US 20150048318A1

(19) **United States**

(12) **Patent Application Publication**

(10) **Pub. No.: US 2015/0048318 A1**

(43) **Pub. Date: Feb. 19, 2015**

Kim

(54) **ORGANIC LIGHT-EMITTING DIODE (OLED) DISPLAY AND METHOD OF MANUFACTURING SAME**

(71) Applicant: **Samsung Display co., Ltd.**, Yongin-City (KR)

(72) Inventor: **Jae-Hoon Kim**, Yongin-City (KR)

(73) Assignee: **Samsung Display Co., Ltd.t**, Yongin-City (KR)

(21) Appl. No.: **14/108,714**

(22) Filed: **Dec. 17, 2013**

(30) **Foreign Application Priority Data**

Aug. 13, 2013 (KR) 10-2013-0096188

Publication Classification

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

(52) **U.S. Cl.**
CPC ***H01L 27/326*** (2013.01)
USPC **257/40**; 438/22

(57) **ABSTRACT**

An organic light-emitting diode (OLED) display is disclosed. In one aspect, the OLED display includes a substrate, a pixel electrode disposed on the substrate and a pixel defining layer which covers an edge of the pixel electrode and exposes a center portion of the pixel electrode. The OLED display also includes a plurality of fine patterns disposed on the center portion, wherein the fine patterns are formed of the same material as that of the pixel defining layer.

