



(19) **United States**

(12) **Patent Application Publication**  
SO et al.

(10) **Pub. No.: US 2019/0103454 A1**

(43) **Pub. Date: Apr. 4, 2019**

(54) **DISPLAY SUBSTRATE AND ORGANIC LIGHT EMITTING DISPLAY DEVICE INCLUDING THE SAME**

**Publication Classification**

(51) **Int. Cl.**  
*H01L 27/32* (2006.01)

(52) **U.S. Cl.**  
CPC ..... *H01L 27/3276* (2013.01); *G09G 3/3266* (2013.01); *H01L 2251/5392* (2013.01)

(71) Applicant: **Samsung Display Co., LTD.**, Yongin-si (KR)

(72) Inventors: **Dong-Yoon SO**, Asan-si (KR); **Taegon KIM**, Cheonan-si (KR)

(57) **ABSTRACT**

A display substrate includes a first conductive line extending along a first direction and a second conductive line partially overlapping the first conductive line with a first insulation layer in between. The second conductive line includes a first substantially linear portion and a second substantially linear portion extending along the first direction, and an angled portion disposed between the first substantially linear portion and the second substantially linear portion. At least one side surface of the angled portion extends along a second direction intersecting the first direction.

(21) Appl. No.: **16/052,616**

(22) Filed: **Aug. 2, 2018**

(30) **Foreign Application Priority Data**

Sep. 29, 2017 (KR) ..... 10-2017-0128142

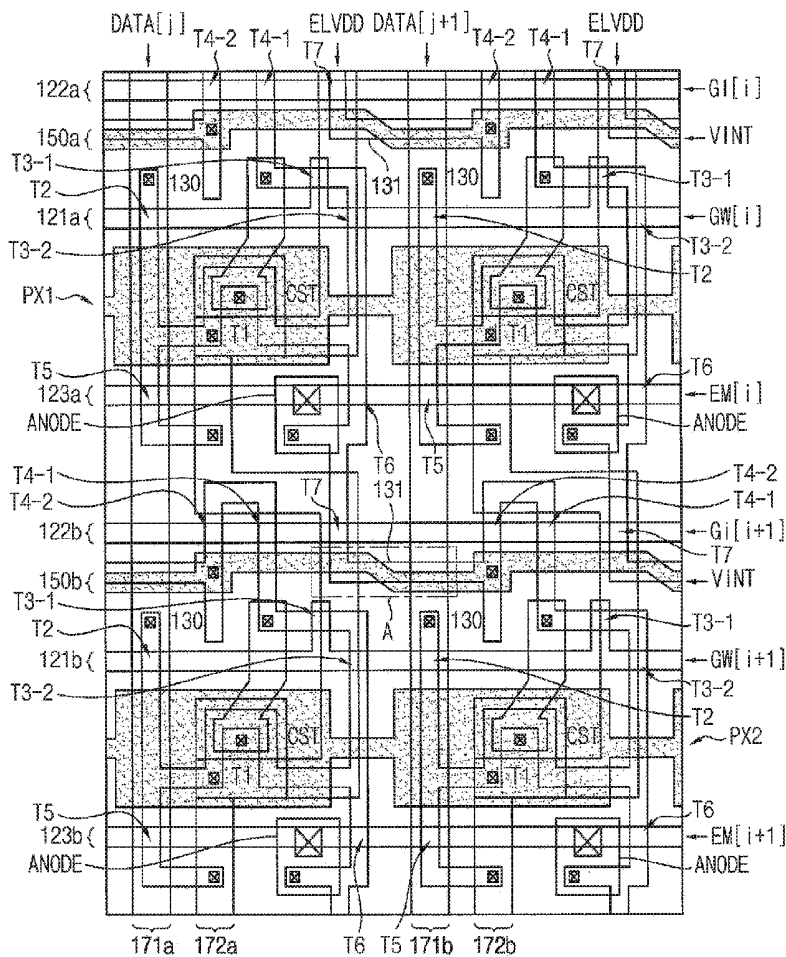


FIG. 1

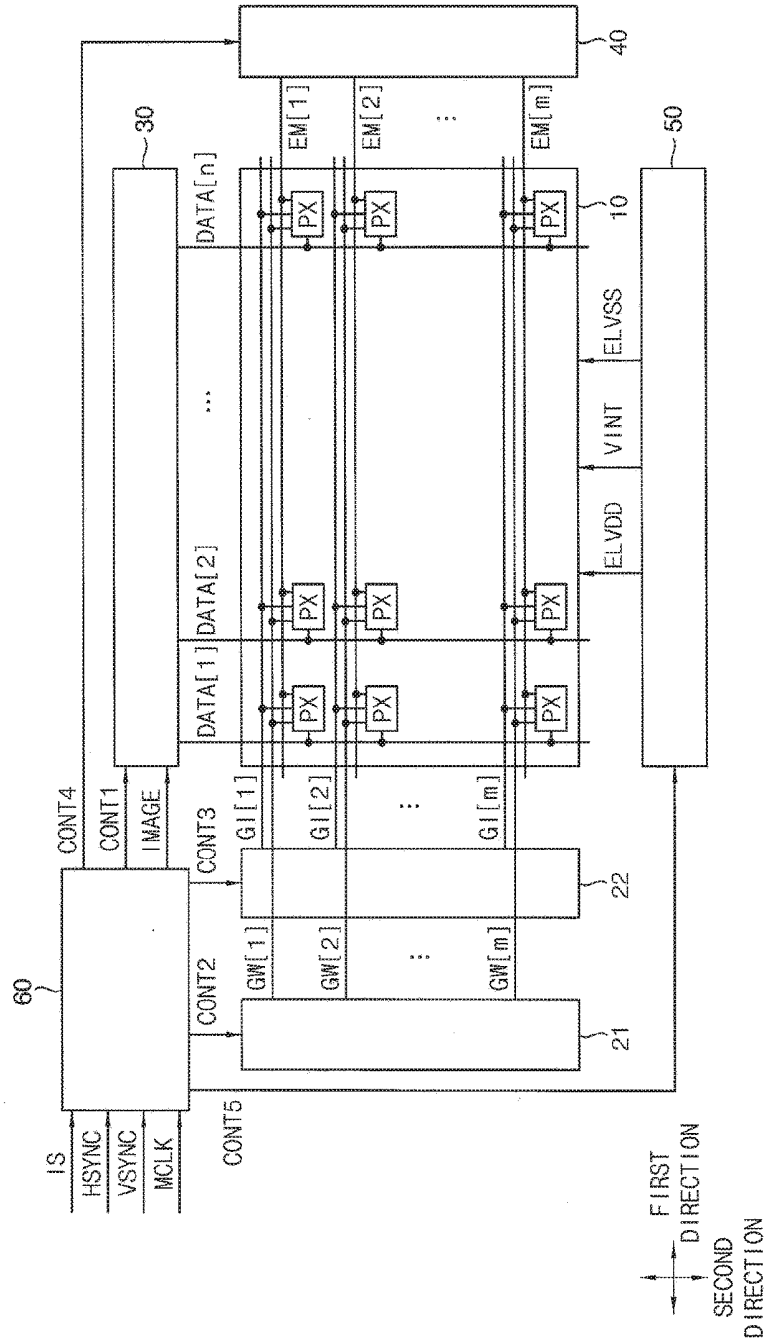


FIG. 2

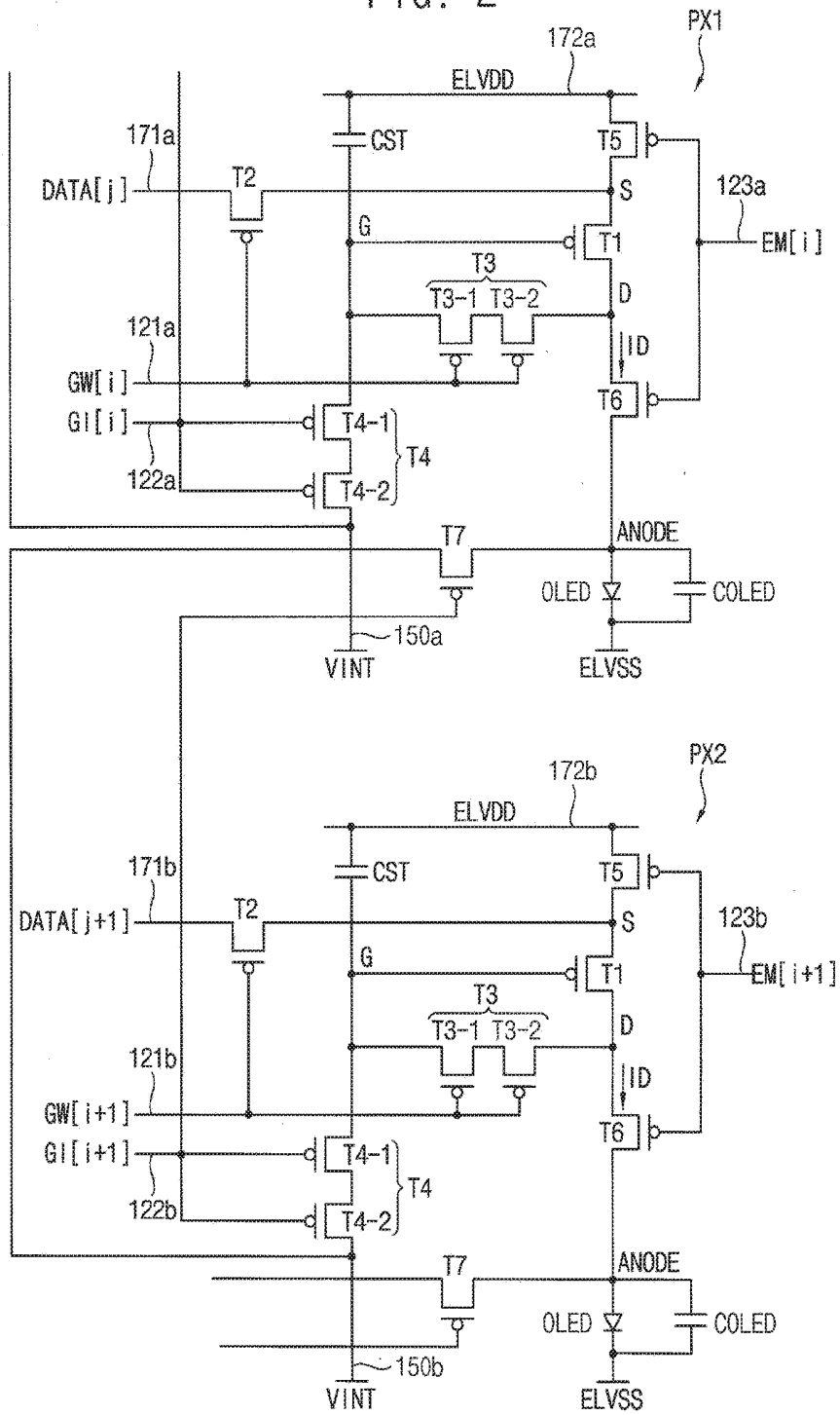


FIG. 3

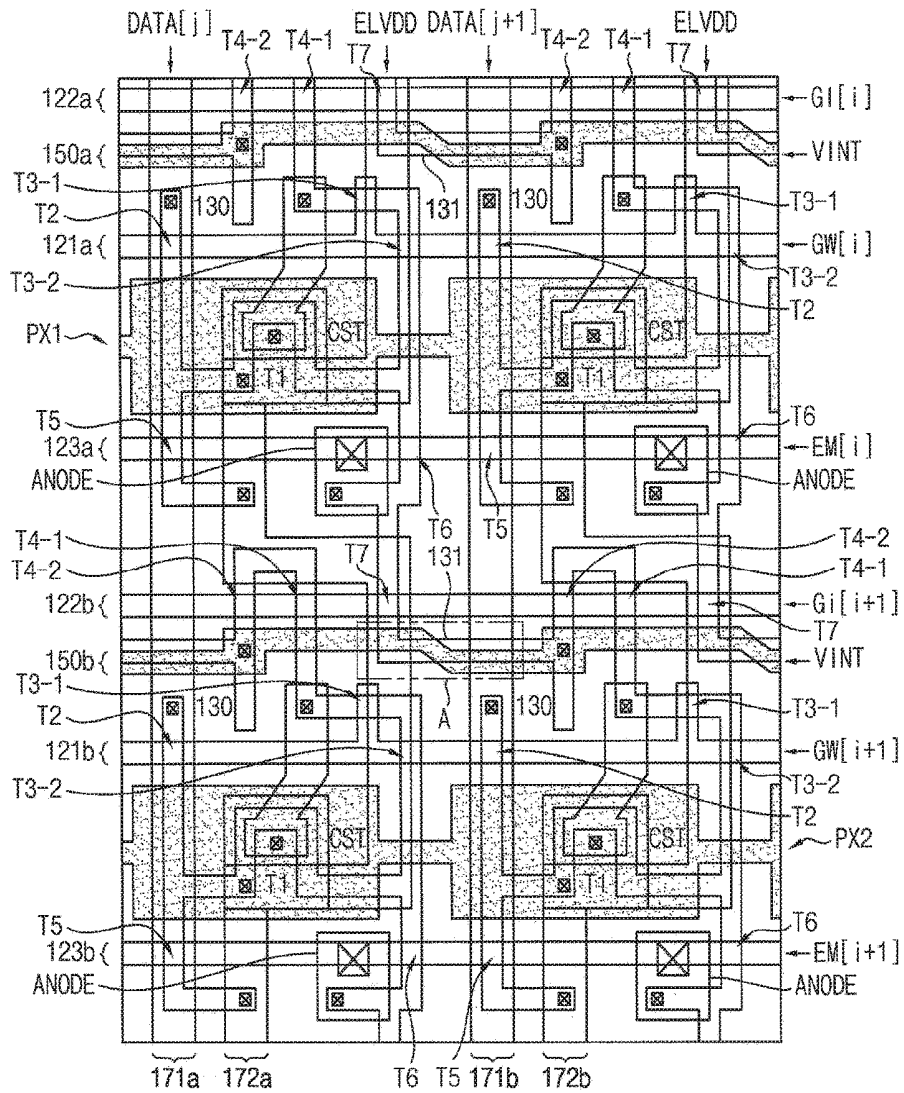


FIG. 4

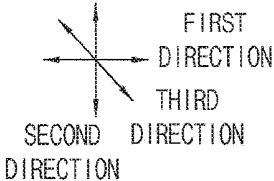
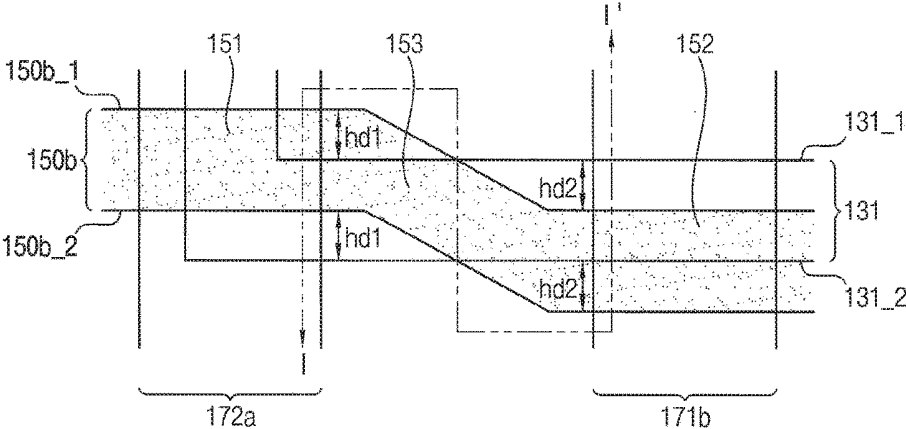


