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

(11) EP 1 811 589 B1

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention of the grant of the patent:
12.06.2019 Bulletin 2019/24

(51) Int Cl.:
H01L 51/52 *(2006.01)* ***H01L 27/32*** *(2006.01)*

(21) Application number: **07250281.8**

(22) Date of filing: **24.01.2007**

(54) **Organic light emitting display and fabricating method of the same**

Organische lichtemittierende Anzeigevorrichtung und Verfahren zu ihrer Herstellung

Dispositif d'affichage électroluminescent organique et son procédé de fabrication

(84) Designated Contracting States:
DE FR GB

(30) Priority: **24.01.2006 KR 20060007353**
21.03.2006 KR 20060025755

(43) Date of publication of application:
25.07.2007 Bulletin 2007/30

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Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention relates to an organic light emitting display and a fabricating method of the same, and more particularly to packaging of an organic light emitting display.

2. Description of the Related Technology

[0002] In recent years, organic light emitting displays, which use organic light emitting diodes, have drawn attention. An organic light emitting display is an emissive display, which electrically excites an organic compound having a fluorescent characteristic in order to emit light. A typical organic light emitting display can be driven at a low voltage and has excellent light-emission, a wide angle of visibility, and a high-speed response.

[0003] Known examples of organic light emitting displays tend to include a plurality of pixels formed on a substrate. Each of the pixels includes an organic light emitting diode and a thin film transistor (TFT) for driving the organic light emitting diode. Since such an organic light emitting diode is susceptible to oxygen and moisture, a sealing structure has been proposed to prevent oxygen and moisture from entering the pixels. The sealing structure covers a deposition substrate with a metal cap having an absorbent or a sealing glass substrate.

[0004] U.S. Patent No. 6,998,776 discloses a structure for sealing an organic light emitting diode by coating a glass substrate with a frit. In U.S. Patent No. 6,998,776, the frit may seal a gap between a substrate and a sealing substrate, and allows the organic light emitting diode to be efficiently protected.

[0005] However, in a structure for sealing an organic light emitting diode using a sealing substrate coated with a frit, during a process of irradiating a laser to the frit, a stress occurs at the substrate due to heat of the laser. This causes a scribing line to be obscure during a process of scribing a mother substrate into unit substrates, which may cause cracks. Accordingly, an occurrence rate of a defective device increases and the impact resistance is deteriorated when conducting reliance tests. The discussion in this section is to provide background information of the related technology, and does not constitute an admission of prior art.

[0006] US 2003/0137630 A1 discloses a display element comprising a pair of substrates and a looped seal member provided between the substrates for enclosing a display layer between the substrates, the looped seal member comprising a plurality of resin layers stacked from an inner side to an outer side.

[0007] JP 2002 280169 A discloses an organic EL device which has an element board having an organic EL element formed on its inside surface and a sealing board facing to the organic EL element with a predetermined clearance and is provided with an adhesive between the circumferential parts of both the boards.

[0008] JP 2005 285354 A discloses organic EL device which is formed by facing a facing substrate and an element substrate, and equipped with a seal material installed between the facing substrate and the element substrate so as to surround a display region.

[0009] KR20010109592 discloses an organic EL device surrounded by a simple frame which includes two discontinuous portions. The discontinuous gaps in the frame are closed, sealing off the EL device after an inert gas is pumped in.

SUMMARY OF CERTAIN INVENTIVE ASPECTS

[0010] The present invention sets out to solve the above problems and provides an organic light emitting display device as set out in Claim I and a method of making an organic light emitting display device as set out in claim 9. Preferred features of the invention are set out in Claims 2 to 8 and 10 to 23.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011] The above and/or other aspects and advantages of the invention will become apparent and more readily appreciated from making reference to the following description in which embodiments of the invention are described by way of example and with reference to the accompanying drawings of which:

FIG. 1 is a schematic top plan view showing an organic light emitting display according to an embodiment of the invention;
FIG. 2 is a schematic top plan view showing a sealing substrate in the organic light emitting display shown in FIG. 1;
FIG. 3 is a schematic cross-sectional view of the organic light emitting display shown in FIG. 1;
FIG. 4 is a flow chart illustrating a method for fabricating an organic light emitting display according to a first embodiment of the invention;
FIG. 5A to FIG. 5F are schematic views illustrating a method for fabricating an organic light emitting display according to a second embodiment of the invention;
FIG. 6A is a schematic exploded view of a passive matrix type organic light emitting display device;
FIG 6B is a schematic exploded view of an active matrix type organic light emitting display device;
FIG. 6C is a schematic top plan view of an organic light emitting display;
FIG. 6D is a cross-sectional view of the organic light emitting display of FIG. 6C, taken along the line d-d; and
FIG. 6E is a schematic perspective view illustrating mass production of organic light emitting devices.

DETAILED DESCRIPTION

[0012] Hereinafter, embodiments of the invention will be described with reference to the accompanying drawings. Here, when one element is connected to another element, one element may be either directly connected to another element or indirectly connected to another element via another element. Further, some elements are omitted for clarity. Also, like reference numerals refer to identical or functionally similar elements.

[0013] An organic light emitting display (OLED) is a display device comprising an array of organic light emitting diodes. Organic light emitting diodes are solid state devices which include an organic material and are adapted to generate and emit light when appropriate electrical potentials are applied.

[0014] OLEDs can be generally grouped into two basic types dependent on the arrangement with which the stimulating electrical current is provided. Fig. 6A schematically illustrates an exploded view of a simplified structure of a passive matrix type OLED 2001. Fig. 6B schematically illustrates a simplified structure of an active matrix type OLED 1001. In both configurations, the OLED 2001, 1001 includes OLED pixels built over a substrate 1002, and the OLED pixels include an anode 1004, a cathode 1006 and an organic layer 1010. When an appropriate electrical current is applied to the anode 1004, electric current flows through the pixels and visible light is emitted from the organic layer.

[0015] Referring to Fig. 6A, the passive matrix OLED (PMOLED) design includes elongate strips of anode 1004 arranged generally perpendicular to elongate strips of cathode 1006 with organic layers interposed therebetween. The intersections of the strips of cathode 1006 and anode 1004 define individual OLED pixels where light is generated and emitted upon appropriate excitation of the corresponding strips of anode 1004 and cathode 1006. PMOLEDs provide the advantage of relatively simple fabrication.

[0016] Referring to Fig. 6B, the active matrix OLED (AMOLED) includes driving circuits 1012 arranged between the substrate 1002 and an array of OLED pixels. An individual pixel of AMOLEDs is defined between the common cathode 1006 and an anode 1004, which is electrically isolated from other anodes. Each driving circuit 1012 is coupled with an anode 1004 of the OLED pixels and further coupled with a data line 1016 and a scan line 1018. The scan lines 1018 supply scan signals that select rows of the driving circuits, and the data lines 1016 supply data signals for particular driving circuits. The data signals and scan signals stimulate the local driving circuits 1012, which excite the anodes 1004 so as to emit light from their corresponding pixels.

[0017] In the illustrated AMOLED, the local driving circuits 1012, the data lines 1016 and scan lines 1018 are buried in a planarization layer 1014, which is interposed between the pixel array and the substrate 1002. The planarization layer 1014 provides a planar top surface on which the organic light emitting pixel array is formed. The planarization layer 1014 may be formed of organic or inorganic materials, and formed of two or more layers although shown as a single layer. The local driving circuits 1012 are typically formed with thin film transistors (TFT) and arranged in a grid or array under the OLED pixel array. The local driving circuits 1012 may be at least partly made of organic materials, including organic TFT. AMOLEDs have the advantage of fast response time improving their desirability for use in displaying data signals. Also, AMOLEDs have the advantages of consuming less power than passive matrix OLEDs.

[0018] Referring to common features of the PMOLED and AMOLED designs, the substrate 1002 provides structural support for the OLED pixels and circuits. In various configurations, the substrate 1002 can comprise rigid or flexible materials as well as opaque or transparent materials, such as plastic, glass, and/or foil. As noted above, each OLED pixel or diode is formed with the anode 1004, cathode 1006 and organic layer 1010 interposed therebetween. When an appropriate electrical current is applied to the anode 1004, the cathode 1006 injects electrons and the anode 1004 injects holes. In certain cases, the anode 1004 and cathode 1006 are inverted; i.e., the cathode is formed on the substrate 1002 and the anode is opposingly arranged.

[0019] Interposed between the cathode 1006 and anode 1004 are one or more organic layers. More specifically, at least one emissive or light emitting layer is interposed between the cathode 1006 and anode 1004. The light emitting layer may comprise one or more light emitting organic compounds. Typically, the light emitting layer is configured to emit visible light in a single color such as blue, green, red or white. In the illustrated example, one organic layer 1010 is formed between the cathode 1006 and anode 1004 and acts as a light emitting layer. Additional layers, which can be formed between the anode 1004 and cathode 1006, can include a hole transporting layer, a hole injection layer, an electron transporting layer and an electron injection layer.

[0020] Hole transporting and/or injection layers can be interposed between the light emitting layer 1010 and the anode 1004. Electron transporting and/or injecting layers can be interposed between the cathode 1006 and the light emitting layer 1010. The electron injection layer facilitates injection of electrons from the cathode 1006 toward the light emitting layer 1010 by reducing the work function for injecting electrons from the cathode 1006. Similarly, the hole injection layer facilitates injection of holes from the anode 1004 toward the light emitting layer 1010. The hole and electron transporting layers facilitate movement of the carriers injected from the respective electrodes toward the light emitting layer.

[0021] In some cases, a single layer may serve both electron injection and transportation functions or both hole injection and transportation functions. In some structures, one or more of these layers are lacking. In some arrangements, one or more organic layers are doped with one or more materials that help injection and/or transportation of the carriers. In examples where only one organic layer is formed between the cathode and anode, the organic layer may include not only an organic light emitting compound but also certain functional materials that help injection or transportation of carriers within that layer.

[0022] There are numerous organic materials that have been developed for use in these layers including the light emitting layer. Also, numerous other organic materials for use in these layers are being developed. In some cases, these organic materials may be macromolecules including oligomers and polymers. In some cases, the organic materials for these layers may be relatively small molecules. The skilled artisan will be able to select appropriate materials for each of these layers in view of the desired functions of the individual layers and the materials for the neighboring layers in particular designs.

[0023] In operation, an electrical circuit provides appropriate potential between the cathode 1006 and anode 1004. This results in an electrical current flowing from the anode 1004 to the cathode 1006 via the interposed organic layer(s). In one case, the cathode 1006 provides electrons to the adjacent organic layer 1010. The anode 1004 injects holes to the organic layer 1010. The holes and electrons recombine in the organic layer 1010 and generate energy particles called "excitons." The excitons transfer their energy to the organic light emitting material in the organic layer 1010, and the energy is used to emit visible light from the organic light emitting material. The spectral characteristics of light generated and emitted by the OLED 2001, 1001 depend on the nature and composition of organic molecules in the organic layer(s). The composition of the one or more organic layers can be selected to suit the needs of a particular application by one of ordinary skill in the art.

[0024] OLED devices can also be categorized based on the direction of the light emission. In one type referred to as "top emission" type, OLED devices emit light and display images through the cathode or top electrode 1006. In these structures, the cathode 1006 is made of a material transparent or at least partially transparent with respect to visible light. In certain cases, to avoid losing any light that can pass through the anode or bottom electrode 1004, the anode may be made of a material substantially reflective of the visible light. A second type of OLED devices emits light through the anode or bottom electrode 1004 and is called "bottom emission" type. In the bottom emission type OLED devices, the anode 1004 is made of a material which is at least partially transparent with respect to visible light. Often, in bottom emission type OLED devices, the cathode 1006 is made of a material substantially reflective of the visible light. A third type of OLED devices emits light in two directions, e.g. through both anode 1004 and cathode 1006. Depending upon the direction(s) of the light emission, the substrate may be formed of a material which is transparent, opaque or reflective of visible light.

[0025] In many cases, an OLED pixel array 1021 comprising a plurality of organic light emitting pixels is arranged over a substrate 1002 as shown in Fig. 6C. The pixels in the array 1021 are controlled to be turned on and off by a driving circuit (not shown), and the plurality of the pixels as a whole displays information or image on the array 1021. In certain cases, the OLED pixel array 1021 is arranged with respect to other components, such as drive and control electronics to define a display region and a non-display region. In these structures, the display region refers to the area of the substrate 1002 where OLED pixel array 1021 is formed. The non-display region refers to the remaining areas of the substrate 1002. The non-display region can contain logic and/or power supply circuitry. It will be understood that there will be at least portions of control/drive circuit elements arranged within the display region. For example, in PMOLEDs, conductive components will extend into the display region to provide appropriate potential to the anode and cathodes. In AMOLEDs, local driving circuits and data/scan lines coupled with the driving circuits will extend into the display region to drive and control the individual pixels of the AMOLEDs.