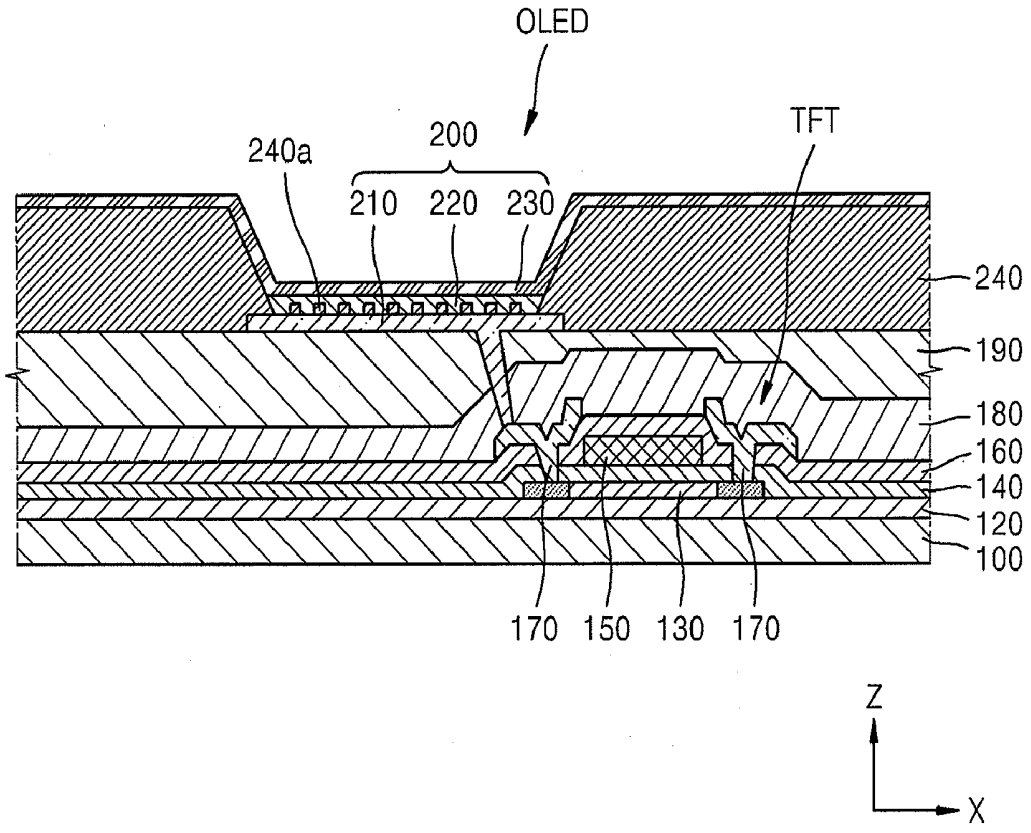


FIG. 1

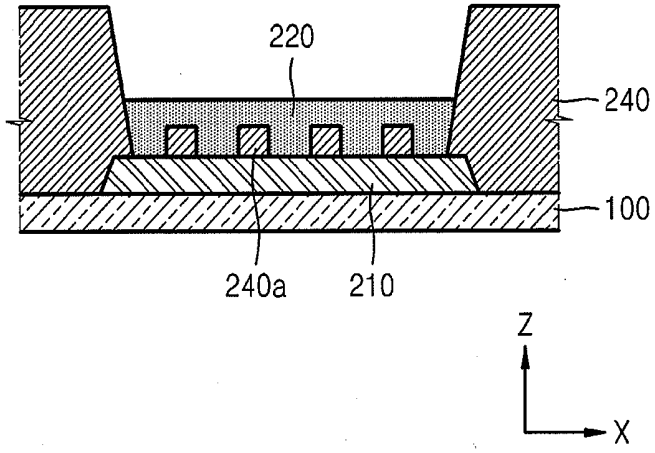


FIG. 2

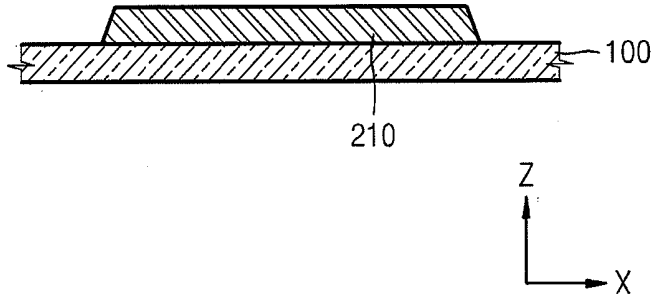


FIG. 3

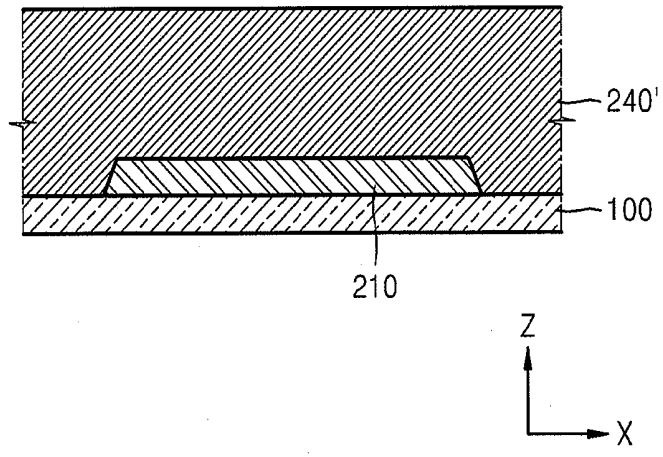


FIG. 4

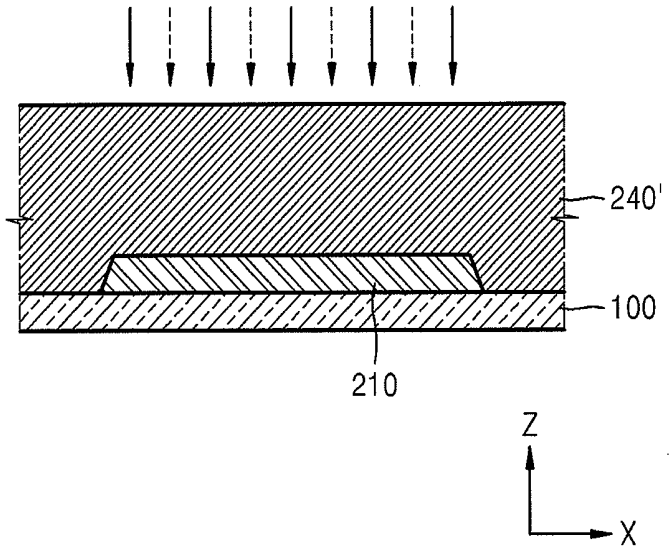


FIG. 5

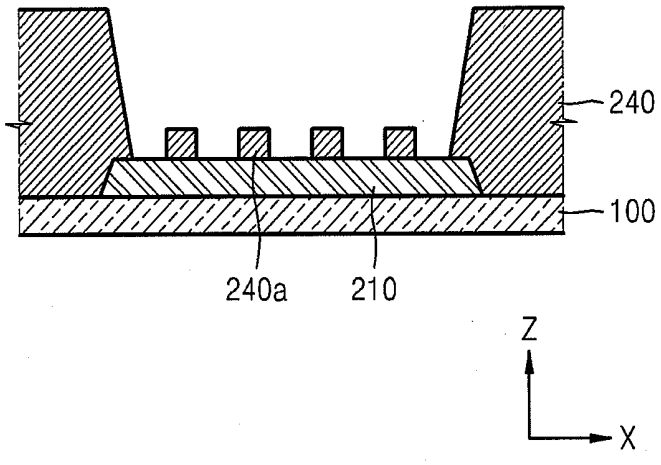


FIG. 6

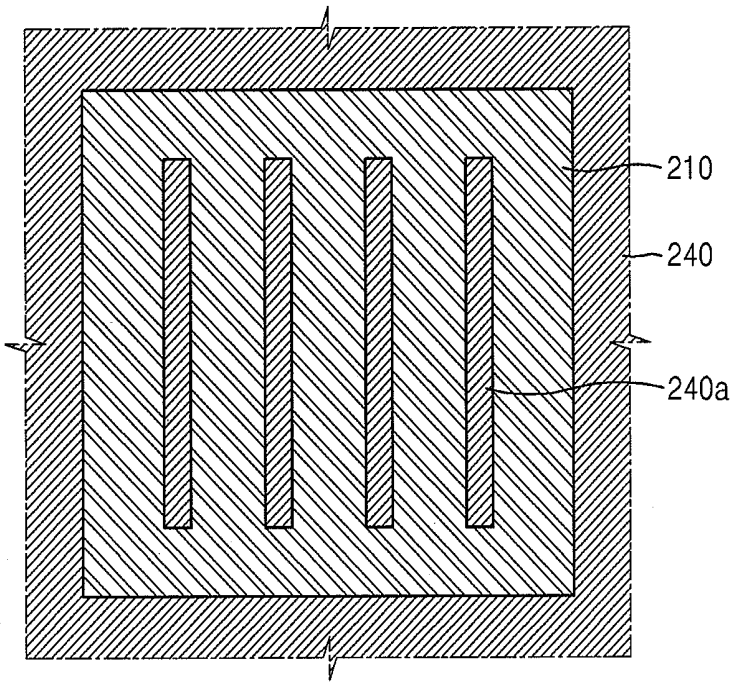


FIG. 7

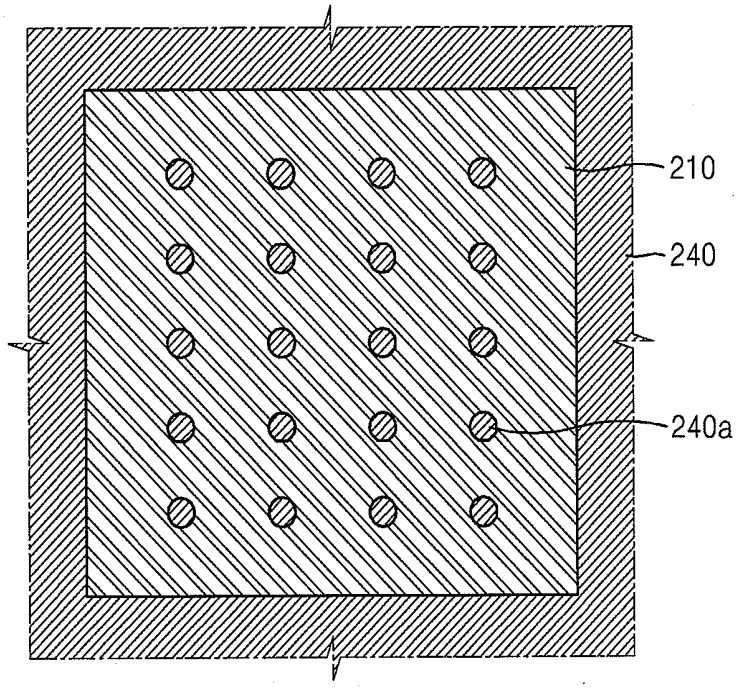
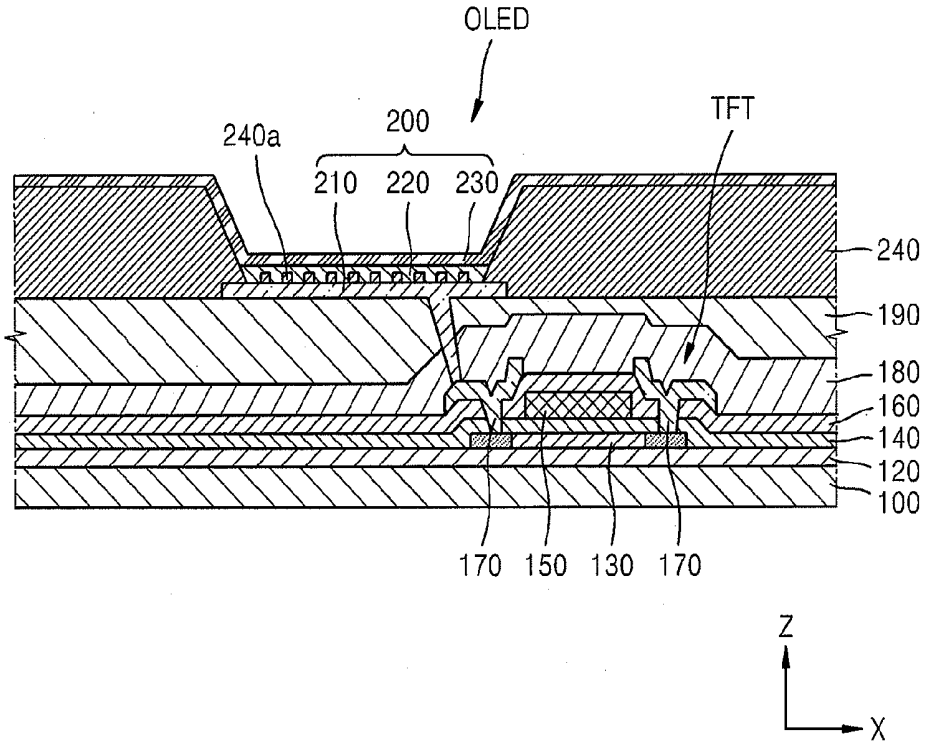


FIG. 8


OLED
TFT
240a
200
210
220
230
240
190
180
160
140
120
100
170
150
130
170
Z
X

ORGANIC LIGHT-EMITTING DIODE (OLED) DISPLAY AND METHOD OF MANUFACTURING SAME

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application claims the benefit of Korean Patent Application No. 10-2013-0096188, filed on Aug. 13, 2013, in the Korean Intellectual Property Office, the disclosure of which is incorporated herein in its entirety by reference.

BACKGROUND

[0002] 1. Field

[0003] The described technology generally relates to an organic light-emitting diode (OLED) display.

[0004] 2. Description of the Related Technology

[0005] OLED displays have attracted attention as next-generation displays due to their favorable qualities, such as wide viewing angles, high contrast, and quick response speeds.

