(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
7 January 2010 (07.01.2010)

PCT

(10) International Publication Number
WO 2010/002795 A1

(51) International Patent Classification:
C30B 15/30 (2006.01) *C30B 29/06* (2006.01)
C30B 30/04 (2006.01)

(21) International Application Number:
PCT/US2009/049069

(22) International Filing Date:
29 June 2009 (29.06.2009)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
61/077,082 30 June 2008 (30.06.2008) US

(71) Applicant *(for all designated States except US)*: **MEMC ELECTRONIC MATERIALS, INC.** [US/US]; 501 Pearl Drive, St. Peters, MO 63376 (US).

(72) Inventors; and
(75) Inventors/Applicants *(for US only)*: **SREEDHARA-MURTHY, Hariprasad** [US/US]; c/o MEMC Electronic Materials, Inc., 501 Pearl Drive, St. Peters, MO 63376 (US). **KULKARNI, Milind, S.** [IN/US]; c/o MEMC Electronic Materials, Inc., 501 Pearl Drive, St. Peters, MO 63376 (US). **SCHRENKER, Richard, G.** [US/US]; c/o MEMC Electronic Materials, Inc., 501 Pearl Drive, St. Peters, MO 63376 (US). **HOLZER, Joseph, C.** [US/US]; c/o MEMC Electronic Materials, Inc., 501 Pearl Drive, St. Peters, MO 63376 (US). **KORB, Harold, W.** [US/US]; c/o MEMC Electronic Materials, Inc., 501 Pearl Drive, St. Peters, MO 63376 (US).

(74) Agents: **KEFALONITIS, Andrew, Jr.** et al.; Armstrong Teasdale LLP, One Metropolitan Square, 26th Floor, St. Louis, MO 63102 (US).

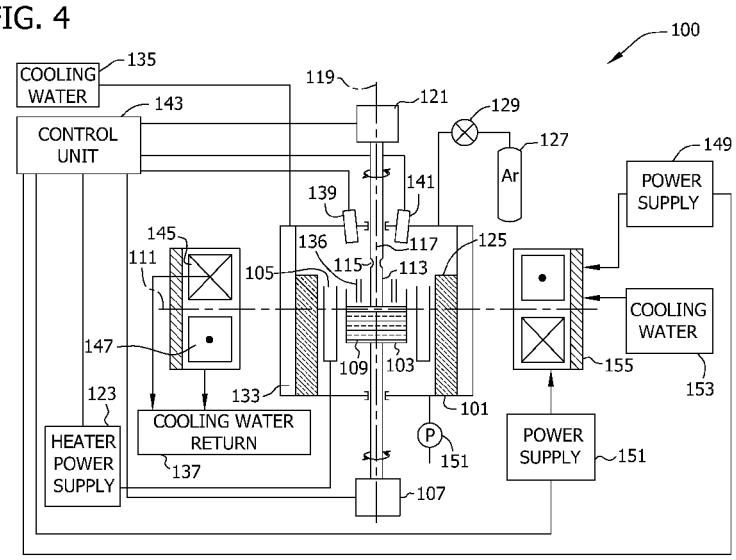
(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, 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, PE, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, ST, 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, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, 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: CONTROLLING A MELT-SOLID INTERFACE SHAPE OF A GROWING SILICON CRYSTAL USING AN UN-BALANCED MAGNETIC FIELD AND ISO-ROTATION

FIG. 4



(57) Abstract: A system for growing silicon crystals that facilitates controlling a shape of a melt-solid interface is described. The crystal growing system includes a heated crucible including a semiconductor melt from which a monocrystalline ingot is grown according to a Czochralski process. The ingot is grown on a seed crystal pulled from the melt. The method includes applying an unbalanced cusped magnetic field to the melt, and rotating the ingot and the crucible in the same direction while the ingot is being pulled from the melt.

WO 2010/002795 A1

Published:

— *with international search report (Art. 21(3))*