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(54) **LIQUID CRYSTAL DISPLAY DEVICE**

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(57) **ABSTRACT**

A liquid crystal display device includes a liquid crystal layer, a first substrate, a second substrate, a pixel electrode, and an insulating layer. The liquid crystal layer is between first and second substrates and includes liquid crystal molecules. The pixel electrode is on the first substrate and includes a first sub-pixel electrode including a first stem portion and a second sub-pixel electrode including a second stem portion. The insulating layer is between the first sub-pixel electrode and the second sub-pixel electrode, and the second stem portion overlaps the first stem portion.

161

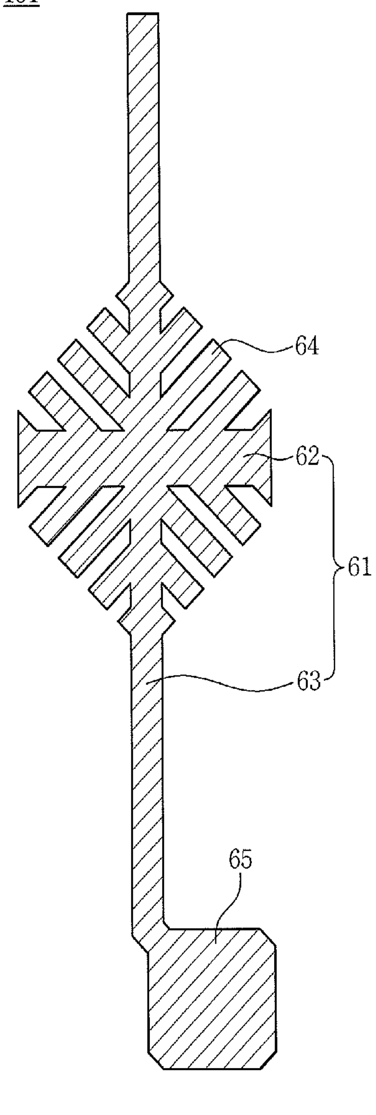


FIG. 1

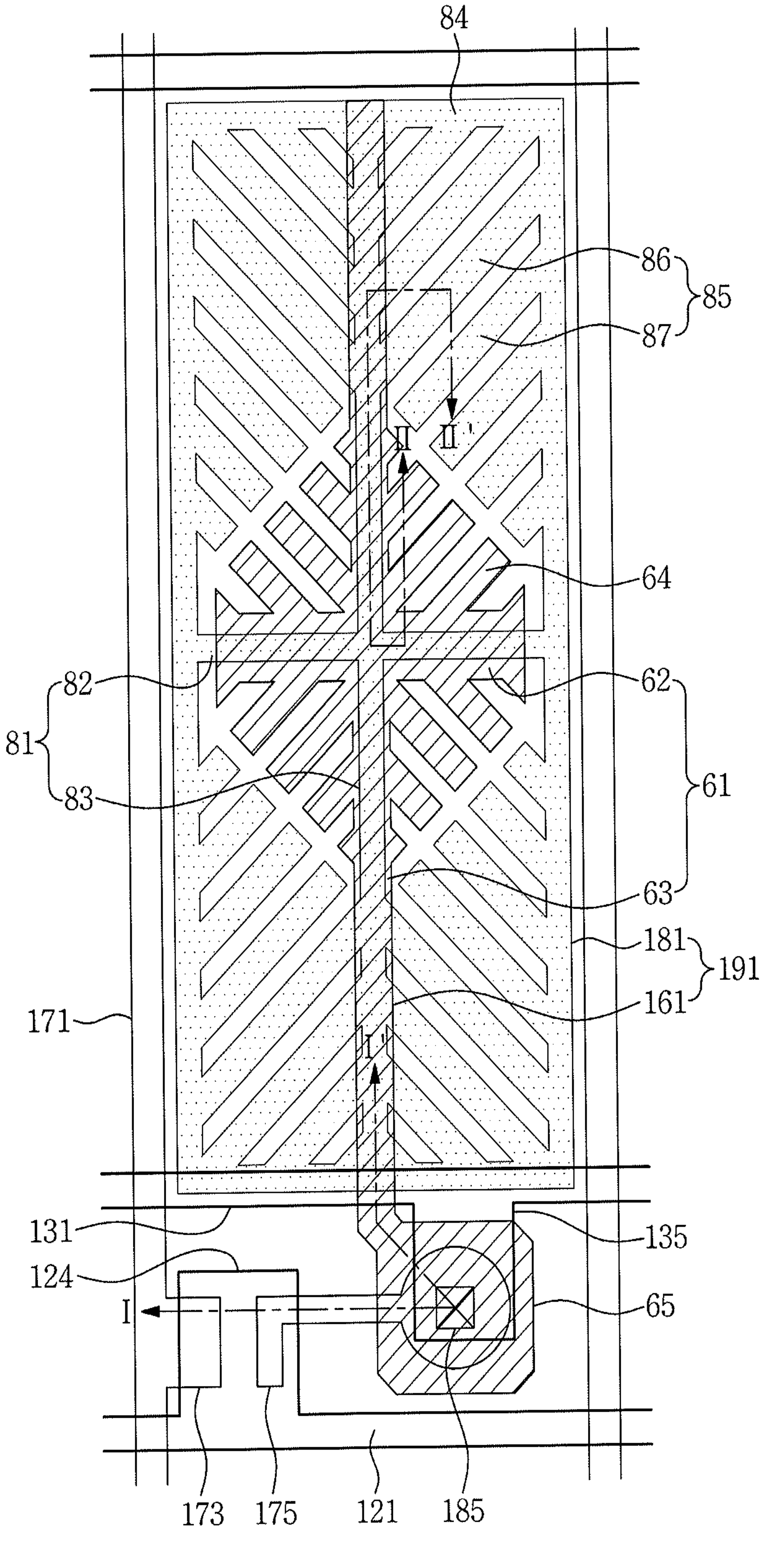

84
86
85
87
II
II'
64
82
62
81
83
61
63
181
191
161
171
I'
131
135
124
I
65
173
175
121
185

FIG. 2

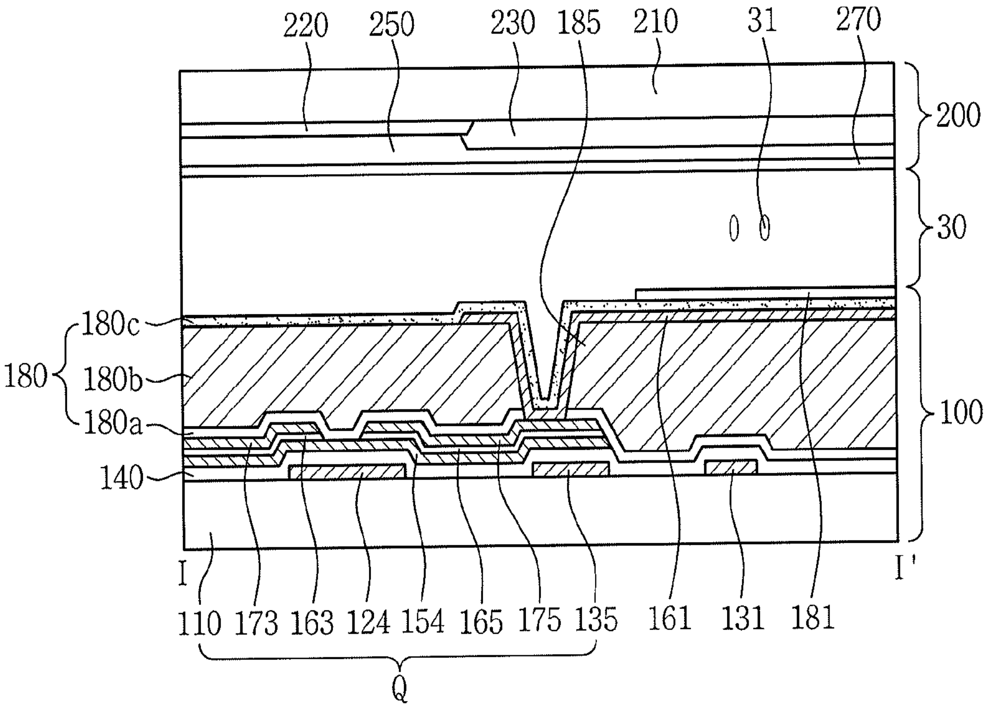

220
250
230
185
210
31
270
200
30
100
180c
180
180b
180a
140
I
I'
110
173
163
124
154
165
175
135
161
131
181
Q

