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 Central District of California on the following

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

DOCKET NO.	DATE FILED March 23, 2016	U.S. DISTRICT COURT Central District of California
PLAINTIFF Nichia Corporation		DEFENDANT VIZIO, Inc.

PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1 7,901,959	March 8, 2011	Nichia Corporation
2 7,915,631	March 29, 2011	Nichia Corporation
3 8,309,375	November 13, 2012	Nichia Corporation
4 7,855,092	December 21, 2010	Nichia Corporation
5		

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

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

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 Central District of California on the following

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

DOCKET NO.	DATE FILED	U.S. DISTRICT COURT
SACV15-1963-DMG-KESx	11/23/2015	Central District of California

PLAINTIFF	DEFENDANT
VIZIO, Inc.	Vizo, Inc.

	PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1	4621356	10/14/2014	VIZIO, Inc.
2	4053025	11/8/2011	VIZIO, Inc.
3	3235417	4/24/2007	VIZIO, Inc.
4	4369035	7/16/2013	VIZIO, Inc.
5			

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

DATE INCLUDED	INCLUDED BY ☐ Amendment ☐ Answer ☐ Cross Bill ☐ 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
Plaintiff's Notice of Dismissal Pursuant to Federal Rules of Civil Procedure 41(a) or (c) filed 3/21/2016.

CLERK	(BY) DEPUTY CLERK	DATE
KIRY K. GRAY	G. Kami	3/23/2016

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

UNITED STATES PATENT AND TRADEMARK OFFICE

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

APPLICATION NO.	ISSUE DATE	PATENT NO.	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/548,618	03/29/2011	7915631	0020-5147PUS5	7447

2292 7590 03/09/2011

BIRCH STEWART KOLASCH & BIRCH
PO BOX 747
FALLS CHURCH, VA 22040-0747

ISSUE NOTIFICATION

The projected patent number and issue date are specified above.

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

The Patent Term Adjustment is 90 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):

Yoshinori SHIMIZU, Naka-gun, JAPAN;
Kensho Sakano, Anan-shi, JAPAN;
Yasunobu Noguchi, Naka-gun, JAPAN;
Toshio Moriguchi, Anan-shi, JAPAN;

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)

2292 7590 01/25/2011

BIRCH STEWART KOLASCH & BIRCH, LLP
PO BOX 747
FALLS CHURCH, VA 22040-0747

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.
12/548,618	08/27/2009	Yoshinori SHIMIZU	0020-5147PUS5	7447

TITLE OF INVENTION: LIGHT EMITTING DEVICE AND DISPLAY

APPLN. TYPE	SMALL ENTITY	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	NO	$1510	$300	$0	$1810	04/25/2011

EXAMINER	ART UNIT	CLASS-SUBCLASS
TRINH, MICHAEL MANH	2822	257-098000

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

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

1 Birch Stewart Kolasch & Birch, LLP
2
3

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

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

(A) NAME OF ASSIGNEE: NICHIA CORPORATION

(B) RESIDENCE: (CITY and STATE OR COUNTRY): Anan-shi, JAPAN

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

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

4b. Payment of Fee(s): **(Please first reapply any previously paid issue fee shown above)**
- ☐ A check is enclosed.
- ☐ Payment by credit card. Form PTO-2038 is attached.
- ☒ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment, to Deposit Account Number 02-2448 (enclose an extra copy of this form).

5. **Change in Entity Status** (from status indicated above)
- ☐ a. Applicant claims SMALL ENTITY status. See 37 CFR 1.27.
- ☐ b. Applicant is no longer claiming SMALL ENTITY status. See 37 CFR 1.27(g)(2).

NOTE: The Issue Fee and Publication Fee (if required) will not be accepted from anyone other than the applicant; a registered attorney or agent; or the assignee or other party in interest as shown by the records of the United States Patent and Trademark Office.

Authorized Signature _____ Date February 22, 2011

Typed or printed name D. Richard Anderson Registration No. 40,439

This collection of information 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.

Electronic Patent Application Fee Transmittal	
Application Number:	12548618
Filing Date:	27-Aug-2009
Title of Invention:	LIGHT EMITTING DEVICE AND DISPLAY
First Named Inventor/Applicant Name:	Yoshinori SHIMIZU
Filer:	David Richard Anderson/Nadine Beasley
Attorney Docket Number:	0020-5147PUS5
Filed as Large Entity	

Utility under 35 USC 111(a) Filing Fees

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	1510	1510
Publ. Fee- early, voluntary, or normal	1504	1	300	300

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Extension-of-Time:				
Miscellaneous:				
			Total in USD ($)	1810

Electronic Acknowledgement Receipt	
EFS ID:	9493791
Application Number:	12548618
International Application Number:	
Confirmation Number:	7447
Title of Invention:	LIGHT EMITTING DEVICE AND DISPLAY
First Named Inventor/Applicant Name:	Yoshinori SHIMIZU
Customer Number:	02292
Filer:	David Richard Anderson/Nadine Beasley
Filer Authorized By:	David Richard Anderson
Attorney Docket Number:	0020-5147PUS5
Receipt Date:	22-FEB-2011
Filing Date:	27-AUG-2009
Time Stamp:	15:56:47
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Deposit Account
Payment was successfully received in RAM	$1810
RAM confirmation Number	2621
Deposit Account	022448
Authorized User	
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows: Charge any Additional Fees required under 37 C.F.R. Section 1.19 (Document supply fees) Charge any Additional Fees required under 37 C.F.R. Section 1.20 (Post Issuance fees)	

Charge any Additional Fees required under 37 C.F.R. Section 1.21 (Miscellaneous fees and charges)					
File Listing:					
Document Number	**Document Description**	**File Name**	**File Size(Bytes)/ Message Digest**	**Multi Part /.zip**	**Pages (if appl.)**
1	Issue Fee Payment (PTO-85B)	IssueFeeTransmittal.pdf	92031 dcdb303c43cfca383386ee33520c53ab3e784462	no	1
Warnings:					
Information:					
2	Fee Worksheet (PTO-875)	fee-info.pdf	32112 bfc8818b52b391bb0dff859300ac654ee9c8649e1	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	124143		

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

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

NOTICE OF ALLOWANCE AND FEE(S) DUE

2292 7590 01/25/2011

BIRCH STEWART KOLASCH & BIRCH
PO BOX 747
FALLS CHURCH, VA 22040-0747

EXAMINER	
TRINH, MICHAEL MANH	
ART UNIT	PAPER NUMBER
2822	

DATE MAILED: 01/25/2011

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/548,618	08/27/2009	Yoshinori SHIMIZU	0020-5147PUS5	7447

TITLE OF INVENTION: LIGHT EMITTING DEVICE AND DISPLAY

APPLN. TYPE	SMALL ENTITY	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	NO	$1510	$300	$0	$1810	04/25/2011

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 SMALL ENTITY status shown above.

If the SMALL ENTITY is shown as YES, verify your current SMALL ENTITY status:

A. If the status is the same, pay the TOTAL FEE(S) DUE shown above.

B. If the status above is to be removed, check box 5b on Part B - Fee(s) Transmittal and pay the PUBLICATION FEE (if required) and twice the amount of the ISSUE FEE shown above, or

If the SMALL ENTITY is shown as NO:

A. Pay TOTAL FEE(S) DUE shown above, or

B. If applicant claimed SMALL ENTITY status before, or is now claiming SMALL ENTITY status, check box 5a on Part B - Fee(s) Transmittal and pay the PUBLICATION FEE (if required) and 1/2 the ISSUE FEE shown above.

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.

PTOL-85 (Rev. 08/07) Approved for use through 08/31/2010.

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)

2292 7590 01/25/2011

BIRCH STEWART KOLASCH & BIRCH
PO BOX 747
FALLS CHURCH, VA 22040-0747

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.
12/548,618	08/27/2009	Yoshinori SHIMIZU	0020-5147PUS5	7447

TITLE OF INVENTION: LIGHT EMITTING DEVICE AND DISPLAY

APPLN. TYPE	SMALL ENTITY	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	NO	$1510	$300	$0	$1810	04/25/2011

EXAMINER	ART UNIT	CLASS-SUBCLASS
TRINH, MICHAEL MANH	2822	257-098000

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).

❑ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.

❑ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-02 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list

(1) the names of up to 3 registered patent attorneys or agents OR, alternatively,

(2) the name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.

1 _____

2 _____

3 _____

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

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

(A) NAME OF ASSIGNEE (B) RESIDENCE: (CITY and STATE OR COUNTRY)

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

4a. The following fee(s) are submitted:

❑ Issue Fee

❑ Publication Fee (No small entity discount permitted)

❑ Advance Order - # of Copies _____

4b. Payment of Fee(s): **(Please first reapply any previously paid issue fee shown above)**

❑ A check is enclosed.

❑ Payment by credit card. Form PTO-2038 is attached.

❑ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment, to Deposit Account Number _____ (enclose an extra copy of this form).

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

❑ a. Applicant claims SMALL ENTITY status. See 37 CFR 1.27.

❑ b. Applicant is no longer claiming SMALL ENTITY status. See 37 CFR 1.27(g)(2).

NOTE: The Issue Fee and Publication Fee (if required) will not be accepted from anyone other than the applicant; a registered attorney or agent; or the assignee or other party in interest as shown by the records of the United States Patent and Trademark Office.

Authorized Signature _____ Date _____

Typed or printed name _____ Registration No. _____

This collection of information 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.

UNITED STATES PATENT AND TRADEMARK OFFICE

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

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/548,618	08/27/2009	Yoshinori SHIMIZU	0020-5147PUS5	7447

2292 7590 01/25/2011

BIRCH STEWART KOLASCH & BIRCH
PO BOX 747
FALLS CHURCH, VA 22040-0747

EXAMINER	
TRINH, MICHAEL MANH	
ART UNIT	PAPER NUMBER
2822	

DATE MAILED: 01/25/2011

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

The Patent Term Adjustment to date is 90 day(s). If the issue fee is paid on the date that is three months after the mailing date of this notice and the patent issues on the Tuesday before the date that is 28 weeks (six and a half months) after the mailing date of this notice, the Patent Term Adjustment will be 90 day(s).

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 Customer Service Center of the Office of Patent Publication at 1-(888)-786-0101 or (571)-272-4200.

Notice of Allowability	Application No.	Applicant(s)	
	12/548,618	SHIMIZU ET AL.	
	Examiner	Art Unit	
	Michael Trinh	2822	

-- 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 *August 27, 2009*.

2. ☒ The allowed claim(s) is/are *1-14*.

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

4. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.

5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
   (a) ☐ including changes required by the Notice of Draftsperson's Patent Drawing Review (PTO-948) attached
      1) ☐ hereto or 2) ☐ to Paper No./Mail Date _____.
   (b) ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.

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

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

Attachment(s)

1. ☒ Notice of References Cited (PTO-892)
2. ☐ Notice of Draftperson's Patent Drawing Review (PTO-948)
3. ☒ Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date See Continuation Sheet
4. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material
5. ☐ Notice of Informal Patent Application
6. ☐ Interview Summary (PTO-413), Paper No./Mail Date _____ .
7. ☐ Examiner's Amendment/Comment
8. ☒ Examiner's Statement of Reasons for Allowance
9. ☐ Other _____.

/Michael Trinh/
Primary Examiner, Art Unit 2822

Continuation of Attachment(s) 3. Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date: 8/27/09; 12/4/09; 7/13/10; 11/1/10; and 12/30/10.

DETAILED ACTION

*** This office action is responsive to filling of the application on August 27, 2009. Claims 1-14 are pending.

Allowable Subject Matter

1. Claims 1-14 are allowed.

2. The following is a statement of reasons for the indication of allowable subject matter:

3. The references of record, alone or in combination, do not fairly anticipatively disclose each and every aspect of the claimed light emitting diode, or fairly make a prima facie obvious case of the claimed light emitting diode, in combination with other claimed limitations as recited in base claim 1, the inclusion of having a transparent material covering said LED chip, and a phosphor contained in said transparent material and absorbing a part of light emitted by said LED chip and emitting light of wavelength different from that of the absorbed light; wherein the main emission peak of said LED chip is within the range from 400 nm to 530 nm, a concentration of said phosphor in the vicinity of said LED chip is larger than a concentration of said phosphor in the vicinity of the surface of said transparent material, and said phosphor diffuses the light from said LED chip and suppresses a formation of an emission pattern by a partial blocking of the light by said electrode.

****

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Michael M. Trinh whose telephone number is (571) 272-1847. The examiner can normally be reached on M-F: 9:00 Am to 5:30 Pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Zandra Smith can be reached on (571) 272-2429. The central fax phone number is (703) 872-9306.

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).
Oacs-25A-1

/Michael Trinh/
Primary Examiner, Art Unit 2822

Notice of References Cited	Application/Control No. 12/548,618	Applicant(s)/Patent Under Reexamination SHIMIZU ET AL.	
	Examiner Michael Trinh	Art Unit 2822	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
*	A	US-5,623,181	04-1997	Suehiro et al.	313/512
*	B	US-5,043,716	08-1991	Latz et al.	345/82
*	C	US-5,847,507	12-1998	Butterworth et al.	313/512
	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	Classification
	N					
	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

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

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

Search Notes

Application/Control No.	Applicant(s)/Patent under Reexamination	
12/548,618	SHIMIZU ET AL.	
Examiner	**Art Unit**	
Michael Trinh	2822	

SEARCHED			
Class	Subclass	Date	Examiner
257	98	1/18/2011	MT
257	13	1/18/2011	MT
257	99	1/18/2011	MT
257	100	1/18/2011	MT
257	101	1/18/2011	MT
257	E33.061	1/18/2011	MT

INTERFERENCE SEARCHED			
Class	Subclass	Date	Examiner
PG-PUB Interference Search History Printout		1/18/2011	MT

SEARCH NOTES (INCLUDING SEARCH STRATEGY)		
	DATE	EXMR
Searched Databases in EAST (Attached Search History Printout)	11/18/2011	MT

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	12548618	SHIMIZU ET AL.
	Examiner	**Art Unit**
	Michael Trinh	2822

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

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

CLAIM		DATE								
Final	Original	01/18/2011								
1	1	=								
2	2	=								
3	3	=								
4	4	=								
5	5	=								
6	6	=								
7	7	=								
8	8	=								
9	9	=								
10	10	=								
11	11	=								
12	12	=								
13	13	=								
14	14	=								

UNITED STATES PATENT AND TRADEMARK OFFICE

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

BIB DATA SHEET

CONFIRMATION NO. 7447

SERIAL NUMBER	FILING or 371(c) DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
12/548,618	08/27/2009 RULE	257 ~~438~~	2822	0020-5147PUS5

APPLICANTS

Yoshinori SHIMIZU, Naka-gun, JAPAN;
Kensho Sakano, Anan-shi, JAPAN;
Yasunobu Noguchi, Naka-gun, JAPAN;
Toshio Moriguchi, Anan-shi, JAPAN;

**** CONTINUING DATA **************************

This application is a DIV of 12/028,062 02/08/2008 PAT 7,682,848
which is a DIV of 10/609,402 07/01/2003 PAT 7,362,048
which is a DIV of 09/458,024 12/10/1999 PAT 6,614,179
which is a DIV of 09/300,315 04/28/1999 PAT 6,069,440
which is a DIV of 08/902,725 07/29/1997 PAT 5,998,925

**** FOREIGN APPLICATIONS **************************

JAPAN P 08-198585 07/29/1996
JAPAN P 08-244339 09/17/1996
JAPAN P 08-245381 09/18/1996
JAPAN P 08-359004 12/27/1996
JAPAN P 09-081010 03/31/1997

**** IF REQUIRED, FOREIGN FILING LICENSE GRANTED ****

09/29/2009

Foreign Priority claimed ☑ Yes ☐ No 35 USC 119(a-d) conditions met ☑ Yes ☐ No Verified and Acknowledged /MICHAEL MANH TRINH/ Examiner's Signature	☐ Met after Allowance Initials	STATE OR COUNTRY	SHEETS DRAWINGS	TOTAL CLAIMS	INDEPENDENT CLAIMS
		JAPAN	19	14	1

ADDRESS

BIRCH STEWART KOLASCH & BIRCH
PO BOX 747
FALLS CHURCH, VA 22040-0747
UNITED STATES

TITLE

LIGHT EMITTING DEVICE AND DISPLAY

FILING FEE RECEIVED		
1090	FEES: Authority has been given in Paper No._____ to charge/credit DEPOSIT ACCOUNT No._____ for following:	☐ All Fees ☐ 1.16 Fees (Filing) ☐ 1.17 Fees (Processing Ext. of time) ☐ 1.18 Fees (Issue) ☐ Other _____ ☐ Credit

BIB (Rev. 05/07).

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L5	360166	(light near2 emitting near2 (diode$1 or element or device $1))	US-PGPUB; USPAT; FPRS; EPO; JPO; IBM_TDB	OR	ON	2011/01/17 21:16
L6	2705	(transparen$3 with resin) with (phosphor or fluorescen$3 or YAG)	US-PGPUB; USPAT; FPRS; EPO; JPO; IBM_TDB	OR	ON	2011/01/17 21:20
L7	392287	wavelength with light	US-PGPUB; USPAT; FPRS; EPO; JPO; IBM_TDB	OR	ON	2011/01/17 21:20
L8	38060	concentration with (phosphor or fluorescen$3 or YAG)	US-PGPUB; USPAT; FPRS; EPO; JPO; IBM_TDB	OR	ON	2011/01/17 21:21
L9	134	(5 same 8) and 6	US-PGPUB; USPAT; FPRS; EPO; JPO; IBM_TDB	OR	ON	2011/01/17 21:21
L10	128	9 and 7	US-PGPUB; USPAT; FPRS; EPO; JPO; IBM_TDB	OR	ON	2011/01/17 21:21
L11	2677	8 with (larger or greater or smaller or higher)	US-PGPUB; USPAT; FPRS; EPO; JPO; IBM_TDB	OR	ON	2011/01/17 21:22
L12	35	10 and 11	US-PGPUB; USPAT; FPRS; EPO; JPO; IBM_TDB	OR	ON	2011/01/17 21:22
L13	314	SHIMIZU-YOSHINORI	US-PGPUB; USPAT; FPRS; EPO; JPO; IBM_TDB	OR	ON	2011/01/17 21:46

L14	51	SAKANO-KENSHO	US-PGPUB; USPAT; FPRS; EPO; JPO; IBM_TDB	OR	ON	2011/01/17 21:46
L15	75	NOGUCHI-YASUNOBU	US-PGPUB; USPAT; FPRS; EPO; JPO; IBM_TDB	OR	ON	2011/01/17 21:46
L16	62	MORIGUCHI-TOSHIO	US-PGPUB; USPAT; FPRS; EPO; JPO; IBM_TDB	OR	ON	2011/01/17 21:47
L17	374	13 14 15 16	US-PGPUB; USPAT; FPRS; EPO; JPO; IBM_TDB	OR	ON	2011/01/17 21:47
L18	6	17 and 11 and 5	US-PGPUB; USPAT; FPRS; EPO; JPO; IBM_TDB	OR	ON	2011/01/17 21:47
L19	12	phospho near3 crystal	US-PGPUB; USPAT; FPRS; EPO; JPO; IBM_TDB	OR	ON	2011/01/17 21:51
L20	5728	phosphor with crystal	US-PGPUB; USPAT; FPRS; EPO; JPO; IBM_TDB	OR	ON	2011/01/17 21:52
L21	732	20 same 5	US-PGPUB; USPAT; FPRS; EPO; JPO; IBM_TDB	OR	ON	2011/01/17 21:52
L22	21	20 with 6	US-PGPUB; USPAT; FPRS; EPO; JPO; IBM_TDB	OR	ON	2011/01/17 21:52

1/17/2011 10:00:32 PM
C:\Documents and Settings\MTrinh\My Documents\EAST\Workspaces\~~ACOLLECTIONSEARCH-25-A-1.wsp

Issue Classification	Application/Control No.	Applicant(s)/Patent under Reexamination	
	12/548,618	SHIMIZU ET AL.	
	Examiner	Art Unit	
	Michael Trinh	2822	

ISSUE CLASSIFICATION

ORIGINAL		CROSS REFERENCE(S)							
CLASS	SUBCLASS	CLASS	SUBCLASS (ONE SUBCLASS PER BLOCK)						
257	98	257	99	100					
INTERNATIONAL CLASSIFICATION		257	E33. 061						
H 0 1 L	29/22								
	/								
	/								
	/								
	/								

---------- (Assistant Examiner) (Date)	/Michael Trinh/ 1/18/2011 (Primary Examiner) (Date)	Total Claims Allowed: 14
(Legal Instruments Examiner) (Date)		O.G. Print Claim(s): 1 / O.G. Print Fig.: 1

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

Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original
1	1		31		61		91		121		151		181
2	2		32		62		92		122		152		182
3	3		33		63		93		123		153		183
4	4		34		64		94		124		154		184
5	5		35		65		95		125		155		185
6	6		36		66		96		126		156		186
7	7		37		67		97		127		157		187
8	8		38		68		98		128		158		188
9	9		39		69		99		129		159		189
10	10		40		70		100		130		160		190
11	11		41		71		101		131		161		191
12	12		42		72		102		132		162		192
13	13		43		73		103		133		163		193
14	14		44		74		104		134		164		194
	15		45		75		105		135		165		195
	16		46		76		106		136		166		196
	17		47		77		107		137		167		197
	18		48		78		108		138		168		198
	19		49		79		109		139		169		199
	20		50		80		110		140		170		200
	21		51		81		111		141		171		201
	22		52		82		112		142		172		202
	23		53		83		113		143		173		203
	24		54		84		114		144		174		204
	25		55		85		115		145		175		205
	26		56		86		116		146		176		206
	27		57		87		117		147		177		207
	28		58		88		118		148		178		208
	29		59		89		119		149		179		209
	30		60		90		120		150		180		210

EAST Search History

EAST Search History (Interference)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L38	2	(((light near2 emitt $3) or LED) and (transparen$2 or transluce$4) and (wavelength or wave-length or (wave adj length)) and absorb$3 and (concentration with phosphor with (larger or higher or greater or smaller or lower)) and diffus$3 and (emission or emitt$4)).clm.	US-PGPUB; USPAT	OR	ON	2011/01/18 11:54

1/18/2011 11:58:24 AM
C:\Documents and Settings\MTrinh\My Documents\EAST\Workspaces\~~ACOLLECTIONSEARCH-25-A-1.wsp

PTO/SB/08a (07-09)
Approved for use through 07/31/2012. OMB 0651-0031
U.S. Patent and Trademark Office: U.S. DEPARTMENT OF COMMERCE

Substitute for form 1449A/PTO

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

Sheet 1 of 2

Complete if Known	
Application Number	12/548,618
Filing Date	08-27-09
First Named Inventor	Yoshinori Shimizu
Art Unit	2812
Examiner Name	Not Yet Assigned
Attorney Docket Number	0020-5147PUS5

U.S. PATENT DOCUMENTS

Examiner initial *	Cite No. 1	Document Number Number - Kind Code 2 (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, columns, Lines, Where Relevant Passages or Relevant Figures Appear
	1	US-4,001,628	01-04-1977	Ryan	
	2	US-5,208,462-A	05-04-1993	O'Connor et al.	
	3	US-5,706,022-A	01-06-1998	Hato	
	4	US-5,743,629-A	04-28-1998	Helstern et al.	
	5	US-6,600,175-B1	07-29-2003	Baretz et al.	

