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(54) ELECTRO-LUMINESCENCE DISPLAY DEVICE

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(52) **U.S. Cl.** **313/512**; 313/504

(57) **ABSTRACT**

An electro-luminescence display device for reinforcing its strength is disclosed. In the device, an organic compound layer is provided on a substrate. A packaging plate covers the organic compound layer. Strength reinforcing members are provided at the packaging plate to reinforce strength of the packaging plate.

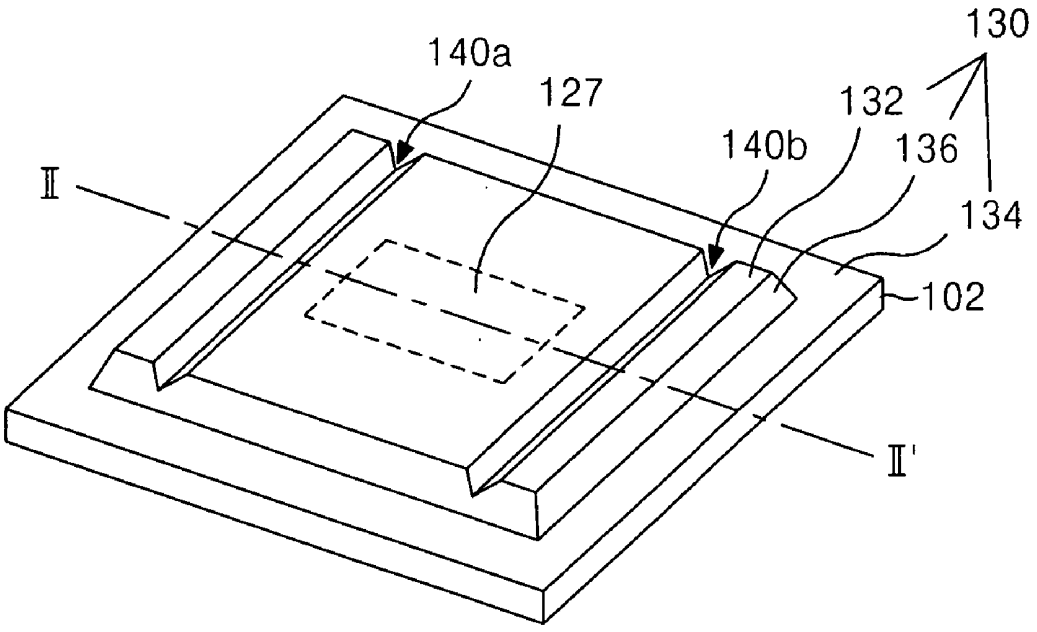


FIG. 1
RELATED ART

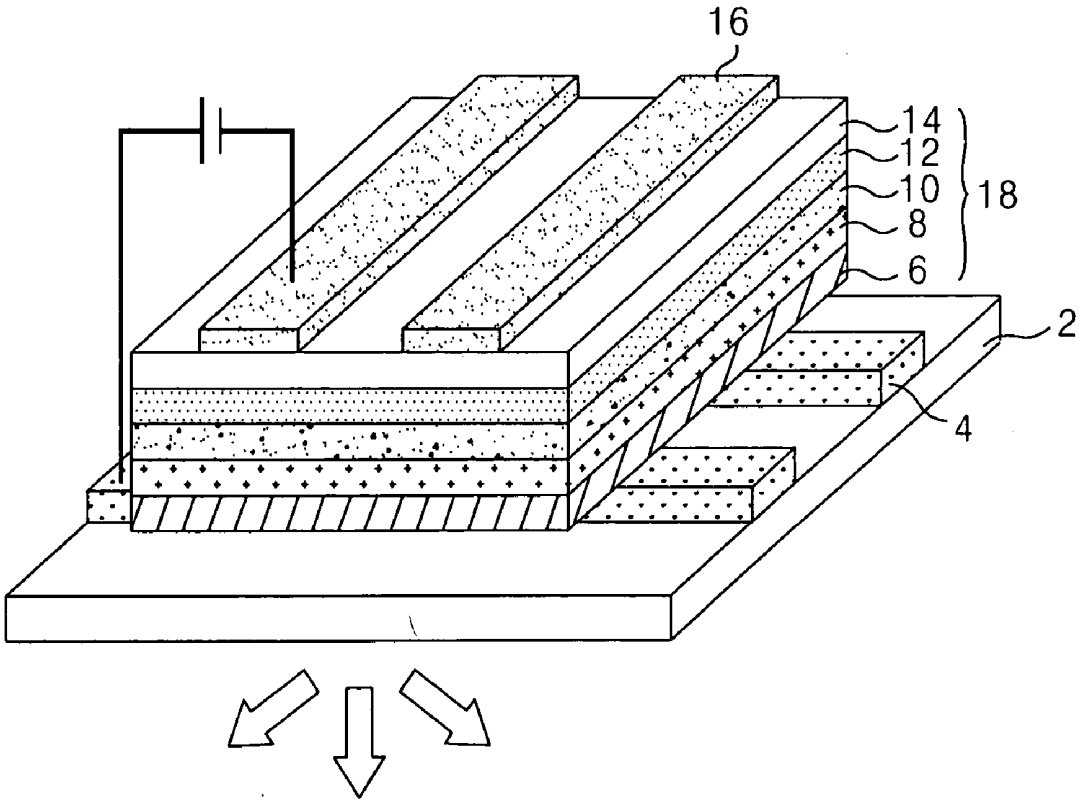
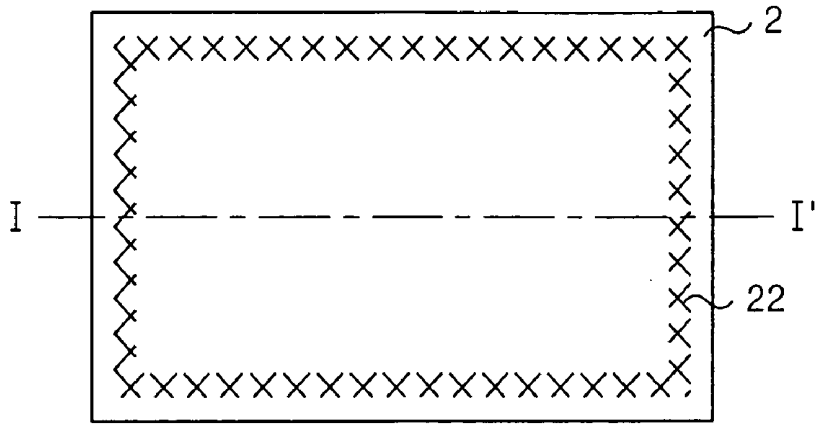


