

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:

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:

Description, Claim(s), and Abstract (47 pages).

- Formal drawings (13 sheets, Figures 1-19D).
- Executed Declaration (4 pages).
- Power of Attorney (1 page).
- 3.73(c) statement.
- Information Disclosure Statement.
- Form PTO-SB08.
- Preliminary Amendment (4 pages).
- 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
64	x	75%	48

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 Examination Fee							\$600.00	=	\$600.00
Size Fee	48	-	100	=	0	x	\$400.00	=	\$0.00
Total Claims:	25	-	20	=	5	x	\$80.00	=	\$400.00
Independents:	1	-	3	=	0	x	\$420.00	=	\$0.00
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:	=	\$2000.00
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								=	\$2000.00

The above-identified fees of \$2000.00 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 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
Telephone: (202) 672-5569
Facsimile: (202) 672-5399

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

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	100415-0199
		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

<input type="checkbox"/>	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
	Hirofumi		ICHIKAWA	
Residence Information (Select One) <input type="radio"/> US Residency <input checked="" type="radio"/> Non US Residency <input type="radio"/> Active US Military Service				
City	Komatsushima-shi	Country of Residence ⁱ	JP	
Mailing Address of Inventor:				
Address 1	c/o NICHIA CORPORATION			
Address 2	491-100, Oka, Kaminaka-cho			
City	Anan-shi, Tokushima	State/Province		
Postal Code	774-8601	Country ⁱ	JP	
Inventor 2 Remove				
Legal Name				
Prefix	Given Name	Middle Name	Family Name	Suffix
	Masaki		HAYASHI	
Residence Information (Select One) <input type="radio"/> US Residency <input checked="" type="radio"/> Non US Residency <input type="radio"/> Active US Military Service				
City	Anan-shi	Country of Residence ⁱ	JP	
Mailing Address of Inventor:				
Address 1	c/o NICHIA CORPORATION			
Address 2	491-100, Oka, Kaminaka-cho			
City	Anan-shi, Tokushima	State/Province		
Postal Code	774-8601	Country ⁱ	JP	
Inventor 3 Remove				
Legal Name				

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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	100415-0199
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Prefix	Given Name	Middle Name	Family Name	Suffix
	Shimpei		SASAOKA	
Residence Information (Select One) <input type="radio"/> US Residency <input checked="" type="radio"/> Non US Residency <input type="radio"/> Active US Military Service				

City	Tokushima-shi	Country of Residence ⁱ	JP
------	---------------	-----------------------------------	----

Mailing Address of Inventor:

Address 1	c/o NICHIA CORPORATION		
Address 2	491-100, Oka, Kaminaka-cho		
City	Anan-shi, Tokushima	State/Province	
Postal Code	774-8601	Country ⁱ	JP

Inventor **4**

Remove

Legal Name

Prefix	Given Name	Middle Name	Family Name	Suffix
	Tomohide		MIKI	
Residence Information (Select One) <input type="radio"/> US Residency <input checked="" type="radio"/> Non US Residency <input type="radio"/> Active US Military Service				

City	Tokushima-shi	Country of Residence ⁱ	JP
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Mailing Address of Inventor:

Address 1	c/o NICHIA CORPORATION		
Address 2	491-100, Oka, Kaminaka-cho		
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

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Application Data Sheet 37 CFR 1.76		Attorney Docket Number	100415-0199
		Application Number	
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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	100415-0199	Small Entity Status Claimed	<input type="checkbox"/>
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

Publication Information:

<input type="checkbox"/> Request Early Publication (Fee required at time of Request 37 CFR 1.219)
<input type="checkbox"/> 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:	<input checked="" type="radio"/> Customer Number	<input type="radio"/> US Patent Practitioner	<input type="radio"/> Limited Recognition (37 CFR 11.9)
Customer Number	22428		

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Application Data Sheet 37 CFR 1.76		Attorney Docket Number	100415-0199
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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		<input type="button" value="Remove"/>	
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)
	Continuation of	13/969182	2013-08-16
Prior Application Status		<input type="button" value="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		<input type="button" value="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.			<input type="button" value="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) 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).

Application Number	Country ⁱ	Filing Date (YYYY-MM-DD)	<input type="button" value="Remove"/>
2008-225408	JP	2008-09-03	Access Code ^j (if applicable)
Additional Foreign Priority Data may be generated within this form by selecting the Add button.			<input type="button" value="Add"/>

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Application Data Sheet 37 CFR 1.76		Attorney Docket Number	100415-0199
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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:

<input checked="" type="checkbox"/> Authorization to Permit Access to the Instant Application by the Participating Offices
<p>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.</p> <p>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.</p> <p>In accordance with 37 CFR 1.14(c), access may be provided to information concerning the date of filing this Authorization.</p>

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.

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	100415-0199
	Application Number	
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Applicant 1		<input type="button" value="Remove"/>	
<p>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.</p>			
<input type="button" value="Clear"/>			
<input checked="" type="radio"/> Assignee	<input type="radio"/> Legal Representative under 35 U.S.C. 117	<input type="radio"/> Joint Inventor	
<input type="radio"/> Person to whom the inventor is obligated to assign.	<input type="radio"/> 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 : <input type="text"/>			
If the Applicant is an Organization check here. <input checked="" type="checkbox"/>			
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. <input type="button" value="Add"/>			

Assignee Information including Non-Applicant Assignee 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.	
Assignee 1	
<p>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.</p>	
<input type="button" value="Remove"/>	
If the Assignee or Non-Applicant Assignee is an Organization check here. <input checked="" type="checkbox"/>	

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	100415-0199	
		Application Number		
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Organization Name	NICHIA CORPORATION			
Mailing Address Information For Assignee including Non-Applicant Assignee:				
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 Assignee or Non-Applicant Assignee Data may be generated within this form by selecting the Add button.				<input type="button" value="Add"/>

Signature:

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.				<input type="button" value="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.**

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 the Freedom of Information Act requires disclosure of these records.
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 inspections 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.

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 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

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]

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.

[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.

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 bonding 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 bonding 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

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 singulation.

[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

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]

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 from 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

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

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 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 $MAISiN_3:Eu$ (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, $M_{p/2}Si_{12p-q}Al_{p+q}O_qN_{16-p}:Ce$ 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, $SrAl_2O_4:R$, $Sr_4Al_{14}O_{25}:R$, $CaAl_2O_4:R$, $BaMg_2Al_{16}O_{27}:R$, $BaMg_2Al_{16}O_{12}:R$, or $BaMgAl_{10}O_{17}:R$ (R is at least one or more selected from Eu, Mn, Eu and Mn).

[0060]

The alkaline-earth sulfide phosphor includes, for example, $\text{La}_2\text{O}_2\text{S}:\text{Eu}$, $\text{Y}_2\text{O}_2\text{S}:\text{Eu}$ or $\text{Gd}_2\text{O}_2\text{S}:\text{Eu}$.

[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 $\text{Y}_3\text{Al}_5\text{O}_{12}:\text{Ce}$, $(\text{Y}_{0.8}\text{Gd}_{0.2})_3\text{Al}_5\text{O}_{12}:\text{Ce}$, $\text{Y}_3(\text{Al}_{0.8}\text{Ga}_{0.2})_5\text{O}_{12}:\text{Ce}$ and $(\text{Y},\text{Gd})_3(\text{Al},\text{Ga})_5\text{O}_{12}:\text{Ce}$. Further, the rare-earth aluminate phosphor also includes $\text{Tb}_3\text{Al}_5\text{O}_{12}:\text{Ce}$ or $\text{Lu}_3\text{Al}_5\text{O}_{12}:\text{Ce}$ where part or all of Y is substituted with, for example, Tb or Lu.

[0062]

The other phosphors include, for example, $\text{ZnS}:\text{Eu}$, $\text{Zn}_2\text{GeO}_4:\text{Mn}$ or $\text{MGe}_2\text{S}_4:\text{Eu}$ (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 280 μm and, in addition, the size of 300 μm 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]

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]

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 21a 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

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 21a. 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 21a 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 24 from being detached. Further, not only the upper surface of the lead frame 21, but also the side surfaces corresponding to the notch parts 21a 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

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 121a.

[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 121a, so that, when singulation is performed using a singulation 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 singulation saw, and reduce the cutting time. Further, singulation is started from the outer upper surface of the resin package 220 using the singulation 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]

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 221c may have about 1/4 to 4/5 of the depth. Although the width of this groove 221c is variously changed according to, for example, the distance to an adjacent concave part or the size of the light emitting device, the groove 221c 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 221c 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 221a. 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>

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 the 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 flat 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 the 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]

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]

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 be 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 21a 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 mold 61 and lower mold 62. The lead frame 21 has a flat plate shape, and is provided with the notch

parts 21a 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 21a 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 be poured in the mold 60. At this time, the thermosetting resin 23 is also filled in the notch parts 21a. 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]

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.

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, and
 - wherein both a part of the at least one metal plate and a part of the resin part are disposed in a region below an upper surface of the at least one metal plate, on four outer lateral surfaces of the resin package.
2. The light emitting device according to claim 1, wherein a portion of the resin part above the upper surface of the at least one metal plate is formed integrally with a portion of the resin part below the upper surface of the at least one metal plate.
3. The light emitting device according to claim 1, wherein the at least one metal plate is substantially flat.
4. The light emitting device according to claim 1, wherein:
 - the at least one metal plate comprises one or more major laterally extending upper surfaces, and
 - all of the one or more major laterally extending upper surfaces are coplanar.
5. The light emitting device according to claim 1, wherein all upper edges of the at least one metal plate are coplanar.
6. The light emitting device according to claim 1, 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.

7. 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.
8. The light emitting device according to claim 7, 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.
9. The light emitting device according to claim 7, 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.
10. The light emitting device according to claim 1, wherein the resin part contains a light reflecting material.
11. The light emitting device according to claim 10, wherein the light reflecting material is titanium dioxide.
12. The light emitting device according to claim 10, wherein the resin part contains 10 to 60% by weight of the titanium dioxide.
13. The light emitting device according to claim 1, wherein the resin part is made using a thermosetting resin.
14. 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.

15. 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.
16. The light emitting device according to claim 1, wherein the outer lateral surface of the at least one metal plate has a notch.
17. 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.
18. 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.
19. 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.
20. The light emitting device according to claim 1, wherein the at least one metal plate has a joint portion at the outer lateral surface of the resin package.
21. The light emitting device according to claim 1, wherein the at least one metal plate comprises a step on a bottom surface or outer lateral surface of the at least one metal plate, and the step is exposed from the resin part.
22. The light emitting device according to claim 21, wherein a metal layer is disposed on the step.
23. The light emitting device according to claim 1, wherein the at least one metal plate comprises surfaces at two or more different levels.

24. The light emitting device according to claim 1, wherein a distance between said surfaces at two or more different levels is in a range of about 1/4 to about 4/5 of a thickness of the at least one metal plate.

