US 20100044692A1

(19) United States

(12) Patent Application Publication

KIM et al.

(10) **Pub. No.: US 2010/0044692 A1**

(43) **Pub. Date: Feb. 25, 2010**

(54) ORGANIC LIGHT EMITTING DIODE DISPLAY AND METHOD FOR MANUFACTURING THE SAME

(75) Inventors: **Eun-Ah KIM**, Suwon-si (KR); **Hee-Chul JEON**, Suwon-si (KR); **Woo-Suk JUNG**, Suwon-si (KR); **Hee-Seong JEONG**, Suwon-si (KR); **Joo-Hwa LEE**, Suwon-si (KR); **Chul-Woo JEONG**, Suwon-si (KR); **Noh-Min KWAK**, Suwon-si (KR); **Soon-Ryong PARK**, Suwon-si (KR)

Correspondence Address:
KNOBBE MARTENS OLSON & BEAR LLP
2040 MAIN STREET, FOURTEENTH FLOOR
IRVINE, CA 92614 (US)

(73) Assignee: **SAMSUNG SDI CO., LTD.**, Suwon-si (KR)

(21) Appl. No.: **12/544,531**

(22) Filed: **Aug. 20, 2009**

(30) **Foreign Application Priority Data**

Aug. 20, 2008 (KR) 10-2008-0081403

Publication Classification

(51) **Int. Cl.**
H01L 51/52 (2006.01)
H01L 51/56 (2006.01)

(52) **U.S. Cl.** **257/40**; 438/29; 257/98; 438/99; 257/E51.022

(57) ABSTRACT

The present invention relates to an organic light emitting diode (OLED) display and a manufacturing method thereof. The OLED display includes a substrate member that includes a plurality of pixel areas. A thin film transistor (TFT) is formed on the substrate member and includes a gate electrode, a source electrode, and a drain electrode. A planarization layer is formed on the TFT and includes a contact hole through which the drain electrode is partially exposed. A pixel electrode is formed on the planarization layer and is connected to the drain electrode of the TFT through the contact hole. A pixel defining layer is formed on the planarization layer and has a through opening. Light scattering spacers are formed on the pixel defining layer to scatter reflected light and may have various shapes and dimensions.

