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(54) **DISPLAY APPARATUS HAVING A LARGER DISPLAY REGION AND MOISTURE IMPERMEABILITY**

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H01L 51/5253-51/5256; H01L 27/3241;
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(Continued)

(58) **Field of Classification Search**

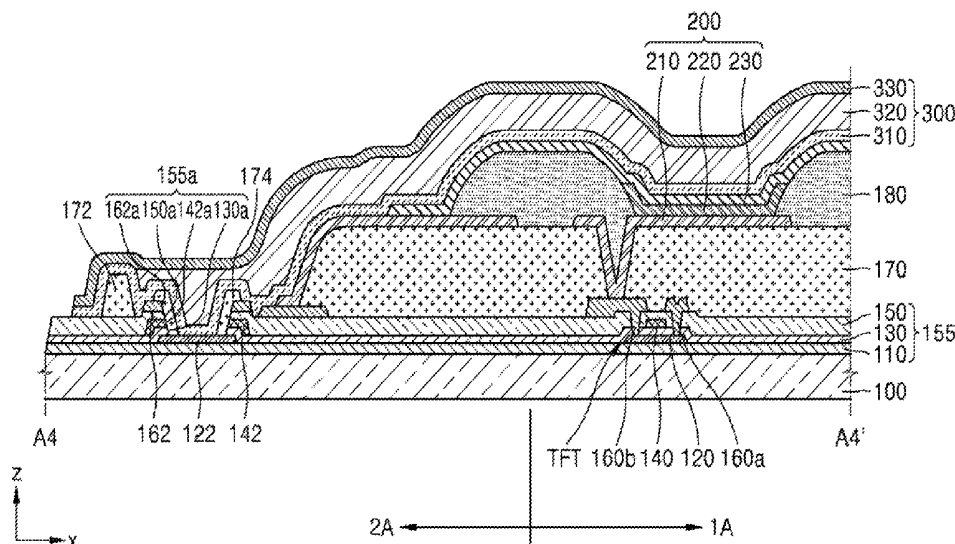
CPC H01L 51/5237; H01L 51/5056; H01L
27/3274; H01L 27/124; H01L 27/3248;

(57)

ABSTRACT

A display apparatus includes a substrate having a first region and a second region surrounding the first region. An insulating part is disposed above the substrate, covering the first region and the second region, and comprising a first opening portion in the second region. A dam part is disposed above the insulating part in the second region and surrounds a periphery of the first opening portion. A first organic insulating layer is disposed above the insulating part and covers an inner surface of the first opening portion. An organic light-emitting device is disposed above the insulating part in the first region and comprises a pixel electrode. An encapsulation layer is disposed above the insulating part in both the first region and the second region. The encapsulation layer covers the organic light-emitting device.

20 Claims, 16 Drawing Sheets



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27/3248 (2013.01); *H01L 27/3258* (2013.01);
H01L 2227/323 (2013.01)

(58) **Field of Classification Search**

CPC *H01L 27/326*; *H01L 27/3262*; *H01L*
27/3281; *H01L 27/3283*; *H01L 27/3295*;
H01L 27/3244–27/3279; *B32B 2457/206*

See application file for complete search history.