[0006] In general, OLED displays include a pixel defining layer which covers the edge of a pixel electrode and exposes a center portion of the pixel electrode. An intermediate layer including an emission layer is formed on the pixel electrode using a method, such as inkjet printing, nozzle printing, or the like.

SUMMARY OF CERTAIN INVENTIVE ASPECTS

[0007] One inventive aspect is an OLED display including a substantially planarized thin film and a method of manufacturing the same by removing the non-uniformity of the thin film. However, the embodiments of the described technology are only illustrative and do not limit the scope of the described technology.

[0008] Another aspect is an OLED display including a substrate, a pixel electrode disposed on the substrate, a pixel defining layer which covers an edge of the pixel electrode and exposes a center portion of the pixel electrode, and a plurality of fine patterns which are disposed on the center portion of the pixel electrode, wherein the fine patterns are formed of the same material as that of the pixel defining layer.

[0009] The OLED display may further include an intermediate layer disposed on the pixel electrode, wherein the intermediate layer is formed using an inkjet printing process.

[0010] The fine patterns may have a substantially line shape.

[0011] The fine patterns may have a substantially dot shape.

[0012] Each of the fine patterns may have a width of about 10 μm or less and a height of about 0.2 μm or less.

[0013] The intermediate layer may substantially cover the fine patterns.

[0014] Another aspect is a method of manufacturing an OLED display including providing a substrate, forming a pixel electrode on the substrate, forming a pixel defining layer which covers the pixel electrode and exposes a center portion of the pixel electrode, and forming a plurality of fine patterns on the pixel electrode, wherein the fine patterns are formed of the same material as that of the pixel defining layer.

[0015] The method further includes forming an intermediate layer on the pixel electrode, wherein the forming of the intermediate layer includes forming the intermediate layer using an inkjet printing process.

[0016] The forming of the pixel defining layer and the forming of the fine patterns may be performed substantially simultaneously using a halftone mask.

[0017] The forming of the fine patterns may include forming the fine patterns to have a substantially line shape.

[0018] The forming of the fine patterns may include forming the fine patterns to have a substantially dot shape.

[0019] The forming of the intermediate layer may include forming the intermediate layer to substantially cover the fine patterns.

BRIEF DESCRIPTION OF THE DRAWINGS

[0020] These and/or other aspects will become apparent and more readily appreciated from the following description of the embodiments, taken in conjunction with the accompanying drawings.

[0021] FIG. **1** is a schematic cross-sectional view of an OLED display according to an embodiment.

[0022] FIGS. **2** to **5** are schematic cross-sectional views illustrating a method of manufacturing an OLED display according to an embodiment.

[0023] FIGS. **6** and **7** are schematic top views of an OLED display according to embodiments.

[0024] FIG. **8** is a schematic cross-sectional view of an OLED display according to an embodiment.

DETAILED DESCRIPTION OF CERTAIN INVENTIVE EMBODIMENTS

[0025] The standard organic light-emitting diode (OLED) display and a method of manufacturing the same can produce stains due to the non-uniformity of the thickness of the intermediate layer of the pixels of the OLED display. The long-term reliability of the standard OLED display panel can be lowered due to these non-uniform thicknesses as well as variations in current density for each area of an OLED.

[0026] Reference will now be made in detail to embodiments, examples of which are illustrated in the accompanying drawings, wherein like reference numerals refer to like elements throughout. In this regard, the present embodiments may have different forms and should not be construed as being limited to the descriptions set forth herein. Accordingly, the embodiments are merely described below, by referring to the figures, to explain aspects of the described technology. The size of elements illustrated in the drawings may be exaggerated for convenience of explanation. In other words, since the size and thickness of components in the drawings may be exaggerated for convenience of explanation, the following embodiments are not limited thereto.

[0027] In the following examples, the x-axis, the y-axis and the z-axis are not limited to the three axes of the rectangular coordinate system and may be interpreted in a broader sense. For example, the x-axis, the y-axis, and the z-axis may be perpendicular to one another or may represent different directions that are not perpendicular to one another.

[0028] It will be understood that when a layer, region, or component is referred to as being "formed on," another layer, region, or component, it can be directly or indirectly formed on the other layer, region, or component. That is, for example, intervening layers, regions, or components may be present.

[0029] As used herein, expressions such as "at least one of," when preceding a list of elements, modify the entire list of elements and do not modify the individual elements of the list.

[0030] FIG. **1** is a schematic cross-sectional view of an OLED display according to an embodiment. As shown in FIG. **1**, the OLED display may include a substrate **100**, a pixel electrode **210**, a pixel defining layer **240**, an intermediate layer **220**, and a plurality of fine patterns **240***a*.

[0031] The pixel electrode **210** is disposed on the substrate **100**. The substrate **100** may be formed of various materials, such as a glass material, a metallic material, or a plastic material. The disposition of the pixel electrode **210** on the substrate **100** includes not only the case where the pixel electrode **210** is directly disposed on the substrate **100** but also cases where various other layers are formed on the substrate **100** and then the pixel electrode **210** is disposed on the other layers. For example, a thin film transistor (TFT, see FIG. **8**) may be disposed on the substrate **100**, a planarization layer may cover the thin film transistor, and the pixel electrode **210** may be disposed on the planarization layer. FIG. **1** shows for convenience of description that the pixel electrode **210** is disposed directly on the substrate **100** and this configuration will be described hereinafter for convenience of description.