[0026] One design and fabrication consideration in OLED devices is that certain organic material layers of OLED devices can suffer damage or accelerated deterioration from exposure to water, oxygen or other harmful gases. Accordingly, it is generally understood that OLED devices be sealed or encapsulated to inhibit exposure to moisture and oxygen or other harmful gases found in a manufacturing or operational environment. Fig. 6D schematically illustrates a cross-section of an encapsulated OLED device 1011 having a layout of Fig. 6C and taken along the line d-d of Fig. 6C. In this device, a generally planar top plate or substrate 1061 engages with a seal 1071 which further engages with a bottom plate or substrate 1002 to enclose or encapsulate the OLED pixel array 1021. In other structures, one or more layers are formed on the top plate 1061 or bottom plate 1002, and the seal 1071 is coupled with the bottom or top substrate 1002, 1061 via such a layer. In the illustrated device, the seal 1071 extends along the periphery of the OLED pixel array 1021 or the bottom or top plate 1002, 1061.

[0027] The seal 1071 is made of a frit material as will be further discussed below. The top and bottom plates 1061, 1002 comprise materials such as plastics, glass and/or metal foils which can provide a barrier to passage of oxygen and/or water to thereby protect the OLED pixel array 1021 from exposure to these substances. At least one of the top plate 1061 and the bottom plate 1002 are formed of a substantially transparent material.

[0028] To lengthen the life time of OLED devices 1011, it is generally desired that seal 1071 and the top and bottom plates 1061, 1002 provide a substantially non-permeable seal to oxygen and water vapor and provide a substantially hermetically enclosed space 1081. In certain applications, it is indicated that the seal 1071 of a frit material in combination with the top and bottom plates

1061, 1002 provide a barrier to oxygen of less than approximately 10^{-3} cc/m^2-day and to water of less than 10^{-6} g/m^2-day. Given that some oxygen and moisture can permeate into the enclosed space 1081, in some devices, a material that can take up oxygen and/or moisture is formed within the enclosed space 1081.

[0029] The seal 1071 has a width W, which is its thickness in a direction parallel to a surface of the top or bottom substrate 1061, 1002 as shown in Fig. 6D. The width varies among devices and ranges from about 300 μm to about 3000 μm, optionally from about 500 μm to about 1500 μm. Also, the width may vary at different positions of the seal 1071. In some cases, the width of the seal 1071 may be the largest where the seal 1071 contacts one of the bottom and top substrate 1002, 1061 or a layer formed thereon. The width may be the smallest where the seal 1071 contacts the other. The width variation in a single cross-section of the seal 1071 relates to the cross-sectional shape of the seal 1071 and other design parameters.

[0030] The seal 1071 has a height H, which is its thickness in a direction perpendicular to a surface of the top or bottom substrate 1061, 1002 as shown in Fig. 6D. The height varies among embodiments and ranges from about 2 μm to about 30 μm, optionally from about 10 μm to about 15 μm. Generally, the height does not significantly vary at different positions of the seal 1071. However, in certain cases, the height of the seal 1071 may vary at different positions thereof.

[0031] In the illustrated device, the seal 1071 has a generally rectangular cross-section. In other structures, however, the seal 1071 can have other various cross-sectional shapes such as a generally square cross-section, a generally trapezoidal cross-section, a cross-section with one or more rounded edges, or other configuration as indicated by the needs of a given application. To improve hermeticity, it is generally desired to increase the interfacial area where the seal 1071 directly contacts the bottom or top substrate 1002, 1061 or a layer formed thereon. In some embodiments, the shape of the seal can be designed such that the interfacial area can be increased.

[0032] The seal 1071 can be arranged immediately adjacent the OLED array 1021, and in other cases, the seal 1071 is spaced some distance from the OLED array 1021. The seal 1071 comprises generally linear segments that are connected together to surround the OLED array 1021. Such linear segments of the seal 1071 can extend, in certain cases, generally parallel to respective boundaries of the OLED array 1021. In other devices, one or more of the linear segments of the seal 1071 are arranged in a non-parallel relationship with respective boundaries of the OLED array 1021. In yet other devices, at least part of the seal 1071 extends between the top plate 1061 and bottom plate 1002 in a curvilinear manner.

[0033] As noted above, in certain structures, the seal 1071 is formed using a frit material or simply "frit" or glass frit," which includes fine glass particles. The frit particles includes one or more of magnesium oxide (MgO), calcium oxide (CaO), barium oxide (BaO), lithium oxide (Li_2O), sodium oxide (Na_2O), potassium oxide (K_2O), boron oxide (B_2O_3), vanadium oxide (V_2O_5), zinc oxide (ZnO), tellurium oxide (TeO_2), aluminum oxide (Al_2O_3), silicon dioxide (SiO_2), lead oxide (PbO), tin oxide (SnO), phosphorous oxide (P_2O_5), ruthenium oxide (Ru_2O), rubidium oxide (Rb_2O), rhodium oxide (Rh_2O), ferrite oxide (Fe_2O_3), copper oxide (CuO), titanium oxide (TiO_2), tungsten oxide (WO_3), bismuth oxide (Bi_2O_3), antimony oxide (Sb_2O_3), lead-borate glass, tin-phosphate glass, vanadate glass, and borosilicate, etc. Typically, these particles range in size from about 2 μm to about 30 μm, optionally about 5 μm to about 10 μm, although not limited only thereto. The particles can be as large as about the distance between the top and bottom substrates 1061, 1002 or any layers formed on these substrates where the frit seal 1071 contacts.

[0034] The frit material used to form the seal 1071 can also include one or more filler or additive materials. The filler or additive materials can be provided to adjust an overall thermal expansion characteristic of the seal 1071 and/or to adjust the absorption characteristics of the seal 1071 for selected frequencies of incident radiant energy. The filler or additive material(s) can also include inversion and/or additive fillers to adjust a coefficient of thermal expansion of the frit. For example, the filler or additive materials can include transition metals, such as chromium (Cr), iron (Fe), manganese (Mn), cobalt (Co), copper (Cu), and/or vanadium. Additional materials for the filler or additives include $ZnSiO_4$, $PbTiO_3$, ZrO_2, eucryptite.

[0035] Typically, a frit material as a dry composition contains glass particles from about 20 to 90 about wt%, and the remainder includes fillers and/or additives. In some cases, the frit paste contains about 10-30 wt% organic materials and about 70-90% inorganic materials. In some cases, the frit paste contains about 20 wt% organic materials and about 80 wt% inorganic materials. In some cases, the organic materials may include about 0-30 wt% binder(s) and about 70-100 wt% solvent(s). In some cases, about 10 wt% is binder(s) and about 90 wt% is solvent(s) among the organic materials. In some cases, the inorganic materials may include about 0-10 wt% additives, about 20-40 wt% fillers and about 50-80 wt% glass powder. In some cases, about 0-5 wt% is additive(s), about 25-30 wt% is filler(s) and about 65-75 wt% is the glass powder among the inorganic materials.

[0036] In forming a frit seal, a liquid material is added to the dry frit material to form a frit paste. Any organic or inorganic solvent with or without additives can be used as the liquid material. Typically, the solvent includes one or more organic compounds. For example, applicable organic compounds are ethyl cellulose, nitro cellulose, hydroxyl propyl cellulose, butyl carbitol acetate, terpineol, butyl cellusolve, acrylate compounds. Then, the thus formed frit paste can be applied to form a shape of the seal 1071 on the top and/or bottom plate 1061, 1002.

[0037] In one case, a shape of the seal 1071 is initially formed from the frit paste and interposed between the top plate 1061 and the bottom plate 1002. The seal 1071 can in certain cases be pre-cured or pre-sintered to one of the top plate and bottom plate 1061, 1002. Following assembly of the top plate 1061 and the bottom plate 1002 with the seal 1071 interposed therebetween, portions of the seal 1071 are selectively heated such that the frit material forming the seal 1071 at least partially melts. The seal 1071 is then allowed to resolidify to form a secure joint between the top plate 1061 and the bottom plate 1002 to thereby inhibit exposure of the enclosed OLED pixel array 1021 to oxygen or water.

[0038] The selective heating of the frit seal is carried out by irradiation of light, such as a laser or directed infrared lamp. As previously noted, the frit material forming the seal 1071 can be combined with one or more additives or filler such as species selected for improved absorption of the irradiated light to facilitate heating and melting of the frit material to form the seal 1071.

[0039] In some cases, OLED devices 1011 are mass produced. In an example illustrated in Fig. 6E, a plurality of separate OLED arrays 1021 is formed on a common bottom substrate 1101. In the illustrated example, each OLED array 1021 is surrounded by a shaped frit to form the seal 1071. A common top substrate (not shown) is placed over the common bottom substrate 1101 and the structures formed thereon such that the OLED arrays 1021 and the shaped frit paste are interposed between the common bottom substrate 1101 and the common top substrate. The OLED arrays 1021 are encapsulated and sealed, such as via the previously described enclosure process for a single OLED display device. The resulting product includes a plurality of OLED devices kept together by the common bottom and top substrates. Then, the resulting product is cut into a plurality of pieces, each of which constitutes an OLED device 1011 of Fig. 6D. In certain cases, the individual OLED devices 1011 then further undergo additional packaging operations to further improve the sealing formed by the frit seal 1071 and the top and bottom substrates 1061, 1002.

[0040] FIG. 1 is a plan view showing an example of an organic light emitting display according to an embodiment of the invention. FIG. 2 is a plan view showing an example of a sealing substrate in the organic light emitting display shown in FIG. 1.

[0041] With reference to FIG. 1 and FIG. 2, the organic light emitting display includes a first substrate 100, a frit 151, an adhesive 152, a reinforcing member 153, and a second substrate 200.

[0042] The first substrate 100 includes a pixel region 100a and a non-pixel region 100b. The pixel region 100a includes a plurality of scan lines S1, S2, S3, .., Sn, a plurality of data lines D1, D2, D3, ..., Dm, and a plurality of pixels 50. The plurality of pixels 50 are arranged at regions defined by the scan lines S1, S2, S3, .., Sn and the data lines D1, D2, D3, ..., Dm. Each of the pixels 50 is coupled with one of the scan lines S1, S2, S3, .., Sn, one of the data lines D1, D2, D3, ..., Dm, and a power supply line (not shown). Each pixel 50 emits one of red, green, blue, and white colors at a predetermined luminance level. Consequently, the pixel region 100a displays an image according to the colors and the luminances of the pixels 50. The non-pixel region 100b is formed to surround the pixel region 100a and includes a data driver 300, a scan driver 400, and a pad portion 500.

[0043] The data driver 300 supplies a data signal to the plurality of data lines D1, D2, and D3 extending in the pixel region 100a of the first substrate 100. The data driver 300 is formed at one side of the pixel region 100a in the first substrate 100 and at another side adjacent to one side of the pixel region on which the scan driver 400 is formed. Here, the data driver 300 is mounted on the first substrate 100 in a chip-on-glass (COG) type chip pattern. Further, the data driver 300 is coupled with a plurality of first pads Pd in the pad portion 500 through a plurality of data supply lines 310.

[0044] The scan driver 400 sequentially supplies a scan signal to the plurality of scan lines S1, S2, S3, .., and Sn extending in the pixel region 100a. The scan driver 400 is formed at one side of the pixel region 100a in the first substrate 100. The scan driver 400 is coupled with at least one first pad Ps in the pad portion 500 through at least one scan supply line 410.

[0045] The pad portion 500 is formed at the first substrate 100 adjacent to the first scan driver 400 and the data driver 500. The pad portion 500 is electrically coupled to the scan supply line 410 and the data supply line 310, and supplies an electric signal to the plurality of scan lines S1, S2, S3, .., Sn and the plurality of data lines D1, D2, D3, ..., Dm of the pixel region 100a.

[0046] The frit 151 is disposed between a non-pixel region 100b of the first substrate 100 and the second substrate 200, and adheres the first substrate 100 and the second substrate 200 to each other. In the illustrated built-in type scan driver 400, the pixel region 100a and the scan driver 400 are sealed with the frit 151. In other embodiments, the scan driver 400 may be outside the frit. The frit may only enclose the pixel region 100a. Since the frit 150 seals a gap between the first substrate 100 and the second substrate 200, an organic light emitting diode interposed between the first substrate 100 and the second substrate 200 can be protected from water or oxygen. The frit 151 may include a filler (not shown) and an absorbent (not shown). The filler may adjust a thermal expansion coefficient. The absorbent absorbs a laser or an infrared ray. Further, the frit 151 may be cured by a laser or ultra-violet ray irradiation. Here, an intensity of the laser irradiated to the frit ranges from about 25 to about 60 W.

[0047] When the temperature of a glass material is rapidly decreased, a frit in powder form is produced. The frit may include a glass powder and an oxide powder. Further, when organic materials are added to the frit, a frit paste in a gel state is formed. The paste in the gel state is applied along a sealing line of the second substrate. Thereafter, when the frit is sintered at a predetermined temperature, the organic materials are removed, leaving a cured frit in a solid state. The sintering temperature may range from about 300 °C to about 700°C.