FIG. 2
RELATED ART



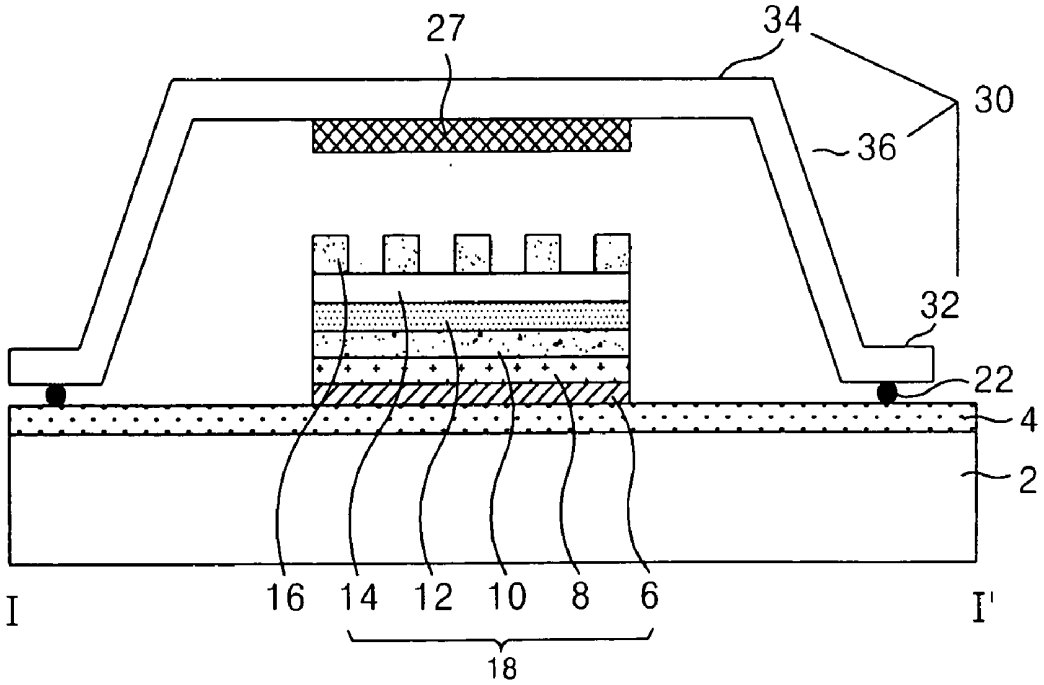


FIG.3

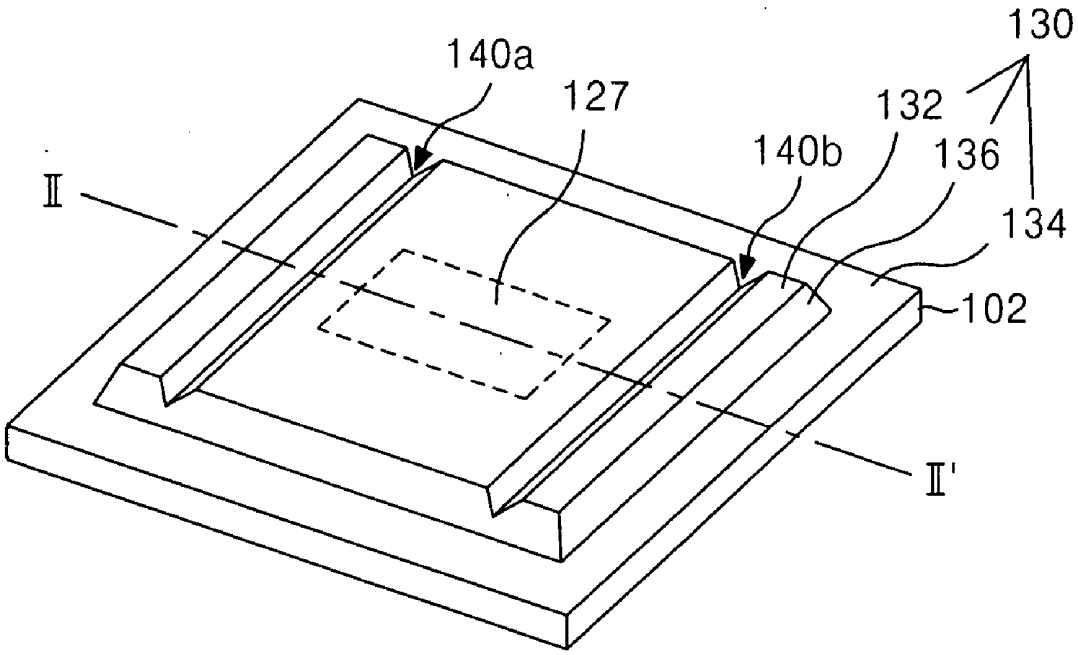


FIG. 4

