IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

First Inventor Name: Hirofumi ICHIKAWA

Title: LIGHT EMITTING DEVICE, RESIN PACKAGE, RESIN-MOLDED BODY, AND METHODS FOR MANUFACTURING LIGHT EMITTING DEVICE, RESIN PACKAGE AND RESIN-MOLDED BODY

Prior Appl. No.: 13/969,182

Prior Appl. Filing Date: 8/16/2013

Examiner: Unassigned

Art Unit: Unassigned

CONTINUING PATENT APPLICATION TRANSMITTAL LETTER

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Commissioner:

Transmitted herewith for filing under 37 C.F.R. § 1.53(b) is a:

[**X**] Continuation [ ] Division [ ] Continuation-In-Part (CIP)

of the above-identified copending prior application in which no patenting, abandonment, or termination of proceedings has occurred. Priority to the above-identified prior application is hereby claimed under 35 U.S.C. § 120 for this continuing application. The entire disclosure of the above-identified prior application is considered as being part of the disclosure of the accompanying continuing application and is hereby incorporated by reference therein.

Enclosed are:

[**X**] Description, Claim(s), and Abstract (48 pages).

[**X**] Formal drawings (13 sheets, Figures 1-19D).

[**X**] Executed Declaration (4 pages).

[**X**] Power of Attorney (1 pages).

[**X**] 3.73(c) statement.

[**X**] Information Disclosure Statement.

[**X**] Form PTO-SB08.

[**X**] Preliminary Amendment (4 pages)

[**X**] Application Data Sheet (37 CFR 1.76).

The adjustment to the number of sheets for EFS-Web filing follows:

Number of Sheets		**EFS-Web Adjustment**	**Number of Sheets for EFS-Web**
65	x	75%	49

The filing fee is calculated below at the large entity rate:

	Number Filed		Included in Basic Fee		Extra		Rate		Fee Totals
Basic Filing Fee							$280.00	=	$280.00
Search Fee							$600.00		$600.00
Examination Fee							$720.00		$720.00
Size Fee	49	-	100	=	0	x	$400.00		$0.00
Total Claims:	30	-	20	=	10	x	$80.00	=	$800.00
Independents:	4	-	3	=	1	x	$420.00	=	$420.00
If any Multiple Dependent Claim(s) present:						+	$780.00	=	$0.00
Surcharge under 37 CFR 1.16(e) for late filing of Executed Declaration or late payment of filing fee						+	$140.00	=	$0.00
Prioritized Examination fee (Track I) under 37 C.F.R. § 1.17 (c)									$0.00
Processing Fee (Track I) under 37 C.F.R. § 1.17 (i)									$0.00
TOTAL FILING FEE:								=	$2820.00
Assignment Recordation Fee:						+	$40.00	=	$0.00
Processing Fee under 37 CFR 1.17(i) for Late Filing of English Translation of Application:						+	$140.00	=	$0.00
TOTAL FEE								=	$2820.00

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The Commissioner is hereby authorized to charge any additional fees which may be required regarding this application under 37 C.F.R. §§ 1.16-1.17, or credit any overpayment, to Deposit Account No. 19-0741. Should no proper payment be enclosed herewith, as by the credit card payment instructions in EFS-Web being incorrect or absent, resulting in a rejected or incorrect credit card transaction, the Commissioner is authorized to charge the unpaid amount to Deposit Account No. 19-0741.

Please direct all correspondence to the undersigned attorney or agent at the address indicated below.

Respectfully submitted,

Date October 30, 2015

By /Stephen B. Maebius/

FOLEY & LARDNER LLP
Customer Number: 22428
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Stephen B. Maebius
Attorney for Applicant
Registration No. 35,264

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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	100415-0198
	Application Number	

Title of Invention	LIGHT EMITTING DEVICE, RESIN PACKAGE, RESIN-MOLDED BODY, AND METHODS FOR MANUFACTURING LIGHT EMITTING DEVICE, RESIN PACKAGE AND RESIN-MOLDED BODY

The application data sheet is part of the provisional or nonprovisional application for which it is being submitted. The following form contains the bibliographic data arranged in a format specified by the United States Patent and Trademark Office as outlined in 37 CFR 1.76.
This document may be completed electronically and submitted to the Office in electronic format using the Electronic Filing System (EFS) or the document may be printed and included in a paper filed application.

Secrecy Order 37 CFR 5.2

☐ Portions or all of the application associated with this Application Data Sheet may fall under a Secrecy Order pursuant to 37 CFR 5.2 (Paper filers only. Applications that fall under Secrecy Order may not be filed electronically.)

Inventor Information:

Inventor 1 Remove

Legal Name

Prefix	Given Name	Middle Name	Family Name	Suffix
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Inventor 2 Remove

Legal Name

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Inventor 3 Remove

Legal Name

VIZIO Ex. 1002 Page 0005

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	100415-0198
	Application Number	

Title of Invention	LIGHT EMITTING DEVICE, RESIN PACKAGE, RESIN-MOLDED BODY, AND METHODS FOR MANUFACTURING LIGHT EMITTING DEVICE, RESIN PACKAGE AND RESIN-MOLDED BODY

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Inventor 4 [Remove]
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City	Anan-shi, Tokushima	**State/Province**	
Postal Code	774-8601	**Country** i	JP

All Inventors Must Be Listed - Additional Inventor Information blocks may be generated within this form by selecting the **Add** button. [Add]

Correspondence Information:

Enter either Customer Number or complete the Correspondence Information section below.
For further information see 37 CFR 1.33(a).

☐ **An Address is being provided for the correspondence Information of this application.**

Customer Number	22428	
Email Address	IPDocketing@foley.com	[Add Email] [Remove Email]

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	100415-0198
	Application Number	
Title of Invention	LIGHT EMITTING DEVICE, RESIN PACKAGE, RESIN-MOLDED BODY, AND METHODS FOR MANUFACTURING LIGHT EMITTING DEVICE, RESIN PACKAGE AND RESIN-MOLDED BODY	

Application Information:

Title of the Invention	LIGHT EMITTING DEVICE, RESIN PACKAGE, RESIN-MOLDED BODY, AND METHODS FOR MANUFACTURING LIGHT EMITTING DEVICE, RESIN PACKAGE AND RESIN-MOLDED BODY		
Attorney Docket Number	100415-0198	**Small Entity Status Claimed** ☐	
Application Type	Nonprovisional		
Subject Matter	Utility		
Total Number of Drawing Sheets (if any)	13	**Suggested Figure for Publication (if any)**	

Filing By Reference :

Only complete this section when filing an application by reference under 35 U.S.C. 111(c) and 37 CFR 1.57(a). Do not complete this section if application papers including a specification and any drawings are being filed. Any domestic benefit or foreign priority information must be provided in the appropriate section(s) below (i.e., "Domestic Benefit/National Stage Information" and "Foreign Priority Information").

For the purposes of a filing date under 37 CFR 1.53(b), the description and any drawings of the present application are replaced by this reference to the previously filed application, subject to conditions and requirements of 37 CFR 1.57(a).

Application number of the previously filed application	Filing date (YYYY-MM-DD)	Intellectual Property Authority or Country i

Publication Information:

☐ Request Early Publication (Fee required at time of Request 37 CFR 1.219)

☐ **Request Not to Publish.** I hereby request that the attached application not be published under 35 U.S.C. 122(b) and certify that the invention disclosed in the attached application **has not and will not** be the subject of an application filed in another country, or under a multilateral international agreement, that requires publication at eighteen months after filing.

Representative Information:

Representative information should be provided for all practitioners having a power of attorney in the application. Providing this information in the Application Data Sheet does not constitute a power of attorney in the application (see 37 CFR 1.32).
Either enter Customer Number or complete the Representative Name section below. If both sections are completed the customer Number will be used for the Representative Information during processing.

Please Select One:	◉ Customer Number	○ US Patent Practitioner	○ Limited Recognition (37 CFR 11.9)
Customer Number	22428		

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	100415-0198
	Application Number	
Title of Invention	LIGHT EMITTING DEVICE, RESIN PACKAGE, RESIN-MOLDED BODY, AND METHODS FOR MANUFACTURING LIGHT EMITTING DEVICE, RESIN PACKAGE AND RESIN-MOLDED BODY	

Domestic Benefit/National Stage Information:

This section allows for the applicant to either claim benefit under 35 U.S.C. 119(e), 120, 121, 365(c), or 386(c) or indicate National Stage entry from a PCT application. Providing this information in the application data sheet constitutes the specific reference required by 35 U.S.C. 119(e) or 120, and 37 CFR 1.78.
When referring to the current application, please leave the application number blank.

Prior Application Status			Remove
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)
	Continuation of	13/969182	2013-08-16
Prior Application Status			Remove
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)
13/969182	Continuation of	12/737940	2011-05-13
Prior Application Status			Remove
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)
12/737940	a 371 of international	PCT/JP2009/004170	2009-08-27
Additional Domestic Benefit/National Stage Data may be generated within this form by selecting the **Add** button.			Add

Foreign Priority Information:

This section allows for the applicant to claim priority to a foreign application. Providing this information in the application data sheet constitutes the claim for priority as required by 35 U.S.C. 119(b) and 37 CFR 1.55. When priority is claimed to a foreign application that is eligible for retrieval under the priority document exchange program (PDX) i the information will be used by the Office to automatically attempt retrieval pursuant to 37 CFR 1.55(i)(1) and (2). Under the PDX program, applicant bears the ultimate responsibility for ensuring that a copy of the foreign application is received by the Office from the participating foreign intellectual property office, or a certified copy of the foreign priority application is filed, within the time period specified in 37 CFR 1.55(g)(1).

			Remove
Application Number	Country i	Filing Date (YYYY-MM-DD)	Access Code i (if applicable)
2008-225408	JP	2008-09-03	
Additional Foreign Priority Data may be generated within this form by selecting the **Add** button.			Add

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	100415-0198
	Application Number	
Title of Invention	LIGHT EMITTING DEVICE, RESIN PACKAGE, RESIN-MOLDED BODY, AND METHODS FOR MANUFACTURING LIGHT EMITTING DEVICE, RESIN PACKAGE AND RESIN-MOLDED BODY	

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications

☐ This application (1) claims priority to or the benefit of an application filed before March 16, 2013 and (2) also contains, or contained at any time, a claim to a claimed invention that has an effective filing date on or after March 16, 2013.
NOTE: By providing this statement under 37 CFR 1.55 or 1.78, this application, with a filing date on or after March 16, 2013, will be examined under the first inventor to file provisions of the AIA.

Authorization to Permit Access:

☒ Authorization to Permit Access to the Instant Application by the Participating Offices

If checked, the undersigned hereby grants the USPTO authority to provide the European Patent Office (EPO), the Japan Patent Office (JPO), the Korean Intellectual Property Office (KIPO), the World Intellectual Property Office (WIPO), and any other intellectual property offices in which a foreign application claiming priority to the instant patent application is filed access to the instant patent application. See 37 CFR 1.14(c) and (h). This box should not be checked if the applicant does not wish the EPO, JPO, KIPO, WIPO, or other intellectual property office in which a foreign application claiming priority to the instant patent application is filed to have access to the instant patent application.

In accordance with 37 CFR 1.14(h)(3), access will be provided to a copy of the instant patent application with respect to: 1) the instant patent application-as-filed; 2) any foreign application to which the instant patent application claims priority under 35 U.S.C. 119(a)-(d) if a copy of the foreign application that satisfies the certified copy requirement of 37 CFR 1.55 has been filed in the instant patent application; and 3) any U.S. application-as-filed from which benefit is sought in the instant patent application.

In accordance with 37 CFR 1.14(c), access may be provided to information concerning the date o f filing this Authorization.

Applicant Information:

Providing assignment information in this section does not substitute for compliance with any requirement of part 3 of Title 37 of CFR to have an assignment recorded by the Office.

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	100415-0198
	Application Number	
Title of Invention	LIGHT EMITTING DEVICE, RESIN PACKAGE, RESIN-MOLDED BODY, AND METHODS FOR MANUFACTURING LIGHT EMITTING DEVICE, RESIN PACKAGE AND RESIN-MOLDED BODY	

Applicant 1 Remove

If the applicant is the inventor (or the remaining joint inventor or inventors under 37 CFR 1.45), this section should not be completed. The information to be provided in this section is the name and address of the legal representative who is the applicant under 37 CFR 1.43; or the name and address of the assignee, person to whom the inventor is under an obligation to assign the invention, or person who otherwise shows sufficient proprietary interest in the matter who is the applicant under 37 CFR 1.46. If the applicant is an applicant under 37 CFR 1.46 (assignee, person to whom the inventor is obligated to assign, or person who otherwise shows sufficient proprietary interest) together with one or more joint inventors, then the joint inventor or inventors who are also the applicant should be identified in this section.

Clear

◉ Assignee ◯ Legal Representative under 35 U.S.C. 117 ◯ Joint Inventor

◯ Person to whom the inventor is obligated to assign. ◯ Person who shows sufficient proprietary interest

If applicant is the legal representative, indicate the authority to file the patent application, the inventor is:

Name of the Deceased or Legally Incapacitated Inventor :

If the Applicant is an Organization check here. ☒

Organization Name	NICHIA CORPORATION		
Mailing Address Information For Applicant:			
Address 1	491-100, Oka, Kaminaka-cho		
Address 2			
City	Anan-shi, Tokushima	**State/Province**	
Country i	JP	Postal Code	774-8601
Phone Number		Fax Number	
Email Address			

Additional Applicant Data may be generated within this form by selecting the Add button. Add

Assignee Information including Non-Applicant Assignee Information:

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Complete this section if assignee information, including non-applicant assignee information, is desired to be included on the patent application publication . An assignee-applicant identified in the "Applicant Information" section will appear on the patent application publication as an applicant. For an assignee-applicant, complete this section only if identification as an assignee is also desired on the patent application publication.

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If the Assignee or Non-Applicant Assignee is an Organization check here. ☒

PTO/AIA/14 (07-14)
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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	100415-0198
	Application Number	

Title of Invention	LIGHT EMITTING DEVICE, RESIN PACKAGE, RESIN-MOLDED BODY, AND METHODS FOR MANUFACTURING LIGHT EMITTING DEVICE, RESIN PACKAGE AND RESIN-MOLDED BODY

Organization Name	NICHIA CORPORATION

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Country i	JP	Postal Code	774-8601
Phone Number		Fax Number	
Email Address			

Additional Assignee or Non-Applicant Assignee Data may be generated within this form by selecting the Add button. Add

Signature:

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NOTE: This form must be signed in accordance with 37 CFR 1.33. See 37 CFR 1.4 for signature requirements and certifications.

Signature	/Stephen B. Maebius/			Date (YYYY-MM-DD)	2015-10-30
First Name	Stephen B.	Last Name	Maebius	Registration Number	35264

Additional Signature may be generated within this form by selecting the Add button. Add

This collection of information is required by 37 CFR 1.76. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 23 minutes to complete, including gathering, preparing, and submitting the completed application data sheet form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these records.
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4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent C o o p eration Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
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8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.
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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

First Inventor Name:	Hirofumi ICHIKAWA
Title:	LIGHT EMITTING DEVICE, RESIN PACKAGE, RESIN-MOLDED BODY, AND METHODS FOR MANUFACTURING LIGHT EMITTING DEVICE, RESIN PACKAGE AND RESIN-MOLDED BODY
Appl. No.:	Unassigned
Filing Date:	10/30/2015
Examiner:	Unassigned
Art Unit:	Unassigned
Confirmation Number:	Unassigned

PRELIMINARY AMENDMENT UNDER 37 CFR 1.115

Mail Stop AMENDMENT
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Commissioner:

Prior to examination of the present Continuing Application, Applicant respectfully requests that the application be amended as follows:

Amendments to the Specification begin on page 2 of this document.

Remarks/Arguments begin on page 3 of this document.

Please amend the application as follows:

Amendments to the Specification:

Please amend paragraph [0001] of specification as follows:

This application is a continuation of U.S. Patent Application No. 13/969,182, filed August 16, 2013, which in turn is a continuation of U.S. Patent Application No. 12/737,940, filed on May 13, 2011, which issued as U.S. Patent No. 8,530,250 on September 10, 2013.

REMARKS

Applicant respectfully requests that the foregoing amendments be made prior to examination of the present application.

Applicant believes that the application is in condition for allowance. Favorable consideration is respectfully requested.

The Examiner is invited to contact the undersigned by telephone if it is felt that a telephone interview would advance prosecution.

Respectfully submitted,

Date Oct. 30, 2015

By /Stephen B. Maebius/

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Stephen B. Maebius
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LIGHT EMITTING DEVICE, RESIN PACKAGE, RESIN-MOLDED BODY, AND METHODS FOR MANUFACTURING LIGHT EMITTING DEVICE, RESIN PACKAGE AND RESIN-MOLDED BODY

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001]

This application is a continuation of U.S. Patent Application No. 12/737,940, filed on May 13, 2011, which issued as U.S. Patent No. 8,530,250 on September 10, 2013.

TECHNICAL FIELD

[0002]

The present invention relates to a light emitting device used for light equipment, a display, a backlight of a mobile telephone, a movie lighting auxiliary light source, and other general consumer light sources, and to a method for manufacturing a light emitting device.

BACKGROUND ART

[0003]

A light emitting device using light emitting elements is small, provides good power efficiency, and emits light of bright color. Further, the light emitting elements are semiconductor elements, and therefore there is no concern for blowout. The light emitting elements have characteristics of good initial driving performance and are robust against vibration and repetition of on and off of lighting. The light emitting elements have these good characteristics, and therefore light emitting devices using light emitting elements such as light emitting diodes (LEDs) and laser diodes (LDs) are utilized as various light sources.

[0004]

FIG. 14 is a perspective view illustrating a method for manufacturing a conventional light emitting device. FIG. 15 is a perspective view illustrating an intermediate of the conventional light emitting device. FIG. 16 is a perspective view illustrating the conventional light emitting device.

[0005]

Conventionally, as a method for manufacturing a light emitting device, a method is disclosed for insert-molding a lead frame with a non-translucent, light reflecting white resin, and molding a resin-molded body which has concave cups at predetermined intervals through the lead frame (e.g., refer to Patent Document 1). Although quality of a material of a white resin is not clearly described, as is insertion-molding performed and as is clear from the figures, a general thermoplastic resin is used. As a general thermoplastic resin, for example, a thermoplastic resin such as liquid crystal polymer, PPS (polyphenylene sulfide), and nylon is often used as a light blocking resin-molded body (e.g., refer to Patent Document 2).

[0006]

However, the thermoplastic resin has little adhesion with a lead frame, and the resin part and lead frame are likely to be detached. Further, the thermosetting resin has lower resin fluidity of the resin and therefore is not adequate to mold a resin-molded body of a complicated shape, and has little light resistance. In recent years in particular, the output of a light emitting element is remarkably improved and, as the output of a light emitting element is increased, light deterioration of a package made of a thermoplastic resin becomes more distinct.

[0007]

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In order to solve the above problems, a light emitting device using a thermosetting resin for a material of a resin-molded body is disclosed (e.g., refer to Patent Document 3). FIG. 17 is a perspective view and sectional view illustrating a conventional light emitting device. FIG. 18 is a schematic sectional view illustrating a method for manufacturing the conventional light emitting device. It is disclosed that, with this light emitting device, metal wires are formed from a metal foil by a common method such as punching or etching and are further arranged in a mold of a predetermined shape, and a thermosetting resin is filled in a mold resin inlet to transfer-mold.

[0008]

However, this manufacturing method has difficulty in manufacturing multiple light emitting devices in a short time. Further, there is a problem that a great amount of a resin of a runner part is discarded per one light emitting device.

[0009]

As a different light emitting device and manufacturing method therefor, an optical semiconductor element mounting package substrate which has a light reflecting thermosetting resin composition layer on the wiring substrate, and manufacturing method therefor are disclosed (e.g., refer to Patent Document 4). FIG. 19 is a schematic view illustrating steps of manufacturing a conventional light emitting device. This optical semiconductor element mounting package substrate is manufactured as an optical semiconductor element mounting package substrate of a matrix pattern which has a plurality of concave parts, by attaching a printed-wiring board having a flat plate shape to a mold, filling a light reflecting thermosetting resin composition in the mold, and heating and pressuring molding the light reflecting thermosetting resin by means of a transfer-molding machine. Further, it is also disclosed that a lead frame is used instead of a printed-wiring board.

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[0010]

However, these wiring board and lead frame have a flat plate shape and have a small adhering area because a thermosetting resin composition is arranged on this flat shape, and therefore there is a problem that, for example, a lead frame and thermosetting resin composition are likely to be detached upon singulation.

[0011]

Patent Document 1: Japanese Patent Application Laid-Open No. 2007-35794

Patent Document 2: Japanese Patent Application Laid-Open No. 11-087780

Patent Document 3: Japanese Patent Application Laid-Open No. 2006-140207

Patent Document 4: Japanese Patent Application Laid-Open No. 2007-235085

BRIEF DESCRIPTION OF THE DRAWINGS

[0012]

FIG. 1 is a perspective view illustrating a light emitting device according to a first embodiment.

FIG. 2 is a sectional view illustrating the light emitting device according to the first embodiment.

FIG. 3 is a plan view illustrating a lead frame used in the first embodiment.

FIG. 4 is a schematic sectional view illustrating a method for manufacturing a light emitting device according to the first embodiment.

FIG. 5 is a plan view illustrating a resin-molded body according to the first embodiment.

FIG. 6 is a perspective view illustrating a light emitting device according to a second embodiment.

FIG. 7 is a plan view illustrating a lead frame used in the second embodiment.

FIG. 8 is a plan view illustrating a resin-molded body according to the second embodiment.

FIG. 9 is a perspective view illustrating a light emitting device according to a third embodiment.

FIG. 10 is a plan view illustrating a lead frame used in the third embodiment.

FIG. 11 is a perspective view illustrating a light emitting device according to a fourth embodiment.

FIG. 12 is a perspective view illustrating a light emitting device according to a fifth embodiment.

FIG. 13 is a perspective view illustrating a resin package according to a sixth embodiment.

FIG. 14 is a perspective view illustrating a method for manufacturing a conventional light emitting device.

FIG. 15 is a perspective view illustrating an intermediate of a conventional light emitting device.

FIG. 16 is a perspective view illustrating a conventional light emitting device.

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FIG. 17 is a perspective view and a sectional view illustrating a conventional light emitting device.

FIG. 18 is a schematic sectional view illustrating a method for manufacturing a conventional light emitting device.

FIG. 19 is a schematic diagram illustrating steps of manufacturing a conventional light emitting device.

DETAILED DESCRIPTION

[0013]

In view of the above problems, an object of the present invention is to provide a simple and low-cost method for manufacturing, in a short time, multiple light emitting devices which has high adhesion between a lead frame and a thermosetting resin composition.

[0014]

The present invention is earnestly studied and as a result is finally completed.

[0015]

In this description, terms such as leads, a resin part, and resin package are used for a singulated light emitting device, and terms such as a lead frame and resin molded body are used in the stage prior to singulation.

[0016]

The present invention relates to a method of manufacturing a light emitting device having a resin package which provides an optical reflectivity equal to or more than 70% at a

wavelength between 350 nm and 800 nm after thermal curing, and in which a resin part and a lead are formed in a substantially same plane in an outer side surface. The method comprises: a step of sandwiching a lead frame provided with a notch part, by means of an upper mold and a lower mold; a step of transfer-molding a thermosetting resin containing a light reflecting material in a mold sandwiched by the upper mold and the lower mold to form a resin-molded body in the lead frame; and a step of cutting the resin molded body and the lead frame along the notch part. With the configuration, the thermosetting resin is filled in the notch parts, and therefore an adhering area between the lead frame and the thermosetting resin becomes large, so that it is possible to improve adhesion between the lead frame and the thermosetting resin. Further, a thermosetting resin having lower viscosity than a thermoplastic resin is used, so that it is possible to fill the thermosetting resin in the notch parts without leaving a gap. Further, it is possible to manufacture multiple light emitting devices at one time and greatly improve productive efficiency. Furthermore, it is possible to reduce runners which are discarded, and provide light emitting devices at low cost.

[0017]

Preferably, plating processing is applied to the lead frame before the lead frame is sandwiched by the upper mold and the lower mold. In this case, in the manufactured light emitting device, plating processing is not applied to a cut surface and is applied to parts other than the cut surface. It is not necessary to apply plating processing per singulated light emitting device and it is possible to simplify a manufacturing method.

[0018]

Preferably, the notch part in a cut part of the lead frame is about half the entire surrounding periphery. By this means, it is possible to reduce the weight of the lead frame and provide light emitting devices at low cost. Further, the part of the lead frame to be cut

decreases, so that it is possible to better prevent the lead frame and the thermosetting resin from detaching.

[0019]

In addition, the difference is that, while the thermosetting resin is filled in the notch parts, the thermosetting resin is not filled in hole parts which are described later. While the notch parts and hole parts penetrate the lead frame, grooves which are described later do not penetrate the lead frame.

[0020]

Preferably, a hole part is provided in the lead frame before the lead frame is sandwiched by the upper mold and the lower mold. By this means, it is possible to reduce the weight of the lead frame more, and provide light emitting devices at low cost. It is possible to apply the plating processing to the hole parts, and consequently prevent exposure of the lead frame.

[0021]

Preferably, a groove is provided in the lead frame before the lead frame is sandwiched by the upper mold and the lower mold. By this means, it is possible to reduce the weight of the lead frame more, and provide light emitting devices at low cost. It is possible to apply plating processing to the grooves, and consequently prevent exposure of the lead frame.

[0022]

Preferably, the upper mold and the lower mold sandwich a part of the lead frame where a light emitting element is placed or near a hole part. By this means, it is possible to prevent the lead frame from flip-flopping and reduce burrs.

[0023]

The present invention relates to a light emitting device having a resin package having an optical reflectivity equal to or more than 70% at a wavelength between 350 nm and 800 nm after thermal curing, wherein a resin part and a lead are formed in a substantially same plane in an outer side surface, and wherein at least one surface of a bottom surface and an upper surface of a lead is plated and the outer side surface of the lead is not plated. By this means, it is possible to prevent exposure of leads to which plating processing is not applied, and provide multiple light emitting devices at one time. Further, by applying plating processing to only the part which reflects light from a light emitting element, it is possible to improve the efficiency to extract light from the light emitting device.

[0024]

Preferably, the lead is exposed at four corners of the resin package. The exposed parts of the leads are reduced compared to leads which are provided on the one entire side surface of a resin package, so that it is possible to improve adhesion between the resin part and the leads. Further, the insulating resin part is provided between a positive lead and a negative lead, so that it is possible to prevent short circuiting.

[0025]

Preferably, four corners of the resin package are formed in an arc shape seen from a bottom surface side. It is also possible to employ a configuration where plating processing is applied to a part which is formed in an arc shape and is not applied to the cut surface. By this means, it is possible to expand a bonding area with, for example, a solder, and improve the boding strength.

[0026]

Preferably, a step is provided in the lead. The differences in level are preferably provided in the bottom surface of the resin package. It is also possible to employ a configuration where plating processing is applied to a part in which differences in level are formed and is not applied to the cut surface. By this means, it is possible to expand a bonding area with, for example, a solder, and improve the boding strength.

[0027]

The present invention relates to a method for manufacturing a resin package having an optical reflectivity equal to or more than 70% at a wavelength between 350 nm and 800 nm after thermal curing, wherein a resin part and a lead are formed in a substantially same plane in an outer side surface. The method comprising: a step of sandwiching a lead frame provided with a notch part, by means of an upper mold and a lower mold; a step of transfer-molding a thermosetting resin containing a light reflecting material in a mold sandwiched by the upper mold and the lower mold to form a resin-molded body in the lead frame; and a step of cutting the resin-molded body and the lead frame along the notch part. With the configuration, the thermosetting resin is filled in the notch parts, and therefore an adhering area between the lead frame and the thermosetting resin becomes large, so that it is possible to improve adhesion between the lead frame and the thermosetting resin. Further, a thermosetting resin having lower viscosity than a thermoplastic resin is used, so that it is possible to fill the thermosetting resin

in the notch parts without leaving a gap. Further, it is possible to manufacture multiple resin packages at one time and greatly improve productive efficiency. Furthermore, it is possible to reduce runners which are discarded, and provide resin packages at low cost.

[0028]

Preferably, plating processing is applied to the lead frame before the lead frame is sandwiched by the upper mold and the lower mold. In this case, in the manufactured resin package, plating processing is not applied to a cut surface and is applied to parts other than the cut surface. It is not necessary to apply plating processing per singulated resin package and it is possible to simplify a manufacturing method.

[0029]

The present invention relates to a resin package having an optical reflectivity equal to or more than 70% at a wavelength between 350 nm and 800 nm after thermal curing, wherein a resin part and a lead are formed in a substantially same plane in an outer side surface, and wherein at least one surface of a bottom surface and an upper surface of a lead is plated and the outer side surface of the lead is not plated. By this means, it is possible to prevent exposure of leads to which plating processing is not applied, and provide multiple resin packages at one time. Further, by applying plating processing to only the part which reflects light from a light emitting element, it is possible to improve the efficiency to extract light from the light emitting device.

[0030]

The present invention relates to a method of manufacturing a resin-molded body having an optical reflectivity equal to or more than 70% at a wavelength between 350 nm and 800 nm after thermal curing, wherein a plurality of concave parts are formed, and in which a part of a lead frame is exposed in inner bottom surfaces of the concave parts. The method comprises: a step of sandwiching the lead frame by means of an upper mold which has convex parts in positions where the concave parts adjacent in the resin molded body are molded and a lower mold, the lead frame being provided with notch parts; a step of transfer-molding a thermosetting resin containing a light reflecting material in a mold sandwiched by

the upper mold and the lower mold to fill the thermosetting resin in the notch parts, and forming the resin-molded body in the lead frame. With this configuration, it is possible to manufacture multiple light emitting devices at one time and greatly improve productive efficiency.

[0031]

The present invention relates to a resin-molded body having an optical reflectivity equal to or more than 70% at a wavelength between 350 nm and 800 nm after thermal curing, wherein a plurality of concave parts are formed and a part of a lead frame is exposed in inner bottom surfaces of the concave parts, and wherein the lead frame has notch parts and a thermosetting resin which becomes the resin-molded body is filled, the resin-molded body having a sidewall between adjacent concave parts. By this means, it is possible to provide a resin-molded body of good thermal resistance and light resistance.

[0032]

The light emitting device and manufacturing method therefor according to the present invention can provide a light emitting device which provides high adhesion between a lead frame and a resin-molded body. Further, it is possible to provide multiple light emitting devices in a short time and greatly improve production efficiency. Furthermore, it is possible to reduce runners which are discarded, and provide light emitting devices at low cost.

[0033]

Hereinafter, the preferred embodiments of a method for manufacturing a light emitting device and a light emitting device according to the present invention will be described in detail with drawings. However, the present invention is not limited to this embodiment.

[0034]

<First Embodiment>

(Light Emitting Device)

A light emitting device according to a first embodiment will be described. FIG. 1 is a perspective view illustrating a light emitting device according to the first embodiment. FIG. 2 is a sectional view illustrating a light emitting device according to the first embodiment. FIG. 2 is a sectional view taken along line II-II illustrated in FIG. 1. FIG. 3 is a plan view illustrating a lead frame used in the first embodiment.

[0035]

A light emitting device 100 according to the first embodiment provides an optical reflectivity equal to or greater than 70% at the wavelength between 350 nm and 800 nm after thermal curing, and has a resin package 20 in which a resin part 25 and leads 22 are formed in the substantially same plane in outer side surfaces 20b. Plating processing is applied to at least one surface of the bottom surface (an outer bottom surface 20a of the resin package 20) and the upper surface (an inner bottom surface 27a of a concave part 27) of the leads 22. By contrast with this, plating processing is not applied to the side surfaces of the leads 22 (the outer side surfaces 20b of the resin package 20). The resin part 25 occupies a large area in the outer side surfaces 20b of the resin package 20, and leads 22 are exposed from corner parts.

[0036]

The resin package 20 is formed with the resin part 25 which mainly contains a light reflecting material 26, and the leads 22. The resin package 20 has the outer bottom surface 20a in which the leads 22 are arranged, outer side surfaces 20b in which part of the leads 22

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are exposed, and the outer upper surface 20c in which an opening concave part 27 is formed. In the resin package 20, the concave part 27 having an inner bottom surface 27a and inner side surface 27b is formed. The leads 22 are exposed in the inner bottom surface 27a of the resin package 20 and the light emitting element 10 is placed on the leads 22. In the concave part 27 of the resin package 20, a sealing member 30 which covers the light emitting element 10 is arranged. The sealing member 30 contains a fluorescent material 40. The light emitting element 10 is electrically connected with the leads 22 through wires 50. The leads 22 are not arranged on the outer upper surface 20c of the resin package 20.

[0037]

Parts from which the leads 22 are exposed have the half or less length than the entire surrounding length of the outer side surfaces 20b of the resin package 20. In a method for manufacturing a light emitting device which is described below, notch parts 21a are provided in a lead frame 21 and the lead frame 21 is cut along the notch parts 21a and, therefore, the cut part of the lead frame 21 is a part which is exposed from the resin package 20.

[0038]

In the resin package 20, the leads 22 are exposed from the four corners. The leads 22 are exposed in the outer side surfaces 20b, and are not subjected to plating processing. Further, the leads 22 may be adapted to be exposed in the outer bottom surface 20a and subjected to plating processing. In addition, it is possible to apply plating processing to the outer side surfaces 20b of the leads 22 after singualtion.

[0039]

The light emitting device 100 provides the optical reflectivity equal to or more than 70% at the wavelength between 350 nm and 800 nm after thermal curing. This means that the

optical reflectivity in a visible light area is high. The light emitting element 10 preferably provides a light emission peak wavelength between 360 nm and 520 nm, and can also use a light emission peak wavelength between 350 nm and 800 nm. More preferably, the light emitting element 10 has a light emission peak wavelength in a short wavelength region of visible light between 420 nm and 480 nm. This resin package 20 has good light resistance against light of a short wavelength equal to or less than 480 nm, and is less likely to be deteriorated. Further, this resin package 20 is not likely to be deteriorated even when the light emitting element 10 generates heat by applying the current thereto, and has good thermal resistance.

[0040]

It is preferable to use as the resin package 20 a translucent thermosetting resin highly filled with a light reflecting material. It is preferable to use, for example, a thermosetting resin which provides the optical transmittance equal to or more than 80% at 350 nm to 800 nm, and it is more preferable to use a thermosetting resin which provides optical transmittance equal to or more than 90%. This is because it is possible to prevent deterioration of the resin package 20 by reducing light which is absorbed by the thermosetting resin. The light reflecting material 26 preferably reflects 90% or more light from the light emitting element 10, and more preferably reflects 95% or more light. Further, the light reflecting material 26 preferably reflects 90% or more light from the fluorescent material 40, and more preferably reflects 95% or more light. By reducing the amount of light which is absorbed by the light reflecting material 26, it is possible to improve the efficiency to extract light from the light emitting device 100.

[0041]

Although the light emitting device 100 may have any shape, the light emitting device 100 may have a polygonal shape such as a generally rectangular parallelepiped, generally cube, or generally hexagonal column. The concave part 27 preferably expands in the opening direction, and may have a cylindrical shape. The concave part 27 can adopt a generally circular shape, generally oval shape, or generally polygonal shape.

[0042]

Hereinafter, each member will be described below.

(Light Emitting Element)

Although a light emitting element is preferably used in which a semiconductor such as GaAlN, ZnS, SnSe, SiC, GaP, GaAlAs, AlN, InN, AlInGaP, InGaN, GaN or AlInGaN is formed on a substrate as a light emitting layer, the semiconductor is not limited to these. Although the light emitting element which provides a light emission peak wavelength between 360 nm and 520 nm is preferable, and a light emitting element which provides a light emission peak wavelength between 350 nm and 800 nm can be used. More preferably, the light emitting element 10 has the light emission peak wavelength in the short wavelength region of visible light between 420 nm and 480 nm.

[0043]

The light emitting element adopting a face-up structure can be used, and, in addition, the light emitting element adopting a face-down structure can also be used. The size of the light emitting element is not particularly limited, and light emitting elements having sizes of 350 μm (350-μm-square), 500 μm (500-μm-square) and 1 mm (1-mm -square) can be used. Further, a plurality of light emitting elements can be used, and all of the light emitting

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elements may be the same type or may be different types which emit emission colors of red, green and blue of three primary colors of light.

(Resin Package)

The resin package has and is made by integrally molding a resin part formed with a thermosetting resin and the leads. Although the resin package provides an optical reflectivity equal to or more than 70% at 350 nm to 800 nm, the resin package more preferably provides an optical reflectivity equal to or more than 80% at 420 nm to 520 nm. Further, the resin package preferably has a high reflectivity in a light emitting area of a light emitting element and a light emitting area of a fluorescent material.

[0044]

The resin package has an outer bottom surface, outer side surfaces and an outer upper surface. The leads are exposed from the outer side surfaces of the resin package. The resin part and leads are formed in the substantially same plane. This substantially same plane means that the resin part and leads are formed in the same cutting step.

[0045]

The outer shape of the resin package is not limited to a generally rectangular parallelepiped, and may have a generally cube, generally hexagonal shape or other polygonal shapes. Further, the resin package seen from the outer upper surface side can also adopt a generally triangular shape, generally square shape, generally pentagonal shape or generally hexagonal shape.

[0046]

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The resin package forms a concave part having an inner bottom surface and an inner side surface. The leads are arranged in the inner bottom surface of the concave part. The concave part seen form the outer upper surface side can adopt various shapes such as a generally circular shape, generally oval shape, generally square shape, generally polygonal shape or combination of these. Although the concave part preferably has a shape expanding in the opening direction, the concave part may have a cylindrical shape. Although the concave part may be provided with a smooth inclination, the concave part may be formed in a shape which has a minute concavity and convexity in its surface and diffuses light.

[0047]

The leads are provided at predetermined intervals to form a pair of positive and negative leads. Plating processing is applied to the leads in the inner bottom surface of the concave part and the leads of the outer bottom surface of the resin package. Although this plating processing can be performed before a resin-molded body is cut out, it is preferable to use a lead frame to which plating processing is applied in advance. By contrast with this, plating processing is not applied to the side surfaces of the leads.

(Resin Part and Resin-molded Body)

As the material of the resin part and resin-molded body, a triazine derivative epoxy resin, which is a thermosetting resin is preferably used. Further, the thermosetting resin can contain an acid anhydride, antioxidant, demolding member, light reflecting member, inorganic filler, curing catalyst, light stabilizer, and lubricant. The light reflecting member uses titanium dioxide and is filled with 10 to *60%* by weight of titanium dioxide.

[0048]

The resin package is not limited to the above mode, and is preferably made of at least one selected from the group consisting of an epoxy resin, modified epoxy resin, silicone resin, modified silicone resin, acrylate resin, and urethane resin of a thermosetting resin. Particularly, the epoxy resin, modified epoxy resin, silicone resin or modified silicone resin is preferable. For example, it is possible to use as a solid epoxy resin composition, 100 parts by weight of a clear and colorless mixture in which the epoxy resin consisting of triglycidylisocyanuratem, bisphenol hydride A glycidyl ether and so on, and an acid anhydride consisting of hexahydrophthalic anhydride, 3-methylhexahydrophthalic anhydride, 4-methylhexahydrophthalic anhydride and so on equivalent to the epoxy resin, have been dissolved and mixed, which has been added with: 0.5 parts by weight of DBU (1,8-Diazabicyclo(5,4,0) undecene-7) as a curing accelerator; 1 parts by weight of ethylene glycol as a promoter; 10 parts by weight of a titanium oxide pigment; and 50 parts by weight of a glass fiber, and which has entered the B stage by being heated and partially cured and reacted.

(Lead and Lead Frame)

Although a metal plate of a flat plate shape can be used for a lead frame, a metal plate in which differences in level or concavity and convexity are provided can be used.

[0049]

The lead frame is formed by, for example, punching or etching a metal plate of a flat plate shape. A concavity and convexity are formed in a sectional shape of the etched lead frame, so that it is possible to improve adhesion between the lead frame and resin·molded body. Particularly when a thin lead frame is used, although, with punching, differences in level or concave-convex shapes are formed to improve adhesion between a lead frame and resin-molded body, the effect of improving adhesion is little because the differences in level

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or concave-convex shapes are small. However, etching can form concave-convex shapes in the entire sectional (etched part) part of the lead frame, so that it is possible to increase a bonding area between the lead frame and resin-molded body and mold a resin package of better adhesion.

[0050]

By contrast with this, the method of punching a metal plate of a flat plate shape increases cost required for replacement parts due to friction of a mold resulting from the punching, and increases cost required for manufacturing the lead frame. By contrast with this, with etching, a punching mold is not used, so that it is possible to manufacture a lead frame per package at low cost when the number of packages cut from one frame is greater.

[0051]

The etching may be performed such that the lead frame is penetrated, or may be started from only one surface such that the lead frame is not penetrated.

[0052]

The notch parts are formed such that a pair of positive and negative leads are provided when the resin-molded body is singulated to the resin package. The notch parts are formed such that the area for cutting the leads is reduced when the resin-molded body is cut. For example, the notch parts are provided in a horizontal direction such that a pair of positive and negative leads are provided, and further notch parts are provided in positions corresponding to cut-out parts for singulating the resin-molded body. Meanwhile, part of the lead frame is jointed such that part of the lead frame does not drop or the leads are exposed in the outer side surfaces of the resin package. To singulate the resin-molded body using a singulation

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saw, the notch parts are preferably formed vertically and horizontally or linearly in an oblique direction.

[0053]

The lead frame is formed using an electrical good conductor such as iron, phosphor bronze or a copper alloy. Further, to increase the reflectivity with respect to light from the light emitting element, metal plating using silver, aluminum, copper, gold or the like can be applied to the lead frame. Although metal plating is preferably is applied to the lead frame before the lead frame is sandwiched by the upper mold and lower mold, that is, for example, after the notch parts are provided or etching processing is performed, metal plating can also be applied to the lead frame before the lead frame is integrally molded with the thermosetting resin.

(Sealing Member)

The material of a sealing member is a thermosetting resin. The sealing member is preferably made of at least one selected from the group consisting of an epoxy resin, modified epoxy resin, silicone resin, modified silicone resin, acrylate resin and urethane resin of a thermosetting resin, and is more preferably made of an epoxy resin, modified epoxy resin, silicone resin or modified silicone resin. The sealing member is preferably made of a hard material to protect the light emitting element. Further, it is preferable to use for the sealing resin a resin having good thermal resistance, weather resistance and light resistance. To provide a predetermined function, the sealing member may be mixed with at least one selected from the group consisting of filler, diffusing agent, pigment, fluorescent material and reflecting material. The sealing member may contain a diffusing agent. As a specific diffusing agent, for example, barium titanate, titanium oxide, aluminum oxide or silicon oxide is adequately used. Further, the sealing member can contain an organic or inorganic

colored dye or colored pigment in order to cut an undesirable wavelength. Further, the sealing member can also contain a fluorescent material which absorbs light from the light emitting element and converts the wavelength.

(Fluorescent Material)

A fluorescent material may be a material which absorbs light from the light emitting element, and converts the wavelengths into light of a different wavelength. The fluorescent material is preferably selected from, for example, at least any one of a nitride phosphor, oxynitride phosphor or sialon phosphor mainly activated by a lanthanoid element such as Eu or Ce, alkaline-earth halogen apatite phosphor, alkaline-earth metal boric acid halogen phosphor, alkaline-earth metal aluminate phosphor, alkaline·earth silicate, alkaline-earth sulfide, alkaline-earth thiogallate, alkaline-earth silicon nitride or germanate mainly activated by a lanthanoid element such as Eu or a transition metal such as Mn, rare-earth aluminate or rare-earth silicon nitride mainly activated by a lanthanoid element such as Ce, or organic and organic complexes mainly activated by a lanthanoid element such as Eu. As a specific example, although the following phosphors can be used, the fluorescent material is not limited to these.

[0054]

The nitride phosphor mainly activated by a lanthanoid element such as Eu or Ce includes, for example, $M_2Si_5N_8$:Eu or $MAlSiN_3$:Eu (where M is at least one or more selected from Sr, Ca, Ba, Mg and Zn). Further, the nitride phosphor also includes MSi_7N_{10}:Eu, $M_{1.8}Si_5O_{0.2}N_8$:Eu or $M_{0.9}Si_7O_{0.1}N_{10}$:Eu in addition to $M_2Si_5N_8$:Eu (where M is at least one or more selected from Sr, Ca, Ba, Mg and Zn).

[0055]

The oxynitride phosphor mainly activated by a lanthanoid element such as Eu or Ce includes, for example, $MSi_2O_2N_2$:Eu (where M is at least one or more selected from Sr, Ca, Ba, Mg and Zn).

[0056]

The sialon phosphor mainly activated by a lanthanoid element such as Eu or Ce includes, for example, $M_{p/2}Si_{12p-q}A1_{p+q}O_qN_{16-p}$:Ce or M-A1-Si-O-N (M is at least one selected from Sr, Ca, Ba, Mg and Zn, q is 0 to 2.5, and p is 1.5 to 3).

[0057]

The alkaline-earth halogen apatite phosphor mainly activated by a lanthanoid element such as Eu or a transition metal such as Mn includes, for example, $M_5(PO_4)_3X$:R (M is at least one or more selected from Sr, Ca, Ba, Mg and Zn, X is at least one or more selected from F, Cl, Br and I and R is at least one or more selected from Eu, Mn, Eu and Mn).

[0058]

The alkaline-earth metal boric acid halogen phosphor includes, for example, $M_2B_5O_9X$:R (M is at least one or more selected from Sr, Ca, Ba, Mg and Zn, X is at least one or more selected from F, Cl, Br and I, and R is at least one or more selected from Eu, Mn, Eu and Mn).

[0059]

The alkaline-earth metal aluminate phosphor includes, for example, $SrA1_2O_4$:R, $Sr_4A1_{14}O_{25}$:R, $CaA1_2O_4$:R, $BaMg_2A1_{16}O_{27}$:R, $BaMg_2A1_{16}O_{12}$:R, or $BaMgA1_{10}O_{17}$:R (R is at least one or more selected from Eu, Mn, Eu and Mn).

[0060]

The alkaline-earth sulfide phosphor includes, for example, La_2O_2S:Eu, Y_2O_2S:Eu or Gd_2O_2S:Eu.

[0061]

The rare-earth aluminate phosphor mainly activated by a lanthanoid element such as Ce includes, for example, YAG phosphors represented by composition formulae of $Y_3Al_5O_{12}$:Ce, $(Y_{0.8}Gd_{0.2})_3Al_5O_{12}$:Ce, $Y_3(Al_{0.8}Ga_{0.2})_5O_{12}$:Ce and $(Y,Gd)_3(Al,Ga)_5O_{12}$:Ce. Further, the rare-earth aluminate phosphor also includes $Tb_3Al_5O_{12}$:Ce or $Lu_3Al_5O_{12}$:Ce where part or all of Y is substituted with, for example, Tb or Lu.

[0062]

The other phosphors include, for example, ZnS:Eu, Zn_2GeO_4:Mn or MGa_2S_4:Eu (where M is at least one or more selected from Sr, Ca, Ba, Mg and Zn).

[0063]

By using one kind alone or two or more kinds in combination, these phosphors can realize blue, green, yellow and red and, in addition, tinges such as turquoise, greenish yellow and orange which are intermediate colors of blue, green, yellow and red.

[0064]

(Others)

In the light emitting device, a zener diode can also be further provided as a protective element. The zener diode can be placed on the leads in the inner bottom surface by being placed apart from the light emitting element. Further, a configuration can also be employed

where a zener diode is placed on leads in the inner bottom surface of the concave part and a light emitting

element is placed on the zener diode. The size of 280μm and, in addition, the size of 300μm can be used.

(Method for Manufacturing Light Emitting Device According to First Embodiment)

The method for manufacturing a light emitting device according to the first embodiment will be described. FIG. 4 is a schematic sectional view illustrating a method for manufacturing a light emitting device according to the first embodiment. FIG. 5 is a plan view illustrating a resin-molded body according to the first embodiment.

[0065]

The method for manufacturing a light emitting device according to the first embodiment includes the steps of sandwiching the lead frame 21 provided with the notch parts 21a by means of an upper mold 61 and a lower mold 62, transfer-molding a thermosetting resin 23 containing the light reflecting material 26, in a mold 60 sandwiched by the upper mold 61 and the lower mold 62 to form a resin-molded body 24 in the lead frame 21, and cutting the resin-molded body 24 and lead frame 21 along the notch parts 21a.

[0066]

First, the mold 60 formed with the upper mold 61 and lower mold 62 used for transfer-molding will be described.

[0067]

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The upper mold 61 has a main body part of a flat plate which forms an upper part of the upper mold, an outer wall part which is formed in a frame shape from end parts of the main body, a plurality of projecting parts which project from the main body part, and an inlet which penetrates part of the outer wall part in the horizontal direction.

[0068]

The outer wall part vertically projects from the end parts of the main body part, and has a first outer wall part, a second outer wall part, a third outer wall part and a fourth outer wall part which form a first outer side surface, a second outer side surface, a third outer side surface and a fourth outer side surface of the resin molded body, respectively. That is, the outer wall part is used for molding the outline of the resin-molded body, and formed in a rectangular shape seen from a plan view. The shape of the outer wall part only needs to be adequately formed according to a desirable shape of the resin-molded body.

[0069]

The projecting parts contact the lead frame 21 upon transfer-molding, and can form an exposed part from which part of the lead frame 21 is exposed from the resin-molded body 24 by preventing the thermosetting resin 23 from flowing in the contacting parts. The projecting parts project downward from the main body part, and are formed by being surrounded by the outer wall. The parts of the projecting parts contacting the lead frame 21 are formed flat. To efficiently form a concave part in an area in the upper surface of the resin molded body 24, the projecting parts are preferably formed in one direction at equal intervals, and the projecting parts are preferably formed at equal intervals in a direction 90 degrees from the one direction of each projecting part.

[0070]

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The inlet is used to inject the thermosetting resin 23, and is formed penetrating in the horizontal direction in the lower end of the substantially center of the outer wall part. The inlet has a semicircular cross sectional surface, and is formed with a width narrowed toward the outlet part from the inlet part of the inlet.

[0071]

Further, although not illustrated, a pin insertion hole which penetrates the main body part is formed in the upper part of the upper mold 61. The pin insertion hole is used for insertion of the pin when the resin-molded body 24 is demolded from the upper mold 61.

[0072]

The lower mold 62 is a plate material with a predetermined thickness, and its surface is formed flat. The lower mold 62 is placed in contact with the upper mold 61 to mold a space part.

[0073]

Next, each manufacturing step will be described.

[0074]

After the notch parts 21a are provided, metal plating processing is applied to the lead frame 21.

[0075]

First, the lead frame 21 provided with the notch parts 21a is sandwiched by the upper mold 61 and lower mold 62. By sandwiching the lead frame 21 by the upper mold 61 and lower mold 62, space is provided in the mold 60.

[0076]

In this case, the notch parts 21a in positions where the concave parts 27 are formed are arranged such that the notch parts 21a are sandwiched by the projecting parts of the upper mold 61 and the lower mold 62. By this means, it is possible to prevent flip-flop of the lead frame 21 in the notch parts 21a, and reduce burrs.

[0077]

Next, the thermosetting resin 23 containing the light reflecting material 26 is transfer-molded in the mold sandwiched by the upper mold 61 and lower mold 62, and the thermosetting resin 23 containing the light reflecting material 26 is injected through the inlet to the space provided in the mold 60 which forms the resin-molded body 24 on the lead frame 21 and is applied a predetermined temperature and pressure to transfer-mold. The lead frame 21 near the notch parts 2la are sandwiched by the upper mold 61 and lower mold 62, so that, when the thermosetting resin 23 is transfer-molded, it is possible to prevent flip-flop of the lead frame 21 and reduce burrs in the inner bottom surface 27a of the concave part 27.

[0078]

The pin is inserted in the pin inserting part to remove the resin-molded body 24 from the upper mold 61. Preferably, the resin-molded body 24 is temporarily cured by being applied a predetermined temperature in the mold 60, then is removed from the mold 60 and is finally cured by being applied a higher temperature than temporary curing.

[0079]

Next, the light emitting element 10 is placed on the lead frame 21 of the inner bottom surface 27a of the concave part 27 formed in the resin-molded body 24 to electrically connect

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with the lead frame 21 through the wires 50. With the step of placing the light emitting element 10, the resin-molded body 24 can be placed after the resin-molded body 24 is removed from the mold 60, or the light emitting element 10 may be placed on the resin package 20 obtained by cutting and singulating the resin-molded body 24. Further, the light emitting elements may be faced down and mounted without using the wires. After the light emitting element 10 is mounted on the lead frame 21, the sealing member 30 containing the fluorescent material 40 is filled and cured in the concave part 27.

[0080]

Next, the resin-molded body 24 and lead frame 21 are cut along the notch parts 2la. The resin-molded body 24 in which a plurality of concave parts 27 are formed is cut in the longitudinal direction and lateral direction such that the sidewalls between adjacent concave parts 27 are separated in the substantially center. The cutting method uses a singulation saw, and starts singulation from the resin-molded body 24 side. By this means, in the cutting surface, the resin-molded body 24 and lead frame 21 are in the substantially same plane, and the lead frame 21 is exposed from the resin-molded body 24. By providing the notch parts 2la in this way, the lead frame 21 to be cut decreases, so that it is possible to prevent the lead frame 21 and resin-molded body 2,1 from being detached. Further, not only the upper surface of the lead frame 21, but also the side surfaces corresponding to the notch parts 2 la adhere to the resin-molded body 24, so that the adhesion strength between the lead frame 21 and resin molded body 24 is improved.

<Second Embodiment>

A light emitting device according to a second embodiment will be described. FIG. 6 is a perspective view illustrating a light emitting device according to the second embodiment. FIG. 7 is a plan view illustrating a lead frame used in the second embodiment. FIG. 8 is a

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plan view illustrating a resin molded body according to the second embodiment. Description of some configurations employing the substantially same configuration as the light emitting device according to the first embodiment will be omitted where necessary.

[0081]

With the light emitting device according to the second embodiment, the light emitting element 10 is placed in the concave part provided in the resin package 120. The corner parts of the outer upper surface 120c of the resin package 120 are formed in an arc shape. Further, the side surface of the lead 122 is formed in an arc shape seen from the upper surface, and the lead 122 is provided with a step such that the lead 122 slightly projects from the resin part 125 seen from the upper surface. Plating processing is applied to the upper surfaces, outer bottom surfaces 120a and arc-shaped curved parts of the projecting leads 122. By contrast with this, plating processing is not applied to the outer side surfaces 120b other than the arc-shaped parts of the leads 122. By increasing the parts to which plating processing is applied in this way, the bonding strength with a conductive material such as a solder increases.

(Method for Manufacturing Light Emitting Device According to Second Embodiment)

With the method for manufacturing a light emitting device according to the second embodiment, notch parts 121a and hole parts 121b are provided in the lead frame 121. Although the shapes of these hole pads 121b are preferably circular, the hole parts 121b can adopt a polygonal shape such as a square shape or hexagonal shape, or an oval shape. The positions of the hole parts 121 in the lead frame 121 are preferably provided on the extension of the notch parts 121a and near a point where the notch parts 121a cross each other. Although the hole parts 121b may adopt any sizes, the holes parts 121b are preferably wider to use for electrodes and increase the bonding strength with a conductive material. Further, it

is possible to expand the adhering area with the conductive material, and increase the bonding strength.

[0082]

Slightly larger holes than the shapes of the hole parts 121b are provided to cover the vicinity of the hole parts 121b of the lead frame 121.

[0083]

The lead frame 121 in which the notch parts 121a are provided is sandwiched by an upper mold and lower mold. In this case, the vicinity of the hole parts 121b is sandwiched by the molds. By this means, upon transfer-molding, a thermosetting resin is not poured into the hole parts 121b and the thermosetting resin in the hole parts 121b do not need to be removed.

[0084]

A thermosetting resin containing a light reflecting material is transfer-molded in the mold sandwiched by the upper mold and lower mold to form the resin-molded body 124 in the lead frame 121.

[0085]

Plating processing is applied to the exposed part of the lead frame 121 of the resin-molded body 124. Plating processing is applied to the inner bottom surface of the concave part, outer bottom surface 120a of the resin package 120, circular inner surface of the lead frame 121 and the upper surface extending therefrom.

[0086]

The resin-molded body 124 and lead frame 121 are cut along the notch parts 12la.

[0087]

By performing the above steps, it is possible to provide the light emitting device according to the second embodiment. The holes 121b are provided on the extension of the notch parts 12la, so that, when singualtion is performed using a singualtion saw, it is possible to reduce the time required for cutting the lead frame 121 because the lead frame 121 to be cut is little. According to this manufacturing method, it is possible to easily provide in a short time a light emitting device which has many plated parts in the lead frame 121.

[0088]

<Third Embodiment>

A light emitting device according to a third embodiment will be described. FIG. 9 is a perspective view illustrating the light emitting device according to the third embodiment. FIG. 10 is a plan view illustrating a lead frame used in the third embodiment. Description of some configurations employing the substantially same configuration as the light emitting device according to the first embodiment will be omitted where necessary.

[0089]

The light emitting device according to the third embodiment provides an optical reflectivity equal to or greater than 70% at the wavelength between 350 nm and 800 nm after thermal curing, and has a resin package 220 in which a resin part 225 and leads 222 are formed in the substantially same plane in an outer side surface 220b. Plating processing is applied to the bottom surface and upper surface of the leads 222, and is not applied to the outer side surfaces. The lead 222 has a predetermined thickness, and is provided with differences in level near the outer side surfaces of the resin package 220. Plating processing applied to the side surfaces which are one step deeper in the differences in level, and the

bottom surface which slightly juts outward. By providing the plate difference in the lead 222 in this way, the bonding area increases, so that it is possible to improve the bonding strength with a conductive material such as a solder. Further, it is possible to reduce the thickness of part of the lead 222 to be cut using the singualtion saw, and reduce the cutting time. Further, singulation is started from the outer upper surface of the resin package 220 using the singualtion saw, and therefore burrs extending in the direction of the outer bottom surface are likely to be produced in the cutting surface of the lead 222. In case where the cutting surfaces and outer bottom surfaces of the leads are in the same plane, although there are cases where the light emitting device is inclined due to burrs when the light emitting device is mounted, differences in level are provided in the cutting surfaces of the leads and therefore the burrs do not reach the outer bottom surface, so that the light emitting device is not inclined due to the burrs.

[0090]

In the lead 222 which is exposed from the resin package 220, the step is formed with a first surface which is exposed in the outer bottom surface 220a of the resin package 220, a second surface which is formed at a substantially right angle from the outer bottom surface 220a in an upward direction, a third surface which is formed at a substantially right angle from the second surface in the direction of the outer side surface of the resin package 220, and a fourth surface which is exposed in the outer side surface of the resin package 220. Although plating processing is applied to the first surface, second surface and third surface, plating processing is not applied to the fourth surface. The second surface and third surface can also be formed as one curved surface. When the second surface and third surface are formed as one curved surface, a solder readily expands in the step.

[0091]

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The resin package 220 forms a generally square shape in the outer upper surface 220c, and is covered by the resin part 225. A generally conic trapezoidal concave part is provided on the outer upper surface 220c side of the resin package 220.

(Method for Manufacturing Light Emitting Device According to Third Embodiment)

With the method for manufacturing a light emitting device according to the third embodiment, grooves 221c of substantially straight lines are provided in the lead frame 221 on the side corresponding to the outer bottom surface side of the light emitting device. Although the depth of these grooves 221c is preferably half the thickness of the lead frame 221, the groove 22lc may have about 114 to 4/5 of the depth. Although the width of this groove 22lc is variously changed according to, for example, the distance to an adjacent concave part or the size of the light emitting device, the groove 22lc only needs to have the depth that can be recognized as the step in the light emitting device when the center of the groove is cut.