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

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

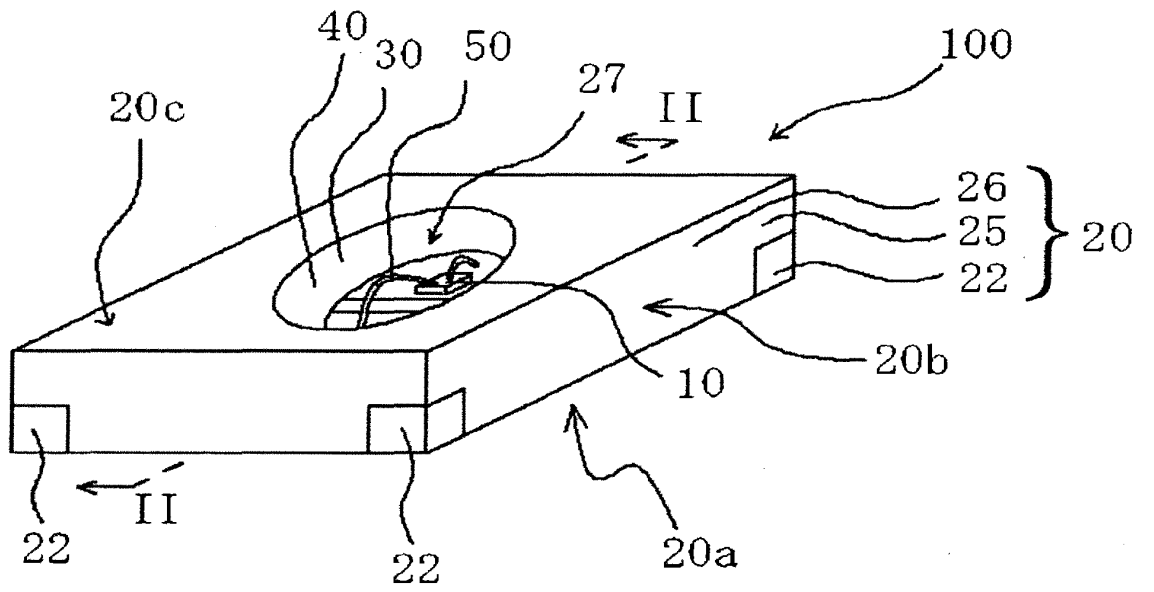


Fig. 2

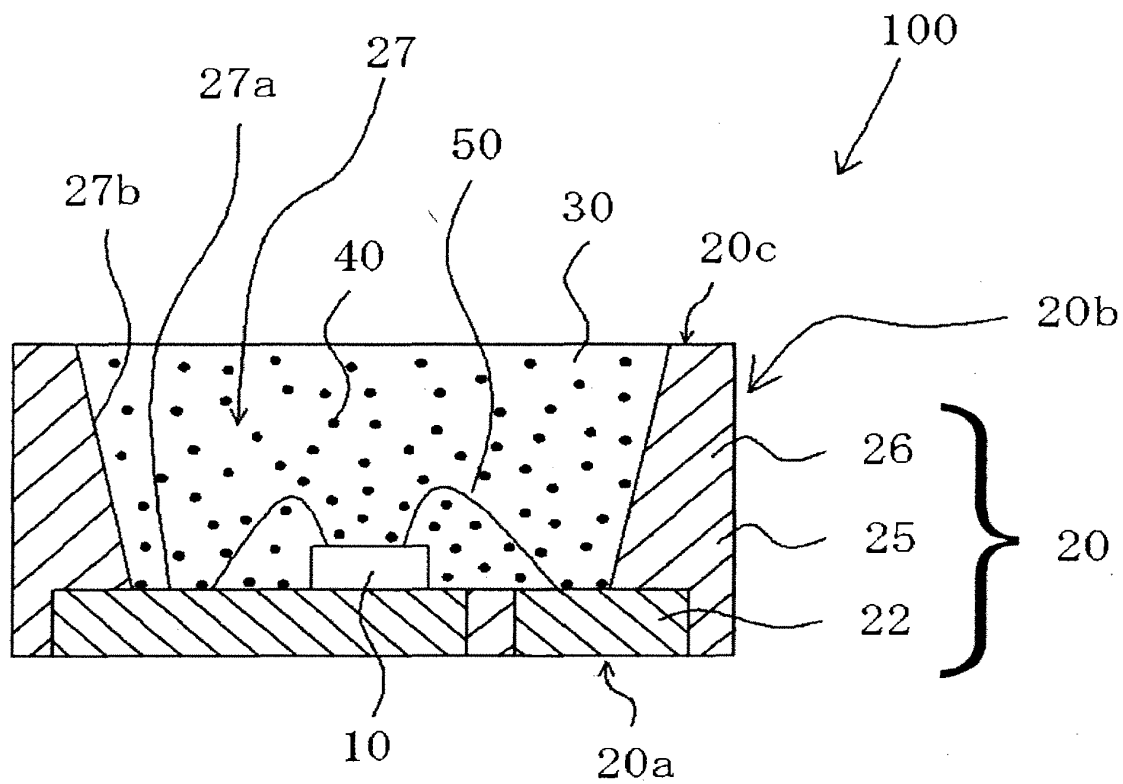


Fig. 3

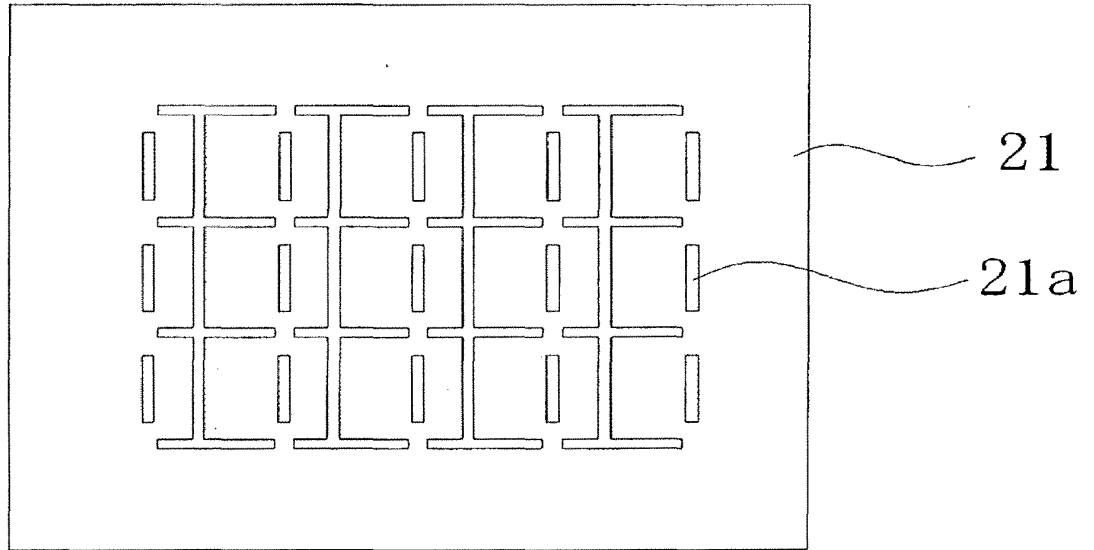


Fig. 4

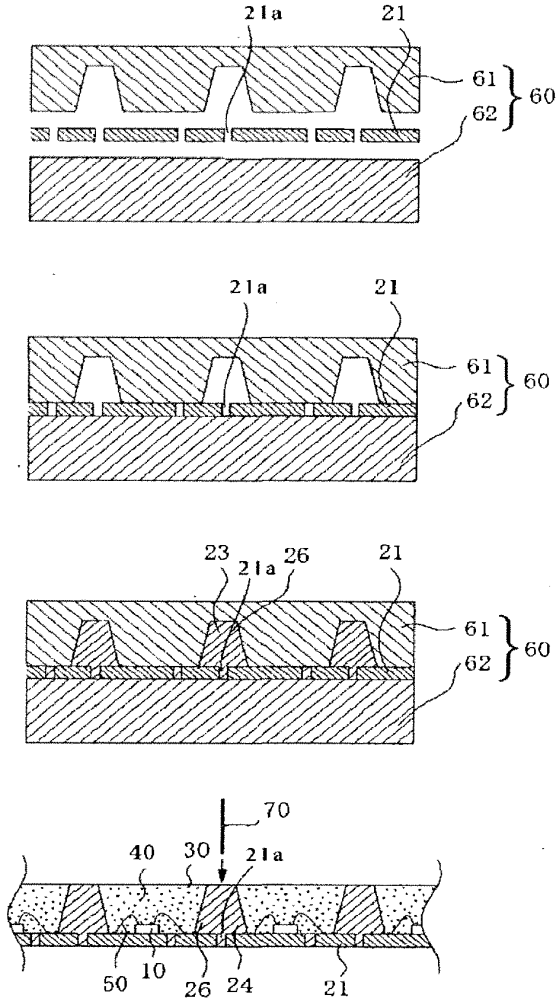


Fig. 5

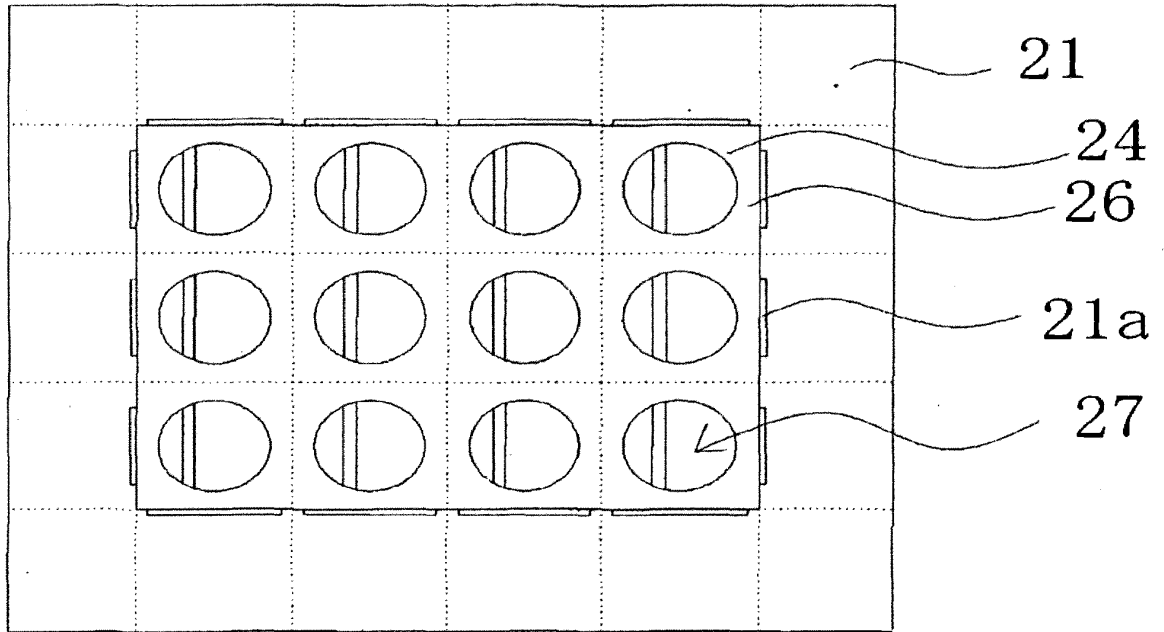


Fig. 6

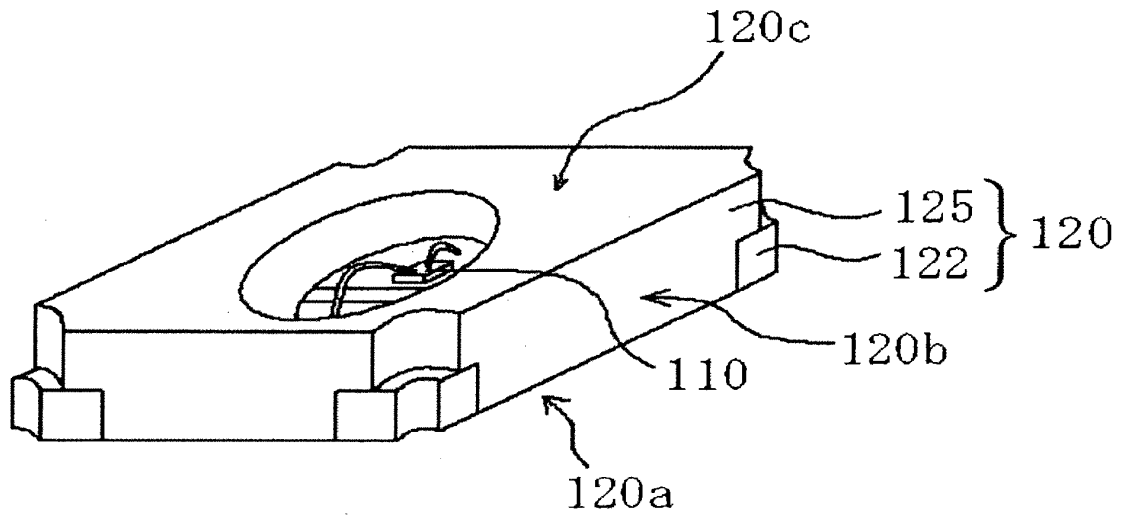


Fig. 7

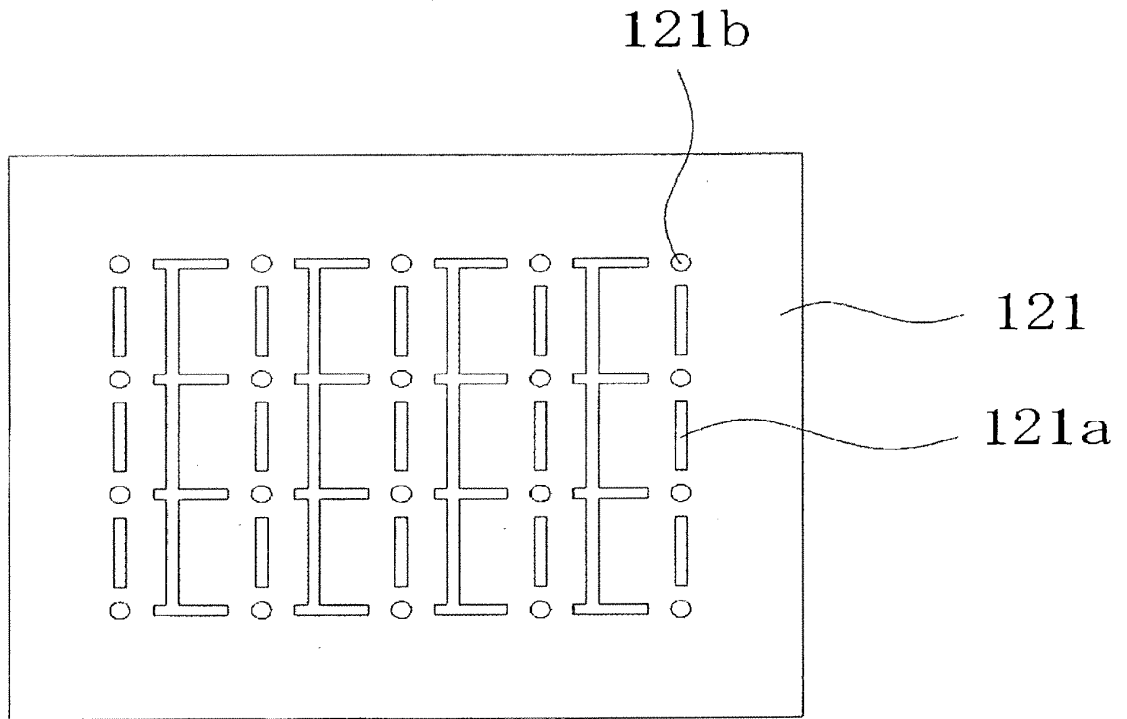


Fig. 8

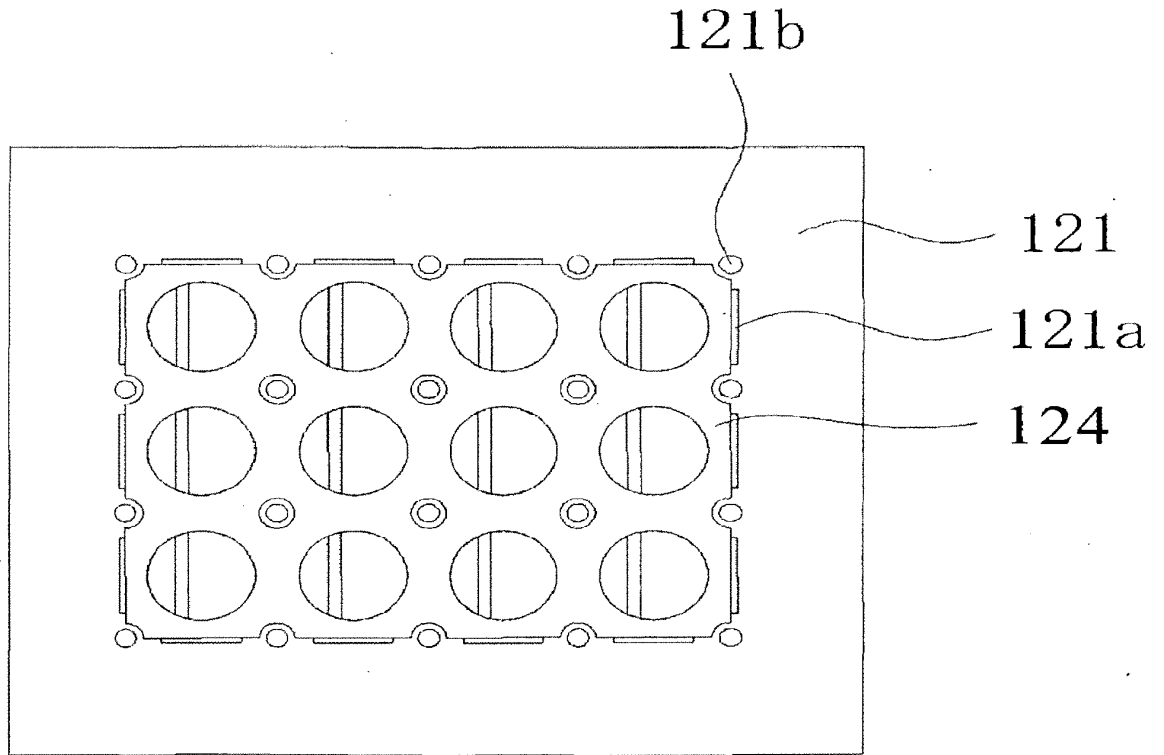


Fig. 9

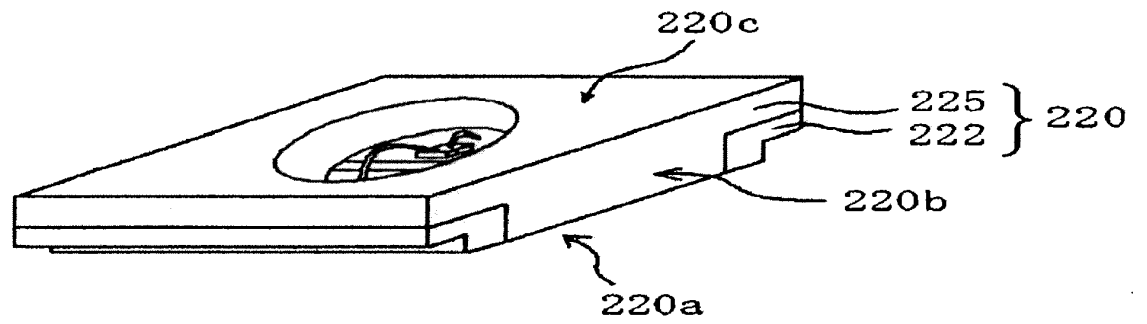


Fig. 10

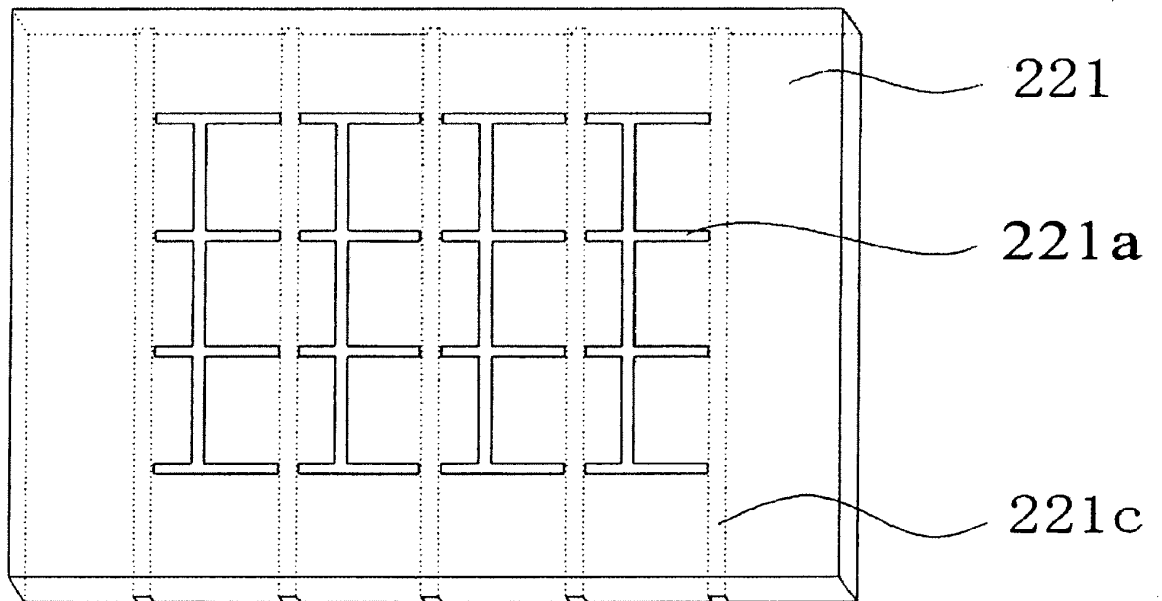


Fig. 11

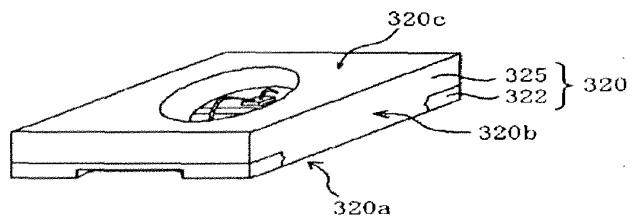


Fig. 12

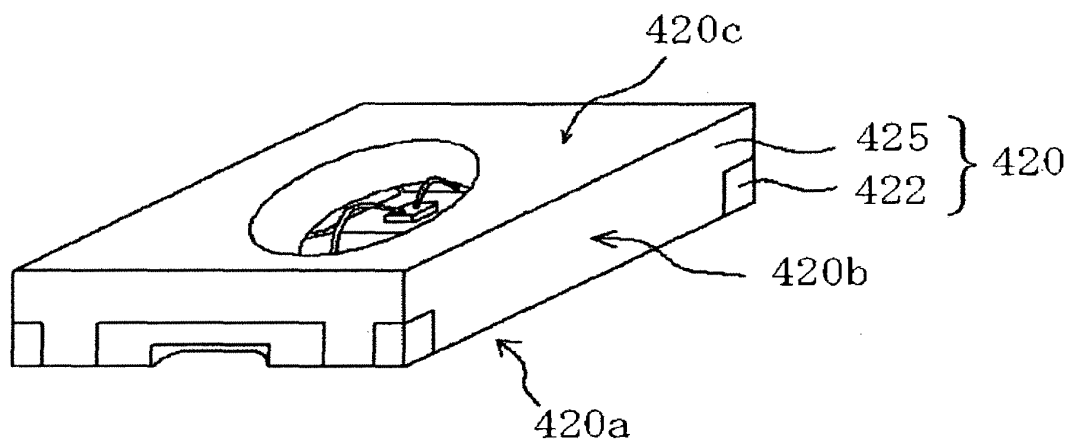


Fig. 13

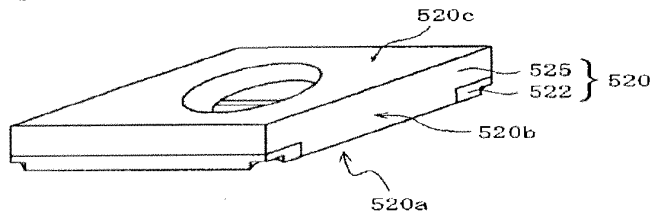


Fig. 14

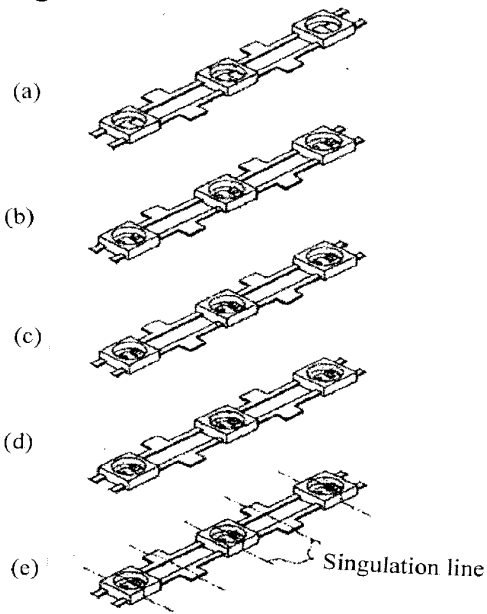


Fig. 15

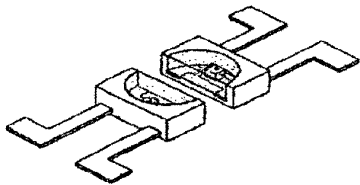


Fig. 16

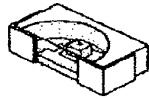


Fig. 17

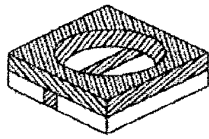


Fig. 18

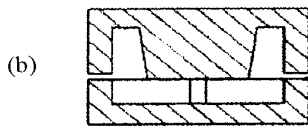
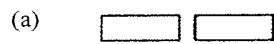
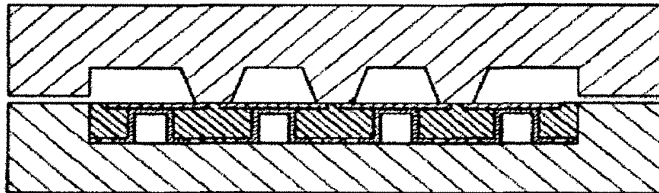


Fig. 19

(a)



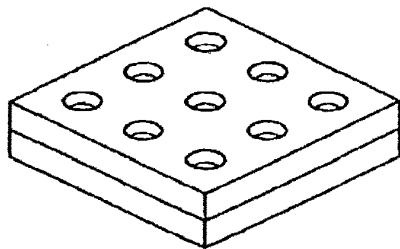
(b)



(c)



(d)



STATEMENT UNDER 37 CFR 3.73(c)Applicant/Patent Owner: NICHIA CORPORATIONApplication No./Patent No.: Unassigned Filed/Issue Date: 10/30/2015Titled: LIGHT EMITTING DEVICE, RESIN PACKAGE, RESIN-MOLDED BODY, AND METHODS FOR MANUFACTURING LIGHT EMITTING DEVICE, RESIN PACKAGE AND RESIN-MOLDED BODYNICHIA 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.

[Page 1 of 2]

This collection of information is required by 37 CFR 3.73(b). 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 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.

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.

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 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.

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.

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 assigned only to the undersigned according to the USPTO assignment records or assignments documents 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


<input type="checkbox"/>	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		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 Sasooka*
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

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
(use as many sheets as necessary)		First Named Inventor	Hirofumi ICHIKAWA
		Art Unit	Unassigned
		Examiner Name	Unassigned
Sheet	1	of	4
		Attorney Docket Number	100415-0199

U.S. PATENT DOCUMENTS					
Examiner Initials*	Cite No. ¹	Document Number	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
		Number-Kind Code ² (if known)			
	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.	
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	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	
	A22	6,107,676	08-22-2000	SUZUKI, SHINICHI	
	A23	6,184,544-B1	02-06-2001	TODA ET AL.	
	A24	6,335,545-B1	01-01-2002	TODA ET AL.	
	A25	6,424,024-B1	07-23-2002	SHIH ET AL.	
	A26	6,433,277-B1	08-13-2002	GLENN, THOMAS P.	
	A27	6,498,099-B1	12-24-2002	MCLELLAN ET AL.	
	A28	6,531,370-B2	03-11-2003	SAKAMOTO ET AL.	
	A29	6,624,007	09-23-2003	KOBAYAKAWA ET AL.	
	A30	6,627,482-B2	09-30-2003	WANG ET AL.	
	A31	6,638,780-B2	10-28-2003	FUKASAWA ET AL.	
	A32	6,770,498-B2	08-03-2004	HSU, CHENG-HSIANG	
	A33	6,853,057-B2	02-08-2005	YASUDA ET AL.	
	A34	6,914,267-B2	07-05-2005	FUKASAWA ET AL.	
	A35	6,978,079-B2	12-20-2005	UWADA ET AL.	
	A36	7,161,190-B2	01-09-2007	CHIKUGAWA, HIROSHI	
	A37	7,301,176-B2	11-27-2007	ABE ET AL.	
	A38	7,364,947-B2	04-29-2008	KOBAYAKAWA, MASAHIKO	
	A39	7,407,834-B2	08-05-2008	SHIMANUKI ET AL.	
	A40	7,687,292-B2	03-30-2010	PARK ET AL.	
	A41	7,799,611-B2	09-21-2010	RAMOS ET AL.	
	A42	8,093,619-B2	01-10-2012	HAYASHI, MASAKI	
	A43	8,637,892-B2	01-28-2014	EGOSHI ET AL.	
	A44	8,530,250-B2	09-10-2013	ICHIKAWA ET AL.	
	A45	2008/0044934-A1	02-21-2008	LOH ET AL.	
	A46	2010/0150638-A1	06-17-2010	NAMIKI ET AL.	
	A47	2002/0140092-A1	10-03-2002	NAKANISHI ET AL.	

Examiner Signature		Date Considered	
-----------------------	--	--------------------	--

Substitute for form 1449/PTO INFORMATION DISCLOSURE STATEMENT BY APPLICANT Date Submitted: October 30, 2015 (use as many sheets as necessary)				Complete if Known	
				Application Number	Unassigned
Sheet 2 of 4				Filing Date	10/30/2015
				First Named Inventor	Hirofumi ICHIKAWA
				Art Unit	Unassigned
				Examiner Name	Unassigned
				Attorney Docket Number	100415-0199

UNPUBLISHED U.S. PATENT APPLICATION DOCUMENTS					
Examiner Initials*	Cite No. ¹	U.S. Patent Application Document	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
		Serial Number-Kind Code ² (if known)			

FOREIGN PATENT DOCUMENTS						
Examiner Initials*	Cite No. ¹	Foreign Patent Document	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
		Country Code ³ Number ⁴ Kind Code ⁵ (if known)				
	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		
	A52	JP-H11-191562-A	07-13-1999	SANYO ELECTRIC CO		
	A53	JP-H11-214754	08-06-1999	ROHM CO LTD.		
	A54	JP-2000-174347-A	06-23-2000	NICHIA CHEM IND LTD		
	A55	JP-2001-036154-A	02-09-2001	NICHIA CHEM IND LTD, ET AL.		
	A56	JP-2001-077160-A	03-23-2001	ADVANTEST CORP		
	A57	JP-2001-077235-A	03-23-2001	mitsui HIGH TEC		
	A58	JP-2001-267482-A	09-28-2001	mitsui HIGH TEC		
	A59	JP-2003-037236-A	02-07-2003	ROHM CO LTD		
	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.		
	A63	JP-2005-243857-A	09-08-2005	MATSUSHITA ELECTRIC IND CO LTD		
	A64	JP-2005-311137-A	11-04-2005	SONY CORP		
	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		
	A68	JP-2006-140207-A	06-01-2006	HITACHI CHEM CO LTD		
	A69	JP-2006-156704-A	06-15-2006	NICHIA KAGAKU KOGYO KK		
	A70	JP-2006-278427-A	10-12-2006	MATSUSHITA ELECTRIC WORKS LTD		
	A71	JP-2006-313943-A	11-16-2006	SHARP KK		
	A72	WO-2007/015426-A1	02-08-2007	NICHIA CORPORATION		
	A73	WO-2007/135707-A1	11-29-2007	NICHIA CORPORATION		
	A74	JP-2007-035794-A	02-08-2007	STANLEY ELECTRIC CO LTD		
	A75	JP-2007-123302-A	05-17-2007	NICHIA CHEM IND LTD		
	A76	JP-2007-235085-A	09-13-2007	HITACHI CHEM CO LTD		
	A77	JP-2007-294506-A	11-08-2007	MATSUSHITA ELECTRIC IND CO LTD		
	A78	JP-2007-297601-A	11-15-2007	HITACHI CHEMICAL CO LTD		

Examiner Signature		Date Considered	
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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 <i>(use as many sheets as necessary)</i>		First Named Inventor	Hirofumi ICHIKAWA
		Art Unit	Unassigned
Sheet 3 of 4		Examiner Name	Unassigned
		Attorney Docket Number	100415-0199

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.		
	A82	WO-2008/081794-A1	07-10-2008	NICHIA CORP		
	A83	JP-2008-103460-A	05-01-2008	SONY CORP		
	A84	JP-2008-106226-A	05-08-2008	HITACHI CHEM CO LTD		
	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.	
	A95	Extended European Search Report for EP Application No. 09 81 1 246.9-1226 dated November 25, 2013 submitted by Eisenfuhr Speiser in a letter dated December 10, 2013.	
	A96	International Search Report in PCT/JP2009/004170 dated November 24, 2009.	
	A97	Non-Final Office Action U.S. Serial No. 12/737,940 dated September 28, 2012.	
	A98	Notice of Allowance issued in U.S. Serial No. 13/969182 dated 7/9/2015.	
	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	
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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 <i>(use as many sheets as necessary)</i>		First Named Inventor	Hirofumi ICHIKAWA
		Art Unit	Unassigned
Sheet	4	of	4
		Examiner Name	Unassigned
		Attorney Docket Number	100415-0199

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.	
	A103	Written Opinion of the International Searching Authority in PCT/JP2009/004170 dated November 24, 2009.	
	A104	Written Opinion of the International Searching Authority in PCT/JP2009/004170 dated November 24, 2009.	
	A105	Notice of Allowance issued in U.S. Serial No. 13/969,182 dated October 30, 2015.	

