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

(11) EP 1 531 504 B1

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention of the grant of the patent:
23.06.2010 Bulletin 2010/25

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

(21) Application number: **04090446.8**

(22) Date of filing: **17.11.2004**

(54) **Organic electroluminescent display**

Organische elektrolumineszente Anzeigevorrichtung

Dispositif d'affichage électroluminescent organique

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HU IE IS IT LI LU MC NL PL PT RO SE SI SK TR

(30) Priority: **17.11.2003 KR 2003081209**

(43) Date of publication of application:
18.05.2005 Bulletin 2005/20

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TW-B- 558 913 **US-A1- 2003 203 551**

- **PATENT ABSTRACTS OF JAPAN vol. 2000, no. 19, 5 June 2001 (2001-06-05) & JP 2001 035659 A (NEC CORP), 9 February 2001 (2001-02-09) -& US 6 737 176 B1 (OTSUKI SHIGEYOSHI ET AL) 18 May 2004 (2004-05-18)**
- **PATENT ABSTRACTS OF JAPAN vol. 2003, no. 09, 3 September 2003 (2003-09-03) & JP 2003 157969 A (HITACHI LTD), 30 May 2003 (2003-05-30)**

EP 1 531 504 B1

Description

BACKGROUND OF THE INVENTION

Field of the Invention

[0001] The field of the present invention relates to organic electroluminescent displays (OLEDs) generally, and, more particularly, to an OLED containing a desiccant formed with holes therein which prevent bubbles from forming when the desiccant is adhered to a substrate or other substantially planar surface.

Description of the Related Art

[0002] OLEDs offer a thinner dimension, wider viewing angle, lighter weight, smaller size, quicker response time, and lower power consumption, as compared to a cathode ray tube (CRT) display or liquid crystal display (LCD). Moreover, OLEDs can be easily fabricated using simple manufacturing processes because its simple structure includes only three major elements, namely an anode electrode, an organic material layer, and a cathode electrode. Because of these and other advantages OLEDs are emerging as the next generation of flat panel displays.

[0003] In an OLED configured in the conventional manner, an organic light emitting device is formed on a lower insulating substrate, with an upper substrate disposed above the organic light emitting device.

[0004] A significant disadvantage associated with this configuration is that materials used to form the organic light emitting layer and cathode electrode have insufficient resistance against moisture and/or oxidation. This weakness deteriorates the reliability of the display over time. In particular, internal oxidation and/or accumulation of moisture causes areas of the display to become non-emissive. Such non-emissive areas are called "dark spots". As time goes by, the dark spots spread to neighboring areas and eventually destroy the entire display.

[0005] In an attempt to solve the foregoing problem, a conventional OLED encapsulates the organic light emitting layer and the cathode electrode to protect them against moisture and oxygen. The process involves forming a desiccant placing recess in an encapsulation substrate made of a glass material; adhering a desiccant in the recess; and bonding the encapsulation substrate to an insulating substrate with a sealant. The bonding process is performed in an inert gas such as nitrogen (N_2), argon (Ar) or the like, to prevent the encapsulation of atmospheric moisture and oxygen.

[0006] Conventionally, the desiccant material is formed on a layer of adhesive material and to a thickness of about 200μm. The desiccant material is made of barium oxide (BaO), calcium carbonate ($CaCO_3$), calcium oxide (CaO), phosphor oxide (P_2O_5), Zeolite, Silicagel, Alumina, and like elements and compounds which eliminate moisture by physisorption or chemisorption.

[0007] A significant disadvantage of using the method described above is that a gas trapped between the desiccant and a substrate will form bubbles as the desiccant is adhered to the substrate. The bubbles place portions of the desiccant into contact with the organic light emitting device, which is problematic because the moisture accumulated by the desiccant eventually penetrates the organic light emitting device and makes it non-emissive.

[0008] Conventional attempts to solve the bubble problem included forming a deep desiccant placing recess to a depth of about 350 μm. This depth prevented protruding and non-protruding areas of the bubble-deformed desiccant from contacting the light-emitting device. However, because the thickness of the substrate is proportional to the depth of the desiccant placing recess, the deep desiccant placing recess necessitates a thick substrate. This, in turn, creates a heavier OLED.

