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(54) **Organic light-emitting display device and method for fabricating the same**

Organische lichtemittierende Anzeigevorrichtung und Verfahren zu deren Herstellung

Dispositif d'affichage électroluminescent organique et son procédé de fabrication

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Description

BACKGROUND

1. Field of the Invention

[0001] The present invention relates to an organic light-emitting display device, and more particularly, to encapsulating an organic light-emitting display device.

2. Discussion of Related Technology

[0002] An organic light-emitting display device is one sort of flat display devices wherein an organic light-emitting layer is positioned between electrodes opposed to each other and voltage is then applied between the electrodes so that holes and electrons injected from the respective electrodes to an organic light-emitting layer are coupled, and the exciting molecules thus generated are returned to a base state, thereby, light-emitting the emitted energy as light.

[0003] The organic light-emitting display device as above is excellent in view of light-emitting efficiency, brightness, view angle and a response speed and can be fabricated in light weight and thinness and therefore, has been spotlighted as a next generation display. The organic light-emitting display device requires the encapsulation of the array of pixels. U.S. Patent Publication No. 6,998,776 discloses a structure to encapsulate the pixel region by applying a frit to a glass substrate. US 2004/075380 A1 discloses a display device comprising a first substrate having a display area formed by arranging a plurality of pixels in a matrix manner and a driving circuit driving the plurality of pixels arranged outside of the display area both provided on a main surface thereof, a second substrate covering the main surface of the first substrate and stuck thereto at a seal material interposed between the first substrate and the second substrate which surrounds the display area and the driving circuit on the main surface of the first substrate. A light shielding layer is provided covering both the display area and the driving circuit to prevent the display area and the driving circuit from being exposed to ultraviolet light incident on the second substrate with which the seal material is irradiated to be cured. Thus, deterioration of characteristics of the active elements in the display area and the driving circuit due to the ultraviolet light impinging thereon is avoided. EP 1 343 206 A2 discloses a light emitting apparatus comprising two substrates, a pixel region and seal. The seal is cured by ultraviolet light to paste the substrates together. However, during such curing process, elements formed under the frit seal may be damaged.

[0004] The discussion in this section is to provide general background information, and does not constitute an admission of prior art.

SUMMARY

[0005] An aspect of the invention provides an organic light-emitting display device comprising, a first substrate comprising a pixel region in which a plurality of organic light-emitting diodes are provided and a non-pixel region in which scan drivers for supplying a driving signal to the pixel region are provided, a second substrate disposed on the upper part of the first substrate to be overlapped with the pixel region and at least one region of the non-pixel region; and a frit seal positioned between the first and the second substrate to adhere the first substrate to the second substrate and comprising a material which absorbs visible light in order to function as a black matrix, wherein the frit seal is formed to be overlapped with at least a part of the non-pixel region including at least one region on the scan drivers, wherein the part of the frit seal which is positioned in an area in which scan drivers are not formed is cured such that it adheres and encapsulates the first and second substrates, whereas the part of the frit seal which is applied to the scan drivers is not adhered to the scan drivers.

Preferably the scan drivers are not adhered to the frit seal. Preferably the frit seal includes glass material, absorbent for absorbing laser or infrared rays, and a filler for reducing thermal expansion coefficient. Preferably, among the frit seals, the frit seal corresponding to the edges of the first and the second substrates on which elements are not formed is formed to be thicker than the frit seal overlapped with the scan drivers, and the first and the second substrates are adhered to each other by means of the frit seal in the part corresponding to the edges of the first and the second substrates. Preferably second substrate is set to be an etched glass wherein the thickness of the center part thereof is thinner than that of the edge thereof. Preferably the thickness of the frit seal corresponding to the edge parts of the first and the second substrates is set to be the same with that of the frit seal overlapped with the scan drivers. The organic light-emitting display device is preferably configured as a top emission display device.

[0006] Another aspect of the invention provides a method for fabricating a top emission type organic light-emitting display device comprising a first substrate comprising: a pixel region in which organic light-emitting diodes are provided and a non-pixel region in which scan drivers are provided, and a second substrate disposed on the upper part of the first substrate to be overlapped with the pixel region and at least one region of the non-pixel region, the method comprising the steps of, forming a frit seal by applying a frit seal paste to at least one of the first and the second substrates to correspond to the non-pixel region including at least one region on the scan drivers said frit seal comprising a material which absorbs visible light in order to function as a black matrix;, bonding the first substrate to the second substrate; and adhering the first substrate to the second substrate by irradiating laser or infrared rays to at least one region of the frit seal formed between the first substrate and the second substrate. The frit seal other than the frit seal overlapped with the scan driver among the frit seals is irradiated by laser or infrared rays using a mask which covers the frit seal portion formed to be overlapped with at least one scan driver. Preferably the wavelength of laser light and infrared rays are set to be from 800nm to 1200nm (more preferably 800 - 900 nm). That is, the maximum intensity of the laser light and infrared rays preferably ranges from 800nm to 1200nm (more preferably 800 - 900 nm). Preferably the frit seal irradiated by laser or infrared rays is formed to be thicker than the frit seal overlapped with the scan drivers. Preferably, in the step of irradiating laser or infrared rays, the frit seal formed to be overlapped with the scan drivers and the region in which elements including the pixel region are formed are masked. Preferably a frit seal including absorbent absorbing laser light or infrared rays is applied, more preferably the frit seal comprises absorbing material which absorbs at least 60% (still more preferably 90%) of the laser light or infrared rays. Preferably the frit seal is melted by absorbing laser or infrared rays and is thus adhered to the first and the second substrates. Preferably the burning temperature of the frit seal is set to be from 300°C to 500°C. Preferably the frit seal is applied to the second substrate.

BRIEF DESCRIPTION OF THE DRAWINGS

[0007] These and other aspects and advantages of the invention will become apparent and more readily appreciated from the following description of the embodiments, taken in conjunction with the accompanying drawings of which:

[0008] FIG. 1 is a cross-sectional view of a conventional organic light-emitting display device;

[0009] FIG. 2 is a plan view of an organic light-emitting display device according to an embodiment of the present invention;

[0010] FIG. 3 is a cross-sectional view of main parts of the pixel shown in FIG. 2;

[0011] FIG. 4 and FIG. 5 are cross-sectional views of an organic light-emitting display device taken along A-A' line in FIG. 2;

[0012] FIG. 6a to FIG. 6d are cross-sectional views showing the fabricating process of the organic light-emitting display device shown in FIG. 4;

[0013] FIG. 7A is a schematic exploded view of a passive matrix type organic light emitting display device in accordance with one embodiment;

[0014] FIG 7B is a schematic exploded view of an active matrix type organic light emitting display device in accordance with one embodiment;

[0015] FIG. 7C is a schematic top plan view of an organic light emitting display in accordance with one embodiment;

[0016] FIG. 7D is a cross-sectional view of the organic light emitting display of FIG. 7C, taken along the line d-d; and

[0017] FIG. 7E is a schematic perspective view illustrating mass production of organic light emitting devices in accordance with one embodiment.

DETAILED DESCRIPTION OF EMBODIMENTS

[0018] Hereinafter, various embodiments of the present invention will be described in a more detailed manner with reference to the accompanying drawings.

[0019] 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.

[0020] OLEDs can be generally grouped into two basic types dependent on the arrangement with which the stimulating electrical current is provided. Fig. 7A schematically illustrates an exploded view of a simplified structure of a passive matrix type OLED 1000. Fig. 7B schematically illustrates a simplified structure of an active matrix type OLED 1001. In both configurations, the OLED 1000, 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.

[0021] Referring to Fig. 7A, 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.

[0022] Referring to Fig. 7B, 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. In embodiments, 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.

[0023] 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.

[0024] Referring to common features of the PMOLED and AMOLED designs, the substrate 1002 provides structural support for the OLED pixels and circuits. In various embodiments, 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 embodiments, the anode 1004 and cathode 1006 are inverted; i.e., the cathode is formed on the substrate 1002 and the anode is opposingly arranged.

[0025] 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 embodiment, 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.

[0026] 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.