[0048] The adhesive 152 is formed to be spaced from the frit 151, and includes two discontinuous portions 52. At least one discontinuous portion 52 serves as an inlet for the reinforcing member 153. The additional discontinuous portion 52 may provide an exit for air bubbles while the reinforcing member 153 is introduced into a gap between the frit 151 and the adhesive 152. This configuration allows the reinforcing member 153 to be uniformly distributed between the frit 151 and the adhesive 152. The adhesive 152 includes at least one resin selected from the group consisting of epoxy, acrylate, urethane acrylate, and acrylate cyanide. Further, the adhesive 152 is formed along a sealing line (not shown), and includes two discontinuous portions 52, causing the adhesive 152 to become discontinuous. Ultra-violet ray or thermal process may be used to cure the adhesive 152.

[0049] The reinforcing member 153 functions to relieve impact applied to the frit 151 during a process of scribing the mother substrate (not shown) into unit substrates after the laser has been applied to the frit 151. The reinforcing member 153 is disposed between the frit 151 and the adhesive 152, and is injected between the frit 151 and the adhesive 152 through one of the discontinuous portions 52 of the adhesive 152. Here, the reinforcing member 153 may prevent the first and second substrates 100 and 200 adhered by the frit 151 from being damaged due to heat of the laser irradiated to the frit during a scribing process of the substrate. A material having a viscosity less than that of the adhesive 152 may be used to form the reinforcing member 153. The reinforcing member 153 includes at least one material selected from the group consisting of epoxy, acryl, and urethane. When the reinforcing member 153 has a viscosity equal to or greater than that of the adhesive 152, the reinforcing member 153 may not spread well, thereby preventing uniform injection of the reinforcing member 153 through the discontinuous portion 52. In one embodiment, the viscosity of the reinforcing member 153 ranges from about 0.1 Pa.s (100 cp) to about 4 Pa.s (4000 cp).

[0050] The second substrate 200 is bonded to one region of the first substrate 100. The second substrate 200 may function to protect an organic light emitting diode (not shown) formed in the pixel region 100a of the first substrate 100 from external water or oxygen. The second substrate 200 may be formed from a silicon oxide SiO_2, a silicon nitride SiNx, or a silicon oxy-nitride SiOxNy, although other suitable material may be used.

[0051] FIG. 3 is a cross-sectional plan view of the organic light emitting display shown in FIG. 1.

[0052] From Fig. 3 it can be seen that the first substrate 100 includes a deposition substrate 101 and at least one organic light emitting diode 110. The at least one organic light emitting diode 110 is formed on the deposition substrate 101. First, a buffer layer 111 is formed on the deposition layer 101. The deposition substrate 101 is formed of a glass. The buffer layer 111 is formed of an insulating material such as silicon oxide SiO_2 or silicon nitride SiNx. The buffer layer 111 prevents the deposition substrate 101 from being damaged due to external heat and the like.

[0053] A semiconductor layer 112 is formed over at least one region of the buffer layer 111. The semiconductor layer 112 includes an active layer 112a and a source/drain region 112b. A gate insulation layer 113 is formed over the buffer layer 111, covering the semiconductor layer 112. A gate electrode 114 is formed over one region of the gate insulation layer 113. The gate electrode 114 has a size corresponding to a width of the active layer 112a.

[0054] An interlayer insulation 115 is formed over the gate insulation layer 113, covering have the gate electrode 114. Source and drain electrodes 116a and 116b are formed over predetermined regions of the interlayer insulation 115. The source and drain electrodes 116a and 116b are coupled to one exposed region of the source/drain region 112b. A planarization layer 117 is formed on the interlayer insulation 115, covering the source and drain electrodes 116a and 116b.

[0055] A first electrode 119 is formed on one region of the planarization layer 117. The first electrode 119 is coupled with one exposed region of the source and drain electrodes 116a and 116b through a via hole 118.

[0056] A pixel definition film 120 is formed on the planarization layer 117, covering the first electrode 119. The pixel definition film 120 includes an opening (not shown) which exposes at least one region of the first electrode 119.

[0057] An organic layer 121 is formed in the opening of the pixel definition film 120. A second electrode layer 122 is formed on the pixel definition film 120, covering the organic layer 121.

[0058] The frit 151 is disposed on the pixel definition film between the non-pixel region 100b of the first substrate 100 and the second substrate 200, and bonds the first substrate 100 and the second substrate 200 to each other.

[0059] FIG. 4 is a flow chart that illustrates a method for fabricating an organic light emitting display according to the invention. The method includes a first step ST100 through to a seventh step ST700. This process can be applied to the formation of the device of Figures 1 to 3.

[0060] The first step ST100 involves forming and heating a frit on one region of the second substrate. The frit is interposed between the second substrate and the non-pixel region of the first substrate.

[0061] The second step ST200 is a step of applying an adhesive along the frit. Applying the adhesive may be performed using a screen printing or dispensing method. In the screen printing method, a desired design pattern is provided on a screen, and areas of the screen are blocked off with a non-permeable material. The adhesive is squeezed through openings of the screen, using a squeegee. In the dispensing method, the adhesive is applied to the second substrate in a predetermined shape and amount, using a machine having a nozzle.

[0062] The third step ST300 is a step of bonding the first substrate and the second substrate to each other. The first and second substrates are bonded to each other so that the organic light emitting diode is interposed between the first and the second substrates.

[0063] The fourth step ST400 is a step of curing the adhesive. The adhesive may be cured by a ultra-violet ray or thermal treatment process.

[0064] The fifth step ST500 is a step of melting the frit. The frit absorbs a laser or infrared ray. The laser or infrared ray irradiation melts the frit. The intensity of the laser for melting the frit ranges from about 25 W to about 50W. The frit is then cured.

[0065] The sixth step ST600 is a step of forming discontinuous portions in two regions of the adhesive. After curing the adhesive and the frit, two regions of the adhesive are perforated. At least one discontinuous portion serves as an inlet for the reinforcing member. The additional discontinuous portion may provide an exit for air bubbles while the reinforcing member is introduced into a gap between the frit and the adhesive. This configuration allows the reinforcing member to be uniformly distributed between the frit and the adhesive.

[0066] The seventh step ST700 is a step of injecting the reinforcing member between the frit and the adhesive through one of the discontinuous portions. Since the frit and the adhesive are spaced apart from each other by a predetermined distance, an empty space exists between the frit and the adhesive. The empty space may prevent the first and second substrates from being bonded to each other completely. Consequently, the first and second substrates are susceptible to impact. During a process of scribing a mother substrate into unit substrates, damage (such as cracking) can easily occur in the device. Accordingly, the reinforcing member is formed to fill the empty space between the frit and the adhesive, and this can absorb impact during the process. The injection process of the reinforcing member may be carried out using capillary action or a pressure difference. Then, the reinforcing member is cured. The reinforcing member can be cured by ultra-violet ray or thermal or rapid curing.

[0067] FIG. 5A to FIG. 5F are views that illustrate a method for fabricating an organic light emitting display according to a further embodiment of the invention. Referring to FIG. 5A to FIG. 5F, the organic light emitting display includes a first mother substrate 1000 and a second mother substrate 2000. The first mother substrate 1000 includes at least one pixel region 100a and at least one non-pixel region 100b. An organic light emitting diode is formed in the pixel region 100a. The non-pixel region 100b is formed outside the pixel region 100a. The second mother substrate 2000 is bonded to the first mother substrate 1000.

[0068] In fabricating an organic light emitting display, the frit 151 is formed and sintered in regions of the second mother substrate 2000 which correspond to the non-pixel regions 100b of the first mother substrate 1000. The frit 151 is interposed between the second mother substrate 2000 and the non-pixel region 100b of the first mother substrate 1000. The frit 151 may include a filler (not shown) and an absorbent (not shown). The filler may adjust a coefficient of thermal expansion. The absorbent absorbs a laser or an infrared ray.

[0069] When a temperature of a glass material is rapidly dropped, a frit is produced. The frit may include a glass powder and an oxide powder. Further, when organic materials are added to the frit 151, a paste in a gel state is formed. The paste in the gel state is applied along a sealing line of the second mother substrate 2000 using a first injector 160a. Thereafter, when the frit 151 is sintered at a predetermined temperature, organic materials are removed, leaving a cured frit in a solid state. The sintering temperature may range from about 300 °C to about 700°C (FIG. 5A).

[0070] Next, the adhesive 152 is applied using a second injector 160b to be spaced from the outside of the frit 151. The adhesive 152 includes discontinuous portions 52. The discontinuous portions 52 are formed by a cut-off region of the adhesive 152 by a predetermined interval. Certain of the discontinuous portions 52 function as inlets for the reinforcing member 153. The additional discontinuous portions provide exits for air bubbles as the reinforcing member 153 is introduced into the gaps between the frit 151 and the adhesive 152. When the discontinuous portions 52 are formed, the reinforcing member 153 is diverted into space between the frit 151 and the adhesive 152. The adhesive 152 includes at least one resin selected from the group consisting of epoxy, acrylate, urethane acrylate, and acrylate cyanide.

[0071] The adhesive is applied using a screen printing or dispensing method. In the screen printing method, a desired design pattern is provided on a screen, and areas of the screen are blocked off with a non-permeable material. The adhesive is squeezed through openings of the screen, using a squeegee. In the dispensing method, the adhesive is applied to the second substrate in a predetermined shape and amount, using a machine having a nozzle (FIG. 5B).

[0072] Next, the first mother substrate 1000 and the second mother substrate 2000 are bonded to each other. At least one organic light emitting diode (not shown) has been already formed on the first mother substrate 1000 in the region of each intended display panel 10. The organic light emitting diode may include a first electrode, an organic layer, and a second electrode. The first mother substrate 1000 and the second mother substrate 2000 are aligned with each other such that the organic light emitting diode is interposed between the first mother substrate 1000 and the second mother substrate 2000 (FIG. 5C).

[0073] Then, the adhesive 152 is cured. The adhesive 152 can be cured using ultra-violet ray or thermal treatment.

[0074] Next, a laser or infrared ray is irradiated to the frit 151 to be melted and cured. The frit 151 may include a filler (not shown) and an absorbent (not shown) therein. The filler may adjust a coefficient of thermal expansion. The absorbent may absorb a laser or an infrared ray. The intensity of the laser for melting the frit 151 may range from 25 to 60 W. The frit 151 is cured to bond the second mother substrate 2000 to the first mother substrate 1000.

[0075] Thereafter, the bonded first and second mother substrates 1000 and 2000 are scribed into a plurality of display panels 10. The adhesive 152 can prevent stress occurring during the scribing process from being transferred to a scribing surface. This reduces the defection rate of the scribing process.

[0076] Next, the reinforcing member 153 is injected between the frit 151 and the adhesive 152 of each panel via a respective discontinuous portion 52 of the adhesive 152. Because the frit 151 and the adhesive 152 are spaced from each other by a predetermined distance, an empty space is formed between the frit 151 and the adhesive 152. The empty space prevents the first mother substrate 1000 and the second mother substrate 2000 from being bonded to each other perfectly. Thus, they are susceptible to external impact. In one embodiment, the reinforcing member 153 may include a material having a viscosity less than that of the adhesive 152. The reinforcing member 153 includes at least one material selected from the group consisting of epoxy, acryl, and urethane. In one embodiment, a viscosity of the reinforcing member 153 ranges from about 0.1 Pa.s (100 cp) to about 4 Pa.s (4000 cp). Also, an injection process of the reinforcing member 153 may be carried out using capillary action or a pressure difference, and then the reinforcing member 153 is cured (FIG. 5E). The reinforcing member 153 can be cured by ultra-violet ray or thermal or rapid curing.

[0077] Although embodiments have been shown and described, it would be appreciated by those skilled in the art that changes might be made to what has been described above without departing from the principles of the invention, the scope of which is defined in the claims.

Claims

1. An organic light emitting display (OLED) device (2001, 1001), comprising:

   a first substrate (100) ;
   a second substrate (200) placed over the first substrate (100), wherein each of the first (100) and second substrates (200) is made of a single layer or comprises a plurality of layers;
   an array of organic light-emitting pixels (1021) interposed between the first (100) and second substrates (200) ; and
   a sealing structure interposed between the first (100) and second substrates (200) while surrounding the array (1021), wherein the sealing structure, the first substrate (100) and the second substrate (200) in combination define an enclosed space (1081) in which the array (1021) is located;
   wherein the sealing structure comprises a first member (151), a second member (153) and a third member (152), the first member (151) comprising a first material, the second member (153) comprising a second material, and the third member (152) comprising a third material, and wherein the second member (153) is located between and contacts the first (151) and third members (152),
   characterized in that the third member (152) includes two discontinuous portions (52) only,
   in that the first material comprises frit, the second material comprises one or more selected from the group consisting of epoxy, acryl, and urethane resin, and the third material comprises one or more selected from the group consisting of epoxy, acrylate, urethane acrylate, and acrylate cyanide resin,
   and
   in that the first member surrounds the array, the second member surrounds the first member, and the third member surrounds the second member.

