(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 1 670 084 B1

(12) EUROPEAN PATENT SPECIFICATION

(45) Date of publication and mention of the grant of the patent:
26.03.2008 Bulletin 2008/13

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

(21) Application number: **05111051.8**

(22) Date of filing: **22.11.2005**

(54) Organic light emitting display and method for fabricating the same

Organische lichtemittierende Vorrichtung und deren Herstellungsmethode

Dispositif d'affichage organique électroluminescent et sa méthode de fabrication

(84) Designated Contracting States:
DE FR GB

(30) Priority: **26.11.2004 KR 2004098238**

(43) Date of publication of application:
14.06.2006 Bulletin 2006/24

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Printed by Jouve, 75001 PARIS (FR)

Description

Background of the Invention

1. Field of the Invention

[0001] The present invention relates to an organic light emitting diode (OLED) display and a method for fabricating the same, and more particularly, to an OLED display and a method for fabricating the same in which an organic capping layer having a refractive index of 1.7 or more is formed on a second electrode of the OLED display.

2. Description of the Related Art

[0002] Among flat panel displays, an organic light emitting diode (OLED) display is an emission display that emits light by electrically exciting an organic compound. As used herein OLED display may refer to a single OLED, multiple OLEDs or an OLED display device. The OLED display requires no backlight, which is used in a liquid crystal display (LCD). Accordingly, the OLED display can be formed to be light-weight and compact in a simplified process. The OLED display can be fabricated at low temperatures and has a fast response speed of 1 ms or less and low power consumption. Further, the OLED display has a wide viewing angle and a high contrast ratio because of its self-emission feature.

[0003] Typically, since an OLED display includes an organic emission layer between an anode and a cathode, holes supplied from the anode and electrons supplied from the cathode are recombined in the organic emission layer, thereby creating hole-electron pairs, i.e., excitons, which generate energy when being transitioned to a ground state to emit light.

[0004] An OLED display may be classified into a bottom-emitting OLED display and a top-emitting OLED display depending on an emitting direction of light that is generated from an organic emission layer. In the bottom-emitting OLED display in which light is emitted toward a substrate, a reflective electrode is formed on an organic emission layer and a transparent electrode is formed beneath the organic emission layer. Here, if the OLED display is an active matrix one, a portion with a thin film transistor formed therein does not transmit light so that a light emitting area is reduced. On the other hand, in the top-emitting OLED display, a transparent electrode is formed on an organic emission layer and a reflective electrode is formed beneath the organic emission layer so that light is emitted in an opposite direction to a substrate side, thereby increasing a light transmitting area and in turn improving luminance.

[0005] FIG. 1 is a cross-sectional view showing the structure of a conventional top-emitting OLED display.

[0006] Referring to FIG. 1, in the conventional top-emitting OLED display, a first electrode 13 is patterned and formed over a transparent substrate 11 such as glass or plastic. The first electrode 13 includes a reflecting layer 12 formed of a metal having a high reflectivity characteristic such as aluminum (Al) or aluminum-neodymium (Al-Nd). The first electrode 13 is formed of a reflective electrode that is made of a transparent electrode such as Indium Tin Oxide (ITO) or Indium Zinc Oxide (IZO) having a high work function.

[0007] An organic layer 15 including at least an organic emission layer is then formed on the first electrode 13 and may further include at least one of a hole injection layer, a hole transport layer, an electron transport layer, and an electron injection layer, in addition to the organic emission layer.

[0008] Then, a second electrode 17 is formed on the entire surface of the organic layer 15. The second electrode 17 is formed of a conductive metal having a low work function selected from Mg, Ag, Al, Ca and alloys thereof. The second electrode 17 may be formed of a transmissive electrode with a small thickness such that light is transmitted or of a transparent electrode such as ITO or IZO.

[0009] A passivation layer 19 is formed on the second electrode 17. The passivation layer 19 may be formed by stacking an inorganic material or an organic material. In one embodiment, the passivation layer 19 is formed to a certain thickness using an inorganic layer such as a silicon nitride (SiNx) layer to protect the second electrode and the organic emission layer from external moisture and contamination.

[0010] In a conventional OLED display, the passivation layer is formed of an inorganic or organic material on the second electrode to protect the second electrode and the organic emission layer from external moisture and contamination after the second electrode, which is a transmissive electrode, is deposited. Such an OLED display is e.g. disclosed in L. S. Hung et al., Applied Physics Letters 78, p. 544, 2001.