FIG. 5

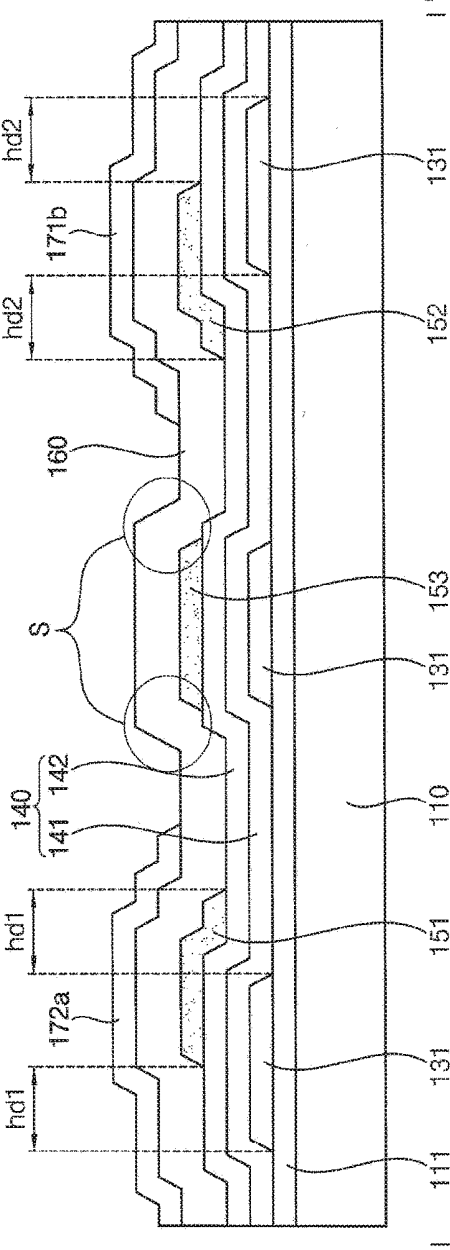


FIG. 6

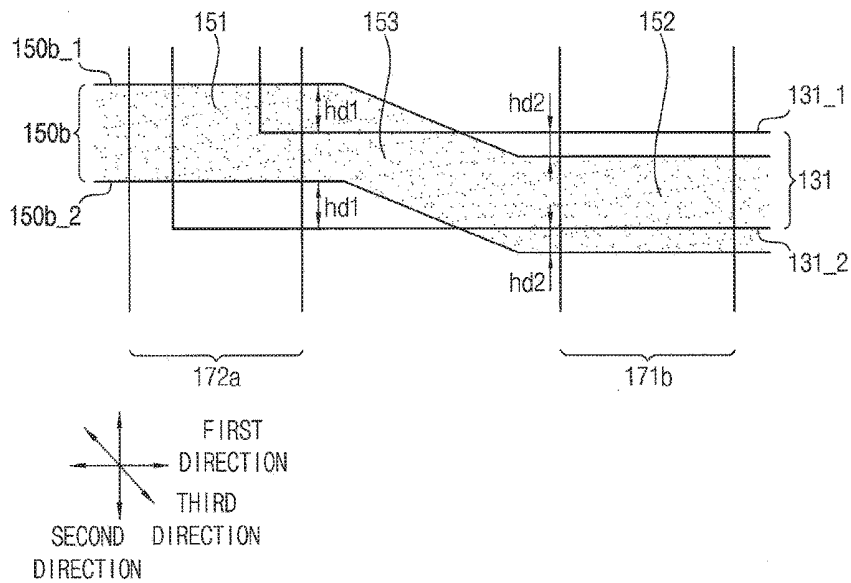


FIG. 7

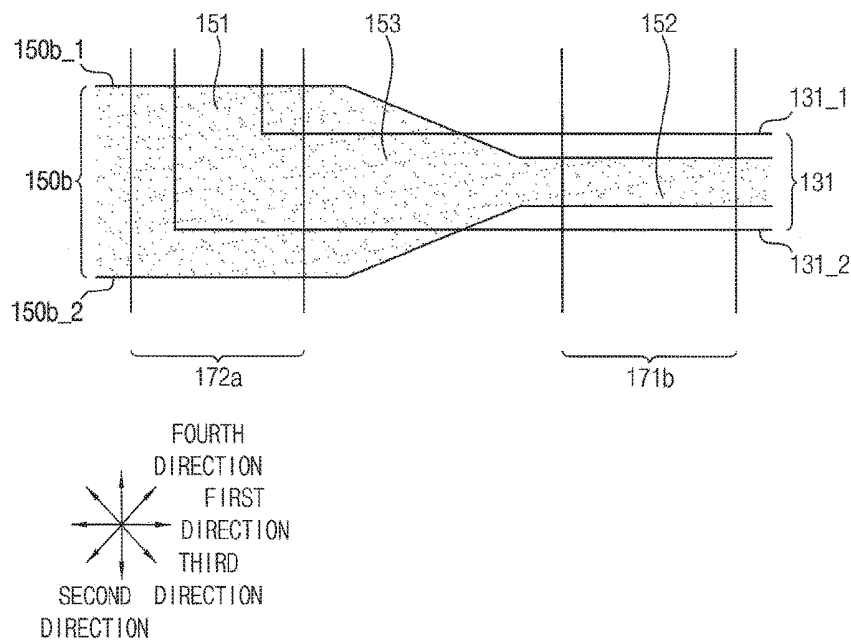


FIG. 8

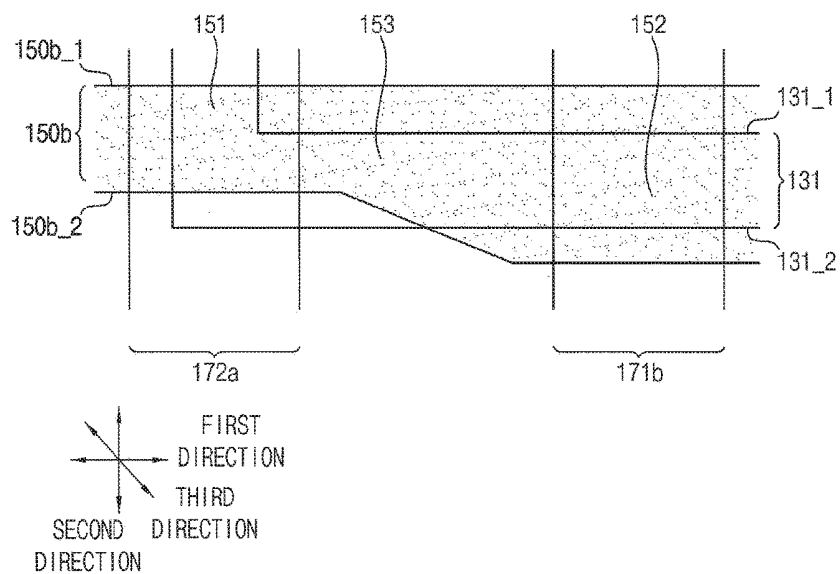
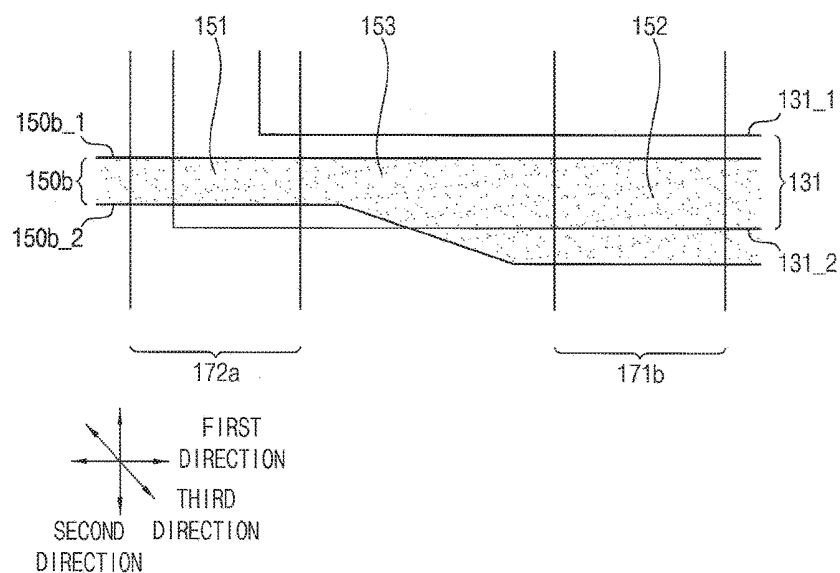


FIG. 9



**DISPLAY SUBSTRATE AND ORGANIC  
LIGHT EMITTING DISPLAY DEVICE  
INCLUDING THE SAME**

**CROSS REFERENCE TO RELATED  
APPLICATION**

**[0001]** This application claims priority from and the benefit of Korean Patent Application No. 10-2017-0128142, filed on Sep. 29, 2017, which is hereby incorporated by reference for all purposes as if fully set forth herein.

**BACKGROUND**

**Field**

**[0002]** Exemplary embodiments of the invention relate generally to display devices and, more specifically, to display substrates including conductive lines and organic light emitting display devices including the display substrates.

**Discussion of the Background**

**[0003]** An organic light emitting display device has an organic light emitting diode (OLED) whose luminance may be controlled by a current or voltage applied thereto. Since the organic light emitting display device is suitable for use in a high contrast and rapid response device, it has been used in mobile devices, smartphones, laptop computers, digital broadcasting terminals, personal digital assistants (PDAs), portable multimedia players (PMPs), navigations, slate computers, tablet computers, ultrabooks, wearable devices, digital TVs, desktop computers, digital signage, and the like.

**[0004]** An organic light emitting display device may include a plurality of gate lines, a plurality of data lines, a plurality of power lines, and a plurality of pixel circuits connected to the gate, data, and power lines. Each pixel circuit may typically include an organic light emitting diode, transistors including a switching transistor transmitting a data signal and a driving transistor driving the organic light emitting diode according to the data signal, and a capacitor maintaining a data voltage of the data signal.

**[0005]** The above information disclosed in this Background section is only for understanding of the background of the inventive concepts, and, therefore, it may contain information that does not constitute prior art.

**SUMMARY**

**[0006]** Display substrates constructed according to exemplary implementations of the invention avoid formation of a residual conductive layer during manufacture of the substrate.

**[0007]** For example, organic light emitting display devices constructed according to exemplary implementations of the invention avoid formation of a residual conductive between a data line and a power line during an etching process for forming the data line and the power line.

**[0008]** Additional features of the inventive concepts will be set forth in the description which follows, and in part will be apparent from the description, or may be learned by practice of the inventive concepts.

**[0009]** According to one or more exemplary embodiments of the invention, a display substrate may include a first conductive line extending along a first direction and a second conductive line partially overlapping the first conductive line with a first insulation layer in between. The

second conductive line may include a first substantially linear portion and a second substantially linear portion extending along the first direction and an angled portion between the first substantially linear portion and the second substantially linear portion, at least one side surface of the angled portion extending along a second direction that may intersect the first direction.

**[0010]** In an exemplary embodiment, the at least one side surface of the angled portion may intersect a side surface of the first conductive line.

**[0011]** In an exemplary embodiment, the angled portion may have opposing side surfaces that may extend along the second direction.

**[0012]** In an exemplary embodiment, the angled portion may have opposing side surfaces, with one of the opposing side surfaces of the angled portion may extend along the second direction, and another of opposing side surfaces of the angled portion may extend along a third direction different from the first and second directions.

**[0013]** In an exemplary embodiment, the angled portion may have opposing side surfaces, with one of the opposing side surfaces of the angled portion may extend along the second direction, and another of the opposing side surfaces of the angled portion may extend along the first direction.

**[0014]** In an exemplary embodiment, the first and second conductive lines may each have side surfaces, and a first horizontal distance between a side surface of the first conductive line and a side surface of the first substantially linear portion of the second conductive line may be greater than about 0.45  $\mu\text{m}$ .

**[0015]** In an exemplary embodiment, the first horizontal distance may be greater than about 1.48  $\mu\text{m}$ .

**[0016]** In an exemplary embodiment, a second horizontal distance between a side surface of the first conductive line and a side surface of the second substantially linear portion of the second conductive line may be greater than about 0.45  $\mu\text{m}$ .

**[0017]** In an exemplary embodiment, the second horizontal distance may be greater than about 1.48  $\mu\text{m}$ .

**[0018]** In an exemplary embodiment, the display substrate may further include a third conductive line and a fourth conductive line each intersecting the second conductive line with a second insulation layer in between. The angled portion of the second conductive line may be disposed between the third conductive line and the fourth conductive line.

**[0019]** According to yet another exemplary embodiment of the invention, an organic light emitting display device may include an active pattern comprising an active line extending along a first direction, a signal line comprising an initialization voltage line partially overlapping the active line with a gate insulation layer in between, a gate line and an initialization line extending along the first direction, and a data line and a power line extending along a second direction intersecting the first direction, and a plurality of pixels each connected to the signal line, the plurality of pixels each comprising a plurality of thin film transistors formed along the active pattern, a capacitor connected to the power line, and an organic light emitting diode. The initialization voltage line may include a first substantially linear portion and a second substantially linear portion extending along the first direction and an angled portion between the first substantially linear portion and the second substantially

linear portion, the angled portion may have at least one side surface extending along a third direction different from the first and second directions.

**[0020]** In an exemplary embodiment, the at least one side surface of the angled portion may intersect a side surface of the active line.

**[0021]** In an exemplary embodiment, the angled portion may have opposing side surfaces that may extend along the third direction.

