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(54) **Panel display device and method for forming protective layer within the same**

Anzeigevorrichtung und Verfahren zur Bildung von einer Schutzschicht in der gleichen Vorrichtung

Dispositif d'affichage et méthode de formation d'un revêtement protecteur dans le même dispositif

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(73) Proprietor: **LG Display Co., Ltd.**
Youngdungpo-gu,
Seoul (KR)

(72) Inventors:
- **Song, Won Jun**
  Tongdaemun-gu,
  Seoul (KR)
- **Yang, Jung Hwan**
  Kwangmyong-shi,
  Kyonggi-do (KR)

(74) Representative: **TER MEER - STEINMEISTER & PARTNER GbR**
Patentanwälte
Postfach 86 07 69
81634 München (DE)

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- **PATENT ABSTRACTS OF JAPAN vol. 2000, no. 22, 9 March 2001 (2001-03-09) & JP 2001 148287 A (TOPPAN PRINTING CO LTD), 29 May 2001 (2001-05-29)**

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Description

BACKGROUND OF THE INVENTION

Field of the Invention

[0001] The present invention relates to a panel display device and a method for forming a multilayered protective layer within the same in which a flat type panel display device is formed using organic electro-luminescence (EL). Such a device and method according to the preamble of claims 1 and 17 are known from EP 0 977 469 A2. An EL device having two protective layers is known from EP 0 917 410 A1 and a device having a single protective layer is known from JP-A-2001 148 287.

Discussion of the Related Art

[0002] Generally, organic light-emitting diode (OLED) is very susceptible to the atmospheric gas. Accordingly, if the OLED is exposed to the atmospheric gas, lifetime is reduced. Particularly, an organic EL layer in a panel display device may be oxidized if it is exposed to the atmospheric gas. This is because the organic EL layer is active to the moisture or O_2. Likewise, electrodes such as cathodes or anodes are likely to be oxidized if they are exposed to the atmospheric gas. An oxide is produced between the electrode surface and the organic EL layer due to oxidation of the electrodes. In this case, a problem arises in that the oxide causes leakage and short in the display device.

[0003] In this respect, Mg-Ag and/or Al-Li has been used to improve efficiency of an organic EL element. However, problems such as edge shorting, dark spot and decrease of a luminescent area still exist in that Mg-Ag and Al-Li are more susceptible to O_2 in the air.

[0004] To solve such problems, a device of a sealing structure has been required, which does not allow gases in the air to cause oxidation or deformation of an organic EL layer and electrodes.

[0005] The sealing structure is generally formed by either a method using silicon oil and resin or a film formation method.

[0006] The method using silicon oil and resin has been used for sealing of an inorganic EL element and is applicable to OLEDs. If this method is used for OLEDs, a solvent of silicon oil and resin is permeated into the organic EL layer and the electrode surface, thereby degrading luminescence characteristics and efficiency.

[0007] The film formation method is to form a protective layer outside an organic EL element which is laminated, using a physical vapor deposition (PVD), a chemical vapor deposition (CVD), a plasma enhanced CVD (PECVD), or sputtering. In the film formation method, electrical resistance, rupture strength, and moisture resistance serve to prevent an organic EL layer and electrodes from being oxidized or deformed.

[0008] In the aforementioned related art sealing structure, when the organic EL element is driven, it is likely to be damaged by a small content of O_2 or moisture(e.g., 1 ppm). For this reason, luminescence characteristic and efficiency of the display device are degraded.

SUMMARY OF THE INVENTION

[0009] Accordingly, in accordance with the caracterising portions of claims 1 and 16 the present invention is directed to a panel display device and a method for forming a protective layer within the same that substantially obviates one or more problems due to limitations and disadvantages of the related art.

[0010] An object of the present invention is to provide a panel display device and a method for forming a protective layer within the same, which has a multi-layered sealing structure to avoid any degradation caused by an external factor such as O_2 or moisture.

[0011] Additional advantages, objects, and features of the invention will be set forth in part in the description which follows and in part will become apparent to those having ordinary skill in the art upon examination of the following or may be learned from practice of the invention. The objectives and other advantages of the invention may be realized and attained by the structure particularly pointed out in the written description and claims hereof as well as the appended drawings.

[0012] To achieve these objects and other advantages and in accordance with the purpose of the invention, as embodied and broadly described herein, a panel display device includes a substrate, an organic EL layer formed on the substrate, a barrier dividing the organic EL layer, and a multi-layered protective layer formed on the organic EL layer.

[0013] The multi-layered protective layer includes a first protective layer formed of a high polymer compound containing fluorine at the lowest part, a second protective layer formed of a silicon composite, a third protective layer formed of a compound hardened by polymerization at a room temperature and a normal pressure, and a fourth protective layer formed of a number of layers adhered to one another at the most upper part.

[0014] In another aspect of the present invention, a method for forming a multi-layered protective layer in a panel display device including a substrate, an organic EL layer, a barrier, and the multi-layered protective layer, includes a) forming a first protective layer of a high polymer compound containing fluorine at the lowest part, b) forming a second protective layer of a silicon composite on the first protective layer, c) forming a third protective layer of a compound on the second protective layer, the compound being hardened by polymerization at a room temperature and a normal pressure, and d) forming a fourth protective layer on the third protective layer, the fourth protective layer having a number of layers adhered to one another.

[0015] It is to be understood that both the foregoing general description and the following detailed description

of the present invention are exemplary and explanatory and are intended to provide further explanation of the invention as claimed.

BRIEF DESCRIPTION OF THE DRAWINGS

[0016] The accompanying drawings, which are included to provide a further understanding of the invention and are incorporated in and constitute a part of this application, illustrate embodiment(s) of the invention and together with the description serve to explain the principle of the invention. In the drawings:

[0017] FIG. 1 is a sectional view illustrating a luminescent structure of a panel display device according to the present invention;

[0018] FIG. 2 is a detailed view illustrating a partial structure of a protective layer provided in a panel display device according to the present invention; and

[0019] FIGS. 3A to 3E illustrate structures of a protective layer provided in a panel display device according to the present invention, in which FIG. 3A illustrates a structure of a protective layer according to the first embodiment of the present invention, FIG. 3B illustrates a structure of a protective layer according to the second embodiment of the present invention, FIG. 3C illustrates a structure of a protective layer according to the third embodiment of the present invention, FIG. 3D illustrates a structure of a protective layer according to the fourth embodiment of the present invention, and FIG. 3E illustrates a structure of a protective layer according to the fifth embodiment of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

[0020] Reference will now be made in detail to the referred embodiments of the present invention, examples of which are illustrated in the accompanying drawings. Wherever possible, the same reference numbers will be used throughout the drawings to refer to the same or like parts.

[0021] FIG. 1 is a sectional view illustrating a luminescent structure of a panel display device according to the present invention.

[0022] Referring to FIG. 1, a panel display device of the present invention includes a lower substrate 100, an organic EL layer 300 formed on the lower substrate 100, a barrier 200 for dividing the organic EL layer 300, and multi-layered protective layers 400, 500, 600 and 700 formed on the organic EL layer 300. The multi-layered protective layers 400, 500, 600 and 700 are formed in a layered structure having no space. A reference numeral 400 represents a first protective layer, 500 represents a second protective layer, 600 represents a third protective layer, and 700 represents a fourth protective layer.