[0032] Although not shown in FIG. **1**, the pixel electrode **210** may be electrically connected to the thin film transistor through contact with any one of a source or drain electrode of the thin film transistor. The pixel electrode **210** may be formed as a transparent (or translucent) electrode or a reflective electrode. When the pixel electrode **210** is formed as a transparent (or translucent) electrode, the pixel electrode **210** may be formed of, for example, an indium tin oxide (ITO), an indium zinc oxide (IZO), a zinc oxide (ZnO), an indium oxide (In_2O_3), an indium gallium oxide (IGO), or an aluminum zinc oxide (AZO). When the pixel electrode **210** is formed as a reflective electrode, the pixel electrode **210** may include a reflective layer formed of silver (Ag), magnesium (Mg), aluminum (Al), platinum (Pt), palladium (Pd), gold (Au), nickel (Ni), neodymium (Nd), iridium (Ir), chromium (Cr), or a compound thereof and a layer formed of ITO, IZO, ZnO, In_2O_3, IGO, or AZO. However, the described technology is not limited thereto; the pixel electrode **210** may be formed of various materials and various modifications may be made such that the structure thereof is a single-layer structure or a multi-layer structure.

[0033] The pixel defining layer **240** which covers an edge of the pixel electrode **210** is disposed on the substrate **100** to expose a center portion of the pixel electrode **210**. The pixel defining layer **240** defines a pixel with openings corresponding to respective sub-pixels, i.e., openings which expose a center portion of each pixel electrode **210**. The pixel defining layer **240** may be formed of, for example, an organic material, such as polyimide or the like.

[0034] The fine patterns **240***a* are disposed on the pixel electrode **210**. For example, the fine patterns **240***a* are disposed on the center portion of the pixel electrode **210** exposed by the pixel defining layer **240**. The fine patterns **240***a* may include the same material as that of the pixel defining layer **240**. The fine patterns **240***a* may also be formed of, for example, an organic material, such as polyimide or the like. In some embodiments, each of the fine patterns **240***a* has a width of about 10 μm or less and a height of about 0.2 μm or less. The fine patterns **240***a* may have various shapes, such as a substantially line shape, a substantially dot shape, or the like.

[0035] The intermediate layer **220** is disposed on the pixel electrode **210** to substantially cover the fine patterns **240***a*. The intermediate layer **220** of an OLED (**200**, see FIG. **8**) may include a low-molecular material or a high-molecular material. When the intermediate layer **220** includes a low-molecular material, the intermediate layer **220** may be formed by stacking a hole injection layer (HIL), a hole transport layer (HTL), an emission layer (EML), an electron transport layer (ETL), an electron injection layer (EIL), and the like in a single or composite structure. The organic materials used to form the intermediate layer **220** may include at least one of copper phthalocyanine (CuPc), N, N'-di(naphthalene-1-yl)-N, N'-diphenyl-benzidine (NPB), tris-8-hydroxyquinoline aluminum (Alq_3), or other various materials.

[0036] When the intermediate layer **220** includes a high-molecular material, the intermediate layer **220** may have a structure including the HTL and the EML. In this case, poly (3,4)-ethylenedioxythiophene (PEDOT) may be used as the HTL, and a high-molecular organic material, such as polyphenylene vinylenes (PPVs), polyfluorenes, or the like, may be used as the EML.

[0037] The intermediate layer **220** is not limited to the above described structures and the structure thereof may be varied according to the design requirements.

[0038] The intermediate layer **220** is disposed on the pixel electrode **210**. The intermediate layer **220** may be formed using inkjet printing, and in this case, the intermediate layer **220** may be disposed to substantially cover the fine patterns **240***a*. Since the intermediate layer **220** is disposed on the pixel electrode **210** on which the fine patterns **240***a* are disposed, the intermediate layer **220** may be substantially uniformly formed.

[0039] If the fine patterns **240***a* are not provided, the thickness of the intermediate layer **220** disposed in each pixel is not uniform, and accordingly, the brightness in each pixel may be non-uniform, thereby causing the quality of the OLED display to suffer. However, according to at least one embodiment, the fine patterns **240***a* are formed of the same material as that of the pixel defining layer **240** and are disposed on the pixel electrode **210** in a pixel area defined by the pixel defining layer **240**. Consequently, ink forming the intermediate layer **220** can be substantially uniformly spread between and along the fine patterns **240***a* by means of capillary action or the like. Accordingly, the uniformity of the intermediate layer **220** may be dramatically increased, and thus, the intermediate layer **220** may be readily formed as a substantially uniform thin film.

[0040] Although the configuration of an OLED display has been described, the described technology is not limited thereto. For example, the described technology may also include a method of manufacturing an OLED display.

[0041] FIGS. **2** to **5** are schematic cross-sectional views illustrating a method of manufacturing an OLED display according to an embodiment.

[0042] First, as shown in FIG. **2**, after preparing the substrate **100**, the pixel electrode **210** is formed on the substrate **100**. The substrate **100** may be formed of various materials, such as a glass material, a metallic material, a plastic material, or the like.