FOREIGN PATENT DOCUMENTS

Examiner Initial *	Cite No. 1	Foreign Patent Document Country 3 Code	Number 4 Kind Code (if known) 5	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, columns, Lines, Where Relevant Passages or Relevant Figures Appear	T 6
	6	JP	6-296043-A	10-21-1994			☑

Examiner Signature	/Michael Trinh/	Date Considered	01/17/2011

* EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not Considered. Include of this form with next communication to applicant.
1. Applicant's unique citation designation number (optional) 2. See Kinds codes of USPTO patent Documents. at www.uspto.gov or MPEP 901.04.
3. Enter Office that isssued the document, by the two-letter code (WIPO Standard ST.3.) 4. For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. 5. Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.f 16 if possible. 6. Applicant is to place a check mark here if English language Translation is attached.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /MT/

PTO/SB/08b (07-09)
Approved for use through 07/31/2012. OMB 0651-0031
U.S. Patent and Trademark Office: U.S. DEPARTMENT OF COMMERCE

Substitute for form 1449B/PTO

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

Sheet 2 of 2

Complete if Known	
Application Number	12/548,618
Filing Date	08-27-09
First Named Inventor	Yoshinori Shimizu
Group Art Unit	2812
Examiner Name	Not Yet Assigned
Attorney Docket Number	0020-5147PUS5

NON PATENT LITERATURE DOCUMENTS

Examiner initial *	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 2
	7	Hide et al., "White light from InGaN/conjugated polymer hybrid light-emitting diodes," Appl. Phys. Lett., Vol. 70 (20), May 19, 1997, http://apl.aip.org/copyright.jsp, pp. 2664-2666.	☐
			☐
			☐
			☐
			☐
			☐
			☐
			☐
			☐
			☐

Examiner Signature	/Michael Trinh/	Date Considered	01/17/2011

* EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.
1. Applicants unique citation designation number. (optional) 2. Applicant is to place a check mark here if English language Translation is attached.
This collection of information is required by 37 CFR 1.97 and 1.98. 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 2 hours to complete, including gathering, preparing, and submitting the completed application form 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 Cheif Information Officer, U.S. Patent and Trademark Office, 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 assisstance in completing the form, call 1-800-PTO-9199 and select option 2.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /MT/

Used in Lieu of PTO/SB/08A/B
(Based on PTO 01-08 version)

Substitute for form 1449/PTO

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

Sheet 1 of 5

Complete if Known	
Application Number	NEW
Filing Date	AUG 27 2009
First Named Inventor	Yoshinori SHIMIZU
Art Unit	N/A
Examiner Name	Not Yet Assigned
Attorney Docket Number	0020-5147PUS5

U.S. PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Document Number: Number-Kind Code[2] (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
	AA*	US-5,700,713-A	12-23-1997	Yamazaki et al.	
	AB*	US-5,257,049	10-26-1993	Van Peteghem	
	AC*	US-6,812,500	11-02-2004	Reeh et al.	
	AD*	US-2001-0030326-A1	10-18-2001	Reeh et al.	
	AE*	US-6,576,930	06-10-2003	Reeh et al.	
	AF*	US-6,784,511	08-31-2004	Kunihara et al.	
	AG*	US-6,066,861	05-23-2000	Hohn et al.	
	AH*	US-5,959,316	09-28-1999	Lowery	
	AI*	US-5,118,985-A	06-02-1992	Patton et al.	
	AJ*	US-4,644,223	02-17-1987	de Hair et al.	
	AK*	US-6,538,371	03-25-2003	Duggal et al.	
	AL*	US-3,875,456	04-01-1975	Kano et al.	
	AM*	US-3,510,732	05-05-1970	R.L. Amans	
	AN*	US-5,550,657	08-27-1996	Tanaka et al.	
	AO*	US-5,578,839	11-26-1996	Nakamura et al.	
	AP*	US-6,004,001-A	12-21-1999	Noll	
	AQ*	US-4,905,060	02-27-1990	Chinone et al.	
	AR*	US-3,652,956	03-28-1972	Pinnow et al.	
	AS*	US-4,314,910	02-09-1982	Barnes	
	AT*	US-5,006,908	04-09-1991	Matsuoka et al.	
	AU*	US-5,369,289	11-29-1994	Tamaki et al.	
	AV*	US-4,727,283	02-23-1988	van Kemenade et al.	
	AW*	US-4,298,820	11-03-1981	Bongers et al.	
	AX*	US-3,699,478	10-17-1972	Pinnow et al.	
	AY*	US-6,798,537	08-25-1998	Nitta	
	AZ*	US-5,202,777	04-13-1993	Sluzky et al.	
	AA1*	US-3,819,974	06-25-1974	Stevenson et al.	
	AB1*	US-5,847,507	12-08-1998	Butterworth et al.	
	AC1*	US-3,691,482	09-12-1972	Pinnow et al.	
	AD1*	US-4,550,256	10-29-1985	Berkstesser et al.	
	AE1*	US-4,716,337	12-29-1987	Huiskes et al.	
	AF1*	US-5,471,113	11-28-1995	De Backer et al.	
	AG1*	US-5,825,125-A	10-20-1998	Ligthart et al.	
	AH1*	US-5,602,418-A	02-11-1997	Imai et al.	
	AI1*	US-6,340,824-B1	01-22-2002	Komoto et al.	
	AJ1*	US-5,949,182	09-07-1999	Shealy et al.	
	AK1*	US-3,748,548	07-24-1973	Haisty et al.	
	AL1*	US-5,512,210	04-30-1996	Sluzky et al.	
	AM1*	US-5,630,741	05-20-1997	Potter	
	AN1*	US-4,857,228	08-15-1989	Kabay et al.	

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 Document	Pages, Columns, Lines, Where Relevant Passages Or Relevant Figures Appear	T[6]
	BA	JP-2002-270020-A	09-20-2002	CASIO COMPUTER CO LTD		

Birch, Stewart, Kolasch & Birch, LLP

ADM/ETP/las

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /MT/

Used in Lieu of PTO/SB/08A/B
(Based on PTO 01-08 version)

Substitute for form 1449/PTO

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

Sheet 2 of 5

Complete if Known	
Application Number	NEW
Filing Date	AUG 27 2009
First Named Inventor	Yoshinori SHIMIZU
Art Unit	N/A
Examiner Name	Not Yet Assigned
Attorney Docket Number	0020-5147PUS5

	BB	JP-7-321407	12-08-1995	FUJI ELECTRIC CO LTD.		
	BC	JP-6-115158	04-26-1994	AGFA GEVAERT NV		
	BD	JP-61-158606	07-18-1986			
	BE	JP-2000-512806	09-26-2000			
	BF	JP-07-288341	10-31-1995	NICHIA CHEM IND LTD		
	BG	JP-5-226676	03-09-1993	SHARP CORP.		
	BH	JP-49-122292	11-22-1974			
	BI	JP-11-500584	01-12-1999			
	BJ	JP-8-78727-A	03-22-1996			√
	BK	JP-03-152898-A	06-28-1991			
	BL	JP-06-139973-A	05-20-1994			
	BM	EP-0 500 937-A1	09-02-1992			
	BN	JP-2001-320094-A	11-16-2001			
	BO	DE-3804293-A1	08-24-1989			
	BP	JP-06-231605-A	08-19-1994			
	BQ	GB-2 000 173	01-04-1979			
	BR	EP-0 383 215-A	08-22-1990			
	BS	DE-9013615-U	01-24-1991			
	BT	JP-59-30107-U	02-24-1984			
	BU	JP-7-32638-U	06-16-1995			
	BV	JP-01-257993-A	10-16-1989			
	BW	JP-01-260707-A	10-18-1989			
	BX	JP-02-111922-A	04-24-1990			
	BY	JP-05-142424-A	06-11-1993			
	BZ	JP-06-160635-A	06-07-1994			
	BA1	JP-06-027327-A	02-04-1994			
	BB1	JP-06-82633-A	03-25-1994			
	BC1	JP-07-114904-A	05-02-1995			
	BD1	JP-07-235207-A	09-05-1995			
	BE1	JP-53-7153	01-21-1978			
	BF1	JP-7-42152-A	07-21-1995			
	BG1	JP-55-4898-A	01-14-1980			
	BH1	JP-55-005533-A	01-16-1990			
	BI1	JP-60-185457	09-20-1985			
	BJ1	JP-62-20237-A	01-28-1987			
	BK1	JP-62-232827-A	10-13-1987			
	BL1	JP-01-189695-A	07-28-1989			
	BM1	JP-07-120754-A	05-12-1995			
	BN1	JP-06-177423-A	06-24-1994			
	BO1	JP-7-99345-A	04-11-1995			√
	BP1	JP-09-027642-A	01-28-1997			√
	BQ1	JP-05-63068-U	08-20-1993			√
	BR1	EP-0 209 942-A1	01-28-1987			√
	BS1	EP-0 541 373-A2	11-05-1992			√
	BT1	JP-0 599 224-A1	06-01-1994			√

Birch, Stewart, Kolasch & Birch, LLP

ADM/ETP/las

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /MT/

Used in Lieu of PTO/SB/08A/B
(Based on PTO 01-08 version)

Substitute for form 1449/PTO

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

Sheet	3	of	5

Complete if Known	
Application Number	NEW
Filing Date	AUG 27 2009
First Named Inventor	Yoshinori SHIMIZU
Art Unit	N/A
Examiner Name	Not Yet Assigned
Attorney Docket Number	0020-5147PUS5

	BU1	JP-01179471-A	07-17-1989			
	BV1	JP-5043913-C1	04-21-1975			
	BW1	JP-554898-A	01-14-1980			
	BX1	JP-09027642-A	01-28-1997			
	BY1**	JP-08007614-A	01-12-1996			
	BZ1**	JP-07176794-A	07-14-1995			
	BA2**	JP-07099345-A	04-11-1995			
	BB2**	JP-05152609	06-18-1993			√
	BC2**	JP-6220237-A	01-28-1987			√
	BD2**	WO-97/50132-A1	12-31-1997			
	BE2**	WO-98/12757-A1	03-26-1998			
	BF2**	JP-5079379	11-24-1973			
	BG2**	JP-742152	07-21-1995			√
	BH2**	JP-4717684	09-09-1972			√
	BI2**	JP-491221	01-12-1974			√
	BJ2**	JP-49112577	10-26-1974			√
	BK2**	JP-62189770	02-15-1986			√
	BL2**	JP-291980	09-29-1988			√
	BM2**	JP-5152609-A	06-18-1993			√
	BN2**	JP-5183189-A	07-23-1993			√
	BO2**	JP-863119	03-08-1996			√
	BP2**	JP-10036835-A	02-10-1998			√
	BQ2**	JP-49106283	12-27-1972			√
	BR2**	JP-5245181	10-14-1977			√
	BS2**	GB-1589964	05-20-1981			
	BT2**	JP-5441660	12-05-1979			√
	BU2**	JP-5472484	11-07-1978			√
	BV2**	JP-5950445	04-01-1984			√
	BW2**	JP-324692	03-14-1991			√
	BX2**	JP-463162	05-29-1992			√
	BY2**	JP-463163	05-29-1992			√
	BZ2**	JP-563068	08-20-1993			√
	BA3**	JP-8170077	07-02-1996			√
	BB3**	JP-5331584	03-24-1978			
	BC3**	JP-60144381	07-30-1985			√
	BD3**	JP-62167387	07-23-1987			√
	BE3**	JP-6208845	07-26-1994			√
	BF3**	JP-06177423	06-24-1994			√
	BG3**	JP-06260680	09-16-1994			√
	BH3**	JP-06268257	09-22-1994			√

Used in Lieu of PTO/SB/08A/B
(Based on PTO 01-08 version)

Substitute for form 1449/PTO

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

Sheet 4 of 5

Complete if Known	
Application Number	NEW
Filing Date	AUG 27 2009
First Named Inventor	Yoshinori SHIMIZU
Art Unit	N/A
Examiner Name	Not Yet Assigned
Attorney Docket Number	0020-5147PUS5

	BI3**	JP-4-234481-A	08-24-1992			
	BJ3**	JP-4-80286-A	03-13-1992			
	BK3**	GB-1 305 111	01-31-1973			
	BL3**	EP-0 667 383-A2	08-16-1995			

Examiner Signature		Date Considered	

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. * CITE NO.: Those application(s) which are marked with an single asterisk (*) next to the Cite No. are not supplied (under 37 CFR 1.98(a)(2)(iii)) because that application was filed after June 30, 2003 or is available in the IFW. ** CITE NO.: Those document(s) which are marked with an double asterisk (**) next to the Cite No. are not supplied because they were previously cited by or submitted to the Office in a prior application relied upon in this application for an earlier filing date under 35 U.S.C. 120. [1] Applicant's unique citation designation number (optional). [2] See Kinds Codes of USPTO Patent Documents at www.uspto.gov or MPEP 901.04. [3] Enter Office that issued the document, by the two-letter code (WIPO Standard ST.3). [4] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [5] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [6] Applicant is to place a check mark here if English language Translation is attached.

NON PATENT LITERATURE DOCUMENTS			
Examiner Initials*	Cite No.[1]	Include name of the author (in CAPITAL LETTERS), 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[2]
	CA	"White LED lamp: Efficient light-emitting; Manufacture cost half", Nikkei Sangyo Shimbun, September 13, 1996, Published by Nihon Keizai Shimbunsha.	
	CB	"SIMENS SMT-TOPLED fur die Oberflachenmontage" Frank Mollmer et al. Simens Components, 29 (1991) Hfet 4.	
	CC	"Proceedings of the Institute of Phosphor Society", Translation of pages 1, 5 to 14 of the 264th Proceedings of the Institute of Phosphor Society, Nov. 29, 1996.	
	CD	"Nichia Chemical starts the sample shipment of white light emitting diode", News Report, translation of page 15 of Nikkei Electronics 1996.9.23 (No. 671).	
	CE	"GaNpn Contact Blue/Ultraviolet light Emitting Diode", H. Amano et al., Applied Physics, Vol. 20, No. 2, pp. 163-166 (1991)	
	CF	"Phosphors Based on Rare-Earths, A New Era in Fluorescent Lighting", B.M.J. Smets, Materials Chemistry and Physics, 16 pp. 283-299 (1987)	
	CG	"A New Phosphor for Flying-Spot Cathode-Ray Tubes for Color Television: Yellow Emitting..", G. Blasse et al., App. Phys. Lett. Vol. 11, No. 2, pp. 53-55 (1967)	
	CH	Y. Nayatani, Color Research & Application, Vol. 20, No. 3, June 1995, pp. 143-155.	
	CI	WUSTLICH MIKRO-/OPTO-ELEKTRONIK GMBH (1994/1995)	
	CJ	W.W. Holloway, Jr. et at., "Optical Properties of Cerium-Activated Garnet Crystals", 1969 Journal of the Optical Society of America, Vol. 59, No. 1, pp. 60-63	
	CK	W.W. HOLLOWAY, Jr. et al., "On The Fluorescence of Cerium - Activated Garnet Crystals", Physics Letters, Vol. 25A, No. 8, 23 October 1967, pp. 614-615.	
	CL	W.J. MINISCALCO et al., "Measurements of Excited-State Absorption in Ce3+:YAGa)", J. Appl. Phys. Vol. 49, No. 12, December 1978, pp. 6109-6111.	
	CM	Takashi MATSUOKA et al., "Growth and Properties of a Wide-Gap Semiconductor InGaN", Optoelectronics-Devices and Technologies, Vol. 5, No. 1, pp.53-64, June 1990.	
	CN	Tadao MIURA, ELECTRONICS ENGINEERING, "High-intensity White Backlighting for LCD of Car Audios", July 1996, Vol. 38, No. 7, pp. 55-58	
	CO	T. NAGATOMO et al., "Ga1-xInxN Blue Light-Emitting Diodes", Proc. Electrochem. Soc., 1993, Vol. 93-10, pp. 136-141.	

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /MT/

Used in Lieu of PTO/SB/08A/B
(Based on PTO 01-08 version)

Substitute for form 1449/PTO

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

Sheet 5 of 5

Complete if Known	
Application Number	NEW
Filing Date	AUG 27 2009
First Named Inventor	Yoshinori SHIMIZU
Art Unit	N/A
Examiner Name	Not Yet Assigned
Attorney Docket Number	0020-5147PUS5

	CP	Shuji NAKAMURA, "Zn-doped InGaN growth and InGaN/AlGaN double-heterostructure blue-light-emitting diodes", Journal of Crystal Growth, 145 (1994), pp. 911-917.	
	CQ	Shuji NAKAMURA, "InGaN/AlGaN blue-light-emitting diodes", J. Vac. Sci. Technol. A 13(3), May/Jun 1995, pp.705-710.	
	CR	Shuji NAKAMURA, "High-Power InGaN/AlGaN Double-Heterostructure Blue-Light-Emitting Diodes", IEDM 94 (1994), IEEE, pp. 567-570.	
	CS	Shuji NAKAMURA et al., "Si-Doped InGaN Films Grown on GaN Films", Jpn. J. Appl. Phys. Vol. 32 (1993), pp. L16-L19, Part 2, No. 1A/B, 15 January 1993.	
	CT	Shuji NAKAMURA et al., "P-GaN/N-InGaN/N-GaN Double-Heterostructure Blue-Light-Emitting Diodes", Jpn. J. Appl. Phys. Vol. 32 (1993), pp. L8-L11, Part 2, No. 1A/B, 15, January 1993.	
	CU	Shigeo SHIONOYA et al. (editors), "Phosphor Handbook", pp. 505-508, CRC Press, 1999.	
	CV	Sato et al., Japanese Journal of Applied Physics, Vol. 35, July 1, 1996, pp. L838-L839.	
	CW	S. Nakaura et al., Japanese Journal of Applied Physics Part 2, Vol. 31, No. 10B, 1992, pp. L1457-1459.	
	CX	R. W. G. Hunt, Color Research & Application, Vol. 16, No. 3, 1991, pp. 146-165.	
	CY	Proceedings of Illumination National Convention in 1983, page 12.	
	CZ	Phosphor Handbook, 1st Edition, 1987, pp. 233-240 and 275-277.	
	CA1	P. Schlouer et al. "Luminescence Conversion of Blue Light Emitting Diodes", Applied Physics Letter, vol. 46, p. 417-418, February 1997	
	CB1	Nikkei Sangyo Shin-bun of September 13, 1996.	
	CC1	Nakamura, SPIE, Vol. 3002, pp. 26-35 (1997)	
	CD1	Mitsubishi Electric Company Technical Report, Vol. 48, No. 9, 1974, pp. 1121-1124.	
	CE1	M.F. YAN et al., "Preparation of Y3Al5O12-Based Phosphor Powders, J. Electrochem. Soc., Vol. 134, No. 2, Feb. 1987.	
	CF1	M. Ikeda, Journal of the Illumination Society, Vol. 71, No. 10, 1987, pp. 612-617 and English Abstract.	
	CG1	M. Ikeda et al., Color Research & Application, Vol. 16, No. 2, April 1991, pp. 72-80.	
	CH1	M. Ikeda et al., Color Research & Application, Vol. 14, No. 4, August 1989, pp. 198-206.	
	CI1	Kozo OSAMURA et al., "Preparation and optical properties of Ga1-xInxN thin films", Journal of Applied Physics, Vol. 46, No. 8, August 1975, pp. 3432-3437.	
	CJ1	Journal of the Television Society, Vol. 47, No. 5, 1993, pp. 753-764.	
	CK1	J.M. Robertson, et al., "Colourshift of the Ce3+ Emission in Monocrystalline Epitaxially Grown Garnet Layers", 1981 Philips J. Res. 36, pp. 15-30	
	CL1	Hoffman, Journal of Ies, pp. 89-91 (1977)	
	CM1	H. Shinoda et al., Color Research & Application, Vol. 18, No. 5, October 1993, pp. 326-333.	
	CN1	G. BLASSE et al., "Investigation of Some Ce3+-Activated Phosphors", Journal of Chemical Physics, Vol. 47, No. 12, 15 December 1967.	
	CO1	E.F. GIBBONS et al., "Some Factors Influencing the Luminous Decay Characteristics of Y3Al5O12:Ce3+", J. Electrochem. Soc., Vol. 120, No. 6, June 1973.	
	CP1	D.J. ROBBINS et al., "Lattice Defects and Energy Transfer Phenomena in Y3Al5O12:Ce3+", pp. 1004-1013, printed June 19, 2001.	
	CQ1	Branko et al., Development and applications of highbright white LED lamps, November 29, 1996, The 264th Proceedings of the Institute of Phosphor Society, pages 4-16 of the English translation .	

Examiner Signature	/Michael Trinh/	Date Considered	01/17/2011

Birch, Stewart, Kolasch & Birch, LLP

ADM/ETP/las

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /MT/

PTO/SB/08a (07-09)
Approved for use through 07/31/2012. OMB 0651-0031
U.S. Patent and Trademark Office: U.S. DEPARTMENT OF COMMERCE

Substitute for form 1449A/PTO

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

Sheet 1 of 2

Complete if Known	
Application Number	12/548,618
Filing Date	08-27-09
First Named Inventor	Yoshinori Shimizu
Art Unit	2812
Examiner Name	Not Yet Assigned
Attorney Docket Number	0020-5147PUS5

U.S. PATENT DOCUMENTS

Examiner initial *	Cite No.	Document Number Number - Kind Code[2] (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, columns, Lines, Where Relevant Passages or Relevant Figures Appear
	1	US-5,221,984 - A	06-22-1993	Furuyama et al.	
	2	US-5,594,751 - A	01-14-1997	Scott	
	3	US-5,801,435 - A	09-01-1998	Otsuki	
	4	US-6,015,200 - A	01-18-2000	Ogura	

FOREIGN PATENT DOCUMENTS

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

Examiner Signature	/Michael Trinh/	Date Considered	01/17/2011

* EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not Considered. Include copy of this form with next communication to applicant. 1. Applicant's unique citation design number (optional). 2 See Kinds Codes of USPTO patent Documents. at www.uspto.gov or MPEP 901.04. 3. Enter Office that issued the document, by the two-letter code (WIPO Standard ST.3). 4. For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. 5. Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST. 16 if possible. 6. Applicant is to place a check mark here if English language Translation is attached.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /MT/

PTO/SB/08b (07-09)
Approved for use through 07/31/2012. OMB 0651-0031
U.S. Patent and Trademark Office: U.S. DEPARTMENT OF COMMERCE

Substitute for form 1449B/PTO

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

Sheet 2 of 2

Complete if Known	
Application Number	12/548,618
Filing Date	08-27-09
First Named Inventor	Yoshinori Shimizu
Art Unit	2812
Examiner Name	Not Yet Assigned
Attorney Docket Number	0020-5147PUS5

NON PATENT LITERATURE DOCUMENTS

Examiner initial *	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 [2]
	5	NAKAMURA et al., "High-Brightness InGaN Blue, Green and Yellow Light-Emitting Diodes with Quantum Well Structures", Japanese Journal of Applied Physics, Vol. 34, No. 7A, Part 2, July 1, 1995, pp. L797-L799 XP000702022	☐
	6	Non-Final Office Action issued August 2, 2010, in co-pending U.S. Application Serial No. 12/559,042.	☐
			☐
			☐
			☐
			☐
			☐
			☐
			☐
			☐

Examiner Signature	/Michael Trinh/	Date Considered	01/17/2011

* EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

1. Applicants unique citation designation number. (optional) 2. Applicant is to place a check mark here if English language Translation is attached.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /MT/

DEC 0 4 2009

PTO/SB/08a (07-09)
Approved for use through 07/31/2012. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

Substitute for form 1449/PTO

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

Sheet 1 of 3

Complete if Known	
Application Number	12/548,618, Conf. #7447
Filing Date	August 27, 2009
First Named Inventor	Yoshinori SHIMIZU
Art Unit	2812
Examiner Name	Not Yet Assigned
Attorney Docket Number	0020-5147PUS5

U.S. PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Document Number Number-Kind Code[2] (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
	AA*	US-5,798,537	08-25-1988	Nitta	
	AB*	US-5,998,925-A	12-07-1999	Shimizu et al.	
	AC*	US-6,069,440-A	05-30-2000	Shimizu et al.	
	AD*	US-6,608,332-B2	08-19-2003	Shimizu et al.	
	AE*	US-6,614,179-B1	09-02-2003	Shimizu et al.	
	AF*	US-7,026,756-B2	04-11-2006	Shimizu et al.	
	AG*	US-7,071,616-B2	07-04-2006	Shimizu et al.	
	AH*	US-7,126,274-B2	10-24-2006	Shimizu et al.	
	AI*	US-7,215,074-B2	05-08-2007	Shimizu et al.	
	AJ*	US-7,329,988-B2	02-12-2008	Shimizu et al.	
	AK*	US-7,362,048-B2	04-22-2008	Shimizu et al.	
	AL*	US-7,531,960-B2	05-12-2009	Shimizu et al.	

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 Document	Pages, Columns, Lines, Where Relevant Passages Or Relevant Figures Appear	T[6]
	BA*	EP-0-550-937-A1	09-02-1992			

Examiner Signature	/Michael Trinh/	Date Considered	01/17/2011

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. * CITE NO.: Those application(s) which are marked with an single asterisk (*) next to the Cite No. are not supplied (under 37 CFR 1.98(a)(2)(iii)) because that application was filed after June 30, 2003 or is available in the IFW. [1] Applicant's unique citation designation number (optional). [2] See Kinds Codes of USPTO Patent Documents at www.uspto.gov or MPEP 901.04. [3] Enter Office that issued the document, by the two-letter code (WIPO Standard ST.3). [4] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [5] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [6] Applicant is to place a check mark here if English language Translation is attached.

Birch, Stewart, Kolasch & Birch, LLP

ADM/ETP/las

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /MT/

PTO/SB/08a (07-09)
Approved for use through 07/31/2012. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

Substitute for form 1449/PTO

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

Sheet 2 of 3

Complete if Known	
Application Number	12/548,618, Conf. #7447
Filing Date	August 27, 2009
First Named Inventor	Yoshinori SHIMIZU
Art Unit	2812
Examiner Name	Not Yet Assigned
Attorney Docket Number	0020-5147PUS5

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[2]
	CA*	Notice of Allowance and Examiner's Comments on Allowance issued January 28, 1999, in U.S. Application No. 08/902,725 (U.S. Patent 5,998,925).	
	CB*	Office Action issued November 17, 2000, in U.S. Application No. 08/902,725 (U.S. Patent 5,998,925).	
	CC*	Notice of Allowance and Examiner's Comments on Allowance issued October 8, 1999, in U.S. Application No. 09/300,315 (U.S. Patent 6,069,440).	
	CD*	Office Action issued March 13, 2001, in U.S. Application No. 09/458,024 (U.S. Patent 6,614,179).	
	CE*	Notice of Allowance and Examiner's Comments on Allowance issued March 26, 2003, in U.S. Application No. 09/458,024 (U.S. Patent 6,614,179).	
	CF*	Office Action issued August 14, 2002, in U.S. Application No. 09/736,425 (U.S. Patent 6,608,332).	
	CG*	Notice of Allowance and Examiner's Comments on Allowance issued March 25, 2003, in U.S. Application No. 09/736,425 (U.S. Patent 6,608,332).	
	CH*	Office Action issued August 19, 2005, in U.S. Application No. 10/609,402 (U.S. Patent 7,362,048).	
	CI*	Office Action issued July 27, 2007, in U.S. Application No. 10/609,402 (U.S. Patent 7,362,048).	
	CJ*	Office Action issued January 2, 2008, in U.S. Application No. 10/609,402 (U.S. Patent 7,362,048).	
	CK*	Notice of Allowance and Examiner's Comments on Allowance issued February 13, 2008, in U.S. Application No. 10/609,402 (U.S. Patent 7,362,048).	
	CL*	Notice of Allowance and Examiner's Comments on Allowance issued May 4, 2005, in U.S. Application No. 10/609,503 (U.S. Patent 7,071,616).	
	CM*	Office Action issued April 8, 2005, in U.S. Application No. 10/677,382 (U.S. Patent 7,026,756).	
	CN*	Notice of Allowance and Examiner's Comments on Allowance issued September 22, 2005, in U.S. Application No. 10/677,382 (U.S. Patent 7,026,756).	
	CO*	Office Action issued February 28, 2006, in U.S. Application No. 10/677,382 (U.S. Patent 7,026,756).	
	CP*	Notice of Allowance and Examiner's Comments on Allowance issued February 11, 2009, in U.S. Application No. 11/682,014 (U.S. Patent 7,531,960).	
	CQ*	Office Action issued September 7, 2005, in U.S. Application No. 10/864,544 (U.S. Patent 7,126,274).	
	CR*	Notice of Allowance and Examiner's Comments on Allowance issued March 10, 2006, in U.S. Application No. 10/864,544 (U.S. Patent 7,126,274).	

