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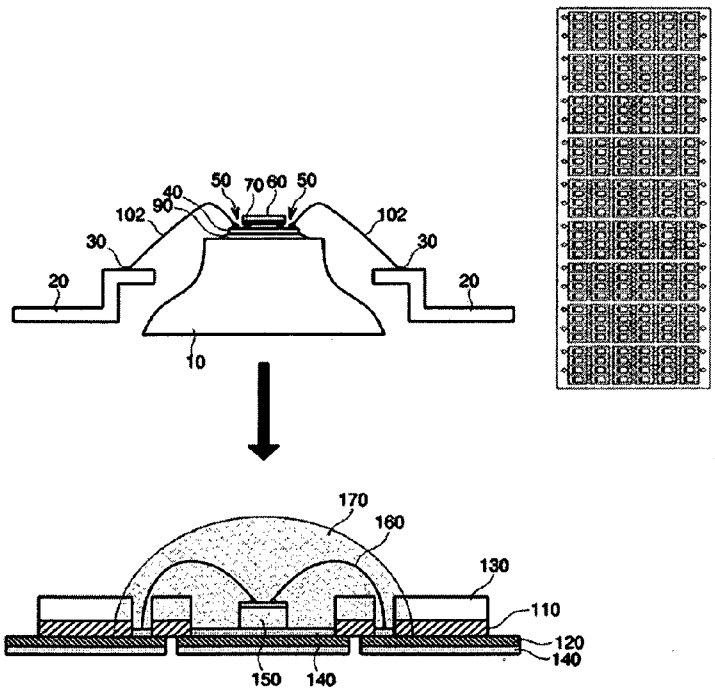
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(54) Title: OPTICAL PACKAGE AND METHOD OF MANUFACTURING THE SAME

[Fig. 3]



(57) Abstract: The present invention relates to an optical package and a method of manufacturing the same, which are capable of reducing the entire volume and thickness of the package by forming a package according to the existing lead frame method through a package using a tape substrate and of producing packages with a high degree of integration by forming a package of a surface emitting method in a dot-emitting method. Further, in accordance with the present invention, luminance and photoefficiency can be increased through a light reflective layer and a white reflective layer or a metal reflective layer and a plating layer.

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Description

Title of Invention: OPTICAL PACKAGE AND METHOD OF MANUFACTURING THE SAME

Technical Field

[1] The present invention relates to an optical package and a method of manufacturing the same, and more particularly, to an optical package and a method of manufacturing the same, which are capable of reducing the volume and thickness of the package, increasing the degree of integration, and improving luminance and photoefficiency.

Background Art

[2] A Light Emitting Diode (LED) refers to an intermetallic compound junction diode which produces minority carriers (i.e., electrons or holes) injected using a p-n junction structure of semiconductors and emits light by changing electric energy into light energy through a recombination of the carriers. That is, when forward voltage is applied to a semiconductor of a specific element, electrons and holes are moved through the junction of a positive pole and a negative pole and then recombined. Energy when the electrons and holes are recombined is smaller than energy when the electrons and the holes are separated from each other. Accordingly, the LED emits light because of a difference in the energy. The LED is being used for not only common display devices, but also lighting devices or the backlight elements of LCDs, and the applications of the LED are gradually widened. In particular, the LED has advantages of being driven with a relatively low voltage, having low generation of heat because of high energy efficiency, and having a long lifespan. It is expected that as technology capable of providing white light of high brightness which was difficult to be implemented conventionally is developed, the LED can replace current most light source devices.

[3] FIG. 1 is a cross-sectional view of an LED package according to an embodiment of the prior art. Referring to FIG. 1, the LED package is configured to electrify leading wires through gold wires 102, bonded to a GaN compound chip emitting light, and to discharge heat through an underlying heat sink 10. Further, electricity is supplied to the LED package through metal leads 20 wire-bonded to an external support and an LED package portion, and thus the LED package is configured to emit light. The above structure forms one package for each chip 60.

[4] The above conventional LED package forms a package type of a lead frame type. However, the lead frame type is difficult to integrate the LED chips because it has a low available package region. Further, the lead frame type inevitably increases the thickness or an external area of a product when the lead frame type is mounted on the

product because a package size for a chip size is relatively large.

[5] Further, the conventional LED package further requires underlying heat sinks for discharging heat generated from the LED chips, and thus the thickness and volume of the LED package are increased that much.

[6] FIG. 2 is a cross-sectional view of an LED package according to another embodiment of the prior art.

[7] Referring to FIG. 2, in an encapsulation process of protecting the bonding of wires 102, after a fluorescent substance and a resin complex are coated, a plastic lens 25 is used in order to the linearity and photoefficiency of light. This serves as a limit to a reduction in the above-described LED package and generates the cost problem in terms of the process.

[8] Accordingly, there is a need for technology which can manufacture an LED package with a low cost, a more reduced size, and a simplified process.

Disclosure of Invention

Technical Problem

[9] Accordingly, the present invention has been made in view of the above problems, and it is an object of the present invention to provide an optical package and a method of manufacturing the same, which are capable of reducing the volume of the optical package with a low cost, reducing the thickness and an external volume of a final product, and enabling integration and a reduction in the size. Further, another object of the present invention is to provide an optical package and a method of manufacturing the same, which can reduce the absorption of light by an insulating layer and can increase luminance and photoefficiency by plating a metal layer, functioning as a heat sink and a support, or plating a light reflective layer and forming a white reflective layer on a top surface or surfaces of the insulating layer or forming a metal reflective layer and a plating layer on the surfaces of the insulating layer.

Solution to Problem

[10] To achieve the above objects, an optical package according to an embodiment of the present invention comprises a metal layer configured to have a circuit pattern formed therein, an insulating layer formed on the metal layer and configured to include holes, an optical element mounted on one of the holes, connection units configured to electrically connect the optical element and the circuit pattern, and a resin unit configured to bury the optical element and the connection units. Accordingly, optical packages can be reduced in size and integrated using the insulating film of a tape type without using a lead frame.

[11] In particular, the optical package further comprises a reflective layer formed on part of a surface or the entire surface of the insulating layer. Accordingly, luminance and

photoefficiency can be increased through the reflective layer.