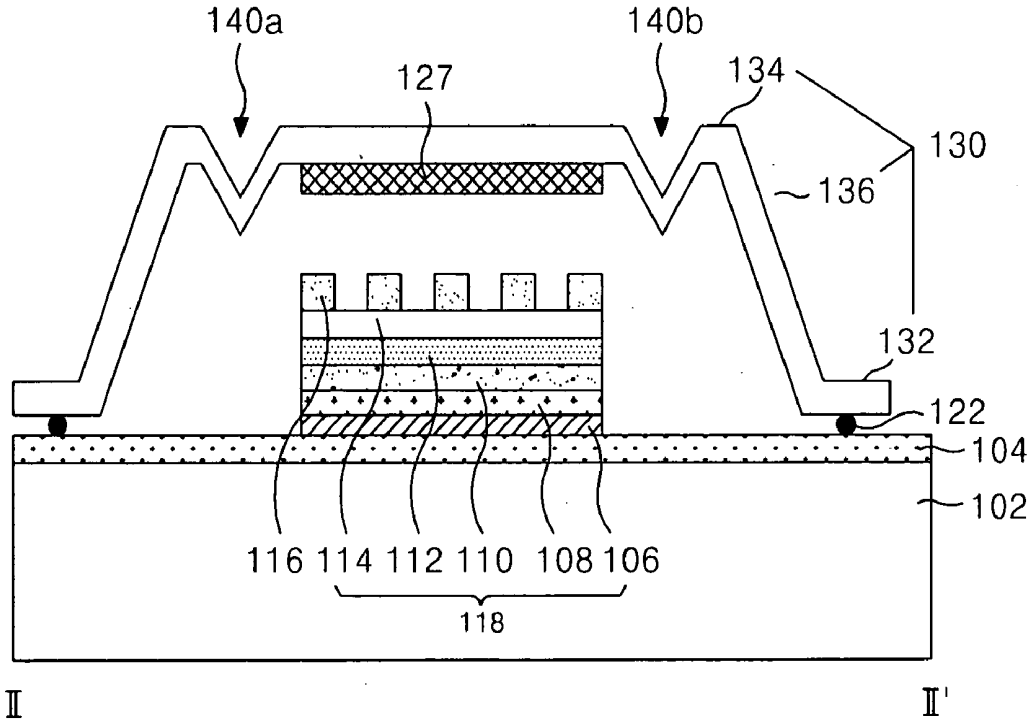

140a
140b
127
134
130
136
132
122
104
102
116 114 112 110 108 106
118
Ⅱ
Ⅱ'