2. A device (1000, 1001) according to Claim 1, wherein the first member (151) forms a closed loop surrounding the array (1021).

3. A device according (1000, 1001) to Claim 1 or 2, wherein the second member (153) forms a closed loop surrounding the first member (151).

4. A device (1000, 1001) according to Claim 1, wherein at least one of the said two discontinuous portions (52) comprises a gap or a material other than the third material.

5. A device (1000, 1001) according to any preceding Claim, wherein the second material is the same as the third material.

6. A device (1000, 1001) according to Claim 5, wherein there is an identifiable interface between the second and third members.

7. A device (1000, 1001) according to one of Claims 1 to 4, wherein the second material is different from the third material.

8. A device (1000, 1001) according to any preceding Claim, wherein the first member (151) comprises one or more materials selected from the group consisting of magnesium oxide (MgO), calcium oxide (CaO), barium oxide (BaO), lithium oxide (Li_2O), sodium ox-

ide (Na_2O), potassium oxide (K_2O), boron oxide (B_2O_3), vanadium oxide (V_2O_5), zinc oxide (ZnO), tellurium oxide (TeO_2), aluminum oxide (Al_2O_3), silicon dioxide (SiO_2), lead oxide (PbO), tin oxide (SnO), phosphorous oxide (P_2O_5), ruthenium oxide (Ru_2O), rubidium oxide (Rb_2O), rhodium oxide (Rh_2O), ferrite oxide (Fe_2O_3), copper oxide (CuO), titanium oxide (TiO_2), tungsten oxide (WO_3), bismuth oxide (Bi_2O_3), antimony oxide (Sb_2O_3), lead-borate glass, tin-phosphate glass, vanadate glass, and borosilicate.

9. A method of making an organic light emitting display (OLED) device(1000, 1001), the method comprising:

providing a device comprising:

a first substrate (100);
a second substrate (200) placed over the first substrate (100);
an array of organic light-emitting pixels (1021) interposed between the first (100) and second substrates (200); and
a first sealing member (151) interposed between the first (100) and second substrates (200) while surrounding the array (1021),
a third sealing member (152) interposed between the first (100) and second substrates (200), while surrounding the first sealing member (151) with a space defined between the first (151) and third sealing members (152) and further between the first (100) and second substrates (200), and comprising two discontinuous portions only, and

filling a material into the space so as to form a second sealing member (153) interposed between the first (100) and second substrates (200) and further between the first (151) and third sealing members (152),
wherein the first material comprises frit, the second material comprises one or more selected from the group consisting of epoxy, acryl, and urethane resin, and the third material comprises one or more selected from the group consisting of epoxy, acrylate, urethane acrylate, and acrylate cyanide resin.

10. A method according to Claim 9, wherein filling comprises injecting the material into the space via at least one of the said two discontinuous portions (52).

11. A method according to Claim 10, wherein filling further comprises moving the material within the space.

12. A method according to Claim 11, wherein moving the material within the space uses positive or negative air pressure.

13. A method according to one of Claims 9 to 12, wherein the third sealing member (152) comprises a portion parallel to a portion of the first sealing member (151).

14. A method according to one of Claims 9 to 13, further comprising curing the material after filling into the space.

15. A method according to one of Claims 9 to 14, wherein the first sealing member (151) forms a closed loop surrounding the array (1021).

16. A method according to one of Claims 9 to 15, wherein the second sealing member (153) and third sealing member (152) comprises the same material.

17. A method according to one of Claims 9 to 16, wherein the second material has a viscosity of from 0.1 Pa.s (100 cp) to 4 Pa.s (4000 cp).

18. A method according to one of Claims 9 to 17, wherein providing the device comprises:

providing the second substrate (200), the first sealing member (151) formed on the second substrate (200) and the third sealing member (152) formed on the second substrate (200) ; and
arranging the first (100) and second substrates (200) such that the array (1021) is interposed between the first (100) and second substrates (200) and that the array (1021) is surrounded by the first sealing member (151).

19. A method according to one of Claims 9 to 17, wherein providing the device comprises:

providing the first substrate (100) and the first sealing member (151) formed on the first substrate (100); and
forming the third sealing member (152) parallel to the first sealing member (151) with a gap therebetween; and
arranging the first (100) and second substrates (200) such that the array (1021) is interposed between the first (100) and second substrates (200) and that the array (1021) is surrounded by the first sealing member (151).

20. A method according to Claim 19, wherein providing the device further comprises melting and re-solidifying at least part of the first sealing member (151) after arranging so as to bond the first sealing member (151) to the first (100) and second substrates (200).

21. A method according to Claim 19 or 20, wherein forming the third sealing material (152) comprises utilizing a screen printing or dispensing method.

22. A method according to one of Claims 9 to 21, wherein the device further comprises:

a plurality of additional arrays of organic light-emitting pixels (1021)interposed between the first (1000) and second substrates (2000);
a plurality of additional first sealing members (151) interposed between the first (1000) and second substrates (2000), a first one of the additional first sealing members (151) surrounding one of the additional arrays (1021);
a plurality of additional third sealing members (152) interposed between the first (1000) and second substrates (2000), one of the additional third sealing members (152) surrounds the first one of the additional first sealing members (151) with an additional space, which is defined between the first one of the additional first sealing members (151) and the one of the additional third sealing members (152), and wherein the additional space is further between the first (1000) and second substrates(2000); and
wherein the method further comprises filling the material into the additional space so as to form an additional second sealing member (153) interposed between the first one of the additional first sealing members (151) and the one of the additional third sealing members (152).

23. A method according to Claim 22, further comprising cutting the first (1000) and second substrates (2000) into a plurality of pieces, comprising a cut-portion of the first substrate (100), a cut-portion of the second substrate (200), the array of organic light-emitting pixels (1021), the first sealing member (151) and the third sealing member (152), prior to filling the material into the additional space so as to form an additional second sealing member (153).

Patentansprüche

1. Organische lichtemittierende Anzeigevorrichtung (organic light emitting display, OLED) (2001, 1001), umfassend:

ein erstes Substrat (100);
ein zweites Substrat (200), das über dem ersten Substrat (100) platziert ist, wobei jedes von dem ersten (100) und dem zweiten Substrat (200) aus einer einzigen Schicht hergestellt ist oder eine Vielzahl von Schichten umfasst;
eine Anordnung von organischen lichtemittierenden Pixeln (1021), die zwischen das erste (100) und das zweite Substrat (200) zwischengestellt sind; und
eine Dichtungsstruktur, die zwischen das erste (100) und das zweite Substrat (200) zwischengestellt ist, während sie die Anordnung (1021) umgibt, wobei die Dichtungsstruktur, das erste Substrat (100) und das zweite Substrat (200) in Kombination einen geschlossenen Raum (1081) definieren, in dem sich die Anordnung (1021) befindet;
wobei die Dichtungsstruktur ein erstes Element (151), ein zweites Element (153) und ein drittes Element (152) umfasst, wobei das erste Element (151) ein erstes Material umfasst, das zweite Element (153) ein zweites Material umfasst und das dritte Element (152) ein drittes Material umfasst, und
wobei sich das zweite Element (153) zwischen dem ersten (151) und dem dritten Element (152) befindet und diese berührt,
dadurch gekennzeichnet, dass das dritte Element (152) nur zwei diskontinuierliche Abschnitte (52) beinhaltet,
dass das erste Material Fritte umfasst, das zweite Material eines oder mehrere ausgewählt aus der Gruppe bestehend aus Epoxid-, Acryl- und Urethanharz umfasst, und das dritte Material eines oder mehrere ausgewählt aus der Gruppe bestehend aus Epoxid-, Acrylat-, Urethanacrylat- und Acrylatcyanidharz umfasst,
und
dass das erste Element die Anordnung umgibt, das zweite Element das erste Element umgibt und das dritte Element das zweite Element umgibt.

2. Vorrichtung (1000, 1001) nach Anspruch 1, wobei das erste Element (151) eine geschlossene Schleife bildet, die die Anordnung (1021) umgibt.

3. Vorrichtung (1000, 1001) gemäß Anspruch 1 oder 2, wobei das zweite Element (153) eine geschlossene Schleife um das erste Element (151) bildet.

4. Vorrichtung (1000, 1001) nach Anspruch 1, wobei mindestens einer der beiden diskontinuierlichen Abschnitte (52) einen Spalt oder ein anderes Material als das dritte Material umfasst.

5. Vorrichtung (1000, 1001) nach einem der vorherigen Ansprüche, wobei das zweite Material das gleiche wie das dritte Material ist.

6. Vorrichtung (1000, 1001) nach Anspruch 5, wobei es zwischen dem zweiten und dritten Element eine identifizierbare Schnittstelle gibt.

7. Vorrichtung (1000, 1001) nach einem der Ansprüche 1 bis 4, wobei sich das zweite Material von dem dritten Material unterscheidet.

8. Vorrichtung (1000, 1001) nach einem der vorherigen Ansprüche, wobei das erste Element (151) ein oder mehrere Materialien umfasst, die aus der Gruppe ausgewählt sind, die aus Magnesiumoxid (MgO), Calciumoxid (CaO), Bariumoxid (BaO), Lithiumoxid (Li_2O), Natriumoxid (Na_2O), Kaliumoxid (K_2O), Boroxid (B_2O_3), Vanadiumoxid (V_2O_5), Zinkoxid (ZnO), Telluroxid (TeO_2), Aluminiumoxid (Al_2O_3), Siliziumdioxid (SiO_2), Bleioxid (PbO), Zinnoxid (SnO), Phosphoroxid (P_2O_5), Rutheniumoxid (Ru_2O), Rubidiumoxid (Rb_2O), Rhodiumoxid (Rh_2O), Ferritoxid (Fe_2O_3), Kupferoxid (CuO), Titanoxid (TiO_2), Wolframoxid (WO_3), Wismutoxid (Bi_2O_3), Antimonoxid (Sb_2O_3), Bleiboratglas, Zinnphosphatglas, Vanadatglas und Borosilikat besteht.

9. Verfahren zur Herstellung einer organischen lichtemittierende Anzeigevorrichtung (organic light emitting display, OLED) (1000, 1001), das Verfahren umfassend:
Bereitstellen einer Vorrichtung, umfassend:

ein erstes Substrat (100);
ein zweites Substrat (200), das über dem ersten Substrat (100) platziert ist;
eine Anordnung von organischen lichtemittierenden Pixeln (1021), die zwischen das erste (100) und das zweite Substrat (200) zwischengestellt sind; und
ein erstes Dichtungselement (151), das zwischen das erste (100) und das zweite Substrat (200) zwischengestellt ist, während es die Anordnung (1021) umgibt,
ein drittes Dichtungselement (152), das zwischen das erste (100) und das zweite Substrat (200) zwischengestellt ist, während es das erste Dichtungselement (151) mit einem zwischen dem ersten (151) und dem dritten Dichtungselement (152) und ferner zwischen dem ersten (100) und dem zweiten Substrat (200) definierten Raum umgibt und nur zwei diskontinuierliche Abschnitte umfasst, und
Füllen eines Materials in den Raum, um ein zweites Dichtungselement (153) zu bilden, das zwischen das erste (100) und das zweite Substrat (200) und ferner zwischen das erste (151) und das dritte Dichtungselement (152) zwischengestellt ist,
wobei das erste Material Fritte umfasst, das zweite Material eines oder mehrere ausgewählt aus der Gruppe bestehend aus Epoxid-, Acryl- und Urethanharz umfasst, und das dritte Material eines oder mehrere ausgewählt aus der Gruppe bestehend aus Epoxid-, Acrylat-, Urethanacrylat- und Acrylatcyanidharz umfasst.

10. Verfahren nach Anspruch 9, wobei das Füllen ein Einspritzen des Materials in den Raum über mindestens einen der zwei diskontinuierlichen Abschnitte (52) umfasst.

11. Verfahren nach Anspruch 10, wobei das Füllen ferner ein Bewegen des Materials innerhalb des Raums umfasst.

12. Verfahren nach Anspruch 11, wobei das Bewegen des Materials innerhalb des Raums einen positiven oder negativen Luftdruck verwendet.

13. Verfahren nach einem der Ansprüche 9 bis 12, wobei das dritte Dichtungselement (152) einen Abschnitt parallel zu einem Abschnitt des ersten Dichtungselements (151) umfasst.

14. Verfahren nach einem der Ansprüche 9 bis 13, ferner umfassend ein Härten des Materials nach dem Füllen in den Raum.

15. Verfahren nach einem der Ansprüche 9 bis 14, wobei das erste Dichtungselement (151) eine geschlossene Schleife bildet, die die Anordnung (1021) umgibt.