Examiner Signature	/Michael Trinh/	Date Considered	01/17/2011

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

[1]Applicant's unique citation designation number (optional). [2]Applicant is to place a check mark here if English language Translation is attached.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /MT/

PTO/SB/08a (07-09)
Approved for use through 07/31/2012. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

Substitute for form 1449/PTO

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

Sheet 3 of 3

Complete if Known	
Application Number	12/548,618, Conf. #7447
Filing Date	August 27, 2009
First Named Inventor	Yoshinori SHIMIZU
Art Unit	2812
Examiner Name	Not Yet Assigned
Attorney Docket Number	0020-5147PUS5

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[2]
	CS*	**Office Action issued December 13, 2005, in U.S. Application No. 11/208,729 (U.S. Patent 7,215,074).**	
	CT*	**Notice of Allowance and Examiner's Comments on Allowance issued September 7, 2006, in U.S. Application No. 11/208,729 (U.S. Patent 7,215,074).**	
	CU*	**Office Action issued April 4, 2007, in U.S. Application 11/653,275 (U.S. Patent 7,329,988).**	
	CV*	**Notice of Allowance and Examiner's Comments on Allowance issued September 25, 2007, in U.S. Application No. 11/653,275 (U.S. Patent 7,329,988).**	

Examiner Signature	/Michael Trinh/	Date Considered	01/17/2011

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

[1]Applicant's unique citation designation number (optional). [2]Applicant is to place a check mark here if English language Translation is attached.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /MT/

PTO/SB/08a (07-09)
Approved for use through 07/31/2012. OMB 0651-0031
U.S. Patent and Trademark Office: U.S. DEPARTMENT OF COMMERCE

Substitute for form 1449A/PTO

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

Sheet 1 of 2

Complete if Known	
Application Number	12/548,618
Filing Date	08-27-09
First Named Inventor	Yoshinori Shimizu
Art Unit	2822
Examiner Name	M. M. TRINH
Attorney Docket Number	0020-5147PUS5

U.S. PATENT DOCUMENTS

Examiner initial *	Cite No.	Document Number Number - Kind Code[2] (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, columns, Lines, Where Relevant Passages or Relevant Figures Appear
	1	US-2009/0315014-A1	12-24-2009	SHIMIZU et al.	
	2	US-2009/0315015-A1	12-24-2009	SHIMIZU et al.	
	3	US-2010/0001258-A1	01-07-2010	SHIMIZU et al.	
	4	US-5,045,867-A	09-03-1991	FUSE	

FOREIGN PATENT DOCUMENTS

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

Examiner Signature	/Michael Trinh/	Date Considered	01/17/2011

* EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not Considered. Include copy of this form with next communication to applicant. 1. Applicant's unique citation design number (optional). 2 See Kinds Codes of USPTO patent Documents. at www.uspto.gov or MPEP 901.04. 3. Enter Office that issued the document, by the two-letter code (WIPO Standard ST.3). 4. For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. 5. Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST. 16 if possible. 6. Applicant is to place a check mark here if English language Translation is attached.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /MT/

PTO/SB/08b (07-09)
Approved for use through 07/31/2012. OMB 0651-0031
U.S. Patent and Trademark Office: U.S. DEPARTMENT OF COMMERCE

Substitute for form 1449B/PTO

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

Sheet 2 of 2

Complete if Known	
Application Number	12/548,618
Filing Date	08-27-09
First Named Inventor	Yoshinori Shimizu
Art Unit	2822
Examiner Name	M. M. TRINH
Attorney Docket Number	0020-5147PUS5

NON PATENT LITERATURE DOCUMENTS

Examiner initial *	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 [2]
	5	Office Action dated July 7, 2010 for US Application No. 12/548,614.	☐
	6	Office Action dated June 16, 2010 for US Application No. 12/548,621.	☐
	7	Office Action dated November 10, 2010 for US Application No. 12/575,162.	☐
	8	Office Action dated November 15, 2010 for US Application No. 12/548,614.	☐
			☐
			☐
			☐
			☐
			☐
			☐

Examiner Signature	/Michael Trinh/	Date Considered	01/17/2011

* EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.
1. Applicants unique citation designation number. (optional) 2. Applicant is to place a check mark here if English language Translation is attached.
This collection of information is required by 37 CFR 1.97 and 1.98. 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 2 hours to complete, including gathering, preparing, and submitting the completed application form 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 Cheif Information Officer, U.S. Patent and Trademark Office, 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 assisstance in completing the form, call 1-800-PTO-9199 and select option 2.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /MT/

PTO/SB/08a (07-09)
Approved for use through 07/31/2012. OMB 0651-0031
U.S. Patent and Trademark Office: U.S. DEPARTMENT OF COMMERCE

Substitute for form 1449A/PTO

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

Sheet 1 of 2

Complete if Known	
Application Number	12/548,618
Filing Date	08-27-09
First Named Inventor	Yoshinori Shimizu
Art Unit	2822
Examiner Name	M. M. TRINH
Attorney Docket Number	0020-5147PUS5

U.S. PATENT DOCUMENTS

Examiner initial *	Cite No.	Document Number Number - Kind Code [2] (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, columns, Lines, Where Relevant Passages or Relevant Figures Appear
	1	US-2009/0315014-A1	12-24-2009	SHIMIZU et al.	
	2	US-2009/0315015-A1	12-24-2009	SHIMIZU et al.	
	3	US-2010/0001258-A1	01-07-2010	SHIMIZU et al.	
	4	US-5,045,867-A	09-03-1991	FUSE	

FOREIGN PATENT DOCUMENTS

Examiner Initial *	Cite No. 1	Foreign Patent Document Country [3] Code Number [4] Kind Code (if known) [5]	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, columns, Lines, Where Relevant Passages or Relevant Figures Appear	T
						☐
						☐
						☐
						☐
						☐
						☐

Examiner Signature		Date Considered	

* EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not Considered. Include copy of this form with next communication to applicant. 1. Applicant's unique citation design number (optional). 2 See Kinds Codes of USPTO patent Documents. at www.uspto.gov or MPEP 901.04. 3. Enter Office that issued the document, by the two-letter code (WIPO Standard ST.3). 4. For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. 5. Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST. 16 if possible. 6. Applicant is to place a check mark here if English language Translation is attached.

PTO/SB/08b (07-09)
Approved for use through 07/31/2012. OMB 0651-0031
U.S. Patent and Trademark Office: U.S. DEPARTMENT OF COMMERCE

Substitute for form 1449B/PTO

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

Sheet 2 of 2

Complete if Known	
Application Number	12/548,618
Filing Date	08-27-09
First Named Inventor	Yoshinori Shimizu
Art Unit	2822
Examiner Name	M. M. TRINH
Attorney Docket Number	0020-5147PUS5

NON PATENT LITERATURE DOCUMENTS

Examiner initial *	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 [2]
	5	Office Action dated July 7, 2010 for US Application No. 12/548,614.	☐
	6	Office Action dated June 16, 2010 for US Application No. 12/548,621.	☐
	7	Office Action dated November 10, 2010 for US Application No. 12/575,162.	☐
	8	Office Action dated November 15, 2010 for US Application No. 12/548,614.	☐
			☐
			☐
			☐
			☐
			☐
			☐

Examiner Signature		Date Considered	

* EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

1. Applicants unique citation designation number. (optional) 2. Applicant is to place a check mark here if English language Translation is attached.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Patent Application of:
Yoshinori SHIMIZU et al.

Application No.:	12/548,618	Confirmation No.:	7447
Filed:	August 27, 2009	Art Unit:	2812
For:	LIGHT EMITTING DEVICE AND DISPLAY	Examiner:	M. M. TRINH

LETTER REGARDING COPENDING APPLICATIONS

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

Sir:

This letter submits potential relevant information advising the Examiner of the following co-pending U.S. Applications which claim the benefit of U.S. Patent 6,600,175 (by Baretz et al., issued on 07/29/2003) which was submitted to USPTO in an IDS on July 13, 2010.

Appl. No.	Filing Date	Group
90/010,940 (Reexamination of USP 6,600,175)	May 6, 2010	3992
11/264,124	November 1, 2005	2814
12/131,118	June 1, 2008	2814
12/131,119	June 1, 2008	2879

The subject matter contained in the above-listed copending U.S. applications may be deemed to relate to the present application, and thus may be material to the prosecution of this instant application.

The above-listed co-pending applications are not to be construed as prior art. By bringing the above-listed applications to the attention of the Examiner, Applicants do NOT waive any

cet

confidentiality concerning the above-listed co-pending applications or this application. See MPEP § 101.

If necessary, the Director is hereby authorized in this, concurrent, and future replies to charge any fees required during the pendency of the above-identified application or credit any overpayment to Deposit Account No. 02-2448.

Dated: DEC 30 2010

Respectfully submitted,

By _____
D. Richard Anderson
Registration No.: 40439
BIRCH, STEWART, KOLASCH & BIRCH, LLP
8110 Gatehouse Road, Suite 100 East
P.O. Box 747
Falls Church, VA 22040-0747
703-205-8000

cet

Docket No.: 0020-5147PUS5
(Patent)

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Patent Application of:
Yoshinori SHIMIZU et al.

Application No.:	12/548,618	Confirmation No.:	7447
Filed:	August 27, 2009	Art Unit:	2822
For:	LIGHT EMITTING DEVICE AND DISPLAY	Examiner:	M. M. TRINH

LETTER REGARDING COPENDING APPLICATIONS

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

Sir:

Under the provisions of MPEP § 2001.06(b), the Examiner is hereby advised of the following copending U.S. Applications:

Appl. No.	Filing Date	Group
12/947,470	November 16, 2010	2812
12/831,586	July 7, 2010	2811
12/942,792	November 9, 2010	2812
12/689,681	January 19, 2010	2812

The subject matter contained in the above-listed copending U.S. applications may be deemed to relate to the present application, and thus may be material to the prosecution of this instant application.

The above-listed co-pending applications are not to be construed as prior art. By bringing the above-listed applications to the attention of the Examiner, Applicants do NOT waive any confidentiality concerning the above-listed co-pending applications or this application. See MPEP § 101.

cet

BIRCH, STEWART, KOLASCH & BIRCH, LLP

DRA/CET/tlb

If necessary, the Director is hereby authorized in this, concurrent, and future replies to charge any fees required during the pendency of the above-identified application or credit any overpayment to Deposit Account No. 02-2448.

Dated: DEC 30 2010

Respectfully submitted,

By _____

D. Richard Anderson
Registration No.: 40439
BIRCH, STEWART, KOLASCH & BIRCH, LLP
8110 Gatehouse Road, Suite 100 East
P.O. Box 747
Falls Church, VA 22040-0747
703-205-8000

cet

Electronic Acknowledgement Receipt

EFS ID:	9137720
Application Number:	12548618
International Application Number:	
Confirmation Number:	7447
Title of Invention:	LIGHT EMITTING DEVICE AND DISPLAY
First Named Inventor/Applicant Name:	Yoshinori SHIMIZU
Customer Number:	02292
Filer:	David Richard Anderson/Sarah Beatty/for Tim Boone
Filer Authorized By:	David Richard Anderson
Attorney Docket Number:	0020-5147PUS5
Receipt Date:	30-DEC-2010
Filing Date:	27-AUG-2009
Time Stamp:	13:23:29
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		00205147PUS5IDS.PDF	360463 f72fb49c1eb586e24540a64cf3e8bacc4aee6382	yes	7

	Multipart Description/PDF files in .zip description				
	Document Description		Start	End	
	Transmittal Letter		1	5	
	Information Disclosure Statement (IDS) Filed (SB/08)		6	7	
Warnings:					
Information:					
2	NPL Documents	OfficeActionUS12548614dated 2010July7.pdf	941491 2af61e61edb21d155d31c7cbde8b095d838b11c2	no	19
Warnings:					
Information:					
3	NPL Documents	OfficeActionUS12548621.pdf	907741 56bca57646256469bb927db584bcf273aa1e862a	no	16
Warnings:					
Information:					
4	NPL Documents	OfficeActionUS12575162.pdf	1362575 0af490c589fa2f913d0069f3315adef625fa9c49	no	21
Warnings:					
Information:					
5	NPL Documents	OfficeActionUS12548614dated 2010Nov15.pdf	634006 9c971c994ae88d09f8a24f2c62a6a4f5248442fb	no	16
Warnings:					
Information:					
6	Miscellaneous Incoming Letter	00205147PUS5LTR.PDF	57915 6c59b5c95eacc43ef4a0cedf2d84423021f55041	no	2
Warnings:					
Information:					
7	Miscellaneous Incoming Letter	00205147PUS5LTR2.PDF	55933 24a47eae23de1d13a6c61d557eb29061ea246827	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	4320124		

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.

Docket No.: 0020-5147PUS5
(Patent)

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Patent Application of:
Yoshinori SHIMIZU et al.

Application No.:	12/548,618	Confirmation No.:	7447
Filed:	August 27, 2009	Art Unit:	2822
For: LIGHT EMITTING DEVICE AND DISPLAY		Examiner:	M. M. TRINH

INFORMATION DISCLOSURE STATEMENT

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

Sir:

Applicant(s) hereby submit(s) an Information Disclosure Statement for consideration by the Examiner.

I. LIST OF PATENTS, PUBLICATIONS OR OTHER INFORMATION

The patents, publications, or other information submitted for consideration by the Office are listed on the attached PTO/SB/08.

II. COPIES

☑ a. Copies of foreign patent documents, non-patent literature and other information.

☐ b. REFERENCES PREVIOUSLY CITED OR SUBMITTED: Copies of any information not provided can be found in one or more of the following applications which has been relied upon for an earlier filing date under 35 U.S.C. § 120:

cet

III. CONCISE EXPLANATION OF THE RELEVANCE/OTHER INFORMATION

☐ a. NON-ENGLISH LANGUAGE DOCUMENTS: A concise explanation of the relevance of all non-English language patents, publications, or other information listed is as follows:

☐ b. ENGLISH LANGUAGE SEARCH REPORT OR FOREIGN PATENT OFFICE COMMUNICATION: An English language version of the search report or Foreign Patent Office communication that indicates the degree of relevance is attached.

☑ c. OTHER: The following additional information is provided.

Copies of the Office Actions dated July 7, 2010 and November 15, 2010 for US Application No. 12/548,614, a copy of the Office Action dated June 16, 2010 for US Application No. 12/548,621 and a copy of the Office Action dated November 10, 2010 for US Application No. 12/575,162 are attached.

All of the references cited in the attached US Office Actions except for US-5,045,867-A, US-2010/0001258-A1, US-2009/0315014-A1 and US-2009/0315015-A1 were previously cited in the IDSes filed August 27, 2009, December 4, 2009, July 13, 2010 or November 1, 2010.

IV. STATEMENT UNDER 37 C.F.R. § 1.97(e)

The undersigned hereby states that:

☐ a. Each item of information contained in the IDS was first cited in any communication from a foreign patent office in a counterpart foreign application not more than **30 days** prior to the filing of this IDS. This statement does not relate to English language counterparts not listed in a communication from the foreign patent office. Such English language counterparts are provided to aid the Examiner's consideration of non-English items first cited in the communication from the foreign patent office; or

cet

☐ b. Each item of information contained in the IDS was first cited in any communication from a foreign patent office in a counterpart foreign application not more than **three months** prior to the filing of this IDS. This statement does not relate to English language counterparts not listed in a communication from the foreign patent office. Such English language counterparts are provided to aid the Examiner's consideration of non-English items first cited in the communication from the foreign patent office; or

☐ c. No item of information contained in the IDS 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 IDS was known to any individual designated in 37 C.F.R. § 1.56(c) more than three months prior to the filing of the IDS.

☐ d. Some of the items of information in the IDS were cited in a communication from a foreign patent office. Such items were first cited in a communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of this IDS. This statement does not relate to English language counterparts not listed in a communication from the foreign patent office. Such English language counterparts are provided to aid the Examiner's consideration of non-English items first cited in the communication from the foreign patent office. As to the remaining items of information, to the knowledge of the person signing the certification after making reasonable inquiry, such remaining items were not known to any individual designated in 37 C.F.R. § 1.56(c) more than three months prior to the filing of this statement.

V. FEES

☐ a. This Information Disclosure Statement is being filed concurrently with the filing of a new patent application or Request for Continued Examination. No fee is required.

☐ b. This Information Disclosure Statement is being filed within three months of the filing date of an application. No fee is required.

☑ c. This Information Disclosure Statement is being filed before the mailing date of a first Action on the merits. No fee is required. If a first Office Action on the merits has issued, please consider this IDS under 37 C.F.R. § 1.97(c) and see the statement under 37 C.F.R. § 1.97(e) above. If no statement has been made, charge our deposit account for the required fee.

☐ d. This Information Disclosure Statement is being filed before the mailing date of a Final Office Action or before the mailing date of a Notice of Allowance (see 37 C.F.R. § 1.97(c)(1)).

☐ No statement. The fee as required by 37 C.F.R. § 1.17(p) is provided.

or

☐ See the above statement. No fee is required.

☐ e. This Information Disclosure Statement is being filed after the mailing date of a Final Office Action or after the mailing date of a Notice of Allowance (see 37 C.F.R. § 1.97(d)), see the statement above. The fee as required by 37 C.F.R. § 1.17(p) is provided.

VI. PAYMENT OF FEES

☐ The required fee is listed on the attached Fee Transmittal.

☑ No fee is required.

cet

If the Examiner has any questions concerning this IDS, please contact the undersigned. If it is determined that this IDS has been filed under the wrong rule, the USPTO is requested to consider this IDS under the proper rule and charge the appropriate fee to Deposit Account No. 02-2448.

Dated: DEC 30 2010

Respectfully submitted,

By
D. Richard Anderson
Registration No.: 40439
BIRCH, STEWART, KOLASCH & BIRCH, LLP
8110 Gatehouse Road, Suite 100 East
P.O. Box 747
Falls Church, VA 22040-0747
703-205-8000

Attachment(s):
- ☑ PTO/SB/08
- ☑ Document(s)
- ☐ Foreign Patent Office Communication
- ☐ Foreign Search Report
- ☐ Fee
- ☑ Other: Four (4) US Office Actions

cet

PTO/SB/08a (07-09)
Approved for use through 07/31/2012. OMB 0651-0031
U.S. Patent and Trademark Office: U.S. DEPARTMENT OF COMMERCE
Under the Paperwork reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

Substitute for form 1449A/PTO

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

Sheet 1 of 2

Complete if Known	
Application Number	12/548,618
Filing Date	08-27-09
First Named Inventor	Yoshinori Shimizu
Art Unit	2812
Examiner Name	Not Yet Assigned
Attorney Docket Number	0020-5147PUS5

U.S. PATENT DOCUMENTS

Examiner initial *	Cite No.	Document Number Number - Kind Code[2] (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, columns, Lines, Where Relevant Passages or Relevant Figures Appear
	1	US-5,221,984 - A	06-22-1993	Furuyama et al.	
	2	US-5,594,751 - A	01-14-1997	Scott	
	3	US-5,801,435 - A	09-01-1998	Otsuki	
	4	US-6,015,200 - A	01-18-2000	Ogura	

FOREIGN PATENT DOCUMENTS

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

Examiner Signature		Date Considered	

* EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not Considered. Include copy of this form with next communication to applicant. 1. Applicant's unique citation design number (optional). 2 See Kinds Codes of USPTO patent Documents. at www.uspto.gov or MPEP 901.04. 3. Enter Office that issued the document, by the two-letter code (WIPO Standard ST.3). 4. For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. 5. Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST. 16 if possible. 6. Applicant is to place a check mark here if English language Translation is attached.

This collection of information is required by 37 CFR 1.97 and 1 98. 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 2 hours to complete, including gathering, preparing, and submitting the completed application form 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, 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 assisstance in completing the form, call 1-800-PTO-9199 (1-800-786.9199) and select option 2.

PTO/SB/08b (07-09)
Approved for use through 07/31/2012. OMB 0651-0031
U.S. Patent and Trademark Office: U.S. DEPARTMENT OF COMMERCE

Substitute for form 1449B/PTO

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

Sheet 2 of 2

Complete if Known	
Application Number	12/548,618
Filing Date	08-27-09
First Named Inventor	Yoshinori Shimizu
Art Unit	2812
Examiner Name	Not Yet Assigned
Attorney Docket Number	0020-5147PUS5

NON PATENT LITERATURE DOCUMENTS

Examiner initial *	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 [2]
	5	NAKAMURA et al., "High-Brightness InGaN Blue, Green and Yellow Light-Emitting Diodes with Quantum Well Structures", Japanese Journal of Applied Physics, Vol. 34, No. 7A, Part 2, July 1, 1995, pp. L797-L799 XP000702022	☐
	6	Non-Final Office Action issued August 2, 2010, in co-pending U.S. Application Serial No. 12/559,042.	☐
			☐
			☐
			☐
			☐
			☐
			☐
			☐
			☐

Examiner Signature		Date Considered	

* EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

1. Applicants unique citation designation number. (optional) 2. Applicant is to place a check mark here if English language Translation is attached.

Electronic Acknowledgement Receipt

EFS ID:	8742974
Application Number:	12548618
International Application Number:	
Confirmation Number:	7447
Title of Invention:	LIGHT EMITTING DEVICE AND DISPLAY
First Named Inventor/Applicant Name:	Yoshinori SHIMIZU
Customer Number:	02292
Filer:	David Richard Anderson/Deborah Schultz
Filer Authorized By:	David Richard Anderson
Attorney Docket Number:	0020-5147PUS5
Receipt Date:	01-NOV-2010
Filing Date:	27-AUG-2009
Time Stamp:	15:25:03
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	NPL Documents	EPSrchRpt.pdf	360706 22b7d9cf688007631f976eb44ea4041e411549cb	no	5

Warnings:	
Information:	

2	NPL Documents	OA12559042-8-2-10.pdf	460093 b1d7fbadff20ad08f6e9ec626277c504e27317ed	no	14
Warnings:					
Information:					
3	NPL Documents	Nakamura.pdf	215864 2b8a55810ab2af8f73d8594a530408e24eeba125	no	3
Warnings:					
Information:					
4		IDSsb08.PDF	331057 c59e2694b721b1704f51f87c0b28df7aeec3fcc1	yes	7

	Multipart Description/PDF files in .zip description		
	Document Description	**Start**	**End**
	Transmittal Letter	1	5
	Information Disclosure Statement (IDS) Filed (SB/08)	6	7

Warnings:	
Information:	
Total Files Size (in bytes):	1367720

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.

Docket No.: 0020-5147PUS5
(Patent)

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Patent Application of:
Yoshinori SHIMIZU et al.

Application No.:	12/548,618	Confirmation No.:	7447
Filed:	August 27, 2009	Art Unit:	2812
For:	LIGHT EMITTING DEVICE AND DISPLAY	Examiner:	Not Yet Assigned

INFORMATION DISCLOSURE STATEMENT

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

Sir:

Applicant(s) hereby submit(s) an Information Disclosure Statement for consideration by the Examiner.

I. LIST OF PATENTS, PUBLICATIONS OR OTHER INFORMATION

The patents, publications, or other information submitted for consideration by the Office are listed on the attached PTO/SB/08.

II. COPIES

☑ a. Copies of foreign patent documents, non-patent literature and other information.

☐ b. REFERENCES PREVIOUSLY CITED OR SUBMITTED: Copies of any information not provided can be found in one or more of the following applications which has been relied upon for an earlier filing date under 35 U.S.C. § 120:

BIRCH, STEWART, KOLASCH & BIRCH, LLP

DRA/CET/das

III. CONCISE EXPLANATION OF THE RELEVANCE/OTHER INFORMATION

☐ a. NON-ENGLISH LANGUAGE DOCUMENTS: A concise explanation of the relevance of all non-English language patents, publications, or other information listed is as follows:

☐ b. ENGLISH LANGUAGE SEARCH REPORT OR FOREIGN PATENT OFFICE COMMUNICATION: An English language version of the search report or Foreign Patent Office communication that indicates the degree of relevance is attached.

☑ c. OTHER: The following additional information is provided. The references listed in the attached European Search Report issued August 23, 2010, in EP 04001377.3, but not cited herein, are all previously submitted in an IDS filed August 27, 2009.

The U.S. references cited herein were cited by the Examiner in an Office Action issued August 2, 2010, in co-pending application Serial No. 12/559,042, a copy of which is attached

IV. STATEMENT UNDER 37 C.F.R. § 1.97(e)

The undersigned hereby states that:

☐ a. Each item of information contained in the IDS was first cited in any communication from a foreign patent office in a counterpart foreign application not more than **30 days** prior to the filing of this IDS. This statement does not relate to English language counterparts not listed in a communication from the foreign patent office. Such English language counterparts are provided to aid the Examiner's consideration of non-English items first cited in the communication from the foreign patent office; or

☐ b. Each item of information contained in the IDS was first cited in any communication from a foreign patent office in a counterpart foreign application not more than **three months** prior to the filing of this IDS. This statement does not relate to English language counterparts not listed in a communication from the foreign patent office. Such English language counterparts are provided to aid the Examiner's consideration of non-English items first cited in the communication from the foreign patent office; or

☐ c. No item of information contained in the IDS 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 IDS was known to any individual designated in 37 C.F.R. § 1.56(c) more than three months prior to the filing of the IDS.

☑ d. Some of the items of information in the IDS were cited in a communication from a foreign patent office. Such items were first cited in a communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of this IDS. This statement does not relate to English language counterparts not listed in a communication from the foreign patent office. Such English language counterparts are provided to aid the Examiner's consideration of non-English items first cited in the communication from the foreign patent office. As to the remaining items of information, to the knowledge of the person signing the certification after making reasonable inquiry, such remaining items were not known to any individual designated in 37 C.F.R. § 1.56(c) more than three months prior to the filing of this statement.

V. FEES

☐ a. This Information Disclosure Statement is being filed concurrently with the filing of a new patent application or Request for Continued Examination. No fee is required.

☐ b. This Information Disclosure Statement is being filed within three months of the filing date of an application. No fee is required.

