polarizer **220** is an externally arranged polarization plate, which is arranged on the side of the first backing plate **210** that is distant from the liquid crystal layer **400**. In the instant embodiment, the upper polarizer **220** is arranged on the side of the first backing plate **210** that is distant from the liquid crystal layer **400**.

[0055] Specifically, the lower polarizer **320** may similarly be an internally arranged polarization plate or, alternatively, an externally arranged polarization plate, and thus, can be arranged on one side of the second backing plate **310** that is distant from the liquid crystal layer **400** or can alternatively be arranged on one side of the second backing plate **310** that is adjacent to the liquid crystal layer **400**. Preferably, the lower polarizer **320** is an externally arranged polarization plate, which is arranged on the side of the second backing plate **310** that is distant from the liquid crystal layer **400**. In the instant embodiment, the lower polarizer **320** is arranged on the side of the second backing plate **310** that is distant from the liquid crystal layer **400**.

[0056] Specifically, the first substrate **200** further comprises a function layer **230** arranged on one side of the first backing plate **210** that is adjacent to the liquid crystal layer **400** for electrode and/or alignment. The second substrate **300** further comprises a thin-film transistor (TFT) layer **330** arranged on one side of the second backing plate **310** that is adjacent to the liquid crystal layer **400**.

[0057] Specifically, as shown in FIG. **3**, the quantum dot color filter plate **520** comprises a pixel separation layer **521** and a red pixel unit **523**, a green pixel unit **524**, and a blue pixel unit **525** that are separated from each other by the pixel separation layer **521**.

[0058] Specifically, the backlight module **900** comprises a blue fluorescent light source. The red pixel unit **523** and the green pixel unit **524** are respectively formed of a red quantum dot ink material and green quantum dot ink material each applied through an inkjet printing operation. Since blue light carries higher energy, which may excite a red quantum dot (that is a quantum dot that emits red light) and a green quantum dot (that is a quantum dot that emits green light) to respectively generate red light and green light, the backlight module **900** that generates blue fluorescent light may serve as a backlighting source such that blue light is supplied by the backlight module **900** itself, and thus, a blue pixel unit **525** may be formed by filling a transparent organic material.

[0059] Specifically, the optic film layer **530** is formed through a patterning operation and is provided for removing the blue fluorescent light that emits from the backlight module **900** but is not yet converted after transmission through the red pixel unit **523** and the green pixel unit **524**.

[0060] Specifically, the first backing plate **210**, the second backing plate **310**, and the third backing plate **510** are each

a glass plate or a flexible plate such as a polyimide (PI) plate or a polyethylene terephthalate (PET) plate.

[0061] The liquid crystal display device of the present invention is structured to arrange the quantum dot color filter plate **520** on a third backing plate **510** that is different from first and second backing plates **210**, **310** that respectively carry upper and lower polarizers **220**, **320** thereon such that the quantum dots contained in the quantum dot color filter plate **520** do not alter the state of polarization of light in the interior of a panel and no complicated polarizer internalization operation is necessary, while ensuring preservation of the advantages of the quantum dot color filter plate **520**, providing the liquid crystal display device with a wider color gamut and higher brightness, and the manufacturing process is made simple.

[0062] Referring to FIG. **4**, which is a schematic view showing a structure of a second embodiment of the liquid crystal display device according to the present invention, compared to the first embodiment described above, the second embodiment is structured such that the third substrate **500** is arranged on the side of the second substrate **300** that is distant from the liquid crystal layer **400**.

[0063] Specifically, the optic film layer **530**, the quantum dot color filter plate **520**, and the third backing plate **510** of the third substrate **500** are arranged, in sequence, on the side of the second substrate **300** that is distant from the liquid crystal layer **400**. Further, in the instant embodiment, the lower polarizer **320** is an internally arranged polarization plate, where the lower polarizer **320** is arranged on the side of the second backing plate **310** that is adjacent to the liquid crystal layer **400** and the TFT layer **330** is arranged on a side of the lower polarizer **320** that is adjacent to the liquid crystal layer **400**. The remaining features are similar to those of the first embodiment described above and repeated description will be omitted herein.