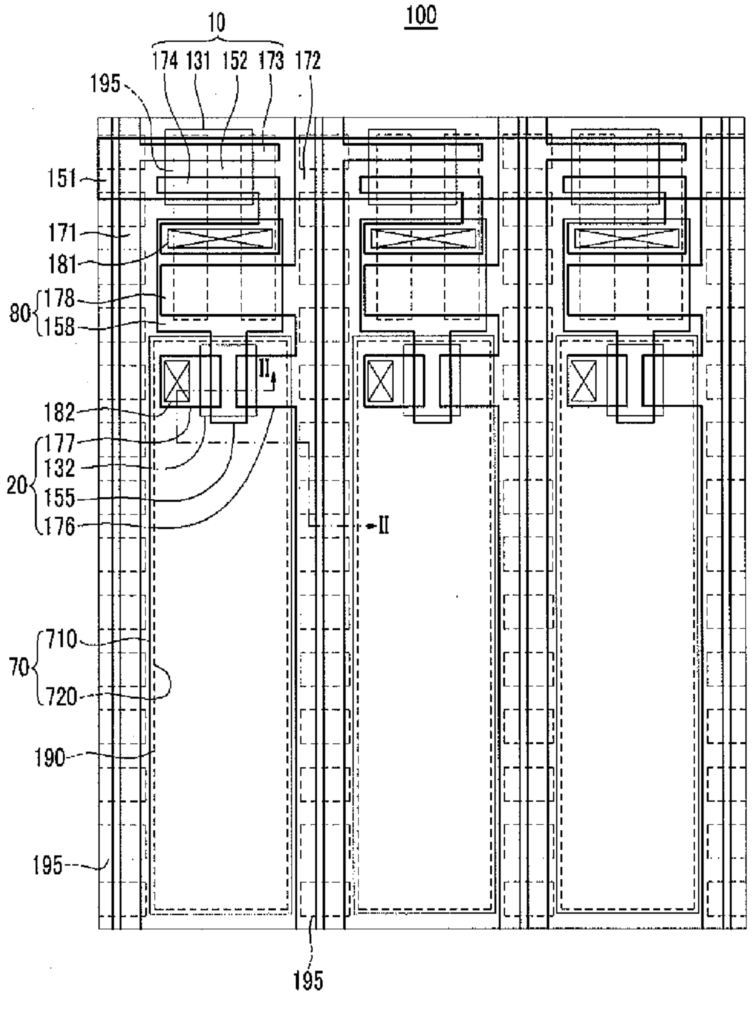


FIG. 1

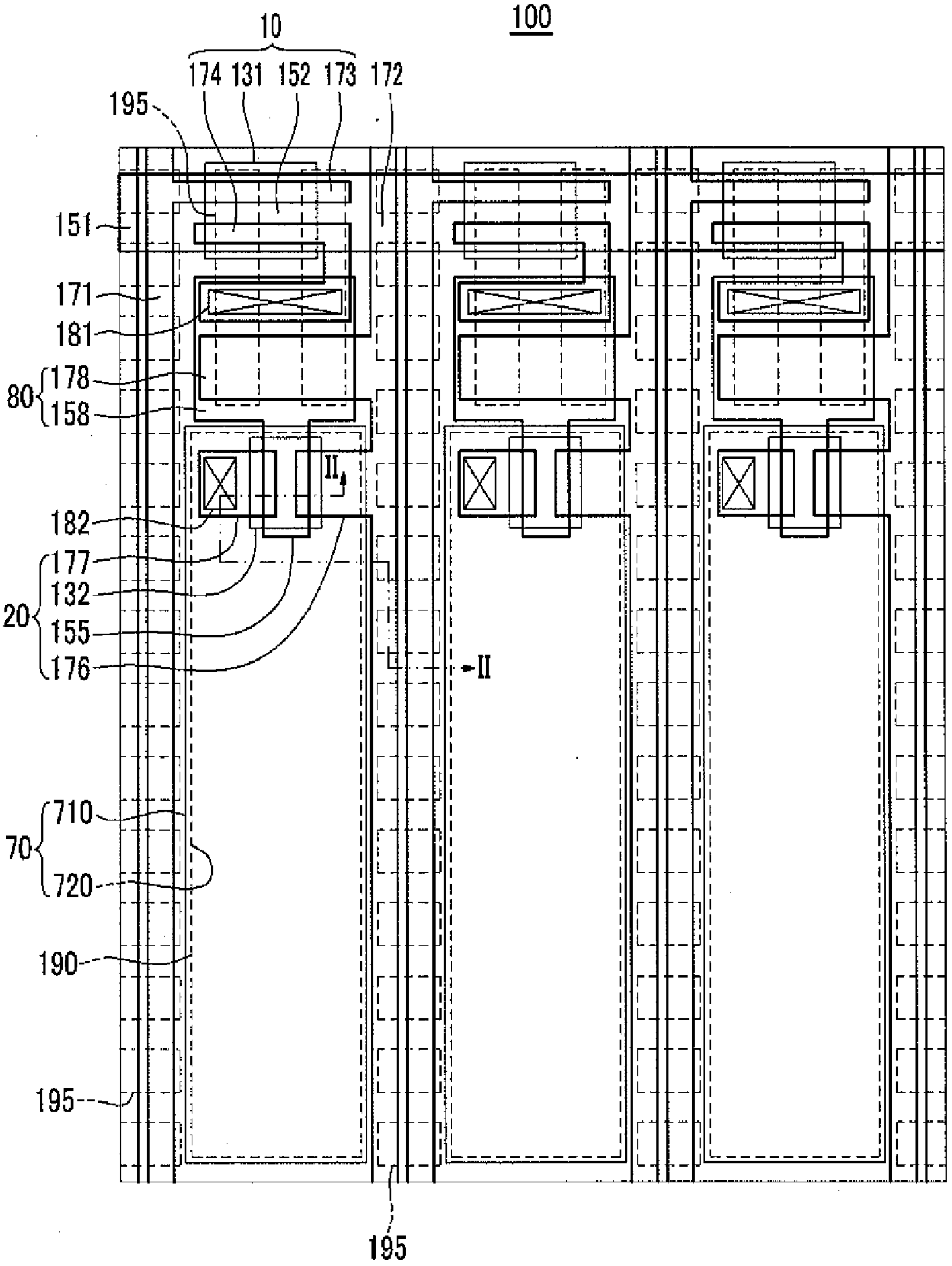

100
10
174
131
152
173
172
195
151
171
181
80
178
158
II
182
20
177
132
155
176
II
70
710
720
190
195
195

FIG. 2

100

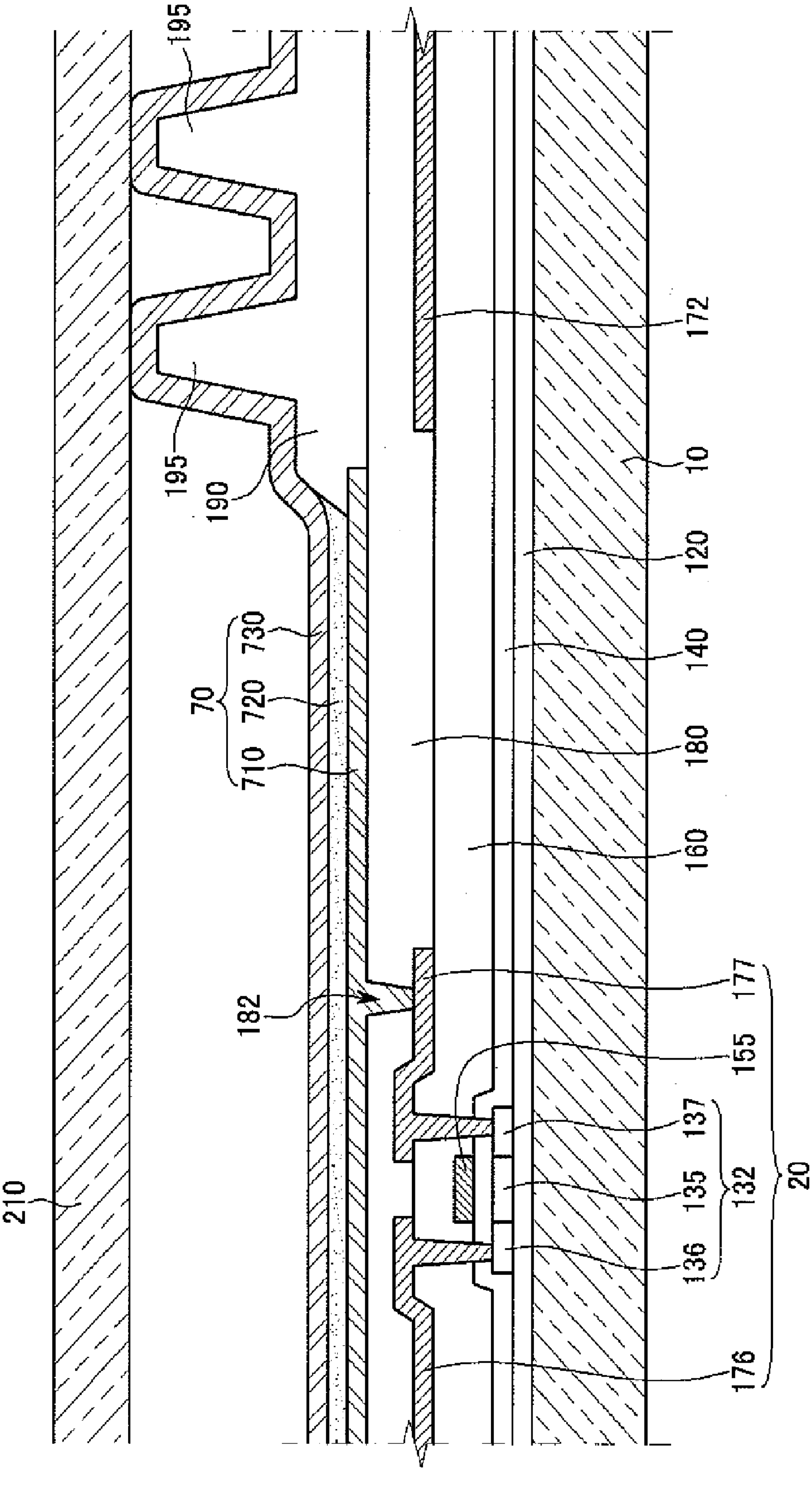

210
195
195
190
70
730
720
710
182
172
10
120
140
180
160
177
155
137
135
136
132
20
176