[0043] Although not shown in FIG. **2**, the pixel electrode **210** may be electrically connected to a thin film transistor through contact with any one of a source or drain electrode of the thin film transistor. The pixel electrode **210** may be formed as a transparent (or translucent) electrode or a reflective electrode. When the pixel electrode **210** is formed as a transparent (or translucent) electrode, the pixel electrode **210** may be formed of, for example, ITO, IZO, ZnO, In_2O_3, IGO, or AZO. When the pixel electrode **210** is formed as a reflective

electrode, the pixel electrode **210** may include a reflective layer formed of Ag, Mg, Al, Pt, Pd, Au, Ni, Nd, Ir, Cr, or a compound thereof and a layer formed of ITO, IZO, ZnO, In_2O_3, IGO, or AZO. However, the described technology is not limited thereto; the pixel electrode **210** may be formed of various materials and various modifications may be made such that the structure thereof is a single-layer structure or a multi-layer structure.

[0044] Thereafter, as shown in FIG. **3**, a photoresist layer **240'** is coated on the pixel electrode **210** to form the pixel defining layer **240** on the pixel electrode **210**. The pixel defining layer **240** defines a pixel with openings corresponding to respective sub-pixels, i.e., openings which expose a center portion of each pixel electrode **210**. The photoresist layer **240'** for forming the pixel defining layer **240** may be formed of, for example, an organic material, such as polyimide or the like.

[0045] After coating the photoresist layer **240'** on the pixel electrode **210** as shown in FIG. **4**, the pixel defining layer **240** may be formed using a halftone mask. Referring to FIG. **5**, when the pixel defining layer **240** is formed, the fine patterns **240***a* are substantially simultaneously formed on a center portion of the pixel electrode **210** exposed by the pixel defining layer **240**.

[0046] When the pixel defining layer **240** is formed using a halftone mask, the photoresist layer **240'** may be formed with a height difference. Thus, when the fine patterns **240***a* are to be formed on a partial area of the pixel electrode **210**, the pixel defining layer **240** and the fine patterns **240***a* may be substantially simultaneously formed on the pixel electrode **210** by exposing the center portion of the pixel electrode **210** so that the partial area is exposed to less light than the exposed portion of the pixel electrode **210** by using the halftone mask. Thus, the fine patterns **240***a* may also include the same material as that of the pixel defining layer **240** and may be formed of, for example, an organic material, such as polyimide or the like, like the pixel defining layer **240**. The fine patterns **240***a* may have various shapes, such as a substantially line shape, a substantially dot shape, or the like.

[0047] After forming the pixel defining layer **240**, which exposes the center portion of the pixel electrode **210**, and forming the fine patterns **240***a* on the center portion of the pixel electrode **210** exposed by the pixel defining layer **240** as described above, the intermediate layer **220** is formed to substantially cover the fine patterns **240***a*.

[0048] The intermediate layer **220** of an OLED (**200**, referring to FIG. **8**) may include a low-molecular material or a high-molecular material. When the intermediate layer **220** includes a low-molecular material, the intermediate layer **220** may be formed by stacking an HIL, an HTL, an EML, an ETL, an EIL, and the like in a single or composite structure. When the intermediate layer **220** includes a high-molecular material, the intermediate layer **220** may have a structure including the HTL and the EML.

[0049] The intermediate layer **220** is not limited to the above description and may have various structures.

[0050] The intermediate layer **220** is disposed on the pixel electrode **210**. The intermediate layer **220** may be formed using inkjet printing, and in this case, the intermediate layer **220** may be disposed to substantially cover the fine patterns **240***a*. In detail, the HIL may be disposed to substantially cover the fine patterns **240***a*, and thereafter, the HTL, the EML, the ETL, the EIL, and the like may be disposed on the HIL and substantially cover the fine patterns **240***a*.

[0051] If the fine patterns **240***a* are not provided, the thickness of the intermediate layer **220** disposed in each pixel is not uniform, and accordingly, the brightness in each pixel may be non-uniform, thereby causing the quality of the OLED display to suffer. However, according to at least one embodiment, the fine patterns **240***a* are formed of the same material as that of the pixel defining layer **240** and are disposed on the pixel electrode **210** in a pixel area defined by the pixel defining layer **240**. Consequently, ink forming the intermediate layer **220** may be substantially uniformly spread between and along the fine patterns **240***a* by means of capillary action or the like. Accordingly, the uniformity of the intermediate layer **220** may be dramatically increased, and thus, the intermediate layer **220** may be readily formed as a substantially uniform thin film.

[0052] FIGS. **6** and **7** are schematic top views of an OLED display according to embodiments. As described above, the fine patterns **240***a* may be formed on the pixel electrode **210** to have various shapes, i.e., formed to have a substantially line shape as shown in FIG. **6** or to have a substantially dot shape as shown in FIG. **7**. However, the shapes of the fine patterns **240***a* are not limited thereto and may be modified to have various other shapes. The thin film of the intermediate layer **220** may be substantially uniformly formed by evenly coating the intermediate layer **220** between the fine patterns **240***a*.

[0053] Although only a portion of the pixel electrode **210** of the OLED display has been described, the OLED display according to an embodiment may have the lower structure illustrated in FIG. **8**.

