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

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
15 September 2011 (15.09.2011)

PCT

(10) International Publication Number
WO 2011/112518 A2

(51) International Patent Classification:
H01L 21/205 (2006.01)

(21) International Application Number:
PCT/US2011/027422

(22) International Filing Date:
7 March 2011 (07.03.2011)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
61/313,206 12 March 2010 (12.03.2010) US
13/041,201 4 March 2011 (04.03.2011) US

(71) Applicant *(for all designated States except US)*: **APPLIED MATERIALS, INC.** [US/US]; P.O. Box 450a, Santa Clara, California 95052 (US).

(72) Inventor; and
(71) Applicant : **SAPRE, Kedar** [IN/US]; 5189 Paseo Olivos, San Jose, California 95130 (US).

(72) Inventors; and
(75) Inventors/Applicants *(for US only)*: **HUA, Zhong Qiang** [CN/US]; 18026 King Court, Saratoga, California 95070 (US). **LUO, Lei** [CN/US]; 3507 Palmilla Drive, Apt. 3051, San Jose, California 95134 (US). **HERNANDEZ, Manuel A.** [US/US]; 1317 Karmen Court, Santa Clara, California 95051 (US). **CAO, Zhitao** [CN/US]; 582 Weston Drive, Campbell, California 95008 (US). **BHATNAGAR, Ajay** [US/US]; 2390 W. Middlefield Road #14, Mountain View, California 94043 (US).

(74) Agents: **CATMULL, Kelvin B.** et al.; Kilpatrick Townsend & Stockton LLP, Two Embarcardero Center, 8th Floor, San Francisco, California 94111-3834 (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,

[Continued on next page]

(54) Title: METHODS FOR FORMING LOW MOISTURE DIELECTRIC FILMS

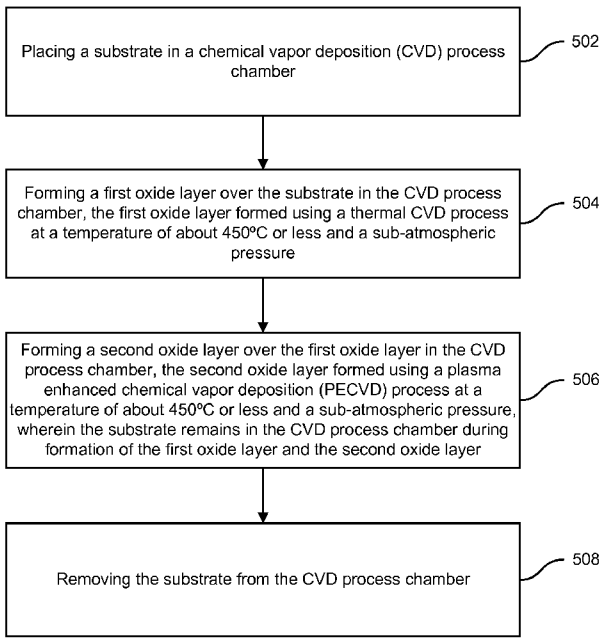


FIG. 5

(57) Abstract: A method for forming a pre-metal dielectric (PMD) layer or an inter-metal dielectric (IMD) layer over a substrate includes placing the substrate in a chemical vapor deposition (CVD) process chamber and forming a first oxide layer over the substrate in the CVD process chamber. The first oxide layer is formed using a thermal CVD process at a temperature of about 450°C or less and a sub-atmospheric pressure. The method also includes forming a second oxide layer over the first oxide layer in the CVD process chamber. The second oxide layer is formed using a plasma enhanced chemical vapor deposition (PECVD) process at a temperature of about 450°C or less and a sub-atmospheric pressure. The substrate remains in the CVD process chamber during formation of the first oxide layer and the second oxide layer.

WO 2011/112518 A2

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))*