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(54) Method of fabricating an organic light-emitting display

Verfahren zur Herstellung einer organischen lichtemittierenden Anzeige

Procédé de fabrication d'un affichage électroluminescent organique

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Description

Field of the Invention

[0001] The present invention relates to a fabricating method of an organic light-emitting display, and more particularly, the present invention relates to a fabricating method capable of fabricating a thin organic light emitting display, shortening fabricating process time and preventing a substrate from being bent or damaged during the fabricating process.

Description of the Related Art

[0002] Generally, an organic light emitting display self-emits light by causing an electric current to flow through a fluorescent or phosphorescent organic compound and allowing an electron and a hole to be coupled to each other. Moreover, an organic light emitting display can display an image by driving organic light emitting diodes, for example, n by m organic light emitting diodes, by a voltage or a current.

[0003] As illustrated in FIG. 1, organic light emitting diodes have a basic structure including an anode (ITO), an organic thin layer and a cathode electrode (metal). The organic thin layer is composed of an EMitting Layer (EML) which emits light when the electrons and the holes meet and thereby form an exciton, an Electron Transport Layer (ETL) for controlling the moving speed of the electrons, and a Hole Transport Layer (HTL) for controlling the moving speed of the holes. An Electron Injecting Layer (EIL) is further formed in the ETL for improving the effectiveness of the injection of electrons, and, a Hole Injecting Layer (HIL) is further formed in the Hole Transport Layer for improving the effectiveness of the injection of holes.

[0004] The organic light emitting display is by no means inferior to other devices because of a wide range of vision, a super high-speed response, and spontaneous light emitting, and it is possible to fabricate a thin light-weight device since the power consumption is low and a backlight is not required. Since it is fabricated at a low temperature and the fabricating processes are simple, the device is fabricated at a low cost. As organic thin layer material technology and the process technology are being developed rapidly, they are considered to be the technology that can replace the conventional flat display device.

[0005] Meanwhile, since electronic devices, such as cellular telephones, Personal Digital Assistants (PDAs), notebook computers, computer monitors, televisions and so forth, have becomes slimmer, it is necessary for the organic light emitting display to have a thickness below about 1mm. However, in the present organic light emitting displays, since a protective layer technology that can substitute for an encapsulation technology has not been sufficiently developed, it is difficult to fabricate an organic light emitting display having a thickness below 1mm.

[0006] In order to fabricate the organic light emitting display having a thickness below 1mm, Japanese Laid-Open Patent Publications Nos. 2005-340182, 2005-222930 and 2005-222789 relate to a method of fabricating a thin organic light emitting display in which element layers (a semiconductor layer and an organic light emitting diode, etc.) are respectively formed on two glass substrates, and the glass substrates are then bonded to each other so that the respective element layers face each other and then the surfaces on which the element layers are not formed are removed by an etching or grinding process.

[0007] However, the above-noted fabricating method has a problem in that the fabricating process time greatly increases because after the semiconductor layer or the organic light emitting diode is formed on the respective glass substrates, the glass substrates are bonded to each other and are etched or ground. Moreover, such a conventional fabricating method has a problem in that the yield of production is low and the fabricating cost is expensive because the partly finished glass substrates are bonded to each other and the glass substrate, the semiconductor layer and the organic light emitting diode is damaged during bonding process.

[0008] A fabricating method is conceivable in which after providing a glass substrate having a thickness below 1mm, an element layer is formed on the surface of the glass substrate. However, such a fabricating method has a problem in that the glass substrate bends or contacts a moving device and is damaged during the moving process because the glass substrate is very thin.

[0009] US2005/0285522 discloses an electro-luminescent display device that includes a substrate having a display region. A sealing substrate is provided that seals the display region in combination with the substrate via a sealing material.

[0010] US2003/0020124 discloses a substrate support rim used in fabrication of organic light emitting diodes. The support rim is located at the edge of a substrate so as to reinforce the substrate.

[0011] US5,811,866 discloses an active-matrix board that has a first light shield film disposed on a face side of a thin-film transistor, and a second light shield disposed on a reverse side of the transparent insulating substrate.

[0012] JP2003173872 discloses an alignment device comprising a substrate holder that holds a flexible substrate with a magnetic film formed thereon. An electromagnet is provided to fix the flexible substrate with the magnetic film stuck thereon to the substrate holder.

SUMMARY OF THE INVENTION

[0013] The present invention is conceived to solve the aforementioned problems, and it is an object of the present invention to provide a method of fabricating a thin organic light emitting display.

[0014] Another object of the present invention is to shorten the fabricating process time by bonding two substrates.

[0015] Another object of the present invention is to generate no defective exposure by preventing UV-rays from impinging upon an undesired portion of the substrate.

[0016] Another object of the present invention to prevent a substrate from being bent or damaged during the fabricating process.

[0017] According to a first aspect of the present invention, a method of fabricating an organic light emitting display is provided as set out in Claim 1. Optional features of this aspect are set out in Claims 2 to 20.

[0018] In accordance with the above, the organic light emitting display manufactured by the method according to the present invention can be easily applied to electronic devices, such as cellular telephones, Personal Digital Assistants (PDAs), notebook computers, computer monitors and televisions, by being made in a thin and compact size.

[0019] In accordance with the above, the organic light emitting display manufactured by the method according to the present invention prevents UV-rays from influencing the semiconductor layer or the organic light emitting diode through the substrate by forming the non-transmissive layer on the substrate.

[0020] In accordance with the above, the organic light emitting display manufactured by the method according to the present invention prevents the substrate from being damaged due to external forces as rigidity is increased by forming the bonding agent on one side of the under surface of the substrate.

[0021] The method of fabricating the organic light emitting display according to the present invention can shorten the overall process time by about 50% as the semiconductor process and the organic thin layer process (including cleaning, etching, exposure, development and heat treatment) are executed simultaneously by bonding two substrates having a thickness of 0.05 to 1mm, and preventing the substrate from being bent by means of obtaining a specific rigidity.

[0022] In accordance with the above, the fabricating method according to the present invention prevents UV-rays due to the exposure process from influencing the other substrate on the opposite side during the fabricating process by forming the non-transmissive layer on the under surface of the substrate.

[0023] In accordance with the above, the fabricating method according to the present invention prevents the organic light emitting display from being bent or damaged due to the repulsion force between the magnetic layer and the transporting machine transporting the magnetic layer (since another magnetic layer repulsive to the magnetic layer is formed on the transporting machine) or the force of gravity during fabricating process as rigidity is increased by forming the non-transmissive layer/magnetic layer on the under surface of the substrate.

[0024] In accordance with the above, the fabricating method according to the present invention prevents the substrates from contacting each other, and thus, from being damaged by forming the non-transmissive layer/magnetic layer/anti-friction layer or the non-transmissive layer/anti-friction layer on the under surface of the substrate.

BRIEF DESCRIPTION OF THE DRAWINGS

[0025] A more complete appreciation of the present invention and many of the attendant advantages thereof, will be readily apparent as the present invention becomes better understood by reference to the following detailed description when considered in conjunction with the accompanying drawings in which like reference symbols indicate the same or similar components, wherein:

Fig. 1 is a schematic view of an organic light emitting diode.

Figs. 2a to 2d are cross-sectional views of organic light emitting displays.

Figs 3a to 3d are cross-sectional views of organic light emitting displays before an encapsulation substrate is formed.

Fig.4 is a flowchart of a method of fabricating an organic light emitting display according to an embodiment of the present invention.

Figs. 5a to 5i are cross-sectional views of a fabricating flow of an organic light emitting display according to an embodiment of the present invention.

Fig. 6 is a plane view of substrate before sawing which is one step in a fabricating method of an organic light emitting display according to an embodiment of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

[0026] Hereinafter, the present invention is described in more detail below with reference to the accompanying drawings, so that a person of ordinarily skill in the art will understand the present invention without difficulty.

[0027] Referring to Figs. 2a-2d, a cross-sectional views of organic light emitting displays are illustrated.

[0028] As illustrated in Figs. 2a-2d, an organic light emitting display 101 includes a substrate 110, a semiconductor layer 130 formed on the substrate 110, a driver circuit 139 formed on one side of the semiconductor layer 130, an organic light emitting diode 190 formed on the semiconductor layer 130, a encapsulant 240 formed on a top surface periphery of the substrate 110, which is an outer periphery of the semiconductor layer 130, the organic light emitting diode 190 and the driver circuit 139, an encapsulation substrate 250 bonded to the encapsulant 240, and a bonding agent 260 formed on a under surface of the substrate 110 which is opposite to the encapsulant 240.

[0029] The bonding agent can be at least one of an epoxy adhesive, an UV-ray setting adhesive, a frit or an equivalent thereof. However, the material is not restricted thereto. If a frit is used as the encapsulant 240, an encapsulating operation can be executed by using a laser beam because the frit must be heated to a predetermined temperature. After arranging the frit between the substrate 110 and the encapsulation substrate 250, if the laser beam irradiates the frit, then the frit melts and the substrate 110 and the encapsulation substrate 250 are strongly attached to each other.

[0030] The encapsulation substrate 250 can be formed of a transparent glass, a transparent plastic, a transparent polymer or an equivalent thereof. However, the material is not restricted thereto.

[0031] The bonding agent 260 is formed during a fabricating process of the organic light emitting display according to an embodiment of the present invention, and reinforces the strength of the-substrate.

[0032] The bonding agent 260 can be formed in the vicinity of at least on one side of the under surface of the substrate 110. The bonding agent 260 can be formed in the vicinity of every edge of the under surface of the substrate 110. The bonding agent 260 can be formed on the under surface of the substrate 110 corresponding to the outer periphery of the semiconductor layer 130 and the organic light emitting diode 190. The bonding agent 260 can be formed on the under surface of the substrate 110 corresponding to the outer periphery of the encapsulant 240 and the encapsulation substrate 250.

[0033] The bonding agent 260 can be formed of at least one of an epoxy adhesive, a UV-ray setting adhesive or an equivalent thereof. However, the material of the bonding agent 260 is not restricted thereto.

[0034] The bonding agent 260 can be formed to have a thickness of about 10 to 100μm. If the thickness of the bonding agent is 10μm or below, the rigidity is weak when two substrates contact each other during the fabricating process, and if the thickness of the bonding agent is 100μm or above, the bonded substrates are too thick. As described above, in order to arrange the bonding agent 260 on the outer periphery of the semiconductor layer 130, the organic light emitting diode 190, the encapsulant 240 and the encapsulation substrate 250, the substrate 110 must have a larger region than that of the encapsulation substrate 250. A non-transmissive layer 210 can be further formed on the under surface of the substrate 110 to prevent UV-rays from penetrating into the semiconductor layer 130 or the organic light emitting diode 190.

[0035] As illustrated in Fig. 2b, in an organic light emitting display 102, a non-transmissive layer 210 and a magnetic layer 220 can be formed on the under surface of the substrate 110 in sequence.