[12] Further, it is preferred that the reflective layer be a white reflective layer or a metal reflective layer.

[13] Further, the optical package can further comprise a light reflective layer or a plating layer formed on the metal layer exposed through the holes.

[14] Further, it is preferred that the reflective layer have inclined planes on the sides of the insulating layer so that light is upwardly reflected.

[15] Further, it is preferred that the white reflective layer bury the sides of the insulating layer in a thickness of 10 ㎛ to 100 ㎛.

[16] Further, the white reflective layer can be formed by printing any one of a silver paste, a white solder resist, and white epoxy.

[17] Further, it is preferred that the metal reflective layer include at least one of silver (Ag), nickel (Ni), copper (Cu), platinum (Pt), palladium (Pd), and gold (Au).

[18] Further, it is preferred that the light reflective layer or the plating layer be further formed on the other side of the metal layer having the insulating layer stacked thereon.

[19] Further, the light reflective layer can contain silver (Ag), or the plating layer includes at least one of silver (Ag), nickel (Ni), copper (Cu), platinum (Pt), palladium (Pd), and gold (Au).

[20] Further, it is preferred that the metal layer be a copper (Cu) layer or the insulating layer is a polyimide film.

[21] Further, it is preferred that the resin unit have a convex lens shape and include a fluorescent substance and a transparent resin.

[22] Further, it is preferred that the transparent resin be made of silicon (Si).

[23] A method of manufacturing an optical package according to an embodiment of the present invention comprises the steps of (a) forming holes in an insulating layer, (b) laminating a metal layer below the insulating layer and forming a circuit pattern in the metal layer, (c) mounting an optical element on one of the holes and electrically connecting the optical element and the circuit pattern through connection units, and (d) forming a resin unit for burying the optical element and the connection units.

[24] In particular, the optical package can further comprise the step (b') of forming a reflective layer on part of a surface or an entire surface of the insulating layer, after the step (b).

[25] Further, it is preferred that the step (b') include forming a white reflective layer or a metal reflective layer.

[26] Further, the method can further comprise the step (b-1) of forming a light reflective layer on the metal layer exposed through the holes, after the step (b).

[27] Further, the method can further comprise the step (b-2) of forming a plating layer on the metal layer exposed through the holes, after the step (b).

[28] Further, it is preferred that the step (b-1) further include forming the light reflective layer on the other side having the insulating layer stacked thereon.

[29] Further, it is preferred that the step (b-2) further include forming a plating layer on the other side having the insulating layer stacked thereon.

Advantageous Effects of Invention

[30] In accordance with the present invention, the entire volume and thickness of a package can be reduced by forming a package according to the existing lead frame method through a package using a tape substrate. Further, packages with a high degree of integration can be produced by forming a package of a surface emitting method in a dot-emitting method. Furthermore, the cost can be reduced, the process can be simplified, and the productivity can be improved by performing an encapsulation process and a process of forming a lens shape at the same time. Luminance and photo-efficiency can be improved through a plated light reflective layer and a plated white reflective layer or a metal reflective layer and a plating layer formed on the surface of an insulating layer.

Brief Description of Drawings

[31] FIG. 1 is a cross-sectional view of an LED package according to an embodiment of the prior art;

[32] FIG. 2 is a cross-sectional view of an LED package according to another embodiment of the prior art;

[33] FIG. 3 is a cross-sectional view showing a comparison of an LED package according to an embodiment of the prior art and an optical package according to an embodiment of the present invention;

[34] FIGS. 4 to 6 are cross-sectional views showing an optical package according to another embodiment of the present invention;

[35] FIG. 7 is a top view of the polyimide face and the circuit pattern unit of the optical package according to an embodiment of the present invention;

[36] FIG. 8 is a cross-sectional view illustrating a process of manufacturing the optical package according to an embodiment of the present invention;

[37] FIGS. 9 and 10 are cross-sectional views illustrating a process of manufacturing the optical package according to another embodiment of the present invention; and

[38] FIG. 11 is a cross-sectional view and a top view, in detail, showing the degree of integration of optical packages according to the prior art and the present invention.

Mode for the Invention

[39] Hereinafter, some preferred embodiments of the present invention are described in detail with reference to the accompanying drawings. However, the present invention can be modified in various forms and should not be construed to be limited to the

following embodiments. The embodiments of the present invention are provided to those skilled in the art in order to more fully describe the embodiments. Accordingly, in the drawings, the shape, etc. of an element has been enlarged for clarity, and the same reference numbers are used throughout the drawings to refer to the same parts.

[40] FIG. 3 is a cross-sectional view showing a comparison of an LED package according to an embodiment of the prior art and an optical package according to an embodiment of the present invention, and FIGS. 4 to 6 are cross-sectional views showing an optical package according to another embodiment of the present invention.

[41] As shown in FIG. 3, in the package structure of the present invention, an insulating layer 110 including holes is formed on a metal layer 120 having a circuit pattern formed therein. The structure further includes an optical element 150 mounted on the holes, connection units 160 configured to electrically connect the optical element 150 and the circuit pattern, and a resin unit 170 configured to bury the optical element 150 and the connection units 160. A white reflective layer 130 (i.e., a reflective layer) is formed on a top surface of the insulating layer 110. It is preferred that a light reflective layer 140 be plated on the metal layer 120 exposed through the holes. Here, it is preferred that the insulating layer 110 be a polyimide film and the metal layer 120 be made of copper (Cu). In the present invention, the white reflective layer 130 is formed on the top surface of the insulating layer 110. It is preferred that the white reflective layer 130 be formed by printing any one of silver paste, a white solder resist, and white epoxy white epoxy.

