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

(11) EP 2 325 916 A1

(12) # EUROPEAN PATENT APPLICATION

(43) Date of publication:
25.05.2011 Bulletin 2011/21

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

(21) Application number: **10191279.8**

(22) Date of filing: **16.11.2010**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME

(30) Priority: **18.11.2009 KR 20090111630**

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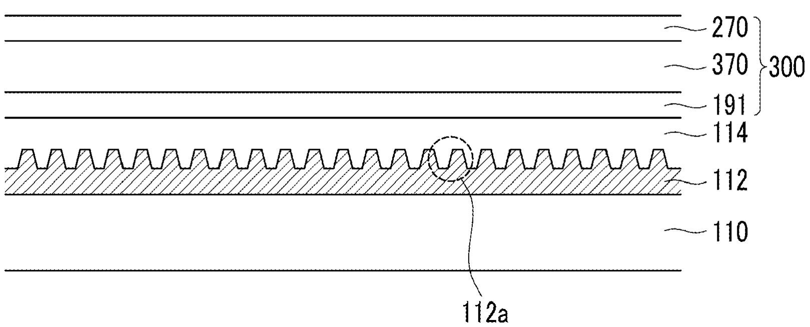
Remarks:
Amended claims in accordance with Rule 137(2) EPC.

(54) **Organic light emitting diode display and method of manufacturing the same**

(57) An organic light emitting diode (OLED) device is disclosed. In one embodiment, the OLED device includes: a substrate (110) and a first thin film (112) formed on the substrate, wherein the first thin film (112) comprises first and second surfaces opposing each other, wherein the first surface contacts the substrate (110), and wherein a plurality of protrusions and depressions (112a) are alternately formed on the second surface of the first thin film (112). The OLED device further includes a second thin film (114) formed on the protrusions and depressions (112a) of the first thin film (112), a first electrode (191) formed on the second thin film (114), an organic light emitting member (370) formed on the first electrode (191) and a second electrode (270) formed on the organic light emitting member (370).

FIG.1



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Description

BACKGROUND

1. Field

[0001] This disclosure relates to an organic light emitting diode (OLED) device and a method of manufacturing the same.

2. Description of the Related Technology

[0002] An organic light emitting diode (OLED) device emits light when electrons injected from one electrode are combined with holes injected from another electrode in an emission layer between the electrodes and generates an exciton, which releases energy. Since the OLED device is self-emissive, it has very low power consumption.

SUMMARY OF CERTAIN INVENTIVE ASPECTS

[0003] One aspect is an organic light emitting diode (OLED) device capable of improving luminous efficiency. Another aspect is a method of manufacturing an OLED device that increases luminous efficiency and simultaneously is applied to a large size OLED device.

[0004] Another aspect is an OLED device that includes a substrate; a first thin film formed on the substrate and having protrusions and depressions at the surface; a second thin film formed on the first thin film and planarizing the protrusions and depressions; a first electrode formed on the second thin film; a light emitting member formed on the first electrode; and a second electrode formed on the light emitting member.

[0005] The first thin film and the second thin film may include materials having refractive index different from each other. The first thin film and the second thin film may have refractive index of about 1.1 to 3, respectively. The refractive index difference between the first thin film and the second thin film may be at least 0.2.

[0006] The refractive index of the first thin film may range from about 1.6 to 2.2; and the refractive index of the second thin film may range from about 1.3 to 1.6. According to one embodiment, the refractive index of the first thin film may range from about 1.3 to 1.6; and the refractive index of the second thin film may range from about 1.6 to 2.2.

[0007] The first thin film may include silicon oxide, silicon nitride, polyacryl, polyimide, or a combination thereof; the second thin film may include silicon nitride, aluminum oxide, or a combination thereof. The protrusions and depressions may be irregularly distributed.

[0008] Another aspect is a method of manufacturing an OLED device that includes providing a first thin film having protrusions and depressions on a substrate; providing a second thin film planarizing the protrusions and depressions on the first thin film; providing a first electrode on the second thin film; providing a light emitting member on the first electrode; and providing a second electrode on the light emitting member.

[0009] The providing a first thin film having protrusions and depressions may include forming a first thin film; coating a dispersing solution including an organic particulate having a first size on the first thin film; drying the dispersing solution; etching the organic particulate to provide an organic particulate having a second size smaller than the first size; and etching the first thin film using the organic particulate having the second size as a mask.

[0010] The organic particulate may have a sphere shape. The organic particulate may include polystyrene. The etching an organic particulate may use plasma. The etching a first thin film may be performed by reactive ion etching.

