



- (51) International Patent Classification:
H01L 33/20 (2010.01) *H01L 33/44* (2010.01)
- (21) International Application Number:
PCT/IB2014/060310
- (22) International Filing Date:
31 March 2014 (31.03.2014)
- (25) Filing Language: English
- (26) Publication Language: English
- (30) Priority Data:
61/810,833 11 April 2013 (11.04.2013) US
61/900,466 6 November 2013 (06.11.2013) US
- (71) Applicant: **KONINKLIJKE PHILIPS N.V.** [NL/NL];
High Tech Campus 5, NL-5656 AE Eindhoven (NL).
- (72) Inventors: **MORAN, Brendan Jude**; c/o High Tech Campus, Building 5, NL-5656 AE Eindhoven (NL). **DE SAMBER, Marc Andre**; c/o High Tech Campus, Building 5, NL-5656 AE Eindhoven (NL). **BASIN, Grigoriy**; c/o High Tech Campus, Building 5, NL-5656 AE Eindhoven (NL). **SWEEGERS, Norbertus Antonius Maria**; c/o High Tech Campus, Building 5, NL-5656 AE Eindhoven (NL). **BUTTERWORTH, Mark Melvin**; c/o High Tech Campus, Building 5, NL-5656 AE Eindhoven (NL). **VAMPOLA, Kenneth**; c/o High Tech Campus, Building 5, NL-5656 AE Eindhoven (NL). **MAZUIR, Clarisse**; c/o High Tech Campus, Building 5, NL-5656 AE Eindhoven (NL).
- (74) Agents: **VAN EEUWIJK, Alexander Henricus Walterus** et al.; High Tech Campus Building 5, NL-5656 AE Eindhoven (NL).

(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Declarations under Rule 4.17:

- as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))
- as to the applicant's entitlement to claim the priority of the earlier application (Rule 4.17(iii))

Published:

- with international search report (Art. 21(3))

(88) Date of publication of the international search report:
8 January 2015

(54) Title: TOP EMITTING SEMICONDUCTOR LIGHT EMITTING DEVICE

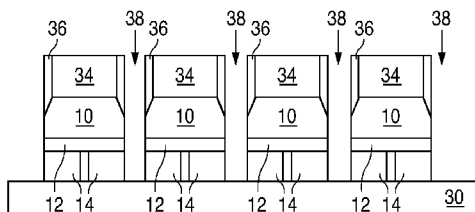


FIG. 6

(57) Abstract: Embodiments of the invention include a semiconductor structure including a light emitting layer sandwiched between an n-type region and a p-type region. A growth substrate is attached to the semiconductor structure. The growth substrate has at least one angled sidewall. A reflective layer is disposed on the angled sidewall. A majority of light extracted from the semiconductor structure and the growth substrate is extracted through a first surface of the growth substrate.



INTERNATIONAL SEARCH REPORT

International application No PCT/IB2014/060310

A. CLASSIFICATION OF SUBJECT MATTER INV. H01L33/20 H01L33/44 ADD.				
According to International Patent Classification (IPC) or to both national classification and IPC				
B. FIELDS SEARCHED				
Minimum documentation searched (classification system followed by classification symbols) H01L				
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched				
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) EPO-Internal, WPI Data				
C. DOCUMENTS CONSIDERED TO BE RELEVANT				
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.		
X	US 6 229 160 B1 (KRAMES MICHAEL R [US] ET AL) 8 May 2001 (2001-05-08) column 3, line 66 - column 4, line 32 column 4, line 49 - column 5, line 2; figure 10 column 8, line 51 - column 9, line 7 claim 3	1-7		
A	----- EP 1 411 557 A2 (STANLEY ELECTRIC CO LTD [JP]) 21 April 2004 (2004-04-21) claim 6; figure 6A	2,5		
X	----- US 2010/279437 A1 (NEFF JAMES G [US] ET AL) 4 November 2010 (2010-11-04)	4-8,10, 13,14		
Y	paragraphs [0023] - [0026]; figures 1, 10, 11 ----- -/--	9		
<input checked="" type="checkbox"/> Further documents are listed in the continuation of Box C. <input checked="" type="checkbox"/> See patent family annex.				
* Special categories of cited documents : <table style="width: 100%; border: none;"> <tr> <td style="width: 50%; border: none; vertical-align: top;"> "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier application or patent but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed </td> <td style="width: 50%; border: none; vertical-align: top;"> "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family </td> </tr> </table>			"A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier application or patent but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family
"A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier application or patent but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family			
Date of the actual completion of the international search	Date of mailing of the international search report			
23 June 2014	21/10/2014			
Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Authorized officer Müller-Kirsch, Lutz			