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FIG. 1

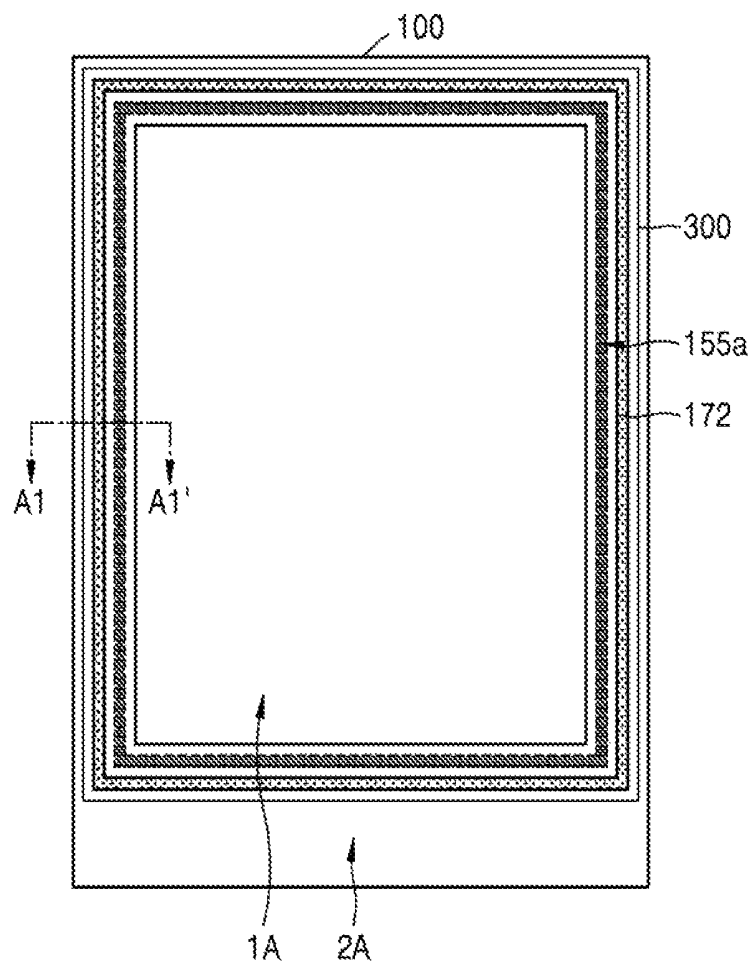


FIG. 5

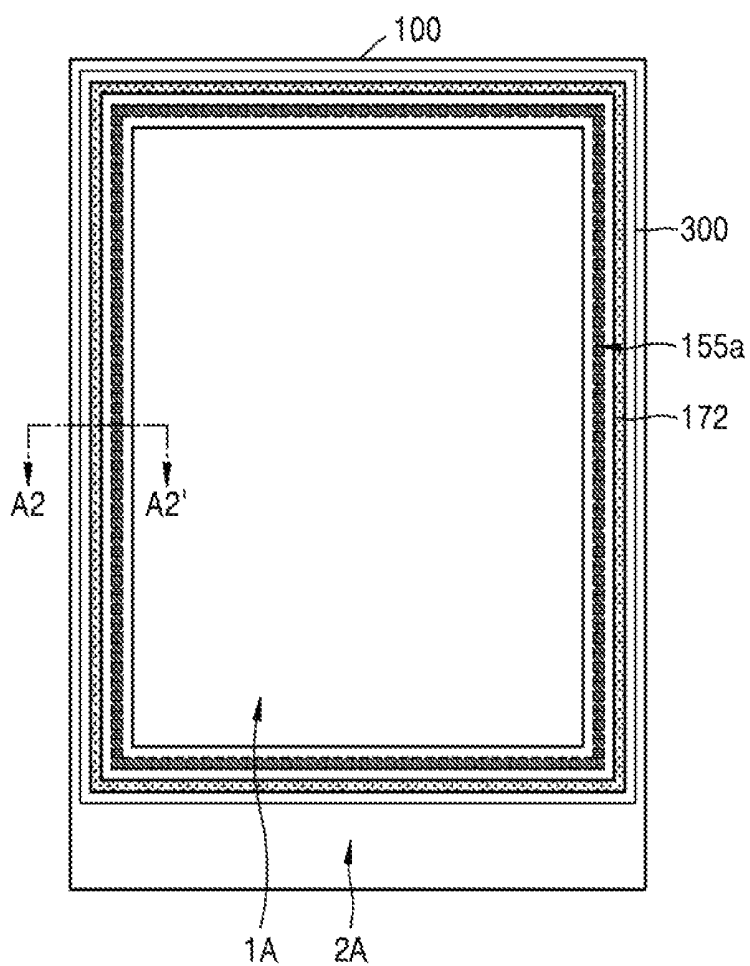


FIG. 7

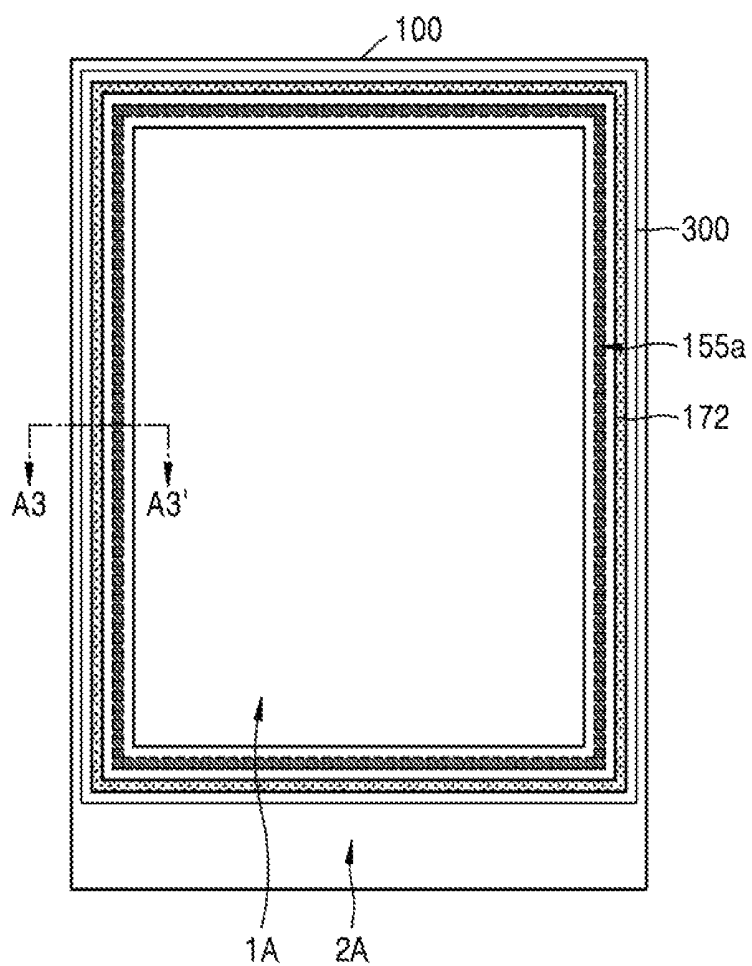


FIG. 8

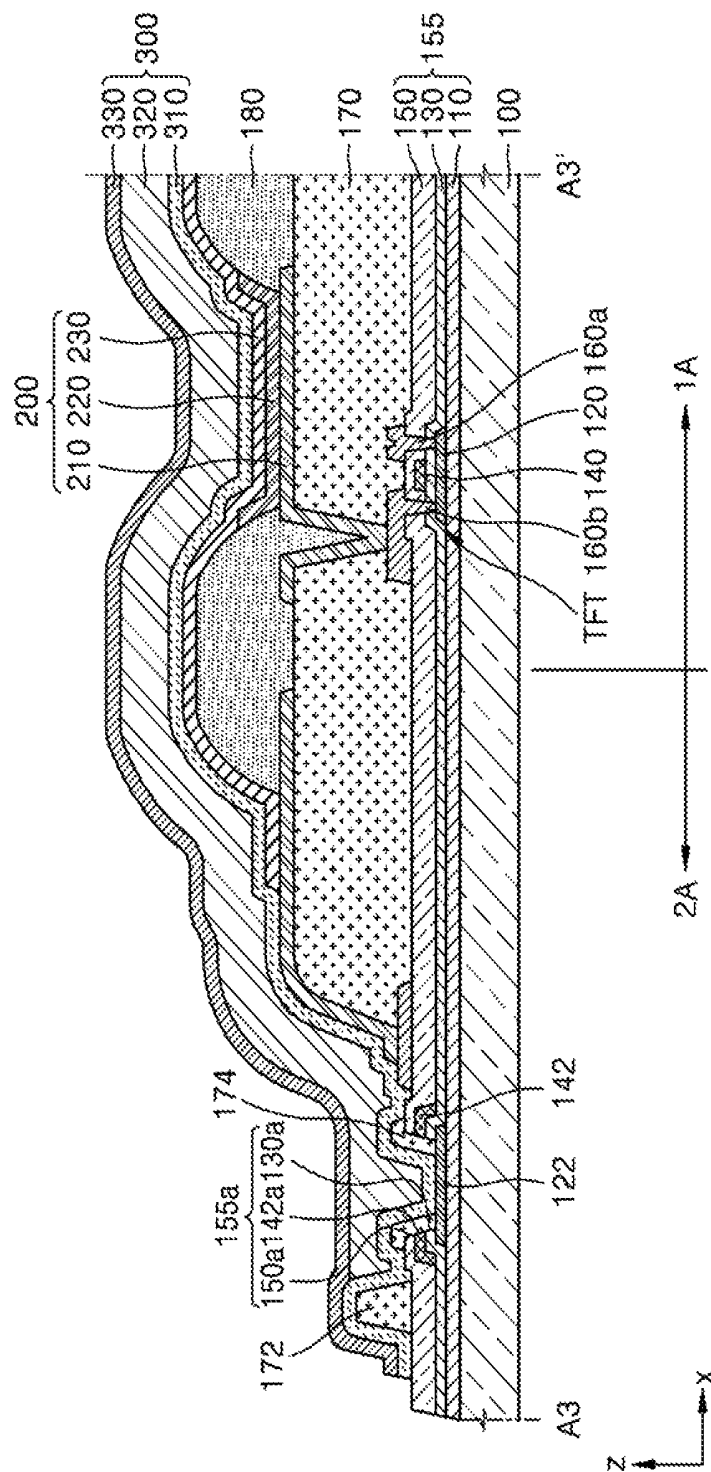


FIG. 9

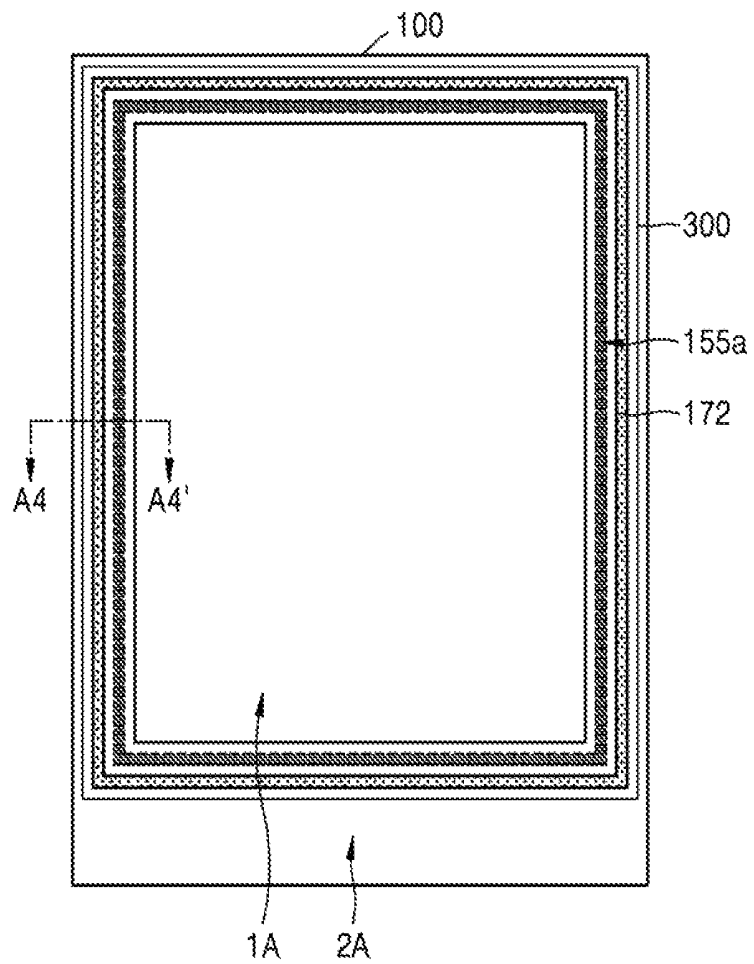


FIG. 11

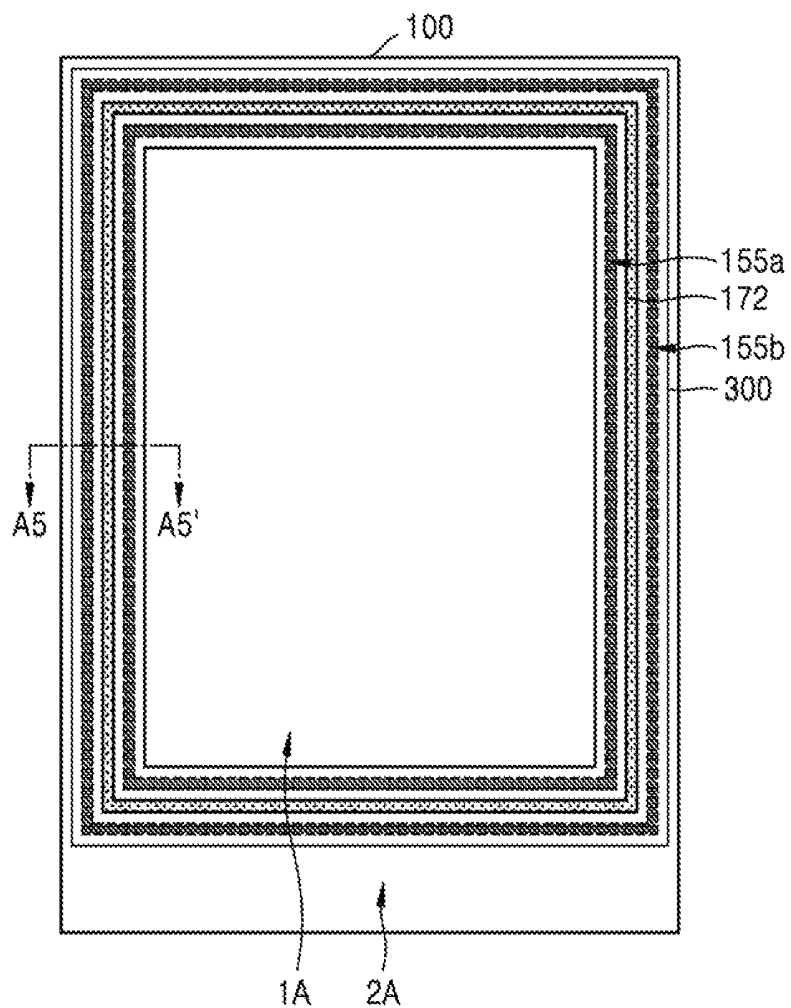


FIG. 12

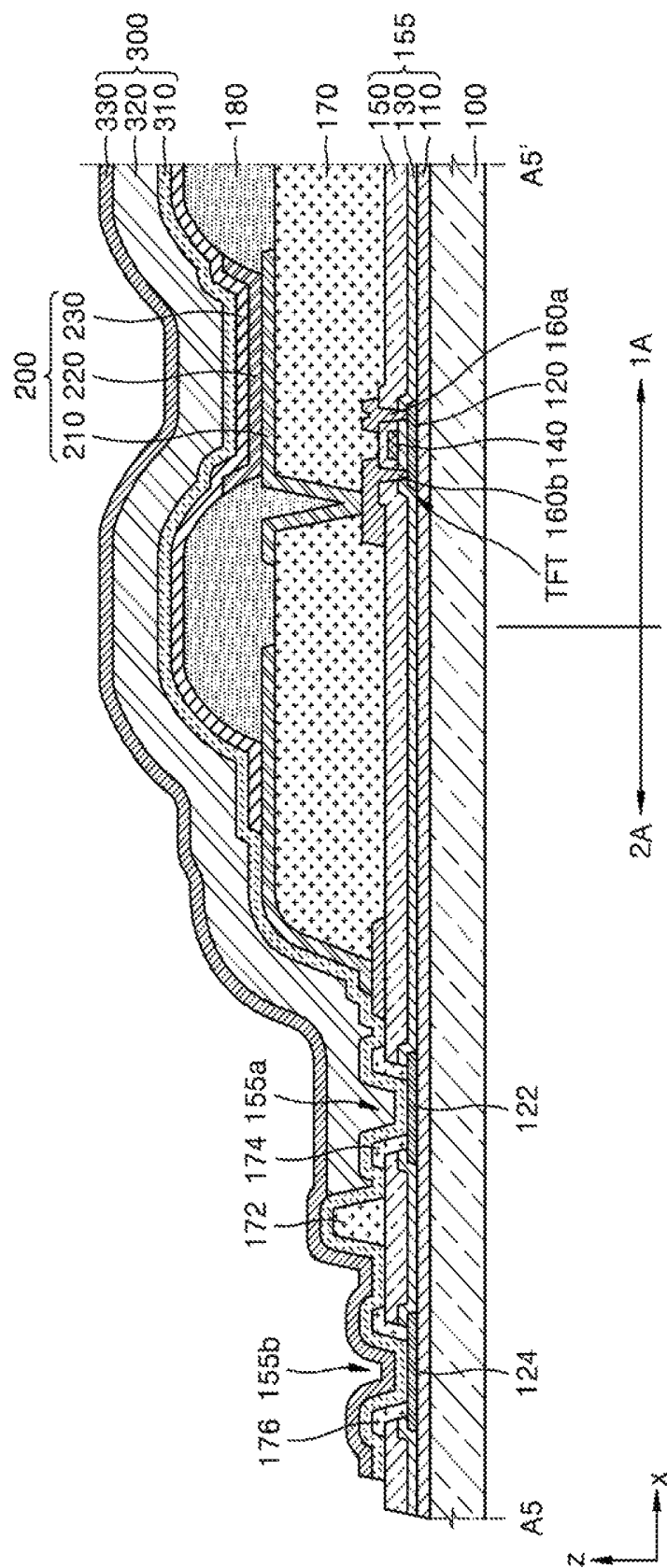


FIG. 13

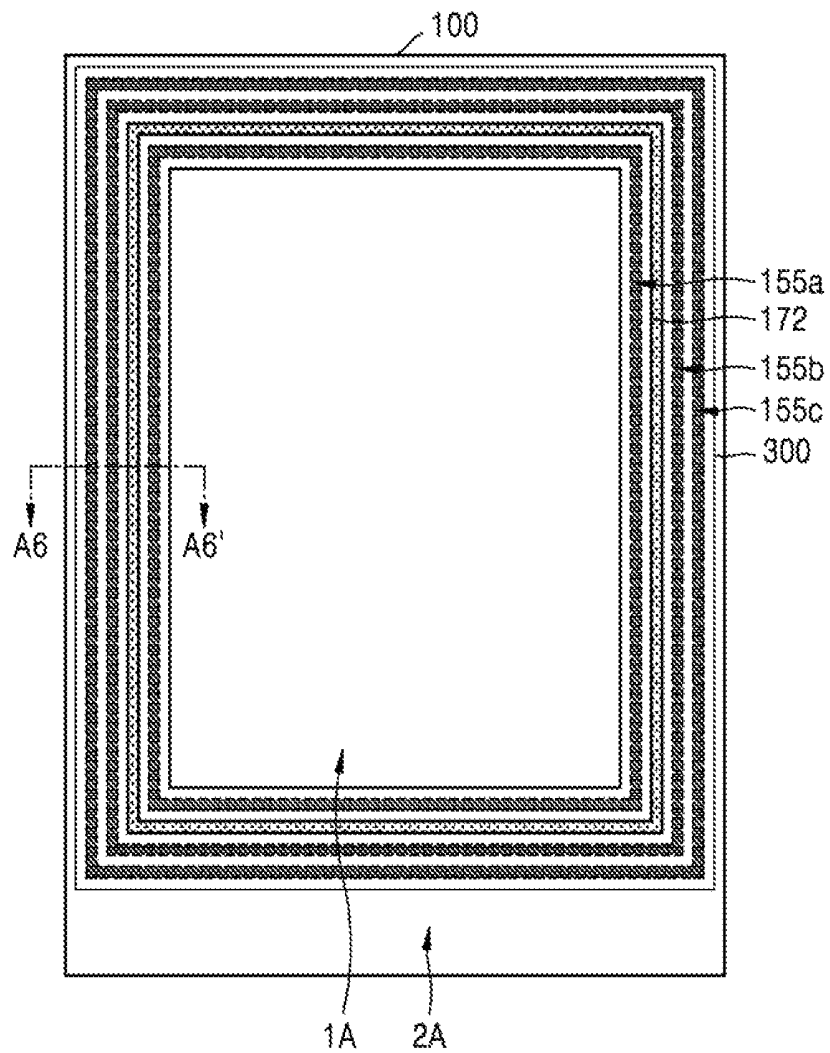
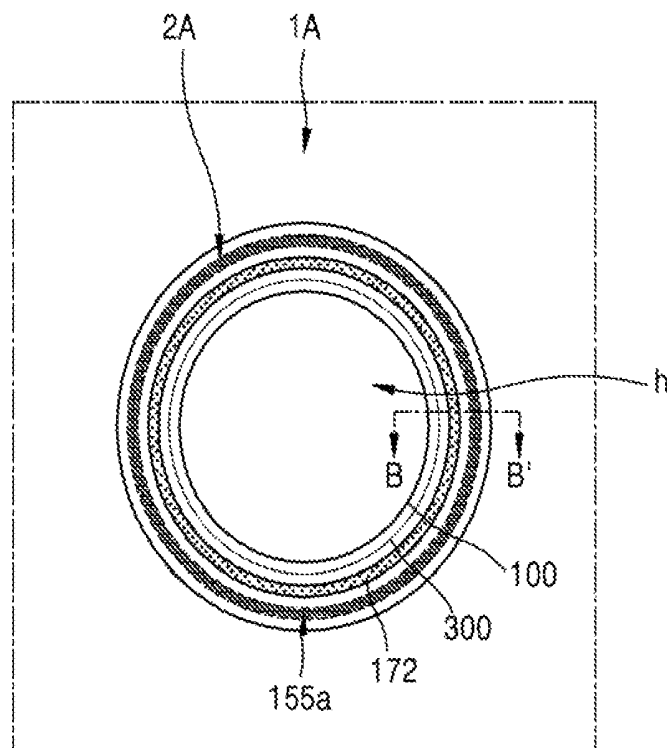


FIG. 15



DISPLAY APPARATUS HAVING A LARGER DISPLAY REGION AND MOISTURE IMPERMEABILITY

CROSS-REFERENCE TO RELATED APPLICATION

This application claims priority to Korean Patent Application No. 10-2016-0091436, filed on Jul. 19, 2016, in the Korean Intellectual Property Office, the disclosure of which is incorporated by reference herein in its entirety.

TECHNICAL FIELD

Exemplary embodiments of the present invention relate to a display apparatus, and more particularly, to a display apparatus having a large display region that is impermeable to external moisture.

DISCUSSION OF THE RELATED ART

An organic light-emitting diode (OLED) display apparatus has a wide viewing angle, a high contrast, and a fast response time. Thus, the OLED display apparatus has attracted attention as a next-generation display apparatus.

Generally, the OLED display apparatus includes thin film transistors and organic light-emitting devices disposed above a substrate. The organic light-emitting devices are capable of emitting light by themselves and so no backlight is needed. The OLED display apparatus may be used as a display panel for a small product such as a mobile phone, or may be used as a display panel for a large product such as a television.

The OLED display apparatus may include a plurality of organic light-emitting devices as a sub-pixels. Each organic light-emitting device includes an intermediate layer with an emission layer disposed between a pixel electrode and an opposite electrode. Since the organic light-emitting device is vulnerable to external moisture, which may permeate therein, an encapsulation layer is disposed above the substrate to cover the organic light-emitting device.

SUMMARY

A display apparatus includes a substrate having a first region and a second region surrounding the first region. An insulating part is disposed above the substrate, covering the first region and the second region, and comprising a first opening portion in the second region. A dam part is disposed above the insulating part in the second region and surrounds a periphery of the first opening portion. A first organic insulating layer is disposed above the insulating part and covers an inner surface of the first opening portion. An organic light-emitting device is disposed above the insulating part in the first region and comprises a pixel electrode. An encapsulation layer is disposed above the insulating part in both the first region and the second region. The encapsulation layer covers the organic light-emitting device.

A display apparatus includes a substrate and an insulating layer disposed on the substrate. The insulating layer has a first opening and a second opening. A thin film transistor (TFT) is disposed within the first opening. An organic film is disposed over the TFT and disposed within the second opening.

