US 20040085014A1

(19) United States
(12) Patent Application Publication
(10) Pub. No.: US 2004/0085014 A1
(43) Pub. Date: May 6, 2004
Park et al.

(54) **ORGANIC ELECTROLUMINESCENT DISPLAY AND METHOD FOR FABRICATING THE SAME**

(76) Inventors: **Joon Young Park**, Seoul (KR); **Jae Jung Kim**, Giheung-eup Yongin-city (KR)

Correspondence Address:
MCGUIREWOODS, LLP
1750 TYSONS BLVD
SUITE 1800
MCLEAN, VA 22102 (US)

(21) Appl. No.: **10/683,286**

(22) Filed: **Oct. 14, 2003**

(30) **Foreign Application Priority Data**

Nov. 4, 2002 (KR) 2002-0067975

Publication Classification

(51) **Int. Cl.**[7] **H05B 33/00**
(52) **U.S. Cl.** **313/504**; 313/503; 445/24

(57) **ABSTRACT**

A method of fabricating an organic electroluminescent display by forming a lower electrode on a substrate and forming an insulating film with an opening part for exposing a portion of the lower electrode. An organic thin film is formed on the substrate and a surface of a portion of the organic thin film layer is selectively treated. A luminescent layer is formed on another portion of the organic thin film layer; and an upper electrode is formed on the front of the substrate.