[0036] As illustrated in Fig. 2c, in an organic light emitting display 103, a non-transmissive layer 210, a magnetic layer 220 and an anti-friction layer 230 can be formed on the under surface of the substrate 110 in sequence.

[0037] As illustrated in Fig. 2d, in an organic light emitting display 104, a non-trransmissive layer 210 and an anti-friction layer 230 can be formed on the under surface of the substrate 110 in sequence. As described above, the non-transmissive layer 210, the magnetic layer 220 and the anti-friction layer 230 are described in more detail below.

[0038] A transparent moisture absorption layer which is not illustrated in the drawings can be formed on the under surface of the encapsulation substrate 250. That is, the transparent moisture absorption layer which is able to absorb moisture without blocking light can be formed on the under surface of the encapsulation substrate 250, since the organic light emitting diode 190 is vulnerable to moisture. This transparent moisture absorption layer is more advantageous as it is getting thicker as long as the transparency is obtained. Typically, it is preferable that the thickness of transparent moisture absorption layer is in a range of 0.1 to 300μm. If the thickness of the transparent moisture absorption layer is 0.1μm or below, a sufficient moisture absorption characteristic is not achieved, and if the thickness of the transparent moisture absorption layer is 300μm or above, there is a risk that it can contact the organic light emitting diode 190. The transparent moisture absorption layer can be made of alkaline metallic oxide, alkaline earth metallic oxide, metallic halide, metallic sulfate, metallic perchlorate, P_2O_5 or an equivalent thereof having an average grain size of 100nm or below, in particular 20 to 100nm. However, the material is not restricted thereto.

[0039] According to the present invention, moisture can be absorbed by filling up the space between the substrate 110 and the encapsulation substrate 250 with at least one of layered inorganic substance, polymer, hardening agent or an equivalent thereof, instead of forming the transparent moisture absorption layer on the encapsulation substrate 250. After this filling, a heat treatment process is performed, so that these materials are hardened.

[0040] A light reflection effect due to external light can be prevented by arranging a polarizer film to the surface of the encapsulation substrate 250.

[0041] Figs. 3a to 3d, are cross-sectional views of organic light emitting displays before the encapsulation substrate is encapsulated.

[0042] As illustrated in Fig. 3a, the organic light emitting display 101 includes a substrate 110, a buffer layer 120 formed on the substrate 110, a semiconductor layer 130 formed on the buffer layer 120, a gate insulating layer 140 formed on the semiconductor layer 130, a gate electrode 150 formed on the gate insulating layer 140, an inter-layer dielectric layer 160 formed on the gate electrode 150, a source/drain electrode 170 formed on the inter-layer dielectric layer 160, an insulating layer 180 formed on the source/drain electrode 170, an organic light emitting diode 190 formed on the insulating layer 180, and a pixel defining film 200 formed on the insulating layer 180 which is disposed at an outer periphery of the organic light emitting diode 190.

[0043] The top surface and the under surface of the substrate 110 are parallel to each other, and a thickness between the top and under surfaces can be formed to be 0.05 to 1mm. If the thickness of the substrate 110 is 0.05mm or below, the substrate is easily damaged by cleaning, etching or heat treatment processes, and is vulnerable to external forces. If the thickness the substrate 110 is 1 mm or above, it is impossible to apply the substrate to various thin display devices. The substrate 110 can be formed of a material selected from a typical glass, plastic, polymer or an equivalent thereof. However, the present invention is not restricted to these materials.

[0044] The buffer layer 120 is formed on the top surface of the substrate 110. This buffer layer 120 prevents H_2O, H_2 or H_2, etc from infiltrating into the semiconductor layer 130 or the organic light emitting diode 190 through the substrate 110. The buffer layer 120 can be made of at least one material selected from SiO_2, Si_3N_4, or equivalents thereof which are easily made during the semiconductor process. However, the present invention is not restricted thereto. This buffer layer 120 can be omitted, if necessary.

[0045] The semiconductor layer 130 is formed on the top surface of the buffer layer 120. This semiconductor layer 130 includes source/drain regions 132 formed on two sides opposite to each other, and a channel region 134 formed between the source/drain regions 132. For example, the semiconductor layer 130 can be a thin film transistor. This thin film transistor can be at least one of an amorphous Si thin film transistor, poly Si thin film transistor, organic thin layer transistor, micro Si thin film transistor or the equivalent thereof. However, the present invention is not restricted to these thin film transistors. If the thin film transistor is the poly Si thin film transistor, the poly Si thin film transistor can be made according to at least one method including a crystallization method using a laser at low temperature, a crystallization method using a metal, a crystallization method using high pressure, or the equivalent thereof. However, the present invention is not restricted to these methods. The crystallization method using a laser can be Excimer Laser Annealing (ELA), Sequential Lateral Solidification (SLS), Thin Beam Direction Crystallization (TDX) and so on. However, the present invention is not restricted to these methods. The crystallization method using a metal can be Solid Phases Crystallization (SPC), Metal Induced Crystallization (MIC), Metal Induced Lateral Crystallization (MILC), Super Grained Silicon (SGS) and so on. However, the present invention is not restricted to these methods. The thin film resistor can be one of PMOS, NMOS or the equivalent thereof. However, the present invention is not restricted thereto.

[0046] The gate insulating layer 140 is formed on the top surface of the semiconductor layer 130. This gate insulating layer 140 is formed on the buffer layer 120 on the outer periphery of the semiconductor layer 130 and on the semiconductor layer 130 itself but with a gap provided over each of the two source/drain regions 132. The gate insulating layer 140 can be made of at least one of a silicon oxide film, a silicon nitride film, an inorganic film or an equivalent thereof which are easily obtained during the semiconductor process. However, the material is not restricted thereto.

[0047] The gate electrode 150 is formed on the top surface of the gate insulating layer 140 that is provided on the semiconductor layer 130. More specifically, the gate electrode 150 is formed on the gate insulating layer 140 corresponding to the channel region 134 of the semiconductor layer 130. As known to those skilled in the art, this gate electrode 150 makes a hole or a channel of an electron in the channel region 134 by applying an electric field to the channel region 134 of the gate insulating layer 140. The gate electrode can be made of a typical metal (MoW, Ti, Cu, Al, AINd, Cr, Mo alloy, Cu alloy, A1 alloy, etc.), a doped poly silicon or the equivalent thereof. However, the material is not restricted thereto.

[0048] The inter-layer dielectric layer 160 is formed on the top surface of the gate electrode 150 and on the top surface of the gate insulating layer 140 on the outer periphery of the gate electrode 150. The inter-layer dielectric layer 160 can be formed of any one of polymers, plastics, glasses or the equivalent thereof. However, the material of the inter-layer dielectric layer 160 is not restricted thereto.

[0049] Two source/drain electrodes 170 are formed on the top surface of the inter-layer dielectric layer 160. Each has an electrically conductive contact 176, which penetrates through the inter-layer dielectric layer 160, and which connects the source/drain electrode 170 and the semiconductor layer 130. That is, the source/drain regions 132 of the semiconductor layer 130 and the source/drain electrodes 170 are electrically coupled by the electrically conductive contacts 176. The source/drain electrodes 170 can be formed of the same metal material as the gate electrode 150. However, the material is not restricted thereto. The above-described semiconductor layer 130 (the thin film transistor) is defined as a coplanar structure. However, the semiconductor layer 130 described in the present invention is not restricted to the coplanar structure, and can be any structure known hereto, for example, the structure can be at least one of an inverted coplanar structure, a staggered structure, an inverted staggered structure or an equivalent thereof. However, the semiconductor layer 130 of the present invention is not restricted thereto.

[0050] The insulating layer 180 is formed on the top surface of the source/drain electrodes 170 and the surrounding portions of the inter-layer dielectric layer 160. In this particular embodiment, the insulating layer 180 includes a protective layer 182 and an planarization layer 184. The protective layer 182 covers the source/drain electrodes 170 and the inter-layer dielectric layer 160, and protects the source/drain electrodes 170, the gate electrode 150 and so on. The protective layer 182 can be formed of a typical inorganic film or an equivalent thereof. However, the material of the protective layer 182 is not restricted thereto. The planarization layer 184 covers the protective layer 182. The planarization layer 184 makes the entire surface of the element flat, and can be formed of at least one of a Benzo Cyclo Butene (BCB), an acrylic or an equivalent thereof. However, the material is not restricted thereto.

[0051] The organic light emitting diode 190 is formed only on the top surface of the insulating layer 180. The organic light emitting diode 190 includes an anode 192, an organic light emitting thin film 194 formed on the top surface of the anode 192, and a cathode 196 formed on the top surface of the organic light emitting thin film 194. The anode 192 can be formed of Indium Tin Oxide (ITO)/Ag, ITO/Ag/ITO, ITO/Ag/ Indium Zinc Oxide(IZO) or the equivalent thereof. However, the material of the anode 192 is not restricted thereto. The ITO is a transparent conductive layer in which a work function is uniform and a hole injecting barrier to the organic light emitting thin layer 194 is small, and the Ag is a layer that reflects the light emitted from the organic light emitting thin layer 194 to the top surface in a top emission system. The organic light emitting thin film 194 can include an EMitting Layer (EML) which emits as an exciton is formed by contact between electrons and holes, an electron transport layer (ETL) which controls the speed of electrons, and a Hole Transport Layer (HTL) which controls the speed of holes. An Electron Injection Layer (EIL) can be further formed on the ETL, and a Hole Injection Layer (HIL) can be further formed on the HTL. The cathode 196 can be at least one of Al, MgAg alloy, MgCa alloy or the equivalent thereof. However, the material of the cathode 196 of the present invention is not restricted thereto. If a top emission system is employed in the present invention, then the Al should be very thin. However, in this case, the resistance becomes high, and thus the electron injecting barrier becomes large. The MgAg alloy has an electron injecting barrier that is smaller than that of the Al, and the MgCa alloy has an electron injecting barrier that is smaller than that of the MgAg Alloy. However, the MgAg alloy and the MgCa alloy must be completely protected from the outside because they are sensitive to the surrounding environment and can oxidize and form an insulating layer. The anode 192 of the organic light emitting diode 190 and the source/drain electrodes 170 are electrically interconnected by an electrical contact 198 penetrating through the insulating layer 180 (the protective layer 182 and the planarization layer 184). Although the present invention has been described based on a top emission system in which the light is emitted in the direction outwardly from the upper part of the substrate 110, the present invention can be applied to a bottom emission system in which the light is emitted in the direction outwardly from the lower part of the substrate 110 or a dual emission system in which the light is simultaneously emitted in the directions from the upper and lower parts of the substrate 110.

[0052] The pixel defining film 200, at an outer periphery of the organic light emitting diode 190, is formed on the top surface of the insulating layer 180. The pixel defining film 200 makes the boundary between a red organic light emitting diode, a green organic light emitting diode and a blue organic light emitting diode clear, and thus it makes the emitting boundary region between the pixels clear. The pixel defining film 200 can be formed of a polyimide or the equivalent thereof. However, the material of the pixel defining film 200 is not restricted thereto.