SUMMARY OF THE INVENTION

[0011] The embodiments of the present invention provide an OLED display with high efficiency and long lifetime by depositing an organic capping layer having a refractive index of at least 1.7 on a second electrode.

[0012] In an exemplary embodiment of the present invention, an OLED display includes: a substrate; a first electrode formed on the substrate and including a reflecting layer; an organic layer formed on the first electrode and including at least organic emission layer; a second electrode formed on the organic layer; and an organic capping layer formed on the second electrode. The organic capping layer has a refractive index of at least 1.7.

Preferably the organic capping layer has a refractive index of 1.7 to 2.4. Preferably the organic capping layer has a refractive index of 1.7 to 2.1. Preferably the organic capping layer has a refractive index of 1.7 to 2.0. Preferably the organic capping layer has a refractive index of 1.7 to 1.9.

Preferably the organic capping layer has a thickness of 300 Å to 900 Å. Preferably the organic capping layer has a thickness of 400 Å to 800 Å. Preferably the organic capping layer has a thickness of 500 Å to 700 Å. Preferably the organic capping layer has a thickness of 600 Å. Preferably the organic capping layer is formed of a triamine derivative, an arylenediamine derivative, CBP, and/or Alq3. Preferably the organic capping layer is formed by a vacuum deposition method. Preferably the first electrode is an anode and the second electrode is a cathode. Preferably the first electrode is a transparent electrode formed of Indium Tin Oxide or Indium Zinc Oxide including the reflecting layer. Preferably the reflecting layer is aluminum or an aluminum alloy. Preferably the second electrode is formed of Mg, Ag, Al, Ca and/or an alloy of Mg, Ag or Ca, the second electrode being a transmissive electrode having a small thickness. Preferably the organic layer further comprises a hole injection layer, a hole transport layer, an electron transport layer and/or an electron injection layer, in addition to the organic emission layer.

[0013] In another exemplary embodiment of the present invention, a method for fabricating an OLED display includes: preparing a substrate; forming a first electrode including a reflecting layer on the substrate; forming an organic layer including at least an organic emission layer over the first electrode; forming a second electrode on the organic layer; and forming an organic capping layer having a refractive index of 1.7 or more on the second electrode.

Preferably the organic capping layer has a refractive index of 1.7 to 2.4. Preferably the organic capping layer has a thickness of 300 Å to 900 Å. Preferably the organic capping layer has a thickness of 600 Å. Preferably the organic capping layer comprises a triamine derivative, an arylenediamine derivative, CBP, and/or Alq3. Preferably the organic capping layer is formed by a vacuum deposition method. Preferably the first electrode is an anode and the second electrode is a cathode. Preferably the first electrode is a transparent electrode formed of Indium Tin Oxide (ITO) or Indium Zinc Oxide (IZO). Preferably the reflecting layer comprises aluminum and/or an aluminum alloy. Preferably the second electrode comprises Mg, Ag, Al, Ca and/or an alloy of Mg, Ag, Al or Ca, the second electrode being a transmissive electrode having a small thickness. Preferably the organic layer further comprises a hole injection layer, a hole transport layer, an electron transport layer and/or an electron injection layer, in addition to the organic emission layer.

BRIEF DESCRIPTION OF THE DRAWINGS

[0014] The above and other features and aspects of the present invention will become more apparent to those of ordinary skill in the art by describing in detail example embodiments thereof with reference to the attached drawings in which:

[0015] FIG. 1 is a cross-sectional view showing the structure of a conventional top-emitting OLED display;

[0016] FIG. 2 is a cross-sectional view showing the structure of a top-emitting OLED display according to an embodiment of the present invention;

[0017] FIG. 3 is a graph showing a refractive index depending on a wavelength for each organic material according to an embodiment of the present invention;

[0018] FIG. 4 is a graph showing red (R) efficiency for each thickness of an organic capping layer according to an embodiment of the present invention;

[0019] FIG. 5 is a graph showing green (G) efficiency for each thickness of an organic capping layer according to an embodiment of the present invention; and

[0020] FIG. 6 is a graph showing blue (B) power consumption for each thickness of an organic capping layer according to an embodiment of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

[0021] Hereinafter, embodiments of the present invention will be described with reference to the accompanying drawings.

[0022] FIG. 2 is a cross-sectional view showing the structure of a top-emitting OLED display according to one embodiment of the present invention.