FIG.5

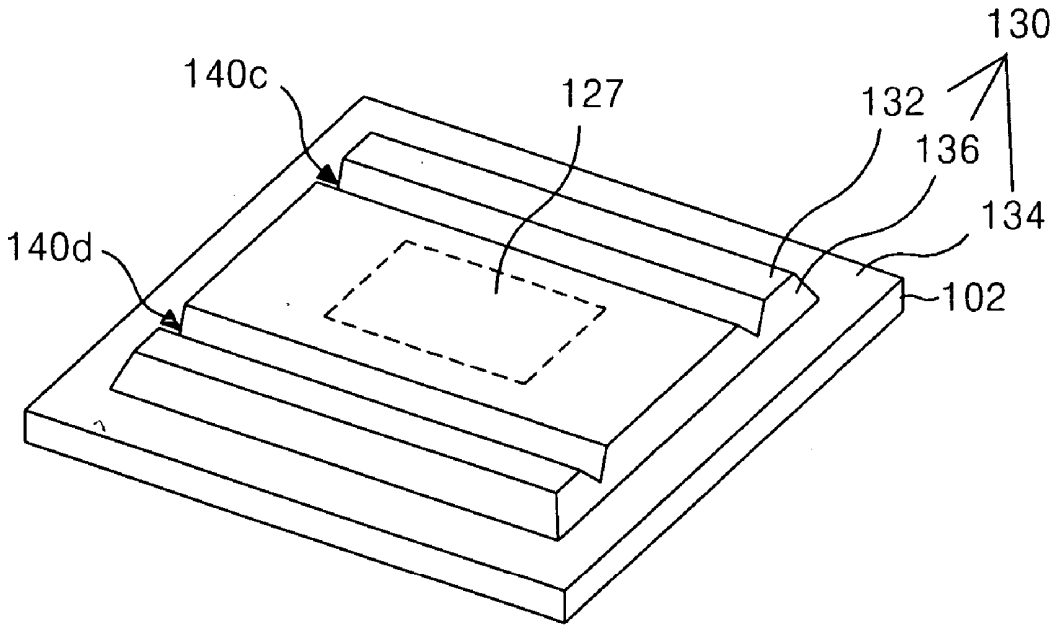


FIG.6

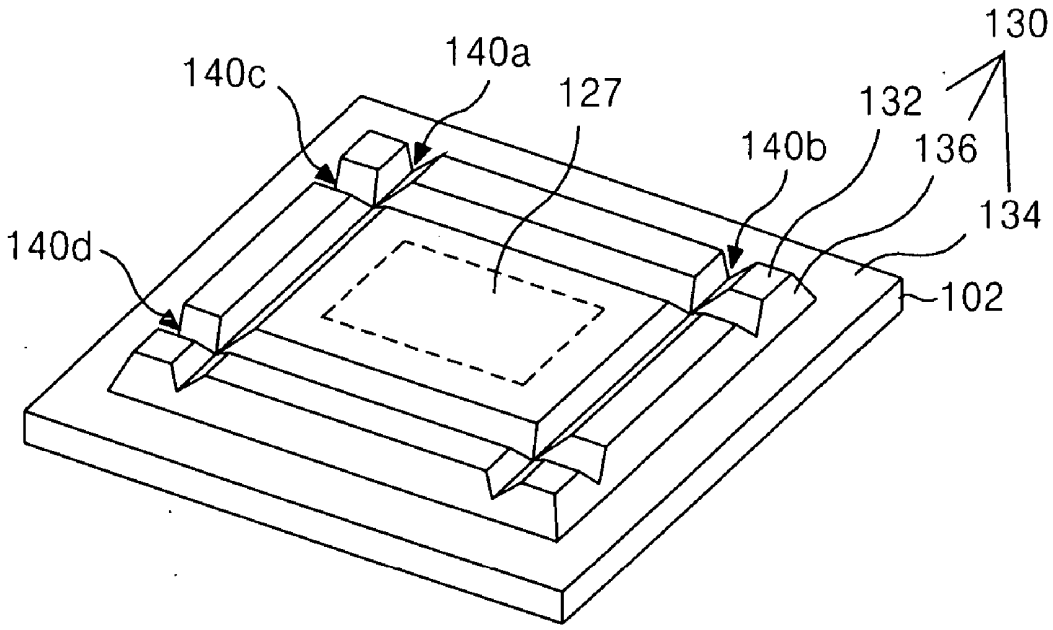


FIG. 7

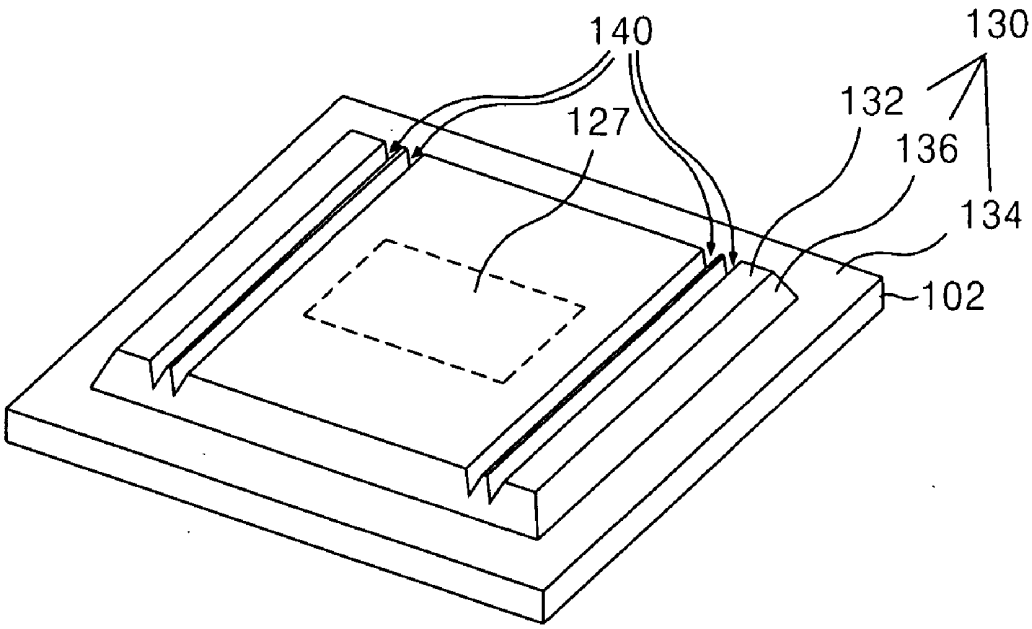
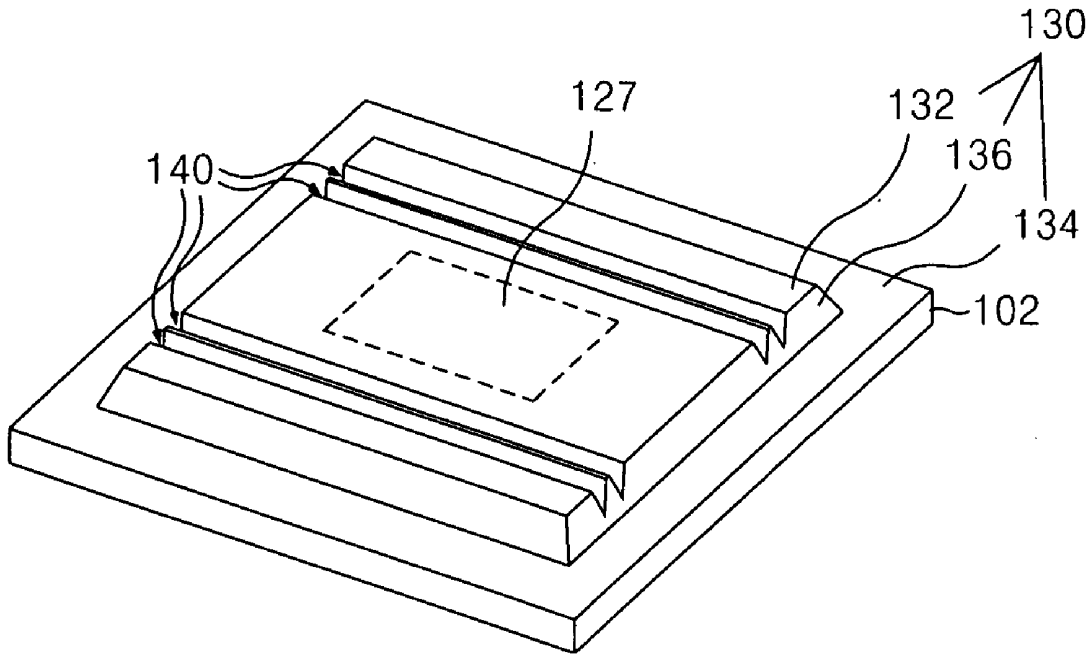


FIG. 8



ELECTRO-LUMINESCENCE DISPLAY DEVICE

[0001] This application claims the benefit of Korean Patent Application No. P2004-07246 filed in Korea on Feb. 4, 2004, which is hereby incorporated by reference.

BACKGROUND OF THE INVENTION

[0002] 1. Field of the Invention

[0003] This invention relates to an electro-luminescence display (ELD), and more particularly to an electro-luminescence display device that is adaptive for reinforcing its strength.

[0004] 2. Description of the Related Art

[0005] Recently, there have been developed various flat panel display devices reduced in weight and bulk that is capable of eliminating disadvantages of a cathode ray tube (CRT). Such flat panel display devices include a liquid crystal display (LCD), a field emission display (FED), a plasma display panel (PDP) and an electro-luminescence (EL) display, etc. There have been actively processed studies for attempting to make a high display quality and a large-dimension screen of the flat panel display device.

[0006] In such flat panel display devices, the PDP has drawbacks in that it has been highlighted as the most advantageous display device to make a light weight, a small size and a large dimension screen because its structure and manufacturing process are simple, but it has low light-emission efficiency and large power consumption. On the other hand, the active matrix LCD employing a thin film transistor (TFT) as a switching device has a difficulty in making a large dimension screen because it is fabricated by a semiconductor process, but has an expanded demand as it is mainly used for a display device of a notebook personal computer. However, the LCD has a drawback in that it has a difficulty in making a large dimension screen and it has large power consumption due to a backlight unit. Also, the LCD has characteristics of a large light loss and a narrow viewing angle due to optical devices such as a polarizing filter, a prism sheet, a diffuser and the like.

[0007] On the other hand, the EL display device is largely classified into an inorganic EL device and an organic EL device depending upon a material of a light-emitting layer, and is a self-luminous device. When compared with the above-mentioned display devices, the EL display device has advantages of a fast response speed, large light-emission efficiency, a large brightness and a large viewing angle.