[0009] Document TW 558913 discloses an organic electroluminescent device comprising an upper substrate encapsulating the OLED device, on which a desiccant layer comprising a plurality of holes is formed.

[0010] Document US 2003/0230978 discloses a sealing substrate opposite an EL substrate wherein a desiccant layer is provided on the inner space of the sealing substrate and the height of the inner space is approximately 0,3 mm.

[0011] Document JP 2001035659 discloses an organic electroluminescent device sealed by a sealing cap wherein a desiccant layer is formed on the inner face of the sealing cap, the desiccant layer comprising a first adhesive layer and a layer of desiccant material.

[0012] Document US 2003/0203551 discloses an OLED display device wherin a desiccant material is provided in a patterned arrangement over the array of OLED elements, the openings in the desiccant layer corresponding to the color subpiscels.

SUMMARY OF THE INVENTION

[0013] In the present invention, the OLED includes a desiccant formed with at least one hole therein. The hole prevents bubbles from forming when the desiccant is adhered to a substrate or other substantially planar surface by permitting gas trapped between the desiccant and the substrate to escape.

[0014] In particular, the present invention provides an organic electro luminescence display, as described in claim 1.

BRIEF DESCRIPTION OF THE DRAWINGS

[0015] FIG. 1 is a cross-sectional view illustrating an organic electroluminescent display configured in accordance with an embodiment of the present invention.

[0016] FIG. 2A is a plan view illustrating a desiccant used in an organic electroluminescent display configured in accordance with an embodiment of the present invention.

[0017] FIG. 2B is a cross-sectional view taken along

line I-I' of FIG. 2A.

[0018] In the drawings, the thickness of layers and regions are exaggerated for clarity.

DETAILED DESCRIPTION OF THE INVENTION

[0019] FIG. 1 is a cross-sectional view of an organic electroluminescent display configured in accordance with an embodiment of the present invention.

[0020] As shown in FIG. 1, the organic electroluminescent display includes a lower insulating substrate 100, an organic light emitting device 110 formed on the lower insulating substrate 100, and an upper substrate 120 having a desiccant placing recess to which a desiccant 130 formed with at least one hole 135 is adhered to an inner surface of the desiccant placing recess. The hole 135 of the desiccant 130 acts to prevent bubbles from forming as the desiccant 130 is adhered to the upper substrate 120.

[0021] As shown, the upper substrate 100 further includes sealing recesses which bond to a sealant 140, such that the upper substrate 120 is bonded to the lower substrate and encapsulates the organic, light-emitting device 110.

[0022] In one embodiment, the organic light emitting device 110 includes a first electrode, an organic emission layer, and a second electrode, wherein when the first electrode is used as an anode electrode, the second electrode is used as a cathode electrode, and vice versa.

[0023] The organic emission layer can be composed of various layers according to its function. In one exemplary embodiment, the organic emission layer is of a multiple-layer structure that includes an emission layer and at least one of a hole injecting layer (HIL), a hole transporting layer (HTL), a hole blocking layer (HBL), an electron transporting layer (ETL) and an electron injecting layer (EIL).

[0024] The layer of desiccant 130 is made of at least one material selected from a group consisting of barium oxide (BaO), calcium carbonate ($CaCO_3$), calcium oxide (CaO), phosphor oxide (P_2O_5), Zeolite, Silicagel, Alumina, and the like. A layer of adhesive material such as a sticker or adhesive thin film, may be used to adhere the desiccant 130 to the upper substrate 120. In one embodiment, the desiccant 130 is a strip of preformed material.

[0025] FIG. 2A is a plan view illustrating a desiccant used in an OLED configured in accordance with an embodiment of the present invention. FIG. 2B is a cross-sectional view taken along line I-I' of FIG 2A.

[0026] Referring to FIGs. 2A and 2B, desiccant 200 may include a layer of desiccant material 220 formed on a layer of adhesive material 210. A plurality of holes 230 formed in the desiccant 200 pass through the desiccant 200 from side to side. The layer of desiccant material 220 absorbs moisture, and the adhesive material 210 affixes the desiccant 200 to the upper substrate 120. In one embodiment, the layer of desiccant material 220 has a thickness of less than about 200μm.