[0027] In some embodiments, a single layer may serve both electron injection and transportation functions or both hole injection and transportation functions. In some embodiments, one or more of these layers are lacking. In some embodiments, one or more organic layers are doped with one or more materials that help injection and/or transportation of the carriers. In embodiments 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.

[0028] 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 embodiments, these organic materials may be macromolecules including oligomers and polymers. In some embodiments, 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.

[0029] 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 embodiment, 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 1000, 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.

[0030] 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 embodiments, the cathode 1006 is made of a material transparent or at least partially transparent with respect to visible light. In certain embodiments, 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.

[0031] In many embodiments, an OLED pixel array 1021 comprising a plurality of organic light emitting pixels is arranged over a substrate 1002 as shown in Fig. 7C. In embodiments, 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 embodiments, 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 embodiments, 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. In embodiments, 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.

[0032] 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. 7D schematically illustrates a cross-section of an encapsulated OLED device 1011 having a layout of Fig. 7C and taken along the line d-d of Fig. 7C. In this embodiment, 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 embodiments, 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 embodiment, the seal 1071 extends along the periphery of the OLED pixel array 1021 or the bottom or top plate 1002, 1061.

[0033] In embodiments, the seal 1071 is made of a frit material as will be further discussed below. In various embodiments, 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. In embodiments, at least one of the top plate 1061 and the bottom plate 1002 are formed of a substantially transparent material.

[0034] 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 embodiments, a material that can take up oxygen and/or moisture is formed within the enclosed space 1081.

[0035] 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. 7D. The width varies among embodiments and ranges from about 300 μm to about 3000 μm, preferably from about 500 μm to about 1500 μm. Also, the width may vary at different positions of the seal 1071. In some embodiments, 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.

[0036] 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. 7D. The height varies among embodiments and ranges from about 2 μm to about 30 μm, preferably 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 embodiments, the height of the seal 1071 may vary at different positions thereof.

[0037] In the illustrated embodiment, the seal 1071 has a generally rectangular cross-section. In other embodiments, 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.

[0038] The seal 1071 can be arranged immediately adjacent the OLED array 1021, and in other embodiments, the seal 1071 is spaced some distance from the OLED array 1021. In certain embodiment, 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 embodiments, generally parallel to respective boundaries of the OLED array 1021. In other embodiment, 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 embodiments, at least part of the seal 1071 extends between the top plate 1061 and bottom plate 1002 in a curvilinear manner.

[0039] As noted above, in certain embodiments, 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. In embodiments, 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.

[0040] 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.

[0041] In embodiments, a frit material as a dry composition contains glass particles from about 20 to 90 about wt%, and the remaining includes fillers and/or additives. In some embodiments, the frit paste contains about 10-30 wt% organic materials and about 70-90% inorganic materials. In some embodiments, the frit paste contains about 20 wt% organic materials and about 80 wt% inorganic materials. In some embodiments, the organic materials may include about 0-30 wt% binder(s) and about 70-100 wt% solvent(s). In some embodiments, about 10 wt% is binder(s) and about 90 wt% is solvent(s) among the organic materials. In some embodiments, the inorganic materials may include about 0-10 wt% additives, about 20-40 wt% fillers and about 50-80 wt% glass powder. In some embodiments, 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.

[0042] 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. In embodiments, 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.

[0043] In one exemplary embodiment, 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 embodiments 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.

[0044] In embodiments, 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.

[0045] In some embodiments, OLED devices 1011 are mass produced. In an embodiment illustrated in Fig. 7E, a plurality of separate OLED arrays 1021 is formed on a common bottom substrate 1101. In the illustrated embodiment, each OLED array 1021 is surrounded by a shaped frit to form the seal 1071. In embodiments, 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. 7D. In certain embodiments, 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.

[0046] FIG. 1 is a cross-sectional view of a conventional organic light-emitting display device. Referring to FIG. 1, an exemplary organic light-emitting display device is configured including a first substrate 10 and a second substrate 20 positioned to be opposed to each other, and the first and the second substrates 10 and 20 are adhered to each other with encapsulating material 30 and the inner side thereof is thus encapsulated. The first substrate 10 is a substrate comprising a pixel region 11 and a driving circuit such as scan drivers 12 and 12' thereon, wherein the pixel region 11 is provided with a plurality of pixels having at least one organic light-emitting diode (not shown); and the driving circuit is provided in a non-pixel region which is the region other than the pixel region 11. The second substrate 20 is adhered to be opposed to the side of the first substrate 10 on which the pixel region 11 and the scan driver 12 and 12' are formed. The second substrate 20 as above is adhered to the first substrate 10 so that at least one region of the first substrate 10, in particular, the pixel region 11 is encapsulated. The encapsulating material 30, which is configured including epoxy resin, is applied along the edge of the first substrate 10 and the second substrate 20, is melted by the irradiation of ultraviolet rays, etc. and is thus cured, adhering the first substrate 10 to the second substrate 20. The encapsulating material as above is to prevent the infiltration of oxygen and moisture, etc. into the pixel region 11, etc. positioned in the encapsulated space between the first substrate 10 and the second substrate 20.

[0047] However, even though the encapsulating material 30 is applied, the infiltration of oxygen and moisture, etc. through fine cracks cannot be completely blocked. In order to prevent this, in the moisture absorbent (not shown), etc., which is coated on the sealing substrate 20 and is then burned, has been used. However, the adhesion between the encapsulating material 30 and the substrates 10 and 20 is deteriorated due to outgassing generated when the moisture absorbent is burned, causing a problem that the pixel region 11 is easily exposed to oxygen and moisture. The frit as above is tinged with black thereby absorbing and blocking light and therefore, can function as a black matrix, BM, preventing light leakage. The light leakage is the phenomenon to be hazily seen due to the reflection of light by means of external light in the non-pixel region, causing a problem that the image quality is deteriorated when the light leakage is generated. However, the frit is applied to only the most-outer edge of the region to be encapsulated, that is, the part on which an element is not formed, ineffectively preventing the light leakage. Thereby, there has been a problem that the phenomenon of the light leakage is still frequently occurred in the non-pixel region adjacent to the pixel region 105. Therefore, there is a need that the scheme for effectively preventing the light leakage should be devised, while encapsulating the first substrate 10 and the second substrate 20 with the frit in order to block the infiltration of oxygen and moisture into the space between the two substrates.

[0048] FIG. 2 is a plan view showing an organic light-emitting display device according to an embodiment of the present invention. And, FIG. 3 is a cross-sectional view of main parts of the pixel shown in FIG. 2. FIG. 2 and FIG. 3 show an active matrix organic light-emitting display device wherein each pixel is provided with at least one thin film transistor and an organic light-emitting diode, although not limited thereto.

[0049] Referring to FIG. 2 and FIG. 3, an organic light-emitting display device according to an embodiment of the present invention comprises: a first substrate 100; and a second substrate 200 disposed on the upper part of the first substrate to be overlapped with at least one region of the first substrate 100, and the first substrate 100 and the second substrate 200 are adhered to each other by means of a frit 300 applied along the edges therebetween.

[0050] On the first substrate 100 a pixel region 105 wherein a plurality of pixels 110 are provided; scan drivers 120 and 120' and a data driver 130 for supplying a driving signal to the pixels 110; and a pad part 102 for supplying a control signal to the scan drivers 120 and 120' and the data driver 130 are formed. The pixel region 105 means the region that scan lines (S 1 to Sn) arranged in a row direction, data lines (D1 to Dm) arranged in a column direction and a plurality of pixels 110 positioned at the point on which the scan lines (S 1 to Sn) are intersected with the data lines (D1 to Dm) are formed. The respective pixels 110 generate light having predetermined brightness corresponding to the scan signal supplied to the scan lines (S1 to Sn) and the data signal supplied to the data lines (D1 to Dm). Thereby, a predetermined image is displayed in the pixel region 105.

[0051] Here, each pixel 110 includes an organic light-emitting diode 118, which is a self light emission element, and at least one thin film transistor connected to the organic light-emitting diode 118, as shown in FIG. 3. However, although the structure of the pixel 110 is an active matrix organic light-emitting display device, the structure thereof can be variously modified in a passive matrix organic light-emitting display device.