FIG. 3

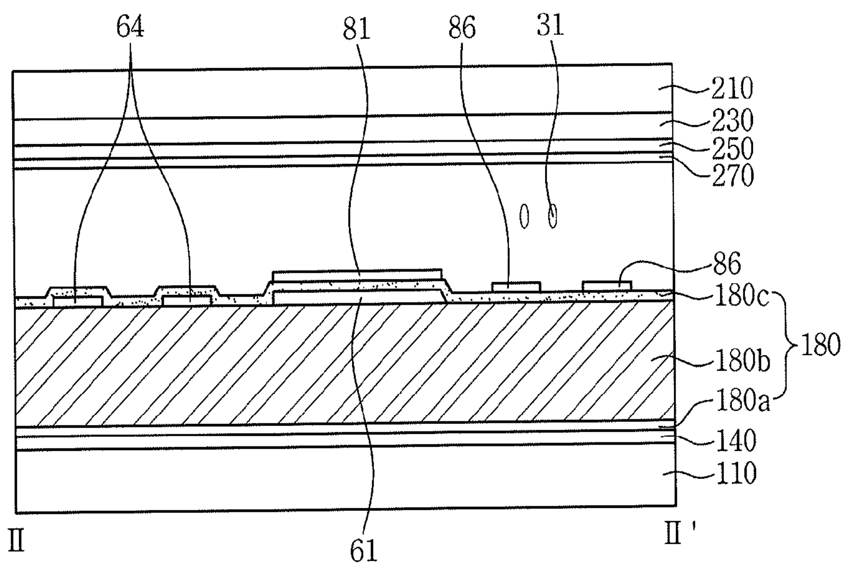

64
81
86
31
210
230
250
270
86
180c
180
180b
180a
140
110
II
II'
61

FIG. 4

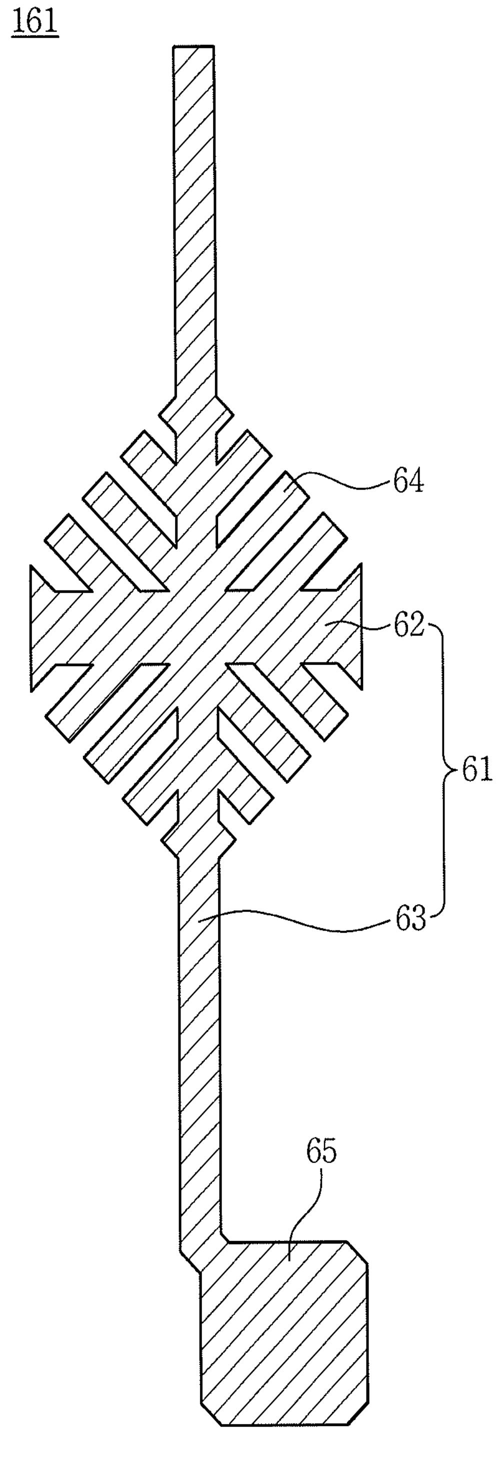