[42] Common polyimide has a brown color or a yellow-series color. The polyimide is problematic in that it has low brightness because it absorbs light rather it reflects light. Accordingly, the white reflective layer 130 not a green-series solder resist is formed on the top surface of the insulating layer 110 in order to increase brightness. In order to further increase brightness, the white reflective layer 130 can be formed not only on the surface (i.e., the top surface) of the insulating layer 110, but also on the sides of the insulating layer 110, as shown in FIG. 4 or 5. It is preferred that the sides of the insulating layer 110 be buried in a thickness of 10 ㎛ to 100 ㎛. The white reflective layer 130 has inclined planes on the sides of the insulating layer 110 so that light generated from the optical element 150 can be better upwardly reflected as shown in FIG. 5, but it is preferred that a distance between the side of the insulating layer 110 and a bottom surface of the inclined plane of the white reflective layer 130 (i.e., X in FIG. 5) be 10 ㎛ to 100 ㎛. As described above, light generated from the optical element 150 through the inclined planes of the white reflective layer 130 is upwardly reflected by the inclined planes of the white reflective layer 130, thereby being capable of increasing photoefficiency. The white reflective layer 130 serves as a reflective layer and thus increases photoefficiency. Further, the white reflective layer 130 serves

as a barrier rib and functions to partition the boundary, when the resin unit 170 is subsequently formed.

[43] Further, the light reflective layer 140 may be plated on the metal layer 120 which is exposed through the holes, from the metal layer 120 in which the white reflective layer 130 is not formed. As shown, it is preferred that the light reflective layer 140 be plated on the other side of the metal layer 120 on which the insulating layer 110 is stacked. It is preferred that the plating of the light reflective layer 140 be silver (Ag) or plating including silver (Ag).

[44] As described above, not gold (Au) plating for wire bonding, but the light reflective layer 140 including silver (Ag), is formed. Accordingly, brightness is improved, thermal conductivity is increased, and a heat dissipation effect according to heat generated from the optical element is increased. Consequently, reflexibility can be increased, the absorption of light can be prevented, and photoefficiency can be maximized. Furthermore, in the present invention, it is preferred that an LED chip (i.e., the optical element 150) be mounted on the light reflective layer 140, gold (Au) wires 160 (i.e., the connection units) for an electrical connection between the chip 150 and the circuit pattern be bonded, and an LED package type of a tape type in which the LED chip 150 and the wires 160 are buried using the resin unit 170 be performed. It is preferred that the resin unit 170 have a convex lens shape and include a fluorescent substance and a transparent resin and the transparent resin be silicon (Si). As described above, the present invention can implement the integrated optical package having a reduced size through the insulating film 110 of a film type and the underlying circuit pattern layer 120 without using an underlying heat sink and a metal lead portion. Further, the circuit pattern layer 120 is formed below the insulating layer 110, and the circuit pattern layer 120 serves as not only a circuit board, but also a heat sink. Further, the wire bonding has an effect in that bonding strength is excellent because of a different in the RZ according to a surface roughness.

[45] FIG. 6 is a diagram showing a cross-sectional view of an optical package according to another embodiment of the present invention. Referring to FIG. 6, in the package structure of the present invention, a metal layer 120 having a circuit pattern formed therein exists below an insulating layer 110 having holes formed therein. Further, a metal reflective layer 135 is formed on the surfaces of the insulating layer 110, and a plating layer 145 is formed on the metal reflective layer 135 and on the metal layer 120 exposed through the holes. It is preferred that the insulating layer 110 be a polyimide film. It is also preferred that the metal layer 120 be a copper (Cu) layer. Further, in the present embodiment, as described above, the metal reflective layer 135 is formed on the surfaces (i.e., a top surface and sides) of the insulating layer 110. It is preferred that the metal reflective layer 135 be printed by coating a conductive paste, such as silver

(Ag), nickel (Ni), copper (Cu), palladium (Pd), platinum (Pt), gold (Au), or carbon. It is most preferred that the metal reflective layer 135 be printed by coating silver paste from among the conductive pastes. Common polyimide has a brown color or a yellow-series color. The polyimide is problematic in that it has low brightness because it absorbs light rather it reflects light. For this reason, the metal reflective layer 135 and the plating layer 145 are formed not only on the top surface of the polyimide layer 110, but also on the sides therereof. Thus, the absorption of light by the polyimide layer 110 can be reduced, and photoefficiency can be increased. It is preferred that the metal reflective layer 135 be formed such that the insulating layer 110 is buried in a right angle form of a barrier rib shape, but such that the barrier rib has an angle (that is, an inclined plane) on the sides of the insulating layer 110, as shown in FIG. 6. Accordingly, light generated from an optical element 150 via the inclined planes of the metal reflective layer 135 is upwardly reflected by the inclined planes of the metal reflective layer 135, thereby being capable of increasing photoefficiency. Further, the plating layer 145, as described above, may be formed on the metal reflective layer 135 and the metal layer 120 exposed through the holes. It is preferred that, as shown in FIG. 6, the plating layer 145 be plated on the other side of the metal layer 120 having the insulating layer 110 stacked thereon. It is preferred that the plating layer 145 be made of any one of silver (Ag), nickel (Ni), copper (Cu), palladium (Pd), platinum (Pt), and gold (Au). As described above, not gold (Au) plating for wire bonding, but the silver (Ag), nickel (Ni), copper (Cu), palladium (Pd), platinum (Pt), or gold (Au) plating layer 140 is formed. Accordingly, brightness is improved, thermal conductivity is increased, and a heat dissipation effect according to heat generated from the LED chip is increased. Consequently, reflexibility can be increased, the absorption of light can be prevented, and photoefficiency can be maximized.

[46] The optical element 150, connection units 160, and a resin unit 170 in FIG. 6 are the same as those of FIGS. 3 to 5, and descriptions thereof are omitted.

[47] FIG. 7 is a top view of the polyimide face and the circuit pattern of an optical package according to an embodiment of the present invention. As shown in FIG. 7, the optical package of the present invention is excellent in the degree of integration as compared with a top view of the conventional LED package (refer to the figure on the right side of FIG. 3).

[48] FIGS. 8 and 9 are cross-sectional views illustrating a process of manufacturing the optical package according to another embodiment of the present invention. Referring to FIGS. 8 and 9, first, holes 115 and 116 are formed in the insulating film 110 through punching (S2, P2). It is preferred that the insulating film 110 be a polyimide film. The holes 115 and 116 include a device hole 115 (i.e., a center hole where the optical element will be placed) and via holes 116 to which wires (i.e., the connection units

160) will be bonded in order to supply a power source to the optical element 150.