[0023] Referring to FIG. 2, in the OLED display according to one embodiment of the present invention, a first electrode 23 including a reflecting layer 22 is patterned and formed on a substrate 21 such as glass, plastic and crystal. The reflecting layer 22 is formed of a high-reflective metal such as aluminum or an aluminum alloy. The first electrode 23 is formed of a reflective electrode that is a transparent electrode such as Indium Tin Oxide (ITO) or Indium Zinc Oxide (IZO) having a high work function.

[0024] An organic layer 25 including at least an organic emission layer is then formed on the first electrode 23. The organic layer 25 may further include at least one of a hole injection layer, a hole transport layer, an electron transport layer, and an electron injection layer, in addition to the organic emission layer.

[0025] A second electrode 27 is formed on the organic layer 25. The second electrode 27 is formed of a transparent electrode such as ITO or IZO, and/or of a transmissive electrode having a small thickness that can transmit light, which may be made from Mg, Ag, Al, Ca and/or alloys thereof that are conductive metals having a low work function.

[0026] By way of example, the second electrode 27 may be formed of Mg, Ag, Al, Ca and/or alloys thereof, and of a transmissive electrode having a small thickness that can transmit light. In one example embodiment, the second electrode 27 is formed of MgAg.

[0027] An organic capping layer 29 is formed on the second electrode 27. The organic capping layer 29 is formed to prevent a significant amount of light from being lost due to total reflection when the second electrode 27 is formed in the top-emitting OLED display. The organic capping layer 29 is formed by stacking an organic material having a refractive index of 1.7 or more to a predetermined thickness. The organic capping layer 29 may be formed of an arylenediamine derivative, a triamine derivative, CBP, and/or aluminum quinolate (Alq3). In one embodiment, the organic capping layer 29 may be formed of an arylenediamine derivative having a refractive index of 1.7 to 2.4.

[0028] FIG. 3 is a graph showing a refractive index depending on a wavelength for each organic material according to an embodiment of the present invention.

[0029] As seen from FIG. 3, the triamine derivative has a refractive index of at least 1.7 to 2.1, arylenediamine derivative of at least 1.7 to 2.4, CBP 1.7 to 2.0, Alq3 1.7 to 2.0, and Blaq 1.5 to 1.7 in a range of wavelengths of 380 nm to 1190 nm.

[0030] With the 1.7 or more refractive index, the organic material for forming the organic capping layer 29 prevents total reflection of light to increase the luminous efficiency of red (R), green (G), and blue (B) light. In one embodiment, the organic material has a refractive index close to 2.4.

[0031] Further, in one embodiment of the present invention, the organic capping layer 29 is formed by stacking a material having a refractive index of 1.7 or more to a thickness of 300 Å (1 x 10^{-8} cm) to 900 Å to maximize luminous efficiency on each color coordinate of R, G and B.

[0032] If the organic capping layer 29 is 300 Å to 900 Å thick, it can be used as an element due to the luminous efficiency of R, G and B, and can increase the luminous efficiency of R, G and B and reduce power consumption.

[0033] In one embodiment, the organic capping layer 29 is deposited to a thickness of 600 Å to maximize the luminous efficiency of R, G and B and minimize power consumption.

[0034] A method for fabricating a top-emitting OLED display according to embodiments of the present invention will be now described.

[0035] Referring back to FIG. 2, a substrate 21 is prepared. The substrate 21 is a transparent substrate, such as glass, plastic and/or crystal.

[0036] A first electrode 23 and a reflecting layer 22 are then formed on the substrate 21. The reflecting layer 22 and the first electrode 23 are deposited by sputtering, ion plating, or the like. The reflecting layer 22 and the first electrode 23 may be deposited by the sputtering method and patterned using photoresist (PR) patterned in a photolithography process as a mask.

[0037] An organic layer 25 including at least an organic emission layer is then formed on the first electrode 23.

[0038] The organic emission layer may include a small molecular or polymer material.

[0039] The small molecular material is formed of Alq3, anthracene, cyclo pentadiene, BeBq2, Almq, ZnPBO, Balq, DPVBi, BSA-2 and/or 2PSP. In one embodiment, the organic emission layer is formed of Alq3. The polymer material is formed of polyphenylene (PPP) and/or a derivative thereof, poly p-phenylenevinylene (PPV) and/or a derivative thereof and/or polythiophene (PT) and/or a derivative thereof.

[0040] If the first electrode 23 is an anode, the organic layer 25 may further include a hole injection layer, a hole transport layer, an electron transport layer, and an electron injection layer, in addition to the organic emission layer.