[0053] According to embodiments of the present invention, a non-transmissive layer 210 is further formed on the under surface of the substrate 110. The non-transmissive layer 210 prevents UV-rays from impinging upon another substrate opposite to the UV-rays during the fabricating process which forms the semiconductor layer 130 and the organic light emitting diode 190 by bonding two substrates 110. The non-transmissive layer 210 prevents external UV-rays from impinging upon the semiconductor layer 130 and the organic light emitting diode 190 after the substrates 110 are divided into pieces. The non-transmissive layer 210 can be formed of a UV-ray protective agent or an equivalent thereof. The non-transmissive layer 210 can be formed of at least one of a metal through which UV-rays are blocked, a transparent UV-ray protective agent or an opaque UV-ray protective agent. If the non-transmissive layer 210 is a metal, then the non-transmissive layer can be formed of at least one of Cr, Cr_2O_3, Al, Au, Ag, MgO, a silver alloy or the equivalent thereof. However, the material is not restricted thereto. It is preferable that the non-transmissive layer 210 is formed to have a thickness of 500 to 3000Å. If the thickness of the non-transmissive layer 210 is 500Å or below, then the elimination rate of UV-rays is low, and thus the semiconductor layer 130 or the organic light emitting diode 190 is affected by the radiation during or after the fabricating process. If the thickness of the non-transmissive layer 210 is 3000Å or above, then the elimination rate of UV-rays is good enough, but the non-transmissive layer 210 is too thick.

[0054] As illustrated in Fig. 3b, in an organic light emitting display 102, a magnetic layer 220 can be further formed on the under surface of the non-transmissive layer 210. The magnetic layer 220 prevents the substrate 110 from being bent during the process forming of the semiconductor layer 130 and the organic light emitting diode 190 by bonding the two substrates 110. It is possible to prevent the substrate 110 from being bent by disposing a magnet with opposite polarity which repels the magnetic layer 220. The magnetic layer 220 can be formed of at least one of AlNiCo magnet, ferrite magnet, rare earth magnet, rubber magnet, plastic magnet or the equivalent thereof. However, the material of the magnetic layer 220 is not restricted thereto. According to the present invention, it is possible to replace the magnetic layer by forming a pattern of an electromagnet instead of the permanent magnet or mounting an electromagnet. It is preferable that the magnetic layer 220 has a thickness of 10 to 100μm. If the magnetic layer 220 is 10μm or below, then it is hard to get sufficient magnetic force, and if the magnetic layer 220 is 100μm or above, the magnetic layer is too thick.

[0055] As illustrated in Fig. 3c, in an organic light emitting display 103, an anti-friction layer 230 can be further formed on the under surface of the magnetic layer 220. The anti-friction layer 230 prevents two substrates 110 from contacting each other during the process which forms the semiconductor 130 and the organic light emitting diode 190 by bonding two substrates 110. It prevents the substrate 110 from being damaged as it prohibits the non-transmissive layer 210 or the magnetic layer 220 formed on the both substrates from contacting each other. The anti-friction layer 230 can be formed of one of an organic material, an inorganic material or an equivalent thereof. However, the material is not restricted thereto. It is preferable that the anti-friction layer 230 is formed to have a thickness of 10 to 100μm. If the thickness of the anti-friction layer 230 is 10μm or below then the substrates can contact each other, and if the thickness of the anti-friction layer 230 is 100μm or above, then the substrate 110 is too thick.

[0056] As illustrated in Fig. 3d, in an organic light emitting display 104, a non-transmissive layer 210 and an anti-friction layer 230 can be formed on the under surface of the substrate 110 in sequence. The material and the thickness of the non-transmissive layer 210 and the anti-friction layer 230 have been omitted, since they are described above. In this embodiment, the magnetic layer 220 is omitted between the non-transmissive layer 210 and the anti-friction layer 230. This is only possible when there is little possibility of bending during the fabricating process due the small area of the substrate 110. In an organic light emitting display 101, it is possible to omit the magnetic layer 220. If the non-transmissive layer 210 and the anti-friction layer 230 are formed to be relatively thick within the permissible range, the substrate 110 is not bent during the fabricating processes due to the increased rigidity.

[0057] Fig. 4, is a flowchart of the fabricating process of an organic light emitting display.

[0058] As illustrated in Fig. 4, a method of fabricating an organic light emitting display according to an embodiment of the present invention includes a step of preparing substrates (S1), a step of forming an non-transmissive layer (S2), a step of bonding the substrates (S3), a step of forming a semiconductor layer (S4), a step of forming an organic light emitting diode (S5), a step of encapsulating (S6), a step of sawing (S7), and a step of separating the substrates (S8). A method of fabricating an organic light emitting display according to an embodiment of the present invention can further include a step of removing the non-transmissive layer (S9).

[0059] Figs. 5a to 5i, are cross-sectional views of a method of fabricating an organic light emitting display according to an embodiment of the present invention. The method of fabricating the organic light emitting display according to an embodiment of the present invention is described below with reference to Fig. 4 and Figs. 5a to 5i.

[0060] In the step of preparing substrates (S1), as illustrated in Fig. 5a, substrates 110 having flat top and under surfaces and having a constant thickness are provided.

[0061] It is preferable that the thickness of the substrate is 110 is 0.05 to 1mm. If the thickness of the substrate 110 is 0.05mm or below, then the substrate may be easily damaged by cleaning, etching and heat treatment processes, and is weak with respect to external forces. If the thickness of the substrate 110 is 1mm or above, it is impossible to apply the substrate to various thin display devices. The substrate 110 can be formed of one of a glass, plastic, polymer and steel, or the equivalent thereof. However, the material or type of substrate 110 is not restricted thereto.

[0062] In the step of forming an non-transmissive layer (S2), as illustrated in Fig. 5b, the non-transmissive layer 210 having a predetermined thickness is formed on the under surface of the substrate 110.

[0063] The non-transmissive layer 210 prevents UV-rays for exposure from impinging upon the other substrate opposite to the UV-rays during the fabricating process that forms the semiconductor layer and the organic light emitting diode by bonding two substrates 110. The non-transmissive layer 210 also prevents the external UV-rays from impinging upon the semiconductor layer and the organic light emitting diode after the substrates 110 are divided into pieces. The non-transmissive layer 210 can be formed of a UV-ray protective agent or the equivalent on the surface of the substrate 110. The non-transmissive layer 210 can be form by depositing or coating at least one of a metal through which UV-rays are blocked, a transparent UV-ray protective agent and an opaque UV-ray protective agent on the surface of the substrate 110. If the non-transmissive layer 210 is a metal, then the non-transmissive layer can be formed by depositing or coating at least one of Cr, Cr_2O_3, Al, Au, Ag, MgO, a silver alloy or the equivalent thereof on the surface of the substrate 110. It is preferable that the non-transmissive layer 210 is formed to have a thickness of 500 to 3000Å. If the thickness of the non-transmissive layer 210 is 500Å or below, then the elimination rate of UV-rays is low, and the semiconductor layer or the organic light emitting diode is affected by the radiation during or after the fabricating process. If the thickness of the non-transmissive layer 190 is 3000Å or above, then the elimination rate of UV-ray is good enough. However, the non-transmissive layer 190 is too thick.

[0064] In the step of forming the non-transmissive layer (S2), a magnetic layer 220 can be formed on the under surface of the non-transmissive layer 210, or a magnetic layer 220 and an anti-friction layer 230 can be formed on the under surface of the non-transmissive layer 210, or an anti-friction layer 230 can be formed on the under surface of the non-transmissive layer 210.

[0065] The magnetic layer 220 prevents the substrate 110 from being bent during the process forming the semiconductor layer 130 and the organic light emitting diode 190 by bonding the two substrates 110. It is possible to prevent the substrate 110 from being bent by disposing a magnet with an opposite polarity which repels the magnetic layer 220. This magnetic layer 220 can be formed of at least one of an AlNiCo magnet, ferrite magnet, rare earth magnet, rubber magnet, plastic magnet or the equivalent thereof. However, the material of the magnetic layer 220 is not restricted thereto. According to the present invention, it is possible to replace the magnetic layer by forming a pattern of an electromagnet. It is preferable that the magnetic layer 220 has a thickness of 10 to 100μm. If the magnetic layer 220 is 10μm or below, it is hard to get sufficient magnetic force, and if the magnetic layer 220 is 100μm or above, the magnetic layer is too thick. The anti-friction layer 230 prevents two substrates 110 from contacting each other during the process which forms the semiconductor and the organic light emitting diode by bonding two substrates 110. That is, it prevents the substrate 110 from being damaged as it prohibits the non-transmissive layer 210 or the magnetic layer formed on the both substrates from contacting each other. The anti-friction layer 230 can be formed of an organic material, an inorganic material or an equivalent thereof. However, the material is not restricted thereto. It is preferable that the anti-friction layer 230 is formed to have a thickness of 10 to 100μm. If the thickness of the anti-friction layer 230 is 10μm or below, then the substrates can contact each other, and if the thickness of the anti-friction layer 230 is 100μm or above, then the anti-friction layer 230 is too thick.

[0066] As illustrated in Fig. 5c, in the step of bonding the substrates (S2), two substrates 110, in which the non-transmissive layer 210, the non-transmissive layer 210/magnetic layer 220 or the non-transmissive layer 210/magnetic layer 220/anti-friction layer 230 are formed, are prepared and bonded to each other back-to-back (i.e. with the two substrates facing outwardly). In Fig. 5c, the non-transmissive layer 210/magnetic layer 220/anti-friction layer 230 is formed in sequence.

[0067] The bonding agent 260 is applied to the gap between the two substrates 110 in order not to separate the two substrates 110. The bonding agent 260 can be formed by using a typical epoxy adhesive, a UV-ray setting adhesive or an equivalent thereof. However, the material of the bonding agent is not restricted thereto. The bonding agent 260 can be formed on the edge of the substrate 110 only, or it can be formed between successive die on the substrate to form a plurality of lines to bond the substrate more stably. In Fig. 5c, a plurality of bonding agents 260 are formed between the two substrates 110.

[0068] The anti-friction layer 230 can be formed not in the step (S2) of forming the non-transmissive layer 210 but in the step (S3) of bonding the substrates 110. If the anti-friction layer 230 in a liquid form is injected into the gap between two substrates after the two substrates 110 are bonded by applying the bonding agent therein, then it fills the gap by a capillary phenomenon. It is preferable that the anti-friction layer 230 is hardened by heat treating at a certain temperature after the anti-friction layer 230 in a liquid form is formed. It is preferable that the anti-friction layer 230 formed on the both substrates 110 contact each other in the step (S3) of bonding the substrates 110. That is, it is preferable that the anti-friction layers 230 are attached to each other to prevent the substrates 110 from being bent or rubbing each other during the transportation of the bonded substrates 110.