Examiner Signature		Date Considered	
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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:		100415-0199		
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	5	80	400
Miscellaneous-Filing:				
Petition:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				
Miscellaneous:				
			Total in USD (\$)	2000

Electronic Acknowledgement Receipt

EFS ID:	23948295
Application Number:	14928570
International Application Number:	
Confirmation Number:	9668
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:	100415-0199
Receipt Date:	30-OCT-2015
Filing Date:	
Time Stamp:	16:45:23
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Credit Card
Payment was successfully received in RAM	\$2000
RAM confirmation Number	3830
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	100415-0199_AppTransmittal.pdf	95527 9a329932d11be5a5d3d147443ec31c9c5885e530d	no	4
Warnings:					
Information:					
2	Application Data Sheet	100415-0199_ADS.pdf	1818914 8780f714f31e38738acbdd3ca181bb04f770f37d	no	8
Warnings:					
Information:					
3	Preliminary Amendment	100415-0199_Preliminary.pdf	102479 cab80acb15f0f6f78f5c24bf96d0e3a7ae5c09f1	no	3
Warnings:					
Information:					
4		100415-0199_SpecClaimsAbstract.pdf	1601991 8a02ba5022dd476d3da4a11be713276864399c45	yes	47
	Multipart Description/PDF files in .zip description				
	Document Description		Start	End	
	Specification		1	42	
	Claims		43	46	
Abstract		47	47		
Warnings:					
Information:					
5	Drawings-only black and white line drawings	100415-0199_Drawings.pdf	406686 bb57ecf2abcc48c28306c5255c641f96768e70c7	no	13
Warnings:					
Information:					
6	Assignee showing of ownership per 37 CFR 3.73	100415-0199_373c.pdf	129840 6e7722695bcf900bf56381efe09c6dd6bcb2b6cb1	no	3

Warnings:					
Information:					
7	Oath or Declaration filed	POA.pdf	87719 83a623571dcf425c4802aae92e382c197442253	no	1
Warnings:					
Information:					
8	Oath or Declaration filed	Declaration.pdf	197086 0ed7af06423f9d9034b201d356a1defbcb836972	no	4
Warnings:					
Information:					
9	Transmittal Letter	100415-0199_IDStransmittal.pdf	100137 68f24a816e6d9c0a1bc0c02c713e29475b120b49	no	2
Warnings:					
Information:					
10	Information Disclosure Statement (IDS) Form (SB08)	100415-0199_SB08.pdf	108862 0618d7acfc6a329f939f5cd7f648d35a99de7df	no	4
Warnings:					
Information:					
This is not an USPTO supplied IDS fillable form					
11	Fee Worksheet (SB06)	fee-info.pdf	37347 b8b33a675c116e10d844cc37ec30b2a3c2e6da8b	no	2
Warnings:					
Information:					
Total Files Size (in bytes):			4686588		
<p>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.</p> <p><u>New Applications Under 35 U.S.C. 111</u> 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.</p> <p><u>National Stage of an International Application under 35 U.S.C. 371</u> 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.</p> <p><u>New International Application Filed with the USPTO as a Receiving Office</u> 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.</p>					



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Table with 7 columns: APPLICATION NUMBER, FILING or 371(c) DATE, GRP ART UNIT, FIL FEE REC'D, ATTY.DOCKET.NO, TOT CLAIMS, IND CLAIMS. Row 1: 14/928,570, 10/30/2015, 2811, 2000, 100415-0199, 25, 1

CONFIRMATION NO. 9668

FILING RECEIPT



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

Date Mailed: 11/13/2015

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 14/928,570**

Projected Publication Date: 02/18/2016

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

page 2 of 4

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).

LICENSE FOR FOREIGN FILING UNDER
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 Assets Control, Department of Treasury (31 CFR Parts 500+) and the Department of Energy.

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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
14/928,570

APPLICATION AS FILED - PART I

(Column 1)		(Column 2)	SMALL ENTITY		OR	OTHER THAN SMALL ENTITY	
FOR	NUMBER FILED	NUMBER EXTRA	RATE(\$)	FEE(\$)		RATE(\$)	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), (l), 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(j))	25 minus 20 = *	5			OR	x 80 =	400
INDEPENDENT CLAIMS (37 CFR 1.16(h))	1 minus 3 = *					x 420 =	0.00
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
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL			TOTAL	2000

APPLICATION AS AMENDED - PART II

AMENDMENT A	(Column 1)	(Column 2)	(Column 3)	SMALL ENTITY		OR	OTHER THAN SMALL ENTITY	
	CLAIMS REMAINING AFTER AMENDMENT	HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE(\$)	ADDITIONAL FEE(\$)		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))						OR		
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))						OR		
				TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

AMENDMENT B	(Column 1)	(Column 2)	(Column 3)	SMALL ENTITY		OR	OTHER THAN SMALL ENTITY	
	CLAIMS REMAINING AFTER AMENDMENT	HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE(\$)	ADDITIONAL FEE(\$)		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))						OR		
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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JAPAN PATENT OFFICE

別紙添付の書類に記載されている事項は下記の出願書類に記載されている事項と同一であることを証明する。

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

出願年月日 2008年 9月 3日
Date of Application:

出願番号 特願2008-225408
Application Number:

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

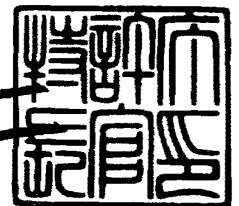
J P 2 0 0 8 - 2 2 5 4 0 8

出願人 日亜化学工業株式会社
Applicant(s):

2015年11月24日

特許庁長官
Commissioner,
Japan Patent Office

伊藤 仁



【書類名】	特許願
【整理番号】	12008077
【提出日】	平成20年 9月 3日
【あて先】	特許庁長官 殿
【国際特許分類】	H01L 33/00
【発明者】	
【住所又は居所】	徳島県阿南市上中町岡4 9 1 番地1 0 0 日亜化学工業株式会社 内
【氏名】	市川 博史
【発明者】	
【住所又は居所】	徳島県阿南市上中町岡4 9 1 番地1 0 0 日亜化学工業株式会社 内
【氏名】	林 正樹
【発明者】	
【住所又は居所】	徳島県阿南市上中町岡4 9 1 番地1 0 0 日亜化学工業株式会社 内
【氏名】	笹岡 慎平
【発明者】	
【住所又は居所】	徳島県阿南市上中町岡4 9 1 番地1 0 0 日亜化学工業株式会社 内
【氏名】	三木 倫英
【特許出願人】	
【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
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【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围周の約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透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至った。

【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周囲周の約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ことができるため、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り、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。ただし、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I-I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と電氣的に接続している。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、筒状でもよい。凹部27の形状は略円形状、略楕円形状、略多角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るが、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、略円形状、略楕円形状、略四角形状、略多角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。凹部は開口方向に広がる形状となっていることが好ましいが、筒状となっても良い。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。凹部の内底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、シリコン樹脂、変性シリコン樹脂、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、シリコン樹脂、変性シリコン樹脂が好ましい。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のもであってもよい。

【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、シリコン樹脂、変性シリコン樹脂、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、シリコン樹脂、変性シリコン樹脂が好ましい。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、 $M_2Si_5N_8:Eu$ 、 $MA_1SiN_3:Eu$ (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サイズその他、□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、本体部の端部から棒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と電氣的に接続する。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用す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用す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I-I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)₅O₁₂:Ceを使用する。

封止部材30としてシリコン樹脂を使用する。

【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氣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をベレット状にし、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を用いて電氣的に接続する。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。

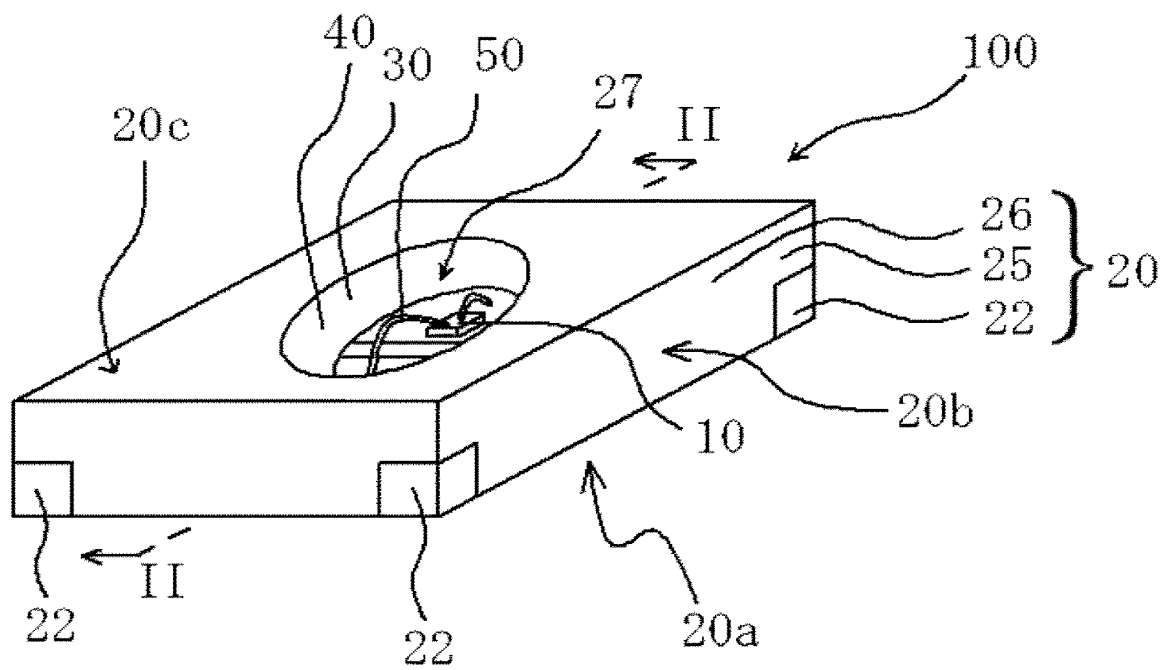
- 【図10】 第3の実施の形態に用いられるリードフレームを示す平面図である。
- 【図11】 第4の実施の形態に係る発光装置を示す斜視図である。
- 【図12】 第5の実施の形態に係る発光装置を示す斜視図である。
- 【図13】 第6の実施の形態に係る樹脂パッケージを示す斜視図である。
- 【図14】 従来の発光装置の製造方法を示す斜視図である。
- 【図15】 従来の発光装置の中間体を示す斜視図である。
- 【図16】 従来の発光装置を示す斜視図である。
- 【図17】 従来の発光装置を示す斜視図及び断面図である。
- 【図18】 従来の発光装置の製造方法を示す概略断面図である。
- 【図19】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