[0052] The thin film transistor comprises: a buffer layer 111 formed on the first substrate 100; a semiconductor layer 112 formed on the buffer layer 111 and including a channel region 112a and a source and a drain regions 112b; a gate insulating film 113 formed on the semiconductor layer 112; a gate electrode 114 formed on the gate insulating film 113; an interlayer insulating film 115 formed on the gate electrode 114; a source and a drain electrodes 116 formed on the interlayer insulating film 115 and connected to the source and drain regions 112b. On the thin film transistor as above a planarization film 117 having a via hole 117a exposing at least one region of the drain electrode is formed.

[0053] And, on the planarization film 117 the organic light-emitting diode 118 connected to the thin film transistor through the via hole 117a is formed. The organic light-emitting diode 118 comprises a first electrode 118a and a second electrode 118c, and an organic light-emitting layer 118b positioned therebetween. The first electrode 118a is formed on the planarization film 117 and is connected to the drain electrode of the thin film transistor through the via hole 117a. In the case of the pixel 110 light-emitted from its top, the first electrode 118a as above can be configured including a reflection layer, which is not shown. On the first electrode 118a as above a pixel defined film 119 having an opening portion exposing at least a part of the first electrode 118a is formed, and the organic light-emitting layer 118b is formed in the opening portion of the pixel defined film 119. And, on the organic light-emitting layer 118b the second electrode 118c is formed. At this time, on the second electrode 118c as above a passivation layer, etc., which is not shown, can further be formed. The organic light-emitting diode 118 as above generate light having predetermined brightness corresponding to the current supplied from the thin film transistor.

[0054] In the non-pixel region other than the pixel region 105 scan drivers 120 and 120', a data driver 130, and a pad part 102 are formed. The scan drivers 120 and 120' generate a scan signal corresponding to the control signals supplied from the pad part 102 and supply it to scan lines (S 1 to Sn). Here, two scan drivers 120 and 120', which are formed on both sides of the pixel region 105, supply the scan signal to the scan lines (S1, S3, ..., Sn-1) in odd order and the scan lines (S2, S4, ..., Sn) in even order, respectively. However, the structure of the scan drivers 120 and 120' is not limited thereto and can be variously modified. The data driver 130 generates a data signal corresponding to data and control signals supplied from the pad part 102, and supplies it to data lines (D1 to Dm). The pad part 102 supplies the control signals supplied from the external to the scan drivers 120 and 120' and the data driver 130.

[0055] The second substrate 200 is disposed on at least one region of the first substrate 100 to be opposed to the side thereof on which the pixel region 105 and the scan drivers 120 and 120' are formed. Here, the pixels 110 formed on the first substrate 100 include the organic light-emitting layer 118a of the organic light-emitting diode 118, etc., resulting in that it can be easily deteriorated when oxygen and moisture infiltrate. Therefore, in order to prevent an infiltration of oxygen and moisture into the pixel region 105, the second substrate 200 is adhered to encapsulate the pixel region 105. And, in FIG. 2 the second substrate 200 is configured to be encapsulated, including the scan drivers 120 and 120', although is not limited thereto. That is, the second substrate 200 is disposed on the upper part of the first substrate 100 to be overlapped with the pixel region 105 and at least a part of the non-pixel region, and is then adhered to the first substrate 100 by means of the frit 300. Assuming that the devices according to embodiments of the present invention are the top emission type organic light-emitting display devices, the second substrate 200 is made of transparent material.

[0056] The frit 300 is applied to the edge of the second substrate 200 and is then positioned to be overlapped with the non-pixel region of the first substrate 100, encapsulating the pixel region 105. Here, the frit 300 originally means glass raw material including additives in the form of a powder, however, in the glass technical field it may commonly means glass formed by melting the frit, and therefore, in embodiments of the present invention it means both of them. The frit 300 as above completely encapsulates the space between the first and the second substrates 100 and 200, effectively blocking an infiltration of oxygen and moisture. Also, the frit, which is made of material including transition metal, is tinged with black thereby preventing light from being passed through, functioning as the black matrix (BM) preventing the light leakage. However, when the frit 300 is formed only in the most-outer edge of the part in which the two substrates are bonded, the light leakage cannot be effectively prevented, and therefore, in embodiments of the present invention the frit 300 is applied to the part adjacent to the pixel region 105, for example, to the upper part of the scan drivers 120 and 120'. That is, the frit is used as only additives for encapsulating the two substrates by applying the frit to the extreme contour of the encapsulated region in which an element is not formed, in embodiments of the present invention the frit 300 is applied even to the scan drivers 120 and 120' adjacent to the pixel region 105 and is thus used as the encapsulating material as well as the black matrix, effectively blocking the light leakage. Here, the detailed explanation of the encapsulating method by applying the frit 300 will be described below.

[0057] FIG. 4 is a cross-sectional view of an organic light-emitting display device taken along A-A' line in FIG. 2. Referring to FIG. 4, the pixel region 105 formed on the first substrate 100 is completely encapsulated by the second substrate 200 and the frit 300. Here, the frit 300 that is material tinged with black is positioned in the edges of the first and the second substrates 100 and 200 as well as on the scan drivers 120 and 120' adjacent to the pixel region 105, effectively blocking the light leakage into the non-pixel region. In general, a frit tinged with black shall be understood as a frit of a material which comprises (and is preferably coated with) a material which absorbs visible light, wherein the reflection coefficient for visible light is preferably less than 10%, and more preferably less than 1%.

Here, the frit 300 formed in the edge part in which elements are not formed is formed to be thicker than the frit 300 positioned on the scan drivers 120 and 120'. However, in certain embodiments, the frit 300 is formed in at least one region of the non-pixel region including the upper part of the scan drivers 120 and 120' is applied to the organic light-emitting display device light-emitting from its front, and the top emission type organic light-emitting display device displays a predetermined image on the top of the pixel region 105, the frit 300 should not be positioned in the pixel region 105.

[0058] Here, the frit 300, which is configured including glass material, absorbent for absorbing laser, and a filler for reducing thermal expansion coefficient, is applied to the second substrate 200 in a frit paste state and is cured; and is melted between the first and the second substrates 100 and 200 by laser or infrared rays and is cured again, adhering the first substrate 100 to the second substrate 200. At this time, if laser or infrared rays is irradiated to even the frit 300 positioned on the scan drivers 120 and 120', the internal circuit of the scan drivers 120 and 120' can be damaged. Therefore, laser or infrared rays should be irradiated to only the frit 300 applied to the part in which elements are not formed. That is, the frit 300 positioned in the edge in which elements are not formed is melted and cured again by absorbing laser or infrared rays so that it adheres and encapsulates the first and the second substrates 100 and 200. Meanwhile, the frit 300 applied to the scan drivers 120 and 120' is not adhered to the scan drivers 120 and 120', not functioning as adhesion but functioning only as the black matrix preventing the light leakage into the outer circumference of the pixel region 105, that is, the non-pixel region. Here, the frit 300 in the edge part adhered to the first and the second substrates 100 and 200 is formed to be thicker than the frit 300 overlapped with the scan drivers 120 and 120'.

[0059] Meanwhile, FIG. 4 shows the second substrate 200 as a bare glass of a flat panel type, however, the second substrate 200 can be set to be an etched glass wherein the thickness of the center part thereof is thinner than that of the edge part thereof. In this case, the frit 300 in the edge part adhered to the first and the second substrate 100 and 200 and the frit 300 in the part overlapped with the scan drivers 120 and 120' can be formed in the same thickness.

[0060] Hereinafter, referring to FIG. 6a to FIG. 6d, the method for fabricating the organic light-emitting display device shown in FIG. 4 will be described in detail. For convenience, although FIG. 6a to FIG. 6d show the method for fabricating the individual organic light-emitting display device, in fact a plurality of display device cells can be fabricated in sheet unit. Referring to FIG. 6a to FIG. 6d, the frit 300 is applied to the edge of the second substrate 200. The frit 300 is applied to at least one region of the non-pixel region not to be overlapped with the pixel region 105 of the first substrate 100 described below. At this time, the frit 300 is applied in a shape corresponding to the edge of the first substrate 100 and the scan drivers 120 and 120' so that it can also be positioned on the scan drivers 120 and 120' formed on the first substrate 100. That is, the edge part of the frit 300 is applied to be thicker than the part to be overlapped with the scan drivers 120 and 120'.