FIG. 3

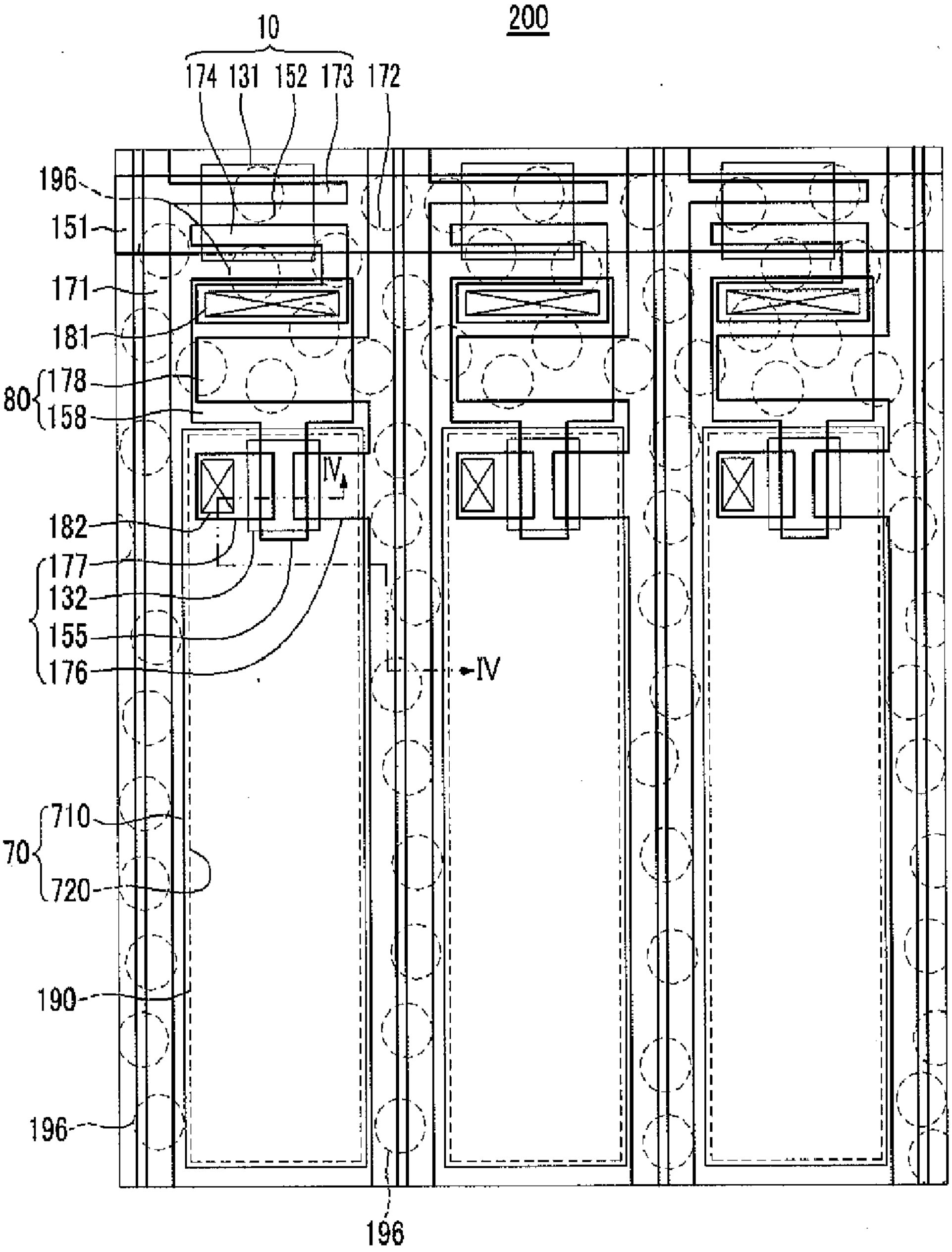

200
10
174
131
152
173
172
196
151
171
181
80
178
158
182
177
132
155
176
IV
IV
70
710
720
190
196
196

FIG. 4

200

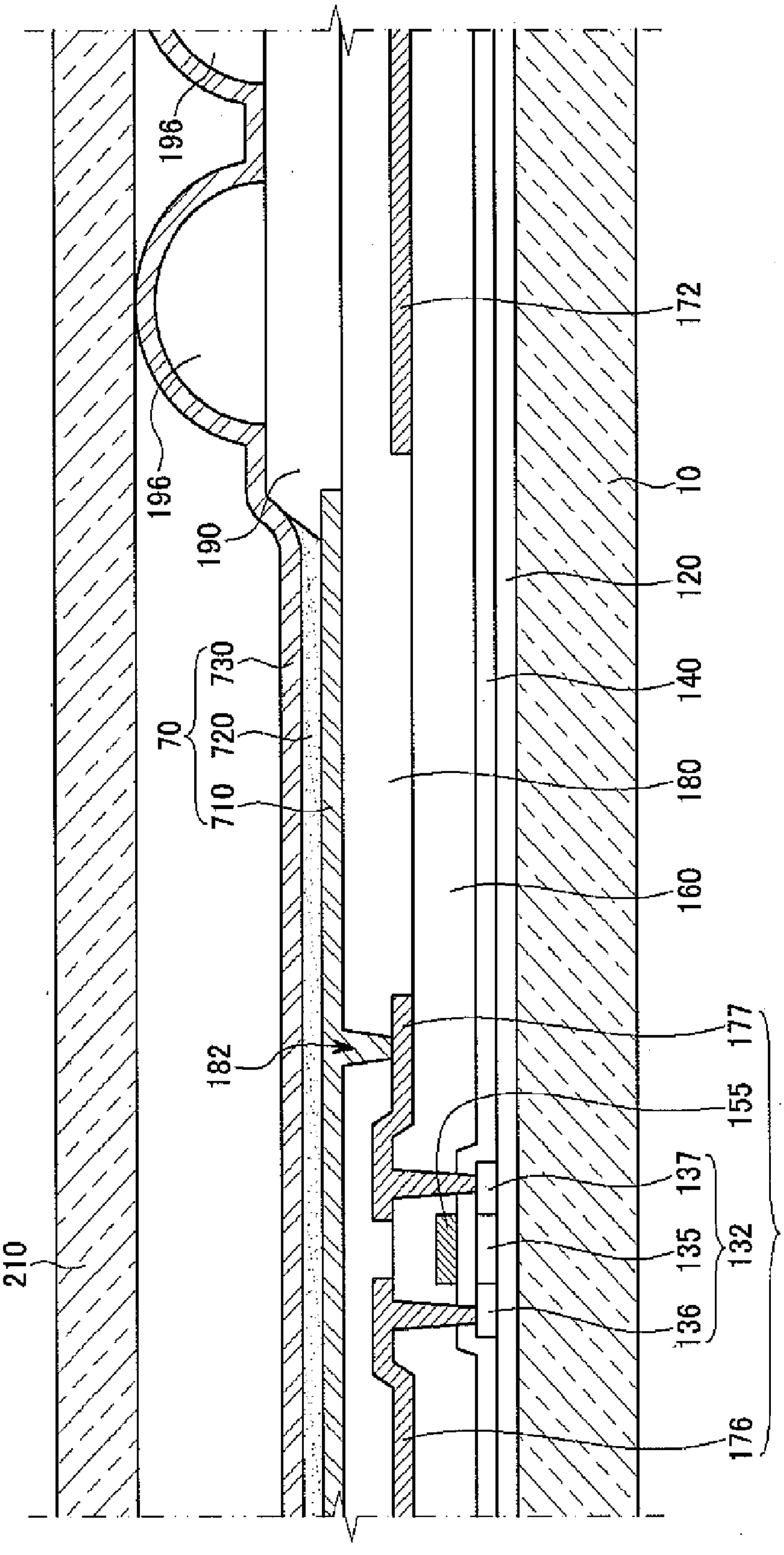

210
196
196
190
70
730
720
710
182
172
10
120
140
180
160
177
155
137
135
136
132
20
176