FIG. 5

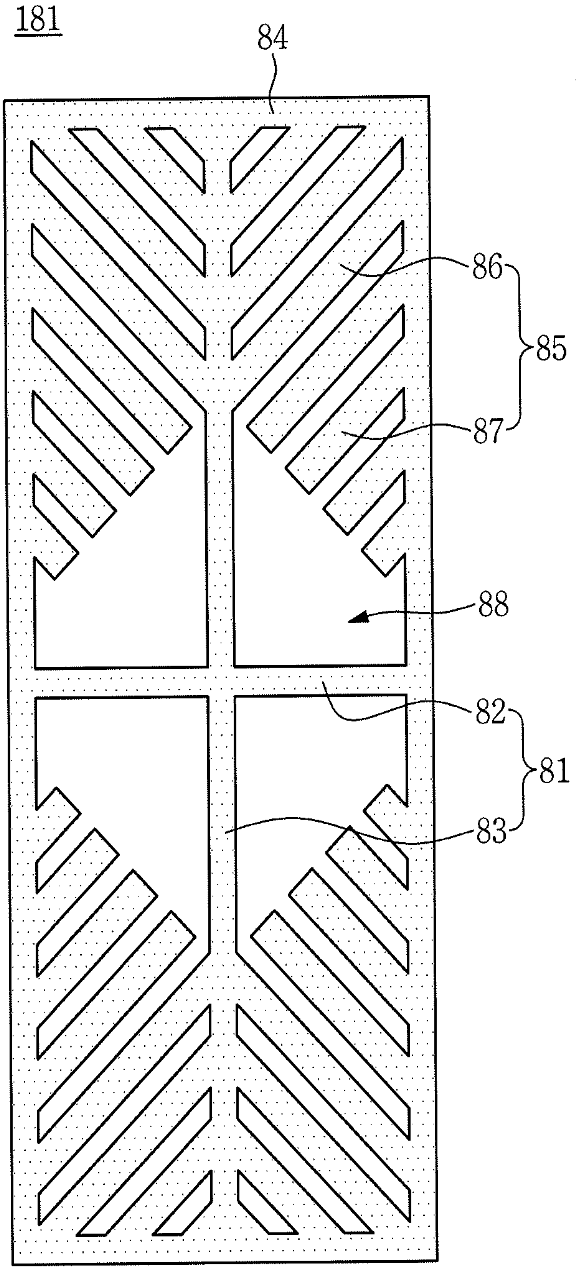


FIG. 6

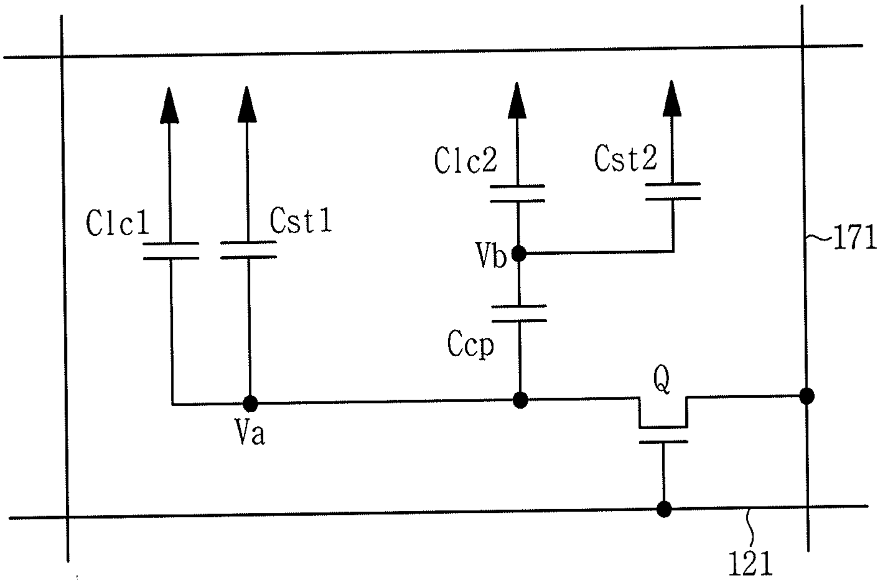
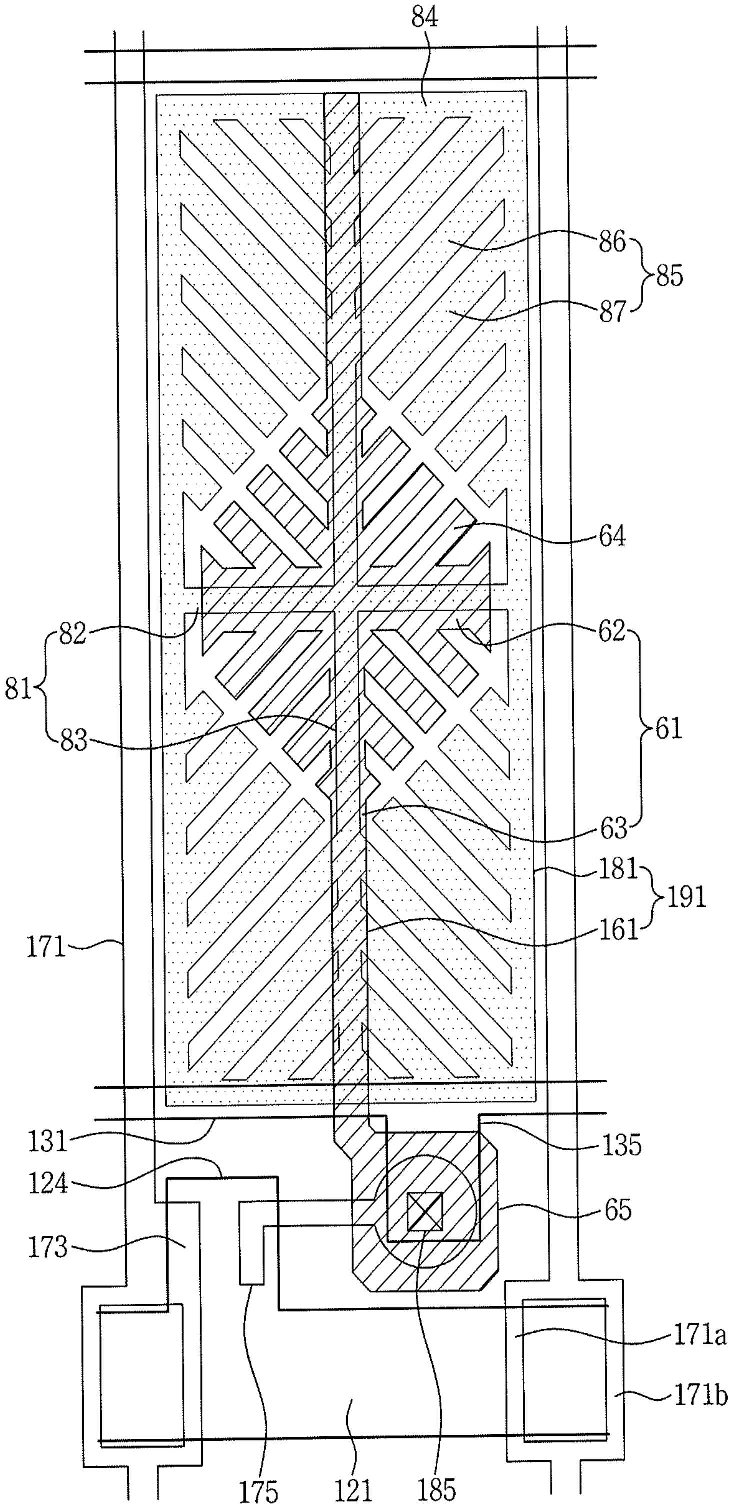


