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(54) PACKAGE FOR A LIGHT EMITTING DIODE AND A PROCESS FOR FABRICATING THE SAME

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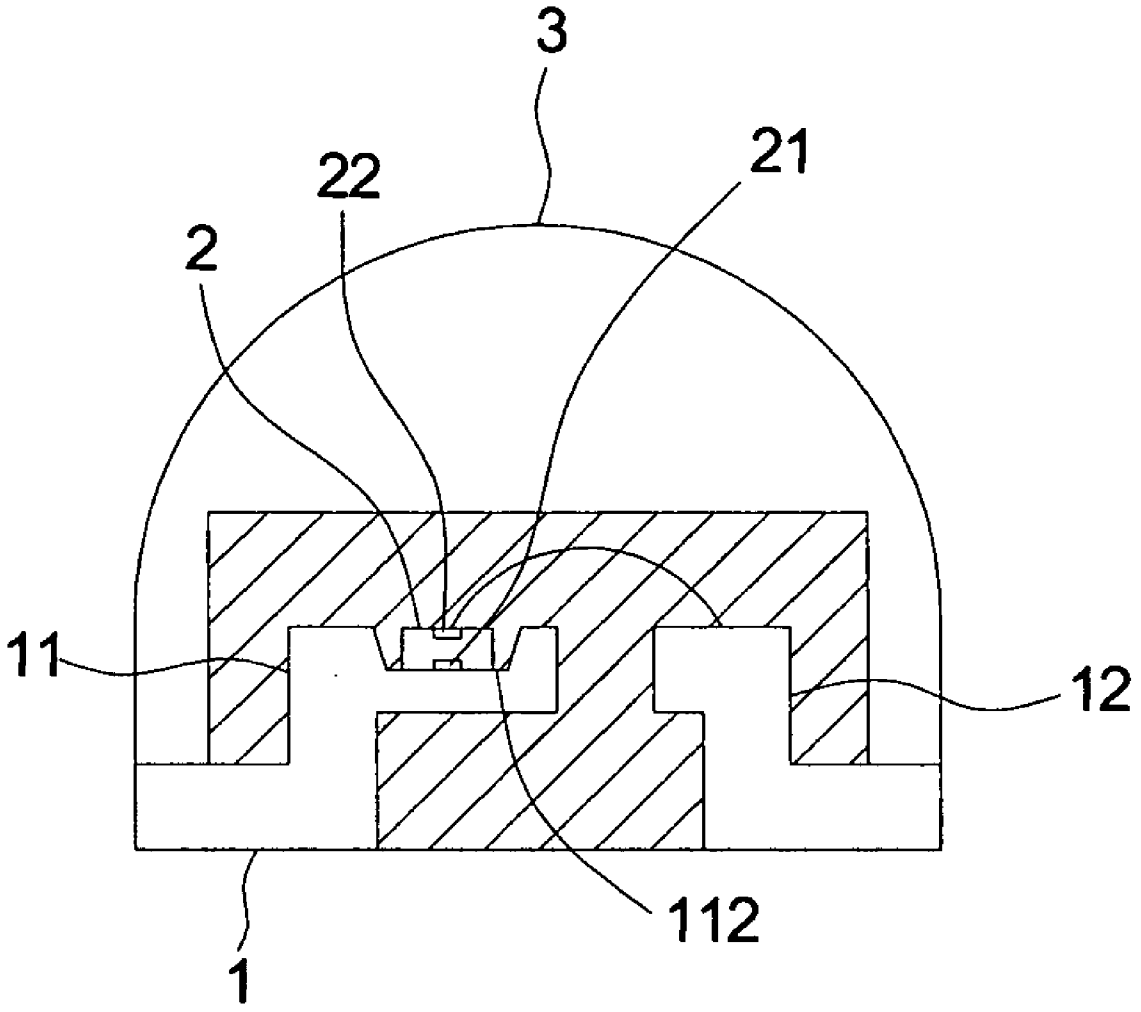
(57) **ABSTRACT**

A package for an LED, comprises a metal substrate, at least one LED chip, and an insulative housing, wherein the metal substrate has a first terminal and a second terminal, and the first terminal is formed with a recess. The at least one LED chip is arranged in the recess of the first terminal of the metal substrate, wherein the chip is electrically connected with the first terminal and the second terminal of the metal substrate. Since the insulative housing caps the chip and the metal substrate, and the LED package can be reduced in size.