☑ c. This Information Disclosure Statement is being filed before the mailing date of a first Action on the merits. No fee is required. If a first Office Action on the merits has issued, please consider this IDS under 37 C.F.R. § 1.97(c) and see the statement under 37 C.F.R. § 1.97(e) above. If no statement has been made, charge our deposit account for the required fee.

☐ d. This Information Disclosure Statement is being filed before the mailing date of a Final Office Action or before the mailing date of a Notice of Allowance (see 37 C.F.R. § 1.97(c)(1)).

☐ No statement. The fee as required by 37 C.F.R. § 1.17(p) is provided.

or

☐ See the above statement. No fee is required.

☐ e. This Information Disclosure Statement is being filed after the mailing date of a Final Office Action or after the mailing date of a Notice of Allowance (see 37 C.F.R. § 1.97(d)), see the statement above. The fee as required by 37 C.F.R. § 1.17(p) is provided.

VI. PAYMENT OF FEES

☐ The required fee is listed on the attached Fee Transmittal.

☑ No fee is required.

If the Examiner has any questions concerning this IDS, please contact the undersigned. If it is determined that this IDS has been filed under the wrong rule, the USPTO is requested to consider this IDS under the proper rule and charge the appropriate fee to Deposit Account No. 02-2448.

Dated: NOV 1_ 2010

Respectfully submitted,

By _____
D. Richard Anderson
Registration No.: 40439
BIRCH, STEWART, KOLASCH & BIRCH, LLP
8110 Gatehouse Road, Suite 100 East
P.O. Box 747
Falls Church, VA 22040-0747
703-205-8000

Attachment(s):
- ☑ PTO/SB/08
- ☑ Document(s)
- ☐ Foreign Patent Office Communication
- ☑ Foreign Search Report
- ☐ Fee
- ☑ Other: Office Action issued August 2, 2010, in co-pending application Serial No. 12/559,042

cet

PTO/SB/08a (07-09)
Approved for use through 07/31/2012. OMB 0651-0031
U.S. Patent and Trademark Office: U.S. DEPARTMENT OF COMMERCE

Substitute for form 1449A/PTO

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

Sheet 1 of 2

Complete if Known	
Application Number	12/548,618
Filing Date	08-27-09
First Named Inventor	Yoshinori Shimizu
Art Unit	2812
Examiner Name	Not Yet Assigned
Attorney Docket Number	0020-5147PUS5

U.S. PATENT DOCUMENTS

Examiner initial *	Cite No. [1]	Document Number: Number - Kind Code [2] (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, columns, Lines, Where Relevant Passages or Relevant Figures Appear
	1	US-4,001,628	01-04-1977	Ryan	
	2	US-5,208,462-A	05-04-1993	O'Connor et al.	
	3	US-5,706,022-A	01-06-1998	Hato	
	4	US-5,743,629-A	04-28-1998	Helstern et al.	
	5	US-6,600,175-B1	07-29-2003	Baretz et al.	

FOREIGN PATENT DOCUMENTS

Examiner Initial *	Cite No. [1]	Foreign Patent Document: Country [3] Code	Number [4] Kind Code (if known) [5]	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, columns, Lines, Where Relevant Passages or Relevant Figures Appear	T [6]
	6	JP	6-296043-A	10-21-1994			☑
							☐
							☐
							☐
							☐
							☐
							☐
							☐
							☐
							☐

Examiner Signature		Date Considered	

* EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not Considered. Include of this form with next communication to applicant.

1. Applicant's unique citation designation number (optional) 2. See Kinds codes of USPTO patent Documents. at www.uspto.gov or MPEP 901.04.
3. Enter Office that isssued the document, by the two-letter code (WIPO Standard ST.3.) 4. For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. 5. Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.f 16 if possible. 6. Applicant is to place a check mark here if English language Translation is attached.

PTO/SB/08b (07-09)
Approved for use through 07/31/2012. OMB 0651-0031
U.S. Patent and Trademark Office: U.S. DEPARTMENT OF COMMERCE
Under the Paperwork reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

Substitute for form 1449B/PTO

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

Sheet 2 of 2

Complete if Known	
Application Number	12/548,618
Filing Date	08-27-09
First Named Inventor	Yoshinori Shimizu
Group Art Unit	2812
Examiner Name	Not Yet Assigned
Attorney Docket Number	0020-5147PUS5

NON PATENT LITERATURE DOCUMENTS

Examiner initial *	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 2
	7	Hide et al., "White light from InGaN/conjugated polymer hybrid light-emitting diodes," Appl. Phys. Lett., Vol. 70 (20), May 19, 1997, http://apl.aip.org/copyright.jsp, pp. 2664-2666.	☐
			☐
			☐
			☐
			☐
			☐
			☐
			☐
			☐
			☐
			☐

Examiner Signature		Date Considered	

* EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

1. Applicants unique citation designation number. (optional) 2. Applicant is to place a check mark here if English language Translation is attached.

This collection of information is required by 37 CFR 1.97 and 1.98. 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 2 hours to complete, including gathering, preparing, and submitting the completed application form 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 Cheif Information Officer, U.S. Patent and Trademark Office, 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 assisstance in completing the form, call 1-800-PTO-9199 and select option 2.

Cet

PATENT ABSTRACTS OF JAPAN

(11)Publication number : 06-296043
(43)Date of publication of application : 21.10.1994

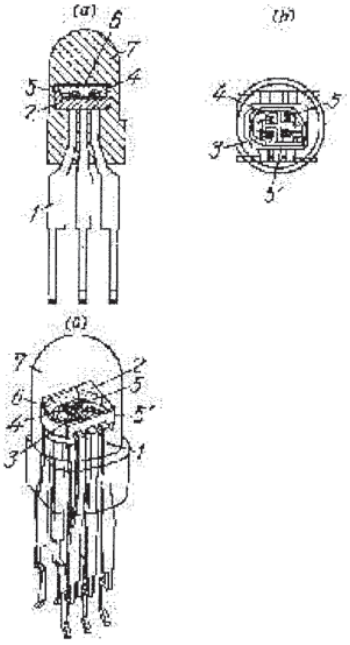
(51)Int.Cl. H01L 33/00

(21)Application number : 05-081651
(22)Date of filing : 08.04.1993

(71)Applicant : MATSUSHITA ELECTRIC IND CO LTD
(72)Inventor : ISECHI NORIHIRO
YUMOTO SHIGEO

(54) LIGHT-EMITTING DIODE

(57)Abstract:
PURPOSE: To make it possible to conduct heterochromatic three LED pellets mounting required for full-color emission, to improve color-mixing property, and to prevent generation of foam when molding.
CONSTITUTION: A double molded structure is formed by molding the recessed part of an inner container 2 using the resin having a high concentration dispersant and the entire inner container 2 is molded by the resin having low concentration dispersant. Also, in the case of single molding, a notch is provided on the inner container 2 so that foam is bled out excellently. As a result, at least three LED pellets can be mounted on the recessed part of the inner container, and color-mixing property can be improved by the double molding structure.



* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

CLAIMS

[Claim(s)]
[Claim 1]A light emitting diode having carried an LED pellet individually on two or more inner leads allocated in the bottom of said crevice of a non-translucency inner container which has a crevice, and carrying out an enclosure mold by translucency resin so that said non-translucency inner container and said LED pellet may be covered to one.
[Claim 2]A light emitting diode having covered by resin which added an optical dispersion agent by the 1st concentration to the crevice upper surface of a non-translucency inner container given in the 1st paragraph of a claim, and carrying out the mold of the periphery by resin which added an optical dispersion agent of little 2nd concentration rather than said 1st concentration.
[Claim 3]A light emitting diode providing infeed which is the depth from the crevice upper surface to the bottom, and reaches an inner container given in the 1st paragraph of a claim from a crevice medial surface to lateral surface.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application]This invention relates to a multicolor light emitting diode.
[0002]
[Description of the Prior Art]A light emitting diode is divided roughly into the red and green which used Ga system compound semiconductors, such as GaP and GaAlAs, as the luminescent color, and three blue colors using compound semiconductors, such as SiC, GaN, and ZnZe, further. The LED pellet of these three colors is arranged in the same enclosure sealed body and what is called a mold in recent years, and the request from a commercial scene has increased to the light emitting diode in which multicolor luminescence is possible.
[0003]The conventional multicolor light emitting diode The passage of the sectional view of drawing 6 (top view of a), and said (b), After having carried out press working of sheet metal of the tip of the metal leadframes 11, having considered it as the LED pellet mount part, forming the flat part 11a and forming the reflection part 11b in the circumference of the flat part 11a further, the mold part 12 was formed with the sealing resin in which the optical dispersion agent was added in the circumference.
[0004]
[Problem(s) to be Solved by the Invention]In the metal leadframes 11 in such press working of sheet metal, it was a limit that area of the flat part 11a in which an LED pellet is carried cannot secure widely, but carries the two LED pellets 13 and 13'.
[0005]In order to produce a red light LED pellet, a green emission LED pellet, and the multicolor light emitting diode further formed combining the luminescent color of three colors of a blue light LED pellet, The leadframe which needs to install the flat part which can carry three or more LED pellets in a leadframe, and can constitute easily the light circuit of these three or more LED pellets is required.
[0006]Although it is better for the resin which forms that mold part to use transparent resin from a point of luminous efficiency when the LED pellet which has the different luminescent color of three or more pieces is carried in the same mold, the luminescent color from each LED pellet can be directly seen in this case.
[0007]For example, since red and green are individually emitted to the exterior when it is transparent resin, red and green can be seen [orange], although obtained by making the LED pellet which emits light in red and green emit light simultaneously, and carrying out mixed colors, if the example which makes orange emit light explains from the outside as it is.
[0008]Forming a mold part with the translucent resin which added the optical dispersion agent for improvement in the mixed-colors performance of the luminescent color is carried out. However, in inverse proportion to the addition of the optical dispersion agent to that mold part, light emitting luminance falls in this case.
[0009]It is required on goods that hue and luminosity should not change even if the mixed-colors light in simultaneous lighting of two or more unique luminescence LED pellets observes from arbitrary directions.
[0010]Although the method of installing a reflection part in the circumference of the LED pellet

mount part of a leadframe is taken as a means which raises the luminous efficiency in the light emitting diode by which the single mold was carried out with the sealing resin which added the optical dispersion agent of arbitrary concentration, The shape where this LED pellet mount part has the high circumference as drawing 4 (a), and an LED pellet mount part is low, This inner container is inserted in the mold 9 with which it filled up with the undiluted solution 14 of sealing resin for molds reverse using what is called the concave inner container 2 as drawing 4 (b) at the time of formation of the mold part 14 of a light emitting diode. If the surrounding air is involved in, it means that that air foam 10 stagnated in this crevice with as as drawing 4 (c) at this time and heat cure of the mold part sealing resin is carried out, the air foam 10 remains in the mold part 14 of a light emitting diode, and it has become factors, such as poor lighting and characteristic defect.

[0011]As above-mentioned, when forming the mold part 14 of a light emitting diode, the leadframe for not generating the air foam 10 is needed in the mold part.

[0012]

[Means for Solving the Problem]This invention an LED pellet mount part in which red, green, and blue LED pellet loading are possible, After carrying an LED pellet in nothing and this leadframe a leadframe top allocated in inside of an inner container formed with thermoplastics, structure which carries out a mold so that this whole inner container may be covered is adopted.

[0013]As a means which takes out the luminescent color when simultaneous lighting of the LED pellet of two or more colors is carried out as one mixed color, It is filled up with translucent resin of the 1st concentration with many additions of an optical dispersion agent to the crevice upper surface of an inner container, and double molding structure which carries out the mold of the circumference with translucent resin of the 2nd concentration with few optical dispersion agents further is adopted.

[0014]Only arbitrary numbers provide infeed which is the depth from the crevice upper surface of this inner container to a recessed bottom face as a structure of making it not make it stagnating in that inner container, and attains air foam from a crevice medial surface to lateral surface.

[0015]

[Function]By attaching an inner container with the concave part which did not provide a crevice directly on the leadframe but was formed with thermoplastics on the leadframe, Three unique luminescence LED pellets, the red light LED pellet and green emission LED pellet which enable multicolor luminescence, and a blue light LED pellet, can be carried in the same light emitting diode.

[0016]It is filled up to the upper surface of the inner container by which translucent resin of the 1st concentration with many additions of an optical dispersion agent is carried in an LED pellet, By adopting the double molding structure which furthermore carried out the mold of the circumference with translucent resin of the 2nd concentration with few optical dispersion agents, change of the hue of the luminescent color when it sees from the luminescent color and a slanting transverse direction when it sees from a transverse plane can also be controlled.

[0017]When only arbitrary numbers provide the infeed which is the depth from the crevice upper surface of the inner container which carries the LED pellet to a recessed bottom face, and reaches from a crevice medial surface to the lateral surface, the air foam in the crevice of a light emitting diode is easily discharged by passing through an infeed part outside.

[0018]

[Example]The light emitting diode of this invention is explained with reference to drawings.

[0019]As shown in the perspective view of drawing 1 (the sectional side elevation of a), top view of the (b), and said (c), the light emitting diode of this invention, The sealing resin 6 of the 1st concentration with many additions of an optical dispersion agent is first filled up with and stiffened to the crevice upper surface of the inner container 2 (LED pellet mount part) of a leadframe, It is compatible in the performance to which luminescence mixed-colors nature furthermore disagrees the circumference with light emitting luminance by adoption of the double

molding structure which forms a lens with the sealing resin 7 of the 2nd concentration with few additions of an optical dispersion agent.
[0020]The flat part 1a which carries the LED pellet manufactured in etching or press working of sheet metal to the metal plates of 0.1-0.275 mm of board thickness like drawing 2 (a) although this structure is realized, and the lead outputting part 1b to the leadframe 1 which it has like drawing 2 (b), The inner container 2 fabricated with the thermoplastics of a white system for the purpose of improvement in the radiant power output to the direction of the front of an LED pellet is formed. The duty holding the leadframe 1 which carries out for relativity and is arranged has also achieved this inner container 2.
[0021]In the crevice of the inner container 2 of the leadframe 1 produced as mentioned above, it becomes possible about the red light LED pellet 3 required for especially multicolor luminescence, the green emission LED pellet 4, and the blue light LED pellet 5 to carry one piece and a total of three LED pellets or more, respectively.
[0022]In the depth from the crevice upper surface of the inner container 2 to a recessed bottom face as the drawing 3 perspective view. And by forming the infeed 8 which reaches from a crevice medial surface to the crevice lateral surface, as contrasted with drawing 5, as shown in drawing 4 (a) - (d), the air foam 10 involved in the inside of a mold can be easily emitted to the exterior through the infeed 8, and can remove the air foam in a light emitting diode mold part.
[0023]Of course, it cuts deeply here and, as for the width and the number of 8, the viscosity of sealing resin for molds must be carefully examined in consideration of the shape and the size of the inner container 2. If width of infeed is enlarged or the number is increased, it will become easy to escape from air foam, but in order for the internal surface product of a crevice which reflects the light of an LED pellet ahead to decrease, it is necessary to determine appropriately so that the fall of luminosity may be controlled.
[0024]
[Effect of the Invention]The sealing resin 6 of the 1st concentration with many additions of an optical dispersion agent is filled up with and stiffened to the crevice upper surface of the inner container of the LED pellet mount part of a leadframe, By forming a lens with the sealing resin 7 of the 2nd concentration with few additions of an optical dispersion agent, the circumference, At the time of simultaneous lighting of two or more unique luminescence LED pellets, even if the luminescent color of a light emitting diode sees from which direction, mixed-colors nature can be improved to such an extent that it is visible with the same color, and control of a fall of the light emitting luminance which disagrees with mixed-colors nature further is attained. In the light emitting diode by which the single mold was carried out with the sealing resin which added the optical dispersion agent of arbitrary concentration, In the depth from the crevice upper surface of the inner container 2 fabricated with the structure which enables improvement in optical power, and three or more unique luminescence LED pellet loading, and the adopted thermoplastics to a recessed bottom face. And when only arbitrary numbers form the infeed 8 which reaches from a crevice medial surface to the lateral surface and the crevice of this inner container 2 is inserted in the mold 9 with which the undiluted solution of sealing resin for molds was filled up, the air foam by which involved in the surrounding air and it was generated can be easily discharged to the exterior.

[Translation done.]

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1](a) The sectional view of the light emitting diode of this invention example
(b) The top view
(c) The perspective view
[Drawing 2](a) The top view of a leadframe circuit part and a lead outputting part used for the light emitting diode of this invention example
(b) The top view in the state where the inner container made of thermoplastics was attached to the leadframe
[Drawing 3]The perspective view of the light emitting diode of this invention example
[Drawing 4](a) The mold part formation figure of a process which manufactures the example of this invention (before insertion to a mold)
(b) The sectional view of the mold with which it similarly filled up with the undiluted solution of sealing resin for molds
(c) The constitutional diagram which similarly inserted the leadframe with an envelope in the mold
(d) The sectional view of completion of a single mold light emitting diode
[Drawing 5](a) mold part formation figure (before insertion to a mold) which expresses the manufacturing process of a device conventionally
(b) The sectional view of the mold with which it similarly filled up with the undiluted solution of sealing resin for molds
(c) The constitutional diagram which similarly inserted the leadframe with an envelope in the mold
(d) Similarly it is a completed chart of a single mold light emitting diode.
[Drawing 6](a) The top view of the conventional multicolor light emitting diode
(b) The side view
[Description of Notations]
1 Leadframe
1a LED pellet mount part
1b Lead outputting part
2 Inner container
3 Red light LED pellet
4 Green emission LED pellet
5 5' Blue light LED pellet
6 The 1st sealing resin
7 The 2nd sealing resin
8 - 8''' infeed
9 The mold with which it filled up with the undiluted solution of sealing resin for molds
10 Air foam
11 Metal leadframe
11a Flat part
11b Reflection part

12 Mold part
13 and 13' LED pellet
14 Mold part

[Translation done.]

(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

特開平6－296043

(43)公開日　平成６年(1994)10月21日

(51)Int.Cl.[5]	識別記号	庁内整理番号	ＦＩ	技術表示箇所
Ｈ０１Ｌ　33/00		Ｎ　7376－4Ｍ		
		Ｆ　7376－4Ｍ		

審査請求　未請求　請求項の数３　ＯＬ　（全　５　頁）

(21)出願番号　特願平5－81651

(22)出願日　平成５年(1993)４月８日

(71)出願人　000005821
松下電器産業株式会社
大阪府門真市大字門真1006番地

(72)発明者　伊瀬知　宣博
大阪府門真市大字門真1006番地　松下電器産業株式会社内

(72)発明者　湯元　重夫
大阪府門真市大字門真1006番地　松下電器産業株式会社内

(74)代理人　弁理士　小鍛治　明　（外２名）

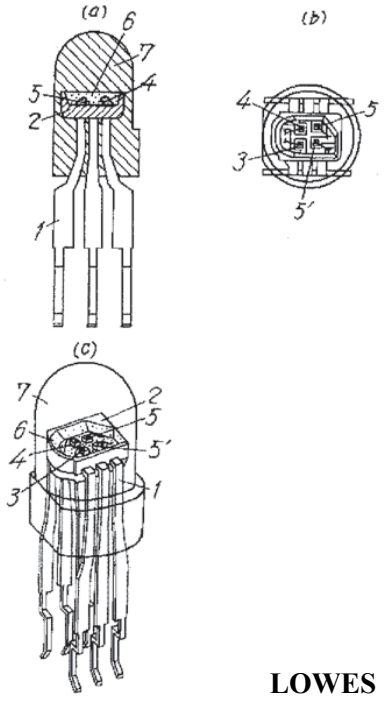
(54)【発明の名称】　発光ダイオード

(57)【要約】

【目的】　フルカラー発光に必要な異色３個のＬＥＤペレット搭載を可能にし、混色性の改善及びモールド時の気泡を防止する。

【構成】　内部容器２の凹部を分散剤の濃度の高い樹脂で、内部容器２の全体を分散剤の濃度の低い樹脂でモールドして混色性を改善した２重モールド構造とする。また、シングルモールドの場合は内部容器２に切込み８を設けて気泡の抜けをよくする。

【効果】　内部容器の凹部に少なくとも３個のＬＥＤペレットを搭載でき、かつ２重モールド構造により混色性がよくなる。



1

【特許請求の範囲】

【請求項１】　凹部を有する非透光性内部容器の、前記凹部の底面に配設した複数のインナーリード上にＬＥＤペレットを個別に搭載すると共に、前記非透光性内部容器及び前記ＬＥＤペレットを一体に覆うように透光性樹脂で外囲モールドしたことを特徴とする発光ダイオード。

【請求項２】　請求項第１項記載の非透光性内部容器の凹部上面まで第１の濃度で光分散剤を添加した樹脂で被い、外周を前記第１の濃度よりも少ない第２の濃度の光分散剤を添加した樹脂でモールドしたことを特徴とする発光ダイオード。

【請求項３】　請求項第１項記載の内部容器に、凹部上面から底面に至る深さで、かつ凹部内側面から外側面へ達する切込みを設けたことを特徴とする発光ダイオード。

【発明の詳細な説明】

【０００１】

【産業上の利用分野】本発明は、マルチカラー発光ダイオードに関するものである。

【０００２】

【従来の技術】発光ダイオードは、発光色としてＧａＰやＧａＡｌＡｓ等のＧａ系化合物半導体を用いた赤色と緑色、さらにＳｉＣやＧａＮやＺｎＺｅ等の化合物半導体を用いた青色の３色に大別される。近年、これらの３色のＬＥＤペレットを同一の外囲封止体、いわゆる、モールド内に配置してマルチカラー発光可能な発光ダイオードに対して市場からの要望が増えてきた。

【０００３】従来のマルチカラー発光ダイオードは、図６（ａ）の平面図、同（ｂ）の断面図の通り、金属製リードフレーム１１の先端をプレス加工してＬＥＤペレット搭載部として平坦部１１ａを形成し、さらに平坦部１１ａの周囲に反射部１１ｂを形成した後、その周囲を光分散剤の添加された封止樹脂でモールド部１２を形成していた。

【０００４】

【発明が解決しようとする課題】このようなプレス加工での金属製リードフレーム１１では、ＬＥＤペレットを搭載する平坦部１１ａの面積が広く確保できず、２個のＬＥＤペレット１３、１３′を搭載するのが限界であった。

【０００５】赤色発光ＬＥＤペレットと緑色発光ＬＥＤペレットとさらに青色発光ＬＥＤペレットの３色の発光色を組合せて形成するマルチカラー発光ダイオードを作製するためには、３個以上のＬＥＤペレットをリードフレームに搭載できる平坦部を設置する必要があり、またこれらの３個以上のＬＥＤペレットの点灯回路を容易に構成できるリードフレームが必要である。

【０００６】また、同一のモールド内に３個以上の異なる発光色を有するＬＥＤペレットを搭載した場合、その

2

モールド部を形成している樹脂は発光効率の点から透明樹脂を用いる方がよいが、この場合、それぞれのＬＥＤペレットからの発光色が直接見えてしまう。

【０００７】たとえば、橙色に発光させる例で説明すると、橙色は、赤色と緑色に発光するＬＥＤペレットを同時に発光させて混色させることで得られるが、透明樹脂の場合は、赤色と緑色とが個別に外部へ放出されるために、赤色と緑色がそのまま外部から見えてしまう。

【０００８】発光色の混色性能の向上のために、光分散剤を添加した半透明樹脂でモールド部を形成することが実施されている。しかし、この場合、そのモールド部への光分散剤の添加量に反比例して、発光輝度は低下する。

【０００９】また、２個以上の異色発光ＬＥＤペレットの同時点灯での混色光が任意の方向から観測しても色相及び輝度が変わらないことが商品上要求される。

【００１０】任意の濃度の光分散剤を添加した封止樹脂でシングルモールドされた発光ダイオードにおいて、その発光効率を向上させる手段として、リードフレームのＬＥＤペレット搭載部の周囲に反射部を設置する方法がとられているが、このＬＥＤペレット搭載部は、図４（ａ）の通り、周囲が高くて、ＬＥＤペレット搭載部が低い形状の、いわゆる凹状の内部容器２を用い、発光ダイオードのモールド部１４の形成時、図４（ｂ）の通り、モールド用封止樹脂の原液１４の充填された型９にこの内部容器を逆さに挿入する。この時、図４（ｃ）の通り、周囲の空気を巻き込み、この凹部にその空気泡１０が滞留したままとなり、モールド部封止樹脂が加熱硬化されると、発光ダイオードのモールド部１４内に空気泡１０が残り、点灯不良や特性不良等の要因となっている。

【００１１】上述の通り、発光ダイオードのモールド部１４を形成する時そのモールド部内に空気泡１０を発生させないためのリードフレームが必要となってきている。

【００１２】

【課題を解決するための手段】本発明は、赤色と緑色と青色のＬＥＤペレット搭載が可能なＬＥＤペレット搭載部を、熱可塑性樹脂で形成された内部容器の内に配設されたリードフレーム上となし、このリードフレームにＬＥＤペレットを搭載した後、この内部容器全体を覆うようにモールドする構造を採用する。

【００１３】さらに、２色以上のＬＥＤペレットを同時点灯した時の発光色をひとつの混合色として取り出す手段として、光分散剤の添加量の多い第１の濃度の半透明樹脂を内部容器の凹部上面まで充填し、さらにその周囲を光分散剤の少ない第２の濃度の半透明樹脂でモールドする２重モールド構造を採用する。

【００１４】空気泡を、その内部容器内に滞留させないようにする構造としてこの内部容器

底面に至る深さで、かつ凹部内側面から外側面へ達する切込みを任意の数だけ設ける。

【００１５】

【作用】リードフレーム上に直接凹部を設けるのではなく、リードフレーム上に熱可塑性樹脂で形成した凹状部をもつ内部容器を付設することにより、マルチカラー発光を可能にする赤色発光ＬＥＤペレットと緑色発光ＬＥＤペレットと青色発光ＬＥＤペレットの３個の異色発光ＬＥＤペレットを同一の発光ダイオード内に搭載することができる。