[49] Next, the metal layer 120 is laminated (S3, P3). It is preferred that the metal layer 120 be made of copper (Cu). Next, after a surface is activated through several chemical processing, a photoresist is coated on the surface, and exposure and development processes are performed. After the development process is completed, necessary circuits are formed through an etching process, and the photoresist is peeled off, thereby forming the circuit pattern layer 120. Next, the white reflective layer 130 is formed on the insulating layer 110 other than a surface for bonding and the via holes for the supply of an external power source (S4).

[50] In general, polyimide is electrically stable, but is problematic in that it has poor re-flexibility because of its brown or yellow-series color and thus has low photoef-ficiency. Photoefficiency can be increased by putting color through the white reflective layer 130. It is preferred that the white reflective layer 130 be printed by coating any one of a silver paste, a white solder resist, and white epoxy not a common green-series solder resist.

[51] It is preferred that the white reflective layer 130 be formed not only on the top surface of the insulating layer 110, but also on the sides of the insulating layer 110, as shown in FIG. 9, in order to improve brightness and photoefficiency (P4). It is more effective to increase luminance and photoefficiency when the white reflective layer 130 buries the sides of the insulating layer 110 in a thickness of 10 ㎛ to 100 ㎛. In particular, although the insulating layer 110 may be buried in a right angle form of a barrier rib form as shown in FIG. 4, it is preferred that the inclined planes be formed on the sides of the insulating layer 110 so that light generated from the optical element 150 is upwardly reflected as shown in FIG. 9. It is preferred that a distance between the side of the insulating layer 110 and a bottom surface of the inclined plane of the white reflective layer 130 (i.e., X in FIG. 9) be 10 ㎛ to 100 ㎛.

[52] Next, the light reflective layer 140 is formed by plating the metal layer 120 exposed through the underlying via holes 115 and 116 (i.e., the holes) through surface processing so that the metal layer 120 can be bonded (S5, P5). Here, it is preferred that the light reflective layer 140 also be plated on a circuit face (i.e., the other side of the metal layer 120 on which the insulating layer 110 is stacked) as shown in the drawings. Further, it is preferred that the plating of the light reflective layer 140 be silver (Ag) or plating including silver (Ag). Since not gold (Au) plating, but silver (Ag) plating is performed as described above, the absorption of light by the polyimide film 110 can be reduced, and photoefficiency can be increased.

[53] Next, the optical element 150 is mounted on the plated light reflective layer 140 where the optical element 150 will be placed, in the via hole formed in the insulating layer 110, through die bonding (S6, P6). It is preferred that the optical element 150

(i.e., an LED chip) be mounted using adhesives. Next, the gold (Au) wires 160 are bonded to the light reflective layer 140 plated with silver (Ag), thereby electrically connecting the circuit pattern layer 120 and the LED chip 150 (S7, P7). Next, the resin unit 170 is formed to bury the LED chip 150 and the Au wires 160 (S8, P8). More particularly, the resin unit 170 of a convex lens shape is formed by excessively coating a fluorescent substance and a transparent resin for a white LED at the boundary portion of the white solder resist, thereby completing the optical package. In case where the fluorescent substance and the transparent resin are excessively coated, the resin unit 170 of a convex lens shape, such as that shown in drawings, is formed because of surface tension. Accordingly, the existing encapsulation process and the existing process of forming the plastic lens shape can be performed at the same time.

[54] FIG. 10 is a cross-sectional view illustrating a process of manufacturing the optical package according to another embodiment of the present invention. Steps Q1 to Q3 and Q6 to Q8 in FIG. 10 are similar to the steps S1 (P1) to S3 (P3), and S6 (P6) to S8 (P8), and thus differences Q4 and Q5 are chiefly described. First, the holes 115 and 116 are formed in the insulating film 110 through punching (Q2). The metal layer 120 is laminated to form the circuit pattern layer 120 (Q3).

[55] Next, the metal reflective layer 135 (i.e., a reflective layer) is formed on part of the entire insulating layer 110 (Q4). It is preferred that the metal reflective layer 135 be printed by coating a conductive paste, such as silver (Ag), nickel (Ni), copper (Cu), palladium (Pd), platinum (Pt), gold (Au), or carbon. It is most preferred that the metal reflective layer 135 be printed by coating the silver (Ag) paste. Although the insulating layer 110 may be buried in a right angle form of a barrier rib form, it is preferred that the inclined planes be formed on the sides of the insulating layer 110 so that light generated from the optical element 150 is upwardly reflected as shown in FIG. 10. Next, the plating layer 145 is formed on the metal reflective layer 135 and on the metal layer 120, exposed through the holes 115 and 116, through surface processing so that it can be bonded (Q5). Here, it is preferred that the plating layer 145 also be formed on a circuit face (i.e., the other side of the metal layer 120 having the insulating layer 110 staked thereon) as shown in FIG. 10. Further, it is preferred that the plating layer 145 be made of silver (Ag), nickel (Ni), copper (Cu), palladium (Pd), platinum (Pt), or gold (Au). In general, polyimide is electrically stable, but is problematic in that it has poor reflexibility because of its brown or yellow-series color and thus has low photoefficiency. Accordingly, if a silver (Ag) paste is coated as in the present invention, the polyimide regions 110 disappear, brilliance is increased through the plating layer 145 as described above, and photoefficiency can be further increased. The steps following the step Q6 are similar to those of FIGS. 8 and 9 as described above, and descriptions thereof are omitted.

[56] FIG. 11 is a cross-sectional view and a top view, in detail, showing the degree of integration of optical packages according to the prior art and the present invention. From FIG. 11, it can be seen that in case where LED packages are formed in the same area, a larger number of LED packages can be formed in the case of the present invention (refer to the drawing on the right side of FIG. 11), as compared with the arrangement of LED chips each having the metal lead portion 20 and the lower heat sink 10 (refer to FIG. 3 and the drawing on the left side of FIG. 11).