[0092]

The lead frame 221 provided with notch parts 221a is sandwiched by the upper mold and lower mold. The notch parts 221a are sandwiched by the upper mold and lower mold and prevented from flip-flopping upon transfer-molding.

[0093]

By transfer-molding a thermosetting resin containing a light reflecting material in the mold sandwiched by the upper mold and lower mold, a resin-molded body is formed in the lead frame 221.

[0094]

Plating processing is applied to the exposed part of the lead frame 221 of the resin-molded body. Plating processing is applied to the inner bottom surface of the concave part, the outer bottom surface 220a of the lead frame 221, and grooves 221c. Plating processing of these grooves 22lc is applied to the first surface, second surface and third surface in the differences in level in the light emitting device.

[0095]

The resin ·molded body and lead frame are cut along the notch parts 22 la. Further, the resin-molded body is cut along the grooves 221c.

[0096]

By performing the above steps, it is possible to provide the light emitting device according to the third embodiment. According to this manufacturing method, it is possible to easily provide in a short time a light emitting device which has many plated parts in the lead frame 121.

[0097]

<Fourth Embodiment>

A light emitting device according to a fourth embodiment will be described. FIG. 11 is a perspective view illustrating a light emitting device according to the fourth embodiment. Description of some configurations employing the substantially same configuration as the light emitting device according to the first embodiment will be omitted where necessary.

[0098]

The light emitting device according to the fourth embodiment has differences in level which are dented in the portions of the outer side surfaces 320b, in the leads 322 of the outer side surfaces 320b of the resin package 320. In the lead 322 which is exposed from the resin package 320, the step is formed with a first surface which is provided in the outer bottom surface 320a of the resin package 320, a second surface which is formed at a substantially right angle from the outer bottom surface 320a in an upward direction, a third surface which is formed at a substantially right angle from the second surface in the direction of the outer side surface of the resin package 320, and a fourth surface of the outer side surface of the resin package 320. The outer upper surface 320c of the resin package 320 is formed in a generally rectangular shape formed with a resin part a25. Plating processing is applied to the outer bottom surface 320a, first surface, second surface provided with a step, third surface and the inner bottom surface of the concave part. By contrast with this, plating processing is not applied to the outer side surfaces 320b provided with no the step are not provided.

[0099]

An etched lead frame is used for the leads 322. In the cut surface of the resin-molded body, the etched leads 322 have a concavity and convexity. This concavity and convexity improve adhesion between the resin part and leads.

[0100]

By providing the differences in level in part of the leads 322, it is possible to expand the bonding area with a conductive material upon mounting, and increase the bonding strength. Further, a concavity is provided in the lead frame, so that it is easy to cut the lead frame and reduce the time required for cutting.

<Fifth Embodiment>

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A light emitting device according to a fifth embodiment will be described. FIG. 12 is a perspective view illustrating the light emitting device according to the fifth embodiment. Description of some configurations employing the substantially same configuration as the light emitting device according to the first embodiment will be omitted where necessary.

[0101]

The light emitting device according to the fifth embodiment has differences in level which are dented in the portions of outer side surfaces 420b, in the leads 422 of trhe outer side surfaces 420b of the resin package 420. In the lead 422 which is exposed from the resin package 420, the step is formed with a first surface which is provided in the outer bottom surface 420a of the resin package 420, a second surface which is formed at a substantially right angle from the outer bottom surface 420a in an upward direction, a third surface which is formed at a substantially right angle from the second surface in the direction of the outer side surface of the resin package 420, and a fourth surface of the resin package 420. In the outer side surface 420b of the resin package 420, the leads 422 are separated into six. The leads 422 may be separated respectively, or jointed. The leads 422 provided with notch parts are more preferable than the leads of a fglate plate shape because a bonding strength between the resin part 425 and leads 422 becomes high. The outer upper surface 420c of the resin package 420 is formed in a generally rectangular shape formed with the resin part 425. Plating processing is applied to the outer bottom surface 420a, first surface, second surface provided with trhe step, the third surface and the inner bottom surface of the concave part. By contrast with this, plating processing is not applied to the outer side surfaces 420b provided with no step.

[0102]

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By providing the differences in level in part of the leads 422, it is possible to expand a bonding area with a conductive member, and increase the bonding strength. Further, a concavity is provided in the lead frame, so that it is easy to cut the lead frame and it is possible to reduce the time required for cutting.

<Sixth Embodiment>

A resin package according to a sixth embodiment will be described. FIG. 13 is a perspective view illustrating the resin package according to the sixth embodiment. Description of some configurations employing the same configuration as the resin package according to the first embodiment and the resin package according to the fifth embodiment will be omitted where necessary.

[0103]

The resin package according to the sixth embodiment has differences in level dented in the corner parts in the leads 522 of the outer side surfaces 520b of the resin package 520. This step has an arc shape seen from the outer bottom surface 520a side in the lead 522 exposed from the resin package 520. This arc shape is obtained by dividing a circle into four. This arc shape is obtained by etching the circle to substantially half the thickness of the circle so as not to penetrate the lead 522, and then cutting the circle into four. Plating processing is applied to the parts of these arc shapes. Plating processing is applied to these arc shape parts and outer bottom surface 520a before the circle is divided into four. By contrast with this, plating processing is not applied to the outer side surfaces 520b provided with no the step. The resin package 520 forms a generally square shape seen from the outer upper surface 520c, from which the resin part 525 is exposed.

[0104]

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By providing the differences in level in the leads 522, it is possible to expand a bonding area with a conductive material, and increase the bonding strength. Further, even when burrs are produced in parts of the differences in level when the resin-molded body is cut, the burrs are provided above the outer bottom surface 520a, so that the resin-molded body does not teeter when the resin-molded body is jointed with a conductive material. Further, concavities are provided in the lead frame, so that it is easy to cut the resin frame and it is possible to reduce the time required for cutting.

<Example>

[0105]

The light emitting device according to Example 1 will be described. Overlapping description of the light emitting device described in the first embodiment will he omitted where necessary. FIG. 1 is a perspective view illustrating the light emitting device according to the first embodiment. FIG. 2 is a sectional view illustrating the light emitting device according to the first embodiment. FIG. 2 is a sectional view taken along line II- II illustrated in FIG. 1. FIG. 3 is a plan view illustrating the lead frame used in the first embodiment.

[0106]

The light emitting device 100 has the light emitting element 10, and the resin package 20 in which the resin part 25 containing the light reflecting material 26 and the leads 22 are integrally molded. The light emitting element 10 is a nitride semiconductor light emitting element which emits blue light with the light emission peak wavelength at 450 nm. The resin package 20 has a generally rectangular parallelepiped shape having a mortar-shaped concave part 27. The size of the resin package 20 is 35 mm long, 35 mm wide and 0.8 mm high, and a substantially diameter on the outer upper surface 20c side of the concave part 27 is 2,9 mm, a

substantially diameter of the inner bottom surface 27a is 2.6 mm and the depth is 0.6 mm. The thickness of the lead 22 is 0.2 mm. Titanium oxide is used for the light reflecting material 26. An epoxy resin which is a thermosetting resin is used for the resin part 25. The epoxy resin contains about 20% by weight of titanium oxide. The resin package 20 provides the optical reflectivity of 81 % at the wavelength of 450 nm after thermal curing. The resin part 25 and leads 22 are formed in the substantially same plane in the outer side surfaces 20b of the resin package 20. The leads 22 are exposed from the four corners of the resin package 20. With the leads 22, plating processing is applied to the outer bottom surface 20a of the resin package 20 and the inner bottom surface 27a of the concave part 27. By contrast with this, with the leads 22, plating processing is not applied to the outer side surfaces 20b of the resin package 20. The sealing member 30 containing the fluorescent material 40 which emits yellow light is filled in the concave part 27. $(Y,Gd)_3(Al,Ga)_5O_{12}$:Ce is used for the fluorescent material 40. A silicone resin is used for the sealing member 30.

[0107]

This light emitting device is manufactured as follows.

[0108]

The lead frame is provided with the notch parts 2la by etching. Although not illustrated, a concavity and convexity are formed in the cross-sectional surface of the notch part 21a. Ag is adhered to the lead frame by electrolytic plating. The plated lead frame 21 provided with the notch parts 21a is used.

[0109]

Next, the lead frame 21 of a predetermined size is sandwiched by the upper mole 61 and lower mold 62. The lead frame 21 has a flat plate shape, and is provided with the notch

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parts 2la matching the size of the light emitting device to be singulated. The notch parts 21a are provided in the vertical direction and horizontal direction such that, when the resin package 20 is singulated, the four corners are exposed and the parts other than the four corners are not exposed. Further, the notch parts 2 la are provided in the horizontal direction such that, when the resin package 20 is singulated, the notch parts 21a are electrically insulated, and are sandwiched by the upper mold 61 and lower mold 62.

[0110]

The thermosetting resin 23 containing the light reflecting material 26 is transfer-molded in the mold 60 sandwiched by the upper mold 61 and lower mold 62 to form the resin-molded body 24 in the lead frame 21. The thermosetting resin 23 containing the light reflecting material 26 is processed to a pellet, and heated and pressured to poured in the mold 60. At this time, the thermosetting resin 23 is also filled in the notch parts 2la. After temporarily curing the thermosetting resin 23 which has poured, the upper mold 61 is removed and the thermosetting resin 23 is further heated and finally cured. By this means, the resin-molded body 24 in which the lead frame 21 and thermosetting resin 23 are integrally molded is manufactured.

[0111]

Next, the light emitting element 10 is mounted on the leads 22 of the inner bottom surface 27a of the concave part 27 using a die bond member. After the light emitting element 10 is placed, the light emitting element 10 and the leads 22 are electrically connected using the wires 50. Next, the sealing member 30 containing the fluorescent material 40 is filled in the concave part 27.

[0112]

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Finally, the resin-molded body 24 and lead frame 21 are cut along the notch parts 2 la and singulated into individual light emitting devices 100. By this means, plating processing is not applied to the cut parts of the leads 22.

[0113]

By performing the above steps, it is possible to manufacture multiple light emitting devices 100 at one time.

[0114]

The present invention can be utilized for light equipment, a display, backlight of a mobile telephone, a movie lighting auxiliary light source and other general consumer light sources.

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1. A light emitting device comprising:

a resin package comprising a resin part and at least one metal plate; and

a light emitting element mounted on the resin package and electrically connected to the at least one metal plate,

wherein at least a portion of an outer lateral surface of the resin part and at least a portion of an outer lateral surface of the at least one metal plate are coplanar at an outer lateral surface of the resin package,

wherein the resin part is located at left and right sides of a portion of the at least one metal plate at an outer lateral surface of the resin package, and

wherein the at least one metal plate is substantially flat.

2. The light emitting device according to claim 1, wherein a metal layer made of a different material from that of the at least one metal plate is disposed on an upper surface and a lower surface of the at least one metal plate.

3. The light emitting device according to claim 2, wherein the metal layer is disposed on all surfaces of the at least one metal plate except a portion of an outer lateral surface of the at least one metal plate.

4. The light emitting device according to claim 2, wherein:

the resin part is disposed over a first portion of the metal layer on the upper surface of the at least one metal plate, and

a second portion of the metal layer on the upper surface of the at least one metal plate is exposed from the resin part.

5. The light emitting device according to claim 1, wherein the resin part contains a light reflecting material.

6. The light emitting device according to claim 5, wherein the light reflecting material is titanium dioxide.

7. The light emitting device according to claim 6, wherein the resin part contains 10 to 60% by weight of the titanium dioxide.

8. The light emitting device according to claim 1, wherein the resin part is made using a thermosetting resin.

9. The light emitting device according to claim 1, wherein the at least one metal plate has a step portion, a concave portion, and/or a convex portion.

10. The light emitting device according to claim 1, wherein the at least one metal plate has means for providing a difference in level to expand a bonding area with a conductive material upon mounting.

11. The light emitting device according to claim 1, wherein the outer lateral surface of the at least one metal plate has a notch.

12. The light emitting device according to claim 1, wherein the resin part has a concave portion having an inner bottom surface and an inner lateral surface.

13. The light emitting device according to claim 1, wherein the light emitting device further comprises a sealing member that contains two or more kinds of phosphors.

14. The light emitting device according to claim 1, wherein the at least one metal plate is exposed from the resin part at corners of the resin package.

15. The light emitting device according to claim 1, wherein at least a portion of the light emitting element is exposed from the resin part.

16. A light emitting device comprising:
a resin package comprising a resin part and at least one metal plate, and

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a light emitting element mounted on the resin package and electrically connected to the at least one metal plate,

wherein at least a portion of an outer lateral surface of the resin part and at least a portion of an outer lateral surface of the at least one metal plate are coplanar at an outer lateral surface of the resin package,

wherein the resin part is located at left and right sides of a portion of the at least one metal plate at an outer lateral surface of the resin package,

wherein the at least one metal plate comprises one or more major laterally extending upper surfaces, and

wherein all of the one or more major laterally extending upper surfaces are coplanar.

17. A light emitting device comprising:

a resin package comprising a resin part and at least one metal plate, and

a light emitting element mounted on the resin package and electrically connected to the at least one metal plate,

wherein at least a portion of an outer lateral surface of the resin part and at least a portion of an outer lateral surface of the at least one metal plate are coplanar at an outer lateral surface of the resin package,

wherein the resin part is located at left and right sides of a portion of the at least one metal plate at an outer lateral surface of the resin package, and

wherein all upper edges of the at least one metal plate are coplanar.

18. A light emitting device comprising:

a resin package comprising a resin part containing a light reflecting material, and at least one metal plate; and

a light emitting element mounted on the resin package and electrically connected to the at least one metal plate,

wherein at least a portion of an outer surface of the resin part and at least a portion of an outer surface of the at least one metal plate are coplanar at an outer surface of the resin package,

wherein at least a portion of an outer lateral surface of the resin part and at least a portion of an outer lateral surface of the at least one metal plate are coplanar at an outer lateral surface of the resin package,

wherein the resin part is located at left and right sides of a portion of the at least one metal plate at an outer lateral surface of the resin package, and

wherein a lower surface of the at least one metal plate is exposed from the resin part in a region directly under the light emitting element.

19. The light emitting device according to claim 18, wherein a metal layer made of a different material from that of the at least one metal plate is disposed on an upper surface and the lower surface of the at least one metal plate.

20. The light emitting device according to claim 19, wherein the metal layer is disposed on all surfaces of the at least one metal plate except an outer lateral surface of the at least one metal plate.

21. The light emitting device according to claim 19, wherein:

the resin part is disposed over a first portion of the metal layer on the upper surface of the at least one metal plate, and

a second portion of the metal layer on the upper surface of the at least one metal plate is exposed from the resin part.

22. The light emitting device according to claim 18, wherein the light reflecting material is titanium dioxide.

23. The light emitting device according to claim 22, wherein the resin part contains 10 to 60% by weight of the titanium dioxide.

24. The light emitting device according to claim 18, wherein the resin part is made using a thermosetting resin.

25. The light emitting device according to claim 18, wherein the at least one metal plate has a step portion, a concave portion, and/or a convex portion.

26. The light emitting device according to claim 19, wherein the at least one metal plate has means for providing a difference in level to expand a bonding area with a conductive material upon mounting.

27. The light emitting device according to claim 18, wherein the outer lateral surface of the at least one metal plate has a notch.

28. The light emitting device according to claim 18, wherein the resin part has a concave portion having an inner bottom surface and an inner lateral surface.

29. The light emitting device according to claim 18, wherein the light emitting device further comprises a sealing member that contains two or more kinds of phosphors.

30. The light emitting device according to claim 18, wherein the at least one metal plate is exposed from the resin part at corners of the resin package.

ABSTRACT

A method of manufacturing a light emitting device having a resin package which provides an optical reflectivity equal to or more than 70% at a wavelength between 350 nm and 800 nm after thermal curing, and in which a resin part and a lead are formed in a substantially same plane in an outer side surface, includes a step of sandwiching a lead frame provided with a notch part, by means of an upper mold and a lower mold, a step of transfer-molding a thermosetting resin containing a light reflecting material in a mold sandwiched by the upper mold and the lower mold to form a resin-molded body in the lead frame and a step of cutting the resin-molded body and the lead frame along the notch part.

Fig. 1

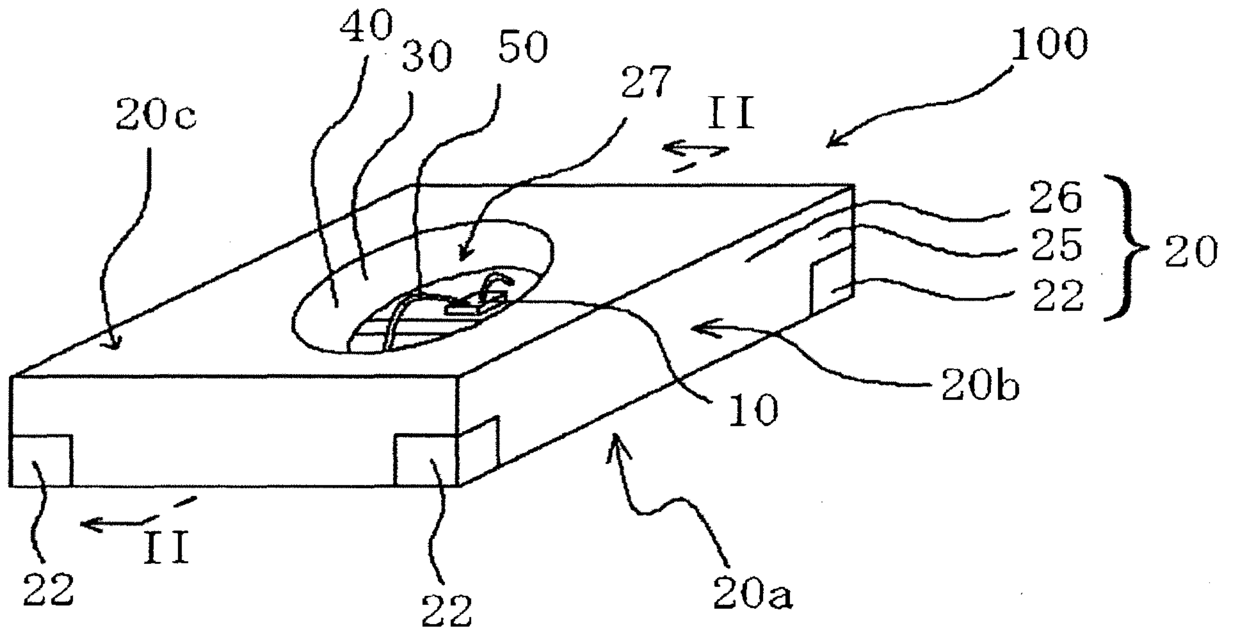


Fig. 2

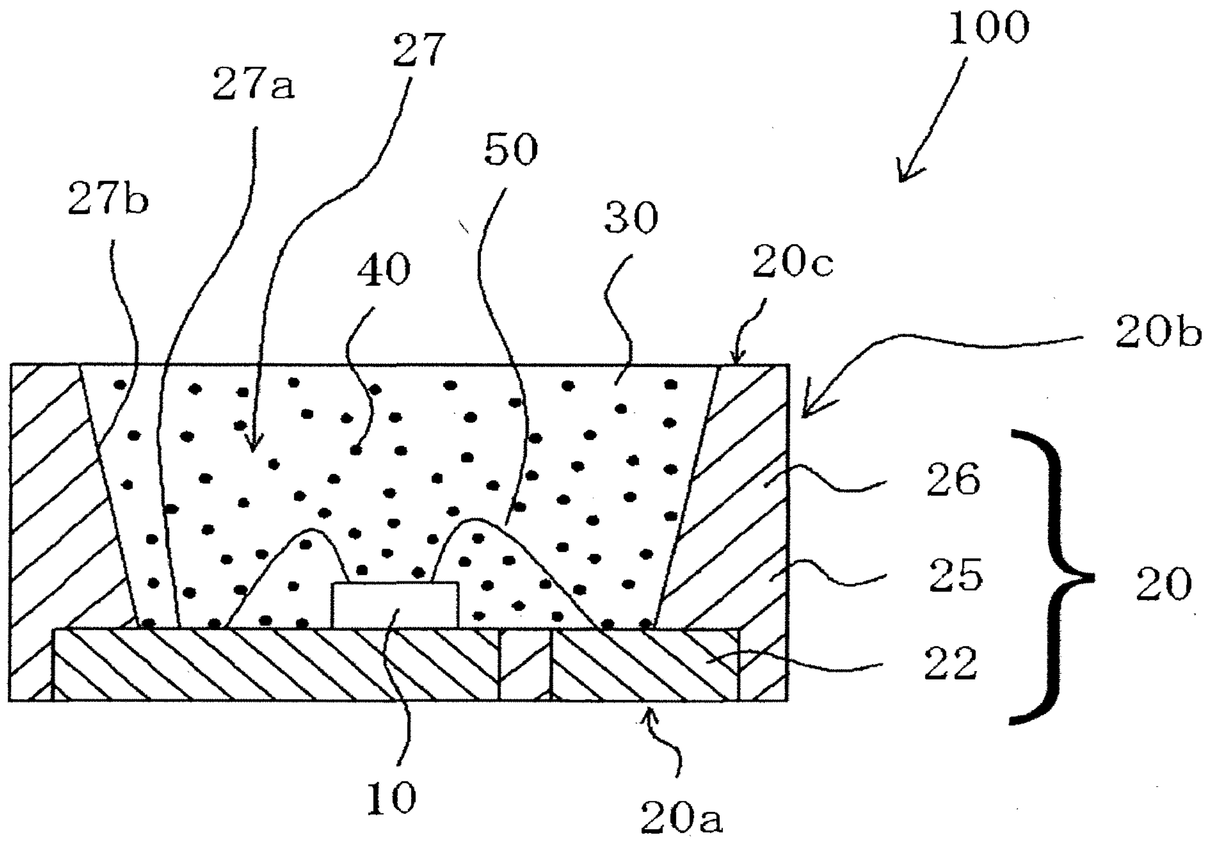


Fig. 3

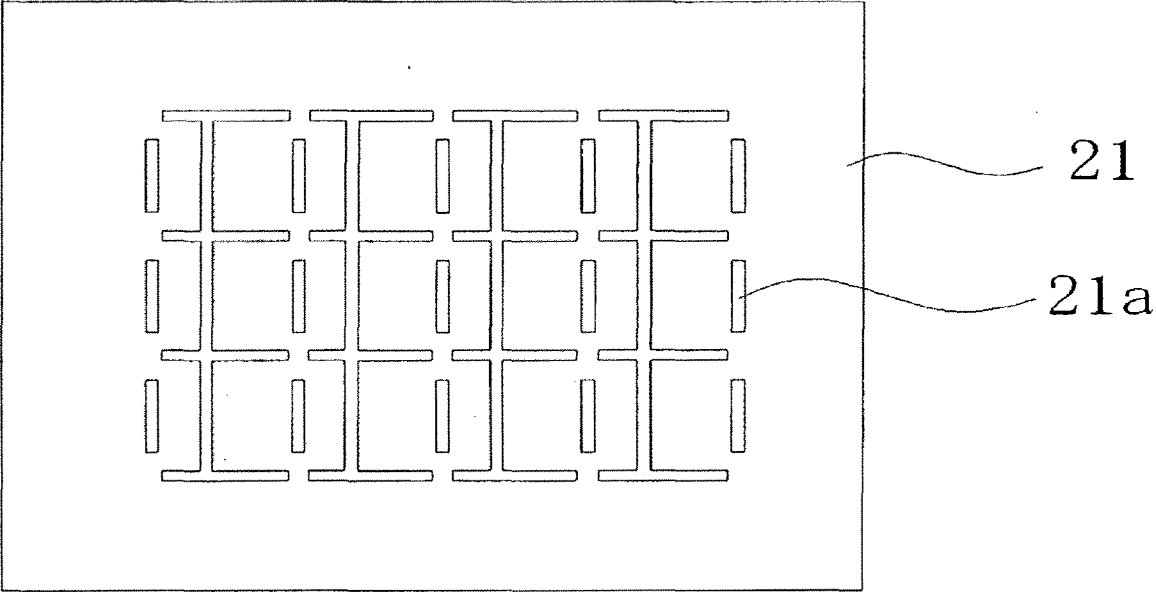


Fig. 4

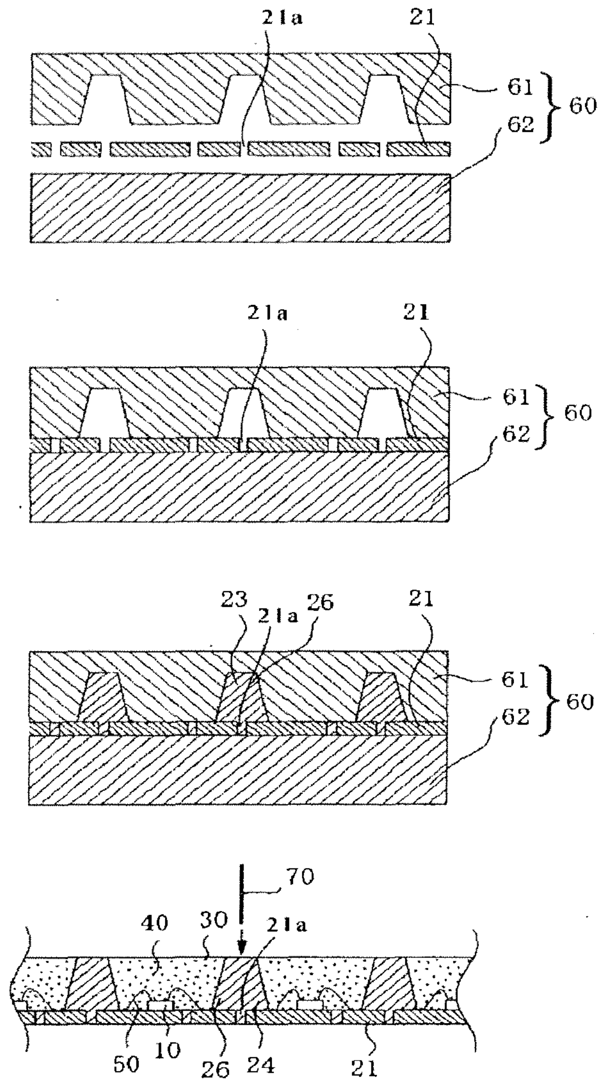


Fig. 5

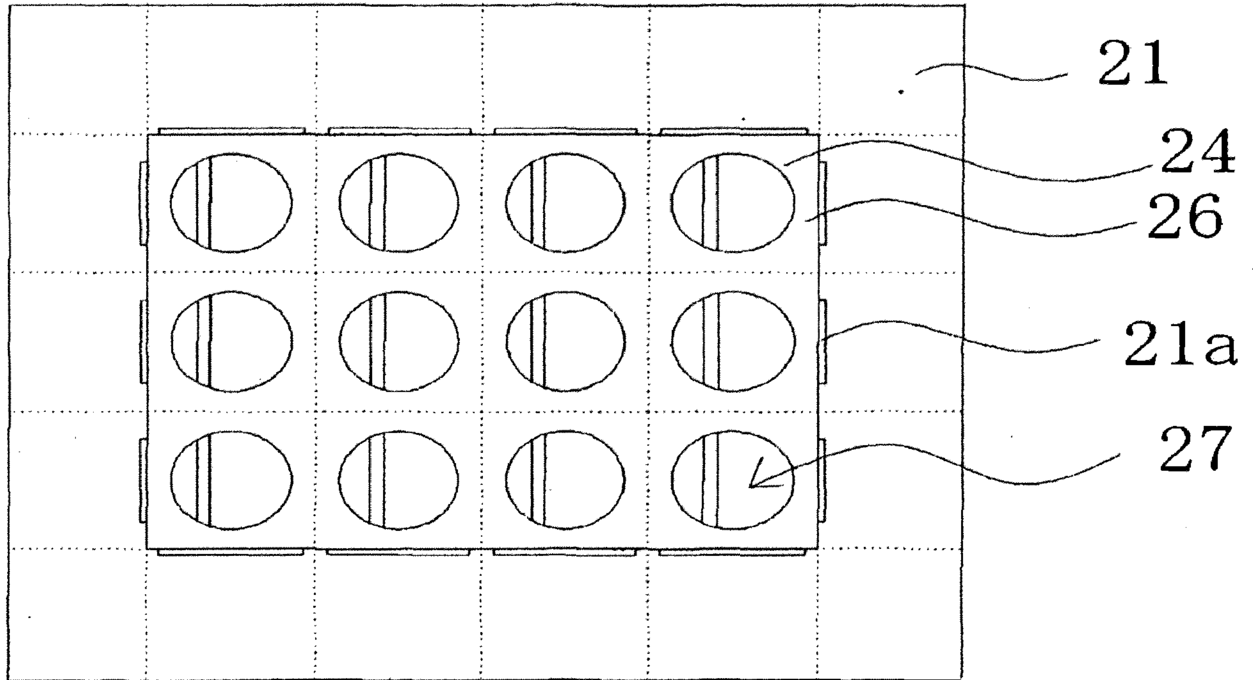


Fig. 6

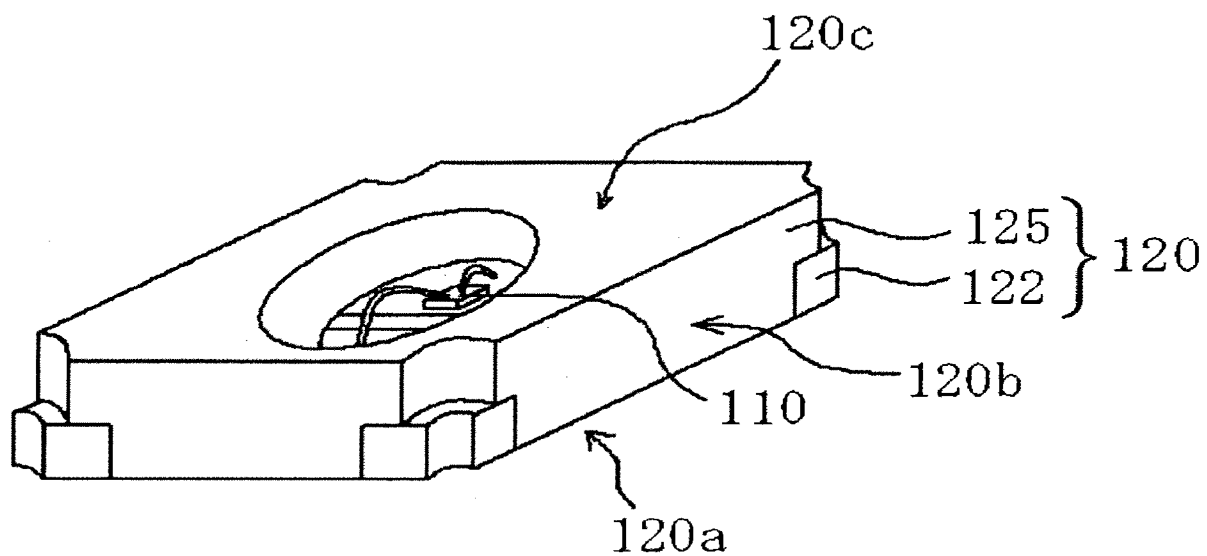


Fig. 7

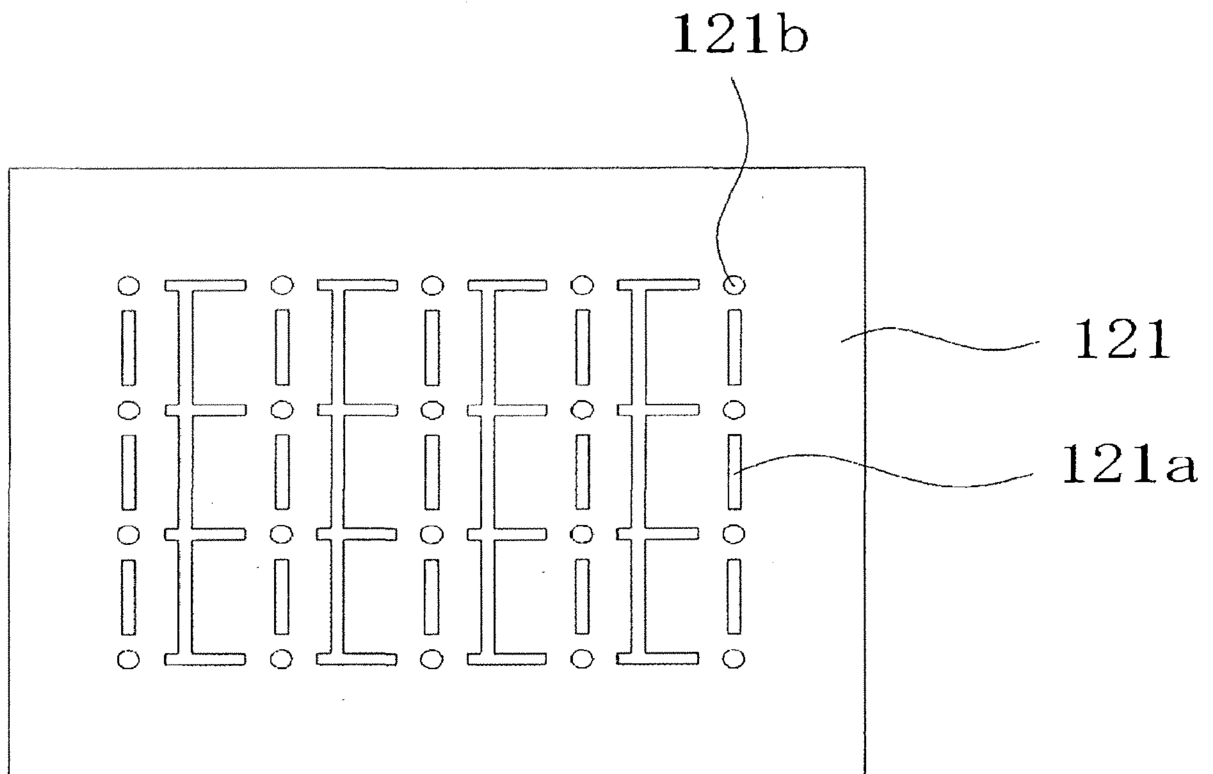


Fig. 8

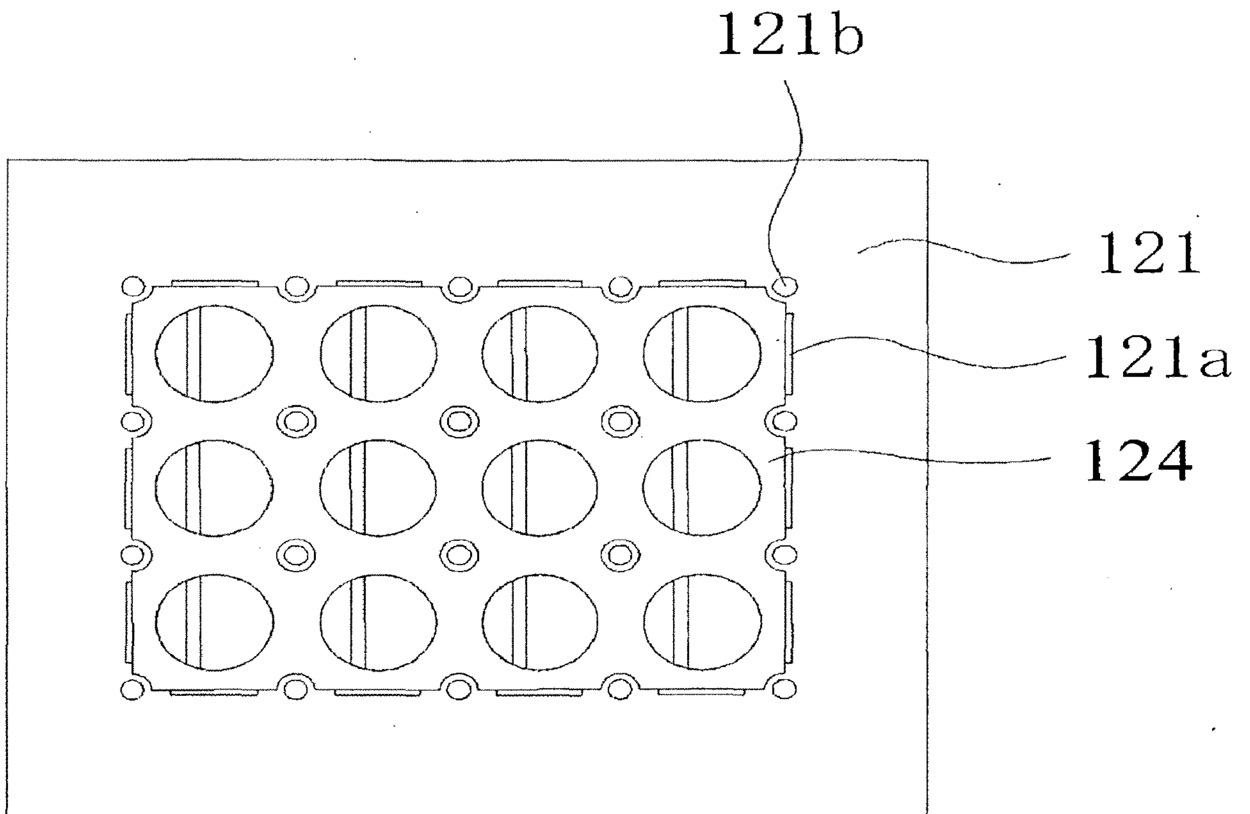


Fig. 9

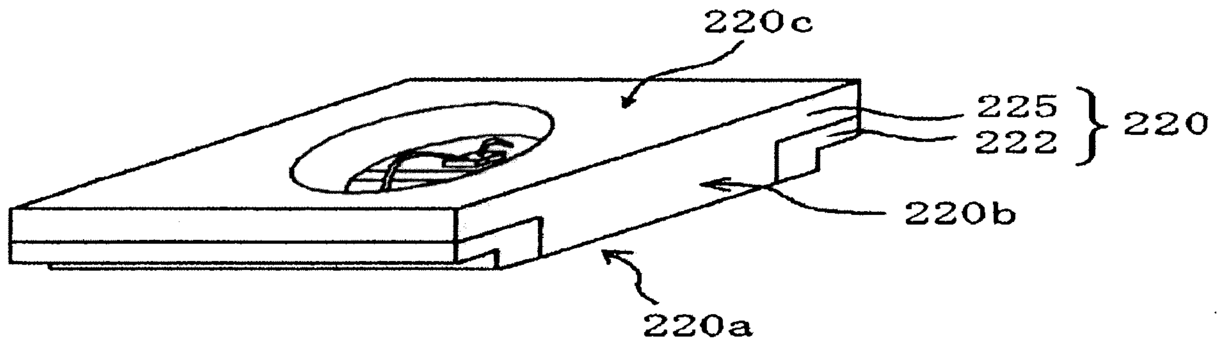


Fig. 10

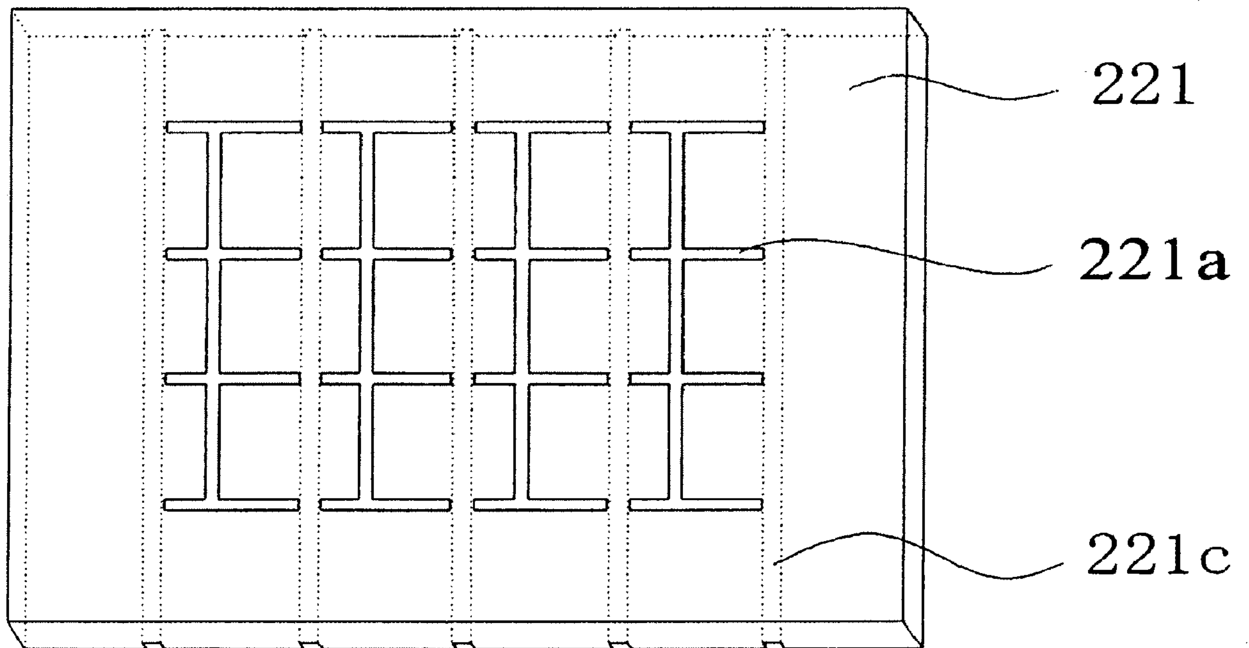


Fig. 11

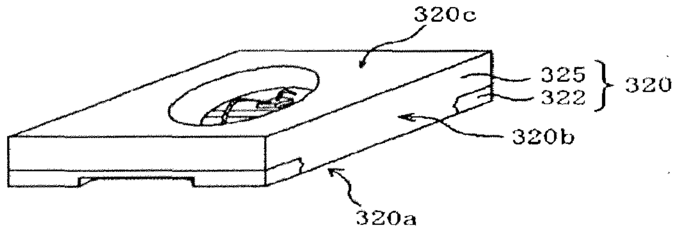


Fig. 12

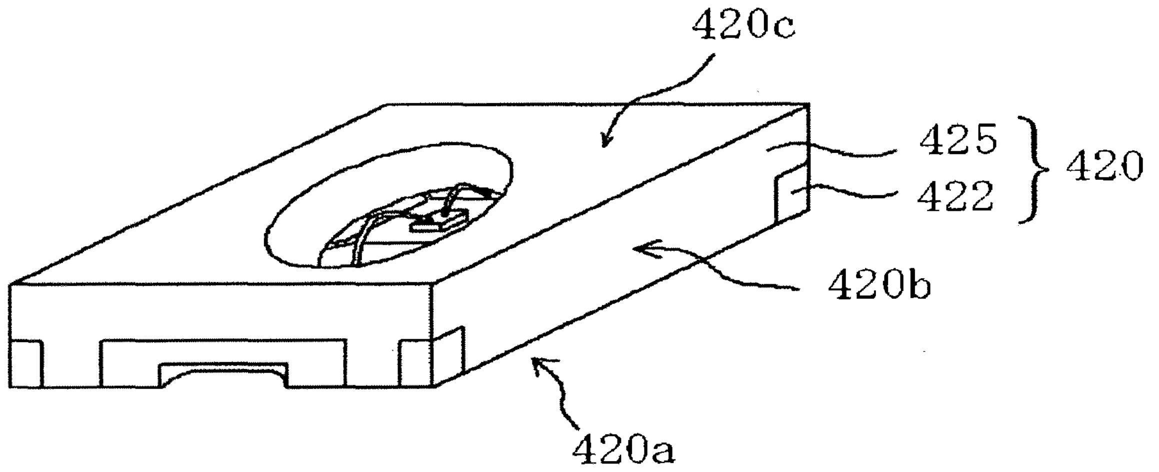


Fig. 13

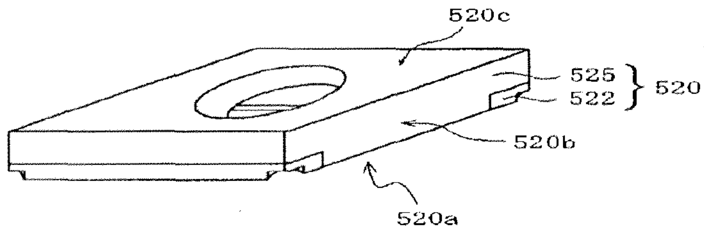


Fig. 14

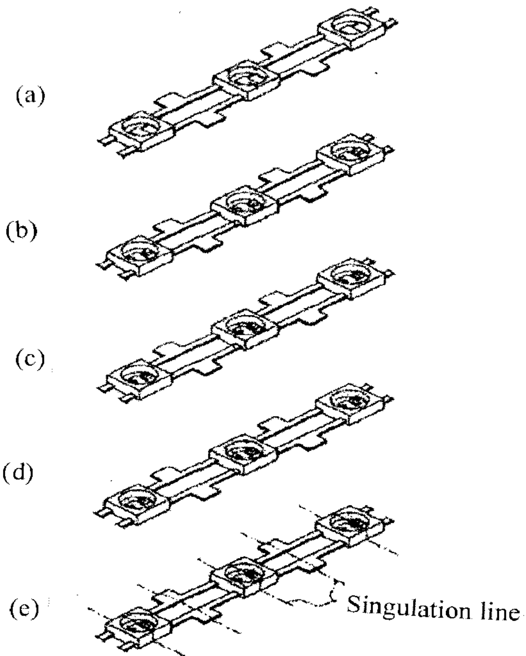


Fig. 15

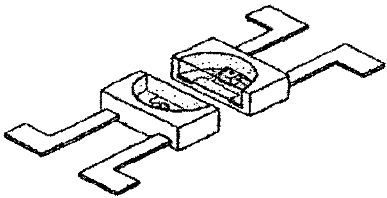


Fig. 16

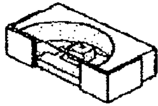


Fig. 17

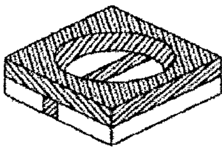
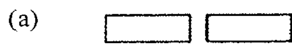
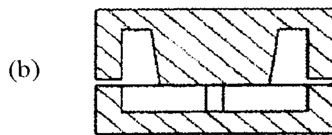


Fig. 18

(a)



(b)



(c)

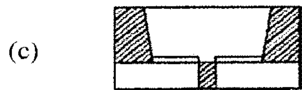
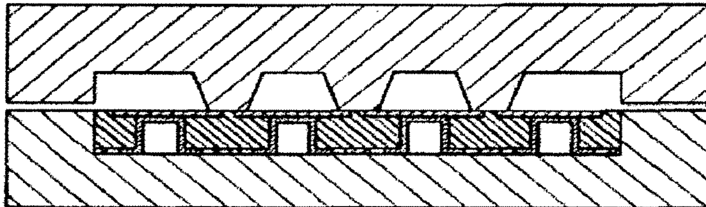


Fig. 19

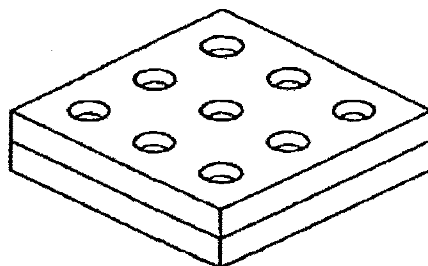
(a)

(b)



(c)

(d)



PTO/AIA/96 (08-12)
Approved for use through 01/31/2013. OMB 0651-0031
U.S. Patent and Trademark Office;U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

STATEMENT UNDER 37 CFR 3.73(c)

Applicant/Patent Owner: NICHIA CORPORATION

Application No./Patent No.: Unassigned Filed/Issue Date: 10/30/2015

Titled: LIGHT EMITTING DEVICE, RESIN PACKAGE, RESIN-MOLDED BODY, AND METHODS FOR MANUFACTURING LIGHT EMITTING DEVICE, RESIN PACKAGE AND RESIN-MOLDED BODY

NICHIA CORPORATION, a Corporation

(Name of Assignee) (Type of Assignee, e.g., corporation, partnership, university, government agency, etc.)

states that, for the patent application/patent identified above, it is (choose **one** of options 1, 2, 3 or 4 below):

1. ☑ The assignee of the entire right, title, and interest.

2. ☐ An assignee of less than the entire right, title, and interest (check applicable box):

☐ The extent (by percentage) of its ownership interest is ____________%. Additional Statement(s) by the owners holding the balance of the interest must be submitted to account for 100% of the ownership interest.

☐ There are unspecified percentages of ownership. The other parties, including inventors, who together own the entire right, title and interest are:

Additional Statement(s) by the owner(s) holding the balance of the interest must be submitted to account for the entire right, title, and interest.

3. ☐ The assignee of an undivided interest in the entirety (a complete assignment from one of the joint inventors was made). The other parties, including inventors, who together own the entire right, title, and interest are:

Additional Statement(s) by the owner(s) holding the balance of the interest must be submitted to account for the entire right, title, and interest.

4. ☐ The recipient, via a court proceeding or the like (*e.g.*, bankruptcy, probate), of an undivided interest in the entirety (a complete transfer of ownership interest was made). The certified document(s) showing the transfer is attached.

The interest identified in option 1, 2 or 3 above (not option 4) is evidenced by either (choose **one** of options A or B below):

A. ☑ An assignment from the inventor(s) of the patent application/patent identified above. The assignment was recorded in the United States Patent and Trademark Office at Reel 031028, Frame 0685, or for which a copy thereof is attached.

B. ☐ A chain of title from the inventor(s), of the patent application/patent identified above, to the current assignee as follows:

1. From: ______________________ To: ______________________

The document was recorded in the United States Patent and Trademark Office at

Reel ____________, Frame ____________, or for which a copy thereof is attached.

2. From: ______________________ To: ______________________

The document was recorded in the United States Patent and Trademark Office at

Reel ____________, Frame ____________, or for which a copy thereof is attached.

This collection of information is required by37 CFR3.73(b). The information is required toobtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentialityis governed by35 U.S.C. 122and 37 CFR1.11 and1.14. Thiscollection is estimated to take 12 minutes to complete, including gathering, preparing, and submittingthe completed application form to the USPTO.Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent tothe Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS.**SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

STATEMENT UNDER 37 CFR 3.73(c)

3. From: ________________________ To: ________________________

The document was recorded in the United States Patent and Trademark Office at

Reel ____________, Frame ____________, or for which a copy thereof is attached.

4. From: ________________________ To: ________________________

The document was recorded in the United States Patent and Trademark Office at

Reel ____________, Frame ____________, or for which a copy thereof is attached.

5. From: ________________________ To: ________________________

The document was recorded in the United States Patent and Trademark Office at

Reel ____________, Frame ____________, or for which a copy thereof is attached.

6. From: ________________________ To: ________________________

The document was recorded in the United States Patent and Trademark Office at

Reel ____________, Frame ____________, or for which a copy thereof is attached.

☐ Additional documents in the chain of title are listed on a supplemental sheet(s).

☑ As required by 37 CFR 3.73(c)(1)(i), the documentary evidence of the chain of title from the original owner to the assignee was, or concurrently is being, submitted for recordation pursuant to 37 CFR 3.11.

[NOTE: A separate copy (i.e., a true copy of the original assignment document(s)) must be submitted to Assignment Division in accordance with 37 CFR Part 3, to record the assignment in the records of the USPTO. See MPEP 302.08]

The undersigned (whose title is supplied below) is authorized to act on behalf of the assignee.

/Stephen B. Maebius/	2015-10-30
Signature	Date
Stephen B. Maebius	35,264
Printed or Typed Name	Title or Registration Number

Privacy Act Statement

The **Privacy Act of 1974 (P.L. 93-579)** requires that yoube given certain informationin connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, pleasebe advised that: (1) the general authority forthe collection of thisinformation is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and(3) the principal purpose forwhich the information isused by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent applicationor patent. If you do not furnish the requested information,the U.S. Patent and Trademark Office may not be able to process and/or examineyour submission,which may result in termination of proceedings or abandonment of the applicationor expiration of the patent.

The informationprovided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the informationin order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an InternationalApplication filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (*i.e.*, GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, arecord may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from thissystem of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

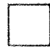
POWER OF ATTORNEY TO PROSECUTE APPLICATIONS BEFORE THE USPTO

I hereby revoke all previous powers of attorney given in the application identified in the attached statement under 37 CFR 3.73(c).

I hereby appoint:

Practitioners associated with Customer Number: 22428

OR

 Practitioner(s) named below (if more than ten patent practitioners are to be named, then a customer number must be used):

Name	Registration Number	Name	Registration Number

As attorney(s) or agent(s) to represent the undersigned before the United States Patent and Trademark Office (USPTO) in connection with any and all patent applications a ssigned only to the undersigned according to the USPTO assignment records or assignments docu ments attached to this form in accordance with 37 CFR 3.73(c).

Please change the correspondence address for the application identified in the attached statement under 37 CFR 3.73(c) to:

The address associated with Customer Number: 22428

OR

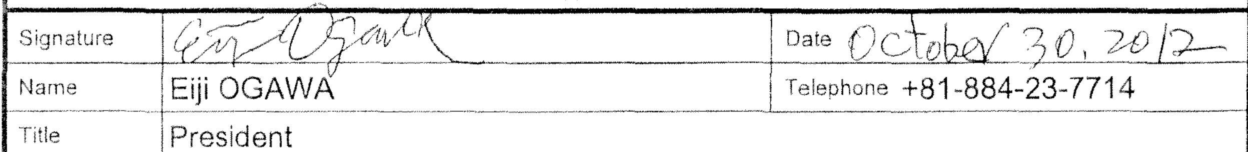
Firm or Individual Name			
Address			
City			
Country			
Telephone		Email	

Assignee Name and Address: NICHIA CORPORATION
491-100, Oka, Kaminaka-cho, Anan-shi,
Tokushima, 774-8601 Japan

A copy of this form, together with a statement under 37 CFR 3.73(c) (Form PTO/SB/96 or equivalent) is required to be Filed in each application in which this form is used. The statement under 37 CFR 3.73(c) may be completed by one of The practitioners appointed in this form, and must identify the application in which this Power of Attorney is to be filed.

SIGNATURE of Assignee of Record

The individual whose signature and title is supplied below is authorized to act on behalf of the assignee



Signature	Eiji Ogawa	Date	October 30, 2012
Name	Eiji OGAWA	Telephone	+81-884-23-7714
Title	President		

This collection of information is required by 37 CFR 1.31, 1.32 and 1.33. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 3 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

DECLARATION

As a below named inventor, I HEREBY DECLARE:

THAT my residence, post office address, and citizenship are as stated below next to my name;

THAT I believe I am the original, first, and sole inventor (if only one inventor is named below) or an original, first, and joint inventor (if plural inventors are named below or in an attached Declaration) of the subject matter which is claimed and for which a patent is sought on the invention entitled

LIGHT EMITTING DEVICE, RESIN PACKAGE, RESIN-MOLDED BODY, AND METHODS FOR MANUFACTURING LIGHT EMITTING DEVICE, RESIN PACKAGE AND RESIN-MOLDED BODY

(Attorney Docket No. 100415-0134)

the application of which (check one)

__ is attached hereto.

_X_ was filed on _August 16, 2013_ as United States Application Number or PCT International Application Number _13/969,182_ and was amended on ____ (if applicable).

THAT the above-identified application was made or authorized to be made by me.

THAT I do not know and do not believe that the same invention was ever known or used by others in the United States of America, or was patented or described in any printed publication in any country, before I (we) invented it;

THAT I do not know and do not believe that the same invention was patented or described in any printed publication in any country, or in public use or on sale in the United States of America, for more than one year prior to the filing date of this United States application;

THAT I do not know and do not believe that the same invention was first patented or made the subject of an inventor's certificate that issued in any country foreign to the United States of America before the filing date of this United States application if the foreign application was filed by me (us), or by my (our) legal representatives or assigns, more than twelve months (six months for design patents) prior to the filing date of this United States application;

THAT I have reviewed and understand the contents of the above-identified application, including the claim(s), as amended by any amendment specifically referred to above;

THAT I believe that the above-identified application contains a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the invention, and sets forth the best mode contemplated by me of carrying out the invention; and

THAT I acknowledge the duty to disclose to the U.S. Patent and Trademark Office all information known to me to be material to patentability as defined in Title 37, Code of Federal Regulations, §1.56.

I HEREBY CLAIM foreign priority benefits under Title 35, United States Code §119(a)-(d) or § 365(b) of any foreign application(s) for patent or inventor's certificate, or §365(a) of any PCT international application which designated at least one country other than the United States of America, listed below and have also identified below any foreign application for patent or inventor's certificate or of any PCT international application having a filing date before that of the application on which priority is claimed.

Prior Foreign Application Number	Country	Foreign Filing Date	Priority Claimed?	Certified Copy Attached?
2008-225408	Japan	9/3/2008	Yes	

I HEREBY CLAIM the benefit under Title 35, United States Code § 119(e) of any United States provisional application(s) listed below.

U.S. Provisional Application Number	Filing Date

I HEREBY CLAIM the benefit under Title 35, United States Code, §120 of any United States application(s), or § 365(c) of any PCT international application designating the United States of America, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT International application in the manner provided by the first paragraph of Title 35, United States Code, § 112, I acknowledge the duty to disclose information which is material to patentability as defined in Title 37, Code of Federal Regulations, § 1.56 which became available between the filing date of the prior application and the national or PCT international filing date of this application.

U.S. Parent Application Number	PCT Parent Application Number	Parent Filing Date	Parent Patent Number
12/737,940	(PCT/JP2009/004170)	5/13/2011	

I FURTHER DECLARE THAT all statements made herein of my own knowledge are true, and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment of not more than five (5) years, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

Name of first inventor	Hirofumi ICHIKAWA
Residence	Komatsushima-shi, Japan
Citizenship Country	Japan
Post Office Address	c/o NICHIA CORPORATION 491-100, Oka Kaminaka-cho, Anan-shi, Tokushima 774-8601 Japan
Inventor's signature	Hirofumi Ichikawa
Date	Apr. 11, 2014

Name of second inventor	Masaki HAYASHI
Residence	Anan-shi, Japan
Citizenship Country	Japan
Post Office Address	c/o NICHIA CORPORATION 491-100, Oka Kaminaka-cho, Anan-shi, Tokushima 774-8601 Japan
Inventor's signature	Masaki Hayashi
Date	Apr. 11, 2014

Name of third inventor	Shimpei SASAOKA
Residence	Tokushima-shi, Japan
Citizenship Country	Japan
Post Office Address	c/o NICHIA CORPORATION 491-100, Oka Kaminaka-cho, Anan-shi, Tokushima 774-8601 Japan
Inventor's signature	Shimpei Sasaoka
Date	Apr. 14, 2014

Name of fourth inventor	Tomohide MIKI
Residence	Tokushima-shi, Japan
Citizenship Country	Japan
Post Office Address	c/o NICHIA CORPORATION 491-100, Oka Kaminaka-cho, Anan-shi, Tokushima 774-8601 Japan
Inventor's signature	Tomohide Miki
Date	Apr. 14. 2014

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

First Inventor Name:	Hirofumi ICHIKAWA
Title:	LIGHT EMITTING DEVICE, RESIN PACKAGE, RESIN-MOLDED BODY, AND METHODS FOR MANUFACTURING LIGHT EMITTING DEVICE, RESIN PACKAGE AND RESIN-MOLDED BODY
Appl. No.:	Unassigned
Filing Date:	10/30/2015
Examiner:	Unassigned
Art Unit:	Unassigned
Confirmation Number:	Unassigned

INFORMATION DISCLOSURE STATEMENT
UNDER 37 CFR §1.56

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Commissioner:

Applicant submits herewith documents for the Examiner's consideration in accordance with 37 CFR §§1.56, 1.97 and 1.98.