【００１６】また、光分散剤の添加量の多い第１の濃度の半透明樹脂をＬＥＤペレットの搭載された内部容器の上面まで充填し、さらにその周囲を光分散剤の少ない第２の濃度の半透明樹脂でモールドした２重モールド構造を採用することで、正面から見た時の発光色と斜め横方向から見た時の発光色の色相の変化をも抑制することができる。

【００１７】ＬＥＤペレットを搭載している内部容器の凹部上面から凹部底面に至る深さで、かつ凹部内側面から外側面へ達する切込みを任意の数だけ設けることにより、発光ダイオードの凹部内の空気泡は切込み部を通り抜けることで容易に外部へ排出される。

【００１８】

【実施例】本発明の発光ダイオードを、図面を参照して説明する。

【００１９】本発明の発光ダイオードは、図１（ａ）の側断面図、同（ｂ）の平面図、同（ｃ）の斜視図に示すように、まずリードフレームの内部容器２（ＬＥＤペレット搭載部）の凹部上面まで光分散剤の添加量の多い第１の濃度の封止樹脂６を充填して硬化させ、さらにその周囲を光分散剤の添加量の少ない第２の濃度の封止樹脂７でレンズを形成する２重モールド構造の採用によって発光輝度と発光混色性の相反する性能を両立することができる。

【００２０】この構造を実現するのに、図２（ａ）のように、板厚０．１～０．２７５ｍｍの金属製平板にエッチングまたはプレス加工にて製作したＬＥＤペレットを搭載する平坦部１ａとリード出力部１ｂとを有するリードフレーム１に、図２（ｂ）のように、ＬＥＤペレットの前方方向への発光出力の向上を目的として白色系の熱可塑性樹脂で成形された内部容器２を形成する。なお、この内部容器２は、相対向して配置されているリードフレーム１を保持する役目も果たしている。

【００２１】以上のように作製されたリードフレーム１の内部容器２の凹部には、特にマルチカラー発光に必要な赤色発光ＬＥＤペレット３、緑色発光ＬＥＤペレット４及び青色発光ＬＥＤペレット５をそれぞれ１個、合計３個以上のＬＥＤペレットを搭載することが可能となる。

【００２２】さらに、図３斜視図の通り、内部容器２の

凹部上面から凹部底面に至る深さで、かつ凹部内側面から凹部外側面へ達する切込み８を設けることにより、図５と対比して、図４（ａ）～（ｄ）に示すように、モールド内部に巻き込んだ空気泡１０は、切込み８を経て容易に外部へ放出でき、発光ダイオードモールド部内の空気泡を取り除くことができる。

【００２３】もちろん、ここで切込み８の幅と個数は内部容器２の形状と大きさを考慮し、並びにモールド用封止樹脂の粘度は、慎重に検討されなければならない。切込みの幅を大きくしたり、個数を増やすと空気泡は抜けやすくなるが、ＬＥＤペレットの光を前方に反射させる凹部の内部面積が減少するために輝度の低下を抑制するように、適切に決定する必要がある。

【００２４】

【発明の効果】リードフレームのＬＥＤペレット搭載部の内部容器の凹部上面まで光分散剤の添加量の多い第１の濃度の封止樹脂６を充填して硬化させ、その周囲を光分散剤の添加量の少ない第２の濃度の封止樹脂７でレンズを形成することにより、２個以上の異色発光ＬＥＤペレットの同時点灯時、発光ダイオードの発光色がどの方向から見ても同一色と見える程度に混色性が向上でき、さらに混色性と相反する発光輝度の低下の抑制が可能となる。また、任意の濃度の光分散剤を添加した封止樹脂でシングルモールドされた発光ダイオードにおいて、光出力向上と３個以上の異色発光ＬＥＤペレット搭載を可能とする構造と採用した熱可塑性樹脂で成形された内部容器２の凹部上面から凹部底面に至る深さで、かつ凹部内側面から外側面へ達する切込み８を任意の数だけ設けることにより、この内部容器２の凹部をモールド用封止樹脂の原液の充填された型９に挿入するとき、周囲の空気を巻き込んで発生した空気泡を容易に外部へ排出することができる。

【図面の簡単な説明】

【図１】（ａ）本発明実施例の発光ダイオードの断面図

（ｂ）同平面図

（ｃ）同斜視図

【図２】（ａ）本発明実施例の発光ダイオードに用いるリードフレーム回路部とリード出力部の平面図

（ｂ）同リードフレームに熱可塑性樹脂製内部容器が付設された状態の平面図

【図３】本発明実施例の発光ダイオードの斜視図

【図４】（ａ）本発明の実施例を製造する過程のモールド部形成図（モールド型への挿入前）

（ｂ）同じくモールド用封止樹脂の原液の充填された型の断面図

（ｃ）同じく外囲器付きリードフレームをモールド型へ挿入した状態図

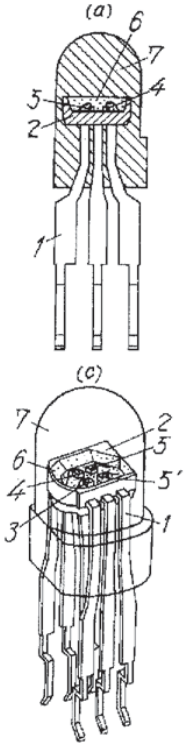
（ｄ）シングルモールド発光ダイオードの完成の断面図

【図５】（ａ）従来装置の製造過程をあらわすモールド部形成図（モールド型への挿入前）

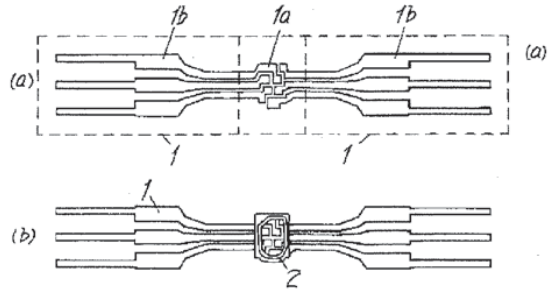
5　　6

（ｂ）同じくモールド用封止樹脂の原液の充填された型の断面図
（ｃ）同じく外囲器付きリードフレームをモールド型へ挿入した状態図
（ｄ）同じくシングルモールド発光ダイオードの完成図
【図６】（ａ）従来のマルチカラー発光ダイオードの平面図
（ｂ）同側面図
【符号の説明】
１　リードフレーム
１ａ　ＬＥＤペレット搭載部
１ｂ　リード出力部
２　内部容器
３　赤色発光ＬＥＤペレット
＊４　緑色発光ＬＥＤペレット
５，５′　青色発光ＬＥＤペレット
６　第１の封止樹脂
７　第２の封止樹脂
８～８′′′　切込み
９　モールド用封止樹脂の原液の充填された型
１０　空気泡
１１　金属製リードフレーム
１１ａ　平坦部
１１ｂ　反射部
１２　モールド部
１３，１３′　ＬＥＤペレット
１４　モールド部

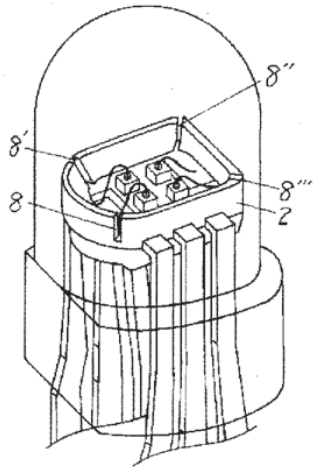
【図１】



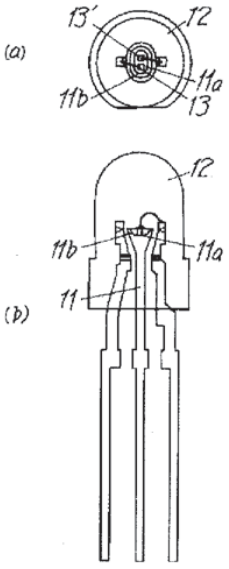
【図２】



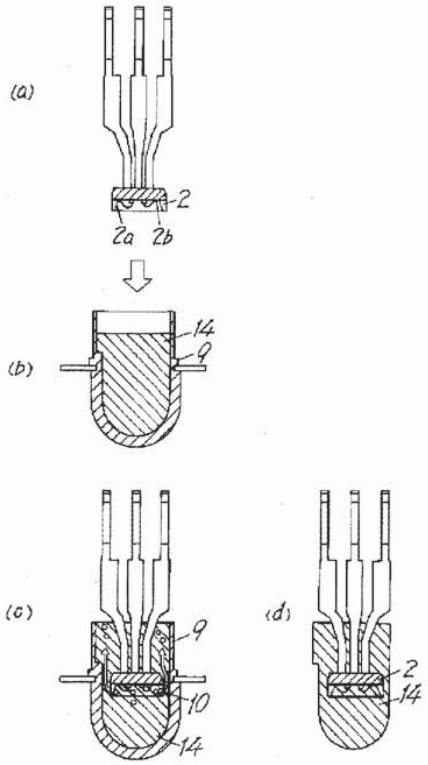
【図３】



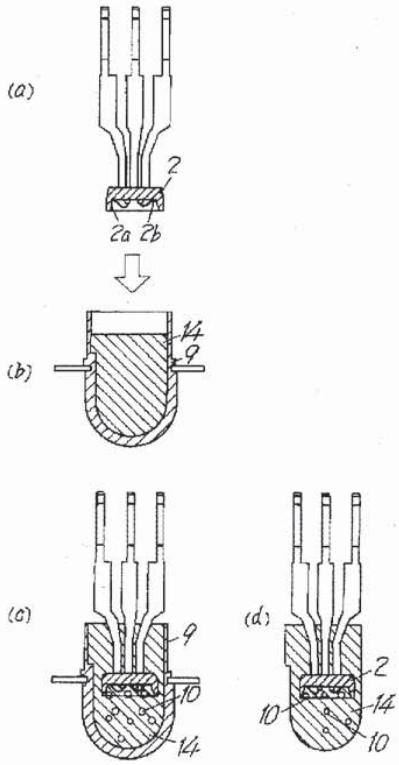
【図６】



【図4】



【図5】



Electronic Acknowledgement Receipt	
EFS ID:	8008473
Application Number:	12548618
International Application Number:	
Confirmation Number:	7447
Title of Invention:	LIGHT EMITTING DEVICE AND DISPLAY
First Named Inventor/Applicant Name:	Yoshinori SHIMIZU
Customer Number:	02292
Filer:	David Richard Anderson/DEBBIE LABRINY
Filer Authorized By:	David Richard Anderson
Attorney Docket Number:	0020-5147PUS5
Receipt Date:	13-JUL-2010
Filing Date:	27-AUG-2009
Time Stamp:	18:46:32
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		00205147PUS520100713IDStransb08.pdf	373824 aa4d89bcec35a8293475571d2a2258ba92322a72	yes	7

	Multipart Description/PDF files in .zip description		
	Document Description	Start	End
	Transmittal Letter	1	5
	Information Disclosure Statement (IDS) Filed (SB/08)	6	7

Warnings:					
Information:					
2	NPL Documents	NPLOA-2.pdf	649901 65186ccc91df82a23abfab2ed8750c06f5f58ee6	no	17
Warnings:					
Information:					
3	Foreign Reference	JP06296043-----.pdf	802658 ba8b8249842284648351bf7ba5b2dacb536ad093	no	12
Warnings:					
Information:					
4	NPL Documents	NPLhide.pdf	328085 b7a6467b9a99b68bc18bb1d3d48322c09119fffa	no	3
Warnings:					
Information:					
		Total Files Size (in bytes):	2154468		

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.

Docket No.: 0020-5147PUS5
(Patent)

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Patent Application of:
Yoshinori SHIMIZU et al.

Application No.:	12/548,618	Confirmation No.:	7447
Filed:	August 27, 2009	Art Unit:	2812
For:	LIGHT EMITTING DEVICE AND DISPLAY	Examiner:	Not Yet Assigned

INFORMATION DISCLOSURE STATEMENT

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

Sir:

Applicants hereby submit an Information Disclosure Statement for consideration by the Examiner.

I. LIST OF PATENTS, PUBLICATIONS OR OTHER INFORMATION

The patents, publications, or other information submitted for consideration by the Office are listed on the attached PTO/SB/08.

II. COPIES

☑ a. Copies of foreign patent documents, non-patent literature and other information.

☐ b. REFERENCES PREVIOUSLY CITED OR SUBMITTED: Copies of any information not provided can be found in one or more of the following applications which has been relied upon for an earlier filing date under 35 U.S.C. § 120:

U.S. Application No. and U.S. Filing Date

III. CONCISE EXPLANATION OF THE RELEVANCE/OTHER INFORMATION

☑ a. NON-ENGLISH LANGUAGE DOCUMENTS: A concise explanation of the relevance of all non-English language patents, publications, or other information listed is as follows:

An English language abstract and a full English machine generated translation are provided for the following reference: JP-6-296043-A

☑ b. ENGLISH LANGUAGE SEARCH REPORT OR FOREIGN PATENT OFFICE COMMUNICATION: An English language version of the search report or Foreign Patent Office communication that indicates the degree of relevance is attached.

☑ c. OTHER: The following additional information is provided. JP-6-296043-A was cited by the Japanese Patent Office on October 20, 2009 in a counterpart foreign application. US-4,001-628 and US-5,208,462-A were cited in a foreign Office Action from Singapore issued on April 9, 2010 in a counterpart foreign application.

IV. STATEMENT UNDER 37 C.F.R. § 1.97(e)

The undersigned hereby states that:

☐ a. Each item of information contained in the IDS was first cited in any communication from a foreign patent office in a counterpart foreign application not more than **30 days** prior to the filing of this IDS. This statement does not relate to English language counterparts not listed in a communication from the foreign patent office. Such English language counterparts are provided to aid the Examiner's consideration of non-English items first cited in the communication from the foreign patent office; or

☐ b. Each item of information contained in the IDS was first cited in any communication from a foreign patent office in a counterpart foreign application not more than **three months** prior to the filing of this IDS. This statement does not relate to English language counterparts not listed in a communication from the foreign patent office. Such English language

counterparts are provided to aid the Examiner's consideration of non-English items first cited in the communication from the foreign patent office; or

☐ c. No item of information contained in the IDS 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 IDS was known to any individual designated in 37 C.F.R. § 1.56(c) more than three months prior to the filing of the IDS.

☐ d. Some of the items of information in the IDS were cited in a communication from a foreign patent office. Such items were first cited in a communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of this IDS. This statement does not relate to English language counterparts not listed in a communication from the foreign patent office. Such English language counterparts are provided to aid the Examiner's consideration of non-English items first cited in the communication from the foreign patent office. As to the remaining items of information, to the knowledge of the person signing the certification after making reasonable inquiry, such remaining items were not known to any individual designated in 37 C.F.R. § 1.56(c) more than three months prior to the filing of this statement.

V. FEES

☐ a. This Information Disclosure Statement is being filed concurrently with the filing of a new patent application or Request for Continued Examination. No fee is required.

☐ b. This Information Disclosure Statement is being filed within three months of the filing date of an application. No fee is required.

☑ c. This Information Disclosure Statement is being filed before the mailing date of a first Action on the merits. No fee is required. If a first Office Action on the merits has issued,

please consider this IDS under 37 C.F.R. § 1.97(c) and see the statement under 37 C.F.R. § 1.97(e) above. If no statement has been made, charge our deposit account for the required fee.

☐ d. This Information Disclosure Statement is being filed before the mailing date of a Final Office Action or before the mailing date of a Notice of Allowance (see 37 C.F.R. § 1.97(c)(1)).

☐ No statement. The fee as required by 37 C.F.R. § 1.17(p) is provided.

or

☐ See the above statement. No fee is required.

☐ e. This Information Disclosure Statement is being filed after the mailing date of a Final Office Action or after the mailing date of a Notice of Allowance (see 37 C.F.R. § 1.97(d)), see the statement above. The fee as required by 37 C.F.R. § 1.17(p) is provided.

VI. PAYMENT OF FEES

☐ The required fee is listed on the attached Fee Transmittal.

☑ No fee is required.

If the Examiner has any questions concerning this IDS, please contact the undersigned. If it is determined that this IDS has been filed under the wrong rule, the USPTO is requested to consider this IDS under the proper rule and charge the appropriate fee to Deposit Account No. 02-2448.

Dated:

JUL 13 2010

Respectfully submitted,

By

D. Richard Anderson
Registration No.: 40439
BIRCH, STEWART, KOLASCH & BIRCH, LLP
8110 Gatehouse Road, Suite 100 East
P.O. Box 747
Falls Church, VA 22040-0747
703-205-8000

Attachment(s):

- ☑ PTO/SB/08
- ☑ Document(s)
- ☑ Foreign Patent Office Communication
- ☐ Foreign Search Report
- ☐ Fee
- ☐ Other:

cet

Docket No.: 0020-5147PUS5
(Patent)

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Patent Application of:
Yoshinori SHIMIZU et al.

Application No.:	12/548,618	Confirmation No.:	7447
Filed:	August 27, 2009	Art Unit:	2812
For:	LIGHT EMITTING DEVICE AND DISPLAY	Examiner:	Not Yet Assigned

INFORMATION DISCLOSURE STATEMENT

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

Sir:

Applicants hereby submit an Information Disclosure Statement for consideration by the Examiner.

I. LIST OF PATENTS, PUBLICATIONS OR OTHER INFORMATION

The patents, publications, or other information submitted for consideration by the Office are listed on the attached PTO/SB/08.

II. COPIES

☑ a. Copies of foreign patent documents, non-patent literature and other information.

☐ b. REFERENCES PREVIOUSLY CITED OR SUBMITTED: Copies of any information not provided can be found in one or more of the following applications which has been relied upon for an earlier filing date under 35 U.S.C. § 120:

U.S. Application No. and U.S. Filing Date

III. CONCISE EXPLANATION OF THE RELEVANCE/OTHER INFORMATION

☑ a. NON-ENGLISH LANGUAGE DOCUMENTS: A concise explanation of the relevance of all non-English language patents, publications, or other information listed is as follows:

An English language abstract and a full English machine generated translation are provided for the following reference: JP-6-296043-A

☑ b. ENGLISH LANGUAGE SEARCH REPORT OR FOREIGN PATENT OFFICE COMMUNICATION: An English language version of the search report or Foreign Patent Office communication that indicates the degree of relevance is attached.

☑ c. OTHER: The following additional information is provided. JP-6-296043-A was cited by the Japanese Patent Office on October 20, 2009 in a counterpart foreign application. US-4,001-628 and US-5,208,462-A were cited in a foreign Office Action from Singapore issued on April 9, 2010 in a counterpart foreign application.

IV. STATEMENT UNDER 37 C.F.R. § 1.97(e)

The undersigned hereby states that:

☐ a. Each item of information contained in the IDS was first cited in any communication from a foreign patent office in a counterpart foreign application not more than **30 days** prior to the filing of this IDS. This statement does not relate to English language counterparts not listed in a communication from the foreign patent office. Such English language counterparts are provided to aid the Examiner's consideration of non-English items first cited in the communication from the foreign patent office; or

☐ b. Each item of information contained in the IDS was first cited in any communication from a foreign patent office in a counterpart foreign application not more than **three months** prior to the filing of this IDS. This statement does not relate to English language counterparts not listed in a communication from the foreign patent office. Such English language

counterparts are provided to aid the Examiner's consideration of non-English items first cited in the communication from the foreign patent office; or

☐ c. No item of information contained in the IDS 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 IDS was known to any individual designated in 37 C.F.R. § 1.56(c) more than three months prior to the filing of the IDS.

☐ d. Some of the items of information in the IDS were cited in a communication from a foreign patent office. Such items were first cited in a communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of this IDS. This statement does not relate to English language counterparts not listed in a communication from the foreign patent office. Such English language counterparts are provided to aid the Examiner's consideration of non-English items first cited in the communication from the foreign patent office. As to the remaining items of information, to the knowledge of the person signing the certification after making reasonable inquiry, such remaining items were not known to any individual designated in 37 C.F.R. § 1.56(c) more than three months prior to the filing of this statement.

V. FEES

☐ a. This Information Disclosure Statement is being filed concurrently with the filing of a new patent application or Request for Continued Examination. No fee is required.

☐ b. This Information Disclosure Statement is being filed within three months of the filing date of an application. No fee is required.

☑ c. This Information Disclosure Statement is being filed before the mailing date of a first Action on the merits. No fee is required. If a first Office Action on the merits has issued,

please consider this IDS under 37 C.F.R. § 1.97(c) and see the statement under 37 C.F.R. § 1.97(e) above. If no statement has been made, charge our deposit account for the required fee.

☐ d. This Information Disclosure Statement is being filed before the mailing date of a Final Office Action or before the mailing date of a Notice of Allowance (see 37 C.F.R. § 1.97(c)(1)).

☐ No statement. The fee as required by 37 C.F.R. § 1.17(p) is provided.

or

☐ See the above statement. No fee is required.

☐ e. This Information Disclosure Statement is being filed after the mailing date of a Final Office Action or after the mailing date of a Notice of Allowance (see 37 C.F.R. § 1.97(d)), see the statement above. The fee as required by 37 C.F.R. § 1.17(p) is provided.

VI. PAYMENT OF FEES

☐ The required fee is listed on the attached Fee Transmittal.

☑ No fee is required.

If the Examiner has any questions concerning this IDS, please contact the undersigned. If it is determined that this IDS has been filed under the wrong rule, the USPTO is requested to consider this IDS under the proper rule and charge the appropriate fee to Deposit Account No. 02-2448.

Dated: JUL 13 2010

Respectfully submitted,

By

D. Richard Anderson
Registration No.: 40439
BIRCH, STEWART, KOLASCH & BIRCH, LLP
8110 Gatehouse Road, Suite 100 East
P.O. Box 747
Falls Church, VA 22040-0747
703-205-8000

Attachment(s):

- ☑ PTO/SB/08
- ☑ Document(s)
- ☑ Foreign Patent Office Communication
- ☐ Foreign Search Report
- ☐ Fee
- ☐ Other:

cet

UNITED STATES PATENT AND TRADEMARK OFFICE

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

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
12/548,618	08/27/2009	Yoshinori SHIMIZU	0020-5147PUS5

CONFIRMATION NO. 7447

2292
BIRCH STEWART KOLASCH & BIRCH
PO BOX 747
FALLS CHURCH, VA 22040-0747

PUBLICATION NOTICE

OC000000039659322

Title:LIGHT EMITTING DEVICE AND DISPLAY

Publication No.US-2010-0006819-A1
Publication Date:01/14/2010

NOTICE OF PUBLICATION OF APPLICATION

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

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

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

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

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

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

DEC 0 4 2009

PTO/SB/08a (07-09)
Approved for use through 07/31/2012. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

Substitute for form 1449/PTO

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

Sheet 1 of 3

Complete if Known	
Application Number	12/548,618, Conf. #7447
Filing Date	August 27, 2009
First Named Inventor	Yoshinori SHIMIZU
Art Unit	2812
Examiner Name	Not Yet Assigned
Attorney Docket Number	0020-5147PUS5

U.S. PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Document Number Number-Kind Code[2] (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
	AA*	US-5,798,537	08-25-1988	Nitta	
	AB*	US-5,998,925-A	12-07-1999	Shimizu et al.	
	AC*	US-6,069,440-A	05-30-2000	Shimizu et al.	
	AD*	US-6,608,332-B2	08-19-2003	Shimizu et al.	
	AE*	US-6,614,179-B1	09-02-2003	Shimizu et al.	
	AF*	US-7,026,756-B2	04-11-2006	Shimizu et al.	
	AG*	US-7,071,616-B2	07-04-2006	Shimizu et al.	
	AH*	US-7,126,274-B2	10-24-2006	Shimizu et al.	
	AI*	US-7,215,074-B2	05-08-2007	Shimizu et al.	
	AJ*	US-7,329,988-B2	02-12-2008	Shimizu et al.	
	AK*	US-7,362,048-B2	04-22-2008	Shimizu et al.	
	AL*	US-7,531,960-B2	05-12-2009	Shimizu et al.	

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 Document	Pages, Columns, Lines, Where Relevant Passages Or Relevant Figures Appear	T[6]
	BA*	EP-0-550-937-A1	09-02-1992			

Examiner Signature		Date Considered	

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. * CITE NO.: Those application(s) which are marked with an single asterisk (*) next to the Cite No. are not supplied (under 37 CFR 1.98(a)(2)(iii)) because that application was filed after June 30, 2003 or is available in the IFW. [1] Applicant's unique citation designation number (optional). [2] See Kinds Codes of USPTO Patent Documents at www.uspto.gov or MPEP 901.04. [3] Enter Office that issued the document, by the two-letter code (WIPO Standard ST.3). [4] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [5] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [6] Applicant is to place a check mark here if English language Translation is attached.