[0061] The frit 300 as above is applied to the second substrate 200 in a frit paste state and burned, being cured after moisture or organic binder included in the paste is removed. Here, the frit paste is fabricated in a gel state by adding oxide powder and organic substance into glass powder and the burning temperature of the frit paste 300 is preferably set to be from about 300°C to about 500°C. And, the thickness of the frit 300 may be from about 10 to about 20μm (FIG. 6a).

[0062] Thereafter, the first substrate 100 on which the pixel region 105 and the scan drivers 120 and 120' are formed is prepared, and the first substrate 100 and the second substrate 200 is adhered to each other so that the pixel region 105 is encapsulated. At this time, the frit 300 is positioned on the edges between the first and the second substrates 100 and 200 opposed to each other and the scan drivers 120 and 120', and is positioned not to be overlapped with the pixel region 105 (FIG. 6b).

[0063] Thereafter, laser or infrared rays is irradiated to the part in which no elements are formed, that is, the frit 300 positioned in the edges between the first and the second substrates 100 and 200. And then, the frit 300, to which laser or infrared rays is irradiated, is melted by absorbing laser or infrared rays. At this time, it is preferable that the wavelength of laser or infrared rays is set to be from about 800nm to about 1200nm (preferably, about 810nm), the beam size is set to be from about 1.0nm to about 3.0nm in diameter, the output electric power is set to be from about 25 watt to about 45 watt, and the part to which laser or infrared rays is not irradiated is to be masked. That is, the parts adjacent to the pixel region 105, in particular, the frit 300 formed to be overlapped with the scan drivers 120 and 120' and the pixel region 105, and the wirings (not shown) positioned between the scan drivers 120 and 120' and the pixel region 105 are masked not to be irradiated by laser or infrared rays, so that the wirings and the elements are prevented from being modified by laser or infrared rays. As material for masking, a double film of copper and aluminum can be used (FIG. 6c). Thereafter, the frit 300 melted by laser or infrared rays is cured again so that it adheres the first substrate 100 to the second substrate 200 (FIG. 6d).

[0064] Meanwhile, the first and the second substrates 100 and 200 are adhered by applying the frit 300 to the second substrate 200 in the fabricating process as described before, although not limited thereto. For example, the frit 300 can first be applied to the first substrate 100 on which the pixel region 105 is formed, or can be applied to both the first and the second substrates 100 and 200, adhering the first and the second substrates 100 and 200. Also, when the second substrate 200 is set to be an etched substrate as shown in FIG. 5, the frit 300 can be applied to the second substrate 200 in the same thickness so that it corresponds to the edge of the first substrate 100 and the scan drivers 120 and 120'.

[0065] In the organic light-emitting display device and the method for fabricating the same as described before, the first and the second substrates 100 and 200 are adhered by means of the frit 300, resulting in that the infiltration of oxygen and moisture, etc. into the internal space including the pixel region 105 can be effectively blocked. Also, the frit 300 tinged with black is also formed on the upper part of the scan drivers 120 and 120' adjacent to the pixel region 105 and is thus functioned as the black matrix, improving image quality by effectively preventing the light leakage into the non-pixel region. And, laser or infrared rays is not irradiated to the part in which elements such as the scan drivers 120 and 120', etc. can be formed but irradiated to only the edge part of the frit 300 wherein elements are not formed, preventing the modification of the elements.

[0066] As described above, according to the organic light-emitting display device and the method for fabricating the same, the first and the second substrates are adhered by means of the frit 300, resulting in that the infiltration of oxygen and moisture, etc. into the internal space including the pixel region can be effectively blocked. Also, the frit tinged with black is also formed on the upper part of the scan drivers adjacent to the pixel region and is thus functioned as the black matrix, improving image quality by effectively preventing the light leakage into the non-pixel region.

Claims

1. An organic light-emitting display device comprising:

a first substrate (100) comprising a pixel region (105) in which a plurality of organic light-emitting diodes are provided and a non-pixel region in which scan drivers (120, 120') for supplying a driving signal to the pixel region (105) are provided;
a second substrate (200) disposed on the upper part of the first substrate (100) to be overlapped with the pixel region (105) and at least one region of the non-pixel region; and
a frit seal (300) positioned between the first and the second substrate (100, 200) and comprising a material which absorbs visible light in order to function as a black matrix,
wherein the frit seal (300) is formed to be overlapped with at least a part of the non-pixel region including at least one region on the scan drivers (120, 120'), **characterized in that**
the part of the frit seal (300) which is positioned in an area in which scan drivers (120, 120') are not formed is cured such that it adheres and encapsulates the first and second substrates (100, 200), whereas the part of the frit seal (300) which is applied to the scan drivers (120, 120') is not adhered to the scan drivers (120, 120').

2. The organic light-emitting display device according to claim 1,
wherein the frit seal (300) includes glass material, absorbent for absorbing laser light or infrared rays, and a filler for reducing thermal expansion coefficient.

3. The organic light-emitting display device according to one of the preceding claims, wherein among the frit seal portions (300), the frit seal portion (300) corresponding to the edges of the first and the second substrates on which elements are not formed is formed to be thicker than the frit seal portion (300) overlapped with the scan drivers (120, 120'), and the first and the second substrates (100, 200) are adhered to each other by means of the frit seal portion (300) in the part corresponding to the edges of the first and the second substrates (100, 200).

4. The organic light-emitting display device according to one of the preceding claims, wherein the second substrate (200) is set to be an etched glass wherein the thickness of the center part thereof is thinner than that of the edge thereof.

5. The organic light-emitting display device as claimed in claim 4,
wherein the thickness of the frit seal (300) corresponding to the edge parts of the first and the second substrates (100, 200) is set to be the same with that of the frit seal (300) overlapped with the scan drivers (120, 120').

6. A method for fabricating a top emission type organic light-emitting display device comprising a first substrate (100) comprising: a pixel region (105) in which organic light-emitting diodes are provided and a non-pixel region in which scan drivers (120, 120') are provided, and a second substrate (200) disposed on the upper part of the first substrate (100) to be overlapped with the pixel region (105) and at least one region of the non-pixel region, the method comprising the steps of:

forming a frit seal (300) by applying a frit seal paste to at least one of the first and the second substrates (100, 200) to correspond to the non-pixel region including at least one region on the scan driver or the scan drivers (120, 120') said frit seal comprising a material which absorbs visible light in order to function as a black matrix;
bonding the first substrate (100) to the second substrate (200); and
adhering the first substrate (100) to the second substrate (200) by irradiating laser light or infrared rays to at least one region of the frit seal (300) formed between the first substrate (100) and the second substrate (200), and
characterized in that
a mask is applied to cover the frit seal portion (300) formed to be overlapped with the at least one scan driver (120, 120') and the region in which elements including the pixel region (105) are formed, and the frit seal portion (300) which is positioned other than the frit seal portion (300) overlapped with the scan driver or the scan drivers (120, 120') among the frit seal portions (300) is burned by infrared laser light or infrared rays.

7. The method as claimed in claim 6, wherein the wavelength of laser light or the infrared rays are set to range between 800nm to 1200nm.

8. The method according to one of claims 6 and 7, wherein the frit seal portion (300) irradiated by laser light or infrared rays is formed to be thicker than the frit seal portion (300) overlapped with the at least one scan driver (120, 120').

9. The method according to one of the claims 6-8, wherein a frit seal (300) including absorbent absorbing laser light or infrared rays is applied.

10. The method as claimed in claim 9, wherein the frit seal (300) is melted by absorbing laser light or infrared rays and is thus adhered to the first and the second substrates (100, 200).

11. The method according to one of the claims 6-10, wherein the burning temperature of the frit seal is set to be from 300°C to 500°C.

12. The method according to one of the claims 6-11, wherein the frit seal (300) is applied to the second substrate (200).