Applicants respectfully request that each listed document be considered by the Examiner and be made of record in the present application and that an initialed copy of Form PTO/SB/08 be returned in accordance with MPEP §609.

Applicant requests that, in accordance with 37 CFR §1.98(d), the Examiner review all applications relied on for an earlier effective filing date under 35 U.S.C. 120, including application no. 12/737,940, filed 5/13/2011; application no. 13/969,182 , filed 8/16/2013, for

copies of references of record therein that are not being provided here; although Applicant would be pleased to provide copies of any such documents at the Examiner's request.

The submission of any document herewith is not an admission that such document constitutes prior art against the claims of the present application or that such document is considered material to patentability as defined in 37 CFR §1.56(b). Applicants do not waive any rights to take any action which would be appropriate to antedate or otherwise remove as a competent reference any document submitted herewith.

TIMING OF THE DISCLOSURE

The listed documents are being submitted in compliance with 37 CFR §1.97(b), within three (3) months of the filing date of the application.

Although Applicant believes that no fee is required, the Commissioner is hereby authorized to charge any additional fees which may be due to Deposit Account No. 19-0741.

Respectfully submitted,

Date October 30, 2015

By /Stephen B. Maebius/

FOLEY & LARDNER LLP
Customer Number: 22428
Telephone: (202) 672-5569
Facsimile: (202) 672-5399

Stephen B. Maebius
Attorney for Applicant
Registration No. 35,264

Substitute for form 1449/PTO				*Complete if Known*	
INFORMATION DISCLOSURE STATEMENT BY APPLICANT				**Application Number**	Unassigned
Date Submitted: October 30, 2015				**Filing Date**	10/30/2015
				First Named Inventor	Hirofumi ICHIKAWA
(use as many sheets as necessary)				Art Unit	Unassigned
				Examiner Name	Unassigned
Sheet	1	of	4	Attorney Docket Number	100415-0198

U.S. PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Document Number Number-Kind Code[2] (*if known*)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
	A1	2002/0028525-A1	03-07-2002	SAKAMOTO ET AL.	
	A2	2004/0066933-A1	04-08-2004	JEFFERY ET AL.	
	A3	2004/0159850-A1	08-19-2004	TAKENAKA, YASUJI	
	A4	2005/0151149-A1	07-14-2005	CHIA ET AL.	
	A5	2005/0280017-A1	12-22-2005	OSHIO ET AL.	
	A6	2006/0170083-A1	08-03-2006	KIM ET AL.	
	A7	2006/0284207-A1	12-21-2006	PARK ET AL.	
	A8	2007/0138697-A1	06-21-2007	TAKEDA ET AL.	
	A9	2007/0241362-A1	10-18-2007	HAN ET AL.	
	A10	2009/0050925-A1	02-26-2009	KURAMOTO ET AL.	
	A11	2009/0315049-A1	12-24-2009	URASAKI ET AL.	
	A12	2010/0038662-A1	02-18-2010	FUSHIMI ET AL.	
	A13	2010/0140638-A1	06-10-2010	KOTANI ET AL.	
	A14	2010/0155739-A1	06-24-2010	KURAMOTO ET AL.	
	A15	2010/0187546-A1	07-29-2010	FUSHIMI ET AL.	
	A16	2010/0314654-A1	12-16-2010	HAYASHI, MASAKI	
	A17	5,302,849	04-12-1994	CAVASIN DANIEL	
	A18	5,428,248	06-27-1995	CHA GI BON	
	A19	5,763,829	06-09-1998	TOMITA ET AL.	
	A20	5,818,105	10-06-1998	KOUDA TSUNENOBU	
	A21	6,107,646	08-22-2000	KIM YOUNG SIK	
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	A36	7,161,190-B2	01-09-2007	CHIKUGAWA, HIROSHI	
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Examiner Signature		Date Considered	

Substitute for form 1449/PTO				*Complete if Known*	
INFORMATION DISCLOSURE STATEMENT BY APPLICANT				**Application Number**	Unassigned
Date Submitted: October 30, 2015				**Filing Date**	10/30/2015
				First Named Inventor	Hirofumi ICHIKAWA
				Art Unit	Unassigned
(use as many sheets as necessary)				Examiner Name	Unassigned
Sheet	2	of	4	Attorney Docket Number	100415-0198

UNPUBLISHED U.S. PATENT APPLICATION DOCUMENTS

Examiner Initials*	Cite No.[1]	U.S. Patent Application Document Serial Number-Kind Code[2] (*if known*)	Filing Date of Cited Document MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear

FOREIGN PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Foreign Patent Document Country Code[3]-Number[4]-Kind Code[5] (*if known*)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Documents	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear	T[6]
	A48	JP-H08-037252	02-06-1996	NEC CORP		
	A49	JP-H11-045958	02-16-1999	KYOWA KASEI KK		
	A50	JP-H11-087780	03-30-1999	SHARP CORP		
	A51	JP-H11-163007-A	06-18-1999	SANYO ELECTRIC CO		
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	A60	JP-2003-110145-A	04-11-2003	HARVATEK CORP		
	A61	JP-2003-218398-A	07-31-2003	CITIZEN ELECTRONICS, KAWAGUCHIKO SEIMITSU CO LTD		
	A62	JP-2003-304000-A	10-24-2003	CITIZEN ELECTRONICS CO LTD ET AL.		
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	A65	WO-2006/126438-A1	11-30-2006	MURATA MANUFACTURING CO., LTD.		
	A66	JP-2006-060034-A	03-02-2006	HITACHI AIC INC		
	A67	JP-2006-093697-A	04-06-2006	TCO CO LTD		
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	A69	JP-2006-156704-A	06-15-2006	NICHIA KAGAKU KOGYO KK		
	A70	JP-2006-278427-A	10-12-2006	MATSUSHITA ELECTRIC WORKS LTD		
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	A74	JP-2007-035794-A	02-08-2007	STANLEY ELECTRIC CO LTD		
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	A78	JP-2007-297601-A	11-15-2007	HITACHI CHEMICAL CO LTD		

Examiner Signature		Date Considered	

Substitute for form 1449/PTO				*Complete if Known*	
INFORMATION DISCLOSURE STATEMENT BY APPLICANT				**Application Number**	Unassigned
				Filing Date	10/30/2015
Date Submitted: October 30, 2015				**First Named Inventor**	Hirofumi ICHIKAWA
				Art Unit	Unassigned
(use as many sheets as necessary)				Examiner Name	Unassigned
Sheet	3	of	4	Attorney Docket Number	100415-0198

FOREIGN PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Foreign Patent Document Country Code[3]-Number[4]-Kind Code[5] *(if known)*	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Documents	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear	T[6]
	A79	JP-2007-329502-A	12-20-2007	TOSHIBA CORP		
	A80	WO-2008/056813-A1	05-15-2008	C.I. KASEI COMPANY, LIMITED		
	A81	WO-2008/059856-A1	05-22-2008	HITACHI CHEMICAL CO., LTD.		
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	A85	JP-2008-130735-A	06-05-2008	C.I. KASEI CO LTD		
	A86	JP-2008-186891-A	08-14-2008	DENSO CORP		
	A87	JP-2008-192880-A	08-21-2008	NICHIA CHEM IND LTD		
	A88	JP-2013-145908-A	07-25-2013	NICHIA CHEM IND LTD		
	A89	JP-2013-153182-A	08-08-2013	NICHIA CHEM IND LTD		
	A90	EP-2 100 908-A1	09-16-2009	HITACHI CHEMICAL CO LTD [JP]		
	A91	JP-S54-069068-A	06-02-1979	HITACHI LTD		
	A92	EP-0 936 683-A1	08-18-1999	IWASAKI ELECTRIC CO LTD		

NON PATENT LITERATURE DOCUMENTS

Examiner Initials*	Cite No.[1]	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.) date, page(s), volume-issue number(s), publisher, city and/or country where published.	T[6]
	A93	EP Communication for application number 09877246.9 dated November 25, 2013 with attached Supplementary European Search Report for EP 09 81 1246 dated October 31, 2013.	
	A94	European Patent Office, Third Party Observation Concerning EP09811246.9 dated August 1, 2013.	
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	A99	Notice of Allowance issued in U.S. Serial No. 12/737,940 dated May 13, 2013.	
	A100	Office Action issued in U.S. Serial No. 13/969,182 dated 12/4/2014.	

Examiner Signature		Date Considered	

Substitute for form 1449/PTO				*Complete if Known*	
INFORMATION DISCLOSURE STATEMENT BY APPLICANT				**Application Number**	Unassigned
Date Submitted: October 30, 2015				**Filing Date**	10/30/2015
				First Named Inventor	Hirofumi ICHIKAWA
				Art Unit	Unassigned
(use as many sheets as necessary)				Examiner Name	Unassigned
Sheet	4	of	4	Attorney Docket Number	100415-0198

NON PATENT LITERATURE DOCUMENTS			
Examiner Initials*	Cite No.[1]	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.) date, page(s), volume-issue number(s), publisher, city and/or country where published.	T[6]
	A101	Office Action issued in U.S. Serial No. 13/969,182 dated 3/5/2014.	
	A102	Translation of JP2007-297601A (Yuasa et al, HITACHI CHEMICAL CO. LTD.), March 2007, 17 pages.	
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	A105	Notice of Allowance issued in U.S. Serial No. 13/969,182 dated October 30, 2015.	

Examiner Signature		Date Considered	

Electronic Patent Application Fee Transmittal

Application Number:	
Filing Date:	
Title of Invention:	LIGHT EMITTING DEVICE, RESIN PACKAGE, RESIN-MOLDED BODY, AND METHODS FOR MANUFACTURING LIGHT EMITTING DEVICE, RESIN PACKAGE AND RESIN-MOLDED BODY
First Named Inventor/Applicant Name:	Hirofumi ICHIKAWA
Filer:	Stephen Bradford Maebius/Cameron Rogers
Attorney Docket Number:	100415-0198

Filed as Large Entity

Filing Fees for **Utility under 35 USC 111(a)**

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Utility application filing	1011	1	280	280
Utility Search Fee	1111	1	600	600
Utility Examination Fee	1311	1	720	720
Pages:				
Claims:				
Claims in Excess of 20	1202	10	80	800
Independent claims in excess of 3	1201	1	420	420
Miscellaneous-Filing:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				
Miscellaneous:				
		Total in USD ($)		**2820**

Electronic Acknowledgement Receipt

EFS ID:	23947558
Application Number:	14928550
International Application Number:	
Confirmation Number:	1591
Title of Invention:	LIGHT EMITTING DEVICE, RESIN PACKAGE, RESIN-MOLDED BODY, AND METHODS FOR MANUFACTURING LIGHT EMITTING DEVICE, RESIN PACKAGE AND RESIN-MOLDED BODY
First Named Inventor/Applicant Name:	Hirofumi ICHIKAWA
Customer Number:	22428
Filer:	Stephen Bradford Maebius/Cameron Rogers
Filer Authorized By:	Stephen Bradford Maebius
Attorney Docket Number:	100415-0198
Receipt Date:	30-OCT-2015
Filing Date:	
Time Stamp:	16:42:04
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Credit Card
Payment was successfully received in RAM	$2820
RAM confirmation Number	3735
Deposit Account	
Authorized User	

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Transmittal of New Application	100415-0198_AppTransmittal.pdf	95767 c2f8db9759d7a6a0fa0abaed7d3088caa335a800	no	4
Warnings:					
Information:					
2	Application Data Sheet	100415-0198_ADS.pdf	1818934 2389513e72d1d8594304cab8c6bab2e2f5cafba2	no	8
Warnings:					
Information:					
3	Preliminary Amendment	100415-0198_Prelim.pdf	102177 d1626c229e116d889b6257b176750a5dc6ee1892	no	3
Warnings:					
Information:					
4		100415-0198_SpecClaimsAbstract.pdf	1615497 ced145045fd4bfe72f91e5cbc77d7a0e90656159	yes	48

Multipart Description/PDF files in .zip description

Document Description	Start	End
Specification	1	42
Claims	43	47
Abstract	48	48

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
Warnings:					
Information:					
5	Drawings-only black and white line drawings	100415-0198_Drawings.pdf	406686 bb57ecf2abcc48c28306c5255c641f96768e70c7	no	13
Warnings:					
Information:					
6	Assignee showing of ownership per 37 CFR 3.73	100415-0198_373c.pdf	129841 404130e456ee1f55044b21305cb5d40912e68ddc	no	3

Warnings:					
Information:					
7	Power of Attorney	POA.pdf	87719 83a623571dcfc425c4802aae92e382c19744 2253	no	1
Warnings:					
Information:					
8	Oath or Declaration filed	Declaration.pdf	197086 f0ee544765329b03e5b0d4ef77aa2c76a908 e860	no	4
Warnings:					
Information:					
9	Transmittal Letter	100415-0198_IDStransmittal. pdf	100842 3bfbee1cd7c3941c8982fa28dc0a7e0a9593 69d3	no	2
Warnings:					
Information:					
10	Information Disclosure Statement (IDS) Form (SB08)	100415-0198_SB08.pdf	108872 b433dff944a1de3394955bb69bc9fb1b076 251f8	no	4
Warnings:					
Information:					
This is not an USPTO supplied IDS fillable form					
11	Fee Worksheet (SB06)	fee-info.pdf	38794 98f3a9ff688414c525c3c556360830ee0c27a 717	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	4702215		

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New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

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APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY.DOCKET.NO	TOT CLAIMS	IND CLAIMS
14/928,550	10/30/2015	2811	2820	100415-0198	30	4

CONFIRMATION NO. 1591

FILING RECEIPT

22428
Foley & Lardner LLP
3000 K STREET N.W.
SUITE 600
WASHINGTON, DC 20007-5109

Date Mailed: 11/16/2015

Receipt is acknowledged of this non-provisional patent application. The application will be taken up for examination in due course. Applicant will be notified as to the results of the examination. Any correspondence concerning the application must include the following identification information: the U.S. APPLICATION NUMBER, FILING DATE, NAME OF APPLICANT, and TITLE OF INVENTION. Fees transmitted by check or draft are subject to collection. Please verify the accuracy of the data presented on this receipt. **If an error is noted on this Filing Receipt, please submit a written request for a Filing Receipt Correction. Please provide a copy of this Filing Receipt with the changes noted thereon. If you received a "Notice to File Missing Parts" for this application, please submit any corrections to this Filing Receipt with your reply to the Notice. When the USPTO processes the reply to the Notice, the USPTO will generate another Filing Receipt incorporating the requested corrections**

Inventor(s)

Hirofumi ICHIKAWA, Komatsushima-shi, JAPAN;
Masaki HAYASHI, Anan-shi, JAPAN;
Shimpei SASAOKA, Tokushima-shi, JAPAN;
Tomohide MIKI, Tokushima-shi, JAPAN;

Applicant(s)

NICHIA CORPORATION, Anan-shi, JAPAN;

Assignment For Published Patent Application

NICHIA CORPORATION, Anan-shi, JAPAN

Power of Attorney: The patent practitioners associated with Customer Number 22428

Domestic Priority data as claimed by applicant

This application is a CON of 13/969,182 08/16/2013
which is a CON of 12/737,940 05/13/2011 PAT 8530250
which is a 371 of PCT/JP2009/004170 08/27/2009

Foreign Applications (You may be eligible to benefit from the **Patent Prosecution Highway** program at the USPTO. Please see http://www.uspto.gov for more information.)
JAPAN 2008-225408 09/03/2008

Permission to Access - A proper **Authorization to Permit Access to Application by Participating Offices** (PTO/SB/39 or its equivalent) has been received by the USPTO.

Request to Retrieve - This application either claims priority to one or more applications filed in an intellectual property Office that participates in the Priority Document Exchange (PDX) program or contains a proper **Request to Retrieve Electronic Priority Application(s)** (PTO/SB/38 or its equivalent). Consequently, the USPTO will attempt to electronically retrieve these priority documents.

If Required, Foreign Filing License Granted: 11/10/2015
The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 14/928,550**
Projected Publication Date: 02/25/2016
Non-Publication Request: No
Early Publication Request: No
Title

LIGHT EMITTING DEVICE, RESIN PACKAGE, RESIN-MOLDED BODY, AND METHODS FOR MANUFACTURING LIGHT EMITTING DEVICE, RESIN PACKAGE AND RESIN-MOLDED BODY

Preliminary Class

257

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications: No

PROTECTING YOUR INVENTION OUTSIDE THE UNITED STATES

Since the rights granted by a U.S. patent extend only throughout the territory of the United States and have no effect in a foreign country, an inventor who wishes patent protection in another country must apply for a patent in a specific country or in regional patent offices. Applicants may wish to consider the filing of an international application under the Patent Cooperation Treaty (PCT). An international (PCT) application generally has the same effect as a regular national patent application in each PCT-member country. The PCT process **simplifies** the filing of patent applications on the same invention in member countries, but **does not result** in a grant of "an international patent" and does not eliminate the need of applicants to file additional documents and fees in countries where patent protection is desired.

Almost every country has its own patent law, and a person desiring a patent in a particular country must make an application for patent in that country in accordance with its particular laws. Since the laws of many countries differ in various respects from the patent law of the United States, applicants are advised to seek guidance from specific foreign countries to ensure that patent rights are not lost prematurely.

Applicants also are advised that in the case of inventions made in the United States, the Director of the USPTO must issue a license before applicants can apply for a patent in a foreign country. The filing of a U.S. patent application serves as a request for a foreign filing license. The application's filing receipt contains further information and guidance as to the status of applicant's license for foreign filing.

Applicants may wish to consult the USPTO booklet, "General Information Concerning Patents" (specifically, the section entitled "Treaties and Foreign Patents") for more information on timeframes and deadlines for filing foreign patent applications. The guide is available either by contacting the USPTO Contact Center at 800-786-9199, or it can be viewed on the USPTO website at http://www.uspto.gov/web/offices/pac/doc/general/index.html.

For information on preventing theft of your intellectual property (patents, trademarks and copyrights), you may wish to consult the U.S. Government website, http://www.stopfakes.gov. Part of a Department of Commerce initiative, this website includes self-help "toolkits" giving innovators guidance on how to protect intellectual property in specific

countries such as China, Korea and Mexico. For questions regarding patent enforcement issues, applicants may call the U.S. Government hotline at 1-866-999-HALT (1-866-999-4258).

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Title 35, United States Code, Section 184

Title 37, Code of Federal Regulations, 5.11 & 5.15

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This license is to be retained by the licensee and may be used at any time on or after the effective date thereof unless it is revoked. This license is automatically transferred to any related applications(s) filed under 37 CFR 1.53(d). This license is not retroactive.

The grant of a license does not in any way lessen the responsibility of a licensee for the security of the subject matter as imposed by any Government contract or the provisions of existing laws relating to espionage and the national security or the export of technical data. Licensees should apprise themselves of current regulations especially with respect to certain countries, of other agencies, particularly the Office of Defense Trade Controls, Department of State (with respect to Arms, Munitions and Implements of War (22 CFR 121-128)); the Bureau of Industry and Security, Department of Commerce (15 CFR parts 730-774); the Office of Foreign AssetsControl, Department of Treasury (31 CFR Parts 500+) and the Department of Energy.

NOT GRANTED

No license under 35 U.S.C. 184 has been granted at this time, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" DOES NOT appear on this form. Applicant may still petition for a license under 37 CFR 5.12, if a license is desired before the expiration of 6 months from the filing date of the application. If 6 months has lapsed from the filing date of this application and the licensee has not received any indication of a secrecy order under 35 U.S.C. 181, the licensee may foreign file the application pursuant to 37 CFR 5.15(b).

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technology, manufacture products, deliver services, and grow your business, visit http://www.SelectUSA.gov or call +1-202-482-6800.

PATENT APPLICATION FEE DETERMINATION RECORD

Substitute for Form PTO-875

Application or Docket Number
14/928,550

APPLICATION AS FILED - PART I

FOR	NUMBER FILED (Column 1)	NUMBER EXTRA (Column 2)	SMALL ENTITY RATE($)	SMALL ENTITY FEE($)	OR	OTHER THAN SMALL ENTITY RATE($)	OTHER THAN SMALL ENTITY FEE($)
BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A			N/A	280
SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A			N/A	600
EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A			N/A	720
TOTAL CLAIMS (37 CFR 1.16(i))	30 minus 20 =	* 10			OR	x 80 =	800
INDEPENDENT CLAIMS (37 CFR 1.16(h))	4 minus 3 =	* 1				x 420 =	420
APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $310 ($155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).						0.00
MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))							0.00
			TOTAL			TOTAL	2820

* If the difference in column 1 is less than zero, enter "0" in column 2.

APPLICATION AS AMENDED - PART II

AMENDMENT A

	CLAIMS REMAINING AFTER AMENDMENT (Column 1)		HIGHEST NUMBER PREVIOUSLY PAID FOR (Column 2)	PRESENT EXTRA (Column 3)	SMALL ENTITY RATE($)	SMALL ENTITY ADDITIONAL FEE($)	OR	OTHER THAN SMALL ENTITY RATE($)	OTHER THAN SMALL ENTITY ADDITIONAL FEE($)
Total (37 CFR 1.16(i))	*	Minus	**	=	x =		OR	x =	
Independent (37 CFR 1.16(h))	*	Minus	***	=	x =		OR	x =	
Application Size Fee (37 CFR 1.16(s))									
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
					TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

AMENDMENT B

	CLAIMS REMAINING AFTER AMENDMENT (Column 1)		HIGHEST NUMBER PREVIOUSLY PAID FOR (Column 2)	PRESENT EXTRA (Column 3)	RATE($)	ADDITIONAL FEE($)	OR	RATE($)	ADDITIONAL FEE($)
Total (37 CFR 1.16(i))	*	Minus	**	=	x =		OR	x =	
Independent (37 CFR 1.16(h))	*	Minus	***	=	x =		OR	x =	
Application Size Fee (37 CFR 1.16(s))									
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
					TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".
The "Highest Number Previously Paid For" (Total or Independent) is the highest found in the appropriate box in column 1.

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This is to certify that the annexed is a true copy of the following application as filed with this Office.

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パリ条約による外国への出願に用いる優先権の主張の基礎となる出願の国コードと出願番号
The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is 　ＪＰ２００８－２２５４０８

出願人
Applicant(s): 　日亜化学工業株式会社

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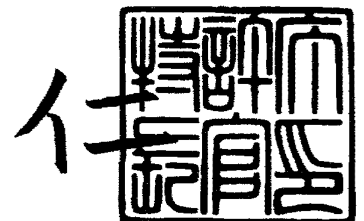

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【物件名】　要約書　1

【書類名】特許請求の範囲
【請求項１】
　熱硬化後の、波長３５０ｎｍ～８００ｎｍにおける光反射率が７０％以上であり、外側面において樹脂部とリードとが略同一面に形成されている樹脂パッケージを有する発光装置の製造方法であって、
　切り欠き部を設けたリードフレームを上金型と下金型とで挟み込む工程と、
　上金型と下金型とで挟み込まれた金型内に、光反射性物質が含有される熱硬化性樹脂をトランスファ・モールドして、リードフレームに樹脂成形体を形成する工程と、
　切り欠き部に沿って樹脂成形体とリードフレームとを切断する工程と、
を有する発光装置の製造方法。
【請求項２】
　上金型と下金型とで挟み込む前に、リードフレームにメッキ処理を施す請求項１に記載の発光装置の製造方法。
【請求項３】
　リードフレームは、切断部分における切り欠き部が全包囲周の約１／２以上である請求項１又は２のいずれかに記載の発光装置の製造方法。
【請求項４】
　上金型と下金型とで挟み込まれる前のリードフレームは、孔部が設けられている請求項１乃至３のいずれか一項に記載の発光装置の製造方法。
【請求項５】
　上金型と下金型とで挟み込まれる前のリードフレームは、溝が設けられている請求項１乃至４のいずれか一項に記載の発光装置の製造方法。
【請求項６】
　上金型と下金型とは、発光素子が載置される部分、若しくは、孔部の近傍の部分のリードフレームを挟み込んでいる請求項１乃至５のいずれか一項に記載の発光装置の製造方法。
【請求項７】
　熱硬化後の、波長３５０ｎｍ～８００ｎｍにおける光反射率が７０％以上であり、外側面において樹脂部とリードとが略同一面に形成されている樹脂パッケージを有する発光装置であって、
　リードは底面及び上面の少なくともいずれか一面にメッキ処理が施されており、かつ、外側面はメッキ処理が施されていない部分を有する発光装置。
【請求項８】
　樹脂パッケージは、四隅からリードが露出されている請求項７に記載の発光装置。
【請求項９】
　樹脂パッケージは、底面側から視認して四隅が弧状に形成されている請求項７又は８のいずれかに記載の発光装置。
【請求項１０】
　リードは、外側面及び外底面より凹んだ段差が設けられている請求項７乃至９のいずれか一項に記載の発光装置。
【請求項１１】
　熱硬化後の、波長３５０ｎｍ～８００ｎｍにおける光反射率が７０％以上であり、外側面において樹脂部とリードとが略同一面に形成されている樹脂パッケージの製造方法であって、
　切り欠き部を設けたリードフレームを上金型と下金型とで挟み込む工程と、
　上金型と下金型とで挟み込まれた金型内に、光反射性物質が含有される熱硬化性樹脂をトランスファ・モールドして、リードフレームに樹脂成形体を形成する工程と、
　切り欠き部に沿って樹脂成形体とリードフレームとを切断する工程と、
を有する樹脂パッケージの製造方法。
【請求項１２】

上金型と下金型とで挟み込む前に、リードフレームにメッキ処理を施す請求項１１に記載の樹脂パッケージの製造方法。
【請求項１３】
熱硬化後の、波長３５０ｎｍ～８００ｎｍにおける光反射率が７０％以上であり、外側面において樹脂部とリードとが略同一面に形成されている樹脂パッケージであって、
リードは底面及び上面の少なくともいずれか一面にメッキ処理が施されており、かつ、外側面はメッキ処理が施されていない樹脂パッケージ。
【請求項１４】
熱硬化後の、波長３５０ｎｍ～８００ｎｍにおける光反射率が７０％以上であり、凹部が複数形成され、該凹部の内底面は、リードフレームの一部が露出されている、樹脂成形体の製造方法であって、
切り欠き部を設けたリードフレームを用い、樹脂成形体において隣り合う凹部が成形される位置に凸部を有する上金型と下金型とでリードフレームを挟み込む工程と、
上金型と下金型とで挟み込まれた金型内に、光反射性物質が含有される熱硬化性樹脂をトランスファ・モールドして、切り欠き部に熱硬化性樹脂を充填させ、かつ、リードフレームに樹脂成形体を形成する工程と、
を有する樹脂成形体の製造方法。
【請求項１５】
熱硬化後の、波長３５０ｎｍ～８００ｎｍにおける光反射率が７０％以上であり、凹部が複数形成され、該凹部の内底面は、リードフレームの一部が露出されている、樹脂成形体であって、
リードフレームは切り欠き部を有しており、該切り欠き部に樹脂成形体となる熱硬化性樹脂が充填されており、隣り合う凹部の間に側壁を有している樹脂成形体。

【書類名】明細書
【発明の名称】発光装置、樹脂パッケージ、樹脂成形体並びにこれらの製造方法
【技術分野】
【０００１】
本発明は、照明器具、ディスプレイ、携帯電話のバックライト、動画照明補助光源、その他の一般的民生用光源などに用いられる発光装置及び発光装置の製造方法などに関する。
【背景技術】
【０００２】
発光素子を用いた発光装置は、小型で電力効率が良く鮮やかな色の発光をする。また、この発光素子は半導体素子であるため球切れなどの心配がない。さらに初期駆動特性が優れ、振動やオン・オフ点灯の繰り返しに強いという特徴を有する。このような優れた特性を有するため、発光ダイオード（ＬＥＤ）、レーザーダイオード（ＬＤ）などの発光素子を用いる発光装置は、各種の光源として利用されている。
【０００３】
図１４は、従来の発光装置の製造方法を示す斜視図である。図１５は、従来の発光装置の中間体を示す斜視図である。図１６は、従来の発光装置を示す斜視図である。
【０００４】
従来、発光装置を製造する方法として、リードフレームを非透光性で光反射性を有する白色樹脂でインサート成形し、リードフレームを介して所定の間隔で凹部形状のカップを有する樹脂成形体を成形する方法が開示されている（例えば、特許文献１参照）。ここでは白色樹脂の材質が明示されていないが、インサート成形することや図面から、一般的な熱可塑性樹脂が用いられる。一般的な熱可塑性樹脂として、例えば、液晶ポリマー、ＰＰＳ（ポリフェニレンサルファイド）、ナイロン等の熱可塑性樹脂を遮光性の樹脂成形体として用いられることが多い（例えば、特許文献２参照）。
【０００５】
しかしながら、熱可塑性樹脂はリードフレームとの密着性に乏しく、樹脂部とリードフレームとの剥離を生じやすい。また、熱硬化性樹脂は樹脂の流動性が低いため複雑な形状の樹脂成形体を成形するには不適切であり、耐光性にも乏しい。特に近年の発光素子の出力向上はめざましく、発光素子の高出力化が図られるにつれ、熱可塑性樹脂からなるパッケージの光劣化は顕著となってきている。
【０００６】
これらの問題点を解決するため、樹脂成形体の材料に熱硬化性樹脂を用いる発光装置が開示されている（例えば、特許文献３参照）。図１７は、従来の発光装置を示す斜視図及び断面図である。図１８は、従来の発光装置の製造方法を示す概略断面図である。この発光装置は、金属箔から打ち抜きやエッチング等の公知の方法により金属配線を形成し、ついで、金属配線を所定形状の金型に配置し、金型の樹脂注入口から熱硬化性樹脂を注入し、トランスファ・モールドすることが開示されている。
【０００７】
しかし、この製造方法は、短時間に多数個の発光装置を製造することが困難である。また、発光装置１個に対して廃棄されるランナー部分の樹脂が大量になるという問題がある。
【０００８】
異なる発光装置及びその製造方法として、配線基板状に光反射用熱硬化性樹脂組成物層を有する光半導体素子搭載用パッケージ基板及びその製造方法が開示されている（例えば、特許文献４参照）。図１９は、従来の発光装置の製造工程を示す概略図である。この光半導体素子搭載用パッケージ基板は、平板状のプリント配線板を金型に取り付け、光反射用熱硬化性樹脂組成物を注入し、トランスファー成型機により加熱加圧成型し、複数の凹部を有する、マトリックス状の光半導体素子搭載用パッケージ基板を作製している。また、プリント配線板の代わりにリードフレームを用いることも記載されている。

【０００９】
しかし、これらの配線板及びリードフレームは平板状であり、平板状の上に熱硬化性樹脂組成物が配置されており、密着面積が小さいため、ダイシングする際にリードフレーム等と熱硬化性樹脂組成物とが剥離し易いという問題がある。
【００１０】
【特許文献１】特開２００７－３５７９４号公報（特に〔００３３〕）
【特許文献２】特開平１１－０８７７８０号公報
【特許文献３】特開２００６－１４０２０７号公報（特に、〔００２８〕）
【特許文献４】特開２００７－２３５０８５号公報
【発明の開示】
【発明が解決しようとする課題】
【００１１】
本発明は上述した問題に鑑みて、リードフレームと熱硬化性樹脂組成物との密着性が高く、短時間に多数個の発光装置を製造する簡易かつ安価な方法を提供することを目的とする。
【課題を解決するための手段】
【００１２】
そこで本発明は、鋭意検討した結果、本発明を完成するに到った。
【００１３】
本明細書において、個片化された後の発光装置には、リード、樹脂部、樹脂パッケージなる用語を用い、個片化される前の段階では、リードフレーム、樹脂成形体なる用語を用いる。
【００１４】
本発明は、熱硬化後の、波長３５０ｎｍ～８００ｎｍにおける光反射率が７０％以上であり、外側面において樹脂部とリードとが略同一面に形成されている樹脂パッケージを有する発光装置の製造方法であって、切り欠き部を設けたリードフレームを上金型と下金型とで挟み込む工程と、上金型と下金型とで挟み込まれた金型内に、光反射性物質が含有される熱硬化性樹脂をトランスファ・モールドして、リードフレームに樹脂成形体を形成する工程と、切り欠き部に沿って樹脂成形体とリードフレームとを切断する工程と、を有する発光装置の製造方法に関する。かかる構成によれば、切り欠き部に熱硬化性樹脂が充填されるため、リードフレームと熱硬化性樹脂との密着面積が大きくなり、リードフレームと熱硬化性樹脂との密着性を向上することができる。また、熱可塑性樹脂よりも粘度が低い熱硬化性樹脂を用いるため、空隙が残ることなく、切り欠き部に熱硬化性樹脂を充填することができる。また、一度に多数個の発光装置を得ることができ、生産効率の大幅な向上を図ることができる。さらに、廃棄されるランナーを低減することができ、安価な発光装置を提供することができる。
【００１５】
上金型と下金型とで挟み込む前に、リードフレームにメッキ処理を施すことが好ましい。このとき、製造された発光装置には切断された面にメッキ処理が施されておらず、それ以外の部分にはメッキ処理が施されている。個片化された発光装置毎にメッキ処理を施す必要がなくなり、製造方法を簡略化することができる。
【００１６】
リードフレームは、切断部分における切り欠き部が全包囲周の約１／２以上であることが好ましい。これによりリードフレームを軽量化でき、安価な発光装置を提供することができる。また、リードフレームにおける切断される部分が少なくなり、リードフレームと熱硬化性樹脂との剥離をより抑制することができる。
【００１７】
なお、切り欠き部には熱硬化性樹脂が充填されるのに対し、後述する孔部には熱硬化性樹脂が充填されない点で異なる。切り欠き部及び孔部はリードフレームを貫通しているのに対し、後述する溝はリードフレームを貫通していない。

【００１８】
上金型と下金型とで挟み込まれる前のリードフレームは、孔部が設けられていることが好ましい。これによりリードフレームを軽量化でき、安価な発光装置を提供することができる。孔部にメッキ処理を施すことができるため、リードフレームの露出を抑えることができる。
【００１９】
上金型と下金型とで挟み込まれる前のリードフレームは、溝が設けられていることが好ましい。これによりリードフレームを軽量化でき、安価な発光装置を提供することができる。溝にメッキ処理を施すことができるため、リードフレームの露出を抑えることができる。
【００２０】
上金型と下金型とは、発光素子が載置される部分、若しくは、孔部の近傍の部分のリードフレームを挟み込んでいることが好ましい。これによりリードフレームのばたつきを防止し、バリの発生を低減することができる。
【００２１】
本発明は、熱硬化後の、波長３５０ｎｍ～８００ｎｍにおける光反射率が７０％以上であり、外側面において樹脂部とリードとが略同一面に形成されている樹脂パッケージを有する発光装置であって、リードは底面及び上面の少なくともいずれか一面にメッキ処理が施されており、かつ、外側面はメッキ処理が施されていない部分を有する発光装置に関する。これによりメッキ処理されていないリードの露出を防止でき、かつ、一度に多数個の発光装置を得ることができる。また、発光素子からの光を反射する部分のみメッキを施すことにより発光装置からの光取り出し効率を向上することができる。
【００２２】
樹脂パッケージは、四隅からリードが露出されていることが好ましい。樹脂パッケージの一側面全体にリードを設けるよりも、リードの露出部分を低減するができるため、樹脂部とリードとの密着性の向上を図ることができる。また、正負の異なるリード間に絶縁性の樹脂部が設けられているため短絡を防止することができる。
【００２３】
樹脂パッケージは、底面側から視認して四隅が弧状に形成されていることが好ましい。弧状に形成されている部分は、メッキ処理が施されており、切断面にはメッキ処理が施されていない構成を採ることもできる。これにより半田等との接合面積が拡がり、接合強度を向上することができる。
【００２４】
リードは、段差が設けられていることが好ましい。この段差は樹脂パッケージの底面に設けられていることが好ましい。段差が形成されている部分は、メッキ処理が施されており、切断面にはメッキ処理が施されていない構成を採ることもできる。これにより半田等との接合面積が拡がり、接合強度を向上することができる。
【００２５】
本発明は、熱硬化後の、波長３５０ｎｍ～８００ｎｍにおける光反射率が７０％以上であり、外側面において樹脂部とリードとが略同一面に形成されている樹脂パッケージの製造方法であって、切り欠き部を設けたリードフレームを上金型と下金型とで挟み込む工程と、上金型と下金型とで挟み込まれた金型内に、光反射性物質が含有される熱硬化性樹脂をトランスファ・モールドして、リードフレームに樹脂成形体を形成する工程と、切り欠き部に沿って樹脂成形体とリードフレームとを切断する工程と、を有する樹脂パッケージの製造方法に関する。かかる構成によれば、切り欠き部に熱硬化性樹脂が充填されるため、リードフレームと熱硬化性樹脂との密着面積が大きくなり、リードフレームと熱硬化性樹脂との密着性を向上することができる。また、熱可塑性樹脂よりも粘度が低い熱硬化性樹脂を用いるため、空隙が残ることなく、切り欠き部に熱硬化性樹脂を充填することができる。また、一度に多数個の樹脂パッケージを得ることができ、生産効率の大幅な向上を図ることができる。さらに、廃棄されるランナーを低減することができ、安価な樹脂パッ

ケージを提供することができる。
【００２６】
上金型と下金型とで挟み込む前に、リードフレームにメッキ処理を施すことが好ましい。このとき、製造された樹脂パッケージには切断された面にメッキ処理が施されておらず、それ以外の部分にはメッキ処理が施されている。個片化された樹脂パッケージ毎にメッキ処理を施す必要がなくなり、製造方法を簡略化することができる。
【００２７】
本発明は、熱硬化後の、波長３５０ｎｍ～８００ｎｍにおける光反射率が７０％以上であり、外側面において樹脂部とリードとが略同一面に形成されている樹脂パッケージであって、リードは底面及び上面の少なくともいずれか一面にメッキ処理が施されており、かつ、外側面はメッキ処理が施されていない部分を有する樹脂パッケージに関する。これによりメッキ処理されていないリードの露出を防止でき、かつ、一度に多数個の樹脂パッケージを得ることができる。また、発光素子からの光を反射する部分のみメッキを施すことにより発光装置からの光取り出し効率を向上することができる。
【００２８】
本発明は、熱硬化後の、波長３５０ｎｍ～８００ｎｍにおける光反射率が７０％以上であり、凹部が複数形成され、該凹部の内底面は、リードフレームの一部が露出されている、樹脂成形体の製造方法であって、切り欠き部を設けたリードフレームを用い、樹脂成形体において隣り合う凹部が成形される位置に凸部を有する上金型と下金型とでリードフレームを挟み込む工程と、上金型と下金型とで挟み込まれた金型内に、光反射性物質が含有される熱硬化性樹脂をトランスファ・モールドして、切り欠き部に熱硬化性樹脂を充填させ、かつ、リードフレームに樹脂成形体を形成する工程と、を有する樹脂成形体の製造方法に関する。かかる構成によれば、一度に多数個の発光装置を得ることができ、生産効率の大幅な向上を図ることができる。
【００２９】
本発明は、熱硬化後の、波長３５０ｎｍ～８００ｎｍにおける光反射率が７０％以上であり、凹部が複数形成され、該凹部の内底面は、リードフレームの一部が露出されている、樹脂成形体であって、リードフレームは切り欠き部を有しており、該切り欠き部に樹脂成形体となる熱硬化性樹脂が充填されており、隣り合う凹部の間に側壁を有している樹脂成形体に関する。これにより、耐熱性、耐光性に優れた樹脂成形体を提供することができる。
【発明の効果】
【００３０】
本発明にかかる発光装置及びその製造方法によれば、リードフレームと樹脂成形体との密着性の高い発光装置を提供することができる。また、短時間に多数個の発光装置を得ることができ、生産効率の大幅な向上を図ることができる。さらに、廃棄されるランナーを低減することができ、安価な発光装置を提供することができる。
【発明を実施するための最良の形態】
【００３１】
以下、本発明に係る発光装置の製造方法および発光装置の最良の実施の形態を図面と共に詳細に説明する。だたし、本発明は、この実施の形態に限定されない。
【００３２】
<第１の実施の形態>
（発光装置）
第１の実施の形態に係る発光装置を説明する。図１は、第１の実施の形態に係る発光装置を示す斜視図である。図２は、第１の実施の形態に係る発光装置を示す断面図である。図２は図１に示すＩＩ－ＩＩの断面図である。図３は、第１の実施の形態に用いられるリードフレームを示す平面図である。
【００３３】
第１の実施の形態に係る発光装置１００は、熱硬化後の、波長３５０ｎｍ～８００ｎｍ

における光反射率が７０％以上であり、外側面２０ｂにおいて樹脂部２５とリード２２とを略同一面に形成する樹脂パッケージ２０を有する。リード２２は底面（樹脂パッケージ２０の外底面２０ａ）及び上面（凹部２７の内底面２７ａ）の少なくともいずれか一面にメッキ処理を施している。一方、リード２２の側面（樹脂パッケージ２０の外側面２０ｂ）はメッキ処理が施されていない。樹脂パッケージ２０の外側面２０ｂは、樹脂部２５が大面積を占めており、リード２２が隅部から露出している。

【００３４】

樹脂パッケージ２０は、主に光反射性物質２６を含有する樹脂部２５と、リード２２と、から構成されている。樹脂パッケージ２０はリード２２を配置している外底面２０ａと、リード２２の一部が露出している外側面２０ｂと、開口する凹部２７を形成する外上面２０ｃと、を有する。樹脂パッケージ２０には内底面２７ａと内側面２７ｂとを有する凹部２７が形成されている。樹脂パッケージ２０の内底面２７ａにはリード２２が露出しており、リード２２に発光素子１０が載置されている。樹脂パッケージ２０の凹部２７内には発光素子１０を被覆する封止部材３０を配置する。封止部材３０は蛍光物質４０を含有している。発光素子１０は、ワイヤ５０を介してリード２０と電気的に接続している。樹脂パッケージ２０の外上面２０ｃはリード２０が配置されていない。

【００３５】

樹脂パッケージ２０の外側面２０ｂの全包囲の長さにおいて、リード２２が露出している部分は１／２より短い長さである。後述する発光装置の製造方法において、リードフレーム２１に切り欠き部２１ａを設け、その切り欠き部２１ａに沿って切断するため、リードフレーム２１の切断部分が樹脂パッケージ２０から露出される部分である。

【００３６】

樹脂パッケージ２０は、四隅からリード２２が露出している。リード２２は外側面２０ｂにおいて露出しており、メッキ処理を施していない。また、リード２２は外底面２０ａにも露出する構造を採ることができ、メッキ処理を施すこともできる。なお、個片化された後にリード２２の外側面２０ｂにメッキ処理を施すことは可能である。

【００３７】

発光装置１００は、熱硬化後の、波長３５０ｎｍ～８００ｎｍにおける光反射率が７０％以上である。これは主に可視光領域の光反射率が高いことを示す。発光素子１０は、発光ピーク波長が３６０ｎｍ～５２０ｎｍにあるものが好ましいが、３５０ｎｍ～８００ｎｍのものも使用することができる。特に、発光素子１０は４２０ｎｍ～４８０ｎｍの可視光の短波長領域に発光ピーク波長を有するものが好ましい。この樹脂パッケージ２０は、４８０ｎｍ以下の短波長側の光に対して優れた耐光性を有しており劣化し難いものである。また、この樹脂パッケージ２０は、電流を投入することにより発光素子１０が発熱しても劣化しにくく耐熱性に優れたものである。

【００３８】

樹脂パッケージ２０は透光性の熱硬化性樹脂に光反射性物質を高充填したものを使用することが好ましい。例えば、３５０ｎｍ～８００ｎｍにおける光透過率が８０％以上の熱硬化性樹脂を用いることが好ましく、特に、光透過率が９０％以上の熱硬化性樹脂が好ましい。熱硬化性樹脂に吸収される光を低減することにより、樹脂パッケージ２０の劣化を抑制することができるからである。光反射性物質２６は発光素子１０からの光を９０％以上反射するものが好ましく、特に９５％以上反射するものが好ましい。また、光反射性物質２６は蛍光物質４０からの光を９０％以上反射するものが好ましく、特に９５％以上反射するものが好ましい。光反射性物質２６に吸収される光量を低減することにより発光装置１００からの光取り出し効率を向上することができる。

【００３９】

発光装置１００の形状は特に問わないが、略直方体、略立方体、略六角柱などの多角形形状としてもよい。凹部２７は、開口方向に拡がっていることが好ましいが、筒状でも良い。凹部２７の形状は略円形状、略楕円形状、略多角形形状などを採ることができる。

【００４０】

以下、各部材について詳述する。
（発光素子）
発光素子は、基板上にＧａＡｌＮ、ＺｎＳ、ＳｎＳｅ、ＳｉＣ、ＧａＰ、ＧａＡｌＡｓ、ＡｌＮ、ＩｎＮ、ＡｌＩｎＧａＰ、ＩｎＧａＮ、ＧａＮ、ＡｌＩｎＧａＮ等の半導体を発光層として形成したものが好適に用いられるが、これに特に限定されない。発光ピーク波長が３６０ｎｍ～５２０ｎｍにあるものが好ましいが、３５０ｎｍ～８００ｎｍのものも使用することができる。特に、発光素子１０は４２０ｎｍ～４８０ｎｍの可視光の短波長領域に発光ピーク波長を有するものが好ましい。

【００４１】
発光素子は、フェイスアップ構造のものを使用することができる他、フェイスダウン構造のものも使用することができる。発光素子の大きさは特に限定されず、□３５０μｍ、□５００μｍ、□１ｍｍのものなども使用することができる。また発光素子は複数個使用することができ、全て同種類のものでもよく、光の三原色となる赤・緑・青の発光色を示す異種類のものでもよい。
（樹脂パッケージ）
樹脂パッケージは、熱硬化性樹脂からなる樹脂部とリードとを有し、一体成形している。樹脂パッケージは、３５０ｎｍ～８００ｎｍにおける光反射率が７０％以上であるが、４２０ｎｍ～５２０ｎｍの光反射率が８０％以上であることが特に好ましい。また、発光素子の発光領域と蛍光物質の発光領域とにおいて高い反射率を有していることが好ましい。

【００４２】
樹脂パッケージは、外底面と外側面と外上面とを有する。樹脂パッケージの外側面からリードが露出している。樹脂部とリードとは略同一面に形成されている。この略同一面とは同じ切断工程で形成されたことを意味する。

【００４３】
樹脂パッケージの外形は、略直方体に限定されず略立方体、略六角柱又は他の多角形形状としてもよい。また、外上面側から見て、略三角形、略四角形、略五角形、略六角形などの形状を採ることもできる。

【００４４】
樹脂パッケージは内底面と内側面とを持つ凹部を形成している。凹部の内底面にはリードを配置している。凹部は外上面側から見て、略円形形状、略楕円形状、略四角形形状、略多角形形状及びこれらの組合せなど種々の形状を採ることができる。凹部は開口方向に拡がる形状となっていることが好ましいが、筒状となっていても良い。凹部は滑らかな傾斜を設けても良いが、表面に細かい凹凸を設け、光を散乱させる形状としてもよい。

【００４５】
リードは正負一対となるように所定の間隔を空けて設けている。凹部の内定面のリード及び樹脂パッケージの外底面のリードはメッキ処理を施している。このメッキ処理は樹脂成形体を切り出す前に行うこともできるが、予めメッキ処理を施したリードフレームを用いる方が好ましい。一方、リードの側面はメッキ処理を施していない。
（樹脂部、樹脂成形体）
樹脂部及び樹脂成形体の材質は熱硬化性樹脂であるトリアジン誘導体エポキシ樹脂を用いることが好ましい。また、熱硬化性樹脂は、酸無水物、酸化防止剤、離型材、光反射部材、無機充填材、硬化触媒、光安定剤、滑剤を含有できる。光反射部材は二酸化チタンを用い、１０～６０ｗｔ％充填されている。

【００４６】
樹脂パッケージは、上述の形態に限らず、熱硬化性樹脂のうち、エポキシ樹脂、変性エポキシ樹脂、シリコーン樹脂、変性シリコーン樹脂、アクリレート樹脂、ウレタン樹脂からなる群から選択される少なくとも１種により形成することが好ましい。特にエポキシ樹脂、変性エポキシ樹脂、シリコーン樹脂、変性シリコーン樹脂が好ましい。例えば、トリグリシジルイソシアヌレート、水素化ビスフェノールＡジグリシジルエーテル他よりなる

エポキシ樹脂と、ヘキサヒドロ無水フタル酸、３－メチルヘキサヒドロ無水フタル酸、４－メチルヘキサヒドロ無水フタル酸他よりなる酸無水物とを、エポキシ樹脂へ当量となるよう溶解混合した無色透明な混合物１００重量部へ、硬化促進剤としてＤＢＵ（1,8-Diazabicyclo(5,4,0) undecene-7）を０．５重量部、助触媒としてエチレングリコールを１重量部、酸化チタン顔料を１０重量部、ガラス繊維を５０重量部添加し、加熱により部分的に硬化反応させＢステージ化した固形状エポキシ樹脂組成物を使用することができる。
（リード、リードフレーム）
リードフレームは平板状の金属板を用いることができるが、段差や凹凸を設けた金属板も用いることができる。
【００４７】
リードフレームは、平板状の金属板に打ち抜き加工やエッチング加工等を行ったものである。エッチング加工されたリードフレームは断面形状において凹凸が形成されており、樹脂成形体との密着性を向上することができる。特に、薄いリードフレームを用いた場合、打ち抜き加工ではリードフレームと樹脂成形体と密着性を上げるため、段差や凹凸形状を形成させるが、その段差、凹凸形状は小さくなるので、密着性向上の効果は小さい。しかし、エッチング加工では、リードフレームの断面（エッチング部分）部分すべてに、凹凸形状を形成させることができるので、リードフレームと樹脂成形体との接合面積が大きくでき、より密着性に富む樹脂パッケージを成形することができる。
【００４８】
一方で、平板状の金属板を打ち抜く加工方法では、打ち抜きに伴う金型の摩耗で、交換部品に要する費用が高くなり、リードフレームの製作費用が高くなる。それに対し、エッチング加工では、打ち抜き用金型は使用せず、１フレームあたりのパッケージの取り数が多い場合は、１パッケージあたりのリードフレーム製作費用を安価にすることができる。
【００４９】
エッチング加工は、リードフレームを貫通するように形成する他、貫通しない程度に片面のみからエッチング加工を行うものであってもよい。
【００５０】
切り欠き部は、樹脂成形体を個片化して樹脂パッケージとした際、リードが正負一対となるように形成されている。また、切り欠き部は、樹脂成形体を切断する際に、リードを切断する面積を少なくするように形成されている。例えば、正負一対のリードとなるように横方向に切り欠き部を設け、また、樹脂成形体を個片化する際の切り出し部分に相当する位置に切り欠き部を設ける。ただし、リードフレームの一部が脱落しないように、又は、樹脂パッケージの外側面にリードを露出させるためにリードフレームの一部を連結しておく。ダイシングソーを用いて樹脂成形体をダイシングするため、切り欠き部は、縦及び横若しくは斜めに直線的に形成されていることが好ましい。
【００５１】
リードフレームは、例えば、鉄、リン青銅、銅合金などの電気良導体を用いて形成される。また、発光素子からの光の反射率を高めるために、銀、アルミニウム、銅及び金などの金属メッキを施すことができる。切り欠き部を設けた後やエッチング処理を行った後など上金型と下金型とで挟み込む前に金属メッキを施すことが好ましいが、リードフレームが熱硬化性樹脂と一体成形される前に金属メッキを施すこともできる。
（封止部材）
封止部材の材質は熱硬化性樹脂である。熱硬化性樹脂のうち、エポキシ樹脂、変性エポキシ樹脂、シリコーン樹脂、変性シリコーン樹脂、アクリレート樹脂、ウレタン樹脂からなる群から選択される少なくとも１種により形成することが好ましく、特にエポキシ樹脂、変性エポキシ樹脂、シリコーン樹脂、変性シリコーン樹脂が好ましい。封止部材は、発光素子を保護するため硬質のものが好ましい。また、封止部材は、耐熱性、耐候性、耐光性に優れた樹脂を用いることが好ましい。封止部材は、所定の機能を持たせるため、フィラー、拡散剤、顔料、蛍光物質、反射性物質からなる群から選択される少なくとも１種を混合することもできる。封止部材中には拡散剤を含有させても良い。具体的な拡散剤とし

ては、チタン酸バリウム、酸化チタン、酸化アルミニウム、酸化珪素等を好適に用いることができる。また、所望外の波長をカットする目的で有機や無機の着色染料や着色顔料を含有させることができる。さらに、封止部材は、発光素子からの光を吸収し、波長変換する蛍光物質を含有させることもできる。
（蛍光物質）
蛍光物質は、発光素子からの光を吸収し異なる波長の光に波長変換するものであればよい。例えば、Ｅｕ、Ｃｅ等のランタノイド系元素で主に賦活される窒化物系蛍光体・酸窒化物系蛍光体・サイアロン系蛍光体、Ｅｕ等のランタノイド系、Ｍｎ等の遷移金属系の元素により主に付活されるアルカリ土類ハロゲンアパタイト蛍光体、アルカリ土類金属ホウ酸ハロゲン蛍光体、アルカリ土類金属アルミン酸塩蛍光体、アルカリ土類ケイ酸塩、アルカリ土類硫化物、アルカリ土類チオガレート、アルカリ土類窒化ケイ素、ゲルマン酸塩、又は、Ｃｅ等のランタノイド系元素で主に付活される希土類アルミン酸塩、希土類ケイ酸塩又はＥｕ等のランタノイド系元素で主に賦活される有機及び有機錯体等から選ばれる少なくともいずれか１以上であることが好ましい。具体例として、下記の蛍光体を使用することができるが、これに限定されない。

【００５２】
Ｅｕ、Ｃｅ等のランタノイド系元素で主に賦活される窒化物系蛍光体は、$M_2Si_5N_8:Eu$、$MAlSiN_3:Eu$（Ｍは、Ｓｒ、Ｃａ、Ｂａ、Ｍｇ、Ｚｎから選ばれる少なくとも１種以上である。）などがある。また、$M_2Si_5N_8:Eu$のほか$MSi_7N_{10}:Eu$、$M_{1.8}Si_5O_{0.2}N_8:Eu$、$M_{0.9}Si_7O_{0.1}N_{10}:Eu$（Ｍは、Ｓｒ、Ｃａ、Ｂａ、Ｍｇ、Ｚｎから選ばれる少なくとも１種以上である。）などもある。

【００５３】
Ｅｕ、Ｃｅ等のランタノイド系元素で主に賦活される酸窒化物系蛍光体は、$MSi_2O_2N_2:Eu$（Ｍは、Ｓｒ、Ｃａ、Ｂａ、Ｍｇ、Ｚｎから選ばれる少なくとも１種以上である。）などがある。

【００５４】
Ｅｕ、Ｃｅ等のランタノイド系元素で主に賦活されるサイアロン系蛍光体は、$M_{p/2}Si_{12-p-q}Al_{p+q}O_qN_{16-p}:Ce$、Ｍ－Ａｌ－Ｓｉ－Ｏ－Ｎ（Ｍは、Ｓｒ、Ｃａ、Ｂａ、Ｍｇ、Ｚｎから選ばれる少なくとも１種以上である。ｑは０～２．５、ｐは１．５～３である。）などがある。

【００５５】
Ｅｕ等のランタノイド系、Ｍｎ等の遷移金属系の元素により主に付活されるアルカリ土類ハロゲンアパタイト蛍光体には、$M_5(PO_4)_3X:R$（Ｍは、Ｓｒ、Ｃａ、Ｂａ、Ｍｇ、Ｚｎから選ばれる少なくとも１種以上である。Ｘは、Ｆ、Ｃｌ、Ｂｒ、Ｉから選ばれる少なくとも１種以上である。Ｒは、Ｅｕ、Ｍｎ、ＥｕとＭｎ、のいずれか１以上である。）などがある。

【００５６】
アルカリ土類金属ホウ酸ハロゲン蛍光体には、$M_2B_5O_9X:R$（Ｍは、Ｓｒ、Ｃａ、Ｂａ、Ｍｇ、Ｚｎから選ばれる少なくとも１種以上である。Ｘは、Ｆ、Ｃｌ、Ｂｒ、Ｉから選ばれる少なくとも１種以上である。Ｒは、Ｅｕ、Ｍｎ、ＥｕとＭｎ、のいずれか１以上である。）などがある。

【００５７】
アルカリ土類金属アルミン酸塩蛍光体には、$SrAl_2O_4:R$、$Sr_4Al_{14}O_{25}:R$、$CaAl_2O_4:R$、$BaMg_2Al_{16}O_{27}:R$、$BaMg_2Al_{16}O_{12}:R$、$BaMgAl_{10}O_{17}:R$（Ｒは、Ｅｕ、Ｍｎ、ＥｕとＭｎ、のいずれか１以上である。）などがある。

【００５８】
アルカリ土類硫化物蛍光体には、$La_2O_2S:Eu$、$Y_2O_2S:Eu$、$Gd_2O_2S:Eu$などがある。

【００５９】
Ｃｅ等のランタノイド系元素で主に賦活される希土類アルミン酸塩蛍光体には、$Y_3Al_5O_{12}$：Ｃｅ、$(Y_{0.8}Gd_{0.2})_3Al_5O_{12}$：Ｃｅ、$Y_3(Al_{0.8}Ga_{0.2})_5O_{12}$：Ｃｅ、$(Y,Gd)_3(Al,Ga)_5O_{12}$：Ｃｅの組成式で表されるＹＡＧ系蛍光体などがある。また、Ｙの一部若しくは全部をＴｂ、Ｌｕ等で置換した$Tb_3Al_5O_{12}$：Ｃｅ、$Lu_3Al_5O_{12}$：Ｃｅなどもある。
【００６０】
その他の蛍光体には、ＺｎＳ：Ｅｕ、Zn_2GeO_4：Ｍｎ、MGa_2S_4：Ｅｕ（Ｍは、Ｓｒ、Ｃａ、Ｂａ、Ｍｇ、Ｚｎから選ばれる少なくとも１種以上である。）などがある。
【００６１】
これらの蛍光体は、単独若しくは２種以上組み合わせて使用することにより、青色、緑色、黄色、赤色などの他、これらの中間色である青緑色、黄緑色、橙色などの色味を実現することができる。
【００６２】
（その他）
発光装置には、さらに保護素子としてツェナーダイオードを設けることもできる。ツェナーダイオードは、発光素子と離れて凹部の内底面のリードに載置することができる。また、ツェナーダイオードは、凹部の内底面のリードに載置され、その上に発光素子を載置する構成を採ることもできる。□２８０μｍサイズの他、□３００μｍサイズ等も使用することができる。
（第１の実施の形態に係る発光装置の製造方法）
第１の実施の形態に係る発光装置の製造方法について説明する。図４は、第１の実施の形態に係る発光装置の製造方法を示す概略断面図である。図５は、第１の実施の形態に係る樹脂成形体を示す平面図である。
【００６３】
第１の実施の形態に係る発光装置の製造方法は、切り欠き部２１ａを設けたリードフレーム２１を上金型６１と下金型６２とで挟み込む工程と、上金型６１と下金型６２とで挟み込まれた金型６０内に、光反射性物質２６が含有される熱硬化性樹脂２３をトランスファ・モールドして、リードフレーム２１に樹脂成形体２４を形成する工程と、切り欠き部２１ａに沿って樹脂成形体２４とリードフレーム２１とを切断する工程と、を有する。
【００６４】
まず、トランスファ・モールドに用いる上金型６１及び下金型６２からなる金型６０について説明する。
【００６５】
上金型６１は、上金型の上部を構成する平板の本体部と、本体部の端部から枠状に形成された外壁部と、本体部から突出した複数の突出部と、外壁部の一部を水平方向に貫通する注入口とを有する。
【００６６】
外壁部は、本体部の端部から垂直に突出されており、樹脂成形体の第一外側面、第二外側面、第三外側面及び第四外側面をそれぞれ成形する第一外壁部、第二外壁部、第三外壁部及び第四外壁部を備えている。即ち、外壁部は樹脂成形体の外郭を成形する部分であって、平面視長方形に形成されている。外壁部の形状は、所望の樹脂成形体の形状に応じて適宜形成すればよい。
【００６７】
突出部はトランスファ・モールドの際にリードフレーム２１と接触する部分であって、その接触部分に熱硬化性樹脂２３が流れ込まないようにすることにより、リードフレーム２１の一部が樹脂成形体２４から露出される露出部を形成できる。突出部は、本体部から下方に突出しており、外壁に囲まれるように形成されている。突出部は、リードフレーム２１と接触する部分が平坦に形成されている。樹脂成形体２４の上面の面積あたりに効率