[0023] The organic EL layer 300 has a structure in which an organic semiconductor layer is formed between the anode and the cathode. The organic semiconductor layer is formed in combination with a hole injection layer, a hole transport layer, a luminescent layer, an electron transport layer, or an electron injection layer in accordance with its purpose of use.

[0024] The organic EL layer 300, as shown in FIG. 1, is divided by the barrier 200, and is represented by one of display pixels formed in a matrix arrangement.

[0025] The four multi-layered protective layers 400, 500, 600 and 700 are layered on the organic EL layer 300 without any space.

[0026] The protective layers 400, 500, 600 and 700 are formed using one of PVD, CVD, PECVD, and sputtering.

[0027] The first to fourth protective layers 400, 500, 600 and 700 will now be described in more detail.

[0028] The first protective layer 400 is formed of a high polymer compound containing fluorine. Poly-chloro-trifluoro-ethylene or poly-dichloro-trifluoro-ethylene is used as the high polymer compound. Also, either a high polymer compound, such as chloro-trifluoro-ethylene and dichloro-trifluoro-ethylene, or a co-polymer such as chloro-trifluoro-ethylene and dichloro-trifluoro-ethylene is used as the first protective layer 400.

[0029] A molecular weight of the aforementioned high polymer compound is used within the range of 1,000gram/mole to 300,000gram/mole. More preferably, the high polymer compound has a molecular weight within the range of 1,000gram/mole to 3,000gram/mole in the present invention.

[0030] Furthermore, the first protective layer 400 can be formed by growing a high polymer thin film using the PECVD(plasma enhanced chemical vapor deposition). In this case, a florine based gas such as CF_4, C_2F_4, C_2F_5H, $C_2F_4H_2$, and NF_3 can be used as a reaction gas. Benzene, naphthalene, or acetylene can be used as a carbon compound. If a florine based gas is used, a thin film of a net structure, such as Teflon, can be obtained. Preferably, C_2F_4 and $C_2F_4H_2$ can be used.

[0031] The first protective layer 400 has a thickness of 0.1~10 μm.

[0032] If the first-protective layer is formed using the PVD, the high polymer compound of 0.1~10nm/s is deposited. If the deposition speed is fast when the first protective layer 400 is formed, surface morphology becomes rough. Therefore, the first protective layer 400 is deposited in such a way that grain is grown below 1μm and a temperature of the substrate 100 is within the range of 50~100°C.

[0033] The second protective layer 500 is formed of silicon composite. SiC, SiO, SiO_2, or Si_XN_Y (X and Y are natural numbers) is used as the silicon composite. More preferably, SiO_2, or Si_XN_Y is used as the silicon composite. The silicon composite is deposited using E-beam deposition or PECVD.

[0034] Particularly, to give the moisture absorption characteristic to the second protective layer 500, any one of Cs, CaO, Na, Li, Mg, and K is co-deposited on the silicon composite at a concentration of 1~10%.

[0035] Si_XN_Y or TiN_X thin film is deposited on the most

upper layer of the second protective layer which is in contact with the third protective layer, so as to avoid flaking.

[0036] The third protective layer 600 is formed of an epoxy based compound, silicon compound, or acrylate based compound. The epoxy based compound is hardened by polymerization at a room temperature and a normal pressure. A compound having low volacility and high melting point, which is a photo-hardening material, is used as the epoxy based compound. Acrylate of a long chain structure such as trimethyl propane triacrylate, ditrimethylolpropane tetraacrylate, trimethylacrylate, 1,6-exanediol-diacrylate, or 1,6-hexanediol dimethacrylate is used as the third protective layer 600.

[0037] The third protective layer 600 is to reduce stress of the first and second protective layers 400 and 500. A hardener is applied to the third protective layer 600 to adhere a film having mechanical and protective characteristics.

[0038] The epoxy based compound is coated in such a way that it is deposited by PVD and hardened by irradiating ultraviolet (UV). The epoxy based compound has semi-transparent characteristics. In addition, the epoxy based compound is coated by a spin-coating method, a spray method, or a Dr. Blade method.

[0039] By contrast, the third protective layer 600 has transparent characteristics if the silicon compound is used as the third protective layer 600. In this case, RT-glass or a silicon sealant is used as the silicon compound. The sealant of the silicon compound is used for a top-emission sealing structure due to its high transmittivity.

[0040] The sealing structure of the silicon compound is formed by a spray method, a spin-coating method, or a Dr. Blade method.

[0041] Finally, the fourth protective layer 700 is formed of a number of layers adhered to one another.

[0042] The fourth protective layer 700 is to prevent the atmospheric gas from being transmitted and has mechanical characteristics. To this end, the fourth protective layer 700 is formed of glass or high polymer film.

[0043] FIG. 2 is a detailed view illustrating a structure of the fourth protective layer provided in the panel display device according to the present invention. The fourth protective layer 700 includes a first layer 700a, a second layer 700b, and a third layer 700c. Polyethylene terephthalate (PET), poly methyl methacrylate (PMMA), or fluorine based high polymer compound is used as the first layer 700a. The second layer 700b is treated with plasma. The third layer 700c is formed of an organic layer at the lowest part. In addition to the organic layer, a metal oxide layer, an organic-inorganic hybrid layer, or a metal complex layer may be used as the third layer 700c. In this case, the third layer 700c is adhered to the sealant that forms the third protective layer 600.

[0044] PET, PMMA, or fluorine based high polymer compound used as the first layer 700a of the first protective layer 700 has a molecular weight within the range of 20,000gram/mole to 250,000gram/mole. The first layer 700a has a thickness of 100~1000 μm.

[0045] In the present invention, glass of a low melting temperature is separately used to form the first layer 700a.

[0046] The second layer 700b of the fourth protective layer 700 is treated with plasma to obtain oxidizing characteristics. In this case, adhesion increases when the sealant that forms the third protective layer 600 is adhered to the fourth protective layer 700 (in more detail, the third layer of the fourth protective layer 700).

[0047] The organic layer, the metal oxide layer, the organic-inorganic hybrid layer, or the metal complex layer that forms the third layer 700c of the fourth protective layer 700 is formed by gas absorption through PVD, CVD, or PECVD. In this case, organic material, metal oxide, organic-inorganic compound, or metal complex is used.

[0048] FIG. 3 illustrates structures of the protective layer provided in the display device according to the present invention.

[0049] FIG. 3A illustrates a structure of the protective layer according to the first embodiment of the present invention. Referring to FIG. 3A, poly-chloro-trifluoro-ethylene is used as the first protective layer 400, SiC is used as the second protective layer 500, and trimethyl propane triacrylate which is epoxy based compound is used as the third protective layer 600. PET is used as the first layer 700a of the fourth protective layer 700, and the organic layer is used as the third layer 700c. The second layer 700b is treated with plasma.

[0050] FIG. 3B illustrates a structure of the protective layer according to the second embodiment of the present invention. Referring to FIG. 3B, poly-dichloro-trifluoro-ethylene is used as the first protective layer 400, SiO is used as the second protective layer 500, and ditrimethylolpropane tetraacrylate which is epoxy based compound is used as the third protective layer 600. PMMA is used as the first layer 700a of the fourth protective layer 700, and the metal oxide layer is used as the third layer 700c. The second layer 700b is treated with plasma.