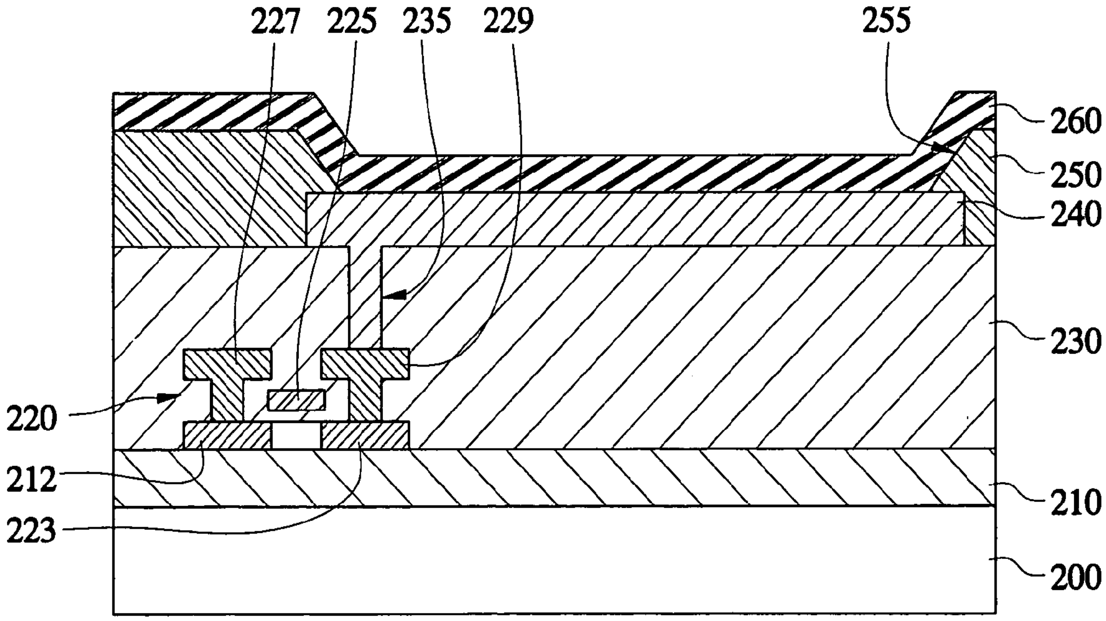


FIG. 1

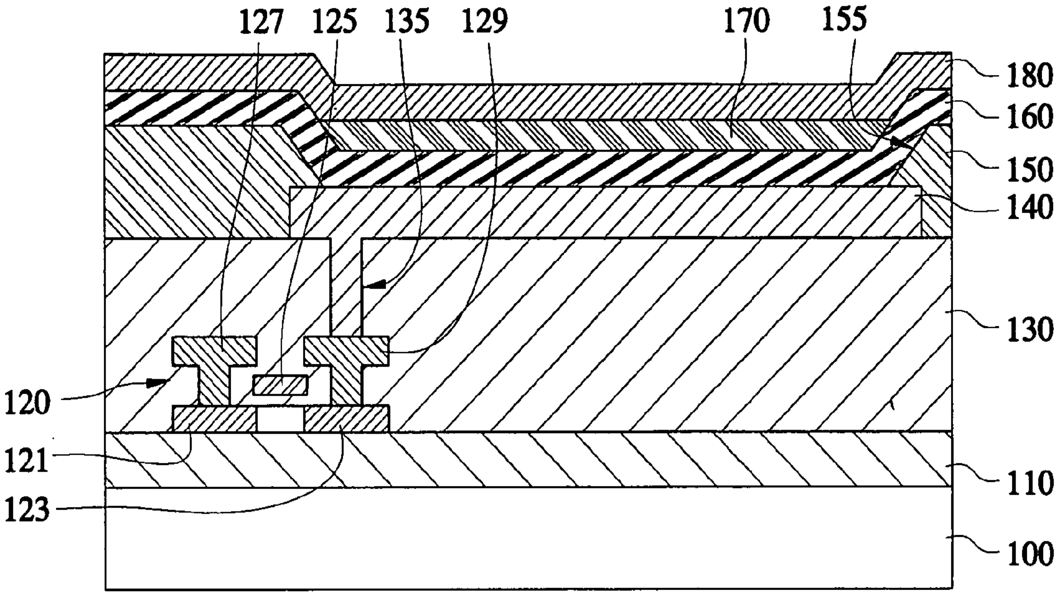

127
125
135
129
170
155
180
160
150
140
130
120
121
110
123
100

FIG. 2A