**[0022]** In an exemplary embodiment, the angled portion may have opposing side surfaces, with one of the opposing side surfaces may extend along the third direction, and another of the opposing side surfaces may extend along a fourth direction.

**[0023]** In an exemplary embodiment, the angled portion may have opposing side surfaces, with one of the opposing side surfaces may extend along the third direction, and another of the opposing side surfaces may extend along the first direction.

**[0024]** In an exemplary embodiment, each of the plurality of pixels may include a switching thin film transistor connected to the gate line and the data line, a driving thin film transistor connected to a drain of the switching thin film transistor, an initialization thin film transistor turned-on by an initialization signal transmitted through the initialization line to apply an initialization voltage transmitted through the initialization voltage line, and a bypass thin film transistor connected to an anode of the organic light emitting diode. The active line may be between the bypass thin film transistor of a pixel in an  $i$ -th row and the initialization thin film transistor of a pixel in an  $(i+1)$ -th row,  $i$  may be a natural number.

**[0025]** In an exemplary embodiment, the active line may be between the bypass thin film transistor of a pixel in a  $j$ -th column and the initialization thin film transistor of a pixel in a  $(j+1)$ -th column,  $j$  may be a natural number.

**[0026]** In an exemplary embodiment, the data line and the power line may intersect the initialization voltage line, respectively, with an insulation interlayer in between, and the angled portion of the initialization voltage line may be between the data line and the power line.

**[0027]** In an exemplary embodiment, the power line may be connected to the capacitor of a pixel in a  $j$ -th column, and the data line may be connected to the switching thin film transistor of a pixel in a  $(j+1)$ -th column.

**[0028]** In an exemplary embodiment, the gate insulation layer may include a first gate insulation layer and a second gate insulation layer. The gate line and the initialization line may be on the active pattern with the first gate insulation layer in between. The initialization voltage line may be on the gate line and the initialization line with the second gate insulation layer in between.

**[0029]** In the display substrate according to the exemplary embodiments, the second conductive line, which overlaps the first conductive line extending along the first direction, may include the angled portion having at least one side surface extending along the second direction. Accordingly, the formation of the unwanted residual conductive layer on the second conductive line may be prevented.

**[0030]** In the organic light emitting display device according to the exemplary embodiments, the initialization voltage line, which overlaps the active line extending along the first direction, may include the angle portion having at least one side surface extending along the second direction. Accord-

ingly, the formation of the unwanted residual conductive layer on the initialization voltage line may be prevented.

**[0031]** It is to be understood that both the foregoing general description and the following detailed description are exemplary and explanatory and are intended to provide further explanation of the invention as claimed.

#### BRIEF DESCRIPTION OF THE DRAWINGS

**[0032]** The accompanying drawings, which are included to provide a further understanding of the invention and are incorporated in and constitute a part of this specification, illustrate exemplary embodiments of the invention, and together with the description serve to explain the inventive concepts.

**[0033]** FIG. 1 is a block diagram illustrating an organic light emitting display device constructed according to an exemplary embodiment of the invention.

**[0034]** FIG. 2 is an equivalent circuit diagram illustrating an exemplary embodiment of pixels that may be used in the organic light emitting display device shown in FIG. 1.

**[0035]** FIG. 3 is a diagram illustrating an exemplary embodiment of a plurality of thin film transistors and a capacitor of a display substrate that may be used in the organic light emitting display device shown in FIG. 1.

**[0036]** FIG. 4 is a diagram illustrating an exemplary embodiment of conductive lines of the display substrate device shown in FIG. 3.

**[0037]** FIG. 5 is a cross-sectional view of the display substrate in FIG. 4 taken along line I-I' of FIG. 4.

**[0038]** FIG. 6 is a diagram illustrating conductive lines of a display substrate according to another exemplary embodiment.

**[0039]** FIG. 7 is a diagram illustrating conductive lines of a display substrate according to yet another exemplary embodiment.

**[0040]** FIG. 8 is a diagram illustrating conductive lines of a display substrate according to still another exemplary embodiment.

**[0041]** FIG. 9 is a diagram illustrating conductive lines of a display substrate according to yet still another exemplary embodiment.

#### DETAILED DESCRIPTION

**[0042]** In the following description, for the purposes of explanation, numerous specific details are set forth in order to provide a thorough understanding of various exemplary embodiments or implementations of implementations of the invention. As used herein “embodiments” and “implementations” are interchangeable words that are non-limiting examples of devices or methods employing one or more of the inventive concepts disclosed herein. It is apparent, however, that various exemplary embodiments may be practiced without these specific details or with one or more equivalent arrangements. In other instances, well-known structures and devices are shown in block diagram form in order to avoid unnecessarily obscuring various exemplary embodiments. Further, various exemplary embodiments may be different, but do not have to be exclusive. For example, specific shapes, configurations, and characteristics of an exemplary embodiment may be used or implemented in another exemplary embodiment without departing from the inventive concepts.

**[0043]** Unless otherwise specified, the illustrated exemplary embodiments are to be understood as providing exemplary features of varying detail of some ways in which the inventive concepts may be implemented in practice. Therefore, unless otherwise specified, the features, components, modules, layers, films, panels, regions, and/or aspects, etc. (hereinafter individually or collectively referred to as “elements”), of the various embodiments may be otherwise combined, separated, interchanged, and/or rearranged without departing from the inventive concepts.

**[0044]** The use of cross-hatching and/or shading in the accompanying drawings is generally provided to clarify boundaries between adjacent elements. As such, neither the presence nor the absence of cross-hatching or shading conveys or indicates any preference or requirement for particular materials, material properties, dimensions, proportions, commonalities between illustrated elements, and/or any other characteristic, attribute, property, etc., of the elements, unless specified. Further, in the accompanying drawings, the size and relative sizes of elements may be exaggerated for clarity and/or descriptive purposes. When an exemplary embodiment may be implemented differently, a specific process order may be performed differently from the described order. For example, two consecutively described processes may be performed substantially at the same time or performed in an order opposite to the described order. Also, like reference numerals denote like elements.

**[0045]** When an element, such as a layer, is referred to as being “on,” “connected to,” or “coupled to” another element or layer, it may be directly on, connected to, or coupled to the other element or layer or intervening elements or layers may be present. When, however, an element or layer is referred to as being “directly on,” “directly connected to,” or “directly coupled to” another element or layer, there are no intervening elements or layers present. To this end, the term “connected” may refer to physical, electrical, and/or fluid connection, with or without intervening elements. For the purposes of this disclosure, “at least one of X, Y, and Z” and “at least one selected from the group consisting of X, Y, and Z” may be construed as X only, Y only, Z only, or any combination of two or more of X, Y, and Z, such as, for instance, XYZ, XYY, YZ, and ZZ. As used herein, the term “and/or” includes any and all combinations of one or more of the associated listed items.

**[0046]** Although the terms “first,” “second,” etc. may be used herein to describe various types of elements, these elements should not be limited by these terms. These terms are used to distinguish one element from another element. Thus, a first element discussed below could be termed a second element without departing from the teachings of the disclosure.

**[0047]** Spatially relative terms, such as “beneath,” “below,” “under,” “lower,” “above,” “upper,” “over,” “higher,” “side” (e.g., as in “sidewall”), and the like, may be used herein for descriptive purposes, and, thereby, to describe one element's relationship to another element(s) as illustrated in the drawings. Spatially relative terms are intended to encompass different orientations of an apparatus in use, operation, and/or manufacture in addition to the orientation depicted in the drawings. For example, if the apparatus in the drawings is turned over, elements described as “below” or “beneath” other elements or features would then be oriented “above” the other elements or features. Thus, the exemplary term “below” can encompass both an

orientation of above and below. Furthermore, the apparatus may be otherwise oriented (e.g., rotated 90 degrees or at other orientations), and, as such, the spatially relative descriptors used herein interpreted accordingly.

**[0048]** The terminology used herein is for the purpose of describing particular embodiments and is not intended to be limiting. As used herein, the singular forms, “a,” “an,” and “the” are intended to include the plural forms as well, unless the context clearly indicates otherwise. Moreover, the terms “comprises,” “comprising,” “includes,” and/or “including,” when used in this specification, specify the presence of stated features, integers, steps, operations, elements, components, and/or groups thereof, but do not preclude the presence or addition of one or more other features, integers, steps, operations, elements, components, and/or groups thereof. It is also noted that, as used herein, the terms “substantially,” “about,” and other similar terms, are used as terms of approximation and not as terms of degree, and, as such, are utilized to account for inherent deviations in measured, calculated, and/or provided values that would be recognized by one of ordinary skill in the art.

**[0049]** Various exemplary embodiments are described herein with reference to sectional and/or exploded illustrations that are schematic illustrations of idealized exemplary embodiments and/or intermediate structures. As such, variations from the shapes of the illustrations as a result, for example, of manufacturing techniques and/or tolerances, are to be expected. Thus, exemplary embodiments disclosed herein should not necessarily be construed as limited to the particular illustrated shapes of regions, but are to include deviations in shapes that result from, for instance, manufacturing. In this manner, regions illustrated in the drawings may be schematic in nature and the shapes of these regions may not reflect actual shapes of regions of a device and, as such, are not necessarily intended to be limiting.

**[0050]** Unless otherwise defined, all terms (including technical and scientific terms) used herein have the same meaning as commonly understood by one of ordinary skill in the art to which this disclosure is a part. Terms, such as those defined in commonly used dictionaries, should be interpreted as having a meaning that is consistent with their meaning in the context of the relevant art and should not be interpreted in an idealized or overly formal sense, unless expressly so defined herein.

**[0051]** Hereinafter, display substrates and organic light emitting display devices constructed in accordance with the principles and exemplary embodiments of the invention will be explained in detail with reference to the accompanying drawings.

**[0052]** FIG. 1 is a block diagram illustrating an organic light emitting display device constructed according to an exemplary embodiment of the invention.