FIG. 5

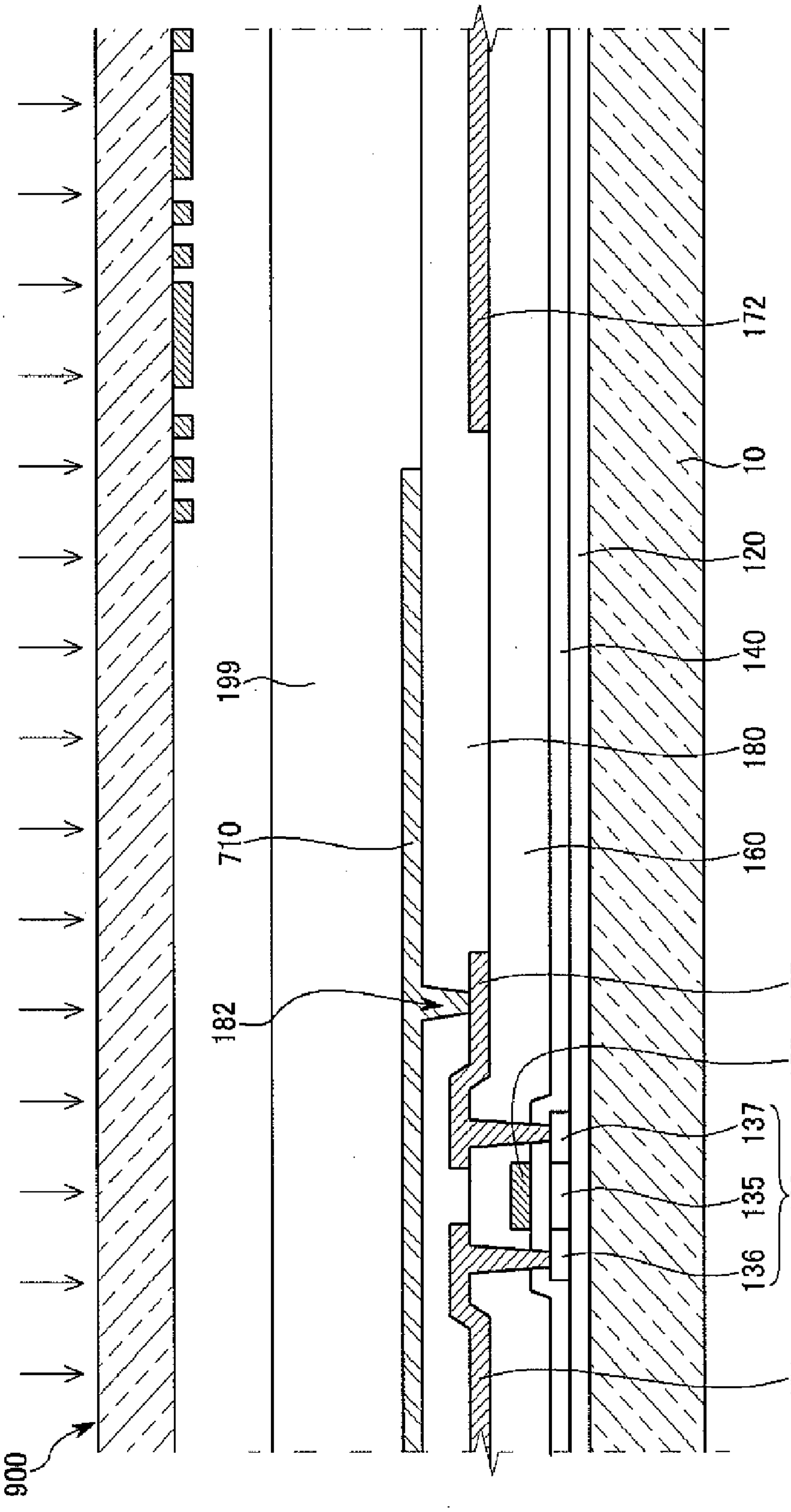
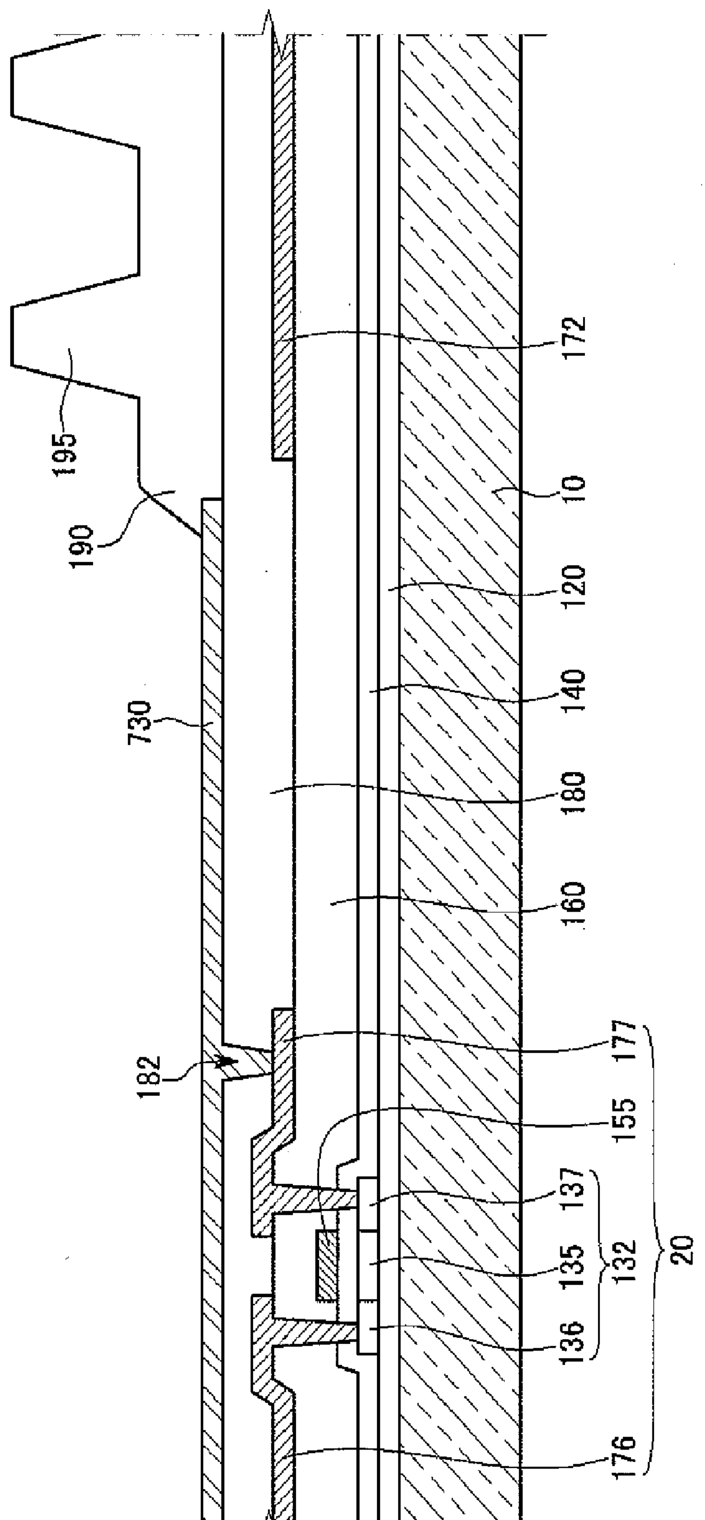

900
199
710
182
172
10
120
140
180
160
177
155
137
135
136
132
176
20

FIG. 6


195
190
730
182
172
10
120
140
180
160
177
155
137
135
136
132
20
176

ORGANIC LIGHT EMITTING DIODE DISPLAY AND METHOD FOR MANUFACTURING THE SAME

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application claims priority to and the benefit of Korean Patent Application No. 10-2008-0081403 filed in the Korean Intellectual Property Office on Aug. 20, 2008, the entire contents of which are incorporated herein by reference.