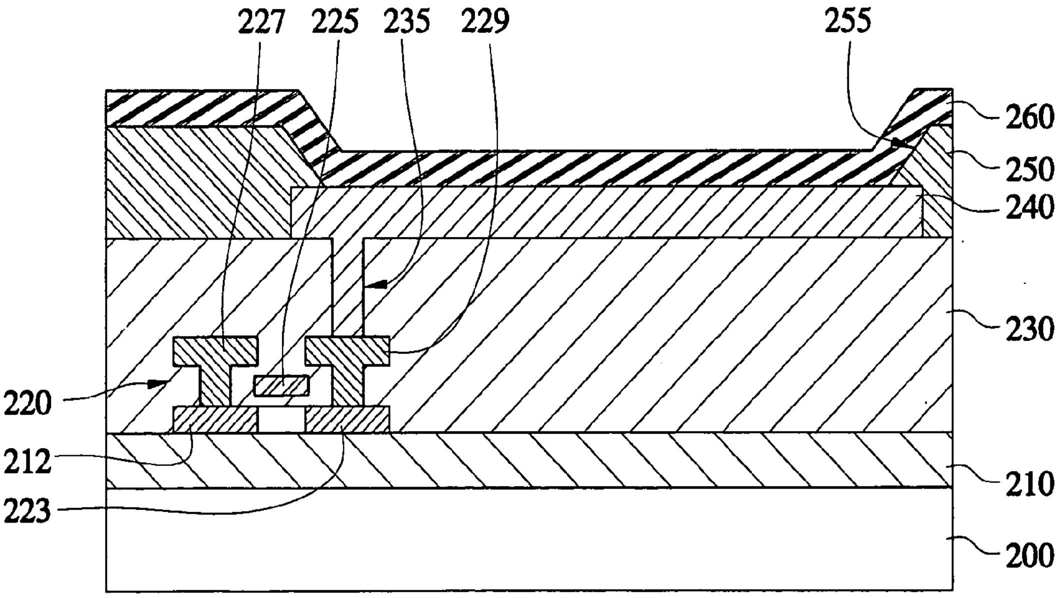

227
225
235
229
255
260
250
240
230
220
212
210
223
200

FIG. 2B

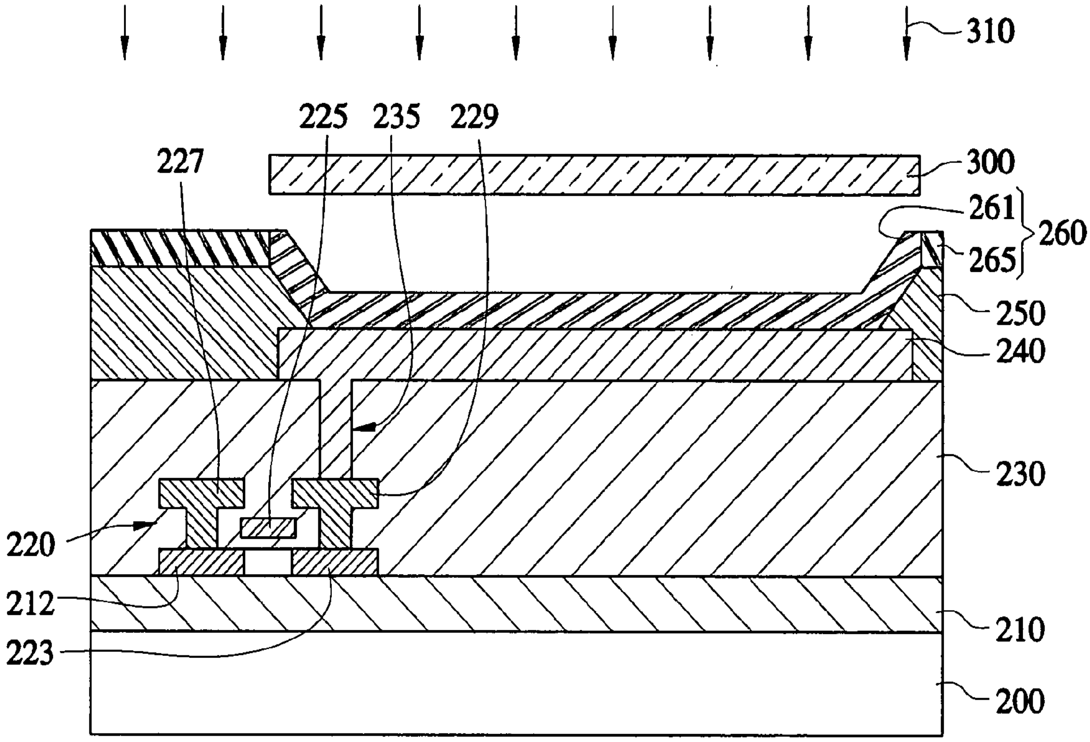
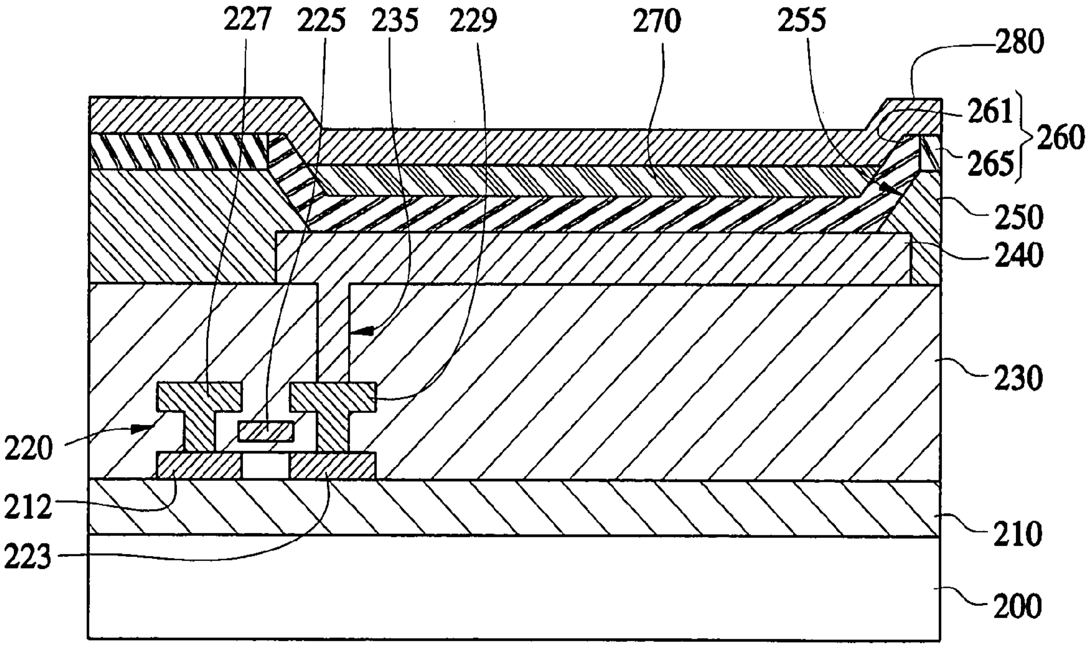

