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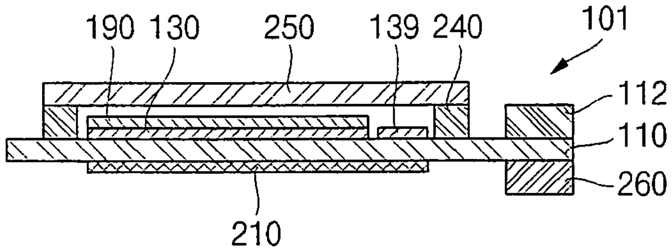
(54) **Organic light emitting display and fabricating method thereof**

(57) An organic light emitting display (101) including a substrate (110), a semiconductor layer (130) formed on the substrate (110), an organic light emitting diode (190) formed on the semiconductor layer (130), an encapsulant (240) formed on a periphery of the substrate (110) which is an outer periphery of the organic light emitting diode (190) and the semiconductor layer (130); and an encapsulation substrate (250) attached to the encapsulant (240).

FIG. 2a



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Description

BACKGROUND OF THE INVENTION

Field of the Invention

[0001] The present invention relates to an organic light emitting display and a fabrication method thereof and, more particularly, the present invention relates to a thin organic light emitting display having a reduced fabrication process time and can prevent a substrate from being bent and damaged during the fabrication 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 it typically offers a wide range of vision, a super high-speed response, and spontaneous light emission, 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 fabrication processes are simple, the device can be fabricated at a low cost. As organic thin layer material technology and the relevant process technology are being developed rapidly, they are considered to be the technology which 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 become slimmer, it is desirable 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 fabrication method has a problem in that the fabrication 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 fabrication method has a problem in that the yield of production is low and the fabrication cost is high 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.

SUMMARY OF THE INVENTION

[0009] The present invention is conceived to solve the above-mentioned problems, and the object of the present invention is to provide a thin organic light emitting display.

[0010] Another object of the present invention is to prevent the bending and damage of the substrate during the fabrication process.

[0011] Another object of the present invention is to shorten the fabrication process time of an organic light emitting display.

[0012] Another object of the present invention is to prevent UV-radiation from reaching on the substrate when it is not desired during the fabrication process.

[0013] According to a first aspect of the invention there is provided, an organic light emitting display as set out in claim 1. Preferred features are set out in claims 2 to 22..

[0014] According to a second aspect of the invention there is provided a method for fabricating an organic light emitting display as set out in claim 23. Preferred features are set out in claims 24 to 45.

[0015] Since an organic light emitting display according to an embodiment of the present invention is formed on the substrate having a thickness of 0.05~1mm, it is easily applied to various kinds of display electronic products as a mobile phone, PDA, a notebook, a computer monitor, and a television and so on which are recently getting slimmer.

[0016] Since an organic light emitting display according to an embodiment of the present invention has the non-transmissive layer formed on the substrate, UV-rays do not affect a semiconductor layer or an organic light emitting display element while the products are being used.

[0017] Since the support or an bonding agent remains one side of the substrate in an organic light emitting display according to an embodiment of the present invention, the rigidity of a product is enhanced and thus the device can not easily damaged by the external force.

[0018] In a method of fabricating an organic light emitting display according to an embodiment of the present invention, since the semiconductor process and the organic thin layer process (washing, etching, exposure, and a heat process are included in every fabricating process) is performed simultaneously after bonding two thin-type substrates having a thickness of 0.05-1mm, the entire process time is shortened by 50%, and the substrate is protected from bending or damages during a transfer process of the substrate by enhancing the rigidity.

[0019] In a method of fabricating an organic light emitting display according an embodiment of the present invention, since a support is formed on one side of a substrate in advance, bending and damages for a substrate is prevented during a fabricating process or after a fabricating process. Therefore, an excellent semiconductor layer and an organic thin layer are formed during a fabricating process without any inferior quality.

[0020] In a method of fabricating an organic light emitting display according to an embodiment of the present invention, since a non-transmissive layer is formed on the under surface of the substrate, the UV-rays generated due to the exposure process does not affect another opposing substrate during a fabricating process.

[0021] In a method of fabricating an organic light emitting display according to an embodiment of the present invention, since an anti-friction layer is formed on a substrate, when bonding two substrates, damage to the substrate is prevented by preventing contact with a metal formed on the substrate or the surface of the substrate.

BRIEF DESCRIPTION OF THE DRAWINGS

[0022] 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:

[0023] FIG. 1 is a schematic diagram of an organic light emitting display element;

[0024] FIG. 2a and FIG. 2b are cross-sections of an organic light emitting display according to an embodiment of the present invention;

[0025] FIG. 3a and FIG. 3b are cross-sections of an organic light emitting display according to an embodiment of the present invention before an encapsulation substrate is formed;

[0026] FIG. 4 is a flowchart of a method of fabricating an organic light emitting display according to an embodiment of the present invention;

[0027] FIG. 5a - FIG. 5i are views of a procedure of a method of fabricating an organic light emitting display according to an embodiment of the present invention; and

[0028] FIG. 6a - FIG. 6d are plan diagrams of the shape of various kinds of supports formed on a substrate of an organic light emitting display according to an embodiment of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

[0029] Hereinafter, embodiments of the present invention are explained in detail below with reference to the attached drawings so that and understanding of the present invention can be derived by a person having ordinary skill in the field to which the present invention belongs.

[0030] As illustrated in FIG. 2a, an organic light emitting display 101 according to an embodiment of the present invention includes a substrate 110, a semiconductor layer 130 formed on the substrate 110, a driving circuit 139 formed on one side of the semiconductor layer 130, an organic light emitting diode 190 formed on the semiconductor layer 130, an encapsulant 240 formed on an upper periphery of the substrate 110 which is the outer perimeter of the organic light emitting diode 190, the semiconductor layer 130 and the driving circuit 139, and an encapsulation substrate 250 attached to the encapsulant 240.

[0031] A support 112 having a constant thickness is further formed on the substrate 110 for preventing bending of the substrate 110 during or after a fabrication process. Since bending of the substrate 110 is prevented during the fabrication process, the driving circuit 139, the semiconductor layer 130, and the organic light emitting diode 190 are formed precisely without inferior quality. The support 112 remains on the substrate 110 even after completion of the fabrication process, thus improving the rigidity of the product. This support 112 is formed on the outer perimeter of the driving circuit 139, the semiconductor layer 130, and the encapsulant 240, and the support is formed in the vicinity of at least one side of the substrate 110. If the plan shape of the substrate 110 is a quadrangle, the support 112 is provided in the vicinity of one side, two sides, three sides or four sides of the substrate 110. The thickness of the support 112 is less than that of the encapsulant 240, or the entire thickness of the encapsulant and the encapsulation substrate to provide a thin organic light emitting display. The support 112 is an insulating material, a conductive material, or the equivalents thereof. However, the material is not limited thereto. For example, the support 112 can be formed of a reinforced plastic or stainless steel. The support 112 is attached to the substrate 110 by a bonding agent which is not illustrated. The support 112 is formed of the same material as that of the substrate 110 and the support 112 is formed simultaneously with the fabrication of the substrate 110.

[0032] The driving circuit 139 is formed on the surface of the substrate 110 between the semiconductor layer 130 and the encapsulant 240. This driving circuit 139, for example is a scan driver, a data driver, an emission driver, or a power control driver. However, the kind of driver is not limited thereto. The driving circuit 139 is formed simultaneously with the fabrication of the semiconductor layer 130.

[0033] The encapsulant 240 is an epoxy adhesive, a UV-ray setting adhesive, a frit or the equivalents thereof. However, the material is not limited thereto. If a frit is used as the encapsulant 240, since it is necessary to heat the frit to a predetermined temperature, an encapsulation process is executed using a laser beam. That is, if the laser beam is illuminated on the frit from one side after positioning the frit between the substrate 110 and the encapsulant 240, the frit starts to melt, and then the substrate 110 becomes strongly attached to the encapsulation substrate 250.

[0034] The encapsulation substrate 250 is formed of a transparent glass, a transparent plastic, a transparent polymer or the equivalents thereof. However, the material is not limited thereto.

[0035] In the substrate 110, a bonding agent 260 having a constant thickness is formed on the side opposite to the side on which the support 112 is formed. The drawing shows that the bonding agent 260 is formed facing the support 112 centering on the substrate 110. However, the present invention is not limited to this position. That is, the support 112 and the bonding agent 260 can also be respectively formed on positions in which they do not face each other. The bonding agent 260 is formed during the fabrication process of an organic light emitting display according to an embodiment of the present invention, but it also performs a function for reinforcing the rigidity of the substrate after completion of the product. The bonding agent 260 can be formed in the vicinity of at least one side of the under surface of the substrate 110. The bonding agent 260 is formed in the vicinity of all sides of the under surface of the substrate 110. The bonding agent 260 can also be formed on the under surface of the substrate 110 corresponding to the outer periphery of the organic light emitting diode 190 and the semiconductor layer 130. The bonding agent 260 can also be formed on the under surface of the substrate 110 corresponding to the outer periphery of the encapsulant 240 and the encapsulation substrate 250. The bonding agent 260 is an epoxy adhesive, a UV-ray setting adhesive, or the equivalents thereof. However, the bonding agent 260 material is not limited thereto. The bonding agent 260 having a thickness of about 10~100μm is formed. If the thickness of the bonding agent 260 is less than 10μm, two substrates 110 are in contact during a fabrication process and the rigidity is feeble, and if the thickness of the bonding agent 260 is more than 100μm, the two substrates 110 become excessively thick. The range of the substrate 110 must be greater than that of the encapsulant so that the bonding agent 260 is positioned on the outer periphery of the organic light emitting diode 190, the semiconductor layer 130, the encapsulant 240 and the encapsulation substrate 250.

[0036] On the contrary, the non-transmissive layer 130 is further formed on the top surface of the substrate 110 for preventing UV-radiation from being transmitted to the semiconductor layer 130 or an organic light emitting display element 190 during the fabrication process or after the fabrication process.

