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(54) **LIQUID CRYSTAL DISPLAY**

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(57) **ABSTRACT**

A liquid crystal display (LCD) includes a first substrate, a pixel electrode formed on the first substrate, a second substrate formed facing the first substrate, a common electrode formed on the second substrate, and a spacer disposed between the first and second substrates. The spacer is circular cylinder shaped or hexahedral-shaped. The spacer may be formed by dissolving a block copolymer that includes a hydrophilic group and a hydrophobic group in an acid aqueous solution including a silica particle precursor or an alkali aqueous solution including a silica particle precursor.

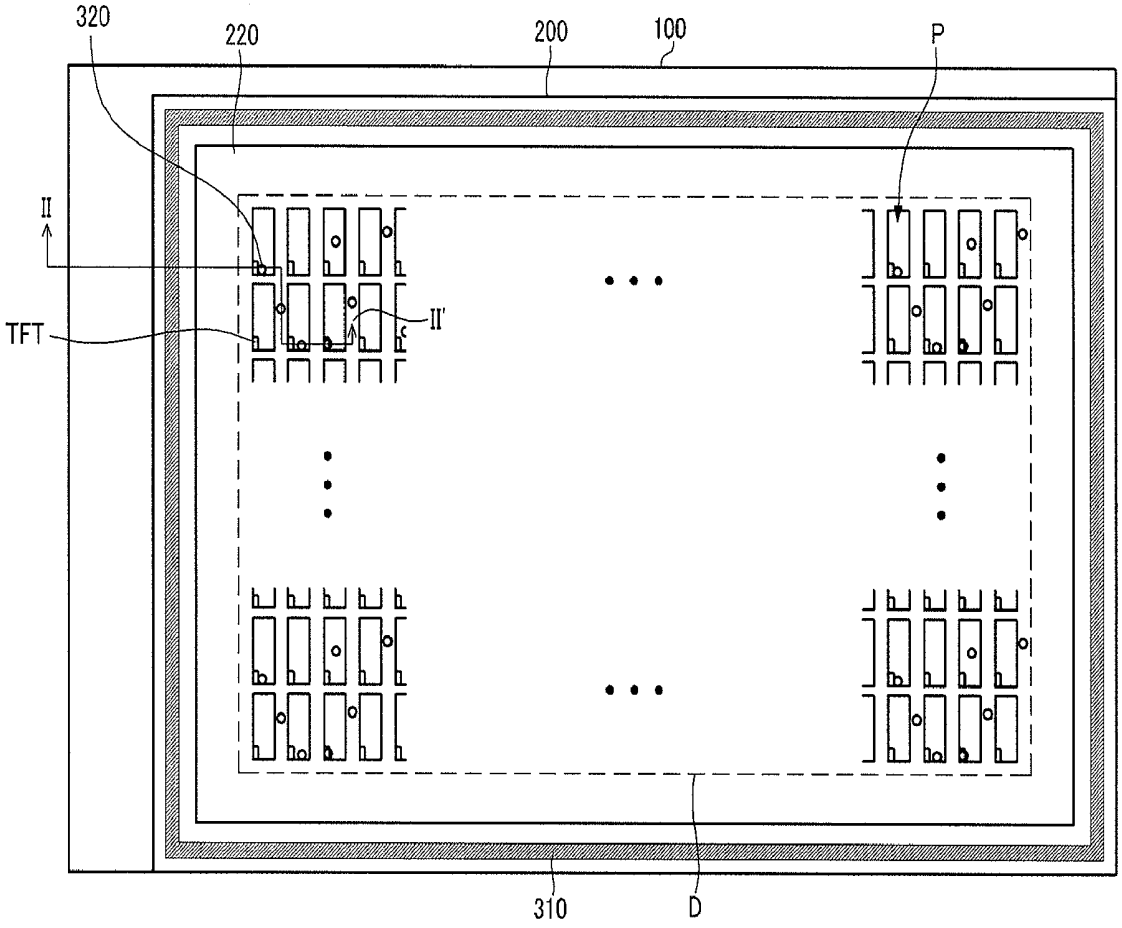


FIG.1

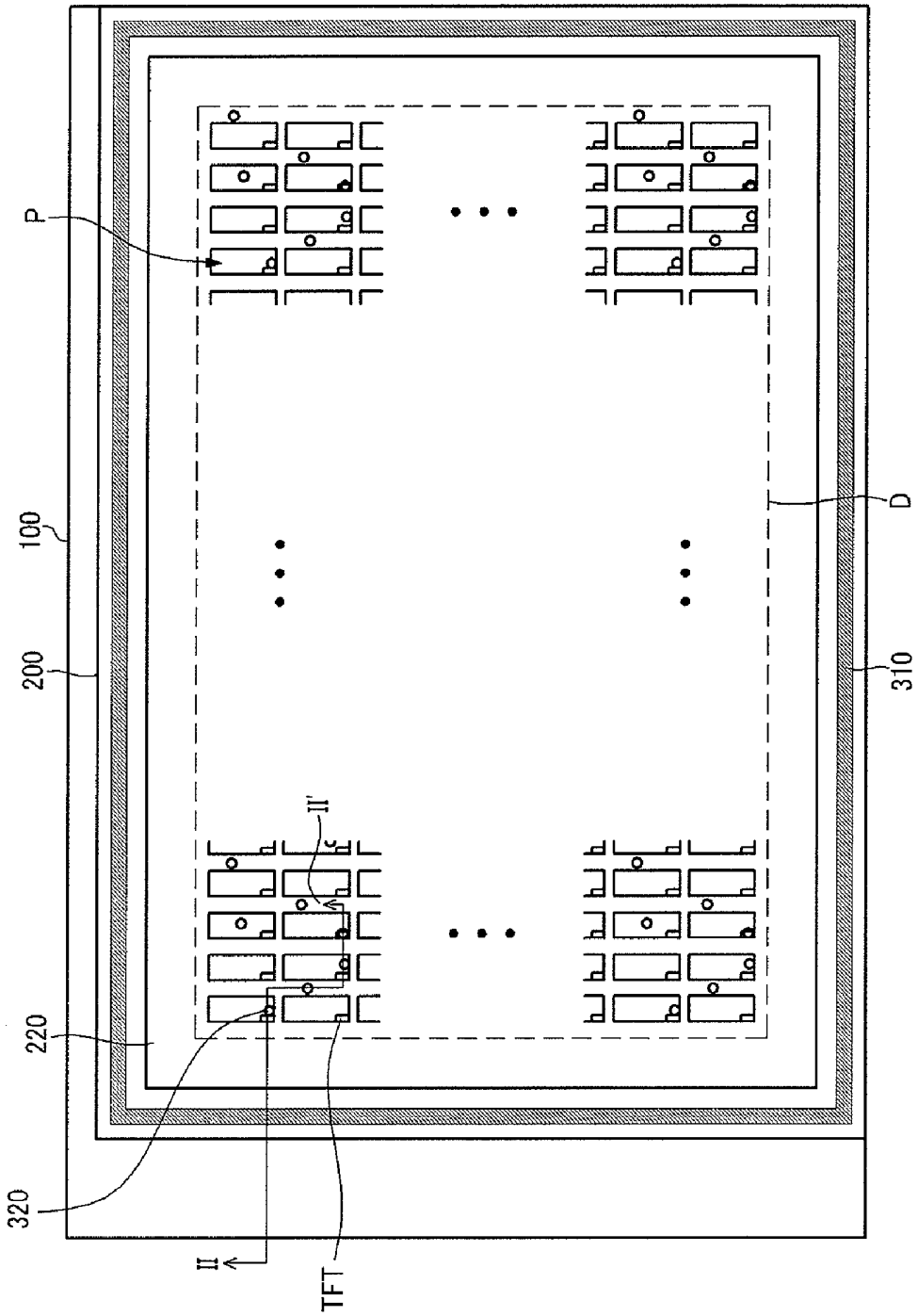


FIG.2

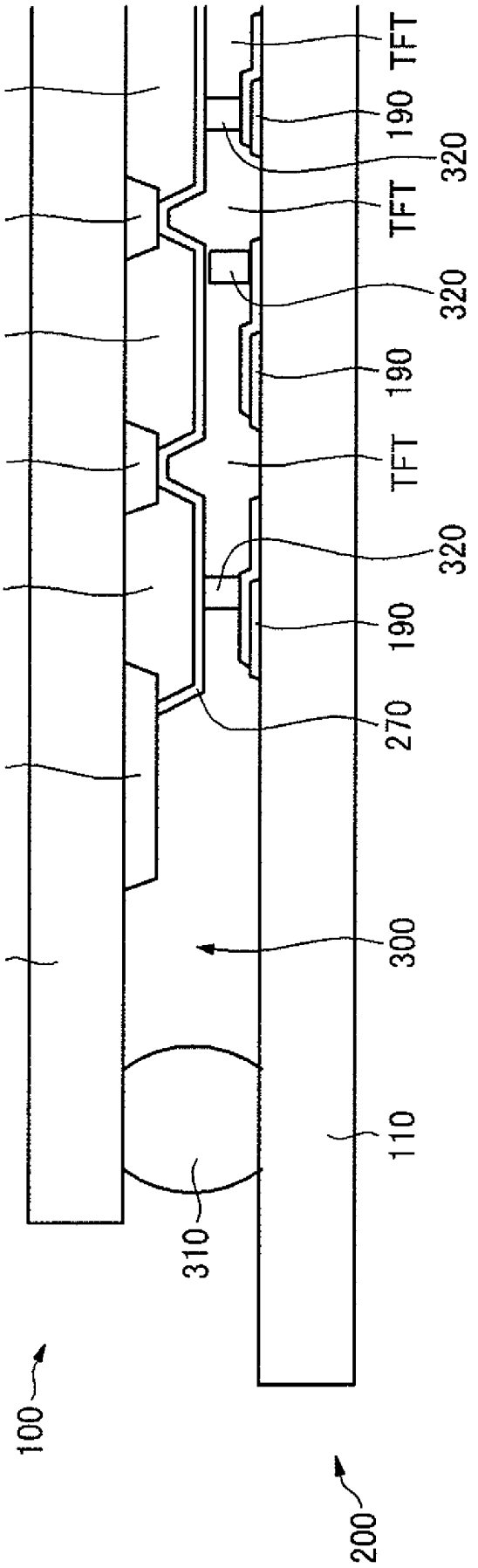

230B
220
230G
220
230R
220
210
TFT
190
320
TFT
320
190
TFT
320
190
270
300
110
310
100
200

FIG.3

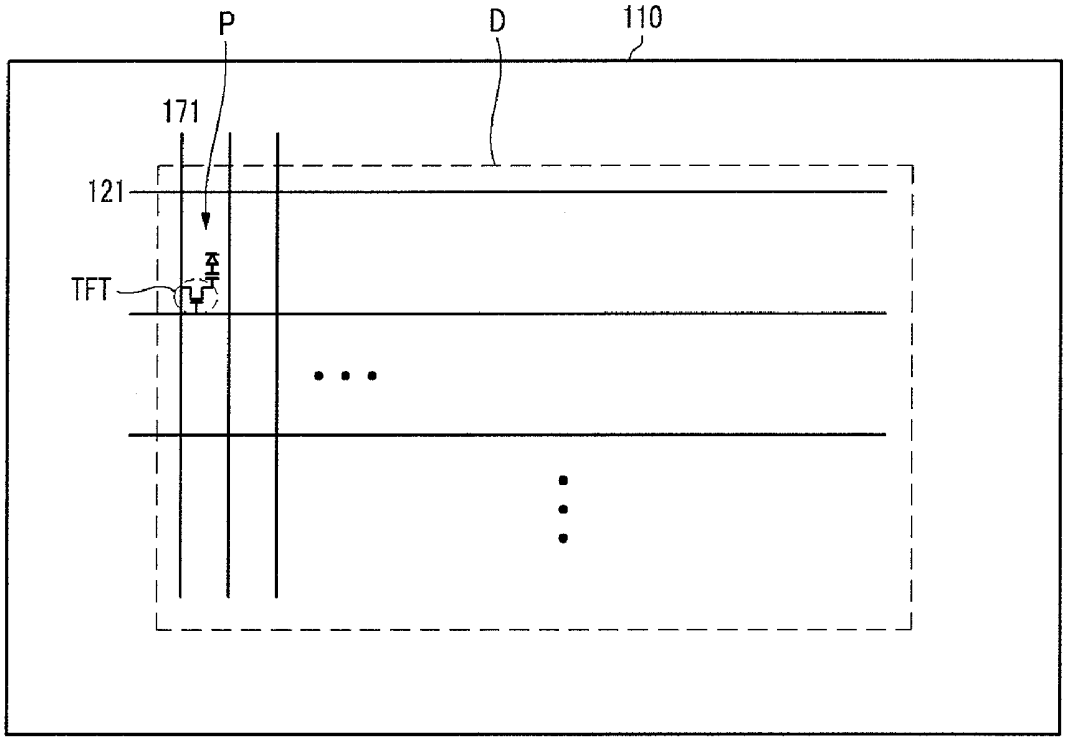


FIG.4

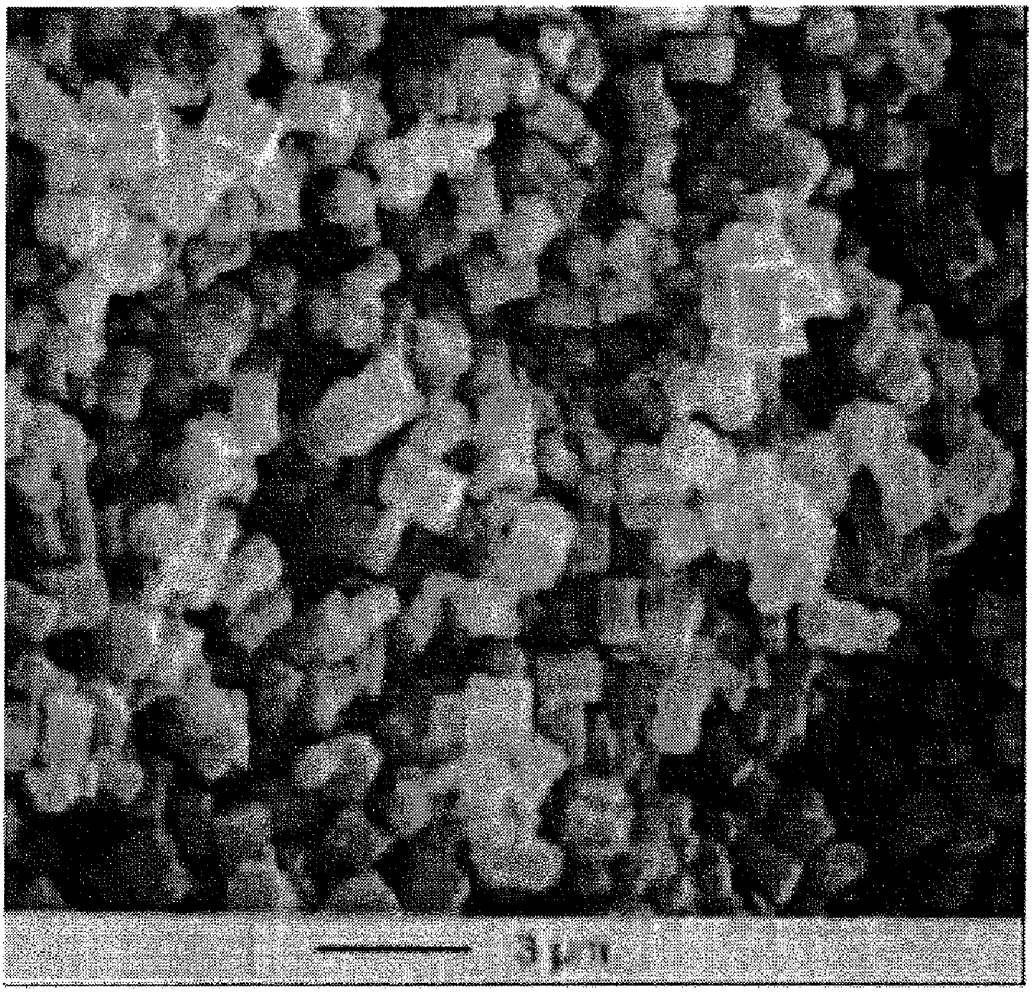
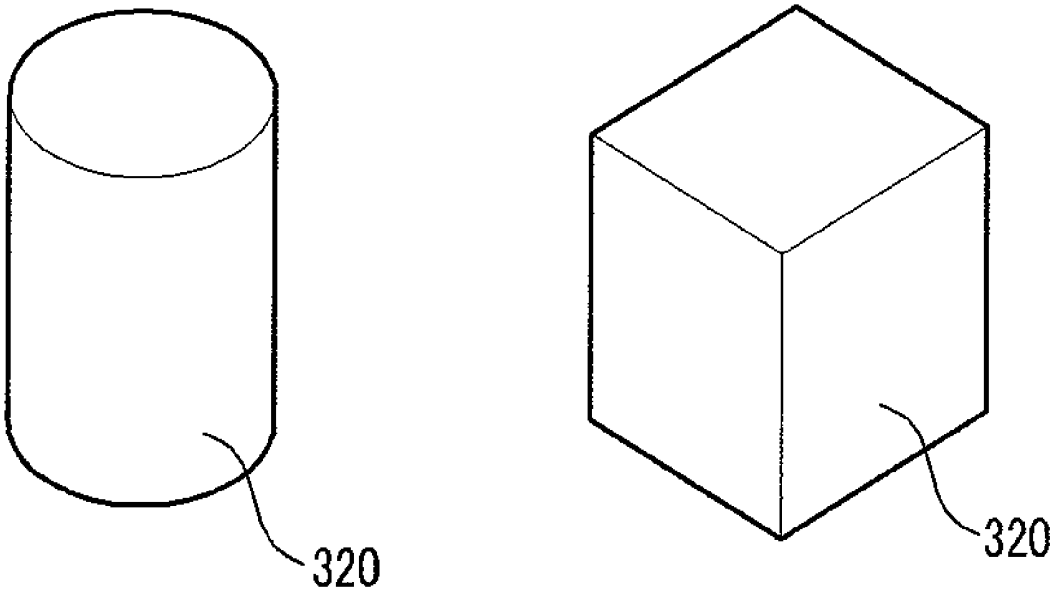


FIG.5



LIQUID CRYSTAL DISPLAY

CROSS-REFERENCE TO RELATED APPLICATION

[0001] This application claims priority to and the benefit of Korean Patent Application No. 10-2007-0006551 filed on Jan. 22, 2007, the contents of which are hereby incorporated by reference herein in their entirety.

BACKGROUND OF THE INVENTION

[0002] (a) Technical Field

[0003] The present disclosure relates to a liquid crystal display, and more particularly relates to a liquid crystal display having a spacer.

[0004] (b) Description of the Related Art

[0005] A liquid crystal display (LCD) is one of the most commonly used flat panel displays. The LCD includes two display panels respectively having electrical field generating electrodes formed thereon, and a liquid crystal layer formed between the two display panels. An electrical field may be generated in the liquid crystal layer by applying a voltage to the electrical field generating electrodes so as to determine the direction of liquid crystal molecules of the liquid crystal layer and control the transmittance of light that penetrates the liquid crystal layer.

[0006] An upper panel should be maintained at a constant distance from a lower panel of the liquid crystal display, and an active spacer is used to maintain a constant cell gap between the upper and lower panels. The active spacer may include a bead spacer and a column spacer.

