

FIG. 1

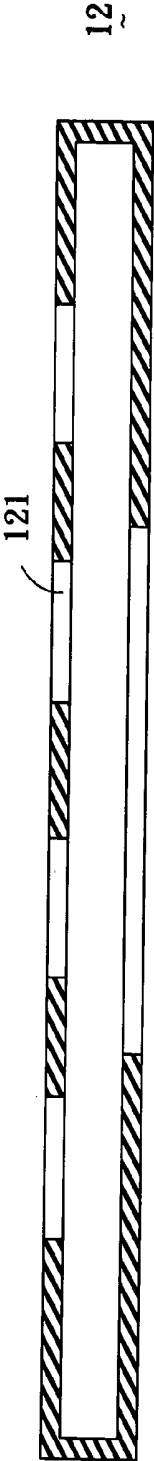


FIG. 3a

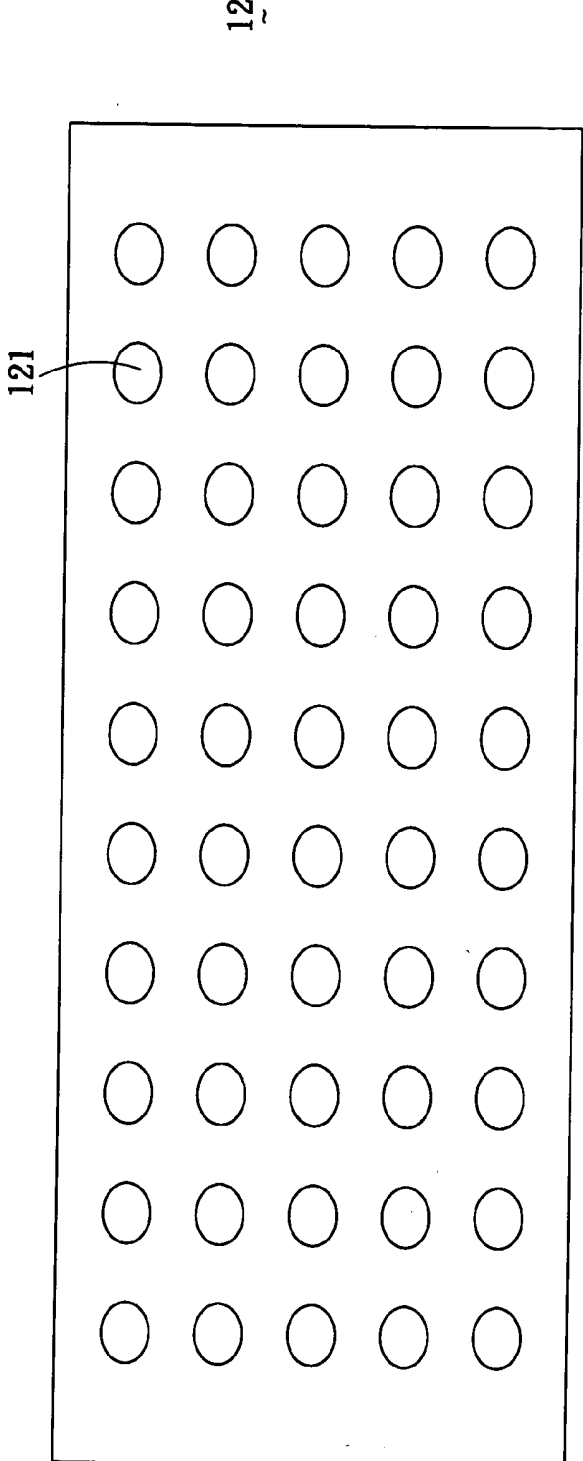


FIG. 3b

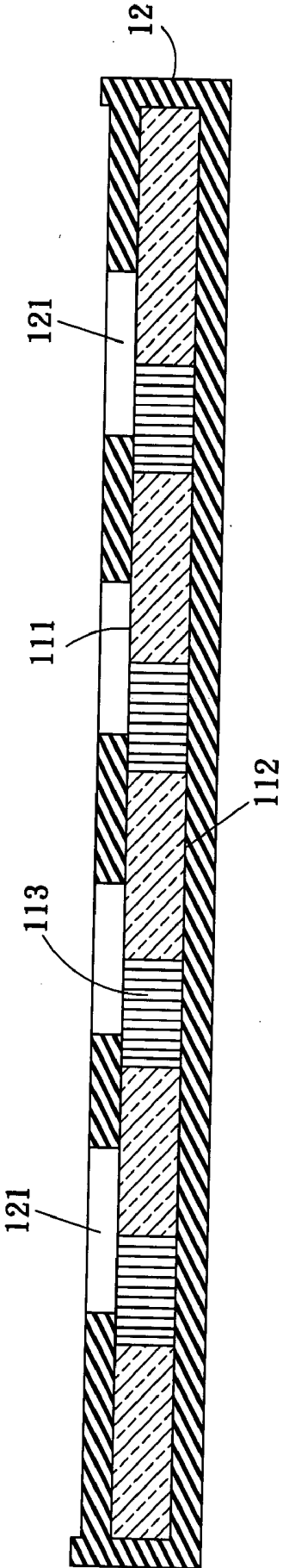
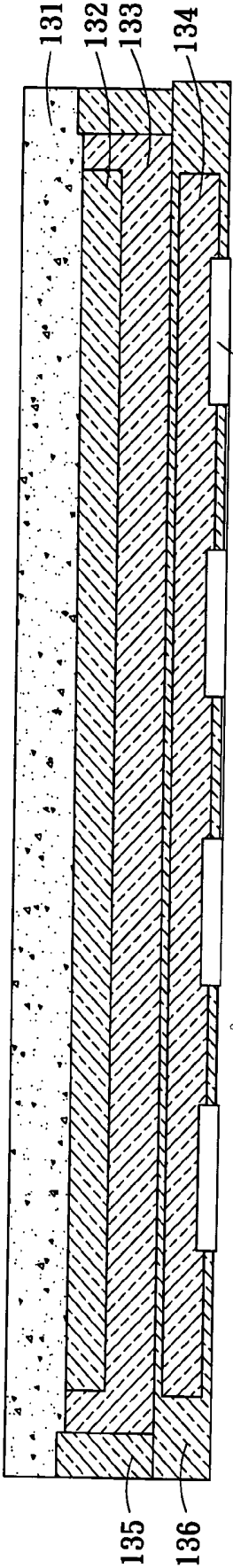


FIG. 4

131
132
133
134
135
136

13



134

FIG. 5

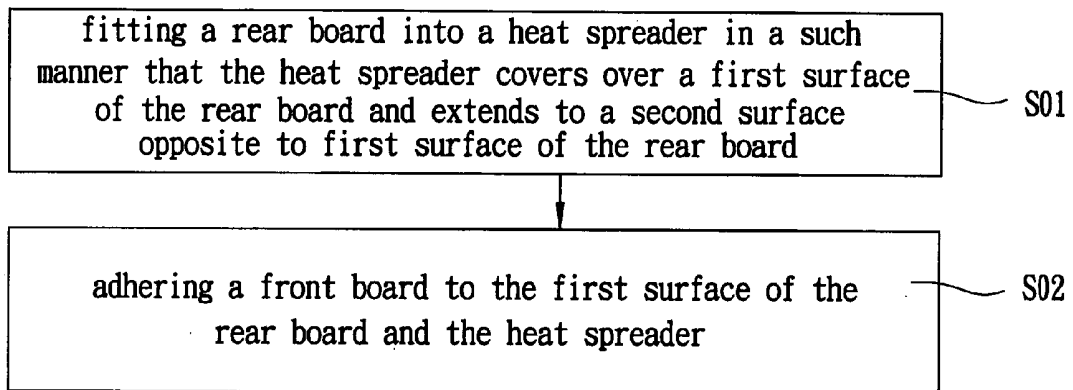


FIG. 6

METHOD FOR MANUFACTURING ORGANIC LIGHT-EMITTING PANEL

[0001] This application is a Divisional of co-pending application Ser. No. 10/321,358, filed on Dec. 18, 2002, and for which priority is claimed under 35 U.S.C. § 120; and this application claims priority of Application No. 091118724 filed in Taiwan, R.O.C. on Aug. 19, 2002 under 35 U.S.C. § 119; the entire contents of all are hereby incorporated by reference.

BACKGROUND OF THE INVENTION

[0002] 1. Field of the Invention

[0003] The invention relates to an organic light-emitting panel and a manufacturing method thereof and, in particular, to an organic light-emitting panel, in which the heat dissipation paths and area may be improved, and a manufacturing method thereof.