[0037] As illustrated in FIG. 2b, in an organic light emitting display 102 according to an embodiment of the present invention, the non-transmissive layer 210 and an anti-friction layer 230 are formed in sequence on the under surface of the substrate 110.

[0038] It is not described in the drawings, but a transparent moisture absorption layer is further formed on the under surface of the encapsulation substrate 250. Since an organic light emitting diode 190 is vulnerable to moisture, it is possible to form the transparent moisture absorption layer on the under surface of the encapsulation substrate 250 which can absorb moisture without hindering the progress of the light. If the transparent moisture absorption layer is getting thicker when the transparency of the encapsulation substrate 250 is secured, it is very useful, and it is preferable that the film having a thickness of 0.1~300μm is formed If the thickness of the transparent moisture absorption layer is below 0.1μm, the transparent moisture absorption layer does not have a sufficient moisture absorption characteristic, and if the thickness of the transparent moisture absorption layer is above 300μm, the transparent moisture absorption layer is in a danger of contacting with the organic light emitting diode 190. The transparent moisture absorption layer is formed of at least one material selected from, but not limited to; an alkali metal oxide, an alkaline-earth metal oxide, a metal halide, a metal sulfate and a metal perchlorate, a phosphorus pentoxide (P_2O_5) and their equivalents the average particle diameter of which is below 100 nm and, in particular, is from 20nm to 100nm.

[0039] According to an embodiment of the present invention, any one selected from a layered inorganic substance, a high-polymer, a hardening agent and the equivalents thereof is filled between the substrate 110 and the encapsulant substrate 250 so that moisture is absorbed instead of forming the transparent moisture absorption layer on the encapsulant substrate 250. Afer the filling, a heat treatment process is executed to harden the material.

[0040] The present invention can also prevent the reflection of external light by attaching a polarizer film on the surface of each encapsulant substrate 250.

[0041] Referring to FIG. 3a and FIG. 3b, an organic light emitting display according to an embodiment of the present invention before sealing an encapsulation substrate is described.

[0042] As illustrated in FIG. 3a, an organic light emitting display 101 according to an embodiment of the present invention can include 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 film 180 formed on the source/drain electrode 170, an organic light emitting diode 190 formed on the insulating film 180, and a pixel defining film 200 formed on the insulating film 180, which is the outer periphery of the organic light emitting diode 190.

[0043] The top surface and the under surface of the substrate 110 are approximately flat, and the substrate has a thickness of about 0.05-1mm. If the thickness of the substrate 110 is less than about 0.05mm, it can be damaged easily due to washing, etching, and a heating process during the fabrication processes, and can be destroyed easily by external forces. If the thickness of the substrate 110 is more than about 1mm, it is difficult to apply it to various kinds of thin display devices. The substrate 110 is formed of a glass, a plastic, a polymer, a stainless steel or the equivalents thereof. However, the present invention is not limited to these materials.

[0044] The buffer layer 120 having a constant thickness is formed on the top surface of the substrate 110. The buffer layer 120 prevents moisture (H_2O), hydrogen (H_2), or oxygen (O_2) and etc. from penetrating and permeating into the semiconductor layer 140 or the organic light emitting diode 190, which are described later, via the substrate 110. The buffer layer 120 is formed using a silicon dioxide film(SiO_2), a silicon nitrate film(Si_3N_4), or the equivalents thereof which is easily fabricated during a semiconductor process. However, the present invention is not limited to these materials. This buffer layer 120 can also be omitted if necessary.

[0045] The semiconductor layer 130 is formed on the top surface of the buffer layer 120. Such a semiconductor layer 130 can include a source/drain region 132 formed on two opposing sides, and a channel region 134 formed between the source/drain regions 132. As an example, the semiconductor layer 130 is a thin-film transistor. Such a thin-film transistor can be an amorphous silicon thin-film transistor, a poly-silicon thin-film transistor, an organic thin layer transistor, a micro silicon thin-film transistor or the equivalents thereof. However, the present invention is not limited to these kinds of thin-film transistors. If the thin-film transistor is a poly-silicon thin-film transistor, it is crystallized by a crystallization method using a laser at a low temperature, a crystallization method using a metal, a crystallization method using a high pressure, or equivalent methods. However, the present invention is not limited to these crystallization methods. Excimer Laser Annealing (ELA), Sequential Lateral Solidification (SLS), and Thin Beam Direction Crystallization (TDX) are examples of crystallizing methods using the laser. However, the present invention is not limited to these methods. Solid Phase Crystallization (SPC), Metal Induced Crystallization (MIC), Metal Induced Lateral Crystallization (MILC), and Super Grained Silicon (SGS) are examples of crystallization methods using a metal. However, the present invention is not limited to these crystallization methods. The thin-film transistor is a PMOS or NMOS transistor or the equivalents. However, the present invention is not limited to these types of thin-film transistors.

[0046] The gate insulating layer 140 is formed on the top surface of the semiconductor layer 130 and the buffer layer 120 at the outer periphery of the semiconductor layer 130. The gate insulating layer 140 is formed using a silicon dioxide film, a silicon nitrate film, or the equivalents thereof which are easily obtained during a semiconductor process. However, the present invention is not limited to these materials.

[0047] The gate electrode 150 is formed on the top surface of the gate insulating layer 140. 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. This gate electrode 150 enables a channel of a hole or an electron to be formed on the channel region 134 by supplying an electric field to a channel region of the under surface of the gate insulating layer 140. The gate electrode 150 is formed of a common metal (Mo, MoW, Ti, Cu, Al, AlNd, Cr, Mo alloy, Cu alloy, A1 alloy, etc.), or a doped poly-silicon or equivalents thereof. However, the present invention is not limited to these materials.

[0048] The inter-layer dielectric layer 160 is formed on the top surface of the gate electrode 150. The inter-layer dielectric layer 160 can also be formed on the gate insulating layer 140 at the outer periphery of the gate electrode 150. The inter-layer dielectric layer 160 is formed by a polymer system, a plastic system, a glass system, or the equivalent systems. However, the present invention is not limited to these materials.

[0049] The source/drain electrode 170 is formed on the top surface of the inter-layer dielectric layer 160. An electrically conductive contact 176 penetrating through the interlayer dielectric layer 170 is formed between the source/drain electrode 170 and the semiconductor layer 130. The source/drain electrode 170 and the semiconductor layer 130 are electrically connected together by the electrically conductive contact 176. The source/drain electrode 170 is formed of the same material used to form the gate electrode 150. However, the present invention is not limited to this material. The semiconductor layer 130 (that is, a thin-film transistor) is generally defined as a coplanar structure. However, the semiconductor layer 130 of the present invention is not limited to the coplanar structure, and it is formed as at least one structure selected from the structures of all kinds of known thin-film transistors, for example, an inverted coplanar structure, a staggered structure, an inverted staggered structure or the equivalent structures. However, the present invention is not limited to these structures.

[0050] The insulating film 180 is formed on the top surface of the source/drain electrode 170. The insulating film 180 can include a protection layer 182 and a planarization layer 184 formed on the top surface of the protection layer 182. The protection layer 182 covers the source/drain electrode 170 and the inter-layer dielectric layer 160, and protects the source/drain electrode 170 and the inter-layer dielectric layer 160. The protection layer 182 is formed of an inorganic film or equivalents thereof. However, the present invention is not limited to this material. Moreover, the planarization layer 184 covers the protection layer 182. The planarization layer 184 flattens the entire surface of an element, and is formed by coating or depositing Benzo Cyclo Butene (BCB), acryl, or the equivalents thereof. However, the present invention is not limited to these materials or formation methods of the planarization layer 184.

[0051] The organic light emitting diode 190 is formed on the top surface of the insulating film 180. The organic light emitting diode 190 includes an anode 192, an organic thin layer 194 formed on the top surface of the anode 192, and a cathode 196 on the top surface of the organic thin layer 194. The anode 192 is formed of Indium Tin Oxide (ITO), Indium Tin Oxide (ITO)/Ag, Indium Tin Oxide (ITO)/Ag/ITO(IZO: Indium Zinc Oxide) or the equivalents thereof. However, the present invention is not limited to these materials or formation methods of the anode 192. 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 layer 194 includes an EML that emits light by joining the electrons with the holes and forming excitons, an ETL that adjusts the moving velocity of the electron, and an HTL that adjusts the moving velocity of the hole. Moreover, an EIL for improving the injection efficiency of the electrons is formed on the ETL, and an HIL for improving the injection efficiency of the holes is further formed on the HTL. Furthermore, the cathode 196 is formed of Al, MgAg alloy, MgCa alloy or their equivalents. However, the present invention is not limited thereto. If the top emission system is employed in the present invention, then the thickness of the Al must be very thin. However, in such a 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. Moreover, the anode 192 of the organic light emitting diode 190 and the source/drain electrode 170 are electrically interconnected by an electrically conductive via 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 of the upper part of the substrate 110, the present invention can also be applied to a bottom emission system in which the light is emitted in the direction of the lower part of the substrate 110 or a dual emission system in which the light is simultaneously emitted in the directions of the upper and lower parts of the substrate 110.

[0052] In a case of phosphorescent organic light emitting diode, a Hole Blocking Layer (HBL) is selectively formed between the EML and the ETL, and the EBL is selectively formed between the EML and the HTL.

[0053] The organic thin layer 194 can also be a thin OLED which further reduces the thickness by mixing two kinds of layers. For example, a Hole Injection Transport Layer (HITL) structure which forms the HIL and the HTL at the same time, and an Electron Injection Transport Layer (EITL) structure which forms the EIL and the ETL at the same time are selectively formed. The thin OLED is used for increasing the light-emitting efficiency.

[0054] A buffer layer as a selection layer is formed between the anode and the emitting layer. The buffer layer is classified into an electron buffer layer for buffering the electrons, and a hole buffer layer for buffering the holes. The electron buffer layer is selectively formed between the cathode and the EIL, and is formed instead of the functions of the EIL. The stack structure of the organic thin layer 194 can include the EML/ETL/electron buffer layer/cathode. Furthermore, the hole buffer layer is selectively formed between the anode and the HIL, and is formed instead of the functions of the HIL. The stack structure of the organic thin layer 194 can include the anode/ hole buffer layer/hole transport layer /ETL/EML.

