

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
27 December 2007 (27.12.2007)

PCT

(10) International Publication Number
WO 2007/149487 A3

(51) International Patent Classification:
H01L 29/04 (2006.01)

(21) International Application Number:
PCT/US2007/014383

(22) International Filing Date: 20 June 2007 (20.06.2007)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
60/815,507 21 June 2006 (21.06.2006) US

(71) Applicants (for all designated States except US): **THE REGENTS OF THE UNIVERSITY OF CALIFORNIA** [US/US]; 1111 Franklin Street, 12th Floor, Oakland, CA 94607-5200 (US). **JAPAN SCIENCE AND TECHNOLOGY AGENCY** [JP/JP]; 4-1-8, Honcho, Kawaguchi City, Saitama Prefecture 332-0012 (JP).

(72) Inventors; and

(75) Inventors/Applicants (for US only): **HASHIMOTO, Tadao** [JP/US]; 5066 Calle Real, B, Santa Barbara, CA 93111 (US). **SATO, Hitoshi** [JP/US]; 4028 Invierno Drive,

#A, Santa Barbara, CA 93110 (US). **NAKAMURA, Shuji** [US/US]; P.O. Box 61656, Santa Barbara, CA 93160 (US).

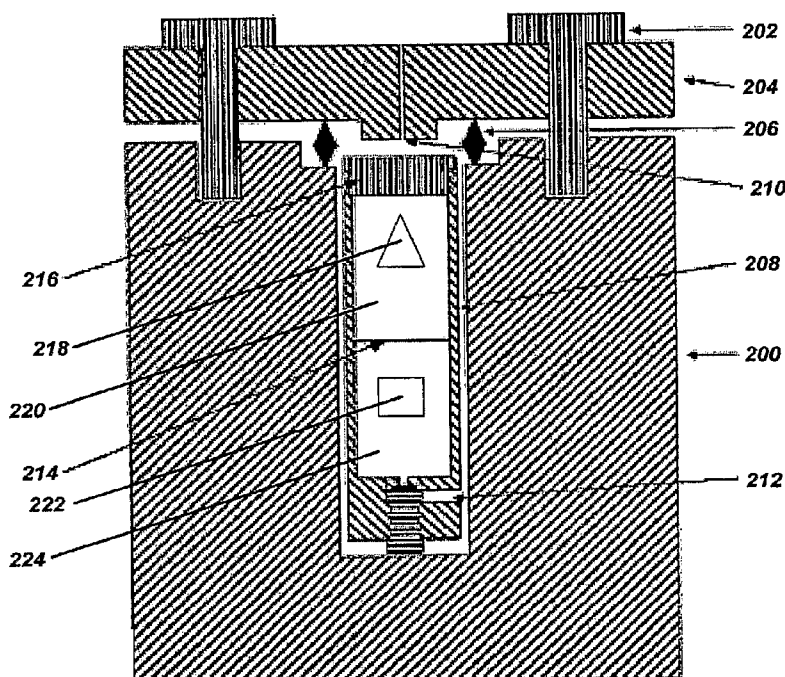
(74) Agent: **ORLER, Anthony, J.**; Gates & Cooper LLP, 6701 Center Drive West, Suite 1050, Los Angeles, CA 90045 (US).

(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, 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, IS, JP, KE, KG, KM, 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, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, SV, SY, 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, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IS, IT, LT, LU, LV, MC, MT, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

[Continued on next page]

(54) Title: OPTO-ELECTRONIC AND ELECTRONIC DEVICES USING N-FACE OR M-PLANE GAN SUBSTRATE PREPARED WITH AMMONOTHERMAL GROWTH



(57) Abstract: A method for growing III-V nitride films having an N-face or M-plane using an ammonothermal growth technique. The method comprises using an autoclave, heating the autoclave, and introducing ammonia into the autoclave to produce smooth N-face or M-plane 3Gallium Nitride films and bulk GaN.

WO 2007/149487 A3



Declaration under Rule 4.17:

— *of inventorship (Rule 4.17(iv))*

(88) Date of publication of the international search report:

13 November 2008

Published:

— *with international search report*

(15) Information about Correction:

Previous Correction:

see Notice of 29 May 2008

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US07/14383

A. CLASSIFICATION OF SUBJECT MATTER

IPC: H01L 29/04(2006.01)

USPC: 257/627

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)

U.S. : 257/627

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)
Google search and EAST-terms GaN and N-face , GaN and N-surface ,and GaN and "000-1"

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	PG Pub 2004/0261692 A1 (Dwilinski et al) Dec. 30, 2004	7-12 and 25
---		-----
Y	Baranowski, JM et al "On GaN Crystallization by Ammonothermal Method" Acta Physica Polonica A 90(1996):763-766	26 and 29
---		-----
Y	PG Pub 2004/0072383 A1 (Nagahama et al) Apr. 15 2004.	30



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 application or patent 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 July 2008 (29.07.2008)

Date of mailing of the international search report

27 AUG 2008

Name and mailing address of the ISA/US

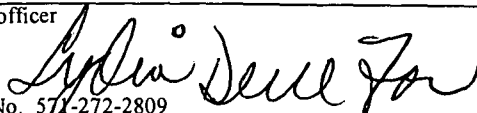
Mail Stop PCT, Attn: ISA/US
Commissioner of Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

Facsimile No. (571) 273-3201

Authorized officer

Sue Purvis

Telephone No. 571-272-2809



INTERNATIONAL SEARCH REPORT

PCT/US07/14383

C. (Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	PG Pub 2005/0121688 A1 (Nagai et al) Jun. 9, 2005, entire document	13
---		-----
Y	Baranowski, JM et al "On GaN Crystallization by Ammonothermal Method" Acta Physica Polonica A 90(1996):763-766	14-15