[0004] 2. Description of the Related Art

[0005] In the conventional methods for packaging organic light-emitting diodes, wire layout is made on a surface of the electroconductive glass. In this method, however, pins only can be formed on a periphery of the electroconductive glass. Thus, the large-scale demands for the organic light-emitting diodes cannot be satisfied, and the resolution of the organic light-emitting diodes is further limited. Meanwhile, heat generated from the organic light-emitting diodes is almost concentrated on the middle of the device, and the problem of poor heat dissipation paths is also caused.

[0006] Another method for packaging organic light-emitting diodes is called as an array area method, in which solder balls and pins serve as metal conductors. Although the method may solve the problem of large-scale devices, there are some practical problems to be overcome because the printed circuit board (i.e., rear board) cannot bear the warpage caused by the high-temperature condition during the high-temperature reflowing process.

[0007] Because about 90% of electric power inputted to the organic light-emitting diodes is converted into heat, removing redundant heat from the organic light-emitting diodes is a big problem to be solved. The above-mentioned package methods have the following drawbacks. First, the heat dissipation paths and the radiation area of the organic light-emitting panel are not sufficient, and in particular, when the rear board is a plastic substrate with a high thermal resistance, the heat cannot be effectively radiated. Second, because the rear board may warp, the dimensional stability of the rear board may be influenced.

SUMMARY OF THE INVENTION

[0008] An objective of the invention is to provide an organic light-emitting panel, in which the heat dissipation paths may be increased and the radiation area may be enlarged so as to avoid warpage of the rear board and facilitate the adhesive dispensing process, and a manufacturing method of the panel.

[0009] To achieve the above-mentioned objective, the invention provides an organic light-emitting panel including a rear board, a heat spreader and a front board. The rear board has a first surface and a second surface opposite to the first surface. The heat spreader covers over the first surface

of the rear board and extends to the second surface of the rear board. The heat spreader, which covers over the first surface of the rear board is formed with plural holes. The front board is set on the heat spreader and the first surface of the rear board.

[0010] In addition, the invention also provides a manufacturing method of the organic light-emitting panel. The method includes the steps of: fitting a rear board into a heat spreader in a such manner that the heat spreader covers over a first surface of the rear board and extends to a second surface opposite to the first surface of the rear board; and adhering a front board to the first surface of the rear board and the heat spreader.

[0011] Compared to the prior art, owing to the increased heat dissipation paths and enlarged radiation area, heat generated from the front board may be effectively transferred to the rear board and then dissipated. In addition, since the rear board is fitted into the heat spreader with the second surface of the rear board partially exposed, stresses generated during the warpage of the rear board may be absorbed and the dimensional stability of the rear board may be enhanced. Therefore, the drawbacks caused by the warpage of the rear board may be overcome. Furthermore, since the heat spreader is formed with plural holes, it is possible to prevent the conductive adhesive from overflowing during the adhesive dispensing process, and good smoothness of the conductive adhesive may be obtained. Further scope of the applicability of the present invention will become apparent from the detailed description given hereinafter. However, it should be understood that the detailed description and specific examples, while indicating preferred embodiments of the invention, are given by way of illustration only, since various changes and modifications within the spirit and scope of the invention will become apparent to those skilled in the art from this detailed description.

BRIEF DESCRIPTION OF THE DRAWINGS

[0012] The present invention will become more fully understood from the detailed description given hereinbelow and the accompanying drawings, which are given by way of illustration only, and thus are not limitative of the present invention, and wherein:

[0013] FIG. 1 is a schematic illustration showing the organic light-emitting panel according to one embodiment of the invention;

[0014] FIG. 2 is a schematic illustration showing a rear board of this embodiment;

[0015] FIG. 3a is a schematic, cross-sectional view showing a heat spreader of this embodiment;

[0016] FIG. 3b is a top view showing the heat spreader of this embodiment;

[0017] FIG. 4 is a schematic illustration showing the rear board covered by the heat spreader of this embodiment;

[0018] FIG. 5 is a schematic illustration showing a front board of this embodiment; and

[0019] FIG. 6 is a block diagram showing a manufacturing method of an organic light-emitting panel according to another embodiment of the invention.

DETAILED DESCRIPTION OF THE
INVENTION

[0020] The organic light-emitting panel and the manufacturing method thereof in accordance with preferred embodiments of the invention will be described with reference to the accompanying drawings, wherein the same reference numbers denote the same elements.