[0055] In connection with above structure, the stacked structures obtained are as follows.

a) Normal Stack Structure

[0056] 1) an anode/a hole injection layer/a hole transport layer/a light emitting layer/an electron transport layer/an electron injection layer/a cathode.

[0057] 2) an anode/a hole buffer layer/a hole injection layer/a hole transport layer/a light emitting layer/an electron transport layer/an electron injection layer/a cathode.

[0058] 3) an anode/a hole injection layer/a hole transport layer/a light emitting layer/an electron transport layer/an electron injection layer/an electron buffer layer/a cathode.

[0059] 4) an anode/a hole buffer layer/a hole injection layer/a hole transport layer/a light emitting layer/an electron transport layer/an electron injection layer/an electron buffer layer/a cathode.

[0060] 5) an anode/a hole injection layer/a hole buffer layer/a hole transport layer/a light emitting layer/an electron transport layer/an electron injection layer/a cathode.

[0061] 6) an anode/a hole injection layer/a hole transport layer/a light emitting layer/an electron transport layer/an electron buffer layer/an electron injection layer/a cathode.

b) Normal Thin Structure

[0062] 1) an anode/a hole injection and transport layer/a light emitting layer/an electron transport layer/an electron injection layer/a cathode.

[0063] 2) an anode/a hole buffer layer/a hole injection and transport layer/a light emitting layer/an electron transport layer/an electron injection layer/a cathode.

[0064] 3) an anode/a hole injection layer/a hole transport layer/a light emitting layer/an electron injection layer/an electron buffer layer/a cathode.

[0065] 4) an anode/a hole buffer layer/a hole transport layer/a light emitting layer/an electron injection and transport layer/an electron buffer layer/a cathode.

[0066] 5) an anode/a hole injection and transport layer/a hole buffer layer/a light emitting layer/an electron transport layer/an electron injection layer/a cathode.

[0067] 6) an anode/a hole injection layer/a hole transport layer/a light emitting layer/an electron buffer layer/an electron injection and transport layer/a cathode.

c) Inverted Stack Structure

[0068] 1) a cathode/an electron injection layer/an electron transport layer/a light emitting layer/a hole transport layer/a hole injection layer/an anode.

[0069] 2) a cathode/an electron injection layer/an electron transport layer/a light emitting layer/a hole transport layer/a hole injection layer/a hole buffer layer/an anode.

[0070] 3) a cathode/an electron buffer layer/an electron injection layer/an electron transport layer/a light emitting layer/a hole transport layer/a hole injection layer/an anode.

[0071] 4) a cathode/an electron buffer layer/an electron injection layer/an electron transport layer/a light emitting layer/a hole transport layer/a hole buffer layer/an anode.

[0072] 5) a cathode/an electron injection layer/an electron transport layer/a light emitting layer/a hole transport layer/a hole buffer layer/a hole injection layer/an anode.

[0073] 6) a cathode/an electron injection layer/an electron buffer layer/ an electron transport layer/a light emitting layer/a hole transport layer/a hole injection layer/an anode.

d) Inverted Thin Structure

[0074] 1) a cathode/an electron injection layer/an electron transport layer/a light emitting layer/a hole injection and transport layer/an anode.

[0075] 2) a cathode/an electron injection layer/an electron transport layer/a light emitting layer/a hole injection and transport layer/a hole buffer layer/an anode.

[0076] 3) a cathode/an electron buffer layer/an electron injection and transport layer/a light emitting layer/a hole transport layer/a hole injection layer/an anode.

[0077] 4) a cathode/an electron buffer layer/an electron injection and transport layer/a light emitting layer/a hole transport layer/a hole buffer layer/an anode.

[0078] 5) a cathode/an electron injection layer/an electron transport layer/a light emitting layer/a hole buffer layer/a hole injection and transport layer/an anode.

[0079] 6) a cathode/an electron injection and transport layer/an electron buffer layer/a light emitting layer/a hole transport layer/a hole injection layer/an anode.

[0080] The pixel defining layer 200 is an outer periphery of the organic light emitting diode 190, and is formed on the top surface of the insulating layer 180. Such a pixel defining layer 200 clearly defines the boundaries among a red organic light emitting diode, a green organic light emitting diode, and a blue organic light emitting diode. Such a pixel defining layer 200 is formed of a polyimide or equivalents thereof. However, the materials of the pixel defining layer 200 are not limited.

[0081] The non-transmissive layer 210 is further formed on the under surface of the substrate 110. Such a non-transmissive layer 210 prevents the UV-rays from impinging on the other opposing substrate during a fabrication process of the semiconductor layer 130 or an organic light emitting display element 190 by attaching two substrates. After the substrate 110 is separated individually, the non-transmissive layer 210 also prevents the external UV-rays from impinging upon the semiconductor layer 130 or an organic light emitting display element 190. The non-transmissive layer 210 is formed in sequence of a UV-ray protective agent or equivalents thereof. The non-transmissive layer 210 is formed of a metal into which a UV-rays can not penetrate, a transparent UV-ray protective agent, an opaque UV-ray protective agent, or the equivalents thereof. If the non-transmissive layer 210 is a metal, it is formed of Cr, Cr_2O_3, Al, Au, Ag, MgO, silver alloy, or the equivalents thereof, However, the present invention is not limited to these materials. It is preferable that the non-transmissive layer 210 having a thickness of about 500Å to 3,000Å is formed. If the thickness of the non-transmissive layer 210 is less than 500Å, the blocking rate of the UV-rays is low, it can affect the semiconductor layer 130 or an organic light emitting display element 190 during a fabrication process or after a fabrication process, and if the thickness of the non-transmissive layer 210 is more than 3000Å, even though sufficient blocking efficiency in blocking the UV-rays is obtained, it becomes excessively thick.

[0082] As illustrated in FIG. 3b, an organic light emitting display 102 according to an embodiment of the present invention can further include an anti-friction layer 230 on the under surface of the non-transmissive layer

210. Such an anti-friction layer 230 prevents two substrates from being contacted during the process of forming the semiconductor layer 130, the organic light emitting diodes 190, and etc. by bonding two substrates 110. Such an anti-friction layer 230 is formed from an organic material, inorganic material or the equivalents thereof. However, the materials of the anti-friction layer 220 are not limited thereto. It is preferable that the anti-friction layer 230 have a thickness of 10-100μm. If the thickness of the anti-friction layer 230 is less than 10μm, it can contact the non-transmissive layer 210 formed on the other substrate 110 during the fabrication processes, and if the thickness of the anti-friction layer 230 is more than 100μm, the substrate 110 becomes excessively thick.

[0083] FIG. 4 is a flowchart of a method of fabricating an organic light emitting display according to an embodiment of the present invention.

[0084] 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 S1 of preparing a substrate, a step S2 of forming a non-transmissive layer, a step of S3 of bonding two prepared substrates, a step S4 of forming a semiconductor layer, a step S5 of forming an organic light emitting diode, an encapsulation step S6, and a sawing step S7 and a step S8 of separating the substrates. In an embodiment of the present invention, a step S9 of removing the non-transmissive layer is further included.

[0085] Referring to FIG. 5a-FIG. 5i, a method of fabricating the organic light emitting display according to an embodiment of the present invention is illustrated in cross-sectional views.

[0086] As illustrated in FIG. 5a, in step S1 of preparing a substrate, a substrate 110 having a substantially flat top surface and a substantially flat under surface, and having a constant thickness is provided.

[0087] It is preferable that the substrate 110 has a thickness of approximately 0.05-1mm. If the thickness of the substrate 110 is less than about 0.05mm, it is easily damaged due to washing, etching, and heat processes during the fabrication processes, it becomes difficult to handle, and is easily destroyed due to external forces. If the thickness of the substrate 110 is more than about 1mm, it is difficult to apply it to various kinds of display devices which are becoming thinner. The substrate 110 is formed of a glass, a plastic, a polymer or equivalents thereof. However, the present invention is not limited to these materials and kinds of substrates 110.

[0088] A support 112 having a constant thickness is further formed on the substrate 110 in order to prevent bending of the substrate 112 during or after a fabrication process. In particular, since bending of the substrate 110 is prevented during a fabrication process by the support 110, the driving circuit 139, the semiconductor layer 130, and the organic light emitting diode 190 can be formed precisely without inferior quality. The support 112 remains on the substrate 110 even after completion of a fabrication process, and thus the rigidity of a product is improved. This support 112 is formed on the outer periphery of the driving circuit 139, the semiconductor layer 130, and the encapsulant 240, and the support is formed in the vicinity of at least one side of the substrate 110. If the plane shape of the substrate 110 is a quadrangle, the support 112 is in the vicinity of one side, two sides, three sides or four sides of the substrate 110. The support 112 is thinner than the encapsulant 240, or the entire thickness of the encapsulant 240 and the encapsulation substrate 250 to provide a thin organic light emitting display. Moreover, the support 112 can be formed of an insulating material, a conductive material, or the equivalents thereof. However, the present invention is not limited to these materials. For example, the support 112 can be formed of a reinforced plastic or a stainless steel. Such a support 112 is attached to the substrate 110 by a bonding agent which is not illustrated. The support 112 can formed of the same material as that of the substrate 110, thereby making it possible to form the support 112 simultaneously with the substrate 110.

[0089] As illustrated in FIG. 5b, in step S2 for forming a non-transmissive layer, a non-transmissive layer 210 having a predetermined thickness is formed on the under surface of the substrate 110.