[0011] The providing a first thin film having protrusions and depressions may include forming a first thin film including an organic material and treating the surface of first thin film with plasma. The manufacturing method may further include applying a metal cluster on the first thin film after forming the first thin film; and the treating the surface of first thin film with plasma may be performed by using the metal cluster as a mask.

[0012] Another aspect is an organic light emitting diode (OLED) device comprising: a substrate; a first layer formed on the substrate, wherein the first layer comprises first and second surfaces opposing each other, wherein the first surface contacts the substrate, and wherein the second surface of the first layer has a plurality of convex and concave portions which are alternately formed with respect to each other; a second layer formed on the convex and concave portions of the first layer; and an organic light emitting diode formed on the second layer.

[0013] In the above OLED device, the first and second layers have different refractive indexes. In the above OLED device, at least two of the convex and concave portions are not uniformly formed with respect to the remaining convex and concave portions. In the above OLED device, the first layer is formed of silicon oxide, silicon nitride, polyacryl, polyimide, or a combination thereof, and wherein the second layer is formed of silicon nitride, aluminum oxide, or a combination thereof.

BRIEF DESCRIPTION OF THE DRAWINGS

[0014] FIG. 1 is a schematic cross-sectional view of an organic light emitting diode (OLED) device according to one embodiment.

[0015] FIG. 2A to FIG. 2D are cross-sectional views sequentially showing a method of manufacturing the OLED device according to one embodiment.

[0016] FIG. 3 is an atomic force microscope image showing protrusions and depressions of an OLED device according to another embodiment.

[0017] FIG. 4 is a scanning electron microscope (SEM) photograph showing protrusions and depressions after removing polystyrene particulate in Example 1.

[0018] FIG. 5 is a SEM photograph showing a planarized surface after depositing silicon nitride in Example 1.

DETAILED DESCRIPTION OF CERTAIN INVENTIVE ASPECTS

[0019] In order to further reduce the power consumption, it is important to increase the luminous efficiency of an organic light emitting diode (OLED) device. The luminous efficiency may be determined by the internal quantum efficiency which is a ratio of the charge number injected from electrode to the quantum number generated from emission layer and the external quantum efficiency which is a ratio of quantum number generated from emission layer to quantum number emitted to the outside.

[0020] This disclosure will be described more fully hereinafter with reference to the accompanying drawings, in which exemplary embodiments of this disclosure are shown. As those skilled in the art would realize, the described embodiments may be modified in various different ways, all without departing from the scope of this disclosure.

[0021] In the drawings, the thickness of layers, films, panels, regions, etc., are exaggerated for clarity. Like reference numerals designate like elements throughout the specification. It will be understood that when an element such as a layer, film, region, or substrate is referred to as being "on" another element, it can be directly on the other element or intervening elements may also be present. In contrast, when an element is referred to as being "directly on" another element, there are no intervening elements present.

[0022] FIG. 1 is a cross-sectional view of an OLED device according to one embodiment. A first thin film (or a first layer) 112 is formed on an insulation substrate 110 made of, for example, transparent glass or plastic. In one embodiment, the first thin film 112 has alternately formed protrusions and depressions (or convex and concave portions) 112a. The protrusions and depressions may be irregularly distributed at the surface. In one embodiment, the protrusions and depressions 112a consists in a photocrystal member having a nano-sized pattern having a height of about 10 nm to about 2μm. In this embodiment, the protrusions and depressions 112a decrease the total reflection of light in the inside and decrease the emitted light amount to the vertical direction from the substrate by controlling the light passage.

[0023] The first thin film 112 may be made of inorganic material or organic material having a refractive index of about 1.1 to about 3.0. The inorganic material may include, for example, silicon oxide (SiO_2), silicon nitride (SiN_x), or a combination thereof; the organic material may include, for example, polyacryl, polyimide, or a combination thereof. When the refractive index of the first thin film 112 is similar to the refractive index of the insulation substrate 110, it is possible to decrease the internal total reflection generated at the interface between the insulation substrate 110 and the first thin film 112.

[0024] A second thin film (or a second layer) 114 may be formed on the first thin film 112 to planarize the protrusions and depressions 112a of the first thin film 112. The second thin film 114 planarizes the protrusions and depressions 112a of the first thin film 112 to provide a plane emission layer. Therefore, it is possible to prevent that an emission layer having a lower thickness is formed on the inclined surface of protrusions and depressions 112a. It is also possible to prevent that the current is concentrated in the inclined part in the case that the emission layer is formed along with the shape of protrusions and depressions 112a. As a result, the degeneration of the device is prevented and the reliability is improved.

[0025] In one embodiment, the second thin film 114 has a refractive index of about 1.1 to about 3.0. In addition, when the refractive index of second thin film 114 is similar to the refractive index of first electrode 191, it is possible to decrease the total internal reflection generated at the interface between the second thin film 114 and the first electrode 191.