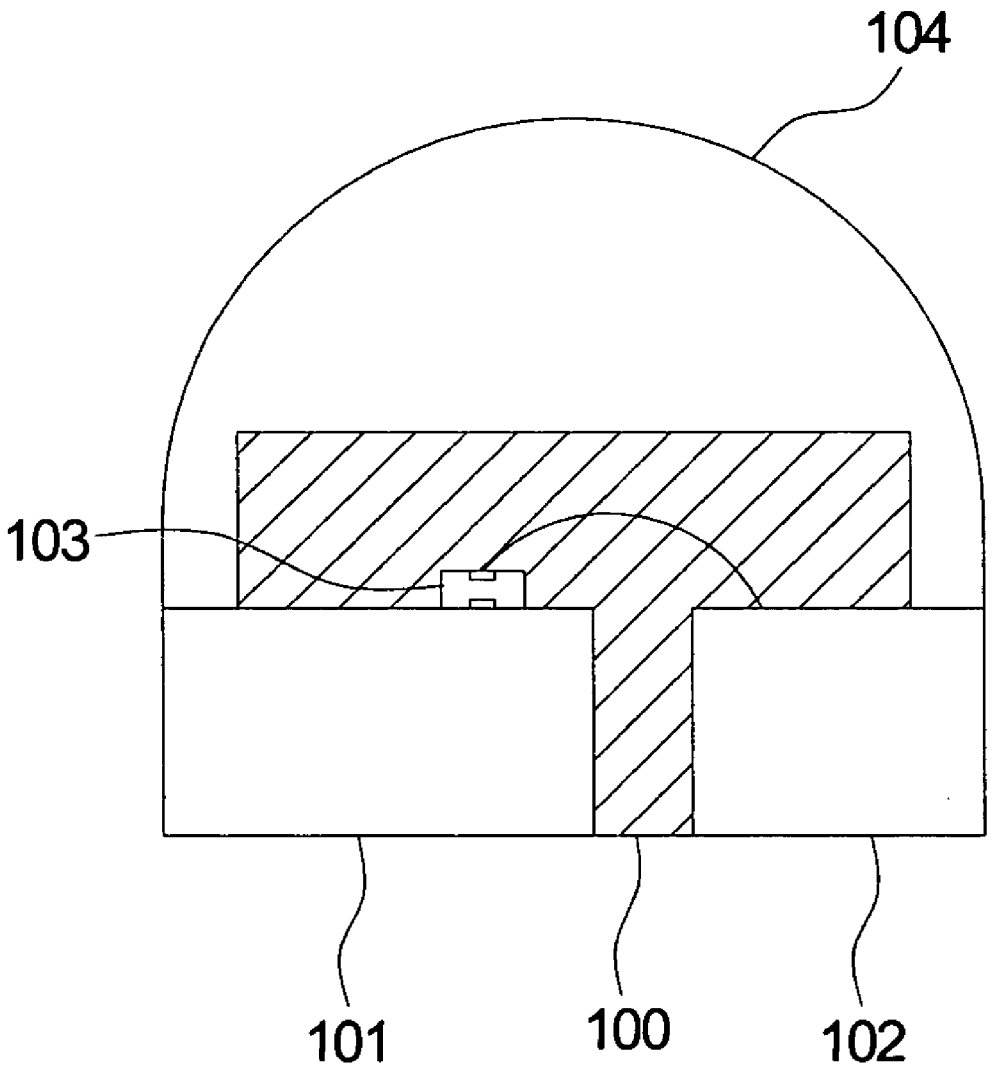


FIG 1
PRIOR ART

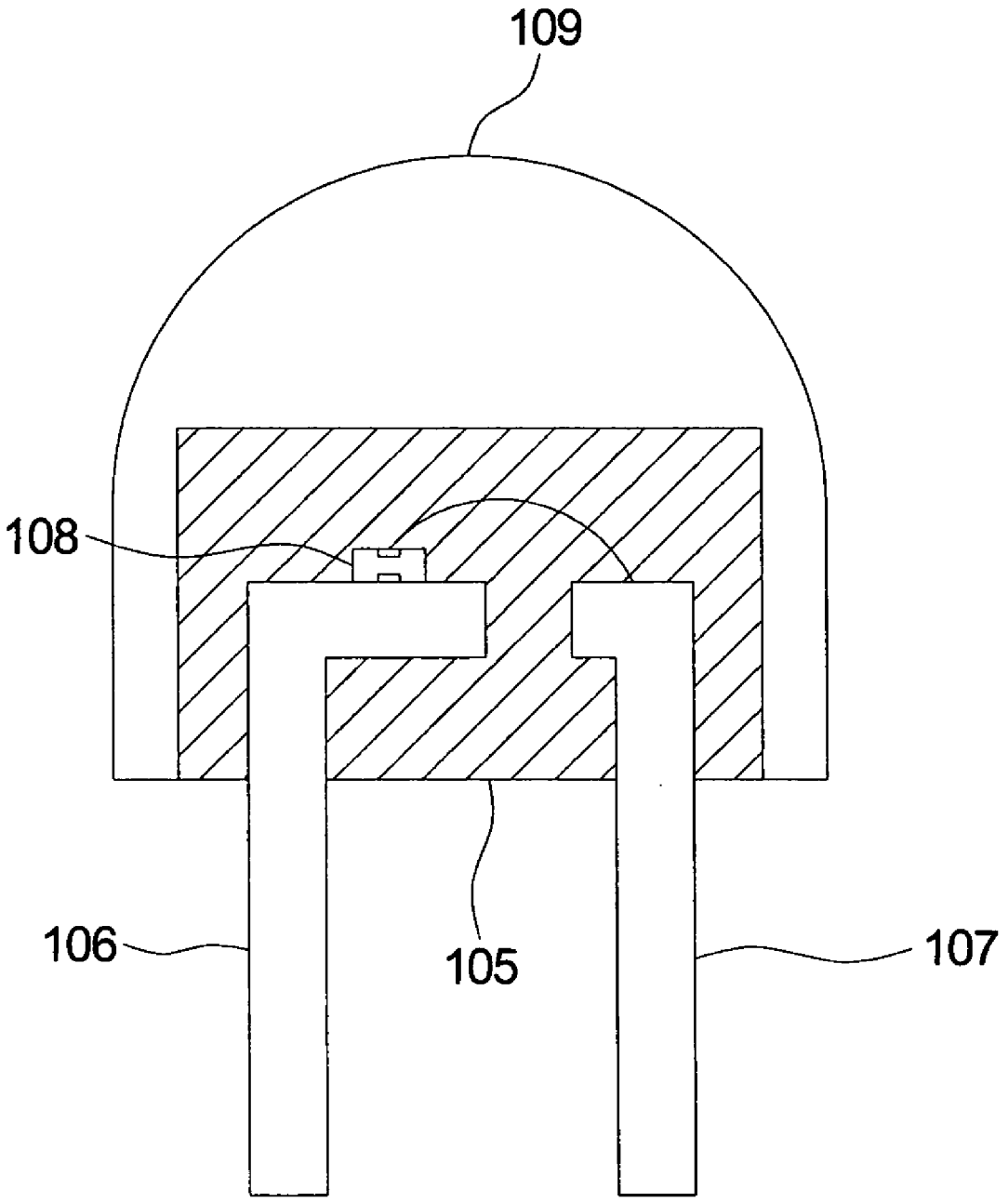


FIG 2
PRIOR ART

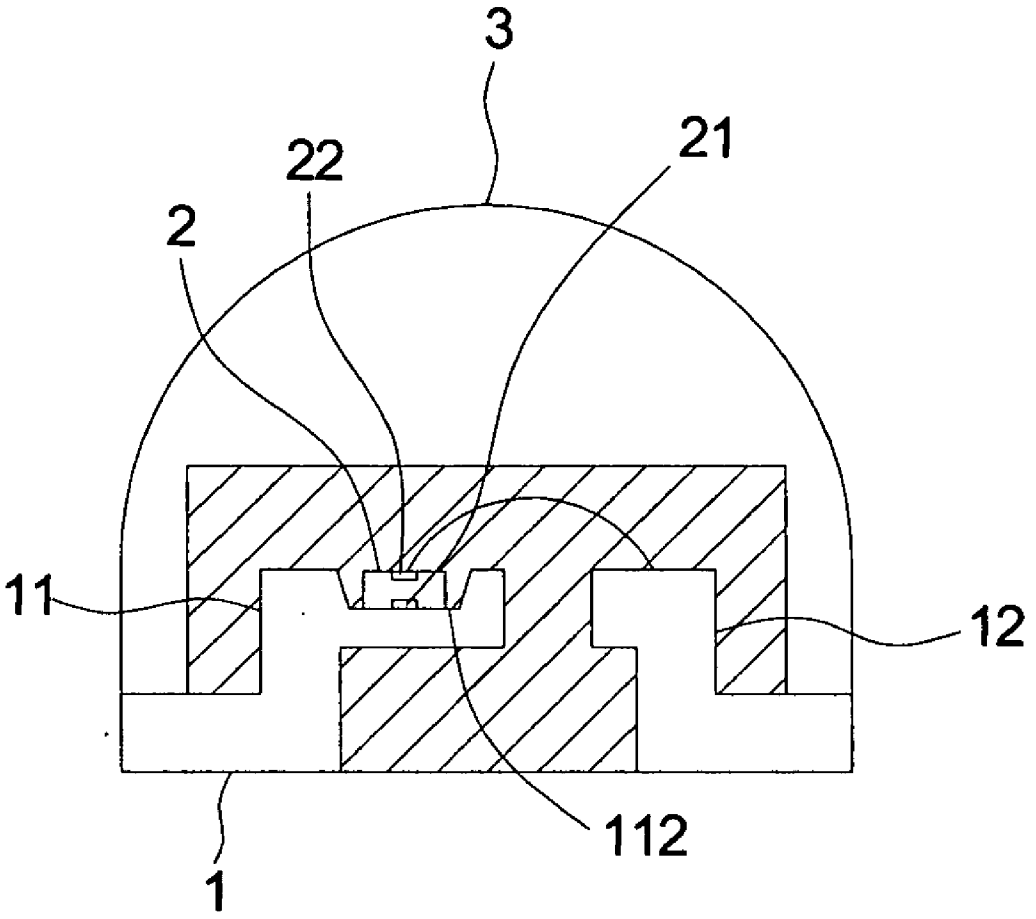