[0090] Such a non-transmissive layer 210 prevents the UV-rays from impinging upon another opposing substrate during a fabrication process of the semiconductor layer or an organic light emitting display element by bonding two substrates. After the substrate 110 is separated individually, the non-transmissive layer 210 also prevents the external UV-rays from impinging upon the semiconductor layer or an organic light emitting display element. The non-transmissive layer 210 is formed in sequence by coating the surface of the substrate with a UV-ray protective agent or an equivalent thereof. The non-transmissive layer 210 is formed by coating the surface of the substrate with a metal into which a UV-rays can not penetrate, a transparent UV-ray protective agent, an opaque UV-ray protective agent, or the equivalents thereof, or by depositing them on the surface of the substrate. If the non-transmissive layer 210 is a metal, it is formed by coating the surface of the substrate with Cr, Cr_2O_3, Al, Au, Ag, MgO, silver alloy, or the equivalents thereof, or by depositing them on the surface of the substrate. It is preferable that the non-transmissive layer 210 has a thickness of about 500Å to 3,000Å. If the thickness of the non-transmissive layer 210 is less than 500Å, the blocking of UV-rays is low, so that it affects the semiconductor layer 130 or an organic light emitting display element 190 during a fabrication process or after a fabrication process. If the thickness of the non-transmissive layer 210 is greater than 3000Å, even though sufficient blocking of the UV-rays is obtained, it becomes excessively thick.

[0091] In step S2 of forming a non-transmissive layer, an anti-friction layer 230 is further formed on the under surface of the non-transmissive layer 210. The anti-friction layer 230 prevents two substrates from being contacted during the process for forming the semiconductor layer, the organic light emitting diodes, etc. by bonding two substrates 110. Damage of the substrate 110 is prevented by allowing the non-transmissive layers 210 formed on both substrates 110 not to be in contact with each other. Such an anti-friction layer 230 is formed of an organic material, an inorganic material or the equivalents thereof. However, the materials of the anti-friction layer 220 are not limited thereto. It is preferable that the anti-friction layer 230 has a thickness of 10-100μm. If the thickness of the anti-friction layer 230 is less than 10μm, it is highly probable that it will contact the non-transmissive layer 210 formed on the other substrate 110 during the fabrication processes and if the thickness of the anti-friction layer 230 is greater than 100μm, the substrate 110 becomes excessively thick.

[0092] As illustrated in FIG. 5c, in step S3 of bonding two substrates, two same substrates 110 in which the non-transmissive layer 210, or the non-transmissive layer 210/the anti-friction layer 220 are prepared and are bonded together. In FIG. 5c, the sequential flow for forming the non-transmissive layer 210/the anti-friction layer 220 is illustrated.

[0093] A bonding agent 260 is inserted between two substrates so that the two substrates can not be separated. An epoxy adhesive, a UV-ray setting adhesive, or the equivalents thereof are employed as the bonding agent 260. However, the present invention is not limited to these materials of the bonding agent 260. The bonding agent 260 is formed on the periphery of the substrate 110, or is formed on the inner periphery of both substrates 110 as a plurality of lines for more stable adhesion of the substrate 110. In FIG. 5c, a structure is illustrated in which a plurality of bonding agents 260 is formed between two substrates 110.

[0094] The bonding agent 260 is formed to face the support 112 on the substrate 110 in the drawings. However, the present invention is not limited to such an opposing position. The support 112 and the bonding agent 260 can also be respectively formed in positions in which they do not face each other.

[0095] The anti-friction layer 230 can also be formed in step S3 of bonding two substrates 110 as well as the step S2 of forming the non-transmissive layer 210. If an anti-friction layer 220 of a liquid type is injected into the substrates after bonding two substrates 110 by inserting an bonding agent 260, all of it seeps into a gap between formed between two substrates 110 due to a capillary phenomenon. It is preferable that the anti-friction layer 230 is hardened by applying a heat treatment to the substrate 110 at a predetermined temperature after the anti-friction layer 230 of a liquid type is formed. It is preferable that the anti-friction layers 230 formed on two substrates 110 are in tight contact with each other to prevent bending and friction of the substrate 110.

[0096] As illustrated in FIG. 5d, in step S4 of forming the semiconductor layer, a semiconductor layer is formed on a respective surface of each of the bonded substrates 110. A driving circuit 139 can also be formed on one side of the semiconductor layer 130. To be more specific, a semiconductor layer 130 is formed on the surface of each of the two bonded substrates 110 which is an opposite surface to the surface on which the anti-friction layers 230 is formed for driving the organic light emitting display. A driving circuit 139 can also be formed on one side of the semiconductor layer 130. It is possible to form a buffer layer (not illustrated) on the surface of the substrate 110 in advance before forming the driving circuit 139 or the semiconductor layer 130. After forming the semiconductor layer 130, a gate insulating layer, a gate electrode, an interlayer insulating layer, a source/drain electrode, an insulating layer(not illustrated) and so on are formed. Explanations related to these elements have been described sufficiently in the preceding sections, and thus explanations about them have been omitted. It is possible to form a pixel defining layer after forming the insulating layer.

[0097] After the driving circuit 139 and the semiconductor layer 130 are formed on one substrate, they are formed on the other substrate. After the driving circuit 139 and the semiconductor layer 130 are formed on one substrate, it is possible to form the driving circuit 139 and the semiconductor layer 130 on the other substrate once again. The semiconductor layer 130 and the driving circuit 139 is formed by turning over one substrate and the other substrate according to the sequence of the processes. If the process equipment is available, the semiconductor layer 130 and the driving circuit 139 can be simultaneously formed on both substrates.

[0098] As illustrated in FIG. 5e, in step S5 of forming an organic light emitting diode, the organic light emitting diode 190 is formed on the top surface of the semiconductor layer 130. To be more specific, as noted above, the anode and the organic thin layer, and the cathode are formed on the insulating layer (not illustrated). The structure of the organic light emitting diode 190 and the method for forming it have already been explained, and an explanation related to it has been omitted.

[0099] Likewise, after the organic light emitting diode 190 is formed on one substrate, it is possible to form the organic light emitting diode 190 on the other substrate. It is possible to form the organic light emitting diode 190 on one substrate, and then to form the organic light emitting diode 190 on the other substrate. The organic light emitting diode 190 is formed by flipping over the substrates according to the sequence of the processes. If the process equipment is available, the organic light emitting diode 190 is simultaneously formed on both substrates.

[0100] As illustrated in FIG. 5f, in step S6 of bonding the encapsulation substrate, the encapsulation substrate 240 is attached to the side on which the organic light emitting diode 190 and the semiconductor layer 130 are formed using the encapsulant 230. The encapsulation substrate 240 is formed of a transparent glass, a transparent plastic, a transparent polymer or the equivalents thereof. However, the present invention is not limited to these materials of the encapsulation substrate 240. It is preferable that an encapsulation substrate 240 having an area smaller than the area formed by the bonding agent 260 is used. To be more specific, it is possible to perform sawing of the edge of the substrate 110 easily by forming the edge of the encapsulation substrate 240 smaller by about 3-8mm in the inside direction from the bonding agent 260. However, the distance of the encapsulation substrate 240 to the bonding agent 260 is not limited thereto. The encapsulant 230 is an epoxy adhesive, a UV-ray setting adhesive, a frit or the equivalents thereof. However, the materials thereof are not limited thereto. If a frit is used as the encapsulant 230, since it is necessary to heat the frit at a predetermined temperature, an encapsulation process can be executed by using a laser beam.

[0101] In the drawings, although the encapsulation process is executed using a respective encapsulation substrate 240 for each region where the driving circuit 139, the organic light emitting diode 190 and each semiconductor layer 130 are formed, it is possible to reduce the complexity of the processes by performing the above processes using an integral-type encapsulation substrate.

[0102] Alhough not illustrated, in an embodiment of the present invention e a transparent moisture absorption layer can be formed on the under surface of the encapsulation substrate 240. Since an organic light emitting diode 190 is vulnerable to moisture, it is possible to form the transparent moisture absorption layer on the under surface of the encapsulation substrate 250 to absorb moisture without hindering the progress of the light. Such a transparent moisture absorption layer is more advantageous as it becomes thicker as long as the transparency of the encapsulation substrate 240 is obtained.I It is preferable that a film having a thickness of 0.1~300μm is formed. If the thickness of the transparent moisture absorption layer is less than 0.1 μm, the transparent moisture absorption layer does not have a sufficient moisture absorption characteristic, and if the thickness of the transparent moisture absorption layer is greater than 300μm, the transparent moisture absorption layer is in a danger of contacting with the organic light emitting diode 190. The transparent moisture absorption layer is formed of an alkali metal oxide, an alkaline earth metal oxide, a metal halide, a metal sulfate, and a metal perchlorate, a phosphorus(P_2O_5) or the equivalents thereof having an average particle diameter of 100nm or less, in particular, an average particle diameter of 20-100nm. However, the present invention is not limited to these materials.

[0103] Further, as noted above, according to embodiments of the present invention, an encapsulation process is completed by allowing a layered inorganic substance, a high-polymer, a hardening agent or the equivalents thereof to fill the space between the substrate 110 and the encapsulant 240 instead of forming the transparent moisture absorption layer on the encapsulation substrate 240. Of course, after such a filling, a heat treatment process is executed, and thus the above-mentioned materials are cured.

[0104] According to embodiments of the present invention, it is natural that the reflection phenomenon of the external light is improved by attaching a polarizing film on the surface of every encapsulation substrate 240.

[0105] As illustrated in FIG. 5g, at the sawing step S7, a sawing process is applied to the substrate 110 so that it is separated into a unit organic light emitting display. It is possible to apply a sawing process to the substrate 110 arranged on the outer periphery of the semiconductor layer 130, the driving circuit 139, and the organic light emitting diode 190. The sawing process is executed by a diamond wheel, a laser beam, or the equivalent methods. However, the present invention is not limited to these sawing methods. In the drawings, the symbol 270 which is not explained is a laser beam emitting device.

[0106] The sawing process is executed so that the support 112 and the bonding agent 260 can remain on at least one side of the substrate 110 during the sawing process. In FIG. 5g, the sawing process is executed so that both the support 112 and the bonding agent 260 remain on the right end of the substrate 110. In this way, the support 112 and the bonding agent 260 remaining in the substrate 110 perform a function to secure the rigidity of the substrate 110 during many processes.