[0054] As shown in FIG. **8**, the OLED display according to an embodiment includes a thin film transistor TFT disposed on the substrate **100** and an OLED **200** electrically connected to the thin film transistor TFT. The thin film transistor TFT includes a semiconductor layer **130**, which includes amorphous silicon, polycrystalline silicon, or an organic semiconductor material, a gate electrode **150**, and source and drain electrodes **170**.

[0055] A buffer layer **120** formed of silicon oxide, silicon nitride, or the like may be disposed on the substrate **100** to substantially planarize the surface of the substrate **100** or to substantially prevent the infiltration of impurities into the semiconductor layer **130** and the semiconductor layer **130** may be disposed on the buffer layer **120**.

[0056] The gate electrode **150** and the source and drain electrodes **170** may be formed of various materials. The material of the gate electrode **150** may be selected in consideration of the adherence to an adjacent layer, the surface planarization of a layer to be stacked thereon, processability, and the like, and the material of the source and drain electrodes **170** may be selected in consideration of the conductivity thereof and the like. For example, the gate electrode **150** and the source and drain electrodes **170** may be formed as a single layer or multiple layers of at least one of Al, Pt, Pd, Ag, Mg, Au, Ni, Nd, Ir, Cr, lithium (Li), calcium (Ca), molybdenum (Mo), titanium (Ti), tungsten (W), or copper (Cu).

[0057] A gate insulating layer **140** is interposed between the gate electrode **150** and the semiconductor layer **130** to electrically insulate the semiconductor layer **130** from the gate electrode **150**. An interlayer insulating layer **160** is interposed between the gate electrode **150** and each of the source and drain electrodes **170**. The gate insulating layer **140** and the interlayer insulating layer **160** may be formed as a single layer or multiple layers of a material, such as silicon oxide, silicon nitride, or the like.

[0058] A protective layer **180** which covers the thin film transistor TFT may be disposed to protect the thin film transistor TFT. The protective layer **180** may be formed of, for example, an inorganic material, such as silicon oxide, silicon nitride, silicon oxynitride, or the like. Although the protective layer **180** is shown as a single layer in FIG. **8**, various modifications may be made such that the protective layer **180** has a multi-layer structure.

[0059] A planarization layer **190** may be disposed on the protective layer **180** according to the design requirements. For example, when the OLED **200** is disposed on the thin film transistor TFT as shown in FIG. **8**, the planarization layer **190** may be disposed to substantially planarize the upper surface of the protective layer **180** covering the thin film transistor TFT. The planarization layer **190** may be formed of, for example, an acrylic organic material, benzocyclobutene (BCB), or the like. Although the planarization layer **190** is shown as a single layer in FIG. **8**, various modifications may be made such that the planarization layer **190** has a multi-layer structure.

[0060] The OLED **200** having the pixel electrode **210**, an opposite electrode **230**, and the intermediate layer **220** interposed therebetween and including the EML is disposed on the planarization layer **190** of the substrate **100**.

[0061] The protective layer **180** and the planarization layer **190** include an opening which exposes at least one of the source and drain electrodes **170** of the thin film transistor TFT. The pixel electrode **210** is disposed on the planarization layer **190** and is electrically connected to the thin film transistor TFT through contract with any one of the source and drain electrodes **170** through the opening.

[0062] The pixel defining layer **240** is disposed on the planarization layer **190**. The pixel defining layer **240** defines a pixel with openings corresponding to respective sub-pixels, i.e., openings which expose a center portion of each pixel electrode **210**. In addition, in the embodiment of FIG. **8**, the pixel defining layer **240** substantially prevents a short circuit between an end of the pixel electrode **210** and the opposite electrode **230** by increasing the distance therebetween. The pixel defining layer **240** may be formed of, for example, an organic material, such as polyimide or the like.

[0063] The fine patterns **240***a* including the same material as that of the pixel defining layer **240** are disposed on a center portion of the pixel electrode exposed by the pixel defining layer **240**. As described above, the fine patterns **240***a* may have various shapes, such as a substantially line shape, a substantially dot shape, or the like, and the fine patterns **240***a* may be substantially simultaneously formed using a halftone mask when the pixel defining layer **240** is formed. As a result, since the fine patterns **240***a* are provided on the pixel electrode **210**, the intermediate layer **220** disposed on the pixel electrode **210** on which the fine patterns **240***a* are disposed may be substantially uniformly formed.

[0064] The intermediate layer **220** of the OLED **200** may include a low-molecular material or a high-molecular material. When the intermediate layer **220** includes a low-molecular material, the intermediate layer **220** may be formed by stacking an HIL, an HTL, an EML, an ETL, an EIL, and the like in a single or composite structure. When the intermediate layer **220** includes a high-molecular material, the intermediate layer **220** may have a structure including the HTL and the EML.

[0065] The intermediate layer **220** is not limited to the above description and may have various other structures.