INTERNATIONAL SEARCH REPORT

International application No PCT/IB2014/060310

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 2011/198665 A1 (FURUKAWA CHISATO [JP]) 18 August 2011 (2011-08-18) paragraphs [0020] - [0047]; figures 1-6 -----	9
A	EP 1 341 991 A2 (EMCORE CORP [US]) 10 September 2003 (2003-09-10) abstract	2
A	& WO 02/41362 A2 (ELIASHEVICH I) 23 May 2002 (2002-05-23) -----	2
A	WO 2006/043796 A1 (SEOUL OPTO DEVICE CO LTD [KR]; POSTECH FOUNDATION [KR]; LEE JONG LAM []) 27 April 2006 (2006-04-27) paragraphs [0122] - [0127]; figures 65,66 -----	8
A	EP 2 511 965 A2 (NITTO DENKO CORP [JP]) 17 October 2012 (2012-10-17) figures 7F, 7E, 9E -----	7,10

INTERNATIONAL SEARCH REPORT

International application No.
PCT/IB2014/060310

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. As all searchable claims could be searched without effort justifying an additional fees, this Authority did not invite payment of additional fees.
3. As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

1-10, 13, 14

Remark on Protest

- The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-10, 13, 14

Device and the method of fabricating the device which is directed to the application of a reflective filling between semiconductor chips on a carrier.

2. claims: 11, 12

Method of fabricating a plurality of semiconductor light emitting devices on a carrier on which a light conversion layer is formed.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/IB2014/060310

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
US 6229160	B1	08-05-2001	DE 19807758 A1	10-12-1998
			GB 2326023 A	09-12-1998
			JP H10341035 A	22-12-1998
			JP 2006135360 A	25-05-2006
			KR 20070042938 A	24-04-2007
			US 6229160 B1	08-05-2001
			US 2001000209 A1	12-04-2001
			US 2001000410 A1	26-04-2001

EP 1411557	A2	21-04-2004	CN 1497745 A	19-05-2004
			EP 1411557 A2	21-04-2004
			JP 4143732 B2	03-09-2008
			JP 2004140090 A	13-05-2004
			US 2004076016 A1	22-04-2004

US 2010279437	A1	04-11-2010	NONE	

US 2011198665	A1	18-08-2011	JP 2011171327 A	01-09-2011
			TW 201130158 A	01-09-2011
			US 2011198665 A1	18-08-2011

EP 1341991	A2	10-09-2003	AU 3928802 A	27-05-2002
			CN 1476365 A	18-02-2004
			EP 1341991 A2	10-09-2003
			JP 2004514285 A	13-05-2004
			TW 512415 B	01-12-2002
			US 2004118825 A1	24-06-2004
			WO 0241362 A2	23-05-2002

WO 2006043796	A1	27-04-2006	CN 101084583 A	05-12-2007
			EP 1810351 A1	25-07-2007
			EP 2426743 A2	07-03-2012
			JP 4999696 B2	15-08-2012
			JP 2008518436 A	29-05-2008
			JP 2012124523 A	28-06-2012
			US 2008006836 A1	10-01-2008
			US 2010124797 A1	20-05-2010
			US 2010213494 A1	26-08-2010
			US 2011169039 A1	14-07-2011
			US 2011278628 A1	17-11-2011
			US 2012146081 A1	14-06-2012
			WO 2006043796 A1	27-04-2006

EP 2511965	A2	17-10-2012	CN 102738362 A	17-10-2012
			EP 2511965 A2	17-10-2012
			JP 2012222315 A	12-11-2012
			KR 20120117660 A	24-10-2012
			TW 201242113 A	16-10-2012
			US 2012261699 A1	18-10-2012