FIG 3

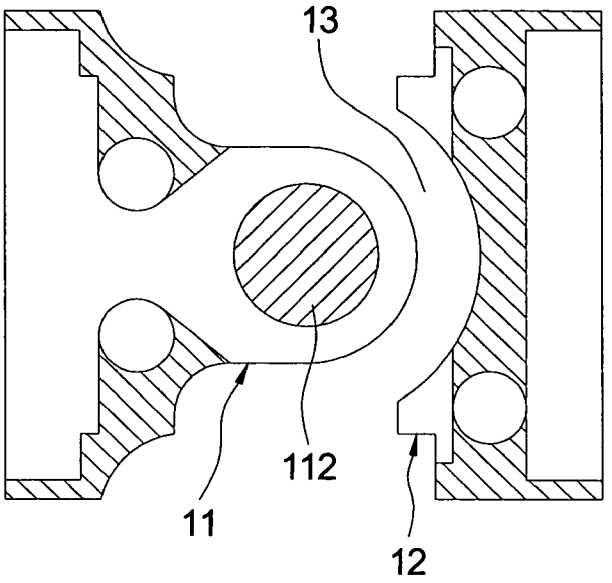


FIG 4A

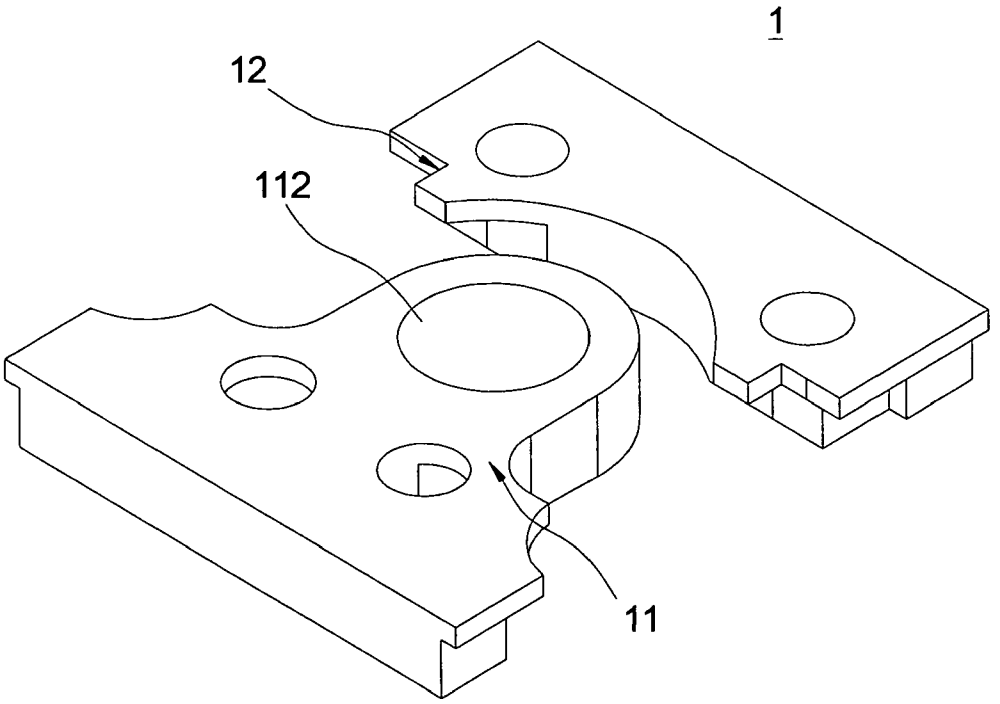


FIG 4B

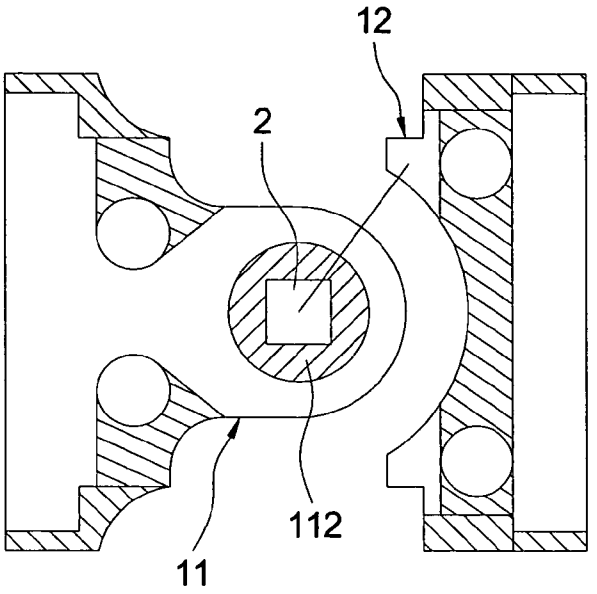


FIG 5A

