US 20070001596A1

(19) United States

(12) Patent Application Publication (10) Pub. No.: US 2007/0001596 A1

Murayama et al. (43) Pub. Date: Jan. 4, 2007

(54) **ORGANIC EL DISPLAY**

(75) Inventors: **Koji Murayama**, Moriyama (JP); **Shinichi Abe**, Yasu (JP)

Correspondence Address:
VOLPE AND KOENIG, P.C.
UNITED PLAZA, SUITE 1600
30 SOUTH 17TH STREET
PHILADELPHIA, PA 19103 (US)

(73) Assignee: **KYOCERA Corporation**, Fushimi-ku (JP)

(21) Appl. No.: **11/476,456**

(22) Filed: **Jun. 27, 2006**

(30) **Foreign Application Priority Data**

Jun. 29, 2005 (JP) 2005-189695
May 25, 2006 (JP) 2006-145736

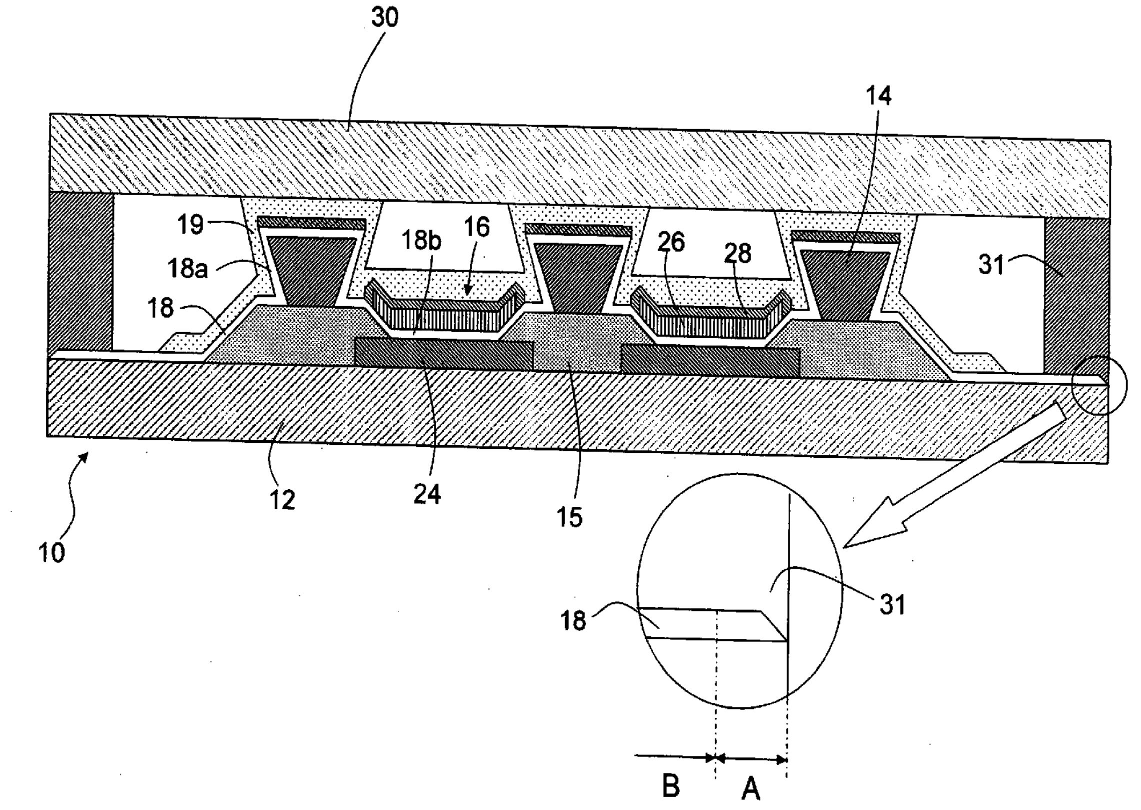
Publication Classification

(51) **Int. Cl.**
H01L 51/52 (2007.01)

(52) **U.S. Cl.** **313/506**; 428/917; 428/332; 313/509; 313/504; 313/512; 257/88; 257/E51; 257/100

(57) **ABSTRACT**

Provided is an organic EL (electroluminescence) display including: a substrate; a plurality of organic EL elements arranged on the substrate; an insulation member disposed between the adjacent organic EL elements; and a first protection layer which is sequentially formed from a region between the lower layer electrode and the function layer of the organic EL element to the surface of the insulation member and includes fluorine.