FIG. 7


84
86
85
87
64
82
62
81
61
83
63
181
191
161
171
131
135
124
65
173
171a
171b
175
121
185

LIQUID CRYSTAL DISPLAY DEVICE

CROSS-REFERENCE TO RELATED APPLICATION

[0001] Korean Patent Application No. 10-2015-0041614, filed on Mar. 25, 2015, and entitled, "Liquid Crystal Display Device," is incorporated by reference herein in its entirety.

BACKGROUND

[0002] 1. Field

[0003] One or more embodiments herein relate to a liquid crystal display device.

[0004] 2. Description of the Related Art

[0005] A liquid crystal display (LCD) is a type of flat panel display which has gained wide acceptance. An LCD includes liquid crystal layer between two substrates having electrodes. In operation, liquid crystal molecules in the liquid crystal layer are arranged based on voltages applied by the electrodes. The arrangement of liquid crystal molecules controls the amount of light transmitted from a backlight to form an image.

[0006] Various types of LCDs have been developed. Examples include twisted nematic mode displays, vertically aligned mode displays, fringe field switching mode displays, and an in-plane switching mode displays. These displays may differ, for example, based on the arrangement state of liquid crystal molecules and the arrangement state of electrodes in the absence of an applied electric field.

[0007] One type of display known as a homeotropic LCD achieves a wide viewing angle through, for example, the formation of a cut-out portion in a pixel electrode or the formation of a projection on a pixel electrode. In such an LCD, the tilt direction of liquid crystal molecules towards the cut-out portion or projection may be determined subsequent to the division of a single pixel into a plurality of domains. The reference viewing angle may be increased by dispersing the tilt direction of the liquid crystal molecules into several directions using the cut-out portion or projection.

[0008] In an LCD device using a domain division scheme, the domains are grouped into groups that receive different data voltages. For example, a single pixel may be divided into two or more domain groups, with different data voltages applied through coupling of a coupling electrode between the domain groups. However, the coupling electrode is made from an opaque metal formed simultaneously with a data line. This may cause a reduction in aperture ratio and light transmittance.

SUMMARY

[0009] In accordance with one embodiment, a liquid crystal display device includes a first substrate; a second substrate opposing the first substrate; a liquid crystal layer between the first and second substrates and including liquid crystal molecules; a pixel electrode on the first substrate and including a first sub-pixel electrode including a first stem portion and a second sub-pixel electrode including a second stem portion; and an insulating layer between the first sub-pixel electrode and the second sub-pixel electrode, wherein the second stem portion overlaps the first stem portion.

[0010] The second sub-pixel electrode may be separated from the first sub-pixel electrode. The display device may include a thin film transistor on the first substrate and connected to the first sub-pixel electrode. The first and second stem portions may be arranged to form a coupling capacitor. The second sub-pixel electrode may be capacitively coupled to the first sub-pixel electrode.

[0011] The first sub-pixel electrode may include a first branch portion extending from the first stem portion in first, second, third, and fourth directions. The first branch portion may not overlap the second sub-pixel electrode. The second sub-pixel electrode may include a peripheral portion connecting end portions of the second stem portion to one another and includes four edges. The second sub-pixel electrode may include a second branch portion extending from the peripheral portion. The second branch portion may not overlap the first branch portion. The second branch portion may not overlap the first stem portion. A portion of the second branch portion may be connected to the second stem portion.

[0012] The second sub-pixel electrode may have an aperture with a shape that substantially corresponds to a shape of the first branch portion. The first sub-pixel electrode may have a plurality of sub-regions in which the first branch portion extends in the first, second, third, and fourth directions. The second sub-pixel electrode may have a plurality of sub-regions disposed outwardly from the sub-regions of the first sub-pixel electrode.