[0069] In the step (S4) of forming the semiconductor layer, as illustrated in Fig. 5d, the semiconductor layer 130 is formed on the exposed surfaces of the bonded substrates 110. The driver circuit 139 is formed on one side of the semiconductor layer 130. More specifically, the semiconductor layer 130 for driving the organic light emitting display is formed on each of the surfaces of the two substrates 110 opposite to the surface in which the anti-friction layer 230 is formed. It is also possible to form the driver circuit 139 on one side of the semiconductor layer 130 and to form the buffer layer (not illustrated in the drawings) on the substrate 110 before the semiconductor layer 130 or the driver circuit 139 is formed. The gate insulating layer, the gate electrode, the inter-layer dielectric layer, the source/drain electrodes, the insulating layer (not illustrated in the drawings) and so on are formed after the semiconductor layer 130 is formed. The explanation thereof has been omitted, since it is sufficiently explained above. It is possible to form the pixel defining film after the insulating layer is formed.

[0070] The semiconductor layer 130 and the driver circuit 139 can be formed on one side of the bonded substrates, and they can be formed on the other side of the bonded substrates. In this particular embodiment, the semiconductor layer 130 and the driver circuit 139 are formed on one side of the bonded substrates, after that the semiconductor layer 130 and the driver circuit 139 are formed on the other side of the bonded substrates. It is possible to form the semiconductor layer 130 and the driver circuit 139 on one side of the bonded substrates and the other side of the bonded substrates in sequence by flipping the bonded substrates. The semiconductor layer 130 and the driver circuit 139 can be completed by forming them on both sides of the bonded substrates simultaneously, if the processing devices are sufficient.

[0071] In the step (S5) of forming the organic light emitting diode, as illustrated in Fig. 5e, the organic light emitting diode 190 is formed on the top surface of the semiconductor layer 130. More specifically, the anode, the organic thin layer and the cathode are formed on the insulating layer (not illustrated in the drawings) in sequence. The structure and the forming method of the organic light emitting diode 190 are described above, and thus an further explanation thereof has been omitted.

[0072] It is possible to form the organic light emitting diode 190 on one side of the bonded substrates and the other side of the bonded substrates. That is, it is possible to complete the organic light emitting diode 190 on one side of the bonded substrates and then the organic light emitting diode 190 on the other side of the bonded substrates. It is possible to form the organic light emitting diode 190 on one side of the bonded substrates and the other side of the bonded substrates in sequence by flipping the bonded substrates. The organic light emitting diodes 190 can be completed by forming them on both sides of the bonded substrates simultaneously, if the processing devices are sufficient.

[0073] In the step (S6) of gluing the encapsulation substrate, as illustrated in Fig. 5f, the encapsulation substrate 250 is attached on the surface, on which the semiconductor layer 130 and the organic light emitting diode 190 are formed, using the encapsulant 240. The encapsulation substrate 250 can be formed of a transparent glass, a transparent plastic, a transparent polymer or an equivalent thereof. However, the material is not restricted thereto. It is preferable that the encapsulation substrate 250 has a smaller area than that of the bonding agent 260. More specifically, it is possible to saw/cut around the edge of each die on the substrate 110 with ease by making the encapsulation substrate 250 smaller than the substrate die by 3 to 8 mm from the bonding agent 260. However, the distance from the encapsulation substrate 250 to the bonding agent 260 is not restricted thereto. The encapsulant 240 can be at least one of an epoxy adhesive, a UV-ray setting adhesive, a frit or an equivalent thereof. However, the material is not restricted thereto. If the frit is used as the encapsulant 240, an encapsulating operation can be executed by using a laser beam because the frit must be heated to a predetermined temperature.

[0074] The encapsulating process is executed by using the respective encapsulation substrate 250 in each region where the respective semiconductor layer 130, the driver circuit 139 and the organic light emitting diode 190 are formed. However, it is possible to reduce the complexity of the process by executing the process using an integral-type encapsulation substrate.

[0075] According to embodiments of the present invention, a transparent moisture absorption layer can be further formed on the under surface of the encapsulation substrate 250. The transparent moisture absorption layer which is able to absorb moisture without blocking light can be formed on the under surface of the encapsulation substrate 250, since the organic light emitting diode 190 is vulnerable to moisture. This transparent moisture absorption layer is more advantageous as it is getting thicker as long as the transparency is obtained, typically it is preferable that the thickness is of 0.1 to 300μm. If the thickness of the transparent moisture absorption layer is 0.1μm or below, sufficient moisture absorption characteristic is not achieved, and if the thickness of the transparent moisture absorption layer is 300μm or above, there is a risk that it can contact the organic light emitting diode 190. The transparent moisture absorption layer can be made of an alkaline metallic oxide, alkaline earth metallic oxide, metallic halide, metallic sulfate, metallic perchlorate, P_2O_5 or an equivalent thereof having an average grain size of 100nm or below, in particular 20 to 100nm. However, the material is not restricted thereto.

[0076] According to embodiments of the present invention, moisture can be absorbed by filling up the space between the substrate 110 and the encapsulation substrate 250 with at least one of a layered inorganic substance, polymer, hardening agent or an equivalent thereof, instead of forming the transparent moisture absorption layer on the encapsulation substrate 250. After this filling, the heat treatment process is executed, so that these materials are hardened.

[0077] A light reflection effect due to an external light can be prevented by arranging a polarizer film on the surface of the encapsulation substrate 250.

[0078] In the step (S7) of sawing, as illustrated in Fig. 5g, the substrate 110 is sawed so that it is divided into a unit of two opposed bonded organic light emitting displays. In the step of sawing, the sawing takes place through the portions of the substrates 110 disposed on the outer periphery of the semiconductor layer 130, the driver circuit 139 and the organic light emitting diode 190. The sawing is achieved by a diamond wheel, a laser beam or an equivalent thereof. However, the sawing method is not restricted thereto. The reference numeral 270 in the drawing is referred to as a laser beam shooter.

[0079] The sawing process is executed so that the bonding agent 260 remains on at least one side of the substrate 110. In Fig. 5g, the substrate 110 is sawed while the bonding agent 260 remains on the right end of the substrate. The remained bonding agent 260 effects the rigidity of the substrate 110 during the foregoing processes.

[0080] In the step (S8) of separating the substrate, as illustrated in Fig. 5h, two substrates 110, which have formed a unit by means of the sawing, are separated. The non-transmissive layer 210, the non-transmissive layer 210/magnetic layer 220, the non-transmissive layer 210/magnetic layer 220/anti-friction layer 230 or the non-transmissive layer 210/anti-friction layer 230 as well as the bonding agent 260 are left on each of the separated substrates 110. In Fig. 5h, the non-transmissive layer 210/magnetic layer 220/anti-friction layer 230 is left on the under surface of the substrates 110.

[0081] If the anti-friction layer 230 is formed on the respective substrate 110 before the substrates are bonded, then the separation of the respective substrate 110 is achieved with ease. However, if the anti-friction layer 230 is formed by injecting the liquid anti-friction layer therein after the substrates are bonded, then the separation of the substrate is not achieved easily. Therefore, the anti-friction layer 230 is removed using a chemical solution which dissolves the anti-friction layer 230. It is preferable that the anti-friction layer 230 is made of an organic material which a chemical solution dissolves with ease.

[0082] Embodiments of the present invention can be completed by the step of the separation of the substrates 110. After the separation step, it is marketed as the product, after a cell test, Flexible Printed Circuit (FPC) bonding, module test and reliability test have been completed.

The cell test can be achieved by forming a region for the cell test on the substrate 110 before the sawing step.

[0083] If the separation step of the substrate is chosen as the last process, the non-transmissive layer 210, the non-transmissive layer 210/magnetic layer 220, the non-transmissive layer 210/magnetic layer 220/anti-friction layer 230 or the non-transmissive layer 210/anti-friction layer 230 as well as the bonding agent 260 can be left on the separated substrate 110.

[0084] In the step (S9) of removing the non-transmissive layer, as illustrated in Fig. 5i, it is possible to remove the non-transmissive layer 210 by etching or grinding. More specifically, if only the non-transmissive layer 210 is left on the under surface of the substrate 110, then the non-transmissive layer 210 is removed. If the non-transmissive layer 210/magnetic layer 220 are left on the under surface of the substrate 110, then it is possible to remove the magnetic layer 220 only or the non-transmissive layer 210/magnetic layer 220. If the non-transmissive layer 210/magnetic layer 220/anti-friction layer 230 are left on the under surface of the substrate 110, then it is possible to remove the anti-friction layer 230 only, or remove the anti-friction layer 230/magnetic layer 220, or remove the non-transmissive layer 210/magnetic layer 220/anti-friction layer 230 altogether. If the non-transmissive layer 210/anti-friction layer 230 are left on the under surface of the substrate 110, then it is possible to remove the anti-friction layer 230 only, or remove the anti-friction layer 230/non-transmissive layer 210 together. The rigidity of the substrate 110 is increased, as the bonding agent 260 is still left on one side of the under surface of the substrate 110 after the non-transmissive layer 210 is removed.

[0085] Fig. 6 is a plane view of a substrate formed before sawing in a method of fabricating an organic light emitting display according to an embodiment of the present invention.

[0086] As illustrated, the organic light emitting diode 190 and the driver circuit 139 are arranged on the substrate 110 in the form of a matrix. The organic light emitting diode 190 and the driver circuit 139 are defined as the unit. The unit is arranged in a 3×3 matrix in Fig. 6. However, the present invention is not limited thereto.

[0087] The encapsulant 240 in the form of a square band is formed on the outer periphery of the respective unit. The encapsulation substrate is seated on the encapsulant 240. However, the encapsulation substrate has been omitted in Fig. 6.

[0088] The bonding agent 260 is formed on the under surface of the substrate 110 so as to bond with another substrate. As shown, the bonding agent 260 is formed in the horizontal direction. However, the present invention is not restricted to this pattern. The bonding agent 260 can be formed in the vertical direction or a checkerboard.

[0089] A two-dot chain line defines the sawing line in the drawings. As illustrated in Fig. 6, the sawing line can be formed in the shape of a checkerboard. The bonding agent 260 is formed in the horizontal direction along one side of the sawing line.

[0090] Therefore, if the sawing is executed according to the sawing line, then the bonding agent 260 with a predetermined thickness is left on one side end of the substrate 110. The position of the bonding agent 260 left on the substrate 110 varies according to the forming position of the bonding agent 260. If the bonding agent 260 is formed along the sawing line with a state that the width of the bonding agent 260 is wider than that of the sawing line, then the bonding agent 260 will remain on every periphery (square periphery) of the sawed substrate 110.

[0091] The bonding agent 260 prevents the organic light emitting display from being bent or damaged by reinforcing the rigidity of the organic light emitting display during the fabricating process or in use, as described above.