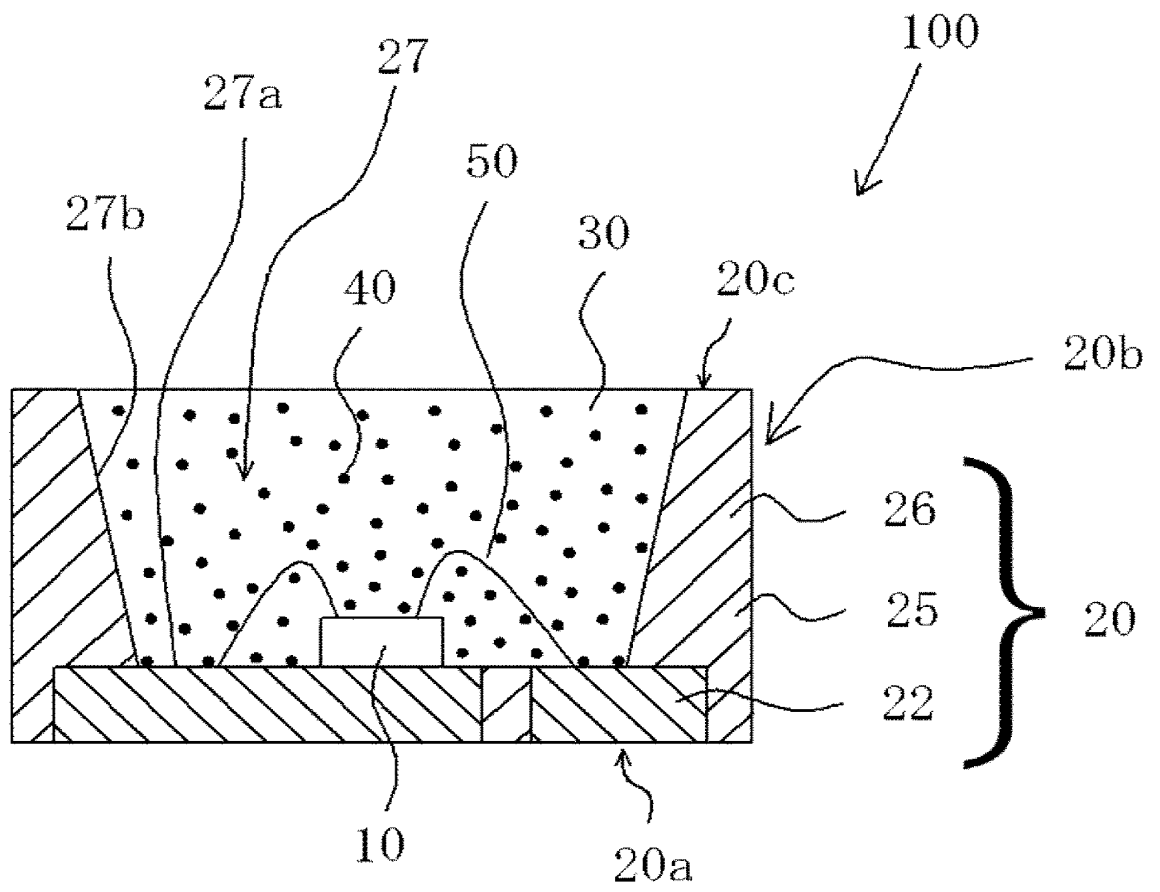
【0114】

- 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

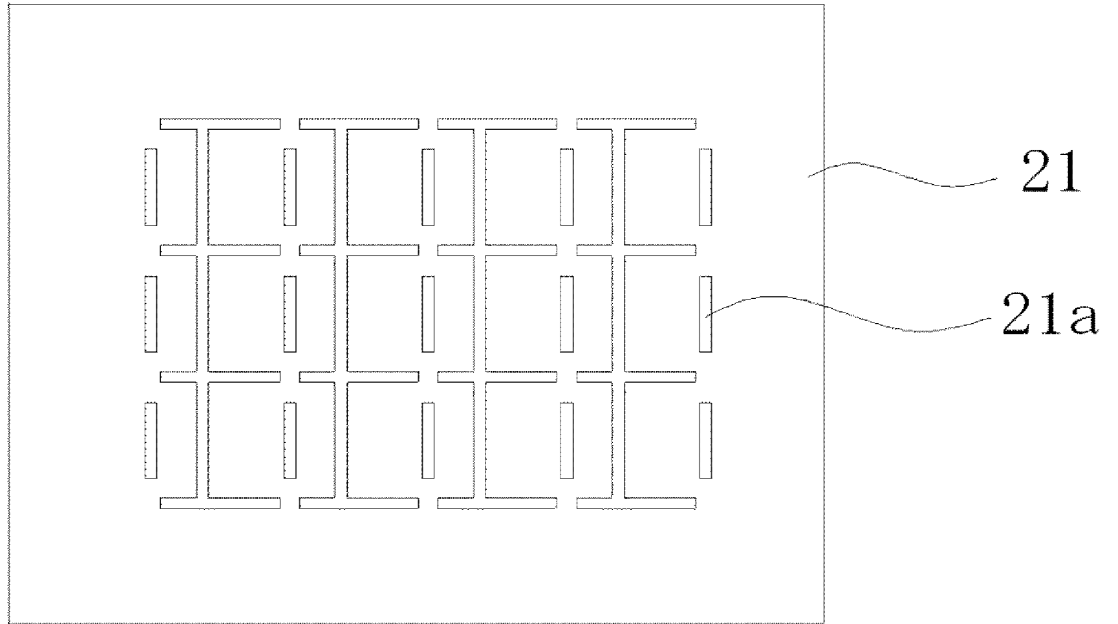
【書類名】 図面
【図 1】



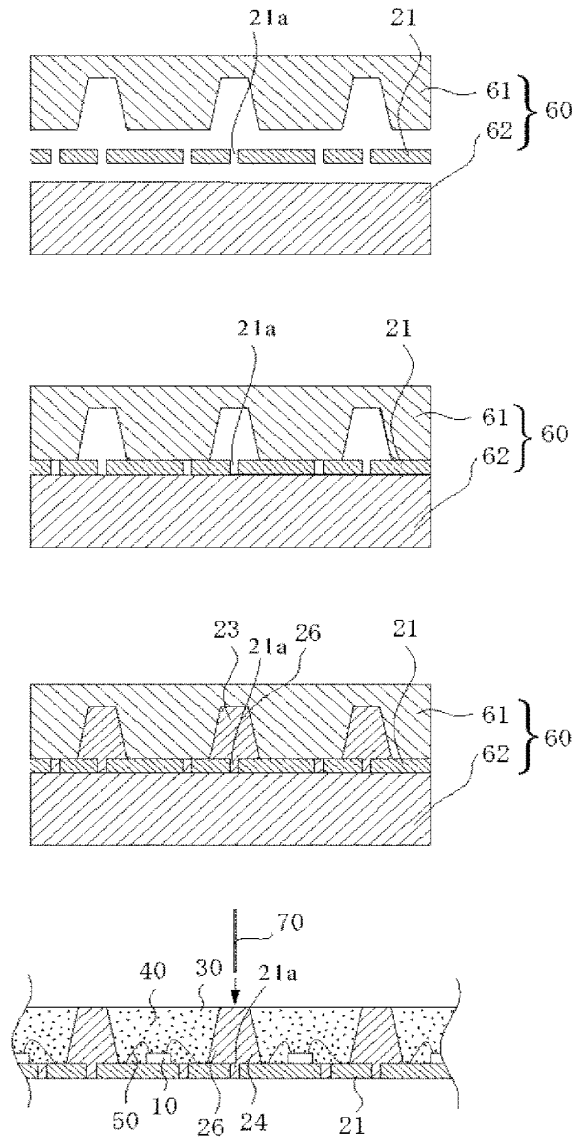
【図2】



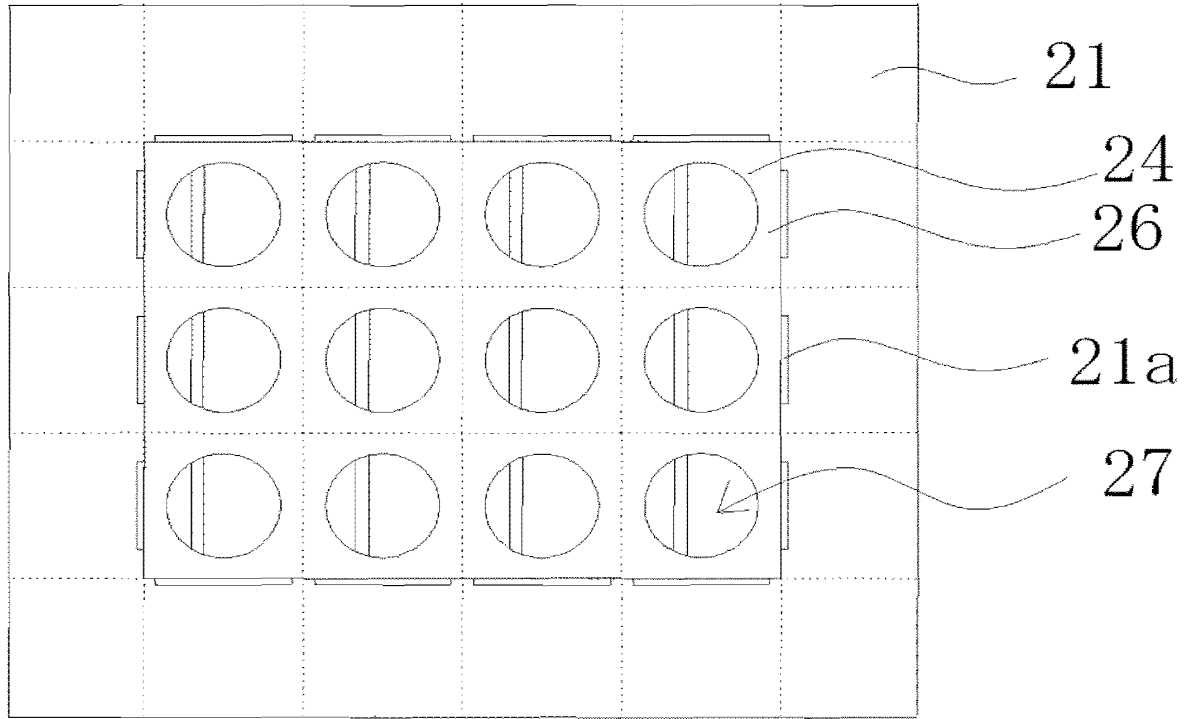
【図3】



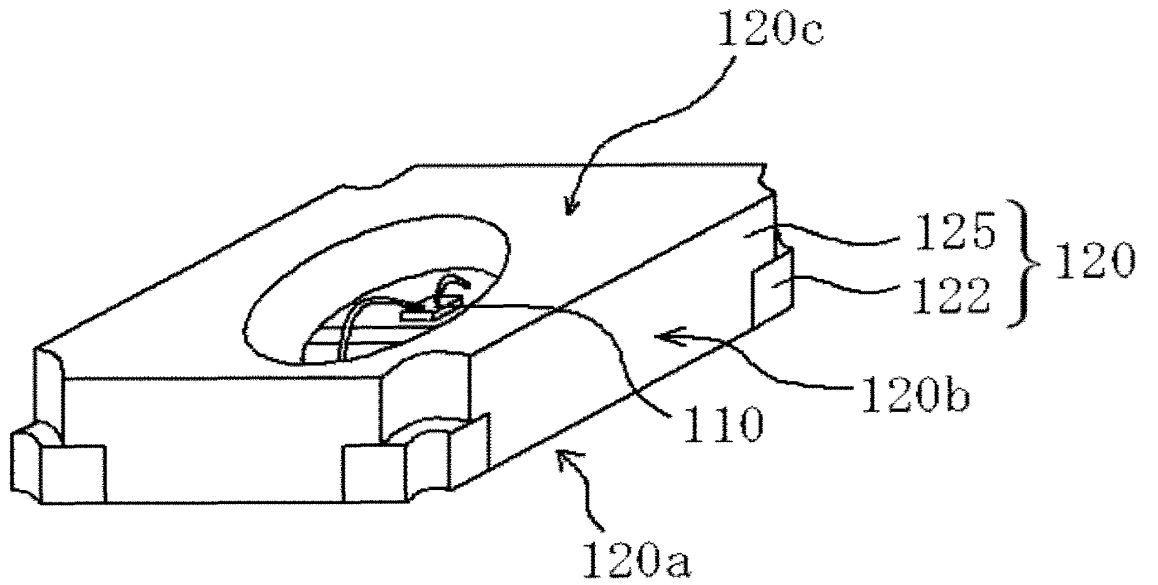
【図4】



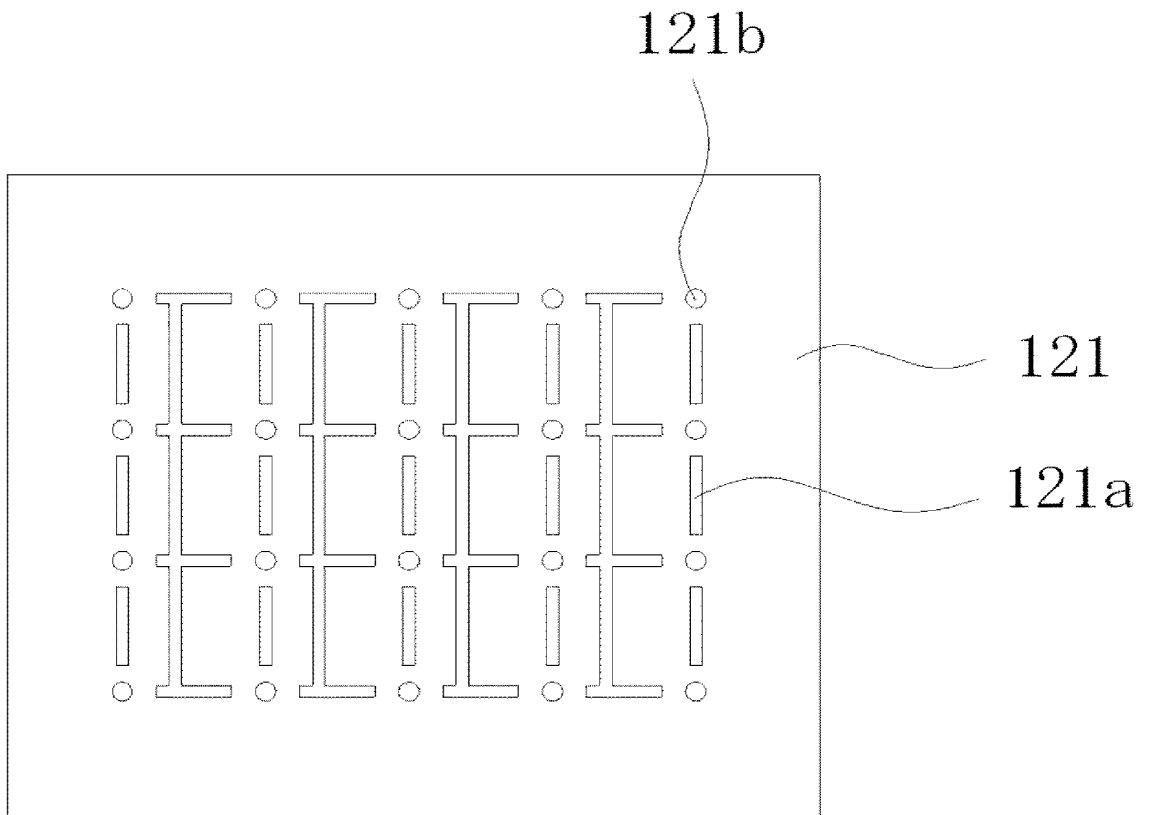
【図5】



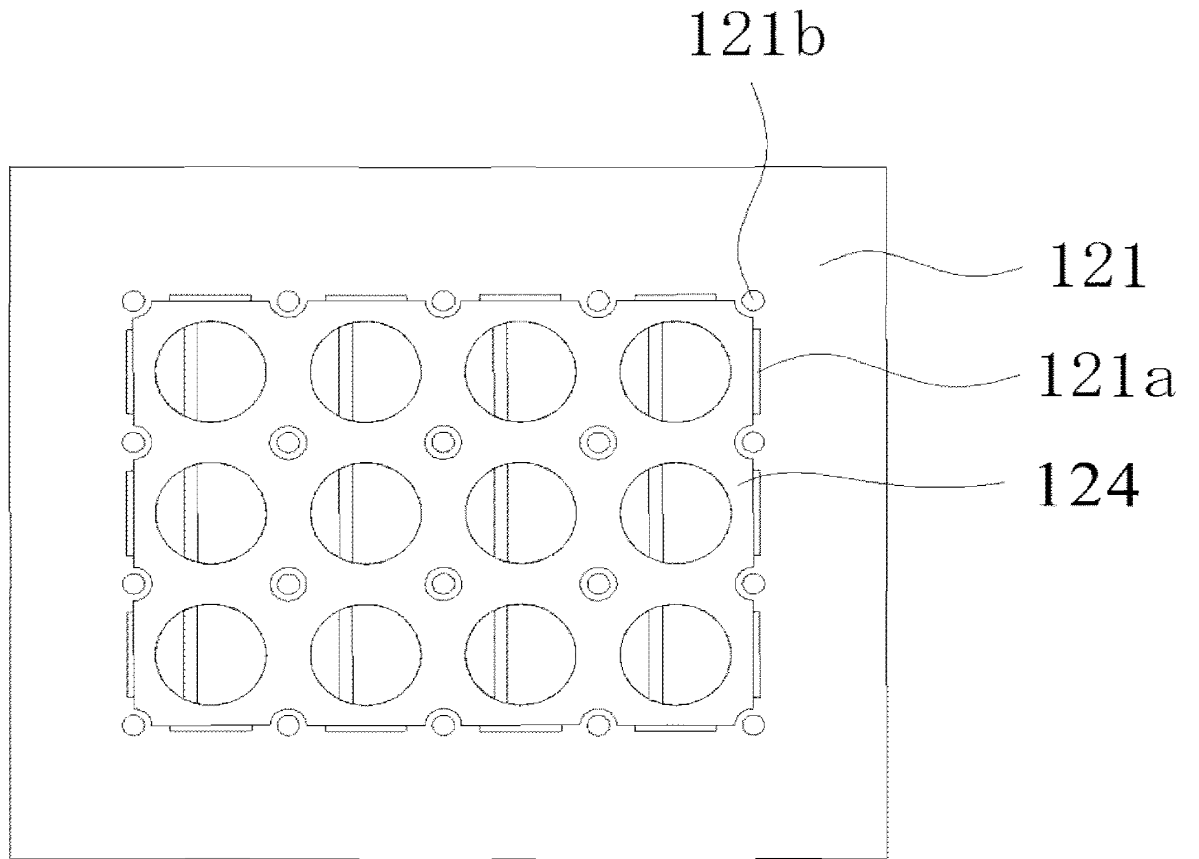
【図6】



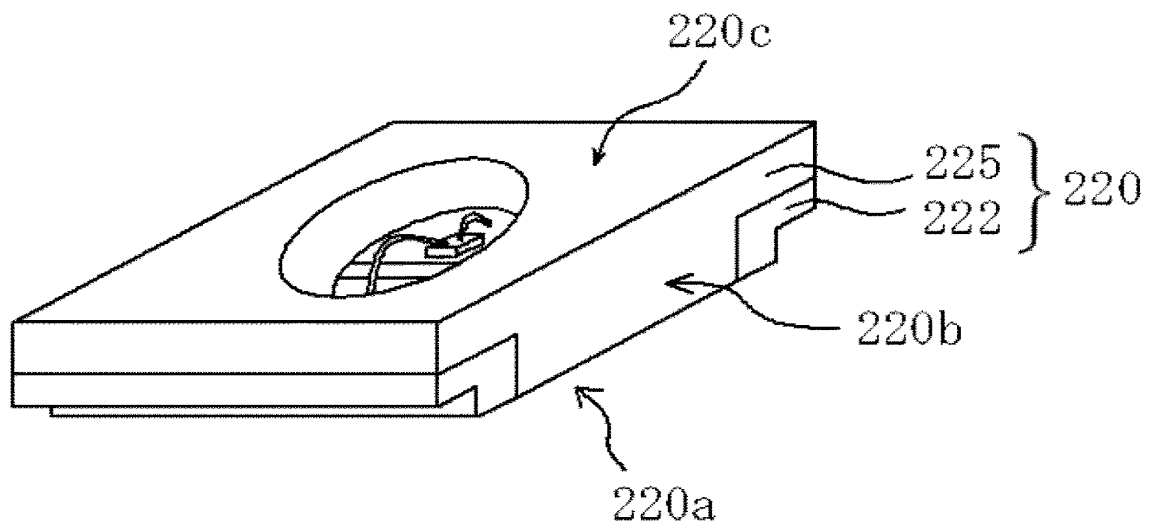
【图 7】



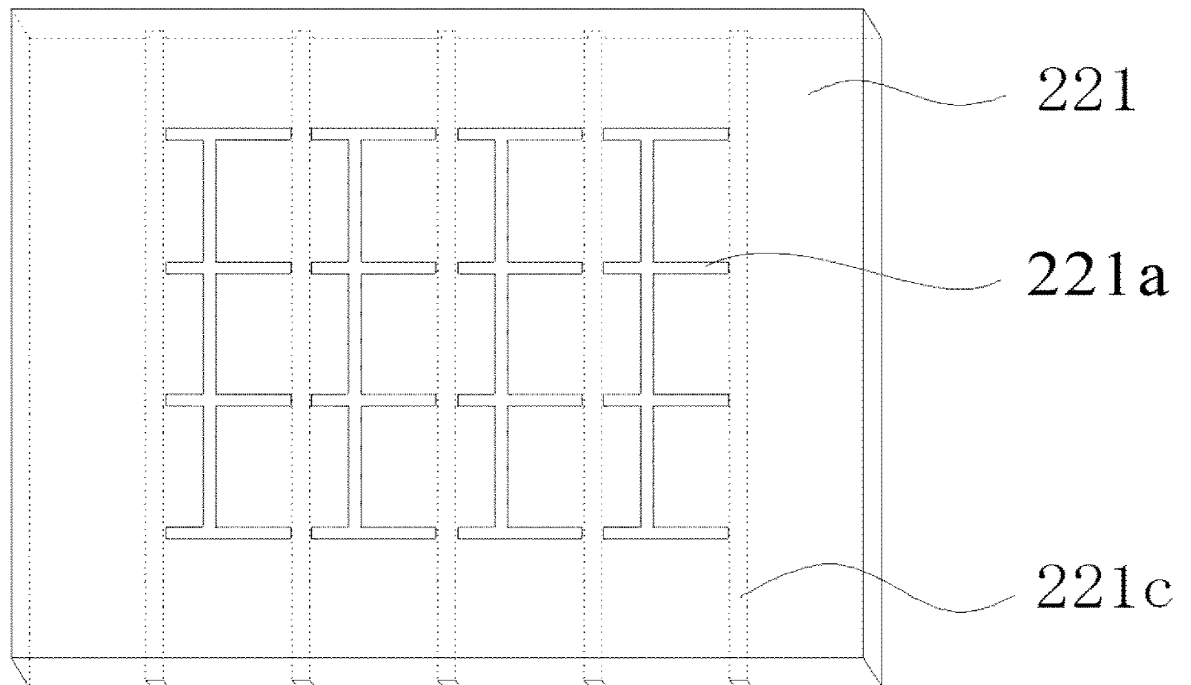
【図 8】



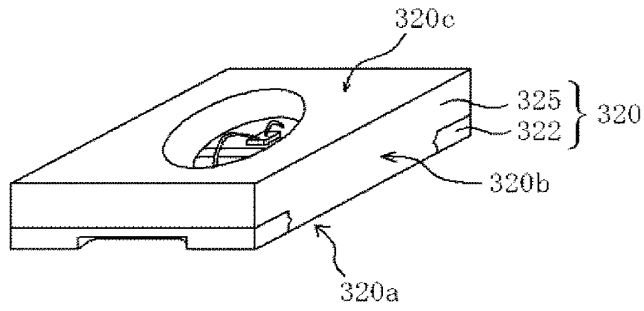
【図9】



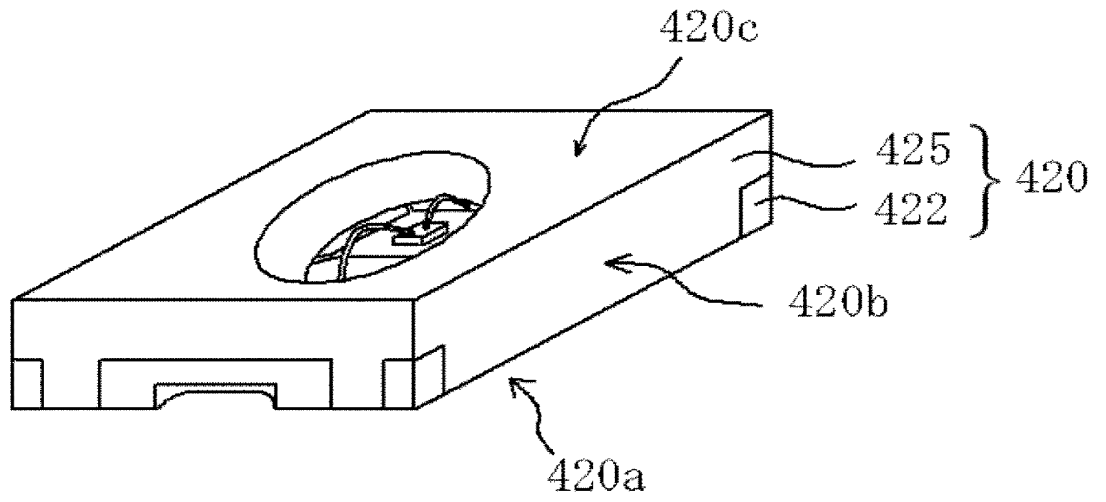
【図10】



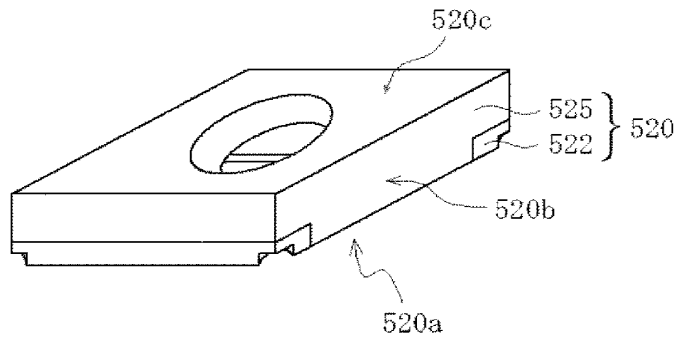
【図 1 1】



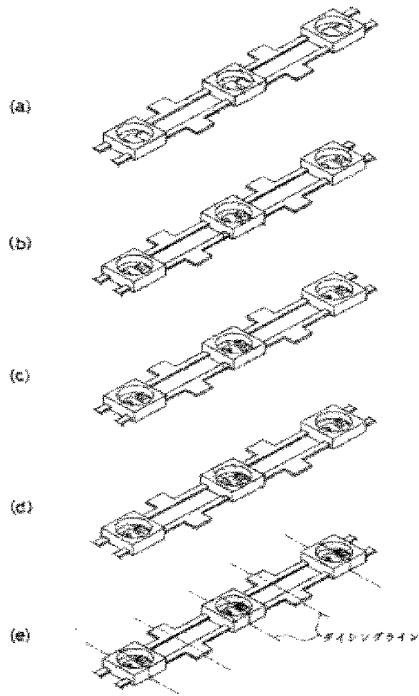
【図 1 2】



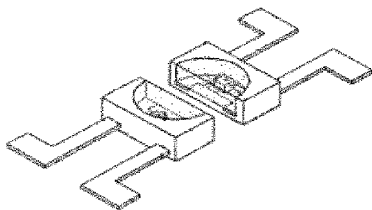
【図 1 3】



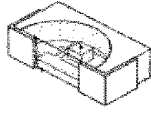
【図 1 4】



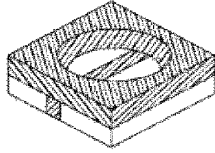
【図 1 5】



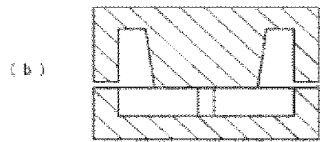
【例 16】



【例 17】



【例 18】

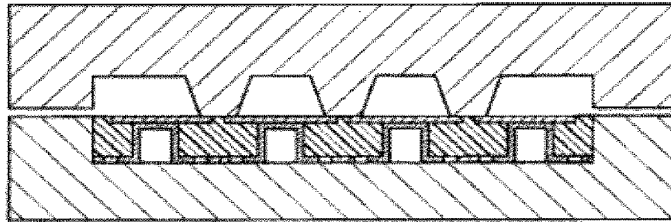


【例 19】

(a)



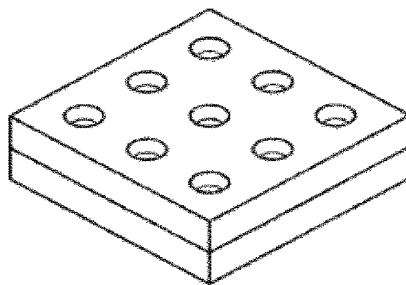
(b)



(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周囲周の約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、前記孔を通し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、前記溝を通し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 350 nm～800 nm 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 350 nm～800 nm 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 350 nm～800 nm 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 350 nm～800 nm 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

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新規登録

徳島県阿南市上中町岡491番地100

日亜化学工業株式会社



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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
14/928,570	10/30/2015	Hirofumi ICHIKAWA	100415-0199	9668
22428	7590	01/04/2016	EXAMINER	
Foley & Lardner LLP 3000 K STREET N.W. SUITE 600 WASHINGTON, DC 20007-5109			EVERHART, CARIDAD	
			ART UNIT	PAPER NUMBER
			2895	
			NOTIFICATION DATE	DELIVERY MODE
			01/04/2016	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

Office Action Summary	Application No. 14/928,570	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) 1-25 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) 1-15, 17, 18, 20 and 23-25 is/are rejected.
- 8) Claim(s) 16, 19, 21 and 22 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 negated 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 1-6, 10-11, 13-14, 17, and 25 are rejected under pre-AIA 35 U.S.C. 102(e) as being anticipated by Loh et al (US 2008/0044934 A1).

Loh et al disclose a light emitting device, as Loh et al disclose light emitting diode packages (paragraphs 0001 and 0002) which includes a resin package which includes a resin part and a metal plate, as Loh et al disclose a lead frame with plastic resin

material molding (paragraph 0010) a light emitting element mounted on the resin package and electrically connected to the metal plate, as Loh et al disclose a light emitting device connected to the leads of the lead frame (paragraph 0038) wherein a portion of an outer lateral surface of the resin part and of the metal plate are coplanar at an outer lateral surface of the package, as Loh et al disclose in Fig. 4 portions of the lead frame or metal plate 133 and 137 are coplanar with outer surfaces of the resin package (paragraph 0047) and wherein both a part of the metal plate and of the resin part are in a region below an upper surface of the metal plate on four outer lateral surfaces of the resin package, as Loh et al disclose in Fig. 2 lower portions 133 of the lead frame or metal plate are shown to be below the upper surfaces of the lead frame or metal plate, and also portions 117 of the plastic or resin are below the upper portions of the lead frame (paragraph 0038).

Re claim 2: Loh et al disclose the lower portion of the resin stated in the rejection of claim 1 is integral to the upper portion of the resin, as disclosed in Fig. 2.

Re claim 3: Loh et al disclose lead frames or metal plates in Fig. 5 which are flat, and is also shown in Fig. 2 that the lead frames or metal plates are flat.

Re claims 4-5: Loh et al disclose the lateral plates of the lead frames in Fig. 2 are coplanar and the edges are coplanar.

Re claim 6: Loh et al disclose in Fig. 3 the metal plate 105 under the light emitting element 114 is exposed (paragraph 0047).

Re claims 10-11: Loh et al disclose the resin material contains reflective material, and the reflective material is titanium dioxide, TiO₂ (paragraph 0037).

Re claim 13: Loh et al discloses the resin is a thermoset resin (paragraph 0052).

Re claim 14: Loh et al disclose the lead frame or plate has a concave portion shown in Fig. 2, in which the portion under the upper layer has a concave portion.

Re claim 17: Loh et al disclose the substrate has a groove 120 which has an inner bottom and lateral side surfaces shown in Fig. 4 (paragraph 0044).

Re claim 25: Loh et al disclose the light emitting element 114 is exposed from the resin part 110 shown in Fig. 3 (paragraph 0045).

