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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))
- before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))

(88) Date of publication of the international search report:
15 October 2009

(54) Title: LIGHT EMITTING DEVICE WITH BONDED INTERFACE

(57) Abstract: In some embodiments of the invention, a transparent substrate AlInGa P device includes an etch stop layer that may be less absorbing than a conventional etch stop layer. In some embodiments of the invention, a transparent substrate Al In GaP device includes a bonded interface that may be configured to give a lower forward voltage than a conventional bonded interface. Reducing the absorption and/or the forward voltage in a device may improve the efficiency of the device.



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INTERNATIONAL SEARCH REPORT

International application No

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A. CLASSIFICATION OF SUBJECT MATTER

INV. H01L33/00

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 practical, search terms used)

EPO-Internal, WPI Data, IBM-TDB, INSPEC, COMPENDEX

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2005/093015 A1 (KURAHASHI TAKAHISA [JP] ET AL) 5 May 2005 (2005-05-05) abstract; figures 1-6 paragraphs [0071] - [0079] -----	1,2,6,7, 9-12
X	WO 2007/004745 A (SHOWA DENKO KK [JP]; TAKEUCHI RYOUICHI [JP]; MATSUMURA ATSUSHI [JP]; W) 11 January 2007 (2007-01-11) abstract; figures 2-4 page 21, line 4 - page 25, line 20 page 28, lines 14-16 -----	1,2,6,9, 11,12



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents :

A document defining the general state of the art which is not considered to be of particular relevance

E earlier document 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

29 June 2009

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INTERNATIONAL SEARCH REPORT

International application No.
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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 allsearchable 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 reportcovers 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.:

1-4, 6, 7, 9-13

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: 1-4,6,7,9-13

Light emitting device comprising two bonded semiconductor structures, wherein a semiconductor layer adjacent the bonding interface is an InGaP layer, less than 1 micron thick, doped with Te to a concentration of at least $2 \times 10^{18} \text{ cm}^{-3}$.

2. claim: 5

Light emitting device comprising two bonded semiconductor structures, wherein a semiconductor layer adjacent the bonding interface has a peak to valley roughness greater than 15 nm.

3. claim: 8

Light emitting device comprising two bonded semiconductor structures, wherein a semiconductor layer adjacent the bonding interface has a graded composition.

4. claims: 14-26

Method comprising growing a first light emitting semiconductor structure with an etch stop layer, removing the substrate, and bonding to a second semiconductor structure.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/IB2008/055316

Patent document cited in search report		Publication date		Patent family member(s)	Publication date
US 2005093015	A1	05-05-2005	CN	1612370 A	04-05-2005
			JP	2005136271 A	26-05-2005
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