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

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
29 December 2011 (29.12.2011)

PCT

(10) International Publication Number
WO 2011/162977 A2

(51) International Patent Classification:
H01L 29/78 (2006.01) *H01L 21/336* (2006.01)

(21) International Application Number:
PCT/US2011/039892

(22) International Filing Date:
10 June 2011 (10.06.2011)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
12/823,163 25 June 2010 (25.06.2010) US

(71) Applicant *(for all designated States except US)*: **INTERNATIONAL BUSINESS MACHINES CORPORATION** [US/US]; New Orchard Road, Armonk, NY 10504 (US).

(72) Inventors; and

(75) Inventors/Applicants *(for US only)*: **CHAN, Kevin, K.** [US/US]; 1101 Kitchawan Road, Yorktown Heights, NY 10598 (US). **DUBE, Abhishek** [IN/US]; 2070 Route 52, Hopewell Junction, NY 12533 (US). **HOLT, Judson, R.** [US/US]; 2070 Route 52, Hopewell Junction, NY 12533 (US). **JOHNSON, Jeffrey, B.** [US/US]; 1000 River Street, Essex Junction, VT 05452 (US). **LI, Jinghong** [US/US]; 2070 Route 52, Hopewell Junction, NY 12533 (US). **PARK, Dae-Gyu** [KR/US]; 2070 Route 52, Hopewell Junction, NY 12533 (US). **ZHU, Zhengmao** [CN/US]; 2070 Route 52, Hopewell Junction, NY 12533 (US).

(74) Agent: **SCHNURMANN, Daniel, H.**; International Business Machines Corporation, 2070 Route 52, Bldg. 321 M/D 482, Hopewell Junction, NY 12533 (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, 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, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, 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, ML, MR, NE, SN, TD, TG).

Published:

— *without international search report and to be republished upon receipt of that report (Rule 48.2(g))*

(54) **Title**: DELTA MONOLAYER DOPANTS EPITAXY FOR EMBEDDED SOURCE/DRAIN SILICIDE

(57) **Abstract**: Semiconductor structures are disclosed that have embedded stressor elements therein. The disclosed structures include at least one FET gate stack (18) located on an upper surface of a semiconductor substrate (12). The at least one FET gate stack includes source and drain extension regions (28) located within the semiconductor substrate at a footprint of the at least one FET gate stack. A device channel (40) is also present between the source and drain extension regions (28) and beneath the at least one gate stack (18). The structure further includes embedded stressor elements (33) located on opposite sides of the at least one FET gate stack and within the semiconductor substrate. Each of the embedded stressor elements includes, from bottom to top, a first layer of a first epitaxy doped semiconductor material (35) having a lattice constant that is different from a lattice constant of the semiconductor substrate and imparts a strain in the device channel, a second layer of a second epitaxy doped semiconductor material (36) located atop the first layer, and a delta monolayer of dopant located on an upper surface of the second layer. The structure further includes a metal semiconductor alloy contact (45) located directly on an upper surface of the delta monolayer (37).

WO 2011/162977 A2