

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
4 October 2007 (04.10.2007)

PCT

(10) International Publication Number
WO 2007/111837 A2

(51) International Patent Classification:

H01L 21/461 (2006.01) **H01L 21/302** (2006.01)
C23F 1/00 (2006.01)

(21) International Application Number:

PCT/US2007/006449

(22) International Filing Date: 14 March 2007 (14.03.2007)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:

11/386,428 22 March 2006 (22.03.2006) US

(71) Applicant: **APPLIED MATERIALS, INC.** [US/US];
3050 Bowers Avenue, Santa Clara, CA 95054 (US).

(72) Inventors: **DELGADINO, Gerardo, A.**; 3655 Pruneridge Avenue #208, Santa Clara, CA 95051 (US). **HAGBORG, Richard**; 440 River Road, Felton, CA 95051 (US). **BUCHBERGER, Douglas, A., Jr.**; 2076 Vintage Lane, Livermore, CA 94500 (US).

(74) Agent: **WALLACE, Robert, M.**; Law Office, Suite 102,
2112 Eastman Avenue, Ventura, CA 93003 (US).

(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM,

AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, 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, 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, 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).

Declaration under Rule 4.17:

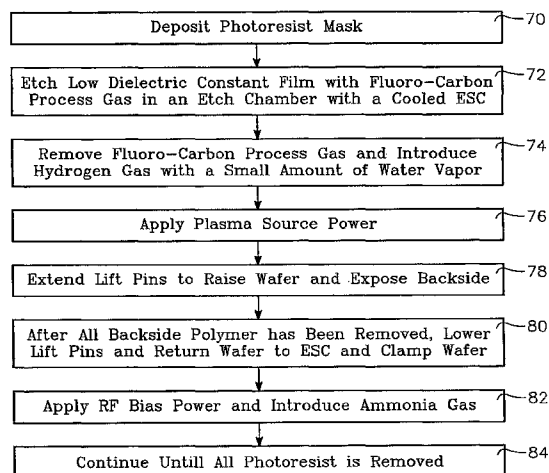
— as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))

Published:

— without international search report and to be republished upon receipt of that report

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: PLASMA DIELECTRIC ETCH PROCESS INCLUDING IN-SITU BACKSIDE POLYMER REMOVAL FOR LOW-DIELECTRIC CONSTANT MATERIAL



(57) Abstract: A plasma etch process with in-situ backside polymer removal begins with a workpiece having a porous or non-porous carbon-doped silicon oxide dielectric layer and a photoresist mask on a surface of the workpiece. The workpiece is clamped onto an electrostatic chuck in an etch reactor chamber. The process includes introducing a fluoro-carbon based process gas and applying RF bias power to the electrostatic chuck and RF source power to an overhead electrode to etch exposed portions of the dielectric layer while depositing protective fluoro-carbon polymer on the photoresist mask. The process further includes removing the fluoro-carbon based process gas and introducing a hydrogen-based process gas and applying RF source power to the overhead electrode. The lift pins in the electrostatic chuck are extended to raise the workpiece above the electrostatic chuck and expose a backside of the workpiece to plasma in the reactor chamber, so as to reduce polymer previously deposited on the backside, until the polymer has been removed from the backside.

WO 2007/111837 A2