Patentansprüche

1. Organische lichtemittierende Anzeigevorrichtung, aufweisend:

ein erstes Substrat (100), das eine Pixelregion (105), in der eine Vielzahl organischer lichtemittierender Dioden bereitgestellt wird, und eine Nicht-Pixelregion, in der Ansteuertreiber (120, 120') zur Versorgung der Pixelregion (105) mit einem Ansteuersignal bereitgestellt werden, aufweist;
ein zweites Substrat (200), das auf dem oberen Teil des ersten Substrats (100) angeordnet ist, so dass es mit der Pixelregion (105) und zumindest einer Region der Nicht-Pixelregion überlappt; und
eine Frittendichtung (300), die zwischen dem ersten und zweiten Substrat (100, 200) angeordnet ist und ein Material aufweist, das sichtbares Licht absorbiert, um als schwarze Matrix zu fungieren,
wobei die Frittendichtung (300) derart ausgebildet ist, dass sie mit zumindest einem Teil der Nicht-Pixelregion überlappt, der zumindest eine Region auf den Ansteuertreibern (120, 120') aufweist,
dadurch gekennzeichnet, dass
der Teil der Frittendichtung (300), der in einem Bereich positioniert ist, in dem keine Ansteuertreiber (120, 120') ausgebildet sind, derart gehärtet wird, dass er das erste und zweite Substrat (100, 200) miteinander verklebt und diese einkapselt, wohingegen der Teil der Frittendichtung (300), der auf die Ansteuertreiber (120, 120') aufgebracht wird, nicht mit den Ansteuertreibern (120, 120') verklebt wird.

2. Organische lichtemittierende Anzeigevorrichtung nach Anspruch 1,
wobei die Frittendichtung (300) Glasmaterial, ein Absorptionsmittel zur Absorption von Laserlicht oder Infrarotstrahlen, und ein Füllmaterial zur Verringerung des Wärmeausdehnungskoeffizienten aufweist.

3. Organische lichtemittierende Anzeigevorrichtung nach einem der vorhergehenden Ansprüche, wobei unter den Frittendichtungsbereichen (300) der Frittendichtungsbereich (300), der den Rändern des ersten und zweiten Substrats entspricht, auf denen keine Elemente ausgebildet sind, derart ausgebildet ist, dass er dicker als der Frittendichtungsbereich (300) ist, der mit den Ansteuertreibern (120, 120') überlappt, und wobei das erste und zweite Substrat (100, 200) durch den Frittendichtungsbereich (300) in dem Teil miteinander verklebt werden, der den Rändern des ersten und zweiten Substrats (100, 200) entspricht.

4. Organische lichtemittierende Anzeigevorrichtung nach einem der vorhergehenden Ansprüche, wobei das zweite Substrat (200) derart festgelegt ist, dass es geätztes Glas ist, wobei die Dicke des Mittelteils desselben kleiner als die Dicke des Randes desselben ist.

5. Organische lichtemittierende Anzeigevorrichtung nach Anspruch 4, wobei die Dicke der Frittendichtung (300), die den Randteilen des ersten und zweiten Substrats (100, 200) entspricht, derart festgelegt ist, dass sie gleich der Dicke der Frittendichtung (300) ist, die mit den Ansteuertreibern (120, 120') überlappt.

6. Verfahren zur Herstellung einer nach oben emittierenden ("top emission") organischen lichtemittierenden Anzeigevorrichtung, aufweisend ein erstes Substrat (100), das aufweist: eine Pixelregion (105), in der organische lichtemittierende Dioden bereitgestellt werden, und eine Nicht-Pixelregion, in der Ansteuertreiber (120, 120') bereitgestellt werden, und ein zweites Substrat (200), das auf dem oberen Teil des ersten Substrats (100) angeordnet ist, so dass es mit der Pixelregion (105) und zumindest einer Region der Nicht-Pixelregion überlappt, wobei das Verfahren die folgenden Schritte aufweist:

Ausbildung einer Frittendichtung (300) durch Aufbringen einer Frittendichtungspaste auf das erste und/oder zweite Substrat (100, 200), so dass sie der Nicht-Pixelregion entspricht, die zumindest eine Region auf dem Ansteuertreiber oder den Ansteuertreibern (120, 120') aufweist, wobei die besagte Frittendichtung ein Material aufweist, das sichtbares Licht absorbiert, um als

schwarze Matrix zu fungieren;
Verbinden des ersten Substrats (100) mit dem zweiten Substrat (200); und
Verkleben des ersten Substrats (100) mit dem zweiten Substrat (200) durch die Einstrahlung von Laserlicht oder Infrarotstrahlen in zumindest eine Region der Frittendichtung (300), die zwischen dem ersten Substrat (100) und dem zweiten Substrat (200) ausgebildet ist, und
dadurch gekennzeichnet, dass
eine Maske aufgebracht wird, die den Frittendichtungsbereich (300), der derart ausgebildet ist, dass er mit dem zumindest einen Ansteuertreiber (120, 120') überlappt, und die Region, in der Elemente ausgebildet sind, die die Pixelregion (105) aufweisen, bedeckt, und
der Frittendichtungsbereich (300) unter den Frittendichtungsbereichen (300), der anders positioniert ist als der Frittendichtungsbereich (300), der mit dem Ansteuertreiber oder den Ansteuertreibern (120, 120') überlappt, mit Infrarotlaserlicht oder Infrarotstrahlen gebrannt wird.

7. Verfahren nach Anspruch 6, wobei die Wellenlänge des Laserlichts oder der Infrarotstrahlen derart festgelegt ist, dass sie im Bereich zwischen 800nm und 1200nm liegt.

8. Verfahren nach einem der Ansprüche 6 und 7, wobei der Frittendichtungsbereich (300), der mit Laserlicht oder Infrarotstrahlen bestrahlt wird, derart ausgebildet ist, dass er dicker als der Frittendichtungsbereich (300) ist, der mit dem zumindest einen Ansteuertreiber (120, 120') überlappt.

9. Verfahren nach einem der Ansprüche 6-8, wobei eine Frittendichtung (300) aufgebracht wird, die ein Absorptionsmittel aufweist, das Laserlicht oder Infrarotstrahlen absorbiert.

10. Verfahren nach Anspruch 9, wobei die Frittendichtung (300) durch die Absorption von Laserlicht oder Infrarotstrahlen geschmolzen wird und **dadurch** mit dem ersten und zweiten Substrat (100, 200) verklebt wird.

11. Verfahren nach einem der Ansprüche 6-10, wobei die Brenntemperatur der Frittendichtung derart festgelegt wird, dass sie zwischen 300°C und 500°C liegt.

12. Verfahren nach einem der Ansprüche 6-11, wobei die Frittendichtung (300) auf das zweite Substrat (200) aufgebracht wird.

Revendications

1. Dispositif organique d'affichage à émission de lumière comprenant :

un premier substrat (100) comprenant une région (105) de pixels dans laquelle est disposée une pluralité de diodes organiques émettrices de lumière et une région sans pixels dans laquelle sont disposés des circuits d'attaque (120, 120') de balayage destinés à délivrer un signal d'attaque à la région (105) de pixels ;
un second substrat (200) disposé sur la partie supérieure du premier substrat (100) pour être recouvert par la région (105) de pixels et au moins une région de la région sans pixels ; et
un joint fritté (300) placé entre le premier et le second substrat (100, 200) et comprenant une matière qui absorbe la lumière visible afin d'agir comme une matrice noire,
dans lequel le joint fritté (300) est formé de façon à être recouvert par au moins une partie de la région sans pixels incluant au moins une région sur les circuits d'attaque (120, 120') de balayage, **caractérisé**
en ce que la partie du joint fritté (300) qui est placée dans une zone dans laquelle il n'y a pas de circuits d'attaque (120, 120') de balayage est cuite de façon qu'elle adhère aux et enrobe les premier et second substrats (100, 200), tandis que la partie du joint fritté (300) qui est appliquée aux circuits d'attaque (120, 120') de balayage n'adhère pas aux circuits d'attaque (120, 120') de balayage.