[0008] Referring to **FIG. 1**, an organic EL device **1** of the EL display devices has an anode electrode **4** formed from a transparent electrode pattern on a substrate **2**, and a light-emitting organic compound layer **18** formed thereon.

[0009] The anode electrode **4** is formed from any one of indium-tin-oxide (ITO), indium-zinc-oxide (IZO) and indium-tin-zinc-oxide (ITZO), etc. on the substrate **2** by a photolithography. Such an anode electrode **4** is used as a data electrode.

[0010] The organic compound layer **18** has a hole injection layer **6** and a hole carrier layer **8** sequentially formed on the anode electrode **4**. A light-emitting layer **10** having a light emission function is provided on the hole carrier layer **8**. Further, an electron carrier layer **12** and an electron injection layer **14** are sequentially formed on the light-emitting layer **10**.

[0011] A cathode electrode **16** formed from aluminum (Al) having a high reflectivity is provided on the organic compound layer **18**.

[0012] In the organic EL device, driving voltage and current are applied to the anode electrode **4** and the cathode electrode **16**, then holes within the hole injection layer **6** and electrons within the electron injection layer **14** are progressed into the light-emitting layer **10** to thereby excite a phosphorous material within the light-emitting layer **10**. A picture or an image is displayed by a principle in which a visible light generated from the light-emitting layer **10** in this manner is emitted out through the transparent anode electrode **4**.

[0013] A life of the light-emitting layer **10** of the organic EL device is critically influenced by damages of the cathode electrode **16** and the organic compound layer **18** caused by moisture and oxygen in the atmosphere. In order to solve this problem, an encapsulation process utilizing a packaging plate formed from a material such as metal or glass, etc. is added.

[0014] Referring to **FIG. 2**, the conventional packaging plate **30** is formed from glass, plastic or canister, etc. The packaging plate **30** includes a first face **32** provided with a getter **27** for absorbing moisture and oxygen, a second face **34** having a sealant **22** coated at the edge thereof, and a connection face **36** for connecting the first and second faces **32** and **34** such that the first and second faces **32** and **34** have a desired height of step coverage.

[0015] The first face **32** is provided with the getter **27** made from barium oxide (BaO) or calcium oxide (CaO) so as to absorb moisture and oxygen. Herein, in order to prevent the getter **27** as a moisture absorbent from being dropped on the organic compound layer **18**, a semi-transmitting film (not shown) is attached onto the first face **32** such that moisture and oxygen, etc. come in and out. The semi-transmitting film is formed from Teflon, polyester or paper, etc.

[0016] The second face **34** is joined with the sealant **22** coated onto the edge of the substrate **2**, thereby attaching the package plate **30** onto the substrate **2**. The second surface **34** of the packaging plate **30** is joined with the substrate **2** by the sealant **22** to make a vacuum state, thereby preventing a life of the EL device from being critically influenced by damage of the cathode electrode **16** and the organic compound layer **18** caused by moisture and oxygen in the atmosphere. Herein, the sealant **22** is made from an ultraviolet-curing epoxy, etc. This ultraviolet-curing epoxy allows the substrate **2** or the packaging plate **30** to be pressurized and joined by a technique such as a dispensing and a printing, etc. and then is cured by an irradiation of an ultraviolet ray. Subsequently, after a sealing was made by the sealant **22**, the organic EL device is filled with an inactive gas with no moisture or oxygen. To this end, a glove box or a vacuum chamber is used.

[0017] The connection face **36** allows the first face **32** provided with the getter **27** and the second face **34** attached onto the substrate **2** to have a desired height of step coverage, thereby causing an internal space of the package plate

30 to be made into a vacuum state. In this case, the connection face **36** may vertically connect the first face **32** with the second face **34**, or may connect the first face **32** with the second face **34** in such a manner to have a desired slope.

[**0018**] However, such a packaging plate **30** has a problem in that it has a low strength because the first face **32** provided with the getter **27** takes a flat structure. Particularly, there is raised a problem in that, when a size of the packaging plate **30** is enlarged, it has a low strength because the first face **32** takes a flat structure, thereby causing a twist of the packaging plate **30**.

SUMMARY OF THE INVENTION

[**0019**] Accordingly, it is an object of the present invention to provide an electro-luminescence display device that is adaptive for reinforcing its strength.

[**0020**] In order to achieve these and other objects of the invention, an electro-luminescence display device according to an embodiment of the present invention includes an organic compound layer provided on a substrate; a packaging plate for covering the organic compound layer; and strength reinforcing means provided at the packaging plate to reinforce strength of the packaging plate.

[**0021**] In the electro-luminescence display device, the packaging plate includes a first face provided with a getter; a second face attached onto the substrate; and a connection face connected between the first face and the second face.

[**0022**] In the electro-luminescence display device, the strength reinforcing means is formed in a long valley shape at the first face.

[**0023**] Herein, the strength reinforcing means is provided between the end of the getter and the end of the face.

[**0024**] The strength reinforcing means is formed in one axis direction of the packaging plate.