Claims 7-9, 12, and 23-24 are rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Loh et al as applied to claim 1 above.

Loh et al discloses the limitations of claim 1 as stated above. Loh et al also discloses copper lead frame (paragraph 0036), and that it is known in the prior art to use plated copper for mounting light emitting devices (paragraph 0003). Loh et al does not explicitly teach the lead frame or plate is plated.

It would have been obvious to one of ordinary skill in the art at the time of the invention to have used plated copper in the device disclosed by Loh et al in order to protect from oxidation as disclosed by Takeda et al because Loh et al discloses that using plated copper is of art recognized suitability for an intended purpose (MPEP 2144.07).

Re claim 8: Loh et al discloses the leads are cut after the molding is applied (paragraph 0047), which implies the lateral ends of the leads do not have plating metal.

Re claim 9: Loh et al disclose in Fig. 3 the light emitting device 114 is exposed from a surface which is partially covered by resin portions 110 and partiall is metal portion 105' (paragraph 0036).

Re claim 12: Loh et al discloses titanium dioxide reflective material in the resin. Loh et al is silent with respect to the recited percentage range of the titanium dioxide. It would have been obvious to one of ordinary skill in the art at the time of the invention to have used titanium dioxide in the recited percentage range because one of ordinary skill in the art would have been able to determine the amount of titanium dioxide by ordinary experimentation and optimization (MPEP 2144.05(II)).

Re claim 23: Loh et al discloses surfaces at two or more levels for the metal plate, as stated in the rejection of claim 7, which states that the metal plate has upper and lower surfaces, which are surfaces which are at different levels. Loh et al also disclose in Fig. 2 that the metal plate has surfaces at different levels, as stated in the rejection of claim 1.

Re claim 24: Loh et al discloses that the metal plate has surfaces at different levels, as stated in the rejection of claim 1 above. Loh et al is silent with respect to the recited relative fraction of the thickness of the plate for the distance between the surfaces. It would have been obvious to one of ordinary skill in the art at the time of the invention to have formed the distance of the levels in the recited range because one of ordinary skill in the art would have been able to determine the relative distances of the levels by ordinary experimentation and optimization (MPEP 2144.05(II)).

Claim 15 is rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Loh et al as applied to claim 1 above, and further in view of Azuma (US 2001/0009301 A1).

Loh et al discloses the limitations of claim 1 as stated above. Loh et al is silent with respect to a difference in bonding level for conductive material upon mounting.

Azuma discloses forming a difference in level for bonding, as Azuma discloses forming concave portions in a metal plate 101 for mounting a semiconductor element 107 with solder (paragraph 0157 and Fig. 2B).

It would have been obvious to one of ordinary skill in the art at the time of the invention to have formed a difference in bonding level in the device disclosed by Loh et al in order to obtain the benefit of improved bonding as disclosed by Azuma .

Claim 18 is rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Loh et al as applied to claim 1 above, and further in view of Soules et al (US 6,252,254 B1).

Loh et al discloses the limitations of claim 1 as stated above. Loh et al also discloses phosphors (paragraph 0042). Loh et al is silent with respect to more than one phosphor.

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 (col. 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 used more than one phosphor in the device disclosed by Loh et al in order to obtain the benefit of the desired color of the emitted light as disclosed by Soules et al .

Claim 20 is rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Loh et al as applied to claim 1 above, and further in view of Takada (US 2008/0224161 A1).

Loh et al discloses the limitations of claim 1 as stated above. Loh et al is silent with respect to joint portions from the lateral portions of the package.

Takada discloses a package which includes lateral portions of a lead frame portions 1c and 1d and of a resin package portions 2 which are coplanar or which can extend as shown in Fig. 2 and in Fig. 10 (paragraphs 0058 , 0097, and 0101).

It would have been obvious to one of ordinary skill in the art at the time of the invention to have formed the device disclosed by Loh et al to include lead portions which extend as disclosed by Takada because Takada discloses that the lead arms can be formed to be coplanar with the resin portion or to extend.

Allowable Subject Matter

Claims 16, 19, and 21-22 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. 14/928,570	Applicant(s)/Patent Under Reexamination ICHIKAWA ET AL.	
	Examiner CARIDAD EVERHART	Art Unit 2895	Page 1 of 1

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	H US-				
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NON-PATENT DOCUMENTS

*	Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	CPC Classification
	Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)				
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	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.

Receipt date: 10/30/2015

14928570 - GAU: 2895
PTO/SB/08 (modified)

Substitute for form 1449/PTO INFORMATION DISCLOSURE STATEMENT BY APPLICANT Date Submitted: October 30, 2015 <i>(use as many sheets as necessary)</i>		Complete if Known	
		Application Number	Unassigned
		Filing Date	10/30/2015
		First Named Inventor	Hirofumi ICHIKAWA
		Art Unit	Unassigned
		Examiner Name	Unassigned
Sheet	1	of	4
		Attorney Docket Number	100415-0199

U.S. PATENT DOCUMENTS					
Examiner Initials*	Cite No. ¹	Document Number	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
		Number-Kind Code ² (if known)			
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Examiner Signature	/Caridad Everhart/	Date Considered	12/28/2015
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Substitute for form 1449/PTO INFORMATION DISCLOSURE STATEMENT BY APPLICANT Date Submitted: October 30, 2015 (use as many sheets as necessary)				Complete if Known	
				Application Number	Unassigned
Sheet 2		of 4	Filing Date	10/30/2015	
			First Named Inventor	Hirofumi ICHIKAWA	
			Art Unit	Unassigned	
			Examiner Name	Unassigned	
			Attorney Docket Number	100415-0199	

UNPUBLISHED U.S. PATENT APPLICATION DOCUMENTS					
Examiner Initials*	Cite No. ¹	U.S. Patent Application Document	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
		Serial Number-Kind Code ² (if known)			

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Examiner Initials*	Cite No. ¹	Foreign Patent Document	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
		Country Code ³ Number ⁴ Kind Code ⁵ (if known)				
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	A53	JP-H11-214754	08-06-1999	ROHM CO LTD.		
	A54	JP-2000-174347-A	06-23-2000	NICHIA CHEM IND LTD		
	A55	JP-2001-036154-A	02-09-2001	NICHIA CHEM IND LTD, ET AL.		
	A56	JP-2001-077160-A	03-23-2001	ADVANTEST CORP		
	A57	JP-2001-077235-A	03-23-2001	mitsui HIGH TEC		
	A58	JP-2001-267482-A	09-28-2001	mitsui HIGH TEC		
	A59	JP-2003-037236-A	02-07-2003	ROHM CO LTD		
	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.		
	A63	JP-2005-243857-A	09-08-2005	MATSUSHITA ELECTRIC IND CO LTD		
	A64	JP-2005-311137-A	11-04-2005	SONY CORP		
	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		
	A68	JP-2006-140207-A	06-01-2006	HITACHI CHEM CO LTD		
	A69	JP-2006-156704-A	06-15-2006	NICHIA KAGAKU KOGYO KK		
	A70	JP-2006-278427-A	10-12-2006	MATSUSHITA ELECTRIC WORKS LTD		
	A71	JP-2006-313943-A	11-16-2006	SHARP KK		
	A72	WO-2007/015426-A1	02-08-2007	NICHIA CORPORATION		
	A73	WO-2007/135707-A1	11-29-2007	NICHIA CORPORATION		
	A74	JP-2007-035794-A	02-08-2007	STANLEY ELECTRIC CO LTD		
	A75	JP-2007-123302-A	05-17-2007	NICHIA CHEM IND LTD		
	A76	JP-2007-235085-A	09-13-2007	HITACHI CHEM CO LTD		
	A77	JP-2007-294506-A	11-08-2007	MATSUSHITA ELECTRIC IND CO LTD		
	A78	JP-2007-297601-A	11-15-2007	HITACHI CHEMICAL CO LTD		

Examiner Signature	/Caridad Everhart/	Date Considered	12/28/2015
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Receipt date: 10/30/2015

14928570 - GAU: 2895
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 <i>(use as many sheets as necessary)</i>		First Named Inventor	Hirofumi ICHIKAWA
		Art Unit	Unassigned
Sheet 3 of 4		Examiner Name	Unassigned
		Attorney Docket Number	100415-0199

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.		
	A82	WO-2008/081794-A1	07-10-2008	NICHIA CORP		
	A83	JP-2008-103460-A	05-01-2008	SONY CORP		
	A84	JP-2008-106226-A	05-08-2008	HITACHI CHEM CO LTD		
	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.	
	A95	Extended European Search Report for EP Application No. 09 81 1 246.9-1226 dated November 25, 2013 submitted by Eisenfuhr Speiser in a letter dated December 10, 2013.	
	A96	International Search Report in PCT/JP2009/004170 dated November 24, 2009.	
	A97	Non-Final Office Action U.S. Serial No. 12/737,940 dated September 28, 2012.	
	A98	Notice of Allowance issued in U.S. Serial No. 13/969182 dated 7/9/2015.	
	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.	

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

Examiner Signature	/Caridad Everhart/	Date Considered	12/28/2015
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4841-7054-9290.1

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

Receipt date: 10/30/2015

14928570 - GAU: 2895
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 <i>(use as many sheets as necessary)</i>		First Named Inventor	Hirofumi ICHIKAWA
		Art Unit	Unassigned
Sheet	4	of	4
		Examiner Name	Unassigned
		Attorney Docket Number	100415-0199

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.	
	A103	Written Opinion of the International Searching Authority in PCT/JP2009/004170 dated November 24, 2009.	
	A104	Written Opinion of the International Searching Authority in PCT/JP2009/004170 dated November 24, 2009.	
	A105	Notice of Allowance issued in U.S. Serial No. 13/969,182 dated October 30, 2015.	

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

Examiner Signature	/Caridad Everhart/	Date Considered	12/28/2015
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4841-7054-9290.1

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


UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
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BIB DATA SHEET
CONFIRMATION NO. 9668

SERIAL NUMBER	FILING or 371(c) DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.		
14/928,570	10/30/2015	438	2895	100415-0199		
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	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Met after Allowance	STATE OR COUNTRY	SHEETS DRAWINGS	TOTAL CLAIMS	INDEPENDENT CLAIMS
35 USC 119(a-d) conditions met	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No		JAPAN	13	25	1
Verified and	/CARIDAD EVERHART/ Examiner's Signature	Initials				
Acknowledged						
ADDRESS Foley & Lardner LLP 3000 K STREET N.W. SUITE 600 WASHINGTON, DC 20007-5109 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 2000	FEES: Authority has been given in Paper No. _____ to charge/credit DEPOSIT ACCOUNT No. _____ for following:			<input type="checkbox"/> All Fees		
				<input type="checkbox"/> 1.16 Fees (Filing)		
				<input type="checkbox"/> 1.17 Fees (Processing Ext. of time)		
				<input type="checkbox"/> 1.18 Fees (Issue)		
				<input type="checkbox"/> Other _____		
			<input type="checkbox"/> Credit			

EAST Search History

EAST Search History (Prior Art)

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EAST Search History (Interference)

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12/ 21/ 2015 1:12:00 PM

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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	ICHI KAWA-HI ROFUMI	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-SHI MPEI	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	OFF	2015/12/19 10:41
L9	53	MIKI-TOMOHI DE	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
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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
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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
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L21	4173	257/100.ccls.	US-PGPUB; USPAT; EPO; JPO;	OR	OFF	2015/12/19 11:16


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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	h01133/0033.cpc.	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	OFF	2015/12/19 11:34
L28	826	h01133/385.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
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L31	1064	b29c45/14655.cpc.	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	OFF	2015/12/19 11:37

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L8	10	SASAOKA-SHI MPEI	US-PGPUB; USPAT	OR	OFF	2015/12/19 10:41
L10	41	MIKI-TOMOHI DE	US-PGPUB; USPAT	OR	OFF	2015/12/19 10:42
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Search Notes 	Application/Control No. 14928570	Applicant(s)/Patent Under Reexamination ICHIKAWA ET AL.
	Examiner CARIDAD EVERHART	Art Unit 2895

CPC- SEARCHED		
Symbol	Date	Examiner
H01L33/0033; H01L33/385; B29C45/055; B29C45/4655; B29C45/14655 (updated from parent)	12/19/2015	cme


CPC COMBINATION SETS - SEARCHED		
Symbol	Date	Examiner

US CLASSIFICATION SEARCHED			
Class	Subclass	Date	Examiner
438	26	12/19/2015	cme
361	820	12/19/2015	cme
257	100; 99	12/19/2015	cme

SEARCH NOTES		
Search Notes	Date	Examiner
reviewed parent	12/21/2015	cme
EAST search of H01L2024/181 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

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Index of Claims 	Application/Control No. 14928570	Applicant(s)/Patent Under Reexamination ICHIKAWA ET AL.
	Examiner CARIDAD EVERHART	Art Unit 2895

✓	Rejected
=	Allowed

-	Cancelled
÷	Restricted

N	Non-Elected
I	Interference

A	Appeal
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									
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	21	○									
	22	○									
	23	✓									
	24	✓									
	25	✓									

Substitute for form 1449/PTO INFORMATION DISCLOSURE STATEMENT BY APPLICANT Date Submitted: January 28, 2016 <i>(use as many sheets as necessary)</i>				Complete if Known	
				Application Number	14/928,570
Sheet 1 of 1				Filing Date	10/30/2015
				First Named Inventor	Hirofumi ICHIKAWA
				Art Unit	2895
				Examiner Name	Caridad EVERHART
				Attorney Docket Number	100415-0199

U.S. PATENT DOCUMENTS					
Examiner Initials*	Cite No. ¹	Document Number	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
		Number-Kind Code ² (if known)			
	B1	2003/0006492-A1	01-09-2003	OGASAWARA ET AL.	

UNPUBLISHED U.S. PATENT APPLICATION DOCUMENTS					
Examiner Initials*	Cite No. ¹	U.S. Patent Application Document	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
		Serial Number-Kind Code ² (if known)			

FOREIGN PATENT DOCUMENTS						
Examiner Initials*	Cite No. ¹	Foreign Patent Document	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
		Country Code ³ -Number ⁴ - Kind Code ⁵ (if known)				

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
	B2	US Office Action issued in U. S. Patent Application 14/928550 dated December 31, 2015	

Examiner Signature		Date Considered	
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Electronic Acknowledgement Receipt

EFS ID:	24747931
Application Number:	14928570
International Application Number:	
Confirmation Number:	9668
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/Shiho Vitale
Filer Authorized By:	Chase J. Brill
Attorney Docket Number:	100415-0199
Receipt Date:	28-JAN-2016
Filing Date:	30-OCT-2015
Time Stamp:	10:58:14
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no
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File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Transmittal Letter	IDS_B.pdf	105161 <small>e0cd428cf3c06147d55f6af2c16c0b4527552562</small>	no	3

Warnings:

Information:

2	Information Disclosure Statement (IDS) Form (SB08)	SB08_B.pdf	92862 <small>a274750c438b770e94f9307fecdd3b2428c90387</small>	no	1
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Information:					
This is not an USPTO supplied IDS fillable form					
3	Non Patent Literature	B2.pdf	978896 <small>232da511c9c8e6048169b9d4bd6b69c0bc658150</small>	no	16
Warnings:					
Information:					
Total Files Size (in bytes):			1176919		
<p>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.</p> <p><u>New Applications Under 35 U.S.C. 111</u> 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.</p> <p><u>National Stage of an International Application under 35 U.S.C. 371</u> 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.</p> <p><u>New International Application Filed with the USPTO as a Receiving Office</u> 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.</p>					

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.: 14/928,570

Filing Date: 10/30/2015

Examiner: Caridad EVERHART

Art Unit: 2895

Confirmation No.: 9668

INFORMATION DISCLOSURE STATEMENT
UNDER 37 CFR §1.56

Mail Stop Amendment
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.

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 was cited during the prosecution of U.S. counterpart application. The Office Action is cited as document B2. The other references listed in the Office Action are already of record in the present application.

TIMING OF THE DISCLOSURE

The listed documents are being submitted in compliance with 37 CFR §1.97(c), before the mailing date of any of a final action under 37 CFR §1.113, a notice of allowance under 37 CFR §1.311, or an action that otherwise closes prosecution in the application.

STATEMENT UNDER 37 CFR §1.97(e)(2)

The undersigned hereby states in accordance with 37 CFR §1.97(e)(2) that no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in § 1.56(c) more than three months prior to the filing of the information disclosure 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.

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 Number 19-0741.

Respectfully submitted,

Date January 28, 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



UNITED STATES PATENT AND TRADEMARK OFFICE

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

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
14/928,570	10/30/2015	Hirofumi ICHIKAWA	100415-0199

CONFIRMATION NO. 9668

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-2016-0049566-A1

Publication Date:02/18/2016

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 Management, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101

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 bottom surface of the concave portion resin package 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 outer lateral surface of the resin package, [[and]]
wherein both a part of the ~~at least one metal plate~~ metal part and a part of the resin part are disposed in a region below an upper surface of the ~~at least one metal plate~~ metal part, on four outer lateral surfaces of the resin package, and
wherein a notch is formed in the metal part at each of the four outer lateral surfaces of the resin package.
2. (Currently Amended) The light emitting device according to claim 1, wherein a portion of the resin part above the upper surface of the ~~at least one metal plate~~ metal part is formed integrally with a portion of the resin part below the upper surface of the ~~at least one metal plate~~ metal part.
3. (Currently Amended) The light emitting device according to claim 1, wherein the ~~at least one metal plate~~ each of the at least two metal plates is substantially flat.
4. (Currently Amended) The light emitting device according to claim 1, wherein:

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

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

5. (Currently Amended) The light emitting device according to claim 1, wherein all upper edges of the ~~at least one metal plate~~ metal part are coplanar.

6. (Currently Amended) The light emitting device according to claim 1, 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.

7. (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.

8. (Currently Amended) The light emitting device according to claim 7, 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.

9. (Currently Amended) The light emitting device according to claim 7, 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.

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

11. (Original) The light emitting device according to claim 10, wherein the light reflecting material is titanium dioxide.

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

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

14. (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.

15. (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.

16. – 17. (Cancelled)

18. (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.

19. (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.

20. (Currently Amended) The light emitting device according to claim 1, wherein the ~~at least one metal plate~~ metal part has a joint portion at the outer lateral surface of the resin package.

21. (Currently Amended) The light emitting device according to claim 1, wherein the ~~at least one metal plate~~ metal part comprises a step on a bottom surface or outer lateral surface of the ~~at least one metal plate~~ metal part, and the step is exposed from the resin part.

22. (Original) The light emitting device according to claim 21, wherein a metal layer is disposed on the step.

23. (Currently Amended) The light emitting device according to claim 1, wherein the ~~at least one metal plate~~ metal part comprises surfaces at two or more different levels.

24. (Currently Amended) The light emitting device according to claim 1, wherein a distance between said surfaces at two or more different levels is in a range of about 1/4 to about 4/5 of a thickness of the ~~at least one metal plate~~ metal part.

25. (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.

26. (New) 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 an outer lateral surface of the resin package,

wherein both a part of the metal part and a part of the resin part are disposed in a region below an upper surface of the metal part, on four outer lateral surfaces of the resin package, and

wherein the metal part comprises a step on a bottom surface or outer lateral surface of the metal part, and the step is exposed from the resin part.

REMARKS

Applicant respectfully requests reconsideration of the present application in view of the foregoing amendments and the reasons that follow.

Status of Claims

Claims 1-9, 14, 15, 19-21, 23, and 24 are amended. Claims 16 and 17 are cancelled. Claim 26 is new. After amending the claims as set forth above, claims 1-15 and 18-26 are now pending in this application. No new matter is added.

Allowable Subject Matter

Applicants appreciate the Examiner's indication that claims 16, 19, 21, and 22 are directed to allowable subject matter.

Independent claim 1 is 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 in allowable claim 16. Thus, claim 1 is patentable for at least the same reasons as previous claim 16.

New independent claim 26 recites that "the metal part comprises a step on a bottom surface or outer lateral surface of the metal part, and the step is exposed from the resin part," which is similar to the limitation in allowable claim 21. Thus, claim 26 is patentable for at least the same reasons as claim 21.

Rejections Under 35 U.S.C. § 102

Claims 1-6, 10-11, 13-14, 17, and 25 stand rejected under pre-AIA 35 U.S.C. 102(e) as allegedly being anticipated by Loh et al (US 2008/0044934 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 in allowable claim 16. Thus, claim 1 is patentable for at least the same reasons as previous claim 16.

Claims 2-6, 10, 11, 13, 14, 17, and 25 depend from independent claim 1, and are patentable for at least the same reasons as claim 1, 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 7-9, 12, and 23-24 stand rejected under pre-AIA 35 U.S.C. 103(a) as allegedly being unpatentable over Loh et al as applied to claim 1 above.

Claims 7-9, 12, and 23-24 depend from independent claim 1, and are patentable for at least the same reasons as claim 1, even without regard to the further patentable features recited therein.

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

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 4, 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 Patent Application Fee Transmittal				
Application Number:	14928570			
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/George Gray			
Attorney Docket Number:	100415-0199			
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:	25689103
Application Number:	14928570
International Application Number:	
Confirmation Number:	9668
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/George Gray
Filer Authorized By:	Chase J. Brill
Attorney Docket Number:	100415-0199
Receipt Date:	04-MAY-2016
Filing Date:	30-OCT-2015
Time Stamp:	19:46:54
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	5916
Deposit Account	
Authorized User	

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Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		Response.pdf	118097 <small>f81d94fddefe5a3c6ac3c37cd4efe413d12d12d0e</small>	yes	8
Multipart Description/PDF files in .zip description					
Document Description		Start	End		
Transmittal Letter		1	1		
Amendment Copy Claims/Response to Suggested Claims		2	5		
Applicant Arguments/Remarks Made in an Amendment		6	8		
Warnings:					
Information:					
2	Fee Worksheet (SB06)	fee-info.pdf	31236 <small>789014189efaf8bdade759918a8454a475e98a6c</small>	no	2
Warnings:					
Information:					
Total Files Size (in bytes):			149333		
<p>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.</p> <p><u>New Applications Under 35 U.S.C. 111</u> 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.</p> <p><u>National Stage of an International Application under 35 U.S.C. 371</u> 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.</p> <p><u>New International Application Filed with the USPTO as a Receiving Office</u> 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.</p>					

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.: 14/928,570

Filing Date: 10/30/2015

Examiner: Caridad EVERHART

Art Unit: 2895

Confirmation Number: 9668

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 January 4, 2016, concerning the above-referenced patent application. Applicants hereby petition for a one-month extension of time. The required extension fee is provided herewith.