[0026] The second thin film 114 may be made of inorganic material or organic material having a refractive index different from that of the first thin film 112. The inorganic material may include, for example, silicon nitride (SiN_x), aluminum oxide (Al_2O_3), or a combination thereof; the organic material may include, for example, polyacryl, polyimide, or a combination thereof.

[0027] The refractive index difference between the first thin film 112 and the second thin film 114 may be at least about 0.2. For example, the first thin film 112 may have a refractive index of about 1.6 to about 2.2 and the second thin film 114 may have a refractive index of about 1.3 to about 1.6. Further, the first thin film 112 may have a refractive index of about 1.3 to about 1.6 and the second thin film 114 may have a refractive index of about 1.6 to about 2.2.

[0028] As mentioned above, the total internal reflection is decreased and the amount of light emitted to the front surface is increased by providing protrusions and depressions at the interface between the first thin film 112 and the second thin film 114 having different refractive index. Accordingly, the light extracting efficiency may be increased.

[0029] A first electrode 191 is formed on the second thin film 114. The first electrode 191 may be either anode or cathode and may be made of a transparent conductive material such as ITO or IZO.

[0030] An organic light emitting member 370 is formed on the first electrode 191. The organic light emitting member 370 may have a multi-layer structure including an emission layer (not shown) and an auxiliary layer (not shown) for improving the luminous efficiency of emission layer.

[0031] The emission layer may be made of and organic material or a mixture of organic material and inorganic material inherently emitting one color light among primary colors of red, green, and blue. It may include aluminum tris(8-hydroxyquinoline), [Alq3], anthracene, distryl compound or a combination thereof. The organic light emitting diode (OLED) device expresses the desirable image by mixing of primary color lights generated from the emission layer.

[0032] The auxiliary layer may include one or at least two layers selected from the group consisting of an electron transport layer (ETL) (not shown) and hole transport layer (HTL) (not shown) for balancing electrons and holes; an electron injection layer (EIL) (not shown) and hole injection layer (HIL) (not shown) for enforcing the injection of electrons and holes.

[0033] A second electrode 270 is formed on the organic light emitting member 370. When the first electrode 191 is made of a transparent conductive material, the second electrode 270 may be made of opaque conductive material such as aluminum (Al), calcium (Ca) barium (Ba), or a combination thereof.

[0034] The first electrode 191 may be an anode, and the second electrode 270 may be a cathode; on the other hand, the first electrode 191 may be a cathode, and the second electrode 270 may be an anode.

[0035] As described above, the OLED device according to one embodiment limits the light passage to increase the light extracting effect to the vertical direction of the substrate and to increase the light amount emitted to the outside among the light generated from the emission layer. Thereby, it is possible to increase the luminous efficiency and the life-span of the device and, simultaneously, to decrease the driving voltage of the OLED device.

[0036] Hereinafter, the method of manufacturing the OLED device shown in FIG. 1 is described with reference to FIG. 2A to FIG. 2D together with FIG. 1.

[0037] FIG. 2A to FIG. 2D are cross sectional views sequentially showing the method of manufacturing the OLED device according to one embodiment. In one embodiment, the OLED is manufactured as follows.

[0038] First, as shown in FIG. 2A, a lower layer 111 is formed on the substrate 110. The lower layer 111 may use, for example, the substrate 110 without any further treatment, or it may be formed of, for example, silicon oxide, silicon nitride in accordance with plasma enhanced chemical vapor deposition (PECVD).

[0039] Then a dispersing solution (not shown) including a plurality of organic particulates 50 is coated on the lower layer 111. The dispersing solution may be, for example, a suspension in which the organic particles 50 are mixed into a dispersing solvent such as water. The coating may be performed, for example, by spin coating.

[0040] In one embodiment, the organic particles 50 have a spherical shape and are made of organic material, for example, polystyrene. Each or at least one of the organic particles (or the first organic particles) 50 may have a size of about 0.03 μm to about 3.2 μm. In one embodiment, the dispersing solution is dried to remove the solvent and thus provide the organic particles 50 on the lower layer 111.

[0041] As shown in FIG. 2B, the organic particles 50 are etched using, for example, oxygen plasma to provide etched organic particles (or second organic particles) 50a having a smaller size than the organic particles 50. Each or at least one of the etched organic particles 50a may have a size of about 0.01 μm to about 2.0 μm.

[0042] Referring to FIG. 2C, the lower layer 111 is etched using the etched organic particles 50a as a mask. The etching may be performed by reactive ion etching (RIE), and it may use, for example, CHF_3, CF_4 plasma. As a result of the etching process, a first thin film 112 having a plurality of protrusions and depressions 112a is provided as shown in FIG. 2C.