[0092] In accordance with the above description, the organic light emitting display formed by the method of the present invention can be easily applied to electronic appliances, such as cellular telephones, Personal Digital Assistants (PDAs), notebook computers, computer monitors and televisions, being made in a thin and compact size, since the organic light emitting display formed by the method according to the present invention is formed on the substrate having a thickness of 0.05 to 1 mm.

[0093] In accordance with the above description, the organic light emitting display formed by the method according to the present invention prevents UV-rays from influencing the semiconductor layer or the organic light emitting diode through the substrate by forming the non-transmissive layer on the substrate.

[0094] In accordance with the above description, the organic light emitting display formed by the method according to the present invention prevents the substrate from being damaged due to external forces as rigidity is increased by forming the bonding agent on one side of the under surface of the substrate.

[0095] The method of fabricating the organic light emitting display according to the present invention can shorten the overall process time by about 50% as the semiconductor process and the organic thin layer process (including cleaning, etching, exposure, development and heat treatment) are executed simultaneously by means of bonding two substrates having a thickness of 0.05 to 1 mm, and prevent the substrate from being bent during the transportation process by obtaining a specific rigidity.

[0096] In accordance with the above described ways, the fabricating method according to the present invention prevents UV-rays due to the exposure process from influencing the other substrate on the opposite side during of fabricating process by forming the non-transmissive layer on the under surface of the substrate.

[0097] In accordance with the above description, the fabricating method according to the present invention prevents the organic light emitting display from being bent or damaged due to the repulsion force between the magnetic layer and the transporting machine transporting the magnetic layer (since another magnetic layer repulsive to the magnetic layer is formed on the transporting machine) or the force of gravity during fabricating process as rigidity is increased by forming the non-transmissive layer/magnetic layer on the under surface of the substrate.

[0098] In accordance with the above description, the fabricating method according to the present invention prevents the substrates from contacting each other, and thus, from being damaged by forming the non-transmissive layer/magnetic layer/anti-friction layer or the non-transmissive layer/anti-friction layer on the under surface of the substrate.

[0099] The explained hitherto is to be considered in all respects as illustrative and not restrictive so as to execute the organic light emitting display according to the present invention and the method thereof. That is, the present invention is not restricted to the exemplary embodiments, and it should be understood that the present invention is not limited thereto.

Claims

1. A method of fabricating an organic light emitting display comprising:

   forming a non-transmissive layer (210) on an under surface of each of two substrates (110);
   bonding the two substrates (110) by applying a bonding agent (260) thereto, such that the non-transmissive layers (210) face each other;
   forming a semiconductor layer (130) on each respective top surface of the bonded substrates (110), opposite to the non-transmissive layer (210);
   forming an organic light emitting diode (190) on each respective semiconductor layer (130);
   after forming the organic light emitting diodes (190), arranging an encapsulation substrate (250) over the top surface of each substrate (110), by applying an encapsulant (240) to the top surface thereof;
   after arranging the encapsulation substrates (250), sawing the region of the two bonded substrates (110) corresponding to an outer periphery of the encapsulant (240) while the two substrates (110) are held together by the bonding agent (260); and
   after the sawing, separating the two bonded substrates (110).

2. A method of fabricating an organic light emitting display according to claim 1, wherein bonding the substrates (110) comprises using one of an epoxy adhesive or a UV-ray setting adhesive as the bonding agent (260).

3. A method of fabricating an organic light emitting display according to claim 1 or 2, wherein bonding the substrates (110) comprises applying the bonding agent (260) to edges of the substrate (110).

4. A method of fabricating an organic light emitting display according to any of the preceding claims, wherein bonding the substrates (110) comprises applying the bonding agent (260) to a region of the under surface of the substrate (110) at a position corresponding to an outer periphery of the semiconductor layer (130) and the organic light emitting diode (190).

5. A method of fabricating an organic light emitting display according to any of the preceding claims, wherein bonding the substrates (110) comprises applying the bonding agent (260) to a region of the under surface of the substrate (110) at a position corresponding to an outer periphery of the encapsulant (240).

6. A method of fabricating an organic light emitting display according to any of the preceding claims, wherein the substrates (110) have a thickness in a range of 0.05 to 1 mm.

7. A method of fabricating an organic light emitting display according to any of the preceding claims, wherein the substrates (110) comprise a glass, plastic, polymer or steel.

8. A method of fabricating an organic light emitting display according to any of the preceding claims, further comprising forming the non-transmissive layer (210) to have a thickness in a range of 500 to 3000 Å.

9. A method of fabricating an organic light emitting display according to any of the preceding claims, further comprising forming the non-transmissive layer (210) by forming a coating comprising one of a metal through which UV-rays are blocked, a transparent UV-ray protective agent, or an opaque UV-ray protective agent.

10. A method of fabricating an organic light emitting display according to any of the preceding claims, further comprising forming the non-transmissive layer (210) of one of Cr, Cr_2O_3, Al, Au, Ag, MgO or a silver alloy.

11. A method of fabricating an organic light emitting display according to any of the preceding claims, further comprising forming a magnetic layer (220) on the under surface of the non-transmissive layer (210).

12. A method of fabricating an organic light emitting display according to claim 11, further comprising forming an anti-friction layer (230) on an under surface of the magnetic layer (220).

13. A method of fabricating an organic light emitting dis-

play according to any of claims 1 to 10, further comprising forming an anti-friction layer (230) on the under surface of the non-transmissive layer (210).

14. A method of fabricating an organic light emitting display according to any of claims 12 or 13, wherein forming the anti-friction layer (230) further comprises forming an anti-friction layer having a thickness in a range of 10 to 100μm.

15. A method of fabricating an organic light emitting display according to any of claims 12 to 14, wherein forming the anti-friction layer (230) further comprises forming an anti-friction layer of either an organic material or an inorganic material.

16. A method of fabricating an organic light emitting display according to any of claims 12 to 15, wherein the step of bonding the substrates comprises forming anti-friction layers (230) on respective substrates to contact each other.

17. A method of fabricating an organic light emitting display according to any of the preceding claims, wherein arranging the encapsulation substrate (250) comprises forming the area of the encapsulation substrate (250) to be smaller than that of the substrate (110).

18. A method of fabricating an organic light emitting display according to any of the preceding claims, wherein the sawing is performed by a laser beam.

19. A method of fabricating an organic light emitting display according to any of the preceding claims, further comprising removing the non-transmissive layer (210) after separating the substrates (110).

20. A method of fabricating an organic light emitting display according to any of the preceding claims, further comprising forming a driver circuit on one side of the semiconductor layer (130) after forming the semiconductor layer (130).

Patentansprüche

1. Verfahren zum Herstellen einer organischen lichtemittierenden Anzeige, umfassend:

Bilden einer undurchlässigen Schicht (210) auf einer unteren Oberfläche von jedem von zwei Substraten (110);
Binden der beiden Substrate (110) durch Auftragen eines Bindemittels (260) darauf, so dass die undurchlässigen Schichten (210) zueinander weisen;
Bilden einer Halbleiterschicht (130) auf jeder jeweiligen oberen Oberfläche der gebundenen Substrate (110) entgegengesetzt zu der undurchlässigen Schicht (210);
Bilden einer organischen lichtemittierenden Diode (190) auf jeder jeweiligen Halbleiterschicht (130);
nach Bilden der organischen lichtemittierenden Dioden (190) Anordnen einer Verkapselungssubstrats (250) über der oberen Oberfläche jedes Substrats (110) durch Auftragen eines Verkapselungsmittels (240) auf die obere Oberfläche davon;
nach Anordnen der Verkapselungssubstrate (250) Sägen der Region der beiden gebundenen Substrate (110) korrespondierend mit einer äußeren Peripherie des Verkapselungsmittels (240), während die beiden Substrate (110) durch das Bindemittel (260) zusammengehalten werden; und
nach dem Sägen Trennen der beiden gebundenen Substrate (110).

2. Verfahren zum Herstellen einer organischen lichtemittierenden Anzeige nach Anspruch 1, wobei Binden der Substrate (110) umfasst, eines eines Epoxidklebers oder eines UV-Strahlen-abbindenden Klebers als das Bindemittel (260) zu verwenden.

3. Verfahren zum Herstellen einer organischen lichtemittierenden Anzeige nach Anspruch 1 oder 2, wobei Binden der Substrate (110) umfasst, das Bindemittel (260) auf Kanten des Substrats (110) aufzutragen.

4. Verfahren zum Herstellen einer organischen lichtemittierenden Anzeige nach einem der vorstehenden Ansprüche, wobei Binden der Substrate (110) umfasst, das Bindemittel (260) auf eine Region der unteren Oberfläche des Substrats (110) an einer Position, die mit einer äußeren Peripherie der Halbleiterschicht (130) und der organischen lichtemittierende Diode (190) korrespondiert, aufzutragen.

5. Verfahren zum Herstellen einer organischen lichtemittierenden Anzeige nach einem der vorstehenden Ansprüche, wobei Binden der Substrate (110) umfasst, das Bindemittel (260) auf eine Region der unteren Oberfläche des Substrats (110) an einer Position, die mit einer äußeren Peripherie des Verkapselungsmittels (240) korrespondiert, aufzutragen.

6. Verfahren zum Herstellen einer organischen lichtemittierenden Anzeige nach einem der vorstehenden Ansprüche, wobei die Substrate (110) eine Dicke in einem Bereich von 0,05 bis 1 mm aufweisen.

7. Verfahren zum Herstellen einer organischen lichtemittierenden Anzeige nach einem der vorstehenden Ansprüche, wobei die Substrate (110) ein Glas, einen Kunststoff, ein Polymer oder einen Stahl umfassen.

8. Verfahren zum Herstellen einer organischen lichtemittierenden Anzeige nach einem der vorstehenden Ansprüche, ferner umfassend, die undurchlässige Schicht (210) zu bilden, um eine Dicke in einem Bereich von 500 bis 3000 Å aufzuweisen.

9. Verfahren zum Herstellen einer organischen lichtemittierenden Anzeige nach einem der vorstehenden Ansprüche, ferner umfassend, die undurchlässige Schicht (210) durch Bilden einer Beschichtung, umfassend eines eines Metalls, durch das UV-Strahlen blockiert werden, eines durchsichtigen UV-Strahlen-Schutzmittels oder eines undurchsichtigen UV-Strahlen-Schutzmittels, zu bilden.

10. Verfahren zum Herstellen einer organischen lichtemittierenden Anzeige nach einem der vorstehenden Ansprüche, ferner umfassend, die undurchlässige Schicht (210) aus einem von Cr, Cr_2O_3, Al, Au, Ag, MgO oder einer Silberlegierung zu bilden.

11. Verfahren zum Herstellen einer organischen lichtemittierenden Anzeige nach einem der vorstehenden Ansprüche, ferner umfassend, eine magnetische Schicht (220) auf der unteren Oberfläche der undurchlässigen Schicht (210) zu bilden.