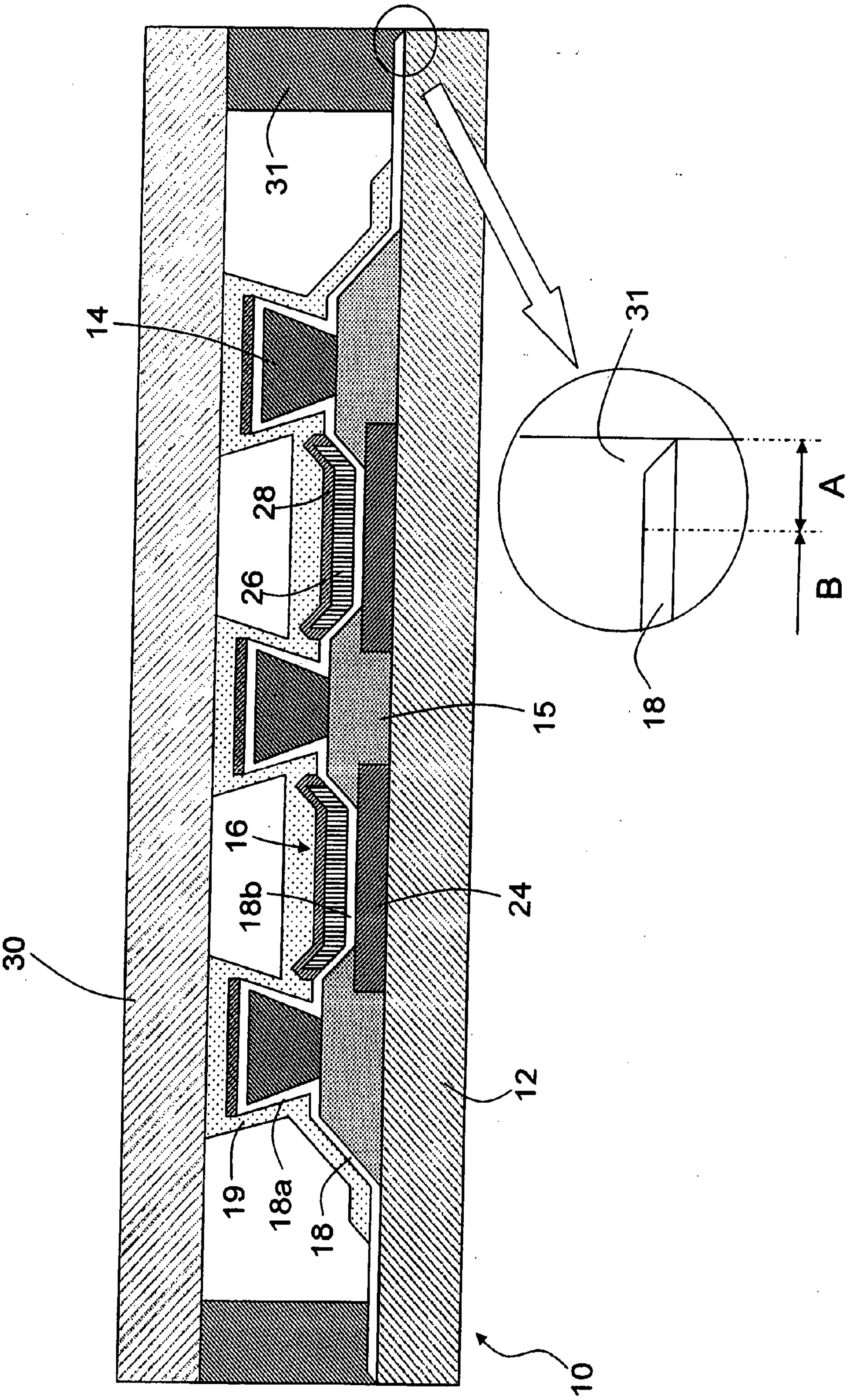


Fig. 1A

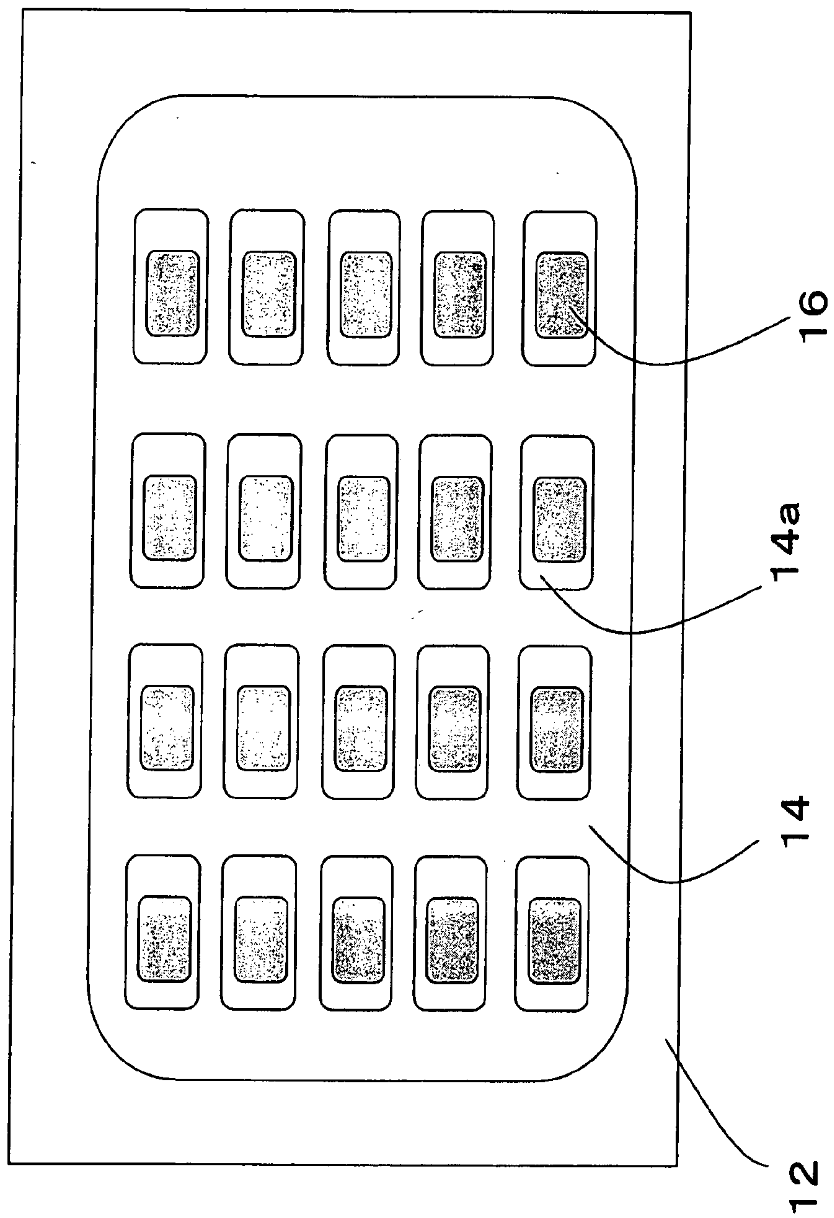


Fig.1B

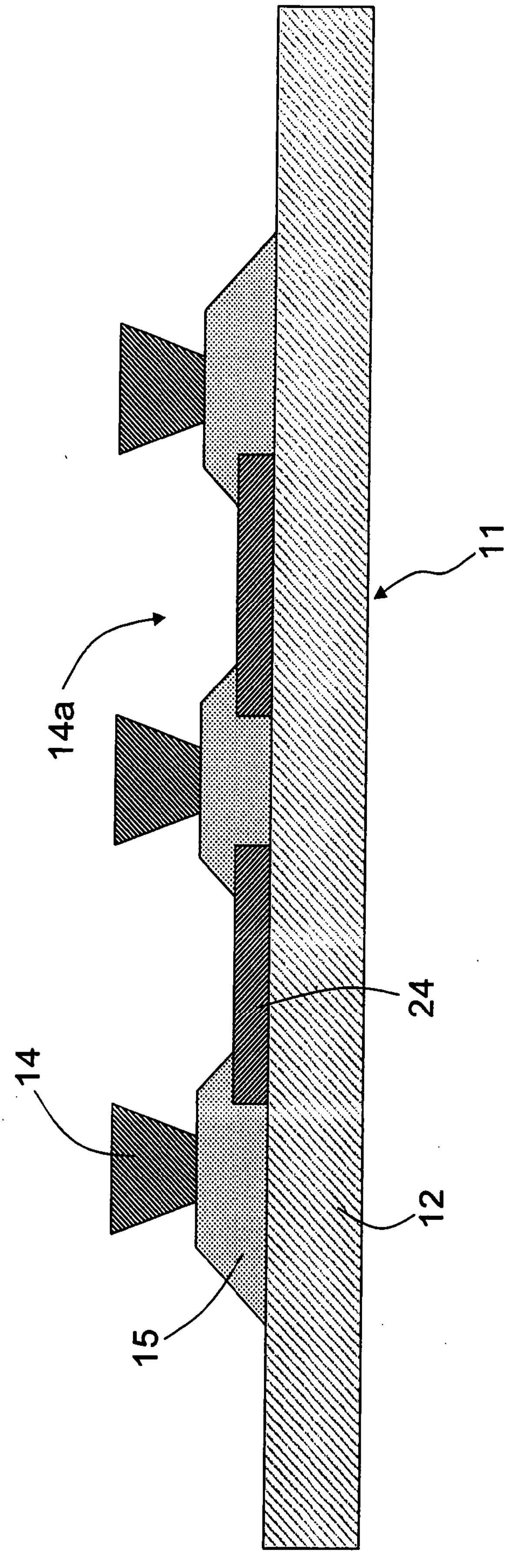


Fig.2A