16. Verfahren nach einem der Ansprüche 9 bis 15, wobei das zweite Dichtungselement (153) und das dritte Dichtungselement (152) das gleiche Material umfassen.

17. Verfahren nach einem der Ansprüche 9 bis 16, wobei das zweite Material eine Viskosität von 0,1 Pa·s (100 cp) bis 4 Pa·s (4000 cp) aufweist.

18. Verfahren nach einem der Ansprüche 9 bis 17, wobei das Bereitstellen der Vorrichtung Folgendes umfasst:

Bereitstellen des zweiten Substrats (200), wobei das erste Dichtungselement (151) auf dem zweiten Substrat (200) gebildet und das dritte Dichtungselement (152) auf dem zweiten Substrat (200) gebildet ist; und
Anordnen des ersten (100) und des zweiten Substrats (200), sodass die Anordnung (1021) zwischen das erste (100) und das zweite Substrat (200) zwischengestellt ist und dass die Anordnung (1021) von dem ersten Dichtungselement (151) umgeben ist.

19. Verfahren nach einem der Ansprüche 9 bis 17, wobei das Bereitstellen der Vorrichtung Folgendes umfasst:

Bereitstellen des ersten Substrats (100) und des ersten Dichtungselements (151), das auf dem ersten Substrat (100) gebildet ist; und

Bilden des dritten Dichtungselements (152) parallel zu dem ersten Dichtungselement (151) mit einem Spalt dazwischen; und

Anordnen des ersten (100) und des zweiten Substrats (200), sodass die Anordnung (1021) zwischen das erste (100) und das zweite Substrat (200) zwischengestellt ist und dass die Anordnung (1021) von dem ersten Dichtungselement (151) umgeben ist.

20. Verfahren nach Anspruch 19, wobei das Bereitstellen der Vorrichtung ferner ein Schmelzen und erneutes Verfestigen mindestens eines Teils des ersten Dichtungselements (151) nach seiner Anordnung umfasst, um das erste Dichtungselement (151) an das erste (100) und das zweite Substrat (200) zu binden.

21. Verfahren nach Anspruch 19 oder 20, wobei das Bilden des dritten Dichtungsmaterials (152) ein Verwenden eines Siebdruck- oder Ausgabeverfahrens umfasst.

22. Verfahren nach einem der Ansprüche 9 bis 21, wobei die Vorrichtung ferner Folgendes umfasst:

eine Vielzahl von zusätzlichen Anordnungen von organischen lichtemittierenden Pixeln (1021), die zwischen das erste (1000) und das zweite Substrat (2000) zwischengestellt sind;

eine Vielzahl von zusätzlichen ersten Dichtungselementen (151), die zwischen das erste (1000) und das zweite Substrat (2000) zwischengestellt sind, wobei ein erstes der zusätzlichen ersten Dichtungselemente (151) eine der zusätzlichen Anordnungen (1021) umgibt;

eine Vielzahl von zusätzlichen dritten Dichtungselementen (152), die zwischen das erste (1000) und das zweite Substrat (2000) zwischengestellt sind, wobei eines der zusätzlichen dritten Dichtungselemente (152) das erste der zusätzlichen ersten Dichtungselemente (151) mit einem zusätzlichen Raum umgibt, der zwischen dem ersten der zusätzlichen ersten Dichtungselemente (151) und dem einen der zusätzlichen dritten Dichtungselemente (152) definiert ist, und wobei der zusätzliche Raum ferner zwischen dem ersten (1000) und dem zweiten Substrat (2000) ist; und

wobei das Verfahren ferner ein Füllen des Materials in den zusätzlichen Raum umfasst, um ein zusätzliches zweites Dichtungselement (153) zu bilden, das zwischen das erste der zusätzlichen ersten Dichtungselemente (151) und das eine der zusätzlichen dritten Dichtungselemente (152) zwischengestellt ist.

23. Verfahren nach Anspruch 22, ferner umfassend ein Schneiden des ersten (1000) und des zweiten Substrats (2000) in eine Vielzahl von Stücken, umfassend einen Schnittabschnitt des ersten Substrats (100), einen Schnittabschnitt des zweiten Substrats (200), die Anordnung von organischen lichtemittierenden Pixeln (1021), das erste Dichtungselement (151) und das dritte Dichtungselement (152), bevor das Material in den zusätzlichen Raum gefüllt wird, um ein zusätzliches zweites Dichtungselement (153) zu bilden.

Revendications

1. Dispositif d'affichage électroluminescent organique (OLED) (2001, 1001), comprenant :

un premier substrat (100) ;

un deuxième substrat (200) placé sur le premier substrat (100), dans lequel chacun des premier (100) et deuxième (200) substrats est constitué d'une seule couche ou comprend une pluralité de couches ;

un réseau de pixels électroluminescents organiques (1021) interposé entre les premier (100) et deuxième (200) substrats ; et

une structure d'étanchéité interposée entre les premier (100) et deuxième (200) substrats tout en entourant le réseau (1021), dans lequel la structure d'étanchéité, le premier substrat (100) et le deuxième substrat (200) en combinaison définissent un espace fermé (1081) dans lequel le réseau (1021) est situé ;

dans lequel la structure d'étanchéité comprend un premier élément (151), un deuxième élément (153) et un troisième élément (152), le premier élément (151) comprenant un premier matériau, le deuxième élément (153) comprenant un deuxième matériau, et le troisième élément (152) comprenant un troisième matériau, et

dans lequel le deuxième élément (153) est situé entre les premier (151) et troisième (152) éléments et est en contact avec ceux-ci,

caractérisé en ce que le troisième élément (152) comprend seulement deux parties discontinues (52),

en ce que le premier matériau comprend une fritte, le deuxième matériau comprend un ou plusieurs matériaux sélectionnés dans le groupe consistant en la résine d'époxy, d'acryle et d'uréthane, et le troisième matériau comprend un ou plusieurs matériaux sélectionnés dans le groupe consistant en la résine d'époxy, d'acrylate, d'acrylate d'uréthane et de cyanure d'acrylate, et

en ce que le premier élément entoure le réseau, le deuxième élément entoure le premier élément, et le troisième élément entoure le deuxième élément.

2. Dispositif (1000, 1001) selon la revendication 1, dans lequel le premier élément (151) forme une boucle fermée entourant le réseau (1021).

3. Dispositif (1000, 1001) selon la revendication 1 ou 2, dans lequel le deuxième élément (153) forme une boucle fermée entourant le premier élément (151).

4. Dispositif (1000, 1001) selon la revendication 1, dans lequel au moins l'une desdites deux parties discontinues (52) comprend un espace ou un matériau autre que le troisième matériau.

5. Dispositif (1000, 1001) selon l'une quelconque des revendications précédentes, dans lequel le deuxième matériau est le même que le troisième matériau.

6. Dispositif (1000, 1001) selon la revendication 5, dans lequel il y a une interface identifiable entre les deuxième et troisième éléments.

7. Dispositif (1000, 1001) selon l'une des revendications 1 à 4, dans lequel le deuxième matériau est différent du troisième matériau.

8. Dispositif (1000, 1001) selon l'une quelconque des revendications précédentes, dans lequel le premier élément (151) comprend un ou plusieurs matériaux sélectionnés dans le groupe consistant en l'oxyde de magnésium (MgO), l'oxyde de calcium (CaO), l'oxyde de baryum (BaO), l'oxyde de lithium (Li_2O), l'oxyde de sodium (Na_2O), l'oxyde de potassium (K_2O), l'oxyde de bore (B_2O_3), l'oxyde de vanadium (V_2O_5), l'oxyde de zinc (ZnO), l'oxyde de tellure (TeO_2), l'oxyde d'aluminium (Al_2O_3), le dioxyde de silicium (SiO_2), l'oxyde de plomb (PbO), l'oxyde d'étain (SnO), l'oxyde de phosphore (P_2O_5), l'oxyde de ruthénium (Ru_2O), l'oxyde de rubidium (Rb_2O), l'oxyde de rhodium (Rh_2O), l'oxyde de ferrite (Fe_2O_3), l'oxyde de cuivre (CuO), l'oxyde de titane (TiO_2), l'oxyde de tungstène (WO_3), l'oxyde de bismuth (Bi_2O_3), l'oxyde d'antimoine (Sb_2O_3), le verre de borate de plomb, le verre de phosphate d'étain, le verre de vanadate, et le borosilicate.

9. Procédé de fabrication d'un dispositif d'affichage électroluminescent organique (OLED) (1000, 1001), le procédé comprenant :
la fourniture d'un dispositif comprenant :

un premier substrat (100) ;
un deuxième substrat (200) placé sur le premier substrat (100) ;
un réseau de pixels électroluminescents organiques (1021) interposé entre les premier (100) et deuxième (200) substrats ; et
un premier élément d'étanchéité (151) interposé entre les premier (100) et deuxième (200) substrats tout en entourant le réseau (1021),
un troisième élément d'étanchéité (152) interposé entre les premier (100) et deuxième (200) substrats, tout en entourant le premier élément d'étanchéité (151) avec un espace défini entre les premier (151) et troisième (152) éléments d'étanchéité et en outre entre les premier (100) et deuxième (200) substrats, et comprenant seulement deux parties discontinues, et
l'introduction d'un matériau dans l'espace de manière à former un deuxième élément d'étanchéité (153) interposé entre les premier (100) et deuxième (200) substrats et en outre entre les premier (151) et troisième (152) éléments d'étanchéité,
dans lequel le premier matériau comprend une fritte, le deuxième matériau comprend un ou plusieurs matériaux sélectionnés dans le groupe consistant en la résine d'époxy, d'acryle et d'uréthane, et le troisième matériau comprend un ou plusieurs matériaux sélectionnés dans le groupe consistant en la résine d'époxy, d'acrylate, d'acrylate d'uréthane et de cyanure d'acrylate.

10. Procédé selon la revendication 9, dans lequel l'introduction comprend l'injection du matériau dans l'espace par l'intermédiaire d'au moins l'une desdites deux parties discontinues (52).

11. Procédé selon la revendication 10, dans lequel l'introduction comprend en outre le déplacement du matériau dans l'espace.

12. Procédé selon la revendication 11, dans lequel le déplacement du matériau dans l'espace utilise une pression d'air positive ou négative.

13. Procédé selon l'une des revendications 9 à 12, dans lequel le troisième élément d'étanchéité (152) comprend une partie parallèle à une partie du premier élément d'étanchéité (151).

14. Procédé selon l'une des revendications 9 à 13, comprenant en outre la cuisson du matériau après son introduction dans l'espace.

15. Procédé selon l'une des revendications 9 à 14, dans lequel le premier élément d'étanchéité (151) forme une boucle fermée entourant le réseau (1021).

16. Procédé selon l'une des revendications 9 à 15, dans lequel le deuxième élément d'étanchéité (153) et le troisième élément d'étanchéité (152) comprennent le même matériau.

17. Procédé selon l'une des revendications 9 à 16, dans lequel le deuxième matériau a une viscosité de 0,1 Pa.s (100 cp) à 4 Pa.s (4000 cp).

18. Procédé selon l'une des revendications 9 à 17, dans lequel la fourniture du dispositif comprend :

la fourniture du deuxième substrat (200), du premier élément d'étanchéité (151) formé sur le deuxième substrat (200) et du troisième élément d'étanchéité (152) formé sur le deuxième substrat (200) ; et
l'agencement des premier (100) et deuxième (200) substrats de sorte que le réseau (1021) soit interposé entre les premier (100) et deuxième (200) substrats et que le réseau (1021) soit entouré par le premier élément d'étanchéité (151).

19. Procédé selon l'une des revendications 9 à 17, dans lequel la fourniture du dispositif comprend :

la fourniture du premier substrat (100) et du premier élément d'étanchéité (151) formé sur le premier substrat (100) ; et
la formation du troisième élément d'étanchéité (152) parallèlement au premier élément d'étanchéité (151) avec un espace entre eux ; et
l'agencement des premier (100) et deuxième (200) substrats de sorte que le réseau (1021) soit interposé entre les premier (100) et deuxième (200) substrats et que le réseau (1021) soit entouré par le premier élément d'étanchéité (151).

20. Procédé selon la revendication 19, dans lequel la fourniture du dispositif comprend en outre la fusion et la resolidification d'au moins une partie du premier élément d'étanchéité (151) après l'agencement de manière à lier le premier élément d'étanchéité (151) aux premier (100) et deuxième (200) substrats.

21. Procédé selon la revendication 19 ou 20, dans lequel la formation du troisième matériau d'étanchéité (152) comprend l'utilisation d'une sérigraphie ou d'un procédé de distribution.