[0027] The holes 230 prevent gas bubbles from forming when the desiccant 200 is adhered to the upper substrate 120, and have a circular, shape. To effectively prevent the formation of the bubbles, each hole 230 should have a circular shape of diameter of more than about 1.0 mm. According to the invention, the diameter of each hole is in the range of about 1.0 mm to about 2.0 mm. If the diameter of the hole 230 is too small, bubbles will form as the desiccant 200 is adhered. Oppositely, if the diameter of the hole 230 is too large, it is difficult to keep the desiccant 200 in a film form, and there are problems adhering the desiccant 200 to the substrate 120.

[0028] In an exemplary embodiment, the holes 230 formed through the desiccant 200 occupy an area of less than 6% of the total area of the desiccant 200. In particular, the holes 230 may occupy an area in the range of about 1% to about 6% of the total area of the desiccant 200. If the area occupied by the holes exceeds more than about 6%, the desiccant's moisture absorbing qualities tend to decrease.

[0029] On the other hand, the number of the holes 230 formed in the desiccant 200 may increase as the area of the desiccant 200 increases. Thus a large desiccant 200 may include more holes than a smaller desiccant. In one embodiment, the desiccant holes number between about 13,000/m^2 to 20,000/m^2, and are formed to extend through the desiccant material from a top surface thereof to a bottom surface thereof.

[0030] To prevent the formation of bubbles the desiccant 200 may be formed with at least one hole per 1cm^2.

[0031] In an OLED configured as described above, gas bubbles are prevented from forming between the desiccant 130, 200 and the upper substrate (120) because a gas normally trapped between the desiccant and the substrate is released through the holes 230. Releasing the trapped gas causes the desiccant 130, 200 to lie flat without contacting the organic light-emitting device. Two benefits incur from this. First, the formation of dark spots is prevented. Second, the desiccant placing recess can be formed in depths of about 350 μm. or less, as measured from an inner surface of the recess on which the desiccant is adhered to an outer surface of the substrate 100 on which the light-emitting device is formed.

[0032] In this manner, the thickness of the upper substrate 120 can be reduced to create a lightweight OLED suitable for mobile transport.

Claims

1. An organic electroluminescence display, comprising:

   a light emitting device formed on a lower insulating substrate (100); and
   an upper substrate (120) mounted to encapsulate the light emitting device,
   wherein the upper substrate (120) is provided

with a desiccant layer (130), the desiccant layer (130) being formed with at least one hole (135) passing through the desiccant layer (130) **characterized in that** the at least one hole (135) of the desiccant layer (130) has a circular shape and a diameter in the range of 1mm to 2mm.

2. The organic electroluminescence display as claimed in claim 1, wherein the upper substrate (120) is provided with a desiccant placing recess.

3. The organic electroluminescence display as claimed in claim 1, wherein the holes (135) occupy an area of less than 6% of the whole area of the desiccant layer (130).

4. The organic electroluminescence display as claimed in claim 3, wherein the holes (135) occupy an area of 1% through 6% of the whole area of the desiccant layer (130).

5. The organic electroluminescence display as claimed in claim 1, wherein the desiccant layer (130) is provided with at least 10,000 holes per m^2.

6. The organic electroluminescence display as claimed in claim 5, wherein the number of the holes (135) is between 13,000/m^2 and 20,000/m^2.

7. The organic electroluminescence display as claimed in claim 2, wherein the depth of the desiccant placing recess is less than 350μm.

8. The organic electro luminescence display as claimed in claim 1, wherein the desiccant layer (130) is composed of a desiccant material layer (210) and an adhesive material layer (220), the adhesive material layer (220) being employed to fix the desiccant layer (130) onto the upper substrate (120).

9. The organic electroluminescence display as claimed in claim 8, wherein the desiccant material layer (220) is composed of at least one material selected from a group consisting of barium oxide (BaO), calcium carbonate ($CaCO_3$), calcium oxide (CaO), phosphor oxide (P_2O_5), Zeolite, Silicagel, and Alumina.