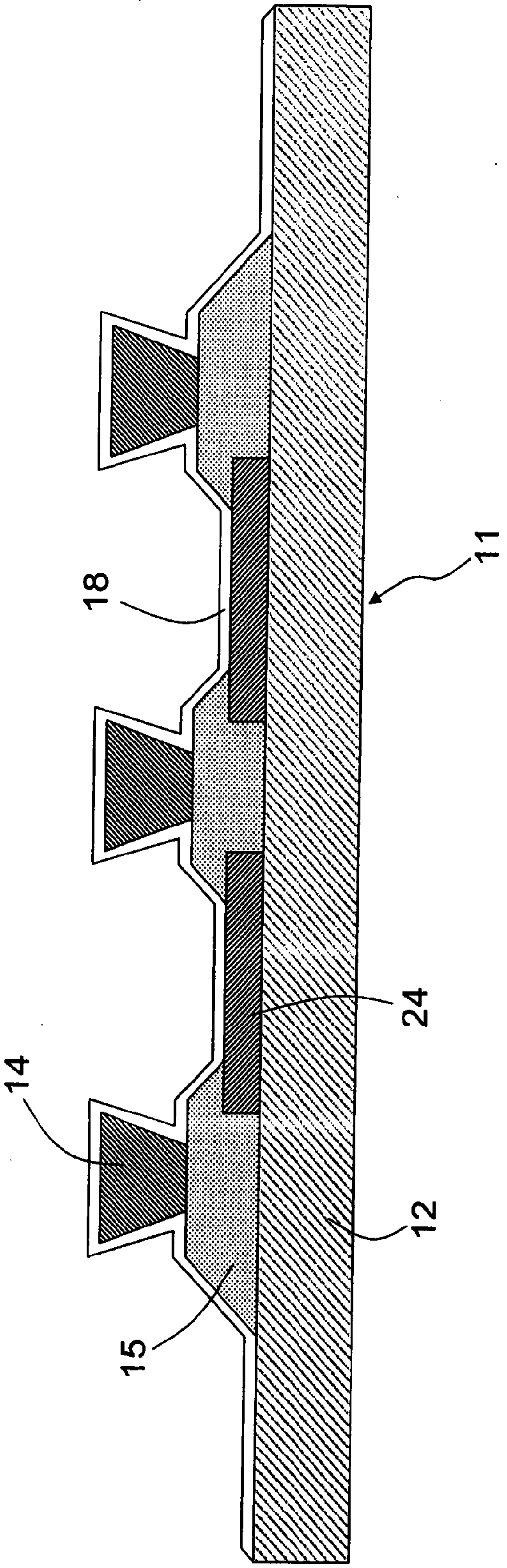


Fig.2B

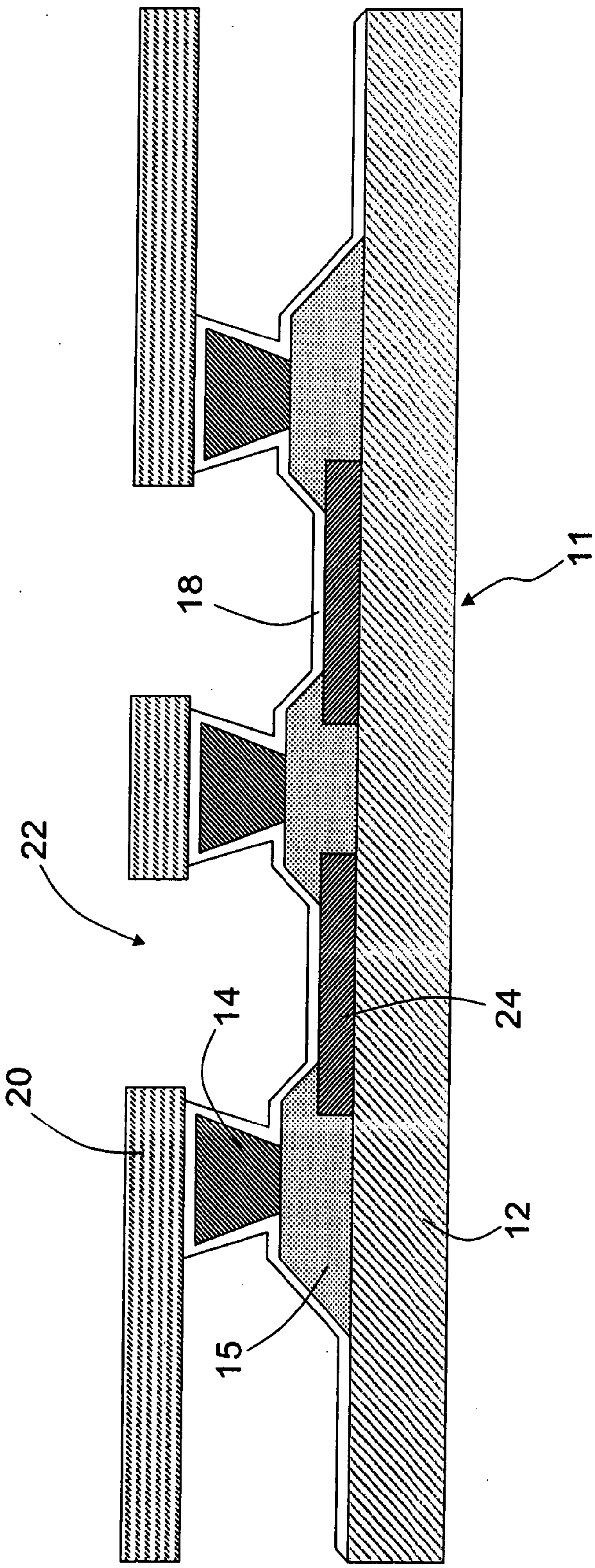


Fig.2C

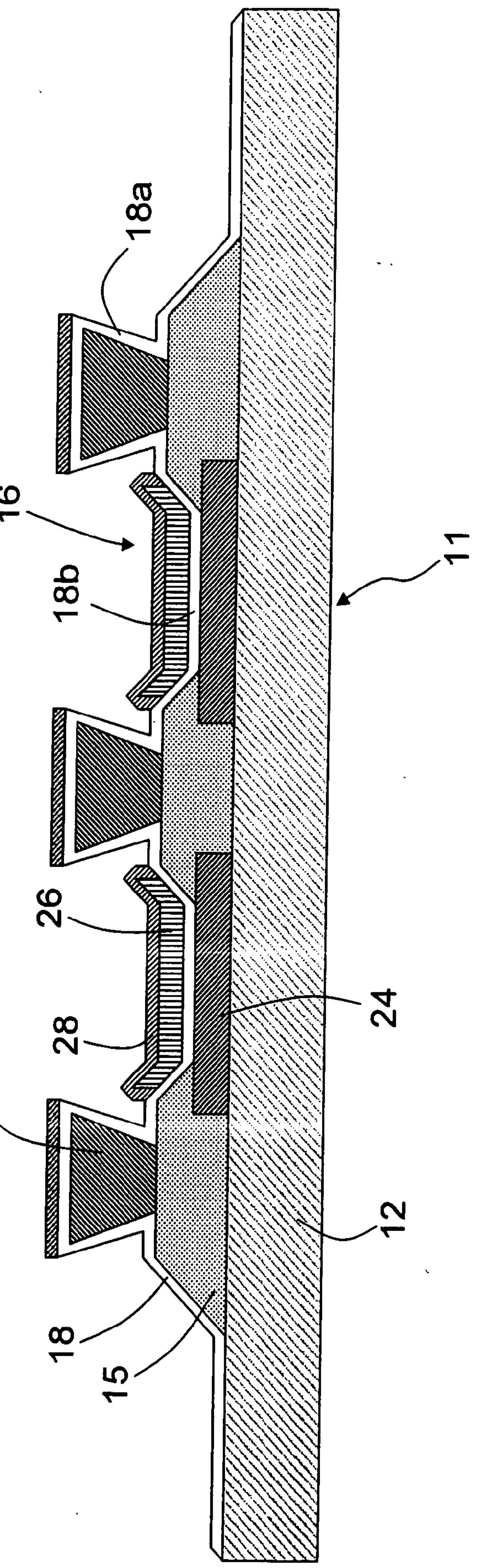


Fig.2D