**[0053]** Referring to FIG. 1, an organic light emitting display device may include a display unit 10, a gate driver 21, an initialization driver 22, a data driver 30, a light emission driver 40, a power supply 50, and a signal controller 60. The organic light emitting display device described herein may include a larger or smaller number of components than those described above.

**[0054]** The display unit 10 may include a plurality of pixels PX that are connected to corresponding gate lines among a plurality of gate lines, corresponding initialization lines among a plurality of initialization lines, corresponding data lines among a plurality of data lines, and corresponding

light emission control lines among a plurality of light emission control lines. The pixels PX may display an image according to data voltages transmitted from the data lines.

**[0055]** The pixels PX may be respectively connected to the gate lines, the initialization lines, the data lines, and the light emission control lines to be approximately arranged in a matrix form. In an exemplary embodiment, the pixels PX may have a matrix structure of m-rows and n-columns (Here, m and n are natural numbers).

**[0056]** The gate lines may extend along a first direction (e.g., a row direction) to be substantially parallel to each other. The initialization lines and the light emission control lines may extend along the first direction to be substantially parallel to each other. The data lines may extend along a second direction (e.g., a column direction) that intersects the first direction to be substantially parallel to each other.

**[0057]** The gate driver **21** may be connected to the display unit **10** through the gate lines. The gate driver **21** may generate a plurality of gate signals GW[1], GW[2], . . . , GW[m] according to a control signal CONT2 and then may transmit the generated gate signals to corresponding gate lines among the gate lines.

**[0058]** The initialization driver **22** may be connected to the display unit **10** through the initialization lines. The initialization driver **22** may generate a plurality of initialization signals GI[1], GI[2], . . . , GI[m] according to a control signal CONT3 and then may transmit the generated initialization signals to corresponding initialization lines among the initialization lines.

**[0059]** The control signals CONT2 and CONT3 may be operating control signals generated by the signal controller **60** and respectively transmitted to the gate driver **21** and the initialization driver **22**. Each of the control signals CONT2 and CONT3 may include a gate start signal and different types of clock signals. The gate start signal may generate a first gate signal GW[1] for displaying an image of one frame. One of the clock signals may be a synchronization signal for sequentially applying the gate signals GW[1], GW[2], . . . , GW[m] to the gate lines, and another of the clock signals may be a synchronization signal for substantially simultaneously (or concurrently) applying the initialization signals GI[1], GI[2], . . . , GI[m] to the initialization lines.

**[0060]** The data driver **30** may be connected to the pixels PX through the data lines. The data driver **30** may receive an image data signal IMAGE and may transmit data signals DATA[1], DATA[2], . . . , DATA[n] to corresponding data lines among the data lines according to a control signal CONT1. The control signal CONT1 may be an operating control signal generated by the signal controller **60** and transmitted to the data driver **30**.

**[0061]** The data driver **30** may select a gray voltage according to the image data signal IMAGE and may transmit the selected gray voltage as the data signals DATA[1], DATA[2], . . . , DATA[n] to the data lines. The data driver **30** may sample and hold the image data signal IMAGE inputted according to the control signal CONT1, and may respectively transmit the data signals DATA[1], DATA[2], . . . , DATA[n] to the data lines. For example, the data driver **30** may apply the data signals DATA[1], DATA[2], . . . , DATA[n] having a predetermined voltage range to the data lines depending on the gate signals GW[1], GW[2], . . . , GW[m] of a gate-on voltage.

**[0062]** The light emission driver **40** may generate a plurality of light emission control signals EM[1], EM[2], . . . , EM[m] according to a control signal CONT4. The light emission driver **40** may respectively transmit the light emission control signals EM[1], EM[2], . . . , EM[m] to the light emission control lines according to the control signal CONT4.

**[0063]** The power supply **50** may apply an initialization voltage VINT, a first driving voltage ELVDD, and a second driving voltage ELVSS to the pixels PX of the display unit **10** according to a control signal CONT5.

**[0064]** The signal controller **60** may receive an image signal IS inputted from the outside and input control signals controlling the image signal IS. The image signal IS may include luminance information that is differentiated based on gray in each pixel PX of the display unit **10**. Meanwhile, the input control signals transmitted to the signal controller **60** may include a horizontal synchronization signal HSYNC, a vertical synchronization signal VSYNC, a main clock signal MCLK, or the like.

**[0065]** The signal controller **60** may generate the control signals CONT1, CONT2, CONT3, CONT4, and CONT5 and the image data signal IMAGE according to the image signal IS, the horizontal synchronization signal HSYNC, the vertical synchronization signal VSYNC, and the main clock signal MCLK. The signal controller **60** may process the image signal IS according to the operating conditions of the display unit **10** and the data driver **30** based on the inputted image signal IS and the input control signals. For example, the signal controller **60** may generate the image data signal IMAGE by applying image processes such as gamma correction, luminance compensation, and the like to the image signal IS.

**[0066]** For example, the signal controller **60** may generate the control signal CONT1 that controls operation of the data driver **30**, and may transmit the generated control signal CONT1 along with the image data signal IMAGE processed by the image processes to the data driver **30**. Further, the signal controller **60** may transmit the control signal CONT2 that controls operation of the gate driver **21** to the gate driver **21**. Further, the signal controller **60** may transmit the control signal CONT3 that controls operation of the initialization driver **22** to the initialization driver **22**. Further, the signal controller **60** may transmit the control signal CONT4 to the light emission driver **40** to drive the light emission driver **40**.

**[0067]** In addition, the signal controller **60** may control the power supply **50**. The power supply **50** may supply the initialization voltage VINT that initializes a gate of a driving transistor and an anode of an organic light emitting diode included in each pixel PX of the display unit **10** with a predetermined voltage, and may supply the driving voltages ELVDD and ELVSS for driving each pixel PX. For example, the signal controller **60** may transmit the control signal CONT5 to the power supply **50** to drive the power supply **50**.

**[0068]** Next, a pixel of an organic light emitting display device according to an exemplary embodiment will be described in detail with reference to FIG. 2.

**[0069]** FIG. 2 is an equivalent circuit diagram illustrating an exemplary embodiment of pixels that may be used in the organic light emitting display device shown in FIG. 1.

**[0070]** Referring to FIG. 2, two adjacent pixels PX1 and PX2 of an organic light emitting display device according to an exemplary embodiment may include a plurality of signal

lines **121a**, **121b**, **122a**, **122b**, **123a**, **123b**, **150a**, **150b**, **171a**, **171b**, **172a**, and **172b**, a plurality of thin film transistors **T1**, **T2**, **T3**, **T4**, **T5**, **T6**, and **T7** connected to the signal lines, a storage capacitor **CST**, and an organic light emitting diode **OLED**. In an exemplary embodiment, a first pixel **PX1** may be a pixel located in an *i*-th row, and a second pixel **PX2** may be a pixel located in an (*i*+1)-th row (Here, *i* is a natural number and less than *m*). In an exemplary embodiment, the first pixel **PX1** may be a pixel located in a *j*-th column, and the second pixel **PX2** may be a pixel located in a (*j*+1)-th column (Here, *j* is a natural number and less than *n*). For example, the first pixel **PX1** may be a pixel located in the *i*-th row and the *j*-th column, and the second pixel **PX2** may be a pixel located in the (*i*+1)-th row and the (*j*+1)-th column.

**[0071]** The thin film transistors **T1**, **T2**, **T3**, **T4**, **T5**, **T6**, and **T7** may include a driving thin film transistor **T1**, a switching thin film transistor **T2**, a compensation thin film transistor **T3**, an initialization thin film transistor **T4**, an operation control thin film transistor **T5**, a light emission control thin film transistor **T6**, and a bypass thin film transistor **T7**.

**[0072]** The signal lines **121a**, **121b**, **122a**, **122b**, **123a**, **123b**, **150a**, **150b**, **171a**, **171b**, **172a**, and **172b** may include gate lines **121a** and **121b** transmitting the gate signals **GW**[*i*] and **GW**[*i*+1], initialization lines **122a** and **122b** transmitting the initialization signals **GI**[*i*] and **GI**[*i*+1] to the initialization thin film transistor **T4** and the bypass thin film transistor **T7**, light emission control lines **123a** and **123b** transmitting the light emission control signals **EM**[*i*] and **EM**[*i*+1] to the operation control thin film transistor **T5** and the light emission control thin film transistor **T6**, initialization voltage lines **150a** and **150b** transmitting the initialization voltage **VINT** that initializes the driving thin film transistor **T1** and the organic light emitting diode **OLED**, data lines **171a** and **171b** intersecting the gate lines **121a** and **121b** and transmitting the data signals **DATA**[*j*] and **DATA**[*j*+1], and power lines **172a** and **172b** transmitting the first driving voltage **ELVDD** and formed to be substantially parallel to the data lines **171a** and **171b**.

**[0073]** In the first pixel **PX1** located in an *i*-th row, a gate **G** of the driving thin film transistor **T1** may be connected to one end of the storage capacitor **CST**, and a source **S** of the driving thin film transistor **T1** may be connected to the power line **172a** via the operation control thin film transistor **T5**. A drain **D** of the driving thin film transistor **T1** may be electrically connected to an anode of the organic light emitting diode **OLED** via the light emission control thin film transistor **T6**. The driving thin film transistor **T1** may receive the data signal **DATA**[*j*] according to a switching operation of the switching thin film transistor **T2** to supply a driving current **ID** to the organic light emitting diode **OLED**.

**[0074]** A gate of the switching thin film transistor **T2** may be connected to the gate line **121a**, and a source of the switching thin film transistor **T2** may be connected to the data line **171a**. A drain of the switching thin film transistor **T2** may be connected to the power line **172a** via the operation control thin film transistor **T5** while being connected to the source **S** of the driving thin film transistor **T1**.