10. The organic electroluminescence display as claimed in claim 8, wherein the desiccant material layer (220) has a thickness of less than 200μm.

Patentansprüche

1. Eine organische Elektrolumineszenzanzeige, umfassend:

eine lichtemittierende Vorrichtung, die auf einem unteren isolierenden Substrat (100) ausgebildet ist;
und
ein oberes Substrat (120), das derart montiert ist, dass es die lichtemittierende Vorrichtung einkapselt,
wobei das obere Substrat (120) mit einer Trokkenmittelschicht (130) versehen ist, wobei die Trockenmittelschicht (130) mit mindestens einem durch die Trockenmittelschicht (130) hindurchführenden Loch (135) ausgebildet ist, **dadurch gekennzeichnet, dass** das mindestens eine Loch (135) der Trockenmittelschicht (130) eine Kreisform und einen Durchmesser zwischen 1mm und 2mm aufweist.

2. Die organische Elektrolumineszenzanzeige nach Anspruch 1, wobei das obere Substrat (120) mit einer Aussparung zur Platzierung von Trockenmittel versehen ist.

3. Die organische Elektrolumineszenzanzeige nach Anspruch 1, wobei die Löcher (135) eine Fläche von weniger als 6% der gesamten Fläche der Trockenmittelschicht (130) einnehmen.

4. Die organische Elektrolumineszenzanzeige nach Anspruch 3, wobei die Löcher (135) eine Fläche von 1% bis 6% der gesamten Fläche der Trockenmittelschicht (130) einnehmen.

5. Die organische Elektrolumineszenzanzeige nach Anspruch 1, wobei die Trockenmittelschicht (130) mit mindestens 10000 Löchern pro m^2 versehen ist.

6. Die organische Elektrolumineszenzanzeige nach Anspruch 5, wobei die Zahl der Löcher (135) zwischen 13000/m^2 und 20000/m^2 liegt.

7. Die organische Elektrolumineszenzanzeige nach Anspruch 2, wobei die Tiefe der Aussparung zur Platzierung von Trockenmittel weniger als 350μm beträgt.

8. Die organische Elektrolumineszenzanzeige nach Anspruch 1, wobei die Trockenmittelschicht (130) aus einer Schicht Trockenmittelmaterials (210) und einer Schicht adhäsiven Materials (220) besteht, wobei die Schicht adhäsiven Materials (220) zum Befestigen der Trockenmittelschicht (130) auf dem oberen Substrat (120) dient.

9. Die organische Elektrolumineszenzanzeige nach Anspruch 8, wobei die Schicht Trockenmittelmaterials (220) aus mindestens einem aus einer aus Bariumoxid (BaO), Calciumcarbonat ($CaCO_3$), Calciumoxid (CaO), Phosphoroxid (P_2O_5), Zeolith, Silicagel und Aluminiumoxid bestehenden Gruppe ausge-

wählten Material besteht.

10. Die organische Elektrolumineszenzanzeige nach Anspruch 8, wobei die Schicht Trockenmittelmaterials (220) eine Stärke von weniger als 200μm aufweist.

Revendications

1. Dispositif d'affichage électroluminescent organique, comprenant :

un dispositif d'émission de lumière formé sur un substrat isolant inférieur (100) ; et
un substrat supérieur (120) monté pour encapsuler le dispositif d'émission de lumière,
où le substrat supérieur (120) est doté d'une couche déshydratante (130), la couche déshydratante (130) étant formée avec au moins un trou (135) passant à travers la couche déshydratante (130), **caractérisé en ce que** l'au moins un trou (135) de la couche déshydratante (130) a une forme circulaire et un diamètre dans la plage de 1 mm à 2 mm.

2. Dispositif d'affichage électroluminescent organique tel que revendiqué dans la revendication 1, dans lequel le substrat supérieur (120) est doté d'un évidement de placement d'un déshydratant.

3. Dispositif d'affichage électroluminescent organique tel que revendiqué dans la revendication 1, dans lequel les trous (135) occupent une surface qui est inférieure à 6 % de la surface totale de la couche déshydratante (130).