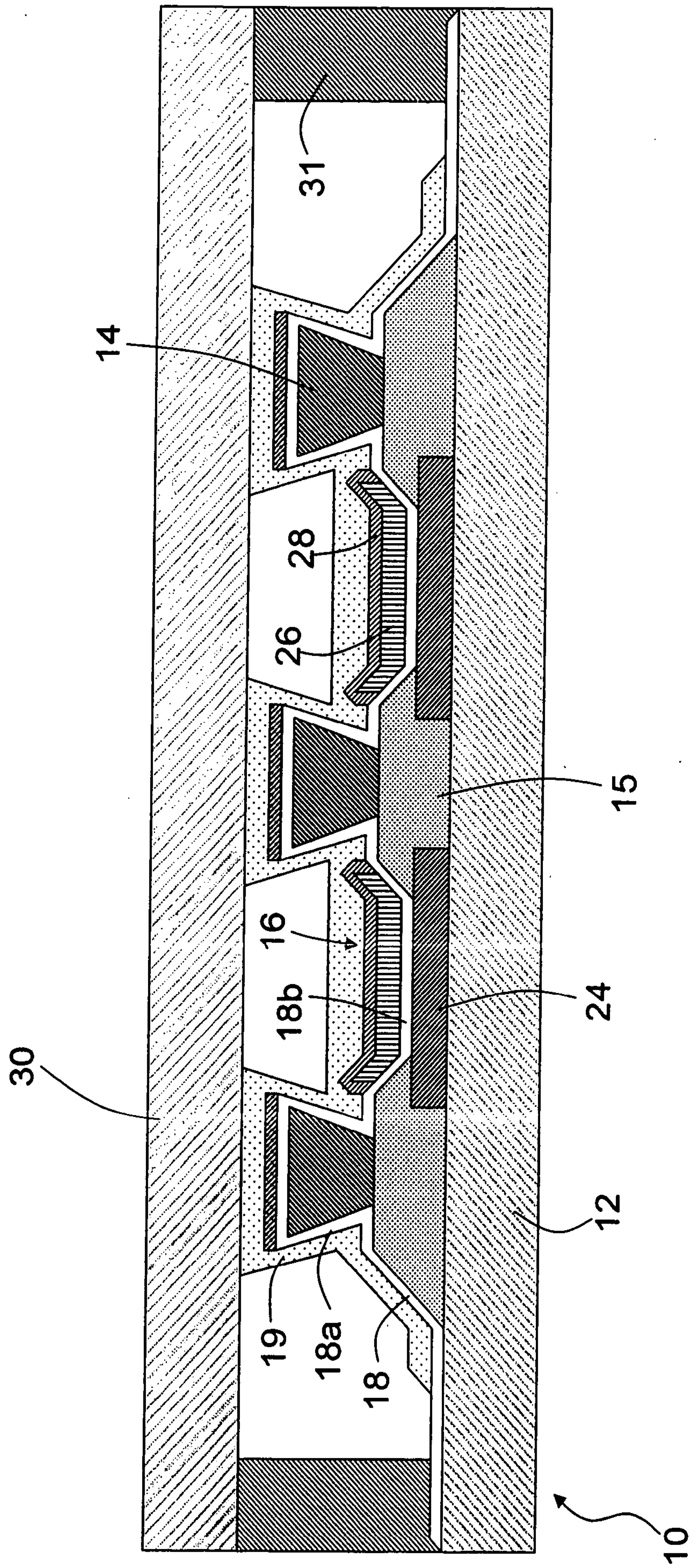


Fig.2E

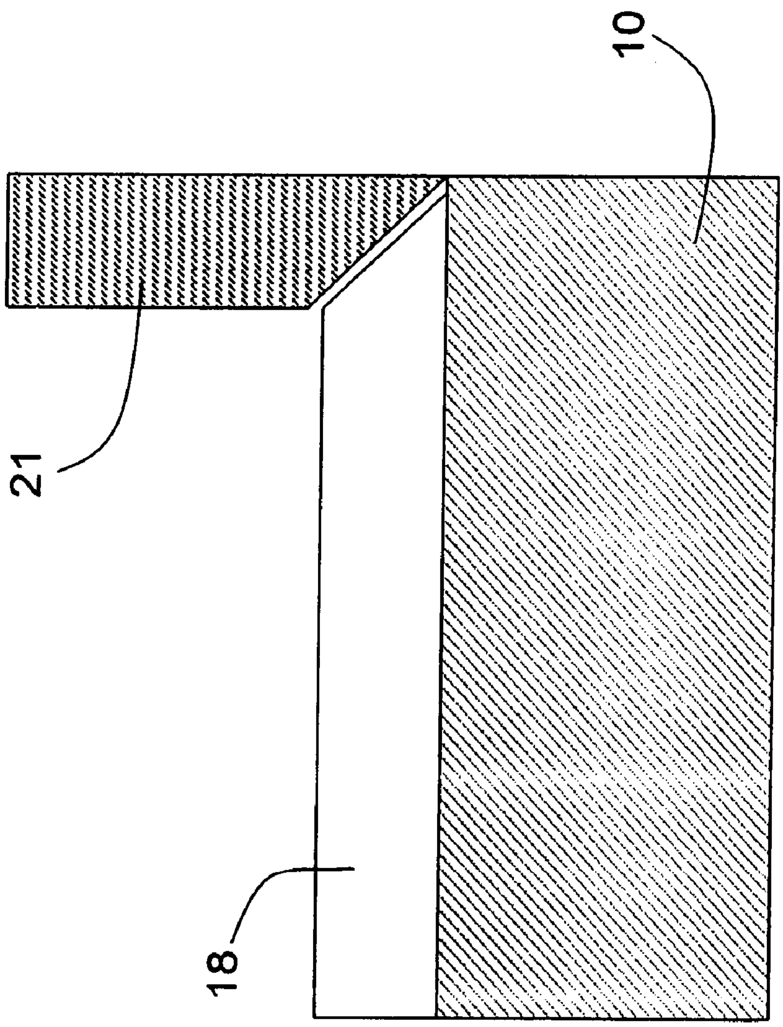


Fig.3

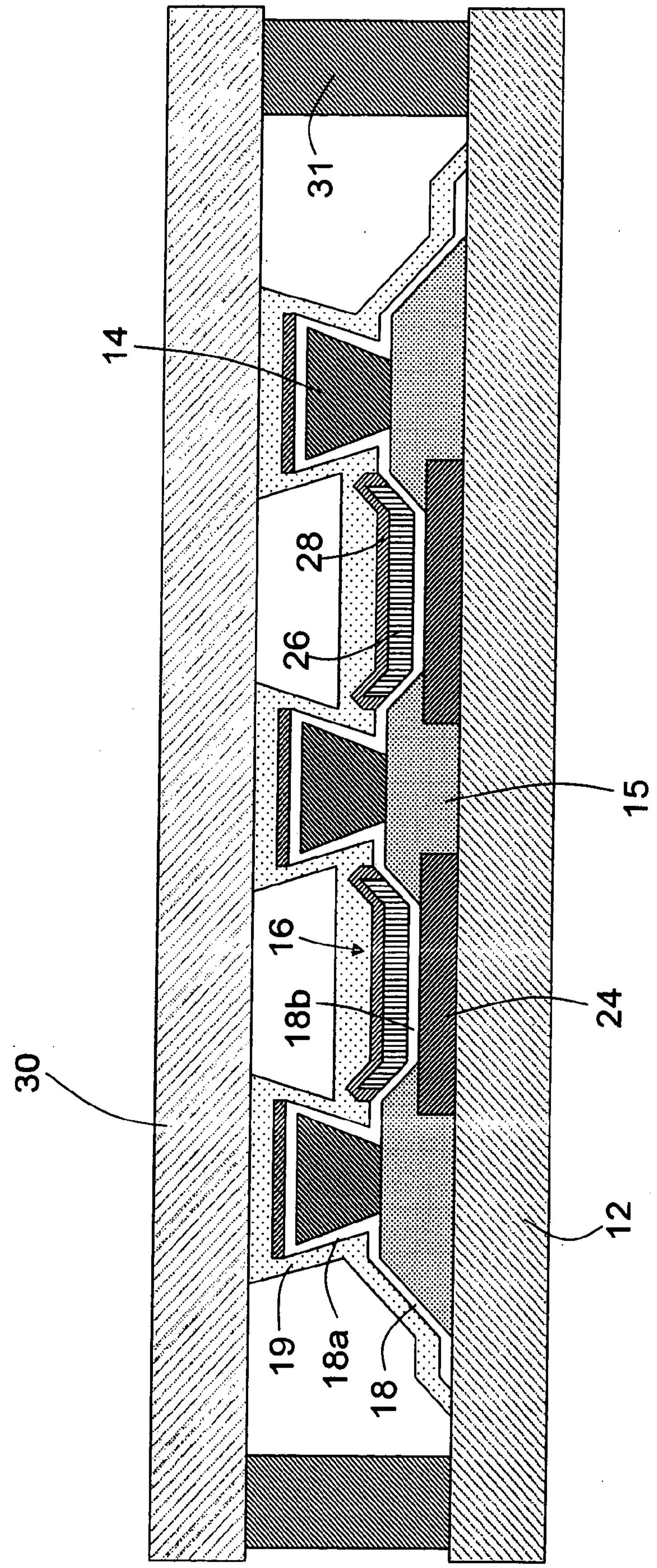
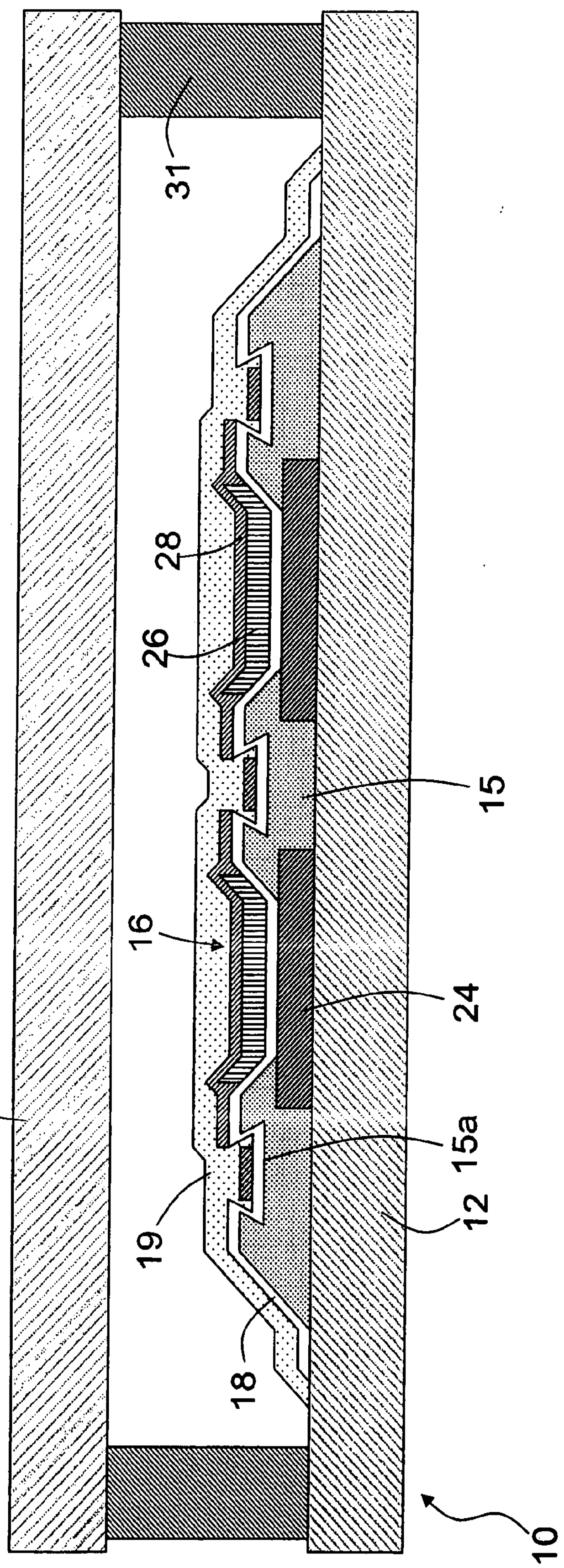