[0107] As illustrated in FIG. 5h, in step S8 of separating two substrates, two substrates 110 to which a sawing process is applied are separated individually. The non-transmissive layer 219 and the non-transmissive layer 219/the anti-friction layer 230 as well as the support 112 and the bonding agent 260 remain on the separated substrate 110. In the drawings, the non-transmissive layer 219/the anti-friction layer 230 remains on the under surface of the substrate 110.

[0108] If the anti-friction layer 230 is formed on each substrate 110 individually before the step of bonding two substrates, separation of the substrates 110 is easily executed. However, if an anti-friction layer 230 of a liquid type is injected after bonding two substrates, the separation of each substrate 110 is not be easily executed. The anti-friction layer 230 is eliminated by using a chemical solution which can dissolve the anti-friction layer 230. It is preferable that the anti-friction layer 230 is formed by an organic material which is dissolved in the chemical solution for this purpose.

[0109] According to embodiments of the present invention, the process is terminated by designating the step of separating two substrates 110 as the final step. After the step of separating two substrates 110, the display device is marketed as a product after passing through a cell test, Flexible Printed Circuit (FPC) bonding, a module test, and a reliability test. The cell test is executed before the sawing step by creating an additional region on the substrate.

[0110] If the step of separating two substrates 110 is employed as a final process as described above, the non-transmissive layer 219 and the non-transmissive layer 219/the anti-friction layer 230, as well as the support 112 and the bonding agent 260 can remain on the organic light emitting display.

[0111] As illustrated in FIG. 5i, in step S9 of removing the non-transmissive layer 219, the non-transmissive layer 219 is removed by an etching or a grinding process. To be more specific, if only the non-transmissive layer 219 remains on the under surface of the substrate 110, the non-transmissive layer 219 is removed. If the non-transmissive layer 219/the anti-friction layer 230 remain on the under surface of the substrate 110, only the anti-friction layer 230 is removed or both of the non-transmissive layer 219/the anti-friction layer is removed. Even after the non-transmissive layer 219 and so on are removed, since the support 112 and the bonding agent 260 remain one side of the substrate 110, the rigidity of the substrate 110 is improved.

[0112] FIG. 6a - FIG. 6d illustrate a planar diagram of the shape of various kinds of supports formed on a substrate of an organic light emitting display according toembodiments of the present invention.

[0113] As illustrated in the drawings, the organic light emitting diode 240 and the driving circuit 139 are arranged in a matrix on the substrate 110. Both the organic light emitting diode 240 and the driving circuit 139 are defined as a unit. 33 units are arranged in the drawings. However, the present invention is not limited to 33 units. The support 112 is formed on the top surface of the substrate 110 in order to prevent bending during a fabrication process or after a fabrication process.

[0114] As illustrated in FIG. 6a, the support 112 is formed as lines in a horizontal direction. As illustrated in FIG. 6b, the support 112 is formed as the lines in a vertical direction. As illustrated in FIG. 6c, the support 112 is formed as a combination (that is, a checkerboard shape) of lines in a vertical direction and lines in a horizontal direction. As illustrated in FIG. 6d, the support 112 is formed as a quadrangle line shape along four sides of the substrate 110.

[0115] A two-dot chain line in the drawings indicates a sawing line. As illustrated in the drawings, the sawing lines form a checkerboard line shape. The support 112 is formed in the vertical direction, the horizontal direction, or is formed in the vertical direction and the horizontal direction simultaneously along one side of the sawing line.

[0116] Therefore, as described above, if a sawing process is executed along the sawing line, the support 112 having a predetermined thickness remains on the end portion of one side of the substrate 110. According to the formation position of the substrate 110, the position of the support 112 remaining on the substrate 110 will vary. While the width of the support 112 is formed as being somewhat larger than that of the sawing diversely, if the support 112 is formed along the entire sawing line, the support 112 can remain on all peripheries (a quadrangle periphery) of the substrate 110 to which a sawing process is applied.

[0117] As described above, the support 112 prevents the organic light emitting display from being damaged or destroyed by reinforcing the rigidity during the remaining processes of the organic light emitting display or while the device is being used.

[0118] Since the organic light emitting display according to embodiments of the present invention described above is formed on a substrate having a thickness of 0.05-1mm, it can be applied to cellular telephones, PDAs, notebooks, computer monitors, and televisions and so on which are becoming thinner.

[0119] As noted above, in an organic light emitting display according to embodiments of the present invention, since the non-transmissive layer is formed on the substrate, UV-rays do not affect a semiconductor layer or an organic light emitting display element while the products are being used.

[0120] As noted above, in an organic light emitting display according to embodiments of the present invention, since the support or an bonding agent remains on one side of the substrate, the rigidity of a product is enhanced and thus the device can not be easily damaged by external forces.

[0121] As noted above, in an organic light emitting display according to embodiments of the present invention, since the semiconductor processes and the organic thin layer processes (washing, etching, exposure, and a heat process are included in every fabricating process) are performed simultaneously after attaching two thin-type substrates having a thickness of 0.05-1mm, the entire process time is shortened by 50%, and the substrate is protected from bending or damage during a transfer process of the substrate by reinforcing the rigidity.

[0122] As noted above, in the method for fabricating an organic light emitting display according to embodiments of the present invention, since a support is formed on one side of a substrate in advance, substrate bending and damage is prevented during a fabrication process. The processes related to a semiconductor layer and an organic thin layer are executed excellently without any inferior quality during a fabricating process.

[0123] As noted above, in the method for fabricating an organic light emitting display according to embodiments of the present invention, since a non-transmissive layer is formed on the under surface of the substrate, the UV-rays generated due to the exposure process does not affect another opposing substrate during a fabrication process.

[0124] As noted above, in the method for fabricating an organic light emitting display according to embodiments of the present invention, since a friction layer is formed on a substrate, when bonding two substrates, damage of the substrate is prevented by blocking a contact with a metal formed on the substrate or the surface of the substrate.

[0125] The embodiments explained above are only exemplary embodiments for realizing an organic light emitting display according to the present invention, and the method thereof, and it is to be noted that the present invention is not limited thereto, and various modifications can be realized by a person skilled in the art to which the present invention belongs without deviating from the scope of the present invention, which is defined in the claims below.

Claims

1. An organic light emitting display, comprising:

a substrate having a support arranged thereon;
a semiconductor layer arranged over the substrate;
an organic light emitting diode arranged over the semiconductor layer;
an encapsulant arranged on a region of the substrate corresponding to an outer periphery of the organic light emitting diode and the semiconductor layer; and
an encapsulation substrate connected to the encapsulant.

2. An organic light emitting display as claimed in claim 1, wherein the support and the semiconductor layer are arranged on a same side of the substrate.

3. An organic light emitting display as claimed in claim 1 or 2, wherein the support is arranged on at least one end region of the substrate.

4. An organic light emitting display as claimed in any one of claims 1 to 3, wherein the support is arranged on the outer periphery of the organic light emitting diode and the semiconductor layer.

5. An organic light emitting display as claimed in any preceding claim, wherein the support comprises at least one of either an insulating material or a conductive material.

6. An organic light emitting display as claimed in any preceding claim, wherein the support is thinner than the encapsulant.

7. An organic light emitting display as claimed in any preceding claim, wherein the support is thinner than the encapsulant and the encapsulation substrate together.

8. An organic light emitting display as claimed in any preceding claim, further comprising a bonding agent formed on a side of the substrate opposite to the side thereof having the support arranged thereon.

9. An organic light emitting display as claimed in the claim 8, wherein the bonding agent is arranged on at least one end region of the substrate.

10. An organic light emitting display as claimed in claim 8 or 9, wherein the bonding agent is arranged on the outer periphery of the encapsulant and the encapsulation substrate.

11. An organic light emitting display as claimed in the claim 1, wherein the substrate has a greater surface area than the surface area of the encapsulation substrate.

12. The organic light emitting display as claimed in any preceding claim, wherein the substrate has a thickness in a range of from 0.05 to 1mm.

13. An organic light emitting display as claimed in any preceding claim, wherein the substrate comprises one of a glass, a plastic, a polymer or a steel.

14. An organic light emitting display as claimed in any preceding claim, further comprising a non-transmissive layer arranged on a side of the substrate opposite to the side thereof having the semiconductor layer arranged thereon.

15. An organic light emitting display as claimed in claim 14, wherein the non-transmissive layer has a thickness in a range of 500Å to 3,000Å.

16. An organic light emitting display as claimed in claim 14 or 15 wherein the non-transmissive layer is one of a metal which blocks UV-rays, a transparent UV-ray protective agent, or an opaque UV-ray protective agent.

17. An organic light emitting display as claimed in any one of claims 14 to 16, wherein, further comprising a non-transmissive layer arranged on a side of the substrate opposite to a side thereof having the semiconductor layer arranged thereon, the non-transmissive layer is one of Cr, Cr_2O_3, Al, Au, Ag, MgO or a silver alloy.

18. An organic light emitting display as claimed in any one of claims 14 to 17, further comprising an anti-friction layer arranged in sequence with the non-transmissive layer on a side of the substrate opposite to the side thereof having the semiconductor layer arranged thereon.

19. An organic light emitting display as claimed in the claim 18, wherein the anti-friction layer has a thickness in a range of 10-100μm.

20. An organic light emitting display as claimed in the claim 18 or 19, wherein the anti-friction layer comprises at least one of an organic material or an inorganic material.

21. The organic light emitting display as claimed in any preceding claim, further comprising:

a buffer layer arranged under the semiconductor layer;
a gate insulation layer arranged over the semiconductor layer;
a gate electrode arranged over the gate insulation layer;
an inter-layer dielectric layer arranged over the gate electrode;
a source/drain electrode arranged over the inter-layer dielectric layer;
an insulation layer arranged over the source/drain electrode; and
an organic light emitting diode arranged over the insulation layer.

22. An organic light emitting display as claimed in any preceding claim, further comprising a driving circuit further arranged over the substrate between the outer periphery of the semiconductor layer and an inner periphery of the encapsulant.