[0021] Referring to FIG. 1, an organic light-emitting panel 1 according to one embodiment of the invention includes a rear board 11, a heat spreader 12 and a front board 13. The rear board 11 has a first surface 111 and a second surface 112 opposite to the first surface 111. The heat spreader 12 covers over the first surface 111 of the rear board 11 and extends to the second surface 112 of the rear board 11. The heat spreader 12, which covers over the first surface 111 of the rear board 11 is formed with plural holes 121. The front board 13 is set on the first surface 111 covered by the heat spreader 12.

[0022] As shown in FIG. 2, the rear board 11 of the embodiment is a printed circuit board (PCB) having internal circuits 113. The printed circuit board is typically formed by plating with a layer of copper foil on a laminated board made of a composite material and then etching the copper foil. The composite material is composed of reinforced fibers and resin.

[0023] Please refer to FIG. 3a, which is a cross-sectional view showing the heat spreader 12, and also to FIG. 3b, which is a top view showing the heat spreader 12. The heat spreader 12 of this embodiment is made by way of extrusion followed by a surface isolating treatment to make the heat spreader 12 isolated. The heat spreader 12 functions to increase the heat dissipation paths and enlarge the radiation area of the organic light-emitting panel so as to effectively transfer heat generated from the front board 13 to the rear board 11 and then dissipate the heat.

[0024] In this case, the heat spreader 12 is made of a metal of, for example, aluminum or copper. The surface of the heat spreader 12 is formed with an oxide of this metal to avoid the short-circuited condition caused by electroconductive traces formed between the internal circuits 113 of the rear board 11 and the cathode 134 (FIG. 5) of the front board 13.

[0025] Referring to FIG. 4, the heat spreader 12 of this embodiment covers over the first surface 111 of the rear board 11 and extends to the second surface 112 of the rear board 11. In this case, the rear board 11 may be fitted into the heat spreader 12. The heat spreader 12, which covers over the first surface 111 of the rear board 11 is formed with plural holes 121. The positions of the holes 121 depend on the relative position relationship between the internal circuits 113 of the rear board 11 and the cathode 134 (FIG. 5) of the front board 13.

[0026] Referring to FIG. 5, the front board 13 of this embodiment includes a transparent substrate 131, a transparent anode 132, an organic electroluminescence layer 133 and a metal cathode 134. The transparent anode 132 and the organic electroluminescence layer 133 are arranged between the transparent substrate 131 and the cathode 134.

[0027] In this case, the transparent substrate 131 may be a glass substrate, a plastic substrate or a flexible substrate. The plastic substrate and the flexible substrate may be a poly-

carbonate (PC) substrate or a polyester (PET) substrate, and the transparent substrate 131 has a thickness of about 0.2 to 5 mm.

[0028] In addition, the transparent anode 132 of this embodiment is formed on the transparent substrate 131 by way of sputtering or ion plating. The transparent anode 132 may be made of an electroconductive metal oxide, which may be indium tin oxide (ITO) or aluminum zinc oxide (AZO) having a thickness of 500 angstroms or more.

[0029] The organic electroluminescence layer 133 includes a hole injection layer, a hole transfer layer, a light-emitting layer, an electron transfer layer and an electron injection layer. The organic electroluminescence layer 133 having a thickness of about 500 to 3000 angstroms is formed on the transparent anode 132 by way of evaporating, spin coating, ink jet printing or printing. In addition, light rays emitting from the organic electroluminescence layer 133 may be blue, green, red, white, or other monochromatic colors.

[0030] Next, the cathode 134 is formed by way of evaporating, electron-beam coating (E-gun) or sputtering. The cathode 134 has a thickness of about 500 to 5000 angstroms and may be made of aluminum, aluminum/lithium, calcium, magnesium-silver alloy or silver.

[0031] Since the organic light-emitting diode is very sensitive to moisture, defects such as dark spots may be easily generated after the organic light-emitting diode contacts the moisture, and the lifetime of the organic light-emitting panel may also be adversely influenced. In this embodiment, after forming the cathode 134, an organic desiccant layer 135 having a thickness of about 1000 to 6000 nm is plated by a CVD (Chemical Vapor Deposition) method. Then, an inorganic desiccant layer 136 having a thickness of about 40 to 450 μm is plated by the CVD or sputtering method so as to isolate the device from moisture. Next, the cathode 134 is defined by way of wet etching.