12. Verfahren zum Herstellen einer organischen lichtemittierenden Anzeige nach Anspruch 11, ferner umfassend, eine Antifriktionsschicht (230) auf einer unteren Oberfläche der magnetischen Schicht (220) zu bilden.

13. Verfahren zum Herstellen einer organischen lichtemittierenden Anzeige nach einem der Ansprüche 1 bis 10, ferner umfassend, eine Antifriktionsschicht (230) auf der unteren Oberfläche der undurchlässigen Schicht (210) zu bilden.

14. Verfahren zum Herstellen einer organischen lichtemittierenden Anzeige nach einem der Ansprüche 12 oder 13, wobei Bilden der Antifriktionsschicht (230) ferner umfasst, eine Antifriktionsschicht mit einer Dicke in einem Bereich von 10 bis 100 μm zu bilden.

15. Verfahren zum Herstellen einer organischen lichtemittierenden Anzeige nach einem der Ansprüche 12 bis 14, wobei Bilden der Antifriktionsschicht (230) ferner umfasst, eine Antifriktionsschicht aus entweder einem organischen Material oder einem anorganischen Material zu bilden.

16. Verfahren zum Herstellen einer organischen lichtemittierenden Anzeige nach einem der Ansprüche 12 bis 15, wobei der Schritt des Bindens der Substrate umfasst, Antifriktionsschichten (230) auf jeweiligen Substraten zu bilden, um einander zu kontaktieren.

17. Verfahren zum Herstellen einer organischen lichtemittierenden Anzeige nach einem der vorstehenden Ansprüche, wobei Anordnen des Verkapselungssubstrats (250) umfasst, die Fläche des Verkapselungssubstrats (250) zu bilden, um kleiner als die des Substrats (110) zu sein.

18. Verfahren zum Herstellen einer organischen lichtemittierenden Anzeige nach einem der vorstehenden Ansprüche, wobei das Sägen durch einen Laserstrahl ausgeführt wird.

19. Verfahren zum Herstellen einer organischen lichtemittierenden Anzeige nach einem der vorstehenden Ansprüche, ferner umfassend, die undurchlässige Schicht (210) nach Trennen der Substrate (110) zu entfernen.

20. Verfahren zum Herstellen einer organischen lichtemittierenden Anzeige nach einem der vorstehenden Ansprüche, ferner umfassend, eine Treiberschaltung auf einer Seite der Halbleiterschicht (130) nach dem Bilden der Halbleiterschicht (130) zu bilden.

Revendications

1. Procédé de fabrication d’un affichage électroluminescent organique, comprenant :

la formation d’une couche non transmissive (210) sur une surface inférieure de chacun de deux substrats (110) ;
la liaison des deux substrats (110) en leur appliquant un agent de liaison (260), de telle sorte que les couches non transmissives (210) soient face à face ;
la formation d’une couche semi-conductrice (130) sur chaque surface supérieure respective des substrats liés (110), opposée à l’opposé de la couche non transmissive (210) ;
la formation d’une diode électroluminescente organique (190) sur chaque couche semi-conductrice respective (130) ;
après formation des diodes électroluminescentes organiques (190), la mise en place d’un substrat d’encapsulation (250) sur la surface supérieure de chaque substrat (110), en appliquant un encapsulant (240) sur leur surface supérieure ;
après mise en place des substrats d’encapsulation (250), le sciage de la région des deux substrats liés (110) correspondant à une périphérie externe de l’encapsulant (240) alors que les deux substrats (110) sont maintenus ensem-

ble par l'agent de liaison (260) ; et
après le sciage, la séparation des deux substrats liés (110).

2. Procédé de fabrication d'un affichage électroluminescent organique selon la revendication 1, dans lequel la liaison des substrats (110) comprend l'utilisation de l'un adhésif époxy ou d'un adhésif durcissant aux UV comme agent de liaison (260).

3. Procédé de fabrication d'un affichage électroluminescent organique selon la revendication 1 ou 2, dans lequel la liaison des substrats (110) comprend l'application de l'agent de liaison (260) sur les bords du substrat (110).

4. Procédé de fabrication d'un affichage électroluminescent organique selon l'une quelconque des revendications précédentes, dans lequel la liaison des substrats (110) comprend l'application de l'agent de liaison (260) sur une région de la surface inférieure du substrat (110) à une position correspondant à une périphérie externe de la couche semi-conductrice (130) et de la diode électroluminescente organique (190).

5. Procédé de fabrication d'un affichage électroluminescent organique selon l'une quelconque des revendications précédentes, dans lequel la liaison des substrats (110) comprend l'application de l'agent de liaison (260) sur une région de la surface inférieure du substrat (110) à une position correspondant à une périphérie externe de l'encapsulant (240).

6. Procédé de fabrication d'un affichage électroluminescent organique selon l'une quelconque des revendications précédentes, dans lequel les substrats (110) ont une épaisseur dans une plage de 0,05 à 1 mm.

7. Procédé de fabrication d'un affichage électroluminescent organique selon l'une quelconque des revendications précédentes, dans lequel les substrats (110) comprennent un verre, un plastique, un polymère ou un acier.

8. Procédé de fabrication d'un affichage électroluminescent organique selon l'une quelconque des revendications précédentes, comprenant en outre la formation de la couche non transmissive (210) de sorte qu'elle ait une épaisseur dans une plage de 500 à 3000 Å.

9. Procédé de fabrication d'un affichage électroluminescent organique selon l'une quelconque des revendications précédentes, comprenant en outre la formation de la couche non transmissive (210) par formation d'un revêtement comprenant l'un d'un métal par lequel les rayons UV sont bloqués, d'un agent anti-UV transparent ou d'un agent anti-UV opaque.

10. Procédé de fabrication d'un affichage électroluminescent organique selon l'une quelconque des revendications précédentes, comprenant en outre la formation de la couche non transmissive (210) à partir de l'un d'un Cr, Cr_2O_3, Al, Au, Ag, MgO ou d'un alliage d'argent.

11. Procédé de fabrication d'un affichage électroluminescent organique selon l'une quelconque des revendications précédentes, comprenant en outre la formation d'une couche magnétique (220) sur la surface inférieure de la couche non transmissive (210).

12. Procédé de fabrication d'un affichage électroluminescent organique selon la revendication 11, comprenant en outre une couche anti-friction (230) sur une surface inférieure de la couche magnétique (220).

13. Procédé de fabrication d'un affichage électroluminescent organique selon l'une quelconque des revendications 1 à 10, comprenant en outre la formation d'une couche anti-friction (230) sur la surface inférieure de la couche non transmissive (210).

14. Procédé de fabrication d'un affichage électroluminescent organique selon l'une quelconque des revendications 12 ou 13, dans lequel la formation de la couche anti-friction (230) comprend en outre la formation d'une couche anti-friction ayant une épaisseur dans une plage de 10 à 100 μm.

15. Procédé de fabrication d'un affichage électroluminescent organique selon l'une quelconque des revendications 12 à 14, dans lequel la formation de la couche anti-friction (230) comprend en outre la formation d'une couche anti-friction à partir d'un matériau organique ou bien d'un matériau inorganique.

16. Procédé de fabrication d'un affichage électroluminescent organique selon l'une quelconque des revendications 12 à 15, dans lequel l'étape de liaison des substrats comprend la formation de couches anti-friction (230) sur les substrats respectifs de sorte qu'elles soient en contact les unes avec les autres.

17. Procédé de fabrication d'un affichage électroluminescent organique selon l'une quelconque des revendications précédentes, dans lequel la mise en place du substrat d'encapsulation (250) comprend la formation de la zone du substrat d'encapsulation (250) de sorte qu'elle soit plus petite que celle du substrat (110).

18. Procédé de fabrication d'un affichage électrolumi-

nescent organique selon l'une quelconque des revendications précédentes, dans lequel le sciage est réalisé au moyen d'un faisceau laser.

19. Procédé de fabrication d'un affichage électroluminescent organique selon l'une quelconque des revendications précédentes, comprenant en outre le retrait de la couche non transmissive (210) après séparation des substrats (110).

20. Procédé de fabrication d'un affichage électroluminescent organique selon l'une quelconque des revendications précédentes, comprenant en outre la formation d'un circuit d'attaque d'un côté de la couche semi-conductrice (130) après formation de la couche semi-conductrice (130).