[0043] Then the etched organic particles 50a are removed, and a second thin film 114 is formed on the first thin film 112. The second thin film 114 may be formed of, for example, silicon nitride, aluminum oxide in accordance with plasma enhanced chemical vapor deposition (PECVD).

[0044] Referring back to FIG. 1, the first electrode 191, the organic light emitting member 370, and the second electrode 270 are sequentially formed on the second thin film 114.

[0045] According to one embodiment, the protrusions and depressions 112a may be easily provided by coating and etching process. Accordingly, it may be easily applied for a large size OLED device, so it is possible to overcome the limits that it cannot apply for the large area when using laser.

[0046] Hereinafter, the method of manufacturing an OLED device according to another embodiment is described. As in the aforementioned embodiment, the lower layer 111 is formed on the substrate 110. The lower layer 111 may be made of an organic material. The lower layer 111 made of organic material may be cured by heating in an oven or on a heating plate after spin coating.

[0047] In one embodiment, the surface of the lower layer 111 made of organic material is treated with plasma to provide a rough surface. The plasma may use, for example, argon (Ar) plasma. By treating the surface of the lower layer 111 made of organic material with plasma, it is possible to relatively easily provide the protrusions and depressions 112a. Therefore, the luminous efficiency is increased due to the protrusions and depressions 112a.

[0048] Hereinafter, the method of manufacturing an OLED device according to further another embodiment is described. As in the aforementioned embodiment, the lower layer 111 is formed and treated with plasma to provide the protrusions and depressions 112a. However, differing from the aforementioned embodiment, a metal cluster is applied on the lower layer 111. Then the lower layer 111 is treated with plasma using the metal cluster as a mask to provide the first thin film 112 having the protrusions and depressions 112a at the surface.

[0049] The following examples illustrate this disclosure in more detail. These examples, however, are not in any sense be interpreted as limiting the scope of this disclosure.

Example 1

[0050] 10 g of sphere polystyrene particles having an average diameter of 0.6 μm was dispersed in 100 mL of water to provide a suspension.

[0051] A silicon oxide (SiO_2) was deposited on a glass substrate in 0.5 μm in accordance with a chemical vapor deposition (CVD) method. Then the suspension was spin-coated on the silicon oxide layer at 800 rpm. The suspension was dried at a temperature of 25°C to remove the solvent. The substrate was introduced in a plasma chamber and supplied with oxygen gas (O_2) and argon gas (Ar) to plasma-etch the polystyrene particles. Oxygen gas (O_2) and argon gas (Ar) were supplied in a flowing amount of 2 sccm and 5 sccm, respectively, and RF (radio frequency) was 200 W. By the plasma etch, the size of polystyrene particles was decreased into about 0.3 μm. The silicon oxide layer was dry-etched with using the etched polystyrene particles as a mask. The dry etching was performed using CHF_3 in an inductive coupled plasma (ICP) etching device. The CHF_3 was supplied in a flowing amount of 20 sccm; the chamber pressure was 50 mTorr (corresponding approximately to 6.66 Pa); the ICP output was 500 W; and it was repeated for three times, each time for 2 minutes. Then the remaining polystyrene particles were removed by supplying oxygen gas (O_2) and argon gas (Ar) in a room pressure plasma chamber.

[0052] FIG. 4 is a scanning electron microscope (SEM) photograph showing protrusions and depressions of SiO_2 after removing polystyrene particles. Then 5000 Å silicon nitride was deposited on the etched silicon oxide layer in accordance with chemical vapor deposition (CVD) and planarized.

[0053] FIG. 5 is a scanning electron microscope (SEM) photograph showing the planarized surface after depositing silicon nitride. Then ITO was sputtered on the silicon nitride layer and patterned. N,N-dinaphthalene-1-yl-N,N-diphenyl-benzidine (NPB) was deposited as a hole injection layer (HIL) and a hole transport layer, and an emission layer oftris-8-hydroxyquinoline aluminum (Alq3) doped with coumarin 6 in 1 wt% was co-deposited thereon. Then an electron transport layer of Alq3 was deposited thereon, and a LiF electron injection layer (EIL) for facilitating the implant of electron and Al anode were sequentially deposited to provide an organic light emitting element 300.

Example 2

[0054] Polyacryl with a thickness of 2.0 μm was spin-coated on a glass substrate and dried. Then a substrate was introduced into a plasma chamber and supplied with argon gas (Ar) and nitrogen gas (N2) to perform a plasma etching. The plasma etching was performed under the condition of flowing amount of argon gas (Ar) of 40 sccm and nitrogen gas (N2) of 3 sccm; a chamber pressure of 200 mTorr (corresponding approximately to 26.66 Pa); ICP output of 400W; and an etching time of 5 minutes. The roughness of the surface of organic layer after the etching was measured by an atomic force microscope (AFM).