2. Dispositif organique d'affichage à émission de lumière selon la revendication 1, dans lequel le joint fritté (300) inclut une matière à base de verre, un absorbant destiné à absorber la lumière laser ou les rayons infrarouges et une charge destinée à réduire le coefficient de dilatation thermique.

3. Dispositif organique d'affichage à émission de lumière selon l'une des revendications précédentes, dans lequel parmi les parties (300) de joint fritté, la partie (300) de joint fritté correspondant aux bords du premier et du second substrat, sur laquelle il n'y a pas d'éléments formés, est faite de façon à être plus épaisse que la partie (300) de joint fritté recouverte par les circuits d'attaque (120, 120') de balayage, et dans lequel le premier et le second substrat (100, 200) sont collés l'un à l'autre au moyen de la partie (300) de joint fritté dans la région correspondant aux bords du premier et du second substrat (100, 200).

4. Dispositif organique d'affichage à émission de lumière selon l'une des revendications précédentes, dans lequel le second substrat (200) est choisi de façon à être un verre dépoli dans lequel l'épaisseur de sa partie centrale est plus mince que celle de son bord.

5. Dispositif organique d'affichage à émission de lumière selon la revendication 4, dans lequel l'épaisseur du joint fritté (300) correspondant aux régions de bord du premier et du second substrat (100, 200) est choisie pour être la même que celle du joint fritté (300) recouvert par les circuits d'attaque (120, 120').

6. Procédé de fabrication d'un dispositif organique d'affichage à émission de lumière du type à émission par le dessus comprenant un premier substrat (100) comprenant une région (105) de pixels dans laquelle sont disposées des diodes organiques émettrices de lumière et une région sans pixels dans laquelle sont disposés des circuits d'attaque (120, 120') de balayage et un second substrat (200) disposé sur la partie supérieure du premier substrat (100) pour être recouvert par la région (105) de pixels et au moins une région de la région sans pixels, le procédé comprenant les étapes consistant :

à former un joint fritté (300) par application d'une pâte de joint fritté à au moins l'un du premier et du second substrat (100, 200) pour correspondre à la région sans pixels incluant au moins une région sur le circuit d'attaque de balayage ou les circuits d'attaque (120, 120') de balayage, ledit joint fritté comprenant une matière qui absorbe la lumière visible afin d'agir comme une matrice noire ;
à lier le premier substrat (100) au second substrat (200) ; et
à faire adhérer le premier substrat (100) au second substrat (200) en projetant de la lumière laser ou des rayons infrarouges sur au moins une région du joint fritté (300) formé entre le premier substrat (100) et le second substrat (200), et
caractérisé :

en ce qu'un masque est appliqué pour couvrir la partie (300) de joint fritté formée pour être recouverte par l'au moins un circuit d'attaque (120, 120') de balayage et la région dans laquelle sont formés des éléments incluant la région (105) de pixels ; et
en ce que la partie (300) de joint fritté qui est placée ailleurs que la partie (300) de joint fritté recouverte par le circuit d'attaque de balayage ou les circuits d'attaque (120, 120') de balayage parmi les parties (300) de joint fritté est brûlée par de la lumière laser infrarouge ou des rayons infrarouges.

7. Procédé selon la revendication 6, dans lequel la longueur d'onde de la lumière laser ou des rayons infrarouges est fixée pour aller de 800 nm à 1 200 nm.

8. Procédé selon l'une des revendications 6 et 7, dans lequel la partie (300) de joint fritté sur laquelle sont projetés la lumière laser ou les rayons infrarouges est formée de façon à être plus épaisse que la partie (300) de joint fritté recouverte par l'au moins un circuit d'attaque (120, 120') de balayage.

9. Procédé selon l'une des revendications 6 à 8, dans lequel est appliqué un joint fritté (300) incluant un absorbant absorbant la lumière laser ou les rayons infrarouges.

10. Procédé selon la revendication 9, dans lequel le joint fritté (300) est fondu par absorption de lumière laser ou de rayons infrarouges et adhère ainsi au premier et au second substrat (100, 200).

11. Procédé selon l'une des revendications 6 à 10, dans lequel la température de brûlage du joint fritté est fixée pour être de 300 °C à 500 °C.

12. Procédé selon l'une des revendications 6 à 11, dans lequel le joint fritté (300) est appliqué au second substrat (200).

FIG. 1
(PRIOR ART)