BRIEF DESCRIPTION OF THE DRAWINGS

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 in which:

FIG. 1 is a schematic plan view of a display apparatus according to an exemplary embodiment of the present invention;

FIG. 2 is a schematic cross-sectional view taken along line A1-A1' of FIG. 1;

FIG. 3 is a schematic cross-sectional view of a display apparatus according to an exemplary embodiment of the present invention;

FIG. 4 is a schematic cross-sectional view of a display apparatus according to an exemplary embodiment of the present invention;

FIG. 5 is a schematic plan view of a display apparatus according to an exemplary embodiment of the present invention;

FIG. 6 is a schematic cross-sectional view taken along line A2-A2' of FIG. 5;

FIG. 7 is a schematic plan view of a display apparatus according to an exemplary embodiment of the present invention;

FIG. 8 is a schematic cross-sectional view taken along line A3-A3' of FIG. 7;

FIG. 9 is a schematic plan view of a display apparatus according to an exemplary embodiment of the present invention;

FIG. 10 is a schematic cross-sectional view taken along line A4-A4' of FIG. 9;

FIG. 11 is a schematic plan view of a display apparatus according to an exemplary embodiment of the present invention;

FIG. 12 is a schematic cross-sectional view taken along line A5-A5' of FIG. 11;

FIG. 13 is a schematic plan view of a display apparatus according to an exemplary embodiment of the present invention;

FIG. 14 is a schematic cross-sectional view taken along line A6-A6' of FIG. 13;

FIG. 15 is a schematic plan view of a display apparatus according to an exemplary embodiment of the present invention; and

FIG. 16 is a schematic cross-sectional view taken along line B-B' of FIG. 15.

DETAILED DESCRIPTION

Reference will now be made in detail to exemplary embodiments of the present invention illustrated in the accompanying drawings, wherein like reference numerals may refer to like elements throughout the specification. In this regard, the embodiments may have different forms and may be modified from the descriptions set forth herein.

Various alterations and modifications may be made to the exemplary embodiments set forth herein, some of which will be illustrated in detail in the drawings and detailed description. The effects and features, and methods of achieving the effects and features will become apparent from the exemplary embodiments described below in detail with reference to the accompanying drawings. However, the inventive concept is not limited to the following embodiments and may be realized in various forms.

It will be understood that although the terms "first", "second", etc. may be used herein to describe various

components, these components should not be limited by these terms. These components are only used to distinguish one component from another.

Sizes of elements in the drawings may be exaggerated for convenience of explanation.

FIG. 1 is a schematic plan view of a display apparatus according to an exemplary embodiment of the present invention, and FIG. 2 is a schematic cross-sectional view taken along line A1-A1' of FIG. 1.

Referring to FIGS. 1 and 2, the display apparatus according to an exemplary embodiment of the present invention includes a substrate **100**; an insulating part **155** disposed above the substrate **100** and having a first opening portion **155a**; a dam part **172** disposed above the insulating part **155** and surrounding the periphery of the first opening portion **155a**; a first organic insulating layer **174** covering an inner surface of the first opening portion **155a**; an organic light-emitting device **200** disposed above the insulating part **155**; and an encapsulation layer **300** covering the organic light-emitting device **200**.

The substrate **100** may include various materials, such as glass, a metal material, and/or a plastic material (e.g., polyethylene terephthalate (PET), polyethylene naphthalate (PEN), polyimide, etc.). When the substrate **100** includes a thin glass material or a thin metal material or includes a plastic material, the substrate **100** may be flexible. The substrate **100** may have a rectangular shape as illustrated in FIG. 1, and the substrate **100** may have various shapes, such as a circular shape or an oval shape, according to a shape of a display.

The substrate **100** may have a first region **1A**, and a second region **2A** surrounding the periphery of the first region **1A**. The first region **1A** may be a display region where the organic light-emitting devices **200** are arranged. The second region **2A** is a peripheral region of the first region **1A**. In the light-emitting devices may be absent from the second region **2A**. The second region **2A** may include wirings and/or circuits. Furthermore, only the substrate **100** or an insulating film above the substrate **100** might be disposed within the second region **2A**. Referring to FIG. 1, the first region **1A** is illustrated as being disposed in the central portion of the substrate **100** and the second region **2A** is illustrated as including edges of the substrate **100** while surrounding the periphery of the first region **1A**. However, exemplary embodiments of the present invention are not limited to this particular arrangement.

Referring to FIG. 2, the insulating part **155** may be disposed above the substrate **100**, and the insulating part **155** may be disposed over the entire surface of the substrate **100**, over both the first region **1A** and the second region **2A** of the substrate **100**. As illustrated in FIG. 2, the insulating part **155** may include a plurality of insulating films. For example, the insulating part **155** may include a buffer layer **110**, a first insulating layer **130**, and a second insulating layer **150**. The first insulating layer **130** may be a gate insulating film that insulates a semiconductor layer **120** and a gate electrode **140** of a thin film transistor TFT in the first region **1A**, and the second insulating layer **150** may be an interlayer insulating film that insulates the gate electrode **140** and a source electrode **160a** of the thin film transistor TFT or insulates the gate electrode **140** and a drain electrode **160b** of the thin film transistor TFT in the first region **1A**.

First, the first region **1A** of the substrate **100** will be described below.

planarize the surface of the substrate **100** or to prevent impurities from permeating the semiconductor layer **120** of the thin film transistor TFT, the buffer layer **110** including

silicon oxide, silicon nitride, and/or silicon oxynitride may be disposed above the substrate **100** and the semiconductor layer **120** may be disposed above the buffer layer **110**. The buffer layer **110** may have a single-layered structure or a multi-layered structure. For example, the buffer layer **110** may have a double-layered structure.

However, exemplary embodiments of the present invention are not limited to this particular configuration. According to one or more exemplary embodiments of the present invention, the buffer layer **110** may be omitted, as illustrated in FIG. 4. In this case, the semiconductor layer **120** may directly contact the substrate **100**.

The gate electrode **140** is disposed above the semiconductor layer **120**, and the source electrode **160a** and the drain electrode **160b** are electrically connected to each other according to a signal applied to the gate electrode **140**. By taking into account adhesion to an adjacent layer, surface flatness of a stacked layer, and processability the gate electrode **140** may be have a single-layered structure or a multi-layered structure that includes aluminum (Al), platinum (Pt), palladium (Pd), silver (Ag), magnesium (Mg), gold (Au), nickel (Ni), neodymium (Nd), iridium (Ir), chromium (Cr), lithium (Li), calcium (Ca), molybdenum (Mo), titanium (Ti), tungsten (W), and/or copper (Cu).

To secure insulation properties between the semiconductor layer **120** and the gate electrode **140**, the first insulating layer **130** including silicon oxide and/or silicon nitride may be disposed between the semiconductor layer **120** and the gate electrode **140**.

The second insulating layer **150** may be disposed above the gate electrode **140**. The second insulating layer **150** may have a single-layered structure or a multi-layered structure including silicon oxide or silicon nitride.

The source electrode **160a** and the drain electrode **160b** may be disposed above the second insulating layer **150**. The source electrode **160a** and the drain electrode **160b** may be electrically connected to the semiconductor layer **120** through contact holes formed in the second insulating layer **150** and the first insulating layer **130**. By taking into account conductivity or the like, the source electrode **160a** and the drain electrode **160b** may have a single-layered structure or a multi-layered structure including Al, Pt, Pd, Ag, Mg, Au, Ni, Nd, Ir, Cr, Li, Ca, Mo, Ti, W, and/or Cu.

The thin film transistor TFT may have the above-described structure and a protection film may be disposed to cover the thin film transistor. The protection film may include an inorganic material, such as silicon oxide, silicon nitride, or silicon oxynitride.

A via layer **170** may be disposed above the substrate **100**. In this case, the via layer **170** may be a planarization film or a protection film. In a case where the organic light-emitting device **200** is disposed above the thin film transistor TFT, the via layer **170** may planarize the top surface of the thin film transistor TFT and protect the thin film transistor TFT and other devices. The via layer **170** may include an acryl-based organic material and/or benzocyclobutene (BCB).

A pixel defining film **180** may be disposed above the thin film transistor TFT. The pixel defining film **180** may be disposed above the via layer **170** and may have an opening defining a pixel region. The pixel defining film **180** may serve to define a pixel region of each pixel through the opening.

The pixel defining film **180** may include, for example, an organic insulating film. The organic insulating film may include an acryl-based polymer such as polymethyl methacrylate (PMMA), a polystyrene (PS), a polymer derivative having a phenol group, an imide-teased polymer, an aryle-

ther-based polymer, an amide-based polymer, a fluorine-based polymer, a p-xylene-based polymer, a vinylalcohol-based polymer, and/or any mixtures thereof.

An organic light-emitting device **200** may be disposed above the via layer **170**. The organic light-emitting device **200** may include a pixel electrode **210**, an intermediate layer **220** including an emission layer (EML), and an opposite electrode **230**.

The pixel electrode **210** may be a transparent (or translucent) electrode or a reflective electrode. When the pixel electrode **210** is the transparent (or translucent) electrode, the pixel electrode **210** may include indium thin oxide (ITO), indium zinc oxide (IZO), zinc oxide (ZnO), indium oxide (In₂O₃), indium gallium oxide (IGO), and/or aluminum zinc oxide (AZO). When the pixel electrode **210** is the reflective electrode, the pixel electrode **210** may include a reflection film including Ag, Mg, Al, Pt, Pd, Au, Ni, Nd, Ir, Cr, and/or any compounds thereof, and a layer including ITO, IZO, ZnO, In₂O₃, IGO, and/or AZO. However, exemplary embodiments of the present invention are not limited to this particular composition. The pixel electrode **210** may include various materials. Various modifications may be made to the pixel electrode **210**. For example, the pixel electrode **210** may have a single-layered structure or a multi-layered structure.