PTO/SB/08a (07-09)
Approved for use through 07/31/2012. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

Substitute for form 1449/PTO

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

Sheet 2 of 3

Complete if Known	
Application Number	12/548,618, Conf. #7447
Filing Date	August 27, 2009
First Named Inventor	Yoshinori SHIMIZU
Art Unit	2812
Examiner Name	Not Yet Assigned
Attorney Docket Number	0020-5147PUS5

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[2]
	CA*	**Notice of Allowance and Examiner's Comments on Allowance issued January 28, 1999, in U.S. Application No. 08/902,725 (U.S. Patent 5,998,925).**	
	CB*	**Office Action issued November 17, 2000, in U.S. Application No. 08/902,725 (U.S. Patent 5,998,925).**	
	CC*	**Notice of Allowance and Examiner's Comments on Allowance issued October 8, 1999, in U.S. Application No. 09/300,315 (U.S. Patent 6,069,440).**	
	CD*	**Office Action issued March 13, 2001, in U.S. Application No. 09/458,024 (U.S. Patent 6,614,179).**	
	CE*	**Notice of Allowance and Examiner's Comments on Allowance issued March 26, 2003, in U.S. Application No. 09/458,024 (U.S. Patent 6,614,179).**	
	CF*	**Office Action issued August 14, 2002, in U.S. Application No. 09/736,425 (U.S. Patent 6,608,332).**	
	CG*	**Notice of Allowance and Examiner's Comments on Allowance issued March 25, 2003, in U.S. Application No. 09/736,425 (U.S. Patent 6,608,332).**	
	CH*	**Office Action issued August 19, 2005, in U.S. Application No. 10/609,402 (U.S. Patent 7,362,048).**	
	CI*	**Office Action issued July 27, 2007, in U.S. Application No. 10/609,402 (U.S. Patent 7,362,048).**	
	CJ*	**Office Action issued January 2, 2008, in U.S. Application No. 10/609,402 (U.S. Patent 7,362,048).**	
	CK*	**Notice of Allowance and Examiner's Comments on Allowance issued February 13, 2008, in U.S. Application No. 10/609,402 (U.S. Patent 7,362,048).**	
	CL*	**Notice of Allowance and Examiner's Comments on Allowance issued May 4, 2005, in U.S. Application No. 10/609,503 (U.S. Patent 7,071,616).**	
	CM*	**Office Action issued April 8, 2005, in U.S. Application No. 10/677,382 (U.S. Patent 7,026,756).**	
	CN*	**Notice of Allowance and Examiner's Comments on Allowance issued September 22, 2005, in U.S. Application No. 10/677,382 (U.S. Patent 7,026,756).**	
	CO*	**Office Action issued February 28, 2006, in U.S. Application No. 10/677,382 (U.S. Patent 7,026,756).**	
	CP*	**Notice of Allowance and Examiner's Comments on Allowance issued February 11, 2009, in U.S. Application No. 11/682,014 (U.S. Patent 7,531,960).**	
	CQ*	**Office Action issued September 7, 2005, in U.S. Application No. 10/864,544 (U.S. Patent 7,126,274).**	
	CR*	**Notice of Allowance and Examiner's Comments on Allowance issued March 10, 2006, in U.S. Application No. 10/864,544 (U.S. Patent 7,126,274).**	

Examiner Signature		Date Considered	

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

[1]Applicant's unique citation designation number (optional). [2]Applicant is to place a check mark here if English language Translation is attached.

PTO/SB/08a (07-09)
Approved for use through 07/31/2012. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

Substitute for form 1449/PTO

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

Sheet 3 of 3

Complete if Known	
Application Number	12/548,618, Conf. #7447
Filing Date	August 27, 2009
First Named Inventor	Yoshinori SHIMIZU
Art Unit	2812
Examiner Name	Not Yet Assigned
Attorney Docket Number	0020-5147PUS5

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[2]
	CS*	**Office Action issued December 13, 2005, in U.S. Application No. 11/208,729 (U.S. Patent 7,215,074).**	
	CT*	**Notice of Allowance and Examiner's Comments on Allowance issued September 7, 2006, in U.S. Application No. 11/208,729 (U.S. Patent 7,215,074).**	
	CU*	**Office Action issued April 4, 2007, in U.S. Application 11/653,275 (U.S. Patent 7,329,988).**	
	CV*	**Notice of Allowance and Examiner's Comments on Allowance issued September 25, 2007, in U.S. Application No. 11/653,275 (U.S. Patent 7,329,988).**	

Examiner Signature		Date Considered	

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

[1]Applicant's unique citation designation number (optional). [2]Applicant is to place a check mark here if English language Translation is attached.

Docket No.: 0020-5147PUS5
(PATENT)

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of:
Yoshinori SHIMIZU et al.

Application No.: 12/548,618 Confirmation No.: 7447

Filed: August 27, 2009 Art Unit: 2812

For: LIGHT EMITTING DEVICE AND DISPLAY Examiner: Not Yet Assigned

COPENDING APPLICATION LETTER

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

Sir:

Under the provisions of MPEP § 2001.06(b), the Examiner is hereby advised of the following co-pending U.S. Application(s):

Appl. No.	Filing Date	Group
12/548,614	08-27-2009	2812
12/548,620	08-27-2009	2812
12/548,621	08-27-2009	2812
12/559,042	09-14-2009	2812
12/575,155	10-07-2009	2812
12/575,162	10-07-2009	2812

The subject matter contained in the above-listed co-pending U.S. applications may be deemed to relate to the present application, and thus may be material to the prosecution of this instant application.

Copies of the cited U.S. patent applications (specification, claims, and the drawings) are available on the USPTO's Image File Wrapper. Therefore copies thereof need not be attached.

☐ The materials in the envelope are considered trade secrets and are being submitted for consideration under MPEP § 724.

The above-listed co-pending applications are not to be construed as prior art. By bringing the above-listed applications to the attention of the Examiner, Applicants do NOT waive any confidentiality concerning the above-listed co-pending applications or this application. See MPEP § 101. Furthermore, if said applications should not mature into patents, such applications should be preserved in secrecy under the provisions of 35 U.S.C. § 122 and 37 C.F.R. § 1.14.

If necessary, the Commissioner is hereby authorized in this, concurrent, and future replies, to charge payment or credit any overpayment to our Deposit Account No. 02-2448 for any additional fees required under 37 C.F.R. § 1.16 or under § 1.17; particularly, extension of time fees.

Dated: DEC 0 4 2009

Respectfully submitted,

By Gene D. Rey #41,501

Andrew D. Meikle
Registration No.: 32,868
BIRCH, STEWART, KOLASCH & BIRCH, LLP
8110 Gatehouse Road, Suite 100 East
P.O. Box 747
Falls Church, Virginia 22040-0747
(703) 205-8000
Attorney for Applicant

Electronic Acknowledgement Receipt

EFS ID:	6572525
Application Number:	12548618
International Application Number:	
Confirmation Number:	7447
Title of Invention:	LIGHT EMITTING DEVICE AND DISPLAY
First Named Inventor/Applicant Name:	Yoshinori SHIMIZU
Customer Number:	02292
Filer:	Andrew Duff Meikle/Lisa Strandberg
Filer Authorized By:	Andrew Duff Meikle
Attorney Docket Number:	0020-5147PUS5
Receipt Date:	04-DEC-2009
Filing Date:	27-AUG-2009
Time Stamp:	10:57:27
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		IDSetc.pdf	469279 723a75cb666c33d23daf891abd58648f208ec403	yes	12

	Multipart Description/PDF files in .zip description		
	Document Description	**Start**	**End**
	Power of Attorney	1	1
	Assignee showing of ownership per 37 CFR 3.73(b).	2	2
	Transmittal Letter	3	7
	Information Disclosure Statement (IDS) Filed (SB/08)	8	10
	Transmittal Letter	11	12
Warnings:			
Information:			
	Total Files Size (in bytes):	469279	

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

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

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

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

PTO/SB/81 (01-09)
Approved for use through 11/30/2011. OMB 0651-0035
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

POWER OF ATTORNEY OR REVOCATION OF POWER OF ATTORNEY WITH A NEW POWER OF ATTORNEY AND CHANGE OF CORRESPONDENCE ADDRESS

Application Number	12/548,618-Conf. #7447
Filing Date	August 27, 2009
First Named Inventor	Yoshinori SHIMIZU
Title	LIGHT EMITTING DEVICE AND DISPLAY
Art Unit	N/A
Examiner Name	Not Yet Assigned
Attorney Docket No.	0020-5147PUS5

I hereby revoke all previous powers of attorney given in the above-identified application.

☐ A Power of Attorney is submitted herewith.

OR

☒ I hereby appoint Practitioner(s) associated with the following Customer Number as my/our attorney(s) or agent(s) to prosecute the application identified above, and to transact all business in the United States Patent and Trademark Office connected therewith: 02292

OR

☐ I hereby appoint Practitioner(s) named below as my/our attorney(s) or agent(s) to prosecute the application identified above, and to transact all business in the United States Patent and Trademark Office connected therewith:

Practitioner(s) Name	Registration Number	Practitioner(s) Name	Registration Number

Please recognize or change the correspondence address for the above-identified application to:

☐ The address associated with the above-mentioned Customer Number:

OR

☐ The address associated with Customer Number:

OR

☐ Firm or Individual Name

Address					
City		State		Zip	
Country		Telephone		Email	

I am the:

☐ Applicant/Inventor.

OR

☒ Assignee of record of the entire interest. See 37 CFR 3.71.
Statement under 37 CFR 3.73(b) (Form PTO/SB/96) submitted herewith or filed on _____

SIGNATURE of Applicant or Assignee of Record

Signature	Eiji Ogawa	Date	October 6, 2009
Name	Eiji OGAWA	Telephone	(81) 884-22-2311
Title and Company	President, NICHIA CORPORATION		

NOTE: Signatures of all the inventors or assignees of record of the entire interest or their representative(s) are required. Submit multiple forms if more than one signature is required, see below*.

☐ *Total of 1 forms are submitted.

STATEMENT UNDER 37 CFR 3.73(b)

Applicant/Patent Owner: Yoshinori SHIMIZU et al.

Application No./Patent No.: 12/548,618 Filed/Issue Date: August 27, 2009

Entitled: LIGHT EMITTING DEVICE AND DISPLAY

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

states that it is:

1. [x] the assignee of the entire right, title, and interest; or

2. [ ] an assignee of less than the entire right, title and interest.
The extent (by percentage) of its ownership interest is _____ %

in the patent application/patent identified above by virtue of either:

A. [ ] An assignment from the inventors of the patent application/patent identified above. The assignment was recorded in Application No. _____ in the United States Patent and Trademark Office at Reel _____, Frame _____, or for which a copy thereof is attached.

OR

B. [ ] A chain of title from the inventor(s), of the patent application/patent identified above, to the current assignee as shown below:

1. From: Yoshinori Shimizu et al. To: Nichia Kagaku Kogyo Kabushiki Kaisha
The document was recorded in the United States Patent and Trademark Office at
Reel 8804 , Frame 0037

2. From: Nichia Kagaku Kogyo Kabushiki To: Nichia Corporation
The document was recorded in the United States Patent and Trademark Office at
Reel 017260 , Frame 0861

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.

[ ] Additional documents in the chain of title are listed on a supplemental sheet.

[ ] Copies of assignments or other documents in the chain of title are attached.
[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, if the assignment is to be recorded 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.

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.

Eiji Ogawa
Signature

October. 16, 2009
Date

Eiji OGAWA
Printed or Typed Name

(81) 884-22-2311
Telephone Number

President, NICHIA CORPORATION
Title

Docket No.: 0020-5147PUS5
(PATENT)

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of:
Yoshinori SHIMIZU et al.

Application No.: 12/548,618 Confirmation No.: 7447

Filed: August 27, 2009 Art Unit: 2812

For: LIGHT EMITTING DEVICE AND DISPLAY Examiner: Not Yet Assigned

INFORMATION DISCLOSURE STATEMENT

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

Sir:

Applicant(s) hereby submit(s) an Information Disclosure Statement for consideration by the Examiner.

I. LIST OF PATENTS, PUBLICATIONS OR OTHER INFORMATION

The patents, publications, or other information submitted for consideration by the Office are listed on the PTO-SB08.

II. COPIES

☐ a. Copies of foreign patent documents, non-patent literature and other information.

☒ **b. REFERENCES PREVIOUSLY CITED OR SUBMITTED: Copies of any information not provided can be found in one or more of the following applications which has been relied upon for an earlier filing date under 35 U.S.C. § 120:**

U.S. Application No. and U.S. Filing Date

12/028,062 filed February 8, 2008

III. CONCISE EXPLANATION OF THE RELEVANCE

☐ a. NON-ENGLISH LANGUAGE DOCUMENTS: A concise explanation of the relevance of all non-English language patents, publications, or other information listed is as follows:

☐ b. ENGLISH LANGUAGE SEARCH REPORT OR FOREIGN PATENT OFFICE COMMUNICATION: An English language version of the search report or Foreign Patent Office communication that indicates the degree of relevance is attached.

☒ **c. OTHER: The following additional information is provided. The documents listed on the attached Form PTO/SB/08 include related U.S. patents and Office Actions that issued in connection with the cited U.S. patents. U.S. 5,798,537 is cited herein, as it was erroneously cited as U.S. 6,798,537 (reference AY) in the IDS filed on August 27, 2009. EP 0 550 937 is cited herein, as it was erroneously cited as EP 0 500 937 (reference BM) in the IDS filed on August 27, 2009.**

IV. STATEMENT UNDER 37 C.F.R. § 1.97(e)

The undersigned hereby states that:

☐ a. Each item of information contained in the IDS was first cited in any communication from a foreign patent office in a counterpart foreign application not more than **30 days** prior to the filing of this IDS. This statement does not relate to English language counterparts not listed in a communication from the foreign patent office. Such English language counterparts are provided to aid the Examiner's consideration of non-English items first cited in the communication from the foreign patent office; or

☐ b. Each item of information contained in the IDS was first cited in any communication from a foreign patent office in a counterpart foreign application not more than **three months** prior to the filing of this IDS. This statement does not relate to English language counterparts not listed in a communication from the foreign patent office. Such English

language counterparts are provided to aid the Examiner's consideration of non-English items first cited in the communication from the foreign patent office; or

☐ c. No item of information contained in the IDS 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 IDS was known to any individual designated in 37 C.F.R. § 1.56(c) more than three months prior to the filing of the IDS.

☐ d. Some of the items of information in the IDS were cited in a communication from a foreign patent office. Such items were first cited in a communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of this IDS. This statement does not relate to English language counterparts not listed in a communication from the foreign patent office. Such English language counterparts are provided to aid the Examiner's consideration of non-English items first cited in the communication from the foreign patent office. As to the remaining items of information, to the knowledge of the person signing the certification after making reasonable inquiry, such remaining items were not known to any individual designated in 37 C.F.R. § 1.56(c) more than three months prior to the filing of this statement.

V. FEES

☐ a. This Information Disclosure Statement is being filed concurrently with the filing of a new patent application or Request for Continued Examination. No fee is required.

☐ b. This Information Disclosure Statement is being filed within three months of the filing date of an application. No fee is required.

☒ **c. This Information Disclosure Statement is being filed before the mailing date of a first Action on the merits. No fee is required. If a first Office Action on the merits has issued, please consider this IDS under 37 C.F.R. § 1.97(c) and see the statement under 37**

C.F.R. § 1.97(e) above. If no statement has been made, charge our deposit account for the required fee.

☐ d. This Information Disclosure Statement is being filed before the mailing date of a Final Office Action or before the mailing date of a Notice of Allowance (see 37 C.F.R. § 1.97(c)(1)).

☐ No statement. The fee as required by 37 C.F.R. § 1.17(p) is provided.

or

☐ See the above statement. No fee is required.

☐ e. This Information Disclosure Statement is being filed after the mailing date of a Final Office Action or after the mailing date of a Notice of Allowance (see 37 C.F.R. § 1.97(d)), see the statement above. The fee as required by 37 C.F.R. § 1.17(p) is provided.

VI. PAYMENT OF FEES

☐ The required fee is listed on the attached Fee Transmittal.

☒ **No fee is required.**

If the Examiner has any questions concerning this IDS, please contact the undersigned. If it is determined that this IDS has been filed under the wrong rule, the USPTO is requested to consider this IDS under the proper rule and charge the appropriate fee to Deposit Account No. 02-2448.

Dated: DEC 0 4 2009

Respectfully submitted,

By #48,501
Andrew D. Meikle
Registration No.: 32,868
BIRCH, STEWART, KOLASCH & BIRCH, LLP
8110 Gatehouse Road, Suite 100 East
P.O. Box 747
Falls Church, Virginia 22040-0747
(703) 205-8000
Attorney for Applicant

Attachments: PTO/SB/08

日 本 国 特 許 庁
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 Date of Application:	１９９６年　７月２９日
出 願 番 号 Application Number:	平成　８年特許願第１９８５８５号
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	ＪＰ１９９６－１９８５８５
出 願 人 Applicant(s):	日亜化学工業株式会社

２００９年１０月　６日

特許庁長官
Commissioner,
Japan Patent Office

細野哲弘

【書類名】特許願

【整理番号】P96ST13

【提出日】平成 8年 7月29日

【あて先】特許庁長官　荒川　寿光　殿

【国際特許分類】

H01L 33/00

【発明の名称】発光ダイオード及びそれを用いた表示装置

【請求項の数】　4

【発明者】

【住所又は居所】徳島県阿南市上中町岡４９１番地１００　日亜化学工業株式会社内

【氏名】清水　義則

【発明者】

【住所又は居所】徳島県阿南市上中町岡４９１番地１００　日亜化学工業株式会社内

【氏名】阪野　顕正

【特許出願人】

【識別番号】000226057

【郵便番号】774

【住所又は居所】徳島県阿南市上中町岡４９１番地１００

【氏名又は名称】日亜化学工業株式会社

【代表者】小川　英治

【電話番号】0884-22-2311

【手数料の表示】

【予納台帳番号】010526

【納付金額】21,000

【提出物件の目録】

【物件名】明細書　1

【物件名】図面　1

【物件名】要約書　1
【プルーフの要否】要

【書類名】　明細書

【発明の名称】　発光ダイオード及びそれを用いた表示装置

【特許請求の範囲】

【請求項１】

発光層が窒化ガリウム系化合物半導体であるＬＥＤチップと、該ＬＥＤチップからの発光の少なくとも一部を吸収し波長変換して発光するフォトルミネセンス蛍光体と、を有する発光ダイオードであって、

前記ＬＥＤチップの発光スペクトルのピークが４００ｎｍから５３０ｎｍの発光波長を有すると共に、前記フォトルミネセンス蛍光体が$RE_3(Al,Ga)_5O_{12}:Ce$であることを特徴とする発光ダイオード。

但し、ＲＥは、Ｙ，Ｇｄ，Ｓｍから選択される少なくとも一種である。

【請求項２】

マウント・リードのカップ内に配置させたＬＥＤチップと、該ＬＥＤチップと導電性ワイヤーを用いて電気的に接続させたインナー・リードと、前記カップ内に充填させたコーティング部材と、該コーティング部材、ＬＥＤチップ、導電性ワイヤー及びマウント・リードとインナー・リードの少なくとも一部を被覆するモールド部材と、を有する発光ダイオードであって、

前記ＬＥＤチップが窒化ガリウム系化合物半導体であり、且つ前記コーティング部材が$RE_3(Al,Ga)_5O_{12}:Ce$フォトルミネセンス蛍光体を有する透光性樹脂であることを特徴とする発光ダイオード。

但し、ＲＥは、Ｙ，Ｇｄ，Ｓｍから選択される少なくとも一種である。

【請求項３】

前記フォトルミネセンス蛍光体の組成が次の一般式で示されることを特徴とする請求項１又は請求項２記載の発光ダイオード。

$$(Y_{1-p-q-r}Gd_pCe_qSm_r)_3(Al_{1-s}Ga_s)_5O_{12}$$

但し、

$$0 \leqq p \leqq 0.8$$

$$0.003 \leqq q \leqq 0.2$$

$$0.0003 \leqq r \leqq 0.08$$

$$0 \leqq s \leqq 1$$

【請求項４】

請求項２記載の発光ダイオードをマトリックス状に配置したＬＥＤ表示器と、該ＬＥＤ表示器と電気的に接続させた駆動回路と、を有するＬＥＤ表示装置。

【発明の詳細な説明】

【０００１】

【産業上の利用分野】

本願発明は、ＬＥＤディスプレイ、バックライト光源、信号機、照光式スイッチ及び各種インジケータなどに利用される発光ダイオードに係わり、特に発光素子であるＬＥＤチップからの発光を変換して発光させるフォトルミネセンス蛍光体を有し使用環境によらず高輝度、高効率な発光ダイオード及びそれを用いた表示装置に関する。

【０００２】

【従来技術】

発光ダイオード（以下、ＬＥＤともいう）は、小型で効率が良く鮮やかな色の発光をする。また、半導体素子であるため球切れなどの心配がない。初期駆動特性が優れ、振動やON／OFF点灯の繰り返しに強いという特徴を有する。そのため各種インジケータや種々の光源として利用されている。最近、超高輝度高効率な発光ダイオードとしてＲＧＢ（赤、緑、青色）などの発光ダイオードがそれぞれ開発された。これに伴いＲＧＢの三原色を利用したＬＥＤディスプレイが省電力、長寿命、軽量などの特長を生かして飛躍的に発展を遂げつつある。

【０００３】

発光ダイオードは使用される発光層の半導体材料、形成条件などによって紫外から赤外まで種々の発光波長を放出させることが可能である。また、優れた単色性ピーク波長を有する。

【０００４】

しかしながら、発光ダイオードは優れた単色性ピーク波長を有するが故に白色系発光光源などとさせるためには、ＲＧＢなどが発光可能な各ＬＥＤチップをそれぞれ近接して発光させ拡散混色させる必要がある。このような発光ダイオードは、種々の色を自由に発光させる発光装置としては有効であるが、白色系などの

色のみを発光させる場合においても赤色系、緑色系及び青色系の発光ダイオード、或いは青緑色系及び黄色系の発光ダイオードをそれぞれ使用せざるを得ない。ＬＥＤチップは、半導体であり色調や輝度のバラツキもまだ相当ある。また、半導体発光素子であるＬＥＤチップがそれぞれ異なる材料を用いて形成されている場合、各ＬＥＤチップの駆動電力などが異なり個々に電源を確保する必要がある。そのため、各半導体ごとに電流などを調節して白色系を発光させなければならない。同様に、半導体発光素子であるため個々の温度特性の差や経時変化が異なり、色調が種々変化してしまう。さらに、ＬＥＤチップからの発光を均一に混色させなければ色むらを生ずる場合がある。

【０００５】

そこで、本出願人は先にＬＥＤチップの発光色を蛍光体で色変換させた発光ダイオードとして特開平５－１５２６０９号公報、特開平７－９９３４５号公報などに記載された発光ダイオードを開発した。これらの発光ダイオードによって、１種類のＬＥＤチップを用いて白色系など他の発光色を発光させることができる。

【０００６】

具体的には、発光層のエネルギーバンドギャップが大きいＬＥＤチップをリードフレームの先端に設けられたカップ上などに配置する。ＬＥＤチップは、ＬＥＤチップが設けられたメタルステムやメタルポストとそれぞれ電気的に接続させる。そして、ＬＥＤチップを被覆する樹脂モールド部材中などにＬＥＤチップからの光を吸収し波長変換する蛍光体を含有させて形成させてある。

【０００７】

ＬＥＤチップからの発光を波長変換した発光ダイオードとして、青色系の発光ダイオードの発光と、その発光を吸収し黄色系を発光する蛍光体からの発光との混色により白色系が発光可能な発光ダイオードなどとすることができる。これらの発光ダイオードは、白色系を発光する発光ダイオードとして利用した場合においても十分な輝度を発光する発光ダイオードとすることができる。

【０００８】

【発明が解決する課題】

発光ダイオードによって励起される蛍光体は、蛍光染料、蛍光顔料さらには有機、無機化合物などから様々なものが挙げられる。また、蛍光体は、発光素子からの発光波長を波長の短いものから長い波長へと変換する、或いは発光素子からの発光波長を波長の長いものから短い波長へと変換するものとがある。

【０００９】

しかしながら、波長の長いものから短い波長へと変換する場合、変換効率が極めて悪く実用に向かない。また、ＬＥＤチップ周辺に近接して配置された蛍光体は、太陽光よりも約３０倍から４０倍にも及ぶ強照射強度の光線にさらされる。特に、発光素子であるＬＥＤチップを高エネルギーバンドギャップを有する半導体を用い蛍光体の変換効率向上や蛍光体の使用量を減らした場合においては、ＬＥＤチップから発光した光が可視光域にあるといっても光エネルギーが必然的に高くなる。この場合、発光強度を更に高め長期に渡って使用すると、蛍光体自体が劣化しやすい。蛍光体が劣化すると色調がずれる、或いは蛍光体が黒ずみ光の外部取り出し効率が低下する場合がある。同様にＬＥＤチップの近傍に設けられた蛍光体は、ＬＥＤチップの昇温や外部環境からの加熱など高温にもさらされる。さらに、発光ダイオードは、一般的に樹脂モールドに被覆されてはいるものの外部環境からの水分の進入などを完全に防ぐことや製造時に付着した水分を完全に除去することはできない。蛍光体によっては、このような水分が発光素子からの高エネルギー光や熱によって蛍光体物質の劣化を促進する場合もある。また、イオン性の有機染料に至ってはチップ近傍では直流電界により電気泳動を起こし、色調が変化する可能性がある。したがって、本願発明は上記課題を解決し、より高輝度、長時間の使用環境下においても発光光率の低下や色ずれの極めて少ない発光ダイオードを提供することを目的とする。

【００１０】

【課題を解決するための手段】

本願発明は、発光層が窒化ガリウム系化合物半導体であるＬＥＤチップと、該ＬＥＤチップからの発光の少なくとも一部を吸収し波長変換して発光するフォトルミネセンス蛍光体と、を有する発光ダイオードであって、前記ＬＥＤチップの発光スペクトルのピークが４００ｎｍから５３０ｎｍの発光波長を有すると共に

、前記フォトルミネセンス蛍光体が$RE_3(Al,Ga)_5O_{12}:Ce$である。但し、REは、Y，Gd，Smから選択される少なくとも一種である。

【００１１】

また、マウント・リードのカップ内に配置させたＬＥＤチップと、該ＬＥＤチップと導電性ワイヤーを用いて電気的に接続させたインナー・リードと、前記カップ内に充填させたコーティング部材と、該コーティング部材、ＬＥＤチップ、導電性ワイヤー及びマウント・リードとインナー・リードの少なくとも一部を被覆するモールド部材と、を有する発光ダイオードであって、前記ＬＥＤチップが窒化ガリウム系化合物半導体であり、且つ前記コーティング部材が$RE_3(Al,Ga)_5O_{12}:Ce$フォトルミネセンス蛍光体を有する透光性樹脂でもある。但し、REは、Y，Gd，Smから選択される少なくとも一種である。

【００１２】

さらに、前記フォトルミネセンス蛍光体の組成が次の一般式で示される発光ダイオードでもある。$(Y_{1-p-q-r}Gd_pCe_qSm_r)_3(Al_{1-s}Ga_s)_5O_{12}$　但し、$0 \leqq p \leqq 0.8$、$0.003 \leqq q \leqq 0.2$、$0.0003 \leqq r \leqq 0.08$、$0 \leqq s \leqq 1$