Fig.4

Fig.5



ORGANIC EL DISPLAY

BACKGROUND OF THE INVENTION

[0001] 1. Field of the Invention

[0002] The present invention relates to an organic EL (electroluminescence) display.

[0003] 2. Description of the Related Art

[0004] Recently, an organic EL display including an OLED (Organic Light Emitting Diode) has drawn attention. Thus, the organic EL display has been used as a display for a variety of products such as mobile phones or digital cameras.

[0005] The conventional organic EL display has a structure comprising a substrate, a plurality of organic EL elements arranged on the substrate, a barrier rib which is disposed between the adjacent organic EL elements and is disposed in order to surround each organic EL element, a protection layer which covers the organic EL elements, and a sealing member (a sealing substrate) for forming a sealed space between the substrate and the sealing member.

[0006] The organic EL element has a structure in which a lower layer electrode, an organic layer including an emission layer, and an upper layer electrode are sequentially laminated on the substrate. When power is supplied to the lower layer electrode and the upper layer electrode, hole and electron are injected towards the emission layer from the lower layer electrode side and the upper layer electrode side, respectively. The injected hole and electron are recombined in the emission layer to emit a specific light.

[0007] In general, the organic EL display is formed in the order of the substrate, the lower layer electrode, the barrier rib, the organic layer, the upper layer electrode, and the protection layer.

[0008] If the organic layer and/or the upper layer electrode are formed by using a deposition mask, the barrier rib serves to support the deposition mask. If the organic layer and the electrodes are formed through a deposition method without using the deposition mask, the barrier rib itself functions as the deposition mask. If the organic layer and the like are formed by using other methods excluding the deposition method (e.g. an inkjet method), the barrier rib can enhance electrical insulation between the adjacent pixels.

[0009] The barrier rib is formed of an organic material such as a novolak or acrylic-based resin, or a material including the organic material. Since the organic material can relatively easily absorb moisture, the barrier rib can easily absorb moisture from external air in the process of forming the organic layer, the upper layer electrode, and the protection layer. Thus, when the manufacturing process of the organic EL display is completed, there is a case in which much moisture is absorbed into the barrier rib. If the absorbed moisture is evaporated due to a change in an internal pressure of the display and the like, the evaporated moisture may enter between the barrier rib and the protection layer so as to reach the organic layer. In this case, the lifespan of the organic EL element may be shortened.

[0010] Meanwhile, Japanese Unexamined Patent Application Publication No. 2005-122924 and Japanese Unexamined Patent Application Publication No. 2003-257655 propose a technique in which a surface of a barrier rib is fluorinated by exposing the surface of the barrier rib formed of a resin to a fluoride gas.

[0011] However, basically, in the technique disclosed in Japanese Unexamined Patent Application Publication No. 2005-122924 and Japanese Unexamined Patent Application Publication No. 2003-257655, the surface of the barrier rib formed of a resin is fluorinated. Therefore, if the moisture, which is absorbed by the barrier rib before a fluorination process is performed after the barrier rib is formed, is evaporated after the manufacturing process of the organic display is completed, there is still high possibility in that the evaporated moisture is absorbed between the fluorinated surface and an inner area of the surface so as to reach the organic layer. Further, impact of the fluorination process against the organic EL element has not been taken into account. Accordingly, there has been a demand for an organic EL display having a novel structure in which the lifespan of the organic EL element can be further improved.

SUMMARY OF THE INVENTION

[0012] The present invention provides an organic EL display comprising: a substrate; a plurality of organic EL elements arranged on the substrate; and an insulation member disposed between the adjacent organic EL elements. The organic EL element may include: a lower layer electrode; an upper layer electrode; and a function layer interposed between the lower layer electrode and the upper layer electrode and having an organic emission layer. In addition, the organic EL element of the present invention may further comprises a first protection layer which is sequentially formed from a region between the lower layer electrode and the function layer of the organic EL element to the surface of the insulation member, and includes fluorine. Preferably, the thickness of the first protection layer may be determined to be 10 nm or less in the region between the upper layer electrode and the function layer. The first protection layer may be formed of a water-repellent material such as a silicon resin or a vinyl chloride, as a material other than fluorine.

BRIEF DESCRIPTION OF THE DRAWINGS

[0013] The above and other features and advantages of the present invention will become more apparent by describing in detail exemplary embodiments thereof with reference to the attached drawings in which:

[0014] FIG. 1A is a cross-sectional view illustrating an organic EL display according to a first embodiment of the invention;

[0015] FIG. 1B is a top plan view illustrating a shape of a barrier rib of the organic EL display;

[0016] FIG. 2A is a cross-sectional view illustrating a prepared display substrate;

[0017] FIG. 2B is a cross-sectional view when a water-repellent layer is formed;

[0018] FIG. 2C is a cross-sectional view when a mask is disposed;

[0019] FIG. 2D is a cross-sectional view when an organic EL element is formed;

[0020] FIG. 2E is a cross-sectional view illustrating a manufactured organic EL display;

[0021] FIG. **3** is a cross-sectional view illustrating a manner of forming a water-repellent layer;

[0022] FIG. **4** is a cross-sectional view illustrating a modified organic EL display according to the first embodiment of the invention; and

[0023] FIG. **5** is a cross-sectional view illustrating an organic EL display according to a second embodiment of the invention.