[0007] As the column spacer is formed by a photolithography process, the column can be fixed to a desired location. However, manufacturing processes for the spacer may become complicated due to the photolithography process.

[0008] The bead spacer may be more beneficial than the column spacer in terms of simpler processing and manufacture. However, as the shape of the bead spacer is a sphere, the bead spacer may contact at one point with the upper and lower array panels so that a pressure deviation may be generated during a pressure process of the manufacturing process, thereby generating a cell gap deviation. Further, the sphere shape may increase the mobility of the bead spacer so that the spacers may be concentrated, and therefore an additional process (e.g. heat treatment) may be required to prevent the spacers from being concentrated.

SUMMARY OF THE INVENTION

[0009] Exemplary embodiments of the present invention provide a liquid crystal display (LCD) having a spacer that eliminates a cell gap deviation between upper and lower array panels of the LCD and minimizes the concentration of the spacer. In accordance with an exemplary embodiment of the present invention, a liquid crystal display (LCD) is provided. The LCD includes a first substrate, a pixel electrode, a second substrate, a common electrode, and a spacer. The pixel electrode is formed on the first substrate, the second substrate is formed facing the first substrate, the common electrode is formed on the second substrate, and the spacer is disposed between the first and second substrates. The spacer is circular cylinder-shaped or hexahedral-shaped, and is formed by dissolving a block copolymer that includes a hydrophilic group and a hydrophobic group in an acid aqueous solution including a silica particle precursor or an alkali aqueous solution, including a silica particle precursor.

[0010] The silica particle precursor may be provided as tetraethyl orthosilicate.

[0011] The block copolymer may include at least one of polyoxyethylene-polyoxypropylene-polyoxyethylene, polyoxyethylene-polyoxypropylene, polyoxypropylene-polyoxyethylene-polyoxypropylene, polystyrene-polyoxyethylene, polystyrene-poly-2-vinylpyridine, polystyrene-poly-4-vinylpyridine, polyethylene-polyoxyethylene, polyethylenepropylene-polyoxyethylene, polymethylmethacrylate-polyoxyethylene, polystyrene-polymethylmethacrylate, polystyrene-polybutadiene, polystyrene-polybutadiene-polystyrene, polystyrene-polyisoprene, polystyrene-polyisoprene-polystyrene, polyN-vinylpyrrolidone-polystyrene, poly(dimethylamino)ethylmethacrylate-methacrylate, poly(2-dimethylamino)ethylmethacrylate-polybutylmethacrylate, polystyrene-poly-2-hyroxyethylmethacrylate, polyisobutyrene-polymethylvinylether, polystyrene-polyhydroxyethylvinylether, polystyrene-polyionicacetylene, polymethyl-3-(methyleneglycol) vinylether-polyisobutylvinylether, poly(2-(1-pyrrolidonyl) ethylvinylether-polyisobutylvinylether), and polylauryllactam-polytetrahydrofuran.

[0012] In accordance with an exemplary embodiment of the present invention, a liquid crystal display (LCD) is provided. The LCD includes a thin film transistor (TFT) array panel, a color filter array panel, a liquid crystal, and a spacer. The TFT array panel includes a first substrate, a gate line and a data line formed insulated from each other and crossing each other on the first substrate, a TFT coupled to the gate line and the data line, and a pixel electrode coupled to the TFT. The color filter array panel is formed facing the TFT array panel, and includes a second substrate, a color filter formed on the second substrate, and a common electrode formed on the color filter. The liquid crystal is provided between the TFT array panel and the color filter array panel. The spacer is formed as a circular cylinder or hexahedron shape, and is disposed between the TFT array panel and the color filter array panel.

[0013] The silica particle precursor may be provided as tetraethyl orthosilicate.

[0014] The block copolymer may include at least one of polyoxyethylene-polyoxypropylene-polyoxyethylene, polyoxyethylene-polyoxypropylene, polyoxypropylene-polyoxyethylene-polyoxypropylene, polystyrene-polyoxyethylene, polystyrene-poly-2-vinylpyridine, polystyrene-poly-4-vinylpyridine, polyethylene-polyoxyethylene, polyethylenepropylene-polyoxyethylene, polymethylmethacrylate-polyoxyethylene, polystyrene-polymethylmethacrylate, polystyrene-polybutadiene, polystyrene-polybutadiene-polystyrene, polystyrene-polyisoprene, polystyrene-polyisoprene-polystyrene, polyN-vinylpyrrolidone-polystyrene, poly(dimethylamino)ethylmethacrylate-methacrylate, poly(2-dimethylamino)ethylmethacrylate-polybutylmethacrylate, polystyrene-poly-2-hyroxyethylmethacrylate, polyisobutyrene-polymethylvinylether, polystyrene-polyhydroxyethylvinylether, polystyrene-polyionicacetylene, polymethyl-3-(methyleneglycol) vinylether-polyisobutylvinylether, poly(2-(1-pyrrolidonyl) ethylvinylether-polyisobutylvinylether), and polylauryllactam-polytetrahydrofuran.