23. A method of fabricating an organic light emitting display, the method comprising:

forming a support on each of two substrates to prevent bending;
forming a non-transmissive layer on a side of each substrate opposite to a side thereof having the support thereon;
bonding the two substrates together using a bonding agent such that the non-transmissive layers of each substrate face each other;
forming a semiconductor layer on each of the bonded substrates, each semiconductor layer being formed on a respective side of the bonded substrates on which the support is formed;
forming an organic light emitting diode on each semiconductor layer;
bonding an encapsulation substrate to each substrate by injecting an encapsulant into an outer periphery of the organic light emitting diode on each insulation layer;
sawing a region corresponding to an outer periphery of the encapsulant of each of the substrates while leaving the support on each substrate; and
separating the two bonded substrates.

24. A method of fabricating an organic light emitting display as claimed in the claim 23, wherein each support is formed on an end region of each respective substrate in which sawing is performed.

25. A method of fabricating an organic light emitting display as claimed in the claim 23 or 24, wherein each support is formed on the outer periphery of each respective organic light emitting diode and semiconductor layer.

26. A method of fabricating an organic light emitting display as claimed in any one of claims 23 to 25, wherein each support is formed of either an insulating material or a conductive material.

27. A method of fabricating an organic light emitting display as claimed in any one of claims 23 to 26, wherein each support is formed to be thinner than the encapsulant.

28. A method of fabricating an organic light emitting display as claimed in any one of claims 23 to 27, wherein each support is formed to be thinner than both the encapsulant and the encapsulation substrate.

29. A method of fabricating an organic light emitting display as claimed in any one of claims 23 to 28, wherein the bonding agent is applied to a region of each substrate corresponding to the outer periphery of the organic light emitting diode and semiconductor layer.

30. A method of fabricating an organic light emitting display as claimed in any one of claims 23 to 29, wherein the bonding agent is applied a region of each substrate corresponding to an outer periphery of the encapsulant.

31. A method of fabricating an organic light emitting display as claimed in any one of claims 23 to 30, wherein each substrate is formed to have a thickness in a range of from 0.05 to 1mm.

32. A method of fabricating an organic light emitting display as claimed in any one of claims 23 to 31, wherein each substrate is formed of one of a glass, a plastic, a polymer or a steel.

33. A method of fabricating an organic light emitting display as claimed in any one of claims 23 to 32, wherein each non-transmissive layer is formed on the under surface of the respective substrate to have a thickness in a range of 500Å to 3,000Å.

34. A method of fabricating an organic light emitting display as claimed in any one of claims 23 to 33, wherein each non-transmissive layer is formed by coating the under surface of each respective substrate with a UV-ray protective agent.

35. A method of fabricating an organic light emitting display as claimed in any one of claim 23 to 34, wherein each non-transmissive layer is formed of one of a metal which blocks UV-rays, a transparent UV-ray protective agent, or an opaque UV-ray protective agent.

36. A method of fabricating an organic light emitting display as claimed in any one of claims 23 to 35, wherein each non-transmissive layer is formed on the under surface of each respective substrate of one of Cr, Cr_2O_3, Al, Au, Ag, MgO or a silver alloy.

37. A method of fabricating an organic light emitting display as claimed in any one of claims 23 to 36, wherein in forming each non-transmissive layer, an anti-friction layer is further formed on an under surface of each respective substrate.

38. A method of fabricating an organic light emitting display as claimed in any one of claims 23 to 37, wherein in forming each non-transmissive layer, an anti-friction layer having a thickness in a range of from 10 to 100μm is formed on an under surface of each respective substrate.

39. A method of fabricating an organic light emitting display as claimed in any one of claims 23 to 38, wherein in forming each non-transmissive layer, an anti-friction layer is further formed of either an organic material or an inorganic material on an under surface of each respective non-transmissive layer.

40. A method of fabricating an organic light emitting display as claimed in any one of claims 37 to 39, wherein in bonding each substrate, an anti-friction layer is formed on each mutually contacted substrate.

41. A method of fabricating an organic light emitting display as claimed in any one of claims 23 to 40, wherein in bonding each encapsulation substrate, the width of the encapsulation substrate is formed to be smaller than that of each respective substrate.

42. A method of fabricating an organic light emitting display as claimed in any one of claims 23 to 41, wherein the sawing is executed using a laser beam.

43. A method of fabricating an organic light emitting display as claimed in any one of claims 23 to 42, wherein the sawing is executed such that the bonding agent remains in each respective substrate.

44. A method of fabricating an organic light emitting display as claimed in any one of claims 23 to 43, wherein after separating the substrates, each non-transmissive layer is removed.

45. A method of fabricating an organic light emitting display as claimed in any one of claims 23 to 44, wherein forming each semiconductor layer includes forming a driving circuit therein.

FIG. 1

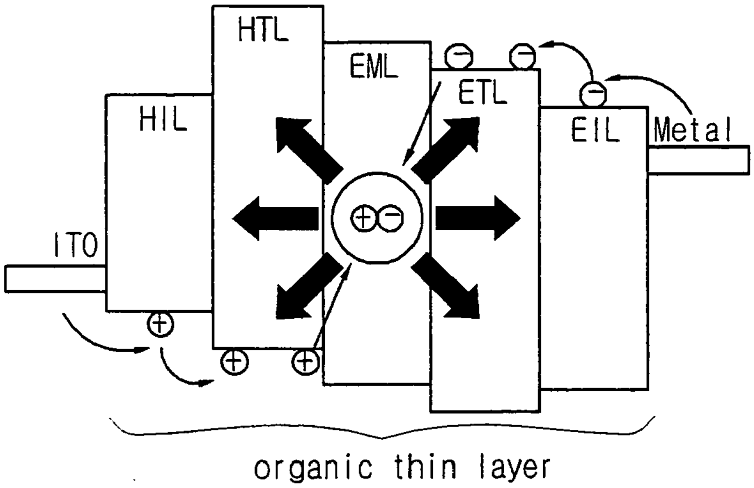

FIG. 2a

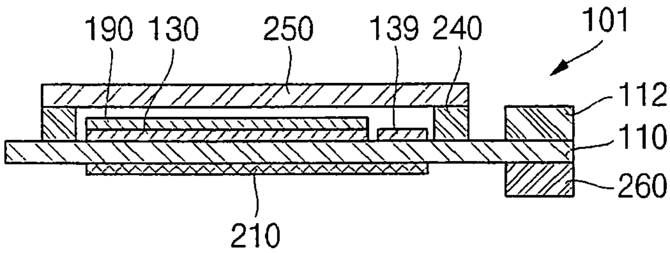

FIG. 2b

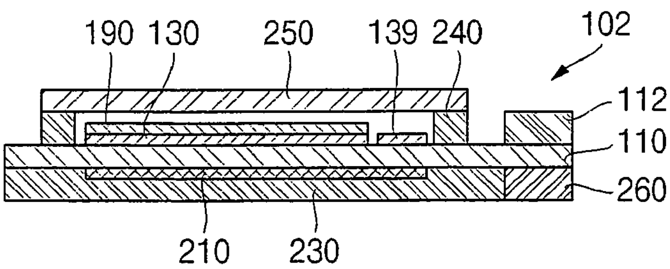

FIG. 3a

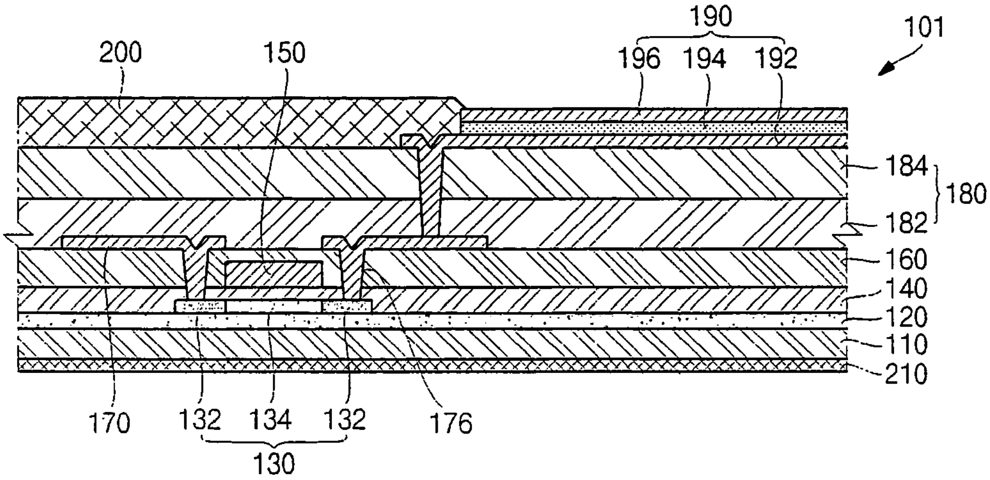
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FIG. 3b

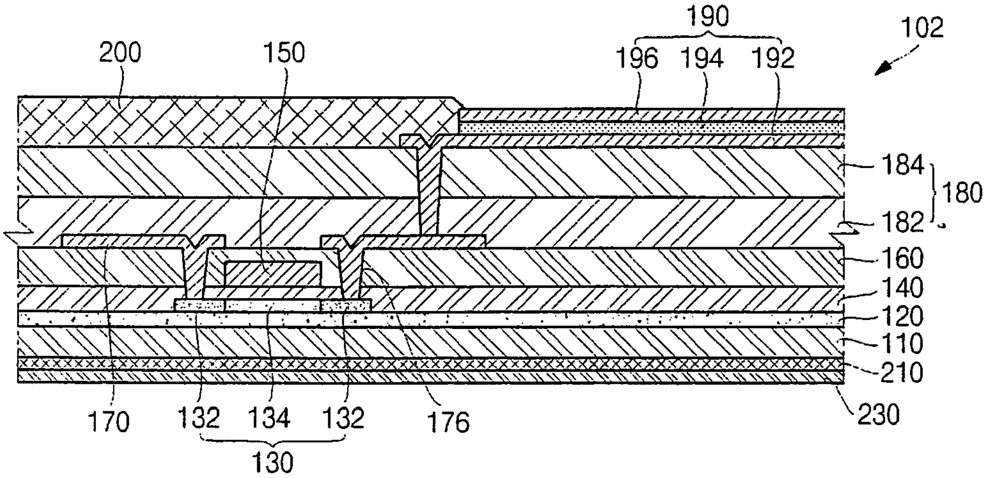
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FIG. 4