よく凹部を形成するためには、一方向かつ等間隔に突出部が形成され、各突出部においてその一方向から９０°方向かつ等間隔に突出部が形成されることが好ましい。
【００６８】
注入口は、熱硬化性樹脂２３を注入するためであって、外壁部の略中央下端に、水平方向に貫通して形成されている。注入口は、半円形状の断面を有し、注入口の入口部分から出口部分に向けて幅が狭くなるように形成されている。
【００６９】
また、特に図示はしないが、上金型６１の上部には、本体部を貫通するピン挿入孔が形成されている。ピン挿入孔は、上金型６１から樹脂成形体２４を脱型するときにピンを挿入させるための孔である。
【００７０】
下金型６２は、所定の厚みを有する板材であって、表面が平坦に形成されている。下金型６２は、上金型６１と接触させることにより、空間部を成形するものである。
【００７１】
次に、各製造工程について説明する。
【００７２】
リードフレーム２１は、切り欠き部２１ａを設けた後、金属メッキ処理を行っておく。
【００７３】
まず、切り欠き部２１ａを設けたリードフレーム２１を上金型６１と下金型６２とで挟み込む。上金型６１と下金型６２とで挟み込むことによって金型６０内に空間が設けられる。
【００７４】
このとき、凹部２７が形成される位置にある切り欠き部２１ａが上金型６１の有する突出部と下金型６２とで挟まれるように配置する。これにより切り欠き部２１ａにおけるリードフレーム２１のバタつきが抑制され、バリの発生を低減することができる。
【００７５】
次に、上金型６１と下金型６２とで挟み込まれた金型内に、光反射性物質２６が含有される熱硬化性樹脂２３をトランスファ・モールドして、リードフレーム２１に樹脂成形体２４を形成する
金型６０内に設けられた空間に、注入口から光反射性物質２６が含有される熱硬化性樹脂２３を注入して、所定の温度と圧力とを加えてトランスファ・モールドする。上金型６１と下金型６２とで切り欠き部２１ａ付近のリードフレーム２１を挟み込んでいるため、熱硬化性樹脂２３をトランスファ・モールドする際に、リードフレーム２１がバタつかず、凹部２７の内底面２７ａにおいてバリの発生を抑制できる。
【００７６】
ピン挿入部にピンを挿入させて樹脂成形体２４を上金型６１から抜脱する。金型６０内において所定の温度を加えて仮硬化を行い、その後、金型６０から抜脱して、仮硬化よりも高い温度を加えて本硬化を行うことが好ましい。
【００７７】
次に、樹脂成形体２４に形成された凹部２７の内底面２７ａのリードフレーム２１に発光素子１０を載置し、ワイヤ５０によりリードフレーム２１と電気的に接続する。発光素子１０を載置する工程は、樹脂成形体２４を金型６０から抜脱した後に載置できる他、樹脂成形体２４を切断し個片化した樹脂パッケージ２０に発光素子１０を載置してもよい。また、ワイヤを用いず発光素子をフェイスダウンして実装してもよい。発光素子１０をリードフレーム２１に実装した後、蛍光物質４０を含有した封止部材３０を凹部２７内に充填し硬化する。
【００７８】
次に、切り欠き部２１ａに沿って樹脂成形体２４とリードフレーム２１とを切断する。
複数の凹部２７が形成された樹脂成形体２４は、隣接する凹部２７の間にある側壁を略中央で分離されるように長手方向及び短手方向に切断する。切断方法はダイシングソーを

用いて樹脂成形体２４側からダイシングする。これにより切断面は樹脂成形体２４とリードフレーム２１とが略同一面となっており、リードフレーム２１が樹脂成形体２４から露出している。このように切り欠き部２１ａを設けることにより、切断されるリードフレーム２１は少なくなりリードフレーム２１と樹脂成形体２４との剥離を抑制することができる。また、リードフレーム２１の上面だけでなく、切り欠き部２１ａに相当する側面も樹脂成形体２４と密着するため、リードフレーム２１と樹脂成形体２４との密着強度が向上する。

＜第２の実施の形態＞

第２の実施の形態に係る発光装置について説明する。図６は、第２の実施の形態に係る発光装置を示す斜視図である。図７は、第２の実施の形態に用いられるリードフレームを示す平面図である。図８は、第２の実施の形態に係る樹脂成形体を示す平面図である。第１の実施の形態に係る発光装置とほぼ同様の構成を採るところは説明を省略することもある。

【００７９】

第２の実施の形態に係る発光装置は、樹脂パッケージ１２０に設けられた凹部内に発光素子１０を載置する。樹脂パッケージ１２０の外上面１２０ｃは、隅部が円弧状に形成されている。また、リード１２２の側面は上面から見て円弧状に形成されており、リード１２２は、上面から見て樹脂部１２５からやや突出するように段差を設けている。突出されているリード１２２の上面及び外底面１２０ａ、円弧状の局面部分はメッキ処理を施している。一方、リード１２２の円弧状以外の外側面１２０ｂ部分はメッキ処理が施されていない。このようにメッキ処理を施した部分を広くすることにより半田等の導電性部材との接合強度が増す。

（第２の実施の形態に係る発光装置の製造方法）

第２の実施の形態に係る発光装置の製造方法において、リードフレーム１２１には切り欠き部１２１ａ及び孔部１２１ｂを設ける。この孔部１２１ｂの形状は円形状であることが好ましいが、四角形状、六角形状などの多角形状や楕円形状などを採ることができる。リードフレーム１２１における孔部１２１ｂの位置は切り欠き部１２１ａの延長線上であって、互いに交差する点付近に設けることが好ましい。孔部１２１ｂの大きさは特に問わないが、電極として用い導電性部材との接合強度を高める場合、広口の方が好ましい。また、導電性部材との密着面積を拡げ、接合強度を高めることができる。

【００８０】

リードフレーム１２１の孔部１２１ｂ近傍を覆うように、孔部１２１ｂの形状よりもやや大きめの孔を設ける。

【００８１】

切り欠き部１２１ａを設けたリードフレーム１２１を上金型と下金型とで挟み込む。このとき、孔部１２１ｂの近傍も金型で挟み込む。これによりトランスファ・モールドの際、熱硬化性樹脂が孔部１２１ｂ内に流れ込まず、孔部１２１ｂ内の熱硬化性樹脂を除去する必要がない。

【００８２】

上金型と下金型とで挟み込まれた金型内に、光反射性物質が含有される熱硬化性樹脂をトランスファ・モールドして、リードフレーム１２１に樹脂成形体１２４を形成する。

【００８３】

樹脂成形体１２４のリードフレーム１２１の露出部分にメッキ処理を施す。凹部の内底面、樹脂パッケージ１２０の外底面１２０ａ、リードフレーム１２１の円形状の内面及びそこから延びる上面にメッキ処理を施す。

【００８４】

切り欠き部１２１ａに沿って樹脂成形体１２４とリードフレーム１２１とを切断する。

【００８５】

以上の工程を経ることにより第２の実施の形態に係る発光装置を提供することができる。切り欠き部１２１ａの延長線上に孔部１２１ｂを設けているため、ダイシングソーを用

いてダイシングを行う際、切断するリードフレーム１２１が少なくてすむため切断時間を短縮できる。この製造方法によれば、簡易かつ短時間でリードフレーム１２１にメッキ処理された部分を多く有する発光装置を提供することができる。

【００８６】

<第３の実施の形態>

第３の実施の形態に係る発光装置について説明する。図９は、第３の実施の形態に係る発光装置を示す斜視図である。図１０は、第３の実施の形態に用いられるリードフレームを示す平面図である。第１の実施の形態に係る発光装置とほぼ同様の構成を採るところは説明を省略することもある。

【００８７】

第３の実施の形態に係る発光装置は、熱硬化後の、波長３５０ｎｍ～８００ｎｍにおける光反射率が７０％以上であり、外側面２２０ｂにおいて樹脂部２２５とリード２２２とが略同一面に形成されている樹脂パッケージ２２０を有する発光装置である。リード２２２は底面及び上面にメッキ処理を施しており、かつ、外側面はメッキ処理が施されていない部分を有する。リード２２２は、所定の厚みを有しており、樹脂パッケージ２２０の外側面付近に段差を設けている。この段差の一段奥まった側面側とわずかに外側に張り出した底面側にはメッキ処理を施している。このようにリード２２２にメッキ処理を施した段差を設けることにより、接合面積が増え、半田等の導電性部材との接合強度を向上させることができる。また、ダイシングソーを用いて切断する部分のリード２２２の厚みを薄くすることができるため、切断時間の短縮を図ることができる。また、樹脂パッケージ２２０の外上面側からダイシングソーを用いてダイシングを行うため、リード２２２の切断面において外底面方向に延びるバリが生じやすい。リードの切断面が外底面と同一面である場合、発光装置を実装する際にバリにより発光装置が傾くことが生じる場合もあるが、リードの切断面に段差を設けることにより、バリが外底面まで届かずバリにより発光装置が傾くことはない。

【００８８】

段差は、樹脂パッケージ２２０から露出されたリード２２２において、樹脂パッケージ２２０の外底面２２０ａで露出された第一面と、外底面２２０ａから上方方向に略直角に形成された第二面と、第二面から樹脂パッケージ２２０の外側面方向に略直角に形成された第三面と、樹脂パッケージ２２０の外側面で露出された第四面とからなる。第一面、第二面及び第三面は、メッキ処理を施しているが、第四面はメッキ処理を施していない。第二面および第三面はひとつの曲面にすることもできる。第二面および第三面を曲面にすることにより、段差部内において半田が広がり易い。

【００８９】

樹脂パッケージ２２０は、外上面２２０ｃにおいて略正方形形状を成しており、樹脂部２２５に覆われている。樹脂パッケージ２２０の外上面２２０ｃ側には略円錐台形の凹部を設けている。

（第３の実施の形態に係る発光装置の製造方法）

第３の実施の形態に係る発光装置の製造方法において、リードフレーム２２１には発光装置の外底面側に相当する側に略直線上の溝２２１ｃを設ける。この溝２２１ｃの深さはリードフレーム２２１の厚みの半分程度であることが好ましいが、１／４～４／５程度の深さでもよい。この溝２２１ｃの幅は、隣り合う凹部までの距離、発光装置の大きさ等により、種々変更されるが、その溝の中心を切断した場合に発光装置に段差があると認識できる程度のものであればよい。

【００９０】

切り欠き部２２１ａを設けたリードフレーム２２１を上金型と下金型とで挟み込む。切り欠き部２２１ａがトランスファ・モールドの際、バタつかないように上金型と下金型とで挟み込む。

【００９１】

上金型と下金型とで挟み込まれた金型内に、光反射性物質が含有される熱硬化性樹脂を

トランスファ・モールドして、リードフレーム２２１に樹脂成形体を形成する。
【００９２】
樹脂成形体のリードフレーム２２１の露出部分にメッキ処理を施す。凹部の内底面、リードフレーム２２１の外底面２２０ａ、溝２２１ｃにメッキ処理を施す。この溝２２１ｃのメッキ処理は、発光装置における段差の第一面、第二面、第三面に相当する。
【００９３】
切り欠き部２２１ａに沿って樹脂成形体とリードフレームとを切断する。また、溝２２１ｃに沿って樹脂成形体を切断する。
【００９４】
以上の工程を経ることにより第３の実施の形態に係る発光装置を提供することができる。この製造方法によれば、簡易かつ短時間でリードフレーム１２１にメッキ処理された部分を多く有する発光装置を提供することができる。
【００９５】
＜第４の実施の形態＞
第４の実施の形態に係る発光装置について説明する。図１１は、第４の実施の形態に係る発光装置を示す斜視図である。第１の実施の形態に係る発光装置とほぼ同様の構成を採るところは説明を省略することもある。
【００９６】
第４の実施の形態に係る発光装置は、樹脂パッケージ３２０の外側面３２０ｂのリード３２２において、一部のみ外側面３２０ｂから凹んだ段差を有している。段差は、樹脂パッケージ３２０から露出されたリード３２２において、樹脂パッケージ３２０の外底面３２０ａに設けられた第一面と、外底面３２０ａから上方方向に略直角に形成された第二面と、第二面から樹脂パッケージ３２０の外側面方向に略直角に形成された第三面と、樹脂パッケージ３２０の外側面の第四面とからなる。樹脂パッケージ３２０の外上面３２０ｃは樹脂部３２５からなる略長方形に形成されている。外底面３２０ａ、第一面、段差を設けた第二面、第三面及び凹部の内底面はメッキ処理を施している。一方、段差を設けていない外側面３２０ｂは、メッキ処理を施していない。
【００９７】
リード３２２はエッチング加工されたリードフレームを用いる。樹脂成形体の切断面において、エッチング加工されたリード３２２は凹凸を有している。この凹凸が樹脂部とリードとの密着性の向上を図っている。
【００９８】
リード３２２の一部に段差を設けることによって実装時における導電性部材との接合面積を広くすることができ、接合強度を高くすることができる。また、リードフレームに凹みを設けているため、切断し易くなり、切断に要する時間も短縮することができる。
＜第５の実施の形態＞
第５の実施の形態に係る発光装置について説明する。図１２は、第５の実施の形態に係る発光装置を示す斜視図である。第１の実施の形態に係る発光装置とほぼ同様の構成を採るところは説明を省略することもある。
【００９９】
第５の実施の形態に係る発光装置は、樹脂パッケージ４２０の外側面４２０ｂのリード４２２において、一部のみ外側面４２０ｂから凹んだ段差を有している。段差は、樹脂パッケージ４２０から露出されたリード４２２において、樹脂パッケージ４２０の外底面４２０ａに設けられた第一面と、外底面４２０ａから上方方向に略直角に形成された第二面と、第二面から樹脂パッケージ４２０の外側面方向に略直角に形成された第三面と、樹脂パッケージ４２０の外側面の第四面とからなる。樹脂パッケージ４２０の外側面４２０ｂは、リード４２２が6つに分離されている。リード４２２はそれぞれ分離されていてもよく、連結されていてもよい。リード４２２は平板状よりも切り欠き部を設けている方が樹脂部４２５とリード４２２との接合強度がより高くなるため好ましい。樹脂パッケージ４２０の外上面４２０ｃは樹脂部４２５からなる略長方形に形成されている。外底面４２０

ａ、第一面、段差を設けた第二面、第三面及び凹部の内底面はメッキ処理を施している。一方、段差を設けていない外側面４２０ｂは、メッキ処理を施していない。

【０１００】

リード４２２の一部に段差を設けることによって導電性部材との接合面積を広くすることができ、接合強度を高くすることができる。また、リードフレームに凹みを設けているため、切断し易くなり、切断に要する時間も短縮することができる。

＜第６の実施の形態＞

第６の実施の形態に係る樹脂パッケージについて説明する。図１３は、第６の実施の形態に係る樹脂パッケージを示す斜視図である。第１の実施の形態に係る樹脂パッケージ、第５の実施の形態に係る樹脂パッケージとほぼ同様の構成を採るところは説明を省略することもある。

【０１０１】

第６の実施の形態に係る樹脂パッケージは、樹脂パッケージ５２０の外側面５２０ｂのリード５２２において、隅部が凹んだ段差を有している。この段差は、樹脂パッケージ５２０から露出されたリード５２２において、外底面５２０ａ側から見て円弧形状になっている。この円弧形状は、円を四分割したものである。この円弧形状は、リード５２２を貫通しないように、厚みの略半分程度までのエッチング処理を行い、その後、四分割したものである。この円弧形状の部分にはメッキ処理が施されている。この円弧形状部分へのメッキ処理及び外底面５２０ａへのメッキ処理は、四分割する前に行っている。一方、段差を設けていない外側面５２０ｂは、メッキ処理を施していない。樹脂パッケージ５２０は外上面５２０ｃから見ると略正方形形状を成しており、樹脂部５２５が露出している。

【０１０２】

リード５２２の一部に段差を設けることによって導電性部材との接合面積を広くすることができ、接合強度を高くすることができる。また、樹脂成形体の切断時において段差部分にバリが生じても外底面５２０ａよりも上方であるため、導電部材との接合時にぐらつきを生じない。更に、リードフレームに凹みを設けているため、切断し易くなり、切断に要する時間も短縮することができる。

【実施例】

【０１０３】

実施例１に係る発光装置を説明する。第１の実施の形態で説明したところと重複するところは説明を省略することもある。図１は、第１の実施の形態に係る発光装置を示す斜視図である。図２は、第１の実施の形態に係る発光装置を示す断面図である。図２は図１に示すＩＩ－ＩＩの断面図である。図３は、第１の実施の形態に用いられるリードフレームを示す平面図である。

【０１０４】

発光装置１００は、発光素子１０と、光反射物質２６を含有する樹脂部２５とリード２２とが一体成形された樹脂パッケージ２０と、を有する。発光素子１０は４５０ｎｍに発光ピーク波長を持ち青色に発光する窒化物半導体発光素子である。樹脂パッケージ２０はすり鉢状の凹部２７を持つ略直方体の形状を成している。樹脂パッケージ２０の大きさは縦３５ｍｍ、横３５ｍｍ、高さ０．８ｍｍであり、凹部２７の外上面２０ｃ側の略直径は２．９ｍｍ、内底面２７ａの略直径は２．６ｍｍ、深さは０．６ｍｍである。リード２２の厚みは０．２ｍｍである。光反射物質２６には酸化チタンを使用する。樹脂部２５には熱硬化性樹脂であるエポキシ樹脂を用いる。酸化チタンはエポキシ樹脂中に２０重量％程度含有している。樹脂パッケージ２０は、熱硬化後の、波長４５０ｎｍにおける光反射率が８１％である。樹脂パッケージ２０の外側面２０ｂにおいて樹脂部２５とリード２２とは略同一面に形成されている。リード２２は樹脂パッケージ２０の四隅から露出している。リード２２は樹脂パッケージ２０の外底面２０ａ及び凹部２７の内底面２７ａにメッキ処理を施している。一方、リード２２は樹脂パッケージ２０の外側面２０ｂにメッキ処理を施していない。凹部２７内に黄色に発光する蛍光物質４０を含有する封止部材３０を充填する。蛍光物質４０として（Ｙ，Ｇｄ）$_3$（Ａｌ，Ｇａ）$_5$Ｏ$_{12}$：Ｃｅを使用する。

封止部材３０としてシリコーン樹脂を使用する。
【０１０５】
この発光装置は以下のようにして製造される。
【０１０６】
リードフレームはエッチング加工により切り欠き部２１ａを設ける。図示しないが切り欠き部２１ａの断面は凹凸が形成されている。そのリードフレームにＡｇを電解メッキにより付着させる。切り欠き部２１ａが設けられメッキ処理が施されたリードフレーム２１を用いる。
【０１０７】
次に、所定の大きさのリードフレーム２１を上金型６１と下金型６２とで挟み込む。リードフレーム２１は平板状であって、個片化する発光装置の大きさに応じた切り欠き部２１ａを設けている。切り欠き部２１ａは樹脂パッケージ２０に個片化した際に四隅が露出し、四隅以外は露出しないように縦横に設けられている。また、切り欠き部２１ａは、樹脂パッケージ２０に個片化した際に電気的に絶縁されるように横方向に設けられており、上金型６１と下金型６２とでこの切り欠き部２１ａを挟み込んでいる。
【０１０８】
上金型６１と下金型６２とで挟み込まれた金型６０内に、光反射性物質２６を含有する熱硬化性樹脂２３をトランスファ・モールドして、リードフレーム２１に樹脂成形体２４を形成する。光反射性物質２６を含有した熱硬化性樹脂２３をペレット状にし、熱と圧力を加えて金型６０内に流し込む。このとき切り欠き部２１ａにも熱硬化性樹脂２３が充填される。流し込まれた熱硬化性樹脂２３を仮硬化した後、上金型６１を取り外し、更に熱を加えて本硬化を行う。これによりリードフレーム２１と熱硬化性樹脂２３とが一体成形された樹脂成形体２４が製造される。
【０１０９】
次に、発光素子１０を凹部２７の内底面２７ａのリード２２上にダイボンド部材を用いて実装する。発光素子１０を載置した後、発光素子１０とリード２２とをワイヤ５０を用いて電気的に接続する。次に、蛍光物質４０を含有した封止部材３０を凹部２７内に充填する。
【０１１０】
最後に、切り欠き部２１ａに沿って樹脂成形体２４とリードフレーム２１とを切断して個々の発光装置１００となるように個片化する。これにより切断部分においてリード２２はメッキ処理されていない。
【０１１１】
以上の工程を経ることにより、一度に多数個の発光装置１００を製造することができる。
【産業上の利用可能性】
【０１１２】
本発明は、照明器具、ディスプレイ、携帯電話のバックライト、動画照明補助光源、その他の一般的民生用光源などに利用することができる。
【図面の簡単な説明】
【０１１３】
【図１】第１の実施の形態に係る発光装置を示す斜視図である。
【図２】第１の実施の形態に係る発光装置を示す断面図である。
【図３】第１の実施の形態に用いられるリードフレームを示す平面図である。
【図４】第１の実施の形態に係る発光装置の製造方法を示す概略断面図である。
【図５】第１の実施の形態に係る樹脂成形体を示す平面図である。
【図６】第２の実施の形態に係る発光装置を示す斜視図である。
【図７】第２の実施の形態に用いられるリードフレームを示す平面図である。
【図８】第２の実施の形態に係る樹脂成形体を示す平面図である。
【図９】第３の実施の形態に係る発光装置を示す斜視図である。

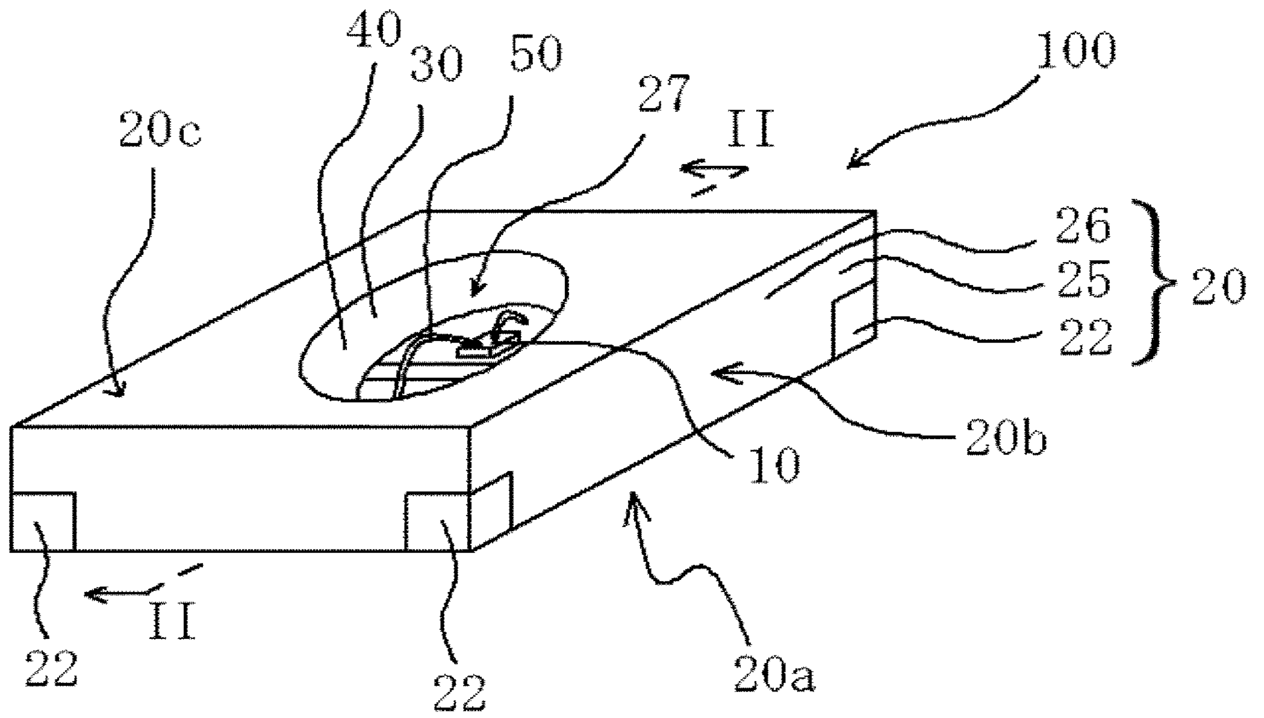
【図１０】第３の実施の形態に用いられるリードフレームを示す平面図である。
【図１１】第４の実施の形態に係る発光装置を示す斜視図である。
【図１２】第５の実施の形態に係る発光装置を示す斜視図である。
【図１３】第６の実施の形態に係る樹脂パッケージを示す斜視図である。
【図１４】従来の発光装置の製造方法を示す斜視図である。
【図１５】従来の発光装置の中間体を示す斜視図である。
【図１６】従来の発光装置を示す斜視図である。
【図１７】従来の発光装置を示す斜視図及び断面図である。
【図１８】従来の発光装置の製造方法を示す概略断面図である。
【図１９】従来の発光装置の製造工程を示す概略図である。

【符号の説明】

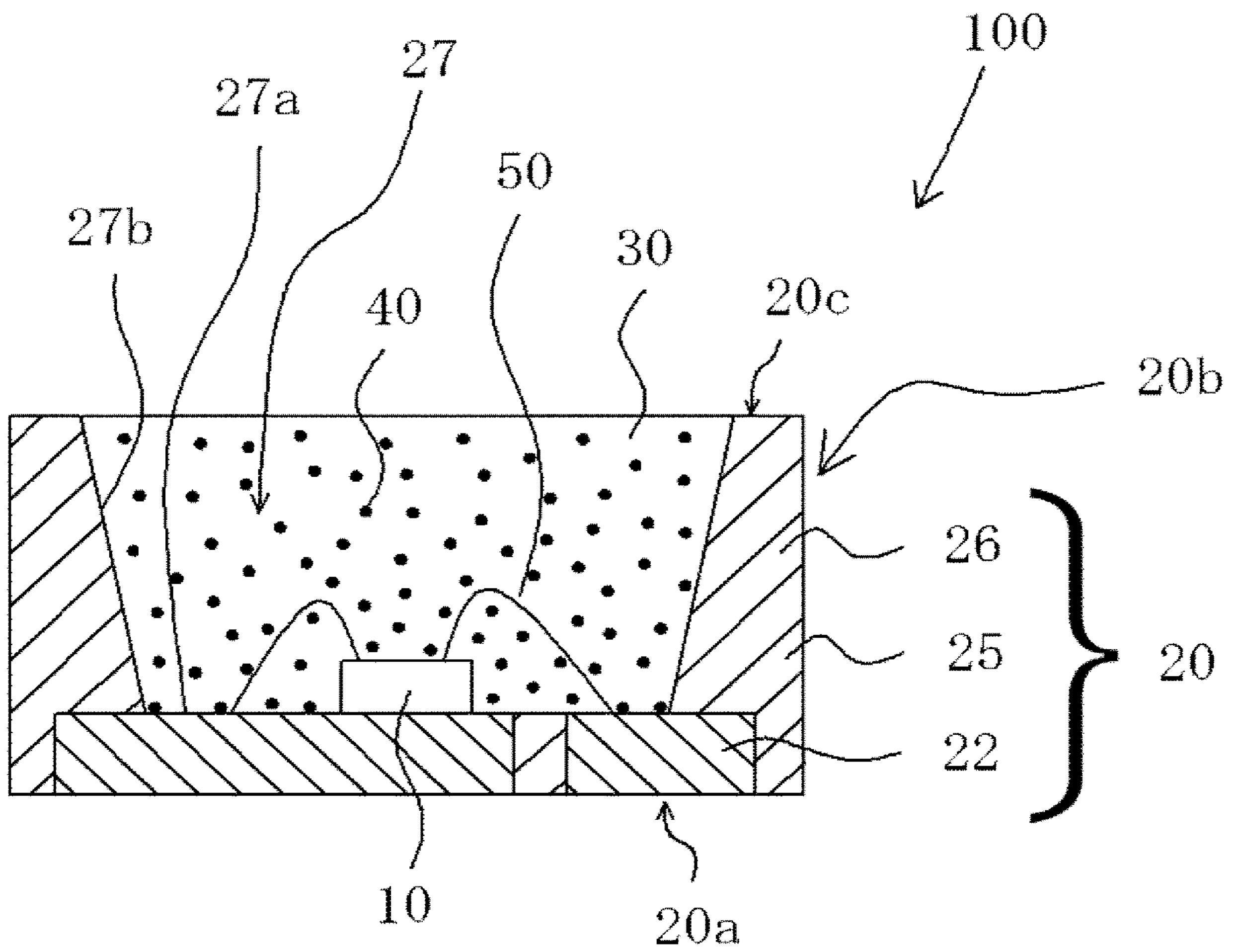
【０１１４】

１０、１１０　発光素子
２０、１２０、２２０、３２０、４２０、５２０　樹脂パッケージ
２０ａ、１２０ａ、２２０ａ、３２０ａ、４２０ａ、５２０ａ　外底面
２０ｂ、１２０ｂ、２２０ｂ、３２０ｂ、４２０ｂ、５２０ｂ　外側面
２０ｃ、１２０ｃ、２２０ｃ、３２０ｃ、４２０ｃ、５２０ｃ　外上面
２１、１２１、２２１　リードフレーム
２１ａ、１２１ａ、２２１ａ　切り欠き部
１２１ｂ　孔部
２２１ｃ　溝
２２、１２２、２２２、３２２、４２２、５２２　リード
２３　熱硬化性樹脂
２４　樹脂成形体
２５、１２５、２２５、３２５、４２５、５２５　樹脂部
２６　光反射性物質
２７　凹部
２７ａ　内底面
２７ｂ　内側面
３０　封止部材
４０　蛍光物質
５０　ワイヤ
６０　金型
６１　上金型
６２　下金型
７０　ダイシングソー
１００　発光装置

【書類名】図面
【図１】



【図２】



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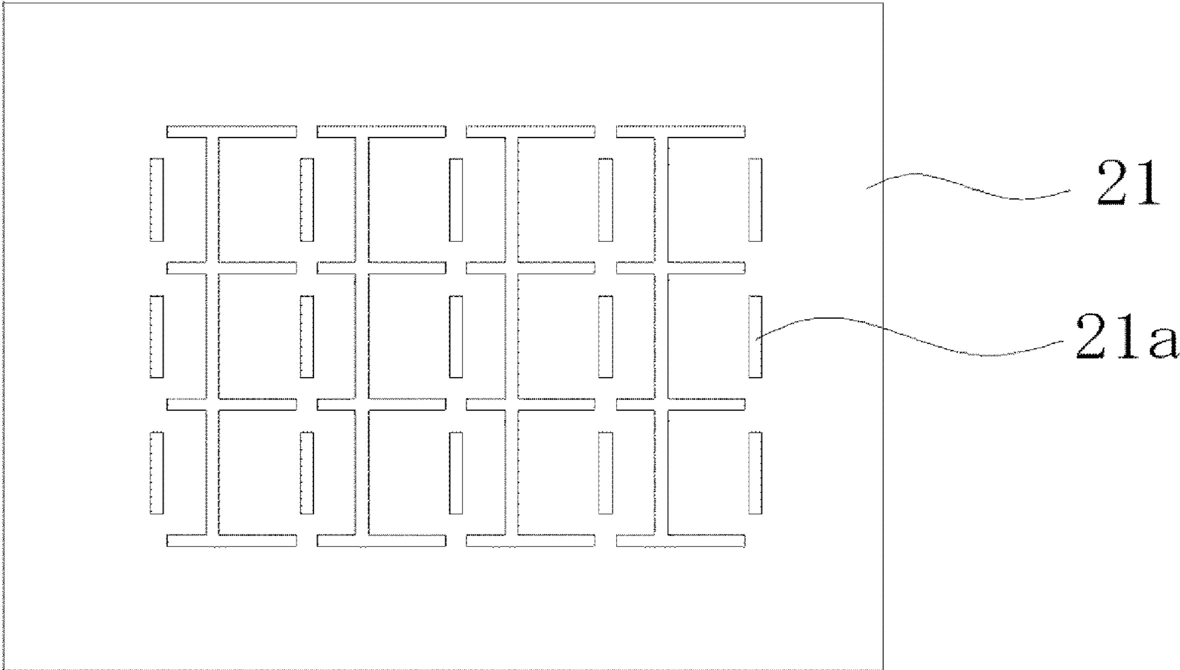

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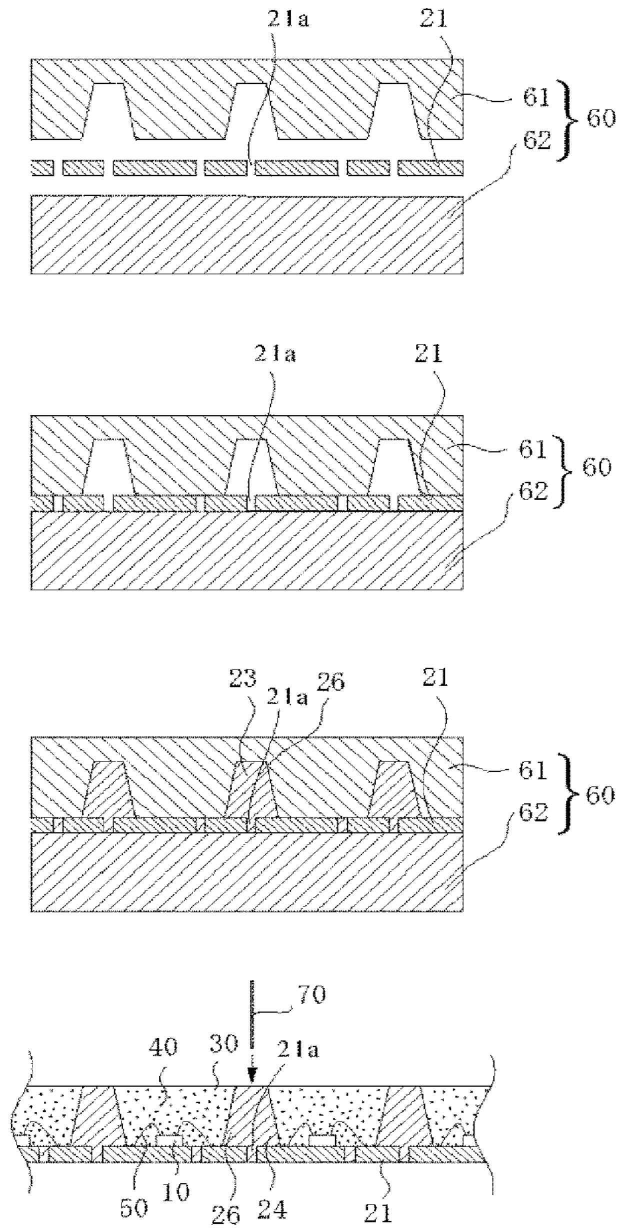

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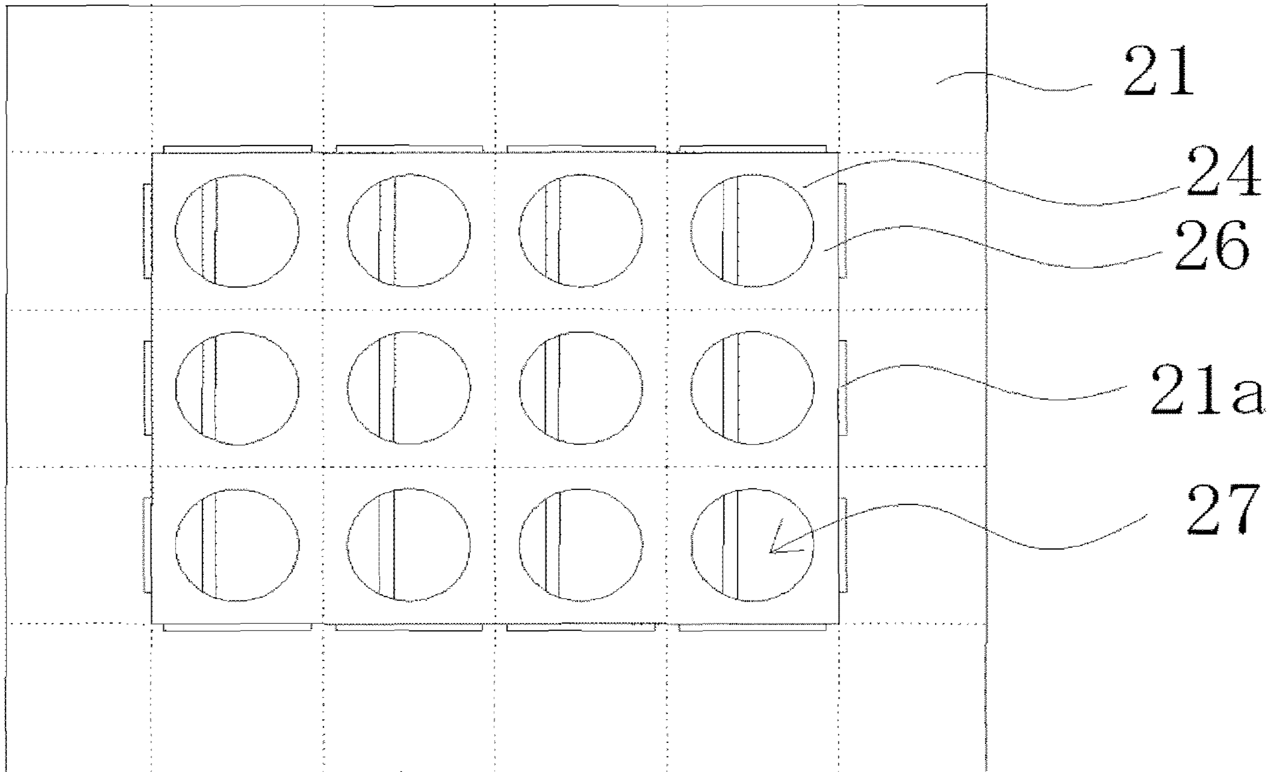

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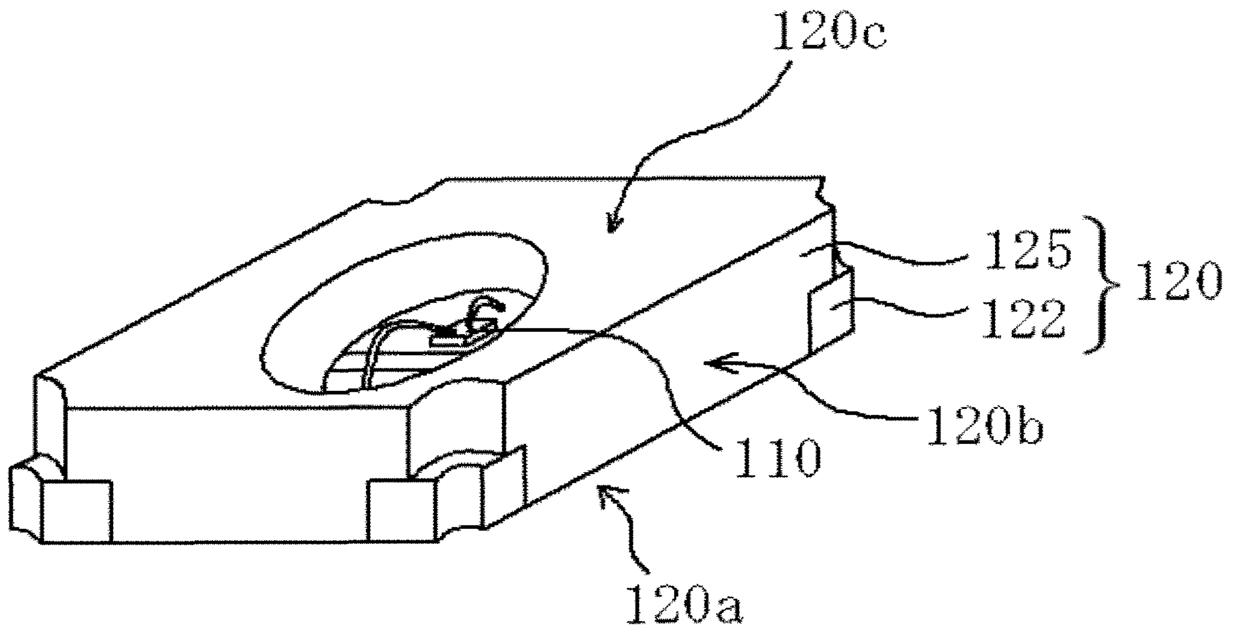

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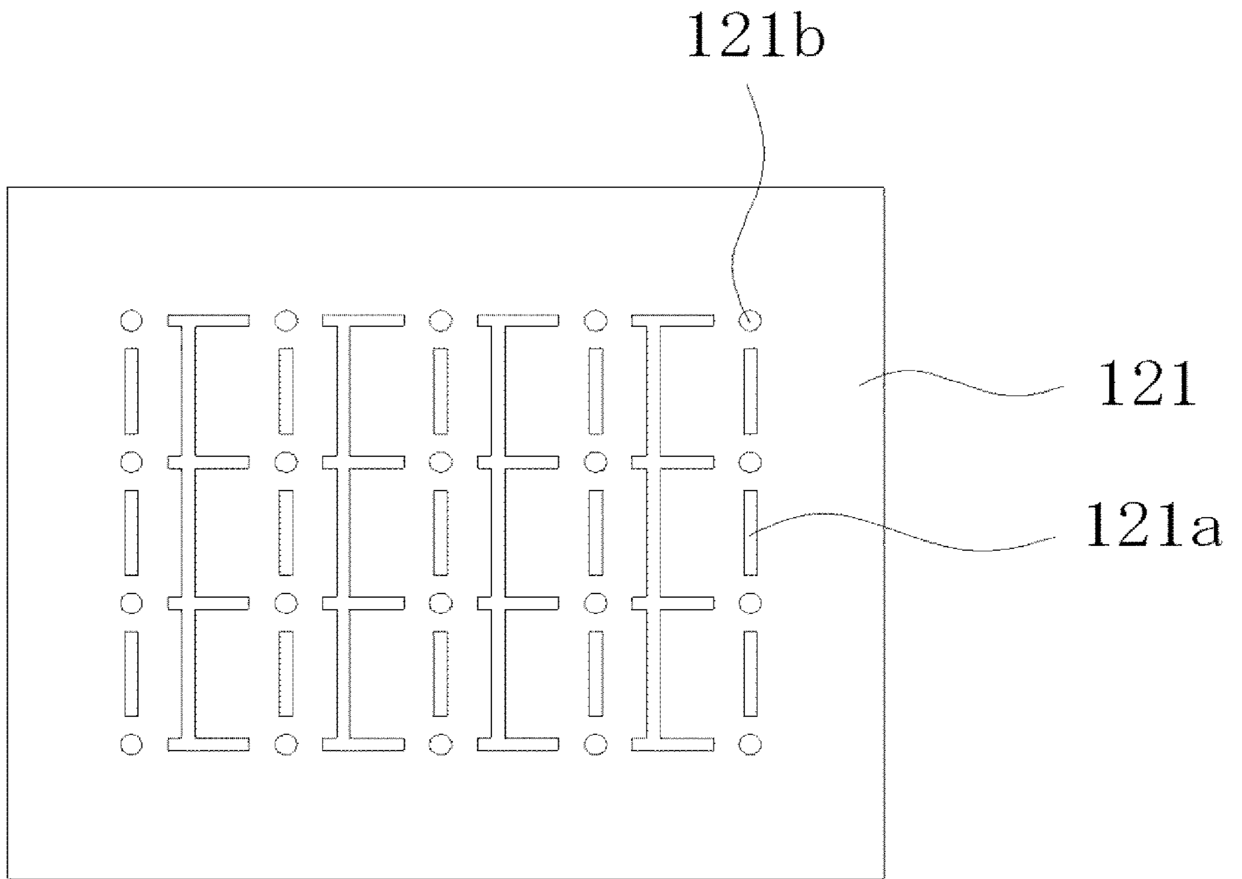

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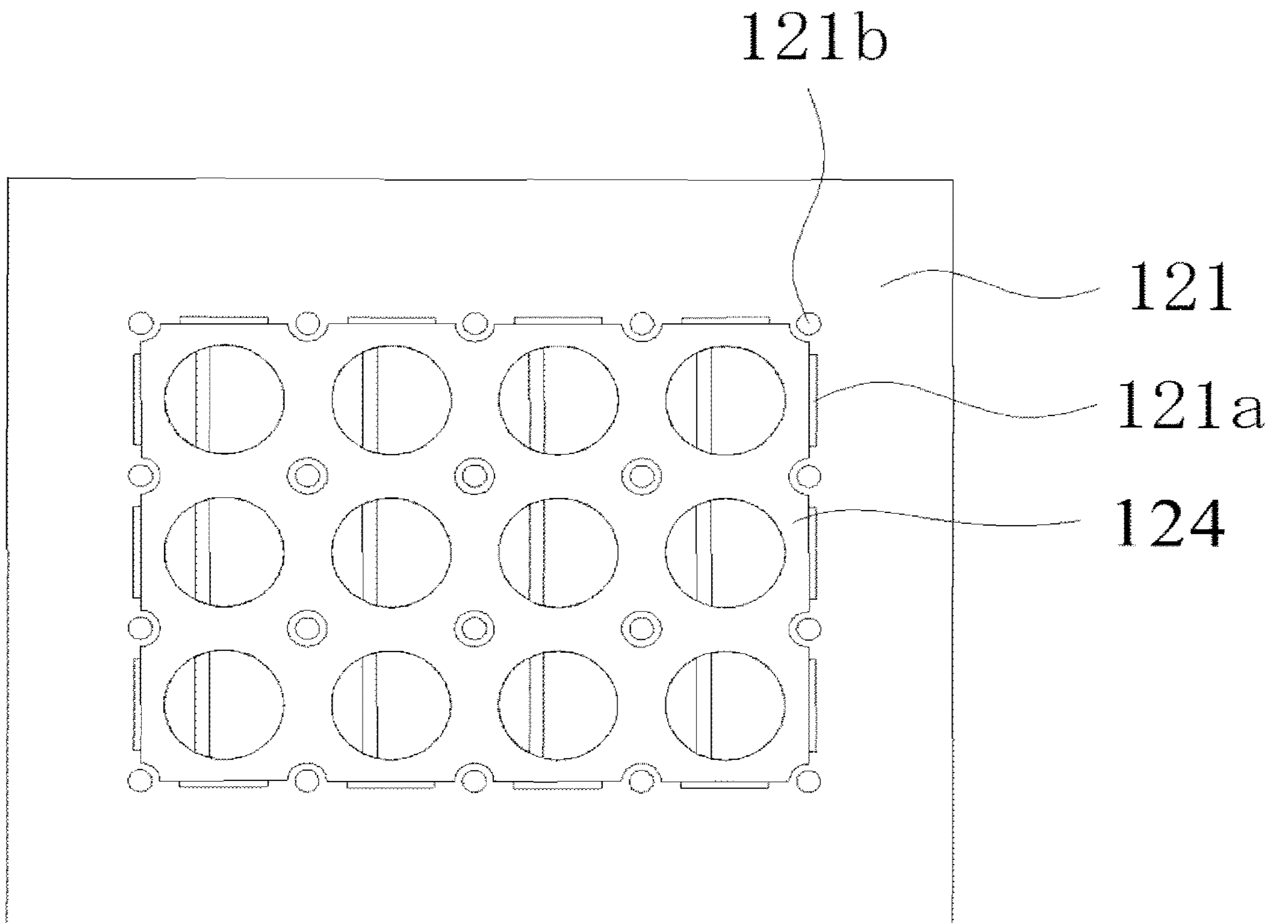

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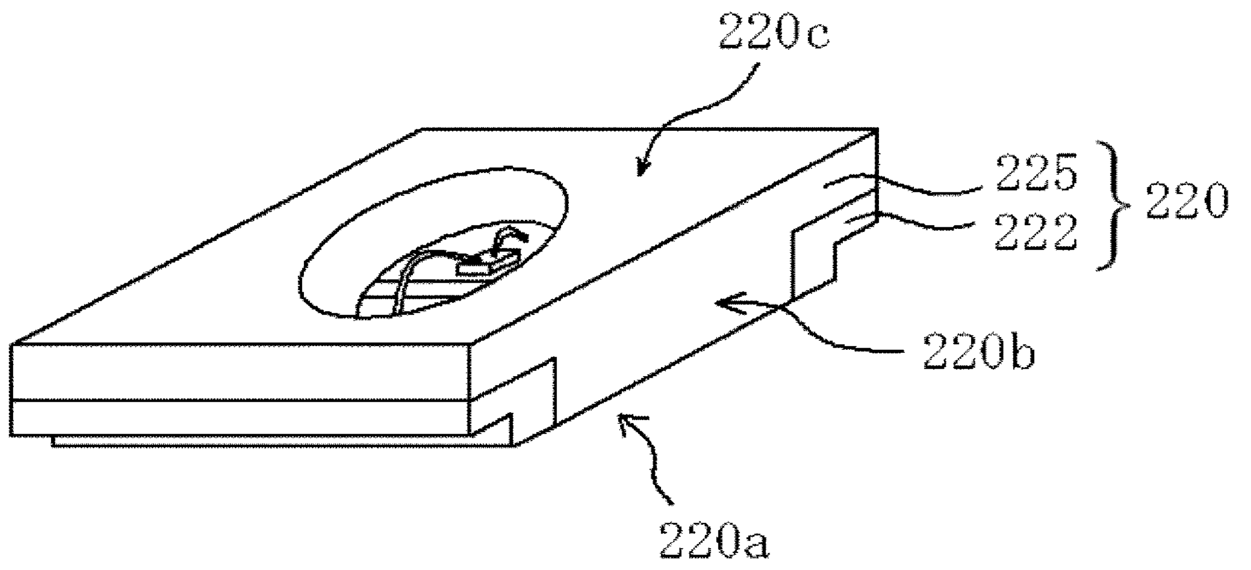
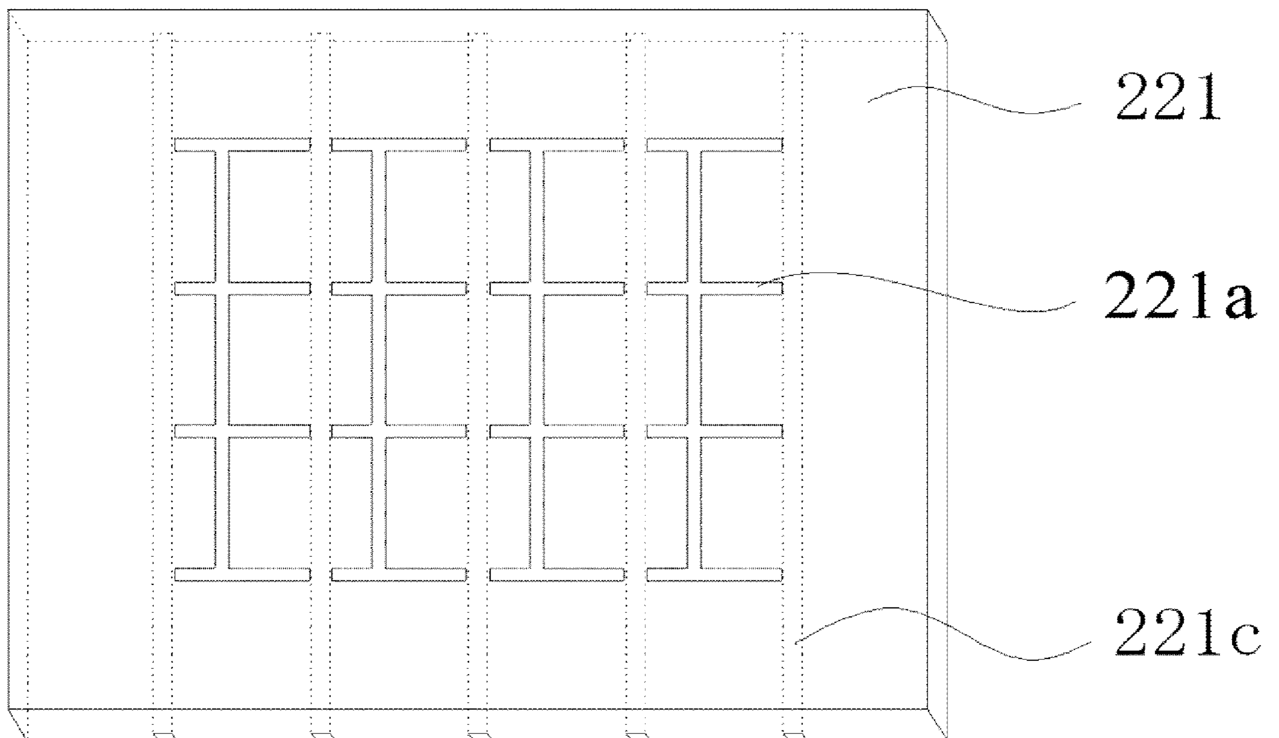
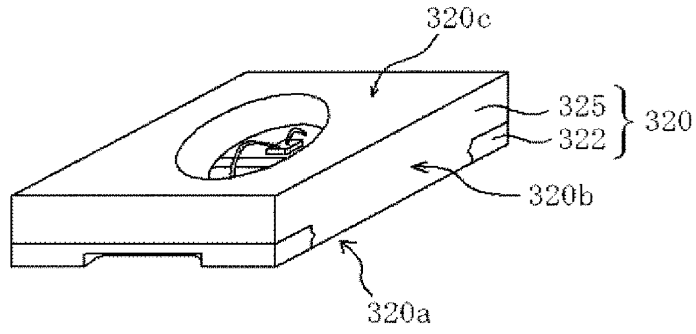


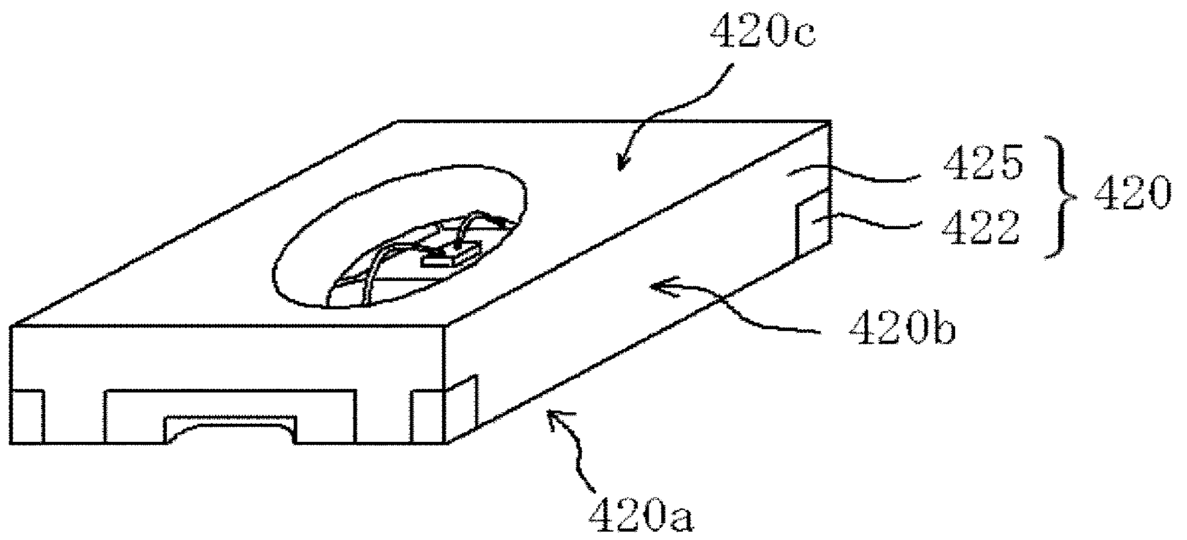
【図１０】



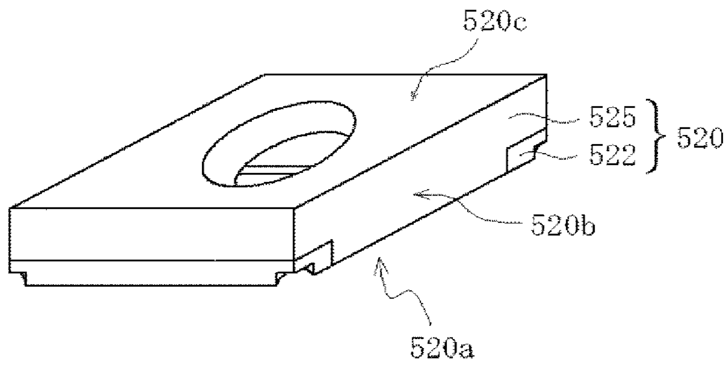
【図１１】



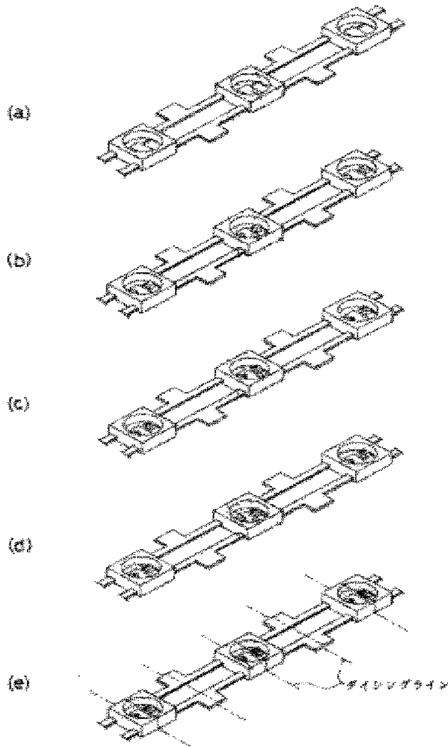
【図１２】



【図１３】



【図１４】



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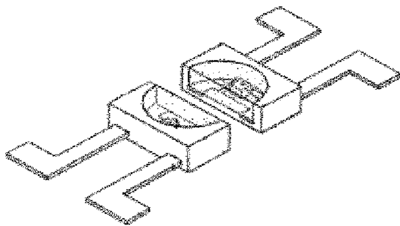
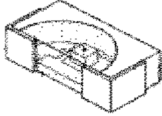
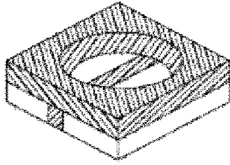
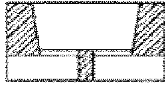


【図１６】



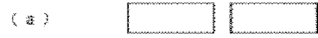
【図１７】



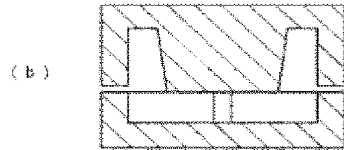


【図１８】

（ａ）



（ｂ）



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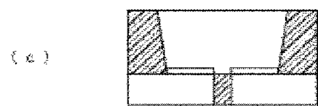
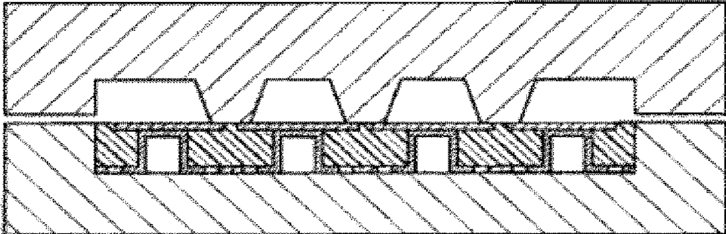


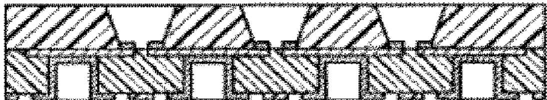
【図１９】

（a）

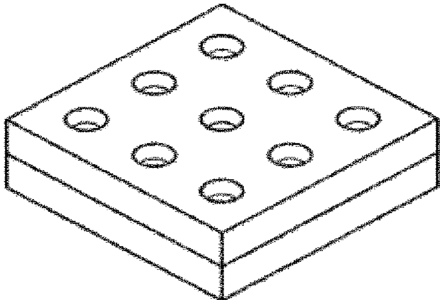
（b）



（c）



（d）



【書類名】要約書
【要約】
【課題】　リードフレームと熱硬化性樹脂組成物との密着性が高く、短時間に多数個の発光装置を製造する簡易かつ安価な方法を提供することを目的とする。
【解決手段】　熱硬化後の、波長３５０ｎｍ～８００ｎｍにおける光反射率が７０％以上であり、外側面２０ｂにおいて樹脂部２５とリード２２とが略同一面に形成されている樹脂パッケージ２０を有する発光装置の製造方法であって、切り欠き部２１ａを設けたリードフレーム２１を上金型６１と下金型６２とで挟み込む工程と、上金型６１と下金型６２とで挟み込まれた金型６０内に、光反射性物質２６が含有される熱硬化性樹脂２３をトランスファ・モールドして、リードフレーム２１に樹脂成形体２４を形成する工程と、切り欠き部２１ａに沿って樹脂成形体２３とリードフレーム２１とを切断する工程と、を有する発光装置の製造方法に関する。
【選択図】　図４

【書類名】　手続補正書
【整理番号】　12008077
【提出日】　平成23年 9月 2日
【あて先】　特許庁長官　殿
【事件の表示】
　【出願番号】　特願2008-225408
【補正をする者】
　【識別番号】　000226057
　【氏名又は名称】　日亜化学工業株式会社
　【代表者】　小川　英治
【手続補正1】
　【補正対象書類名】　特許請求の範囲
　【補正対象項目名】　全文
　【補正方法】　変更
　【補正の内容】
　　【書類名】特許請求の範囲
　　【請求項１】
　熱硬化後の、波長３５０ｎｍ～８００ｎｍにおける光反射率が７０％以上であり、外側面において樹脂部とリードとが略同一面に形成されている樹脂パッケージを有する発光装置の製造方法であって、
　切り欠き部を設けたリードフレームを上金型と下金型とで挟み込む工程と、
　前記上金型と下金型とで挟み込まれた金型内に、光反射性物質が含有される熱硬化性樹脂をトランスファ・モールドして、前記切り欠き部に前記熱硬化性樹脂を充填させて、前記リードフレームに樹脂成形体を形成する工程と、
　前記切り欠き部に沿って前記樹脂成形体と前記リードフレームとを切断する工程と、
を有する発光装置の製造方法。
　　【請求項２】
　前記上金型と下金型とで挟み込む前に、前記リードフレームにメッキ処理を施す請求項１に記載の発光装置の製造方法。
　　【請求項３】
　前記リードフレームは、切断部分における前記切り欠き部が全包囲周の約１／２以上である請求項１又は２のいずれかに記載の発光装置の製造方法。
　　【請求項４】
　前記リードフレームは、少なくとも１つ以上の孔を有し、
　前記切断する工程において、前記孔を通って前記リードフレームを切断する請求項１乃至３のいずれか一項に記載の発光装置の製造方法。
　　【請求項５】
　前記リードフレームは、少なくとも１つ以上の溝を有し、
　前記切断する工程において、前記溝を通って前記リードフレームを切断する請求項１乃至４のいずれか一項に記載の発光装置の製造方法。
　　【請求項６】
　前記上金型と下金型とは、発光素子が載置される部分、若しくは、前記孔部の近傍の部分のリードフレームを挟み込んでいる請求項１乃至５のいずれか一項に記載の発光装置の製造方法。
　　【請求項７】
　熱硬化後の、波長３５０ｎｍ～８００ｎｍにおける光反射率が７０％以上であり、外側面において樹脂部とリードとが略同一面に形成されている樹脂パッケージを有する発光装置であって、
　前記リードは底面及び上面の少なくともいずれか一面にメッキ処理が施されており、かつ、前記外側面はメッキ処理が施されていない部分を有する発光装置。

【請求項８】
前記樹脂パッケージは、四隅からリードが露出されている請求項７に記載の発光装置。
【請求項９】
前記樹脂パッケージは、底面側から視認して四隅が弧状に形成されている請求項７又は８のいずれかに記載の発光装置。
【請求項１０】
前記リードは、前記外側面及び外底面より凹んだ段差が設けられている請求項７乃至９のいずれか一項に記載の発光装置。
【請求項１１】
熱硬化後の、波長３５０ｎｍ～８００ｎｍにおける光反射率が７０％以上であり、外側面において樹脂部とリードとが略同一面に形成されている樹脂パッケージの製造方法であって、
切り欠き部を設けたリードフレームを上金型と下金型とで挟み込む工程と、
前記上金型と下金型とで挟み込まれた金型内に、光反射性物質が含有される熱硬化性樹脂をトランスファ・モールドして、前記切り欠き部に前記熱硬化性樹脂を充填させて、前記リードフレームに樹脂成形体を形成する工程と、
前記切り欠き部に沿って前記樹脂成形体と前記リードフレームとを切断する工程と、
を有する樹脂パッケージの製造方法。
【請求項１２】
前記上金型と下金型とで挟み込む前に、前記リードフレームにメッキ処理を施す請求項１１に記載の樹脂パッケージの製造方法。
【請求項１３】
熱硬化後の、波長３５０ｎｍ～８００ｎｍにおける光反射率が７０％以上であり、外側面において樹脂部とリードとが略同一面に形成されている樹脂パッケージであって、
前記リードは底面及び上面の少なくともいずれか一面にメッキ処理が施されており、かつ、前記外側面はメッキ処理が施されていない樹脂パッケージ。
【請求項１４】
熱硬化後の、波長３５０ｎｍ～８００ｎｍにおける光反射率が７０％以上であり、凹部が複数形成され、該凹部の内底面は、リードフレームの一部が露出されている、樹脂成形体の製造方法であって、
切り欠き部を設けたリードフレームを用い、前記樹脂成形体において隣り合う前記凹部が成形される位置に凸部を有する上金型と下金型とでリードフレームを挟み込む工程と、
前記上金型と下金型とで挟み込まれた金型内に、光反射性物質が含有される熱硬化性樹脂をトランスファ・モールドして、前記切り欠き部に前記熱硬化性樹脂を充填させ、かつ、前記リードフレームに前記樹脂成形体を形成する工程と、
を有する樹脂成形体の製造方法。
【請求項１５】
熱硬化後の、波長３５０ｎｍ～８００ｎｍにおける光反射率が７０％以上であり、凹部が複数形成され、該凹部の内底面は、リードフレームの一部が露出されている、樹脂成形体であって、
前記リードフレームは切り欠き部を有しており、該切り欠き部に前記樹脂成形体となる熱硬化性樹脂が充填されており、隣り合う凹部の間に側壁を有している樹脂成形体。

出願人履歴

０００２２６０５７

19900818

新規登録

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日亜化学工業株式会社

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United States Patent and Trademark Office
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P.O. Box 1450
Alexandria, Virginia 22313-1450
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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
14/928,550	10/30/2015	Hirofumi ICHIKAWA	100415-0198	1591

22428 7590 12/31/2015
Foley & Lardner LLP
3000 K STREET N.W.
SUITE 600
WASHINGTON, DC 20007-5109

EXAMINER	
EVERHART, CARIDAD	

ART UNIT	PAPER NUMBER
2895	

NOTIFICATION DATE	DELIVERY MODE
12/31/2015	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

ipdocketing@foley.com

PTOL-90A (Rev. 04/07)

Office Action Summary	Application No. 14/928,550	Applicant(s) ICHIKAWA ET AL.	
	Examiner CARIDAD EVERHART	Art Unit 2895	AIA (First Inventor to File) Status No

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE _3_ MONTHS FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____.
☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.