【００１３】

また、請求項２記載の発光ダイオードをマトリックス状に配置したＬＥＤ表示器と、該ＬＥＤ表示器と電気的に接続させた駆動回路と、を有するＬＥＤ表示装置である。

【００１４】

【発明の実施の態様】

本願発明者は、種々の実験の結果、可視光域における光エネルギーが比較的高いＬＥＤチップからの発光光をフォトルミネセンス蛍光体によって色変換させる発光ダイオードにおいて、特定の半導体及び蛍光体を選択することにより高輝度、長時間の使用時における光効率低下や色ずれを防止できることを見出し本願発明を成すに至った。

【００１５】

即ち、発光ダイオードに用いられるフォトルミネセンス蛍光体としては、

１．耐光性に優れていることが要求される。特に、半導体発光素子などの微小領域から強放射されるために太陽光の約３０倍から４０倍にもおよぶ強照射強度にも十分耐える必要がある。２．発光素子との混色を利用するため紫外線ではなく青色系発光で効率よく発光すること。３．混色を考慮して緑色系から赤色系の光が発光可能なこと。４．発光素子近傍に配置されるため温度特性が良好であること。５．色調が組成比或いは複数の蛍光体の混合比で連続的に変えられること。６．発光ダイオードの利用環境に応じて耐候性があることなどの特徴を有することが求められる。

【００１６】

これらの条件を満たすものとして本願発明は、発光素子として発光層に高エネルギーバンドギャップを有する窒化ガリウム系化合物半導体素子を、フォトルミネセンス蛍光体として$RE_3(Al,Ga)_5O_{12}$：Ce蛍光体を用いる。これにより発光素子から放出された可視光域における高エネルギー光を長時間近傍で高輝度に照射した場合であっても発光色の色ずれや発光輝度の低下が極めて少ない発光ダイオードとすることができるものである。

【００１７】

具体的な発光ダイオードの一例として、チップタイプＬＥＤを図２に示す。チップタイプＬＥＤの筐体２０４内に窒化ガリウム系半導体を用いたＬＥＤチップ２０２をエポキシ樹脂などを用いて固定させてある。導電性ワイヤー２０３として金線をＬＥＤチップ２０２の各電極と筐体に設けられた各電極２０５とにそれぞれ電気的に接続させてある。$RE_3(Al,Ga)_5O_{12}$：Ce蛍光体をエポキシ樹脂中に混合分散させたものをＬＥＤチップ、導電性ワイヤーなどを外部応力などから保護するモールド部材２０１として均一に硬化形成させる。このような発光ダイオードに電力を供給させることによってＬＥＤチップ２０２を発光させる。ＬＥＤチップ２０２からの発光と、その発光によって励起されたフォトルミネセンス蛍光体からの発光光との混色により白色系などが発光可能な発光ダイオードとすることができる。以下、本願発明の構成部材について詳述する。

【００１８】

（蛍光体）

本願発明に用いられるフォトルミネセンス蛍光体としては、半導体発光層から発光された可視光及び紫外線で励起されて発光するフォトルミネセンス蛍光体をいう。具体的なフォトルミネセンス蛍光体としては、$RE_3(Al,Ga)_5O_{12}$：Ce（但し、REは、Y，Gd，Smから選択される少なくとも一種）である。窒化ガリウム系化合物半導体を用いたＬＥＤチップから発光した光と、ボディーカラーが黄色でありフォトルミネセンス蛍光体から発光する光が補色関係などにある場合、ＬＥＤチップからの発光と、フォトルミネセンス蛍光体からの発光と、を混色表示させると白色系の発光色表示を行うことができる。そのため発光ダイオード外部には、ＬＥＤチップからの発光とフォトルミネセンス蛍光体からの発光とがモールド部材を透過する必要がある。したがって、フォトルミネセンス蛍光体のバルク層内などにＬＥＤチップを閉じこめ、フォトルミネセンス蛍光体層にＬＥＤチップからの光が透過する開口部を１乃至２以上有する構成の発光ダイオードとしても良い。また、フォトルミネセンス蛍光体の粉体を樹脂や硝子中に含有させＬＥＤチップからの光が透過する程度に薄く形成させても良い。フォトルミネセンス蛍光体と樹脂などとの比率や塗布、充填量を種々調整すること及び発光素子の発光波長を選択することにより白色を含め電球色など任意の色調を提供させることができる。

【００１９】

さらに、フォトルミネセンス蛍光体の含有分布は、混色性や耐久性にも影響する。すなわち、フォトルミネセンス蛍光体が含有されたコーティング部やモールド部材の表面側からＬＥＤチップに向かってフォトルミネセンス蛍光体の分布濃度が高い場合は、外部環境からの水分などの影響をより受けにくく水分による劣化を抑制しやすい。他方、フォトルミネセンス蛍光体の含有分布をＬＥＤチップからモールド部材表面側に向かって分布濃度が高くなると外部環境からの水分の影響を受けやすいがＬＥＤチップからの発熱、照射強度などの影響がより少なくフォトルミネセンス蛍光体の劣化を抑制することができる。このような、フォトルミネセンス蛍光体の分布は、フォトルミネセンス蛍光体を含有する部材、形成温度、粘度やフォトルミネセンス蛍光体の形状、粒度分布などを調整させることによって種々形成させることができる。したがって、使用条件などにより蛍光体

の分布濃度を、種々選択することができる。

【００２０】

本願発明のフォトルミネセンス蛍光体は、特にＬＥＤチップと接する或いは近接して配置され放射照度として（Ｅｅ）＝３Ｗ・ｃｍ－２以上１０Ｗ・ｃｍ－２以下においても高効率に十分な耐光性有する発光ダイオードとすることができる。

【００２１】

本願発明に用いられるフォトルミネセンス蛍光体は、ガーネット構造のため、熱、光及び水分に強く、励起スペクトルのピークが４５０ｎｍ付近にさせることができる。また、発光ピークも５３０ｎｍ付近にあり７００ｎｍまで裾を引くブロードな発光スペクトルを持つ。しかも、組成のＡｌの一部をＧａで置換することで発光波長が短波長にシフトし、また組成のＹの一部をＧｄで置換することで、発光波長が短波長へシフトする。このように組成を変化することで発光色を連続的に調節することが可能である。したがって、長波長側の強度がＧｄの組成比で連続的に変えられるなど窒化物半導体の青色系発光を白色系発光に変換するための理想条件を備えている。

【００２２】

また、窒化ガリウム系半導体を用いたＬＥＤチップと、セリウムで付活されたイットリウム・アルミニウム・ガーネット蛍光体（ＹＡＧ）に希土類元素のサマリウム（Ｓｍ）を含有させたフォトルミネセンス蛍光体と、を有する発光ダイオードとすることによりさらに光効率を向上させることができる。

【００２３】

このようなフォトルミネセンス蛍光体は、Ｙ、Ｇｄ、Ｃｅ、Ｓｍ、Ａｌ及びＧａの原料として酸化物、又は高温で容易に酸化物になる化合物を使用し、それらを化学量論比で十分に混合して原料を得る。又は、Ｙ、Ｇｄ、Ｃｅ、Ｓｍの希土類元素を化学量論比で酸に溶解した溶解液を修酸で共沈したものを焼成して得られる共沈酸化物と、酸化アルミニウム、酸化ガリウムとを混合して混合原料を得る。これにフラックスとしてフッ化アンモニウム等のフッ化物を適量混合して坩堝に詰め、空気中１３５０～１４５０°Ｃの温度範囲で２～５時間焼成して焼成品を得、次に焼成品を水中でボールミルして、洗浄、分離、乾燥、最後に篩を通

すことで得ることができる。

【００２４】

（$Y_{1-p-q-r}Gd_pCe_qSm_r)_3Al_5O_{12}$フォトルミネセンス蛍光体は、結晶中にＧｄを含有することにより、特に４６０ｎｍ以上の長波長域の励起発光効率を高くすることができる。ガドリニウムの含有量の増加により、発光ピーク波長が、５３０ｎｍから５７０ｎｍまで長波長に移動し、全体の発光波長も長波長側にシフトする。赤みの強い発光色が必要な場合、Ｇｄの置換量を多くすることで達成できる。一方、Ｇｄが増加すると共に、青色光によるフォトルミネセンスの発光輝度は徐々に低下する。したがって、ｐは０．８以下であることが好ましく、０．７以下であることがより好ましい。さらに好ましくは０．６以下である。

【００２５】

Ｓｍを含有する（$Y_{1-p-q-r}Gd_pCe_qSm_r)_3Al_5O_{12}$蛍光体は、Ｇｄの含有量の増加に関わらず温度特性の低下が少ない。このようにＳｍを含有させることにより、高温度におけるフォトルミネセンス蛍光体の発光輝度は大幅に改善される。その改善される程度はＧｄの含有量が高くなるほど大きくなる。すなわち、Ｇｄを増加してフォトルミネセンス蛍光体の発光色調に赤みを付与した組成ほどＳｍの含有による温度特性改善に効果的であることが分かった。（なお、ここでの温度特性とは、４５０ｎｍの青色光による常温（２５°Ｃ）における励起発光輝度に対する、同蛍光体の高温（２００°Ｃ）における発光輝度の相対値（％）で表している。）

【００２６】

Ｓｍの含有量は０．０００３≦ｒ≦０．０８の範囲で温度特性が６０％以上となり好ましい。この範囲よりｒが小さいと、温度特性改良の効果が小さくなる。また、この範囲よりｒが大きくなると温度特性は逆に低下してくる。０．０００７≦ｒ≦０．０２の範囲では温度特性は８０％以上となり最も好ましい。

【００２７】

Ｃｅは０．００３≦ｑ≦０．２の範囲で相対発光輝度が７０％以上となる。ｑが０．００３以下では、Ｃｅによるフォトルミネセンスの励起発光中心の数が減少することで輝度低下し、逆に、０．２より大きくなると濃度消光が生ずる。

【００２８】

本願発明の発光ダイオードにおいてこのようなフォトルミネセンス蛍光体は、２種類以上のＲＥ$_3$（Ａｌ，Ｇａ）$_5$Ｏ$_{12}$：Ｃｅフォトルミネセンス蛍光体を混合させてもよい。即ち、Ａｌ、Ｇａ、Ｙ及びＧｄやＳｍの含有量が異なる２種類以上のＲＥ$_3$（Ａｌ，Ｇａ）$_5$Ｏ$_{12}$：Ｃｅフォトルミネセンス蛍光体を混合させてＲＧＢの波長成分を増やすことができる。これに、カラーフィルターを用いることによりフルカラー液晶表示装置用としても利用できる。

【００２９】

（ＬＥＤチップ１０２、２０２、７０２）

本願発明に用いられるＬＥＤチップとは、ＲＥ$_3$（Ａｌ，Ｇａ）$_5$Ｏ$_{12}$：Ｃｅ蛍光体を効率良く励起できる窒化物系化合物半導体が挙げられる。発光素子であるＬＥＤチップは、ＭＯＣＶＤ法等により基板上にＩｎＧａＮ等の半導体を発光層として形成させる。半導体の構造としては、ＭＩＳ接合、ＰＩＮ接合やＰＮ接合などを有するホモ構造、ヘテロ構造あるいはダブルヘテロ構成のものが挙げられる。半導体層の材料やその混晶度によって発光波長を種々選択することができる。また、半導体活性層を量子効果が生ずる薄膜に形成させた単一量子井戸構造や多重量子井戸構造とすることもできる。

【００３０】

窒化ガリウム系化合物半導体を使用した場合、半導体基板にはサファイヤ、スピネル、ＳｉＣ、Ｓｉ、ＺｎＯ等の材料が用いられる。結晶性の良い窒化ガリウムを形成させるためにはサファイヤ基板を用いることが好ましい。このサファイヤ基板上にＧａＮ、ＡｌＮ等のバッファー層を形成しその上にＰＮ接合を有する窒化ガリウム半導体を形成させる。窒化ガリウム系半導体は、不純物をドープしない状態でＮ型導電性を示す。発光効率を向上させるなど所望のＮ型窒化ガリウム半導体を形成させる場合は、Ｎ型ドーパントとしてＳｉ、Ｇｅ、Ｓｅ、Ｔｅ、Ｃ等を適宜導入することが好ましい。一方、Ｐ型窒化ガリウム半導体を形成させる場合は、Ｐ型ドーパンドであるＺｎ、Ｍｇ、Ｂｅ、Ｃａ、Ｓｒ、Ｂａ等をドープさせる。窒化ガリウム系化合物半導体は、Ｐ型ドーパントをドープしただけではＰ型化しにくいためＰ型ドーパント導入後に、低電子線照射させたり、プラズ

マ照射等によりアニールすることでＰ型化させることが好ましい。エッチングなどによりＰ型半導体及びＮ型半導体の露出面を形成させた後、半導体層上にスパッタリング法や真空蒸着法などを用いて所望の形状の各電極を形成させる。

【００３１】

次に、形成された半導体ウエハー等をダイヤモンド製の刃先を有するブレードが回転するダイシングソーにより直接フルカットするか、又は刃先幅よりも広い幅の溝を切り込んだ後（ハーフカット）、外力によって半導体ウエハーを割る。あるいは、先端のダイヤモンド針が往復直線運動するスクライバーにより半導体ウエハーに極めて細いスクライブライン（経線）を例えば碁盤目状に引いた後、外力によってウエハーを割り半導体ウエハーからチップ状にカットする。このようにして窒化ガリウム系化合物半導体であるＬＥＤチップを形成させることができる。

【００３２】

本願発明の発光ダイオードにおいて白色系を発光させる場合は、フォトルミネセンス蛍光体との補色等を考慮して発光素子の発光波長は４００ｎｍ以上５３０ｎｍ以下が好ましく、４２０ｎｍ以上４９０ｎｍ以下がより好ましい。ＬＥＤチップとフォトルミネセンス蛍光体との効率をそれぞれより向上させるためには、４５０ｎｍ以上４７５ｎｍ以下がさらに好ましい。本願発明の白色系発光ダイオードの発光スペクトルを図３に示す。４５０ｎｍ付近にピークを持つ発光がＬＥＤチップからの発光であり、５７０ｎｍ付近にピークを持つ発光がＬＥＤチップによって励起されたフォトルミネセンスの発光である。

【００３３】

（導電性ワイヤー１０３、２０３）

導電性ワイヤー１０３、２０３としては、ＬＥＤチップ１０２、２０２の電極とのオーミック性、機械的接続性、電気伝導性及び熱伝導性がよいものが求められる。熱伝導度としては０．０１ｃａｌ／ｃｍ^2／ｃｍ／℃以上が好ましく、より好ましくは０．５ｃａｌ／ｃｍ^2／ｃｍ／℃以上である。また、作業性などを考慮して導電性ワイヤーの直径は、好ましくは、Φ１０μｍ以上、Φ４５μｍ以下である。このような導電性ワイヤーとして具体的には、金、銅、白金、アルミ

ニウム等の金属及びそれらの合金を用いた導電性ワイヤーが挙げられる。このような導電性ワイヤーは、各ＬＥＤチップの電極と、インナー・リード及びマウント・リードなどと、をワイヤーボンディング機器によって容易に接続させることができる。

【００３４】

（マウント・リード１０５）

マウント・リード１０５としては、ＬＥＤチップ１０２を配置させるものであり、ダイボンド機器などで積載するのに十分な大きさがあれば良い。また、ＬＥＤチップを複数設置しマウント・リードをＬＥＤチップの共通電極として利用する場合においては、十分な電気伝導性とボンディングワイヤー等との接続性が求められる。また、マウント・リード上のカップ内にＬＥＤチップを配置すると共に蛍光体を内部に充填させる場合は、近接して配置させた別の発光ダイオードからの光により疑似点灯することを防止することができる。

【００３５】

ＬＥＤチップ１０２とマウント・リード１０５のカップとの接着は熱硬化性樹脂などによって行うことができる。具体的には、エポキシ樹脂、アクリル樹脂やイミド樹脂などが挙げられる。また、フェースダウンＬＥＤチップなどによりマウント・リードと接着させると共に電気的に接続させるためにはＡｇペースト、カーボンペースト、金属バンプ等を用いることができる。さらに、発光ダイオードの光利用効率を向上させるためにＬＥＤチップが配置されるマウント・リードの表面を鏡面状とし、表面に反射機能を持たせても良い。この場合の表面粗さは、０．１Ｓ以上０．８Ｓ以下が好ましい。また、マウント・リードの具体的な電気抵抗としては３００μΩ－ｃｍ以下が好ましく、より好ましくは、３μΩ－ｃｍ以下である。また、マウント・リード上に複数のＬＥＤチップを積置する場合は、ＬＥＤチップからの発熱量が多くなるため熱伝導度がよいことが求められる。具体的には、０．０１ｃａｌ／ｃｍ^2／ｃｍ／℃以上が好ましくより好ましくは ０．５ｃａｌ／ｃｍ^2／ｃｍ／℃以上である。これらの条件を満たす材料としては、鉄、銅、鉄入り銅、錫入り銅、メタライズパターン付きセラミック等が挙げられる。

【００３６】

（インナー・リード１０６）

インナー・リード１０６としては、マウント・リード１０５上に配置されたＬＥＤチップ１０２と接続された導電性ワイヤー１０３との接続を図るものである。マウント・リード上に複数のＬＥＤチップを設けた場合は、各導電性ワイヤー同士が接触しないよう配置できる構成とする必要がある。具体的には、マウント・リードから離れるに従って、インナー・リードのワイヤーボンディングさせる端面の面積を大きくすることなどによってマウント・リードからより離れたインナー・リードと接続させる導電性ワイヤーの接触を防ぐことができる。導電性ワイヤーとの接続端面の粗さは、密着性を考慮して１．６Ｓ以上１０Ｓ以下が好ましい。インナー・リードの先端部を種々の形状に形成させるためには、あらかじめリードフレームの形状を型枠で決めて打ち抜き形成させてもよく、或いは全てのインナー・リードを形成させた後にインナー・リード上部の一部を削ることによって形成させても良い。さらには、インナ・リードを打ち抜き形成後、端面方向から加圧することにより所望の端面の面積と端面高さを同時に形成させることもできる。

【００３７】

インナー・リードは、導電性ワイヤーであるボンディングワイヤー等との接続性及び電気伝導性が良いことが求められる。具体的な電気抵抗としては、３００μΩ－ｃｍ以下が好ましく、より好ましくは３μΩ－ｃｍ以下である。これらの条件を満たす材料としては、鉄、銅、鉄入り銅、錫入り銅及び銅、金、銀をメッキしたアルミニウム、鉄、銅等が挙げられる。

【００３８】

（コーティング部１０１）

本願発明に用いられるコーティング部１０１とは、モールド部材１０４とは別にマウント・リードのカップに設けられるものでありＬＥＤチップの発光を変換するフォトルミネセンス蛍光体が含有されるものである。コーティング部の具体的材料としては、エポキシ樹脂、ユリア樹脂、シリコーンなどの耐候性に優れた透明樹脂や硝子などが好適に用いられる。また、フォトルミネセンス蛍光体と共

に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、酸化珪素等が好適に用いられる。

【００３９】

（モールド部材１０４）

モールド部材１０４は、発光ダイオードの使用用途に応じてＬＥＤチップ１０２、導電性ワイヤー１０３、フォトルミネセンス蛍光体が含有されたコーティング部１０１などを外部から保護するために設けることができる。モールド部材は、一般には樹脂を用いて形成させることができる。また、フォトルミネセンス蛍光体を含有させることによって視野角を増やすことができるが、樹脂モールドに拡散剤を含有させることによってＬＥＤチップ１０２からの指向性を緩和させ視野角をさらに増やすことができる。更にまた、モールド部材１０４を所望の形状にすることによってＬＥＤチップからの発光を集束させたり拡散させたりするレンズ効果を持たせることができる。従って、モールド部材１０４は複数積層した構造でもよい。具体的には、凸レンズ形状、凹レンズ形状さらには、発光観測面から見て楕円形状やそれらを複数組み合わせた物である。モールド部材１０４の具体的材料としては、主としてエポキシ樹脂、ユリア樹脂、シリコーンなどの耐候性に優れた透明樹脂や硝子などが好適に用いられる。また、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、酸化珪素等が好適に用いられる。さらに、拡散剤に加えてモールド部材中にもフォトルミネセンス蛍光体を含有させることもできる。したがって、フォトルミネセンス蛍光体はモールド部材中に含有させてもそれ以外のコーティング部などに含有させて用いてもよい。また、コーティング部をフォトルミネセンス蛍光体が含有された樹脂、モールド部材を硝子などとした異なる部材を用いて形成させても良い。この場合、生産性良くより水分などの影響が少ない発光ダイオードとすることができる。また、屈折率を考慮してモールド部材とコーティング部とを同じ部材を用いて形成させても良い。

【００４０】

（表示装置）

本願発明の発光ダイオードをＬＥＤ表示器に利用した場合、ＲＧＢをそれぞれ

発光する発光ダイオードの組み合わせだけによるＬＥＤ表示器よりも、より高精細に白色系表示させることができる。すなわち、各発光ダイオードを組み合わせて白色系などを混色表示させるためにはＲＧＢの各発光ダイオードをそれぞれ同時に発光せざるを得ない。そのため赤色系、緑色系、青色系のそれぞれ単色表示した場合に比べて一画素あたりの表示が大きくなる。したがって、白色系の表示の場合においてはＲＧＢ単色表示と比較して高精細に表示させることができない。また、白色系の表示は各発光ダイオードを調節して表示させるため各半導体の温度特性などを考慮し種々調整しなければならない。さらに、混色による表示であるが故にＬＥＤ表示器の視認する方向や角度によって、ＲＧＢの発光ダイオードが部分的に遮光され表示色が変わる場合もある。本願発明の発光ダイオードをＲＧＢの発光ダイオードに加えて利用することにより、より高精細化が可能となると共に白色系の発光が安定し色むらをなくすこともできる。また、ＲＧＢの各発光ダイオードともに発光させることにより輝度を向上させることもできる。

【００４１】

本願発明の発光ダイオードを用いて表示装置の１つとして、ＲＧＢの各発光ダイオードに加えて白色系発光ダイオードを１絵素として利用し、標識やマトリクス状など任意の形状に配置させたＬＥＤ表示器の概略構成を示す。ＬＥＤ表示器は、駆動回路である点灯回路などと電気的に接続させる。駆動回路からの出力パルスによって種々の画像が表示可能なデイスプレイ等とすることができる。駆動回路としては、入力される表示データを一時的に記憶させるＲＡＭ（Ｒａｎｄｏｍ、Ａｃｃｅｓｓ、Ｍｅｍｏｒｙ）と、ＲＡＭに記憶されるデータから各発光ダイオードを所定の明るさに点灯させるための階調信号を演算する階調制御回路と、階調制御回路の出力信号でスイッチングされて、各発光ダイオードを点灯させるドライバーとを備える。階調制御回路は、ＲＡＭに記憶されるデータから発光ダイオードの点灯時間を演算してパルス信号を出力する。ここで、白色系の表示を行う場合は、ＲＧＢ各発光ダイオードのパルス信号を短くする、パルス高を低くする或いは全く点灯させない。他方、それを補償するように白色系発光ダイオードにパルス信号を出力する。これにより、ＬＥＤ表示器の白色を表示する。

【００４２】

したがって、白色系発光ダイオードを所望の輝度で点灯させるためのパルス信号を演算する階調制御回路としてＣＰＵを別途備えることが好ましい。階調制御回路から出力されるパルス信号は、白色系発光ダイオードのドライバーに入力されてドライバをスイッチングさせる。ドライバーがオンになると白色系発光ダイオードが点灯され、オフになると消灯される。

【００４３】

また、本願発明の発光ダイオードを用いた別のＬＥＤ表示器を示す。本願発明の白色系発光ダイオードのみを用い白黒用のＬＥＤ表示装置とすることもできる。白黒用のＬＥＤ表示器は、本願発明の発光ダイオード５０１のみをマトリックス状などに配置し構成することができる。ＲＧＢのそれぞれの駆動回路の代わりに白色発光可能な本願発明の発光ダイオード用駆動回路のみとしてＬＥＤ表示器を構成させることができる。ＬＥＤ表示器は、駆動回路である点灯回路などと電気的に接続させる。駆動回路からの出力パルスによって種々の画像が表示可能なデイスプレイ等とすることができる。駆動回路としては、入力される表示データを一時的に記憶させるＲＡＭ（Ｒａｎｄｏｍ、Ａｃｃｅｓｓ、Ｍｅｍｏｒｙ）と、ＲＡＭに記憶されるデータから発光ダイオードを所定の明るさに点灯させるための階調信号を演算する階調制御回路と、階調制御回路の出力信号でスイッチングされて、発光ダイオードを点灯させるドライバーとを備える。階調制御回路は、ＲＡＭに記憶されるデータから発光ダイオードの点灯時間を演算してパルス信号を出力する。

【００４４】

したがって、白黒用のＬＥＤ表示器はＲＧＢのフルカラー表示器と異なり当然回路構成を簡略化できると共に高精細化できる。そのため、安価にＲＧＢの発光ダイオードの特性に伴う色むらなどのないディスプレイとすることができるものである。また、従来の赤色、緑色のみを用いたＬＥＤ表示器に比べ人間の目に対する刺激が少なく長時間の使用に適している。