[0041] The hole injection layer is formed of copper phthalocyanine (CuPc), PEDOT, m-MTDATA, and/or triphenylamine. The hole transport layer includes at least one hole transport compound, e.g., aromatic tertiary amine. This compound contains at least one trivalent nitrogen atom combined only to carbon atoms (at least one of the carbon atoms is an element of an aromatic ring). In one form, the aromatic tertiary amine may be arylamine, e.g., monoarylamine, diarylamine, triarylamine, or polymeric arylamine.

[0042] In one embodiment, a material useful for forming the electron transport layer is a metal chelated oxynoide compound containing chelate of oxyn itself (commonly referred to as '8-quinolinol' or '8-hydroxy quinoline'). Such a compound helps electron injection and transport and provides high performance, and is easily fabricated in the form of a thin film. Butadiene derivative and heterocyclic optical brighteners are contained in other electron transport materials. Benzazole and triazine are also useful as the electron transport material. Further, when a dopant is applied to the emission layer, Alq3, used as a host material of the emission layer, is widely used because of its feature as an electron transporter.

[0043] The organic layer 25 is deposited by vacuum deposition, spin coating, inkjet printing, doctor blade, laser induced thermal imaging (LITI), or the like.

[0044] Meanwhile, the organic layer 25 may be patterned and formed in each unit pixel. The organic layer 25 may be patterned by laser induced thermal imaging, vacuum deposition using a shadow mask, or the like.

[0045] A second electrode 27 is then formed on the entire surface of the organic layer 25. The second electrode 27 is formed by vacuum deposition.

[0046] An organic capping layer 29 is formed on the second electrode 27. The organic capping layer 29 is formed by vacuum deposition so that deterioration is minimized due to thermal damage of the organic emission layer. As such, the use of the organic capping layer can minimize lifetime reduction and dark spot generation due to thermal damage of the organic emission layer, which may be caused when an inorganic layer having a similar characteristic is formed at high temperature by sputtering. Further, the deposition of the organic capping layer in optimal conditions leads to increased efficiency over about 1.5 times, thereby increasing the lifetime of the top-emitting OLED display. As a result, it is possible to obtain a high-efficiency and long-lifetime top-emitting OLED display.

[0047] The substrate including the organic capping layer 29 is encapsulated with an upper substrate by a typical method, thereby completing the top-emitting OLED display.

[0048] Embodiments of the present invention will be now described. However, the following embodiments are disclosed for illustrative purposes only so that the present invention is easily understood and not intended to limit the present invention.

Embodiments 1 to 4 and Comparative example

[0049] In Embodiments 1 to 4 and the Comparative example, a test substrate for a top-emitting OLED display was fabricated.

Embodiment 1

[0050] A glass substrate was prepared. A reflecting layer of a first electrode was formed of Al on the substrate, and ITO was deposited on the reflecting layer of Al. An organic layer was then formed on the ITO by depositing m-TDATA in a hole injection layer, NPB in a hole transport layer, red-CBP:BTPlr, green-CBP:lr ppy 3 and blue-Alq3:DPBVi in an emission layer, Balq in a hole blocking layer, Alq3 in an electron transport layer, and LiF in an electron injection layer. MgAg was deposited as a second electrode, and then an organic capping layer having a thickness of 200 Å was deposited by performing vacuum deposition on an arylenediamine derivative having a 1.7 or more refractive index in conditions of 280 to 300 °C in temperature, about 10e-7 in vacuum and 1 Å/sec in a deposition rate, thus completing the top-emitting OLED display.

Embodiment 2

[0051] A top-emitting OLED display was formed as in Embodiment 1 except that an organic capping layer was deposited to a thickness of 400 Å.

Embodiment 3

[0052] A top-emitting OLED display was formed as in Embodiment 1 except that an organic capping layer was deposited to a thickness of 600 Å.

Embodiment 4

[0053] A top-emitting OLED display was formed as in Embodiment 1 except that an organic capping layer was deposited to a thickness of 800 Å.

Comparative example

[0054] An OLED display including a substrate, a first electrode, an organic layer and a second electrode was completed as in Embodiment 1. In this case, an organic capping layer is not deposited.

< Evaluation of efficiency and power consumption>

[0055] R and G efficiencies depending on the thickness of the organic capping layer in the OLED displays formed as in Embodiments 1 to 4 and the comparative example were evaluated.

[0056] In the case of B, a change in color coordinates significantly affects total power consumption and, accordingly, an absolute comparison between efficiency values is meaningless. For this reason, both color coordinates and efficiency were considered in evaluating the power consumption.