[0051] FIG. 3C illustrates a structure of the protective layer according to the third embodiment of the present invention. Referring to FIG. 3C, chloro-trifluoro-ethylene is used as the first protective layer 400, SiO_2 is used as the second protective layer 500, and trimethylacrylate is used as the third protective layer 600. Fluorine based high polymer compound is used as the first layer 700a of the fourth protective layer 700, and the organic-inorganic hybrid layer is used as the third layer 700c. The second layer 700b is treated with plasma.

[0052] FIG. 3D illustrates a structure of the protective layer according to the fourth embodiment of the present invention. Referring to FIG. 3D, dichloro-trifluoro-ethylene is used as the first protective layer 400, Si_XN_Y (X and Y are natural numbers) is used as the second protective layer 500, and RT-glass is used as the third protective layer 600. Fluorine based high polymer compound is used as the first layer 700a of the fourth protective layer 700, and the metal complex layer is used as the

third layer 700c. The second layer 700b is treated with plasma.

[0053] FIG. 3E illustrates a structure of the protective layer according to the fifth embodiment of the present invention. Referring to FIG. 3E, co-polymer of chloro-trifluoro-ethylene and dichloro-trifluoro-ethylene is used as the first protective layer 400, SiO_2 and Cs of 1~10% are used as the second protective layer 500, and a silicon sealant is used as the third protective layer 600. Glass of low melting temperature is used as the first layer 700a of the fourth protective layer 700, and the metal complex layer is used as the third layer 700c. The second layer 700b is treated with plasma.

[0054] As aforementioned, the panel display device and the method for forming a protective layer within the same have the following advantages.

[0055] The protective layer having a multi-layered structure is to block an external factor (e.g., transmittance of the atmospheric gas such as moisture or O_2). In other words, since the protective layer is formed in a layered structure without any space, it is possible to remarkably reduce transmittance of O_2 or moisture. In this case, luminescent characteristics and efficiency cf the display device can be improved. Also, stability of the display device is maintained for a longer time than the existing sealing structure.

[0056] Finally, the display device of the present invention can be used for the top emission sealing structure due to high photo-transmittivity.

Claims

1. A panel display device comprising:

a substrate (100);
an organic EL (electroluminescence) layer (300) formed on the substrate; and
a multi-layered protective layer(400, 500, 600, 700) formed on the organic EL layer (300),
wherein the multi-layered protective layer (400, 500, 600, 700) includes a first protective layer (400) formed of a high polymer compound containing fluorine at the lowest part for protecting the organic EL layer, a second protective layer (500) formed of a silicon composite, a third protective layer(600) formed of an epoxy based compound, silicon compound, or acrylate based compound, and a fourth protective layer (700),
characterized in that
the device comprises a barrier (200) dividing the organic EL layer (300);
the fourth protective layer(700) is formed of a number of layers adhered to one another at the most upper part; and
the first protective layer (400) is formed of a high polymer compound having a molecular weight within the range of 1,000 gram/mole to 300,000 gram/mole.

2. The panel display device of claim 1, wherein the device has a sealing structure.

3. The panel display device of claim 1, wherein the first protective layer (400) is formed of poly-chloro-trifluoro-ethylene, poly-dichloro-trifluoro-ethylene, chloro-trifluoro-ethylene, dichloro-trifluoro-ethylene, or a co-polymer of chloro-trifluoro-ethylene and dichloro-trifluoro-ethylene.

4. The panel display device of claim 1, wherein the first protective layer(400) is formed of a high polymer compound having a molecular weight within the range of 1,000 gram/mole to 3,000 gram/mole.

5. The panel display device of claim 1, wherein the first protective layer(400) has a thickness of 0.1~10μm.

6. The panel display device of claim 1, wherein the second protective layer (500) is formed of silicon composite using SiC, SiO, SiO_2, or Si_XN_Y (X and Y are natural numbers).

7. The panel display device of claim 1, wherein the second protective layer (500) includes any one of Cs, CaO, Na, Li, Mg and K within the range of 1~10%.

8. The panel display device of claim 1, wherein the third protective layer (600) is formed of trimethyl propane triacrylate, ditrimethylolpropane tetraacrylate, or trimethylacrylate.

9. The panel display device of claim 1, wherein the third protective layer(600) is formed of RT-glass or a silicon sealant to form a transparent layer.

10. The panel display device of claim 1, wherein the fourth protective layer(700) has a three-layered structure (700a, 700b, 700c) including glass or high polymer film.

11. The panel display device of claim 1, wherein the fourth protective layer(700) has the most upper layer which is formed of polyethylene terephthalate (PET), poly methyl methacrylate (PMMA), or fluorine based high polymer compound.

12. The panel display device of claim 11, wherein the fourth protective layer (700) has the most upper layer which is formed of a compound having a molecular weight within the range of 20,000 gram/mole to 250,000 gram/mole.

13. The panel display device of claim 11, wherein the fourth protective layer (700) has the most upper layer which is formed with a thickness of 100~1000μm.

14. The panel display device of claim 1, wherein the fourth protective layer (700) has the most upper layer which is formed of glass of a low melting temperature.

15. The panel display device of claim 1, wherein the fourth protective layer(700) has the lowest layer which is formed of an organic material, metal oxide, organic-inorganic hybrid, or metal complex.

16. A method for forming a multi-layered protective layer in a panel display device including a substrate (100), an organic electroluminescence (EL) layer (300), and the multi-layered protective layer (400, 500, 600, 700),
the method comprising:

a) forming a first protective layer(400) of a high polymer compound containing fluorine at the lowest part;
b) forming a second protective layer (500) of a silicon composite on the first protective layer;
c) forming a third protective layer (600) of an epoxy based compound, silicon compound, or acrylate based compound on the second protective layer the compound being hardened by polymerization at a room temperature and a normal pressure;
d) forming a fourth protective layer (700) on the third protective layer, **characterized in that**

the device further comprises a barrier (200) dividing the organic EL layer (300),
the fourth protective layer(700) has a number of layers (700a, 700b, 700c) adhered to one another at the most upper part, and
the first protective layer (400) is formed of a high polymer compound having a molecular weight within the range of 1,000 gram/mole to 300,000 gram/mole.

17. The method of claim 16, wherein the first protective layer (400) in the step a) is formed by physical vapor deposition (PVD), chemical vapor deposition (CVD), plasma enhanced CVD (PECVD), or sputtering.

18. The method of claim 17, wherein the high polymer compound containing fluorine is deposited at 0.1~10nm/s using the PVD.

19. The method of claim 18, wherein the high polymer compound is deposited at a temperature of 50~100°C of the substrate.

20. The method of claim 16, wherein the second protective layer(500) in the step b) is formed by E-beam deposition or plasma enhanced CVD (PECVD).

21. The method of claim 20, wherein the step c) includes co-depositing Cs on the silicon composite at a concentration of 1~10% to give moisture absorption to the second protective layer(500).

22. The method of claim 16, wherein the step c) includes depositing the compound hardened by polymerization at a room temperature and a normal pressure using the PVD and hardening the same by irradiating ultraviolet (UV).

23. The method of claim 16, wherein the step c) includes coating either epoxy based compound hardened by polymerization at a room temperature and a normal pressure of silicon compound using spin-coating, spray method, or Dr. Blade method.

