

(19) World Intellectual Property Organization  
International Bureau



(43) International Publication Date  
7 August 2008 (07.08.2008)

PCT

(10) International Publication Number  
**WO 2008/095111 A3**

(51) International Patent Classification:  
C30B 27/02 (2006.01) C30B 30/00 (2006.01)

(74) Agent: HULSEY, William, N.; Hulseyp Intellectual Property Lawyers, P.C., 919 Congress Avenue, Suite 919, Austin, TX 78701 (US).

(21) International Application Number:  
PCT/US2008/052676

(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, 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

(22) International Filing Date: 31 January 2008 (31.01.2008)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:  
11/700,391 31 January 2007 (31.01.2007) US

(71) Applicant (for all designated States except US): CAL-ISOLAR, INC. [US/US]; 3723 Haven Avenue, Suite 133, Menlo Park, CA 94025 (US).

(72) Inventors; and

(75) Inventors/Applicants (for US only): HEUER, Matthias [DE/DE]; Schamborststrasse 53, 04275 Leipzig (DE). KIRSCHT, Fritz [US/DE]; Wernitzer Strasse 36, D12621 Berlin (DE). LINKE, Dieter [DE/DE]; Alt-schmoeckwitz 5, 12527 Berlin (DE). RAKOTONIANA, Jean, Patrice [MG/DE]; Richterstr. 09, D-12456 Berlin (DE). OUNAD-JELA, Kamel [FR/US]; 116 Clipper Drive, Belmont, CA 94002 (US).

(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, HR, HU, IE, IS, IT, LT, LU, LV, MC, MT, NL, NO, 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: METHOD AND SYSTEM FOR FORMING A HIGHER PURITY SEMICONDUCTOR INGOT USING LOW PURITY SEMICONDUCTOR FEEDSTOCK

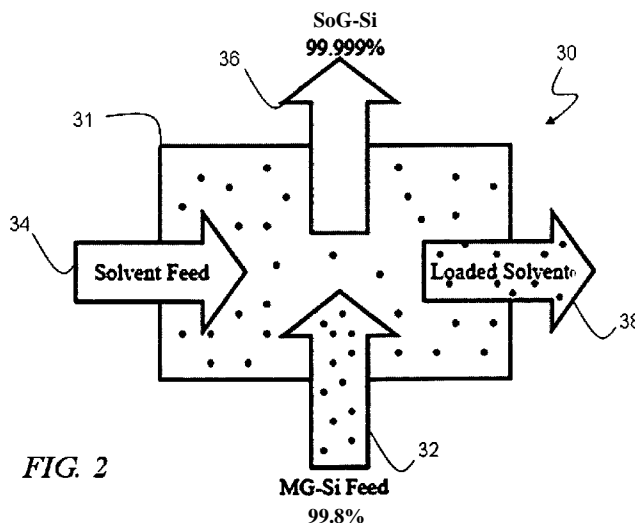


FIG. 2

(57) Abstract: Techniques for the formation of a higher purity semiconductor ingot using a low purity semiconductor feedstock include associating within a crucible a low-grade silicon feedstock, which crucible forms a process environment of said molten silicon. The process associates with the low-grade silicon feedstock, a quantity of the at least one metal and includes forming within the crucible a molten solution (e.g., a binary or ternary solution) of molten silicon and the metal at a temperature below the melting temperature of said low-grade silicon feedstock. A silicon seed crystal associates with the molten solution within the crucible for inducing directional silicon crystallization. The process further forms a silicon ingot from a portion of the molten solution in association with the silicon seed. The silicon ingot includes at least one silicon crystalline formation grown in the induced directional silicon crystallization process. The resulting silicon ingot has a silicon purity substantially exceeding the silicon purity of said low grade silicon feedstock.



WO 2008/095111 A3



**Declarations under Rule 4.17:**

- *as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(H))*
- *of inventorship (Rule 4.17(iv))*

- *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments*

**Published:**

- *with international search report*

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

16 October 2008

INTERNATIONAL SEARCH REPORT

International application No  
PCT/US 08/52676

**A CLASSIFICATION OF SUBJECT MATTER**  
IPC(8) - C30B 27/02, C30B 30/00 (2008.04)  
USPC - 117/18: 117/208, 117/214  
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)  
IPC (8) - C30B 27/02, C30B 30/00 (2008 04)  
USPC - 117/18, 117/208, 117/214

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched  
IPC (8) - C30B 27/02, C30B 30/00 (2008 04)  
USPC - 117/18, 117/208, 117/214

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)  
PUBWEST (PGPB.USPT.USOC EPAB JPAB) Terms - silicon aluminum zinc copper tin silver nickel melt crystal getter metallurgical grade calisolar seed crystal aluminum crucible puller  
Google - high purity silicon ingot zinc, high purity silicon ingot calisolar, silicon seed crystal aluminum crucible

**C DOCUMENTS CONSIDERED TO BE RELEVANT**

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No
X --- Y	US 2006/0194417 A1 (ISHIHARA et al) 31 August 2006 (31 08 2006), para 10011] [0023], [0027]-[0031], [0040], [0047]	1-16, 18 20-36, 38, 40-41 ----- 17 19 37, 39
Y	US 2006/0048698 A1 (HALL et al) 09 March 2006 (09 03 2006) para [0036]	17 37
Y	US 5,779,792 A (ATAMI et al) 14 July 1998 (14 07 1998), col 2, ln 13-25	19 39

Further documents are listed in the continuation of Box C

- \* Special categories of cited documents
- "A" document defining the general state of the art which is not considered to be of particular relevance
- "L" earlier application originally 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 relating 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 31 July 2008 (31 07 2008)	Date of mailing of the international search report <b>07 AUG 2008</b>
--	--

Name and mailing address of the ISA/US Mail Stop PCT, AHn ISA/US, Commissioner (or Patents) P O Box 1450, Alexandria, Virginia 22313-1450 Facsimile No 571-273-3201	Authorized officer  Lee W Young  PCI Hq/pt/psk 571-272-4300 PCI OSP 571-272-7774
--	---