4)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims*

5)☒ Claim(s) _1-30_ is/are pending in the application.
5a) Of the above claim(s) _____ is/are withdrawn from consideration.

6)☐ Claim(s) _____ is/are allowed.

7)☒ Claim(s) _1-10,12,13,15-26,28 and 29_ is/are rejected.

8)☒ Claim(s) _11,14, 27, and 30_ is/are objected to.

9)☐ Claim(s) _____ are subject to restriction and/or election requirement.

* If any claims have been determined allowable, you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to PPHfeedback@uspto.gov.

Application Papers

10)☐ The specification is objected to by the Examiner.

11)☒ The drawing(s) filed on _10/30/2015_ is/are: a)☒ accepted or b)☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

Certified copies:

a)☒ All b)☐ Some** c)☐ None of the:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

** See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☒ Information Disclosure Statement(s) (PTO/SB/08a and/or PTO/SB/08b) Paper No(s)/Mail Date _____.

3) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

4) ☐ Other: _____.

The present application is being examined under the pre-AIA first to invent provisions.

Claim Rejections - 35 USC § 102

In the event the determination of the status of the application as subject to AIA 35 U.S.C. 102 and 103 (or as subject to pre-AIA 35 U.S.C. 102 and 103) is incorrect, any correction of the statutory basis for the rejection will not be considered a new ground of rejection if the prior art relied upon, and the rationale supporting the rejection, would be the same under either status.

The following is a quotation of the appropriate paragraphs of pre-AIA 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claim Rejections - 35 USC § 103

The following is a quotation of pre-AIA 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under pre-AIA 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.

2. Ascertaining the differences between the prior art and the claims at issue.

3. Resolving the level of ordinary skill in the pertinent art.

4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

This application currently names joint inventors. In considering patentability of the claims under pre-AIA 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of pre-AIA 35 U.S.C. 103(c) and potential pre-AIA 35 U.S.C. 102(e), (f) or (g) prior art under pre-AIA 35 U.S.C. 103(a).

Claims 1,-5, 8-9, 12, 15-18, 24-25 and 28 are rejected under pre-AIA 35 U.S.C. 102(e) as being anticipated by Takada (US 2008/0224151 A1).

Takada discloses a resin package which includes a resin part 2 (paragraph 0057 and Fig. 1) and a lead frame 1 which corresponds to a metal plate with a mounting portion 1c (paragraph 0057), a light emitting element which is a chip 4 (paragraph 0069)

mounted on the package as shown in Fig. 1 and electrically connected to the metal plate by the wire 5 (paragraph 0061), a portion of the outer lateral surface of the resin part and a portion of the outer lateral surface of the metal plate are coplanar at an outer lateral surface of the package, as disclosed in Fig. 2, which shows the lead frame parts which are coplanar to the resin parts at the sides the package, the resin part is located at left and right sides of a portion of the metal plate at an outer lateral surface of the resin package as shown in Fig. 2 on the right and left sides of the figure, and the metal plate is substantially flat, as shown in Fig. 1.

Re claim 5: Takada discloses the resin 2 contains a light reflecting material (paragraphs 0068 and 0069).

Re claim 8: Takada discloses the resin is a thermosetting resin (paragraph 0057).

Re claim 9: Takada discloses the lead frame which is the plate has a concave portion which is a slit-like groove 1m (paragraph 0067).

Re claim 12: Takada discloses resin portion 1m (paragraph 0059) shown in Fig. 2 which has concave portion and inner lateral portions.

Re claim 15: Fig. 1 and Fig. 2 show that the chip is exposed from the resin part.

Re claims 16-17: Takada discloses the limitations of claim 1, which are also limitations included in claims 16-17, and in addition Takada discloses in Fig. 1 the upper surfaces of the lead frame 1 are coplanar.

Re claim 18: Takada disclose the limitations of claim 1, which are also limitations of claim 18, and in addition Takada discloses in Fig. 1 a portion of the lead frame 1 exposed at the bottom of the package.

Re claim 24: Takada discloses the resin 2 contains a light reflecting material (paragraphs 0068 and 0069).

Re claim 25: : Takada discloses the lead frame which is the plate has a concave portion which is a slit-like groove 1m (paragraph 0067).

Re claim 28: Takada discloses resin portion 1m (paragraph 0059) shown in Fig. 2 which has concave portion and inner lateral portions.

Claims 2-4 and 19-21 are rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Takada as applied to claims 1 and 18 above, and further in view of Takeda et al (US 2007/0138697 A1).

Takada discloses the limitations of claims 1 and 18 as stated above. Takada is silent with respect to plating the lead frame or plate.

Takeda et al discloses plating the lead frame with a different metal on the upper and lower surfaces, as Takeda et al discloses plating the lead frame in the stage of manufacturing the lead frame (paragraph 0052), which is before the molding step (paragraph 0053), and therefore the upper and lower surfaces of the lead frame will be plated. Takeda et al disclose that the plating protects from oxidation, which is a disclosure that the metal with which the lead frame or plate is plated is a different metal which protects the lead frame metal.

It would have been obvious to one of ordinary skill in the art at the time of the invention to plate the metal of the lead frame disclosed by Takada as disclosed by Takeda et al in order to obtain the benefit of protecting the metal of the lead frame from oxidation as disclosed by Takeda et al .

Re claims 3 and 20: The combination of Takada in view of Takeda et al discloses the limitation of the metal layer being on the lead frame or plate except the lateral outer surfaces because the combination of Takada in view of Takeda et al discloses plating the lead frame or plate before the cutting of the lead frame step to separate the packages, which results in the lateral surfaces of the lead frame exposed on the lateral surfaces of the package not having a covering of the plated metal.

Re claims 4-21: Takada discloses in Fig. 7 and Fig. 8 portions of the metal plate 1c are exposed from the resin layer 3 and portions are covered by resin layer 3 (paragraphs 0095 and 0098).

Claims 6-7 and 22-23 are rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Takada as applied to claims 5 and 18 above, and further in view of Loh et al (US 2008/0044934 A1).

Takada discloses the limitations of claims 5 and 18 as stated above. Takada is silent with respect to titanium dioxide in the resin.

Loh et al disclose TiO2 added to the plastic in an LED package which includes a lead frame and a plastic material (paragraph 0036) , with TiO2 added as the reflective material (paragraphs 0037).

It would have been obvious to one of ordinary skill in the art at the time of the invention to have used TiO2 as the reflective material in the device disclosed by Takada as disclosed by Loh et al because this is a material of art recognized suitability for an intended purpose (MPEP 2144.07).

Re claims 7 and 23: Takada in view of Loh et al is silent with respect to the recited percentage of TiO2 in the resin. It would have been obvious to one of ordinary skill in the art to have formed the resin disclosed by Takada in view of Loh et al within the recited range of TiO2 because one of ordinary skill in the art would have been able to determine the amount of TiO2 added to the resin by routine optimization (MPEP 2144.05(II)).

Claims 10 and 26 are rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Takada as applied to claim 1 or over Takada in view of Takeda et al as applied to claim 19 above, and further in view of Azuma (US 2001/0009301 A1).

Takada discloses the limitations of claim 1 as stated above.

Takada is silent with respect to a level difference for expanding the area for conductor for bonding area upon mounting.

Azuma discloses a level difference which are concave portions 131 for mounting material 109 for mounting the chip 107 in a semiconductor package (paragraph 0157). The package includes a metal plate with pad portions 105 (paragraph 0152) and resin 113 (paragraph 0152 and Fig. 1 and Fig. 2B).

It would have been obvious to one of ordinary skill in the art at the time of the invention to have combined the disclosure made by Azuma with the device disclosed by Takada in order to obtain the benefit of improved bonding with bonding material of the semiconductor element as disclosed by Azuma (paragraph 0197).

Re claim 26: Takada in view of Takeda et al is silent with respect to expanding the area for conductor for bonding area upon mounting.

Azuma discloses the level difference as stated above. The reasons for combining Takada in view of Takeda et al are the same as stated above in the rejection of claim 10.

Claims 13 and 29 are rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Takada as applied to claims 1 and 18 above, and further in view of Soules et al (US 6,252,254 B1).

Takada discloses the limitations of 1 and 18 . Takada is silent with respect to two phosphors, although Takada does disclose phosphors in the resin which covers the semiconductor chip (paragraph 0084).

Soules et al discloses a resin in an LED package which contains two phosphors (column 4, lines 1-24), in order to combine the two phosphors in order to obtain the desired color of emitting light (column 4, lines 1-24).

It would have been obvious to one of ordinary skill in the art at the time of the invention to have combined two phosphors in the resin disclosed by Takada as

disclosed by Soules et al in order to obtain the benefit of the desired emission and because this is of art recognized suitability for an intended purpose (MPEP 2144.07).

Allowable Subject Matter

Claims 11, 14, 27, and 30 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to CARIDAD EVERHART whose telephone number is (571)272-1892. The examiner can normally be reached on Monday through Fridays 7:30-4:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, M. Islam can be reached on 571-270-5878. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Caridad Everhart/
Primary Examiner
AU 2895

12/28/2015

Notice of References Cited	Application/Control No. 14/928,550	Applicant(s)/Patent Under Reexamination ICHIKAWA ET AL.	
	Examiner CARIDAD EVERHART	Art Unit 2895	Page 1 of 1

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*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	CPC Classification	US Classification
*	A	US-2001/0009301 A1	07-2001	Azuma, Kosuke	H01L21/4832	257/698
*	B	US-2007/0138697 A1	06-2007	Takeda; Takeshi	B29C45/14221	264/278
*	C	US-2008/0044934 A1	02-2008	Loh; Ban P.	B29C45/14655	438/21
*	D	US-6,252,254 B1	06-2001	Soules; Thomas Frederick	C09K11/7731	257/100
*	E	US-2003/0006492 A1	01-2003	Ogasawara, Kazuto	H01L21/561	257/684
*	F	US-2008/0224161 A1	09-2008	Takada; Toshiyuki	H01L33/486	257/98
	G	US-				
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	I	US-				
	J	US-				
	K	US-				
	L	US-				
	M	US-				

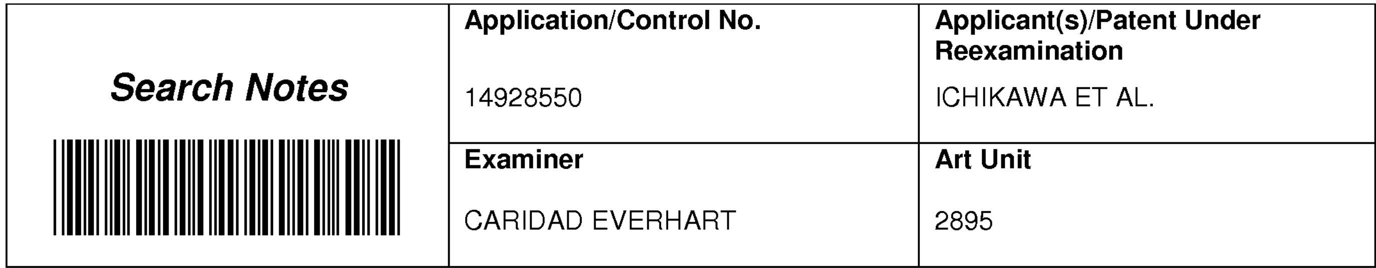
FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	CPC Classification
	N					
	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	
	V	
	W	
	X	

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.



Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	14928550	ICHIKAWA ET AL.
	Examiner	Art Unit
	CARIDAD EVERHART	2895

CPC- SEARCHED

Symbol	Date	Examiner
H01L33/0033; H01L33/385; B29C45/0055; B29C45/14655 (updated from parent)	12/19/2015	cme

CPC COMBINATION SETS - SEARCHED

Symbol	Date	Examiner

US CLASSIFICATION SEARCHED

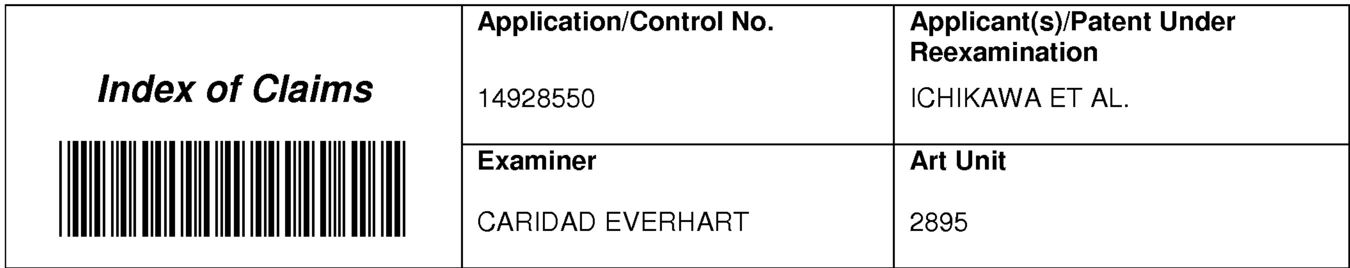
Class	Subclass	Date	Examiner
361	820 (updated from parent)	12/19/2015	cme
438	26 (updated from parent)	12/19/2015	cme
257	99; 100; E23.066	12/19/2015	cme

SEARCH NOTES

Search Notes	Date	Examiner
reviewed parent	12/21/2015	cme
EAST search H01L2924/181 or H01L33/62 or H01L33/60 with search terms (attached)	12/19/2015	cme

INTERFERENCE SEARCH

US Class/ CPC Symbol	US Subclass / CPC Group	Date	Examiner
EAST	attached	12/19/2015	cme



Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	14928550	ICHIKAWA ET AL.
	Examiner	**Art Unit**
	CARIDAD EVERHART	2895

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

CLAIM		DATE								
Final	Original	12/28/2015								
	1	✓								
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	30	O								

EAST Search History

EAST Search History (Prior Art)

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L1	3	"20140084320"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2015/12/19 10:33
L2	7	"8530250"	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	OFF	2015/12/19 10:34
L3	21	ICHIKAWA-HIROFUMI	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	OFF	2015/12/19 10:41
L5	1224	HAYASHI-MASAKI	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	OFF	2015/12/19 10:41
L7	11	SASAOKA-SHIMPEI	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	OFF	2015/12/19 10:41
L9	53	MIKI-TOMOHIDE	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	OFF	2015/12/19 10:42
L11	21	(3 or 5 or 7 or 9) and (((lead adj frame) or plate) same ("LED" or (light adj emitting adj diode)) same resin)	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	OFF	2015/12/19 10:43
L14	186	h01l021/00.ipc. and (((lead adj frame) or plate) same ("LED" or (light adj emitting adj diode)) same resin)	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	OFF	2015/12/19 10:44
L15	10335	(((lead adj frame) or plate) same ("LED" or (light adj emitting adj diode)) same resin)	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	OFF	2015/12/19 10:56
L16	1318	15 AND ((H01L2924/181 OR H01L33/62 OR H01L33/60).CPC.)	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	OFF	2015/12/19 10:57
L17	4043	438/26.ccls.	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	OFF	2015/12/19 11:11
L18	3798	438/27.ccls.	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	OFF	2015/12/19 11:11
L19	4043	438/26.ccls.	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	OFF	2015/12/19 11:11
L20	12754	257/99.ccls.	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	OFF	2015/12/19 11:15
L21	4173	257/100.ccls.	US-PGPUB; USPAT; EPO; JPO;	OR	OFF	2015/12/19 11:16

			DERWENT			
L22	12754	257/99.ccls.	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	OFF	2015/12/19 11:20
L23	698	361/820.ccls.	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	OFF	2015/12/19 11:29
L24	0	257/e21/504.ccls.	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	OFF	2015/12/19 11:30
L25	3169	257/e21.504.ccls.	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	OFF	2015/12/19 11:30
L26	947	257/e23.066.ccls.	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	OFF	2015/12/19 11:31
L27	72	h01l33/0033.cpc.	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	OFF	2015/12/19 11:34
L28	826	h01l33/385.cpc.	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	OFF	2015/12/19 11:35
L29	595	b29c45/0055.cpc.	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	OFF	2015/12/19 11:36
L30	0	b29c45/4655.cpc.	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	OFF	2015/12/19 11:37
L31	1064	b29c45/14655.cpc.	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	OFF	2015/12/19 11:37

EAST Search History (Interference)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L4	10	ICHIKAWA-HIROFUMI	US-PGPUB; USPAT	OR	OFF	2015/12/19 10:41
L6	364	HAYASHI-MASAKI	US-PGPUB; USPAT	OR	OFF	2015/12/19 10:41
L8	10	SASAOKA-SHIMPEI	US-PGPUB; USPAT	OR	OFF	2015/12/19 10:41
L10	41	MIKI-TOMOHIDE	US-PGPUB; USPAT	OR	OFF	2015/12/19 10:42
L12	21	(4 or 6 or 8 or 10) and (((lead adj frame) or plate) same ("LED" or (light adj emitting adj diode)) same resin)	US-PGPUB; USPAT	OR	OFF	2015/12/19 10:43
L13	186	h01l021/00.ipc. and (((lead adj frame) or plate) same ("LED" or (light adj emitting adj diode)) same resin)	US-PGPUB; USPAT	OR	OFF	2015/12/19 10:44

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EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
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EAST Search History (Interference)

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PTO/SB/08 (modified)

Substitute for form 1449/PTO				Complete if Known	
INFORMATION DISCLOSURE STATEMENT BY APPLICANT				**Application Number**	Unassigned
				Filing Date	10/30/2015
Date Submitted: October 30, 2015				**First Named Inventor**	Hirofumi ICHIKAWA
				Art Unit	Unassigned
(use as many sheets as necessary)				Examiner Name	Unassigned
Sheet	1	of	4	Attorney Docket Number	100415-0198

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Examiner Initials*	Cite No.[1]	Document Number Number-Kind Code[2] (*if known*)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
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ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /C.E./

Examiner Signature	/Caridad Everhart/	Date Considered	12/28/2015

4815-8574-6474.1

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /C.E./

Substitute for form 1449/PTO				Complete if Known	
INFORMATION DISCLOSURE STATEMENT BY APPLICANT				**Application Number**	Unassigned
Date Submitted: October 30, 2015				**Filing Date**	10/30/2015
(use as many sheets as necessary)				**First Named Inventor**	Hirofumi ICHIKAWA
				Art Unit	Unassigned
				Examiner Name	Unassigned
Sheet	2	of	4	Attorney Docket Number	100415-0198

UNPUBLISHED U.S. PATENT APPLICATION DOCUMENTS

Examiner Initials*	Cite No.[1]	U.S. Patent Application Document Serial Number-Kind Code[2] (*if known*)	Filing Date of Cited Document MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear

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Examiner Initials*	Cite No.[1]	Foreign Patent Document Country Code[3]-Number[4]-Kind Code[5] (*if known*)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Documents	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear	T[6]
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Examiner Signature	/Caridad Everhart/	Date Considered	12/28/2015

4815-8574-6474.1

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /C.E./

Substitute for form 1449/PTO				Complete if Known	
INFORMATION DISCLOSURE STATEMENT BY APPLICANT				**Application Number**	Unassigned
Date Submitted: October 30, 2015				**Filing Date**	10/30/2015
				First Named Inventor	Hirofumi ICHIKAWA
(use as many sheets as necessary)				Art Unit	Unassigned
				Examiner Name	Unassigned
Sheet	3	of	4	Attorney Docket Number	100415-0198

FOREIGN PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Foreign Patent Document Country Code[3]-Number[4]-Kind Code[5] (*if known*)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Documents	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear	T[6]
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NON PATENT LITERATURE DOCUMENTS

Examiner Initials*	Cite No.[1]	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.) date, page(s), volume-issue number(s), publisher, city and/or country where published.	T[6]
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ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /C.E./

Examiner Signature	/Caridad Everhart/	Date Considered	12/28/2015

4815-8574-6474.1

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /C.E./

Substitute for form 1449/PTO				Complete if Known	
INFORMATION DISCLOSURE STATEMENT BY APPLICANT				**Application Number**	Unassigned
				Filing Date	10/30/2015
Date Submitted: October 30, 2015				**First Named Inventor**	Hirofumi ICHIKAWA
				Art Unit	Unassigned
(use as many sheets as necessary)				Examiner Name	Unassigned
Sheet	4	of	4	Attorney Docket Number	100415-0198

NON PATENT LITERATURE DOCUMENTS

Examiner Initials*	Cite No.[1]	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.) date, page(s), volume-issue number(s), publisher, city and/or country where published.	T[6]
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ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /C.E./

Examiner Signature	/Caridad Everhart/	Date Considered	12/28/2015

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BIB DATA SHEET

CONFIRMATION NO. 1591

SERIAL NUMBER	FILING or 371(c) DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
14/928,550	10/30/2015 **RULE**	438	2895	100415-0198

APPLICANTS
NICHIA CORPORATION, Anan-shi, JAPAN;

INVENTORS
Hirofumi ICHIKAWA, Komatsushima-shi, JAPAN;
Masaki HAYASHI, Anan-shi, JAPAN;
Shimpei SASAOKA, Tokushima-shi, JAPAN;
Tomohide MIKI, Tokushima-shi, JAPAN;

** **CONTINUING DATA** *************************
This application is a CON of 13/969,182 08/16/2013
which is a CON of 12/737,940 05/13/2011 PAT 8530250
which is a 371 of PCT/JP2009/004170 08/27/2009

** **FOREIGN APPLICATIONS** ************************
JAPAN 2008-225408 09/03/2008

** **IF REQUIRED, FOREIGN FILING LICENSE GRANTED** **
11/10/2015

Foreign Priority claimed ☑ Yes ☐ No 35 USC 119(a-d) conditions met ☑ Yes ☐ No Verified and Acknowledged /CARIDAD EVERHART/ Examiner's Signature	☐ Met after Allowance Initials	STATE OR COUNTRY	SHEETS DRAWINGS	TOTAL CLAIMS	INDEPENDENT CLAIMS
		JAPAN	13	30	4

ADDRESS

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UNITED STATES

TITLE

LIGHT EMITTING DEVICE, RESIN PACKAGE, RESIN-MOLDED BODY, AND METHODS FOR MANUFACTURING LIGHT EMITTING DEVICE, RESIN PACKAGE AND RESIN-MOLDED BODY

FILING FEE RECEIVED	FEES: Authority has been given in Paper	
2820	No.____________ to charge/credit DEPOSIT ACCOUNT No.____________ for following:	☐ All Fees ☐ 1.16 Fees (Filing) ☐ 1.17 Fees (Processing Ext. of time) ☐ 1.18 Fees (Issue) ☐ Other ________________ ☐ Credit

BIB (Rev. 05/07).

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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
14/928,550	10/30/2015	Hirofumi ICHIKAWA	100415-0198

CONFIRMATION NO. 1591

PUBLICATION NOTICE

22428
Foley & Lardner LLP
3000 K STREET N.W.
SUITE 600
WASHINGTON, DC 20007-5109

Title:LIGHT EMITTING DEVICE, RESIN PACKAGE, RESIN-MOLDED BODY, AND METHODS FOR MANUFACTURING LIGHT EMITTING DEVICE, RESIN PACKAGE AND RESIN-MOLDED BODY

Publication No.US-2016-0056357-A1
Publication Date:02/25/2016

NOTICE OF PUBLICATION OF APPLICATION

The above-identified application will be electronically published as a patent application publication pursuant to 37 CFR 1.211, et seq. The patent application publication number and publication date are set forth above.

The publication may be accessed through the USPTO's publically available Searchable Databases via the Internet at www.uspto.gov. The direct link to access the publication is currently http://www.uspto.gov/patft/.

The publication process established by the Office does not provide for mailing a copy of the publication to applicant. A copy of the publication may be obtained from the Office upon payment of the appropriate fee set forth in 37 CFR 1.19(a)(1). Orders for copies of patent application publications are handled by the USPTO's Office of Public Records. The Office of Public Records can be reached by telephone at (703) 308-9726 or (800) 972-6382, by facsimile at (703) 305-8759, by mail addressed to the United States Patent and Trademark Office, Office of Public Records, Alexandria, VA 22313-1450 or via the Internet.

In addition, information on the status of the application, including the mailing date of Office actions and the dates of receipt of correspondence filed in the Office, may also be accessed via the Internet through the Patent Electronic Business Center at www.uspto.gov using the public side of the Patent Application Information and Retrieval (PAIR) system. The direct link to access this status information is currently http://pair.uspto.gov/. Prior to publication, such status information is confidential and may only be obtained by applicant using the private side of PAIR.

Further assistance in electronically accessing the publication, or about PAIR, is available by calling the Patent Electronic Business Center at 1-866-217-9197.

Office of Data Managment, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

First Inventor Name:	Hirofumi ICHIKAWA
Title:	LIGHT EMITTING DEVICE, RESIN PACKAGE, RESIN-MOLDED BODY, AND METHODS FOR MANUFACTURING LIGHT EMITTING DEVICE, RESIN PACKAGE AND RESIN-MOLDED BODY
Appl. No.:	14/928,550
Filing Date:	10/30/2015
Examiner:	Caridad EVERHART
Art Unit:	2895
Confirmation Number:	1591

AMENDMENT AND REPLY UNDER 37 CFR 1.111

Mail Stop AMENDMENT
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Commissioner:

This communication is responsive to the non-final Office Action mailed December 31, 2015, concerning the above-referenced patent application.

Amendments to the Claims are reflected in the listing of claims which begins on page 2 of this document.

Remarks begin on page 8 of this document.

Please amend the application as follows:

Amendments to the Claims:

This listing of claims will replace all prior versions and listings of claims in the application:

Listing of Claims:

1. (Currently Amended) A light emitting device comprising:

a resin package comprising a resin part and a metal part including at least [[one]] two metal [[plate]] plates, said resin package having four outer lateral surfaces and having a concave portion having a bottom surface; and

a light emitting element mounted on the ~~resin package~~ bottom surface of the concave portion and electrically connected to the ~~at least one metal plate~~ metal part,

wherein at least a portion of an outer lateral surface of the resin part and at least a portion of an outer lateral surface of the ~~at least one metal plate~~ metal part are coplanar at [[an]] each of the four outer lateral ~~surface~~ surfaces of the resin package,

wherein a notch is formed in the metal part at each of the four outer lateral surfaces of the resin package,

wherein the resin part is located at left and right sides of a portion of the ~~at least one metal plate~~ metal part at ~~an outer lateral surface~~ at least two of the four outer lateral surfaces of the resin package, and

wherein ~~the at least one metal plate~~ each of the two metal plates is substantially flat.

2. (Currently Amended) The light emitting device according to claim 1, wherein ~~a metal layer made of a different material from that of the at least one metal plate is disposed on an upper surface and a lower surface of the at least one metal plate~~ the metal part includes a base portion and a metal layer disposed on each of an upper surface and a lower surface of the base portion, the metal layers being made of a material that is different from that of the base portion.

3. (Currently Amended) The light emitting device according to claim 2, wherein the metal layer is disposed [[on]] at all surfaces of the ~~at least one metal plate~~ metal part except a portion of an outer lateral surface of the ~~at least one metal plate~~ metal part.

4. (Currently Amended) The light emitting device according to claim 2, wherein:

the resin part is disposed over a first portion of the metal layer [[on]] at the upper surface of the ~~at least one metal plate~~ metal part, and

a second portion of the metal layer [[on]] at the upper surface of the ~~at least one metal plate~~ metal part is exposed from the resin part.

5. (Original) The light emitting device according to claim 1, wherein the resin part contains a light reflecting material.

6. (Original) The light emitting device according to claim 5, wherein the light reflecting material is titanium dioxide.

7. (Original) The light emitting device according to claim 6, wherein the resin part contains 10 to 60% by weight of the titanium dioxide.

8. (Original) The light emitting device according to claim 1, wherein the resin part is made using a thermosetting resin.

9. (Currently Amended) The light emitting device according to claim 1, wherein the ~~at least one metal plate~~ metal part has a step portion, a concave portion, and/or a convex portion.

10. (Currently Amended) The light emitting device according to claim 1, wherein the ~~at least one metal plate~~ metal part has means for providing a difference in level to expand a bonding area with a conductive material upon mounting.

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11. – 12. (Cancelled)

13. (Original) The light emitting device according to claim 1, wherein the light emitting device further comprises a sealing member that contains two or more kinds of phosphors.

14. (Currently Amended) The light emitting device according to claim 1, wherein the ~~at least one metal plate~~ metal part is exposed from the resin part at corners of the resin package.

15. (Original) The light emitting device according to claim 1, wherein at least a portion of the light emitting element is exposed from the resin part.

16. (Currently Amended) A light emitting device comprising:

a resin package comprising a resin part and a metal part including at least [[one]] two metal [[plate]] plates, said resin package having four outer lateral surfaces and having a concave portion having a bottom surface; and

a light emitting element mounted on the ~~resin package~~ bottom surface of the concave portion and electrically connected to the ~~at least one metal plate~~ metal part,

wherein at least a portion of an outer lateral surface of the resin part and at least a portion of an outer lateral surface of the ~~at least one metal plate~~ metal part are coplanar at [[an]] each of the four outer lateral ~~surface~~ surfaces of the resin package,

wherein a notch is formed in the metal part at each of the four outer lateral surfaces of the resin package,

wherein the resin part is located at left and right sides of a portion of the ~~at least one metal plate~~ metal part at ~~an outer lateral surface~~ at least two of the four outer lateral surfaces of the resin package,

wherein the ~~at least one metal plate~~ metal part comprises [[one]] two or more major laterally extending upper surfaces, and

wherein all of the [[one]] two or more major laterally extending upper surfaces are coplanar.

17. (Currently Amended) A light emitting device comprising:

a resin package comprising a resin part and a metal part including at least [[one]] two metal [[plate]] plates, said resin package having four outer lateral surfaces and having a concave portion having a bottom surface; and

a light emitting element mounted on the ~~resin package~~ bottom surface of the concave portion and electrically connected to the ~~at least one metal plate~~ metal part,

wherein at least a portion of an outer lateral surface of the resin part and at least a portion of an outer lateral surface of the ~~at least one metal plate~~ metal part are coplanar at [[an]] each of the four outer lateral ~~surface~~ surfaces of the resin package,

wherein a notch is formed in the metal part at each of the four outer lateral surfaces of the resin package,

wherein the resin part is located at left and right sides of a portion of the ~~at least one metal plate~~ metal part at ~~an outer lateral surface~~ at least two of the four outer lateral surfaces of the resin package, and

wherein all upper edges of the ~~at least one metal plate~~ metal part are coplanar.

18. (Currently Amended) A light emitting device comprising:

a resin package comprising a resin part ~~containing a light reflecting material,~~ and a metal part including at least [[one]] two metal [[plate]] plates, said resin package having four outer lateral surfaces and having a concave portion having a bottom surface; and

a light emitting element mounted on the ~~resin package~~ bottom surface of the concave portion and electrically connected to the ~~at least one metal plate~~ metal part,

wherein at least a portion of an outer surface of the resin part and at least a portion of an outer surface of the ~~at least one metal plate~~ metal part are coplanar at an outer bottom surface of the resin package,

wherein at least a portion of an outer lateral surface of the resin part and at least a portion of an outer lateral surface of the ~~at least one metal plate~~ metal are coplanar at [[an]] each of the four outer lateral ~~surface~~ surfaces of the resin package,

wherein a notch is formed in the metal part at each of the four outer lateral surfaces of the resin package,

wherein the resin part is located at left and right sides of a portion of the ~~at least one metal plate~~ metal part at ~~an outer lateral surface~~ at least two of the four outer lateral surfaces of the resin package, and

wherein a lower surface of the ~~at least one metal plate~~ metal part is exposed from the resin part in a region directly under the light emitting element.

19. (Currently Amended) The light emitting device according to claim 18, wherein ~~a metal layer made of a different material from that of the at least one metal plate is disposed on an upper surface and the lower surface of the at least one metal plate~~ the metal part includes a base portion and a metal layer disposed on each of an upper surface and a lower surface of the base portion, the metal layers being made of a material that is different from that of the base portion.

20. (Currently Amended) The light emitting device according to claim 19, wherein the metal layer is disposed [[on]] at all surfaces of the ~~at least one metal plate~~ metal part except an outer lateral surface of the ~~at least one metal plate~~ metal part.

21. (Currently Amended) The light emitting device according to claim 19, wherein:

the resin part is disposed over a first portion of the metal layer [[on]] at the upper surface of the ~~at least one metal plate~~ metal part, and

a second portion of the metal layer on the upper surface of the ~~at least one metal plate~~ metal part is exposed from the resin part.

22. (Currently Amended) The light emitting device according to claim 18, wherein the ~~light reflecting material is titanium dioxide~~ resin part contains a light reflecting material.

23. (Currently Amended) The light emitting device according to claim 22, wherein the light reflecting material is titanium dioxide, and the resin part contains 10 to 60% by weight of the titanium dioxide.

24. (Original) The light emitting device according to claim 18, wherein the resin part is made using a thermosetting resin.

25. (Currently Amended) The light emitting device according to claim 18, wherein the ~~at least one metal plate~~ metal part has a step portion, a concave portion, and/or a convex portion.

26. (Currently Amended) The light emitting device according to claim 19, wherein the ~~at least one metal plate~~ metal part has means for providing a difference in level to expand a bonding area with a conductive material upon mounting.

27. – 28. (Cancelled)

29. (Original) The light emitting device according to claim 18, wherein the light emitting device further comprises a sealing member that contains two or more kinds of phosphors.

30. (Currently Amended) The light emitting device according to claim 18, wherein the ~~at least one metal plate~~ metal part is exposed from the resin part at corners of the resin package.

REMARKS

Applicants respectfully request reconsideration of the present application in view of the foregoing amendments and the reasons that follow.

Status of Claims

Claims 1-4, 9, 10, 14, 16-23, 25, 26, and 30 are amended. Claims 11, 12, 27, and 28 are cancelled. After amending the claims as set forth above, claims 1-10, 13-26, 29, and 30 are now pending in this application. No new matter is added.

Allowable Subject Matter

Applicants appreciate the Examiner's indication that claims 11, 14, 27, and 30 are directed to allowable subject matter.

Independent claims 1 and 16-18 are amended to recite that "a notch is formed in the metal part at each of the four outer lateral surfaces of the resin package," which is similar, though narrower than, the limitation is allowable claims 11 and 27. Thus, claims 1 and 16-18 are patentable for at least the same reasons as previous claims 11 and 27.

Rejections Under 35 U.S.C. § 102

Claims 1, 5, 8-9, 12, 15-18, 24-25 and 28 stand rejected under pre-AIA 35 U.S.C. 102(e) as allegedly being anticipated by Takada (US 2008/0224161 A1).

Applicants do not acquiesce to the propriety of the rejection. However, to advance prosecution of the present application, independent claims 1 and 16-18 are amended to recite that "a notch is formed in the metal part at each of the four outer lateral surfaces of the resin package," which is similar, though narrower than, the limitation is allowable claims 11 and 27. Thus, claims 1 and 16-18 are patentable for at least the same reasons as previous claims 11 and 27.

Claims 2-5, 8, 9, 12, 15, 24, 25, and 28 depend from independent claims 1 and 18, and are patentable for at least the same reasons as claims 1 and 18, even without regard to the further patentable features recited therein.

For at least these reasons, Applicants respectfully request favorable reconsideration of the rejection.

Rejections Under 35 U.S.C. § 103

Claims 2-4 and 19-21 stand rejected under pre-AIA 35 U.S.C. 103(a) as allegedly being unpatentable over Takada as applied to claims 1 and 18 above, and further in view of Takeda et al (US 2007/0138697 A1).

Claims 6-7 and 22-23 stand rejected under pre-AIA 35 U.S.C. 103(a) as allegedly being unpatentable over Takada as applied to claims 5 and 18 above, and further in view of Loh et al (US 2008/0044934 A1).

Claims 10 and 26 stand rejected under pre-AIA 35 U.S.C. 103(a) as allegedly being unpatentable over Takada as applied to claim 1 or over Takada in view of Takeda et al as applied to claim 19 above, and further in view of Azuma (US 2001/0009301 A1).

Claims 13 and 29 stand rejected under pre-AIA 35 U.S.C. 103(a) as allegedly being unpatentable over Takada as applied to claims 1 and 18 above, and further in view of Soules et al (US 6,252,254 B1).

Claims 2-4, 6, 7, 10, 13, 19-23, 26, and 29 depend from independent claims 1 and 18, and are patentable for at least the same reasons as claims 1 and 18, even without regard to the further patentable features recited therein.

For at least these reasons, Applicants respectfully request favorable reconsideration of the rejections.

Concluding Remarks

Applicants believe that the application is in condition for allowance. Favorable reconsideration is respectfully requested. The Examiner is invited to contact the undersigned by telephone if it is felt that a telephone interview would advance prosecution.

The Commissioner is hereby authorized to charge any additional fees which may be required regarding this application, or credit any overpayment, to Deposit Account No. 19-0741. If any extensions of time are needed for timely acceptance of papers submitted herewith, Applicants hereby petition for such extension under 37 C.F.R. §1.136 and authorize payment of any such extensions fees to Deposit Account No. 19-0741.

Respectfully submitted,

Date May 2, 2016

By /Chase J. Brill/

FOLEY & LARDNER LLP
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Chase J. Brill
Attorney for Applicant
Registration No. 61,378

Electronic Patent Application Fee Transmittal

Application Number:	14928550
Filing Date:	30-Oct-2015
Title of Invention:	LIGHT EMITTING DEVICE, RESIN PACKAGE, RESIN-MOLDED BODY, AND METHODS FOR MANUFACTURING LIGHT EMITTING DEVICE, RESIN PACKAGE AND RESIN-MOLDED BODY
First Named Inventor/Applicant Name:	Hirofumi ICHIKAWA
Filer:	Chase J. Brill/Stacy Jen
Attorney Docket Number:	100415-0198

Filed as Large Entity

Filing Fees for **Utility under 35 USC 111(a)**

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Extension - 1 month with $0 paid	1251	1	200	200
Miscellaneous:				
		Total in USD ($)		**200**

Electronic Acknowledgement Receipt

EFS ID:	25657237
Application Number:	14928550
International Application Number:	
Confirmation Number:	1591
Title of Invention:	LIGHT EMITTING DEVICE, RESIN PACKAGE, RESIN-MOLDED BODY, AND METHODS FOR MANUFACTURING LIGHT EMITTING DEVICE, RESIN PACKAGE AND RESIN-MOLDED BODY
First Named Inventor/Applicant Name:	Hirofumi ICHIKAWA
Customer Number:	22428
Filer:	Chase J. Brill/Stacy Jen
Filer Authorized By:	Chase J. Brill
Attorney Docket Number:	100415-0198
Receipt Date:	02-MAY-2016
Filing Date:	30-OCT-2015
Time Stamp:	15:54:31
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Credit Card
Payment was successfully received in RAM	$200
RAM confirmation Number	16557
Deposit Account	
Authorized User	

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		100415-0198_Response_to_NFOA_31Dec2015.pdf	123864 922f673101c9a35c957e4fcc37226fd56ae391cf	yes	10

Multipart Description/PDF files in .zip description		
Document Description	**Start**	**End**
Amendment/Req. Reconsideration-After Non-Final Reject	1	1
Claims	2	7
Applicant Arguments/Remarks Made in an Amendment	8	10

Warnings:

Information:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
2	Fee Worksheet (SB06)	fee-info.pdf	31201 77ecad46e549b61c5a82ad63bfdc6aeb94c26e3e	no	2

Warnings:

Information:

Total Files Size (in bytes):	155065

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

PTO/SB/06 (09-11)
Approved for use through 1/31/2014. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number 14/928,550	Filing Date 10/30/2015	☐ To be Mailed

ENTITY: ☒ LARGE ☐ SMALL ☐ MICRO

APPLICATION AS FILED – PART I

FOR	(Column 1) NUMBER FILED	(Column 2) NUMBER EXTRA	RATE ($)	FEE ($)
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A	
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A	
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 =	*	X $ =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*	X $ =	
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $310 ($155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).			
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))				
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL	

APPLICATION AS AMENDED – PART II

AMENDMENT	05/02/2016	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	* 26	Minus	** 30	= 0	x $80 =	0
	Independent (37 CFR 1.16(h))	* 4	Minus	***4	= 0	x $420 =	0
	☐ Application Size Fee (37 CFR 1.16(s))						
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))						
						TOTAL ADD'L FEE	**0**

AMENDMENT		(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	*	Minus	**	=	X $ =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	X $ =	
	☐ Application Size Fee (37 CFR 1.16(s))						
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))						
						TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.

LIE
/SHEILA D. CHAPMAN/

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

NOTICE OF ALLOWANCE AND FEE(S) DUE

22428 7590 08/26/2016
Foley & Lardner LLP
3000 K STREET N.W.
SUITE 600
WASHINGTON, DC 20007-5109

EXAMINER	
EVERHART, CARIDAD	
ART UNIT	PAPER NUMBER
2895	

DATE MAILED: 08/26/2016

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
14/928,550	10/30/2015	Hirofumi ICHIKAWA	100415-0198	1591

TITLE OF INVENTION: LIGHT EMITTING DEVICE, RESIN PACKAGE, RESIN-MOLDED BODY, AND METHODS FOR MANUFACTURING LIGHT EMITTING DEVICE, RESIN PACKAGE AND RESIN-MOLDED BODY

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	$960	$0	$0	$960	11/28/2016

THE APPLICATION IDENTIFIED ABOVE HAS BEEN EXAMINED AND IS ALLOWED FOR ISSUANCE AS A PATENT. PROSECUTION ON THE MERITS IS CLOSED. THIS NOTICE OF ALLOWANCE IS NOT A GRANT OF PATENT RIGHTS. THIS APPLICATION IS SUBJECT TO WITHDRAWAL FROM ISSUE AT THE INITIATIVE OF THE OFFICE OR UPON PETITION BY THE APPLICANT. SEE 37 CFR 1.313 AND MPEP 1308.

THE ISSUE FEE AND PUBLICATION FEE (IF REQUIRED) MUST BE PAID WITHIN THREE MONTHS FROM THE MAILING DATE OF THIS NOTICE OR THIS APPLICATION SHALL BE REGARDED AS ABANDONED. THIS STATUTORY PERIOD CANNOT BE EXTENDED. SEE 35 U.S.C. 151. THE ISSUE FEE DUE INDICATED ABOVE DOES NOT REFLECT A CREDIT FOR ANY PREVIOUSLY PAID ISSUE FEE IN THIS APPLICATION. IF AN ISSUE FEE HAS PREVIOUSLY BEEN PAID IN THIS APPLICATION (AS SHOWN ABOVE), THE RETURN OF PART B OF THIS FORM WILL BE CONSIDERED A REQUEST TO REAPPLY THE PREVIOUSLY PAID ISSUE FEE TOWARD THE ISSUE FEE NOW DUE.

HOW TO REPLY TO THIS NOTICE:

I. Review the ENTITY STATUS shown above. If the ENTITY STATUS is shown as SMALL or MICRO, verify whether entitlement to that entity status still applies.

If the ENTITY STATUS is the same as shown above, pay the TOTAL FEE(S) DUE shown above.

If the ENTITY STATUS is changed from that shown above, on PART B - FEE(S) TRANSMITTAL, complete section number 5 titled "Change in Entity Status (from status indicated above)".

For purposes of this notice, small entity fees are 1/2 the amount of undiscounted fees, and micro entity fees are 1/2 the amount of small entity fees.

II. PART B - FEE(S) TRANSMITTAL, or its equivalent, must be completed and returned to the United States Patent and Trademark Office (USPTO) with your ISSUE FEE and PUBLICATION FEE (if required). If you are charging the fee(s) to your deposit account, section "4b" of Part B - Fee(s) Transmittal should be completed and an extra copy of the form should be submitted. If an equivalent of Part B is filed, a request to reapply a previously paid issue fee must be clearly made, and delays in processing may occur due to the difficulty in recognizing the paper as an equivalent of Part B.

III. All communications regarding this application must give the application number. Please direct all communications prior to issuance to Mail Stop ISSUE FEE unless advised to the contrary.

IMPORTANT REMINDER: Utility patents issuing on applications filed on or after Dec. 12, 1980 may require payment of maintenance fees. It is patentee's responsibility to ensure timely payment of maintenance fees when due.

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), to: Mail **Mail Stop ISSUE FEE**
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450
or Fax (571)-273-2885

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

22428 7590 08/26/2016

Foley & Lardner LLP
3000 K STREET N.W.
SUITE 600
WASHINGTON, DC 20007-5109

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

Certificate of Mailing or Transmission

I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being facsimile transmitted to the USPTO (571) 273-2885, on the date indicated below.

(Depositor's name)

(Signature)

(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
14/928,550	10/30/2015	Hirofumi ICHIKAWA	100415-0198	1591

TITLE OF INVENTION: LIGHT EMITTING DEVICE, RESIN PACKAGE, RESIN-MOLDED BODY, AND METHODS FOR MANUFACTURING LIGHT EMITTING DEVICE, RESIN PACKAGE AND RESIN-MOLDED BODY

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	$960	$0	$0	$960	11/28/2016

EXAMINER	ART UNIT	CLASS-SUBCLASS
EVERHART, CARIDAD	2895	438-026000

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).
   - ❑ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.
   - ❑ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-02 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list
   (1) The names of up to 3 registered patent attorneys or agents OR, alternatively,
   (2) The name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.
   1 ____________
   2 ____________
   3 ____________

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document has been filed for recordation as set forth in 37 CFR 3.11. Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE

(B) RESIDENCE: (CITY and STATE OR COUNTRY)

Please check the appropriate assignee category or categories (will not be printed on the patent) : ❑ Individual ❑ Corporation or other private group entity ❑ Government

4a. The following fee(s) are submitted:
- ❑ Issue Fee
- ❑ Publication Fee (No small entity discount permitted)
- ❑ Advance Order - # of Copies ____________

4b. Payment of Fee(s): **(Please first reapply any previously paid issue fee shown above)**
- ❑ A check is enclosed.
- ❑ Payment by credit card. Form PTO-2038 is attached.
- ❑ The director is hereby authorized to charge the required fee(s), any deficiency, or credits any overpayment, to Deposit Account Number ____________ (enclose an extra copy of this form).

5. **Change in Entity Status** (from status indicated above)
- ❑ Applicant certifying micro entity status. See 37 CFR 1.29

  NOTE: Absent a valid certification of Micro Entity Status (see forms PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.
- ❑ Applicant asserting small entity status. See 37 CFR 1.27

  NOTE: If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.
- ❑ Applicant changing to regular undiscounted fee status.

  NOTE: Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

NOTE: This form must be signed in accordance with 37 CFR 1.31 and 1.33. See 37 CFR 1.4 for signature requirements and certifications.

Authorized Signature ____________ Date ____________

Typed or printed name ____________ Registration No. ____________

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
14/928,550	10/30/2015	Hirofumi ICHIKAWA	100415-0198	1591

22428 7590 08/26/2016

Foley & Lardner LLP
3000 K STREET N.W.
SUITE 600
WASHINGTON, DC 20007-5109

EXAMINER	
EVERHART, CARIDAD	
ART UNIT	PAPER NUMBER
2895	

DATE MAILED: 08/26/2016

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)
(Applications filed on or after May 29, 2000)

The Office has discontinued providing a Patent Term Adjustment (PTA) calculation with the Notice of Allowance.

Section 1(h)(2) of the AIA Technical Corrections Act amended 35 U.S.C. 154(b)(3)(B)(i) to eliminate the requirement that the Office provide a patent term adjustment determination with the notice of allowance. See Revisions to Patent Term Adjustment, 78 Fed. Reg. 19416, 19417 (Apr. 1, 2013). Therefore, the Office is no longer providing an initial patent term adjustment determination with the notice of allowance. The Office will continue to provide a patent term adjustment determination with the Issue Notification Letter that is mailed to applicant approximately three weeks prior to the issue date of the patent, and will include the patent term adjustment on the patent. Any request for reconsideration of the patent term adjustment determination (or reinstatement of patent term adjustment) should follow the process outlined in 37 CFR 1.705.

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Customer Service Center of the Office of Patent Publication at 1-(888)-786-0101 or (571)-272-4200.

VIZIO Ex. 1002 Page 0178

OMB Clearance and PRA Burden Statement for PTOL-85 Part B

The Paperwork Reduction Act (PRA) of 1995 requires Federal agencies to obtain Office of Management and Budget approval before requesting most types of information from the public. When OMB approves an agency request to collect information from the public, OMB (i) provides a valid OMB Control Number and expiration date for the agency to display on the instrument that will be used to collect the information and (ii) requires the agency to inform the public about the OMB Control Number's legal significance in accordance with 5 CFR 1320.5(b).

The information collected by PTOL-85 Part B is required by 37 CFR 1.311. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450. Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Notice of Allowability	**Application No.** 14/928,550	**Applicant(s)** ICHIKAWA ET AL.	
	Examiner CARIDAD EVERHART	**Art Unit** 2895	**AIA (First Inventor to File) Status** No

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to *amendment filed 5/2/2016*.
   ☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on______.

2. ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.

3. ☒ The allowed claim(s) is/are *1-10,13-26,29 and 30*. As a result of the allowed claim(s), you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to PPHfeedback@uspto.gov.

4. ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

   Certified copies:

   a) ☒ All b) ☐ Some *c) ☐ None of the:

   1. ☒ Certified copies of the priority documents have been received.
   2. ☐ Certified copies of the priority documents have been received in Application No. ______ .
   3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

   * Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

5. ☒ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.

   ☒ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.

   Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).

6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☐ Notice of References Cited (PTO-892)
2. ☐ Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date _____
3. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material
4. ☒ Interview Summary (PTO-413), Paper No./Mail Date _____ .
5. ☒ Examiner's Amendment/Comment
6. ☐ Examiner's Statement of Reasons for Allowance
7. ☐ Other _____.

/Caridad Everhart/
Primary Examiner
AU 2895

The present application is being examined under the pre-AIA first to invent provisions.

EXAMINER'S AMENDMENT

An examiner's amendment to the record appears below. Should the changes and/or additions be unacceptable to applicant, an amendment may be filed as provided by 37 CFR 1.312. To ensure consideration of such an amendment, it MUST be submitted no later than the payment of the issue fee.

Authorization for this examiner's amendment was given in an interview with Attorney Chase J. Brill on 8/17/2016.

The application has been amended as follows:

In the Claims:

In claim 1, line 2, please delete:

"at least two"

And substitute therefor:

first and second

.

In claim 1, in the last line, after the words "each of the", please delete:

"two"

And substitute therefor:

first and second

.

In claim 16, line 2, please delete:

"at least two"

And substitute therefor:

first and second

.

In claim 17, line 2, please delete:

"at least two"

And substitute therefor:

first and second

.

In claim 18, line 3, please delete:

"at least two"

And substitute therefor:

first and second

.

Drawings

The following changes to the drawings have been approved by the examiner and agreed upon by applicant: Figures 14, 15, 16, 17, 18, and 19 should be designated by a legend such as --Prior Art-- because only that which is old is illustrated. See MPEP § 608.02(g). Corrected drawings in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. The replacement sheet(s) should be labeled “Replacement Sheet” in the page header (as per 37 CFR 1.84(c)) so as not to obstruct any portion of the drawing figures. If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

In order to avoid abandonment of the application, applicant must make these above agreed upon drawing changes.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to CARIDAD EVERHART whose telephone number is (571)272-1892. The examiner can normally be reached on Monday through Fridays 7:30-4:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, M. Islam can be reached on 571-270-5878. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Caridad Everhart/
Primary Examiner
AU 2895 8/17/2016

Examiner-Initiated Interview Summary	Application No.	Applicant(s)	
	14/928,550	ICHIKAWA ET AL.	
	Examiner	Art Unit	
	CARIDAD EVERHART	2895	

All participants (applicant, applicant's representative, PTO personnel):

(1) *CARIDAD EVERHART*. (3)_____.

(2) *Attorney Chase J. Brill*. (4)_____.