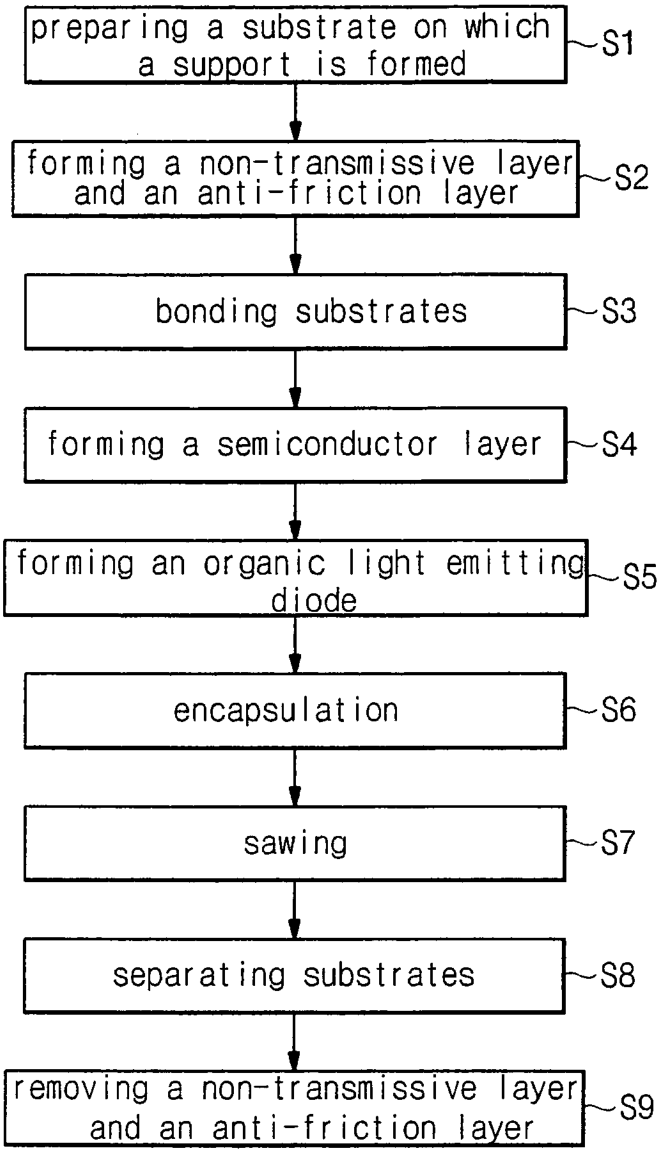

preparing a substrate on which a support is formed
S1
forming a non-transmissive layer and an anti-friction layer
S2
bonding substrates
S3
forming a semiconductor layer
S4
forming an organic light emitting diode
S5
encapsulation
S6
sawing
S7
separating substrates
S8
removing a non-transmissive layer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