[57] The most suitable embodiments have been disclosed in the drawings and specification. Although the specific terms have been used, they are used for the purpose of merely describing the present invention, but are not used to limit their meanings or the scope of the present invention written in the claims. Thus, those skilled in the art will understand that a variety of modifications and other equivalent embodiments can be possible from the above embodiments. Accordingly, the true technical scope of the present invention should be defined by the appended claims.

Claims

[Claim 1] An optical package, comprising:
a metal layer configured to have a circuit pattern formed therein;
an insulating layer formed on the metal layer and configured to include holes;
an optical element mounted on one of the holes;
connection units configured to electrically connect the optical element and the circuit pattern; and
a resin unit configured to bury the optical element and the connection units.

[Claim 2] The optical package of claim 1, further comprising a reflective layer formed on part of a surface or an entire surface of the insulating layer.

[Claim 3] The optical package of claim 2, wherein the reflective layer is a white reflective layer or a metal reflective layer.

[Claim 4] The optical package of claim 1, further comprising a light reflective layer or a plating layer formed on the metal layer exposed through the holes.

[Claim 5] The optical package of claim 2, wherein the reflective layer has inclined planes on sides of the insulating layer so that light is upwardly reflected.

[Claim 6] The optical package of claim 3, wherein the white reflective layer buries sides of the insulating layer in a thickness of 10 ㎛ to 100 ㎛.

[Claim 7] The optical package of claim 3, wherein the white reflective layer is formed by printing any one of a silver paste, a white solder resist, and white epoxy.

[Claim 8] The optical package of claim 3, wherein the metal reflective layer includes at least one of silver (Ag), nickel (Ni), copper (Cu), platinum (Pt), palladium (Pd), and gold (Au).

[Claim 9] The optical package of claim 4, wherein the light reflective layer or the plating layer is further formed on the other side of the metal layer having the insulating layer stacked thereon.

[Claim 10] The optical package of claim 4 or 9, wherein the light reflective layer contains silver (Ag), or the plating layer includes at least one of silver (Ag), nickel (Ni), copper (Cu), platinum (Pt), palladium (Pd), and gold (Au).

[Claim 11] The optical package of claim 1, wherein the metal layer is a copper (Cu) layer or the insulating layer is a polyimide film.

[Claim 12] The optical package of claim 1, wherein the resin unit has a convex lens shape and includes a fluorescent substance and a transparent resin.

[Claim 13] The optical package of claim 12, wherein the transparent resin is made of silicon (Si).

[Claim 14] A method of manufacturing an optical package, comprising the steps of:
(a) forming holes in an insulating layer;
(b) laminating a metal layer below the insulating layer and forming a circuit pattern in the metal layer;
(c) mounting an optical element on one of the holes and electrically connecting the optical element and the circuit pattern through connection units; and
(d) forming a resin unit for burying the optical element and the connection units.

[Claim 15] The method of claim 14, further comprising the step (b') of forming a reflective layer on part of a surface or an entire surface of the insulating layer, after the step (b).

[Claim 16] The method of claim 15, wherein the step (b') includes forming a white reflective layer or a metal reflective layer.

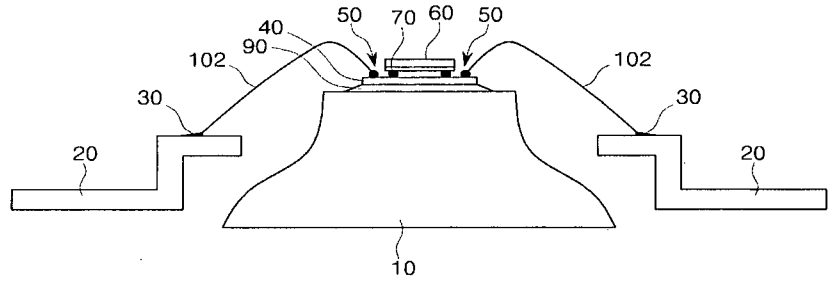
[Claim 17] The method of claim 14, further comprising the step (b-1) of forming a light reflective layer on the metal layer exposed through the holes, after the step (b).

[Claim 18] The method of claim 14, further comprising the step (b-2) of forming a plating layer on the metal layer exposed through the holes, after the step (b).

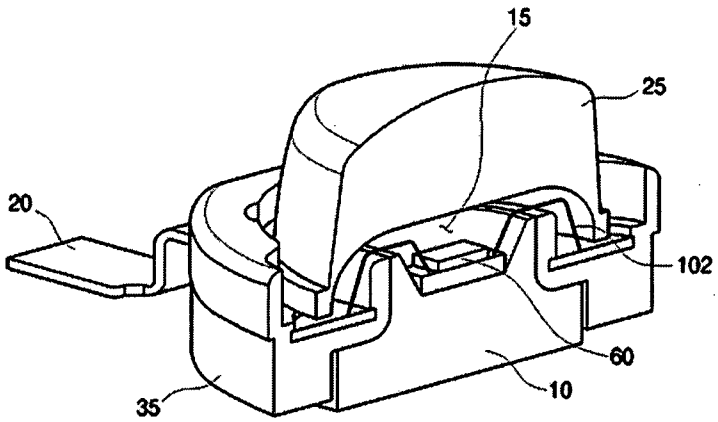
[Claim 19] The method of claim 17, wherein the step (b-1) further includes forming the light reflective layer on the other side having the insulating layer stacked thereon.

[Claim 20] The method of claim 18, wherein the step (b-2) further includes forming a plating layer on the other side having the insulating layer stacked thereon.