[0024] **10**: Organic EL display

[0025] **11**: Display substrate

[0026] **12**: Substrate

[0027] **14**: Barrier rib

[0028] **14***a*: Opening

[0029] **15**: interlayer insulation film

[0030] **15***a*: concave portion

[0031] **16**: Organic EL element

[0032] **18**: Water-repellent layer

[0033] **18***a*: Covering portion

[0034] **18***b*: Interposed portion

[0035] **19**: Protection layer

[0036] **20**: Mask

[0037] **22**: Hole

[0038] **24**: Lower layer electrode

[0039] **26**: Organic layer

[0040] **28**: Upper layer electrode

[0041] **30**: Sealing substrate

[0042] **31**: Sealing material

DETAILED DESCRIPTION OF THE INVENTION

(First Embodiment)

Organic EL Display

[0043] Now, an organic EL display according to a first embodiment of the present invention will be described with reference to the accompanying drawings.

[0044] Referring to FIG. **1**A, an organic EL display **10** includes a substrate **12**, a barrier rib **14** serving as an insulation member which is disposed on the substrate **12** and has a plurality of openings **14***a*. The organic EL display **10** also includes a plurality of organic EL elements **16**, each of which is formed within each of the openings **14***a*, and a water-repellent layer **18** which is formed on a surface of the barrier rib **14** and a lower layer electrode **24** constituting the organic EL element **16** and serves as a first protection layer. The organic EL elements **16** further includes a protection layer **19** which functions as a second protection layer for protecting the organic EL element **16**, and a sealing substrate **30** which forms a sealed space between the substrate **12** and the sealing substrate **30**.

[0045] The substrate **12** functions as a support base material for supporting the barrier rib **14**, the organic EL element **16**, and the protection layer **19** and the like formed on the upper surface side of the substrate **12**. In the case of a bottom emission type organic EL display in which light is emitted to the substrate **12** side, the substrate **12** is formed of a transparent or semitransparent material. On the other hand, in the case of a top emission type organic EL display in which light is emitted from the protection layer **19** side, the substrate **12** may be formed of not only the transparent or semitransparent material but also an opaque material. In general, the substrate **12** is formed of glass.

[0046] As shown in FIG. **1**B, the barrier rib **14** has the openings **14***a*, which surrounds the organic EL element **16**, disposed in a matrix form. Although each of the organic EL elements **16** is surrounded by the barrier rib **14** in the present embodiment, the organic EL element **16** does not have to be surrounded thereby. In addition, although the openings **14***a* of the barrier rib **14** are disposed in a matrix form, for example, if a passive type organic EL display is used, the openings **14***a* may be disposed in a stripe form by disposing the barrier rib **14** in a stripe form.

[0047] The barrier rib **14** prevents the adjacent organic EL elements **16** from short circuiting with each other. When the organic EL elements **16** are formed by a mask deposition, the barrier rib **14** functions as a supporter that supports a deposition mask. In addition, since the barrier rib **14** has an upper portion wider than a lower portion, the barrier rib **14** itself may function as a mask.

[0048] The barrier rib **14** is formed of a material, for example, such as a photosensitive negative type resist. In general, the barrier rib **14** is formed of an organic material such as a novolak or acrylic-based resin, or an organic resin. Therefore, the barrier rib **14** has a property which easily absorbs moisture in an atmosphere. The barrier rib **14** is generally formed by a conventional well-known photolithography method, a spin coating method, and the like.

[0049] The organic EL element **16** is disposed in each of the openings **14***a* of the barrier rib **14**. The organic EL element **16** is classified into three types, that is, a red light emission type, a blue light emission type, and a green light emission type (a white light emission type is optionally added).

[0050] The organic EL element **16** generally includes a lower layer electrode **24** (an anode electrode in the present embodiment), an upper layer electrode **28** (a cathode electrode in the present embodiment), and an organic layer **26** serving as a function layer which is interposed between the lower layer electrode **24** and the upper layer electrode **28**. Further, the organic EL element **16** further includes a water-repellent layer **18** which is interposed between the organic layer **26** and the lower layer electrode **24** to be described below.

[0051] The organic layer **26** includes an organic light emitting layer. In the organic layer **26**, a hole injection layer and/or a hole transport layer may be properly interposed between the lower layer electrode **24** and the organic light emitting layer by considering adherence property between the organic light emitting layer and the lower layer and between upper layer electrodes **24** and **28**. An electron injection layer and/or an electron transport layer may be interposed between the upper layer electrode **28** and the organic light emitting layer. In the present embodiment, the organic layer **26** includes the organic light emitting layer, the hole transport layer, and the electron transport layer. Although the lower layer electrode **24** is defined as an anode electrode, and the upper layer electrode **28** is defined as a cathode electrode in the present embodiment, vice-versa is also possible.

[0052] In order to carry out a display function, the organic light emitting layer emits light with a predetermined luminance by using energy generated when hole and electron respectively provided from the lower layer electrode **24** and the upper layer electrode **28** towards the organic light emitting layer are recombined.

[0053] The organic light emitting layer is formed of an organic material which emits light at a predetermined wavelength by applying current, such as Alq_3, anthracene, Znq_2, $Balq_2$, $Almq_3$, $Tb(acac)_3$, DCJTB, C545T, perylene, quinacridone derivatives, rubrene, or rhodamine. The hole transport layer or the electron transport layer are formed of a material such as NPB, TPD, or Alq_3.

[0054] As for materials of the lower layer electrode **24** and the upper layer electrode **28**, if the organic EL element **16** is a top emission type, the upper layer electrode **28** is formed of a transparent or semi-transparent metal material, and the lower layer electrode **24** is formed of a metal material having a good reflectivity. On the other hand, if the organic EL element **16** is a bottom emission type, the upper layer electrode **28** is formed of a metal material having a good reflectivity, and the lower layer electrode **24** is formed of a transparent or semi-transparent metal material. As for the transparent or semi-transparent metal material, a metal material such as ITO, Mg, Ca, Ag, Li and their alloys are appropriately used. As for the metal material having a good reflectivity, a metal material such as Al, Cu, Au, Ag and their alloys are appropriately used.

[0055] The organic EL element **16** is formed by using a conventional well-known thin film formation technology such as a vacuum deposition method, a CVD, a spin coating method, or an inkjet method. An interlayer insulation film **15** is interposed between the barrier rib **14** and the substrate **12**.

[0056] The interlayer insulation film **15** is partially interposed between the lower layer electrode **24** and the upper layer electrode **28**, so as to prevent short circuit of the lower layer electrode **24** and the upper layer electrode **28**. The interlayer insulation film **15** is formed of an inorganic material (e.g. a silicon oxide film, a silicon nitride film, etc) or a novolak or acrylic-based organic resin having an insulation property, and is formed by using the conventional well-known thin film formation technology.

[0057] The water-repellent layer **18** is disposed on the surface of the barrier rib **14**. The water-repellent layer **18** includes a covering portion **18*a*** that covers the upper surface and the lateral surfaces of the barrier rib **14**, and an interposed portion **18*b*** that is interposed between the lower layer electrode **24** and the organic layer **26**. The covering portion **18*a*** and the interposed portion **18*b*** are sequentially connected. In the present embodiment, the water-repellent layer **18** is deposited to the entire substrate **12**, and formed up to an end portion of the substrate **12**.

[0058] The water-repellent layer **18** generally restrains not only the barrier rib **14** from absorbing moisture contained in the external air but also the absorbed moisture from reaching the organic layer **26** of the organic EL element **16**. Accordingly, the water-repellent layer **18** can easily repel moisture as its name indicates. Preferably, a contact angle of a material constituting the water-repellent layer **18** against water is from 80° to 120°.

[0059] The thickness of the water-repellent layer **18** is determined to be from 0.5 nm, to 20 nm. However, the thickness of the interposed portion **18*b*** is preferably determined to be 10 nm or less. The reason is that, even if water-repellence is improved with respect to the organic layer **26** when the thickness of the interposed portion **18*b*** is greater than 10 nm, power consumption increases because an electrical resistance of the organic EL element **16** itself increases in the presence of the interposed portion **18*b***.