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

Remarks begin on page 6 of this document.

Please amend the application as follows:

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 14/928,570	Filing Date 10/30/2015	<input type="checkbox"/> To be Mailed
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ENTITY: LARGE SMALL MICRO

APPLICATION AS FILED – PART I

FOR	NUMBER FILED	NUMBER EXTRA	RATE (\$)	FEE (\$)
<input type="checkbox"/> BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A	
<input type="checkbox"/> SEARCH FEE (37 CFR 1.16(k), (j), or (m))	N/A	N/A	N/A	
<input type="checkbox"/> 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 \$ =	
<input type="checkbox"/> 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).			
<input type="checkbox"/> 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

	(Column 1)	(Column 2)	(Column 3)	(Column 4)	(Column 5)	RATE (\$)	ADDITIONAL FEE (\$)
AMENDMENT	05/04/2016	CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA		
	Total (37 CFR 1.16(j))	+ 24	Minus	** 25	= 0	x \$80 =	0
	Independent (37 CFR 1.16(h))	+ 2	Minus	***3	= 0	x \$420 =	0
	<input type="checkbox"/> Application Size Fee (37 CFR 1.16(s))						
	<input type="checkbox"/> FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))						
						TOTAL ADD'L FEE	0

	(Column 1)	(Column 2)	(Column 3)	(Column 4)	(Column 5)	RATE (\$)	ADDITIONAL FEE (\$)
AMENDMENT		CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA		
	Total (37 CFR 1.16(j))	+	Minus	**	=	X \$ =	
	Independent (37 CFR 1.16(h))	+	Minus	***	=	X \$ =	
	<input type="checkbox"/> Application Size Fee (37 CFR 1.16(s))						
	<input type="checkbox"/> 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
/VANESSA HODGES/

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.**

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NOTICE OF ALLOWANCE AND FEE(S) DUE

22428 7590 08/05/2016
Foley & Lardner LLP
3000 K STREET N.W.
SUITE 600
WASHINGTON, DC 20007-5109

EXAMINER

EVERHART, CARIDAD

ART UNIT PAPER NUMBER

2895

DATE MAILED: 08/05/2016

Table with 5 columns: APPLICATION NO., FILING DATE, FIRST NAMED INVENTOR, ATTORNEY DOCKET NO., CONFIRMATION NO.

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

Table with 7 columns: APPLN. TYPE, ENTITY STATUS, ISSUE FEE DUE, PUBLICATION FEE DUE, PREV. PAID ISSUE FEE, TOTAL FEE(S) DUE, DATE DUE

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 08/05/2016
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.
14/928,570	10/30/2015	Hirofumi ICHIKAWA	100415-0199	9668

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	11/07/2016

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

<p>1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).</p> <p><input type="checkbox"/> Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.</p> <p><input type="checkbox"/> "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.</p>	<p>2. For printing on the patent front page, list</p> <p>(1) The names of up to 3 registered patent attorneys or agents OR, alternatively, 1 _____</p> <p>(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. 2 _____</p> <p>3 _____</p>
---	---

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

<p>4a. The following fee(s) are submitted:</p> <p><input type="checkbox"/> Issue Fee</p> <p><input type="checkbox"/> Publication Fee (No small entity discount permitted)</p> <p><input type="checkbox"/> Advance Order - # of Copies _____</p>	<p>4b. Payment of Fee(s): (Please first reapply any previously paid issue fee shown above)</p> <p><input type="checkbox"/> A check is enclosed.</p> <p><input type="checkbox"/> Payment by credit card. Form PTO-2038 is attached.</p> <p><input type="checkbox"/> 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).</p>
---	--

5. **Change in Entity Status** (from status indicated above)

Applicant certifying micro entity status. See 37 CFR 1.29

Applicant asserting small entity status. See 37 CFR 1.27

Applicant changing to regular undiscounted fee status.

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.

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.

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
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P.O. Box 1450
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www.uspto.gov

Table with columns: APPLICATION NO., FILING DATE, FIRST NAMED INVENTOR, ATTORNEY DOCKET NO., CONFIRMATION NO., EXAMINER, ART UNIT, PAPER NUMBER. Includes details for application 14/928,570 and examiner EVERHART, CARIDAD.

DATE MAILED: 08/05/2016

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.

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.

Examiner-Initiated Interview Summary	Application No. 14/928,570	Applicant(s) ICHIKAWA ET AL.	
	Examiner CARIDAD EVERHART	Art Unit 2895	

All participants (applicant, applicant's representative, PTO personnel):

(1) CARIDAD EVERHART. (3)_____.

(2) Attorney Chase J. Brill. (4)_____.

Date of Interview: 02 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...)

The examiner left a telephone message for applicant's representative on a voice message machine in which the examiner stated that the Notice of Allowance will indicate that changes to the drawings are needed to indicate that Figs. 14-19 are "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
--	---

Notice of Allowability	Application No. 14/928,570	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 5/4/2016.
 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 1-15 and 18-26. 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)

- | | |
|--|--|
| <ol style="list-style-type: none"> 1. <input type="checkbox"/> Notice of References Cited (PTO-892) 2. <input checked="" type="checkbox"/> Information Disclosure Statements (PTO/SB/08),
Paper No./Mail Date _____ 3. <input type="checkbox"/> Examiner's Comment Regarding Requirement for Deposit
of Biological Material 4. <input checked="" type="checkbox"/> Interview Summary (PTO-413),
Paper No./Mail Date _____. | <ol style="list-style-type: none"> 5. <input type="checkbox"/> Examiner's Amendment/Comment 6. <input checked="" type="checkbox"/> Examiner's Statement of Reasons for Allowance 7. <input type="checkbox"/> Other _____. |
|--|--|

	/Caridad Everhart/ Primary Examiner AU 2895
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The present application is being examined under the pre-AIA first to invent provisions.

Drawings

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.

REASONS FOR ALLOWANCE

The following is an examiner's statement of reasons for allowance: The IDS filed 10/30/2015 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. Ogasawara et al discloses a cut portion 1c, which is a step portion, however, Ogasawara et al discloses the cut portion 1c is covered with resin (paragraph 0064 and Fig. 12), and therefor Ogasawara et al does not disclose nor suggest the limitation "wherein the metal part comprises a step on a bottom surface or outer lateral surface of the metal part, and the step is exposed from the resin part".

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, 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/

Application/Control Number: 14/928,570

Page 4

Art Unit: 2895

Primary Examiner

AU 2895

8/2/2016

Examiner-Initiated Interview Summary	Application No. 14/928,570	Applicant(s) ICHIKAWA ET AL.	
	Examiner CARIDAD EVERHART	Art Unit 2895	

All participants (applicant, applicant's representative, PTO personnel):

(1) CARIDAD EVERHART. (3)_____.

(2) Attorney Chase J. Brill. (4)_____.

Date of Interview: 02 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...)


The examiner left a telephone message for applicant's representative on a voice message machine in which the examiner stated that the Notice of Allowance will indicate that changes to the drawings are needed to indicate that Figs. 14-19 are "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
--	---

Search Notes 	Application/Control No. 14928570	Applicant(s)/Patent Under Reexamination ICHIKAWA ET AL.
	Examiner CARIDAD EVERHART	Art Unit 2895

CPC- SEARCHED		
Symbol	Date	Examiner
H01L33/0033; H01L33/385; B29C45/055; B29C45/4655; B29C45/14655 (updated from parent)	12/19/2015	cme
H01L33/0033; H01L33/385; B29C45/055; B29C45/4655; B29C45/14655; H01L2924/00; H01L2924/181; H01L2224/48247; H01L33/486; H01L33/60; H01L33/641	8/1/2016	cme

CPC COMBINATION SETS - SEARCHED		
Symbol	Date	Examiner

US CLASSIFICATION SEARCHED			
Class	Subclass	Date	Examiner
438	26	12/19/2015	cme
361	820	12/19/2015	cme
257	100; 99	12/19/2015	cme

SEARCH NOTES		
Search Notes	Date	Examiner
reviewed parent	12/21/2015	cme
EAST search of H01L2024/181 or H01L33/62 or H01L33/60 with search terms (attached)	12/19/2015	cme
EAST attached	8/1/2016	cme
The CPC classes listed above under CPC search were EAST classification searched and searched with search terms (attached)	8/1/2016	cme

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

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INTERFERENCE SEARCH

US Class/ CPC Symbol	US Subclass / CPC Group	Date	Examiner
EAST	attached	8/1/2016	cme

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Receipt date: 01/28/2016

14928570 - GAU: 2895
PTO/SB/08 (modified)

Substitute for form 1449/PTO INFORMATION DISCLOSURE STATEMENT BY APPLICANT Date Submitted: January 28, 2016 (use as many sheets as necessary)		Complete if Known	
		Application Number Filing Date First Named Inventor Art Unit Examiner Name Attorney Docket Number	14/928,570 10/30/2015 Hirofumi ICHIKAWA 2895 Caridad EVERHART 100415-0199
Sheet	1	of	1


U.S. PATENT DOCUMENTS					
Examiner Initials*	Cite No. ¹	Document Number	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
		Number-Kind Code ² (if known)			
/C.E./	B1	2003/0006492-A1	01-09-2003	OGASAWARA ET AL.	

UNPUBLISHED U.S. PATENT APPLICATION DOCUMENTS					
Examiner Initials*	Cite No. ¹	U.S. Patent Application Document	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
		Serial Number-Kind Code ² (if known)			

FOREIGN PATENT DOCUMENTS						
Examiner Initials*	Cite No. ¹	Foreign Patent Document	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
		Country Code ³ -Number ⁴ -Kind Code ⁵ (if known)				

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./	B2	US Office Action issued in U. S. Patent Application 14/928550 dated December 31, 2015	

Examiner Signature	/Caridad Everhart/	Date Considered	08/01/2016
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Index of Claims 	Application/Control No. 14928570	Applicant(s)/Patent Under Reexamination ICHIKAWA ET AL.
	Examiner CARIDAD EVERHART	Art Unit 2895

✓	Rejected
=	Allowed

-	Cancelled
÷	Restricted

N	Non-Elected
I	Interference

A	Appeal
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	08/02/2016						
1	1	✓	=						
2	2	✓	=						
3	3	✓	=						
4	4	✓	=						
5	5	✓	=						
6	6	✓	=						
16	7	✓	=						
17	8	✓	=						
18	9	✓	=						
19	10	✓	=						
20	11	✓	=						
21	12	✓	=						
7	13	✓	=						
8	14	✓	=						
9	15	✓	=						
	16	○	-						
	17	✓	-						
10	18	✓	=						
11	19	○	=						
12	20	✓	=						
22	21	○	=						
23	22	○	=						
13	23	✓	=						
14	24	✓	=						
15	25	✓	=						
24	26		=						

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L22	0	21 and ((two adj metal adj plates) and (four adj3 lateral adj surfaces) and concave and resin and notch).clm.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/08/01 13:18
L23	2	("9287476").PN.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2016/08/01 13:19
L24	0	23 and ((two adj metal adj plates) and (four adj3 lateral adj surfaces) and concave and resin and notch).clm.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/08/01 13:20
L25	4	("8530250").PN.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2016/08/01 13:20
L26	0	25 and ((two adj metal adj plates) and (four adj3 lateral adj surfaces) and concave and resin and notch).clm.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/08/01 13:20
L27	0	21 and ((two adj metal adj plates) and (four adj3 lateral adj surfaces) and concave and resin and notch).clm.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/08/01 13:21
L28	44	ICHI KAWA-HI ROFUMI	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/08/01 13:22
L30	1789	HAYASHI-MASAKI	US-PGPUB;	OR	ON	2016/08/01

			USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB			13:22
L32	25	SASAOKA-SHI MPEI	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/08/01 13:23
L34	106	MIKI-TOMOHI DE	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/08/01 13:23
L36	0	(28 or 30 or 32 or 34) and ((two adj metal adj plates) and (four adj3 lateral adj surfaces) and concave and resin and notch).clm.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/08/01 13:24
L37	2	(28 or 30 or 32 or 34) and ((metal adj plates) and (lateral adj surfaces) and concave and resin and notch).clm.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/08/01 13:24
L41	2	(nichia adj corporation) and ((metal adj plates) and (lateral adj surfaces) and concave and (resin near2 package\$1) and notch)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/08/01 13:29
L42	2	41 AND ((H01L2924/181 OR H01L2924/12041 OR H01L2224/48247 OR H01L2224/48257 OR H01L33/486 OR H01L33/641 OR B29C45/14655).CPC.)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/08/01 13:31
L43	2	"20160087071"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/08/01 13:32
L44	61948	((resin or polymer\$4) adj1 package) and notch\$3 or ((light adj emitting adj diode)) and (metal same (resin or polymer\$4))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT;	OR	ON	2016/08/01 13:35


			IBM_TDB			
L45	61948	((resin or polymer\$4) adj1 package) and notch\$3 or ((light adj emitting adj diode)) and (metal same (resin or polymer\$4))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/08/01 13:36
L46	20909	((resin or polymer\$4) adj1 package) and notch\$3 or ((light adj emitting adj diode)) and (metal near4 plate\$1)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/08/01 13:40
L47	20909	((resin or polymer\$4) adj1 package) and notch\$3 or ((light adj emitting adj diode)) and (metal near4 plate\$1)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/08/01 13:40
L48	2241	((resin or polymer\$4) adj1 package) and notch\$3 or ((light adj emitting adj diode)) and (metal near4 plate\$1) and packag\$4 and encapsulat\$5	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/08/01 13:44
L49	2241	((resin or polymer\$4) adj1 package) and notch\$3 or ((light adj emitting adj diode)) and (metal near4 plate\$1) and packag\$4 and encapsulat\$5	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/08/01 13:44
L50	26	49 AND ((B29C45/0055 OR B29C45/14655).CPC.)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/08/01 13:50
L51	2241	((resin or polymer\$4) adj1 package) and notch\$3 or ((light adj emitting adj diode)) and (metal near4 plate\$1) and packag\$4 and encapsulat\$5	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/08/01 13:57
L52	1086	51 AND ((H01L2924/00 OR H01L2924/181 OR H01L2224/48247 OR H01L33/486 OR H01L33/60 OR H01L33/641).CPC.)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/08/01 14:00
L53	3	((resin or polymer\$4) adj1 package) and notch\$3 and ((light adj emitting adj diode)) and (metal near4 plate\$1) and (packag\$4) and encapsulat\$5	US-PGPUB; USPAT; USOCR; FPRS; EPO;	OR	ON	2016/08/01 14:01

			JPO; DERWENT; IBM_TDB			
L54	5	((resin or polymer\$4) adj1 package) and notch\$3 and ((light adj emitting adj diode)) and (metal near4 (base or plate\$1)) and (packag\$4) and encapsulat\$5	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/08/01 14:02
L55	61	52 and (stepped)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/08/01 14:06
L56	0	(h01I33/0033.cpc. or h01I33/385.cpc or b29c45/055.cpc. or b29c45/14655.cpc. or b29c45/4655.cpc.) and (((resin or polymer\$4) adj1 package) and notch\$3 and ((light adj emitting adj diode)) and (metal near4 plate\$1) and (packag\$4) and encapsulat\$5)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/08/01 14:09
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L58	6	(h01I33/0033.cpc. or h01I33/385.cpc or b29c45/055.cpc. or b29c45/14655.cpc. or b29c45/4655.cpc.) and ((resin or polymer\$4) and notch\$3 and ((light adj emitting adj diode)) and (metal near4 (base or plate\$1)) and (packag\$4) and encapsulat\$5)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/08/01 14:11
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L60	0	h01I021/283.ipc. and ((resin or polymer\$4) and notch\$3 and ((light adj emitting adj diode)) and (metal near4 (base or plate\$1)) and (packag\$4) and encapsulat\$5)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/08/01 14:12
L61	15	h01I021/00.ipc. and ((resin or polymer\$4) and notch\$3 and ((light adj emitting adj diode)) and (metal near4 (base or plate\$1)) and (packag\$4) and encapsulat\$5)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/08/01 14:15

EAST Search History (Interference)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L29	15	ICHI KAWA-HI ROFUMI	US-PGPUB; USPAT	OR	ON	2016/08/01 13:22
L31	373	HAYASHI-MASAKI	US-PGPUB; USPAT	OR	ON	2016/08/01 13:22
L33	16	SASAOKA-SHI MPEI	US-PGPUB; USPAT	OR	ON	2016/08/01 13:23
L35	49	MIKI-TOMOHI DE	US-PGPUB; USPAT	OR	ON	2016/08/01 13:23
L38	2	(29 or 31 or 33 or 35) and ((metal adj plates) and (lateral adj surfaces) and concave and resin and notch).clm.	US-PGPUB; USPAT	OR	ON	2016/08/01 13:26
L39	2	(nichia adj corporation) and ((metal adj plates) and (lateral adj surfaces) and concave and resin and notch).clm.	US-PGPUB; USPAT	OR	ON	2016/08/01 13:26
L40	2	(nichia adj corporation) and ((metal adj plates) and (lateral adj surfaces) and concave and (resin near2 package\$1) and notch)	US-PGPUB; USPAT	OR	ON	2016/08/01 13:29


8/ 1/ 2016 2:24:35 PM

Issue Classification 	Application/Control No. 14928570	Applicant(s)/Patent Under Reexamination ICHIKAWA ET AL.	
	Examiner CARIDAD EVERHART	Art Unit 2895	

CPC						
Symbol					Type	Version
H01L	33	62			F	2013-01-01
B29C	45	0055			I	2013-01-01
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
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H01L	24	97			I	2013-01-01
H01L	2924	3025			A	2013-01-01
H01L	2924	12041			A	2013-01-01
H01L	2924	181			A	2013-01-01
H01L	2924	12035			A	2013-01-01
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CPC Combination Sets								
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H01L	2924	00			A	2	2	2013-01-01
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NONE		Total Claims Allowed:	
		24	
(Assistant Examiner)	(Date)		
/CARIDAD EVERHART/ Primary Examiner. Art Unit 2895	8/2/2016	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	6

Issue Classification 	Application/Control No. 14928570	Applicant(s)/Patent Under Reexamination ICHIKAWA ET AL.
	Examiner CARIDAD EVERHART	Art Unit 2895


H01L	2924	00	A	5	2	2013-01-01
H01L	2924	12042	A	6	1	2013-01-01
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H01L	2924	181	A	7	1	2013-01-01
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NONE		Total Claims Allowed:	
(Assistant Examiner)		24	
(Date)			
/CARIDAD EVERHART/ Primary Examiner. Art Unit 2895	8/2/2016	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	6

Issue Classification 	Application/Control No. 14928570	Applicant(s)/Patent Under Reexamination ICHIKAWA ET AL.
	Examiner CARIDAD EVERHART	Art Unit 2895

US ORIGINAL CLASSIFICATION						INTERNATIONAL CLASSIFICATION											
CLASS			SUBCLASS			CLAIMED				NON-CLAIMED							
CROSS REFERENCE(S)						H	0	1	L	21 / 00 (2006.01.01)							
						H	0	1	L	21 / 283 (2006.01.01)							
						H	0	1	L	29 / 66 (2006.01.01)							
CLASS	SUBCLASS (ONE SUBCLASS PER BLOCK)																

NONE		Total Claims Allowed:	
		24	
(Assistant Examiner)	(Date)	O.G. Print Claim(s)	O.G. Print Figure
/CARIDAD EVERHART/ Primary Examiner. Art Unit 2895	8/2/2016	1	6
(Primary Examiner)	(Date)		

Issue Classification 	Application/Control No. 14928570	Applicant(s)/Patent Under Reexamination ICHIKAWA ET AL.
	Examiner CARIDAD EVERHART	Art Unit 2895

<input type="checkbox"/> Claims renumbered in the same order as presented by applicant <input type="checkbox"/> CPA <input type="checkbox"/> T.D. <input type="checkbox"/> R.1.47															
Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original
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2	2	10	18												
3	3	11	19												
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8	14														
9	15														
	16														

NONE		Total Claims Allowed:	
		24	
(Assistant Examiner)	(Date)	O.G. Print Claim(s)	O.G. Print Figure
/CARIDAD EVERHART/ Primary Examiner. Art Unit 2895	8/2/2016	1	6
(Primary Examiner)	(Date)		

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.: 14/928,570

Filing Date: 10/30/2015

Examiner: Caridad EVERHART

Art Unit: 2895

Confirmation Number: 9668

TRANSMITTAL OF REPLACEMENT 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 5, 2016. Figures 14–19 are amended to add the label “Prior Art.” No new matter is added.