[0013] The display device may include a common electrode on the second substrate, wherein a voltage difference between the first sub-pixel electrode and the common electrode is different from a voltage difference between the second sub-pixel electrode and the common electrode. The voltage difference between the first sub-pixel electrode and the common electrode may be greater than the voltage difference between the second sub-pixel electrode and the common electrode.

[0014] The first sub-pixel electrode may be below the insulating layer, and the second sub-pixel electrode may be on the insulating layer. The display device may include a storage electrode line on the first substrate. A portion of the first sub-pixel electrode and a portion of the second sub-pixel electrode may overlap the storage electrode line.

BRIEF DESCRIPTION OF THE DRAWINGS

[0015] Features will become apparent to those of skill in the art by describing in detail exemplary embodiments with reference to the attached drawings in which:

[0016] FIG. **1** illustrates an embodiment of an LCD device;

[0017] FIG. **2** illustrates a view along section line I-I' in FIG. **1**;

[0018] FIG. **3** illustrates a view along section line II-II' in FIG. **1**;

[0019] FIG. **4** illustrates an embodiment of a first sub-pixel electrode;

[0020] FIG. **5** illustrates an embodiment of a second sub-pixel electrode;

[0021] FIG. **6** illustrates an embodiment of a pixel; and

[0022] FIG. **7** illustrates another embodiment of an LCD device.

DETAILED DESCRIPTION

[0023] Example embodiments are described more fully hereinafter with reference to the accompanying drawings; however, they may be embodied in 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 exemplary implementations to those skilled in the art. The embodiments may be combined to form additional embodiments.

[0024] It will also be understood that when a layer or element is referred to as being "on" another layer or substrate, it can be directly on the other layer or substrate, or intervening layers may also be present. Further, it will be understood that when a layer is referred to as being "under" another layer, it can be directly under, and one or more intervening layers may also be present. In addition, it will also be understood that when a layer is referred to as being "between" two layers, it can be the only layer between the two layers, or one or more intervening layers may also be present. Like reference numerals refer to like elements throughout.

[0025] FIGS. **1** to **6** illustrate an embodiment of an LCD device which includes a liquid crystal layer **30** between a lower display panel **100** and an upper display panel **200**. The upper display panel **200** includes a light shielding member **220** and a color filter **230** formed on a second substrate **210**. The second substrate may include a transparent material, e.g., glass or plastic. The light shielding member **220** may be considered to be a black matrix which prevents light leakage between pixels. The color filter **230** displays one of a plurality of primary colors, for example, the three primary colors of red, green, and blue. In another embodiment, at least one of the light shielding member **220** or the color filter **230** may be disposed on the lower display panel **100**.

[0026] The upper display panel **200** also includes an overcoat layer **250** and a common electrode **270**. The overcoat layer **250** is on the color filter **230** and the light shielding member **220**. The common electrode **270** is on the overcoat layer **250** which is formed on the second substrate **210**. The common electrode **270** may be a surface-type electrode formed, for example, as a single plate that extends over the entire surface of the second substrate **210**.

[0027] The liquid crystal layer **30** includes liquid crystal molecules **31** having dielectric anisotropy, e.g., positive dielectric anisotropy. Each liquid crystal molecule **31** has a major axis vertically aligned with respect to the lower and upper display panels **100** and **200** in the absence of an applied electric field in the liquid crystal layer **30**. The liquid crystal molecules **31** may be nematic liquid crystal molecules having a structure in which the direction of the major axis is twisted into a spiral shape from the lower display panel **100** to the upper display panel **200**.

[0028] An alignment layer may be coated on an inner surface of at least one of the lower or upper display panels **100** and **200**. The alignment layer may be, for example, a homeotropic alignment layer. The alignment layer may be rubbed or photo-aligned in a predetermined direction. Accordingly, in one embodiment, the liquid crystal molecules **31** in the liquid crystal layer **30** may be initially aligned in a direction perpendicular to the lower and upper display panels **100** and **200**.

[0029] The lower display panel **100** may correspond to a thin film transistor display panel. A gate conductor including a plurality of gate lines **121** may be formed on a first substrate **110** made of a transparent material such as glass or plastic. The gate lines **121** are formed on the first substrate **110** and extend primarily in a first direction (e.g., transverse direction) for transmitting gate signals. Each of the gate lines **121** may include a plurality of gate electrodes **124**.

[0030] A storage electrode line **131** may extend in the transverse direction along with the gate line **121**, and may include a storage electrode **135** extending therefrom. The storage electrode **135** may extend in a longitudinal direction and may be disposed in an edge portion of a pixel.

[0031] The gate line **121** and the storage electrode line **131** may be formed of a metal such as aluminum (Al), an Al alloy, silver (Ag), a Ag alloy, copper (Cu), a Cu alloy, molybdenum (Mo), a Mo alloy, chromium (Cr), titanium (Ti), or tantalum (Ta). The gate line **121** and the storage electrode line **131** may have a monolayer structure or a multilayer structure including a metal layer of, for example, Cr, Mo, Ti, Ta, having excellent physicochemical properties, and a metal layer of Al-based or Ag-based metal or Cu having a relatively low resistivity. By way of example, the multilayer may include a Mo (or a Mo alloy)/Al (or Al alloy) layer.

[0032] A gate insulating layer **140** may be on the gate line **121** and may be formed of an inorganic insulating material such as silicon nitride (SiN_x) or silicon oxide (SiO_x).

[0033] A semiconductor **154** may be on the gate insulating layer **140** and may include, for example, amorphous silicon, polycrystalline silicon, or an oxide semiconductor. The oxide semiconductor may include one or more predetermined materials including but not limited to zinc (Zn), gallium (Ga), indium (In), and tin (Sn). The oxide semiconductor may be an oxide semiconductor material, for example, Zn, Ga, Sn, or In based oxide, or a composite oxide such as zinc oxide (ZnO), indium-gallium-zinc oxide ($InGaZnO_4$), indium-zinc oxide (In—Zn—O), or zinc-tin oxide (Zn—Sn—O).