4. Dispositif d'affichage électroluminescent organique tel que revendiqué dans la revendication 3, dans lequel les trous (135) occupent une surface de 1 % à 6 % de la surface totale de la couche déshydratante (130).

5. Dispositif d'affichage électroluminescent organique tel que revendiqué dans la revendication 1, dans lequel la couche déshydratante (130) est dotée d'au moins 10 000 trous par m^2.

6. Dispositif d'affichage électroluminescent organique tel que revendiqué dans la revendication 5, dans lequel le nombre des trous (135) est entre 13 000/m^2 et 20 000/m^2.

7. Dispositif d'affichage électroluminescent organique tel que revendiqué dans la revendication 2, dans lequel la profondeur de l'évidement de placement du déshydratant est inférieure à 350 μm.

8. Dispositif d'affichage électroluminescent organique tel que revendiqué dans la revendication 1, dans lequel la couche déshydratante (130) est composée d'une couche de matériau déshydratant (210) et d'une couche de matériau adhésif (220), la couche de matériau adhésif (220) étant utilisée pour fixer la couche déshydratante (130) sur le substrat supérieur (120).

9. Dispositif d'affichage électroluminescent organique tel que revendiqué dans la revendication 8, dans lequel la couche de matériau déshydratant (220) est composée d'au moins un matériau choisi dans le groupe constitué d'oxyde de baryum (BaO), de carbonate de calcium ($CaCO_3$), d'oxyde de calcium (CaO), d'oxyde de phosphore (P_2O_5), de Zéolite, de gel de silice et d'alumine,

10. Dispositif d'affichage électroluminescent organique tel que revendiqué dans la revendication 8, dans lequel la couche de matériau déshydratant (220) a une épaisseur inférieure à 200 μm.