[**0025**] Herein, said one axis direction is a minor axis direction of the packaging plate.

[**0026**] Alternatively, said one axis direction is a longitudinal axis direction of the packaging plate.

[**0027**] Otherwise, the strength reinforcing means is formed-in two axes directions crossing each other.

[**0028**] In the electro-luminescence display device, the packaging plate is made from a metal.

BRIEF DESCRIPTION OF THE DRAWINGS

[**0029**] These and other objects of the invention will be apparent from the following detailed description of the embodiments of the present invention with reference to the accompanying drawings, in which:

[**0030**] **FIG. 1** is a perspective view showing a structure of a conventional electro-luminescence display device;

[**0031**] **FIG. 2** is a section view of the conventional packaged electro-luminescence display device

[**0032**] **FIG. 3** is a perspective view showing a structure of an electro-luminescence display device according to an embodiment of the present invention;

[**0033**] **FIG. 4** is a section view of the electro-luminescence taken along the II-II' in **FIG. 3**; and

[**0034**] **FIG. 5** to **FIG. 8** illustrate an electro-luminescence display device according to another embodiment of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

[**0035**] Reference will now be made in detail to the preferred embodiments of the present invention, examples of which are illustrated in the accompanying drawings.

[**0036**] Hereinafter, the preferred embodiments of the present invention will be described in detail with reference to FIGS. **3** to **8**.

[**0037**] **FIG. 3** is a perspective view showing a structure of an electro-luminescence (EL) display device according to an embodiment of the present invention, and **FIG. 4** is a section view of the electro-luminescence taken along the II-II' in **FIG. 3**.

[**0038**] Referring to **FIG. 3** and **FIG. 4**, the EL display device according to the embodiment of the present invention includes an anode electrode **104** provided on a substrate **102**, an organic compound layer **118** provided on the anode electrode **104**, a cathode electrode **116** provided on the organic compound layer **118**, and a packaging plate **134** for protecting the organic compound layer **118** from oxygen and moisture.

[**0039**] The anode electrode **104** is formed from any one of indium-tin-oxide (ITO), indium-zinc-oxide (IZO) and indium-tin-zinc-oxide (ITZO), etc. on the substrate **102** by a photolithography. Such an anode electrode **104** is used as a data electrode.

[**0040**] The organic compound layer **118** has a hole injection layer **106** and a hole carrier layer **108** sequentially formed on the anode electrode **104**. A light-emitting layer **110** having a light emission function is provided on the hole carrier layer **108**. Further, an electron carrier layer **112** and an electron injection layer **114** are sequentially formed on the light-emitting layer **110**.

[**0041**] A cathode electrode **116** formed from aluminum (Al) having a high reflectivity is provided on the organic compound layer **118**. Such a cathode electrode **116** is used as a scan electrode.

[**0042**] In the organic EL device, driving voltage and current are applied to the anode electrode **104** and the cathode electrode **116**, then holes within the hole injection layer **106** and electrons within the electron injection layer **114** are progressed into the light-emitting layer **110** to thereby excite a phosphorous material within the light-emitting layer **110**. A picture or an image is displayed by a principle in which a visible light generated from the light-emitting layer **110** in this manner is emitted out through the transparent anode electrode **104**.

[**0043**] The packaging plate **130** is formed from glass, plastic or canister, etc so that the light-emitting layer **110** can be easily deteriorated by moisture and oxygen in the atmosphere. The packaging plate **130** includes a first face **132** provided with a getter **27** for absorbing moisture and oxygen and a strength reinforcing member **140** for reinforcing its

strength, a second face **134** having a sealant **122** coated onto the edge thereof, and a connection face **136** for connecting the first face **132** with the second face **134** such that the first and second faces **132** and **134** have a desired height of step coverage. In this case, the packaging plate **130** is formed by a mold having the same shape. To this end, the packaging plate **130** is formed from a metal material.

[**0044**] The first face **132** is provided with the getter **27** made from barium oxide (BaO) or calcium oxide (CaO) so as to absorb moisture and oxygen. Herein, in order to prevent the getter **127** as a moisture absorbent from being dropped on the organic compound layer **118**, a semi-transmitting film (not shown) is attached onto the first face **132** such that moisture and oxygen, etc. come in and out. The semi-transmitting film is formed from Teflon, polyester or paper, etc. The first face **132** is provided with first and second strength reinforcing members **140***a* and **140***b* taking a desired depth of long valley shape in one axis direction (e.g., the minor axis direction). In this case, the first and second reinforcing members **140***a* and **140***b* are provided between the end of the getter **127** formed at the first face **132** and the end of the first face **132** to be uninfluenced by the first and second strength reinforcing members **140***a* and **140***b* when the getter **127** is formed at the first face **132**. Strength of the packaging plate **130** can be reinforced by the first and second strength reinforcing members **140***a* and **140***a* provided at the first face **132**.