[0034] The oxide semiconductor may include, for example, IGZO-based oxide including In, Ga, Zn, and oxygen (O). The oxide semiconductor may include In—Sn—Zn—O based metal oxide, In—Al—Zn—O based metal oxide, Sn—Ga—Zn—O based metal oxide, Al—Ga—Zn—O based metal oxide, Sn—Al—Zn—O based metal oxide, In—Zn—O based metal oxide, Sn—Zn—O based metal oxide, Al—Zn—O based metal oxide, In—O based metal oxide, Sn—O based metal oxide, and Zn—O based metal oxide.

[0035] Ohmic contact members **163** and **165** may be on the semiconductor **154** and may include, for example, silicide or n+hydrogenated amorphous silicon doped with n-type impurities at high concentration such as phosphorus. The ohmic contact members **163** and **165** may be disposed on the semiconductor **154** in pairs. If the semiconductor **154** is an oxide semiconductor, the ohmic contact members **163** and **165** may be omitted.

[0036] A data conductor including a data line **171**, which includes a source electrode **173** and drain electrode **175**, may be formed on the ohmic contact members **163** and **165** and the gate insulating layer **140**. The data line **171** transmits a data signal, and may be on the first substrate **110** and may extend in a second direction (e.g., longitudinal direction) intersecting the gate line **121**.

[0037] The gate electrode **124**, the source electrode **173**, and the drain electrode **175** form a single thin film transistor (TFT) Q, along with the semiconductor **154**. In operation, a channel of the TFT Q is formed in the semiconductor **154** between the source electrode **173** and the drain electrode **175**.

[0038] An insulating layer **180** may insulate different components. The insulating layer **180** includes a first insulating layer **180***a*, a second insulating layer **180***b*, and a third insulating layer **180***c*. The first insulating layer **180***a* is on the data conductor, the gate insulating layer **140**, and an exposed portion of the semiconductor **154**. The first insulating layer **180***a* may be formed of at least one of the following materials:

an inorganic insulating material such as SiN_x or SiO_x, an organic insulating material, or a low dielectric constant insulating material.

[0039] The second insulating layer **180***b* is on the first insulating layer **180***a* and may be formed of an organic insulating material with a planarized surface. The second insulating layer **180***b* may have a thickness that varies based on a position. In other words, the second insulating layer **180***b* may serve as a planarization layer.

[0040] The second insulating layer **180***b* may include a color filter for emitting light of one of a plurality of primary colors. Examples of the primary colors include, for example, the colors of red, green, and blue or the colors of yellow, cyan, magenta.

[0041] As illustrated in FIGS. **1** and **2**, a pixel electrode **191** includes a first sub-pixel electrode **161** separated from a second sub-pixel electrode **181**. The pixel electrode **191** may be formed of a transparent conductive material such as indium-tin oxide (ITO) or indium-zinc oxide (IZO).

[0042] The third insulating layer **180***c* is between the first sub-pixel electrode **161** and the second sub-pixel electrode **181**. The first sub-pixel electrode **161** may be below the third insulating layer **180***c* and the second sub-pixel electrode **181** may be on the third insulating layer **180***c*. Alternatively, the first sub-pixel electrode **161** may be on the third insulating layer **180***c* and the second sub-pixel electrode **181** may be below the third insulating layer **180***c*.

[0043] Referring to FIG. **4**, the first sub-pixel electrode **161** may be on the second insulating layer **180***b* and may include a first stem portion **61** including a first transverse stem portion **62** and a first longitudinal stem portion **63**, a first branch portion **64**, and a protrusion portion **65**. The first stem portion **61**, the first branch portion **64**, and the protrusion portion **65** may be integrally formed.

[0044] The first sub-pixel electrode **161** may have a predetermined (e.g., a polygonal) shape such as a hexagon. The first sub-pixel **161** may include the first longitudinal stem portion **63** and the first transverse stem portion **62**, which are formed in a central portion of the first sub-pixel electrode **161** and which are connected to one another. The first branch portion **64** extends from the first transverse stem portion **62** and the first longitudinal stem portion **63**. The first stem portion **61** may have, for example, a cross shape and may overlap a second stem portion **81** of the second sub-pixel electrode **181**.

[0045] The first branch portion **64** extends from the first stem portion **61** in upper right, lower right, upper left, and lower left directions. The first branch portion **64** may not overlap the second sub-pixel electrode **181**. The first branch portion **64** may form an angle in a range of, for example, about 45 to about 135 degrees relative to the gate line **121** or the first transverse stem portion **62**. In addition, first branch portions **64** in two adjacent sub-regions of the first sub-pixel electrode **161** may intersect one another. The width of the first branch portion **64** and an interval between two adjacent first branch portions **64** may be, for example, in a range of about 1 micrometer (μm) to about 10 μm.

[0046] The first sub-pixel electrode **161** may be divided into a plurality of sub-regions based on the direction in which the first branch portion **64** extends, with the first stem portion **61** serving as a boundary therebetween. The first sub-pixel electrode **161** may have the plurality of sub-regions in which the first branch portion **64** extends in the upper right, lower right, upper left, and lower left directions. For example, the first sub-pixel electrode **161** of the LCD device may be divided into four sub-regions. The first branch portion **64** may extend in the four sub-regions in four different directions.

[0047] The third insulating layer **180***c* may be on the first sub-pixel electrode **161**, may be formed of an organic insulating material, and may insulate the first sub-pixel electrode **161** from the second sub-pixel electrode **181**. The second sub-pixel electrode **181** may be on the third insulating layer **180***c* and may include a second stem portion **81** which includes a second transverse stem portion **82** and a second longitudinal stem portion **83**, a second branch portion **85**, and a peripheral portion **84**.

[0048] Referring to FIG. **5**, the second sub-pixel electrode **181** may surround the first sub-pixel electrode **161**. The second longitudinal stem portion **83** and the second transverse stem portion **82** may be connected to one another. The second stem portion **81** of the second sub-pixel electrode **181** may overlap the first stem portion **61** of the first sub-pixel electrode **161**.