The intermediate layer **220** may be disposed within the pixel region defined by the pixel defining film **180**. The intermediate layer **220** may include an emission layer (EML) that emits light according to an electrical signal. The intermediate layer **220** may have a single-layered structure or a multi-layered structure including, in addition to the EML, a hole injection layer (HIL) and a hole transport layer (HTL), which are disposed between the EML and the pixel electrode **210**. The intermediate layer **220** may further include an electron transport layer (ETL) and an electron injection layer (EIL), which are disposed between the EML and the opposite electrode **230**. However, the intermediate layer **220** is not limited to this particular configuration. The intermediate layer **220** may have various structures.

The opposite electrode **230**, which covers the intermediate layer **220** including the EML and faces the pixel electrode **210**, may be disposed over the entire surface of the substrate **100**. The opposite electrode **230** may be a transparent (or translucent) electrode or a reflective electrode.

The intermediate layer **220** may include a low-molecular-weight organic material or a high-molecular-weight organic material.

When the intermediate layer **220** includes a low-molecular-weight organic material, an HTL, an HIL, an ETL, and an EIL may be stacked with respect to an EML. When necessary, various layers may be further stacked. In this case examples of available organic materials may include copper phthalocyanine (CuPc), N'-di(naphthalene-1-yl)-N, N'-diphenyl-benzidine (NPB), and tris-8-hydroxyquinoline aluminum (Alq₃).

When the intermediate layer **220** includes a high-molecular-weight organic material, the intermediate layer **220** may further include an HTL. The HTL may include poly-(2,4)-ethylene-dihydroxy thiophene (PEDOT) or polyaniline (PANI). In this case, examples of available organic materials may include a high-molecular-weight organic material that includes poly-phenylenevinylene (PPV) or polyfluorene. Also, an inorganic material may be disposed between the intermediate layer **220** and the pixel electrode **210** and between the intermediate layer **220** and the opposite electrode **230**.

In this case, the HTL, the HIL, the ETL, and the EIL may be integrally formed above the entire surface of the substrate **100**, and only the EML may be formed at each pixel. The EML may be formed by an inkjet printing process. The HTL, the HIL, the ETL, and the EIL may be in a lead-in portion.

When the opposite electrode **230** is a transparent (or translucent) electrode, the opposite electrode **230** may include a layer including a metal having a small work function, for example, Li, Ca, LiF/Ca, LiP/Al, Al, Ag, Mg, and any compounds thereof, and a transparent (or translucent) conductive layer including ITO, IZO, ZnO, or In₂O₃. When the opposite electrode **230** is a reflective electrode, the opposite electrode **230** may include a layer including Li, Ca, LiF/Ca, LiF/Al, Al, Ag, Mg, and any compounds thereof. The structure and material of the opposite electrode **230** are not limited thereto, and various modifications may be made thereto.

The encapsulation layer **300** may be disposed above the organic light-emitting device **200** to cover the organic light-emitting device **200**. Although not illustrated, in one or more exemplary embodiments of the present invention, functional layers, such as a polarization layer, may be further disposed between the opposite electrode **230** and the encapsulation layer **300**.

The encapsulation layer **300** may include a first inorganic film **310**, a second inorganic film **330**, and an organic film **320** disposed between the first inorganic film **310** and the second inorganic film **330**. The encapsulation layer **300** may serve to seal the organic light-emitting device **200** that is vulnerable external moisture permeation. The encapsulation layer **300** may have a multi-layered structure in which the inorganic film and the organic film **320** are alternately stacked, so as to increase sealing performance. Also, the organic film **320** of the encapsulation layer **300** may be thicker than the first inorganic film **310** and the second inorganic film **330**.

The first inorganic film **310** and the second inorganic film **330** may be disposed above the entire surface of the substrate **100** in the first region **1A** and the second region **2A**. The first inorganic film **310** and the second inorganic film **330** may include, for example, silicon nitride, aluminum nitride, zirconium nitride, titanium nitride, hafnium nitride, tantalum nitride, silicon oxide, aluminum oxide, titanium oxide, tin oxide, cerium oxide, and/or oxynitride (SiON). In this case, the material of the first inorganic film **310** may be identical to or different from the material of the second inorganic film **330**.

The organic film **320** may be disposed between the first inorganic film **310** and the second inorganic film **330**, so as to increase flexibility of the encapsulation layer **300**. The organic film **320** may be sealed by the first inorganic film **310** and the second inorganic film **330**. For example, the side of the organic film **320** may be covered by the first inorganic film **310** and the second inorganic film **330**. For example, the organic film **320** may be completely covered by the second inorganic film **330** above the organic film **320**. Edges of the first inorganic film **310** and the second inorganic film **330** covering the side of the organic film **320** may directly contact each other. Since the organic film **320** is a passage by which external moisture may permeate, the organic film **320** is completely sealed by the first inorganic film **310** and the second inorganic film **330**. The organic film **320** may include, for example, an acryl-based resin, a methacryl-based resin, a polyisoprene-based resin, a vinyl-based resin, an epoxy-based resin, a urethane-based resin, a cellulose-based resin, and/or a perylene-based resin. The material of

the first organic film may be identical to or different from the material of the second organic film.

Next, the second region 2A of the substrate 100 will be described with reference to FIG. 2.

The second region 2A of the substrate 100 may be a region that surrounds the periphery of the first region 1A and includes the edges of the substrate 100. Wirings, circuits, and the like, except for the organic light-emitting device 200, may be arranged in the second region 2A. Furthermore, only the substrate 100 or an insulating film above the substrate 100 may be disposed in the second region 2A. According to an exemplary embodiment of the present invention, the insulating part 155 may be disposed over the first region 1A and the second region 2A of the substrate 100. A portion of the via layer in the first region 1A may extend to the second region 2A. Also, a portion of the encapsulation layer 300 in the first region 1A may extend to the second region 2A.

The insulating part 155 in the second region 2A may have a first opening portion 155a disposed around an edge of the first region 1A. For example, the first opening portion 155a may be disposed in the second region 2A around the first region 1A. The first opening portion 155a may have a closed loop along the first region 1A, or may have an opened loop. As illustrated in FIG. 2, the first opening portion 155a may expose at least a portion of the buffer layer.

The first opening portion 155a may include a first opening 130a and a second opening 150a corresponding to the first opening portion 155a. For example, the insulating part 155 may include the buffer layer 110, and the first insulating layer 130 and the second insulating layer 150 above the buffer layer 110. The first insulating layer 130 may have the first opening 130a corresponding to the first opening portion 155a. Similarly, the second insulating layer 150 may have the second opening 150a corresponding to the first opening portion 155a. An inner surface of the first opening 130a is illustrated in FIG. 2 as matching an inner surface of the second opening 150a, but a cross-section of the first opening 130a may or might not match a cross-section of the second opening 150a. For example, in a case where the first insulating layer 130 and the second insulating layer 150 include the same inorganic material, the inner surfaces of the first insulating layer 130 and the second insulating layer 150 may match each other through etching using the same mask. However, in a case where the first insulating layer 130 and the second insulating layer 150 include different inorganic materials, the inner surfaces of the first insulating layer 130 and the second insulating layer 150 might not match each other through etching using the same mask. In a case where the inner surfaces of the first insulating layer 130 and the second insulating layer 150 do not match each other, the first inorganic film 310 of the encapsulation layer 300 extending to the second region 2A might not easily cover the inner surface of the first opening portion 155a. In a case where the first inorganic film 310 does not easily cover the inner surface of the first opening portion 155a, external moisture may permeate the display apparatus through the region where the first inorganic film 310 is discontinuously formed. Thus, it is possible to increase step coverage of the first inorganic film 310 by covering the inner surface of the first opening portion 155a by using the first organic insulating layer 174.

The first organic insulating layer 174 covering the inner surface of the first opening portion 155a may be disposed above the insulating part 155 in the first opening portion 155a. As illustrated in FIG. 2, the first organic insulating layer 174 may cover the inner surface of the first opening

portion 155a, and may cover at least a portion of the top surface of the insulating part 155 where the first opening portion 155a is disposed. The first organic insulating layer 174 may cover the inner surface of the first opening portion 155a and expose at least a portion of the buffer layer 110. The first organic insulating layer 174 and the via layer 170 may include the same material. As illustrated in FIG. 3, the first organic insulating layer 174 and the pixel defining film 180 may include the same material.

The dam part 172 may be disposed above the insulating part 155 in the second region 2A to surround the periphery of the first opening portion 155a. As in the first opening portion 155a, the dam part 172 may have a closed loop or may have an opened loop. The dam part 172 may serve to prevent the organic film 320 of the encapsulation layer 300 from overflowing to the edges of the substrate 100 and may allow the organic film 320 to be easily sealed by the first inorganic film 310 and the second inorganic film 330.

The dam part 172 and the via layer 170 may include the same material. As illustrated in FIG. 3, the dam part 172 and the pixel defining film 180 may include the same material. When the dam part 172 and the via layer 170 include the same material, a height of the dam part 172 may be equal to or less than a height of the via layer 170. In one or more exemplary embodiments of the present invention, when the dam part 172 and the pixel defining film 180 include the same material, a height of the dam part 172 may be equal to or less than a height of the pixel defining film 160. When the height of the dam part 172 is less than the height of the dam part 172 or the via layer 170, the height of the dam part 172 may be adjusted by using a halftone mask or the like during a manufacturing process. The dam part 172 is formed to have a single-layered structure, but in other embodiments, the dam part 172 may have a multi-layered structure. In this case, the dam part 172 may have a multi-layered structure including a layer including the same material as that of the via layer 170 and a layer including the same material as that of the pixel defining film 180.