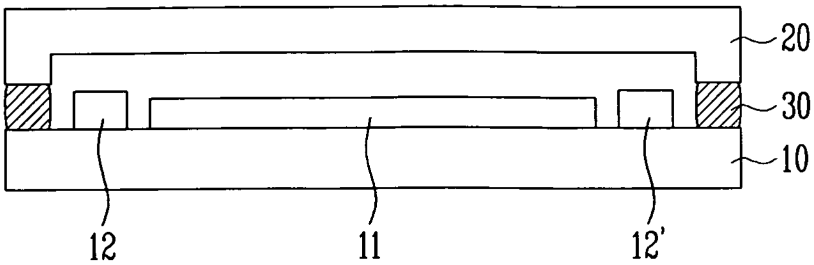


FIG. 2

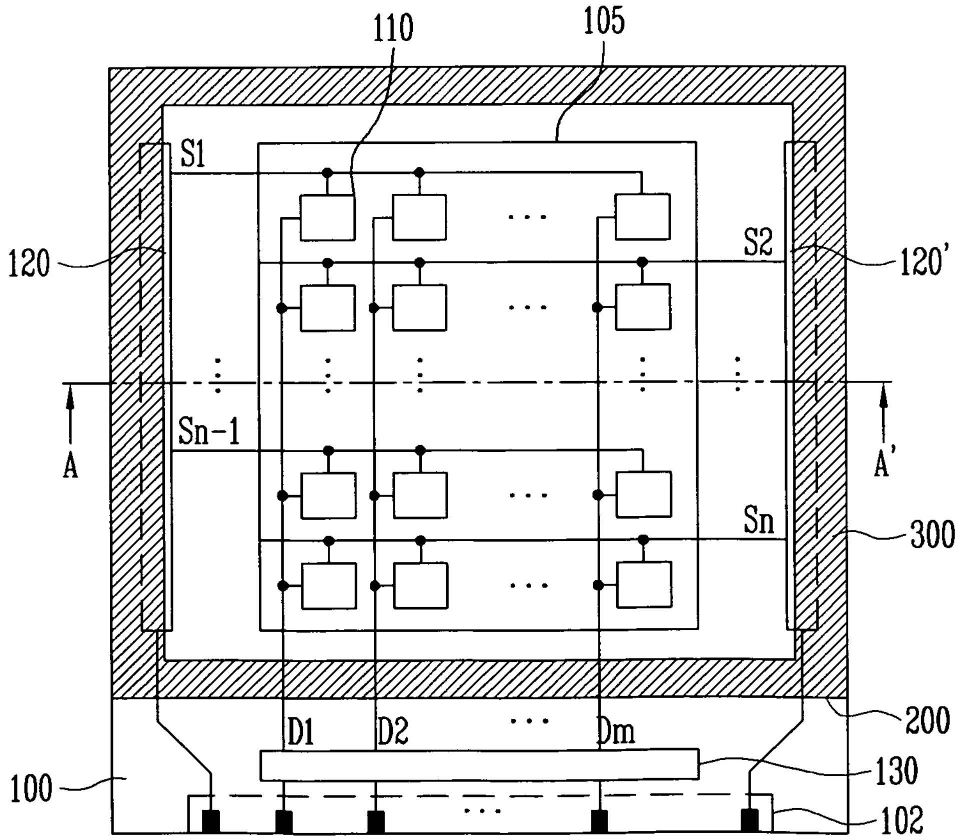


FIG. 3

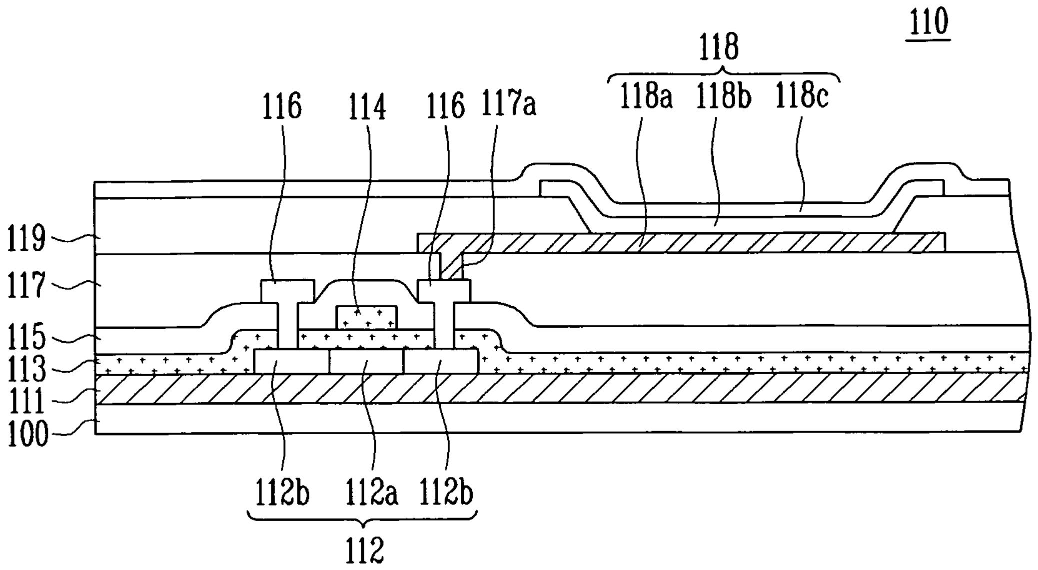

110
118
118a 118b 118c
116 114 116 117a
119
117
115
113
111
100
112b 112a 112b
112

FIG. 4

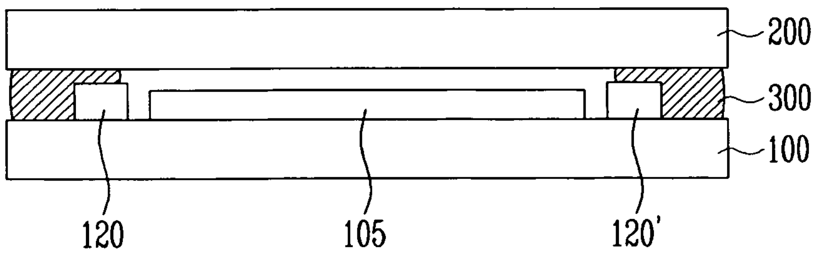

200
300
100
120
105
120'