310
225
235
229
227
300
261
260
265
250
240
230
220
212
210
223
200

FIG. 2C


227
225
235
229
270
255
280
261
260
265
250
240
230
220
212
210
223
200

ORGANIC ELECTROLUMINESCENT DISPLAY AND METHOD FOR FABRICATING THE SAME

CROSS REFERENCE TO RELATED APPLICATION

[0001] This application claims priority to and the benefit of Korean Patent Application No. 2002-67975 filed on Nov. 4, 2002, the disclosure of which is hereby incorporated by reference in its entirety.

BACK GROUD OF THE INVENTION

[0002] 1. Field of the Invention

[0003] The present invention relates to an organic electroluminescent display and, more particularly, to an organic polymer electroluminescent device capable of preventing leakage current between adjacent pixels and improving inkjet-printing quality of a luminescent layer by selectively treating the surface of a hole transport layer and a method for fabricating the same.

[0004] 2. Description of Related Art

[0005] **FIG. 1** illustrates a cross sectional view of one pixel of a conventional organic electroluminescent display.

[0006] Referring to **FIG. 1, a** buffer layer **110** is formed on an insulating substrate **100**, and a thin film transistor **120** is formed on the buffer layer **110** in an ordinary manner. As shown in **FIG. 1**, the thin film transistor comprises a gate **125**, a source electrode **127**, which is electrically connected to the source region **121**, and a drain electrode **129** which is electrically connected to the drain region **123**.

[0007] A via hole **135** for exposing one of the source electrode **127** or the drain electrode **129**, e.g., the drain electrode **129** is formed on an insulating film **130** after the insulating film **130** is formed on the thin film transistor **120** and the buffer layer **110**. A lower electrode **140** which is connected to the drain electrode **129**, for example, through the via hole **135** is formed on the insulating film **130**. An opening part **155** for exposing the lower electrode **140** is formed by patterning a planarization film **150** after the planarization film **150** is deposited on the substrate.

[0008] Subsequently, a hole transport layer **160** is formed, for example, by spin coating an organic material such as PEDOT (Poly-3, 4-Ethylenedioxythiophene) or PANI (polyaniline) on the substrate. A luminescent layer **170** is formed on the hole transport layer **160** of the opening part **155** via an inkjet process, and an upper electrode **180** is formed over the substrate.

[0009] Ordinarily, the luminescent layer is formed by using an inkjet process or by using laser induced thermal imaging (LITI) process when an organic polymer material is used as the luminescent layer of the organic electroluminescent display.

[0010] The inkjet process is a process for forming the luminescent layer on a lower electrode by injecting the solution onto the substrate from the inkjet head. The solution is ejected at a high speed from a head containing solution comprising EL (electro-luminescence) material, e.g., organic polymer EL material, such that the solution is arranged while the inkjet head is spaced apart from the substrate at a certain distance.

[0011] Although respective R, G and B luminescent layers should be independently formed per each pixel in an organic luminescent display, there has been a problem in that a solution comprising organic polymer material which is ejected from the head is dispersed onto adjacent pixels in case of the inkjet process.

[0012] In order to solve the problem, it is suggested in Korean Patent Application No. 10-1999-7010647 that a luminescent layer is formed after forming a bank layer to cover the edge part of the lower electrode per each pixel. The bank layer is formed of an insulating material. The method for forming a luminescent layer via an inkjet process using the bank layer enables the luminescent layer to be independently formed per each pixel by preventing a solution comprising an organic polymer material from being dispersed onto adjacent other pixels. Thus, by using the bank layer the solution is provided only on the upper part of the lower electrode of a relevant pixel.