[0049] The second branch portion **85** may extend from the peripheral portion **84**. For example, the second branch portion **85** may, as illustrated in FIG. **5**, extend from the peripheral portion **84** in the upper right, lower right, upper left, and lower left directions. The second branch portion **85** may form an angle in a range of, for example, about **45** to about **135** relative to the gate line **121** or the second transverse stem portion **82**. In addition, second branch portions **85** in two adjacent sub-regions of the second sub-pixel electrode **181** may intersect one another.

[0050] The second branch portion **85** of the second sub-pixel electrode **181** may be spaced apart from the first branch portion **64** of the first sub-pixel electrode **161** at a predetermined interval. As illustrated in FIGS. **1** and **5**, a portion of the second branch portion **85** may be connected to the second stem portion **81**. For example, a first portion **86** of the second branch portion **85** may extend from the peripheral portion **84** to be connected to the second longitudinal stem portion **83**. A second portion **87** of the second branch portion **85** may extend from the peripheral portion **84** and may not be connected to the second longitudinal stem portion **83**. In other words, the second branch portion **85** may be formed so as not to overlap the first branch portion **64**. In addition, the second branch portion **85** may not overlap the first stem portion **61**. In order for the second branch portion **85** to not overlap the first sub-pixel electrode **161**, the second sub-pixel electrode **181** may have an aperture **88** having a shape corresponding to a shape of the first branch portion **84**.

[0051] The peripheral portion **84** may connect end portions of the second stem portion **81** to one another and may include a plurality (e.g., four) edges. As previously described, the peripheral portion **84** may be connected to the second longitudinal stem portion **83** through the first portion **86** of the second branch portion **85**.

[0052] The second sub-pixel electrode **181** may have a plurality of sub-regions disposed outwardly from the sub-regions of the first sub-pixel electrode **161**. For example, the second sub-pixel electrode **181** may include a plurality of sub-regions in four sides of the first sub-pixel electrode **161**, which may have, for example, a polygonal shape. The sub-regions of the second sub-pixel electrode **181** may be divided by a space between the first branch portion **64** and the second branch portion **85**, and by the peripheral portion **84**. For example, the second sub-pixel electrode **181** of the LCD device may be divided into four sub-regions.

[0053] A portion of the first sub-pixel electrode **161** and a portion of the second sub-pixel electrode **181** may overlap the storage electrode line **131** to form a storage capacitor. The upper display panel **200** and the lower display panel **100** having a structure as described above may be aligned to be coupled to one another. Liquid crystal material may be injected therebetween to be vertically aligned.

[0054] Hereinafter, an example of voltages applied to the first sub-pixel electrode **161** and the second sub-pixel electrode **181** and a coupling capacitor formed by the first sub-pixel electrode **161** and the second sub-pixel electrode **181** will be discussed.

[0055] The first sub-pixel electrode **161** is connected to the TFT Q through the drain electrode **175**. As a result, the first sub-pixel electrode **161** receives an applied image signal voltage transmitted through the TFT Q and the data line **171**. On the other hand, since a voltage of the second sub-pixel electrode **181** varies due to a capacitive coupling based on overlap between the second first and sub-pixel electrodes **161** and **181**, the voltage of the second sub-pixel electrode **181** may have an absolute level invariably lower than the voltage of the first sub-pixel electrode **161**. In this regard, two sub-pixel electrodes (e.g., first and second sub-pixel electrodes **161** and **181**) which have different voltages may be disposed in a single pixel region, so that different gamma curves may be obtained. These different gamma curves may compensate with one another in order to reduce distortion, thereby achieving excellent visibility.

[0056] FIG. **6** provides an indication of one reason that the voltage of the first sub-pixel electrode **161** is maintained to be lower than the voltage of the second sub-pixel electrode **181**. In FIG. **6**, Clc**1** is a liquid crystal capacitor between the first sub-pixel electrode **161** and the common electrode **270**, Cst**1** is a storage capacitor between the first sub-pixel electrode **161** and the storage electrode line **131**, Clc**2** is a liquid crystal capacitor between the second sub-pixel electrode **181** and the common electrode **270**, Cst**2** is a storage capacitor between the second sub-pixel electrode **181** and the storage electrode line **131**, and Ccp is a coupling capacitor between the second sub-pixel electrode **181** and the first sub-pixel electrode **161**.

[0057] The voltage of the first sub-pixel electrode **161** with respect to the voltage of the common electrode **270** is denoted by Va. The voltage of the second sub-pixel electrode **181** is denoted by Vb. Thus, $Vb=Va\times[Ccp/(Ccp+Clc1)]$, based on the voltage divider rule. Since the value calculated by $Ccp/(Ccp+Clc2)$ is invariably less than 1, Vb may be invariably lower than Va.

[0058] The ratio of Vb to Va may be adjusted by adjusting the coupling capacitor Ccp.

[0059] Adjustment of the coupling capacitor Ccp may be performed, for example, by adjusting the overlapping area and a distance between the first stem portion **61** of the first sub-pixel electrode **161** and the second stem portion **81** of the second sub-pixel electrode **181**. In one embodiment, the overlapping area may be readily adjusted by varying the width of the second stem portion **81** of the second sub-pixel electrode **181**, and the distance may be adjusted by varying a thickness of the third insulating layer **180***c* or a position of the second stem portion **81**. In this instance, Vb may be higher than Va, e.g., by about 0.6 to about 0.8 times.

[0060] The third insulating layer **180***c* is between the first stem portion **61** and the second stem portion **81**, which overlap one another. Thus, the first and second stem portions **61** and **81** may form the coupling capacitor Ccp. For example, the coupling capacitor Ccp is formed using the transparent second sub-pixel electrode **181** without forming an additional opaque coupling electrode. As a result, aperture ratio may be enhanced, and accordingly side visibility of the LCD device may be improved.