FIG.1

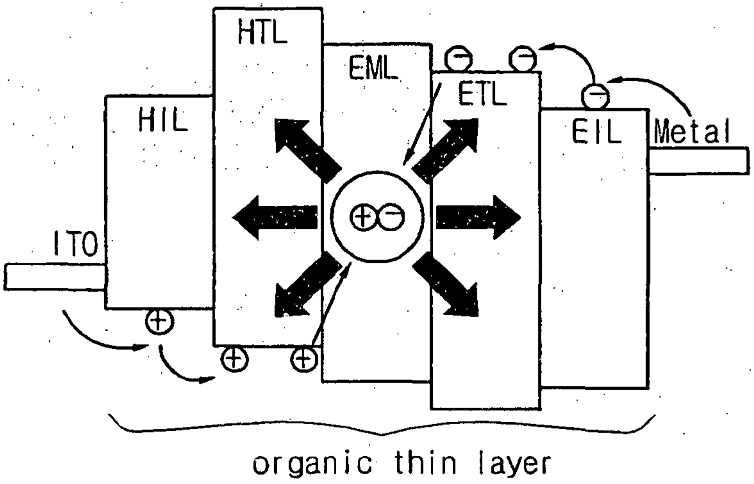

HTL
EML
ETL
HIL
EIL
Metal
ITO
organic thin layer

FIG.2a

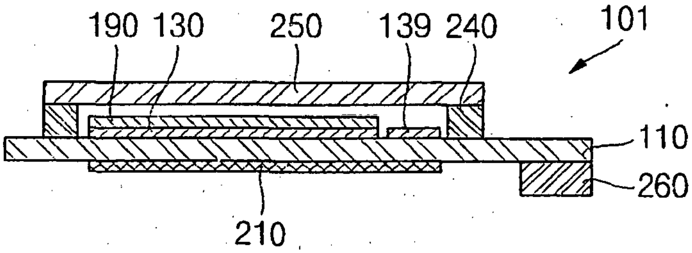

190
130
250
139
240
101
110
260
210

FIG. 2b

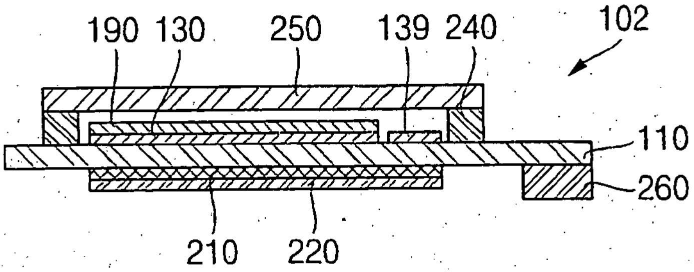


FIG.2c

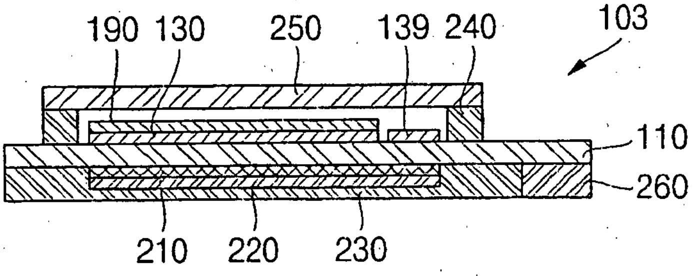


FIG.2d

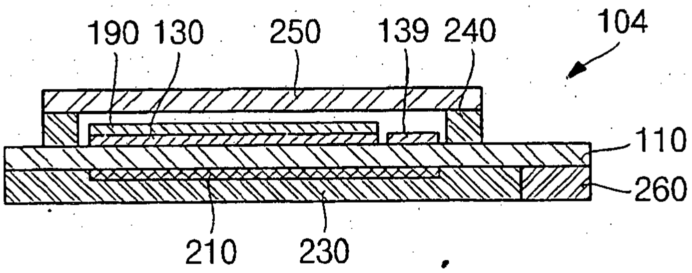


FIG.3a

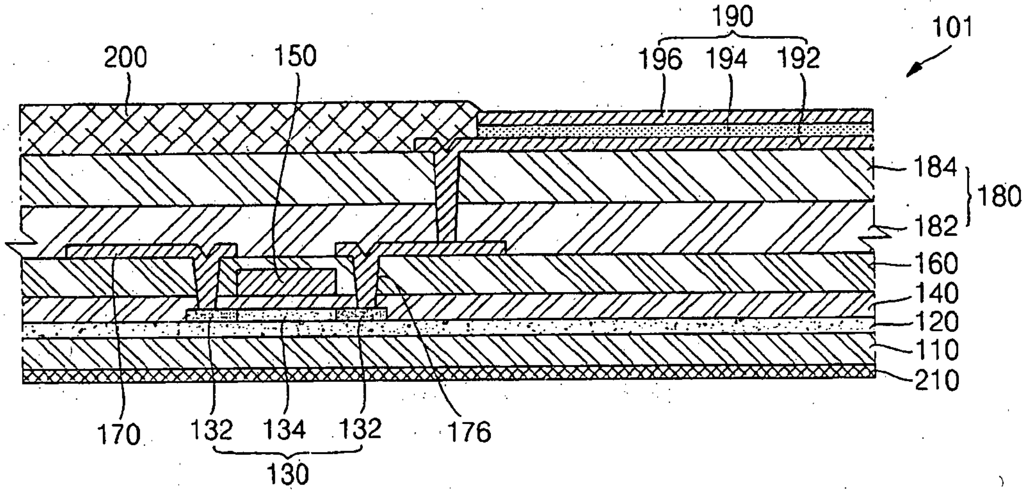
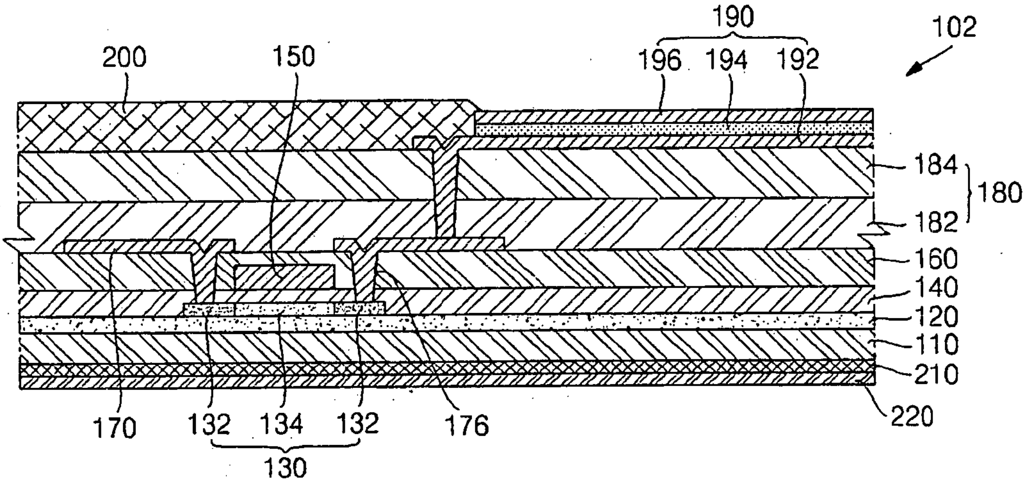

190
101
200
150
196
194
192
184
180
182
160
140
120
110
210
170
132
134
132
176
130

FIG.3b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102
200
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140
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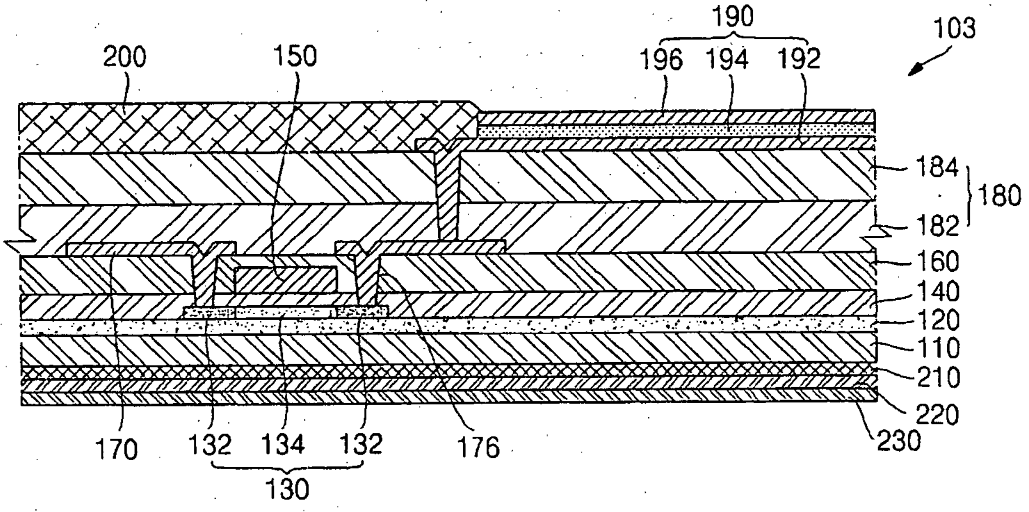
132
176
130

FIG.3c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200
150
196
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160
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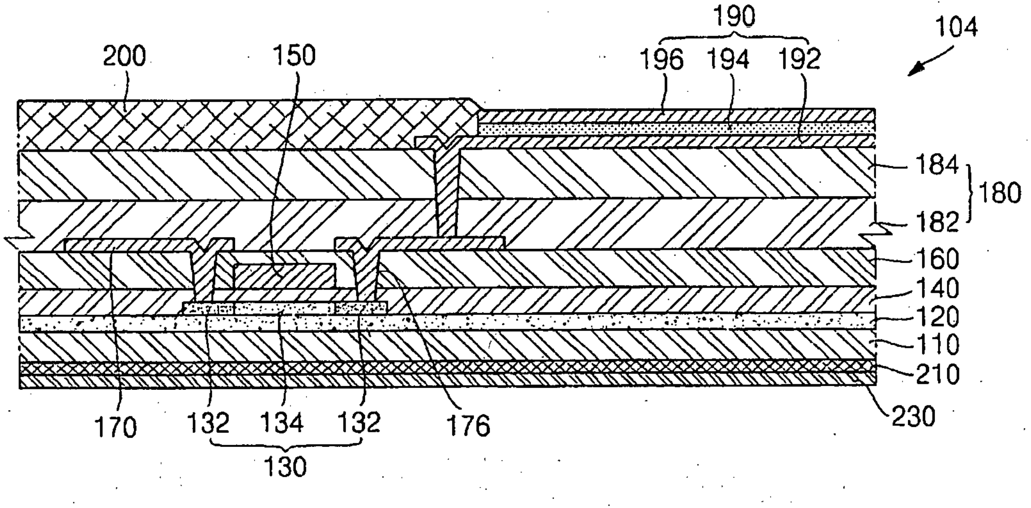
120
110
210
220
230
170
132
134
132
176
130

FIG.3d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104
200
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140
120
110
210
230
170
132
134
132
176
130

FIG. 4

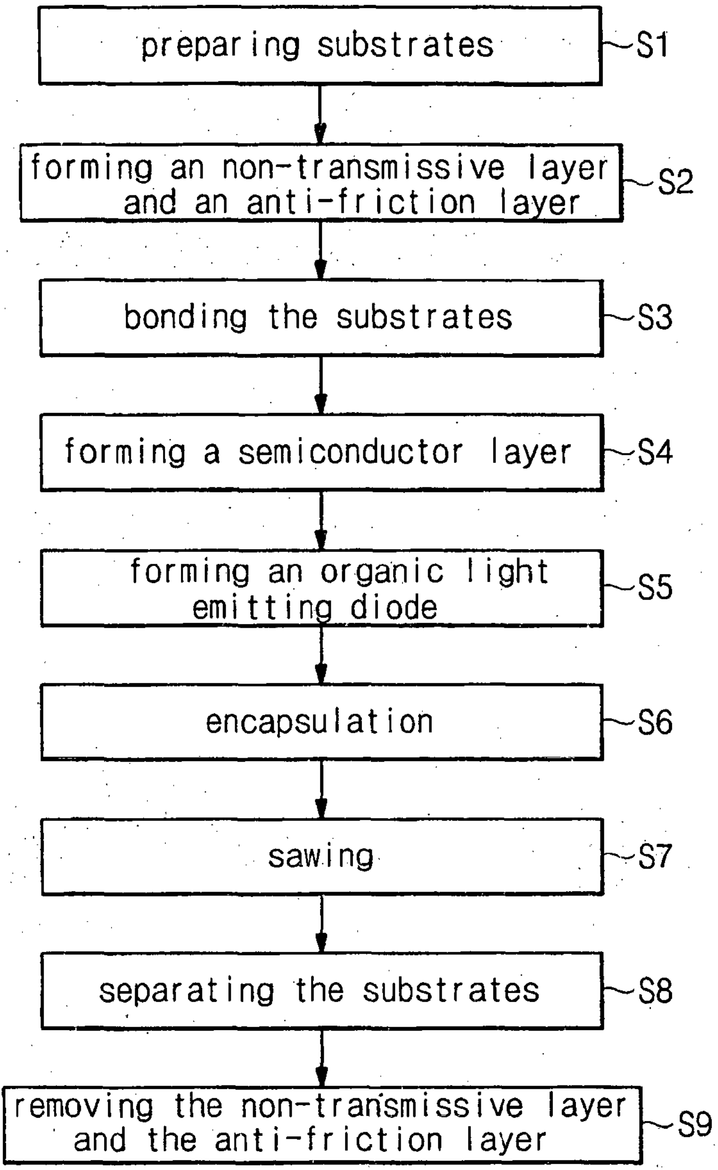

preparing substrates
S1
forming an non-transmissive layer and an anti-friction layer
S2
bonding the substrates
S3
forming a semiconductor layer
S4
forming an organic light emitting diode
S5
encapsulation
S6
sawing
S7
separating the substrates
S8
removing the non-transmissive layer and the anti-friction layer
S9