[0015] In accordance with another exemplary embodiment of the present invention, a liquid crystal display (LCD) is provided. The LCD includes a first substrate, a pixel electrode formed on the first substrate, a second substrate facing the first substrate and a common electrode formed on the second substrate. The LCD further includes a spacer disposed between the first substrate and the second substrate, with the spacer being circular cylinder-shaped or hexahedral-shaped.

BRIEF DESCRIPTION OF THE DRAWINGS

[0016] Exemplary embodiments of the present invention can be understood in more detail from the following detailed description when taken in conjunction with the attached drawings in which:

[0017] FIG. **1** is a layout view of a liquid crystal display (LCD) according to an exemplary embodiment of the present invention.

[0018] FIG. **2** is a cross-sectional view of along the line II-II of FIG. **1**.

[0019] FIG. **3** is a layout view of a display area of a lower display panel in the LCD of FIG. **1**.

[0020] FIG. **4** is a photo showing a cubic inorganic particle (ZnO) formed by controlling the shape of an inorganic material by using a block copolymer as a templating agent.

[0021] FIG. **5** shows a distributed spacer according to an exemplary embodiment of the present invention.

DETAILED DESCRIPTION OF THE EXEMPLARY EMBODIMENTS OF THE INVENTION

[0022] As those skilled in the art would realize, the described embodiments may be modified in various different ways, all without departing from the spirit or scope of the present invention.

[0023] In the drawings, the thickness of layers, films, panels, regions, etc., are exaggerated for clarity. Like reference numerals designate like elements throughout the specification. When it is said that any part, such as a layer, film, area, or plate is positioned on another part, it means the part is directly on the other part or above the other part with at least one intermediate part. In contrast, when an element is referred to as being "directly on" another element, there are no intervening elements present.

[0024] A thin film transistor (TFT) array panel according to an exemplary embodiment of the present invention will be described in further detail with reference to the accompanying drawings.

[0025] FIG. **1** is a layout view of a liquid crystal display (LCD) according to an exemplary embodiment of the present invention, FIG. **2** is a cross-sectional view along the line II-II of FIG. **1**, and FIG. **3** is an enlarged layout view of a display area of a lower array panel of the LCD of FIG. **1**.

[0026] As shown in FIG. **1** and FIG. **2**, a liquid crystal display (LCD) according to an exemplary embodiment of the present invention includes a thin film transistor (TFT) array panel **100**, a color filter array panel **200** disposed facing the TFT array panel **100**, and a liquid crystal layer **300** filled between the two panels **100** and **200**. The liquid crystal layer **300** is sealed by a sealant **310**. The two panels **100** and **200** are supported by a distributed spacer **320**. The LCD may further includes a compensation film formed outside the respective panels **100** and **200**, a polarizer, and a backlight unit disposed at an external front or external side of the TFT array panel **100**.

[0027] The TFT array panel **100** includes an insulation substrate **110** formed of a transparent insulation material such as, for example, glass, and a plurality of gate lines **121** and data lines **171** are formed in the insulation substrate **110**. The gate lines **121** and the data lines **171** are formed crossing but insulated from each other. The gate line **121** transmits a scanning signal and the data line **171** transmits an image signal.

[0028] A plurality of pixel areas Ps defined by the respective gate lines **121** and the respective data lines **171** form a display area D on which an image is displayed. One end of the respective gate lines **121** and one end of the respective data lines **171** are extended over the display area D to a peripheral area so as to receive external signals. An area excluding the display area D will be referred to as the peripheral area.

[0029] A switch (e.g., a TFT) is formed in the respective pixel areas Ps, and the TFT turns on/off an image signal according to a scan signal.

[0030] Each TFT is coupled with a pixel electrode **190** formed of a transparent conductive material (e.g., indium tin oxide (ITO) or indium zinc oxide (IZO)), and the pixel electrode **190** receives an image signal voltage from the corresponding TFT. When the LCD is provided as a reflective LCD, the pixel electrode **190** can be formed of a conductive material with improved reflectivity rather than the transparent material. In this case, the lower polarizer and the lower compensation film are not needed.

[0031] On the insulation substrate **210** of the color filter array panel **200**, a light blocking member **220**, called a black matrix, is formed to prevent light leakage. The light blocking member **220** includes a plurality of openings disposed facing the pixel electrode **190**. Each opening is formed with almost the same shape as the pixel electrode **190**. The light blocking member **220** may further include an area facing the TFT, and can be extended only along the data line **171**.

[0032] For example, the light blocking member **220** may be formed of a single layer of chromium, a double layer of chromium and chromium oxide, or an organic layer including a black pigment.

[0033] In addition, a plurality of color filters **230**R, **230**G, and **230**B are formed on the insulation substrate **210**. The color filters **230**R, **230**G, and **230**B are respectively disposed facing the pixel electrode **190** and formed in a band shape, extending along a vertical direction, and respectively express one of primary colors (e.g. red, green, and blue).