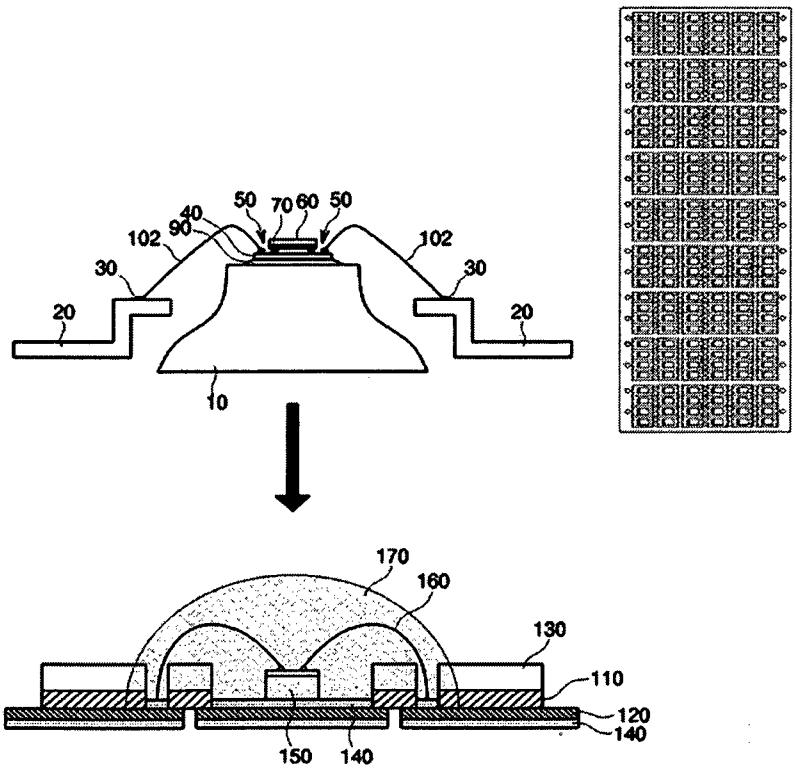
[Fig. 1]



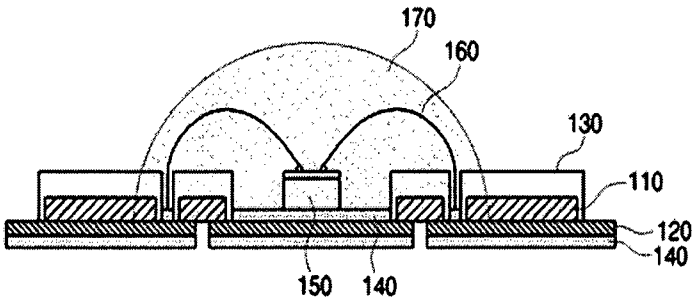
[Fig. 2]



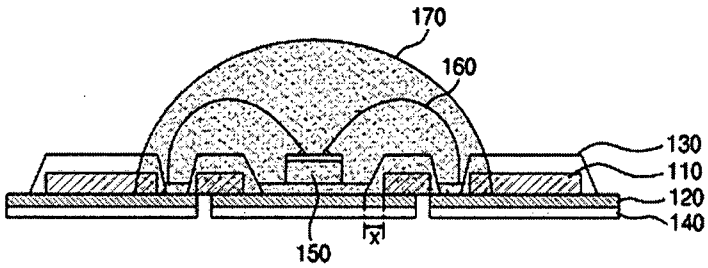
[Fig. 3]



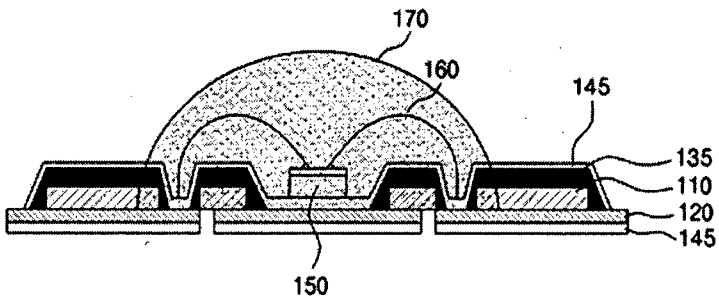
[Fig. 4]



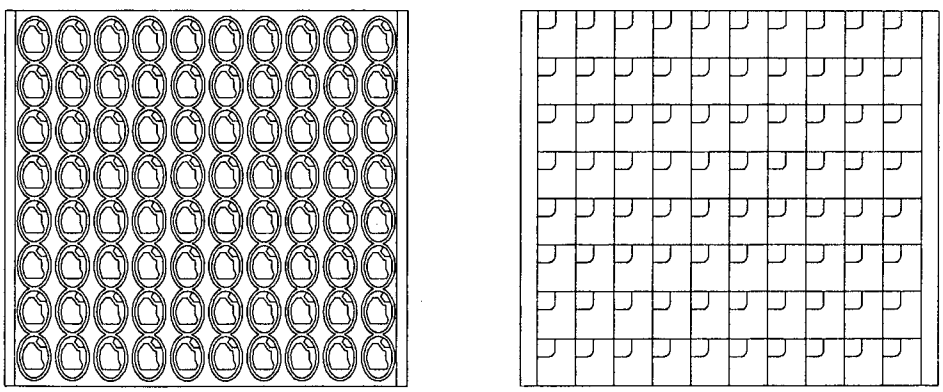
[Fig. 5]