24. The method of claim 16, wherein the step d) includes:

forming a third layer (700 c) at the lowest part using organic material, metal oxide, organic-inorganic hybrid, or metal complex;
forming a second layer (700 b) treated with plasma, on the third layer to enhance adhesion with the third protective layer; and
forming a first layer (700 a) of PET, PMMA, fluorine based high polymer compound, or glass of a low melting temperature.

25. The method of claim 24, wherein the third layer (700 c) is formed by gas absorption of the organic material, the metal oxide, the organic-inorganic hybrid, or the metal complex using the PVD, the CVD, or the PECVD.

26. The method of claim 16, wherein the first protective layer (400) is formed by growing a high polymer thin film using the PECVD (plasma enhanced chemical vapor deposition) by using fluorine based gas and a carbon compound.

27. The method of claim 26, the fluorine based gas is one of CF_4, C_2F_4, C_2F_5H, $C_2F_4H_2$, and NF_3.

28. The method of claim 26, wherein the high polymer thin film has a net structure, such as Teflon by using the fluorine based gas.

29. The method of claim 26, the carbon compound is one of benzene, naphthalene, and acetylene.

Patentansprüche

1. Anzeigevorrichtung, umfassend:

ein Substrat (100);
eine organische EL (Elektrolumineszenz) Schicht (300), auf dem Substrat gebildet; und

eine vielschichtige Schutzschicht (400, 500, 600, 700), auf der organischen EL Schicht (300) gebildet,
wobei die vielschichtige Schutzschicht (400, 500, 600, 700) eine erste Schutzschicht (400), aus einer Hochpolymerverbindung gebildet, enthaltend Fluor im untersten Bereich zum Schutz der organischen EL Schicht, eine zweite Schutzschicht (500), aus einem Siliciumverbund gebildet, eine dritte Schutzschicht (600), aus einer Epoxy-basierten Verbindung, Siliciumverbindung oder Acrylat-basierten Verbindung gebildet, und eine vierte Schutzschicht (700) umfasst,
dadurch gekennzeichnet, dass
die Vorrichtung eine Barriere (200) umfasst, die die organische EL Schicht (300) unterteilt;
die vierte Schutzschicht (700) aus einer Vielzahl von Schichten gebildet list, die im obersten Bereich aneinander haften; und
die erste Schutzschicht (400) aus einer Hochpolymerverbindung mit einem Molekulargewicht im Bereich von 1.000 Gramm/Mol bis 300.000 Gramm/Mol gebildet ist.

2. Anzeigevorrichtung gemäß Anspruch 1, wobei die Vorrichtung eine Dichtungsstruktur aufweist.

3. Anzeigevorrichtung gemäß Anspruch 1, wobei die erste Schutzschicht (400) aus Polychlortrifluorethylen, Polydichlortrifluorethylen, Chlortrifluorethylen, Dichlortrifluorethylen oder einem Copolymer aus Chlortrifluorethylen und Dichlortrifluorethylen gebildet ist.

4. Anzeigevorrichtung gemäß Anspruch 1, wobei die erste Schutzschicht (400) aus einer Hochpolymerverbindung mit einem Molekulargewicht im Bereich von 1.000 Gramm/Mol bis 3.000 Gramm/Mol gebildet ist.

5. Anzeigevorrichtung gemäß Anspruch 1, wobei die erste Schutzschicht (400) eine Dicke von 0,1 bis 10 μm aufweist.

6. Anzeigevorrichtung gemäß Anspruch 1, wobei die zweite Schutzschicht (500) aus einem Siliciumverbund unter Verwendung von SiC, SiO, SiO_2 oder Si_XN_Y (X und Y sind natürliche Zahlen) gebildet ist.

7. Anzeigevorrichtung gemäß Anspruch 1, wobei die zweite Schutzschicht (500) irgendeines aus Cs, CaO, Na, Li, Mg und K innerhalb des Bereiches von 1-10 % umfasst.

8. Anzeigevorrichtung gemäß Anspruch 1, wobei die dritte Schutzschicht (600) aus Trimethylpropantriacrylat, Ditrimethylolpropantetraacrylat oder Trimethylacrylat gebildet ist.

9. Anzeigevorrichtung gemäß Anspruch 1, wobei die dritte Schutzschicht (600) aus RT-Glas oder einer Siliciumdichtung gebildet ist, um eine transparente Schicht zu bilden.

10. Anzeigevorrichtung gemäß Anspruch 1, wobei die vierte Schutzschicht (700) eine dreischichtige Struktur (700a, 700b, 700c) aufweist, umfassend Glas oder Hochpolymerfolie.

11. Anzeigevorrichtung gemäß Anspruch 1, wobei die vierte Schutzschicht (700) die oberste Schicht aufweist, die aus Polyethylenterephthalat (PET), Polymethylmethacrylat (PMMA) oder Fluor-basierter Hochpolymerverbindung gebildet ist.

12. Anzeigevorrichtung gemäß Anspruch 11, wobei die vierte Schutzschicht (700) die oberste Schicht aufweist, die aus einer Verbindung mit einem Molekulargewicht im Bereich von 20.000 Gramm/Mol bis 250.000 Gramm/Mol aufweist.

13. Anzeigevorrichtung gemäß Anspruch 11, wobei die vierte Schutzschicht (700) die oberste Schicht aufweist, die mit einer Dicke von 100-1.000 μm gebildet ist.

14. Anzeigevorrichtung gemäß Anspruch 1, wobei die vierte Schutzschicht (700) die oberste Schicht aufweist, die aus Glas von niedriger Schmelztemperatur gebildet ist.

15. Anzeigevorrichtung gemäß Anspruch 1, wobei die vierte Schutzschicht (700) die unterste Schicht aufweist, die aus einem organischen Material, Metalloxid, organisch-anorganischem Hybrid oder Metallkomplex gebildet ist.

16. Verfahren zur Bildung einer mehrschichtigen Schutzschicht in einer Anzeigevorrichtung, umfassend ein Substrat (100), eine organische Elekrolumineszenz (EL) Schicht (300) und die mehrschichtige Schutzschicht (400, 500, 600, 700), wobei das Verfahren umfasst:

a) Bilden einer ersten Schutzschicht (400) aus einer Hochpolymerverbindung, enthaltend Fluor im untersten Bereich;
b) Bilden einer zweiten Schutzschicht (500) aus einem Siliciumverbund auf der ersten Schutzschicht;
c) Bilden einer dritten Schutzschicht (600) aus einer Epoxy-basierten Verbindung, Siliciumverbindung oder Acrylat-basierten Verbindung auf der zweiten Schutzschicht, wobei die Verbindung durch Polymerisation bei Raumtempera-

tur und Normaldruck gehärtet wird;
d) Bilden einer vierten Schutzschicht (700) auf der dritten Schutzschicht, **dadurch gekennzeichnet,**

dass die Vorrichtung des weiteren eine Barriere (200) umfasst, die die organische EL Schicht (300) unterteilt,
die vierte Schutzschicht (700) eine Vielzahl von Schichten (700a, 700b, 700c) aufweist, die im obersten Bereich aneinander haften,
und die erste Schutzschicht (400) aus einer Hochpolymerverbindung mit einem Molekulargewicht im Bereich von 1.000 Gramm/Mol bis 300.000 Gramm/Mol gebildet ist.