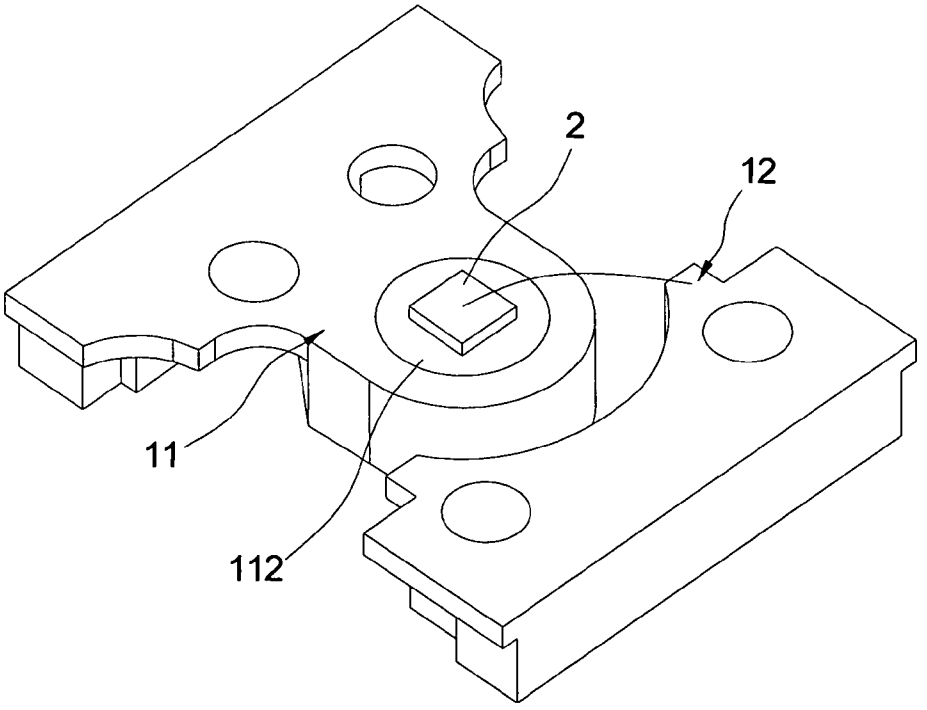


FIG 5B

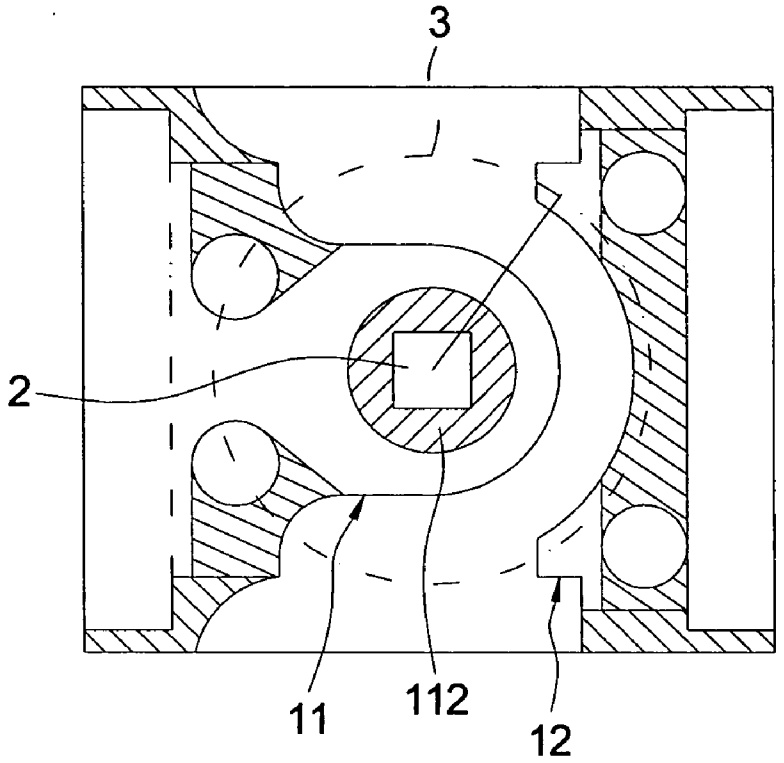


FIG 6A

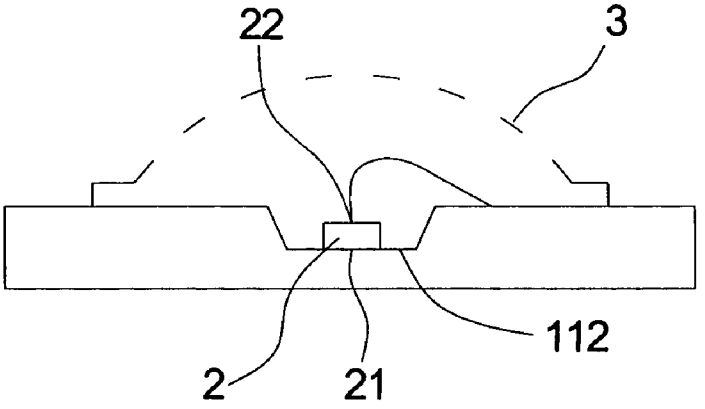


FIG 6B