[0060] Further, it is preferable that, comparing a region A (a region within 1 μm from the end portion of the substrate **12**) near the end of the substrate **12** with a region B disposed inwards the region A, the thickness of the water-repellent layer **18** is thinner in a portion of the region A (see the enlarged cross-sectional view of FIG. **1**A). This is because, if the thickness of the water-repellent layer **18** is thin in the region A, inner stress of the water-repellent layer **18** in the region A is reduced, and thus the water-repellent layer **18** can be prevented from peeling.

[0061] As a water-repellent material constituting the water-repellent layer **18**, a material such as a fluorine-based resin, a silicon resin, a vinyl chloride, etc, which has a water-repellent property and an appropriate insulation property capable of preventing the adjacent organic EL elements **16** from short circuiting, is used. When the water-repellent layer **18** is formed of the fluorine-based resin, it is preferable that the water-repellent layer **18** satisfies the composition of CH_XF_Y ($0 \leqq x \leqq 1$, $0.3 \leqq y \leqq 2$, $1.3 \leqq x+y \leqq 2$). The CF_X or CH_XF_Y film has a property similar to PolyTetraFluoroEthylene.

[0062] The protection layer **19** is deposited on the water-repellent layer **18** and the organic EL element **16**. The protection layer **19** protects the organic EL element **16** from external moisture, and is formed of a SiN-based inorganic material or a SiO-based inorganic material. The protection layer **19** is generally formed by using the conventional well-known thin film formation technology (e.g. a vacuum deposition method, a CVD method, etc).

[0063] The sealing substrate **30** that forms the sealed space between the substrate **12** and the sealing substrate **30** is disposed on the substrate **12**, with a sealing material **31** being interposed therebetween. The sealing substrate **30** protects the organic EL element **16** from an external object or the external air. When the top emission type organic EL element is used, the sealing substrate **30** is formed of a transparent material (e.g. glass, polyimide, etc). On the other hand, if the bottom emission type organic EL element is used, the sealing substrate **30** may be formed of an opaque material. Further, the sealing material **31** bonds the substrate **12** to the sealing substrate **30**, and surrounds a pixel region.

Manufacturing Method of Organic EL Display

[0064] Now, a manufacturing method of the aforementioned organic EL display will be described with reference to FIGS. **2**A through **2**E.

[0065] (1) First, as illustrated in FIG. **2**A, a display substrate **11** including a substrate **12**, a barrier rib **14** having a plurality of openings **14***a*, and a lower layer electrode **24** formed within each of the openings **14***a* is prepared.

[0066] For example, if the lower layer electrode **24** is formed of a metal material such as ITO or Al, in the process of forming the lower layer electrode **24**, the metal material is formed with a predetermined thickness by using the conventional well-known thin film formation technology, specifically, the deposition method or the sputtering method, and is then processed to have a specific pattern by using a technology such as a photolithography or an etching. In the process of forming the barrier rib **14**, a photosensitive photoresist (e.g. a novolak-based resin, an acrylic-based resin, etc) is coated on the substrate with a predetermined thickness by using the spin coating method, and is then exposed to light to have a specific pattern. Thereafter, an unnecessary portion is removed by liquid chemical etching.

[0067] (2) Next, as illustrated in FIG. **2**B, a water-repellent layer **18** is formed on the barrier rib **14** and the lower layer electrode **24**. For example, if the water-repellent layer **18** is formed of the fluorine-based resin, in the process of forming the water-repellent layer **18**, an ambient gas is deposited on the upper surface and the lateral surfaces of the barrier rib **14** by generating a high-vacuum plasma (pressure: over 0.3 Pa, for example, 0.31 Pa~100 Pa) within a chamber filled with the fluoro-carbon based ambient gas. In this case, the water-repellent layer **18** on the lower layer electrode **24** has to be 10 nm or less. In order to allow the thickness of the water-repellent layer **18** to be thin near the end portion of the substrate **12**, as illustrated in FIG. **3**, it is preferable that the water-repellent layer **18** is formed after disposing a taper shaped mask **21** having a width that is tapered down towards the substrate **12**.

[0068] After the barrier rib **14** is formed and before and/or when the water-repellent layer **18** is formed, and/or when the water-repellent layer **18** is formed, if moisture content within the chamber is determined to be 100 ppm or less, the amount of moisture absorbed into the barrier rib **14** can be restricted to be small.

[0069] (3) Next, as illustrated in FIG. **2**C, a mask **20** having a plurality of holes **22** corresponding to the openings **14***a* is brought to contact with the barrier rib **14**, with the water-repellent layer **18** being interposed therebetween.

[0070] When the mask **20** is brought to contact with the barrier rib **14**, a magnet is disposed in the opposite surface with respect to a surface of the substrate **12** on which the barrier rib **14** is formed, and then the mask **20** is closely attached to the water-repellent layer **18** on the barrier **14**. If the location of the mask **20** is fixed by magnetic force of the magnet in this manner, the mask **20** is formed of a magnetic substance such as Ni alloy, No—Co alloy, or Fe—Ni—Co alloy.

[0071] When aligning the substrate **12** and the mask **20**, alignment marks respectively disposed thereto are photographed by a CCD camera, and deviation between the substrate **12** and the mask **20** is calculated from its relative distance. Then, the mask **20** is moved by the calculated result.

[0072] (4) Next, as illustrated in FIG. **2**D, the organic EL elements **16** are formed by performing deposition using the mask **20**.

[0073] Specifically, a deposition source having a deposition material is disposed below the mask **20** (in the opposite direction with respect to the substrate **12**), and the deposition source is heated to evaporate the deposition material. The evaporated deposition material is deposited on the substrate **12** within the openings **14***a* by the use of the holes of the mask **20**. In this manner, the organic layer **26** and the upper layer electrode **28** are sequentially laminated on the lower layer electrode **24**. The deposition material may be an organic material constituting the organic layer **26**, or a metal material (e.g. Ca, Mg, LiF/Al, AlLi, etc) constituting the upper layer electrode **28**.

[0074] (5) The protection layer **19**, which protects the organic EL element **16** and is formed of a SiN-based inorganic material, a SiO-based inorganic material, etc, is being formed on the water-repellent layer **18** by the CVD. The organic EL elements **16** and the protection layer **19** are sealed by the sealing substrate **30** and the sealing material **31**, thereby completing the organic EL display **10** (FIG. **2**E).

[0075] In the aforementioned steps (3) to (5), the moisture absorbed into the barrier rib **14** may be evaporated and discharged out of the barrier rib **14** due to an increase in an external temperature, a change in an internal pressure of the display **10**, etc. However, in the present embodiment, since the water-repellent layer **18** is sequentially connected from the surface of the barrier rib **14** to the surface of the lower layer electrode **24**, the moisture discharged out of the barrier rib **14** is restricted from reaching the organic layer **26** of the organic EL element **16**. Accordingly, the lifespan of the organic EL display can be prolonged.

[0076] As described above, according to the first embodiment of the invention, since the water-repellent layer **18** is formed on the surface of the barrier rib **14**, the barrier rib **14** can be restrained from absorbing moisture in a satisfactory manner when manufacturing the organic EL display. Moreover, even if the moisture absorbed into the barrier rib **14** is evaporated after the manufacturing process of the organic EL display is completed, and is then discharged out of the barrier rib **14**, the moisture discharged out of the barrier rib **14** can be kept between the water-repellent layer **18** and the barrier rib **14**, or between the water-repellent layer **18** and the lower layer electrode **24**, thereby restricting the moisture from reaching the organic layer **26**. Accordingly, the deterioration of the organic layer **26** can be significantly restricted, and thus the organic EL display having a long lifespan can be achieved.

[0077] In addition, since the thickness of the water-repellent layer **18** located between the lower layer electrode **24** and the organic layer **26** is 10 nm or less, consumption power required for emission of the organic element EL **16** can be sufficiently restricted from increasing.

[0078] In addition, since the water-repellent layer **18** is sequentially connected over the entire surface of the substrate **12**, the water-repellent layer **18** is not easily peeled. Further, according to the first embodiment, since the thickness of the water-repellent layer **18** is thin near the end portion of the substrate, inner stress of the water-repellent layer **18** is reduced, which effectively prevents the water-repellent layer **18** from peeling.