BACKGROUND

[0002] 1. Field

[0003] The present invention relates to an organic light emitting diode (OLED) display and a manufacturing method thereof. More particularly, the present invention relates to an OLED display with improved visibility by suppressing reflection of external light, and a manufacturing method thereof.

[0004] 2. Description of the Related Art

[0005] An OLED display includes a plurality of organic light emitting diodes (OLEDs). OLEDS typically include hole injection electrodes, an organic light emission layer, and electron injection electrodes. Light is emitted as excitons are generated in the organic light emission layer. The excitons are generated as electrons and holes are combined and drop from an excited state to a ground state. The OLED display displays an image by using the light resulting from these excitons.

[0006] Accordingly, an OLED display has self-luminance characteristics, and unlike a liquid crystal display (LCD), the thickness and weight thereof can be reduced since a separate light resource is not required. OLED displays are thus used in various applications, such as displays in mobile electronic devices, because OLED displays have low power consumption, high luminance, and high reaction speed.

[0007] However, the electrodes and other metal wires in the OLED display can reflect external light, such as ambient light. Unfortunately, this reflection of external light can deteriorate an OLED's display characteristics, such as black color expression and contrast.

[0008] The above information disclosed in this Background section is only for enhancement of understanding. Therefore, it may contain information that does not form the prior art that is already known in this country to a person of ordinary skill in the art.

SUMMARY

[0009] Embodiments of the present invention can provide an organic light emitting diode (OLED) display having improved visibility by suppressing reflection of external light, such as ambient light. Furthermore, embodiments of the present invention provide a manufacturing method for an OLED display.

[0010] An exemplary OLED display according to an embodiment of the present invention includes: a substrate member including a plurality of pixel areas; a thin film transistor (TFT) including a gate electrode, a source electrode, and a drain electrode and formed on the substrate member; a planarization layer formed on the TFT and having a contact hole through which the drain electrode is partially exposed; a pixel electrode formed on the planarization layer, and connected to the drain electrode of the TFT through the contact hole; a pixel defining layer formed on the planarization layer and having an opening therethrough; and a light scattering spacer formed on the pixel defining layer. Each pixel area includes one pixel electrode and a plurality of light scattering spacers.

[0011] The OLED display may further include a conductive layer that is formed on the same layer as at least one of the gate electrode, the source electrode, and the pixel electrode with the same material thereof. At least a part of the conductive layer may be disposed under the light scattering spacer.

[0012] The light scattering spacer may be shaped as a frustum of a pyramid, a prism, a truncated circular cone, a cylinder, a hemisphere, and a hemispheroid. The plurality of light scattering spacers may also be irregularly disposed in each pixel area. A ratio of the entire bottom dimension of the light scattering spacers to each pixel area may be greater than 30% of a ratio of an area of the pixel defining layer to the pixel area. A bottom dimension of one light scattering spacer may range between 1% to 20% of the ratio of the area of the pixel defining layer to the pixel area.

[0013] The OLED display may further include a sealing member disposed facing the substrate member with the thin film transistor interposed therebetween. The light scattering spacer may maintain a distance between the substrate member and the sealing member. The light scattering spacer may be integrally formed with the pixel defining layer and may be formed with the same material as the pixel defining layer.

[0014] An exemplary manufacturing method of an OLED display according to another embodiment of the present invention includes: forming a thin film transistor (TFT) that includes a gate electrode, a source electrode, and a drain electrode on a substrate member that includes a plurality of pixel areas; forming a planarization layer that covers the TFT and has a contact hole through which the drain electrode is partially exposed; forming a pixel electrode connected to the drain electrode of the TFT through the contact hole on the planarization layer; coating a photo-sensitive material layer on the planarization layer and the pixel electrode; and forming a pixel defining layer by patterning the photo-sensitive material layer with a photolithography process using a mask on the planarization layer and simultaneously forming a light scattering spacer on the pixel defining layer, the pixel defining layer having an opening through which the pixel electrode is exposed. Each of the respective pixel areas includes one pixel electrode and a plurality of light scattering spacers. The photolithography process may include a half-tone exposure process.

BRIEF DESCRIPTION OF THE DRAWINGS

[0015] FIG. **1** is a layout view of an organic light emitting diode (OLED) display according to a first exemplary embodiment of the present invention.

[0016] FIG. **2** is a cross-sectional view of FIG. **1**, taken along the line II-II.

[0017] FIG. **3** is a layout view of an OLED display according to a second exemplary embodiment of the present invention.

[0018] FIG. **4** is a cross-sectional view of FIG. **3**, taken along the line IV-IV.

[0019] FIG. **5** and FIG. **6** are sequential cross-sectional views of a manufacturing process of the OLED display shown in FIG. **1**.

DETAILED DESCRIPTION OF SOME EMBODIMENTS

[0020] The present invention will now be described with reference to the accompanying drawings, in which exemplary embodiments of the invention are shown. Those skilled in the art will realize that the described embodiments may be modified in various different ways, all without departing from the spirit or scope of the present invention. Constituent elements having the same configuration are representatively described with reference to one or more embodiments. Other exemplary embodiments may then be described by referring to various differences between the embodiments.

[0021] The drawings and description are to be regarded as illustrative in nature and not restrictive. Like reference numerals designate like elements throughout the specification.

[0022] In the drawings, the thickness of layers, films, panels, regions, etc., may be exaggerated for clarity. For example, it should be understood that when an element, such as a layer, film, region, or substrate is referred to as being "on" another element, it can be directly on the other element or intervening elements may also be present. When an element is referred to as being "directly on" another element, there are no intervening elements present. In addition, the size and the thickness of each element in the drawing are provided for better understanding and ease of description of various embodiments and are not intended to limit the present invention.

[0023] In the accompanying drawings, an organic light emitting diode (OLED) display is illustrated. For purposes of illustration, an active matrix (AM)-type OLED display is shown having a 2Tr-1Cap structure in which two thin film transistors (TFTs) and one capacitor are formed in one pixel. But, the embodiments of the present invention are not limited thereto. Other OLED display embodiments consistent with the present invention can have various structures. For example, three or more TFTs and two or more capacitors can be provided in one pixel of an OLED display, and separate wires can be further provided in the OLED display.

[0024] One skilled in the art will recognize that the term pixel can refer to a minimum unit for displaying an image. An OLED display displays an image by using a plurality of pixels, and thus, has a plurality of pixel areas.