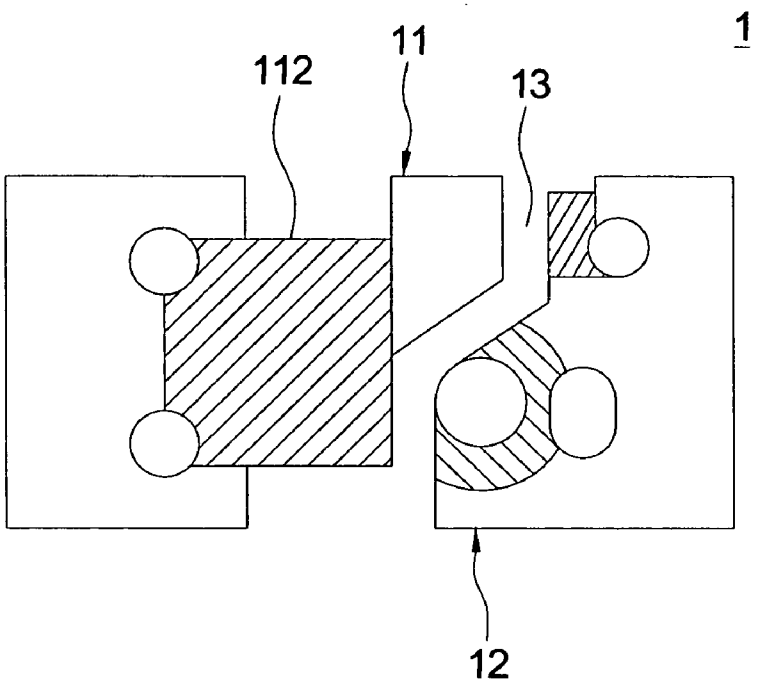


FIG 7A

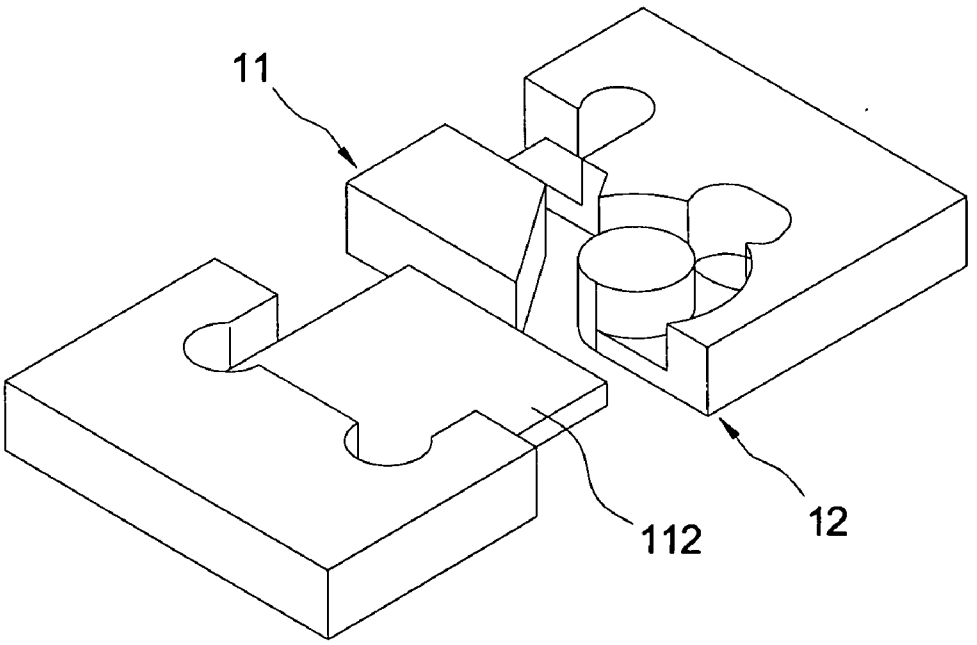


FIG 7B

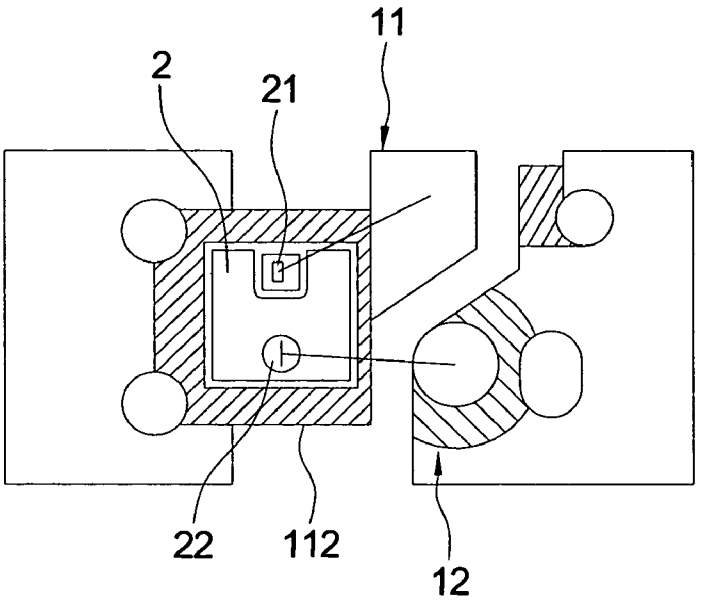


FIG 8A

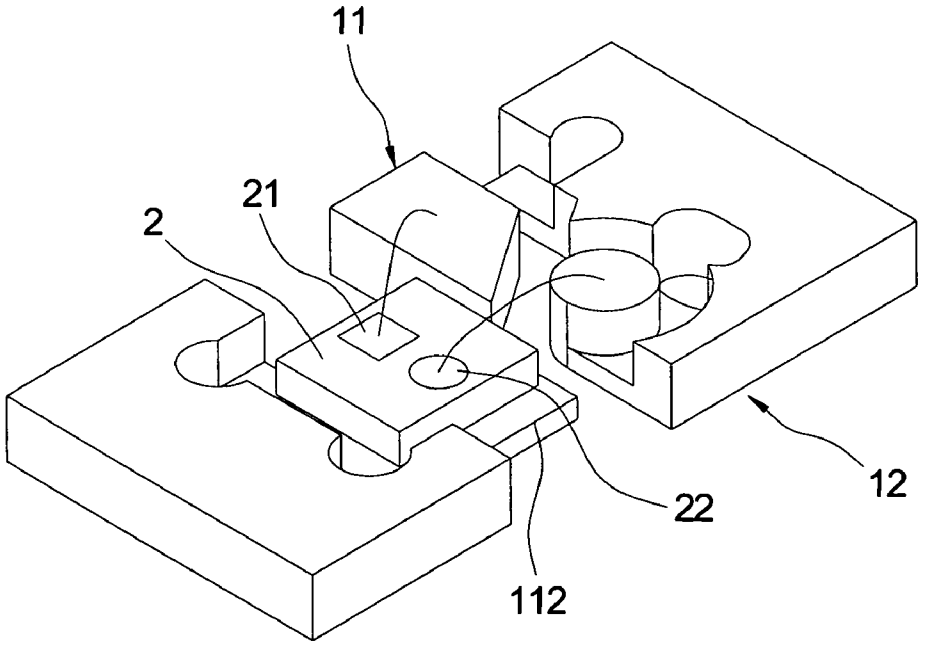


