US006876148B2

(12) **United States Patent**
Wu et al.

(10) **Patent No.: US 6,876,148 B2**
(45) **Date of Patent: Apr. 5, 2005**

(54) **ORGANIC LIGHT-EMITTING PANEL AND MANUFACTURING METHOD THEREOF**

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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 216 days.

(21) Appl. No.: **10/321,358**

(22) Filed: **Dec. 18, 2002**

(65) **Prior Publication Data**

US 2004/0032209 A1 Feb. 19, 2004

(30) **Foreign Application Priority Data**

Aug. 19, 2002 (TW) .... 91118724 A

(51) **Int. Cl.**[7] **H05B 33/04**; H05B 33/14

(52) **U.S. Cl.** **313/512**; 313/46; 313/506

(58) **Field of Search** 313/512, 511, 313/504–506, 498, 46, 17, 18, 20, 28, 33

(56) **References Cited**

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(57) **ABSTRACT**

An organic light-emitting panel includes a rear board, a heat spreader and a front board. In this case, the rear board has a first surface and a second surface opposite to the first surface. The heat spreader covers over the first surface and extends to the second surface. 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 first surface and the heat spreader. The invention also discloses a manufacturing method of the panel. The method includes 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.

10 Claims, 6 Drawing Sheets

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14 15 111(11) 112(11) 121(12) 14 12