Date of Interview: *17 August 2016*.

Type: ☒ Telephonic ☐ Video Conference
☐ Personal [copy given to: ☐ applicant ☐ applicant's representative]

Exhibit shown or demonstration conducted: ☐ Yes ☐ No.
If Yes, brief description: _____.

Issues Discussed ☐101 ☐112 ☐102 ☐103 ☐Others
(For each of the checked box(es) above, please describe below the issue and detailed description of the discussion)

Claim(s) discussed: _____.

Identification of prior art discussed: _____.

Substance of Interview
(For each issue discussed, provide a detailed description and indicate if agreement was reached. Some topics may include: identification or clarification of a reference or a portion thereof, claim interpretation, proposed amendments, arguments of any applied references etc...)

Applicant's representative gave permission for an examiner's amendment to claims 1, 16, 17, and 18, to change "at least two" to read "first and second metal plates". On 18 August 2016 the examiner also called to state that the Notice of Allowability would include a change required in the drawings: Fig. 14 through Fig. 19 should be labelled "Prior Art".

Applicant recordation instructions: It is not necessary for applicant to provide a separate record of the substance of interview.

Examiner recordation instructions: Examiners must summarize the substance of any interview of record. A complete and proper recordation of the substance of an interview should include the items listed in MPEP 713.04 for complete and proper recordation including the identification of the general thrust of each argument or issue discussed, a general indication of any other pertinent matters discussed regarding patentability and the general results or outcome of the interview, to include an indication as to whether or not agreement was reached on the issues raised.

☐ Attachment

/Caridad Everhart/
Primary Examiner
AU 2895

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L18	423	(((resin or plastic or polymer$2) adj2 package) and (first adj2 second adj2 metal))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/08/18 14:06
L19	36	18 AND ((H01L2224/94 OR H01L2224/05556 OR H01L2924/12044 OR H01L23/142).CPC.)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/08/18 14:11
L20	423	(((resin or plastic or polymer$2) adj2 package) and (first adj2 second adj2 metal))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/08/18 14:14
L21	33	(((resin or plastic or polymer$2) adj2 package) and (first adj2 second adj2 metal)) and ((light adj emitting) or oled)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/08/18 14:16
L22	2	"20160056357"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/08/18 14:19
L23	45	(((resin or plastic or polymer$2) adj2 package) and (first adj2 second adj2 (plates or metal))) and ((light adj emitting) or oled)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/08/18 14:22
L24	23	23 AND ((H01L2924/12043 OR H01L33/60 OR H01L2924/12041 OR H01L33/486 OR H01L33/62 OR H01L33/642 OR H01L33/505 OR H01L25/167).CPC.)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/08/18 14:29
L25	14	(h01l33/62.cpc. or h01l33/486.cpc. or	US-PGPUB;	OR	ON	2016/08/18

		h01l33/60.cpc. or h01l33/641.cpc.) and ((((resin or plastic or polymer$2) adj2 package) and (first adj2 second adj2 (plates or metal))) and ((light adj emitting) or oled))	USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB			14:46
L26	2	h01l33/62.ipc. and ((((resin or plastic or polymer$2) adj2 package) and (first adj2 second adj2 (plates or metal))) and ((light adj emitting) or oled))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/08/18 14:48
L27	0	h01l33/63.ipc. and ((((resin or plastic or polymer$2) adj2 package) and (first adj2 second adj2 (plates or metal))) and ((light adj emitting) or oled))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/08/18 14:48
L28	4	h01l33/60.ipc. and ((((resin or plastic or polymer$2) adj2 package) and (first adj2 second adj2 (plates or metal))) and ((light adj emitting) or oled))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/08/18 14:48
L29	3	h01l33/48.ipc. and ((((resin or plastic or polymer$2) adj2 package) and (first adj2 second adj2 (plates or metal))) and ((light adj emitting) or oled))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/08/18 14:49
L30	33	(b29c45/0055.cpc. or b29c45/14655.cpc. or b29c2794/0009.cpc. or h01l2924/00.cpc. or h01l2924/000112.cpc. or h01l2924/181.cpc.) and ((((resin or plastic or polymer$2) adj2 package) and (first adj2 second adj2 (plates or metal))) and ((light adj emitting) or oled))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/08/18 14:52

EAST Search History (Interference)

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L5	17	ICHIKAWA-HIROBUMI ICHIKAWA-HIROFUMI	US-PGPUB; USPAT	OR	ON	2016/08/18 13:29
L6	3	HAYASHI-MAKI	US-PGPUB; USPAT	OR	ON	2016/08/18 13:29
L7	17	SASAOKA-SHIMPEI	US-PGPUB; USPAT	OR	ON	2016/08/18 13:30
L8	49	MIKI-TOMOHIDE	US-PGPUB; USPAT	OR	ON	2016/08/18 13:30
L10	0	(5 or 6 or 7 or 8) and (first adj2 second adj2	US-	OR	ON	2016/08/18

		metal).clm.	PGPUB; USPAT			13:31
L11	28	(((resin or plastic or polymer$2) adj2 package) and (first adj2 second adj2 metal)).clm.	US-PGPUB; USPAT	OR	ON	2016/08/18 13:33
L12	14	nichia and (first adj2 second adj2 metal).clm.	US-PGPUB; USPAT	OR	ON	2016/08/18 13:35
L13	0	nichia and (((resin or plastic or polymer$2) adj2 package) and (first adj2 second adj2 metal)).clm.	US-PGPUB; USPAT	OR	ON	2016/08/18 13:36
L14	376	(((resin or plastic or polymer$2) adj2 package) and (first adj2 second adj2 metal))	US-PGPUB; USPAT	OR	ON	2016/08/18 13:37
L15	30	14 AND ((H01L2224/94 OR H01L23/492 OR H01L2224/37011 OR H01L2924/12044).CPC.)	US-PGPUB; USPAT	OR	ON	2016/08/18 13:43

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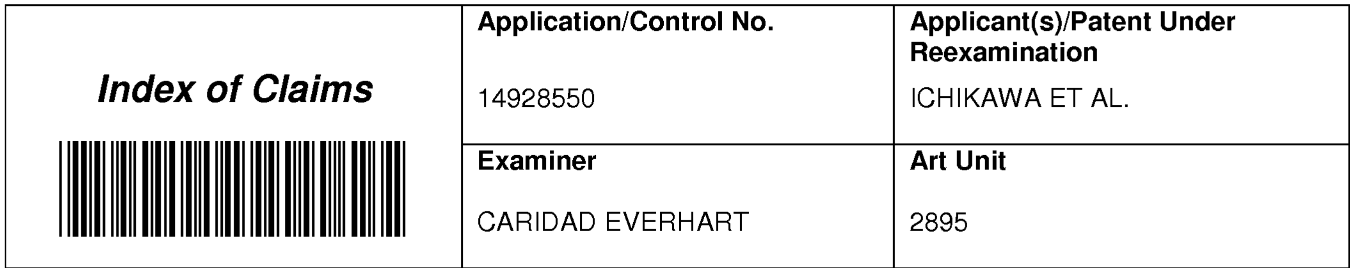

Index of Claims	Application/Control No. 14928550	Applicant(s)/Patent Under Reexamination ICHIKAWA ET AL.
	Examiner CARIDAD EVERHART	Art Unit 2895

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

CLAIM		DATE								
Final	Original	12/28/2015	08/13/2016							
1	1	✓	=							
5	2	✓	=							
6	3	✓	=							
7	4	O	=							
8	5	✓	=							
9	6	✓	=							
10	7	✓	=							
11	8	✓	=							
12	9	✓	=							
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	11	O	-							
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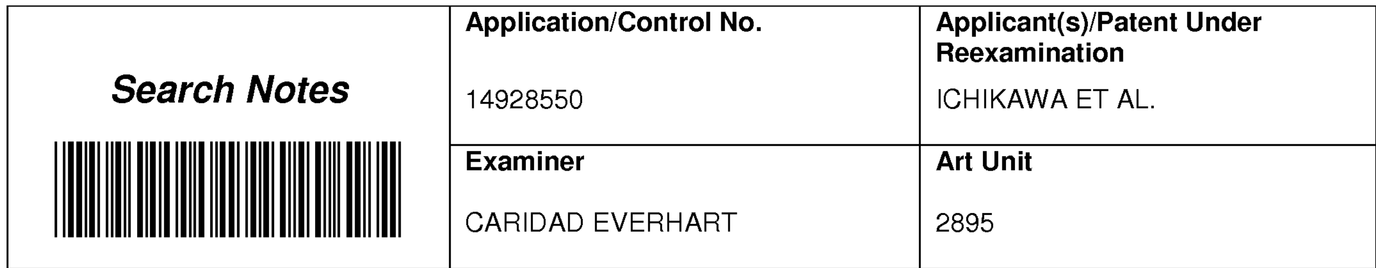

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	14928550	ICHIKAWA ET AL.
	Examiner	**Art Unit**
	CARIDAD EVERHART	2895

CPC- SEARCHED

Symbol	Date	Examiner
H01L33/0033; H01L33/385; B29C45/0055; B29C45/14655 (updated from parent)	12/19/2015	cme
H01L24/97; H01L33/62; H01L33/60; H01L33/486; H01L33/641; H01L2924/48091; H01L2924/3025; H01L2924/12041; H01L2924/12035; H01L2924/00012; H01L2924/00; H01L2924/00014; B29C45/0066; B29C45/14655;	8/13/16; 8/18/16	cme

CPC COMBINATION SETS - SEARCHED

Symbol	Date	Examiner

US CLASSIFICATION SEARCHED

Class	Subclass	Date	Examiner
361	820 (updated from parent)	12/19/2015	cme
438	26 (updated from parent)	12/19/2015	cme
257	99; 100; E23.066	12/19/2015	cme

SEARCH NOTES

Search Notes	Date	Examiner
reviewed parent	12/21/2015	cme
EAST search H01L2924/181 or H01L33/62 or H01L33/60 with search terms (attached)	12/19/2015	cme
EAST attached	8/13/16; 8/18/16	cme
The CPC classes listed in the CPC Search have been EAST classification searched with search terms	8/13/16; 8/18/16	cme

INTERFERENCE SEARCH

US Class/ CPC Symbol	US Subclass / CPC Group	Date	Examiner

INTERFERENCE SEARCH			
US Class/ CPC Symbol	**US Subclass / CPC Group**	**Date**	**Examiner**
EAST	attached	12/19/2015	cme
EAST	attached	8/13/16; 8/18/16	cme

EAST Search History

EAST Search History (Prior Art)

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L1	2	("20160056357").PN.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2016/08/13 08:53
L2	1	((two near5 (metal adj (plate$1 or part$1))) and ((resin or polymeric or plastic) near4 package) and coplanar and (metal near9 (notch or notched))).clm.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/08/13 09:06
L3	1	((two near5 (metal adj (plate$1 or part$1))) and ((resin or polymeric or plastic) near4 package) and coplanar and (metal near9 (step or stepped))).clm.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/08/13 09:07
L4	0	((two near5 (metal adj (plate$1 or part$1))) and ((resin or polymeric or plastic) near4 package) and coplanar and (metal near9 ((step or stepped)) same (four or corner$1))).clm.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/08/13 09:09
L5	0	((two near5 (metal adj (plate$1 or part$1))) and ((resin or polymeric or plastic) near4 package) and coplanar and ((metal near9 (notch or notched)) same (four or corner$1))).clm.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/08/13 09:09
L6	4	((two near5 (metal adj (plate$1 or part$1))) and ((resin or polymeric or plastic) near4 package) and coplanar and (metal near9 ((step or stepped)) same (four or corner$1)))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/08/13 09:09
L7	4	6 AND ((H01L2924/00).CPC.)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/08/13 09:14
L8	0	((two near5 (metal adj (plate$1 or	US-PGPUB;	OR	ON	2016/08/13

		part$1))) and ((resin or polymeric or plastic) near4 package) and coplanar and ((metal near9 (notch or notched)) same (four or corner$1)))	USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB			09:14
L9	10	((two near5 (metal adj (plate$1 or part$1))) and ((resin or polymeric or plastic) near4 package) and coplanar and (metal near9 (notch or notched)))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/08/13 09:14
L10	10	9 AND ((H01L2924/00 OR H01L2924/00014 OR H01L2224/48091 OR H01L2924/12035 OR H01L2924/12041 OR H01L2924/3025 OR H01L2924/00012 OR H01L24/97 OR H01L33/486 OR H01L33/60 OR H01L33/62 OR H01L33/641).CPC.)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/08/13 09:18
L11	3	(h01l2033/0033.cpc. or h01l2224/4825.cpc. or h01l2224/48247.cpc. or h01l2224/48091.cpc. or h01l2033/0033.cpc.) and ((two near5 (metal adj (plate$1 or part$1))) and ((resin or polymeric or plastic) near4 package) and coplanar and (metal near9 (notch or notched or step or stepped)))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/08/13 09:21
L12	1	(b29c45/0055.cpc. or b29c45/14655.cpc. or b29c2793/009.cpc) and ((two near5 (metal adj (plate$1 or part$1))) and ((resin or polymeric or plastic) near4 package) and coplanar and (metal near9 (notch or notched)))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/08/13 09:23
L13	1	h01l33/62.ipc. and ((two near5 (metal adj (plate$1 or part$1))) and ((resin or polymeric or plastic) near4 package) and coplanar and (metal near9 (notch or notched)))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/08/13 09:23
L14	1	h01l33/60.ipc. and ((two near5 (metal adj (plate$1 or part$1))) and ((resin or polymeric or plastic) near4 package) and coplanar and (metal near9 (notch or notched)))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/08/13 09:24
L15	0	h01l33/48.ipc. and ((two near5 (metal adj (plate$1 or part$1))) and ((resin or polymeric or plastic) near4 package) and coplanar and (metal near9 (notch or notched)))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/08/13 09:24
L16	0	h01l33/48.ipc. and ((two near5 (metal adj (plate$1 or part$1))) and ((resin or polymeric or plastic) near4 package) and coplanar and (metal near9 (step or	US-PGPUB; USPAT; USOCR; FPRS; EPO;	OR	ON	2016/08/13 09:25

VIZIO Ex. 1002 Page 0193

		stepped)))	JPO; DERWENT; IBM_TDB			
L17	1	h01l33/60.ipc. and ((two near5 (metal adj (plate$1 or part$1))) and ((resin or polymeric or plastic) near4 package) and coplanar and (metal near9 (step or stepped)))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/08/13 09:25
L18	1	h01l33/62.ipc. and ((two near5 (metal adj (plate$1 or part$1))) and ((resin or polymeric or plastic) near4 package) and coplanar and (metal near9 (step or stepped)))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/08/13 09:25
L22	41	((two near5 (metal adj (plate$1 or part$1))) and ((resin or polymeric or plastic) near4 package) and coplanar)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/08/13 09:28
L23	20	((two near5 (metal adj (plate$1 or part$1))) and ((resin or polymeric or plastic) near4 package) and coplanar and (metal near9 (step or stepped or notch or notched)))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/08/13 09:28
L24	41	((two near5 (metal adj (plate$1 or part$1))) and ((resin or polymeric or plastic) near4 package) and coplanar)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/08/13 09:29

EAST Search History (Interference)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
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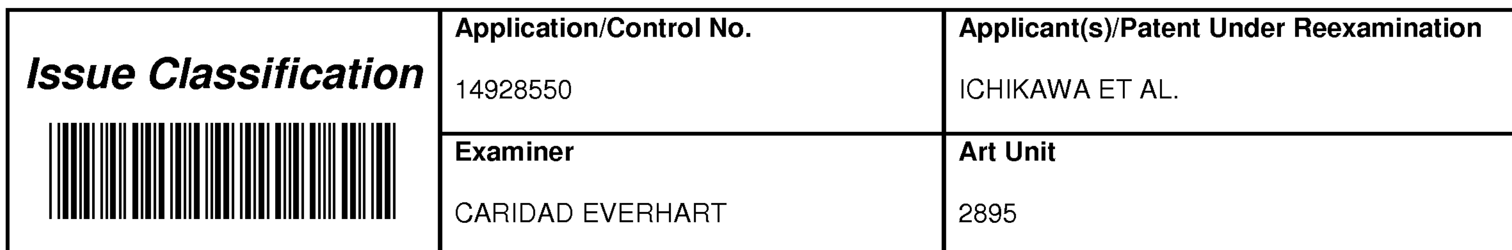
L21	11	((two near5 (metal adj (plate$1 or part$1))) and ((resin or polymeric or plastic) near4 package)).clm.	US-PGPUB; USPAT	OR	ON	2016/08/13 09:27

8/13/2016 9:32:14 AM



Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	14928550	ICHIKAWA ET AL.
	Examiner	**Art Unit**
	CARIDAD EVERHART	2895

CPC

Symbol			Type	Version
H01L	33	62	F	2013-01-01
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B29C	45	14655	I	2013-01-01
B29C	2793	009	A	2013-01-01
H01L	33	60	I	2013-01-01
H01L	2224	48091	A	2013-01-01
H01L	2224	48247	A	2013-01-01
H01L	33	486	I	2013-01-01
H01L	2933	0033	A	2013-01-01
H01L	2933	0066	A	2013-01-01
H01L	24	97	I	2013-01-01
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H01L	2924	12041	A	2013-01-01
H01L	2924	181	A	2013-01-01
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CPC Combination Sets

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H01L	2924	12041	A	3	1	2013-01-01
H01L	2924	00	A	3	2	2013-01-01
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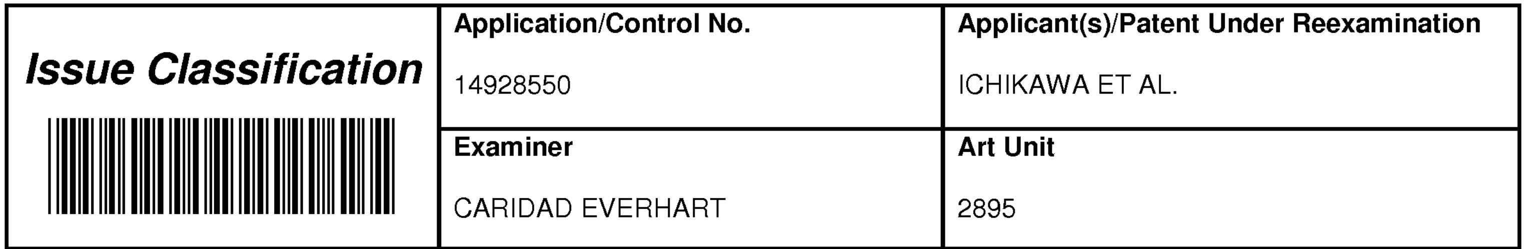
H01L	2924	12035	A	5	1	2013-01-01

NONE (Assistant Examiner)	(Date)	**Total Claims Allowed:** 26	
/CARIDAD EVERHART/ Primary Examiner.Art Unit 2895 (Primary Examiner)	8/13/2016 (Date)	O.G. Print Claim(s) 1	O.G. Print Figure 6



Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	14928550	ICHIKAWA ET AL.
	Examiner	**Art Unit**
	CARIDAD EVERHART	2895

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H01L		2924	/	181	A	7	1	2013-01-01
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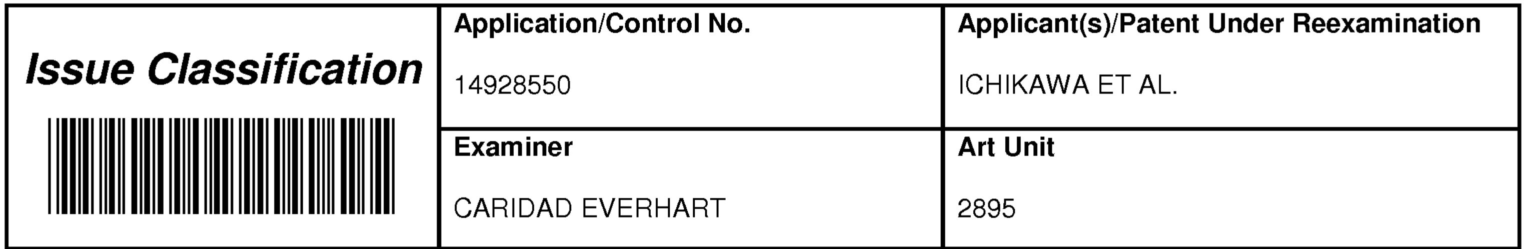
NONE (Assistant Examiner)	(Date)	**Total Claims Allowed:** 26	
/CARIDAD EVERHART/ Primary Examiner.Art Unit 2895 (Primary Examiner)	8/13/2016 (Date)	O.G. Print Claim(s) 1	O.G. Print Figure 6



Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	14928550	ICHIKAWA ET AL.
	Examiner	**Art Unit**
	CARIDAD EVERHART	2895

US ORIGINAL CLASSIFICATION	
CLASS	**SUBCLASS**

CROSS REFERENCE(S)

CLASS	SUBCLASS (ONE SUBCLASS PER BLOCK)				

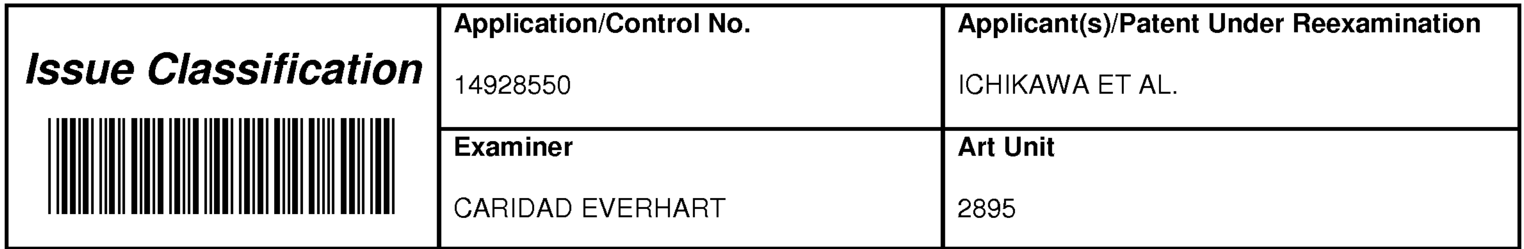
INTERNATIONAL CLASSIFICATION

CLAIMED					NON-CLAIMED				
H	0	1	L	33 / 60 (2010.01.01)					
H	0	1	L	33 / 62 (2010.01.01)					
H	0	1	L	33 / 48 (2010.01.01)					

NONE (Assistant Examiner) (Date)	**Total Claims Allowed:** 26	
/CARIDAD EVERHART/ Primary Examiner.Art Unit 2895 8/13/2016 (Primary Examiner) (Date)	O.G. Print Claim(s) 1	O.G. Print Figure 6

U.S. Patent and Trademark Office

Part of Paper No. 20160813



Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	14928550	ICHIKAWA ET AL.
	Examiner	**Art Unit**
	CARIDAD EVERHART	2895

☐ **Claims renumbered in the same order as presented by applicant** ☐ **CPA** ☐ **T.D.** ☐ **R.1.47**

Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original
1	1	15	17												
5	2	16	18												
6	3	21	19												
7	4	22	20												
8	5	23	21												
9	6	25	22												
10	7	26	23												
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	12		28												
2	13	19	29												
3	14	20	30												
4	15														
14	16														

NONE (Assistant Examiner)	(Date)	**Total Claims Allowed:** 26	
/CARIDAD EVERHART/ Primary Examiner.Art Unit 2895 (Primary Examiner)	8/13/2016 (Date)	O.G. Print Claim(s) 1	O.G. Print Figure 6

Atty. Dkt. No. 100415-0198

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

First Inventor Name:	Hirofumi ICHIKAWA
Title:	LIGHT EMITTING DEVICE, RESIN PACKAGE, RESIN-MOLDED BODY, AND METHODS FOR MANUFACTURING LIGHT EMITTING DEVICE, RESIN PACKAGE AND RESIN-MOLDED BODY
Appl. No.:	14/928,550
Filing Date:	10/30/2015
Examiner:	Caridad EVERHART
Art Unit:	2895
Confirmation Number:	1591

TRANSMITTAL OF FORMAL DRAWINGS

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Commissioner:

Transmitted herewith are replacement drawing sheets (3 sheets, containing Figures 13-19) for the above-identified application in response to Notice of Allowance mailed August 26, 2016. Figures 14–19 are amended to add the label "Prior Art." No new matter is added.

Respectfully submitted,

Date September 6, 2016

By /Chase J. Brill/

FOLEY & LARDNER LLP
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Chase J. Brill
Attorney for Applicant
Registration No. 61,378

Fig. 13

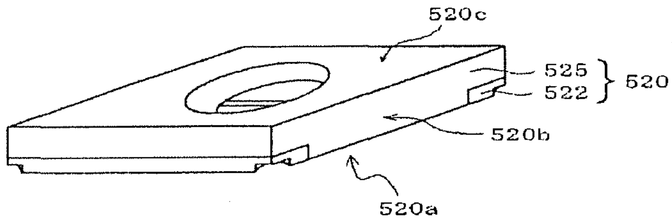


Fig. 14 (Prior Art)

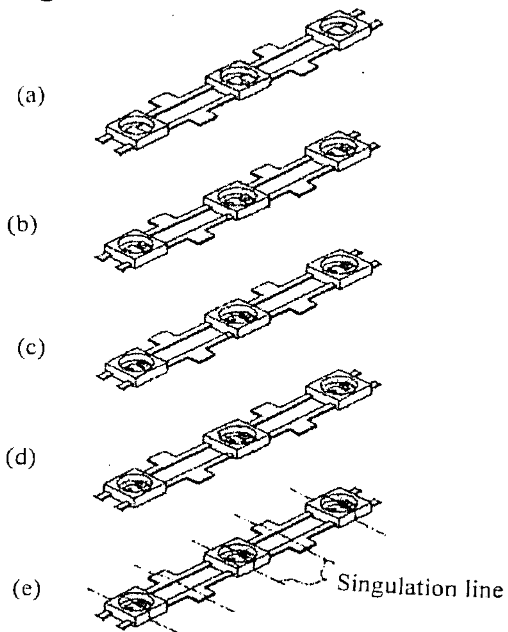


Fig. 15 (Prior Art)

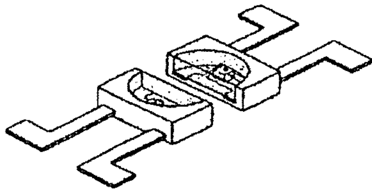


Fig. 16 (Prior Art)

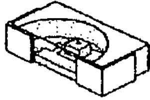


Fig. 17 (Prior Art)

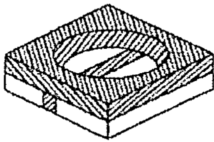
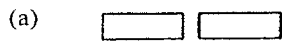
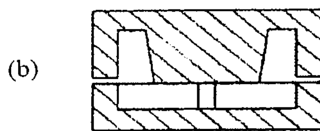


Fig. 18 (Prior Art)

(a)



(b)

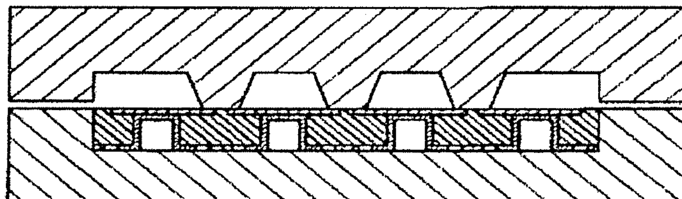


(c)

Fig. 19 (Prior Art)

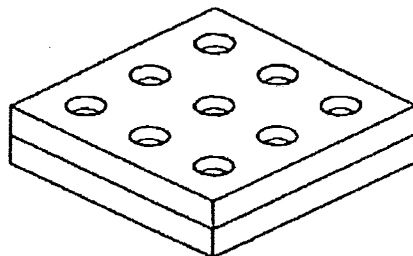
(a)

(b)



(c)

(d)



Electronic Acknowledgement Receipt

EFS ID:	26851570
Application Number:	14928550
International Application Number:	
Confirmation Number:	1591
Title of Invention:	LIGHT EMITTING DEVICE, RESIN PACKAGE, RESIN-MOLDED BODY, AND METHODS FOR MANUFACTURING LIGHT EMITTING DEVICE, RESIN PACKAGE AND RESIN-MOLDED BODY
First Named Inventor/Applicant Name:	Hirofumi ICHIKAWA
Customer Number:	22428
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Attorney Docket Number:	100415-0198
Receipt Date:	07-SEP-2016
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Time Stamp:	11:42:27
Application Type:	Utility under 35 USC 111(a)

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File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Drawings-only black and white line drawings	198_ReplacementDrawings.pdf	57233 6d07088bbc5cd2361f029b6bff752eff6c2664b2	no	5

Warnings:

Information:	
Total Files Size (in bytes):	57233

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New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

PTO/SB/08 (modified)

Substitute for form 1449/PTO **INFORMATION DISCLOSURE STATEMENT BY APPLICANT** Date Submitted: September 29, 2016 *(use as many sheets as necessary)*	*Complete if Known*	
	Application Number	14/928,550
	Filing Date	10/30/2015
	First Named Inventor	Hirofumi ICHIKAWA
	Art Unit	2895
	Examiner Name	Caridad EVERHART
Sheet 1 of 1	Attorney Docket Number	100415-0198

U.S. PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Document Number Number-Kind Code[2] *(if known)*	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
	B1	2004/0051171-A1	03-18-2004	NG ET AL.	

UNPUBLISHED U.S. PATENT APPLICATION DOCUMENTS

Examiner Initials*	Cite No.[1]	U.S. Patent Application Document Serial Number-Kind Code[2] *(if known)*	Filing Date of Cited Document MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear

FOREIGN PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Foreign Patent Document Country Code[3]-Number[4]-Kind Code[5] *(if known)*	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Documents	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear	T[6]
	B2	JP-2004-111964-A	04-08-2004	AGILENT TECHNOLOGIES INC	= B1	Abs.

NON PATENT LITERATURE DOCUMENTS

Examiner Initials*	Cite No.[1]	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.) date, page(s), volume-issue number(s), publisher, city and/or country where published.	T[6]
	B3	Office Action issued in Japanese Patent Application No. 2015-200794 mailed September 13, 2016.	

Examiner Signature		Date Considered	

4848-4599-9673.1

Espacenet

Bibliographic data: JP2004111964 (A) — 2004-04-08

SURFACE-MOUNTED ELECTRONIC DEVICE

Inventor(s): NG KEE YEAN; SINGH GUBBIR + (NG KEE YEAN, ; SINGH GUBBIR)

Applicant(s): AGILENT TECHNOLOGIES INC + (AGILENT TECHNOL INC)

Classification:
- international: ***H01C1/14; H01L23/31; H01L23/495; H01L33/48; H01L33/62; H05K3/34;*** *H01L23/498;* (IPC1-7): H01L33/00
- cooperative: **H01C1/14; H01L23/3107; H01L23/49551; H01L33/486; H05K3/3442;** H01L2224/05599; H01L2224/32245; H01L2224/45099; H01L2224/48091; H01L2224/48247; H01L2224/73265; H01L2224/85399; H01L23/49805; H01L24/48; H01L24/73; H01L2924/00014; H01L2924/01068; H01L2924/12041; H01L33/62; H05K2201/09154; H05K2201/09472; H05K2201/09745; H05K2201/10106; Y02P70/613 more

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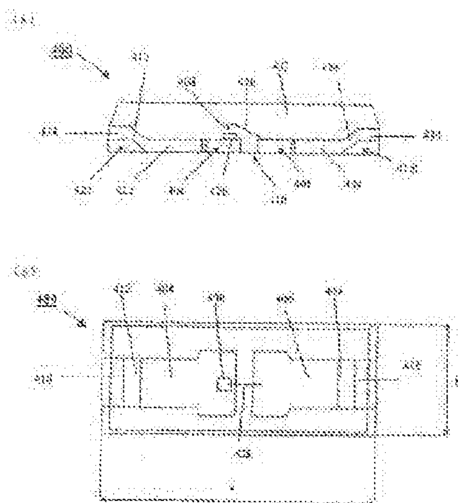
Abstract of JP2004111964 (A)

PROBLEM TO BE SOLVED: To provide a mounting structure for improving contrast of an LED device. ;SOLUTION: The surface-mounted device comprises a body (402) having a first face (410) for device mounting, recesses (420, 421) formed in the first face (410), and a plurality of electric contact members (404, 406) located on the first face (410). The electric contact members (404, 406) include first sections (412, 414) constituting at least a part of at least one internal surface of the recesses (420, 421). ;COPYRIGHT: (C)2004,JPO



(19)日本国特許庁(JP)　(12)公開特許公報(A)　(11)特許出願公開番号
特開2004-111964
(P2004-111964A)
(43)公開日　平成16年4月8日(2004.4.8)

(51)Int.Cl.^{7}	F I		テーマコード（参考）
H01L 33/00	H01L 33/00	N	5F041

審査請求 未請求 請求項の数 10 OL （全 18 頁）

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(33)優先権主張国　マレイシア(MY)

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AGILENT TECHNOLOGIES, INC.
アメリカ合衆国カリフォルニア州パロアルト ページ・ミル・ロード 395
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弁理士　加藤　公久
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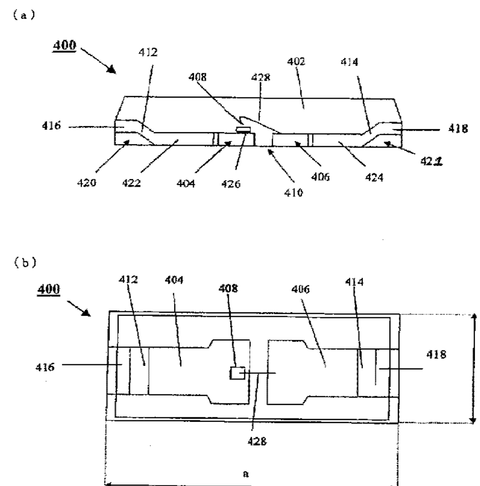
マレイシア　ペナン　プライ　タマン・インデラワシ　ハラマン・キキック6

最終頁に続く

(54)【発明の名称】表面実装型電子デバイス

(57)【要約】
【課題】ＬＥＤデバイスのコントラストを改善するための実装構造を提供すること。
【解決手段】表面実装型デバイスは、デバイス実装の為の第１の面（４１０）を有する本体（４０２）と、第１の面（４１０）に形成される窪み部分（４２０、４２１）と、第１の面（４１０）に位置する複数の電気接触部材（４０４、４０６）とを備える。電気接触部材（４０４、４０６）は、窪み部分（４２０、４２１）の少なくとも１つの内表面の少なくとも一部分を構成する第１の部分（４１２、４１４）を含む。
【選択図】図４



【特許請求の範囲】
【請求項１】
デバイスを実装する為の第１の面を有する本体と、前記第１の面に形成される窪み部分と、前記第１の面に位置する複数の電気接触部材とを備え、該電気接触部材が、前記窪み部分の内表面の少なくとも一部分を構成する第１の部分を有することを特徴とする表面実装型電子デバイス。
【請求項２】
前記電気接触部材の各々は、少なくとも部分的に前記第１の面に延び、該第１の面が平坦面上に実装されるとき、前記第１の部分が前記平坦面から間隔を空けた位置に置かれることを特徴とする請求項１に記載の表面実装型デバイス。 10
【請求項３】
前記窪み部分にある前記第１の部分の少なくとも一部は、前記第１の面に対して実質的に平行であることを特徴とする請求項１に記載の表面実装型デバイス。
【請求項４】
前記窪み部分にある前記第１の部分の少なくとも一部は、前記第１の面に対して非平行とされることを特徴とする請求項１に記載の表面実装型デバイス。
【請求項５】
前記窪み部分にある前記第１の部分の少なくとも一部は、前記第１の面に対して垂直とされることを特徴とする請求項４に記載の表面実装型デバイス。
【請求項６】 20
前記窪み部分にある前記第１の部分の少なくとも一部は、傾斜部分を有し、前記第１の面から斜めに遠ざかる方向に延びていることを特徴とする請求項４に記載の表面実装型デバイス。
【請求項７】
前記窪み部分にある前記第１の部分は、前記第１の面から斜めに遠ざかる方向に延びる傾斜部分と、前記第１の面に実質的に平行に延び、前記第１の面から最も遠い前記傾斜部分の端部に結合する平行部分とを有することを特徴とする請求項１に記載の表面実装型デバイス。
【請求項８】
前記電気接触部材は、前記第１の面の前記窪み部分から外れて位置する第２の部分を有することを特徴とする請求項１に記載の表面実装型デバイス。 30
【請求項９】
前記電気接触部材は、前記本体の前記第１の面に沿って外側に向かって延びており、前記第１の部分が前記本体の前記第１の面の外側端部に向かって配置されていることを特徴とする請求項１に記載の表面実装型デバイス。
【請求項１０】
前記デバイスがプリント回路基板上に実装されており、前記電気接触部材が前記プリント回路基板の端子と直接接触した状態にあり、前記第１の部分と前記プリント回路基板との間に接着剤が設けられており、前記電気接触部材がヒートシンクとして機能することを特徴とする請求項１に記載の表面実装型デバイス。 40

【発明の詳細な説明】
【技術分野】
【０００１】
本発明は表面実装技術（ＳＭＴ）に関するものである。より具体的には、デバイスを基板表面に接続するための電気接続部を窪み中に設けることにより、窪み中ではんだ付けすることを可能とした表面実装型電子装置又は電子デバイスに関する。
【背景技術】
【０００２】
差し込み方式によらずにデバイスを表面に直接的に実装する表面実装技術（ＳＭＴ）は 50

、電子デバイスのアプリケーションにおいては広く利用されている。ＳＭＴの利用には、例えば発光ダイオード（ＬＥＤ）デバイスのような光電デバイスの小型化の要求に関係する。表面実装技術によるＬＥＤは、サイズが非常に小さく、ＳＭＴ型にしてプリント回路基板（ＰＣＢ）上に組み立てられる。ＬＥＤでは、より輝度の高い半導体材料の出現により表面実装型光電デバイスの利用がバックライティング、可変メッセージ標識等の電子標識・シンボル、或いは大型フルカラービデオスクリーン等の（野外及び室内アプリケーションにおける）領域で増えている。

【０００３】

周囲の光が明るい条件下においては、ＬＥＤは見る者からの視認性をより高める為に十分な輝度を持っていなければならない。ＬＥＤの輝度は使用されている半導体材料の種類や駆動電流等といった要因に依存する。インジウムガリウム窒素（ＩｎＧａＡＳ）及びアルミニウムインジウムガリウム燐（ＡｌＩｎＧａＰ）はより高い光効率を持っており、その為ＬＥＤの製造に用いられている。より高い駆動電流については、発生する熱に耐えられるようにＬＥＤは熱抵抗（即ち、熱伝導に対する抵抗）の非常に低いパッケージ中に組み立てられる。これは、ＬＥＤの全体的なパッケージデザインに依存するものである。

【０００４】

パッケージサイズはパッケージデザインに影響されるものである。パッケージサイズは表示装置の解像度を決定する。組立部品面積が固定である場合、パッケージサイズが大きい程、実装し得るデバイスの数は少なくなり、表示解像度も低くなる。

【０００５】

光電デバイスの組立工程においては、ＳＭＴ部品のリード線が基板へ適正にはんだ付け出来るようになっていない場合に問題が生じる。現在、ＳＭＴデバイスのリードは、はんだリフロー時に適正なはんだフィレットを形成することが出来るように、垂直な側壁を持たせて、或いはデバイスから外に向かって延びるように設計されている。

【０００６】

公知の表面実装型光電デバイスの第１の例を図１（ａ）、（ｂ）に示した。図１（ａ）は側面図であり、図１（ｂ）は平面図である。

【０００７】

第１のデバイス１００においては、ＬＥＤ１０１が導電性媒体１０３により接触部材（コンタクト部材）１０２上に電気的に取り付けられている。ボンディングワイヤ１０４がＬＥＤ１０１を他方の接触部材１０５へと電気的に接続している。接触部材１０２、１０５は、デバイス１００の本体１０６中を水平に（図１（ａ）に矢印で示す方向に）伸びている。本体１０６の殆どの部分は、反転させた円錐台形の空洞１０７を除いて光学的に不透明である。この空洞１０７の中にＬＥＤ１０１、ボンディングワイヤ１０４、そして２つの接触部材１０２、１０５の内部端が光学的に透明なプラスチック中に収容されており、空洞１０７の端部がＬＥＤ１０１から発される光のリフレクタとして作用している。２つの接触部材１０２、１０５は水平に本体１０５の端部に向かって外側に水平に伸びており、下半分の側面１０８に沿って下に回り込んで、底端部１０９の下で逆方向に戻るように延びている。はんだリフロー処理においては、デバイス１００を基板１１０へと固定する為に、側面１０８を下に伸びる接触部材１０２、１０５がはんだ接合１１１により基板１１０へと接続されるが、このはんだ接合１１１はＬＥＤデバイス１００の外部側壁１０８とは反対側に広がっている。

【０００８】

従来から周知の表面実装型光電デバイスの第２の例を図２（ａ）～図２（ｂ）に示した。図２（ａ）は上面の側面図であり、図２（ｂ）は平面図である。

【０００９】

第２のデバイス２００においては、ＬＥＤ２０１が導電性媒体２０３により接触部材２０２上に電気的に取り付けられている。ボンディングワイヤ２０４がＬＥＤ２０１を他方の接触部材２０５へと電気接続している。デバイス２００の本体全体は、光学的に透明なプラスチックである。２つの接触部材２０２、２０５は、デバイス１００の本体２０６の

下に沿って外側に水平に伸びており、本体２０６の外の水平部分で終わっている。はんだリフロー処理において、接触部材２０２、２０５ははんだ接合２１１により基板２１０に接続されるが、このはんだ接合２１１は接触部材２０２、２０５の端部における、外側垂直面とは反対に向かっている。上述した例のいずれにおいても、はんだ付けポイントも導電性部材もプラスチック本体の端部の外へと伸びているのである。図１又は図２に示す構成に類似する従来の公知技術が、例えば、以下の特許文献1ないし３に記載される。

【特許文献１】特開平１０－６５２２０号

【特許文献２】特開平８－７８７３２号

【特許文献３】特表平１１－５００５８４号

【発明の開示】

【発明が解決しようとする課題】

【００１０】

図１（ａ）及び（ｂ）に示したＬＥＤデバイスには多くの欠点がある。例えば、ＬＥＤと基板との間の熱経路が非常に長く、これにより、今度はＬＥＤの温度を上昇させる為、デバイスの熱抵抗が非常に高くなっている点である。温度の上昇はＬＥＤの駆動電流に悪影響を及ぼす。デバイスのフットプリントはプラスチック本体のサイズａ×ｂよりもあまり大きくはないが、それを実装する為のはんだは、そのフットプリントのかなり外側に伸びることになる。

【００１１】

図２（ａ）及び（ｂ）に示した延長導電性部材含むデザインは、図１（ａ）及び（ｂ）に示したものよりも更に長いフットプリントを持っている。これにより、ＬＥＤデバイスを基板上に密に搭載することが出来ない。デバイスのフットプリントは長さｃであるが、これはデバイスの本体ａよりもかなり長い。はんだ付けすることにより、必要とされる全体長は更に長くなってしまう。

【００１２】

従来技術によるデバイスに要するサイズは、ＬＥＤデバイスのアレイの画素解像度に影響を与える。図２（ａ）及び（ｂ）に示したデバイスのアレイを図３に示したが、これらのデバイスはＰＣＢ３００上に搭載されている。ＬＥＤデバイスのピッチｄは、小さくすることは出来ない。小さくした場合、組立工程或いは使用中に短絡が発生する可能性があるのである。

【００１３】

更に、図１、及び図２に示したデバイスにおいては、延長された導電性部材及びはんだ接合部が見る者に対して視覚的に現れることになり、これらの反射性が高いことから、見た目に望ましくない障害となってしまう。換言すると、これらはＬＥＤと基板との間のコントラストを低下させてしまうのである。この現象は日光等の明るい周囲光がある状況下では、より強調される。

【００１４】

フットプリントを小さくしつつも熱抵抗を低く維持した表面実装電子デバイスの必要性がある。ＬＥＤデバイスにおいては更に、より良好なコントラストが求められている。従って、本発明の目的は、従来技術における１つ以上の欠点を少なくとも部分的に緩和することである。

【００１５】

本発明の一態様によれば、デバイスを実装する為の第１の実装表面を持つ本体を含む表面実装電子デバイスが提供される。第１の表面は、窪み部分をその中に持っている。また、少なくとも２つの電気接触部材が第１の表面に設けられている。電気接触部材は、窪み部分の少なくとも１つの内面の少なくとも一部を形成する第１の部分を含む。従って、デバイスが実装された場合にこれらの下には間隙が生じることになる。

【課題を解決するための手段】

【００１６】

本発明は、デバイスを実装する為の第１の面を持つ本体と、前記第１の面中の窪み部分

と、前記第１の面中の複数の電気接触部材とを具備し、前記電気接触部材が、前記窪み部分の少なくとも１つの内表面の少なくとも一部分を構成する第１の部分を有することを特徴とする表面実装型電子デバイスを提供する。
【００１７】
好ましくは、前記電気接触部材の各々が、少なくとも部分的に、前記第１の面にわたって延びたものであり、前記第１の面が平坦面上に実装された場合に、前記第１の部分が前記平坦面から間隔を空けた位置に置かれる。
【００１８】
好ましくは、前記窪み部分中にある前記第１の部分の少なくとも一部が、前記第１の面に対して実質的に平行である。　10
【００１９】
好ましくは、前記窪み部分中にある前記第１の部分の少なくとも一部が、前記第１の面に対して平行ではないようにされる。
【００２０】
好ましくは、前記窪み部分中にある前記第１の部分の少なくとも一部が、前記第１の面に対して垂直とされる。
【００２１】
好ましくは、前記窪み部分中にある前記第１の部分の少なくとも一部が、斜め部分であり、前記第１の面から斜めに遠のく方向に延びている。
【００２２】　20
好ましくは、前記窪み部分中にある前記第１の部分が、前記第１の面から斜めに遠のく方向に延びる斜め部分と、そして前記第１の面に実質的に平行に延び、前記第１の面から最も遠い前記斜め部分の端部に接続する平行部分とを有する。
【００２３】
好ましくは、前記電気接触部材が、更に第２の部分を前記第１の面の非窪み部分に有することを特徴とする請求項１に記載のデバイス。
【００２４】
好ましくは、前記電気接触部材が、前記本体の前記第１の面に沿って外側に向かって延びており、前記第１の部分が前記本体の前記第１の面の外側端部に向かって配置される。
【００２５】　30
好ましくは、前記デバイスがプリント回路基板上に実装されており、前記電気接触部材が前記プリント回路基板の端子と直接接触した状態にあり、前記第１の部分と前記プリント回路基板との間に接着剤が設けられており、前記電気接触部材がヒートシンクとして機能する。
【００２６】
典型的な実施態様によれば、本発明は、以下のように説明される。これは、発明を限定的に解釈するためのものではない。
【００２７】
本発明の表面実装型光電デバイスの態様は、２つの導電性部材をその裏側（第１の面）に設けたものである。２つの導電性部材の前端部は、相互に間隙を隔てて向き合っており　40
、その後端部（第１の部分）はデバイスの端子とは反対方向を向いており、デバイス本体の下に窪みを作る為にある角度で上に曲げられている。ＬＥＤの第１の電極は、第１の導電性部材の前端部に取り付けられる。導電性相互接続がＬＥＤの第２の電極と第２の導電性部材との間に伸びている。ＰＣＢの適正な配置にはんだを設け、その上にデバイスを実装することが出来るが、これははんだを窪み領域中に配置し、ここでリフローするという形式で実施される。かわりに、はんだリフロー処理中に、導電性部材の隆起部分の下にある窪み領域中へとはんだを導入することも出来る。はんだは導電性部材を基板へと固定し、これがパッケージの端部を超えて出た場合であっても、その突出はわずかとなる。
【００２８】
よって本発明は、デバイスを実装する為の第１の実装面を持つ本体を含む表面実装電子　50

デバイスを提供するものである。第１の面にはその内側に窪んだ窪み部分が設けられている。また、第１の面には複数の接触部材（通常は２、３個）が設けられている。電気接触部材は、各窪み部分の内表面の少なくとも一部分を形成する面を持つ第１の部分を含む。
【００２９】
通常、接触部材は第１の面に沿って延びている。第１の面が平坦面上に搭載された場合、接触部材はその平坦面と接触することになる一方で、第１の部分はその平坦面から間隔をあけることになる。
【００３０】
第１の部分は第１の面に対して実質的に平行に延びていても、非平行に延びていても良く、或いはその両方の部分を含んでいても良い。第１の部分は、それが水平面であれ傾斜面（湾曲した斜面を含む）であれ、窪み部分の少なくとも上面を形成するものであることが望ましい。代わりに、或いはそれに加えて窪み部分の垂直面を形成するものであっても良い。第１の部分は、電気接触部材の斜めに上向きに延びる部分であっても良い。更に電気接触部材には、斜め上向きに延びる部分の上端部に設けた水平部分があっても良い。
【００３１】
電気接触部材は更に第２の部分を含んでいても良く、これはデバイスが平坦面に実装される場合、その平坦面と接触することになる部分である。このような第２の部分を設ける場合、これは斜め上向きに延びる部分の下端部から水平に伸びる部分とすることが出来る。
【００３２】
本デバイスは、これが平坦面上に実装される場合、平坦面と第１の部分との間の空間を、デバイスと平坦面とを接着させる為に充填することが可能であり、理想的な形で構成することが出来る。
【００３３】
好適な実施形態においては、電気接触部材が本体の下側に沿って外側に延びており、第１の部分はその本体の下側の外側に向けて配置される。窪み部分中にある第１の部分は、デバイスが平坦面上に実装された場合でもデバイス側面からのアクセスが可能である。通常、電気接触は本体の端部を超えて延びることは無い。
【００３４】
本発明は、デバイスが光電デバイスであった場合に最もその利点を活用することが出来る。このようなデバイスは、本体中に設けられ、電気接触部材に電気的に接続された少なくとも１つの発光手段を含む。このような発光手段とは、デバイスの実装面とは反対方向を向いた電気接触部材の１つの面上に実装され、他方の電気接触部材に電気的に接続された少なくとも１つの発光ダイオードとすることが出来る。
【００３５】
本発明のデバイスは、プリント回路基板へと実装し、電気接触部材をプリント回路基板の端子と直接的に接触させることが出来る。第１の部分とプリント回路基板との間の窪みは接着剤で充填することが可能である。接着剤は、第１の部分と端子とを電気的にも粘着的にも接続するものであることが望ましい。接着手段としては、はんだ付けが望ましいが、導電性エポキシ接着剤を利用することも可能である。
【００３６】
本発明の実施形態は、デバイスの接触部が最も下に、即ち下面に位置している図示の配向を仮定して説明するものである。これは単に説明目的でそのように仮定したものであり、限定的な意味は無い。実際上、接触部は最も上にあっても、或いは他の配置であっても良いものである。
【発明の効果】
【００３７】
本発明による表面実装型のデバイスは、実装される面に設けられる窪み部分にはんだ付けのための実装部又は接続部を有するので、実装面積を最小にすることができ、また、はんだ付け部分が視認されにくいように実装することができる。このことは、デバイスを比

較的狭ピッチで実装できることにも繋がる。更に、従来品と比較して接触部材は、比較的短くなり、発生する熱を逃がすための放熱手段として有効に機能する。
【発明を実施するための最良の形態】
【００３８】
以下に添付図面を参照して、本発明の好適実施形態となる表面実装デバイスについて詳細に説明する。第１の実施形態に基づく表面実装型光電デバイス４００を、図４（ａ）及び（ｂ）に示したが、これは透光性本体４０２と、２つの概ね平坦な電気接触部材４０４、４０６と、そしてＬＥＤ４０８を含んでいる。
【００３９】
本体４０２は平面図においては概ね長方形をしているが、その側端部は若干外側に傾斜しており、よってその基部は上部よりも大きくなっている。その最も大きい寸法が、長さａ×幅ｂである。　10
【００４０】
２つの電気接触部材４０４、４０６が本体４０２の下面４１０に取り付けられており、この接触部材４０４、４０６の下側は、外からのアクセスが可能となっている。この下側４１０それ自体がデバイスの実装面である。２つの接触部材はデバイス４００の中間にある間隙により分割されており、デバイスの中間から反対側の端部まで水平に伸びている。各接触部材はそれぞれの端部からの短い距離において第１の部分を持っているが、この部分は、各端部とも斜め上向きに延びる部分４１２、４１４と、それに続く水平部分４１６、４１８を含み、ジグザグ形状を呈している。本体は第１の部分の下を埋めてはおらず、その下には何も無い。この結果、窪み４２０、４２１がそれぞれの端部（第１の部分とデバイスを実装する平坦面との間）に形成されている。各接触部材の残りの部分は第２の部分４２２、４２４である。　20
【００４１】
ＬＥＤ４０８は、２つあるうちの左側の接触部材４０４の上であり、２つのうちの他方の接触部材４０６に面した接触部材４０４の端部付近に導電性媒体により実装されている。ボンディングワイヤ４２８がＬＥＤ４０８の上部を他方の電気接触部材４０６の近い方の端部に電気的に接続している。
【００４２】
上述から、２つの接触部材４０４、４０６は概してへら状、或いは漏斗状の形状をしているように見えるものである。デバイスの中間近くにおいて相対する端部は、各接触部材の他の部分よりも幅広い。　30
【００４３】
この特定の実施形態においては、本体４０２はＬＥＤ４０８及び２つの接触部材４０４、４０６の上面を封止する光学的に透明なプラスチックとし得る。
【００４４】
先に説明した従来のデバイスとは異なり、接触部材はパッケージの本体を超えて水平に伸びてはいない。かわりにそのフットプリントは本体の長さａ或いは幅ｂに略等しく、より小さくなっている。更に、窪みがデバイスをＰＣＢへと搭載する為のはんだを収容する空間を提供しており、はんだが本体の長さａを超えることはない。よってこれらのデバイスはより緊密に設けることが出来、上から見た場合に、はんだは見える位置に略存在しないように実装され得る。　40
【００４５】
本発明の第２の好適実施形態となるデバイスを図５（ａ）、（ｂ）に示す。
【００４６】
表面実装型光電デバイス５００は、本体５０２、３つの概ね平坦な電気接触部材５０４、５０６、５０７、そして２つのＬＥＤ５０８、５０９を含む。その構成において、デバイス５００は第１の実施形態におけるデバイス４００にかなり似ている。
【００４７】
本体５０２は平面図においては概ね長方形であるが、しかし第１の実施形態と比べると　50

幅広である。その端部は若干外側に向かって傾斜しており、従って、その基部は上部よりも大きくなっている。
【００４８】
３つの電気接触部材５０４、５０６、５０７は本体５０２の実装面５１０の下側に取り付けられており、接触部材の下側は下からのアクセスが可能となっている。３つの接触部材は全て独立している。主要接触部材５０４の前側端部はデバイスのほぼ全体にわたって伸びており、デバイス５００の中間にある間隙を隔てて他の副接触部材５０６、５０７の両方に面している。これらの副接触部材５０６、５０７は相互に対して平行である。全ての３つの接触部材５０４、５０６、５０７はデバイスの中間から反対側の端部に向かって水平に伸びている。各接触部材は、これらの端部からの短い距離において第１の部分を含み、各端部はそれぞれに斜め上向きに延びる部分５１２、５１４、５１７と、それに続く水平部分５１６、５１８、５１９を含み、ジグザグ形状（段差形状）を呈している。本体は第１の部分の下を埋めてはいない。この結果、デバイスが実装されている各接触部材の第１の部分と平面の間に窪み５２０がそれぞれの接触部材の外側端部の下に１つづつ形成されている。各接触部材の残りの部分は第２の部分５２２、５２４、５２５である。
【００４９】
ＬＥＤ５０８、５０９は両方とも主要接触部材５０４の前端部近くに導電性媒体５２６を介して実装されているが、各々からは分離されている。ボンディングワイヤ５２８、５２９は、一方のＬＥＤ５０８の上部を近い方の副接触部材５０６へ、そして他方のＬＥＤ５０９の上部を他の近い方の副接触部材５０７へと接続している。
【００５０】
上述から、主要接触部材５０４は概ねＴ字型であり、Ｔ字型の上部分と軸部分との間にウエブを持った形状をしている。２つの副接触部材５０６、５０７は図４（ａ）、（ｂ）の実施形態と同様に概ねへら状又は漏斗状に見える。デバイスの中間近くで相互に向き合う接触部材の端部は、各接触部材の他の部分よりも幅が広くなっている。
【００５１】
本実施形態においては、本体５０２は光学的に不透明なプラスチックから成り、これが２つのＬＥＤ５０８、５０９及び反転させた円錐台形の空洞５３０の周辺部分を除き、３つの電気接触部材５０４、５０６、５０７の上表面の多くを封止している。この空洞５３０は光学的に透明なプラスチックで満たされており、その上面は本体の他の部分と面一になっている。よってこの実施形態においては、光は閉じ込められ、円錐台形の空洞を通じて逃げることになる。
【００５２】
先に述べた従来技術によるデバイスと異なり、接触部材がパッケージ本体を超えて水平に伸びてはいない。かわりに、フットプリントはより小さくなっており、本体の長さａと幅ｂに収まっている。更に、窪みがデバイスをＰＣＢへと実装する為のはんだを収容する空間を提供しており、はんだが本体の長さａを超えることはない。よってこれらのデバイスはより緊密に設けることが出来、上から見た場合に、はんだは見える位置に略存在しないように実装され得る。
【００５３】
第３の実施形態となるデバイス６００を図６（ａ）及び（ｂ）に示したが、これは電気接触部材の形状を除き、図４（ａ）及び（ｂ）の実施形態と似ているものであり、対応する作用部及び部品には符号の最初の数字を４から６に変えた以外は同様の符号を付してある。光学的に透明な本体６０２は２つの水平な接触部材６０４、６０６を持っている。ＬＥＤ６０８は第１の接触部材６０４上に実装される。２つの接触部材はそれ自体が本体６０２の下側６１０に設けられている。接触６０４、６０６は、第１の部分６１６、６１８で終わる外側端部を持ち、これらは斜め上向きに傾斜しており、第１の部分６１６、６１８の各々の下にそれぞれ窪み６２０、６２１を提供している。各接触部材の第１の部分以外の残りの部分は第２の部分６２２、６２４である。ＬＥＤ６０８は、第１の接触部材の第２の部分６２２上に実装されており、ボンディングワイヤ６２８がＬＥＤの上部を第２