**[0075]** The switching thin film transistor **T2** may be turned on according to the gate signal **GW**[*i*] transmitted through the gate line **121a** to transmit the data signal **DATA**[*j*] transmitted from the data line **171a** to the source **S** of the driving thin film transistor **T1**, through the switching operation thereof.

**[0076]** The compensation thin film transistor **T3** may be formed as double-gate transistors **T3-1** and **T3-2** to prevent current leakage. Gates of the compensation thin film transistors **T3-1** and **T3-2** may be connected to the gate line **121a**, and a source of the compensation thin film transistor **T3-2** may be connected to the anode of the organic light emitting diode **OLED** via the light emission control thin film transistor **T6** while being connected to the drain **D** of the driving thin film transistor **T1**. A drain of the compensation thin film transistor **T3-1** may be connected to one end of the storage capacitor **CST**, a drain of the initialization thin film transistor **T4**, and the gate **G** of the driving thin film transistor **T1**. Further, a drain of the compensation thin film transistor **T3-2** and a source of the compensation thin film transistor **T3-1** may be connected to each other. The compensation thin film transistor **T3** may be turned on according to the gate signal **GW**[*i*] transmitted through the gate line **121a** to connect the gate **G** and the drain **D** of the driving thin film transistor **T1** to each other, such that the driving thin film transistor **T1** may be operated as a diode.

**[0077]** The initialization thin film transistor **T4** may be formed as double-gate transistors **T4-1** and **T4-2**, thereby preventing current leakage. A gate of the initialization thin film transistor **T4-1** may be connected to the initialization line **122a**, and a drain of the initialization thin film transistor **T4-1** may be connected to a source of the initialization thin film transistor **T4-2**. A source of the initialization thin film transistor **T4-1** may be connected to one end of the storage capacitor **CST**, the drain of the compensation thin film transistor **T3-1**, and the gate **G** of the driving thin film transistor **T1**.

**[0078]** A gate of the initialization thin film transistor **T4-2** may be connected to the initialization line **122a**, and a drain of the initialization thin film transistor **T4-2** may be connected to the initialization voltage line **150a**. A source of the initialization thin film transistor **T4-2** may be connected to the drain of the initialization thin film transistor **T4-1**.

**[0079]** The initialization thin film transistor **T4** may be turned on according to the initialization signal **GI**[*i*] transmitted through the initialization line **122a** to transmit the initialization voltage **VINT** to the gate **G** of the driving thin film transistor **T1** such that a voltage of the gate **G** of the driving thin film transistor **T1** may be initialized.

**[0080]** A gate of the operation control thin film transistor **T5** may be connected to the light emission control line **123a**, and a source of the operation control thin film transistor **T5** may be connected to the power line **172a**. A drain of the operation control thin film transistor **T5** may be connected to the source **S** of the driving thin film transistor **T1** and the drain of the switching thin film transistor **T2**.

**[0081]** A gate of the light emission control thin film transistor **T6** may be connected to the light emission control line **123a**, and a source of the light emission control thin film transistor **T6** may be connected to the drain **D** of the driving thin film transistor **T1** and the source of the compensation thin film transistor **T3**. A drain of the light emission control thin film transistor **T6** may be electrically connected to the anode of the organic light emitting diode **OLED** and a source of the bypass thin film transistor **T7**.

**[0082]** The operation control thin film transistor **T5** and the light emission control thin film transistor **T6** may be substantially simultaneously (or concurrently) turned on according to the light emission control signal **EM**[*i*] transmitted through the light emission control line **123a**, and thus

the first driving voltage ELVDD may be transmitted to the organic light emitting diode OLED for the driving current  $I_d$  to flow through the organic light emitting diode OLED.

[0083] A gate of the bypass thin film transistor T7 may be connected to an (i+1)-th row initialization line 122b, and a drain of the bypass thin film transistor T7 may be connected to an (i+1)-th row initialization voltage line 150b. A source of the bypass thin film transistor T7 may be electrically connected to the anode of the organic light emitting diode OLED and the drain of the light emission control thin film transistor T6.

[0084] The bypass thin film transistor T7 may be turned on according to the initialization signal  $GI[i+1]$  transmitted through the (i+1)-th initialization line 122b to initialize an anode voltage of the organic light emitting diode OLED with the initialization voltage VINT.

[0085] The other end of the storage capacitor CST may be connected to the power line 172a, and a cathode of the organic light emitting diode OLED may receive the second driving voltage ELVSS. Accordingly, the organic light emitting diode OLED may receive the driving current  $I_d$  from the driving thin film transistor T1 and then may emit light to display an image.

[0086] A structure of the pixel of the organic light emitting display device illustrated in FIG. 2 will be described in detail with reference to FIG. 3 along with FIG. 2.

[0087] FIG. 3 is a diagram illustrating an exemplary embodiment of a plurality of thin film transistors and a capacitor of a display substrate that may be used in the organic light emitting display device shown in FIG. 1.

[0088] Referring to FIG. 3, a display substrate according to an exemplary embodiment may include the gate lines 121a and 121b, the initialization lines 122a and 122b, and the light emission control lines 123a and 123b, which respectively apply the gate signals  $GW[i]$  and  $GW[i+1]$ , the initialization signals  $GI[i]$  and  $GI[i+1]$ , and the light emission control signals  $EM[i]$  and  $EM[i+1]$ , and which are formed along the first direction. Further, the display substrate may include the initialization voltage lines 150a and 150b that apply the initialization voltage VINT. The organic light emitting display device described with reference to FIGS. 1 and 2 may include the display substrate illustrated in FIG. 3.

[0089] The display substrate may include the data lines 171a and 171b and the power lines 172a and 172b, which respectively apply the data signals  $DATA[j]$  and  $DATA[j+1]$ , and the first driving voltage ELVDD to the pixels PX, and which intersect all of the gate lines 121a and 121b, the initialization lines 122a and 122b, and the light emission control lines 123a and 123b.

[0090] The driving thin film transistor T1, the switching thin film transistor T2, the compensation thin film transistor T3, the initialization thin film transistor T4, the operation control thin film transistor T5, the light emission control thin film transistor T6, the bypass thin film transistor T7, and the storage capacitor CST may be formed in each of the pixels PX.

[0091] The thin film transistors T1, T2, T3, T4, T5, T6, and T7 may be at least one of an amorphous silicon thin film transistor (amorphous-Si TFT), a low temperature polysilicon (LTPS) thin film transistor, or an oxide thin film transistor (Oxide TFT). The oxide thin film transistor may include an oxide semiconductor layer formed of amorphous

indium-gallium-zinc-oxide (IGZO), zinc-oxide (ZnO), titanium oxide (TiO), or the like as an active pattern 130.

[0092] The driving thin film transistor T1, the switching thin film transistor T2, the compensation thin film transistor T3, the initialization thin film transistor T4, the operation control thin film transistor T5, the light emission control thin film transistor T6, and the bypass thin film transistor T7 may be formed along the active pattern 130, and the active pattern 130 may be formed to be bent into various shapes.

[0093] The active pattern 130 may include an active line 131 extending along the first direction. In an exemplary embodiment, the active line 131 may be located between the active pattern 130 of the bypass thin film transistor T7 of a pixel located in an i-th row and the active pattern 130 of the initialization thin film transistor T4 of a pixel located in an (i+1)-th row. In an exemplary embodiment, the active line 131 may be located between the active pattern 130 of the bypass thin film transistor T7 of a pixel located in a j-th column and the active pattern 130 of the initialization thin film transistor T4 of a pixel located in a (j+1)-th row. For example, the active line 131 may be located between the active pattern 130 of the bypass thin film transistor T7 of the first pixel PX1 located in the i-th row and the j-th column and the active pattern 130 of the initialization thin film transistor T4 of the second pixel PX2 located in the (i+1)-th row and the (j+1)-th column.

[0094] The initialization voltage lines 150a and 150b may be disposed on the active line 131 while being insulated thereto. The initialization voltage lines 150a and 150b may partially overlap the active line 131.

[0095] Hereinafter, structures of the active line 131 and the initialization voltage line 150b of the display substrate according to an exemplary embodiment will be described in detail with reference to FIGS. 4 and 5.

[0096] FIG. 4 is a diagram illustrating an exemplary embodiment of conductive lines of the display substrate device shown in FIG. 3. For example, FIG. 4 illustrates an enlarged area A in FIG. 3. FIG. 5 is a cross-sectional view of the display substrate in FIG. 4 taken along a line I-I' of FIG. 4.

[0097] Referring to FIGS. 4 and 5, a buffer layer 111 may be disposed on a substrate 110. The substrate 110 may be formed as an insulation substrate that is made of glass, quartz, ceramic, plastic, or the like.

[0098] A first conductive line may be disposed on the buffer layer 111. The first conductive line may correspond to the active line 131 in FIG. 3. The first conductive line is not limited to the active line 131. However, for explanatory purposes only, the description hereinafter will be made based on an assumption that the first conductive line is the active line 131. The active line 131 may extend along the first direction, and may include a first side surface 131\_1 and a second side surface 131\_2 disposed opposite to each other.

[0099] A first insulation layer covering the active line 131 may be disposed on the buffer layer 111. The first insulation layer may correspond to a gate insulation layer 140. The first insulation layer is not limited to the gate insulation layer 140. However, for explanatory purposes only, the description hereinafter will be made based on an assumption that the first insulation layer is the gate insulation layer 140. The gate insulation layer 140 may include a first gate insulation layer 141 disposed on the buffer layer 111 and covering the active line 131, and a second gate insulation layer 142 disposed on the first gate insulation layer 141.

[0100] The gate lines **121a** and **121b**, the initialization lines **122a** and **122b**, and light emission control lines **123a** and **123b** illustrated in FIG. 3 may be disposed on the first gate insulation layer **141**. Further, one end of the storage capacitor CST and an electrode acting as the gate of the driving thin film transistor T1 may be disposed on the first gate insulation layer **141**.