As described above, the encapsulation layer 300 may extend from the first region 1A to the second region 2A above the insulating part 155 in the second region 2A. As illustrated in FIG. 2, the first inorganic film 310 may be disposed above the opposite electrode in the first region 1A, may extend to the second region 2A, and may be disposed above the first opening portion 155a, the first organic insulating layer 174 covering the inner surface of the first opening portion 155a, and the dam part 172. The first inorganic film 310 may cover the entire surface of the substrate 100 and may extend to the edges of the substrate 100.

The organic film 320 may be disposed above the first inorganic film 310 and may be disposed in a portion of the first region 1A and the second region 2A. In this case, the expression that “the organic film 320 is in a portion of the second region 2A” may denote that the organic film 320 is arranged up to the dam part 172 and disposed in the second region 2A. For example, the overflow of the organic film 320 is prevented by the dam part 172, and thus, the organic film 320 is not formed up to the edges of the substrate 100. The organic film 320 may be buried in the first opening portion 155a formed in the insulating part 155. The top surface of the organic film 320 buried in the first opening portion 155a may have an approximately flat shape.

The second inorganic film 330 may be disposed above the organic film 320. The second inorganic film 330 may be disposed above the organic film 320 and may come into direct surface contact with the organic film 320 in the region

where the organic film 320 is formed. As described above, since the region of the organic film 320 is defined by the dam part 172 of the second region 2A, the second inorganic film 330 may directly contact the organic film 320 until just before the dam part 172, and comes into direct surface contact with the first inorganic film 310 from the top surface of the dam part 172 to the edge of the substrate 100. For example, the organic film 320 is not present from the top surface of the dam part 172 to the edge of the substrate 100, and the first inorganic film 310 extends to the edge of the first inorganic film 310.

In the related art, the second region 2A has more than a certain width to prevent damage to the display apparatus due to external moisture permeation. For example, in the encapsulation layer 300 playing a major role in preventing external moisture permeation, the region where the first inorganic film 310 and the second inorganic film 330 come into direct contact with each other may have more than a certain width. However, in this case, as the width of the second region 2A is increased in the periphery of the first region 1A, except for the first region 1A where pixels are arranged, a non-display region of the display apparatus, e.g., a dead space, is expanded.

Since the insulating part 155 in the second region 2A has the first opening portion 155a and the organic film 320 is partially buried in the first opening portion 155a, a passage of external moisture permeability through the side of the insulating film is blocked to thereby make a display apparatus robust to moisture permeation. Due to the first organic insulating layer 174 covering the inner surface of the first opening portion 155a, step coverage of the first inorganic film 310 may be increased. Also, due to the first opening portion 155a blocking the passage of moisture permeability, the non-display region of the display apparatus, for example, the dead space, may be reduced.

FIG. 5 is a schematic plan view of a display apparatus according to an exemplary embodiment of the present invention, and FIG. 6 is a schematic cross-sectional view taken along line A2-A2' of FIG. 5.

Referring to FIGS. 5 and 6, the display apparatus according to an exemplary embodiment of the present invention includes a substrate 100; an insulating part 155 above the substrate 100 having a first opening portion 155a; a dam part 172 disposed above the insulating part 155 and surrounding the periphery of the first opening portion 155a; an organic insulating layer 174 covering an inner surface of the first opening portion 155a; an organic light-emitting device 200 disposed above the insulating part 155; an encapsulation layer 300 covering the organic light-emitting device 200; and a first material layer 122 disposed between the substrate 100 and the insulating part 155.

The approach illustrated in FIG. 6 is substantially identical to the approach illustrated in FIG. 2, except that according to the approach illustrated in FIG. 6, the first material layer 122 is disposed in a region where the first opening portion 155a is disposed.

Referring to FIG. 6, the first material layer 122 may be disposed between the substrate 100 and the insulating part 155 of the second region 2A. For example, the first material layer 122 may be disposed above the buffer layer and may be disposed between the buffer layer and the first insulating layer 130. The first opening portion 155a may be formed to expose at least a portion of the first material layer 122. The first material layer 122 may include the same material as that of a semiconductor layer 120 of a thin film transistor TFT, but might not undergo a doping process as is performed in the semiconductor layer 120.

In the manufacturing process of forming the first opening portion 155a, when the first opening portion 155a is formed through etching, the first material layer 122 may serve as an etch stopper to adjust a depth to be defined by the first opening portion 155a. As such, the depth of the first opening portion 155a may be controlled according to which layer the first material layer 122 is arranged on.

As described above, since the first opening portion 155a is formed to expose at least a portion of the first material layer 122, the first organic insulating layer 174 covering the inner surface of the first opening portion 155a may expose at least a portion of the first material layer 122. In this case, at least a portion of the first organic insulating layer 174 may directly contact with the first material layer 122. Therefore, the region where the first organic insulating layer 174 exposes the first material layer 122 may be smaller than the region where the first opening portion 155a exposes the first material layer 122.

The first inorganic film 310 of the encapsulation layer 300 may be disposed above the insulating part 155 so as to cover the first organic insulating layer 174, and may come into direct contact with the first material layer 122, at least a portion of which is exposed by the first opening portion 155a and the first organic insulating layer 174.

According to an exemplary embodiment of the present invention, since the insulating part 155 in the second region 2A has the first opening portion 155a and the organic film 320 is partially buried in the first opening portion 155a, a passage of external moisture permeability through the side of the insulating film is blocked to thereby provide a display apparatus robust to moisture permeation. Due to the first organic insulating layer 174 covering the inner surface of the first opening portion 155a, it is possible to increase step coverage of the first inorganic film 310. Also, due to the first opening portion 155a blocking the passage of moisture permeability, it is possible to reduce the width of the non-display region of the display apparatus, that is, for example, the dead space.

FIG. 7 is a schematic plan view of a display apparatus according to an exemplary embodiment of the present invention, and 8 is a schematic cross-sectional view taken along line A3-A3' of FIG. 7.

Referring to FIGS. 7 and 8, the display apparatus according to an exemplary embodiment of the present invention includes a substrate 100; an insulating part 155 disposed above the substrate 100 and having a first opening portion 155a; a dam part 172 disposed above the insulating part 155 and surrounding the periphery of the first opening portion 155a; an organic insulating layer 174 covering an inner surface of the first opening portion 155a; an organic light-emitting device 200 disposed above the insulating part 155; an encapsulation layer 300 covering the organic light-emitting device 200; a first material layer 122 disposed between the substrate 100 and the insulating part 155; and a first metal layer 142.

The approach illustrated in FIG. 8 is substantially identical to the approach illustrated in FIGS. 2 and 6, except that, according to the approach illustrated in FIG. 8, the first metal layer 142 is disposed between the first insulating layer 130 and the second insulating layer 150.

Referring to FIG. 8, the insulating part 155 disposed above the substrate 100 may include a buffer layer 110, a first insulating layer 130, and a second insulating layer 150. As described above, the first insulating layer 130 may have a first opening 130a corresponding to the first opening portion 155a, and the second insulating layer 150 may have a second opening 150a corresponding to the first opening

portion 155a. According to an exemplary embodiment of the present invention, the first metal layer 142 may be further provided between the first insulating layer 130 and the second insulating layer 150. Like the first opening 130a of the first insulating layer 130 and the second opening 150a of the second insulating layer 150, the first metal layer 142 may have a third opening 142a corresponding to the first opening portion 155a. The first opening 130a, the second opening 150a, and the third opening 142a are illustrated in FIG. 7 as having the same inner surface, but the first opening 130a, the second opening 150a, and the third opening 142a might not have the same inner surface. For example, the first opening 130a, the second opening 150a, and the third opening 142a may have different sizes. In this case, the first opening 130a, the second opening 150a, and the third opening 142a may have different inner surfaces.

As such, the first metal layer 142 may include the same material as that of a gate electrode 140 of a thin film transistor TFT in the first region 1A, but the exact composition of the first metal layer 142 is not limited thereto.

The first organic insulating layer 174 may cover the inner surface of the first opening portion 155a including the first opening 130a, the second opening 150a, and the third opening 142a. As described above, even when the first opening 130a, the second opening 150a, and the third opening 142a have different inner surfaces, the first organic insulating layer 174 covers the entire inner surface of the first opening portion 155a, thereby preventing a discontinuous formation of the first inorganic film 310 covering the first opening portion 155a.

Due to the first metal layer 142 having the third opening 142a corresponding to the first opening portion 155a, a depth of the first opening portion 155a may be increased as much as a thickness of the first metal layer 142. As the depth of the first opening portion 155a is increased, an area of the first inorganic film 310 covering the first opening portion 155a may be increased and the depth of the organic film 320 buried in the first opening portion 155a may be increased. Thus, it is more effective to the blocking of the permeation of external moisture.

According to an exemplary embodiment of the present invention, since the insulating part 155 in the second region 2A has the first opening portion 155a and the organic film 320 is partially buried in the first opening portion 155a, a passage of external moisture permeability through the side of the insulating film is blocked to thereby provide a display apparatus robust to moisture permeation. Due to the first organic insulating layer 174 covering the inner surface of the first opening portion 155a, step coverage of the first inorganic film 310 may be increased. Also, due to the first opening portion 155a blocking the permeation of moisture, the width of the non-display region of the display apparatus, for example, the dead space, may be narrowed.