[0025] Exemplary embodiments of the present invention will now be described with reference to FIG. **1** and FIG. **2**. As shown in FIG. **1**, an organic light emitting diode (OLED) display **100** includes a switching thin film transistor **10**, a driving thin film transistor **20**, an OLED **70**, and a capacitor **80**. In addition, the OLED display **100** can further include a gate line **151** aligned in one direction, a data line **171** and a common power line **172**. The data line and common power line **172** respectively cross the gate line **151** to be insulated therefrom. In the example shown, the boundary of one pixel area may be defined by the gate line **151**, the data line **171**, and the common power line **172**.

[0026] The switching thin film transistor **10** is used as a switch for selecting a pixel to be light-emitted. The switching thin film transistor **10** includes a switching semiconductor layer **131**, a switching gate electrode **152**, a switching source electrode **173**, and a switching drain electrode **174**. The switching gate electrode **152** is connected to the gate line **151**. The switching source electrode **173** is connected to the data line **171**. The switching drain electrode **174** is disposed at a distance from the switching source electrode **173**, and is connected to the first sustain electrode **158**.

[0027] The driving thin film transistor **20** applies driving power for light emission of an organic emission layer **720** of an OLED **70** in the selected pixel to the pixel electrode **710**. The driving thin film transistor **20** can include a driving semiconductor layer **132**, a driving gate electrode **155**, a driving source electrode **176**, and a driving drain electrode **177**. The driving gate electrode **155** is connected to the first sustain electrode **158**. The driving source electrode **176** and the second sustain electrode **178** are respectively connected to the common power line **172**. The driving drain electrode **177** is connected to the pixel electrode **710** of the OLED **70** through a contact hole **182**.

[0028] The OLED **70** includes a pixel electrode **710**, an organic emission layer **720** formed on the pixel electrode **710**, and a common electrode **730** (also shown in FIG. **2**), which is formed on the organic emission layer **720**. Here, the pixel electrode **710** is a positive (+) electrode, which is a hole injection electrode, and the common electrode **730** is a negative (−) electrode, which is an electron injection electrode. However, the present invention is not limited to this configuration. For example, the pixel electrode **710** may be the negative electrode and the common electrode **730** may be the positive electrode.

[0029] Holes and electrodes are injected into the organic emission layer **720** respectively from the pixel electrode **710** and the common electrode **730**. Light is then emitted from the OLED **70** when holes and electrons drop from an excited state to a base state and generate excitons.

[0030] The capacitor **80** includes a first sustain electrode **158** and a second sustain electrode **178** that are disposed with a gate insulation layer **140** (also shown in FIG. **2**) that is interposed therebetween. With the above-described structure, the switching thin film transistor **10** can be driven to transmit a data voltage applied to the data line **171** to the driving this film transistor **20** by a gate voltage applied to the gate line **151**. The capacitor **80** stores a voltage that corresponds to a voltage difference between a common voltage transmitted from the common power line **172** to the driving thin film transistor **20** and the data voltage transmitted from the switching thin film transistor **10**. A current corresponding to the voltage stored in the capacitor **80** flows to the OLED **70** through the driving thin film transistor **20** so that OLED **70** emits light.

[0031] The OLED display **100** may further include a pixel defining layer **190** and a light scattering spacer **195**. The pixel defining layer **190** includes an opening through which the pixel electrode **710** is exposed. The organic emission layer **720** is substantially disposed in the opening of the pixel defining layer **190**. That is, a portion in which the pixel defining layer **190** is formed is substantially equivalent to other portions, excluding a portion where the pixel electrode **710** is formed.

[0032] The light scattering spacer **195** is formed on the pixel defining layer **190**. In one embodiment, the light scattering spacer **195** is integrally formed with the pixel defining layer **190** by using a material that is the same as that the pixel defining layer **190**. For example, the pixel defining layer **190** and the light scattering spacer **195** can be formed together by controlling the amount of exposure through a half-tone exposure process. However, the present invention is not limited to this process. For example, the pixel defining layer **190** and the light scattering spacer **195** may be sequentially formed, and they can be respectively made of different materials. In some embodiments, one pixel electrode **710** and a plurality of light scattering spacers **195** are provided in each pixel area.

[0033] As shown in FIG. **1**, the light scattering spacer **195** is overlapped with at least a part of a conductive layer formed on the same layer with the same material together with at least one of gate electrodes **152** and **155**, source electrodes **173** and **176**, drain electrodes **174** and **177**, and a pixel electrode **710**. Here, the conductive layer includes the gate line **151**, the data line **171**, the common power line **172**, the first sustain electrode **158**, and the second sustain electrode **178**. That is, at least a part of at least one of the gate line **151**, the data line **171**, the common power line **172**, the first sustain electrode **158**, and the second sustain electrode **178** may be disposed under the light scattering spacer **195**.

[0034] In addition, the light scattering spacers **195** disposed in one pixel area may have the same bottom dimension or different bottom dimensions. For example, various light scattering spacers **195** may have various bottom dimensions.

[0035] The light scattering spacer **195** scatters external light reflected to the conductive layer disposed thereunder and may suppress reflection of external light, such as ambient light. Therefore, the OLED display **100** may have improved visibility and performance.

[0036] In some embodiments, the ratio of the entire bottom dimension of light scattering spacers **195** to one pixel area is greater than 30% of a ratio of an area of the pixel defining layer **190** to the pixel area. In addition a bottom dimension of one light scattering spacer **195** may range approximately from 1% to 20% of the ratio of the area of the pixel defining layer **190** to the pixel area.

[0037] When the bottom dimension of the light scattering spacer **195** is less than 30%, a sufficient light scattering effect is not expected. However, if the bottom dimension of the light scattering spacer **195** is decreased, consistency and surface roughness may be increased so that the light scattering effect is enhanced. On the other hand, if the bottom dimension is too small, the light scattering spacer **195** may not function as a spacer.

[0038] Reference will now be made to FIG. **2**. FIG. **2** shows an OLED display **100**, the driving thin film transistor **20**, the organic light emitting element **70**, and the capacitor **80**. With the above-described configuration, the OLED display **100** can have improved visibility by suppressing reflection of external light.

[0039] Certain features of the switching thin film transistor **10** may be described to illustrate some differences from the driving thin film transistor **20**. For example, the switching thin film transistor **10** (not shown in FIG. **2**) may be a polycrystalline thin film transistor or an amorphous thin film transistor that includes an amorphous silicon layer.

[0040] The driving film transistor **20** may be a polycrystalline thin film transistor that includes a polysilicon layer. In an embodiment, the driving thin file transistor **20** may be a PMOS-structured thin film transistor with a P-type impurity. One skilled in the art will recognize that other types of thin film transistors may be employed in the embodiments. For example, the driving thin file transistor **20** may be a NMOS-structured thin film transistor or a CMOS-structure thin film transistor. The configuration of the driving thin film transistor **20** is thus not limited to the above-described embodiment. One skilled in the art will recognize that the driving thin file transistor **20** may be modified in various ways.