17. Verfahren gemäß Anspruch 16, wobei die erste Schutzschicht (400) im Schritt a) durch physikalische Dampfabscheidung (PVD), chemische Dampfabscheidung (CVD), Plasma-unterstützte CVD (PECVD) oder Sputtern gebildet wird.

18. Verfahren gemäß Anspruch 17, wobei die Hochpolymerverbindung, enthaltend Fluor bei 0,1-10 nm/s unter Verwendung der PVD abgeschieden wird.

19. Verfahren gemäß Anspruch 18, wobei die Hochpolymerverbindung bei einer Temperatur von 50-100°C des Substrats abgeschieden wird.

20. Verfahren gemäß Anspruch 16, wobei die zweite Schutzschicht (500) im Schritt b) durch E-Strahlabscheidung oder Plasma-unterstützte CVD (PECVD) gebildet wird.

21. Verfahren gemäß Anspruch 20, wobei der Schritt c) die Co-Abscheidung von Cs auf dem Siliciumverbund bei einer Konzentration von 1-10 % umfasst, um Feuchtigkeitsabsorption bei der zweiten Schutzschicht (500) zu erreichen.

22. Verfahren gemäß Anspruch 16, wobei der Schritt c) die Abscheidung der durch Polymerisation bei Raumtemperatur und Normaldruck unter Verwendung der PVD gehärteten Verbindung und das Härten dieser durch ultraviolett (UV) Bestrahlen umfasst.

23. Verfahren gemäß Anspruch 16, wobei der Schritt c) das Beschichten der Siliciumverbindung mit der durch Polymerisation bei Raumtemperatur und Normaldruck gehärteten Epoxy-basierten Verbindung unter Verwendung von entweder Spin-Coating, Sprühverfahren oder Dr. Blade Verfahren umfasst.

24. Verfahren gemäß Anspruch 16, wobei der Schritt d) umfasst:

Das Bilden einer dritten Schicht (700c) im untersten Bereich unter Verwendung von organischem Material, Metalloxid, organisch-anorganischem Hybrid oder Metallkomplex;
das Bilden einer mit Plasma behandelten zweiten Schicht (700b) auf der dritten Schicht, um die Adhäsion mit der dritten Schutzschicht zu erhöhen; und
das Bilden einer ersten Schicht (700a) aus PET, PMMA, Fluor-basierter Hochpolymerverbindung oder Glas mit niedriger Schmelztemperatur.

25. Verfahren gemäß Anspruch 24, wobei die dritte Schicht (700c) durch Gasabsorption des organischen Materials, des Metalloxids, des organisch-anorganischen Hybrids oder des Metallkomplexes unter Verwendung der PVD, der CVD oder der PECVD gebildet wird.

26. Verfahren gemäß Anspruch 16, wobei die erste Schutzschicht (400) durch Entwickeln einer dünnen Hochpolymerfolie unter Verwendung der PECVD (Plasma-unterstützte chemische Dampfabscheidung) unter Verwendung von Fluor-basiertem Gas und einer Kohlenstoffverbindung gebildet wird.

27. Verfahren gemäß Anspruch 26, wobei das Fluor-basierte Gas eines aus CF_4, C_2F_4, C_2F_5H, $C_2F_4H_2$ und NF_3 ist.

28. Verfahren gemäß Anspruch 26, wobei die dünne Hochpolymerfolie eine Netzstruktur, wie Teflon aufweist unter Verwendung des Fluor-basierten Gases.

29. Verfahren gemäß Anspruch 26, wobei die Kohlenstoffverbindung eine aus Benzol, Naphthalen und Acetylen ist.

Revendications

1. Dispositif d'affichage comprenant :

un substrat (100) ;
une couche EL (électroluminescente) organique (300) formée sur le substrat ; et
une couche protectrice multicouche (400, 500, 600, 700) formée sur la couche EL organique (300),
la protectrice multicouche (400, 500, 600, 700) comprenant une première couche protectrice (400) constituée d'un haut polymère contenant du fluor sur la partie inférieure pour protéger la couche EL organique, une deuxième couche protectrice (500) constituée d'un composite de

silicium, une troisième couche protectrice (600) constituée d'un composé à base d'époxy, d'un composé à base de silicium et d'un composé à base d'acrylate, et une quatrième couche protectrice (700),
caractérisé en ce que
le dispositif comprend une barrière (200) divisant la couche EL organique (300) ;
la quatrième couche protectrice (700) se compose d'un certain nombre de couches qui adhèrent les unes aux autres sur la partie supérieure ; et
la première couche protectrice (400) se compose d'un haut polymère possédant un poids moléculaire compris dans la plage allant de 1000 g/mole à 300 000 g/mole.

2. Dispositif d'affichage selon la revendication 1, dans lequel le dispositif possède une structure d'étanchéité.

3. Dispositif d'affichage selon la revendication 1, dans lequel la première couche protectrice (400) se compose de polychlorotrifluoroéthylène, polydichlorotrifluoroéthylène, chlorotrifluoroéthylène, dichlorotrifluoroéthylène ou d'un copolymère de chlorotrifluoroéthylène et de dichlorotrifluoroéthylène.

4. Dispositif d'affichage selon la revendication 1, dans lequel la première couche protectrice (400) se compose d'un haut polymère possédant un poids moléculaire compris dans la plage allant de 1000 g/mole à 300 000 g/mole.

5. Dispositif d'affichage selon la revendication 1, dans lequel la première couche protectrice (400) possède une épaisseur comprise dans la plage allant de 0,1 à environ 10 μm.

6. Dispositif d'affichage selon la revendication 1, dans lequel la deuxième couche protectrice (500) se compose de composite de silicium utilisant du SiC, SiO, SiO_2 ou Si_xNy (X et Y étant des entiers naturels).

7. Dispositif d'affichage selon la revendication 1, dans lequel la deuxième couche protectrice (500) comprend l'un quelconque de Cs, CaO, Na, Li, Mg et K dans la plage allant de 1 à environ 10 %.

8. Dispositif d'affichage selon la revendication 1, dans lequel la troisième couche protectrice (600) se compose de triacrylate de triméthylpropane, tétraacrylate de ditriméthylolpropane ou d'acrylate de triméthyle.

9. Dispositif d'affichage selon la revendication 1, dans lequel la troisième couche protectrice (600) se compose de verre RT ou d'un agent d'étanchéité à base de silicium pour former une couche transparente.

10. Dispositif d'affichage selon la revendication 1, dans lequel la quatrième couche protectrice (700) possède une structure de trois couches (700a, 700b, 700c) comprenant du verre ou un film de haut polymère.

11. Dispositif d'affichage selon la revendication 1, dans lequel la couche supérieure de la quatrième couche protectrice (700) se compose de poly(téréphtalate d'éthylène) (PET), de poly(méthacrylate de méthyle) (PMMA) ou d'un haut polymère à base de fluor.

12. Dispositif d'affichage selon la revendication 11, dans lequel la couche supérieure de la quatrième couche protectrice (700) se compose d'un composé possédant un poids moléculaire compris dans la plage allant de 20 000 g/mole à 250 000 g/mole.

13. Dispositif d'affichage selon la revendication 11, dans lequel la couche supérieure de la quatrième couche protectrice (700) est formée avec une épaisseur de 100 à environ 1000 μm.

14. Dispositif d'affichage selon la revendication 1, dans lequel la couche supérieure de la quatrième couche protectrice (700) se compose de verre de faible point de fusion.