[0055] FIG. 3 is an image obtained with an atomic force microscope showing protrusions and depressions of an OLED device obtained from another embodiment. Referring to FIG. 3, it is confirmed that protrusions and depressions 112a had a height of about 200 to about 500 Å and were irregularly distributed on the entire surface of substrate. Then similarly to Example 1, a silicon nitride layer, ITO, an emission layer, and silver were sequentially laminated to provide an organic light emitting element 300.

Example 3

[0056] Silicon oxide (SiO2) was laminated on a glass substrate with a thickness of 0.5 μm in accordance with a chemical vapor deposition (CVD) method. Then a Ni layer was deposited on the silicon oxide layer with a thickness of 5 nm using an electron beam depositor. A substrate was introduced in a rapid thermal annealing (RTA) device and treated at 850°C for one minute to provide a nano-sized Ni cluster. A silicon oxide layer was etched by a reactive ion etching (RIE) using the Ni cluster as a mask. Then the Ni cluster was removed using a nitric acid solution. Then, similarly to Example 1, a silicon nitride layer, ITO, an emission layer, and silver were sequentially laminated to provide an organic light emitting element 300.

[0057] According to at least one embodiment, since the protrusions and depressions are formed where light generated from the emission layer passes, the light extracting efficiency in the vertical dimension of the substrate increases. Furthermore, the amount of light emitted to the environment increases. Thereby, the luminous efficiency is improved, and the life-span of the device is lengthened. Simultaneously, the driving voltage of an organic light emitting diode (OLED) device may be decreased. In addition, since the protrusions and depressions may be formed by a wet process such as spin-coating or a dry process such as plasma etching, it is possible to be applied for a large size display device.

[0058] While this disclosure has been described in connection with what is presently considered to be practical exemplary embodiments, it is to be understood that this disclosure is not limited to the disclosed embodiments, but, on the contrary, is intended to cover various modifications and equivalent arrangements included within the scope of the appended claims.

Claims

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

a substrate (110);
a first thin film (112) formed on the substrate (110), wherein the first thin film (112) comprises first and second surfaces opposing each other, wherein the first surface contacts the substrate (110), and wherein a plurality of protrusions and depressions (112a) are alternately formed on the second surface of the first thin film (112);
a second thin film (114) formed on the protrusions and depressions (112a) of the first thin film (112) for planarizing the protrusions and depressions (112a) of the first thin film (112);
a first electrode (191) formed on the second thin film (114);
an organic light emitting member (370) formed on the first electrode (191); and
a second electrode (270) formed on the organic light emitting member (370).

2. The OLED device of claim 1, wherein the first thin film (112) and the second thin film (114) have different refractive indexes.

3. The OLED device of one of the preceding claims, wherein each of the first thin film (112) and the second thin film (114) has a refractive index ranging from 1.1 to 3.

4. The OLED device of claim 3, wherein the refractive indexes of the first thin film (112) and second thin film (114) differ by at least 0.2.

5. The OLED device of one of the preceding claims, wherein the first thin film (112) has a refractive index ranging from 1.6 to 2.2 and the second thin film (114) has a refractive index ranging from 1.3 to 1.6, or wherein the first thin film (112) has a refractive index ranging from 1.3 to 1.6, and the second thin film (114) has a refractive index ranging from 1.6 to 2.2.

6. The OLED device of one of the preceding claims, wherein the first thin film (112) is formed of silicon oxide, silicon nitride, polyacryl, polyimide, or a combination thereof, and/or
wherein the second thin film (114) is formed of silicon nitride, aluminum oxide, or a combination thereof.

7. The OLED device of one of the preceding claims, wherein the protrusions and depressions (112a) are irregularly distributed.

8. A method of manufacturing an organic light emitting diode (OLED) device comprising:

providing a first thin film (112) on a substrate (110), wherein the first thin film (112) comprises first and second surfaces opposing each other, wherein the first surface contacts the substrate (110), and wherein the second surface of the first thin film (112) has a plurality of protrusions and depressions (112a) which are alternately formed with respect to each other;
providing a second thin film (114) on the second surface of the first thin film (112) so as to planarize the protrusions and depressions (112a);
providing a first electrode (191) on the second thin film (114);
providing a light emitting member (370) on the first electrode (191); and
providing a second electrode (270) on the light emitting member (370).

9. The method of claim 8, wherein the providing of the first thin film (112) comprises:

forming a lower layer (111) on the substrate (110);
coating a dispersing solution on the lower layer (111), wherein the dispersing solution contains a plurality of first organic particles (50) at least one of which has a first size;
drying the dispersing solution;
etching the first organic particles (50) into a plurality of second organic particles (50a) at least one of which has a second size smaller than the first size; and
etching the lower layer (111) with the use of the second organic particles (50a) as a mask to obtain the first thin film (112) with protrusions and depressions (112a).