FIG 8B

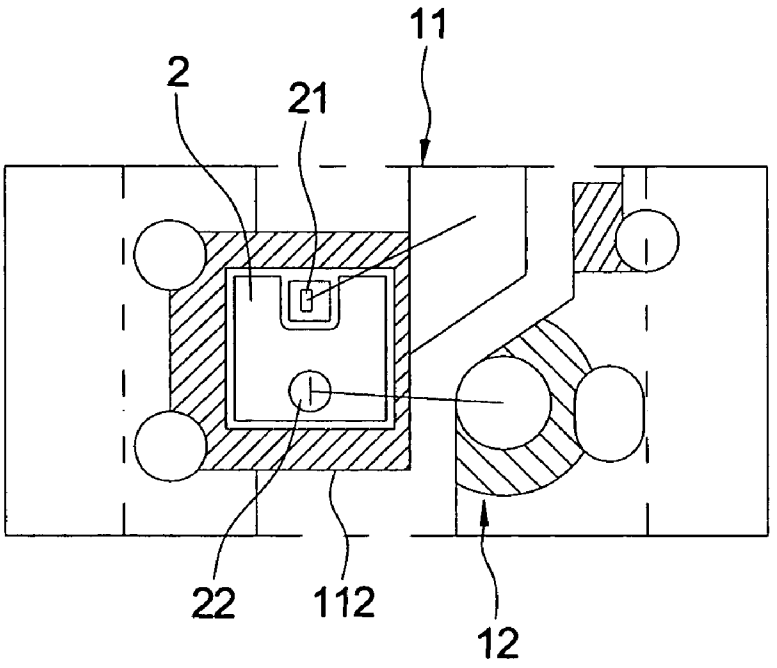


FIG 9A

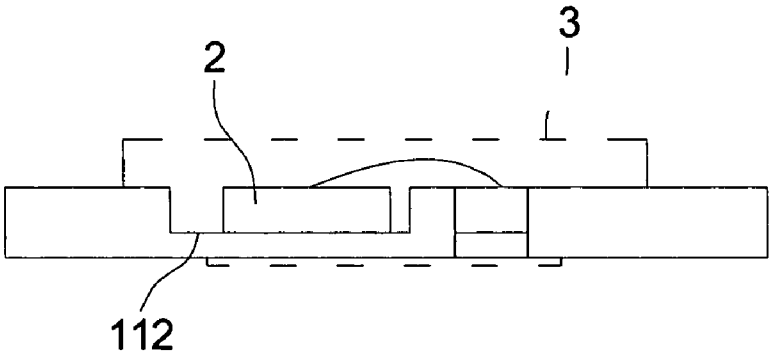
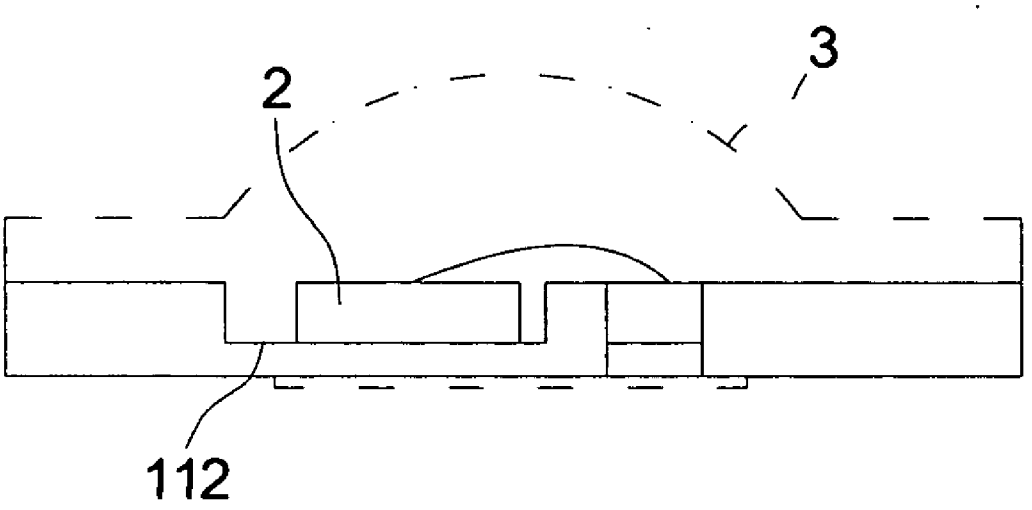