Respectfully submitted,

Date September 7, 2016

FOLEY & LARDNER LLP
Customer Number: 22428
Telephone: (202) 295-4787
Facsimile: (202) 672-5399

By /Chase J. Brill/

Chase J. Brill
Attorney for Applicant
Registration No. 61,378

REPLACEMENT SHEET

Fig. 13

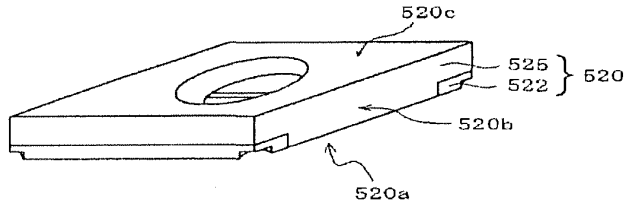


Fig. 14 (Prior Art)

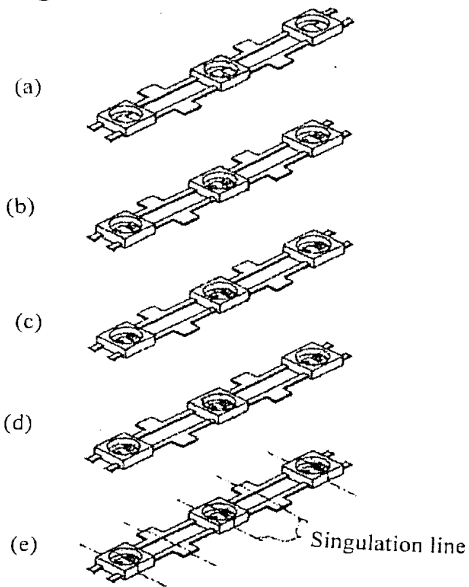
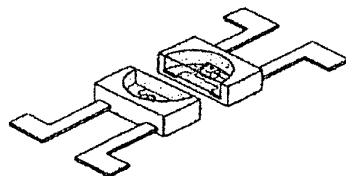


Fig. 15 (Prior Art)



REPLACEMENT SHEET

Fig. 16 (Prior Art)

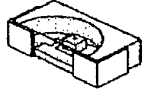


Fig. 17 (Prior Art)

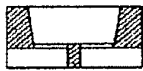
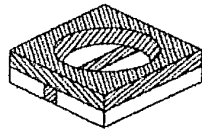
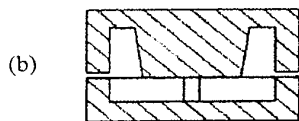
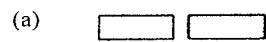


Fig. 18 (Prior Art)



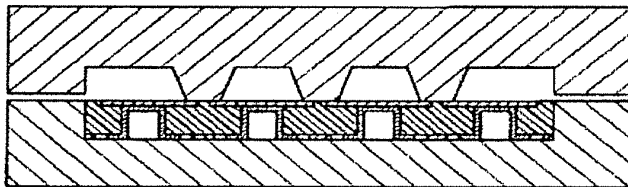
REPLACEMENT SHEET

Fig. 19 (Prior Art)

(a)



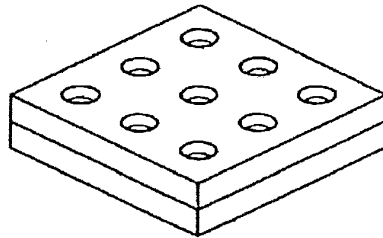
(b)



(c)



(d)



Electronic Acknowledgement Receipt

EFS ID:	26851641
Application Number:	14928570
International Application Number:	
Confirmation Number:	9668
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/Shiho Vitale
Filer Authorized By:	Chase J. Brill
Attorney Docket Number:	100415-0199
Receipt Date:	07-SEP-2016
Filing Date:	30-OCT-2015
Time Stamp:	11:46:08
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no
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File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		100415_199ReplacementDrawings.pdf	58175 f0efb09e647d2a4f01bed7bde71f22ecee0f2023	yes	5

Multipart Description/PDF files in .zip description			
Document Description		Start	End
Transmittal Letter		1	2
Drawings-only black and white line drawings		3	5
Warnings:			
Information:			
Total Files Size (in bytes):		58175	
<p>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.</p> <p><u>New Applications Under 35 U.S.C. 111</u> 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.</p> <p><u>National Stage of an International Application under 35 U.S.C. 371</u> 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.</p> <p><u>New International Application Filed with the USPTO as a Receiving Office</u> 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.</p>			

Substitute for form 1449/PTO INFORMATION DISCLOSURE STATEMENT BY APPLICANT Date Submitted: September 29, 2016 <i>(use as many sheets as necessary)</i>				Complete if Known	
				Application Number	14/928,570
Sheet 1 of 1				Filing Date	10/30/2015
				First Named Inventor	Hirofumi ICHIKAWA
				Art Unit	2895
				Examiner Name	Caridad EVERHART
				Attorney Docket Number	100415-0199

U.S. PATENT DOCUMENTS					
Examiner Initials*	Cite No. ¹	Document Number	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
		Number-Kind Code ² (if known)			
	C1	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	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
		Serial Number-Kind Code ² (if known)			

FOREIGN PATENT DOCUMENTS						
Examiner Initials*	Cite No. ¹	Foreign Patent Document	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
		Country Code ³ Number ⁴ - Kind Code ⁵ (if known)				
	C2	JP-2004-111964-A	04-08-2004	AGILENT TECHNOLOGIES INC	= C1	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
	C3	Office Action issued in Japanese Patent Application No. 2015-200794 mailed September 13, 2016.	

Examiner Signature		Date Considered	
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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

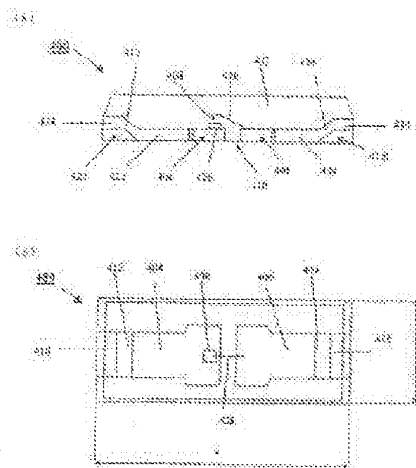
Application number: JP20030316609 20030909

Priority number(s): MY2002PI03479 20020918

Also published as: US2004051171 (A1) US6879040 (B2) DE10340069 (A1) DE10340069 (B4)

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

H01L 33/00

F I

H01L 33/00

N

テーマコード(参考)

5FO41

審査請求 未請求 請求項の数 10 O L (全 18 頁)

<p>(21) 出願番号 特願2003-316609 (P2003-316609)</p> <p>(22) 出願日 平成15年9月9日(2003. 9. 9)</p> <p>(31) 優先権主張番号 PI20023479</p> <p>(32) 優先日 平成14年9月18日(2002. 9. 18)</p> <p>(33) 優先権主張国 マレーシア(MY)</p>	<p>(71) 出願人 399117121 アジレント・テクノロジーズ・インク AGILENT TECHNOLOGIE S. 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 395 395 Page Mill Road Palo Alto, Californi a U. S. A.</p> <p>(74) 代理人 100105913 弁理士 加藤 公久</p> <p>(72) 発明者 エヌ・ジー・キー・ヤーン マレーシア 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</p>
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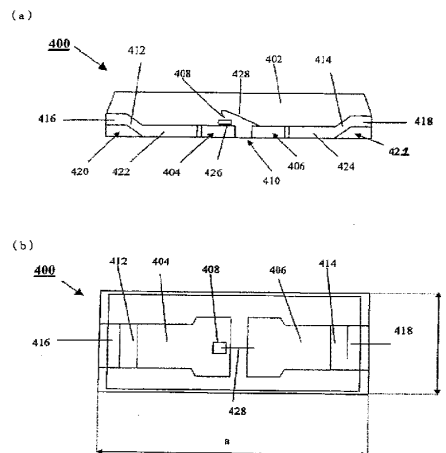
(54) 【発明の名称】 表面実装型電子デバイス

(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)の少なくとも一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。

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【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。

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【請求項 6】

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。

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【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。

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【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

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、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(AIInGaP)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くらい、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108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から発せら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106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208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 of 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 $a \times b$ 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ふ。

【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 PCB 800 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ふ。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ふのである。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

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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。

【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】

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】

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、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、ごごり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

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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の部分の設ける場合、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、電気接触部材に電氣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氣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氣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。實際上、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出来る。このことは、デバイスを比

較的狭ビ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。

【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それぞ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、シ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ならず、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。

【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氣的に接続している。

【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。

【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。

【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、8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

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つずつ形成されている。各接触部材の残りの部分は第2の部分522、524、525である。

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【0049】

LED508、509は両方とも主要接触部材504の前側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。

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【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がっている。

【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。

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【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いる。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ぞれが本体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

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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の部分の外表面が固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。

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【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。

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【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ぞれ自体が本体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。

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【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。

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【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

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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(a)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。

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【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。

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【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。

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【0062】

第6の実施形態900を図9(a)及び(b)に示した。これは図5(a)、(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。

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【0063】

よって図5(a)及び(b)、図9(a)及び(b)の実施形態との違いは、各接触部

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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。

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【0065】

図10は、図5(a)、(b)の実施形態の使用中的側面図である。図11は、図7(a)、(b)の実施形態の使用中的側面図である。図12は、図9(a)、(b)の実施形態の使用中的側面図である。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的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により電氣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。

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【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と直接電氣的に接触している。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。

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【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へと電氣的、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。更に明らかのように、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へと電氣的、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。

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【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氣的、粘着的に接続している。はんだフィレット932、934は水

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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ならず、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8に示したレイと比較すると、デバイスはより緊密に実装されており、ピッチは図8におけるピッチよりも小さく、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事が可能となる。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、相應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、8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ことを示した。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ない。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形状の表面を持っていても、或いはパターン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。

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【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。

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【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ようように助けます。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。

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【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。

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【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。

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【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4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5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6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

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ひ上面図である。

【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4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6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】

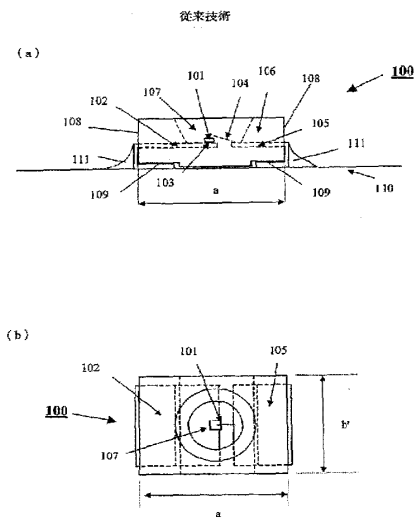
【0087】

10 フリント回路基板
 12、14 フ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
 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

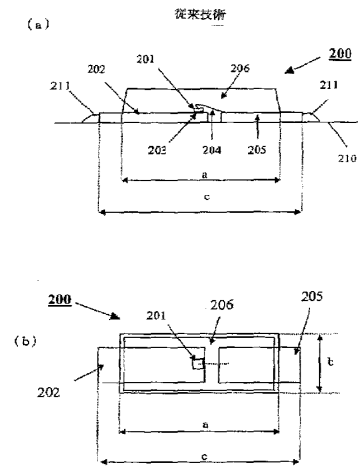
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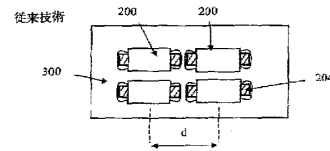
【図 1】



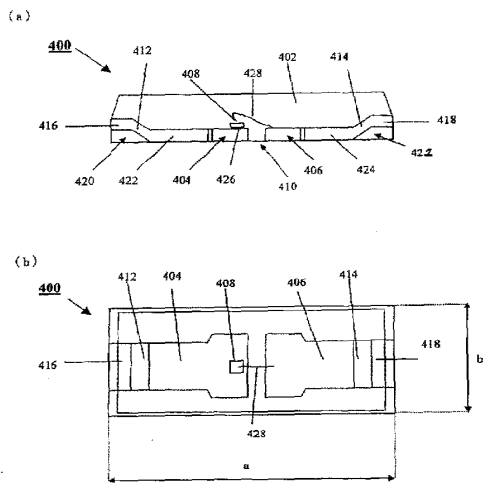
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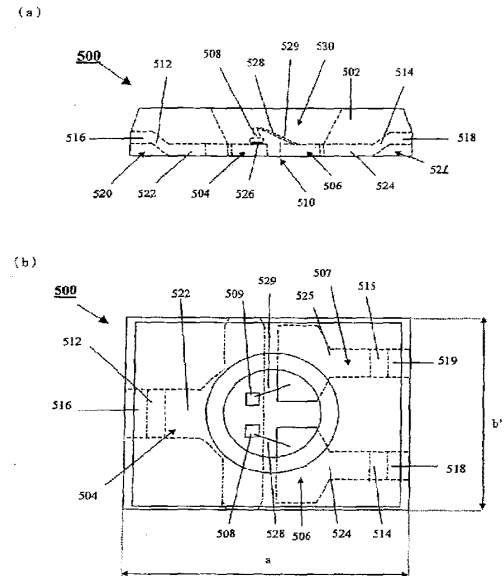
【図 3】



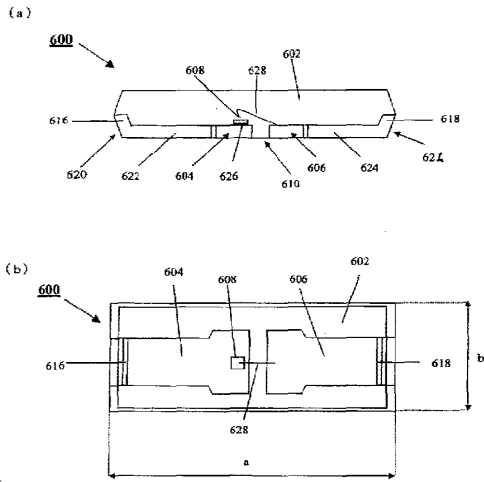
【図 4】



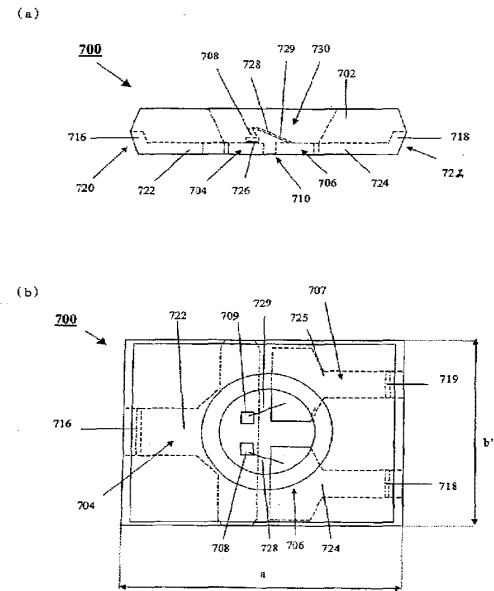
【図 5】



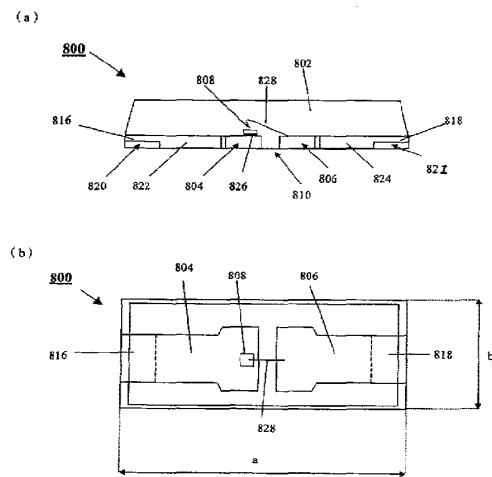
【 図 6 】



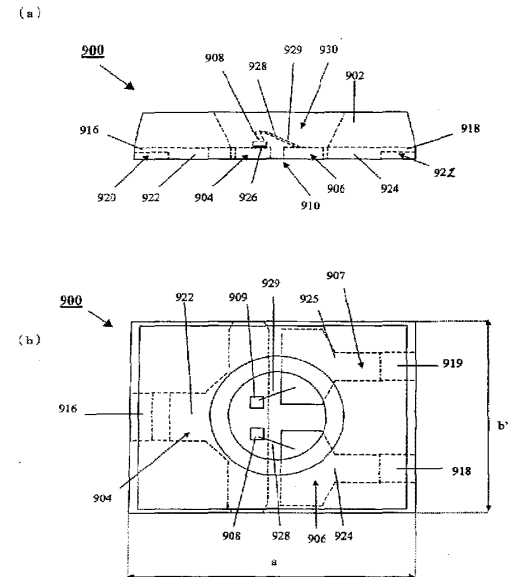
【 図 7 】



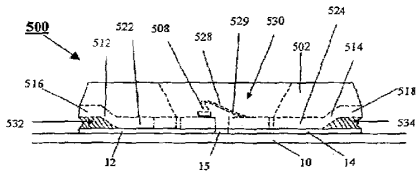
【 図 8 】



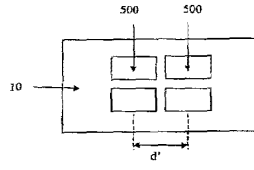
【 図 9 】



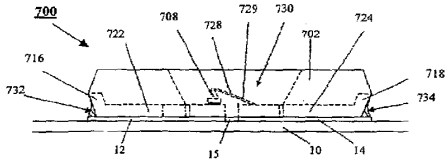
【図10】



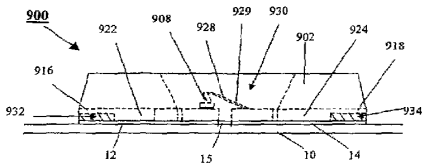
【図13】



【図11】



【図12】



フロントページの続き

(72)発明者 ガーバー・シン

マレーシア ペナン アイランド・パーク ソロック・ベシ 1 1

Fターム(参考) 5F041 AA31 DA07 DA12 DA13 DA61 DA88

Electronic Patent Application Fee Transmittal				
Application Number:	14928570			
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:	100415-0199			
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

Electronic Acknowledgement Receipt

EFS ID:	27077138
Application Number:	14928570
International Application Number:	
Confirmation Number:	9668
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:	100415-0199
Receipt Date:	29-SEP-2016
Filing Date:	30-OCT-2015
Time Stamp:	16:33:15
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Credit Card
Payment was successfully received in RAM	\$180
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			3490d633fd2a7cb5e0220aa8a81be854a0f2190a		
Warnings:					
Information:					
2	Information Disclosure Statement (IDS) Form (SB08)	100415-0199_IDS_SB08_C.pdf	90877	no	1
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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.

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.: 14/928,570
Filing Date: 10/30/2015
Examiner: Caridad EVERHART
Art Unit: 2895
Confirmation No.: 9668

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.

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; 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 C1 is an English-language counterpart of foreign-language document C2. An English-language abstract is also provided for foreign-language document C2.

Foreign-language document C2 was cited during the prosecution of a corresponding Japanese patent application. The Japanese Office Action is cited as document C3 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/

FOLEY & LARDNER LLP
Customer Number: 22428
Telephone: (202) 295-4787
Facsimile: (202) 672-5399

Chase J. Brill
Attorney for Applicant
Registration No. 61,378

PART B - FEE(S) TRANSMITTAL

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

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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.
14/928,570	10/30/2015	Hirofumi ICHIKAWA	100415-0199	9668

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

APPL. 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	11/07/2016

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

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).
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Authorized Signature /Chase J. Brill/ Date October 3, 2016
 Typed or printed name Chase J. Brill Registration No. 61,378

Electronic Patent Application Fee Transmittal				
Application Number:	14928570			
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:	100415-0199			
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:	27104806
Application Number:	14928570
International Application Number:	
Confirmation Number:	9668
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:	100415-0199
Receipt Date:	03-OCT-2016
Filing Date:	30-OCT-2015
Time Stamp:	16:24:34
Application Type:	Utility under 35 USC 111(a)

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			3beff2d146a2a98c2a3678b7e92154c4cb2f0e14		
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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
14/928,570	10/30/2015	Hirofumi ICHIKAWA	100415-0199	9668
22428	7590	10/12/2016	EXAMINER	
Foley & Lardner LLP 3000 K STREET N.W. SUITE 600 WASHINGTON, DC 20007-5109			EVERHART, CARIDAD	
			ART UNIT	PAPER NUMBER
			2895	
			NOTIFICATION DATE	DELIVERY MODE
			10/12/2016	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. 14/928,570	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 5/4/2016.
 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 1-15 and 18-26. 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. <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 5. <input type="checkbox"/> Examiner's Amendment/Comment |
| 2. <input checked="" type="checkbox"/> Information Disclosure Statements (PTO/SB/08),
Paper No./Mail Date _____ | 6. <input checked="" type="checkbox"/> Examiner's Statement of Reasons for Allowance |
| 3. <input type="checkbox"/> Examiner's Comment Regarding Requirement for Deposit
of Biological Material | 7. <input type="checkbox"/> Other _____. |
| 4. <input type="checkbox"/> Interview Summary (PTO-413),
Paper No./Mail Date _____. | |

	/Caridad Everhart/ Primary Examiner AU 2895
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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 resin part and at least a portion of an outer lateral surface of the metal part are coplanar at an outer lateral surface 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). 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 both a part of the metal part and a part of the resin part are disposed in a region below an upper surface of the metal part on 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 0008) which is a polyimide in an embodiment (paragraph 0021) and Sorg et al also discloses that it is not desirable to have encapsulation

Art Unit: 2895

material on the underside of the leadframe (paragraph 0060), which is a disclosure that it is not desirable to have encapsulation material below the upper surface of the metal part . 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 "both a part of the metal part and a part of the resin part are disposed in a region below an upper surface of the metal part , on 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.