FIG. 9 is a schematic plan view of a display apparatus according to an exemplary embodiment of the present invention, and FIG. 10 is a schematic cross-sectional view taken along line A4-A4' of FIG. 9.

Referring to FIGS. 9 and 10, the display apparatus according to an exemplary embodiment of the present invention includes a substrate 100; an insulating part 155 disposed above the substrate 100 and having a first opening portion 155a; a dam part 172 disposed above the insulating part 155 and surrounding the periphery of the first opening portion 155a; an organic insulating layer 174 covering an inner surface of the first opening portion 155a; an organic light-emitting device 200 disposed above the insulating part 155; all encapsulation layer 300 covering the organic light-

emitting device 200; a first material layer 122 disposed between the substrate 100 and the insulating part 155; and a second metal layer 162.

The approach illustrated in FIG. 10 is substantially identical to the approach illustrated in FIGS. 2 and 8, except that the second metal layer 162 is disposed on the top surface of the insulating part 155 having the first opening portion 155a.

Referring to FIG. 10, the insulating part 155 above the substrate 100 may include a buffer layer 110, a first insulating layer 130, and a second insulating layer 150. As described above, the first insulating layer 130 may have a first opening 130a corresponding to the first opening portion 155a. The second insulating layer 150 may have a second opening 150a corresponding to the first opening portion 155a. According to an exemplary embodiment of the present invention, the display apparatus may further include the first metal layer 142 disposed between the first insulating layer 130 and the second insulating layer 150, and the second metal layer 162 disposed above the second insulating layer 150.

Like the first opening 130a of the first insulating layer 130 and the second opening 150a of the second insulating layer 150, the first metal layer 142 may have a third opening 142a corresponding to the first opening portion 155a. Also, the second metal layer 162 may have a fourth opening 162a corresponding to the first opening portion 155a. The first opening 130a, the second opening 150a, the third opening 142a, and the fourth opening 162a are illustrated in FIG. 9 as having the same inner surface, but the first opening 130a, the second opening 150a, the third opening 142a, and the fourth opening 162a might not have the same inner surface. For example, the first opening 130a, the second opening 150a, the third opening 142a, and the fourth opening 162a may have different sizes. In this case, the first opening 130a, the second opening 150a, the third opening 142a, and the fourth opening 162a may have different inner surfaces.

As such, the first metal layer 142 may include the same material as that of a gate electrode 140 of a thin film transistor TFT in the first region. 1A, but the composition of the first metal layer 142 is not limited thereto. Also, the second metal layer 162 may include the same material as that of a source electrode 160a or a drain electrode 160b of the thin film transistor TFT.

The first organic insulating layer 174 may cover the inner surface of the first opening portion 155a further including the third opening 142a and the fourth opening 162a. As described above, even when the first opening 130a, the second opening 150a, the third opening 142a, and the fourth opening 162a have different inner surfaces, the first organic insulating layer 174 covers the entire inner surface of the first opening portion 155a, thereby preventing a discontinuous formation of the first inorganic film 310 covering the first opening portion 155a.

Due to the first metal layer 142 having the third opening 142a corresponding to the first opening portion 155a and the second metal layer 162 having the fourth opening 162a corresponding to the first opening portion 155a, a depth of the first opening portion 155a may be increased by as much as a thickness of the first metal layer 142 and the second metal layer 162. As the depth of the first opening portion 155a is increased, an area of the first inorganic film 310 covering the first opening portion 155a may be increased and the depth of the organic film 320 buried in the first opening portion 155a may be increased. Thus the blocking of the passage of external moisture permeation may be increased.

According to an exemplary embodiment of the present invention, since the insulating part **155** in the second region **2A** has the first opening portion **155a** and the organic film **320** is partially buried in the first opening portion **155a**, a passage of external moisture permeation through the side of the insulating film is blocked to thereby provide a display apparatus robust to moisture permeation. Due to the first organic insulating layer **174** covering the inner surface of the first opening portion **155a**, it is possible to increase step coverage of the first inorganic film **310**. Also, due to the first opening portion **155a** blocking the permeation of moisture, it is possible to narrow the width of the non-display region of the display apparatus, which may be regarded as dead space.

FIG. **11** is a schematic plan view of a display apparatus according to an exemplary embodiment of the present invention, and FIG. **12** is a schematic cross-sectional view taken along line **A5-A5'** of FIG. **11**.

Referring to FIGS. **11** and **12**, the display apparatus according to an exemplary embodiment of the present invention includes a substrate **100**; an insulating part **155** disposed above the substrate **100** and having a first opening portion **155a** and a second opening portion **155b**; a dam part **172** disposed above the insulating part **155** and surrounding the periphery of the first opening portion **155a**; a first organic insulating layer **174** covering an inner surface of the first opening portion **155a**; an organic light-emitting device **200** disposed above the insulating part **155**; and an encapsulation layer **300** covering the organic light-emitting device **200**.

The approach illustrated in FIG. **12** differs from the above-described approaches, in that in the approach of FIG. **12**, the second opening portion **155b** is further included in addition to the first opening portion **155a**.

Referring to FIG. **12**, the insulating part **155** disposed above the substrate **100** may have the first opening portion **155a** in the second region **2A**, and the second opening portion **155b** covering the periphery of the first opening portion **155a**. The dam part **172** may be disposed between the first opening portion **155a** and the second opening portion **155b**. For example, the second opening portion **155b** may cover the periphery of the dam part **172**.

A second material layer **124** may be disposed at a position corresponding to the second opening portion **155b**. The second material layer **124** may be disposed between a buffer layer **110** and a first insulating layer **130**. Therefore, the second opening portion **155b** may expose at least a portion of the second material layer **124**, and may be formed so that the first insulating layer **130** covers the edge of the second material layer **124**. As in the first material layer **122**, in the manufacturing process of forming the first opening portion **155a**, when the second opening portion **155b** is formed through etching, the second material layer **124** may serve as an etch stopper to adjust a depth to be defined by the second opening portion **155b**. As such, the depth of the second opening portion **155b** may be controlled according to which layer the second material layer **124** is arranged on.

The second material layer **124** may include the same material as that of a semiconductor layer **120** of a thin film transistor TFT, but might not undergo a doping process as in the semiconductor layer **120**. In one or more exemplary embodiments of the present invention, when the depth of the second opening portion **155b** is formed to be relatively shallow, the second material layer **124** may include the same material as that of the gate electrode **140**. In this case, the second material layer **124** may be disposed above the first insulating film.

A second organic insulating layer **176** may be disposed above the insulating part **153** and may cover the inner surface of the second opening portion **155b**. The second organic insulating layer **176** covers the inner surface of the second opening portion **155b**. Thus, even when the inner surface of the second opening portion **155b** is not smoothly formed, it is possible to prevent a discontinuous formation of the first inorganic film **310** above the inner surface of the second opening portion **155b**.

As described above, the first inorganic film **310** may cover the second opening portion **155b** covered by the second organic insulating layer **176** and the first material layer **122**, at least a portion of which is exposed by the second opening portion **155b**. As illustrated, the first inorganic film **310** may be disposed above the entire surface of the substrate **100** over both the first region **1A** and the second region **2A**.

Above the insulating part **155** where the second opening portion **155b** is arranged, the second inorganic film **330** may be disposed directly on the first inorganic film **310**. For example, the first inorganic film **310** may come into surface contact with the second inorganic film **330** above the insulating film from the dam part **172** to the edge of the substrate **100**.

FIG. **13** is a schematic plan view of a display apparatus according to an exemplary embodiment of the present invention, and FIG. **14** is a schematic cross-sectional view taken along line **A6-A6'** of FIG. **13**.

Referring to FIGS. **13** and **14**, the display apparatus according to an exemplary embodiment of the present invention includes a substrate **100**; an insulating part **155** disposed above the substrate **100** and having a first opening portion **155a**, a second opening portion **155b**, and a third opening portion **155c**; a dam part **172** disposed above the insulating part **155**, surrounding the periphery of the first opening portion **155a**, and disposed between the first opening portion **155a** and the second opening portion **155b**; a first organic insulating layer **174** covering an inner surface of the first opening portion **155a**; a second organic insulating layer **176** covering an inner surface of the second opening portion **155b**; a first organic insulating layer **178** covering an inner surface of the third opening portion **155c**; an organic light emitting device **200** disposed above the insulating part **155**; and an encapsulation layer **300** covering the organic light-emitting device **200**.

The approach illustrated in FIG. **14** differs from the above-described approaches, in that the third opening portion **155c** is further included in addition to the first opening portion **155a** and the second opening portion **155b**.

The approach illustrated in FIG. **15** differs from the above-described approaches, in that the third opening portion **155c** is further included in addition to the first opening portion **155a** and the second opening portion **155b**. The third opening portion **155c** may surround the periphery of the second opening portion **155b**. For example, the first opening portion **155a** may be in a region closest to the first region **1A** so as to surround the periphery of the first region **1A** where pixels are arranged. The dam part **172** may surround the periphery of the first opening portion **155a**. The second opening portion **155b** may surround the dam part **172**. The third opening portion **155c** may surround the second opening portion **155b**.

As illustrated in FIG. **13**, the third opening portion **155c** may include an opening formed in the second insulating film **150**. In this case, a third material layer **126** may be further above the first insulating film **130**. The third opening portion **155c** may expose at least a portion of the third material layer

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126. The third material layer 126 may include the same material as that of a gate electrode 140 of a thin film transistor TFT.

in one or more exemplary embodiments of the present invention, as in the second opening portion 155b, an opening may be further formed in the first insulating film 130. In this case, the third material layer 126 may be disposed above a buffer layer 110 and may include the same material as that of a semiconductor layer 120 of the thin film transistor TFT.