【００４５】

（信号機）

本願発明の発光ダイオードを表示装置の１種である信号機として利用した場合

、長時間安定して発光させることが可能であると共に発光ダイオードの一部が消灯しても色むらなどが生じないという特徴がある。本願発明の発光ダイオードを用いた信号機の概略構成として、導電性パターンが形成された基板上に白色系発光ダイオードを配置させる。このような発光ダイオードを直列又は直並列に接続された発光ダイオードの回路を発光ダイオード群として扱う。発光ダイオード群を２つ以上用いそれぞれ渦巻き状に発光ダイオードを配置させる。全ての発光ダイオードが配置されると円状に全面に配置される。各発光ダイオード及び基板から外部電力と接続させる電源コードをそれぞれ、ハンダにより接続させた後、鉄道用信号用の筐体内に固定させる。ＬＥＤ表示器は、遮光部材が付いたアルミダイキャストの筐体内に配置され表面にシリコーンゴムの充填材で封止されている。筐体の表示面は、白色レンズを設けてある。また、ＬＥＤ表示器の電気的配線は、筐体の裏面からゴムパッキンを通し筐体内を密閉する。これにより白色系信号機を形成することができる。本願発明の発光ダイオードを、複数の群に分け中心部から外側に向け輪を描く渦巻き状などに配置し、並列接続させることでより信頼性が高い信号機とさせることができる。中心部から外側に向け輪を描くとは連続的に輪を描くものも断続的に配置するものをも含む。したがって、ＬＥＤ表示器の表示面積などにより配置される発光ダイオードの数や発光ダイオード群の数を種々選択することができる。この信号機により、一方の発光ダイオード群や一部の発光ダイオードが何らかのトラブルにより消灯したとしても他方の発光ダイオード群や残った発光ダイオードにより信号機を円形状に均一に発光させることが可能となるものである。また、色ずれが生ずることもない。渦巻き状に配置してあることから中心部を密に配置することができ電球発光の信号と何ら違和感なく駆動させることができる。

【００４６】

（面状発光光源）

本願発明の発光ダイオードを用いて図７の如く面状発光光源を構成することができる。面状発光光源の場合、フォトルミネセンス蛍光体をコーティング部や導光板上の散乱シート７０６に含有させる。或いはバインダー樹脂と共に散乱シート７０６に塗布などさせシート状７０１に形成しモールド部材を省略しても良い

。具体的には、絶縁層及び導電性パターンが形成されたコの字形状の金属基板７０３内にＬＥＤチップ７０２を固定する。ＬＥＤチップと導電性パターンとの電気的導通を取った後、フォトルミネセンス蛍光体をエポキシ樹脂と混合撹拌しＬＥＤチップ７０２が積載された基板７０３上に充填させ発光ダイオードを形成させる。こうして形成された発光ダイオードは、アクリル性導光板７０４の端面にエポキシ樹脂などで固定される。導光板７０４の一方の主面上には、蛍現象防止のため白色散乱剤が含有されたフィルム状の反射部材７０７を配置させてある。同様に、導光板の裏面側全面や発光ダイオードが配置されていない端面上にも反射部材７０５を設け発光光率を向上させてある。これにより、ＬＣＤのバックライトとして十分な明るさを得られる面状発光光源とすることができる。液晶表示装置として利用する場合は、導光板７０４の主面上に不示図の透光性導電性パターンが形成された硝子基板間に注入された液晶装置を介して配された偏光板により構成させることができる。以下、本願発明の実施例について説明するが、本願発明は具体的実施例のみに限定されるものではないことは言うまでもない。

【００４７】

【実施例】

（実施例１）

発光素子として発光ピークが４５０ｎｍのＧａＩｎＮ半導体を用いた。ＬＥＤチップは、洗浄させたサファイヤ基板上にＴＭＧ（トリメチルガリウム）ガス、ＴＭＡ（トリメチルアルミニウム）ガス、窒素ガス及びドーパントガスをキャリアガスと共に流し、ＭＯＣＶＤ法で窒化ガリウム系化合物半導体を成膜させることにより形成させた。ドーパントガスとしてSiH_4とCp_2Mgと、を切り替えることによってＮ型導電性を有する窒化ガリウム半導体とＰ型導電性を有する窒化ガリウム半導体を形成しＰＮ接合を形成させた。（なお、Ｐ型半導体は、成膜後４００℃以上でアニールさせてある。）

【００４８】

エッチングによりＰＮ各半導体表面を露出させた後、スパッタリングにより各電極をそれぞれ形成させた。こうして出来上がった半導体ウエハーをスクライブラインを引いた後、外力により分割させ発光素子としてＬＥＤチップを形成させ

た。

【００４９】

銀メッキした銅製リードフレームの先端にカップを有するマウント・リードにＬＥＤチップをエポキシ樹脂でダイボンディングした。ＬＥＤチップの各電極とマウント・リード及びインナー・リードと、をそれぞれ金線でワイヤーボンディングし電気的導通を取った。

【００５０】

一方、フォトルミネセンス蛍光体は、Ｙ、Ｇｄ、Ｃｅの希土類元素を化学量論比で酸に溶解した溶解液を蓚酸で共沈させた。これを焼成して得られる共沈酸化物と、酸化アルミニウム、酸化ガリウムと混合して混合原料を得る。これにフラックスとしてフッ化アンモニウムを混合して坩堝に詰め、空気中１４００°Ｃの温度範囲で３時間焼成して焼成品を得た。焼成品を水中でボールミルして、洗浄、分離、乾燥、最後に篩を通して形成させた。

【００５１】

形成された（$Y_{1.2}Gd_{0.8}$）Al_3O_{12}：Ｃｅ蛍光体８０重量部、エポキシ樹脂１００重量部をよく混合してスリラーとさせた。このスリラーをＬＥＤチップが配置されたマウント・リード上のカップ内に注入させた。注入後、フォトルミネセンス蛍光体が含有された樹脂を１３０℃１時間で硬化させた。こうしてＬＥＤチップ上に厚さ１２０μのフォトルミネセンス蛍光体が含有されたコーティング部が形成された。なお、コーティング部には、ＬＥＤチップに向かってフォトルミネセンス蛍光体が徐々に多くしてある。その後、さらにＬＥＤチップやフォトルミネセンス蛍光体を外部応力、水分及び塵芥などから保護する目的でモールド部材として透光性エポキシ樹脂を形成させた。モールド部材は、砲弾型の型枠の中にフォトルミネセンス蛍光体のコーティング部が形成されたリードフレームを挿入し透光性エポシキ樹脂を混入後、１５０℃５時間にて硬化させた。こうして形成された発光ダイオードは、発光観測正面から視認するとフォトルミネセンス蛍光体のボディーカラーにより中央部が黄色っぽく着色していた。

【００５２】

こうして得られた白色系が発光可能な発光ダイオードの色度点、色温度、演色

性指数を測定した。それぞれ、色度点（ｘ＝０．３０２、ｙ＝０．２８０）、色温度８０８０Ｋ、Ｒａ（演色性指数）＝８７．５と三波長型蛍光灯に近い性能を示した。また、発光光率は９．５１ｍ／ｗと白色電球並であった。さらに耐侯試験として室温６０ｍＡ通電、室温２０ｍＡ通電、６０℃９０％ＲＨ下で２０ｍＡ通電の各試験においても蛍光体に起因する変化は観測されず通常の青色発光ダイオードと寿命特性に差がないことが確認できた。

【００５３】

（比較例１）

フォトルミネセンス蛍光体を（$Y_{1.2}Gd_{0.8}$）Al_3O_{12}：Ｃｅから（ＺｎＣｄ）Ｓ：Ｃｕ、Ａｌとした以外は、実施例１と同様にして発光ダイオードの形成及び耐侯試験を行った。形成された発光ダイオードは通電直後、実施例１と同様白色系の発光が確信されたが輝度が低かった。また、耐侯試験においては、約１００時間で出力がゼロになった。劣化原因を解析した結果、蛍光体が黒化していた。

【００５４】

これは、発光素子の発光光と蛍光体に付着していた水分或いは外部環境から進入した水分により光分解し蛍光体結晶表面にコロイド状亜鉛金属を析出し外観が黒色に変色したものと考えられる。

【００５５】

（実施例２）

ＬＥＤチップの窒化物系化合物半導体を実施例１よりもＩｎの含有量を増やし発光ピークを４６０ｎｍとした。同様にフォトルミネセンス蛍光体として実施例１よりもＧｄの含有量を増やした以外は実施例１と同様にして発光ダイオードを１００個形成し耐侯試験を行った。

【００５６】

こうして得られた白色系が発光可能な発光ダイオードの色度点、色温度、演色性指数を測定した。それぞれ、色度点（ｘ＝０．３７５、ｙ＝０．３７０）、色温度４４００Ｋ、Ｒａ（演色性指数）＝８６．０であった。さらに耐侯試験においては、形成させた発光ダイオード１００個平均で行った。耐候性試験前の光度

を１００％とし１０００時間経過後における平均光度を調べた。耐候性試験後も９８．８％であり特性に差がないことが確認できた。

【００５７】

（実施例３）

フォトルミネセンス蛍光体をＹ、Ｇｄ、Ｃｅの希土類元素に加えＳｍを含有させ（$Y_{0.39}Gd_{0.57}Ce_{0.03}Sm_{0.01})_3Al_5O_{12}$蛍光体とした以外は、実施例１と同様にして発光ダイオードを１００個形成した。この発光ダイオードを１３０℃の高温下において点灯させても実施例１の発光ダイオードと比較して平均温度特性が８％ほど良好であった。

【００５８】

（実施例４）

本願発明の発光ダイオードを図５の如くＬＥＤ表示器の１つであるディスプレイに利用した。実施例１と同様にして形成させた発光ダイオードを銅パターンを形成させたセラミックス基板上に、１６×１６のマトリックス状に配置させた。基板と発光ダイオードとは自動ハンダ実装装置を用いてハンダ付けを行った。次にフェノール樹脂によって形成された筐体５０４内部に配置し固定させた。遮光部材５０５は、筐体と一体成形させてある。発光ダイオードの先端部を除いて筐体、発光ダイオード、基板及び遮光部材の一部をピグメントにより黒色に着色したシリコンゴム４０６によって充填させた。その後、常温、７２時間でシリコンゴムを硬化させＬＥＤ表示器を形成させた。このＬＥＤ表示器と、入力される表示データを一時的に記憶させるＲＡＭ（Ｒａｎｄｏｍ、Ａｃｃｅｓｓ、Ｍｅｍｏｒｙ）及びＲＡＭに記憶されるデータから発光ダイオードを所定の明るさに点灯させるための階調信号を演算する階調制御回路と階調制御回路の出力信号でスイッチングされて発光ダイオードを点灯させるドライバーとを備えたＣＰＵの駆動手段と、を電気的に接続させてＬＥＤ表示装置を構成した。ＬＥＤ表示器を駆動させ白黒ＬＥＤ表示装置として駆動できることを確認した。

【００５９】

【発明の効果】

本願発明の構成とすることにより高出力の窒化物系化合物半導体の発光素子と

、ＲＥ$_3$（Ａｌ，Ｇａ）$_5$Ｏ$_{12}$：Ｃｅ蛍光体と、を利用した発光ダイオードとすることにより長時間高輝度時の使用においても発光効率が高い発光ダイオードとすることができる。さらに、信頼性や省電力化、小型化さらには色温度の可変性など車載や航空産業、一般電気機器に表示の他に照明として新たな用途を開くことができる。また、白色は人間の目で長時間視認する場合には刺激が少なく目に優しい発光ダイオードとすることができる。

【００６０】

特に、本願発明の請求項１に記載の構成とすることにより高輝度、長時間の使用においても色ずれ、発光光率の低下が極めて少ない白色系が発光可能な発光ダイオードなど種々の発光ダイオードとすることができる。

【００６１】

本願発明の請求項２の構成とすることにより、高輝度、長時間の使用においても色ずれ、発光光率の低下が極めて少ない発光ダイオードなど種々の発光ダイオードとすることができることに加えて、発光ダイオードを複数近接して配置した場合においても他方の発光ダイオードからの光により蛍光体が励起され疑似点灯されることを防止させることができる。また、ＬＥＤチップ自体の発光むらを蛍光体により分散することができるためより均一な発光光を有する発光ダイオードとすることができる。

【００６２】

本願発明の請求項３の構成とすることにより、より温度依存性の少ない発光ダイオードとすることができる。

【００６３】

本願発明の請求項４の構成とすることにより、比較的安価で高精細なＬＥＤ表示装置や視認角度によって色むらの少ないＬＥＤ表示装置とすることができる。

【００６４】

【図面の簡単な説明】

【図１】

図１は、本願発明の発光ダイオードの模式的断面図である。

【図２】

図２は、本願発明の他の発光ダイオードの模式的断面図である。

【図３】

図３は、本願発明の発光ダイオードの発光スペクトルの一例を示した図である。

【図４】

図４（Ａ）は、本願発明に使用されるフォトルミネセンス蛍光体の吸収スペクトルの一例を示し、図４（Ｂ）は、本願発明に使用されるフォトルミネセンス蛍光体の発光スペクトルの一例を示した図である。

【図５】

図５は、本願発明の発光ダイオードを用いたＬＥＤ表示装置の模式図である。

【図６】

図６は、図５に用いられるＬＥＤ表示装置のブロック図である。

【図７】

図７は、本願発明の発光ダイオードを用いた別のＬＥＤ表示装置の模式図である。

【符号の説明】

１０１、７０１・・・フォトルミネセンスが含有されたコーティング部

１０２、２０２、７０２・・・ＬＥＤチップ

１０３、２０３・・・導電性ワイヤー

１０４・・・モールド部材

１０５・・・マウント・リード

１０６・・・インナー・リード

２０１・・・フォトルミネセンスが含有されたモールド部材

２０４・・・筐体

２０５・・・筐体に設けられた電極

５０１・・・発光ダイオード

５０４・・・筐体

５０５・・・遮光部材

５０６・・・充填材

７０３・・・金属製基板

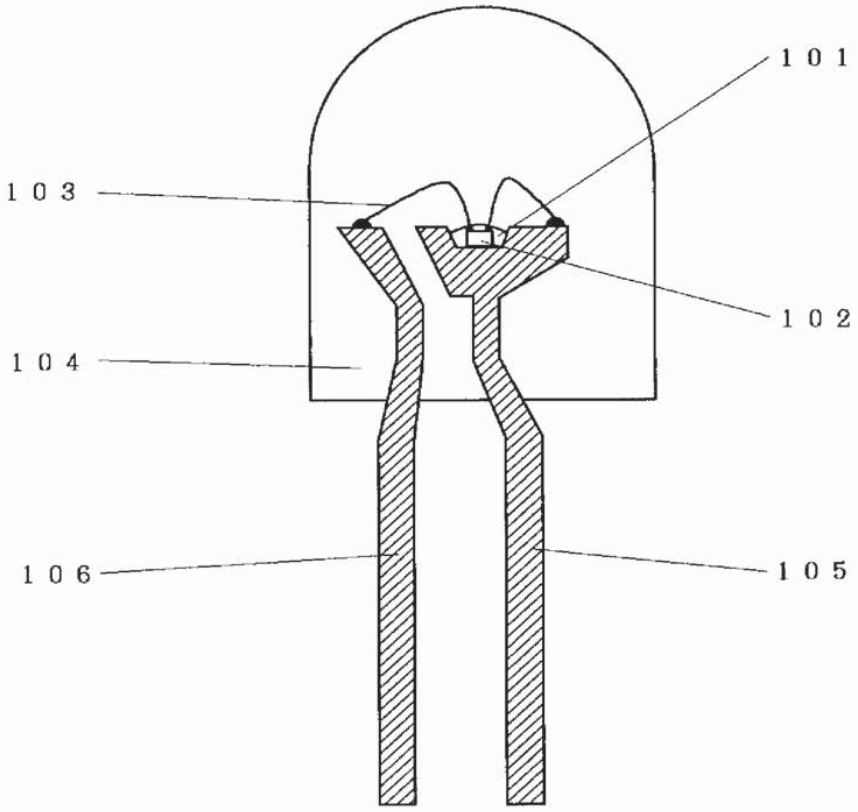
７０４・・・導光板

７０５、７０７・・・反射部材

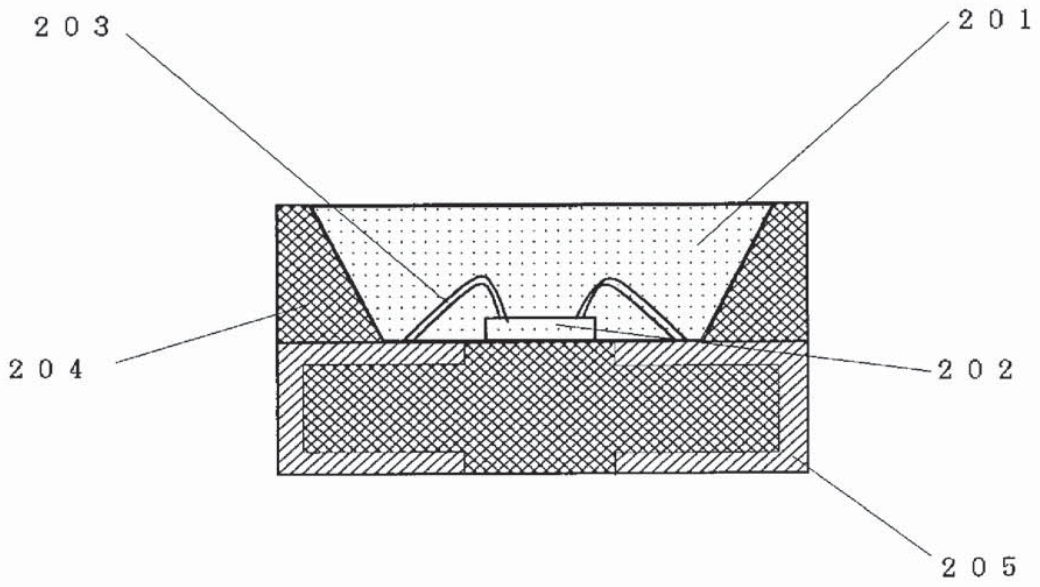
７０６・・・散乱シート

【書類名】　図面

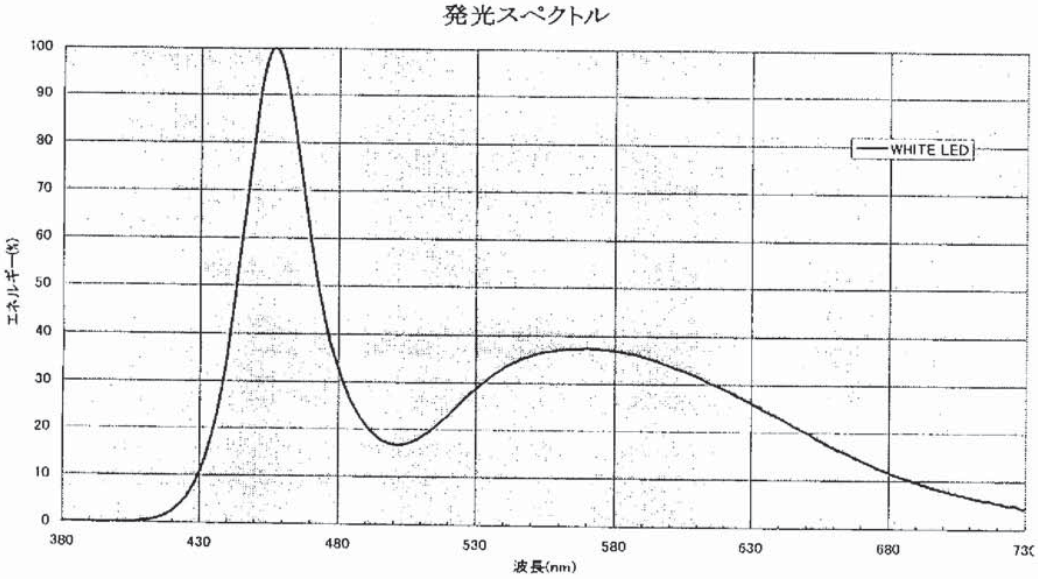
【図１】



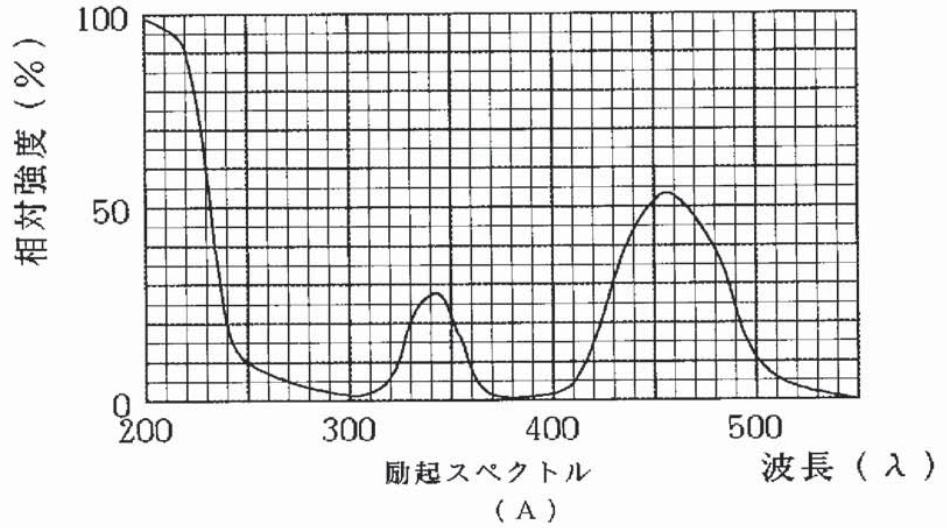
【図２】



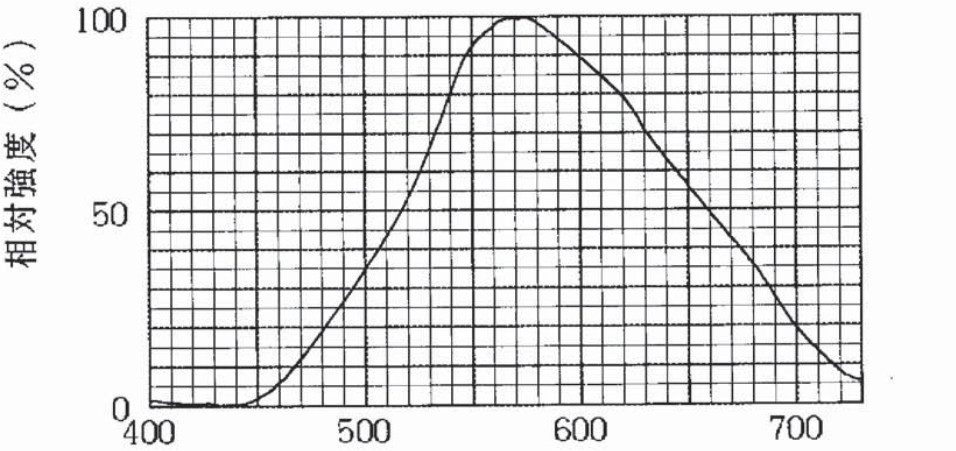
【図３】


発光スペクトル
WHITE LED
エネルギー(%)
100
90
80
70
60
50
40
30
20
10
0
380
430
480
530
580
630
680
730
波長(nm)

【図４】

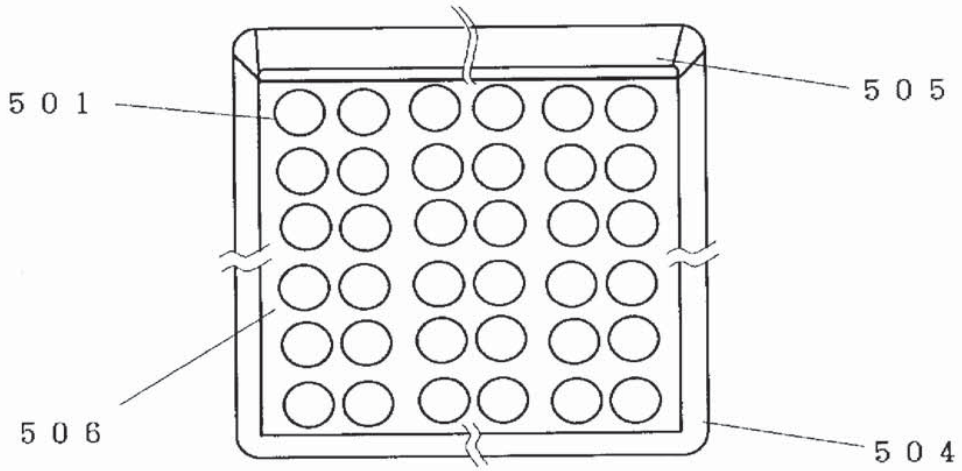


励起スペクトル
（Ａ）

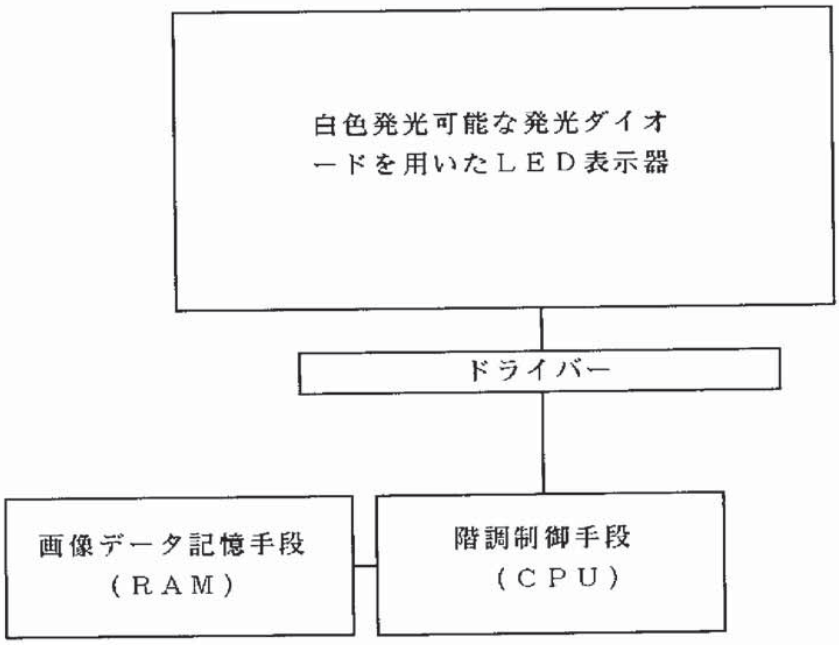


発光スペクトル
（Ｂ）

【図５】



【図６】


白色発光可能な発光ダイオードを用いたＬＥＤ表示器
ドライバー
画像データ記憶手段（ＲＡＭ）
階調制御手段（ＣＰＵ）