FIG. 1

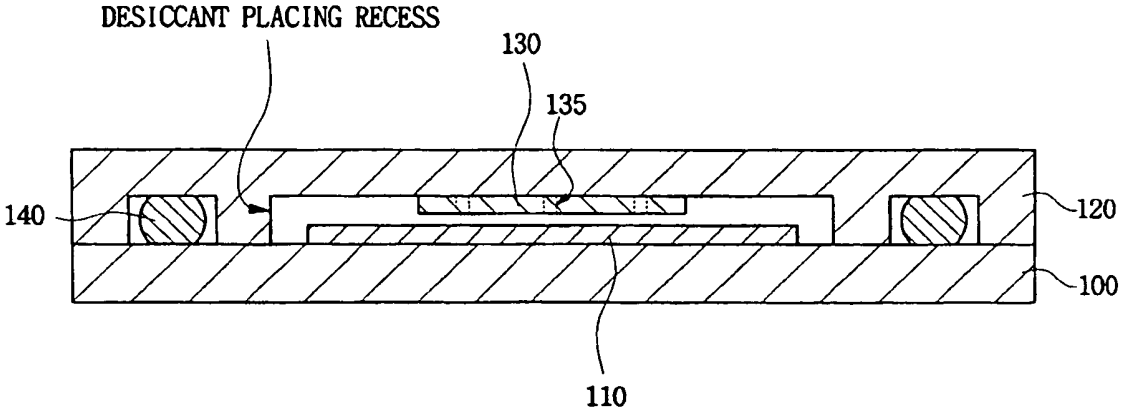


FIG. 2A

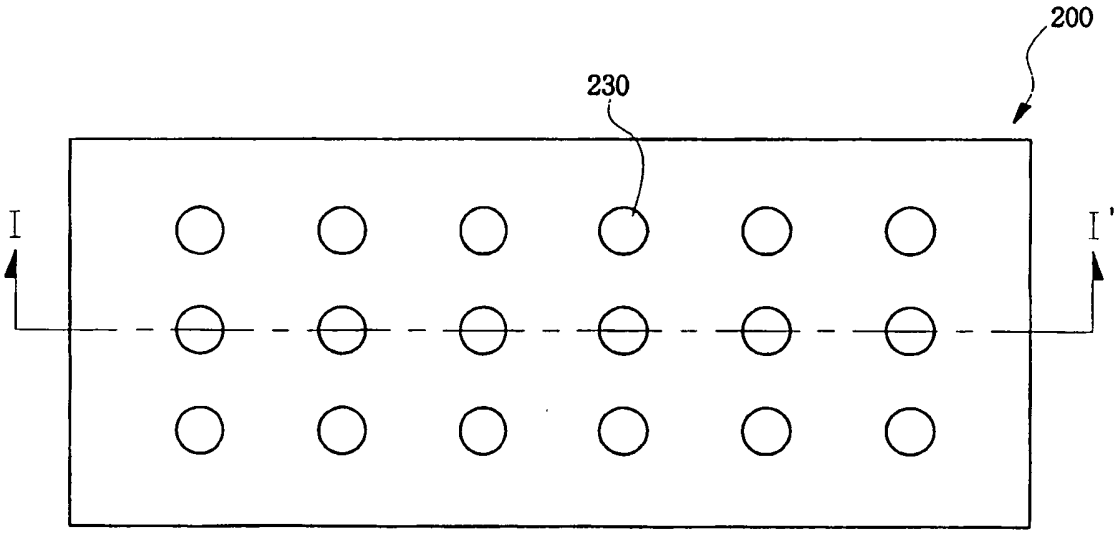
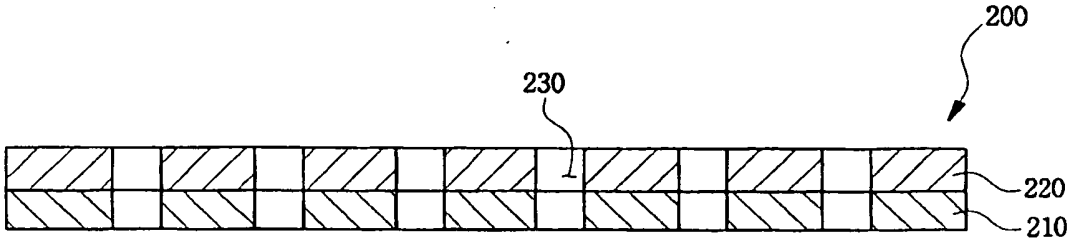


FIG. 2B



REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- TW 558913 **[0009]**
- US 20030230978 A **[0010]**
- JP 2001035659 B **[0011]**
- US 20030203551 A **[0012]**

专利名称(译)	有机电致发光显示器		
公开(公告)号	EP1531504B1	公开(公告)日	2010-06-23
申请号	EP2004090446	申请日	2004-11-17
[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)	三星移动显示器有限公司.		
[标]发明人	LEE HO SEOK CHOE WON KYU		
发明人	LEE, HO-SEOK CHOE, WON-KYU		
IPC分类号	H01L51/52 H05B33/04 B01D53/26 B01J20/16 H01L51/50		
CPC分类号	H01L51/5259 H01L51/524		
代理机构(译)	hengelhaupt，Jürgen		
优先权	1020030081209 2003-11-17 KR		
其他公开文献	EP1531504A3 EP1531504A2		
外部链接	Espacenet		

摘要(译)

特别地，本发明的一个实施例提供了一种有机电致发光显示器，其包括形成在下绝缘基板上的发光器件，以及安装以封装发光器件的上基板，其中上基板设置有干燥剂，干燥剂形成有至少一个穿过干燥剂的孔。

FIG. 1

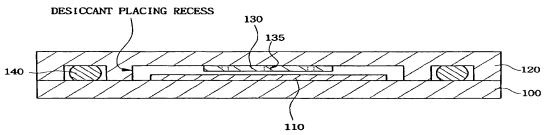

FIG. 2A

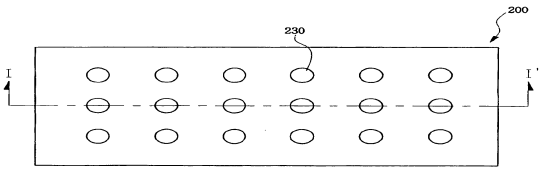

FIG. 2B