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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. 14/928,570	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.	H01L21/4846
Q					
R					
S					
T					

NON-PATENT DOCUMENTS

*	Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
U	Translation of JP2007-235085A (Urasaki) 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

特開2007-235085
(P2007-235085A)

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HO 1 L 33/00 (2006. 01) HO 1 L 33/00 N 5 F O 4 1

審査請求 未請求 請求項の数 10 O L (全 13 頁)

(21) 出願番号	特願2006-198489 (P2006-198489)	(71) 出願人	000004455 日立化成工業株式会社 東京都新宿区西新宿2丁目1番1号
(22) 出願日	平成18年7月20日 (2006. 7. 20)	(74) 代理人	100083806 弁理士 三好 秀和
(31) 優先権主張番号	特願2006-26961 (P2006-26961)	(74) 代理人	100100712 弁理士 岩▲崎▼ 幸邦
(32) 優先日	平成18年2月3日 (2006. 2. 3)	(74) 代理人	100100929 弁理士 川又 澄雄
(33) 優先権主張国	日本国 (JP)	(74) 代理人	100095500 弁理士 伊藤 正和
		(74) 代理人	100101247 弁理士 高橋 俊一
		(74) 代理人	100098327 弁理士 高松 俊雄

最終頁に続く

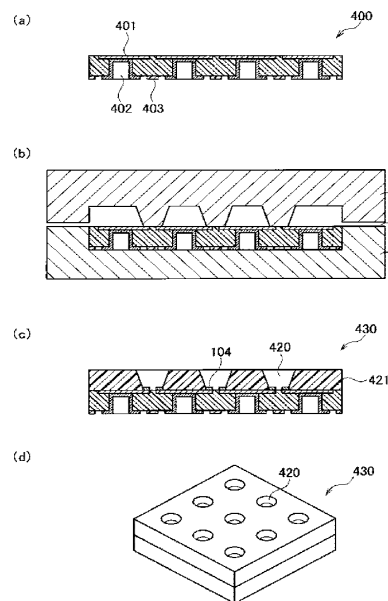
(54) 【発明の名称】 光半導体素子搭載用パッケージ基板の製造方法およびこれを用いた光半導体装置の製造方法

(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。

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【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。

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【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。

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【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。

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【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】

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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、基板上的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

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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

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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。

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【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。

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【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、トリー-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、十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。

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【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】

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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1~50 μ mの範囲にあることが好ましい。平均粒径が1 μ m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、50 μ m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

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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、はんだパンプ 107 等の公知の方法で電氣的に接続した後、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
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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 0.6 mm 及び銅箔厚さ 18 μ m 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 (口立化成工業 (株) 製、商品名) に、穴あけ、無電解め
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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 $^{\circ}$ C、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- α , α -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 20 μ m)

600 重量部

アルミナ (平均粒径 1 μ m)

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 27
 μ m)

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 $^{\circ}$ C、90 秒
間、6.9 MPa の条件でトランスファー成型機 (藤和精機 (株) 製、TEP150) に
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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°C 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素子と端子を電氣的に接続した後、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°C 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。

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【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。

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【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 $100\sim 220^\circ\text{C}$ 、射出圧力 $490\sim 1120\text{kg}/\text{cm}^2$ 、保持時間 $10\sim 40$ 秒、背圧 $7\sim 70\text{kg}/\text{cm}^2$ 、サイクル時間 $20\sim 60$ 秒、押出器ノズル温度 $330\sim 360^\circ\text{C}$ 、バレル先端温度 $320\sim 350^\circ\text{C}$ 、スクリー回転速度 $20\sim$

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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により一体化し、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

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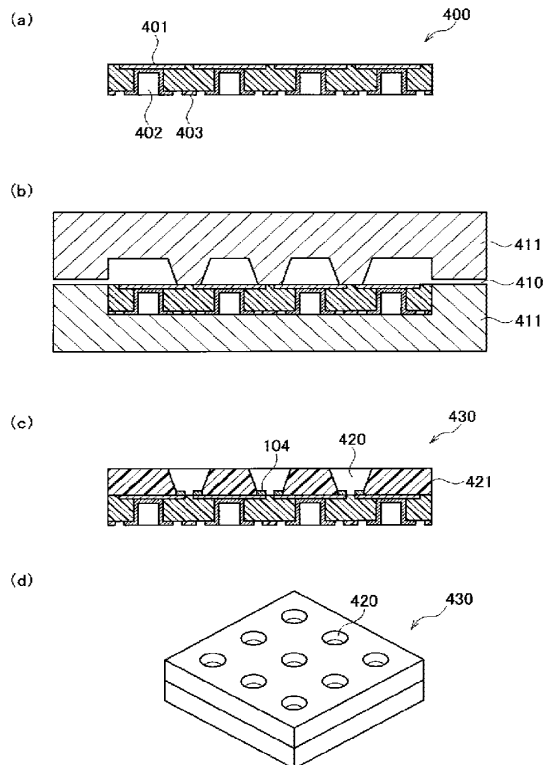
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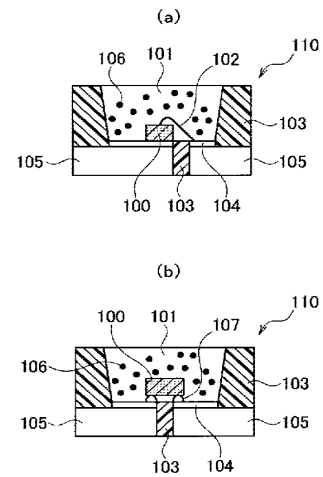
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- 1 0 2 ボンディングワイヤ
- 1 0 3 リフレクター
- 1 0 4 N i / A g めっき
- 1 0 5 金属配線
- 1 0 6 蛍光体
- 1 0 7 はんだバンプ
- 1 1 0 光半導体装置
- 4 0 0 プリント配線板
- 4 0 1 金属配線
- 4 0 2 層間接続穴
- 4 0 3 ソルダーレジスト
- 4 1 0 樹脂注入口
- 4 1 1 金型
- 4 2 0 凹部（光半導体素子搭載領域）
- 4 2 1 光反射用熱硬化性樹脂硬化物（リフレクター）
- 4 3 0 マトリックス状の光半導体素子搭載用パッケージ基板

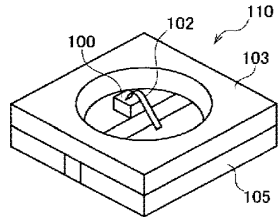
【図 1】



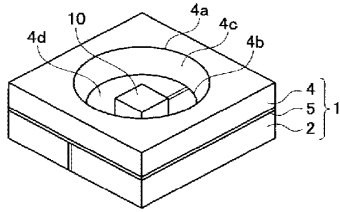
【図 2】



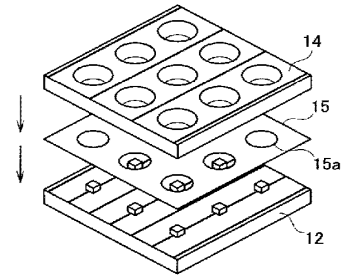
【 図 3 】



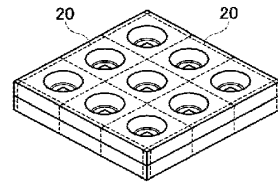
【 図 4 】



【 図 5 】



【 図 6 】



フロントページの続き

(72)発明者 浦崎 直之

茨城県つくば市和台4-8 日立化成工業株式会社先端材料研究所内

Fターム(参考) 5F041 AA03 AA42 DA20 DA74 DA78

DERWENT- 2007-757639
ACC-NO:
DERWENT- 201345
WEEK:

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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:

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JP 2007235085 A	September 13, 2007	JA
JP 5232369 B2	July 10, 2013	JA

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PUB-NO	APPL-DESCRIPTOR	APPL-NO	APPL-DATE
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JP 5232369B2	Previous Publ	2006JP-198489	July 20, 2006

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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;

Substitute for form 1449/PTO		Complete if Known	
INFORMATION DISCLOSURE STATEMENT BY APPLICANT		Application Number	14/928,570
Date Submitted: September 29, 2016		Filing Date	10/30/2015
<i>(use as many sheets as necessary)</i>		First Named Inventor	Hirofumi ICHIKAWA
		Art Unit	2895
		Examiner Name	Caridad EVERHART
Sheet	1	Attorney Docket Number	100415-0199
	of		1

U.S. PATENT DOCUMENTS						
Examiner Initials*	Cite No. ¹	Document Number		Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
		Number-Kind Code ² (if known)				
/C.E./	C1	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		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
		Serial Number-Kind Code ² (if known)				

FOREIGN PATENT DOCUMENTS							
Examiner Initials*	Cite No. ¹	Foreign Patent Document		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
		Country Code ³	Number ⁴ -Kind Code ⁵ (if known)				
/C.E./	C2	JP	2004-111964-A	04-08-2004	AGILENT TECHNOLOGIES INC	= C1	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./	C3	Office Action issued in Japanese Patent Application No. 2015-200794 mailed September 13, 2016.	

Examiner Signature	/CARIDAD EVERHART/	Date Considered	10/05/2016
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Foley & Lardner LLP
3000 K STREET N.W.
SUITE 600
WASHINGTON, DC 20007-5109

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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.

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 OBTAIN A DOUBLE PATENTING REJECTION OVER A "PRIOR" PATENT	
Application Number	14928570	
Filing Date	30-Oct-2015	
First Named Inventor	Hirofumi ICHIKAWA	
Attorney Docket Number	100415-0199	
Title of Invention	LIGHT EMITTING DEVICE, RESIN PACKAGE, RESIN-MOLDED BODY, AND METHODS FOR MANUFACTURING LIGHT EMITTING DEVICE, RESIN PACKAGE AND RESIN-MOLDED BODY	
<input checked="" type="checkbox"/> Filing of terminal disclaimer does not obviate requirement for response under 37 CFR 1.111 to outstanding Office Action <input checked="" type="checkbox"/> This electronic Terminal Disclaimer is not being used for a Joint Research Agreement.		
Owner	Percent Interest	
NICHIA CORPORATION	100%	
<p>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)</p> <p>9287476 8530250</p> <p>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.</p> <p>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:</p> <ul style="list-style-type: none"> - 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:	14928570			
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:	100415-0199			
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.: 14928570

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:	27313010
Application Number:	14928570
International Application Number:	
Confirmation Number:	9668
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:	100415-0199
Receipt Date:	26-OCT-2016
Filing Date:	30-OCT-2015
Time Stamp:	15:34:42
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	102716INTEFSW15344000
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	33667	no	2
			e85ceea883eaa18dbe322db4577d9154285eacbd		
Warnings:					
Information:					
2	Fee Worksheet (SB06)	fee-info.pdf	31097	no	2
			dea337383f3b02a167e4bcf248bd13221ce89621		
Warnings:					
Information:					
Total Files Size (in bytes):			64764		
<p>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.</p> <p><u>New Applications Under 35 U.S.C. 111</u> 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.</p> <p><u>National Stage of an International Application under 35 U.S.C. 371</u> 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.</p> <p><u>New International Application Filed with the USPTO as a Receiving Office</u> 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.</p>					



Ifw

Atty. Dkt. No. 100415-0199

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.: 14/928,570

Filing Date: 10/30/2015

Examiner: Caridad EVERHART

Art Unit: 2895

Confirmation Number: 9668

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 12, 2016.

On pages 2-3 of the Supplemental Notice of Allowability under “Reasons for Allowance,” the Office provides a statement of reasons for allowance. Applicant thanks the Examiner for the Notice of Allowance. In response, Applicant stresses 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 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 an outer lateral surface 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, Applicant hereby petitions for such extension under 37 C.F.R. §1.136 and authorizes payment of any such extensions fees to Deposit Account No. 19-0741.

Respectfully submitted,

Date November 7, 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
Patent. No.: 9,490,411
Issue Date: 11/8/2016
Examiner: Caridad EVERHART
Art Unit: 2895
Confirmation Number: 9668

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 9,490,411 issued November 8, 2016.

Please make the follow corrections:

On the Front of the Patent

The “(*) Notice ” section is incomplete. This patent is subject to a terminal disclaimer. An electronic terminal disclaimer was filed and approved by EFS-Web on October 26, 2016.

In the Specification

The exact column and line number(s) where the errors in the issued patent are shown correctly in the application are:

Column 6, Line 64

Please replace “scaling member” with --sealing member--.

Column 7, Line 17

Please replace “singualtion” with --singulation--.

Column 11, Line 1

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 13, Lines 36-37

Please replace “resin-molded body 2,1” with --resin-molded body 24--.

Column 14, Line 8

Please replace “hole pads” with --hole parts--.

Column 14, Lines 44-45

Please replace “when singualtion is performed using a singualtion saw” with --when singulation is performed using a singulation saw--.

Column 15, Line 12

Please replace “singualtion saw” with --singulation saw--.

Column 15, Line 14

Please replace “singualtion saw” with --singulation saw--.

Column 15, Line 56

Please replace “114” with -- $\frac{1}{4}$ --.

Column 16, Line 44

Please replace “resin part a25” with --resin part 325--.

Column 17, Line 47

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 December 9, 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

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)

**UNITED STATES PATENT AND TRADEMARK OFFICE
CERTIFICATE OF CORRECTION**

PATENT NO. : 9,490,411
APPLICATION NO. : 14/928,570
DATED : 11/8/2016
INVENTORS : 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:

On the Front of the Patent

The "(*) Notice" section is incomplete. This patent is subject to a terminal disclaimer.

In the Specification

Column 6, Line 64

Please replace "scaling member" with --sealing member--.

Column 7, Line 17

Please replace "singualtion" with --singulation--.

Column 11, Line 1

Please replace " $M_{p/2}Si_{12p-q}Al_{p+q}O_qN_{16-p}:Ce$ or M-Al-Si-O-N" with -- $M_{p/2}Si_{12p-q}Al_{p+q}O_qN_{16-p}:Ce$ or M-Al-Si-O-N--.

Column 13, Line 37

Please replace "resin-molded body 2,1" with --resin-molded body 24--.

Column 14, Line 8

Please replace "hole pads" with --hole parts--.

Column 14, Lines 44-45

Please replace "when singualtion is performed using a singualtion saw" with --when singulation is performed using a singulation saw--.

Column 15, Line 12

Please replace "singualtion saw" with --singulation saw--.

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 15, Line 14

Please replace "singualtion saw" with --singulation saw--.

Column 15, Line 56

Please replace "114" with --1/4--.

Column 16, Line 44

Please replace "resin part a25" with --resin part 325--.

Column 17, Line 47

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.

Electronic Patent Application Fee Transmittal				
Application Number:	14928570			
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:	100415-0199			
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:	27751823
Application Number:	14928570
International Application Number:	
Confirmation Number:	9668
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:	100415-0199
Receipt Date:	09-DEC-2016
Filing Date:	30-OCT-2015
Time Stamp:	16:42:55
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	121216INTEFSW16431500
Deposit Account	
Authorized User	

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

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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	100415-0199_Request_for_CO C.pdf	106942	no	3
			5449e1181dc07932028ff04adf6ee54f564bcae1		

Warnings:

Information:

2	Request for Certificate of Correction	100415-0199_COC.pdf	77428	no	2
			30d53aed137dc3892152d8a06d9c100afc5d1e2e		

Warnings:

Information:

3	Fee Worksheet (SB06)	fee-info.pdf	30679	no	2
			62cb8f41b7530c3606229cec3d7280c39636fb4		

Warnings:

Information:

Total Files Size (in bytes):	215049
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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.

UNITED STATES PATENT AND TRADEMARK OFFICE
CERTIFICATE OF CORRECTION

PATENT NO. : 9,490,411 B2
APPLICATION NO. : 14/928570
DATED : November 8, 2016
INVENTOR(S) : Hirofumi Ichikawa et al.

Page 1 of 2

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

On the Title Page

The “(*) Notice” section is incomplete. Add: This patent is subject to a terminal disclaimer.

In the Specification

Column 6, Line 64

Please replace “scaling member” with --sealing member--.

Column 7, Line 17

Please replace “singualtion” with --singulation--.

Column 11, Line 1

Please replace “ $M_{p/2}Si_{12p-q}Al_{p+q}O_qN_{16-p};Ce$ or M-Al-Si-O-N” with
-- $M_{p/2}Si_{12p-q}Al_{p+q}O_qN_{16-p};Ce$ or M-Al-Si-O-N--.

Column 13, Line 37

Please replace “resin-molded body 2,1” with --resin-molded body 24--.

Column 14, Line 8

Please replace “hole pads” with --hole parts--.

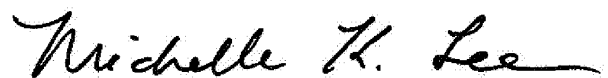
Column 14, Lines 44-45

Please replace “when singualtion is performed using a singualtion saw” with --when
singulation is performed using a singulation saw--.

Column 15, Line 12

Please replace “singualtion saw” with --singulation saw--.

Signed and Sealed this
Thirty-first Day of January, 2017



Michelle K. Lee
Director of the United States Patent and Trademark Office

CERTIFICATE OF CORRECTION (continued)
U.S. Pat. No. 9,490,411 B2

Page 2 of 2

Column 15, Line 14

Please replace "singualtion saw" with --singulation saw--.

Column 15, Line 56

Please replace "114" with --¼--.

Column 16, Line 44

Please replace "resin part a25" with --resin part 325--.

Column 17, Line 47

Please replace "are shape" with --arc shape--.

AO 120 (Rev. 08/10)

TO: Mail Stop 8 Director of the U.S. Patent and Trademark Office P.O. Box 1450 Alexandria, VA 22313-1450	REPORT ON THE FILING OR DETERMINATION OF AN ACTION REGARDING A PATENT OR TRADEMARK
---	---

In Compliance with 35 U.S.C. § 290 and/or 15 U.S.C. § 1116 you are hereby advised that a court action has been filed in the U.S. District Court Eastern District of Texas, Marshall Division on the following

Trademarks or Patents. (the patent action involves 35 U.S.C. § 292.);

DOCKET NO. 2:16-cv-1452	DATE FILED 12/27/2016	U.S. DISTRICT COURT Eastern District of Texas, Marshall Division
PLAINTIFF NICHIA CORPORATION		DEFENDANT TCL MULTIMEDIA TECHNOLOGY HOLDINGS LIMITED and TTE TECHNOLOGY, INC.
PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1 9,490,411	11/8/2016	NICHIA CORPORATION
2		
3		
4		
5		

In the above—entitled case, the following patent(s)/ trademark(s) have been included:

DATE INCLUDED	INCLUDED BY <input type="checkbox"/> Amendment <input type="checkbox"/> Answer <input type="checkbox"/> Cross Bill <input type="checkbox"/> Other Pleading	
PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1		
2		
3		
4		
5		

In the above—entitled case, the following decision has been rendered or judgement issued:

DECISION/JUDGEMENT

CLERK	(BY) DEPUTY CLERK	DATE
-------	-------------------	------

Copy 1—Upon initiation of action, mail this copy to Director Copy 3—Upon termination of action, mail this copy to Director
 Copy 2—Upon filing document adding patent(s), mail this copy to Director Copy 4—Case file copy

AO 120 (Rev. 08/10)

TO: Mail Stop 8 Director of the U.S. Patent and Trademark Office P.O. Box 1450 Alexandria, VA 22313-1450	REPORT ON THE FILING OR DETERMINATION OF AN ACTION REGARDING A PATENT OR TRADEMARK
---	---

In Compliance with 35 U.S.C. § 290 and/or 15 U.S.C. § 1116 you are hereby advised that a court action has been filed in the U.S. District Court Eastern District of Texas, Marshall Division on the following

Trademarks or Patents. (the patent action involves 35 U.S.C. § 292.);

DOCKET NO. 2:16-cv-1453	DATE FILED 12/27/2016	U.S. DISTRICT COURT Eastern District of Texas, Marshall Division
PLAINTIFF NICHIA CORPORATION		DEFENDANT VIZIO, INC.
PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1 9,490,411	11/8/2016	NICHIA CORPORATION
2		
3		
4		
5		

In the above—entitled case, the following patent(s)/ trademark(s) have been included:

DATE INCLUDED	INCLUDED BY <input type="checkbox"/> Amendment <input type="checkbox"/> Answer <input type="checkbox"/> Cross Bill <input type="checkbox"/> Other Pleading		
PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK	
1			
2			
3			
4			
5			

In the above—entitled case, the following decision has been rendered or judgement issued:

DECISION/JUDGEMENT

CLERK	(BY) DEPUTY CLERK	DATE
-------	-------------------	------

Copy 1—Upon initiation of action, mail this copy to Director Copy 3—Upon termination of action, mail this copy to Director
 Copy 2—Upon filing document adding patent(s), mail this copy to Director Copy 4—Case file copy

AO 120 (Rev. 08/10)

TO: Mail Stop 8 Director of the U.S. Patent and Trademark Office P.O. Box 1450 Alexandria, VA 22313-1450	REPORT ON THE FILING OR DETERMINATION OF AN ACTION REGARDING A PATENT OR TRADEMARK
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In Compliance with 35 U.S.C. § 290 and/or 15 U.S.C. § 1116 you are hereby advised that a court action has been filed in the U.S. District Court Eastern District of Texas, Marshall Division on the following

Trademarks or Patents. (the patent action involves 35 U.S.C. § 292.);

DOCKET NO. 2:16-cv-1454	DATE FILED 12/27/2016	U.S. DISTRICT COURT Eastern District of Texas, Marshall Division
PLAINTIFF NICHIA CORPORATION		DEFENDANT FEIT ELECTRIC COMPANY, INC.
PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1 9,490,411	11/8/2016	NICHIA CORPORATION
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In the above—entitled case, the following patent(s)/ trademark(s) have been included:

DATE INCLUDED	INCLUDED BY	
	<input type="checkbox"/> Amendment <input type="checkbox"/> Answer <input type="checkbox"/> Cross Bill <input type="checkbox"/> Other Pleading	
PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
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In the above—entitled case, the following decision has been rendered or judgement issued:

DECISION/JUDGEMENT

CLERK	(BY) DEPUTY CLERK	DATE
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Copy 1—Upon initiation of action, mail this copy to Director Copy 3—Upon termination of action, mail this copy to Director
 Copy 2—Upon filing document adding patent(s), mail this copy to Director Copy 4—Case file copy

AO 120 (Rev. 08/10)

TO: Mail Stop 8 Director of the U.S. Patent and Trademark Office P.O. Box 1450 Alexandria, VA 22313-1450	REPORT ON THE FILING OR DETERMINATION OF AN ACTION REGARDING A PATENT OR TRADEMARK
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DOCKET NO. 2:16-cv-1455	DATE FILED 12/27/2016	U.S. DISTRICT COURT Eastern District of Texas, Marshall Division
PLAINTIFF NICHIA CORPORATION		DEFENDANT LOWE'S HOME CENTERS, LLC and L G SOURCING, INC.
PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1 9,490,411	11/8/2016	NICHIA CORPORATION
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DOCKET NO. 2:16-cv-1454	DATE FILED 12/27/2016	U.S. DISTRICT COURT Eastern District of Texas, Marshall Division
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DOCKET NO. 2:16-cv-1453	DATE FILED 12/27/2016	U.S. DISTRICT COURT Eastern District of Texas, Marshall Division
PLAINTIFF NICHIA CORPORATION		DEFENDANT VIZIO, INC.
PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1 9,490,411	11/8/2016	NICHIA CORPORATION
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 Trademarks or Patents. (the patent action involves 35 U.S.C. § 292.);

DOCKET NO. 2:16-cv-1452	DATE FILED 12/27/2016	U.S. DISTRICT COURT Eastern District of Texas, Marshall Division
PLAINTIFF NICHIA CORPORATION		DEFENDANT TCL MULTIMEDIA TECHNOLOGY HOLDINGS LIMITED and TTE TECHNOLOGY, INC.
PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1 9,490,411	11/8/2016	NICHIA CORPORATION
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