FIG. 5a

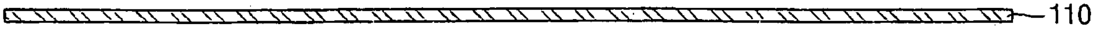


FIG. 5b

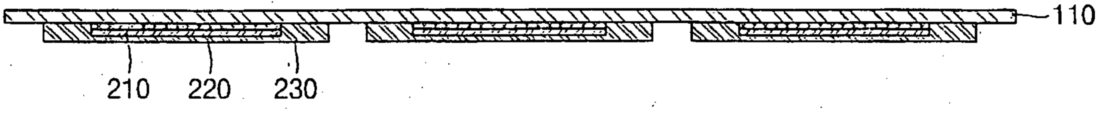


FIG. 5c

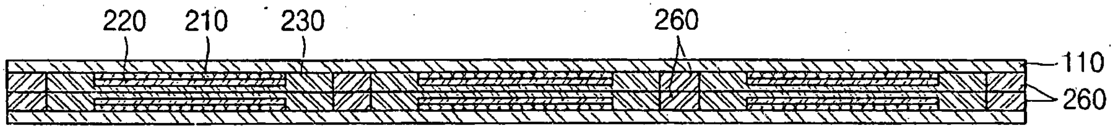


FIG. 5d

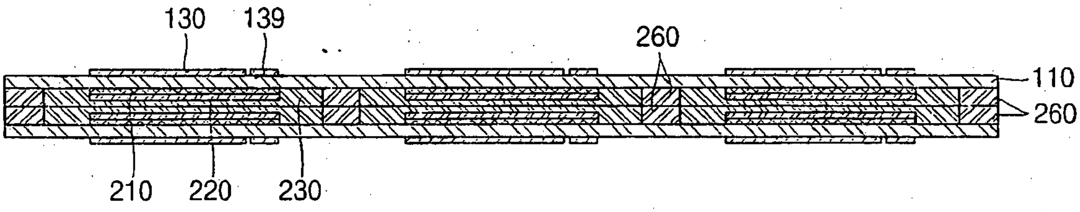


FIG. 5e

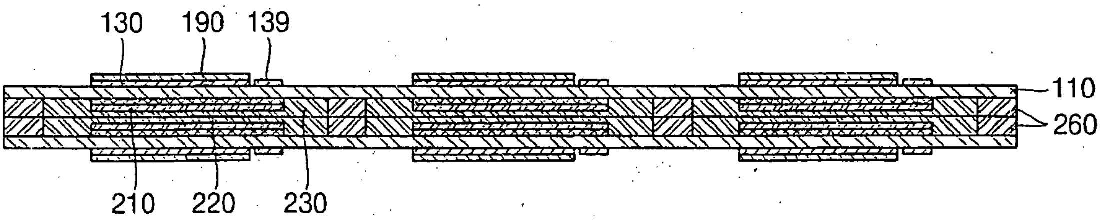


FIG. 5f

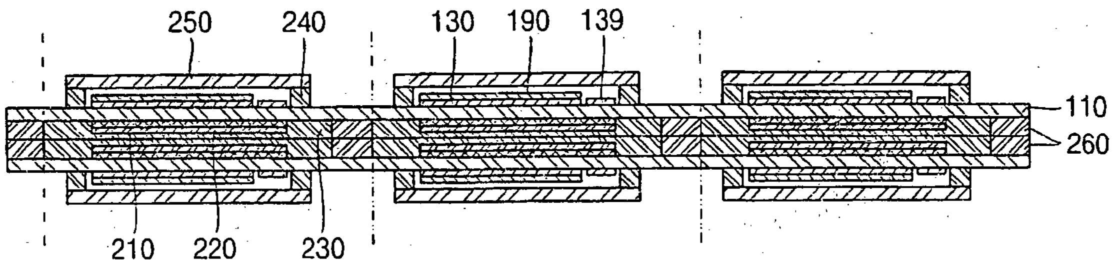


FIG. 5g

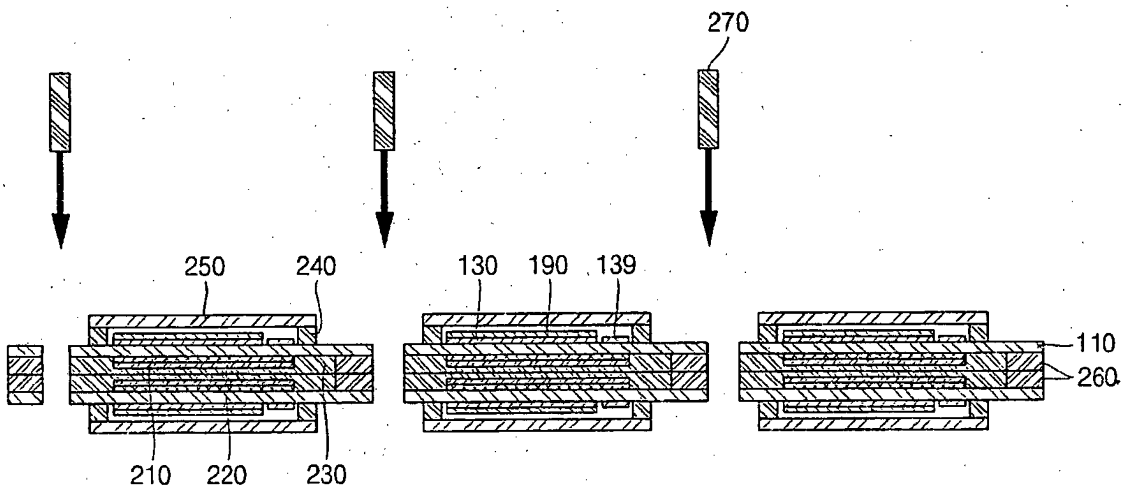


FIG. 5h

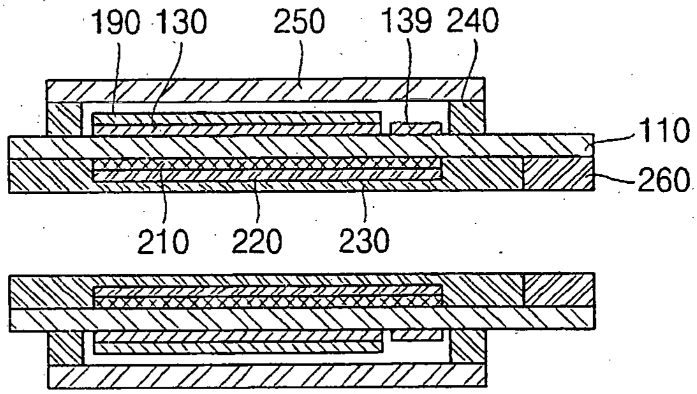


FIG. 5i

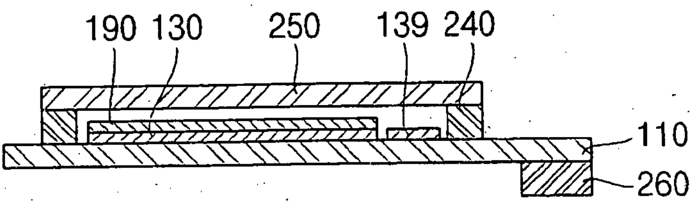
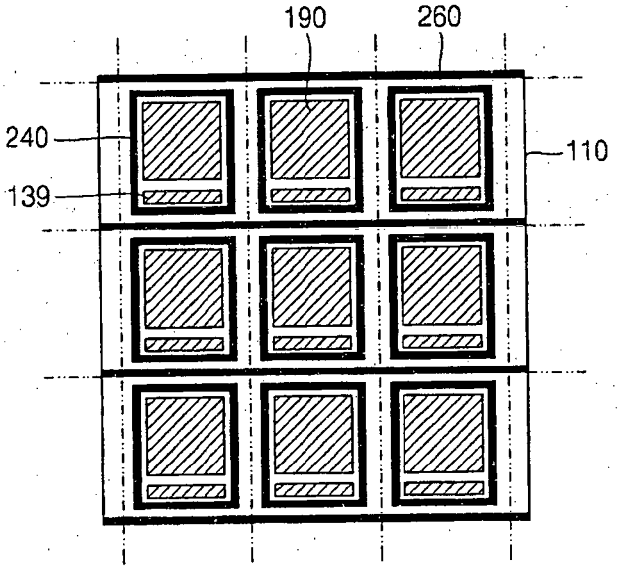


FIG. 6



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- JP 2005340182 A **[0006]**
- JP 2005222930 A **[0006]**
- JP 2005222789 A **[0006]**
- US 20050285522 A **[0009]**
- US 20030020124 A **[0010]**
- US 5811866 A **[0011]**
- JP 2003173872 B **[0012]**

专利名称(译)	制造有机发光显示器的方法		
公开(公告)号	EP1928041B1	公开(公告)日	2014-04-16
申请号	EP2007252153	申请日	2007-05-25
[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DISPLAY CO.，LTD.		
[标]发明人	KIM JONGYUN C O LEGAL & IP TEAM CHOI BYOUNGDEOG C O LEGAL & IP TEAM		
发明人	KIM, JONGYUN C/O LEGAL & IP TEAM CHOI, BYOUNGDEOG C/O LEGAL & IP TEAM		
IPC分类号	H01L51/52 H01L51/56		
CPC分类号	H01L51/5246 H01L51/0097 H01L51/56 H01L2251/5338		
优先权	1020060120208 2006-11-30 KR		
其他公开文献	EP1928041A1		
外部链接	Espacenet		

摘要(译)

有机发光显示器（101）包括基板（110），布置在基板（110）的顶表面上的半导体层（130），布置在半导体层（130）上的有机发光二极管（190），密封剂（240），设置在基板（110）的顶表面上，在半导体层（130）和有机发光二极管（190）的外围，密封基板（250），与密封剂（240）结合）和布置在基板（110）的下表面上的粘合剂（260）。还公开了根据上述的制造有机发光显示器的方法。

FIG.1

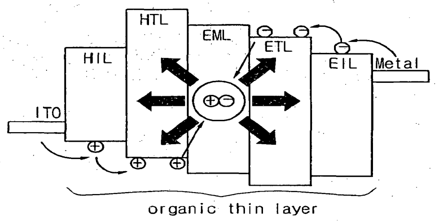

FIG.2a