22. Procédé selon l'une des revendications 9 à 21, dans lequel le dispositif comprend en outre :

une pluralité de réseaux supplémentaires de pixels électroluminescents organiques (1021) interposés entre les premier (1000) et deuxième substrats (2000) ;
une pluralité de premiers éléments d'étanchéité supplémentaires (151) interposés entre les premier (1000) et deuxième substrats (2000), un premier des premiers éléments d'étanchéité supplémentaires (151) entourant l'un des réseaux supplémentaires (1021) ;
une pluralité de troisièmes éléments d'étanchéité supplémentaires (152) interposés entre les premier (1000) et deuxième substrats (2000), l'un des troisièmes éléments d'étanchéité supplémentaires (152) entoure le premier des premiers éléments d'étanchéité supplémentaires (151) avec un espace supplémentaire, qui est défini entre le premier des premiers éléments d'étanchéité supplémentaires (151) et ledit un des troisièmes éléments d'étanchéité supplémentaires (152), et dans lequel l'espace supplémentaire est en outre entre les premier (1000) et deuxième substrats (2000) ; et
dans lequel le procédé comprend en outre l'introduction du matériau dans l'espace supplémentaire de manière à former un deuxième élément d'étanchéité supplémentaire (153) interposé entre le premier des premiers éléments d'étanchéité supplémentaires (151) et ledit un des troisièmes éléments d'étanchéité supplémentaires (152).

23. Procédé selon la revendication 22, comprenant en outre la découpe des premier (1000) et deuxième substrats (2000) en une pluralité de morceaux, comprenant une partie découpée du premier substrat (100), une partie découpée du deuxième substrat (200), le réseau de pixels électroluminescents organiques (1021), le premier élément d'étanchéité (151) et le troisième élément d'étanchéité (152), avant l'introduction du matériau dans l'espace supplémentaire de manière à former un deuxième élément d'étanchéité supplémentaire (153).

FIG. 1

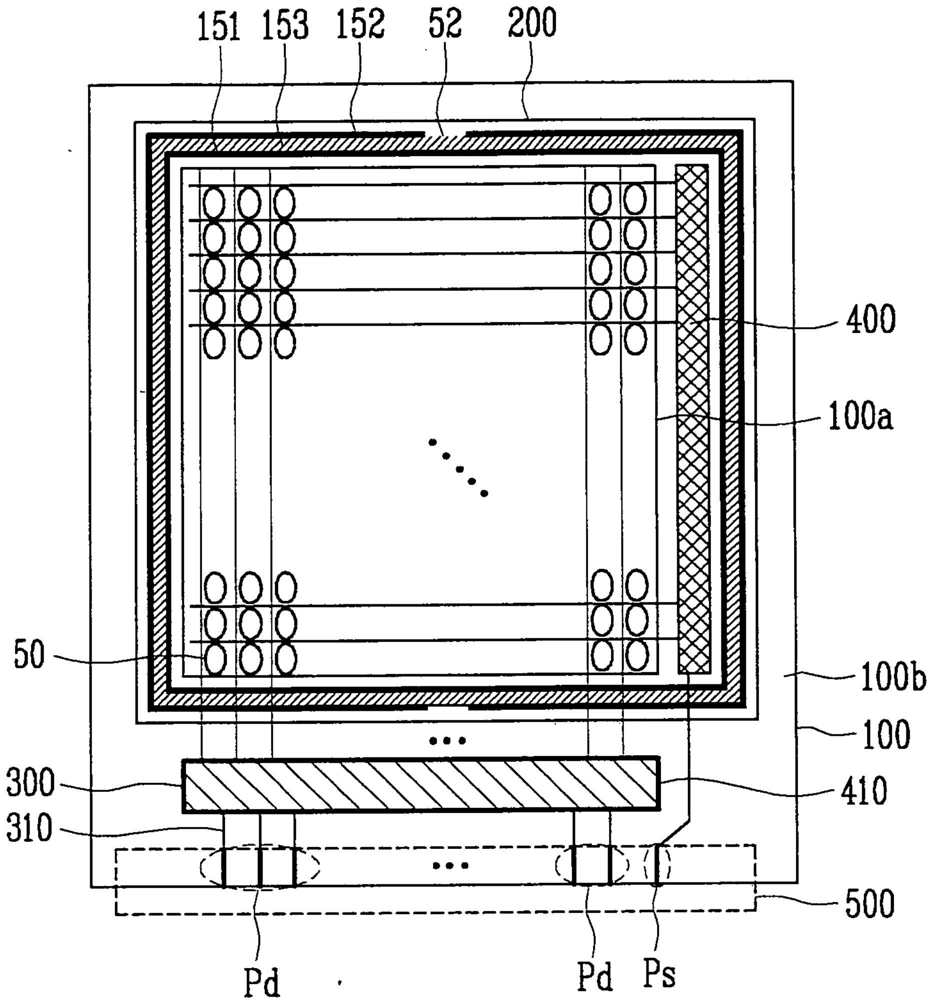


FIG. 2

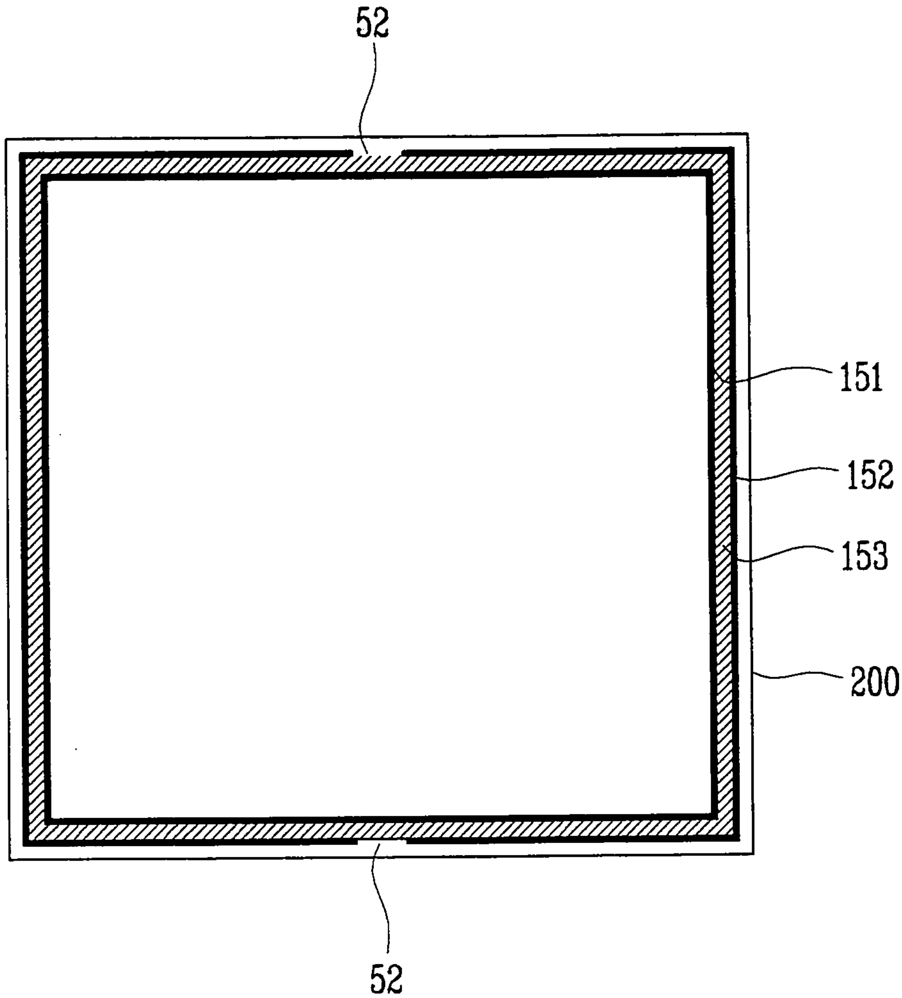


FIG. 3

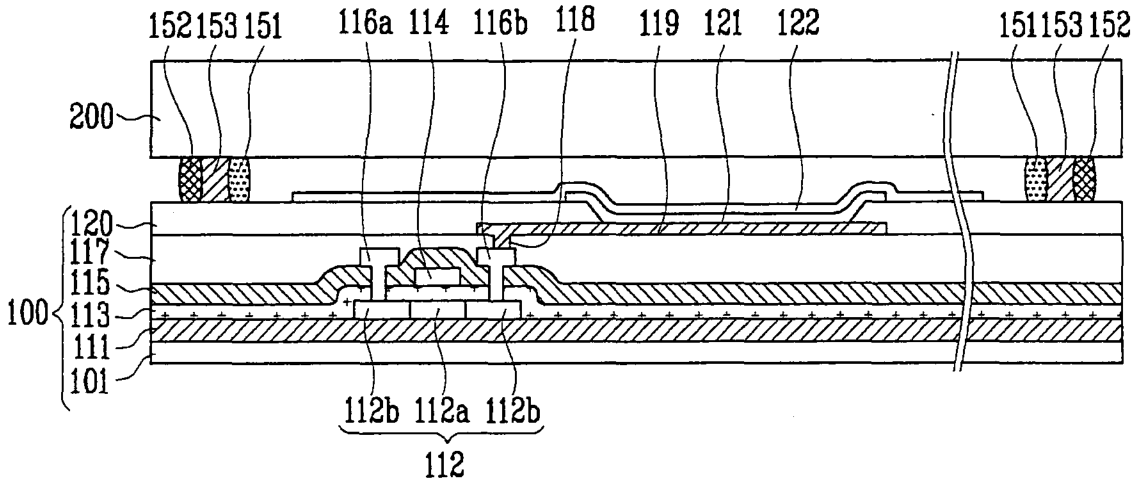

152 153 151
116a 114 116b 118
119 121 122
151 153 152
200
120
117
115
100
113
111
101
112b 112a 112b
112

FIG. 4

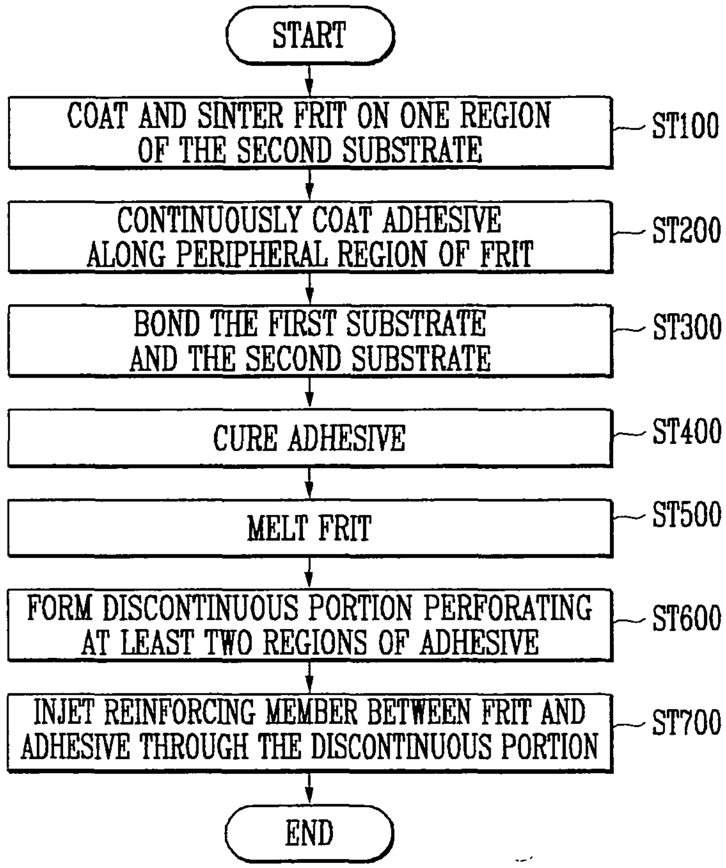

START
COAT AND SINTER FRIT ON ONE REGION OF THE SECOND SUBSTRATE
ST100
CONTINUOUSLY COAT ADHESIVE ALONG PERIPHERAL REGION OF FRIT
ST200
BOND THE FIRST SUBSTRATE AND THE SECOND SUBSTRATE
ST300
CURE ADHESIVE
ST400
MELT FRIT
ST500
FORM DISCONTINUOUS PORTION PERFORATING AT LEAST TWO REGIONS OF ADHESIVE
ST600
INJET REINFORCING MEMBER BETWEEN FRIT AND ADHESIVE THROUGH THE DISCONTINUOUS PORTION
ST700
END