[0013] However, there has been a problem in that printing quality is lowered as a solution comprising an organic polymer material is dispersed on the bank layer since surface characteristics of the hole transport layer are maintained in all the pixels on the substrate by forming a hole transport layer over the substrate after the bank layer is formed, even when the inkjet process uses the bank layer.

[0014] Furthermore, a conventional organic electroluminescent display forms a hole transport layer **160** that has conductivity between the lower electrode **140** and the luminescent layer **170**. Thus, luminescence efficiency is improved by improving injection efficiency of holes from the lower electrode **140** to the luminescent layer **170**. However, there has been a problem that light is emitted even from adjacent off pixels because the hole transport layer which is conductive is formed over the substrate. Thus, leakage current flows between the hole transport layer **160**, which is conductive and the lower electrode **140**.

[0015] There have also been problems in that a process for forming an additional partition wall is required, and adhesion defects are generated between the succeeding cathode electrode and the organic luminescent layer due to the stepped profile of a the thick partition wall. When the organic luminescent layer is formed using a partition wall for defining a pixel region on which the organic luminescent layer is to be formed, a thick partition wall should be formed to cover the edge part of a pixel electrode.

SUMMARY OF THE INVENTION

[0016] This invention provides a method of fabricating an organic electroluminescent display by forming a lower electrode on a substrate and forming an insulating film with an opening part for exposing a portion of the lower electrode. An organic thin film is formed on the substrate and a surface of a portion of the organic thin film layer is selectively treated. A luminescent layer is formed on another portion of the organic thin film layer; and an upper electrode is formed on the front of the substrate.

BRIEF DESCRIPTION OF THE DRAWINGS

[0017] Further objects and advantages of the invention can be more fully understood from the following detailed description taken in conjunction with the accompanying drawings.

[0018] **FIG. 1** is a cross sectional view of a conventional organic electroluminescent display.

[0019] **FIGS. 2A, 2B** and 2C are cross sectional views for explaining a method for fabricating an organic electroluminescent display using UV surface treatment according to exemplary embodiments of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

[0020] The present invention will now be described in detail in connection with exemplary embodiments with reference to the accompanying drawings. For reference, like reference characters designate corresponding parts throughout several views.

[0021] **FIGS. 2A, 2B** and 2C illustrate cross sectional structures for explaining a method for fabricating an active matrix organic electroluminescent display according to exemplary embodiments of the present invention.

[0022] Referring to **FIG. 2A, a** buffer layer **210** is formed on an insulating substrate **200**, and a thin film transistor **220** is formed on the buffer layer **210**. The thin film transistor **220** comprises a source region **212** and a drain region **223** which are formed on an activation layer. The thin film transistor **220** further comprises a gate **225**, a source electrode **227** which is electrically connect to the source region **212** and a drain electrode **229**, which is electrically connected to the drain region **223**.

[0023] An insulating film **230** is formed over the buffer layer **210** and the thin film transistor **220**. A via hole **235** exposes one of the source electrode **227** or the drain electrode **229**, e.g., the drain electrode **229** and is formed by etching the insulating film **230**. A lower electrode **240**, which is connected to the drain electrode **229** through the via hole **235**, is formed on the insulating film **230**.

[0024] A planarization film **250** is formed by spin coating a planarization material, such as, acryl on the substrate, and an opening part **255** is formed by etching the planarization film **250** so that a portion of the lower electrode **240** is exposed. A hole transport layer **260** is formed by spin coating a conductive polymer material, such as, PEDOT (Poly-3, 4-Ethylenedioxythiophene) or PANI (polyaniline) on the substrate including the opening part **255**.