[0064] In summary, the present invention provides a liquid crystal display device, which comprises a liquid crystal panel comprising a first substrate and a second substrate respectively arranged at upper and lower sides and opposite to each other, a liquid crystal layer, and a third substrate that is arranged on one side of the first substrate that is distant from the liquid crystal layer or one side of the second substrate that is distant from the liquid crystal layer, wherein the first substrate comprises a first backing plate and an upper polarizer arranged on the first backing plate; the second substrate comprises a second backing plate and a lower polarizer arranged on the second backing plate; and the third substrate comprises a third backing plate and a quantum dot color filter plate arranged on the third backing plate. The present invention is structured to have the quantum dot color filter plate arranged on the third backing plate that is different from the backing plates that carry the upper and lower polarizers thereon so that the quantum dots do not alter the state of polarization of light in the interior of the panel and no complicated polarizer internalization operation is necessary, while ensuring preservation of the advantages of the quantum dot color filter plate, providing the liquid crystal display device with a wider color gamut and higher brightness, and the manufacturing process is made simple.

[0065] Based on the description given above, those having ordinary skills in the art may easily contemplate various changes and modifications of the technical solution and the technical ideas of the present invention. All these changes and modifications are considered belonging to the protection scope of the present invention as defined in the appended claims.

What is claimed is:

1. A liquid crystal display device, comprising a liquid crystal panel and a backlight module arranged under the liquid crystal panel;

wherein the liquid crystal panel comprises a first substrate and a second substrate respectively arranged on upper and lower sides and opposite to each other, a liquid crystal layer arranged between the first substrate and the second substrate, and a third substrate arranged on a side of the first substrate that is distant from the liquid crystal layer or a side of the second substrate that is distant from the liquid crystal layer;

the first substrate comprises a first backing plate and an upper polarizer arranged on the first backing plate;

the second substrate comprises a second backing plate and a lower polarizer arranged on the second backing plate; and

the third substrate comprises a third backing plate and a quantum dot color filter plate arranged on the third backing plate.

2. The liquid crystal display device as claimed in claim **1**, wherein the third substrate further comprises an optic film layer arranged on the quantum dot color filter plate and providing a function of wave filtration.

3. The liquid crystal display device as claimed in claim **2**, wherein the third substrate is arranged on the side of the first substrate that is distant from the liquid crystal layer;

the third substrate further comprises an encapsulation layer arranged on the optic film layer; and

the third backing plate, the quantum dot color filter plate, the optic film layer, and the encapsulation layer of the third substrate are arranged, in sequence, on the side of the first substrate that is distant from the liquid crystal layer.

4. The liquid crystal display device as claimed in claim **2**, wherein the third substrate arranged on the side of the second substrate that is distant from the liquid crystal layer; and

the optic film layer, the quantum dot color filter plate, and the third backing plate of the third substrate are arranged, in sequence, on the side of the second substrate that is distant from the liquid crystal layer.

5. The liquid crystal display device as claimed in claim **1**, wherein the third substrate is attached to the side of the first substrate that is distant from the liquid crystal layer by coating adhesive on a circumferential edge or an entire surface of the first substrate; or, alternatively,

the third substrate is attached to the side of the second substrate that is distant from the liquid crystal layer by coating adhesive on a circumferential edge or an entire surface of the second substrate.

6. The liquid crystal display device as claimed in claim **1**, wherein the upper polarizer is arranged on a side of the first backing plate that is distant from or adjacent to the liquid crystal layer; and

the lower polarizer is arranged on a side of the second backing plate that is distant from or adjacent to the liquid crystal layer.

7. The liquid crystal display device as claimed in claim **2**, wherein the quantum dot color filter plate comprises a pixel

separation layer and a red pixel unit, a green pixel unit, and a blue pixel unit that are separated from each other by the pixel separation layer.

8. The liquid crystal display device as claimed in claim **7**, wherein the backlight module comprises a blue fluorescent light source and the red pixel unit and the green pixel unit are respectively formed of a red quantum dot ink material and a green quantum dot ink material through inkjet printing and the blue pixel unit is formed of a material comprising a transparent organic material.

9. The liquid crystal display device as claimed in claim **8**, wherein the optic film layer is formed through patterning and functions to remove blue fluorescent light that emits from the backlight module and is not converted after transmission through the red pixel unit and the green pixel unit.