[0057] Table 1 shows an evaluation result of R and G efficiencies and B power consumption for each thickness of the organic capping layer according to an embodiment of the present invention.

[0058] FiGs. 4 and 5 are graphs that respectively show R and G efficiencies for each thickness of an organic capping layer according to an embodiment of the present invention, respectively, and FIG. 6 is a graph showing B power consumption for each thickness of an organic capping layer according to an embodiment of the present invention.

Table 1

	Thickness (Å) of organic capping layer	R efficiency, cd/A	G efficiency, cd/A	B power consumption, mW
Comparative example	0	2.83	23.63	538.5
Embodiment1	200	3.52	26.30	533.7
Embodiment2	400	4.50	35.65	422.4
Embodiment3	600	4.98	39.60	373.6
Embodiment4	800	4.34	34.33	434.9

[0059] From Table 1 and FiGs. 4 to 6, it was ascertained that when the thickness of the organic capping layer increases from 0 Å to 200 Å, 400 Å and 600 Å as in the comparative examples, and Embodiments 1 to 3, the R efficiency increases from 2.83 candelas per ampere (cd/A) to 4.98 cd/A, the G efficiency increases from 23.63 cd/A to 39.60 cd/A, and the B power consumption is reduced from 538.5 milli-watts (mW) to 373.6 mW.

[0060] In particular, it was ascertained that when the organic capping layer has a thickness of 600 Å as in Embodiment 3, the R and G efficiencies are maximized to be 4.98 cd/A and 39.60 cd/A, respectively, and the B power consumption is minimized to be 373.6 mW.

[0061] It was also ascertained that if the organic capping layer has a thickness of 800 Å as in Embodiment 4, the R and G efficiencies are reduced to 4.34 cd/A and 34.33 cd/A, respectively, and the B power consumption is increased to 434.9 mW, compared to Embodiment 3.

[0062] It was seen from the above that it is beneficial that the organic capping layer is formed by depositing an organic material having a refractive index of 1.7 or higher to a thickness of 600 Å, thereby achieving maximized R, G and B efficiencies and low power consumption. However, other suitable thicknesses may be used for the organic capping layer, as disclosed herein.

[0063] As described above, according to the present invention, it is possible to obtain a high-efficiency and long-lifetime top-emitting OLED display by stacking an organic capping layer having a refractive index of 1.7 or more on the second electrode of the top-emitting OLED display.

Claims

1. An organic light emitting diode display comprising:

a substrate (21);
a first electrode (23) formed on the substrate (21), the first electrode (23) including a reflecting layer (22);
an organic layer (25) formed on the first electrode (23), the organic layer (25) including an organic emission layer;
a second electrode (27) formed on the organic layer (25); and
an organic capping layer (29) formed on the second electrode (27), the organic capping layer (29) having a refractive index of at least 1.7, and having a thickness of 600 Å.

2. The organic light emitting diode display of claim 1, wherein the organic capping layer has a refractive index of 1.7 to 2.4.

3. The organic light emitting diode display of claim 2, wherein the organic capping layer is formed of a triamine derivative, an arylenediamine derivative, CBP, and/or Alq3.

4. The organic light emitting diode display of claim 1, wherein the first electrode is an anode and the second electrode is a cathode.

5. The organic light emitting diode display of to claim 1, wherein the first electrode is a transparent electrode formed of Indium Tin Oxide or Indium Zinc Oxide including the reflecting layer and wherein the reflecting layer is aluminum or an aluminum alloy and wherein the second electrode is formed of Mg, Ag, Al, Ca and/or an alloy of Mg, Ag or Ca, the second electrode being a transmissive electrode

6. The organic light emitting diode display according to one of the preceding claims, wherein the organic layer further comprises:

a hole injection layer, a hole transport layer, an electron transport layer and/or an electron injection layer, in addition to the organic emission layer.

7. A method for fabricating an organic light emitting diode display, comprising:

preparing a substrate (21);
forming a first electrode (23) including a reflecting layer (22) on the substrate (21);
forming an organic layer (25) including an organic emission layer over the first electrode (23);
forming a second electrode (27) on the organic layer (25); and
forming an organic capping layer (29) having a refractive index of at least 1.7, and having a thickness of 600 Å, on the second electrode.