[0025] As shown in **FIG.** 2B, the surface of the hole transport layer **260** is treated by selectively irradiating UV rays **310** onto the hole transport layer **260**. The surface of the hole transport layer **260** is selectively treated by irradiating UV rays **310** onto the hole transport layer **260** while a portion of the hole transport layer **260** corresponding to the lower electrode **240**, namely, a portion corresponding to a luminescence region of each pixel is masked using a mask **300**. An un-masked portion **265** of the hole-transport layer **260** where the surface is treated by irradiation of UV rays, that is, the non-luminescence region of each pixel has hydrophobicity. The masked portion **261** of the hole-transport layer **260** on which UV rays are not irradiated, that is, the luminescence region has hydrophilicity. Therefore, un-masked portion **265** of the hole-transport layer **260** where the surface is treated by irradiation of UV rays has surface characteristics which are different from the masked portion **261** of the hole-transport layer **260** on which UV rays are not irradiated. Also, the un-masked portion **265** of the hole-transport layer **260** has a relatively high resistance value compared with the masked portion **261** of the hole-transport layer **260** so that the un-masked portion **265** where the surface is treated by irradiation of UV rays is in the nonconductive state.

[0026] Referring to **FIG. 2C, a** luminescent layer **270** is formed on the hole transport layer **260** via an inkjet process, wherein a solution containing an organic polymer material is dispersed onto the hole transport layer **260**. The solution which is ejected from the inkjet head is prevented from dispersing onto neighboring pixels because the surface of the un-masked portion **265** of the hole-transport layer which corresponds to a non-luminescence region in the hole transport layer **260** is treated with UV rays. Thus, the un-masked portion **265** of the hole-transport layer **260** which corresponds to a non-luminescence region has surface characteristics different from the masked portion **261** of the hole transport layer **260** which corresponds to a luminescence region over the lower electrode **240**. Therefore, the luminescent layer **270** does not influence neighboring pixels and is formed over the upper portion of the lower electrode **240** of a relevant pixel. It is possible for the luminescent layer **270** to only be formed on the upper portion of the lower electrode **240** of a relevant pixel.

[0027] Furthermore, the masked portion **261** of the hole-transport layer which corresponds to a luminescence region in the hole transport layer **260** maintains the conductive state and is to improve luminescence efficiency by improving the injection efficiency of holes from the lower electrode **240** to the organic luminescent layer **270**. The un-masked portion **265** of the hole-transport layer **260** becomes non-conductive by the UV surface treatment so that flow of leakage current between adjacent pixels via the hole transport layer **260** and the lower electrode **240** is prevented.

[0028] A method for fabricating an organic electroluminescent display using UV surface treatment of the present invention can not only be applied to active matrix and passive matrix displays as well as front-emission luminescent and rear-emission luminescent displays, but can also be applied to a method for fabricating a flat panel display using inkjet process.

[0029] Although exemplary embodiments of the present invention illustrate methods for UV surface treatment by forming a hole transport layer on a planarization film, the various embodiments of the present invention can also be applied to a method for fabricating an organic electroluminescent display by forming the hole transport layer and performing UV surface treatment after forming a bank layer on the planarization film **250**.

[0030] An organic electroluminescent display and a method for fabricating the same according to the present invention prevent all and/or substantially all leakage current between adjacent pixels by irradiating UV rays and treating the surface of a portion of the hole transport layer other than the luminescent region of each pixel. Thus, printing quality is improved when forming a luminescent layer by an inkjet process and the resistance value of a portion on which UV rays are irradiated is increased.

[0031] While the invention has been particularly shown and described with reference to exemplary embodiments thereof, it will be understood by those skilled in the art that the foregoing and other changes in form and details may be made therein without departing from the spirit and scope of the invention.

What is claimed is:

1. A method of fabricating an organic electroluminescent display comprising the steps of:

forming a lower electrode on a substrate;

forming an insulating film with an opening part for exposing a portion of the lower electrode;

forming an organic thin film on the substrate;

selectively treating a surface of a portion of the organic thin film layer;

forming a luminescent layer on another portion of the organic thin film layer; and

forming an upper electrode on a front of the substrate.

2. The method for fabricating an organic electroluminescent display according to claim 1, wherein the surface of the organic thin film is selectively treated by irradiating the organic thin film layer with UV rays while the another portion is masked.

3. The method for fabricating an organic electroluminescent display according to claim 1, wherein the luminescent layer is formed by an inkjet process.

4. The method for fabricating an organic electroluminescent display according to claim 3, wherein the treated surface portion of the organic thin film layer keeps ink for the luminescent layer within the opening part when forming the luminescent layer by an ink-jet process.

5. The method for fabricating an organic electroluminescent display according to claim 1, wherein the insulating film is formed of an insulating film for planarization.