10. The method of claim 9, wherein the first and second organic particles (50, 50a) have a spherical shape.

11. The method of one of claims 9 and 10, wherein the first and second organic particles (50, 50a) contain polystyrene.

12. The method of one of claims 9-11, wherein the etching of the first organic particles (50) is performed by plasma.

13. The method of one of claims 9-12, wherein the etching of the lower layer (111) is performed by reactive ion etching.

14. The method of claim 8, wherein the providing of the first thin film (112) comprises:

forming a first thin film (112) containing an organic material; and
treating the surface of the first thin film (112) with plasma.

15. The method of claim 14, further comprising applying

a metal cluster on the first thin film (112) after laminating the first thin film (112); and
wherein the plasma treating of the surface of the first thin film (112) is performed with the use of the metal cluster as a mask.

Amended claims in accordance with Rule 137(2) EPC.

1. A method of manufacturing an organic light emitting diode (OLED) device comprising:

providing a first thin film (112) on a substrate (110), wherein the first thin film (112) comprises first and second surfaces opposing each other, wherein the first surface contacts the substrate (110), and wherein the second surface of the first thin film (112) has a plurality of protrusions and depressions (112a) which are alternately formed with respect to each other;
providing a second thin film (114) on the second surface of the first thin film (112) so as to planarize the protrusions and depressions (112a), wherein the first thin film (112) and the second thin film (114) have different refractive indexes;
providing a first electrode (191) on the second thin film (114);
providing a light emitting member (370) on the first electrode (191); and
providing a second electrode (270) on the light emitting member (370), wherein the step of providing of the first thin film (112) comprises:
forming a lower layer (111) on the substrate (110);
coating a dispersing solution on the lower layer (111), wherein the dispersing solution contains a plurality of first organic particles (50) at least one of which has a first size;
drying the dispersing solution;
etching the first organic particles (50) into a plurality of second organic particles (50a) at least one of which has a second size smaller than the first size; and
etching the lower layer (111) with the use of the second organic particles (50a) as a mask to obtain the first thin film (112) with protrusions and depressions (112a).

2. The method of claim 1, wherein the first and second organic particles (50, 50a) have a spherical shape.

3. The method of one of claims 1 and 2, wherein the first and second organic particles (50, 50a) contain polystyrene.

4. The method of one of the preceding claims, wherein the etching of the first organic particles (50) is performed by plasma.

5. The method of one of the preceding claims, wherein the etching of the lower layer (111) is performed by reactive ion etching.

6. The method of claim 1, wherein the providing of the first thin film (112) comprises:

forming a first thin film (112) containing an organic material; and
treating the surface of the first thin film (112) with plasma.

7. The method of claim 6, further comprising applying a metal cluster on the first thin film (112) after laminating the first thin film (112); and
wherein the plasma treating of the surface of the first thin film (112) is performed with the use of the metal cluster as a mask.