[0101] The second gate insulation layer **142** covering the gate lines **121a** and **121b**, the initialization lines **122a** and **122b**, and light emission control lines **123a** and **123b** may be disposed on the first gate insulation layer **141**. A second conductive line may be disposed on the second gate insulation layer **142**. The second conductive line may correspond to the initialization voltage lines **150a** and **150b** in FIG. 3. The second conductive line is not limited to the initialization voltage lines **150a** and **150b**. However, for explanatory purposes only, the description hereinafter will be made based on an assumption that the second conductive line is one of the initialization voltage lines **150a** and **150b**. Further, an electrode acting as the other end of the storage capacitor CST may be disposed on the second gate insulation layer **142**.

[0102] A second insulation layer covering the initialization voltage lines **150a** and **150b** may be disposed on the second gate insulation layer **142**. The second insulation layer may correspond to an insulation interlayer **160**. The second insulation layer is not limited to the insulation interlayer **160**. However, for explanatory purposes only, the description hereinafter will be made based on an assumption that the second insulation layer is the insulation interlayer **160**. A third conductive line and a fourth conductive line may be disposed on the insulation interlayer **160**. The third conductive line and the fourth conductive line may correspond to the data lines **171a** and **171b** and the power lines **172a** and **172b** in FIG. 3, respectively. The third conductive line and the fourth conductive line are not limited to the data lines **171a** and **171b** and the power lines **172a** and **172b**, respectively. However, for explanatory purposes only, the description hereinafter will be made based on an assumption that the third conductive line and the fourth conductive line are the data lines **171a** and **171b** and the power lines **172a** and **172b**, respectively. The data lines **171a** and **171b** and the power lines **172a** and **172b** may intersect the initialization voltage lines **150a** and **150b** with the insulation interlayer **160** disposed in between. For example, the data lines **171a** and **171b** and the power lines **172a** and **172b** may extend along the second direction.

[0103] As illustrated in FIG. 4, the initialization voltage line **150b** may include portions overlapped with the active line **131**. In the portions overlapped with the active line **131**, the initialization voltage line **150b** may include substantially linear portions, such as a first straight portion **151** and a second straight portion **152** which extend along the first direction, and an angled portion, such as diagonal portion **153**, disposed between the first straight portion **151** and the second straight portion **152**. At least one side surface of the diagonal portion **153** may extend along a third direction. The third direction may be a direction between the first direction and the second direction which intersects the first and second directions. For example, the third direction may make an acute angle with the first direction in a clockwise direction. The initialization voltage line **150b** may include a first side surface **150b\_1** and a second side surface **150b\_2** opposite to each other. Accordingly, at least one of the first

side surface **150b\_1** and the second side surface **150b\_2** of the diagonal portion **153** may extend along the third direction. Further, all of the first side surface **150b\_1** and the second side surface **150b\_2** of the first straight portion **151** and the first side surface **150b\_1** and the second side surface **150b\_2** of the second straight portion **152** may extend along the first direction.

[0104] In an exemplary embodiment, the diagonal portion **153** of the initialization voltage line **150b** may be located between the data line **171a** and **171b** and the power line **172a** and **172b**. For example, the diagonal portion **153** of the initialization voltage line **150b** may be located between a *j*-th column power line **172a** and a (*j*+1)-th column data line **171b**. In this case, the first straight portion **151** of the initialization voltage line **150b** may intersect the *j*-th column power line **172a**, and the second straight portion **152** of the initialization voltage line **150b** may intersect the (*j*+1)-th column data line **171b**.

[0105] As shown in the plan view of FIG. 4, at least one side surface of the diagonal portion **153** of the initialization voltage line **150b** may extend in a direction intersecting the direction of a side surface of the active line **131**. At least one of the first side surface **150b\_1** and the second side surface **150b\_2** of the diagonal portion **153** of the initialization voltage line **150b** may extend in a direction intersecting the direction of any one of the first side surface **131\_1** and the second side surface **131\_2** of the active line **131**. In an exemplary embodiment, the first side surface **150b\_1** of the diagonal portion **153** of the initialization voltage line **150b** may extend in a direction intersecting the direction of the first side surface **131\_1** of the active line **131**, and the second side surface **150b\_2** of the diagonal portion **153** of the initialization voltage line **150b** may extend in a direction intersecting the direction of the second side surface **131\_2** of the active line **131**.

[0106] In an exemplary embodiment, opposing side surfaces **150b\_1** and **150b\_2** of the diagonal portion **153** of the initialization voltage line **150b** may extend along the third direction. In this case, a part of the first straight portion **151** of the initialization voltage line **150b** may overlap the active line **131**, and a part of the second straight portion **152** of the initialization voltage line **150b** may overlap the active line **131**. For example, as illustrated in FIG. 4, a part of the first straight portion **151** of the initialization voltage line **150b** adjacent to the second side surface **150b\_2** may overlap a part of the active line **131** adjacent to the first side surface **131\_1**, and a part of the second straight portion **152** of the initialization voltage line **150b** adjacent to the first side surface **150b\_1** may overlap a part of the active line **131** adjacent to the second side surface **131\_2**. In an exemplary embodiment, the first side surface **150b\_1** and the second side surface **150b\_2** of the diagonal portion **153** of the initialization voltage line **150b** may be parallel to each other.

[0107] A first horizontal distance **hd1** extending between respective side surfaces of the active line **131** and the first straight portion **151** of the initialization voltage line **150b** or a second horizontal distance **hd2** extending between respective side surfaces of the active line **131** and the second straight portion **152** of the initialization voltage line **150b** may be greater than a predetermined distance. The first horizontal distance **hd1** may be a horizontal distance between the first side surface **131\_1** of the active line **131** and the first side surface **150b\_1** of the first straight portion **151** of the initialization voltage line **150b** or a horizontal

distance between the second side surface **131\_2** of the active line **131** and the second side surface **150b\_2** of the first straight portion **151** of the initialization voltage line **150b**. Further, the second horizontal distance **hd2** may be a horizontal distance between the first side surface **131\_1** of the active line **131** and the first side surface **150b\_1** of the second straight portion **152** of the initialization voltage line **150b** or a horizontal distance between the second side surface **131\_2** of the active line **131** and the second side surface **150b\_2** of the second straight portion **152** of the initialization voltage line **150b**. Here, the horizontal distance may be a distance between respective side surfaces of the active line **131** and initialization voltage line **150b** assuming that the active line **131** and the initialization voltage line **150b** are located in the same planar surface. In an exemplary embodiment, the first horizontal distance **hd1** or the second horizontal distance **hd2** may be greater than about  $0.45\ \mu\text{m}$ . In an exemplary embodiment, the first horizontal distance **hd1** or the second horizontal distance **hd2** may be greater than about  $1.48\ \mu\text{m}$  in consideration of the process margin.

[0108] In an exemplary embodiment, the first horizontal distance **hd1** and the second horizontal distance **hd2** may be greater than about  $0.45\ \mu\text{m}$  as illustrated in FIG. 4. When the horizontal distance between respective side surfaces of the active line **131** and the initialization voltage line **150b** is less than about  $0.45\ \mu\text{m}$ , a relatively large and deep step portion in the regions indicated with S in FIG. 5 may be formed on the insulation interlayer **160** where it overlaps section **153** of the initialization voltage line **150b**, and an unwanted residual conductive layer may be formed on the insulation interlayer **160** during the etching process that removes material to form data and power lines **172a** and **171b**, due to the depth of the large step portion at S. When the residual conductive layer is formed along the first direction, the data line **171b** and the power line **172a** may be shorted by the residual conductive layer.

[0109] When the first horizontal distance **hd1** and the second horizontal distance **hd2** are greater than about  $0.45\ \mu\text{m}$  like as the above-described exemplary embodiment, a relatively small step portion may be formed in the insulation interlayer **160** covering the initialization voltage line **150b**, and the unwanted residual conductive layer may not be formed on the insulation interlayer **160**. In an exemplary embodiment, the first horizontal distance **hd1** and the second horizontal distance **hd2** may be greater than about  $1.48\ \mu\text{m}$ .

[0110] FIG. 6 is a diagram illustrating conductive lines of a display substrate according to another exemplary embodiment.

[0111] In an exemplary embodiment, one of the first horizontal distance **hd1** and the second horizontal distance **hd2** may be greater than about  $0.45\ \mu\text{m}$ , and the other may be less than about  $0.45\ \mu\text{m}$ . For example, the first horizontal distance **hd1** may be greater than about  $0.45\ \mu\text{m}$ , and the second horizontal distance **hd2** may be less than about  $0.45\ \mu\text{m}$  as illustrated in FIG. 6. When a horizontal distance between a respective side surfaces of the active line **131** and the initialization voltage line **150b** is less than about  $0.45\ \mu\text{m}$ , a relatively large step portion may be formed in the insulation interlayer **160** covering the initialization voltage line **150b** according to the active line **131** and the initialization voltage line **150b**, which are overlapped, and an unwanted residual conductive layer may be formed on the insulation interlayer **160** due to the large step portion. When the residual conductive layer is formed along the first

direction, the data line **171b** and the power line **172a** may be connected by the residual conductive layer.

[0112] When the first horizontal distance **hd1** is greater than about  $0.45\ \mu\text{m}$  and the second horizontal distance **hd2** is less than about  $0.45\ \mu\text{m}$  like as the above-described exemplary embodiment, an unwanted residual conductive layer may be formed at a portion on the insulation interlayer **160** adjacent to the data line **171b**, however, the unwanted residual conductive layer may not be formed at a portion on the insulation interlayer **160** adjacent to the power line **172a**. Therefore, the data line **171b** and the power line **172a** may not be connected to each other. In an exemplary embodiment, one of the first horizontal distance **hd1** and the second horizontal distance **hd2** may be greater than about  $1.48\ \mu\text{m}$ , and the other may be less than about  $1.48\ \mu\text{m}$  in consideration of the process margin.