[0034] A common electrode **270** formed of a transparent conductive material (e.g., ITO and IZO) is formed below the color filter **230** and the light blocking member **220**.

[0035] The distributed spacer **320** is disposed between the TFT array panel **100** and the color filter array panel **200**. The spacer **320** is disposed in correspondence with the light blocking member **220**. In addition, the spacer **320** is formed in, for example, a circular cylinder shape or a hexahedron shape.

[0036] To form the circular cylinder-shaped spacer or the hexahedral-shaped spacer, a templating agent is used. An amphoteric block copolymer can be used as the templating agent. One-side block of the amphoteric block copolymer forms a swollen layer, and the other-side block contacts solid particles and forms an anchor. Herein, the block copolymer is a polymer composed of more than two types of monomers arranged in separate partitions.

[0037] FIG. **4** is a photo showing a cubic inorganic particle (ZnO) formed by controlling the shape of an inorganic material by using a block copolymer as a templating agent.

[0038] The spacer according to the exemplary embodiment of the present invention is formed of silicon dioxide, and is provided as a distributed spacer in a circular cylinder shape or a hexahedral shape as shown in FIG. **5**. Herein, the silicon dioxide is formed by dissolving a block copolymer including a hydrophilic group and a hydrophobic group in an acid aqueous solution or an alkali aqueous solution, including a silica particle precursor such as TEOS.

[0039] The block polymer used for manufacturing the spacer for the LCD according to the exemplary embodiment of the present invention may include, for example, at least one of polyoxyethylene-polyoxypropylene-polyoxyethylene, polyoxyethylene-polyoxypropylene, polyoxypropylene-polyoxyethylene-polyoxypropylene, polystyrene-polyoxyethylene, polystyrene-poly-2-vinylpyridine, polystyrene-poly-4-vinylpyridine, polyethylene-polyoxyethylene, polyethylenepropylene-polyoxyethylene, polymethylmethacrylate-polyoxyethylene, polystyrene-polymethylmethacrylate, polystyrene-polybutadiene, polystyrene-polybutadiene-polystyrene, polystyrene-polyisoprene, polystyrene-polyisoprene-polystyrene, polyN-vinylpyrrolidone-polystyrene, poly(dimethylamino)ethylmethacrylate-methacrylate, poly(2-dimethylamino)ethylmethacrylate-polybutylmethacrylate, polystyrene-poly-2-hyroxyethylmethacrylate, polyisobutyrene-polymethylvinylether, polystyrene-polyhydroxyethylvinylether, polystyrene-polyionicacetylene, polymethyl-3-(methyleneglycol) vinylether-polyisobutylvinylether, poly(2-(1-pyrrolidonyl) ethylvinylether-polyisobutylvinylether, and polylauryllactam-polytetrahydrofuran.

[0040] As described, when the spacer is formed in the circular cylinder or hexahedron shape, a contact area of the lower substrate may be increased so that a pressure deviation of a pressure process during a manufacturing process can be reduced, thereby reducing a cell gap deviation. In addition, concentration of the spacer is minimized, and accordingly difficulties due to the concentration of the spacer may be reduced.

[0041] Having described the exemplary embodiments of the present invention, it is further noted that it is readily apparent to those of reasonable skill in the art that various modifications may be made without departing from the spirit and scope of the invention which is defined by the metes and bounds of the appended claims.

What is claimed is:

1. A liquid crystal display (LCD) comprising:

a first substrate,

a pixel electrode formed on the first substrate;

a second substrate facing the first substrate;

a common electrode formed on the second substrate; and

a spacer disposed between the first substrate and the second substrate,

wherein the spacer is circular cylinder-shaped or hexahedral-shaped and is formed by dissolving a block copolymer that includes a hydrophilic group and a hydrophobic group in an acid aqueous solution including a silica particle precursor or an alkali aqueous solution including a silica particle precursor.

2. The LCD of claim **1**, wherein the silica particle precursor is tetraethyl orthosilicate.

3. The LCD of claim **1**, wherein the block copolymer comprises at least one of polyoxyethylene-polyoxypropylene-polyoxyethylene, polyoxyethylene-polyoxypropylene, polyoxypropylene-polyoxyethylene-polyoxypropylene, polystyrene-polyoxyethylene, polystyrene-poly-2-vinylpyridine, polystyrene-poly-4-vinylpyridine, polyethylene-polyoxyethylene, polyethylenepropylene-polyoxyethylene, polymethylmethacrylate-polyoxyethylene, polystyrene-polymethylmethacrylate, polystyrene-polybutadiene, polystyrene-polybutadiene-polystyrene, polystyrene-polyisoprene, polystyrene-polyisoprene-polystyrene, polyN-vinylpyrrolidone-polystyrene, poly(dimethylamino)ethylmethacrylate-methacrylate, poly(2-dimethylamino) ethylmethacrylate-polybutylmethacrylate, polystyrene-poly-2-hyroxyethylmethacrylate, polyisobutyrene-polymethylvinylether, polystyrene-polyhydroxyethylvinylether, polystyrene-polyionicacetylene, polymethyl-3-(methyleneglycol) vinylether-polyisobutylvinylether, poly(2-(1-pyrrolidonyl) ethylvinylether-polyisobutylvinylether), and polylauryllactam-polytetrahydrofuran.