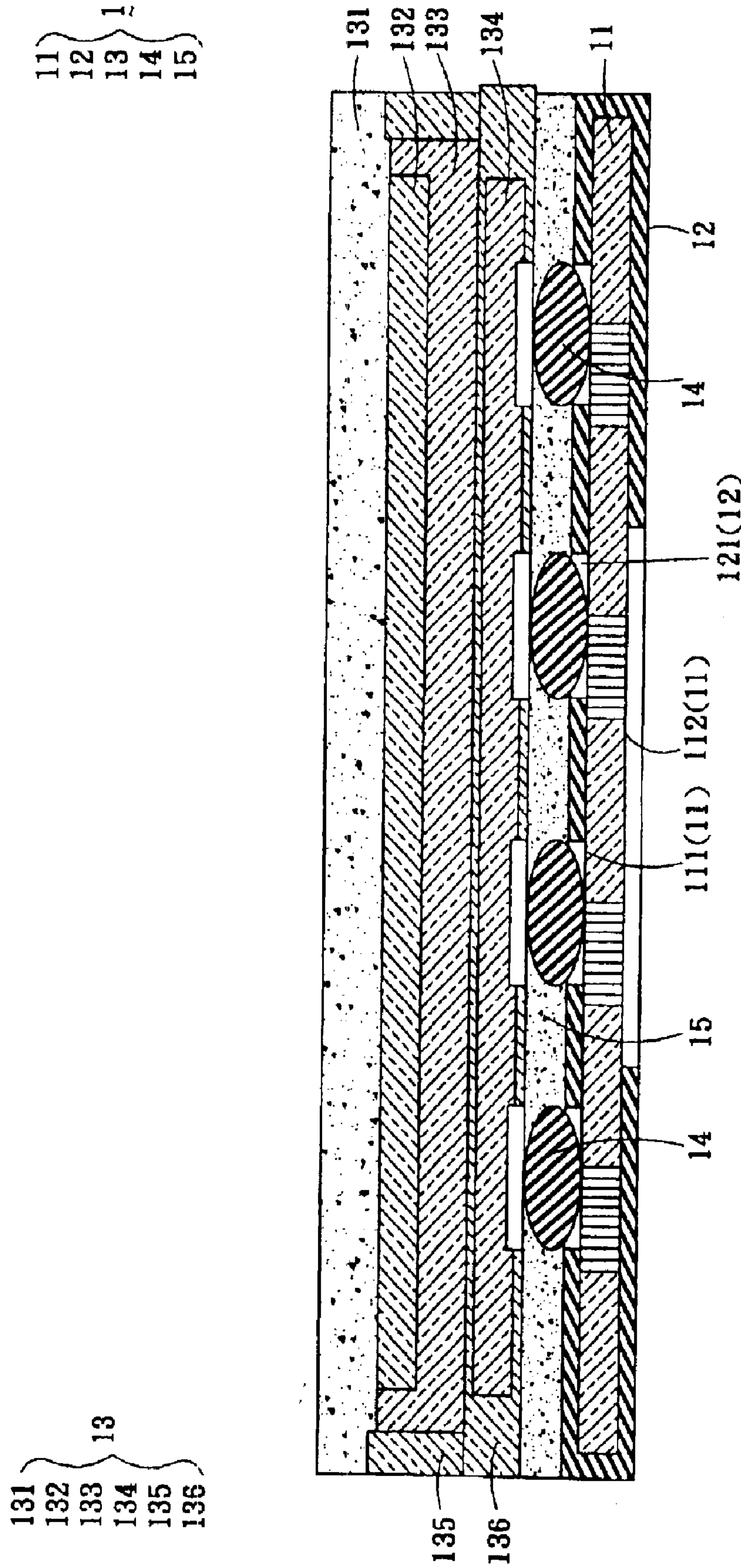

FIG. 1

111
112
113

FIG. 2

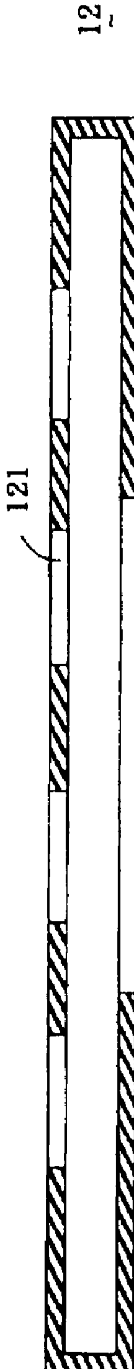

FIG. 3a

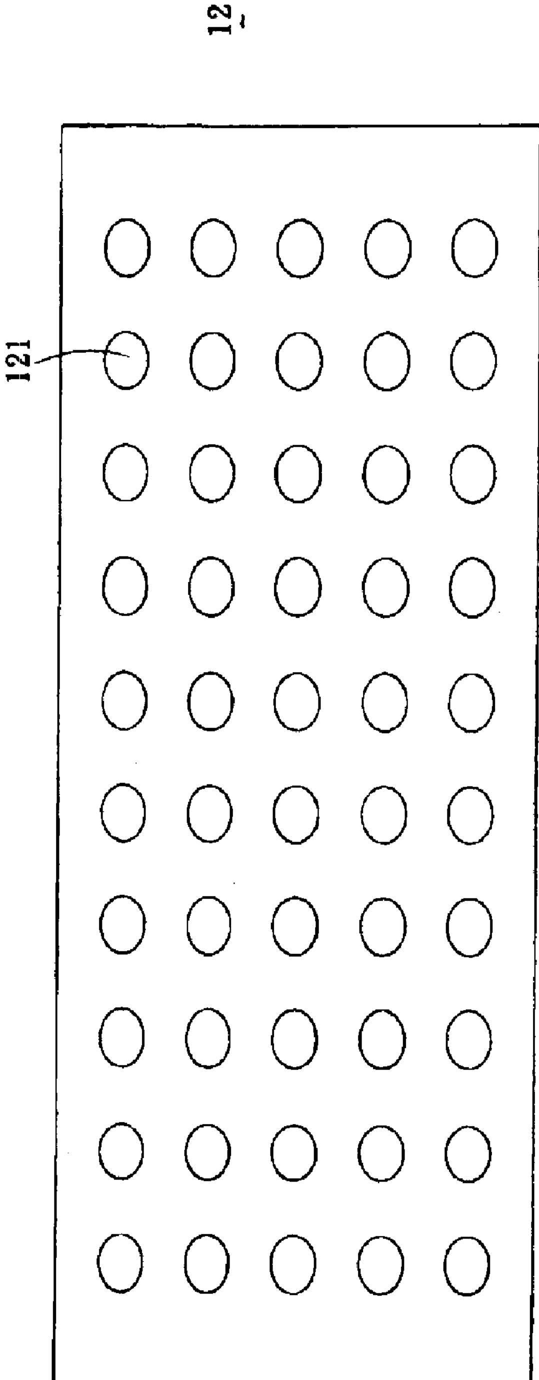

FIG. 3b

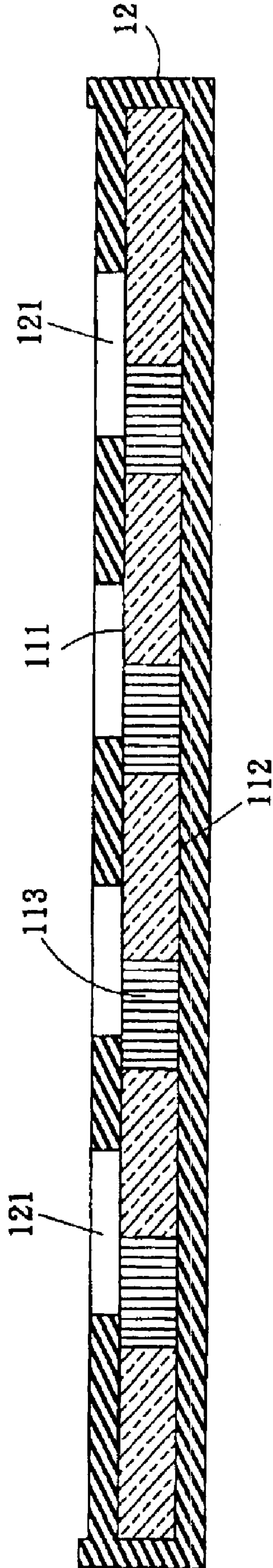

FIG. 4

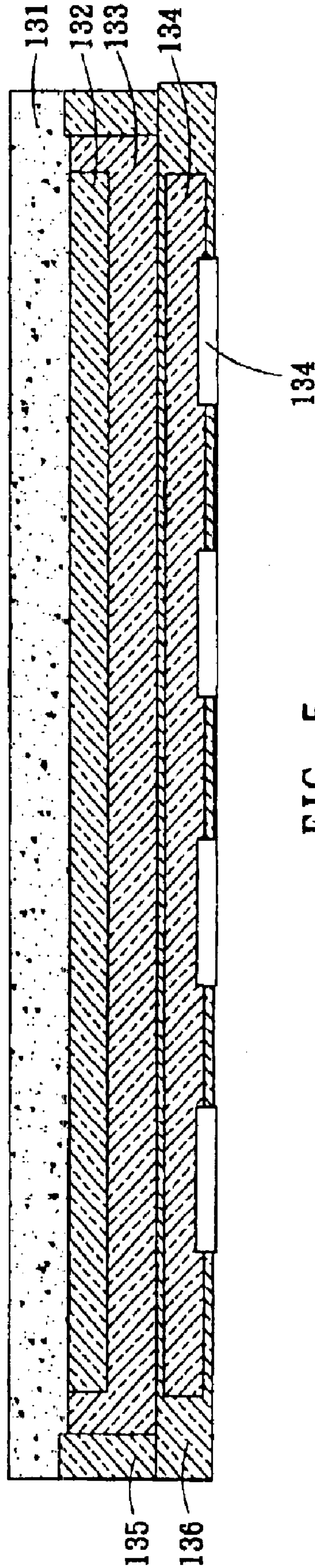