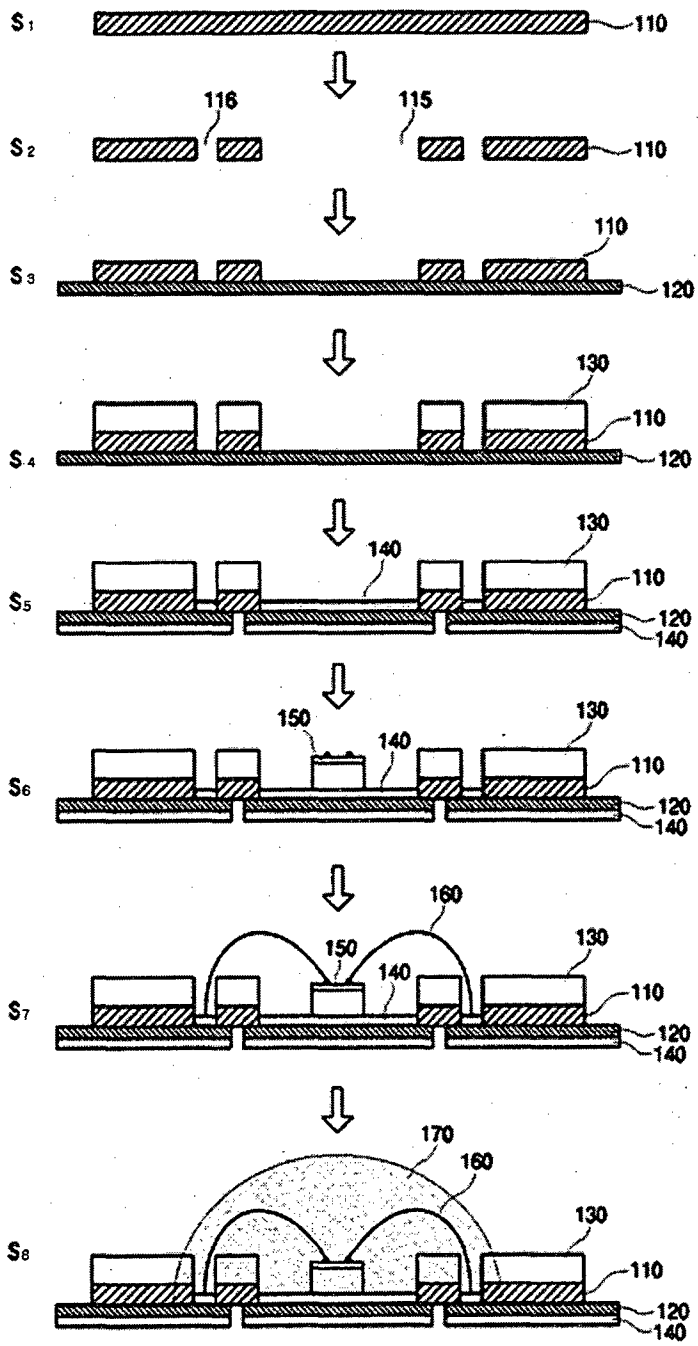
[Fig. 6]



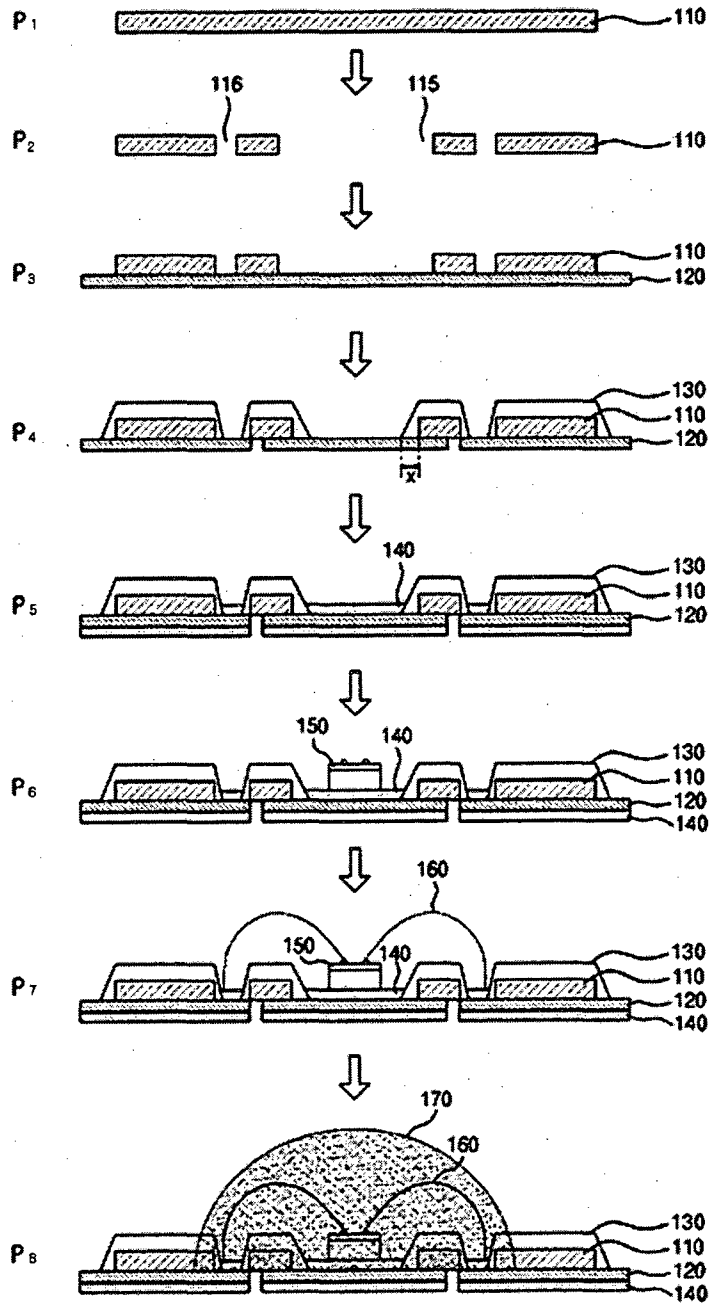
[Fig. 7]