15. Dispositif d'affichage selon la revendication 1, dans lequel la couche inférieure de la quatrième couche protectrice (700) se compose d'un matériau organique, d'un oxyde métallique, d'un hybride organique-inorganique ou d'un complexe métallique.

16. Procédé de formation d'une couche protectrice multicouche dans un dispositif d'affichage comprenant un substrat (100), une couche électroluminescente (EL) organique (300), et la couche protectrice multicouche (400, 500, 600, 700), le procédé comprenant les étapes consistant à :

a) former une première couche protectrice (400) d'un haut polymère contenant du fluor sur la partie inférieure ;
b) former une deuxième couche protectrice (500) d'un composite de silicium sur la première couche protectrice ;
c) former une troisième couche protectrice (600) d'un composé à base d'époxy, d'un composé à base de silicium ou d'un composé à base d'acrylate sur la deuxième couche protectrice, le composé étant durci par polymérisation à température ambiante et pression normale ;
d) former une quatrième couche protectrice (700) sur la troisième couche protectrice sur la deuxième couche protectrice, le composé étant durci par polymérisation à température ambian-

te et pression normale ;

caractérisé en ce que
le dispositif comprend en outre une barrière (200) divisant la couche EL organique (300),
la quatrième couche protectrice (700) se compose d'un certain nombre de couches (700a, 700b, 700c) qui adhèrent les unes aux autres sur la partie supérieure, et
la première couche protectrice (400) se compose d'un haut polymère possédant un poids moléculaire compris dans la plage allant de 1000 g/mole à 300 000 g/mole.

17. Procédé selon la revendication 16, dans lequel la première couche protectrice (400) de l'étape a) est formée par dépôt physique en phase vapeur (PVD), dépôt chimique en phase vapeur (CVD), dépôt chimique en phase vapeur activé par plasma (PECVD) ou pulvérisation cathodique.

18. Procédé selon la revendication 17, dans lequel le haut polymère contenant du fluor est déposé à 0,1 à environ 10 nm/s en utilisation le procédé physique en phase vapeur (PVD).

19. Procédé selon la revendication 18, dans lequel le haut polymère est déposé à une température du substrat de 50 à environ 100 °C.

20. Procédé selon la revendication 16, dans lequel la deuxième couche protectrice (500) dans l'étape b) est formée par un dépôt par faisceau électronique ou un dépôt chimique en phase vapeur activé par plasma (PECVD).

21. Procédé selon la revendication 20, dans lequel l'étape c) comprend le co-dépôt de Cs sur le composite de silicium à une concentration de 1 à environ 10 % pour offrir une propriété d'absorption d'humidité à la deuxième couche protectrice (500).

22. Procédé selon la revendication 16, dans lequel l'étape c) comprend le dépôt du composé durci par polymérisation à température ambiante et pression normale en utilisant le dépôt physique en phase vapeur et le durcissement du composé par rayonnement d'ultraviolets (UV).

23. Procédé selon la revendication 16, dans lequel l'étape c) comprend un revêtement d'un composé à base d'époxy durci par polymérisation à température ambiante et pression normale ou d'un composé à base de silicium en utilisant un procédé de dépôt à la tournette, un procédé de pulvérisation ou un procédé avec applicateur Doctor Blade.

24. Procédé selon la revendication 16, dans lequel l'étape d) comprend :

la formation d'une troisième couche (700c) sur la partie inférieure en utilisant un matériau organique, un oxyde métallique, un hybride organique-inorganique ou un complexe métallique ;
la formation d'une deuxième couche (700b) traitée par plasma, sur la troisième couche pour améliorer l'adhérence à la troisième couche protectrice ; et
la formation d'une première couche (700a) de PET, PMMA, haut polymère à base de fluor ou verre de faible point de fusion.

25. Procédé selon la revendication 24, dans lequel la troisième couche (700c) est formée par absorption gazeuse du matériau organique, de l'oxyde métallique, de l'hybride organique-inorganique ou du complexe métallique en utilisant le dépôt physique en phase vapeur (PVD), le dépôt chimique en phase vapeur (CVD) ou le dépôt chimique en phase vapeur activé par plasma (PECVD).

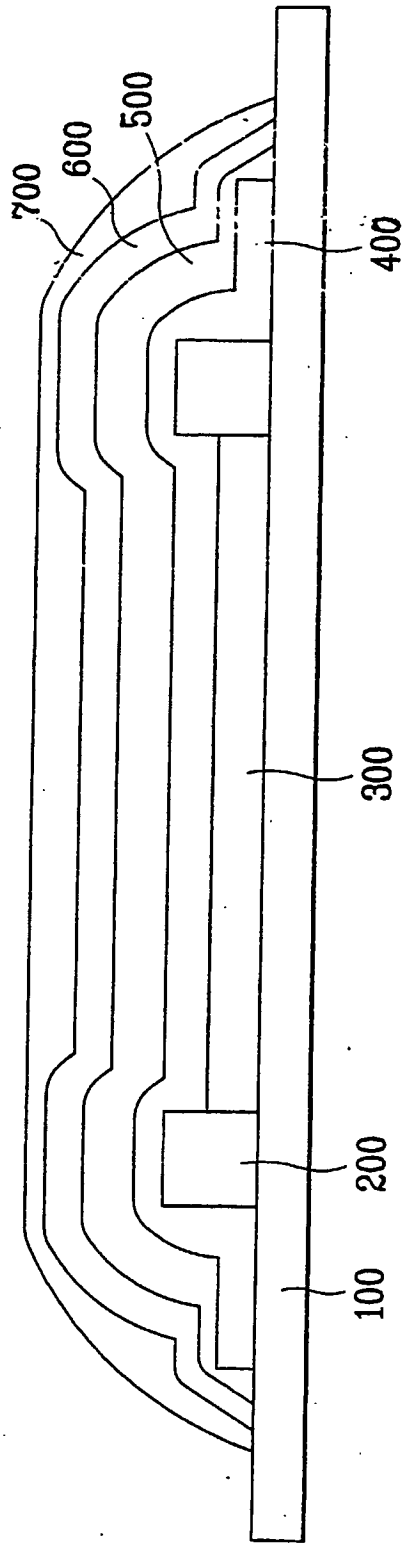
26. Procédé selon la revendication 16, dans lequel la première couche protectrice (400) est formée par formation d'un film fin de haut polymère en utilisant le dépôt chimique en phase vapeur activé par plasma (PECVD) en utilisant un gaz fluoré et un composé carboné.

27. Procédé selon la revendication 26, dans lequel le gaz fluoré est choisi parmi CF_4, C_2F_4, C_2F_5H, $C_2F_4H_2$ et NF_3.

28. Procédé selon la revendication 26, dans lequel le film fin de haut polymère possède la structure de réseau, comme le téflon, en utilisant le gaz fluoré.

29. Procédé selon la revendication 26, dans lequel le composé carboné est choisi parmi le benzène, le naphtalène et l'acétylène.