[0041] As shown in FIG. **2**, a substrate member **110** is formed as an insulation substrate and may be made of glass, quartz, ceramic, plastic, etc. However, the present invention is not limited to these materials. For example, the substrate member **110** can be formed from a metal, such as stainless steel.

[0042] The substrate member **110** can include a plurality of pixel areas. For example, the substrate member **110** may include a pixel area partitioned into a plurality of areas. A pixel electrode **710** and a plurality of light scattering spacers **195** may be disposed in each pixel area.

[0043] A buffer layer **120** is formed on the substrate member **110**. The buffer layer **120** prevents impurities from permeating the substrate member **110**. The buffer layer **120** may also serve as a planarization surface for the substrate member **110**. The buffer layer **120** can be made of various materials. For example, the buffer layer **120** can be made of one of a silicon nitride (SiNx) layer, a silicon dioxide (SiO_2) layer, and a silicon oxynitride (SiOxNy) layer. However, the buffer layer **120** is not always necessary and, in some embodiments, may be omitted based on the type and process conditions of the substrate member **110**.

[0044] A driving semiconductor **132** is formed on the driving buffer layer **120**. The driving semiconductor layer **132** may be formed with a polysilicon layer. The driving semiconductor layer **132** can include a channel region **135** that is not doped. The driving semiconductor layer **132** may further include a source region **136** and a drain region **137** that are doped with p+ impurities at respective sides of the channel region **135**. The doped ion material may be a P-type impurity, such as boron (B) material like B_2H_6. The impurities used may change in accordance with the type of the thin film transistor employed. The gate insulation layer **140** made of silicon nitride (SiNx) or silicon dioxide (SiO_2) is formed on the driving semiconductor layer **132**. A gate wire including the driving gate electrode **155** is formed on the gate insulating layer **140**. The gate wire further includes the gate line **151** (shown in FIG. **1**), the first sustain electrode **158** (shown in FIG. **1**), and other wires. In addition, the driving gate electrode **155** is formed to overlap at least a part of the driving semiconductor layer **132**, and particularly, is formed to overlap the channel region **135**.

[0045] An interlayer insulation layer **160** that covers the driving gate electrode **155** is formed on the gate insulating layer **140**. The gate insulating layer **140** and the interlayer insulating layer **160** share through-holes exposing the source region **136** and the drain region **137** of the driving semiconductor layer **132**. Like the gate insulation layer **140**, the interlayer insulating layer **160** is made of silicon nitride (SiNx) or silicon dioxide (SiO_2).

[0046] A data wire including the driving source electrode **176** and the driving drain electrode **177** is formed on the interlayer insulating layer **160**. The data wire further includes the data line (**171** of FIG. **1**), the common power line **172**, the second sustain electrode (**178** of FIG. **1**), and other wires. In addition, the driving source electrode **176** and the driving drain electrode **177** are respectively connected to the source region **136** and the drain region **137** of the driving semiconductor layer **132** through the through-holes.

[0047] As described, the driving thin film transistor **20** including the driving semiconductor layer **132**, the gate electrode **155**, the driving source electrode **176**, and the driving drain electrode **177** is formed. A planarization layer **180** that covers the data wires **172**, **176**, **177**, and **178** is formed on the interlayer insulating layer **160**. The planarization layer **180** removes steps and performs planarization in order to increase luminous efficiency of the OLED **70**. In addition, the planarization layer **180** has a contact hole **182** through which the drain electrode **177** is partially exposed.

[0048] The planarization layer **180** can be made of at least one of polyacrylates resin, epoxy resin, phenolic resin, polyamide resin, polyimide resin, unsaturated polyesters resin, poly phenylenethers resin, poly phenylenesulfide resin, and benzocyclobutene (BCB). The pixel electrode **710** of the OLED **70** is formed on the planarization layer **180**. The pixel electrode **710** is connected to the drain electrode **177** through the contact hole **182** of the planarization layer **180**.

[0049] In addition, a pixel defining layer **190** having an opening that exposes the pixel electrode **710** is formed on the planarization layer **180**. The pixel electrode **710** may be disposed at a location corresponding to the opening of the pixel defining layer **190**. The pixel defining layer **190** can be made of an inorganic material like a resin or silica group, such as polyacrylate resin and polyimide.

[0050] The light scattering spacer **195** is formed on the pixel defining layer **190**. The light scattering spacer **195** may be made together with the pixel defining layer **190** and may be made of substantially the same material as the pixel defining layer **190**. In addition, the light scattering spacer **195** may be disposed on a light-reflective metal wire at various locations, such as on the gate line (**151** of FIG. **1**), the data line (**171** of FIG. **1**), the common power line **172**, the first sustain electrode (**158** of FIG. **1**), and the second sustain electrode (**178** of FIG. **1**).

[0051] The light scattering spacer **195** scatters external light reflected by a metal wire and may also help maintain the distance between the substrate member **110** and the sealing member **210** facing the substrate member **110**. The sealing member **210** covers the thin film transistors **10** and **20** and the OLED **70** formed on the substrate member **110**. The sealing member **210** may be used to protect these components from external environmental conditions, such as temperature variations, moisture, etc.

[0052] The light scattering spacer **195** may have various shapes in order promote the scattering of external light. For example, the light scattering spacer **195** may be shaped as a frustum of a pyramid, a prism, a truncated circular cone, and a cylinder. One skilled in the art will recognize that light scattering spacer **195** may employ one or more other shapes.

[0053] As noted previously, the OLED **70** may generally include the pixel electrode **710**, the organic emission layer **720**, and the common electrode **730**. The organic emission layer **720** is formed on the pixel electrode **710** in the opening of the pixel defining layer **190**. The common electrode **720** is formed on the pixel defining layer **190** and the organic emission layer **720**. One of the pixel electrode **710** and the common electrode **730** can be made of a transparent conductive material, and the other can be made of a transflective or reflective conductive material. Depending on the configuration of the pixel electrode **710** and the common electrode **730**, the OLED display **100** can be classified as a top light emitting type, a bottom light emitting type, or a dual-side light emitting type. For purposes of illustration, the OLED display **100** is shown as a top light emitting type of OLED display. However, one skilled in the art will recognize how OLED display **100** may be any type of OLED display configuration.

[0054] For the transparent conductive material, indium tin oxide (ITO), indium zinc oxide (IZO), zinc oxide (ZnO), or indium oxide (In_2O_3) can be used. For the reflective material, lithium (Li), calcium (Ca), fluorinated lithium/calcium (LiF/Ca), fluorinated lithium/aluminum (LiF/Al), aluminum (Al), silver (Ag), magnesium (Mg), or gold (Au) can be used.

[0055] The organic emission layer **720** is made of a low-molecular organic material or a high-molecular organic material. The organic emission layer **720** can be formed in a multi-layer structure that includes a hole injection layer (HIL), a hole transport layer (HTL), an emission layer, an electron transport layer (ETL), and an electron injection layer (EIL). The HIL may be disposed on the pixel electrode **710**, which is a positive electrode, and the HTL, the emission layer, the ETL, and the EIL may then be sequentially stacked thereon. Another embodiment will now be described with reference to FIG. **3** and FIG. **4**. As shown in FIG. **3** and FIG. **4**, an OLED display **200** may include a plurality of light scattering spacers **196**. These light scattering spacers **196** may have various shapes, such as a hemisphere and a hemispheroid. In addition, the light scattering spacers **196** may be irregularly distributed on a pixel defining layer **190**. Accordingly, the light scattering spacer **196** may be highly effective in scattering external light reflected to the conductive layer **172** disposed thereunder, and thus, substantially suppress the reflection of the external light.