FIG. 5

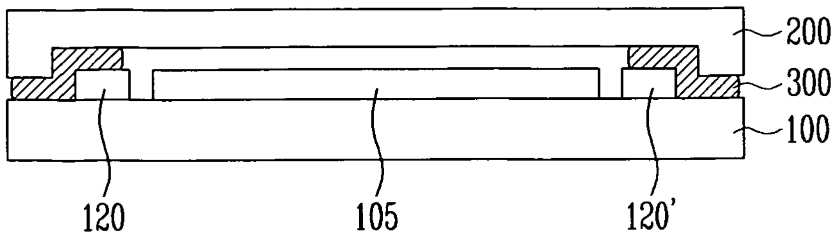


FIG. 6A

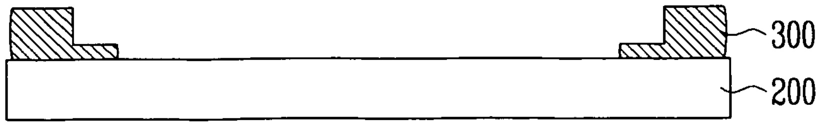


FIG. 6B

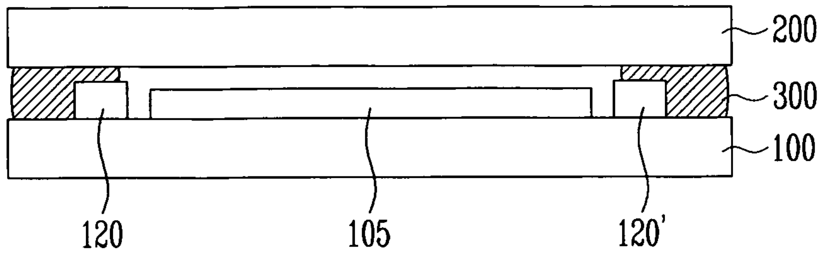


FIG. 6C

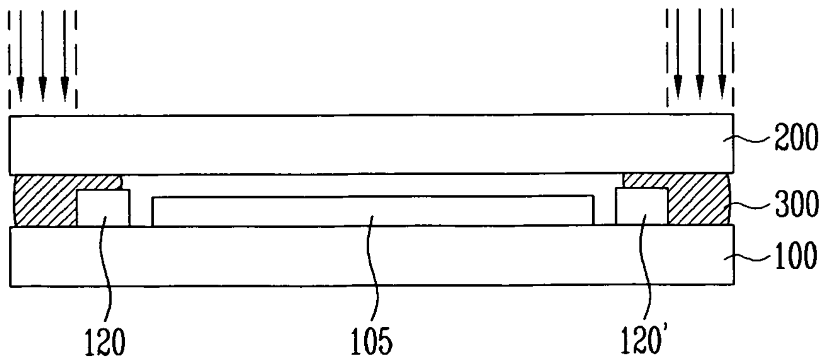


FIG. 6D

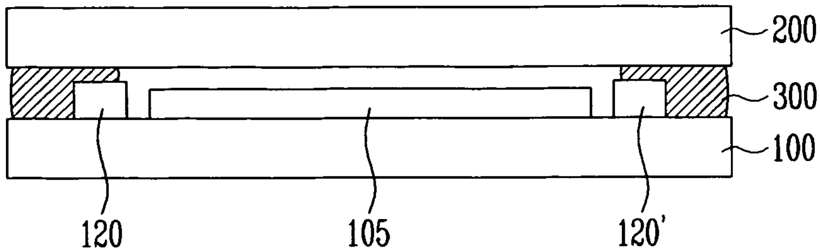


FIG. 7A

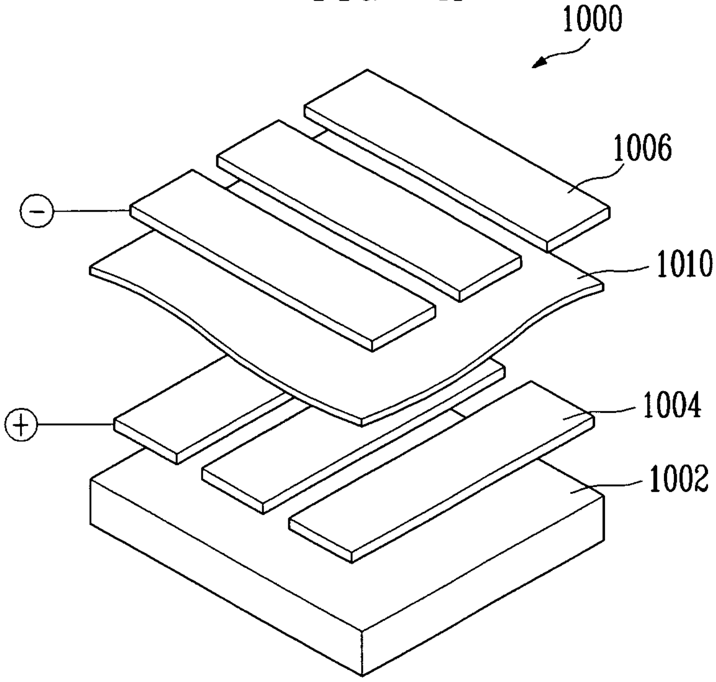

1000
1006
1010
1004
1002
−
+

FIG. 7B

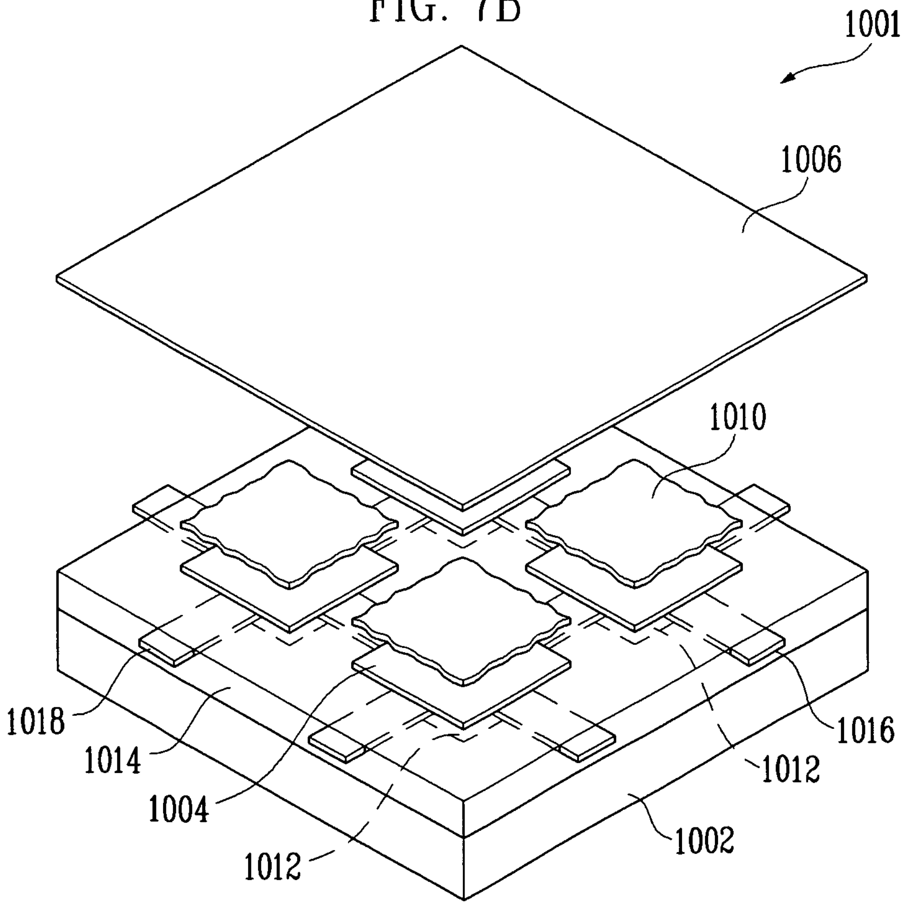

1001
1006
1010
1018
1014
1004
1012
1016
1012
1002

FIG. 7C

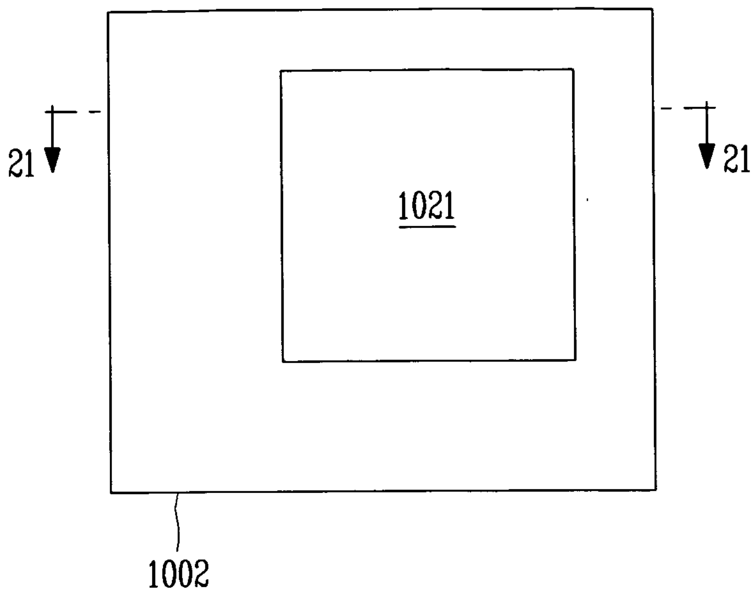


FIG. 7D

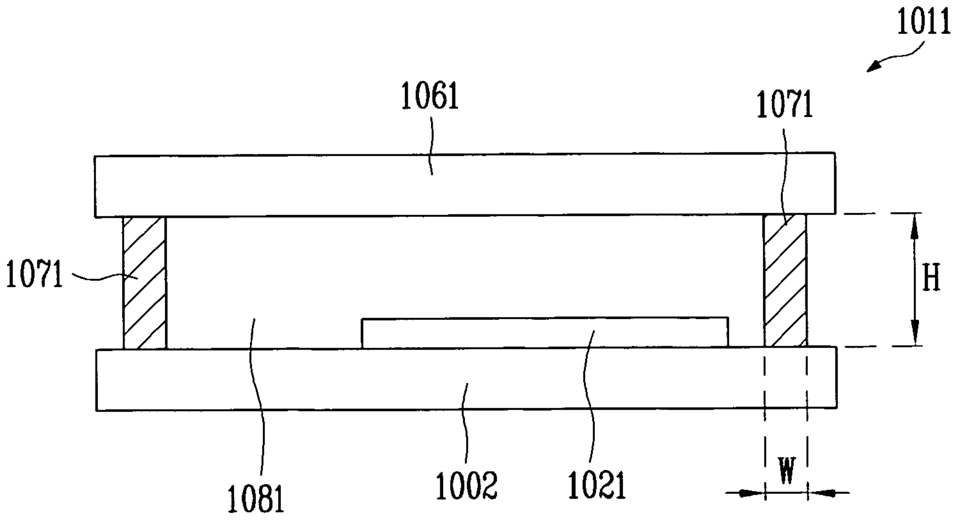
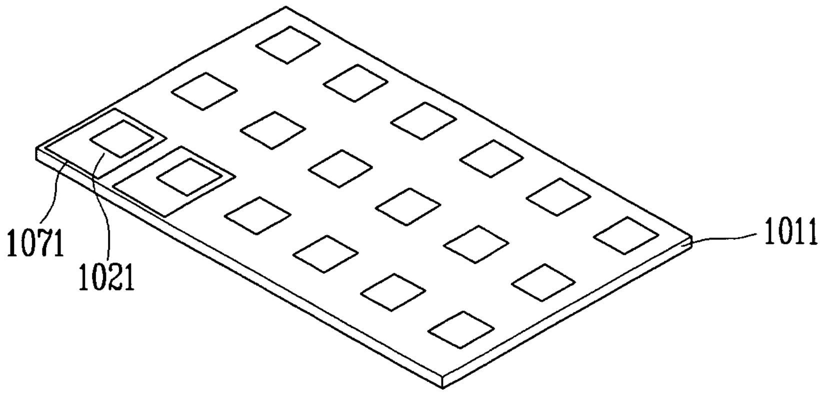


FIG. 7E



REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- US 6998776 B **[0003]**
- US 2004075380 A1 **[0003]**
- EP 1343206 A2 **[0003]**

专利名称(译)	有机发光显示装置及其制造方法		
公开(公告)号	EP1814176B1	公开(公告)日	2010-12-01
申请号	EP2007101230	申请日	2007-01-26
[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	KWAK WON KYU LEGAL & IP TEAM SAMSUNG SDI CO LTD		
发明人	KWAK, WON KYU LEGAL & IP TEAM, SAMSUNG SDI CO., LTD.		
IPC分类号	H01L51/52		
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代理机构(译)	hengelhaupt，Jürgen		
优先权	1020060008764 2006-01-27 KR		
其他公开文献	EP1814176A2 EP1814176A3 EP1814176A8		
外部链接	Espacenet		

摘要(译)

公开了一种有机发光显示装置，其能够通过用玻璃料互连第一和第二基板来封装像素阵列来阻挡氧气和水分等的渗透。有机发光显示装置包括第一基板，与第一基板相对的第二基板，插入在第一基板和第二基板之间的像素阵列，以及位于第一基板和第二基板之间的玻璃料，以将第一基板粘附到第一基板和第二基板之间。第二基板。形成玻璃料以与扫描驱动器的至少一部分重叠。

FIG. 1
(PRIOR ART)

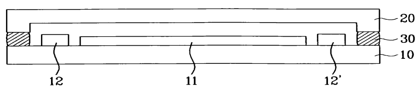

FIG. 2