FIG.1



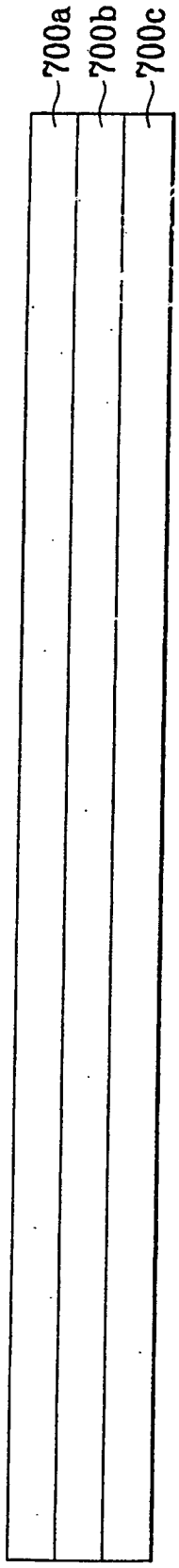


FIG.2

FIG.3.A

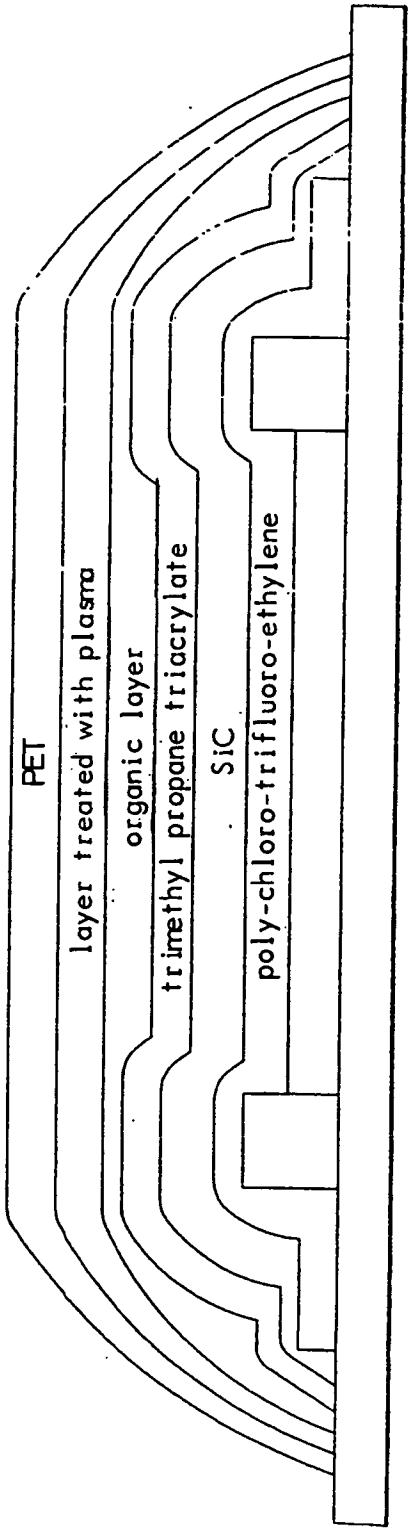

PET
layer treated with plasma
organic layer
trimethyl propane triacrylate
SiC
poly-chloro-trifluoro-ethylene

FIG.3B

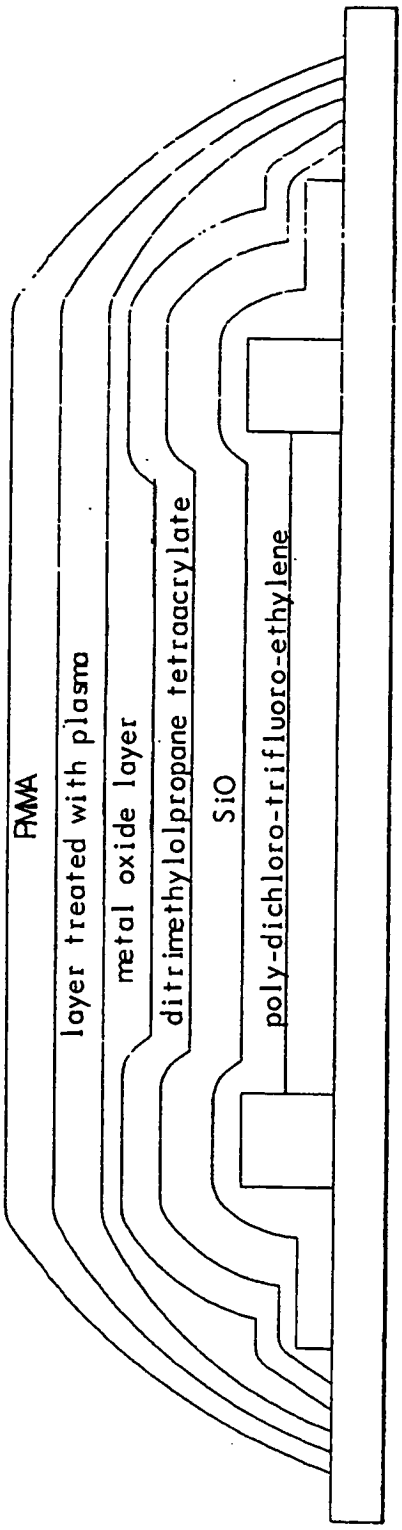

PMMA
layer treated with plasma
metal oxide layer
ditrimethylolpropane tetraacrylate
SiO
poly-dichloro-trifluoro-ethylene

FIG.3C

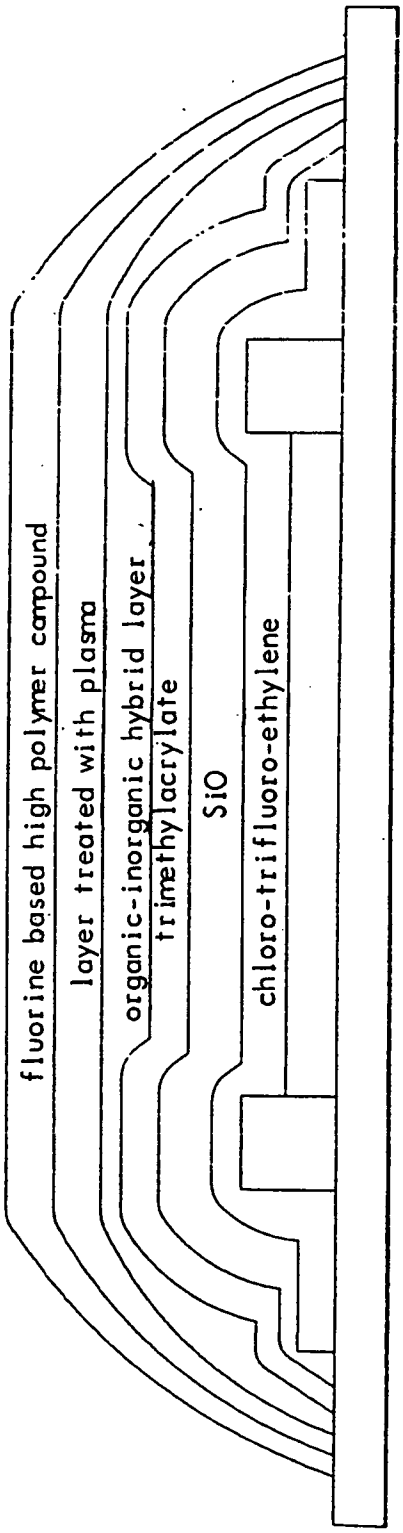

fluorine based high polymer compound
layer treated with plasma
organic-inorganic hybrid layer
trimethylacrylate
SiO
chloro-trifluoro-ethylene