の接触部材６０６の第２の部分６２４へと接続している。
【００５４】
本実施形態と図４（ａ）及び（ｂ）に示した実施形態との違いは、第１の部分（及びそれに関わる本体の領域）にある。本実施形態においては、第１の部分の各々は、斜め上向きに延びる部分に続く水平部分から構成されてはいない。かわりに、それぞれ各端部にある第１の部分６１６、６１８は、本体６０２の下にはあるものの、接触部材の端部付近で斜め上に伸びているのみである。本体は第１の部分６１６、６１８の下には存在しない。よって第１の部分６１６、６１８は、デバイス６００のそれぞれの端部に窪み６２０、６２１を画定している。この例においては、本体の端部形状は第１の部分の外表面が画定する形状と同じであり、斜め上向きに傾斜している。しかしながら、本発明の他の実施形態においては、残りの本体が第１の部分の外側端部の上から実質的に垂直に下に伸びている場合もある。このような実施形態においては、第１の部分は本体の端部中に沈み込むことになる。
【００５５】
先に述べた従来技術によるデバイスとは異なり、接触部材がパッケージ本体を超えて水平に伸びてはいない。かわりに、フットプリントはより小さくなっており、本体の長さａと幅ｂに収まっている。更に、窪みがデバイスをＰＣＢへと搭載する為のはんだを収容する空間を提供しており、はんだが本体の長さａを超えることはない。よってこれらのデバイスはより緊密に設けることが出来、上から見た場合に、はんだは略見える位置に存在しないように実装され得る。
【００５６】
第４の実施形態７００を図７（ａ）及び（ｂ）に示した。これは図５（ａ）及び（ｂ）の実施形態と似たものであるが、側面から見た場合に図６に示した実施形態にある接触部材の第１の部分の形状を採用しており、対応する造作及び部品には符号の頭を５から７に変えた以外は同様の符号を付してある。概ね光学的に不透明な本体７０２は３つの水平な接触部材７０４、７０６、７０７を持っている。２つのＬＥＤ７０８、７０９は第１の主要接触部材７０４上に実装されている。３つの接触部材はそれ自体が本体７０２の下側７１０に設けられている。接触部材７０４、７０６、７０７は第１の部分７１６、７１８、７１９で終わる外側端部を持っており、これが斜め上向きに傾斜しており、第１の部分７１６、７１８、７１９の各々の下にそれぞれ窪み７２０、７２１を提供している。各接触部材の第１の部分以外の残りの部分は第２の部分７２２、７２４、７２５である。ＬＥＤ７０８、７０９は第１の接触部材７０４の第２の部分７２２上に実装されており、ボンディングワイヤ７２８が第１のＬＥＤ７０８の上部を第１の副接触部材７０６の第２の部分７２４へと接続し、第２のボンディングワイヤ７２９が第２のＬＥＤ７０９の上部を第２の副接触部材７０７の第２の部分７２５へと接続している。光学的に透明なプラスチックで満たされた反転させた円錐台形空洞７３０は、２つのＬＥＤ７０８、７０９からの光を上向きに逃がすようになっている。
【００５７】
本実施形態と図５（ａ）及び（ｂ）に示した実施形態の違いは、第１の部分（及びそれに付随する本体領域）にある。本実施形態においては、３つの電気接触部材７０４、７０６、７０７が、本体７０２の下にはあるが、接触部材端部において斜め上向きに伸びてた第１の部分７１６、７１８、７１９を含んでいる。本体は第１の部分７１６、７１８、７１９の下には存在しない。よって第１の部分７１６、７１８、７１９は窪み７２０、７２１をその下に画定している。図６（ａ）及び（ｂ）の場合の他の実施形態と同様に、本体は第１の部分の形状に順じている必要はなく、実質的に垂直の（或いは他の様々な態様の）端部を持つものであっても良い。
【００５８】
先に述べた従来技術によるデバイスとは異なり、接触部材がパッケージ本体を超えて水平に伸びてはいない。かわりに、フットプリントはより小さくなっており、本体の長さａと幅ｂに収まっている。更に、窪みがデバイスをＰＣＢへと搭載する為のはんだを収容す

る空間を提供しており、はんだが本体の長さαを超えることはない。よってこれらのデバイスはより緊密に設けることが出来、上から見た場合に、はんだは見える位置に略存在しないように実装され得る。

【００５９】

第５の実施形態８００を図８（α）及び（ｂ）に示したが、これは図４（ｂ）の実施形態に類似したものであり、対応する造作及び部品には符号の頭を４から８に変えた以外は同様の符号を付してある。光学的に透明な本体８０２は２つの水平な接触部材８０４、８０６を持っている。ＬＥＤ８０８は第１の接触部材８０４上に実装される。２つの接触部材自体が本体８０２の下側８１０に設けられている。接触部材８０４、８０６は、第１の部分８１６、８１８において終わっている外端部を含み、その上面は各接触部材の残りの部分と同じレベルにあるが、縦の厚さが接触部材の残りの部分の半分しかない。よってこれら第１の部分８１６、８１８の下にはそれぞれに窪み８２０、８２１がある。各接触部材の第１の部分以外の残りの部分は第２の部分８２２、８２４である。ＬＥＤ８０８は第１の接触部材の第２の部分８２２の上に実装され、ボンディングワイヤ８２８がＬＥＤの上部を第２の接触部材８０６の第２の部分８２４へと接続している。

【００６０】

よって実施形態間の違いは、電気接触部材８０４、８０６の第１の部分８１６、８１８の本体８０２基部における形状と厚さの違いにある。特に、平坦部分、それに続く斜め上向きに延びる部分、そしてまたそれに続く更なる平坦部分を持たせるよりも、接触部材下部を平坦部分、それに続き、短い距離だけ垂直に上に伸びる実質的に直角（垂直）な部分、そして再度外向きの更なる平坦部分で構成した方が、接触部材の上面を平坦にすることが出来る。厚さを薄くした平坦部分が第１の部分８１６、８１８を形成する。本体は第１の部分８１６、８１８の下には存在していない。よって第１の部分８１０が窪み８２０、８２１を画定することになる。

【００６１】

先に述べた従来技術によるデバイスとは異なり、接触部材がパッケージ本体を超えて水平に伸びてはいない。代わりに、フットプリントはより小さくなっており、本体の長さαと幅ｂに収まっている。更に、窪みがデバイスをＰＣＢへと搭載する為のはんだを収容する空間を提供しており、はんだが本体の長さαを超えることはない。よってこれらのデバイスはより緊密に設けることが出来、上から見た場合に、はんだは見える位置に略存在しないように実装され得る。

【００６２】

第６の実施形態９００を図９（α）及び（ｂ）に示した。これは図５（α）、（ｂ）の実施形態と似ているが、上から見た場合の接触部材の形状が図８の実施形態と同じものであり、対応する造作及び部品には符号の頭を５から９に変えた以外は同様の符号を付してある。概ね光学的に不透明な本体９０２は３つの水平接触部材９０４、９０６、９０７を含んでいる。２つのＬＥＤ９０８、９０９は、第１の主要接触部材９０４上に実装される。これら３つの接触部材自体が本体９０２の下側９１０に設けられる。接触部材９０４、９０６、９０７は第１の部分９１６、９１８、９１９で終わる外側端部を持っており、これらの上面は各接触部材の残りの部分と同じレベルにあるが、その厚さは接触部材の他の部分の縦の厚さの半分しかない。よって各第１の部分９１６、９１８、９１９の下には窪み９２０、９２１がある。各接触部材の第１の部分以外の残りの部分は第２の部分９２２、９２４、９２５である。ＬＥＤ９０８、９０９は、第１の接触部材９０４の第２の部分９２２上に実装されており、第１のボンディングワイヤ９２８が第１のＬＥＤ９０８の上部を第１の副接触部材９０６の第２の部分９２４へと接続し、第２のボンディングワイヤ９２９が第２のＬＥＤ９０９の上部を第２の副接触部材９０７の第２の部分９２５へと接続している。光学的に透明なプラスチックで満たされた反転させた円錐台形の空洞９３０が２つのＬＥＤ９０８、９０９からの光を上方向に逃がすようになっている。

【００６３】

よって図５（α）及び（ｂ）、図９（α）及び（ｂ）の実施形態との違いは、各接触部

材９０４、９０６、９０７の第１の部分９１６、９１８、９１９にある。これらは本体９０２の下にありながらも、垂直に窪みを作っている。第１の部分９１６、９１８、９１９の下には本体は存在していない。よってこの場合にも、窪み９２０、９２１が画定されている。
【００６４】
先に述べた従来技術によるデバイスとは異なり、接触部材がパッケージ本体を超えて水平に伸びてはいない。かわりに、フットプリントはより小さくなっており、本体の長さａと幅ｂに収まっている。更に、窪みがデバイスをＰＣＢへと搭載する為のはんだを収容する空間を提供しており、はんだが本体の長さａを超えることはない。よってこれらのデバイスはより緊密に設けることが出来、上から見た場合に、はんだは見える位置に略存在しないように実装され得る。　10
【００６５】
図１０は、図５（ａ）、（ｂ）の実施形態の使用中の側面図である。図１１は、図７（ａ）、（ｂ）の実施形態の使用中の側面図である。図１２は、図９（ａ）、（ｂ）の実施形態の使用中の側面図である。これらは側面図であるが、各図におけるはんだ部分は、よくわかるように網掛けで示した。図４（ａ）、（ｂ）、図６（ａ）、（ｂ）、及び図８（ａ）、（ｂ）の実施形態の使用中の側面図はこれらに類似したものである。
【００６６】
図１０においては、各々が間隙１５により電気的に分離されている、３つの電気絶縁はんだパッド端子１２、１４（この側面図においては３つのうちの２つが見えている）を介してデバイス５００がプリント回路基板（ＰＣＢ）１０に実装されている。　20
【００６７】
主要はんだパッド端子１２は、主要接触部材５０４の第２の部分５２２の水平長全体にわたって主要接触部材５０４と直接電気的に接触している。しかしながら、主要接触部材は主要接触部材の第１の部分５１２、５１６において、はんだパッド端子１２の上に持ち上げられた状態になっており、窪み５２０（図５（ａ）に図示）が設けられている。独立した副はんだパッド端子１４は副接触部材５０６、５０７の第２の部分５２４、５２５と直接接触している。しかしながら、副接触部材は副接触部材の第１の部分５１４、５１５、５１８、５１９において副はんだパッド端子１４の上に持ち上げられた状態にあり、窪み５２１（図５（ａ）に図示）が設けられている。３つのはんだパッド端子１２、１４は、実装されたデバイス５００との電気接触として作用するだけではなく、熱を放散する為のヒートシンクとしての働きも持っている。　30
【００６８】
はんだフィレット５３２、５３４は窪み５２０、５２１を充填し、デバイスの接触５０４、５０６、５０７をはんだパッド端子１２、１４へと電気的、粘着的に接続する。このように、表面実装型デバイスはＰＣＢ１０上に有効に実装される。更に明らかなように、はんだフィレット５３２、５３４は水平方向においてパッケージを超えて延びることはなく、従って実装された場合にデバイスのフットプリントが増大することはない。
【００６９】
同じＰＣＢ１０及びはんだパッド端子１２、１４を図１１に示したが、この場合はデバイス７００を使用している。図１０の実施形態と同様、窪み７２０、７２１中のはんだフィレット７３２、７３４はデバイスの接触部材７０４、７０６、７０７をはんだパッド端子１２、１４へと電気的、粘着的に接続している。はんだフィレット７３２、７３４は水平方向においてパッケージを超えてわずかにしか、或いは全く延びてはおらず、従って実装された場合にデバイスのフットプリントが増大することはない。　40
【００７０】
同じＰＣＢ１０、はんだパッド端子１２、１４を更に図１２にも示したが、この場合はデバイス９００を使用したものである。図１０の実施形態と同様、窪み９２０、９２１中のはんだフィレット９３２、９３４はデバイスの接触部材９０４、９０６、９０７をはんだパッド端子へと電気的、粘着的に接続している。はんだフィレット９３２、９３４は水　50

平方向においてパッケージを超えてわずかにしか、或いは全く延びてはおらず、従って実装された場合にデバイスのフットプリントが増大することはない。

【００７１】

図１３はデバイス５００のアレイを示すものであり、デバイスの各々は図１０に示した方法で一般的なＰＣＢ１０上に実装されている。図３に示したアレイと比較すると、デバイスはより緊密に実装されており、ピッチｄは図３におけるピッチｄよりも小さく、より高い解像度が提供されている。加えて、はんだフィレットはアレイを上から見た場合に見えない、或いはほぼ見えない状態にあり、これにより暗いＰＣＢ表面と発光アレイとのあいだのコントラストが改善されている。

【００７２】

様々な実施形態における接触部材は、光電デバイスの下側に沿って設けられている。図示の便宜上、デバイスの本体は接触部材の上面、或いは接触部材の底面まで延びるものとして描いたが、本体は電気接触部材の上面から底面までのいずれのレベルにまで延びるものであっても良い。出来れば、本体は接触部材の底面とほぼ同じレベルにまで延びるものであることが望ましいが、例えば各接触部材の厚さの中間のレベル等、より短くすることも可能である。よって接触部材は、実質的に本体の長さに沿った窪み中に設けられるのである。

【００７３】

本発明は少なくとも水平部品（斜めの部分があったとしても）に窪みを設けるものである。これにより、より堅固で強いはんだ接続を同じ水平距離に作ることが可能となる。はんだのデバイスへの接触地点が単に垂直面であった場合、相応の強度を得るにはより長い垂直方向の広がりが必要となる。一方、本発明は、はんだに同じ水平及び垂直空間においてより広い表面積を提供しており、より高い強度のボンドを実現するものである。

【００７４】

窪みはデバイスの端部に設けられ、水平方向に空いており、デバイスが所定位置に配置された場合でもはんだを流入或いは流出させることが可能である。

【００７５】

上述した実施形態においては、斜め部分に続く水平部分を持つもの、まっすぐに斜めのもの、そして垂直部分に続く水平部分を持つものの、３つの特定の接触部材の形状のみを示した。勿論、概ね湾曲した部分を持つものも含めて他の形状も可能である。また、更に下向きに延びる部分を含むものも、窪みを外側から遮断しない限りにおいては可能である。いずれのデバイスにおいても、第１の部分に関して異なるデザインが可能である。

【００７６】

接触部材は、上面及び底面が平行であるものを示した。これは推奨されるものであるが、必ずしもそうである必要は無い。更に、これらは概ね平坦部分から構成されているように描いた。これも必須ではない。これらは、本体又ははんだ等への接着性を高める為に波状形状の表面を持っていても、或いはパターニングされた表面を持っていても良い。

【００７７】

第１の部分は、必要な窪みを造ることが出来るように、例えば選択的エッチング処理で接触部材材料から選択的に除去することにより作られる。かわりに、例えば打ち抜き加工や機械加工、ダイカスト加工或いは押し出し成型加工等による他の加工法によることも可能である。

【００７８】

窪みは本体のモールディング加工時に用いられる型の形状により形成される。

【００７９】

上述した実施形態においては、窪みは接触部材の第１の部分と同じ幅を持っている。これは推奨されることであるが、必ずしもそうである必要はない。窪みはその幅よりも大きくても小さくても良い（例えばデバイスの幅全体にわたっていても、或いは接触部材の第１の部分に対応する領域のみにわたるものであっても良い）。その広さは本体のモールディング加工で使用される型により決まる。

【００８０】
上述した実施形態においては、ＬＥＤが１つだけの場合には本体は光学的に透明であり、２つある場合においては不透明である。本発明はこれに限られたものではない。
【００８１】
接触部材は、説明したものとは異なる形状を持っていても良い。例えば、幅を各端部で同じとし、中間で漸減しているもの等でも良い。形状は、例えば熱流の容易性やプラスチックと接触部材の接着強度、そして製造上の利便性といった要因を考慮しつつ様々に設計することが出来る。プラスチック製の本体と接触部材との接着強度を改善する為には固定穴を用いることが一般的である。一般に、接触部材の最終形状は熱及びストレス解析シミュレーションを通じて決定される。　10
【００８２】
更に、ＬＥＤの接触部材上への配置方法は変えることが出来、また、２つ以上のＬＥＤを用いることも出来る。更に、ＬＥＤを配置する接触面にも、カップ形状の空洞、又は窪みを作り、そこにＬＥＤを配置することが出来る。空洞の壁はリフレクタとしても作用し、ＬＥＤが放射する側面光を集光して向きを変えるように助けます。また、上述した実施形態においては、本体は必ずしも平坦な上面を持つものと限られてはいない。所望の光学特性を得る為に、上面を適切にレンズ形状としたり、上面にレンズを取り付けたりすることが出来る。
【００８３】
上述した実施形態は、例えば高さが０．２５ｍｍから１０ｍｍ、長さ及び幅が０．２５ｍｍから５０ｍｍといった、様々なパッケージ寸法を持つＳＭＤに適用することが出来る。窪みの高さは、通常は０．０５ｍｍから５ｍｍの範囲であり、第１の部分の長さは約０．１ｍｍから５ｍｍである。第１及び第２の実施形態においては、第１の部分の斜め部分は約４５°の角度である。　20
【００８４】
図８（ａ）、（ｂ）に示した実施形態の本体は、例えば長さ約１．６ｍｍ、幅約０．８ｍｍ、高さ約０．４ｍｍであり、そして長さ約０．１５ｍｍ、高さ約０．１ｍｍ及び幅約０．５ｍｍの窪みを持ったものである。
【００８５】
特許請求の範囲によって定義される本発明の範囲において、他にも更に多数の実施形態が実現可能である。ＬＥＤを用いて本発明を説明したが、本発明の概念は他のＳＭＤについても適用可能であり、特に隣接するＳＭＤ間のピッチを小さくする応用に利用することができる。　30
【図面の簡単な説明】
【００８６】
【図１】既存の表面実装型光電デバイスの側面図及び上面図である。
【図２】他の既存の表面実装型光電デバイスの側面図及び上面図である。
【図３】図２のデバイスのアレイを示す平面図であり、基板にはんだ付けされた状態を示した図である。
【図４】本発明の第１の実施形態に基づくリード無し表面実装型光電デバイスの側面図及び上面図である。　40
【図５】本発明の第２の実施形態に基づくリード無し表面実装型光電デバイスの側面図及び上面図である。
【図６】本発明の第３の実施形態に基づくリード無し表面実装型光電デバイスの側面図及び上面図である。
【図７】本発明の第四の実施形態に基づくリード無し表面実装型光電デバイスの側面図及び上面図である。
【図８】本発明の第五の実施形態に基づくリード無し表面実装型光電デバイスの側面図及び上面図である。
【図９】本発明の第六の実施形態に基づくリード無し表面実装型光電デバイスの側面図及　50

び上面図である。
【図１０】第２の実施形態に基づくリード無し表面実装型光電デバイスを基板に実装したアセンブリの側面図である。
【図１１】第四の実施形態に基づくリード無し表面実装型光電デバイスを基板に実装したアセンブリの側面図である。
【図１２】第六の実施形態に基づくリード無し表面実装型光電デバイスを基板に実装したアセンブリの側面図である。
【図１３】第２の実施形態に基づく表面実装型光電デバイスを基板に実装したアレイの上面図である。
【符号の説明】　10
【００８７】
　１０　プリント回路基板
　１２、１４　プリント回路基板の端子
　４００、５００、６００、７００、８００、９００　表面実装型電子デバイス
　４０２、５０２、６０２、７０２、８０２、９０２　本体
　４０４、４０６、５０４、５０６、５０７、６０４、６０６、７０４、７０６、７０７、８０４、８０６、９０４、９０６、９０７　電気接触部材
　４１０、５１０、６１０、７１０、８１０、９１０　本体の第１の面
　４１２、４１４、４１６、４１８、５１２、５１４、５１６～５１９、６１６、６１８、７１６、７１８、７１９、８１６、８１８、９１６、９１８、９１９　電気接触部材の第１の部分　20
　４２０、４２１、５２０、５２１、６２０、６２１、７２０、７２１、８２０、８２１、９２０、９２１　窪み
　４２２、４２４、５２２、５２４、５２５、６２２、６２４、７２２、７２４、７２５、８２２、８２４、９２２、９２４、９２５　電気接触部材の第２の部分

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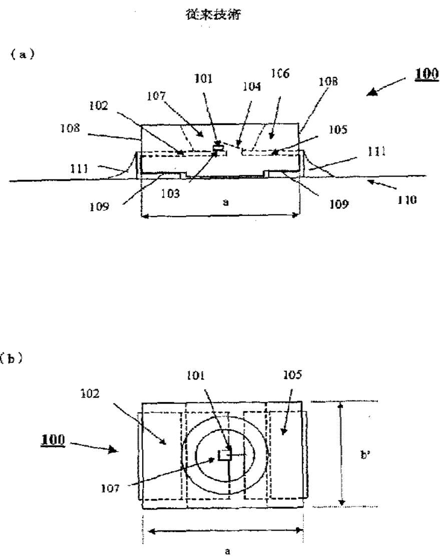
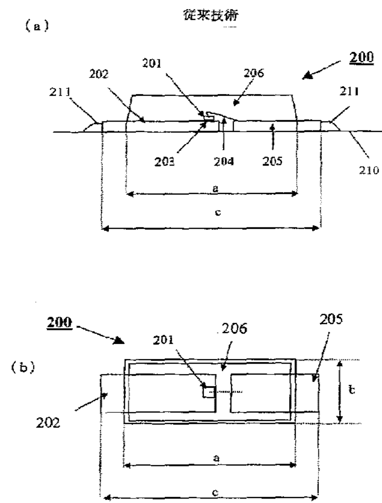
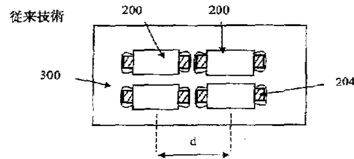
【図1】



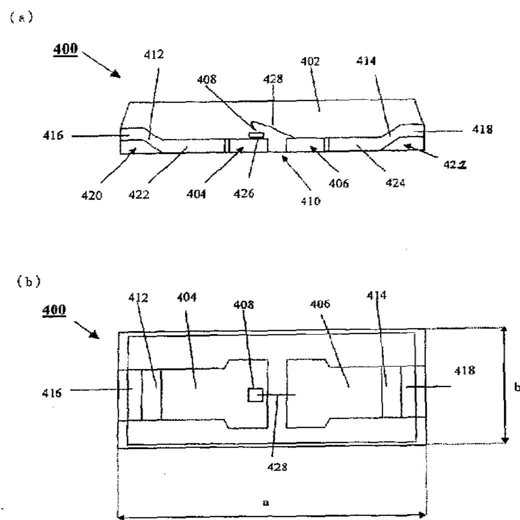
【図2】



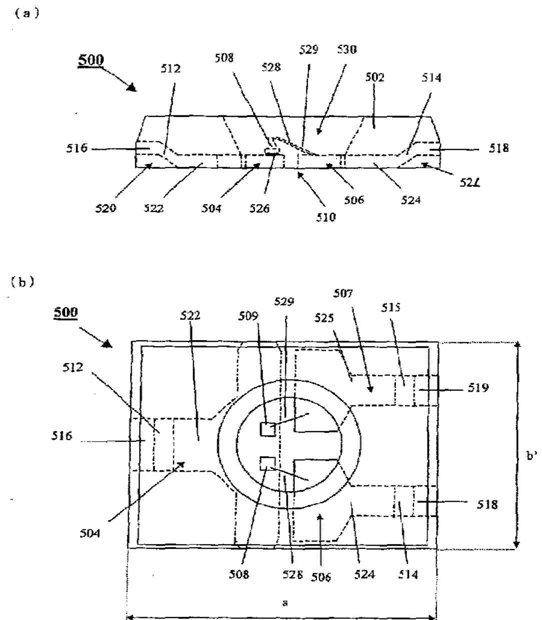
【図3】



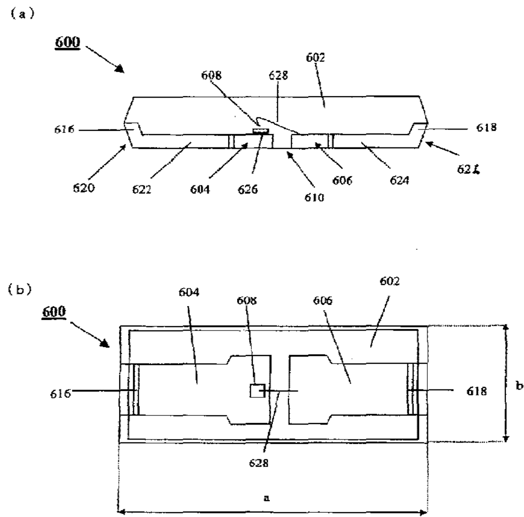
【図4】



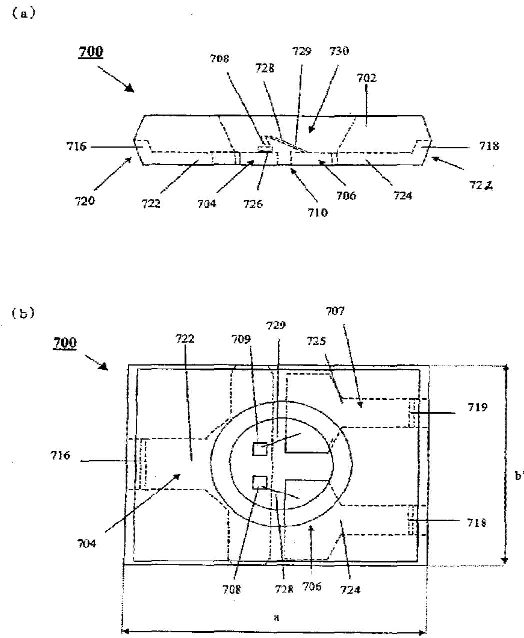
【図5】



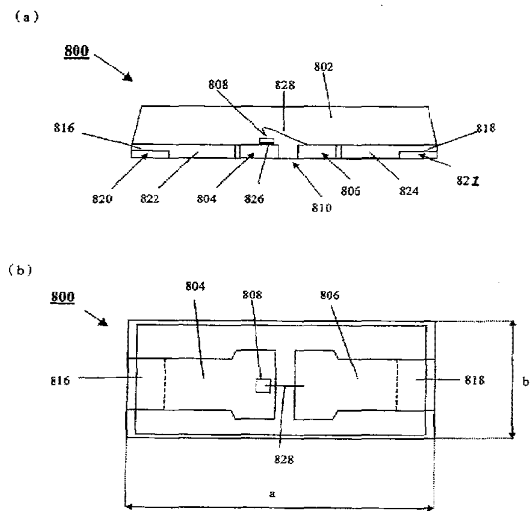
【図６】



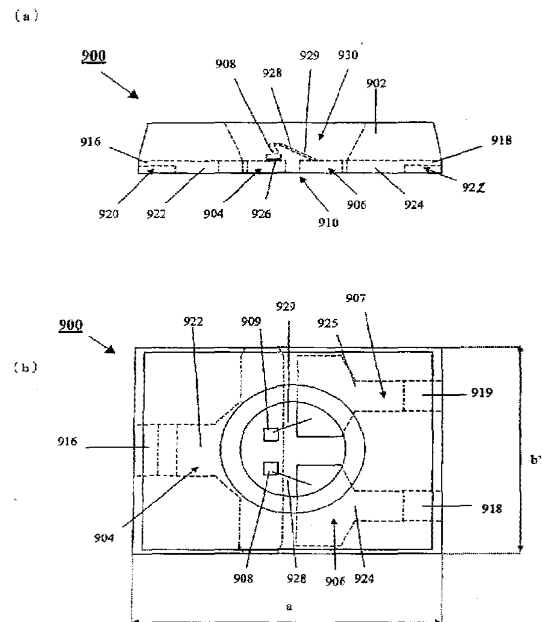
【図７】



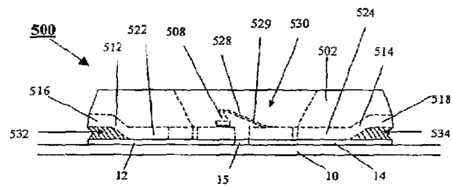
【図８】



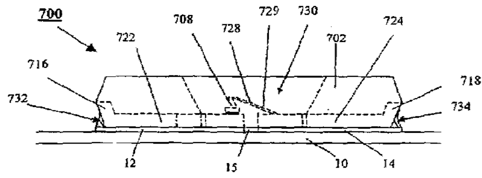
【図９】



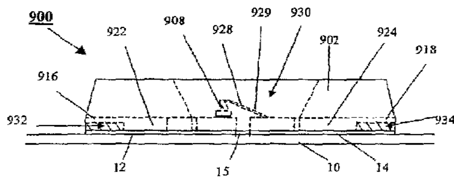
【図１０】



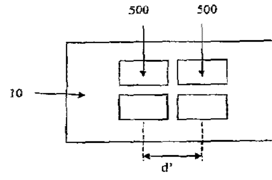
【図１１】



【図１２】



【図１３】



フロントページの続き

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Electronic Patent Application Fee Transmittal

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Filing Date:	30-Oct-2015
Title of Invention:	LIGHT EMITTING DEVICE, RESIN PACKAGE, RESIN-MOLDED BODY, AND METHODS FOR MANUFACTURING LIGHT EMITTING DEVICE, RESIN PACKAGE AND RESIN-MOLDED BODY
First Named Inventor/Applicant Name:	Hirofumi ICHIKAWA
Filer:	Chase J. Brill/Stacy Jen
Attorney Docket Number:	100415-0198

Filed as Large Entity

Filing Fees for **Utility under 35 USC 111(a)**

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Miscellaneous:				
Submission- Information Disclosure Stmt	1806	1	180	180
		Total in USD ($)		**180**

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First Named Inventor/Applicant Name:	Hirofumi ICHIKAWA
Customer Number:	22428
Filer:	Chase J. Brill/Stacy Jen
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Warnings:					
Information:					
2	Information Disclosure Statement (IDS) Form (SB08)	100415-0198_IDS_SB08_B.pdf	90873 5f9dcb3c39930846c0e64b1c34b2f4cb9f3e8f50	no	1
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3	Foreign Reference	B2_JP2004111964A.pdf	981005 f5d002a7391d9c1b63b26d74d6e7632dabe11489	no	19
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4	Non Patent Literature	B3_JPOA.pdf	89288 628cc7736cb44e441e29c85de1d650d1aac5af84	no	2
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5	Fee Worksheet (SB06)	fee-info.pdf	31003 06a1a6bd234163e540b1861e91a938be8b549aa8	no	2
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If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

First Inventor Name:	Hirofumi ICHIKAWA
Title:	LIGHT EMITTING DEVICE, RESIN PACKAGE, RESIN-MOLDED BODY, AND METHODS FOR MANUFACTURING LIGHT EMITTING DEVICE, RESIN PACKAGE AND RESIN-MOLDED BODY
Application No.:	14/928,550
Filing Date:	10/30/2015
Examiner:	Caridad EVERHART
Art Unit:	2895
Confirmation No.:	1591

INFORMATION DISCLOSURE STATEMENT
UNDER 37 CFR §1.56

Mail Stop Issue Fee
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Commissioner:

Applicant submits herewith documents for the Examiner's consideration in accordance with 37 CFR §§1.56, 1.97 and 1.98.

Applicant respectfully requests that each listed document be considered by the Examiner and be made of record in the present application and that an initialed copy of Form PTO/SB/08 be returned in accordance with MPEP §609.

Applicant requests that, in accordance with 37 CFR §1.98(d), the Examiner review all applications relied on for an earlier effective filing date under 35 U.S.C. 120, including application no. 12/737,940, filed 5/13/2011; and application no. 13/969,182 , filed 8/16/2013, for

copies of references of record therein that are not being provided here; although Applicant would be pleased to provide copies of any such documents at the Examiner's request.

The submission of any document herewith is not an admission that such document constitutes prior art against the claims of the present application or that such document is considered material to patentability as defined in 37 CFR §1.56(b). Applicants do not waive any rights to take any action which would be appropriate to antedate or otherwise remove as a competent reference any document submitted herewith. However, in accordance with MPEP § 609.04(a)(I), Applicant hereby states that for items for which the date of publication supplied does not include the month of publication, the year of publication is sufficiently earlier than the effective U.S. filing date and any foreign priority date so that the particular month of publication is not in issue.

CONCISE EXPLANATION OF RELEVANCE

Document B1 is an English-language counterpart of foreign-language document B2. An English-language abstract is also provided for foreign-language document B2.

Foreign-language document B2 was cited during the prosecution of a corresponding Japanese patent application. The Japanese Office Action is cited as document B3 and sets forth the portion of the document considered relevant by the examiner.

TIMING OF THE DISCLOSURE

The listed documents are being submitted in compliance with 37 CFR §1.97(d), before payment of the issue fee.

STATEMENT UNDER 37 CFR §1.97(e)

The undersigned hereby states in accordance with 37 CFR §1.97(e)(1) that each item of information contained in this information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three (3) months prior to filing of this Statement.

STATEMENT UNDER 37 CFR §1.704(d)

The undersigned hereby states in accordance with 37 CFR §1.704(d) that each item of information contained in the information disclosure statement was first cited in any communication from a patent office in a counterpart foreign or international application or from the Office, and that this communication was not received by any individual designated in 37 CFR §1.56(c) more than thirty days prior to the filing of the information disclosure statement.

FEE

Fees in the amount of $180.00 to cover the fee associated with an information disclosure statement are being paid by credit card via EFS-Web.

The Commissioner is hereby authorized to charge any additional fees which may be required regarding this submission under 37 C.F.R. §§ 1.16-1.17, or credit any overpayment, to Deposit Account Number 19-0741.

Respectfully submitted,

Date September 29, 2016

By /Chase J. Brill/

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
14/928,550	10/30/2015	Hirofumi ICHIKAWA	100415-0198	1591

22428 7590 10/13/2016
Foley & Lardner LLP
3000 K STREET N.W.
SUITE 600
WASHINGTON, DC 20007-5109

EXAMINER	
EVERHART, CARIDAD	

ART UNIT	PAPER NUMBER
2895	

NOTIFICATION DATE	DELIVERY MODE
10/13/2016	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

ipdocketing@foley.com

Supplemental Notice of Allowability	**Application No.** 14/928,550	**Applicant(s)** ICHIKAWA ET AL.	
	Examiner CARIDAD EVERHART	**Art Unit** 2895	**AIA (First Inventor to File) Status** No

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to *amendment filed 5/2/2016*.
   ☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on______.
2. ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.
3. ☒ The allowed claim(s) is/are *1-10,13-26,29 and 30*. As a result of the allowed claim(s), you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to PPHfeedback@uspto.gov.
4. ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

   Certified copies:

   a) ☒ All b) ☐ Some *c) ☐ None of the:
   1. ☒ Certified copies of the priority documents have been received.
   2. ☐ Certified copies of the priority documents have been received in Application No. ______ .
   3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

   * Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
   ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.

   Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).
6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☒ Notice of References Cited (PTO-892)
2. ☒ Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date _____
3. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material
4. ☐ Interview Summary (PTO-413), Paper No./Mail Date _____ .
5. ☐ Examiner's Amendment/Comment
6. ☒ Examiner's Statement of Reasons for Allowance
7. ☐ Other _____.

/Caridad Everhart/
Primary Examiner
AU 2895

The present application is being examined under the pre-AIA first to invent provisions.

REASONS FOR ALLOWANCE

The following is an examiner's statement of reasons for allowance: The IDS filed 9/29/2016 has been considered. The prior art of record is considered relevant to applicant's disclosure. The prior art of record does not disclose nor suggest all of the limitations of the allowed claims. Ng et al (US 2004/0051171 A1), which is the English language equivalent of JP2004-111964, does not disclose nor suggest the limitation "at least a portion of an outer lateral surface of the metal part are coplanar at each of the four outer lateral surfaces of the resin package, wherein a notch is formed in the metal part at each of the four outer lateral surfaces of the resin package", and Ng et al disclose that the sides of the package slope (paragraphs 0043 and 0051) so that the base is larger than its top (paragraph 0051), and Fig. 9A and Fig. 9B show that Ng et al does not disclose the metal part and the resin part are coplanar, which includes the that the sides slope, as stated above, and Ng et al also does not disclose "a notch is formed in the metal part at each of the four outer lateral surfaces of the resin package". Sorg et al (US 2004/0106234 A1), which is the English language equivalent of WO2004/015769 A1 , which is also related to JP 2005-535135, which was cited in the Non Patent Literature Document C3 in the IDS filed 9/29/2016, does not disclose or suggest the limitation "wherein at least a portion of an outer lateral surface of the resin part and at least a portion of an outer lateral surface of the metal part are copolanar at each of the four outer lateral surfaces of the resin package" and "wherein the resin part is located at

left and right sides of a portion of the metal part at at least two of the four outer lateral surfaces of the resin package", because Sorg et al disclose in Fig. 1 the resin part 6 which is an encapsulation material (paragraph 0008) which transmits electromagnetic radiation (paragraph 0053) above the metal part 2 and 3 (paragraph 0007), and Sorg et al also disclose a carrier 9 (paragraph 0009), which is between the metal parts 2 and 3 and the encapsulation 6 (Fig. 1 and Fig. 2), and therefore the encapsulation is not on the left and right sides of the metal parts . Urasaki (JP2007/235085) was also cited in citation C3 of the IDS filed 9/29/2016. Urasaki does not disclose all of the limitations of the allowed claims, for example Urasaki does not disclose or suggest the limitation "a notch is formed in the metal part at each of the four outer lateral surfaces of the resin package, wherein the resin part is located at left and right sides of a portion of the metal part at at least two of the four outer lateral surfaces of the resin package", as seen in the Figures.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled “Comments on Statement of Reasons for Allowance.”

Any inquiry concerning this communication or earlier communications from the examiner should be directed to CARIDAD EVERHART whose telephone number is

(571)272-1892. The examiner can normally be reached on Monday through Fridays 7:30-4:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor A. Sofocleous can be reached on (571)272-0635. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Caridad Everhart/
Primary Examiner
AU 2895 10/5/2016

Notice of References Cited	Application/Control No. 14/928,550	Applicant(s)/Patent Under Reexamination ICHIKAWA ET AL.	
	Examiner CARIDAD EVERHART	Art Unit 2895	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	CPC Classification	US Classification
*	A	US-2004/0106234 A1	06-2004	Sorg, Joerg-Erich	H01L21/4846	438/123
	B	US-				
	C	US-				
	D	US-				
	E	US-				
	F	US-				
	G	US-				
	H	US-				
	I	US-				
	J	US-				
	K	US-				
	L	US-				
	M	US-				

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	CPC Classification
*	N	JP2005535135W	11-2005	Japan	Sorg et al	H01L21/4846
	O	JP2007235085A	09-2007	Japan	Urasaki	H01L24/97
	P	WO2004015769A1	02-2004	WIPO	Osram Opto Semicond.	H01L21/4868
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	Translation of JP 2007-235085A (Urashaki) Sept. 13, 2007, 16 pages.
	V	
	W	
	X	

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

(19)日本国特許庁(JP)　(12)公開特許公報(A)　(11)特許出願公開番号
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(51) Int.Cl.		F I		テーマコード（参考）
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審査請求 未請求　請求項の数 10　OL　（全 13 頁）

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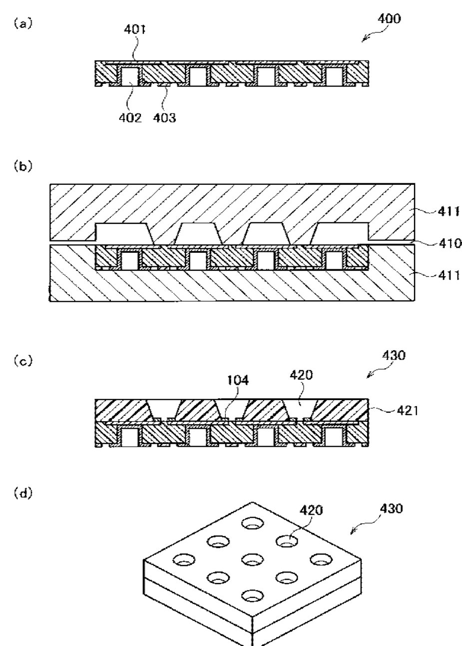
最終頁に続く

(54)【発明の名称】光半導体素子搭載用パッケージ基板の製造方法およびこれを用いた光半導体装置の製造方法

(57)【要約】
【課題】リードタイムの短縮、使用する部材や工程の低減による生産性の向上、低コスト化が可能な光半導体素子搭載用パッケージ基板の製造方法およびこれを用いた光半導体装置の製造方法を提供することを目的とする。
【解決手段】光半導体素子搭載領域となる凹部が２つ以上形成された光反射用熱硬化性樹脂組成物層を配線基板上に有する光半導体素子搭載用パッケージ基板の製造方法であって、前記光反射用熱硬化性樹脂組成物層をトランスファー成型により形成することを特徴とする、光半導体素子搭載用パッケージ基板の製造方法。
【選択図】図１



【特許請求の範囲】
【請求項１】
光半導体素子搭載領域となる凹部が２つ以上形成された光反射用熱硬化性樹脂組成物層を配線基板上に有する光半導体素子搭載用パッケージ基板の製造方法であって、前記光反射用熱硬化性樹脂組成物層をトランスファー成型により形成することを特徴とする、光半導体素子搭載用パッケージ基板の製造方法。
【請求項２】
前記光反射用熱硬化性樹脂組成物が、（Ａ）エポキシ樹脂、（Ｂ）硬化剤、（Ｃ）硬化促進剤、（Ｄ）無機充填剤、（Ｅ）白色顔料及び（Ｆ）カップリング剤を必須成分として含み、熱硬化後の、波長８００ｎｍ～３５０ｎｍにおける光反射率が８０％以上であり、熱硬化前には室温（２５℃）で加圧成型可能なものであることを特徴とする、請求項１に記載の光半導体素子搭載用パッケージ基板の製造方法。
【請求項３】
前記（Ｄ）無機充填剤が、シリカ、アルミナ、酸化マグネシウム、酸化アンチモン、水酸化アルミニウム、硫酸バリウム、炭酸マグネシウム、炭酸バリウムからなる群の中から選ばれる少なくとも１種以上であることを特徴とする、請求項２に記載の光半導体素子搭載用パッケージ基板の製造方法。
【請求項４】
前記（Ｅ）白色顔料が、無機中空粒子であることを特徴とする、請求項２または３に記載の光半導体素子搭載用パッケージ基板の製造方法。
【請求項５】
前記（Ｅ）白色顔料の平均粒径が、１μｍ～５０μｍの範囲にあることを特徴とする、請求項２～４のいずれか１項に記載の光半導体素子搭載用パッケージ基板の製造方法。
【請求項６】
前記（Ｄ）無機充填剤と前記（Ｅ）白色顔料の合計量が、前記光反射用熱硬化性樹脂組成物全体に対して７０体積％～８５体積％の範囲であることを特徴とする請求項２～５のいずれか１項に記載の光半導体素子搭載用パッケージ基板の製造方法。
【請求項７】
前記配線基板が、リードフレーム、プリント配線板、フレキシブル配線板、およびメタルベース配線板のいずれかであることを特徴とする、請求項１～６のいずれか１項に記載の光半導体素子搭載用パッケージ基板の製造方法。
【請求項８】
請求項１～７のいずれか１項に記載の製造方法によって得られる光半導体素子搭載用パッケージ基板に形成された２つ以上の凹部の各底面に、光半導体素子を搭載する工程、および
前記光半導体素子を封止樹脂により覆う工程、
を有することを特徴とする光半導体装置の製造方法。
【請求項９】
前記樹脂封止工程後、前記光半導体素子を１つ有する光半導体装置単体に分割する工程、をさらに有することを特徴とする、請求項８に記載の光半導体装置の製造方法。
【請求項１０】
前記分割する工程が、ダイシングにより行われることを特徴とする、請求項９に記載の光半導体装置の製造方法。
【発明の詳細な説明】
【技術分野】
【０００１】
本発明は、光半導体素子と蛍光体などの波長変換手段とを組み合わせた光半導体装置を製造するのに有用な光半導体素子搭載用パッケージ基板の製造方法に関する。
【背景技術】
【０００２】

近年、電子機器の小型化、軽量化、高性能化、多機能化に伴い、電子部品を基板上に高密度に実装することが行われている。高密度に実装するための電子部品としては、例えば、基板上の配線パターンにリフロー半田付け等により接続することが可能なＳＭＤ（Ｓｕｒｆａｃｅ　ｍｏｕｎｔｅｄ　ｄｅｖｉｃｅ）が広く用いられている（例えば、特許文献１参照）。

【０００３】

このような電子部品の一例であるＬＥＤ（Ｌｉｇｈｔ　Ｅｍｉｔｔｉｎｇ　Ｄｉｏｄｅ：発光ダイオード）は、光半導体素子と蛍光体を組み合わせた光半導体装置であり、省電力で寿命が長い発光装置として注目されている。

【０００４】

ＳＭＤ型ＬＥＤのパッケージ基板について、図面に基づいてその概要を説明する。図４は一般的なＳＭＤ型ＬＥＤの斜視図である。図４において、１はＬＥＤ素子搭載用パッケージ基板であり、配線基板２、樹脂層４およびこれらを固着させるための接着シート５からなる。配線基板２の上面には搭載されるＬＥＤ素子１０を接続するための一対の接続端子が形成されており、各端子には銀めっき等の表面処理が施されている。また、樹脂層４には、ＬＥＤ素子１０の搭載領域となるカップ形状の貫通穴４ｄ（上部開口４ａ、下部開口４ｂおよび側面４ｃからなる凹部）が形成されており、当該穴の内周面は、その底面に搭載されたＬＥＤ素子１０が発する光を反射させ上方へ導くリフレクターとしての役割を果たす。また、接着シート５は上記貫通穴４ｄの下部開口４ｂに対応する部分が取り除かれている。

【０００５】

また、このようなＳＭＤ型ＬＥＤは、通常、図５に示すように、複数のＬＥＤ素子がマトリックス状に実装された配線基板１２上に、当該複数のＬＥＤ素子の搭載位置に対応したカップ形状の貫通穴を有する樹脂層板（リフレクター）１４を、当該複数のＬＥＤ素子の搭載位置に対応した穴１５ａが形成されている接着シート１５をはさんで、加熱加圧して接着した後、図６に示す２方向のダイシングライン２０に沿って複数のＳＭＤ型ＬＥＤを個片に切り離すことで得ることができる。このような製造法によれば、ＳＭＤ型ＬＥＤを多数個同時に作製することができる。

【０００６】

しかしながら、上記した従来のＳＭＤ型ＬＥＤの製造方法では、貫通穴を有する樹脂層板を作製する工程、穴を有する接着シートを作製する工程、樹脂層板と接着シートとＬＥＤ素子を搭載した配線基板を位置合わせして一体化する工程といった複数の工程やこれに伴う複数の部材が必要となる。

【０００７】

また、ＬＥＤ用パッケージ基板における樹脂層板を、耐熱性の高い熱可塑性樹脂を用い、射出成型により製造することが、例えば、特許文献２～４に開示されているが、４００ｍｍ^{2}のマトリックス状の大型の樹脂層板を一括成型した場合、線膨張率の違いによる応力で反りが発生し易く、その後の実装工程を進めることが困難となる場合がある等の課題があった。また、一般に使用されているリフレクター材料は、酸化チタンを顔料として用いているため、発光波長が短波長領域になると急激にその反射率が低下してしまう。また、紫外線による劣化が原因で可視領域の光に対しても反射率の低下が起こることが課題となっている。

【特許文献１】特開２００３－２１８３９８号公報
【特許文献２】特開２００５－１９４５１３号公報
【特許文献３】特開２００４－２７７５３９号公報
【特許文献４】特開２００４－０７５９９４号公報

【発明の開示】

【発明が解決しようとする課題】

【０００８】

上記を鑑みて、本発明は、リードタイムの短縮、使用する部材や工程の低減による生産

性の向上、低コスト化が可能な光半導体素子搭載用パッケージ基板の製造方法およびこれを用いた光半導体装置の製造方法を提供することを目的とする。

【０００９】

また、本発明は、硬化後の、可視光から近紫外光の反射率が高い光反射用熱硬化性樹脂組成物を用いた光半導体素子搭載用パッケージ基板の製造方法およびこれを用いた光半導体装置の製造方法を提供することを目的とする。

【課題を解決するための手段】

【００１０】

本発明は、下記（１）～（１０）に記載の事項をその特徴とするものである。

【００１１】

（１）光半導体素子搭載領域となる凹部が２つ以上形成された光反射用熱硬化性樹脂組成物層を配線基板上に有する光半導体素子搭載用パッケージ基板の製造方法であって、前記光反射用熱硬化性樹脂組成物層をトランスファー成型により形成することを特徴とする、光半導体素子搭載用パッケージ基板の製造方法。

【００１２】

（２）前記光反射用熱硬化性樹脂組成物が、（Ａ）エポキシ樹脂、（Ｂ）硬化剤、（Ｃ）硬化促進剤、（Ｄ）無機充填剤、（Ｅ）白色顔料及び（Ｆ）カップリング剤を必須成分として含み、熱硬化後の、波長８００ｎｍ～３５０ｎｍにおける光反射率が８０％以上であり、熱硬化前には室温（２５℃）で加圧成型可能なものであることを特徴とする、上記（１）に記載の光半導体素子搭載用パッケージ基板の製造方法。

【００１３】

（３）前記（Ｄ）無機充填剤が、シリカ、アルミナ、酸化マグネシウム、酸化アンチモン、水酸化アルミニウム、硫酸バリウム、炭酸マグネシウム、炭酸バリウムからなる群の中から選ばれる少なくとも１種以上であることを特徴とする、上記（２）に記載の光半導体素子搭載用パッケージ基板の製造方法。

【００１４】

（４）前記（Ｅ）白色顔料が、無機中空粒子であることを特徴とする、上記（２）または（３）に記載の光半導体素子搭載用パッケージ基板の製造方法。

【００１５】

（５）前記（Ｅ）白色顔料の平均粒径が、１μｍ～５０μｍの範囲にあることを特徴とする、上記（２）～（４）のいずれか１項に記載の光半導体素子搭載用パッケージ基板の製造方法。

【００１６】

（６）前記（Ｄ）無機充填剤と前記（Ｅ）白色顔料の合計量が、前記光反射用熱硬化性樹脂組成物全体に対して７０体積％～８５体積％の範囲であることを特徴とする上記（２）～（５）のいずれか１項に記載の光半導体素子搭載用パッケージ基板の製造方法。

【００１７】

（７）前記配線基板が、リードフレーム、プリント配線板、フレキシブル配線板、およびメタルベース配線板のいずれかであることを特徴とする、上記（１）～（６）のいずれか１項に記載の光半導体素子搭載用パッケージ基板の製造方法。

【００１８】

（８）上記（１）～（７）のいずれか１項に記載の製造方法によって得られる光半導体素子搭載用パッケージ基板に形成された２つ以上の凹部の各底面に、光半導体素子を搭載する工程、および前記光半導体素子を封止樹脂により覆う工程、を有することを特徴とする光半導体装置の製造方法。

【００１９】

（９）前記樹脂封止工程後、前記光半導体素子を１つ有する光半導体装置単体に分割する工程、をさらに有することを特徴とする、上記（８）に記載の光半導体装置の製造方法。

【００２０】

（１０）前記分割する工程が、ダイシングにより行われることを特徴とする、上記（９）に記載の光半導体装置の製造方法。
【発明の効果】
【００２１】
本発明によれば、従来必要であった複数の工程をトランスファー成型の一つの工程で行うことが可能となるため、リードタイムの短縮、使用する部材や工程の低減による生産性の向上、低コスト化が可能な光半導体素子搭載用パッケージ基板の製造方法および半導体装置の製造方法を提供することが可能となり、また、反りが少ない光半導体素子搭載用パッケージ基板や半導体装置を提供することが可能となる。
【００２２】
また、上記（２）～（６）に記載したような光反射用熱硬化性樹脂組成物を用いて凹部を形成することで、硬化後の、可視光から近紫外光の反射率が特に優れた光半導体素子搭載用パッケージ基板や光半導体装置を提供することが可能となる。
【発明を実施するための最良の形態】
【００２３】
本発明は、配線基板と、当該配線基板上に形成され、光半導体素子搭載領域となる凹部（貫通孔）が所定位置に２つ以上形成されている光反射用熱硬化性樹脂組成物層とを有する光半導体素子搭載用パッケージ基板の製造方法であって、上記光反射用熱硬化性樹脂組成物層をトランスファー成型により一括形成することをその特徴とするものである。
【００２４】
上記トランスファー成型による形成について、より具体的には、例えば、上記配線基板として、図１（ａ）に示すような、金属配線４０１を有するプリント配線板４００を用い、これを図１（ｂ）に示すように、所定形状の金型４１１内に配置し、金型４１１の樹脂注入口４１０から光反射用熱硬化性樹脂組成物を注入する。ついで、注入した光反射用熱硬化性樹脂組成物を好ましくは、金型温度１７０℃～１９０℃で６０秒～１２０秒、アフターキュア温度１２０℃～１８０℃で１時間～３時間の条件で熱硬化させた後、金型４１１を外すことで、凹部（光半導体素子搭載領域）４２０が２つ以上形成された光反射用熱硬化性樹脂組成物層（リフレクター）４２１を配線基板上に有する光半導体素子搭載用パッケージ基板４３０を得ることができる（図１（ｃ）、（ｄ））。また、凹部底面の、光半導体素子が接続される端子表面に電気めっき等によりＮｉ／Ａｇめっき１０４を施すこともできる。また、凹部の形状は、特に限定されないが、搭載されたＬＥＤ素子１０が発する光を反射させて上方へ導くようなカップ形状（円錐台形状）であることが望ましい。
【００２５】
上記光反射用熱硬化性樹脂組成物としては、公知のものを使用することも可能であるが、好ましくは、熱硬化後の、波長８００ｎｍ～３５０ｎｍにおける光反射率が８０％以上であり、熱硬化前には室温（２５℃）で加圧成型可能な光反射用熱硬化性樹脂組成物を用い、より好ましくは、（Ａ）エポキシ樹脂、（Ｂ）硬化剤、（Ｃ）硬化促進剤、（Ｄ）無機充填剤、（Ｅ）白色顔料及び（Ｆ）カップリング剤を必須成分として含み、かつ熱硬化後の、波長８００ｎｍ～３５０ｎｍにおける光反射率が８０％以上であり、熱硬化前には室温（２５℃）で加圧成型可能な光反射用熱硬化性樹脂組成物を用いる。上記光反射率が８０％未満であると、光半導体装置の輝度向上に十分寄与できない傾向がある。より好ましくは、光反射率が９０％以上である。また、上記加圧成形は、例えば、室温（約２５℃）において、０．５ＭＰａ～２ＭＰａの圧力で、１秒～５秒程度の条件下で行うことができればよい。また、本発明において用いる光反射用熱硬化性樹脂組成物の熱伝導率は、１Ｗ／ｍＫ以上であることが好ましい。この熱伝導率が１Ｗ／ｍＫ未満であると光半導体素子から発生する熱を十分に逃がすことができず、封止樹脂等を劣化させてしまう恐れがある。
【００２６】
上記（Ａ）エポキシ樹脂としては、電子部品封止用エポキシ樹脂成形材料で一般に使用されているものを用いることができ、特に制限はないが、例えば、フェノールノボラック

型エポキシ樹脂、オルソクレゾールノボラック型エポキシ樹脂をはじめとするフェノール類とアルデヒド類のノボラック樹脂をエポキシ化したもの、ビスフェノールＡ、ビスフェノールＦ、ビスフェノールＳ、アルキル置換ビフェノール等のジグリシジエーテル、ジアミノジフェニルメタン、イソシアヌル酸等のポリアミンとエピクロルヒドリンの反応により得られるグリシジルアミン型エポキシ樹脂、オレフィン結合を過酢酸等の過酸で酸化して得られる鎖状脂肪族エポキシ樹脂及び脂環族エポキシ樹脂などがあり、これらは単独でも、２種以上併用してもよい。また、使用するエポキシ樹脂は、比較的着色のないものであることが好ましく、そのようなエポキシ樹脂としては、例えば、ビスフェノールＡ型エポキシ樹脂、ビスフェノールＦ型エポキシ樹脂、ビスフェノールＳ型エポキシ樹脂、トリグリシジルイソシアヌレートを挙げることができる。 10

【００２７】

上記（Ｂ）硬化剤としては、エポキシ樹脂と反応するものであれば、特に制限はないが、例えば、酸無水物系硬化剤、フェノール系硬化剤などが挙げられ、比較的着色のないものであることが好ましい。酸無水物系硬化剤としては、例えば、無水フタル酸、無水マレイン酸、無水トリメリット酸、無水ピロメリット酸、ヘキサヒドロ無水フタル酸、テトラヒドロ無水フタル酸、無水メチルナジック酸、無水ナジック酸、無水グルタル酸、メチルヘキサヒドロ無水フタル酸、メチルテトラヒドロ無水フタル酸等が挙げられ、中でも、無水フタル酸、ヘキサヒドロ無水フタル酸、テトラヒドロ無水フタル酸、メチルヘキサヒドロ無水フタル酸を用いることが好ましい。また、用いる酸無水物系硬化剤は、その分子量が１４０～２００程度のものであることが好ましく、また、無色ないし淡黄色の酸無水物であることが好ましい。また、これら硬化剤は単独で用いても、二種以上併用して用いてもよい。エポキシ樹脂と硬化剤との配合割合は、エポキシ樹脂中のエポキシ基１当量に対して、硬化剤におけるエポキシ基と反応可能な活性基（酸無水基又は水酸基）が０．５当量～１．５当量となるような割合であることが好ましく、０．７当量～１．２当量となるような割合であることがより好ましい。活性基が０．５当量未満の場合は、エポキシ樹脂組成物の硬化速度が遅くなるとともに、得られる硬化体のガラス転移温度が低くなる場合があり、一方、１．５当量を超える場合は、耐湿性が低下する場合がある。 20

【００２８】

上記（Ｃ）硬化促進剤としては、特に制限はなく、例えば、１，８－ジアザービシクロ（５，４，０）ウンデセン－７、トリエチレンジアミン、トリ－２，４，６－ジメチルアミノメチルフェノール等の３級アミン類、２－エチル－４－メチルイミダゾール、２－メチルイミダゾールなどのイミダゾール類、トリフェニルホスフィン、テトラフェニルホスホニウムテトラフェニルボレート、テトラ－ｎ－ブチルホスホニウム－ｏ，ｏ－ジエチルホスホロジチオエート等のリン化合物、４級アンモニウム塩、有機金属塩類及びこれらの誘導体などが挙げられる。これらは単独で使用してもよく、又は併用して用いてもよい。これら硬化促進剤の中では、３級アミン類、イミダゾール類、リン化合物を用いることが好ましい。硬化促進剤の含有率は、エポキシ樹脂に対して、０．０１重量％～８．０重量％であることが好ましく、より好ましくは、０．１重量％～３．０重量％であることがより好ましい。硬化促進剤の含有率が、０．０１重量％未満では、充分な硬化促進効果を得られない場合があり、また、８．０重量％を超えると、得られる硬化体に変色が見られる場合がある。 30 40

【００２９】

上記（Ｄ）無機充填材としては、例えば、シリカ、アルミナ、酸化マグネシウム、酸化アンチモン、水酸化アルミニウム、硫酸バリウム、炭酸マグネシウム、炭酸バリウム等を挙げることができ、これらは単独でも、併用して用いてもよい。熱伝導性、光反射特性、成型性、難燃性の点からは、シリカ、アルミナ、酸化アンチモン、水酸化アルミニウムのうちの２種以上の混合物であることが好ましい。また、無機充填材の粒径は、特に制限はないが、白色顔料とのパッキング効率を考慮すると、平均粒径が１μｍ～１００μｍの範囲であることが好ましい。

【００３０】 50

上記（Ｅ）白色顔料としては、例えば、アルミナ、酸化マグネシウム、酸化アンチモン、水酸化アルミニウム、硫酸バリウム、炭酸マグネシウム、炭酸バリウム、無機中空粒子等を挙げることができ、これらは単独でも、併用して用いてもよい。無機中空粒子としては、珪酸ソーダガラス、アルミ珪酸ガラス、ホウケイ酸ソーダガラス、シラス等がある。熱伝導性、光反射特性の点からは、アルミナ、酸化マグネシウム、無機中空粒子又はそれらの混合物であることが好ましい。また、白色顔料の粒径は、平均粒径が１～５０μｍの範囲にあることが好ましい。平均粒径が１μｍ未満であると粒子が凝集しやすく、分散性が悪くなる傾向があり、５０μｍを超えると反射特性が十分に得られなくなる傾向がある。

【００３１】

上記（Ｄ）無機充填材と上記（Ｅ）白色顔料の合計量は、光反射用熱硬化性樹脂組成物全体に対して、７０～８５体積％の範囲であることが好ましい。この合計量が７０体積％未満であると熱伝導性や光反射特性が不十分になる恐れがあり、８５体積％を超えると樹脂組成物の成型性が悪くなり、光半導体素子搭載用基板の作製が困難となる傾向がある。