In one or more exemplary embodiments of the present invention, the third opening portion 155c might not include the third material layer. In this case, the third opening portion 155c may expose at least a portion of the buffer layer 110.

FIG. 15 is a schematic plan view of a display apparatus according to an exemplary embodiment of the present invention, and FIG. 16 is a schematic cross-sectional view taken along line B-B' of FIG. 15.

Referring to FIG. 15, the display apparatus according to an exemplary embodiment of the present invention may include a first region 1A as a display region where a plurality of pixels are arranged, and a second region 2A as a non-display region that surrounds the periphery of the first region 1A. A substrate 100 having a hole h may be provided in a certain region. The hole h may be disposed in the display region. The display apparatus may include a dam part 172 in the second region 2A surrounding the hole h, and an opening portion 155c in the second region 2A surrounding the dam part 172 with respect to the edge of the substrate 100 where the hole h is formed.

Referring to FIGS. 15 and 16, the display apparatus according to an exemplary embodiment of the present invention includes a substrate 100; an insulating part 155 disposed above the substrate 100 and having a first opening portion 155a; a dam part 172 disposed above the insulating part 155 and surrounding the periphery of the first opening portion 155a; a first organic insulating layer 174 covering an inner surface of the first opening portion 155a; an organic light-emitting device 200 disposed above the insulating part 155; and an encapsulation layer 300 covering the organic light-emitting device 200.

The cross-sectional structure illustrated in FIG. 16 may be substantially similar to the cross-sectional structure illustrated in FIG. 2.

Also, in the display apparatus of FIG. 15, the cross-sectional structure taken along line B-B' is not limited to the arrangement illustrated in FIG. 16. In one or more exemplary embodiments of the present invention, the cross-sectional structure taken along line B-B' of FIG. 15 may have the cross-sectional structure of FIG. 2, 3, 4, 6, 8, 10, 12, or 14.

According to the related art, the second region 2A must have more than a certain width in order to prevent a damage to the display apparatus due to external moisture permeability. The encapsulation layer 300 therefore plays a major role in preventing external moisture permeability, and the region where the first inorganic film 310 and the second inorganic film 330 come into direct contact with each other will have more than a certain width. However, in this case, as the width of the second region 2A is increased in the periphery of the first region 1A, except for the first region 1A where pixels are arranged, the non-display region of the display apparatus, e.g., the dead space, is expanded.

According to an exemplary embodiment, since the insulating part 155 in the second region 2A has the first opening portion 155a and the organic film 320 is partially buried in the first opening portion 155a, the permeation of external

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moisture permeability through the side of the insulating film is blocked to thereby provide a display apparatus robustness to moisture permeation. Due to the first organic insulating layer 174 covering the inner surface of the first opening portion 155a, step coverage of the first inorganic film 310 may be increased. Also, due to the first opening portion 155a blocking the passage of moisture permeation, it is possible to narrow the non-display region of the display apparatus, that is, for example, the dead space.

As described above, according to one or more exemplary embodiments of the present invention, it is possible to provide the display apparatus that has an increased display region size and is robust to external moisture permeation.

While one or more exemplary embodiments of the present invention have been described herein 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 disclosure.

What is claimed is:

1. A display apparatus comprising:

- a substrate having a first region and a second region surrounding the first region;
- an insulating part disposed above the substrate, covering the first region and the second region, and comprising a first opening portion in the second region;
- a first material layer disposed between the substrate and the insulating part in the second region;
- a dam part disposed above the insulating part in the second region and surrounding a periphery of the first opening portion;
- a first organic insulating layer disposed above the insulating part, covering an inner surface of the first opening portion and making contact with the first material layer;
- an organic light-emitting device disposed above the insulating part in the first region and comprising a pixel electrode; and
- an encapsulation layer, disposed above the insulating part in both the first region and the second region, the encapsulation layer covering the organic light-emitting device.

2. The display apparatus of claim 1, wherein the encapsulation layer comprises a first inorganic film, a second inorganic film, and an organic film disposed between the first inorganic film and the second inorganic film, and at least a portion of the organic film is recessed within the first opening portion.

3. The display apparatus of claim 2, wherein the first inorganic film and the second inorganic film extend to an edge of the substrate and come into direct contact with each other in the second region.

4. The display apparatus of claim 2, wherein the organic film is fully enclosed by the second inorganic film and the first inorganic film.

5. The display apparatus of claim 2, wherein the first inorganic film covers the insulating part and the first organic insulating layer.

6. The display apparatus of claim 1, wherein the first opening portion exposes at least a portion of the first material layer.

7. A display apparatus comprising:

- a substrate having a first region and a second region surrounding the first region;
- an insulating part disposed above the substrate, covering the first region and the second region, and comprising a first opening portion in the second region;

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a dam part disposed above the insulating part in the second region and surrounding a periphery of the first opening portion;
 a first organic insulating layer disposed above the insulating part and covering an inner surface of the first opening portion;
 an organic light-emitting device disposed above the insulating part in the first region and comprising a pixel electrode;
 an encapsulation layer, disposed above the insulating part in both the first region and the second region, the encapsulation layer covering the organic light-emitting device; and
 a first material layer disposed between the substrate and the insulating part, wherein the first opening portion exposes at least a portion of the first material layer, wherein the first organic insulating layer exposes at least a portion of the first material layer.

8. The display apparatus of claim 7, wherein the first inorganic film comes into direct contact with at least a portion of the first material layer.

9. The display apparatus of claim 6, further comprising: a thin film transistor disposed in the first region and comprising a semiconductor layer and a gate electrode, wherein the first material layer comprises a same material as the semiconductor layer.

10. The display apparatus of claim 1, wherein the insulating part is disposed above the substrate in both the first region and the second region and the insulating part comprises a first insulating layer, having a first opening corresponding to the first opening portion, and a second insulating layer, having a second opening corresponding to the first opening portion.

11. A display apparatus comprising:

a substrate having a first region and a second region surrounding the first region;
 an insulating part disposed above the substrate, covering the first region and the second region, and comprising a first opening portion in the second region;
 a dam part disposed above the insulating part in the second region and surrounding a periphery of the first opening portion;
 a first organic insulating layer disposed above the insulating part and covering an inner surface of the first opening portion;
 an organic light-emitting device disposed above the insulating part in the first region and comprising a pixel electrode; and
 an encapsulation layer, disposed above the insulating part in both the first region and the second region, the encapsulation layer covering the organic light-emitting device,

wherein the insulating part is disposed above the substrate in both the first region and the second region and the insulating part comprises a first insulating layer, having a first opening corresponding to the first opening portion, and a second insulating layer, having a second opening corresponding to the first opening portion, wherein the display apparatus further comprises a first metal layer disposed between the first insulating layer and the second insulating layer of the second region, and comprising a third opening corresponding to the first opening portion.

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12. The display apparatus of claim 11, further comprising: a second metal layer disposed above the second insulating layer of the second region, and comprising a fourth opening corresponding to the first opening portion.

13. The display apparatus of claim 12, wherein the first organic insulating layer covers inner surfaces of the first opening, the second opening, the third opening, and the fourth opening.

14. The display apparatus of claim 12, further comprising: a thin film transistor disposed in the first region and comprising a semiconductor layer, a gate electrode, a source electrode, and a drain electrode, wherein the first metal layer comprises a same material as the gate electrode, and the second metal layer comprises a same material as the source electrode or the drain electrode.

15. A display apparatus comprising:

a substrate having a first region and a second region surrounding the first region;
 an insulating part disposed above the substrate, covering the first region and the second region, and comprising a first opening portion in the second region;
 a dam part disposed above the insulating part in the second region and surrounding a periphery of the first opening portion;
 a first organic insulating layer disposed above the insulating part, covering an inner surface of the first opening portion;
 an organic light-emitting device disposed above the insulating part in the first region and comprising a pixel electrode;
 an encapsulation layer, disposed above the insulating part in both the first region and the second region, the encapsulation layer covering the organic light-emitting device;
 a via layer disposed between the insulating part and the pixel electrode in the first region; and
 a pixel defining film covering an edge of the pixel electrode and exposing a central portion thereof, wherein the first organic insulating layer comprises a same material as the via layer or the pixel defining film.

16. The display apparatus of claim 15, wherein the dam part comprises a same material as the via layer or the pixel defining film.

17. The display apparatus of claim 1, wherein the insulating part further comprises a second opening portion surrounding a periphery of the dam part.

18. The display apparatus of claim 17, further comprising: a second organic insulating layer disposed above the insulating part and covering an inner surface of the second opening portion, wherein the second organic insulating layer exposes at least a portion of the first material layer.

19. The display apparatus of claim 17, further comprising: a second material layer disposed between the substrate and the insulating part, wherein the second opening portion exposes at least a portion of the second material layer.

20. The display apparatus of claim 19, further comprising: a thin film transistor disposed in the first region, comprising a semiconductor layer and a gate electrode, wherein the second material layer comprises a same material as the semiconductor layer or the gate electrode.

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

一种显示装置，包括具有第一区域和围绕第一区域的第二区域的基板。绝缘部分设置在基板上方，覆盖第一区域和第二区域，并且包括第二区域中的第一开口部分。坝部设置在第二区域中的绝缘部分上方并围绕第一开口部分的周边。第一有机绝缘层设置在绝缘部分上方并覆盖第一开口部分的内表面。有机发光装置设置在第一区域中的绝缘部分上方并包括像素电极。封装层设置在第一区域和第二区域中的绝缘部分上方。封装层覆盖有机发光装置。