FIG 9B



FI G 9C

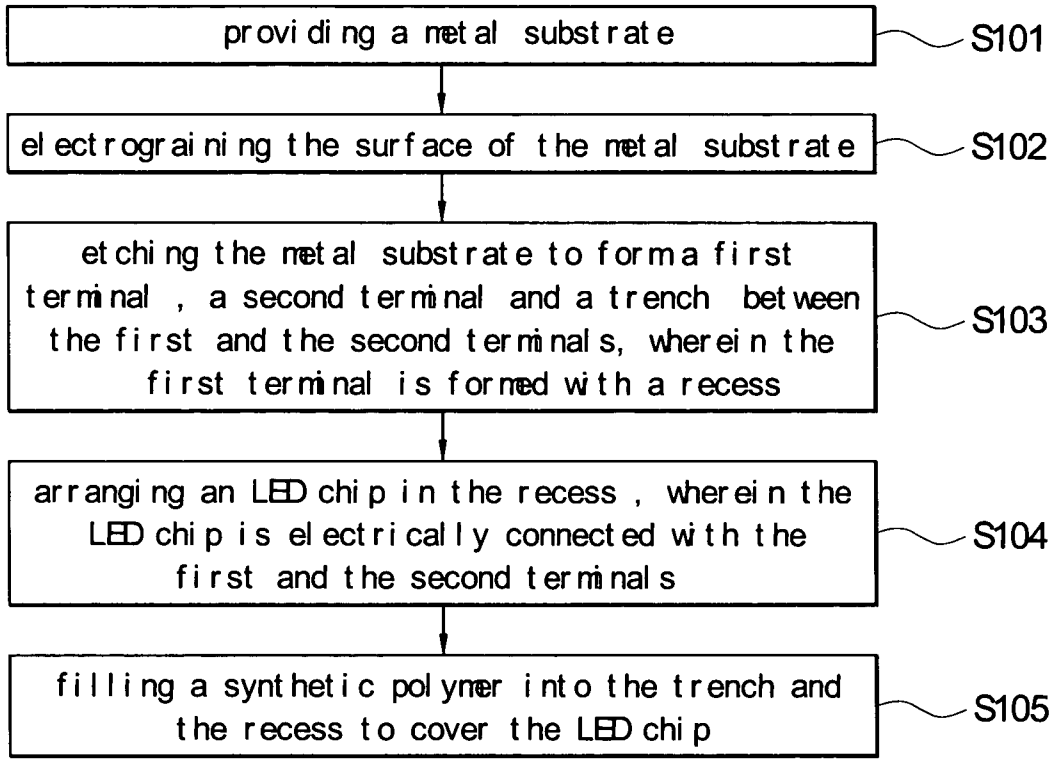

providing a metal substrate
S101
electrograining the surface of the metal substrate
S102
etching the metal substrate to form a first terminal, a second terminal and a trench between the first and the second terminals, wherein the first terminal is formed with a recess
S103
arranging an LED chip in the recess, wherein the LED chip is electrically connected with the first and the second terminals
S104
filling a synthetic polymer into the trench and the recess to cover the LED chip
S105

FIG 10

PACKAGE FOR A LIGHT EMITTING DIODE AND A PROCESS FOR FABRICATING THE SAME

BACKGROUND OF THE INVENTION

[0001] 1. Field of the Invention

[0002] The present invention generally relates to a package for a light emitting diode (referred to as an "LED" hereinafter), and more particular to an LED package provided with a recess and a process for fabricating such an LED package.

[0003] 2. Description of Prior Art

[0004] Referring to FIG. **1**, a conventional package for an LED comprises a substrate **100**, an LED chip **103**, and a housing **104**. The substrate **100** has a first terminal **101** and a second terminal **102**. The LED chip **103** is mounted on a top surface of the first terminal **101**. The housing **104** caps the LED chip **103** and the substrate **100**. The chip **103** is electrically connected with the first terminal **101** and the second terminal **102**.

[0005] Referring to FIG. **2**, another conventional package for an LED comprises a substrate **105**, a first terminal **106**, a second terminal **107**, an LED chip **108**, and a housing **109**. The LED chip **108** is mounted on a top surface of the first terminal **106** of the substrate **105**. The housing **109** caps the chip **108** and the substrate **105**. The chip **108** is electrically connected with the first terminal **106** and the second terminal **107**. LEDs have been widely applied to car braking lights, LCD panels, outdoor color advertising signs and traffic lights. To meet the demanding requirements from these and other applications, there is a great demand for the size of LED packages to be reduced. However, according to the prior art, the sizes of conventional packages for LEDs are not satisfying since the chips **103** and **108** are mounted on the top surfaces of the first terminals **101** and **106** of the substrates **100** and **105**, respectively.

[0006] Therefore, in view of the above drawbacks existing in the conventional LED packages, the inventor proposes the present invention to overcome the above problems based on his deliberate research and related principles.

SUMMARY OF THE INVENTION

[0007] The object of the present invention is to provide a package for an LED and a process for fabricating such a package. According to the present invention, a metal substrate formed with a recess is obtained by etching, and an LED chip is arranged in the recess of the metal substrate. Therefore, a smaller package for an LED becomes possible.

[0008] In order to achieve the above object, the present invention provides a package for an LED, which comprises: a metal substrate having a first terminal and a second terminal, wherein the first terminal is formed with a recess; at least one light emitting diode chip arranged in the recess of the first terminal of the metal substrate, wherein the chip is electrically connected with the first terminal and the second terminal of the metal substrate; and an insulative housing capping the chip and the metal substrate.

[0009] The present invention also provides a process for fabricating the above mentioned LED package, which comprises the following steps: providing a metal substrate; etching the metal substrate to form a first terminal, a second terminal and a trench between the first and the second terminals, wherein the first terminal is formed with a recess; arranging an LED chip in the recess, wherein the LED chip is electrically connected with the first and the second terminals; and filling a synthetic polymer into the trench and the recess to cover the LED chip.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010] The characteristics and the technical contents of the present invention will be further understood in view of the detailed description and accompanying drawings. However, it should be noted that the drawings are illustrative but not used to limit the scope of the present invention. Wherein:

[0011] FIG. **1** is a cross-sectional view of a conventional package for an LED chip according to the prior art;

[0012] FIG. **2** is a cross-sectional view of a conventional package for an LED chip according to another prior art;

[0013] FIG. **3** is a cross-sectional view of a package for an LED chip according to the present invention;

[0014] FIG. **4**A is a top view showing an etched metal substrate (closed type) according to the present invention;

[0015] FIG. **4**B is a perspective view showing the etched metal substrate shown in FIG. **4**A;

[0016] FIG. **5**A is a top view showing an LED chip which is mounted on the metal substrate shown in FIG. **4**A and bonded by a wire according to the present invention;

[0017] FIG. **5**B is a perspective view of FIG. **5**A;

[0018] FIG. **6**A is a top view showing an LED chip which is capped with encapsulant according to the present invention;

[0019] FIG. **6**B is a cross-sectional view of FIG. **6**A;

[0020] FIG. **7**A is a top view showing another etched metal substrate (open type according to the present invention;

[0021] FIG. **7**B is a perspective view showing the etched metal substrate shown in FIG. **7**A;

[0022] FIG. **8**A is a top view showing an LED chip mounted on the metal substrate shown in FIG. **7**A and bonded by wires according to the present invention;

[0023] FIG. **8**B is a perspective view of FIG. **8**A;

[0024] FIG. **9**A is a top view showing the LED chip shown in FIG. **8**A capped with encapsulant according to the present invention;

[0025] FIG. **9**B is a cross-sectional view of FIG. **9**A;

[0026] FIG. **9**C is another cross-sectional view of FIG. **9**A; and

[0027] FIG. **10** is a flow chart showing a process for packaging an LED chip.

DETAILED DESCRIPTION OF THE INVENTION

[0028] Referring to FIG. **3**, a package for an LED chip comprises a metal substrate **1**, at least one LED chip **2** and an insulative housing **3**, according to the present invention. The metal substrate **1** has a first terminal **11** and a second terminal **12**. The first terminal **11** is formed with a recess **112** of any possible shape. The LED chip **2** is arranged in the recess **112** of the first terminal **11** and it has a first electrode **21** and a second electrode **22**. The first electrode **21** and the second electrode **22** may be arranged in a top and a bottom surfaces of the LED chip **2**, respectively. Alternatively, both the first electrode **21** and the second electrode **22** may be arranged in a top surface of the LED chip **2**. The first electrode **21** and the second electrode **22** are electrically connected with the first terminal **11** and the second terminal

12 of the metal substrate 1. The insulative housing 3 caps the LED chip 2 and the metal substrate 1, and it is substantially a light converging element.