[0079] In addition, according to the first embodiment, if ambient moisture content before and/or after the water-repellent layer **18** is formed is determined to be 100 ppm or less, the amount of moisture absorbed into the barrier rib **14** can be reduced. As a result, the lifespan of the organic EL display can be further prolonged.

[**0080**] Although the organic layer **26** is used as a function layer in the first embodiment, the function layer may be not only the organic layer but also an inorganic layer. In this case, the inorganic layer is preferably a hole injection layer and/or an electron injection layer. The inorganic layer may be formed of lithium fluoride, calcium fluoride, titanium dioxide, nickel oxide, molybdenum oxide, or vanadium oxide.

[**0081**] In addition, in the first embodiment, as illustrated in FIG. **4**, the periphery of the water-repellent layer **18** may be located inwards the periphery of the protection layer **19**. When the water-repellent layer **18** includes fluorine, the water-repellent layer **18** is not much strongly adhered to other materials. If the organic EL display has a structure of FIG. **4**, the end portion of the protection layer **19** can be attached to the substrate **12** without having to interpose the water-repellent layer **18**. Thus, even when the water-repellent layer **18** is formed, the protection layer **19** can have a high adhesive property with respect to the substrate **12**. As a result, it is possible for the protection layer **19** to have a further increased sealing property with respect to the protection layer **19**.

[**0082**] In addition, in the first embodiment, as shown in FIG. **4**, the water-repellent layer **18** may not be deposited to a region where the sealing material **31** is formed, and the periphery of the water-repellent layer **18** may be disposed inwards with respect to the sealing material **31**. In this case, the sealing material **31** can be also deposited to the substrate **12** without having to interpose the water-repellent layer **18**. As a result, the sealing material **31** can maintain a high adherence property with respect to the substrate **12**, and thus a space surrounded by the substrate **12**, the sealing substrate **30**, and the sealing materiel **31** can be maintained in an airtight manner.

(Second Embodiment)

[**0083**] In an organic EL display according to a second embodiment of the invention, unlike in the first embodiment, as illustrated in FIG. **5**, the interlayer insulation film **15** is used as an insulation member that divides the adjacent organic EL elements **16**. Even in a structure in which the barrier rib **14** is omitted, if the interlayer insulation film **15** is formed by an organic resin, the formation of the water-repellent layer **18** is effective similarly to the case of the first embodiment since the interlayer insulation film **15** can easily absorb moisture. In this case, the water-repellent layer **18** is sequentially deposited from the surface of the lower layer electrode **24** to the surface of the interlayer insulation film **15**.

[**0084**] Therefore, in the interlayer insulation film **15**, the water-repellent layer **18** restrains moisture from absorbing into the organic layer **26** in a satisfactory manner even when the inter-insulation layer **15** absorbs the moisture in a condition that the moisture is not easily absorbed during a manufacturing process of the organic EL display. In addition, since the barrier rib **14** can be omitted, the structure of the organic EL display can be simplified.

[**0085**] A concave portion **15***a* is disposed in the upper surface of the interlayer insulation film **15**. Since the width of the concave portion **15***a* is wider in its lower portion than its upper portion, the upper layer electrode **28** is divided by the concave portion **15***a* in a satisfactory manner. Thus, electrical insulation between the adjacent organic EL elements **16** can be maintained in a satisfactory manner. When the concave portion **15***a* is formed, it is preferable that the first protection layer **18** is formed along the inner surface of the concave portion **15***a*, in terms of avoiding moisture absorption into the interlayer insulation film **15** or moisture discharge from the organic layer **26**.

[**0086**] The invention is not limited to the first and second embodiments and various changes in form and details may be made therein without departing from the spirit and scope of the invention.

What is claimed is:

1. An organic EL display comprising:

a substrate;

a plurality of organic EL elements arranged on the substrate and having a lower layer electrode, an upper layer electrode and a function layer interposed between the lower and the upper layer electrodes, the function layer including an organic light emitting layer;

an insulation member disposed between the adjacent organic EL elements; and

a first protection layer sequentially formed from a region between the lower layer electrode and the function layer to a surface of the insulation member, and comprising fluorine.

2. The organic EL display of claim 1, wherein a thickness of the first protection layer is 10 nm or less in the region between the lower layer electrode and the function layer.

3. The organic EL display of claim 1, wherein the first protection layer has a composition of CH_xF_y ($0 \leqq x \leqq 1$, $0.3 \leqq y \leqq 2$, $1.3 \leqq x+y \leqq 2$).

4. The organic EL display of claim 1, wherein the first protection layer is formed substantially over an entire surface of the substrate.

5. The organic EL display of claim 4, wherein the first protection layer is tapered down near an end portion of the substrate.

6. The organic EL display of claim 1, further comprising a second protection layer which covers the organic EL elements,

wherein a periphery of the first protection layer is located inwards with respect to a periphery of the second protection layer.

7. The organic EL display of claim 1, further comprising:

a sealing substrate disposed on the substrate; and

a sealing material interposed between the substrate and the sealing substrate, and surrounding a region where the plurality of organic EL elements are arranged,

wherein a periphery of the first protection layer is located inwards with respect to a region where the sealing material is formed.

8. An organic EL display comprising:

a substrate;

a plurality of organic EL elements arranged on the substrate and having a lower layer electrode, an upper layer electrode and a function layer interposed between the lower and the upper layer electrodes, the function layer including an organic light emitting layer;

an insulation member disposed between the adjacent organic EL elements; and

a first protection layer sequentially formed from a region between the lower layer electrode and the function layer to a surface of the insulation member, and comprising a water-repellent material.

9. The organic EL display of claim 8, wherein the thickness of the first protection layer is 10 nm or less in the region between the lower layer electrode and the function layer.

10. The organic EL display of claim 8, wherein the first protection layer comprises fluorine.

11. The organic EL display of claim 10, wherein the first protection layer has a composition of CH_xF_y ($0 \leqq x \leqq 1$, $0.3 \leqq y \leqq 2$, $1.3 \leqq x+y \leqq 2$).

12. The organic EL display of claim 8, wherein the first protection layer is formed substantially over an entire surface of the substrate.

13. The organic EL display of claim 8, wherein the first protection layer is tapered down near an end portion of the substrate.

14. The organic EL display of claim 8, further comprising a second protection layer which covers the organic EL elements,

wherein a periphery of the first protection layer is located inwards with respect to a periphery of the second protection layer.

15. The organic EL display of claim 8, further comprising:

a sealing substrate disposed on the substrate; and

a sealing material disposed between the substrate and the sealing substrate, and surrounding a region where the plurality of organic EL elements are arranged,

wherein the periphery of the first protection layer is located inwards with respect to a region where the sealing material is formed.

* * * * *

专利名称(译)	有机EL显示屏		
公开(公告)号	US20070001596A1	公开(公告)日	2007-01-04
申请号	US11/476456	申请日	2006-06-27
[标]申请(专利权)人(译)	京瓷株式会社		
申请(专利权)人(译)	京瓷株式会社		
当前申请(专利权)人(译)	LG DISPLAY CO. , LTD.		
[标]发明人	MURAYAMA KOJI ABE SHINICHI		
发明人	MURAYAMA, KOJI ABE, SHINICHI		
IPC分类号	H01L51/52		
CPC分类号	H01L27/3281 H01L27/3295 Y10T428/26 H01L51/5237 H01L51/50 H01L27/3246 H01L27/3283 H01L51/5253		
优先权	2006145736 2006-05-25 JP 2005189695 2005-06-29 JP		
其他公开文献	US7741776		
外部链接	Espacenet USPTO		

摘要(译)

提供一种有机EL（电致发光）显示器，包括：基板;多个有机EL元件排列在基板上;绝缘构件设置在相邻的有机EL元件之间;第一保护层，其从下层电极和有机EL元件的功能层之间的区域依次形成到绝缘构件的表面，并包括氟。