[**0045**] The second face **134** is joined with the sealant **122** coated onto the edge of the substrate **102**, thereby attaching the package plate **130** onto the substrate **102**. The second surface **134** of the packaging plate **130** is joined with the substrate **102** by the sealant **122** to make a vacuum state, thereby preventing a life of the EL device from being critically influenced by damage of the cathode electrode **16** and the organic compound layer **118** caused by moisture and oxygen in the atmosphere. Herein, the sealant **122** is made from an ultraviolet-curing epoxy, etc. This ultraviolet-curing epoxy allows the substrate **102** or the packaging plate **130** to be pressurized and joined by a technique such as a dispensing and a printing, etc. and then is cured by an irradiation of an ultraviolet ray. Subsequently, after a sealing was made by the sealant **122**, the organic EL device is filled with an inactive gas with no moisture or oxygen. To this end, a glove box or a vacuum chamber is used.

[**0046**] The connection face **136** allows the first face **132** provided with the getter **127** and the second face **134** attached onto the substrate **102** to have a desired height of step coverage, thereby causing an internal space of the package plate **130** to be made into a vacuum state. In this case, the connection face **136** may vertically connect the first face **132** with the second face **134**, or may connect the first face **132** with the second face **134** in such a manner to have a desired slope.

[**0047**] Alternatively, as shown in **FIG. 5**, the first face **132** of the packaging plate according to the embodiment of the present invention is provided with third and fourth strength reinforcing members **140***c* and **140***d* taking a long valley shape in one axis direction (e.g., a longitudinal axis direction). Otherwise, as shown in **FIG. 6**, the first face **132** of the packaging plate **130** is provided with first to fourth strength reinforcing members **140***a* to **140***d* taking a long valley shape) in two axes directions crossing each other (i.e., the minor axis direction and the longitudinal axis direction crossing each other). Strength of the packaging plate **130** can be reinforced by the first to fourth strength reinforcing members **140***a* to **140***d* provided at the first face **132**. Otherwise, as shown in **FIG. 7** and **FIG. 8**, the first face **132** of the packaging plate **130** according to the embodiment of the present invention is provided with at least two strength reinforcing members **140** taking a long valley shape, thereby reinforcing strength of the packaging plate **130**.

[**0048**] As described above, the EL display device according to the present invention attaches the packaging plate onto the substrate so as to prevent the light-emitting layer from being easily deteriorated due to moisture and oxygen in the atmosphere. Furthermore, the packaging plate is provided with at least one of strength reinforcing member taking a long valley shape, thereby enhancing strength of the packaging plate.

[**0049**] Although the present invention has been explained by the embodiments shown in the drawings described above, it should be understood to the ordinary skilled person in the art that the invention is not limited to the embodiments, but rather that various changes or modifications thereof are possible without departing from the spirit of the invention. Accordingly, the scope of the invention shall be determined only by the appended claims and their equivalents.

What is claimed is:

1. An electro-luminescence display device, comprising:

an organic compound layer provided on a substrate;

a packaging plate for covering the organic compound layer; and

strength reinforcing means provided at the packaging plate to reinforce strength of the packaging plate.

2. The electro-luminescence display device according to claim 1, wherein the packaging plate includes:

a first face provided with a getter;

a second face attached onto the substrate; and

a connection face connected between the first face and the second face.

3. The electro-luminescence display device according to claim 2, wherein the strength reinforcing means is formed in a long valley shape at the first face.

4. The electro-luminescence display device according to claim 3, wherein the strength reinforcing means is provided between the end of the getter and the end of the face.

5. The electro-luminescence display device according to claim 4, wherein the strength reinforcing means is formed in one axis direction of the packaging plate.

6. The electro-luminescence display device according to claim 5, wherein said one axis direction is a minor axis direction of the packaging plate.

7. The electro-luminescence display device according to claim 5, wherein said one axis direction is a longitudinal axis direction of the packaging plate.

8. The electro-luminescence display device according to claim 4, wherein the strength reinforcing means is formed in two axes directions crossing each other.

9. The electro-luminescence display device according to claim 1, wherein the packaging plate is made from a metal.

* * * * *

专利名称(译)	电致发光显示装置		
公开(公告)号	US20050168143A1	公开(公告)日	2005-08-04
申请号	US11/045381	申请日	2005-01-31
申请(专利权)人(译)	LG电子株式会社.		
当前申请(专利权)人(译)	LG DISPLAY CO. , LTD.		
[标]发明人	KUM DO YOUNG MO SUNG HO LEE JEUNG HWAN		
发明人	KUM, DO YOUNG MO, SUNG HO LEE, JEUNG HWAN		
IPC分类号	H05B33/04 H01J1/62 H01L51/52 H05B33/00		
CPC分类号	H01L51/5237 H01L51/5259 H01L51/524 H01L51/5243		
优先权	1020040007246 2004-02-04 KR		
其他公开文献	US7479735		
外部链接	Espacenet USPTO		

摘要(译)

公开了一种用于增强其强度的电致发光显示装置。在该器件中，在衬底上提供有机化合物层。包装板覆盖有机化合物层。在包装板上设置强度加强构件以增强包装板的强度。