6. The method for fabricating an organic electroluminescent display according to claim 1, wherein the insulating film is formed of an insulating film for planarization with a bank layer formed thereon.

7. The method for fabricating an organic electroluminescent display according to claim 1, wherein the organic thin film layer is a hole transport layer.

8. The method for fabricating an organic electroluminescent display according to claim 7, wherein the hole transport layer is formed of PEDOT (Poly-3,4-Ethylenedioxythiophene) or PANI (polyaniline).

9. The method for fabricating an organic electroluminescent display according to claim 1, wherein a surface treated portion in the organic thin film becomes the non-conductive and helps prevent leakage current to the lower electrode.

10. The method of claim 1, wherein the another portion is a portion of the organic thin film layer which was not treated.

11. The method of claim 2, wherein the another portion is a portion of the organic thin film layer which corresponds to the lower electrode.

12. An organic electroluminescent display comprising a lower electrode, a hole transport layer, a luminescent layer and an upper electrode sequentially formed on a substrate, wherein a portion corresponding to the lower electrode in the hole transport layer has surface characteristics and a resistance value different from a portion other than the portion corresponding to the lower electrode.

13. An organic electroluminescent display comprising;

a lower electrode formed on a substrate;

an insulating film formed on the substrate so that a portion of the lower electrode is exposed;

an organic thin film layer formed on an exposed lower electrode and the insulating film;

a luminescent layer formed on a portion of the organic thin film layer corresponding to the lower electrode; and

an upper electrode formed on the substrate, wherein a portion of the organic thin film layer under the luminescent layer has surface characteristics different from another portion of the organic thin film layer other than the portion under the luminescent layer.

14. The organic electroluminescent display according to claim 13, wherein the organic thin film layer is a hole transport layer.

15. The organic electroluminescent display according to claim 14, wherein the hole transport layer is formed of PEDOT (Poly-3,4-Ethylenedioxythiophene) or PANI (polyaniline).

16. The organic electroluminescent display according to claim 13, wherein the insulating film is a planarization film.

17. The organic electroluminescent display according to claim 13, wherein the insulating film is a planarization film with a bank film is formed thereon.

18. The organic electroluminescent display according to claim 13, wherein the another portion of the organic thin film layer other than the portion under the luminescent layer, has an UV ray treated portion and a higher resistance value than the portion under the luminescent layer, and the another portion of the organic thin film layer helps prevent leakage current between the organic thin film layer and the lower electrode.

19. A method for fabricating an organic electroluminescent display comprising the steps of:

forming an organic thin film on a substrate;

treating a portion of the organic thin film with UV rays while covering another portion of the organic thin film; and

forming a luminescent of on the another portion of the organic thin film.

* * * * *

专利名称(译)	有机电致发光显示器及其制造方法		
公开(公告)号	US20040085014A1	公开(公告)日	2004-05-06
申请号	US10/683286	申请日	2003-10-14
[标]申请(专利权)人(译)	PARK JOON YOUNG KIM JAE JUNG		
申请(专利权)人(译)	PARK JOON YOUNG KIM JAE JUNG		
当前申请(专利权)人(译)	三星DISPLAY CO.，LTD.		
[标]发明人	PARK JOON YOUNG KIM JAE JUNG		
发明人	PARK, JOON YOUNG KIM, JAE JUNG		
IPC分类号	H05B33/10 H01L27/32 H01L51/00 H01L51/30 H01L51/40 H01L51/50 H01L51/56 H05B33/12 H05B33/22 H05B33/26 H05B33/00		
CPC分类号	H05B33/26 H01L27/3295 H01L51/0005 Y10S428/917 H01L51/5048 H01L51/56 H01L51/0037		
优先权	1020020067975 2002-11-04 KR		
其他公开文献	US7285910		
外部链接	Espacenet USPTO		

摘要(译)

一种制造有机电致发光显示器的方法，其通过在基板上形成下电极并形成具有开口部分的绝缘膜，所述开口部分用于暴露下电极的一部分。在基板上形成有机薄膜，并选择性地处理有机薄膜层的一部分的表面。在有机薄膜层的另一部分上形成发光层;并且在基板的正面上形成上电极。