[0029] Referring to FIGS. 4A and 4B, the etched metal substrate 1 has a closed configuration, according to the present invention. The metal substrate 1 has a first terminal 11, a second terminal 12, and a trench 13 arranged between the first terminal 11 and the second terminal 12. The recess 112 is closed on the four inner surfaces thereof (such a recess is called a "closed type").

[0030] FIGS. 5A and 5B are respectively a top view and a perspective view showing the LED chip 2 mounted on the metal substrate shown in FIG. 4A and bonded by a wire according to the present invention. The LED chip 2 is arranged in the recess 112 of the first terminal 11, and it is electrically connected with the first terminal 11 and the second terminal 12 of the metal substrate 1. Referring to FIGS. 6A and 6B, the first and the second electrodes 21, 22 of the chip 2 are arranged in the top and bottom surfaces of the chip 2. The insulative housing 3 caps the chip 2 and the substrate 1 and it is substantially a light converging element. Therefore, the package for LED can converge light.

[0031] Referring to FIG. 7A and 7B, the metal substrate 1 has the first terminal 11, the second terminal 12, and the trench 13. The first terminal 11 is formed with a recess 112, and the recess 112 is closed on two inner surfaces thereof (such a recess is called an "open type").

[0032] Referring to FIG. 8A and 8B, the LED chip 2 is mounted in the recess 112 of the first terminal 11 and electrically connected with the first terminal 11 and the second terminal 12 of the metal substrate 1. Furthermore, the first electrode 21 and the second electrode 22 are arranged on the top surface of the LED chip. Referring to FIG. 9A-9C, the insulative housing 3 caps the chip 2 and the metal substrate 1, and it is substantially a light converging element. Therefore, the whole package for the LED can converge light. Referring to FIG. 10, a process for fabricating the package for the LED comprises the following steps: 1) providing a metal substrate 1 (S101), 2) electrograining the surface of the metal substrate 1 through a chemical or blasting process (S102), 3) etching the metal substrate 1 to form a first terminal 11, a second terminal 12 and a trench 13 between the first and the second terminals 11, 12, wherein the first terminal is formed with a recess 112 (S103), 4) arranging an LED chip 2 in the recess 112, wherein the LED chip 2 is electrically connected with the first and the second terminals 11, 12 (S104), and 5) filling a synthetic polymer into the trench 13 and the recess 112 to cover the LED chip (S105), wherein the step of filling a synthetic polymer is a mold pressing process. The above process further comprises a step of capping the synthetic polymer with a light converging element.

[0033] When the metal substrate 1 is in contact with the synthetic polymer, the material properties of the metal substrate 1 and the cost of the equipment required by the fabricating process is reduced. Furthermore, after the metal substrate 1 is covered with the synthetic polymer, its structure becomes stronger and it is more readily cut with less burrs. Meanwhile, the fabricating process does not conflict with and can even be incorporated into the prior fabricating process since none of the machines required by the prior art needs to be changed therefore.

[0034] According to the present invention, the metal substrate 1 is etched to be formed with the recess 112 for accommodating the LED chip 2. The recess 112 can be either closed on the four, three or two inner surfaces thereof, and the recess 112 can be formed in any desired shape to reduce the size of the entire LED package.

[0035] The present invention has the following advantages: 1) the metal substrate 1 has good mechanical properties, 2) the metal substrate can be readily cut with less burrs, 3) the cost of equipment required by the fabricating process can be reduced, 4) the fabricating process can be conducted together with the original one, 5) the package for the LED can be reduced in size, and 6) the package for the LED can converge light.

[0036] Although the present invention has been described with reference to the foregoing preferred embodiments, it will be understood that the invention is not limited to the details thereof. Various equivalent variations and modifications can still be occurred to those skilled in this art in view of the teachings of the present invention. Thus, all such variations and equivalent modifications are also embraced within the scope of the invention as defined in the appended claims.

What is claimed is:

1. A package for a light emitting diode, the package comprising:
   - a metal substrate having a first terminal and a second terminal, said first terminal formed with a recess;
   - at least one light emitting diode chip arranged in the recess of the first terminal of the metal substrate, wherein the chip is electrically connected with the first terminal and the second terminal of the metal substrate; and
   - an insulative housing capping the chip and the metal substrate.

2. A package for a light emitting diode according to claim 1, wherein the recess of the first terminal is closed on four inner surfaces thereof.

3. A package for a light emitting diode according to claim 1, wherein the recess of the first terminal is closed on two inner surfaces thereof.

4. A package for a light emitting diode according to claim 1, wherein the light emitting diode chip has a first and a second electrode, the first and the second electrodes are electrically connected with the first and the second terminals, respectively.

5. A package for a light emitting diode according to claim 1, wherein the first and the second electrodes are positioned on a top and a bottom surface of the substrate.

6. A package for a light emitting diode according to claim 1, wherein both the first and the second electrodes are positioned on a top surface of the substrate.

7. A package for a light emitting diode according to claim 1, wherein the insulative housing is a light converging element.

8. A process for fabricating a light emitting diode package, the process comprising the following steps:
   1) providing a metal substrate;
   2) etching the metal substrate to form a first terminal, a second terminal, and a trench between the first and the second terminals, wherein the first terminal is formed with a recess; and
   3) filling a synthetic polymer into the trench and the recess to cover the LED chip.

9. The process for fabricating a light emitting diode package according to claim 8, further comprising a follow-

ing step prior to the step of etching: electrograining the surface of the metal substrate, wherein the step of electrograining is obtained through a chemical process or a blasting process.

10. The process for fabricating a light emitting diode package according to claim **8**, wherein the recess of the first terminal is closed on four inner surfaces thereof.

11. The process for fabricating a light emitting diode package according to claim **8**, wherein the recess of the first terminal is closed on two inner surfaces thereof.

12. The process for fabricating a light emitting diode package according to claim **8**, wherein the step of filling a synthetic polymer is a mold pressing process.

13. The process for fabricating a light emitting diode package according to claim **8**, wherein the filling a synthetic polymer further comprises a step of capping the synthetic polymer with a light converging element.

* * * * *