FIG.1

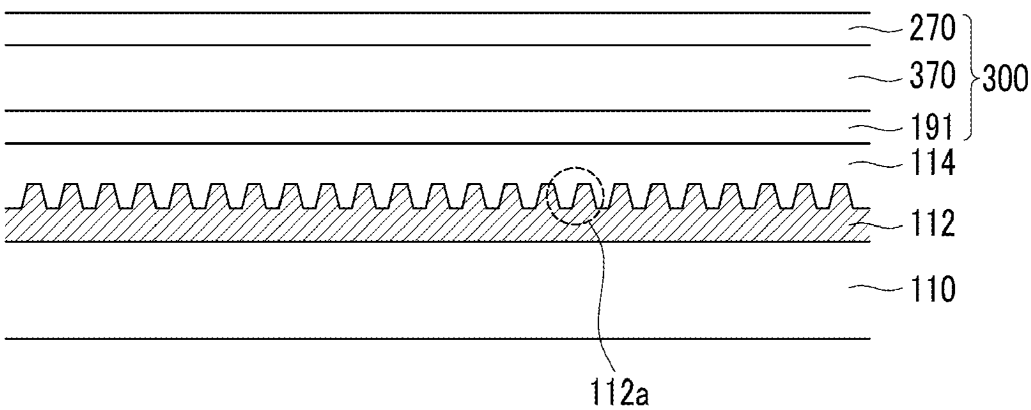

FIG.2A

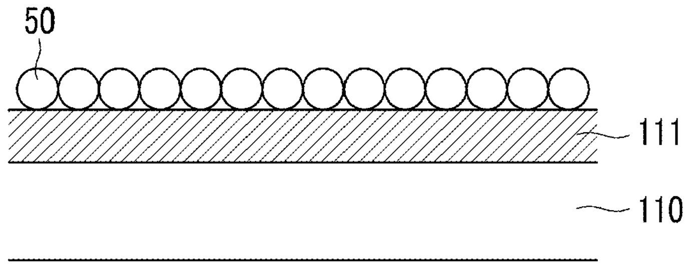

FIG.2B

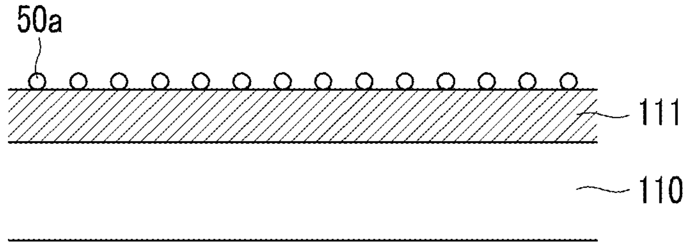

FIG.2C

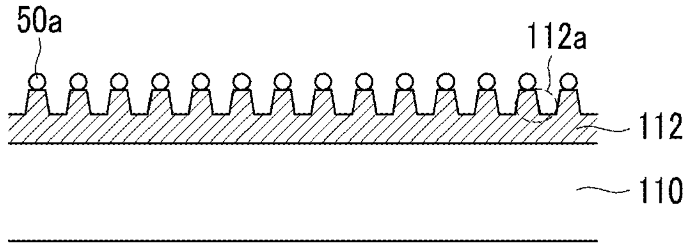

FIG.2D

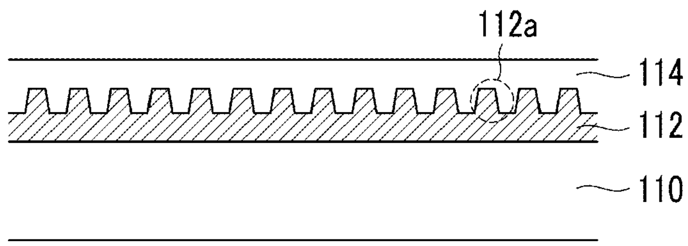

FIG.3

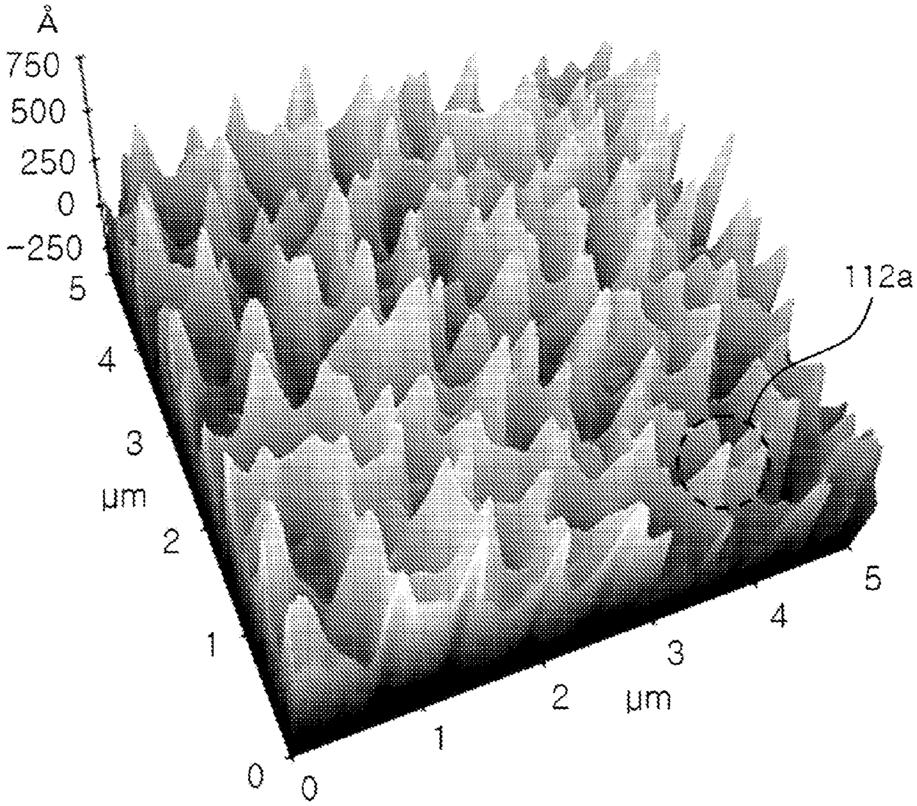

FIG.4

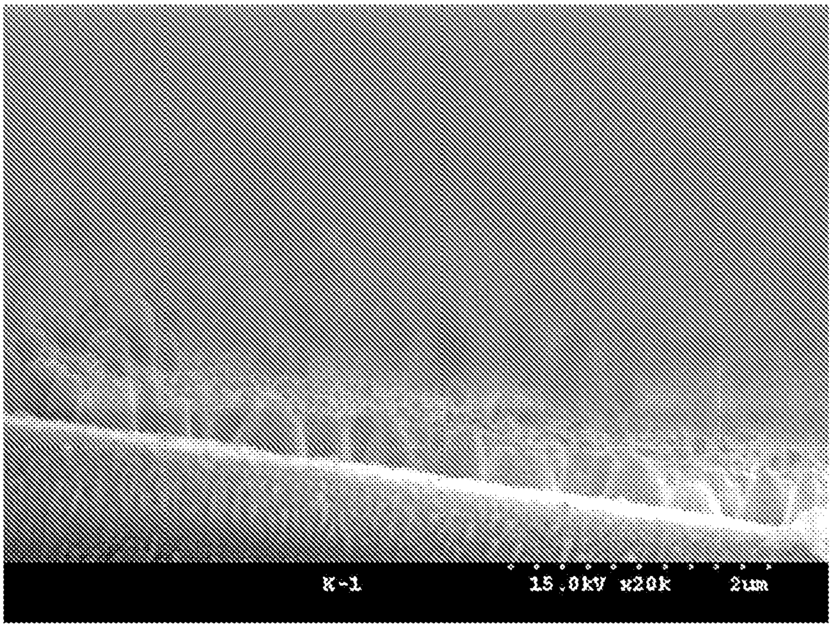

FIG.5

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EUROPEAN SEARCH REPORT

Application Number
EP 10 19 1279

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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X	EP 1 603 367 A1 (MITSUBISHI CHEM CORP [JP]) 7 December 2005 (2005-12-07) * paragraphs [0171] - [0188]; figure 11 *	1,2,8,14	
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	-/--		

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	14 January 2011	Persat, Nathalie

3

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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L : document cited for other reasons

& : member of the same patent family, corresponding document

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EUROPEAN SEARCH REPORT

Application Number
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DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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X	SAXENA K ET AL: "A review on the light extraction techniques in organic electroluminescent devices", OPTICAL MATERIALS, ELSEVIER SCIENCE PUBLISHERS B.V. AMSTERDAM, NL, vol. 32, no. 1, 1 November 2009 (2009-11-01), pages 221-233, XP026698742, ISSN: 0925-3467, DOI: DOI:10.1016/J.OPTMAT.2009.07.014 [retrieved on 2009-08-27] * pages 227-229; figures 6c,8a * -----	1,2,8	