4. A liquid crystal display (LCD) comprising:

a thin film transistor (TFT) array panel including a first substrate, a gate line and a data line formed insulated from each other and crossing each other on the first substrate, a TFT coupled to the gate line and the data line, and a pixel electrode coupled to the TFT;

a color filter array panel formed facing the TFT array panel, and including a second substrate, a color filter formed on the second substrate, and a common electrode formed on the color filter;

a liquid crystal provided between the TFT array panel and the color filter array panel; and

a spacer formed in a circular cylinder or hexahedron shape, and the spacer being disposed between the TFT array panel and the color filter array panel,

wherein the spacer is formed by dissolving a block copolymer that includes a hydrophilic group and a hydrophobic group in an acid aqueous solution including a silica particle precursor or an alkali aqueous solution including a silica particle precursor.

5. The LCD of claim **4**, wherein the silica particle precursor is tetraethyl orthosilicate.

6. The LCD of claim **4**, wherein the block copolymer comprises at least one of polyoxyethylene-polyoxypropylene-polyoxyethylene, polyoxyethylene-polyoxypropylene, polyoxypropylene-polyoxyethylene-polyoxypropylene, polystyrene-polyoxyethylene, polystyrene-poly-2-vinylpyridine, polystyrene-poly-4-vinylpyridine, polyethylene-polyoxyethylene, polyethylenepropylene-polyoxyethylene, polymethylmethacrylate-polyoxyethylene, polystyrene-polymethylmethacrylate, polystyrene-polybutadiene, polystyrene-polybutadiene-polystyrene, polystyrene-polyisoprene, polystyrene-polyisoprene-polystyrene, polyN-vinylpyrrolidone-polystyrene, poly(dimethylamino)ethylmethacrylate-methacrylate, poly(2-dimethylamino) ethylmethacrylate-polybutylmethacrylate, polystyrene-poly-2-hyroxyethylmethacrylate, polyisobutyrene-polymethylvinylether, polystyrene-polyhydroxyethylvinylether, polystyrene-polyionicacetylene, polymethyl-3-(methyleneglycol) vinylether-polyisobutylvinylether, poly(2-(1-pyrrolidonyl) ethylvinylether-polyisobutylvinylether), and polylauryllactam-polytetrahydrofuran.

7. The LCD of claim **4**, further comprising a light blocking member disposed on the second substrate of the color filter array panel.

8. The LCD of claim **7**, wherein the light blocking member includes a plurality of openings disposed facing the pixel electrode.

9. The LCD of claim **8**, wherein each opening is formed with substantially the same shape as the pixel electrode.

10. The LCD of claim **7**, wherein the light blocking member is formed of a single layer of chromium.

11. The LCD of claim **7**, wherein the light blocking member is formed of a double layer of chromium and chromium oxide.

12. The LCD of claim **7**, wherein the light blocking member is formed of an organic layer which includes a black pigment.

13. The LCD of claim **4**, wherein the color filter includes a plurality of color filters disposed facing the pixel electrode and formed in a band shape, extending along a vertical direction.

14. A liquid crystal display (LCD) comprising:

a first substrate,

a pixel electrode formed on the first substrate;

a second substrate facing the first substrate;

a common electrode formed on the second substrate; and

a spacer disposed between the first substrate and the second substrate,

wherein the spacer is circular cylinder-shaped or hexahedral-shaped.

* * * * *

专利名称(译)	液晶显示器		
公开(公告)号	US20080174726A1	公开(公告)日	2008-07-24
申请号	US11/931909	申请日	2007-10-31
[标]申请(专利权)人(译)	三星电子株式会社		
申请(专利权)人(译)	SAMSUNG ELECTRONICS CO.，LTD.		
当前申请(专利权)人(译)	SAMSUNG ELECTRONICS CO.，LTD.		
[标]发明人	KIM JONG SEONG		
发明人	KIM, JONG SEONG		
IPC分类号	G02F1/1339 G02F1/1335		
CPC分类号	G02F2202/022 G02F1/13394		
优先权	1020070006551 2007-01-22 KR		
外部链接	Espacenet USPTO		

摘要(译)

液晶显示器（LCD）包括第一基板，形成在第一基板上的像素电极，形成为面对第一基板的第二基板，形成在第二基板上的公共电极，以及设置在第一基板和第二基板之间的间隔物。间隔物是圆柱形或六面体形。间隔物可以通过将包含亲水基团和疏水基团的嵌段共聚物溶解在包含二氧化硅颗粒前体的酸性水溶液或包含二氧化硅颗粒前体的碱性水溶液中来形成。