FIG.3D

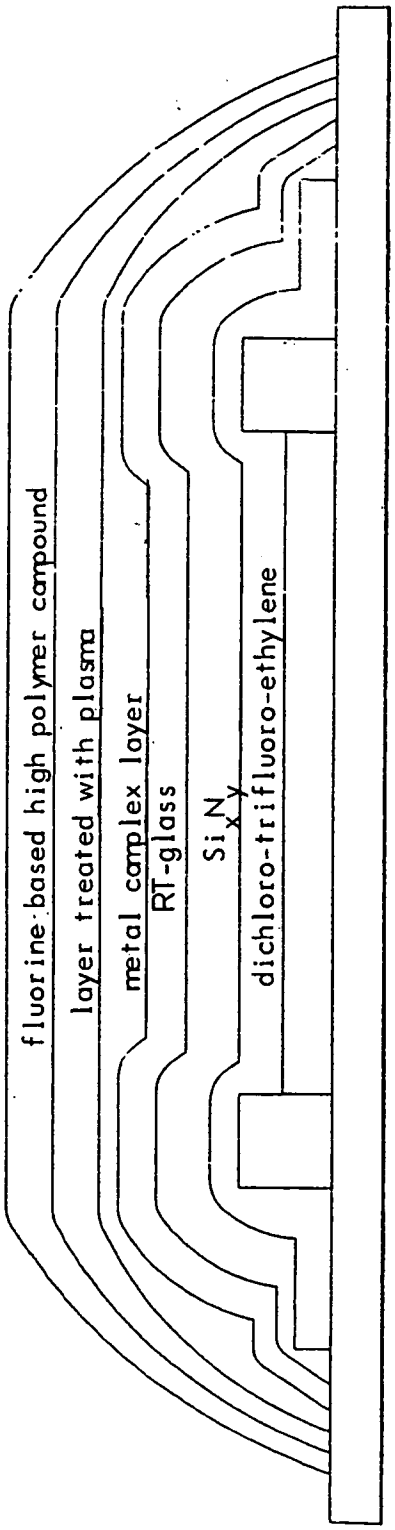
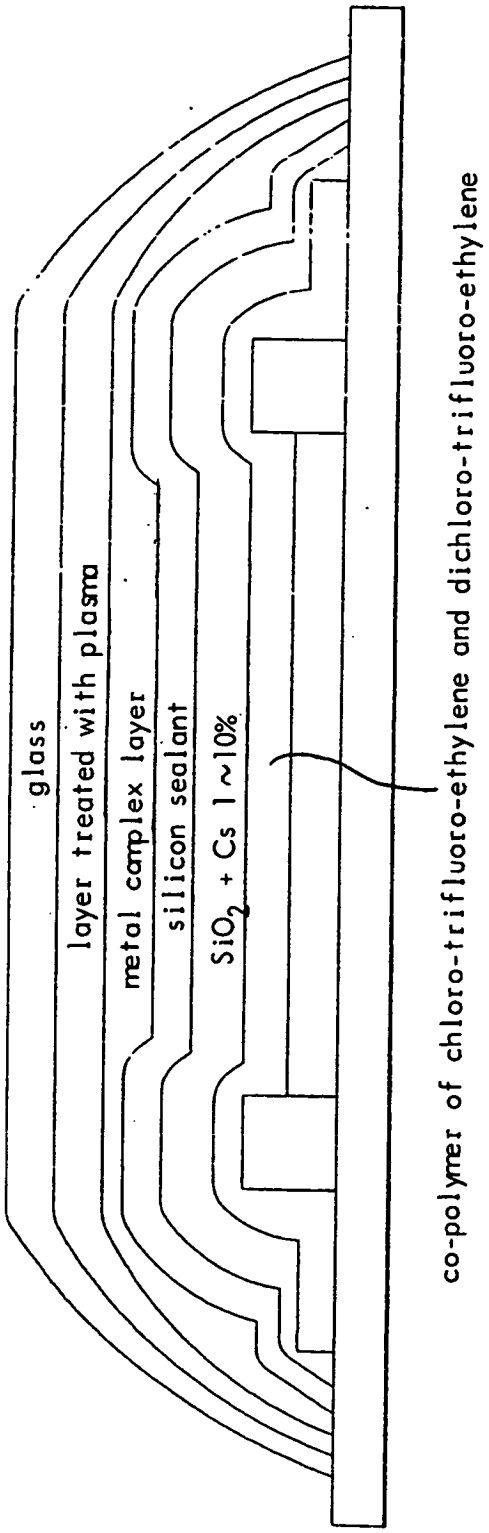

fluorine-based high polymer compound
layer treated with plasma
metal complex layer
RT-glass
Si_xN_y
dichloro-trifluoro-ethylene

FIG.3E


glass
layer treated with plasma
metal complex layer
silicon sealant
SiO_2 + Cs 1~10%
co-polymer of chloro-trifluoro-ethylene and dichloro-trifluoro-ethylene

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- EP 0977469 A2 **[0001]**
- EP 0917410 A1 **[0001]**
- JP 2001148287 A **[0001]**

专利名称(译)	面板显示装置和在其内形成保护层的方法		
公开(公告)号	EP1278244B1	公开(公告)日	2011-06-15
申请号	EP2002016229	申请日	2002-07-19
申请(专利权)人(译)	LG电子株式会社.		
当前申请(专利权)人(译)	LG DISPLAY CO. , LTD.		
[标]发明人	SONG WON JUN YANG JUNG HWAN		
发明人	SONG, WON JUN YANG, JUNG HWAN		
IPC分类号	H01L51/52 H05B33/04 B32B7/02 B32B27/30 C23C14/06 C23C16/30 H01L27/32 H01L51/50 H05B33/10 H05B33/12 H05B33/22		
CPC分类号	H01L51/5253 H01L27/32 Y10S428/917 Y10T428/23 Y10T428/239 Y10T428/26 Y10T428/3154 Y10T428/31935		
优先权	1020010043756 2001-07-20 KR		
其他公开文献	EP1278244A2 EP1278244A3		
外部链接	Espacenet		

摘要(译)

公开了一种面板显示装置和用于在其内形成保护层的方法，其中提供具有多层密封结构的保护层，以避免由诸如O 2或水分的外部因素引起的任何劣化。该面板显示装置包括基板，形成在基板上的有机EL层，分隔有机EL层的阻挡层，以及形成在有机EL层上的多层保护层。

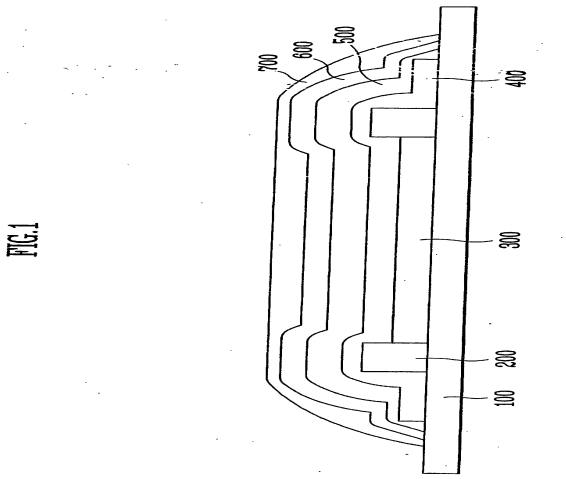

FIG.1