8. The method according to claim 7, wherein the organic capping layer is formed by a vacuum deposition method.

Patentansprüche

1. Eine organische Leuchtdiodenanzeige, umfassend:

ein Substrat (21);
eine auf dem Substrat (21) ausgebildete erste Elektrode (23), wobei die erste Elektrode (23) eine reflektierende Schicht (22) beinhaltet;
eine auf der ersten Elektrode (23) ausgebildete organische Schicht (25), wobei die organische Schicht (25) eine organische Emissionsschicht beinhaltet;
eine auf der organischen Schicht (25) ausgebildete zweite Elektrode (27); und
eine auf der zweiten Elektrode (27) ausgebildete organische Deckschicht (29), wobei die organische Deckschicht (29) einen Brechungsindex von mindestens 1,7 aufweist und eine Stärke von 600 Å aufweist.

2. Die organische Leuchtdiodenanzeige nach Anspruch 1, wobei die organische Deckschicht einen Brechungsindex von 1,7 bis 2,4 aufweist.

3. Die organische Leuchtdiodenanzeige nach Anspruch 2, wobei die organische Deckschicht aus einem Triaminderivat, einem Arylendiaminderivat, CBP und/oder Alq3 gebildet ist.

4. Die organische Leuchtdiodenanzeige nach Anspruch 1, wobei die erste Elektrode eine Anode ist und die zweite Elektrode eine Kathode ist.

5. Die organische Leuchtdiodenanzeige nach Anspruch 1, wobei die erste Elektrode eine die reflektierende Schicht einschließende, aus Indiumzinnoxid oder Indiumzinkoxid gebildete transparente Elektrode ist und wobei die reflektierende Schicht Aluminium oder eine Aluminiumlegierung ist und wobei die zweite Elektrode aus Mg, Ag, Al, Ca und/oder einer Legierung von Mg, Ag oder Ca gebildet ist, wobei die zweite Elektrode eine lichtdurchlässige Elektrode ist.

6. Die organische Leuchtdiodenanzeige nach einem der vorangehenden Ansprüche, wobei die organische Schicht ferner umfasst:

eine Lochinjelctionsschicht, eine Lochtransportschicht, eine Elektronentranspartschicht und/oder eine Elektroneninjektionsschicht, zusätzlich zu der organischen Emissionsschicht.

7. Ein Verfahren zur Herstellung einer organischen Leuchtdiodenanzeige, umfassend:

Präparieren eines Substrats (21);
Ausbilden einer ersten Elektrode (23) mit einer reflektierenden Schicht (22) auf dem Substrat (21);
Ausbilden einer organischen Schicht (25) mit einer organischen Emissionsschicht über der ersten Elektrode (23);
Ausbilden einer zweiten Elektrode (27) auf der organischen Schicht (25); und
Ausbilden einer organischen Deckschicht (29) mit einem Brechungsindex von mindestens 1,7 und einer Stärke von 600 Å auf der zweiten Elektrode.

8. Das Verfahren nach Anspruch 7, wobei die organische Deckschicht durch ein Vakuumabscheidungsverfahren gebildet wird.

Revendications

1. Dispositif d'affichage organique à diode émettrice de lumière comportant :

un substrat (21) ;
une première électrode (23) formée sur le substrat (21), la première électrode (23) comprenant une couche réfléchissante (22) ;
une couche organique (25) formée sur la première électrode (23), la couche organique (25) comprenant une couche d'émission organique ;
une seconde électrode (27) formée sur la couche organique (25) ; et
une couche de recouvrement organique (29) formée sur la seconde électrode (27), la couche de recouvrement organique (29) ayant un indice de réfraction d'au moins 1,7 et ayant une épaisseur de 600 Å.

2. Dispositif d'affichage organique à diode émettrice de lumière selon la revendication 1, dans lequel la couche de recouvrement organique a un indice de réfraction de 1,7 à 2,4.

3. Dispositif d'affichage organique à diode émettrice de lumière selon la revendication 2, dans lequel la couche de recouvrement organique est formée d'un dérivé de triamine, d'un dérivé d'arylènediamine, de CBP et/ou d'Alq3.

4. Dispositif d'affichage organique à diode émettrice de lumière selon la revendication 1, dans lequel la première électrode est une anode et la seconde électrode est une cathode.

5. Dispositif d'affichage organique à diode émettrice de lumière selon la revendication 1, dans lequel la première électrode est une électrode transparente formée d'oxyde d'étain dopé à l'indium ou d'oxyde de zinc dopé à l'indium comprenant la couche réfléchissante et dans lequel la couche réfléchissante est en aluminium ou en un alliage aluminium, et dans lequel la seconde électrode est formée de Mg, d'Ag, d'Al, de Ca et/ou d'un alliage de Mg, Ag ou Ca, la seconde électrode étant une électrode de transmission.