[0061] As previously described, since the second sub-pixel electrode **181** receives a voltage applied thereto having a level lower than that of the first sub-pixel electrode **161**, the voltage difference between the first sub-pixel electrode **161** and the common electrode **270** may differ from a voltage difference between the second sub-pixel electrode **181** and the common electrode **270**. For example, the voltage difference between the first sub-pixel electrode **161** and the common electrode **270** may be greater than the voltage difference between the second sub-pixel electrode **181** and the common electrode **270**.

[0062] The first sub-pixel electrode **161** and the second sub-pixel electrode **181** receive different applied voltages to generate electric fields, along with the common electrode **270** of the upper display panel **200**. The electric fields control the directions of the liquid crystal molecules **31** in the liquid crystal layer **30** between the pixel electrode **191** and the common electrode **270**. The luminance of light transmitting through the liquid crystal layer **30** varies based on the direction of the liquid crystal molecules **31**.

[0063] FIG. **7** illustrates another embodiment of an LCD device which has substantially the same configuration as the previous embodiment, except for the shape of a portion of the data line **171**. Referring to FIG. **7**, the data line **171** has a first connection portion **171***a* and a second connection portion **171***b* at a position where the data line **171** overlaps a gate line **121**. When the data line **171** suffers a short-circuit defect with the gate line **121**, one of the first connection portion **171***a* or the second connection portion **171***b* may be cut through laser cutting. Thus, the short-circuit defect may be removed.

[0064] By way of summation and review, an LCD device a pixel may be divided into two or more domain groups, with different data voltages applied through coupling of a coupling electrode between the domain groups. However, the coupling electrode is made from an opaque metal formed simultaneously with a data line. This may cause a reduction in aperture ratio and light transmittance.

[0065] In accordance with one or more of the aforementioned embodiments, an LCD device may achieve excellent side visibility as a result of a capacitive coupling between first and second sub-pixel electrodes. Also, the aperture ratio may be improved because the coupling electrode may be omitted. Also, the second sub-pixel electrode may directly overlap the first sub-pixel electrode to allow high resolution to be achieved.

[0066] Example embodiments have been disclosed herein, and although specific terms are employed, they are used and are to be interpreted in a generic and descriptive sense only and not for purpose of limitation. In some instances, as would be apparent to one of skill in the art as of the filing of the present application, features, characteristics, and/or elements described in connection with a particular embodiment may be used singly or in combination with features, characteristics, and/or elements described in connection with other embodiments unless otherwise indicated. Accordingly, it will be understood by those of skill in the art that various changes in form and details may be made without departing from the spirit and scope of the invention as set forth in the following claims.

What is claimed is:

1. A liquid crystal display device, comprising:
a first substrate;
a second substrate opposing the first substrate;
a liquid crystal layer between the first and second substrates and including liquid crystal molecules;
a pixel electrode on the first substrate, the pixel electrode including a first sub-pixel electrode having a first stem portion and a second sub-pixel electrode having a second stem portion; and
an insulating layer between the first sub-pixel electrode and the second sub-pixel electrode, wherein the second stem portion overlaps the first stem portion.

2. The device as claimed in claim **1**, wherein the second sub-pixel electrode is separated from the first sub-pixel electrode.

3. The device as claimed in claim **2**, further comprising:
a thin film transistor on the first substrate and connected to the first sub-pixel electrode.

4. The device as claimed in claim **3**, wherein the first and second stem portions are arranged to form a coupling capacitor.

5. The device as claimed in claim **4**, wherein the second sub-pixel electrode is capacitively coupled to the first sub-pixel electrode.

6. The device as claimed in claim **1**, wherein the first sub-pixel electrode includes a first branch portion extending from the first stem portion in first, second, third, and fourth directions.

7. The device as claimed in claim **6**, wherein the first branch portion does not overlap the second sub-pixel electrode.

8. The device as claimed in claim **6**, wherein the second sub-pixel electrode includes a peripheral portion connecting end portions of the second stem portion to one another and includes four edges.

9. The device as claimed in claim **8**, wherein the second sub-pixel electrode includes a second branch portion extending from the peripheral portion.

10. The device as claimed in claim **9**, wherein the second branch portion does not overlap the first branch portion.

11. The device as claimed in claim **10**, wherein the second branch portion does not overlap the first stem portion.

12. The device as claimed in claim **11**, wherein a portion of the second branch portion is connected to the second stem portion.

13. The device as claimed in claim **6**, wherein the second sub-pixel electrode has an aperture with a shape that substantially corresponds to a shape of the first branch portion.

14. The device as claimed in claim **6**, wherein the first sub-pixel electrode has a plurality of sub-regions in which the first branch portion extends in the first, second, third, and fourth directions.

15. The device as claimed in claim **14**, wherein the second sub-pixel electrode has a plurality of sub-regions disposed outwardly from the sub-regions of the first sub-pixel electrode.

16. The device as claimed in claim **1**, further comprising:
a common electrode on the second substrate,
wherein a voltage difference between the first sub-pixel electrode and the common electrode is different from a voltage difference between the second sub-pixel electrode and the common electrode.

17. The device as claimed in claim **16**, wherein the voltage difference between the first sub-pixel electrode and the common electrode is greater than the voltage difference between the second sub-pixel electrode and the common electrode.

18. The device as claimed in claim **1**, wherein:
the first sub-pixel electrode is below the insulating layer, and
the second sub-pixel electrode is on the insulating layer.

19. The device as claimed in claim **1**, further comprising:
a storage electrode line on the first substrate.

20. The device as claimed in claim **19**, wherein a portion of the first sub-pixel electrode and a portion of the second sub-pixel electrode overlap the storage electrode line.

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[标]申请(专利权)人(译)	三星显示有限公司		
申请(专利权)人(译)	三星DISPLAY CO.，LTD.		
当前申请(专利权)人(译)	三星DISPLAY CO.，LTD.		
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摘要(译)

液晶显示装置包括液晶层，第一基板，第二基板，像素电极和绝缘层。液晶层位于第一和第二基板之间，并包括液晶分子。像素电极位于第一基板上，并包括包括第一杆部的第一子像素电极和包括第二杆部的第二子像素电极。绝缘层位于第一子像素电极和第二子像素电极之间，第二茎部与第一茎部重叠。