10. The liquid crystal display device as claimed in claim **1**, wherein the first backing plate, the second backing plate, and the third backing plate each comprise a glass plate, a polyimide (PI) plate, or a polyethylene terephthalate (PET) plate.

11. A liquid crystal display device, comprising a liquid crystal panel and a backlight module arranged under the liquid crystal panel;

wherein the liquid crystal panel comprises a first substrate and a second substrate respectively arranged on upper and lower sides and opposite to each other, a liquid crystal layer arranged between the first substrate and the second substrate, and a third substrate arranged on a side of the first substrate that is distant from the liquid crystal layer or a side of the second substrate that is distant from the liquid crystal layer;

the first substrate comprises a first backing plate and an upper polarizer arranged on the first backing plate;

the second substrate comprises a second backing plate and a lower polarizer arranged on the second backing plate; and

the third substrate comprises a third backing plate and a quantum dot color filter plate arranged on the third backing plate;

wherein the third substrate further comprises an optic film layer arranged on the quantum dot color filter plate and providing a function of wave filtration; and

wherein the first backing plate, the second backing plate, and the third backing plate each comprise a glass plate, a polyimide (PI) plate, or a polyethylene terephthalate (PET) plate.

12. The liquid crystal display device as claimed in claim **11**, wherein the third substrate is arranged on the side of the first substrate that is distant from the liquid crystal layer;

the third substrate further comprises an encapsulation layer arranged on the optic film layer; and

the third backing plate, the quantum dot color filter plate, the optic film layer, and the encapsulation layer of the third substrate are arranged, in sequence, on the side of the first substrate that is distant from the liquid crystal layer.

13. The liquid crystal display device as claimed in claim **11**, wherein the third substrate arranged on the side of the second substrate that is distant from the liquid crystal layer; and

the optic film layer, the quantum dot color filter plate, and the third backing plate of the third substrate are arranged, in sequence, on the side of the second substrate that is distant from the liquid crystal layer.

14. The liquid crystal display device as claimed in claim **11**, wherein the third substrate is attached to the side of the first substrate that is distant from the liquid crystal layer by coating adhesive on a circumferential edge or an entire surface of the first substrate; or, alternatively,

the third substrate is attached to the side of the second substrate that is distant from the liquid crystal layer by coating adhesive on a circumferential edge or an entire surface of the second substrate.

15. The liquid crystal display device as claimed in claim **11**, wherein the upper polarizer is arranged on a side of the first backing plate that is distant from or adjacent to the liquid crystal layer; and

the lower polarizer is arranged on a side of the second backing plate that is distant from or adjacent to the liquid crystal layer.

16. The liquid crystal display device as claimed in claim **11**, wherein the quantum dot color filter plate comprises a pixel separation layer and a red pixel unit, a green pixel unit, and a blue pixel unit that are separated from each other by the pixel separation layer.

17. The liquid crystal display device as claimed in claim **16**, wherein the backlight module comprises a blue fluorescent light source and the red pixel unit and the green pixel unit are respectively formed of a red quantum dot ink material and a green quantum dot ink material through inkjet printing and the blue pixel unit is formed of a material comprising a transparent organic material.

18. The liquid crystal display device as claimed in claim **17**, wherein the optic film layer is formed through patterning and functions to remove blue fluorescent light that emits from the backlight module and is not converted after transmission through the red pixel unit and the green pixel unit.

* * * * *

专利名称(译)	液晶显示装置		
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摘要(译)

本发明提供一种液晶显示装置，包括：液晶面板，包括分别设置在上下两侧并且彼此相对的第一基板和第二基板;液晶层;以及布置在其上的第三基板。第一基板的远离液晶层的一侧或第二基板的远离液晶层的一侧，其中第一基板包括第一背板和设置在第一背板上的上偏振器;第二基板包括第二背板和设置在第二背板上的下偏振器;第三基板包括第三背板和设置在第三背板上的量子点彩色滤光板。本发明被构造成具有布置在第三背板上的量子点滤色板，其不同于在其上承载上偏振器和下偏振器的背板，使得量子点不会改变光的偏振状态。在确保保留量子点彩色滤光片的优点的同时，面板的内部并没有复杂的偏振器内化操作，为液晶显示装置提供了更宽的色域和更高的亮度，并且制造工艺变得简单。