6. Dispositif d'affichage organique à diode émettrice de lumière selon l'une des revendications précédentes, dans lequel la couche organique comporte en outre :

une couche d'injection de trous, une couche de transport de trous, une couche de transport d'électrons et/ou une couche d'injection d'électrons, en plus de la couche d'émission organique.

7. Procédé pour la fabrication d'un dispositif d'affichage organique à diode émettrice de lumière, comprenant :

la préparation d'un substrat (21) ;
la formation d'une première électrode (23) comprenant une couche réfléchissante (22) sur le substrat (21) ;
la formation d'une couche organique (25) comprenant une couche d'émission organique sur la première électrode (23) ;
la formation d'une seconde électrode (27) sur la couche organique (25) ; et
la formation d'une couche de recouvrement organique (29) ayant un indice de réfraction d'au moins 1,7, et ayant une épaisseur de 600 Å, sur la seconde électrode.

8. Procédé selon la revendication 7, dans lequel la couche de recouvrement organique est formée par un procédé de dépôt sous vide.

FIG. 1

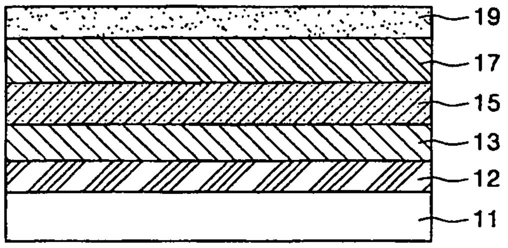


FIG. 2

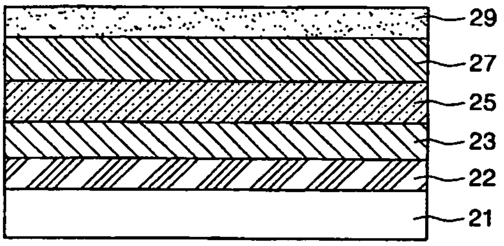


FIG. 3

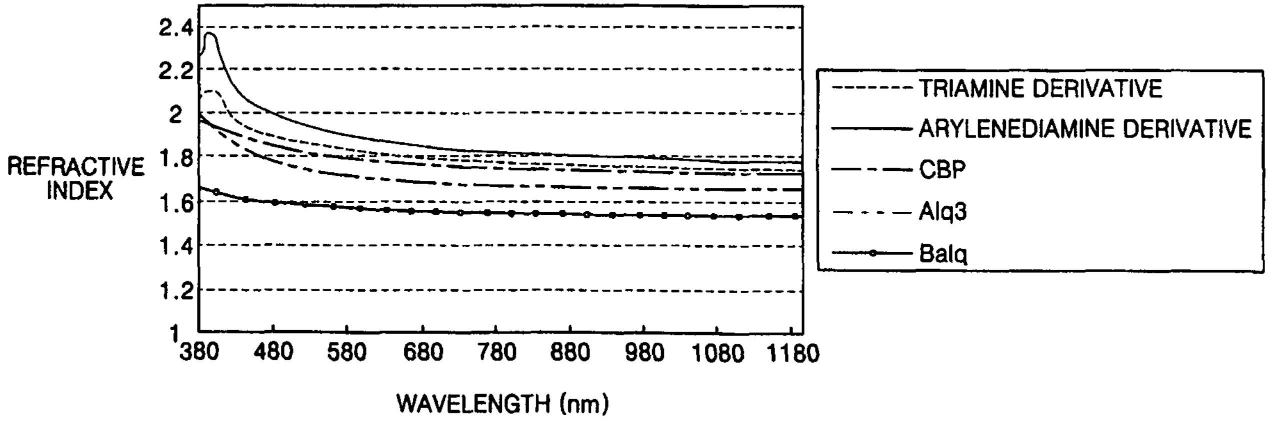

REFRACTIVE INDEX
2.4
2.2
2
1.8
1.6
1.4
1.2
1
380
480
580
680
780
880
980
1080
1180
WAVELENGTH (nm)
TRIAMINE DERIVATIVE
ARYLENEDIAMINE DERIVATIVE
CBP
Alq3
Balq