FIG. 5a

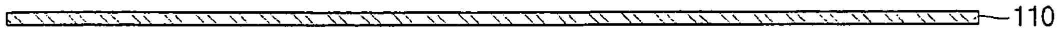


FIG. 5b

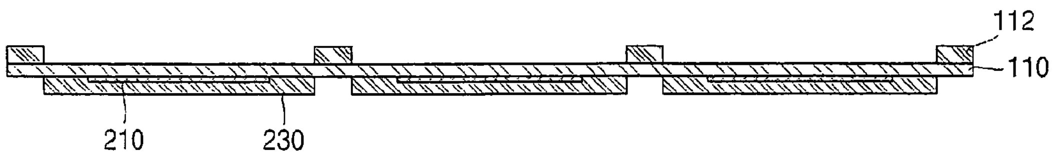


FIG. 5c

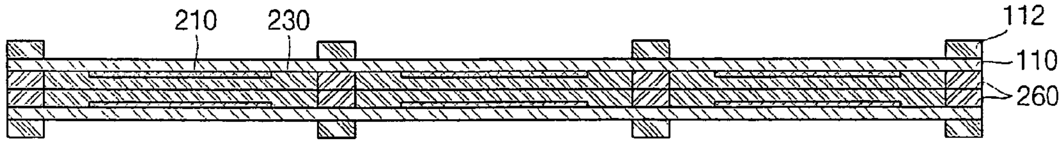


FIG. 5d

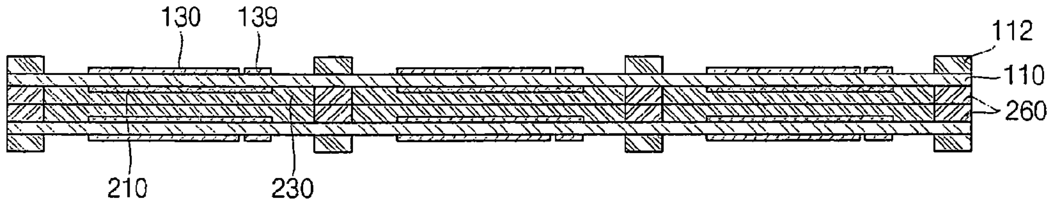


FIG. 5e

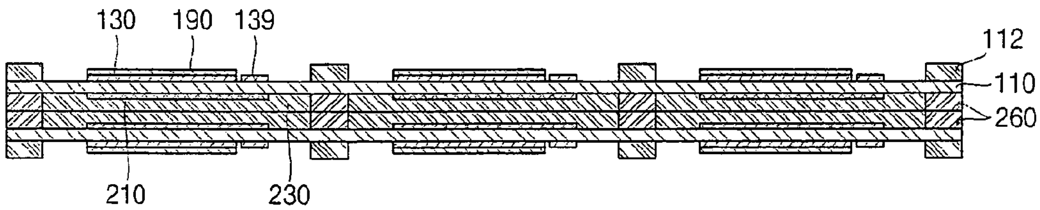


FIG. 5f

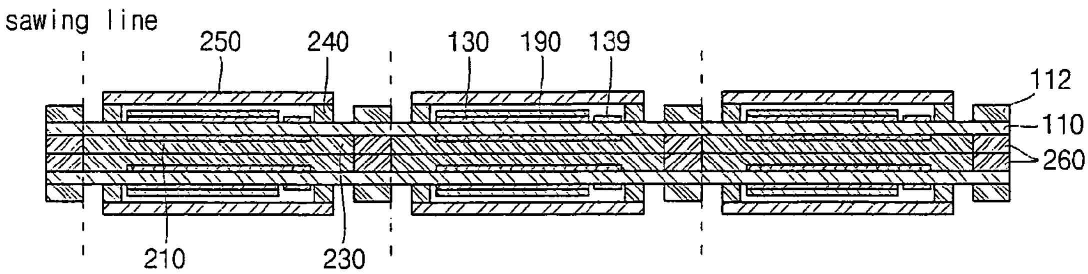


FIG. 5g

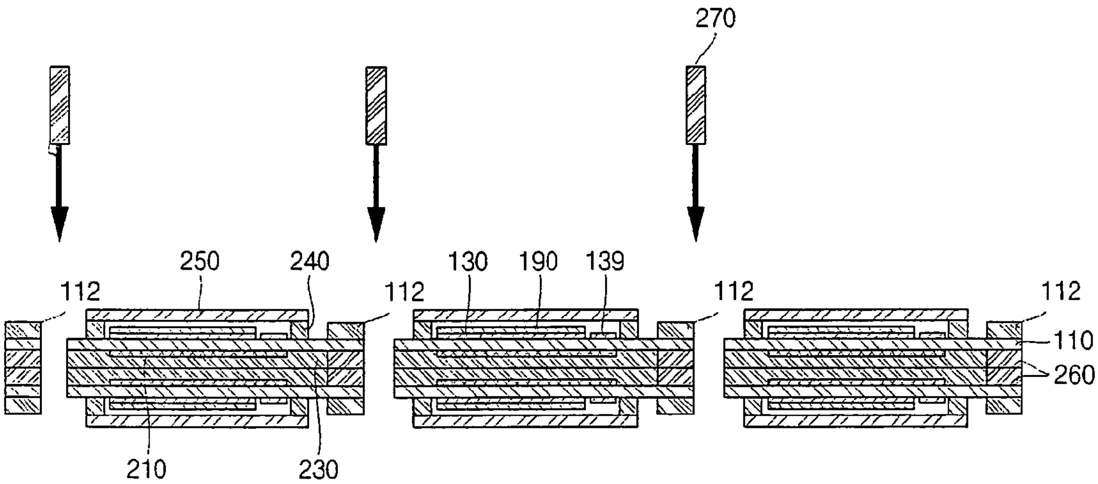


FIG. 5h

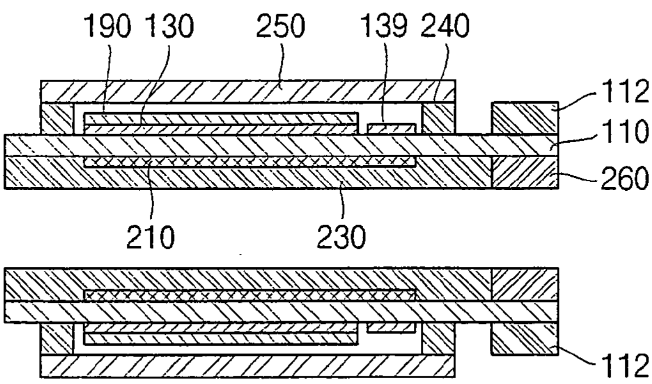


FIG. 5i

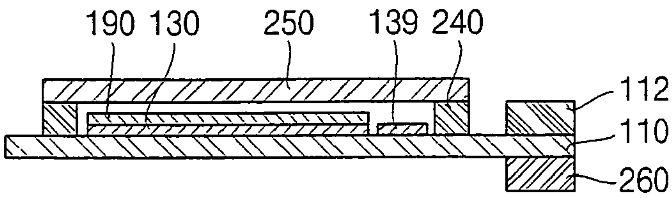


FIG. 6a

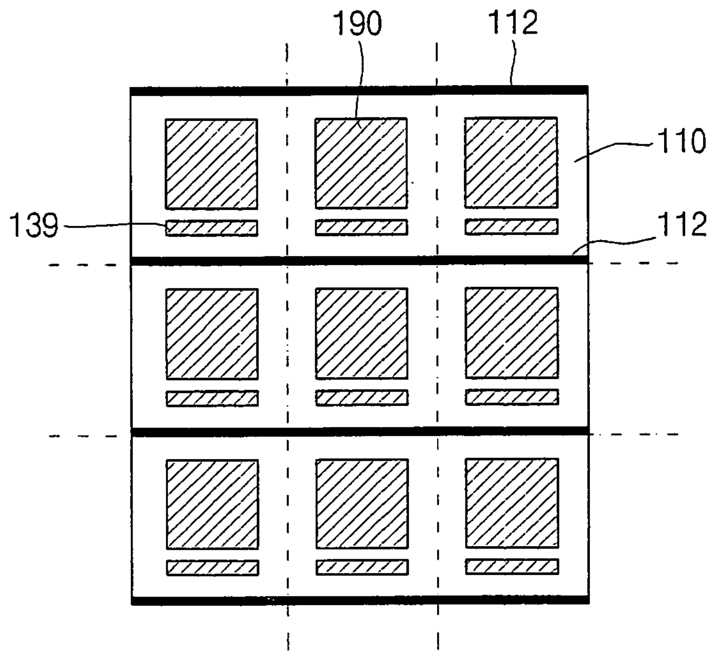


FIG. 6b

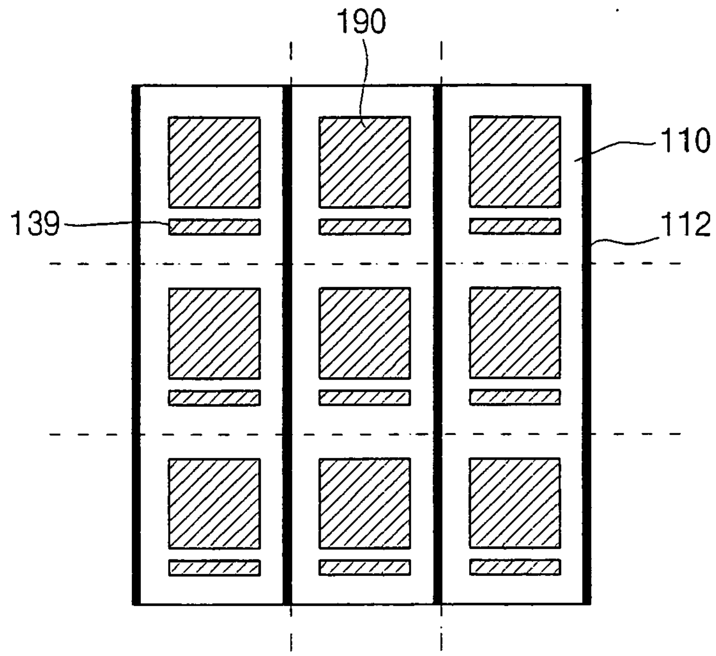


FIG. 6c

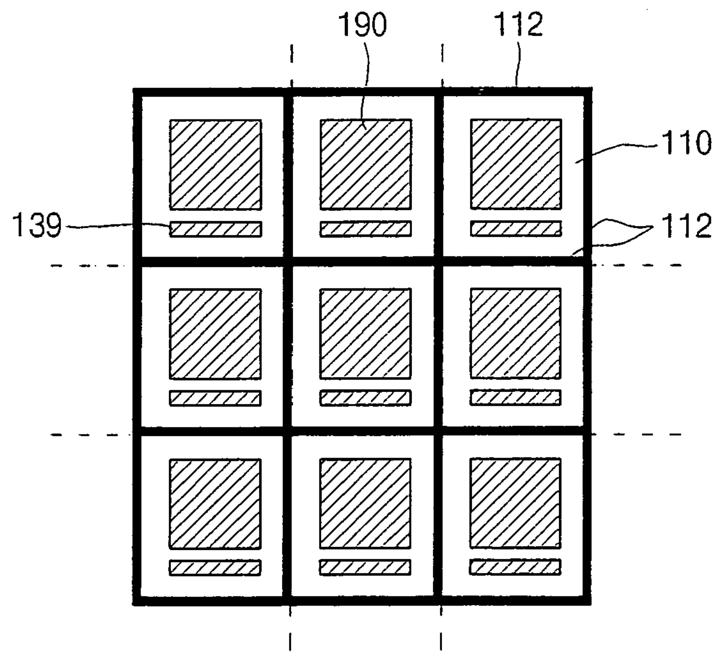
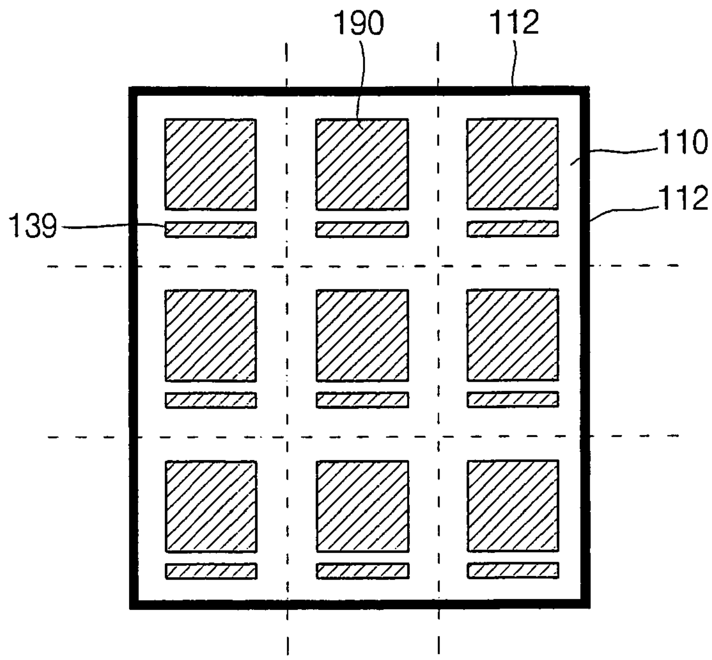


FIG. 6d



European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 07 25 2178

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X Y	EP 1 584 971 A (SAMSUNG SDI CO LTD [KR]) 12 October 2005 (2005-10-12) * paragraphs [0029] - [0033], [0037], [0045]; figures 1,2a,4a *	1-11,13, 22 14-20	INV. H01L51/52 H01L51/56
Y	US 2005/285522 A1 (HAN DONG-WON [KR] ET AL) 29 December 2005 (2005-12-29) * paragraphs [0023] - [0033], [0038] - [0040]; figures 2a-c *	1-5, 11-13, 21,22	
Y	US 2003/020124 A1 (GUENTHER EWALD KARL MICHAEL [SG]) 30 January 2003 (2003-01-30) * paragraphs [0009] - [0013]; figure 2 *	1-5, 11-13, 21,22	
Y	US 5 811 866 A (HIRATA KAZUMI [JP]) 22 September 1998 (1998-09-22) * column 5, line 1 - line 57; figure 5 *	14-20	TECHNICAL FIELDS SEARCHED (IPC)
A	US 2003/010062 A1 (MATTHIES DENNIS L [US]) 16 January 2003 (2003-01-16) * paragraphs [0019] - [0022] *	23-45	H01L H05B G02F
A	KR 2006 0089638 A (SEIKO INSTR KABUSHIKI KAISHA A [JP]) 9 August 2006 (2006-08-09) & US 2007/048895 A1 (SUGINOYA MITSURU [JP] ET AL) 1 March 2007 (2007-03-01) * paragraphs [0014] - [0019]; figures 1a-e *	23-45	

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	1 April 2008	Bakos, Tamás

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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01-04-2008

Patent document cited in search report		Publication date	Patent family member(s)			Publication date
EP 1584971	A	12-10-2005	CN	1678141	A	05-10-2005
			JP	2005284252	A	13-10-2005
			KR	20050095934	A	05-10-2005
			US	2005211990	A1	29-09-2005
US 2005285522	A1	29-12-2005	CN	1710999	A	21-12-2005
			JP	2006004909	A	05-01-2006
			KR	20050119892	A	22-12-2005
US 2003020124	A1	30-01-2003	DE	10234178	A1	06-03-2003
			JP	2003059664	A	28-02-2003
US 5811866	A	22-09-1998	JP	9080476	A	28-03-1997
US 2003010062	A1	16-01-2003	NONE			
KR 20060089638	A	09-08-2006	JP	2006216456	A	17-08-2006
			US	2007048895	A1	01-03-2007
US 2007048895	A1	01-03-2007	JP	2006216456	A	17-08-2006
			KR	20060089638	A	09-08-2006

EPO FORM P0459

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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 2005340182 A **[0006]**
- JP 2005222930 A **[0006]**
- JP 2005222789 A **[0006]**

专利名称(译)	有机发光显示器及其制造方法		
公开(公告)号	EP1933401A1	公开(公告)日	2008-06-18
申请号	EP2007252178	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)	三星移动显示器有限公司.		
[标]发明人	KIM JONGYUN CHOI BYOUNGDEOG		
发明人	KIM, JONGYUN CHOI, BYOUNGDEOG		
IPC分类号	H01L51/52 H01L51/56		
CPC分类号	H01L51/5237 H01L51/0097 H01L51/524 H01L51/56 H01L2251/5338		
优先权	1020060127290 2006-12-13 KR		
其他公开文献	EP1933401B1		
外部链接	Espacenet		

摘要(译)

一种有机发光显示器（101），包括基板（110），形成在基板（110）上的半导体层（130），形成在半导体层（130）上的有机发光二极管（190），密封剂（240）形成在基板（110）的周边上，基板（110）是有机发光二极管（190）和半导体层（130）的外周;封装基板（250）附接到密封剂（240）。

FIG. 2a