[0032] Please refer again to FIG. 1. The front board 13 is adhered to the first surface 111 of the rear board 11 and the heat spreader 12 using a conductive adhesive 14 and an adhesive agent 15. In this case, the conductive adhesive 14 is an epoxy resin (silver paste), the electroconductive property of which relates to the coating thickness and area. The adhesive agent 15 is a non-conductive adhesive, the function of which is similar to that of the underfill. In other words, the adhesive agent 15 is used to solve the problem of the global thermal expansion mismatch of the organic light-emitting panel. That is, the rear board 11 is tightly combined with the front board 13 by the adhesive agent 15, and the stresses therebetween are redistributed over the whole region.

[0033] Referring to FIG. 6, the invention also provides a manufacturing method of the organic light-emitting panel 1. The method includes the steps of: fitting a rear board 11 into a heat spreader 12 in a such manner that the heat spreader 12 covers over a first surface 111 of the rear board 11 and extends to a second surface 112 opposite to first surface 111 of the rear board 11 (S01); and adhering a front board 13 to the first surface 111 of the rear board 11 and the heat spreader 12 (S02).

[0034] The elements and functions of the organic light-emitting panel 1 in this embodiment are the same as those of FIG. 1, and detailed descriptions thereof are omitted.

[0035] In step S01, the rear board 11 is fitted into the heat spreader 12 in such a manner that holes 121 of the heat spreader 12 are aligned with internal circuits 113 of the rear board 11, respectively.

[0036] In this case, the heat spreader 12 is formed by way of press molding. Then, holes 121 are formed at positions corresponding to the cathode 134 of the front board 13 and the internal circuits 113 of the rear board 11 using a chemical or mechanical way. Next, a metal film (i.e., black oxidation) forming method is adopted to form a metal oxide layer having a thickness of 25 to 100 μm on the surface of the heat spreader 12. In this case, the metal oxide layer is used to avoid the short-circuited condition caused by the electro-conductive traces formed between the cathode 134 of the front board 13 and the internal circuits 113 of the rear board 11.

[0037] In step S02, the front board 13 is adhered to the first surface 111 of the rear board 11 and the heat spreader 12, and the organic light-emitting panel 1 is thus formed. In this case, a conductive adhesive 14 and an adhesive agent 15 (non-conductive adhesive) are printed on the first surface 111 of the rear board 11 and the heat spreader 12. Next, the front board 13 is placed on the conductive adhesive 14 and the adhesive agent 15.

[0038] Because the organic light-emitting panel of the invention includes a heat spreader, the heat dissipation paths of the organic light-emitting panel may be increased and the radiation area thereof may be enlarged. Compared to the prior art, owing to the increased heat dissipation paths and enlarged radiation area, heat generated from the front board may be effectively transferred to the rear board and then dissipated. In addition, since the rear board is fitted into the heat spreader with the second surface of the rear board partially exposed, stresses generated during the warpage of the rear board may be absorbed and the dimensional stability of the rear board may be enhanced. Therefore, the drawbacks caused by the warpage of the rear board may be overcome. Furthermore, since the heat spreader is formed with plural holes, it is possible to prevent the conductive adhesive from overflowing during the adhesive dispensing process, and good smoothness of the conductive adhesive may be obtained.

[0039] While the invention has been described by way of an example and in terms of a preferred embodiment, it is to be understood that the invention is not limited to the disclosed embodiment. To the contrary, it is intended to cover various modifications. Therefore, the scope of the appended claims should be accorded the broadest interpretation so as to encompass all such modifications.

What is claimed is:

1. A manufacturing method of an organic light-emitting panel, comprising the steps of:

fitting a rear board into a heat spreader in such a manner that the heat spreader covers over a first surface of the rear board and extends to a second surface opposite to the first surface of the rear board; and

adhering a front board to the first surface of the rear board and the heat spreader.

2. The method according to claim 1, wherein the heat spreader which covers over the first surface of the rear board is formed with plural holes.

3. The method according to claim 1, wherein the front board includes a transparent substrate, a transparent anode, an organic electroluminescence layer and a cathode.

4. The method according to claim 1, wherein the front board is adhered to the heat spreader and the rear board by a conductive adhesive and an adhesive agent.

5. The method according to claim 4, wherein the conductive adhesive is an epoxy resin.

6. The method according to claim 4, wherein the adhesive agent is a non-conductive adhesive.

7. The method according to claim 1, wherein the rear board is a printed circuit board.

8. The method according to claim 1, wherein the heat spreader is formed by way of press molding.

9. The method according to claim 1, wherein the heat spreader is isolated.

10. The method according to claim 1, wherein the heat spreader is made of a metal, and a metal oxide is formed on a surface of the heat spreader.

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