FIG. 4

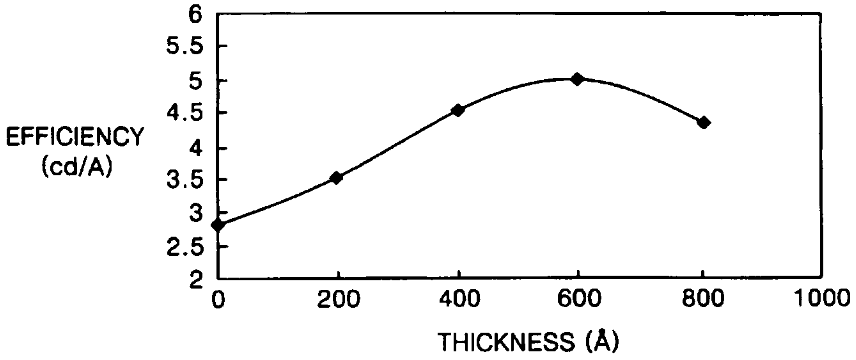


FIG. 5

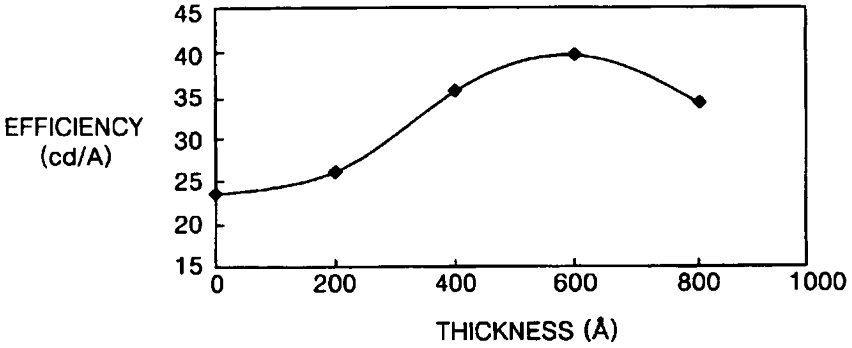
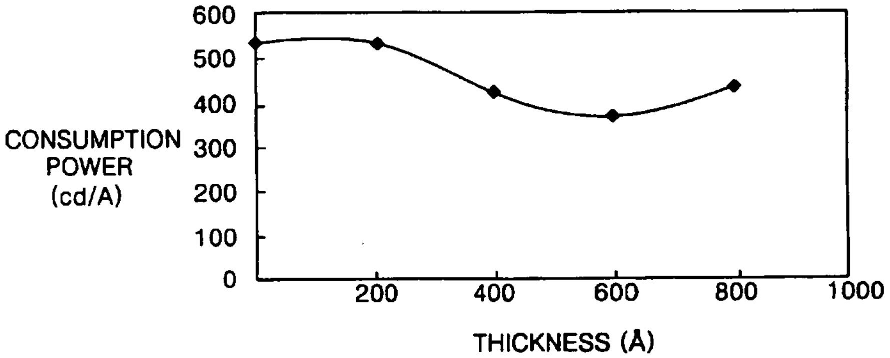


FIG. 6



REFERENCES CITED IN THE DESCRIPTION

Non-patent literature cited in the description

- **L. S. HUNG et al.** *Applied Physics Letters,* 2001, vol. 78, 544 **[0010]**

专利名称(译)	有机发光显示器及其制造方法		
公开(公告)号	EP1670084B1	公开(公告)日	2008-03-26
申请号	EP2005111051	申请日	2005-11-22
[标]申请(专利权)人(译)	三星斯笛爱股份有限公司		
申请(专利权)人(译)	三星SDI CO.，LTD.		
当前申请(专利权)人(译)	三星SDI CO.，LTD.		
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IPC分类号	H01L51/52		
CPC分类号	H01L51/5275 H01L51/5253		
代理机构(译)	hengelhaupt，Jürgen		
优先权	1020040098238 2004-11-26 KR		
其他公开文献	EP1670084A1		
外部链接	Espacenet		

摘要(译)

有机发光二极管（OLED）显示器及其制造方法。 OLED显示器包括：基板;第一电极，形成在所述基板上并且包括反射层;有机层，形成在所述第一电极上并且至少包括有机发射层;形成在所述有机层上的第二电极;以及形成在第二电极上的有机覆盖层。有机覆盖层通过堆叠折射率为1.7或更大的有机材料形成，从而提供高效率和长寿命的顶部发射OLED显示器。

FIG. 1

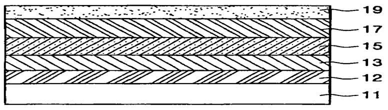

FIG. 2