[0056] A manufacturing method of the OLED display will now be described with reference to FIG. **5**, and FIG. **6**. As shown in FIG. **5**, a thin film transistor **20** may include a gate electrode **155**, a source electrode **176**, and a drain electrode **177**. The thin file transistor **20** is formed on a substrate member **110** that includes a plurality of pixel areas. A planarization layer **180** covers the thin film transistor **20**. A contact hole **182** is also formed to partially expose the drain electrode **177**. Subsequently, a pixel electrode **710** is formed through this contact hole **182** and is connected to the drain electrode **177** of the thin film transistor **20**.

[0057] Next, a photo-sensitive material layer **199** is coated on the planarization layer **180** and the pixel electrode **710**. A half-tone exposure process is then performed by using a mask **900**. The mask **900** can selectively control transmission of light by using various known methods, including using a slit pattern. Accordingly, the photo-sensitive material layer **199** is selectively exposed as desired.

[0058] As shown in FIG. **6**, a pixel defining layer **190** and a light scattering spacer **195** are formed together by developing the exposed photo-sensitive material layer **199**. A plurality of light scattering spacers **195** can thus be formed in each pixel area. In addition, each of the light scattering spacers **195** may be shaped based on the light blocking pattern of the mask **900**. For example, the light scattering spacers **195** may be shaped as a frustum of a pyramid, a prism, a truncated circular cone, a cylinder, a hemisphere, and a hemispheroid. Other shapes for the light scattering spacer **195** may be used in the embodiments.

[0059] Then, the organic emission layer **720** is formed on the pixel electrode **710** in the opening of the pixel defining layer **190**. The common electrode **730** is also formed on the organic emission layer **720**. While this invention has been described in connection with what is presently considered to be practical exemplary embodiments, it is to be understood that the invention is not limited to the disclosed embodiments, but, on the contrary, is intended to cover various modifications and equivalent arrangements included within the spirit and scope of the appended claims.

What is claimed is:

1. An organic light emitting diode (OLED) display comprising:

a substrate member including a plurality of pixel areas;

a thin film transistor (TFT) including a gate electrode, a source electrode, and a drain electrode and formed on the substrate member;

a planarization layer formed on the TFT and having a contact hole through which the drain electrode is partially exposed;

a pixel electrode formed on the planarization layer, and connected to the drain electrode of the TFT through the contact hole;

a pixel defining layer formed on the planarization layer and having a through opening; and

a light scattering spacer formed on the pixel defining layer,

wherein each pixel area includes one pixel electrode and a plurality of light scattering spacers.

2. The OLED display of claim **1**, further comprising a conductive layer that is formed on the same layer as at least one of the gate electrode, the source electrode, and the pixel electrode with the same material thereof, and at least a part of the conductive layer is disposed under the light scattering spacer.

3. The OLED display of claim **2**, wherein the light scattering spacer is shaped as at least one of a frustum of a pyramid, a prism, a truncated circular cone, a cylinder, a hemisphere, and a hemispheroid.

4. The OLED display of claim **2**, wherein the plurality of light scattering spacers are irregularly disposed in each pixel area.

5. The OLED display of claim **2**, wherein a ratio of the entire bottom dimension of the light scattering spacers to each pixel area is greater than 30% of a ratio of an area of the pixel defining layer to the pixel area.

6. The OLED display of claim **5**, wherein a bottom dimension of one light scattering spacer is in a range between 1% to 20% of the ratio of the area of the pixel defining layer to the pixel area.

7. The OLED display of claim **1**, further comprising a sealing member disposed facing the substrate member with the thin film transistor interposed therebetween, wherein the light scattering spacer maintains a distance between the substrate member and the sealing member.

8. The OLED display of claim **7**, wherein the light scattering spacer is integrally formed with the pixel defining layer with the same material as the pixel defining layer.

9. A manufacturing method of an organic light emitting diode (OLED) display, comprising:

forming a thin film transistor (TFT) that includes a gate electrode, a source electrode, and a drain electrode on a substrate member that includes a plurality of pixel areas;

forming a planarization layer that covers the TFT and has a contact hole through which the drain electrode is partially exposed;

forming a pixel electrode connected to the drain electrode of the TFT through the contact hole on the planarization layer;

coating a photo-sensitive material layer on the planarization layer and the pixel electrode; and

forming a pixel defining layer by patterning the photo-sensitive material layer with a photolithography process using a mask on the planarization layer and simultaneously forming a light scattering spacer on the pixel defining layer, the pixel defining layer having an opening through which the pixel electrode is exposed,

wherein each of the respective pixel areas includes one pixel electrode and a plurality of light scattering spacers.

10. The manufacturing method of claim **9**, wherein the photolithography process comprises a half-tone exposure process.

11. The manufacturing method of claim **9**, wherein the light scattering spacer is shaped as at least one of a frustum of a pyramid, a prism, a truncated circular cone, a cylinder, a hemisphere, and a hemispheroid.

* * * * *

专利名称(译)	有机发光二极管显示器及其制造方法		
公开(公告)号	US20100044692A1	公开(公告)日	2010-02-25
申请号	US12/544531	申请日	2009-08-20
申请(专利权)人(译)	三星SDI CO.，LTD.		
当前申请(专利权)人(译)	三星DISPLAY CO.，LTD.		
[标]发明人	KIM EUN AH JEON HEE CHUL JUNG WOO SUK JEONG HEE SEONG LEE JOO HWA JEONG CHUL WOO KWAK NOH MIN PARK SOON RYONG		
发明人	KIM, EUN-AH JEON, HEE-CHUL JUNG, WOO-SUK JEONG, HEE-SEONG LEE, JOO-HWA JEONG, CHUL-WOO KWAK, NOH-MIN PARK, SOON-RYONG		
IPC分类号	H01L51/52 H01L51/56		
CPC分类号	H01L27/3246 H01L51/5281 H01L51/5268		
优先权	1020080081403 2008-08-20 KR		
其他公开文献	US8242692		
外部链接	Espacenet USPTO		

摘要(译)

本发明涉及有机发光二极管（OLED）显示器及其制造方法。 OLED显示器包括基板构件，该基板构件包括多个像素区域。薄膜晶体管（TFT）形成在基板构件上，并包括栅电极，源电极和漏电极。平坦化层形成在TFT上并包括接触孔，漏电极通过该接触孔部分地暴露。像素电极形成在平坦化层上并通过接触孔连接到TFT的漏电极。像素限定层形成在平坦化层上并具有通孔。光散射间隔物形成在像素限定层上以散射反射光，并且可以具有各种形状和尺寸。