[0113] FIG. 7 is a diagram illustrating conductive lines of a display substrate according to yet another exemplary embodiment.

[0114] Referring to FIG. 7, in an exemplary embodiment, one of the opposing side surfaces of the diagonal portion **153** of the initialization voltage line **150b** may extend along the third direction, and another of the opposing side surfaces of the diagonal portion **153** may extend along a fourth direction. The fourth direction may be a direction between the first direction and the second direction which intersect each other, and may intersect the third direction. For example, the fourth direction may make an acute angle with the first direction in a counter clockwise direction. In this case, a part of the first straight portion **151** of the initialization voltage line **150b** may overlap the active line **131**, and an entirety of the second straight portion **152** of the initialization voltage line **150b** may overlap the active line **131**. For example, as illustrated in FIG. 7, parts of the first straight portion **151** of the initialization voltage line **150b** respectively adjacent to the first side surface **150b\_1** and the second side surface **150b\_2** may not overlap the active line **131**, and parts of the second straight portion **152** of the initialization voltage line **150b** respectively adjacent to the first side surface **150b\_1** and the second side surface **150b\_2** may overlap the active line **131**. In an exemplary embodiment, the first side surface **150b\_1** and the second side surface **150b\_2** of the diagonal portion **153** of the initialization voltage line **150b** may be symmetrical with respect to the first direction.

[0115] FIG. 8 is a diagram illustrating conductive lines of a display substrate according to still another exemplary embodiment. FIG. 9 is a diagram illustrating conductive lines of a display substrate according to yet still another exemplary embodiment.

[0116] Referring to FIGS. 8 and 9, one of the opposing side surfaces of the diagonal portion **153** of the initialization voltage line **150b** may extend along the third direction, and another of the opposing side surfaces of the diagonal portion **153** may extend along the first direction. In this case, one of the opposing side surfaces **150b\_1** and **150b\_2** of the initialization voltage line **150b** may extend along the first direction. For example, the first side surface **150b\_1** of the initialization voltage line **150b** may extend along the first direction as illustrated in FIG. 8.

[0117] In an exemplary embodiment, a part of the initialization voltage line **150b** adjacent to a side surface extending along the first direction may not overlap the active line **131**. For example, a part of the initialization voltage line **150b**

adjacent to the first side surface **150b\_1** extending along the first direction may not overlap the active line **131** as illustrated in FIG. 8.

**[0118]** In an exemplary embodiment, a part of the initialization voltage line **150b** adjacent to a side surface extending along the first direction may overlap the active line **131**. For example, a part of the initialization voltage line **150b** adjacent to the first side surface **150b\_1** extending along the first direction may overlap the active line **131** as illustrated in FIG. 9.

**[0119]** Organic light emitting display device constructed according to principles and exemplary embodiments of the invention may be applied to display devices included in a computer, a notebook, a mobile phone, a smartphone, a smart pad, a PMP, a PDA, an MP3 player, or the like. Moreover, the principles of the invention may be applied to and used in the display substrates of other types of display devices beside organic light emitting display devices.

**[0120]** Some of the advantages that may be achieved by exemplary embodiments of the invention include reducing the formation of a residual conductive layer during an etching process of a substrate, and reducing a residual conductive layer between a data line and a power line of an organic light emitting display device, during an etching process for forming such data line and the power line.

**[0121]** Although certain exemplary embodiments and implementations have been described herein, other exemplary embodiments and modifications will be apparent from this description. Accordingly, the inventive concepts are not limited to such exemplary embodiments, but rather to the broader scope of the appended claims and various obvious modifications and equivalent arrangements as would be apparent to a person of ordinary skill in the art.

What is claimed is:

1. A display substrate, comprising:

a first conductive line extending along a first direction; and

a second conductive line partially overlapping the first conductive line with a first insulation layer in between, wherein the second conductive line includes:

a first substantially linear portion and a second substantially linear portion extending along the first direction; and

an angled portion disposed between the first substantially linear portion and the second substantially linear portion, the angled portion having at least one side surface extending along a second direction intersecting the first direction.

2. The display substrate of claim 1, wherein the at least one side surface of the angled portion intersects a side surface of the first conductive line.

3. The display substrate of claim 1, wherein the angled portion has opposing side surfaces extending along the second direction.

4. The display substrate of claim 1, wherein the angled portion has opposing side surfaces, with one of the opposing side surfaces of the angled portion extending along the second direction, and

another of the opposing side surfaces of the angled portion extending along a third direction different from the first and second directions.

5. The display substrate of claim 1, wherein the angled portion has opposing side surfaces, with one of the opposing side surfaces of the angled portion extending along the second direction, and

another of the opposing side surfaces of the angled portion extending along the first direction.

6. The display substrate of claim 1, wherein the first and second conductive lines each has side surfaces, and a first horizontal distance between a side surface of the first conductive line and a side surface of the first substantially linear portion of the second conductive line is greater than about 0.45  $\mu\text{m}$ .

7. The display substrate of claim 6, wherein the first horizontal distance is greater than about 1.48  $\mu\text{m}$ .

8. The display substrate of claim 6, wherein a second horizontal distance between a side surface of the first conductive line and a side surface of the second substantially linear portion of the second conductive line is greater than about 0.45  $\mu\text{m}$ .

9. The display substrate of claim 8, wherein the second horizontal distance is greater than about 1.48  $\mu\text{m}$ .

10. The display substrate of claim 1, further comprising a third conductive line and a fourth conductive line each intersecting the second conductive line with a second insulation layer in between,

wherein the angled portion of the second conductive line is disposed between the third conductive line and the fourth conductive line.

11. An organic light emitting display device, comprising: an active pattern comprising an active line extending along a first direction;

a signal line comprising an initialization voltage line partially overlapping the active line with a gate insulation layer in between, a gate line and an initialization line extending along the first direction, and a data line and a power line extending along a second direction intersecting the first direction; and

a plurality of pixels each connected to the signal line, the plurality of pixels each comprising a plurality of thin film transistors formed along the active pattern, a capacitor connected to the power line, and an organic light emitting diode,

wherein the initialization voltage line includes:

a first substantially linear portion and a second substantially linear portion extending along the first direction; and

an angled portion disposed between the first substantially linear portion and the second substantially linear portion, the angled portion having at least one side surface extending along a third direction different from the first and second directions.

12. The organic light emitting display device of claim 11, wherein the at least one side surface of the angled portion intersects a side surface of the active line.

13. The organic light emitting display device of claim 11, wherein the angled portion has opposing side surfaces extending along the third direction.

14. The organic light emitting display device of claim 11, wherein the angled portion has opposing side surfaces, with one of the opposing side surfaces of the angled portion extending along the third direction, and

another of the opposing side surfaces extending along a fourth direction.

**15.** The organic light emitting display device of claim **11**, wherein the angled portion has opposing side surfaces, with one of the opposing side surfaces extending along the third direction, and

another of the opposing side surfaces extending along the first direction.

**16.** The organic light emitting display device of claim **11**, wherein each of the plurality of pixels comprises a switching thin film transistor connected to the gate line and the data line, a driving thin film transistor connected to a drain of the switching thin film transistor, an initialization thin film transistor turned on by an initialization signal transmitted through the initialization line to apply an initialization voltage transmitted through the initialization voltage line, and a bypass thin film transistor connected to an anode of the organic light emitting diode, and

wherein the active line is between the bypass thin film transistor of a pixel in an  $i$ -th row and the initialization thin film transistor of a pixel in an  $(i+1)$ -th row, wherein  $i$  is a natural number.

**17.** The organic light emitting display device of claim **16**, wherein the active line is between the bypass thin film transistor of a pixel in a  $j$ -th column and the initialization thin film transistor of a pixel in a  $(j+1)$ -th column, wherein  $j$  is a natural number.

**18.** The organic light emitting display device of claim **11**, wherein the data line and the power line intersect the initialization voltage line, respectively, with an insulation interlayer in between, and

wherein the angled portion of the initialization voltage line is between the data line and the power line.

**19.** The organic light emitting display device of claim **18**, wherein each of the plurality of pixels comprises a switching thin film transistor connected to the gate line and the data line,

wherein the power line is connected to the capacitor of a pixel in a  $j$ -th column, and

wherein the data line is connected to the switching thin film transistor of a pixel in a  $(j+1)$ -th column, wherein  $j$  is a natural number.

**20.** The organic light emitting display device of claim **11**, wherein the gate insulation layer comprises a first gate insulation layer and a second gate insulation layer,

wherein the gate line and the initialization line are on the active pattern with the first gate insulation layer in between, and

wherein the initialization voltage line is on the gate line and the initialization line with the second gate insulation layer in between.

\* \* \* \* \*

专利名称(译)	显示基板和包括其的有机发光显示装置		
公开(公告)号	<a href="#">US20190103454A1</a>	公开(公告)日	2019-04-04
申请号	US16/052616	申请日	2018-08-02
[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.		
[标]发明人	SO DONG YOON KIM TAE GON		
发明人	SO, DONG-YOON KIM, TAE GON		
IPC分类号	H01L27/32		
CPC分类号	H01L27/3276 H01L2251/5392 G09G3/3266 G09G3/3291 G09G2310/08 G09G3/3233 G09G2300/0842 G09G2310/0251 G09G2310/0262		
优先权	1020170128142 2017-09-29 KR		
外部链接	<a href="#">Espacenet</a> <a href="#">USPTO</a>		

摘要(译)

显示基板包括沿第一方向延伸的第一导线和与第一导线部分重叠的第二导线，其间具有第一绝缘层。第二导线包括沿第一方向延伸的第一基本线性部分和第二基本线性部分，以及设置在第一基本线性部分和第二基本线性部分之间的成角度部分。成角度部分的至少一个侧表面沿与第一方向相交的第二方向延伸。