			TECHNICAL FIELDS SEARCHED (IPC)

The present search report has been drawn up for all claims

3

Place of search	Date of completion of the search	Examiner
The Hague	14 January 2011	Persat, Nathalie

CATEGORY OF CITED DOCUMENTS

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& : member of the same patent family, corresponding document

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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 10 19 1279

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14-01-2011

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

专利名称(译)	有机发光二极管显示器及其制造方法		
公开(公告)号	EP2325916A1	公开(公告)日	2011-05-25
申请号	EP2010191279	申请日	2010-11-16
[标]申请(专利权)人(译)	三星显示有限公司		
申请(专利权)人(译)	三星移动显示器有限公司. 庆北大学产学合作基础		
当前申请(专利权)人(译)	三星DISPLAY CO.，LTD.		
[标]发明人	LEE SUNG HUN LEE GWAN HYOUNG CHU CHANG WOONG JU YOUNG GU		
发明人	LEE, SUNG-HUN LEE, GWAN-HYOUNG CHU, CHANG-WOONG JU, YOUNG-GU		
IPC分类号	H01L51/52		
CPC分类号	H01L51/5262 H01L51/5268 H01L2251/5369		
优先权	1020090111630 2009-11-18 KR		
外部链接	Espacenet		

摘要(译)

公开了一种有机发光二极管（OLED）器件。在一个实施例中，OLED器件包括：基板（110）和形成在基板上的第一薄膜（112），其中第一薄膜（112）包括彼此相对的第一和第二表面，其中第一表面与第一表面接触基板（110），其中在第一薄膜（112）的第二表面上交替地形成多个凸起和凹陷（112a）。 OLED器件还包括形成在第一薄膜（112）的凸起和凹陷（112a）上的第二薄膜（114），形成在第二薄膜（114）上的第一电极（191），有机发光器件形成在第一电极（191）上的构件（370）和形成在有机发光构件（370）上的第二电极（270）。

FIG.1