FIG. 5

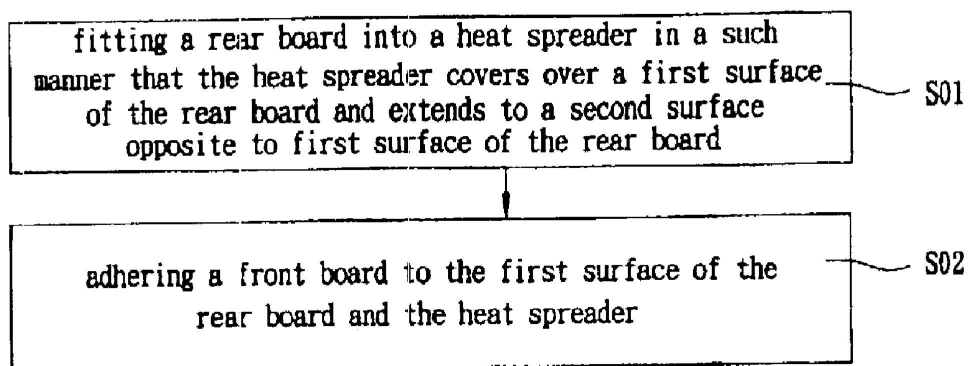

FIG. 6

ORGANIC LIGHT-EMITTING PANEL AND MANUFACTURING METHOD THEREOF

BACKGROUND OF THE INVENTION

1. Field of the Invention

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.