[0066] The opposite electrode **230** may be disposed to correspond to the whole surface of the substrate **100** as shown in FIG. **8**. That is, the opposite electrode **230** may be formed commonly for a plurality of OLEDs **200** and may correspond to a plurality of pixel electrodes **210**. The opposite electrode **230** may be formed as a transparent (or translucent) electrode or a reflective electrode. When the opposite electrode **230** is formed as a transparent (or translucent) electrode, the opposite electrode **230** may include a layer formed of a metal having a small work function, i.e., Li, Ca, lithium fluoride (LiF)/Ca, LiF/Al, Al, Ag, or Mg, or a compound thereof and a transparent (or translucent) conductive layer formed of ITO, IZO, ZnO, In_2O_3, or the like. When the opposite electrode **230** is formed as a reflective electrode, the opposite electrode **230** may include a layer formed of Li, Ca, LiF/Ca, LiF/Al, Al, Ag, Mg, or a compound thereof. The structure and material of the opposite electrode **230** are not limited thereto, and various modifications may be made.

[0067] According to at least one embodiment, the fine patterns **240***a* are disposed on the pixel electrode **210**. Ink forming the intermediate layer **220** can be substantially uniformly spread between and along the fine patterns **240***a* by means of capillary action or the like. Accordingly, the uniformity of the intermediate layer **220** may be dramatically increased, and thus, the intermediate layer **220** may be readily formed as a substantially uniform thin film.

[0068] As described above, according to at least one embodiment, an OLED display including a substantially planarized thin film and a method of manufacturing the same by removing the non-uniformity of the thin film are disclosed. However, the scope of the described technology is not limited due to the effects thereof.

[0069] It should be understood that the exemplary embodiments described herein should be considered in a descriptive sense only and not for purposes of limitation. Descriptions of features or aspects within each embodiment should typically be considered as available for other similar features or aspects in other embodiments.

[0070] While one or more embodiment of the described technology have been described with reference to the figures, it will be understood by those of ordinary skill in the art that various changes in form and details may be made therein without departing from the spirit and scope of the present invention as defined by the following claims.

What is claimed is:

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

a substrate;

a pixel electrode formed over the substrate;

a pixel defining layer i) covering an edge of the pixel electrode and ii) exposing a center portion of the pixel electrode; and

a plurality of fine patterns i) formed over the center portion and ii) include the same material as that of the pixel defining layer.

2. The OLED display of claim **1**, further comprising an intermediate layer formed over the pixel electrode.

3. The OLED display of claim **1**, wherein the fine patterns have a substantially line shape.

4. The OLED display of claim **1**, wherein the fine patterns have a substantially dot shape.

5. The OLED display of claim **1**, wherein the width of each of the fine patterns is about 10 μm or less and wherein the height of each fine pattern is about 0.2 μm or less.

6. The OLED display of claim 1, further comprising an intermediate layer formed over the pixel electrode, wherein the intermediate layer substantially covers the fine patterns.

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

providing a substrate;

forming a pixel electrode over the substrate;

forming a pixel defining layer i) covering an edge of the pixel electrode and ii) exposing a center portion of the pixel electrode; and

forming a plurality of fine patterns over the center portion, wherein the fine patterns include the same material as that of the pixel defining layer.

8. The method of claim 7, further comprising forming an intermediate layer over the pixel electrode, wherein the intermediate layer is formed by an inkjet printing process.

9. The method of claim 7, wherein the forming of the pixel defining layer and the forming of the fine patterns are performed substantially simultaneously using a halftone mask.

10. The method of claim 7, wherein the forming of the fine patterns comprises forming the fine patterns to have a substantially line shape.

11. The method of claim 7, wherein the forming of the fine patterns comprises forming the fine patterns to have a substantially dot shape.

12. The method of claim 7, further comprising forming an intermediate layer over the pixel electrode to substantially cover the fine patterns.

13. An organic light-emitting diode (OLED) display, comprising:

a pixel electrode including a center portion;

a plurality of fine patterns formed over the center portion; and

an intermediate layer formed over the pixel electrode and substantially covering the fine patterns.

14. The OLED display of claim 13, further comprising a pixel defining layer i) covering an edge of the pixel electrode and ii) exposing the center portion.

15. The OLED display of claim 14, wherein the fine patterns are formed of the same material as that of the pixel defining layer.

16. The OLED display of claim 13, wherein the fine patterns have a substantially line shape.

17. The OLED display of claim 13, wherein the fine patterns have a substantially dot shape.

18. The OLED display of claim 13, further comprising a thin film transistor electrically connected to the pixel electrode.

19. The OLED display of claim 13, wherein the width of each of the fine patterns is about 10 μm or less.

20. The OLED display of claim 13, wherein the height of each of the fine patterns is about 0.2 μm or less.

* * * * *

专利名称(译)	有机发光二极管（OLED）显示器及其制造方法		
公开(公告)号	US20150048318A1	公开(公告)日	2015-02-19
申请号	US14/108714	申请日	2013-12-17
[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	KIM JAE HOON		
发明人	KIM, JAE-HOON		
IPC分类号	H01L27/32		
CPC分类号	H01L27/326		
优先权	1020130096188 2013-08-13 KR		
外部链接	Espacenet USPTO		

摘要(译)

公开了一种有机发光二极管（OLED）显示器。在一个方面，OLED显示器包括基板，设置在基板上的像素电极和覆盖像素电极的边缘并暴露像素电极的中心部分的像素限定层。 OLED显示器还包括设置在中心部分上的多个精细图案，其中精细图案由与像素限定层的材料相同的材料形成。