FIG. 5A

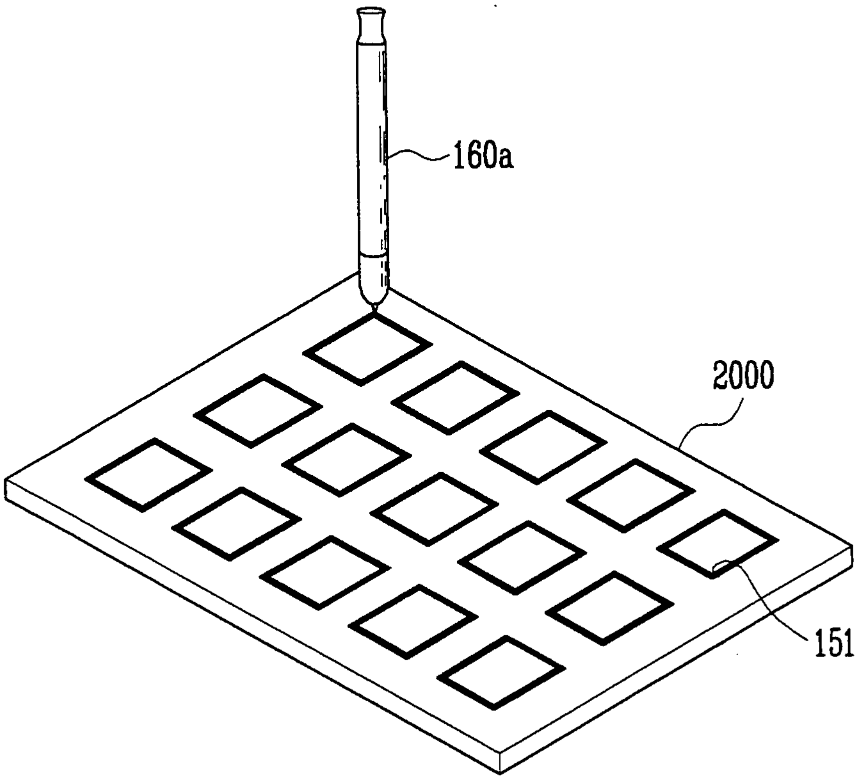


FIG. 5B

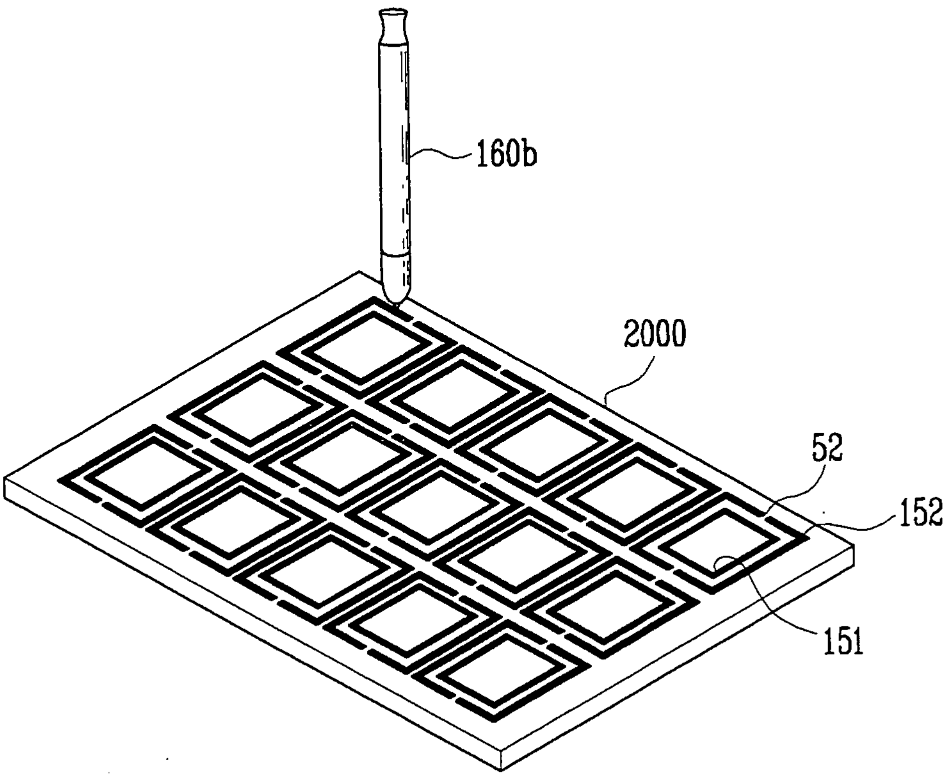


FIG. 5C

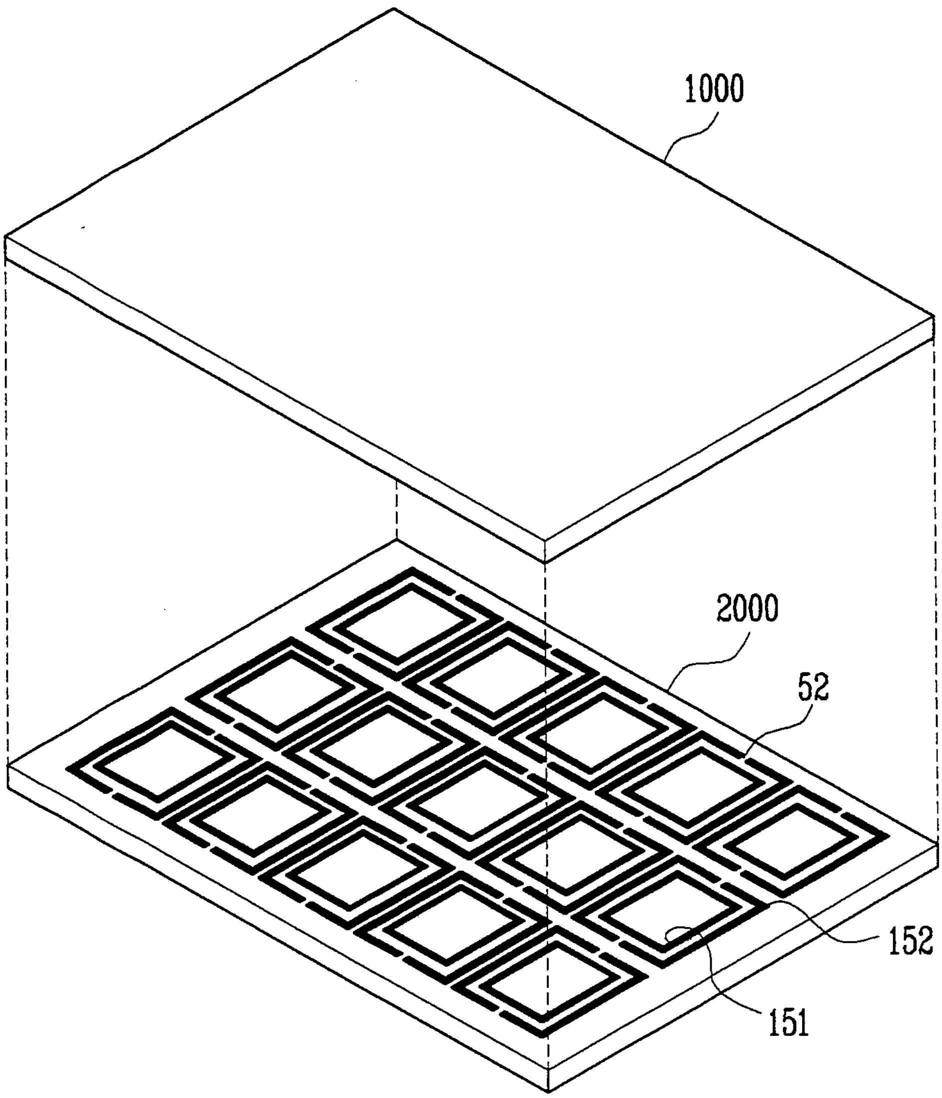


FIG. 5D

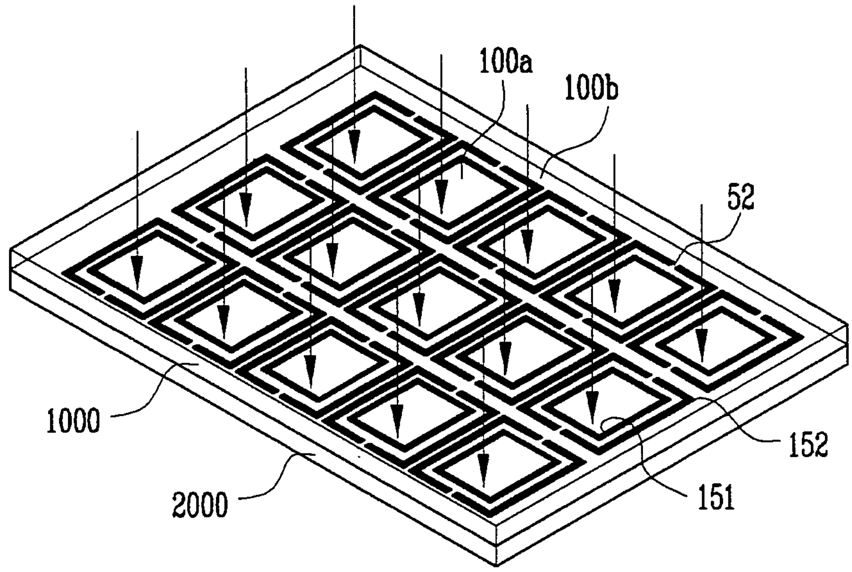

LASER
100a
100b
52
1000
2000
152
151

FIG. 5E

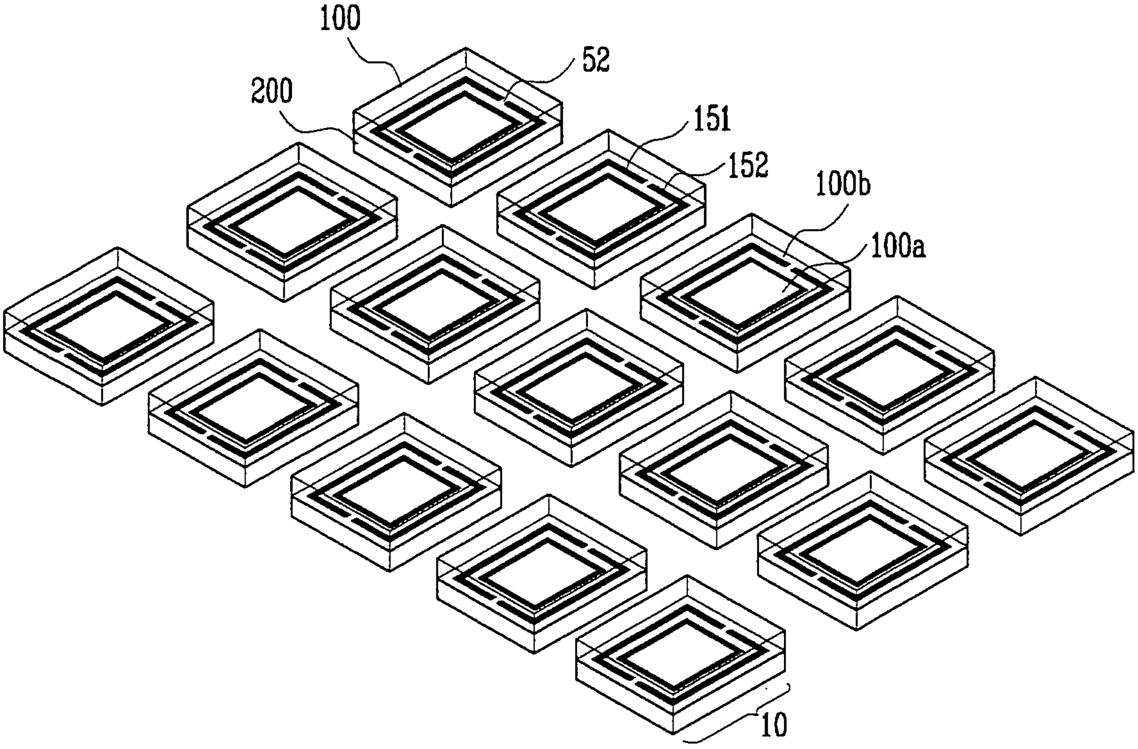

100
52
200
151
152
100b
100a
10

FIG. 5F

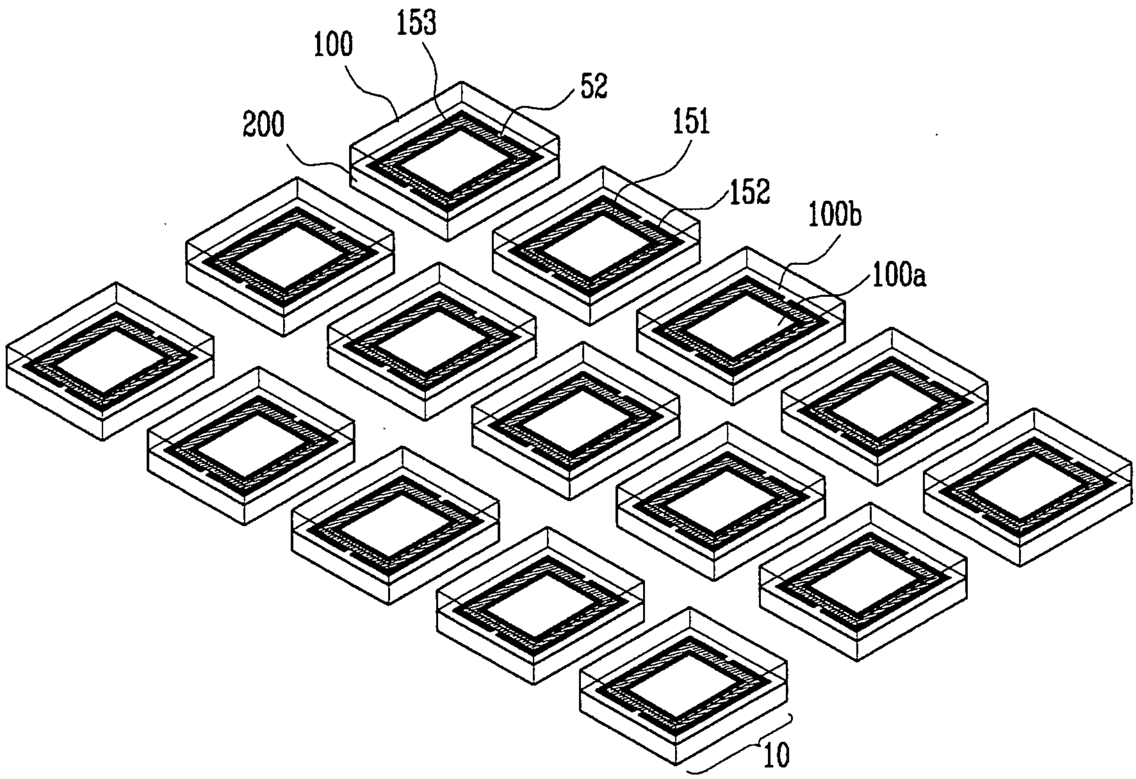


FIG. 6A

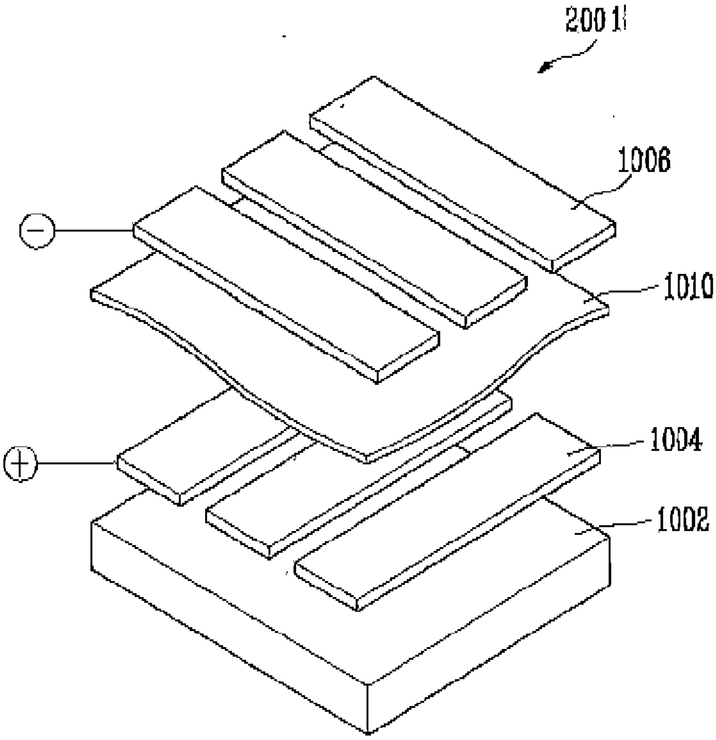


FIG. 6B

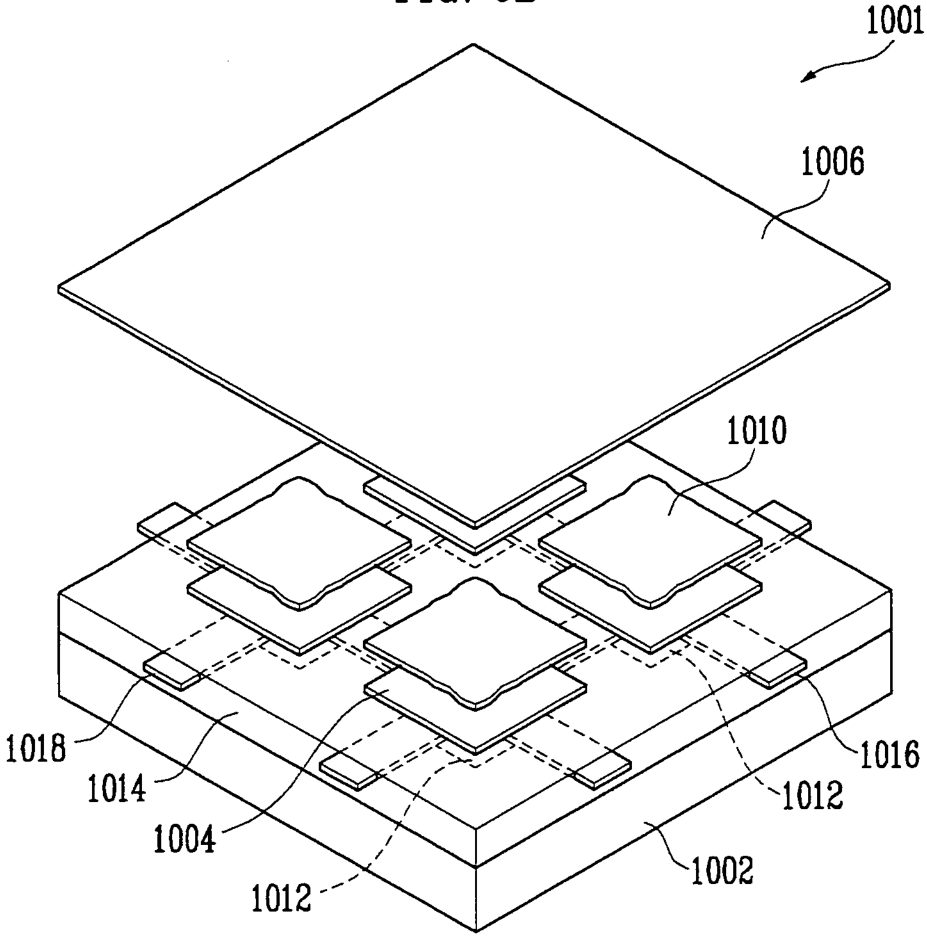

1001
1006
1010
1018
1014
1004
1012
1016
1012
1002

FIG. 6C

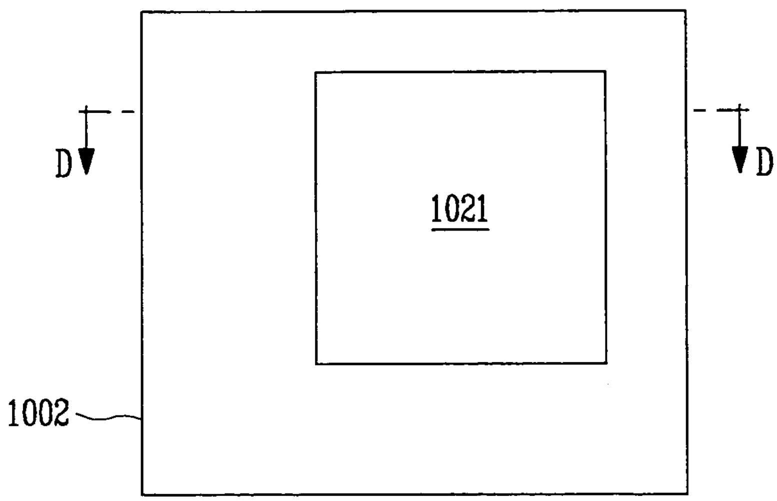

D
D
1021
1002

FIG. 6D

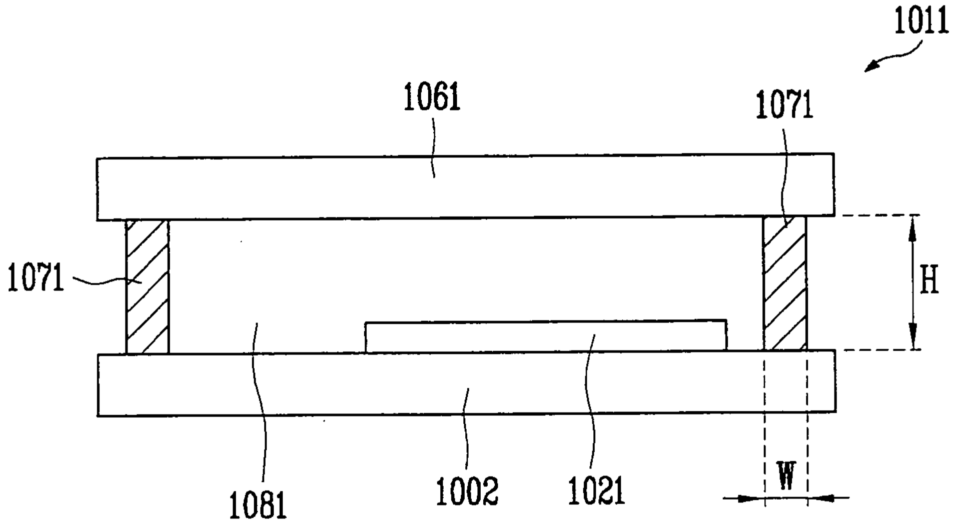
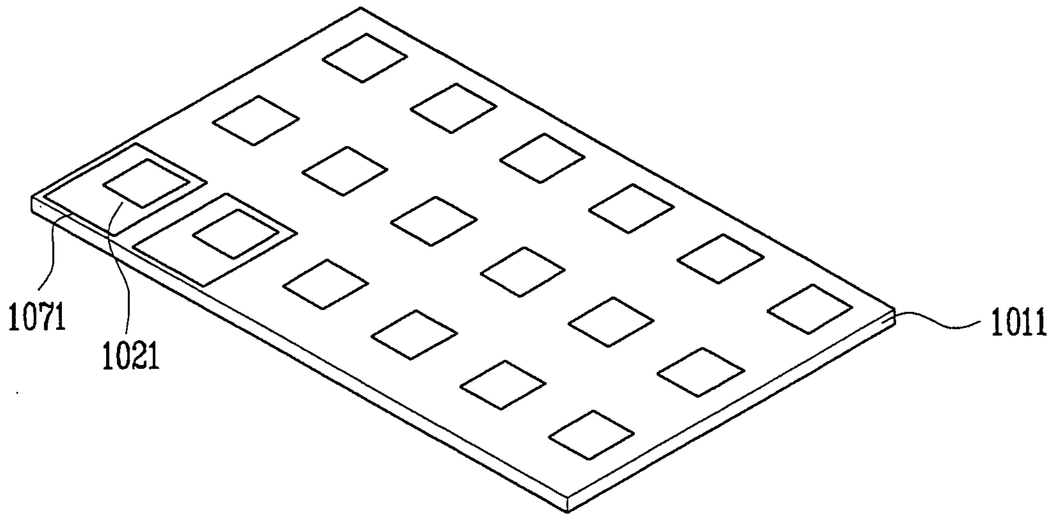


FIG. 6E



REFERENCES CITED IN THE DESCRIPTION

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- US 6998776 B **[0004]**
- US 20030137630 A1 **[0006]**
- JP 2002280169 A **[0007]**
- JP 2005285354 A **[0008]**