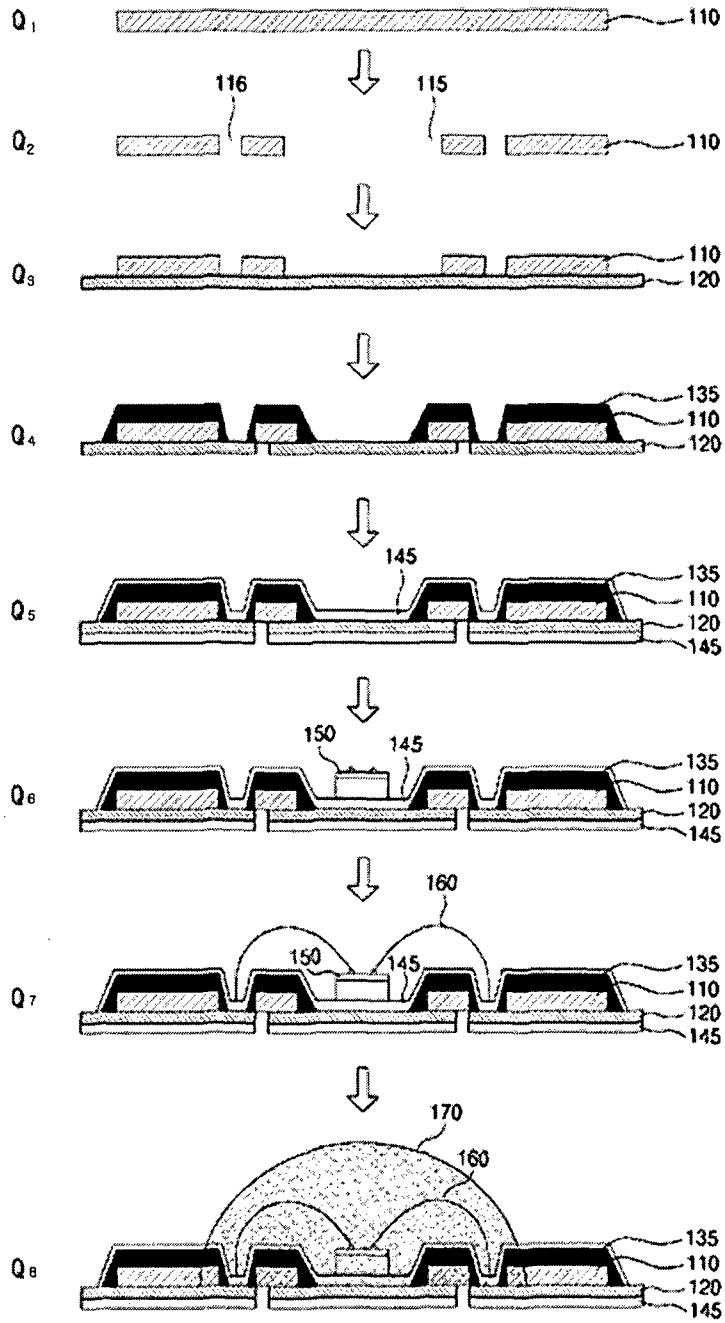
[Fig. 8]


S1
110
S2
116
115
110
S3
110
120
S4
130
110
120
S5
140
130
110
120
140
S6
150
140
130
110
120
140
S7
160
150
140
130
110
120
140
S8
170
160
130
110
120
140

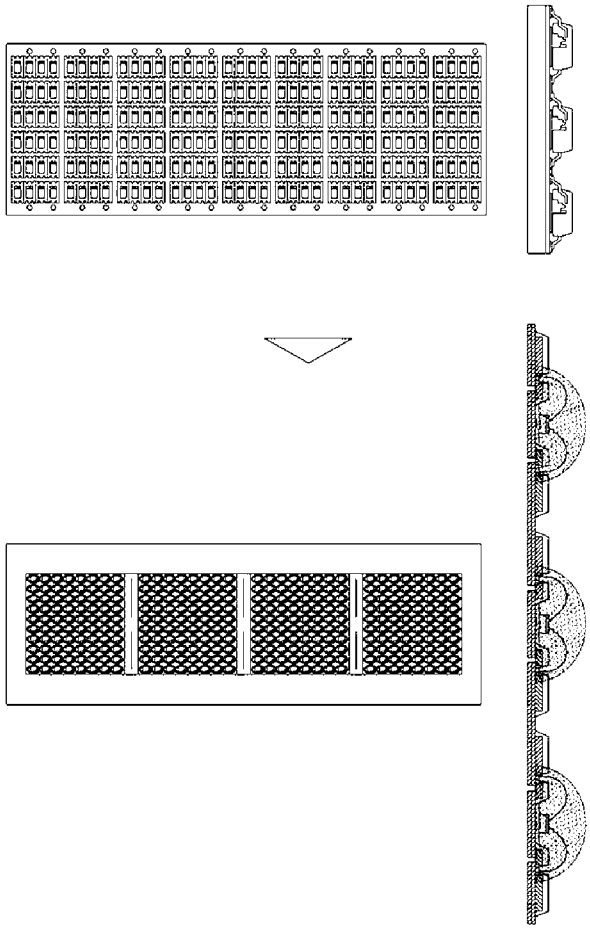
[Fig. 9]


P1
110
P2
116
115
110
P3
110
120
P4
130
110
120
x
P5
140
130
110
120
P6
150
140
130
110
120
140
P7
160
150
140
130
110
120
140
P8
170
160
130
110
120
140

[Fig. 10]


Q1
110
116
115
Q2
110
Q3
110
120
Q4
135
110
120
Q5
145
135
110
120
145
Q6
150
145
135
110
120
145
Q7
160
150
145
135
110
120
145
Q8
170
160
135
110
120
145

[Fig. 11]



INTERNATIONAL SEARCH REPORT

International application No.
PCT/KR2010/006895

A. CLASSIFICATION OF SUBJECT MATTER

H01L 33/48(2010.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

H01L 33/48; H01L 21/50; H01L 25/075; H01L 33/00; H05K 7/18; H01L 33/62

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Korean utility models and applications for utility models
Japanese utility models and applications for utility models

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

eKOMPASS(KIPO internal) & Keywords: package, metal layer, hole, circuit pattern

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X A	KR 10-0853963 B1 (ITSWELL CO., LTD.) 25 August 2008 See claims 2-9, 12-14 and figures 7-9	1-8,10-13 9,14-20
A	US 2009-0206358 A1 (PIN CHUAN CHEN et al.) 20 August 2009 See the abstract and figures 6, 8	1-20
A	US 2008-0224161 A1 (TOSHIYUKI TAKADA) 18 September 2008 See the abstract and figure 1	1-20
A	WO 2009-132618 A1 (OSRAM OPTO SEMICONDUCTORS GMBH et al.) 05 November 2009 See the abstract and figure 1	1-20
A	US 2009-0146155 A1 (CHUN-WEI WANG et al.) 11 June 2009 See the abstract and figure 1	1-20

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
27 MAY 2011 (27.05.2011)	**30 MAY 2011 (30.05.2011)**
Name and mailing address of the ISA/KR Korean Intellectual Property Office Government Complex-Daejeon, 189 Cheongsa-ro, Seo-gu, Daejeon 302-701, Republic of Korea Facsimile No. 82-42-472-7140	Authorized officer PARK, Hye Lyun Telephone No. 82-42-481-8362

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/KR2010/006895

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US 2009-0146155 A1	11.06.2009	EP 2071637 A2	17.06.2009