2. Description of the Related Art

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.

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.

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

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.

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.

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.

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.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will become more fully understood from the detailed description given in the herein below illustration, and thus are not limitative of the present invention, and wherein:

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

FIG. **2** is a schematic illustration showing a rear board of this embodiment;

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

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

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

FIG. **5** is a schematic illustration showing a front board of this embodiment; and

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

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.

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**.

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.

Please refer to FIG. **3***a*, which is a cross-sectional view showing the heat spreader **12**, and also to FIG. **3***b*, 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.

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**.

Referring to FIG. **4**, the beat 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**.

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**.

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

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.

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.

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.

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.

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.

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**).

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.

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.

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 electroconductive traces formed between the cathode **134** of the front board **13** and the internal circuits **113** of the rear board **11**.

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**.

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.

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. An organic light-emitting panel, comprising:

a rear board having a first surface and a second surface opposite to the first surface;

a heat spreader covering over the first surface of the rear board and extending to the second surface of the rear board, the heat spreader which covers over the first surface of the rear board being formed with plural holes; and

a front board setting on the heat spreader and the first surface of the rear board.

2. The organic light-emitting panel according to claim **1**, wherein the front board comprises a transparent substrate, a transparent anode, an organic electroluminescence layer and a cathode, and the transparent anode and the organic electroluminescence layer are arranged between the transparent substrate and cathode.

3. The organic light-emitting panel according to claim **1**, wherein the front board is adhered to the rear board and the heat spreader by a conductive adhesive and an adhesive agent.

4. The organic light-emitting panel according to claim **3**, wherein the conductive adhesive is an epoxy resin.

5. The organic light-emitting panel according to claim **3**, wherein the adhesive agent is a non-conductive adhesive.

6. The organic light-emitting panel according to claim **1**, wherein the rear board is a printed circuit board.

7. The organic light-emitting panel according to claim **1**, wherein the rear board is fitted into the heat spreader.

8. The organic light-emitting panel according to claim **1**, wherein the heat spreader is formed by way of press molding.

9. The organic light-emitting panel according to claim **1**, wherein the heat spreader is isolated.

10. The organic light-emitting panel 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.

* * * * *

patsnap

专利名称(译)	有机发光面板及其制造方法		
公开(公告)号	US6876148	公开(公告)日	2005-04-05
申请号	US10/321358	申请日	2002-12-18
[标]申请(专利权)人(译)	吴钦龙 PAI SUNG YI 黄天王		
申请(专利权)人(译)	吴钦龙 PAI SUNG-YI 黄天王		
当前申请(专利权)人(译)	铼宝科技股份有限公司		
[标]发明人	WU CHIN LONG PAI SUNG YI HUANG TIEN WANG		
发明人	WU, CHIN-LONG PAI, SUNG-YI HUANG, TIEN-WANG		
IPC分类号	H05B33/22 H01L51/52 H05B33/04 H05B33/14		
CPC分类号	H05B33/22 H01L51/529		
审查员(译)	WILLIAMS , JOSEPH		
优先权	091118724 2002-08-19 TW		
其他公开文献	US20040032209A1		
外部链接	Espacenet USPTO		

摘要(译)

有机发光面板包括后板，散热器和前板。在这种情况下，后板具有第一表面和与第一表面相对的第二表面。散热器覆盖第一表面并延伸到第二表面。覆盖在后板的第一表面上的散热器形成有多个孔。前板设置在第一表面和散热器上。本发明还公开了一种面板的制造方法。该方法包括以下步骤：将后板安装到散热器中，使得散热器覆盖后板的第一表面并延伸到与后板的第一表面相对的第二表面;并将前板粘贴在后板的第一表面和散热器上。