- KR 20010109592 **[0009]**

专利名称(译)	有机发光显示器及其制造方法		
公开(公告)号	[EP1811589B1]	公开(公告)日	2019-06-12
申请号	EP2007250281	申请日	2007-01-24
[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.		
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发明人	KIM, TAE SEUNG, SAMSUNG SDI CO., LTD. LIM, DAE HO, SAMSUNG SDI CO., LTD. LEE, HO SEOK, SAMSUNG SDI CO., LTD. LEE, JONG WOO, SAMSUNG SDI CO., LTD.		
IPC分类号	H01L51/52 H01L27/32		
CPC分类号	H01L27/3244 H01L51/5246 H01L2251/566 Y10T428/10		
优先权	1020060007353 2006-01-24 KR 1020060025755 2006-03-21 KR		
其他公开文献	EP1811589A3 EP1811589A2		
外部链接	[Espacenet]		

摘要(译)

公开了一种有机发光显示器及其制造方法，其改善了除密封剂之外的使用加强构件的装置的抗冲击性和密封性。第一基板（100）包括像素区域（100a）和非像素区域（100b），至少一个有机发光二极管形成在像素区域处并且具有第一电极，有机层和第二电极非像素区域形成在像素区域的外围部分处。第二衬底（200）接合到具有像素区域的第一衬底（100）的一个区域。玻璃料（151）设置在第一基板的非像素区域和第二基板之间，用于将第一基板和第二基板彼此粘附。粘合剂（152）被涂覆以沿着玻璃料的周边区域间隔开，并且包括至少两个不连续部分（52）。加强构件（153）设置在玻璃料和粘合剂之间。

FIG. 1