【００３２】

上記（Ｆ）カップリング剤としては、特に制限はないが、例えば、シラン系カップリング剤、チタネート系カップリング剤等を用いることができ、シランカップリング剤としては、例えば、エポキシシラン系、アミノシラン系、カチオニックシラン系、ビニルシラン系、アクリルシラン系、メルカプトシラン系及びこれらの複合系などを用いることができる。カップリング剤の種類や処理条件は特に制限はないが、カップリング剤の配合量は、光反射用熱硬化性樹脂組成物全体に対して、５重量％以下であることが好ましい。

【００３３】

また、上記光反射用熱硬化性樹脂組成物には、必要に応じて、酸化防止剤、離型剤、イオン補足剤等の添加剤を添加してもよい。

【００３４】

また、本発明において用いる上記配線基板としては、公知のものを使用することができ、特に限定されないが、例えば、上記プリント配線のほかに、リードフレーム、フレキシブル配線板、メタルベース配線板等を用いることができる。

【００３５】

上記プリント配線は、例えば、銅箔付プリプレグに対して、公知の手法を用いて回路となる配線を形成した後、絶縁用の樹脂を回路上に形成して得ることができる。その際、絶縁用の樹脂及びプリプレグに含浸する樹脂には、ＬＥＤ素子からの光を効率よく反射できるように白色の絶縁樹脂を用いることが望ましい。また、上記リードフレームは、例えば、銅、４２アロイ等の基板を公知の手法を用いて回路を形成して得ることができる。その際、基板表面にはＬＥＤ素子からの光を効率よく反射できるように銀めっきを施しておくことが望ましい。また、上記フレキシブル配線板は、例えば、銅箔付のポリイミド基板を公知の手法を用いて回路となる配線を形成した後、絶縁用の樹脂を回路上に形成して得ることができる。その際、絶縁用の樹脂にはＬＥＤ素子からの光を効率よく反射できるように白色の絶縁樹脂を用いることが望ましい。また、上記メタルベース配線板は、例えば、銅やアルミニウムの基板に絶縁層を形成し、公知の手法を用いて回路となる配線を形成した後、絶縁用の樹脂を回路上に形成して得ることができる。その際、金属基板上の絶縁層及び回路絶縁用の樹脂にはＬＥＤ素子からの光を効率よく反射できるように白色の絶縁樹脂を用いることが望ましい。

【００３６】

本発明の光半導体装置の製造方法は、上記本発明の光半導体素子搭載用パッケージ基板の製造方法により得られた光半導体素子搭載用パッケージ基板に形成された２つ以上の凹部の各底面に、光半導体素子を搭載する工程、および当該光半導体素子を透明な封止樹脂により覆う工程、を有することをその特徴とするものである。

【００３７】

より具体的には、例えば、図１（ｃ）および（ｄ）に示す光半導体素子搭載用パッケー

ジ基板４３０の凹部４２０の各底面の所定位置に、例えば、図２および図３に示すように、光半導体素子１００を搭載し、該光半導体素子１００と金属配線１０５とをボンディングワイヤ１０２、はんだバンプ１０７等の公知の方法で電気的に接続した後、公知の蛍光体１０６を含む透明な封止樹脂１０１により該光半導体素子１００を覆うことで本発明の光半導体装置を製造する。なお、図１（ｃ）および（ｄ）には、光半導体素子を搭載する凹部が９箇所形成された場合について示されているが、本発明がこれに限定されないことはいうまでもない。

【００３８】

　また、上記樹脂封止工程後に、マトリックス状である上記光半導体装置を、ダイシング、レーザ加工、ウォータージェット加工、金型加工等の公知の方法により分割することで、光半導体素子を１つ有する光半導体装置単体（ＳＭＤ型光半導体装置）を得ることができる。好ましくは、図６に示すような、マトリックス状の光半導体装置にダンシングラインを形成し、これに沿ってダイシングする。

【実施例】

【００３９】

（実施例１）

＜プリント配線板＞

　基板厚さ０．６ｍｍ及び銅箔厚さ１８μｍのガラス布－エポキシ樹脂含浸両面銅張り積層板であるＭＣＬ－Ｅ－６７９（日立化成工業（株）製、商品名）に、穴あけ、無電解めっきを行い、通常のサブトラクト法によって回路を形成し、銅の回路の保護にソルダーレジストを形成し、プリント配線板を作製した。

【００４０】

＜光反射用熱硬化性樹脂組成物＞

　下記組成の材料を混練温度２０～３０℃、混練時間１０分の条件でロール混練を行い、光反射用熱硬化性樹脂組成物を作製した。

【００４１】

（Ａ）エポキシ樹脂：トリグリシジルイソシアヌレート

１００重量部（エポキシ当量１００）

（Ｂ）硬化剤：ヘキサヒドロ無水フタル酸

１４０重量部

（Ｃ）硬化促進剤：テトラ－ｎ－ブチルホスホニウム－ｏ，ｏ－ジエチルホスホロジチオエート

２．４重量部

（Ｄ）無機充填剤：溶融シリカ（平均粒径２０μｍ）

６００重量部

アルミナ（平均粒径１μｍ）

８９０重量部

（Ｅ）白色顔料：ホウケイ酸ソーダガラス中空粒子（３Ｍ製、Ｓ６０ＨＳ、平均粒径２７μｍ）

１８５重量部

（Ｆ）カップリング剤：エポキシシラン

１９重量部

（Ｇ）酸化防止剤：９，１０－ジヒドロ－９－オキサ－１０－ホスファフェナントレン－１０－オキシド

１重量部

【００４２】

＜光半導体素子搭載用パッケージ基板の成型＞

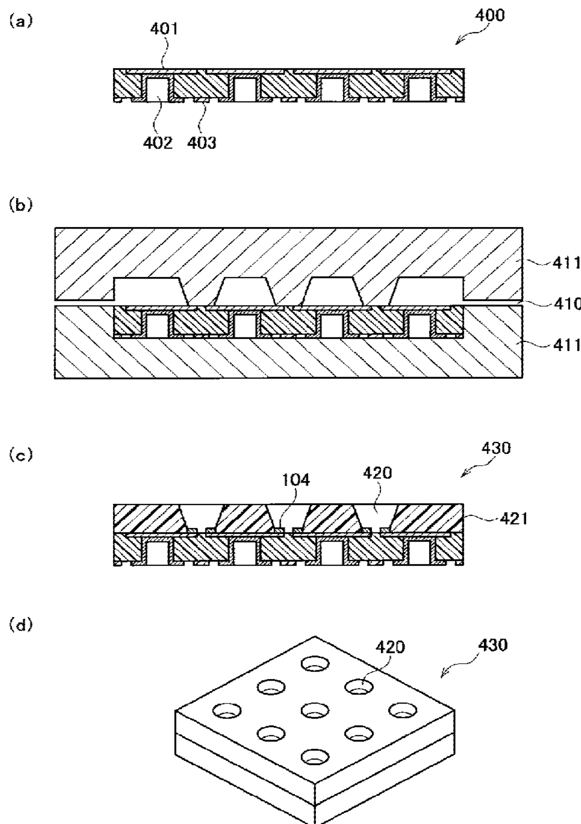
　上記で得たプリント配線板を図１（ｂ）に示すような形状の金型に位置あわせして取り付け、上記で得た光反射用熱硬化性樹脂組成物を注入した後、金型温度１８０℃、９０秒間、６．９ＭＰａの条件でトランスファー成型機（藤和精機（株）製、ＴＥＰ１５０）に

より加熱加圧成型し、複数の凹部を有する、１６００ｍｍ^{2}のマトリックス状の光半導体素子搭載用パッケージ基板を作製した。
【００４３】
＜光半導体装置の製造＞
上記で得た光半導体素子搭載用パッケージ基板に形成された各凹部底面の回路上に、ＬＥＤ素子をダイボンド材（日立化成工業（株）製、ＥＮ４６２０Ｋ）にて固定し、１５０℃で１時間加熱することによりＬＥＤ素子を端子上に固着させた。ついで、金線でＬＥＤ素子と端子を電気的に接続した後、下記組成の透明封止樹脂をポッティングにより各凹部に流し込み、１５０℃で２時間加熱硬化し、ＬＥＤ素子を樹脂封止した。
【００４４】
（透明封止樹脂組成）
・水素添加ビスフェノールＡ型エポキシ樹脂：デナコールＥＸ２５２（ナガセケムテックス社製）
９０重量部
・脂環式エポキシ樹脂：ＣＥＬ－２０２１Ｐ（ダイセル化学社製）
１０重量部
・４－メチルヘキサヒドロフタル酸無水物ＨＮ－５５００Ｅ（日立化成工業製）
９０重量部
・２、６ジターシャルブチル－４－メチルフェノールＢＨＴ
０．４重量部
・２－エチル－４－メチルイミダゾール
０．９重量部
【００４５】
＜ダイシング＞
上記透明封止樹脂を硬化させた後、マトリックス状の光半導体装置をダイシング装置（（株）ディスコ製、ＤＡＤ３８１）により個片化し、ＬＥＤ素子を１つ有する単体の光半導体装置（ＳＭＤ型ＬＥＤ）を複数製造した。
【００４６】
（実施例２）
プリント配線板の代わりにリードフレームを用いた以外は、実施例１と同様にして光半導体装置を製造した。
【００４７】
（実施例３）
プリント配線板の代わりにメタルコア基板を用いた以外は、実施例１と同様にして光半導体装置を製造した。
【００４８】
（実施例４）
プリント配線板の代わりにフレキシブル基板を用いた以外は、実施例１と同様にして光半導体装置を製造した。
【００４９】
（実施例５）
プリント配線板の代わりに、複数のＬＥＤ素子をマトリックス状態で動作させるための回路を形成した配線基板を用い、また、樹脂封止後のダイシングを行わなかった以外は、実施例１と同様にして、マトリックス状の光半導体装置を製造した。
【００５０】
（比較例１）
光反射用樹脂組成物として、熱可塑性のポリフタルアミドを用い、これを射出成型することにより（金型温度１００～２２０℃、射出圧力４９０～１１２０ｋｇ／ｃｍ^2、保持時間１０～４０秒、背圧７～７０ｋｇ／ｃｍ^2、サイクル時間２０～６０秒、押出器ノズル温度３３０～３６０℃、バレル先端温度３２０～３５０℃、スクリュー回転速度２０～

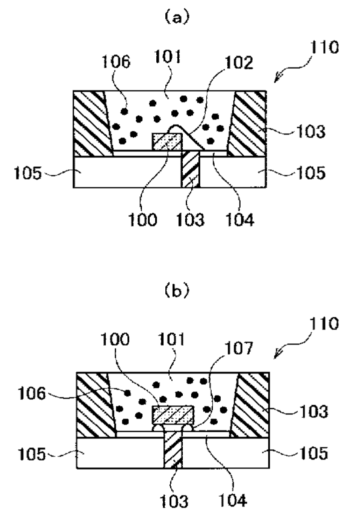
６０回転／分）、凹部を有する樹脂層板（リフレクター）を作製した。
【００５１】
（比較例２）
光反射用樹脂組成物として、熱可塑性のポリフタルアミドを用い、これを比較例１と同様の条件で射出成型することにより作製した複数の凹部を有する樹脂層板（リフレクター）と、複数のＬＥＤを所定位置に搭載したプリント配線板との間に、上記樹脂基板の貫通穴の位置に合わせて穴開けした接着シート（日立化成工業（株）製、ＡＳ－３０００）を位置合わせして挟み、これを１７０℃、０．２ＭＰａ、６０分の条件で加熱加圧硬化することより一体化し、光半導体装置を製造した。
【００５２】
実施例１～５により製造された光半導体素子搭載用パッケージ基板は、その反りが０．５ｍｍ未満であり、また、当該パッケージ基板に形成された複数の凹部底面に光半導体素子を搭載し、これを樹脂封止して製造したマトリックス状の半導体装置からは、そのダイシングによりＳＭＤ型ＬＥＤを効率的に多数製造することが可能であった。
【００５３】
一方、比較例１で製造した凹部を有する樹脂層板は、大きな反りが発生し、マトリックス状樹脂層板（リフレクター）とプリント配線板の間に剥離が生じ、その後の実装工程等を行うことが困難であった。また、比較例２においては、実施例と同様の光半導体装置を製造することができたが、複数の工程と複数の部材を用いる必要があるため、実施例と比較して効率が悪く、経済的ではない。
【図面の簡単な説明】
【００５４】
【図１】本発明のマトリックス状光半導体素子搭載用パッケージ基板の製造工程を示す概略図である。
【図２】本発明により得られる光半導体装置の一実施形態を示す断面図である。
【図３】本発明により得られる光半導体装置（封止樹脂除く）の一実施形態を示す斜視図である。
【図４】一般的なＳＭＤ型ＬＥＤの構造を示す斜視図である。
【図５】従来のマトリックス状光半導体素子搭載用パッケージ基板の製造工程の概略図である。
【図６】マトリックス状光半導体素子搭載用パッケージ基板のダイシング前の状態を示す斜視図である。
【符号の説明】
【００５５】
１　ＬＥＤ素子搭載用パッケージ基板
２　配線基板
４　樹脂層（リフレクター）
　４ａ　上部開口
　４ｂ　下部開口
　４ｃ　側面
　４ｄ　貫通穴
５　接着シート
１０　ＬＥＤ素子
１２　ＬＥＤ素子実装済み配線基板
１４　樹脂層板（リフレクター）
１５　接着シート
　１５ａ　穴
２０　ダイシングライン
１００　光半導体素子（ＬＥＤ素子）
１０１　封止樹脂

１０２　ボンディングワイヤ
１０３　リフレクター
１０４　Ｎｉ／Ａｇめっき
１０５　金属配線
１０６　蛍光体
１０７　はんだバンプ
１１０　光半導体装置
４００　プリント配線板
４０１　金属配線
４０２　層間接続穴
４０３　ソルダーレジスト
４１０　樹脂注入口
４１１　金型
４２０　凹部（光半導体素子搭載領域）
４２１　光反射用熱硬化性樹脂硬化物（リフレクター）
４３０　マトリックス状の光半導体素子搭載用パッケージ基板

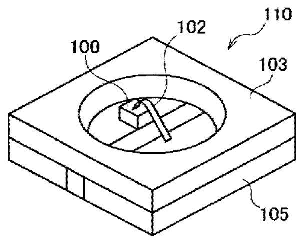
【図１】



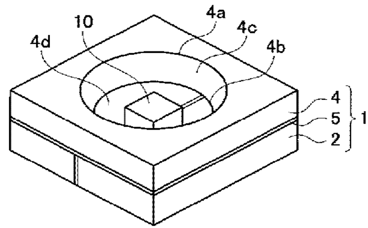
【図２】



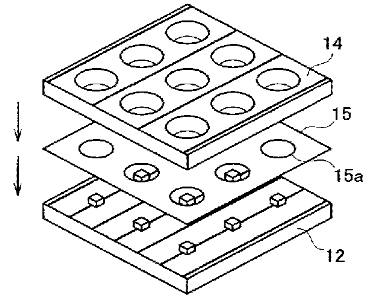
【図３】



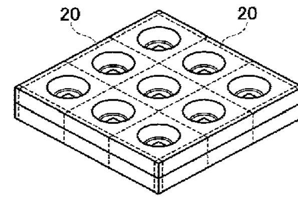
【図４】



【図５】



【図６】



フロントページの続き

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Ｆターム(参考) 5F041 AA03 AA42 DA20 DA74 DA78

DERWENT-ACC-NO: 2007-757639

DERWENT-WEEK: 201345

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TITLE: Manufacture of package substrate for mounting of optical semiconductor element for semiconductor device, involves forming concave portions having thermosetting resin composition layer formed by transfer molding, on wiring board

INVENTOR: URASAKI N

PATENT-ASSIGNEE: HITACHI CHEM CO LTD[HITB]

PRIORITY-DATA: 2006JP-026961 (February 3, 2006)

PATENT-FAMILY:

PUB-NO	PUB-DATE	LANGUAGE
JP 2007235085 A	September 13, 2007	JA
JP 5232369 B2	July 10, 2013	JA

APPLICATION-DATA:

PUB-NO	APPL-DESCRIPTOR	APPL-NO	APPL-DATE
JP2007235085A	N/A	2006JP-198489	July 20, 2006
JP 5232369B2	Previous Publ	2006JP-198489	July 20, 2006

CPC-CURRENT:

CPC-INVENTIVE:

TYPE	CPC	DATE
CPCI	H01L24/97	20130101

CPC-ADDITIONAL:

TYPE	CPC	DATE
CPCA	H01L2224/45144	20130101
CPCA	H01L2224/48091	20130101
CPCA	H01L2924/00	20130101
CPCA	H01L2924/00014	20130101
CPCA	H01L2924/181	20130101

JPO FI-CL-CURRENT:

JPO FI-INVENTIVE:

TYPE	JPO	FI
JFIC	H01L33/00	400

JPO F-TERM-CURRENT	THEME-FTERM
JFTC	5F041
JFTC	5F041 AA03
JFTC	5F041 AA42
JFTC	5F142 AA44
JFTC	5F142 AA64
JFTC	5F142 AA75
JFTC	5F142 AA76
JFTC	5F142 AA82
JFTC	5F142 AA84
JFTC	5F142 BA02
JFTC	5F142 BA32
JFTC	5F142 CA03
JFTC	5F142 CA11
JFTC	5F142 CA13
JFTC	5F142 CD02
JFTC	5F142 CD13
JFTC	5F142 CE03
JFTC	5F142 CE06
JFTC	5F142 CE08
JFTC	5F142 CE13
JFTC	5F142 CE16
JFTC	5F142 CE18
JFTC	5F142 CF12
JFTC	5F142 CF25
JFTC	5F142 DA12
JFTC	5F041 DA20
JFTC	5F041 DA74
JFTC	5F041 DA78
JFTC	5F142 EA02
JFTC	5F142 EA18
JFTC	5F142 FA03
JFTC	5F142 FA42
JFTC	5F142 FA48

INT-CL-CURRENT:

TYPE	IPC	DATE
CIPP	H01L33/48	20100101
CIPP	H01L33/50	20100101
CIPS	H01L33/60	20100101

RELATED-ACC-NO: 2013-L71009 2015-61547K

ABSTRACTED-PUB-NO: JP 2007235085 A

BASIC-ABSTRACT:

NOVELTY - Two or more concave portion (420) used as optical semiconductor element mounting region having thermosetting resin composition layer for light reflection are formed on a wiring board, to manufacture a package substrate (430). The thermosetting resin composition layer is formed by transfer molding.

USE - For manufacture of package substrate for mounting of optical semiconductor element for manufacture of optical semiconductor device (claimed).

ADVANTAGE - The package substrate of suppressed curvature is efficiently, economically and rapidly manufactured at improved productivity. The package substrate is excellent in reflectance of visible light to near-ultraviolet light.

DESCRIPTION OF DRAWING(S) - The figure shows the manufacture of package substrate.

Metal plating (104)

Printed wiring board (400)

Metal wiring (401)

Concave portion (420)

Package substrate (430)

EQUIVALENT-ABSTRACTS:

INORGANIC CHEMISTRY

Preferred Filler: The inorganic filler is silica, alumina, magnesium oxide, antimony oxide, aluminum hydroxide, barium sulfate, magnesium carbonate and/or barium carbonate.

POLYMERS

Preferred Composition: The thermosetting resin composition contains epoxy resin, hardener, hardening accelerator, inorganic filler, white pigment and coupling agent.

CHOSEN-DRAWING: Dwg.1/6

TITLE-TERMS: MANUFACTURE PACKAGE SUBSTRATE MOUNT OPTICAL SEMICONDUCTOR ELEMENT DEVICE FORMING CONCAVE PORTION THERMOSETTING RESIN COMPOSITION LAYER TRANSFER MOULD WIRE BOARD

DERWENT-CLASS: A85 L03 U11 U12

CPI-CODES: A12-E07C; L04-C21; L04-C22;

EPI-CODES: U11-C18B4; U12-A01A2;

ENHANCED- Polymer Index [1.1] 2004 ; P0464*R D01 D22 D42 F47;

POLYMER-INDEXING: H0328;

Polymer Index [1.2] 2004 ; ND01; K9449; K9676*R; K9483*R; Q9999 Q7476 Q7330;

Polymer Index [1.3] 2004 ; A999 A033;

Polymer Index [1.4] 2004 ; A999 A102 A077; B9999 B5209 B5185 B4740;

Polymer Index [1.5] 2004 ; D00 G2482*R F20 O* 6A Sb 5A; D00 F20 O* 6A Si 4A R01694 107016; D00 F20 Al 3A O* 6A R01544 92; D00 F20 Mg 2A O* 6A R01510 157; D00 D67 F21 H* Al 3A O* 6A R02020 87080 87080; D00 F60 O* 6A S* Ba 2A R01739 88364; D00 F44 Mg 2A C* 4A O* 6A R01359 99994; D00 F44 C* 4A O* 6A Ba 2A R01311 88360; A999 A237; A999 A771;

VIZIO Ex. 1002 Page 0256

PTO/SB/08 (modified)

Substitute for form 1449/PTO **INFORMATION DISCLOSURE STATEMENT BY APPLICANT** Date Submitted: September 29, 2016 *(use as many sheets as necessary)*				***Complete if Known***	
				Application Number	14/928,550
				Filing Date	10/30/2015
				First Named Inventor	Hirofumi ICHIKAWA
				Art Unit	2895
				Examiner Name	Caridad EVERHART
Sheet	1	of	1	Attorney Docket Number	100415-0198

U.S. PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Document Number Number-Kind Code[2] *(if known)*	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
/C.E/	B1	2004/0051171-A1	03-18-2004	NG ET AL.	

UNPUBLISHED U.S. PATENT APPLICATION DOCUMENTS

Examiner Initials*	Cite No.[1]	U.S. Patent Application Document Serial Number-Kind Code[2] *(if known)*	Filing Date of Cited Document MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear

FOREIGN PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Foreign Patent Document Country Code[3]-Number[4]-Kind Code[5] *(if known)*	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Documents	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear	T[6]
/C.E/	B2	JP-2004-111964-A	04-08-2004	AGILENT TECHNOLOGIES INC	= B1	Abs.

NON PATENT LITERATURE DOCUMENTS

Examiner Initials*	Cite No.[1]	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.) date, page(s), volume-issue number(s), publisher, city and/or country where published.	T[6]
/C.E/	B3	Office Action issued in Japanese Patent Application No. 2015-200794 mailed September 13, 2016.	

Examiner Signature	/CARIDAD EVERHART/	Date Considered	10/05/2016

4848-4599-9673.1

Doc Code: DIST.E.FILE Document Description: Electronic Terminal Disclaimer - Filed	PTO/SB/26 U.S. Patent and Trademark Office Department of Commerce

Electronic Petition Request	**TERMINAL DISCLAIMER TO OBVIATE A DOUBLE PATENTING REJECTION OVER A "PRIOR" PATENT**
Application Number	14928550
Filing Date	30-Oct-2015
First Named Inventor	Hirofumi ICHIKAWA
Attorney Docket Number	100415-0198
Title of Invention	LIGHT EMITTING DEVICE, RESIN PACKAGE, RESIN-MOLDED BODY, AND METHODS FOR MANUFACTURING LIGHT EMITTING DEVICE, RESIN PACKAGE AND RESIN-MOLDED BODY

☒ Filing of terminal disclaimer does not obviate requirement for response under 37 CFR 1.111 to outstanding Office Action

☒ This electronic Terminal Disclaimer is not being used for a Joint Research Agreement.

Owner	Percent Interest
NICHIA CORPORATION	100%

The owner(s) with percent interest listed above in the instant application hereby disclaims, except as provided below, the terminal part of the statutory term of any patent granted on the instant application which would extend beyond the expiration date of the full statutory term of prior patent number(s)

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as the term of said prior patent is presently shortened by any terminal disclaimer. The owner hereby agrees that any patent so granted on the instant application shall be enforceable only for and during such period that it and the prior patent are commonly owned. This agreement runs with any patent granted on the instant application and is binding upon the grantee, its successors or assigns.

In making the above disclaimer, the owner does not disclaim the terminal part of the term of any patent granted on the instant application that would extend to the expiration date of the full statutory term of the prior patent, "as the term of said prior patent is presently shortened by any terminal disclaimer," in the event that said prior patent later:
- expires for failure to pay a maintenance fee;
- is held unenforceable;
- is found invalid by a court of competent jurisdiction;
- is statutorily disclaimed in whole or terminally disclaimed under 37 CFR 1.321;
- has all claims canceled by a reexamination certificate;
- is reissued; or
- is in any manner terminated prior to the expiration of its full statutory term as presently shortened by any terminal disclaimer.

◉ Terminal disclaimer fee under 37 CFR 1.20(d) is included with Electronic Terminal Disclaimer request.

○ I certify, in accordance with 37 CFR 1.4(d)(4), that the terminal disclaimer fee under 37 CFR 1.20(d) required for this terminal disclaimer has already been paid in the above-identified application.

Applicant claims the following fee status:

○ Small Entity

○ Micro Entity

◉ Regular Undiscounted

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

THIS PORTION MUST BE COMPLETED BY THE SIGNATORY OR SIGNATORIES

I certify, in accordance with 37 CFR 1.4(d)(4) that I am:

◉ An attorney or agent registered to practice before the Patent and Trademark Office who is of record in this application

Registration Number 35264

○ A sole inventor

○ A joint inventor; I certify that I am authorized to sign this submission on behalf of all of the inventors as evidenced by the power of attorney in the application

○ A joint inventor; all of whom are signing this request

Signature	/ Stephen B. Maebius /
Name	Stephen B. Maebius

*Statement under 37 CFR 3.73(b) is required if terminal disclaimer is signed by the assignee (owner).
Form PTO/SB/96 may be used for making this certification. See MPEP § 324.

Electronic Patent Application Fee Transmittal

Application Number:	14928550
Filing Date:	30-Oct-2015
Title of Invention:	LIGHT EMITTING DEVICE, RESIN PACKAGE, RESIN-MOLDED BODY, AND METHODS FOR MANUFACTURING LIGHT EMITTING DEVICE, RESIN PACKAGE AND RESIN-MOLDED BODY
First Named Inventor/Applicant Name:	Hirofumi ICHIKAWA
Filer:	Stephen Bradford Maebius/Stacy Jen
Attorney Docket Number:	100415-0198

Filed as Large Entity

Filing Fees for **Utility under 35 USC 111(a)**

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
STATUTORY OR TERMINAL DISCLAIMER	1814	1	160	160
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Extension-of-Time:				
Miscellaneous:				
	Total in USD ($)			160

Doc Code: DISQ.E.FILE
Document Description: Electronic Terminal Disclaimer – Approved

Application No.: 14928550

Filing Date: 30-Oct-2015

Applicant/Patent under Reexamination: ICHIKAWA et al.

Electronic Terminal Disclaimer filed on October 26, 2016

☒ APPROVED

This patent is subject to a terminal disclaimer

☐ DISAPPROVED

Approved/Disapproved by: Electronic Terminal Disclaimer automatically approved by EFS-Web

U.S. Patent and Trademark Office

Electronic Acknowledgement Receipt

EFS ID:	27312959
Application Number:	14928550
International Application Number:	
Confirmation Number:	1591
Title of Invention:	LIGHT EMITTING DEVICE, RESIN PACKAGE, RESIN-MOLDED BODY, AND METHODS FOR MANUFACTURING LIGHT EMITTING DEVICE, RESIN PACKAGE AND RESIN-MOLDED BODY
First Named Inventor/Applicant Name:	Hirofumi ICHIKAWA
Customer Number:	22428
Filer:	Stephen Bradford Maebius/Stacy Jen
Filer Authorized By:	Stephen Bradford Maebius
Attorney Docket Number:	100415-0198
Receipt Date:	26-OCT-2016
Filing Date:	30-OCT-2015
Time Stamp:	15:24:27
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	CARD
Payment was successfully received in RAM	$160
RAM confirmation Number	102716INTEFSW15242500
Deposit Account	
Authorized User	

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Electronic Terminal Disclaimer-Filed	eTerminal-Disclaimer.pdf	33666 76b4123b2ff3666f61dae20313cee7f3e513 4d47	no	2
Warnings:					
Information:					
2	Fee Worksheet (SB06)	fee-info.pdf	31065 62c96968dd99dd5208cd3fc6b37ec0043fca c0e9	no	2
Warnings:					
Information:					
			Total Files Size (in bytes):	64731	

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

First Inventor Name:	Hirofumi ICHIKAWA
Title:	LIGHT EMITTING DEVICE, RESIN PACKAGE, RESIN-MOLDED BODY, AND METHODS FOR MANUFACTURING LIGHT EMITTING DEVICE, RESIN PACKAGE AND RESIN-MOLDED BODY
Appl. No.:	14/928,550
Filing Date:	10/30/2015
Examiner:	Caridad EVERHART
Art Unit:	2895
Confirmation Number:	1591

AMENDMENT AND REPLY UNDER 37 CFR 1.312

Mail Stop ISSUE FEE
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Commissioner:

Applicant acknowledges receipt of a Notice of Allowance in the above-captioned application. Please amend the application as follows:

Amendments to the Claims are reflected in the listing of claims which begins on page 2 of this document.

Remarks begin on page 8 of this document.

Please amend the application as follows:

Amendments to the Claims:

This listing of claims will replace all prior versions and listings of claims in the application:

Listing of Claims:

1. (Previously Presented) A light emitting device comprising:

a resin package comprising a resin part and a metal part including at least two metal plates, said resin package having four outer lateral surfaces and having a concave portion having a bottom surface; and

a light emitting element mounted on the bottom surface of the concave portion and electrically connected to the metal part,

wherein at least a portion of an outer lateral surface of the resin part and at least a portion of an outer lateral surface of the metal part are coplanar at each of the four outer lateral surfaces of the resin package,

wherein a notch is formed in the metal part at each of the four outer lateral surfaces of the resin package,

wherein the resin part is located at left and right sides of a portion of the metal part at at least two of the four outer lateral surfaces of the resin package, and

wherein each of the two metal plates is substantially flat.

2. (Previously Presented) The light emitting device according to claim 1, wherein the metal part includes a base portion and a metal layer disposed on each of an upper surface and a lower surface of the base portion, the metal layers being made of a material that is different from that of the base portion.

3. (Previously Presented) The light emitting device according to claim 2, wherein the metal layer is disposed at all surfaces of the metal part except a portion of an outer lateral surface of the metal part.

4. (Previously Presented) The light emitting device according to claim 2, wherein:

the resin part is disposed over a first portion of the metal layer at the upper surface of the metal part, and

a second portion of the metal layer at the upper surface of the metal part is exposed from the resin part.

5. (Original) The light emitting device according to claim 1, wherein the resin part contains a light reflecting material.

6. (Original) The light emitting device according to claim 5, wherein the light reflecting material is titanium dioxide.

7. (Original) The light emitting device according to claim 6, wherein the resin part contains 10 to 60% by weight of the titanium dioxide.

8. (Original) The light emitting device according to claim 1, wherein the resin part is made using a thermosetting resin.

9. (Previously Presented) The light emitting device according to claim 1, wherein the metal part has a step portion, a concave portion, and/or a convex portion.

10. (Previously Presented) The light emitting device according to claim 1, wherein the metal part has means for providing a difference in level to expand a bonding area with a conductive material upon mounting.

11. – 12. (Cancelled)

13. (Original) The light emitting device according to claim 1, wherein the light emitting device further comprises a sealing member that contains two or more kinds of phosphors.

14. (Previously Presented) The light emitting device according to claim 1, wherein the metal part is exposed from the resin part at corners of the resin package.

15. (Original) The light emitting device according to claim 1, wherein at least a portion of the light emitting element is exposed from the resin part.

16. (Previously Presented) A light emitting device comprising:

a resin package comprising a resin part and a metal part including at least two metal plates, said resin package having four outer lateral surfaces and having a concave portion having a bottom surface; and

a light emitting element mounted on the bottom surface of the concave portion and electrically connected to the metal part,

wherein at least a portion of an outer lateral surface of the resin part and at least a portion of an outer lateral surface of the metal part are coplanar at each of the four outer lateral surfaces of the resin package,

wherein a notch is formed in the metal part at each of the four outer lateral surfaces of the resin package,

wherein the resin part is located at left and right sides of a portion of the metal part at least two of the four outer lateral surfaces of the resin package,

wherein the metal part comprises two or more major laterally extending upper surfaces, and

wherein all of the two or more major laterally extending upper surfaces are coplanar.

17. (Previously Presented) A light emitting device comprising:

a resin package comprising a resin part and a metal part including at least two metal plates, said resin package having four outer lateral surfaces and having a concave portion having a bottom surface; and

a light emitting element mounted on the bottom surface of the concave portion and electrically connected to the metal part,

wherein at least a portion of an outer lateral surface of the resin part and at least a portion of an outer lateral surface of the metal part are coplanar at each of the four outer lateral surfaces of the resin package,

wherein a notch is formed in the metal part at each of the four outer lateral surfaces of the resin package,

wherein the resin part is located at left and right sides of a portion of the metal part at at least two of the four outer lateral surfaces of the resin package, and

wherein all upper edges of the metal part are coplanar.

18. (Currently Amended) A light emitting device comprising:

a resin package comprising a resin part and a metal part including at least two metal plates, said resin package having four outer lateral surfaces and having a concave portion having a bottom surface; and

a light emitting element mounted on the bottom surface of the concave portion and electrically connected to the metal part,

wherein at least a portion of an outer surface of the resin part and at least a portion of an outer surface of the metal part are coplanar at an outer bottom surface of the resin package,

wherein at least a portion of an outer lateral surface of the resin part and at least a portion of an outer lateral surface of the metal part are coplanar at each of the four outer lateral surfaces of the resin package,

wherein a notch is formed in the metal part at each of the four outer lateral surfaces of the resin package,

wherein the resin part is located at left and right sides of a portion of the metal part at at least two of the four outer lateral surfaces of the resin package, and

wherein a lower surface of the metal part is exposed from the resin part in a region directly under the light emitting element.

19. (Previously Presented) The light emitting device according to claim 18, wherein the metal part includes a base portion and a metal layer disposed on each of an upper surface and a lower surface of the base portion, the metal layers being made of a material that is different from that of the base portion.

20. (Previously Presented) The light emitting device according to claim 19, wherein the metal layer is disposed at all surfaces of the metal part except an outer lateral surface of the metal part.

21. (Previously Presented) The light emitting device according to claim 19, wherein:

the resin part is disposed over a first portion of the metal layer at the upper surface of the metal part, and

a second portion of the metal layer on the upper surface of the metal part is exposed from the resin part.

22. (Previously Presented) The light emitting device according to claim 18, wherein the resin part contains a light reflecting material.

23. (Previously Presented) The light emitting device according to claim 22, wherein the light reflecting material is titanium dioxide, and the resin part contains 10 to 60% by weight of the titanium dioxide.

24. (Original) The light emitting device according to claim 18, wherein the resin part is made using a thermosetting resin.

25. (Previously Presented) The light emitting device according to claim 18, wherein the metal part has a step portion, a concave portion, and/or a convex portion.

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26. (Previously Presented) The light emitting device according to claim 19, wherein the metal part has means for providing a difference in level to expand a bonding area with a conductive material upon mounting.

27. – 28. (Cancelled)

29. (Original) The light emitting device according to claim 18, wherein the light emitting device further comprises a sealing member that contains two or more kinds of phosphors.

30. (Previously Presented) The light emitting device according to claim 18, wherein the metal part is exposed from the resin part at corners of the resin package.

REMARKS

This amendment is being filed prior to payment of the issue fee. Entry of the foregoing amendment is respectfully requested. The amendment is required to address a typographical error in claim 18. The amendment does not change the scope of the claims. Accordingly, entry of the amendment is requested.

Status of Claims

Claim 18 is amended. After amending the claims as set forth above, claims 1-10, 13-26, 29, and 30 remain pending in this application. No new matter is added.

Claim 18 is amended to replace the term "metal" with "metal part" in line 10.

Concluding Remarks

Applicants believe that the application is in condition for allowance. Favorable reconsideration is respectfully requested. The Examiner is invited to contact the undersigned by telephone if it is felt that a telephone interview would advance prosecution.

The Commissioner is hereby authorized to charge any additional fees which may be required regarding this application, or credit any overpayment, to Deposit Account No. 19-0741. If any extensions of time are needed for timely acceptance of papers submitted herewith, Applicants hereby petition for such extension under 37 C.F.R. §1.136 and authorize payment of any such extensions fees to Deposit Account No. 19-0741.

Respectfully submitted,

Date November 8, 2016 By /Chase J. Brill/

FOLEY & LARDNER LLP
Customer Number: 22428
Telephone: (202) 295-4787
Facsimile: (202) 672-5399

Chase J. Brill
Attorney for Applicant
Registration No. 61,378

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

First Inventor Name: Hirofumi ICHIKAWA

Title: LIGHT EMITTING DEVICE, RESIN PACKAGE, RESIN-MOLDED BODY, AND METHODS FOR MANUFACTURING LIGHT EMITTING DEVICE, RESIN PACKAGE AND RESIN-MOLDED BODY

Appl. No.: 14/928,550

Filing Date: 10/30/2015

Examiner: Caridad EVERHART

Art Unit: 2895

Confirmation Number: 1591

COMMENTS ON STATEMENT OF REASONS FOR ALLOWANCE

Mail Stop ISSUE FEE
Commissioner for Patents
PO Box 1450
Alexandria, Virginia 22313-1450

These Comments on Statement of Reasons for Allowance under 37 C.F.R. § 1.104 are responsive to the Supplemental Notice of Allowability dated October 13, 2016.

On pages 2-3 of the Supplemental Notice of Allowability under "Reasons for Allowance," the Office provides a statement of reasons for allowance. Applicants thank the Examiner for the Notice of Allowance. In response, Applicants stress that other reasons of record exist for the allowance of the allowed claims that go beyond the PTO's reasoning.

Additionally, the Notice of Allowability states:

> Ng et al (US 2004/0051171 A 1), which is the English language equivalent of JP2004-111964, does not disclose nor suggest the

> limitation "at least a portion of an outer lateral surface of the metal part are coplanar at each of the four outer lateral surfaces of the resin package, wherein a notch is formed in the metal part at each of the four outer lateral surfaces of the resin package", and Ng et al disclose that the sides of the package slope (paragraphs 0043 and 0051) so that the base is larger than its top (paragraph 0051), and Fig. 9A and Fig. 9B show that Ng et al does not disclose the metal part and the resin part are coplanar, which includes the that the sides slope, as stated above . . . .

To the extent this statement suggests that the claims require the ***entire*** outer lateral surface of the resin package is coplanar with a portion of an outer lateral surface of the metal part, Applicant wishes to point out that the independent claims actually recite that "***at least a portion*** of an outer lateral surface of the resin part and ***at least a portion*** of an outer lateral surface of the metal part are coplanar at each of the four outer lateral surfaces of the resin package."

The Commissioner is hereby authorized to charge any additional fees which may be required regarding this application, or credit any overpayment, to Deposit Account No. 19-0741. If any extensions of time are needed for timely acceptance of papers submitted herewith, Applicants hereby petition for such extension under 37 C.F.R. §1.136 and authorize payment of any such extensions fees to Deposit Account No. 19-0741.

Respectfully submitted,

Date November 8, 2016

By /Chase J. Brill/

FOLEY & LARDNER LLP
Customer Number: 22428
Telephone: (202) 295-4787
Facsimile: (202) 672-5399

Chase J. Brill
Attorney for Applicant
Registration No. 61,378

Electronic Acknowledgement Receipt

EFS ID:	27446365
Application Number:	14928550
International Application Number:	
Confirmation Number:	1591
Title of Invention:	LIGHT EMITTING DEVICE, RESIN PACKAGE, RESIN-MOLDED BODY, AND METHODS FOR MANUFACTURING LIGHT EMITTING DEVICE, RESIN PACKAGE AND RESIN-MOLDED BODY
First Named Inventor/Applicant Name:	Hirofumi ICHIKAWA
Customer Number:	22428
Filer:	Chase J. Brill/Stacy Jen
Filer Authorized By:	Chase J. Brill
Attorney Docket Number:	100415-0198
Receipt Date:	08-NOV-2016
Filing Date:	30-OCT-2015
Time Stamp:	13:23:38
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		100415-0198_312_Amendment.pdf	114969 0fecfd39bb8918de312f451643284f7912e39912	yes	9

	Multipart Description/PDF files in .zip description		
	Document Description	**Start**	**End**
	Amendment after Notice of Allowance (Rule 312)	1	1
	Claims	2	7
	Applicant Arguments/Remarks Made in an Amendment	8	9

Warnings:

Information:

2	Post Allowance Communication - Incoming	100415-0198_Comments_on_Statement_for_Reasons_for_Allowance.pdf	101932 d410a73f6de3a44899ad4d63e33eb47f403ffc53	no	2

Warnings:

Information:

Total Files Size (in bytes):	216901

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), to: Mail **Mail Stop ISSUE FEE**
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450
or Fax (571)-273-2885

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

22428 7590 08/26/2016
Foley & Lardner LLP
3000 K STREET N.W.
SUITE 600
WASHINGTON, DC 20007-5109

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

Certificate of Mailing or Transmission

I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being facsimile transmitted to the USPTO (571) 273-2885, on the date indicated below.

(Depositor's name)
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
14/928,550	10/30/2015	Hirofumi ICHIKAWA	100415-0198	1591

TITLE OF INVENTION: LIGHT EMITTING DEVICE, RESIN PACKAGE, RESIN-MOLDED BODY, AND METHODS FOR MANUFACTURING LIGHT EMITTING DEVICE, RESIN PACKAGE AND RESIN-MOLDED BODY

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	$960	$0	$0	$960	11/28/2016

EXAMINER	ART UNIT	CLASS-SUBCLASS
EVERHART, CARIDAD	2895	438-026000

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).
   - ☐ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.
   - ☐ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-02 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list
   (1) The names of up to 3 registered patent attorneys or agents OR, alternatively,
   (2) The name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.
   1. FOLEY & LARDNER LLP
   2.
   3.

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document has been filed for recordation as set forth in 37 CFR 3.11. Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE: NICHIA CORPORATION

(B) RESIDENCE: (CITY and STATE OR COUNTRY): ANAN-SHI, JAPAN

Please check the appropriate assignee category or categories (will not be printed on the patent) : ☐ Individual ☒ Corporation or other private group entity ☐ Government

4a. The following fee(s) are submitted:
- ☒ Issue Fee
- ☐ Publication Fee (No small entity discount permitted)
- ☐ Advance Order - # of Copies ....

4b. Payment of Fee(s): **(Please first reapply any previously paid issue fee shown above)**
- ☐ A check is enclosed.
- ☒ Payment by credit card. XXXXXXXXXXXXXXXX
- ☒ The director is hereby authorized to charge the required fee(s), any deficiency, or credits any overpayment, to Deposit Account Number 19-0741 XXXXXXXXXXXXXXXXX

5. **Change in Entity Status** (from status indicated above)
- ☐ Applicant certifying micro entity status. See 37 CFR 1.29
  NOTE: Absent a valid certification of Micro Entity Status (see forms PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.
- ☐ Applicant asserting small entity status. See 37 CFR 1.27
  NOTE: If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.
- ☐ Applicant changing to regular undiscounted fee status.
  NOTE: Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

NOTE: This form must be signed in accordance with 37 CFR 1.31 and 1.33. See 37 CFR 1.4 for signature requirements and certifications.

Authorized Signature /Chase J. Brill/ Date November 23, 2016

Typed or printed name Chase J. Brill Registration No. 61,378

VIZIO Ex. 1002 Page 0278

Electronic Patent Application Fee Transmittal

Application Number:	14928550
Filing Date:	30-Oct-2015
Title of Invention:	LIGHT EMITTING DEVICE, RESIN PACKAGE, RESIN-MOLDED BODY, AND METHODS FOR MANUFACTURING LIGHT EMITTING DEVICE, RESIN PACKAGE AND RESIN-MOLDED BODY
First Named Inventor/Applicant Name:	Hirofumi ICHIKAWA
Filer:	Chase J. Brill/Stacy Jen
Attorney Docket Number:	100415-0198

Filed as Large Entity

Filing Fees for **Utility under 35 USC 111(a)**

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
UTILITY APPL ISSUE FEE	1501	1	960	960

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Extension-of-Time:				
Miscellaneous:				
		Total in USD ($)		**960**

Electronic Acknowledgement Receipt

EFS ID:	27603121
Application Number:	14928550
International Application Number:	
Confirmation Number:	1591
Title of Invention:	LIGHT EMITTING DEVICE, RESIN PACKAGE, RESIN-MOLDED BODY, AND METHODS FOR MANUFACTURING LIGHT EMITTING DEVICE, RESIN PACKAGE AND RESIN-MOLDED BODY
First Named Inventor/Applicant Name:	Hirofumi ICHIKAWA
Customer Number:	22428
Filer:	Chase J. Brill/Stacy Jen
Filer Authorized By:	Chase J. Brill
Attorney Docket Number:	100415-0198
Receipt Date:	23-NOV-2016
Filing Date:	30-OCT-2015
Time Stamp:	14:38:48
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	CARD
Payment was successfully received in RAM	$960
RAM confirmation Number	112516INTEFSW14393900
Deposit Account	
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File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Issue Fee Payment (PTO-85B)	100415-0198_Issue_Fee_Transmittal.pdf	287941 0b9d10d5188ad012b4ca6d1322eb1275eccf8123	no	1
Warnings:					
Information:					
2	Fee Worksheet (SB06)	fee-info.pdf	30995 2f565c3167551e6c5943b81b013494297a38f93f	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	318936		

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

OK TO ENTER: /C.E/

Atty. Dkt. No. 100415-0198

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

First Inventor Name:	Hirofumi ICHIKAWA
Title:	LIGHT EMITTING DEVICE, RESIN PACKAGE, RESIN-MOLDED BODY, AND METHODS FOR MANUFACTURING LIGHT EMITTING DEVICE, RESIN PACKAGE AND RESIN-MOLDED BODY
Appl. No.:	14/928,550
Filing Date:	10/30/2015
Examiner:	Caridad EVERHART
Art Unit:	2895
Confirmation Number:	1591

AMENDMENT AND REPLY UNDER 37 CFR 1.312

Mail Stop ISSUE FEE
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Commissioner:

Applicant acknowledges receipt of a Notice of Allowance in the above-captioned application. Please amend the application as follows:

Amendments to the Claims are reflected in the listing of claims which begins on page 2 of this document.

Remarks begin on page 8 of this document.

Please amend the application as follows:

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
14/928,550	10/30/2015	Hirofumi ICHIKAWA	100415-0198	1591

22428 7590 11/25/2016
Foley & Lardner LLP
3000 K STREET N.W.
SUITE 600
WASHINGTON, DC 20007-5109

EXAMINER	
EVERHART, CARIDAD	

ART UNIT	PAPER NUMBER
2895	

NOTIFICATION DATE	DELIVERY MODE
11/25/2016	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

ipdocketing@foley.com

PTOL-90A (Rev. 04/07)

Response to Rule 312 Communication	**Application No.** 14/928,550	**Applicant(s)** ICHIKAWA ET AL.
	Examiner CARIDAD EVERHART	**Art Unit** 2895

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address –

1. ☒ The amendment filed on *08 November 2016* under 37 CFR 1.312 has been considered, and has been:

a) ☐ entered.

b) ☒ entered as directed to matters of form not affecting the scope of the invention.

c) ☐ disapproved because the amendment was filed after the payment of the issue fee.
Any amendment filed after the date the issue fee is paid must be accompanied by a petition under 37 CFR 1.313(c)(1) and the required fee to withdraw the application from issue.

d) ☐ disapproved. See explanation below.

e) ☐ entered in part. See explanation below.

/Caridad Everhart/
Primary Examiner
AU 2895

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	ISSUE DATE	PATENT NO.	ATTORNEY DOCKET NO.	CONFIRMATION NO.
14/928,550	01/03/2017	9537071	100415-0198	1591

22428 7590 12/14/2016

Foley & Lardner LLP
3000 K STREET N.W.
SUITE 600
WASHINGTON, DC 20007-5109

ISSUE NOTIFICATION

The projected patent number and issue date are specified above.

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)
(application filed on or after May 29, 2000)

The Patent Term Adjustment is 0 day(s). Any patent to issue from the above-identified application will include an indication of the adjustment on the front page.

If a Continued Prosecution Application (CPA) was filed in the above-identified application, the filing date that determines Patent Term Adjustment is the filing date of the most recent CPA.

Applicant will be able to obtain more detailed information by accessing the Patent Application Information Retrieval (PAIR) WEB site (http://pair.uspto.gov).

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Application Assistance Unit (AAU) of the Office of Data Management (ODM) at (571)-272-4200.

APPLICANT(s) (Please see PAIR WEB site http://pair.uspto.gov for additional applicants):

Hirofumi ICHIKAWA, Komatsushima-shi, JAPAN;
NICHIA CORPORATION, Anan-shi, JAPAN;
Masaki HAYASHI, Anan-shi, JAPAN;
Shimpei SASAOKA, Tokushima-shi, JAPAN;
Tomohide MIKI, Tokushima-shi, JAPAN;

The United States represents the largest, most dynamic marketplace in the world and is an unparalleled location for business investment, innovation, and commercialization of new technologies. The USA offers tremendous resources and advantages for those who invest and manufacture goods here. Through SelectUSA, our nation works to encourage and facilitate business investment. To learn more about why the USA is the best country in the world to develop technology, manufacture products, and grow your business, visit SelectUSA.gov.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

First Inventor Name:	Hirofumi ICHIKAWA
Title:	LIGHT EMITTING DEVICE, RESIN PACKAGE, RESIN-MOLDED BODY, AND METHODS FOR MANUFACTURING LIGHT EMITTING DEVICE, RESIN PACKAGE AND RESIN-MOLDED BODY
Patent. No.:	9,537,071
Issue Date:	1/3/2017
Examiner:	Caridad EVERHART
Art Unit:	2895
Confirmation Number:	1591

REQUEST FOR CERTIFICATE OF CORRECTION PURSUANT TO 37 C.F.R. § 1.323

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Commissioner:

Enclosed is a Certificate of Correction, Form PTO-SB/44, for United States Patent Number 9,537,071 issued January 3, 2017.

Please make the following corrections:

In the Specification

Column 6, line 60

Please replace "scaling member" with --sealing member--.

Column 7, line 13

Please replace "singualtion" with --singulation--.

Column 9, line 29

Please replace "resin•molded body" with --resin-molded body--.

Column 10, line 42

Please replace "alkaline•earth silicate" with --alkaline-earth silicate--.

Column 10, lines 60-61

Please replace "element such as Eu or Cc includes, for example, $MSi_2O_2N_2$:En" with --element such as Eu or Ce includes, for example, $MSi_2O_2N_2$:Eu--.

Column 10, lines 64-65

Please replace "$M_{p/2}Si_{12p\text{-}q}Al_{p+q}O_qN_{16\text{-}p}$:Ce or M-Al—Si—O—N" with --$M_{p/2}Si_{12\text{-}p\text{-}q}Al_{p+q}O_qN_{16\text{-}p}$:Ce or M—Al—Si—O—N--.

Column 12, line 32

Please replace "cross sectional" with --cross-sectional--.

Column 13, lines 36-37

Please replace "resin-molded body **2,1**" with --resin-molded body **24**--.

Column 14, line 6

Please replace "hole pads" with --hole parts--.

Column 14, lines 42-43

Please replace "when singualtion is performed using a singualtion saw" with --when singulation is performed using a singulation saw--.

Column 15, line 8

Please replace "singualtion saw" with --singulation saw--.

Column 15, line 10

Please replace "singualtion saw" with --singulation saw--.

Column 15, line 50

Please replace "114" with --¼--.

Column 16, line 35

Please replace "resin part **a25**" with --resin part **325**--.

Column 17, line 8

Please replace "fglate plate shape" with --flat plate shape--.

Column 17, line 35

Please replace "are shape" with --arc shape--.

Applicant submits that the noted errors do not constitute new matter, and correction thereof would not require reexamination.

Pursuant to 37 C.F.R. §1.323, Applicant requests that the enclosed Certificate of Correction be approved.

Since at least one of the noted errors is not the fault of the Patent Office, payment is enclosed of the required fee of $100.00. The required fee is being paid by credit card via EFS-Web.

The Commissioner is hereby authorized to charge any additional fees which may be required regarding this application under 37 C.F.R. §§ 1.16-1.17, or credit any overpayment, to Deposit Account No. 19-0741. Should no proper payment be enclosed herewith, as by the credit card payment instructions in EFS-Web being incorrect or absent, resulting in a rejected or incorrect credit card transaction, the Commissioner is authorized to charge the unpaid amount to Deposit Account No. 19-0741.

Respectfully submitted,

Date January 25, 2017

By /Chase J. Brill/

FOLEY & LARDNER LLP
Customer Number: 22428
Telephone: (202) 295-4787
Facsimile: (202) 672-5399

Chase J. Brill
Attorney for Applicant
Registration No. 61,378

MODIFIED PTO/SB/44 (04-05)
Approved for use through 04/30/2007. OMB 0651-0033
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(Also Form PTO-1050)

UNITED STATES PATENT AND TRADEMARK OFFICE

CERTIFICATE OF CORRECTION

PATENT NO. : 9,537,071

APPLICATION NO. : 14/928,550

DATED : 1/3/2017

INVENTOR(S) : Hirofumi ICHIKAWA ; Masaki HAYASHI ; Shimpei SASAOKA ; Tomohide MIKI

It is certified that an error appears or errors appear in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

In the Specification

Column 6, line 60
Please replace “scaling member” with --sealing member--.

Column 7, line 13
Please replace “singualtion” with --singulation--.

Column 9, line 29
Please replace “resin•molded body” with --resin-molded body--.

Column 10, line 42
Please replace “alkaline•earth silicate” with --alkaline-earth silicate--.

Column 10, lines 60-61
Please replace “element such as Eu or Cc includes, for example, $MSi_2O_2N_2$:En” with --element such as Eu or Ce includes, for example, $MSi_2O_2N_2$:Eu--.

Column 10, lines 64-65
Please replace “$M_{p/2}Si_{12p-q}Al_{p+q}O_qN_{16-p}$:Ce or M-Al—Si—O—N” with --$M_{p/2}Si_{12-p-q}Al_{p+q}O_qN_{16-p}$:Ce or M—Al—Si—O—N--.

Column 12, line 32
Please replace “cross sectional” with --cross-sectional--.

Column 13, lines 36-37
Please replace “resin-molded body **2,1**” with --resin-molded body **24**--.

Column 14, line 6
Please replace “hole pads” with --hole parts--.

4829-3542-7904.1

MODIFIED PTO/SB/44 (04-05)
Approved for use through 04/30/2007. OMB 0651-0033
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.
(Also Form PTO-1050)

Column 14, lines 42-43
Please replace “when singualtion is performed using a singualtion saw” with --when singulation is performed using a singulation saw--.

Column 15, line 8
Please replace “singualtion saw” with --singulation saw--.

Column 15, line 10
Please replace “singualtion saw” with --singulation saw--.

Column 15, line 50
Please replace “114” with --¼--.

Column 16, line 35
Please replace “resin part **a25**” with --resin part **325**--.

Column 17, line 8
Please replace “fglate plate shape” with --flat plate shape--.

Column 17, line 35
Please replace “are shape” with --arc shape--.

MAILING ADDRESS OF SENDER (Please do not use customer number below):

3000 K Street, N.W.
Suite 600
Washington, D.C. 20007-5109

This collection of information is required by 37 CFR 1.322, 1.323, and 1.324. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1.0 hour to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer,
U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: **Attention Certificate of Corrections Branch, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**
If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

4829-3542-7904.1

Electronic Patent Application Fee Transmittal

Application Number:	14928550
Filing Date:	30-Oct-2015
Title of Invention:	LIGHT EMITTING DEVICE, RESIN PACKAGE, RESIN-MOLDED BODY, AND METHODS FOR MANUFACTURING LIGHT EMITTING DEVICE, RESIN PACKAGE AND RESIN-MOLDED BODY
First Named Inventor/Applicant Name:	Hirofumi ICHIKAWA
Filer:	Chase J. Brill/Stacy Jen
Attorney Docket Number:	100415-0198

Filed as Large Entity

Filing Fees for Utility under 35 USC 111(a)

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Certificate of correction	1811	1	100	100

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Extension-of-Time:				
Miscellaneous:				
		Total in USD ($)		**100**

Electronic Acknowledgement Receipt

EFS ID:	28165737
Application Number:	14928550
International Application Number:	
Confirmation Number:	1591
Title of Invention:	LIGHT EMITTING DEVICE, RESIN PACKAGE, RESIN-MOLDED BODY, AND METHODS FOR MANUFACTURING LIGHT EMITTING DEVICE, RESIN PACKAGE AND RESIN-MOLDED BODY
First Named Inventor/Applicant Name:	Hirofumi ICHIKAWA
Customer Number:	22428
Filer:	Chase J. Brill/Stacy Jen
Filer Authorized By:	Chase J. Brill
Attorney Docket Number:	100415-0198
Receipt Date:	25-JAN-2017
Filing Date:	30-OCT-2015
Time Stamp:	15:41:51
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	CARD
Payment was successfully received in RAM	$100
RAM confirmation Number	012617INTEFSW15422600
Deposit Account	
Authorized User	

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Request for Certificate of Correction	100415-0198_Request_for_COC.pdf	119521 c2d54a5e97b0dc189d88ea49b60036811c6cb6d8	no	4
Warnings:					
Information:					
2	Request for Certificate of Correction	100415-0198_COC.pdf	78109 0b29bcdff6c345653d5ebab24fb0f64b5b80c59b	no	2
Warnings:					
Information:					
3	Fee Worksheet (SB06)	fee-info.pdf	30645 95c5e979a55a36f93007da9e0051b61b5ad00e77	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	228275		

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

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UNITED STATES PATENT AND TRADEMARK OFFICE

CERTIFICATE OF CORRECTION

PATENT NO. : 9,537,071 B2
APPLICATION NO. : 14/928550
DATED : January 3, 2017
INVENTOR(S) : Hirofumi Ichikawa et al.

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

In the Specification

Column 6, Line 60:
Please replace "scaling member" with --sealing member--.

Column 7, Line 13:
Please replace "singualtion" with --singulation--.

Column 9, Line 29:
Please replace "resin•molded body" with --resin-molded body--.

Column 10, Line 42:
Please replace "alkaline•earth silicate" with --alkaline-earth silicate--.

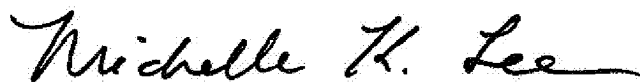
Column 10, Lines 60-61:
Please replace "element such as Eu or Cc includes, for example, $MSi_2O_2N_2$:En" with --element such as Eu or Ce includes, for example, $MSi_2O_2N_2$:Eu--.

Column 10, Lines 64-65:
Please replace "$M_{p/2}Si_{12p-q}Al_{p+q}O_qN_{16-p}$:Ce or M-Al—Si—O—N" with --$M_{p/2}Si_{12-p-q}Al_{p+q}O_qN_{16-p}$:Ce or M—Al—Si—O—N--.

Column 12, Line 32:
Please replace "cross sectional" with --cross-sectional--.

Column 13, Lines 36-37:
Please replace "resin-molded body **2,1**" with --resin-molded body **24**--.

Signed and Sealed this
Twenty-eighth Day of February, 2017



Michelle K. Lee
Director of the United States Patent and Trademark Office

Column 14, Line 6:
Please replace “hole pads” with --hole parts--.

Column 14, Lines 42-43:
Please replace “when singualtion is performed using a singualtion saw” with --when singulation is performed using a singulation saw--.

Column 15, Line 8:
Please replace “singualtion saw” with --singulation saw--.

Column 15, Line 10:
Please replace “singualtion saw” with --singulation saw--.

Column 15, Line 50:
Please replace “114” with --¼--.

Column 16, Line 35:
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Column 17, Line 8:
Please replace “fglate plate shape” with --flat plate shape--.

Column 17, Line 35:
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