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

CORRECTED VERSION

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
6 October 2005 (06.10.2005)

PCT

(10) International Publication Number
WO 2005/091974 A2

(51) International Patent Classification: Not classified

(21) International Application Number:
PCT/US2005/007886

(22) International Filing Date: 9 March 2005 (09.03.2005)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
10/804,430 19 March 2004 (19.03.2004) US

(71) Applicant *(for all designated States except US)*: **LAM RESEARCH CORPORATION** [US/US]; 4650 Cushing Parkway, P1205PCT, Fremont, California 94538 (US).

(72) Inventors; and

(75) Inventors/Applicants *(for US only)*: **KIM, Jisoo** [KR/US]; 4621 Cochise Court, Pleasanton, California 94588 (US). **WORSHAM, Binet** [US/US]; 1194 Boranda Avenue #4, Mountain View, California 94040 (US). **YEN, Bi-Ming** [CN/US]; 40495 Carmelita Court, Fremont, California 94539 (US). **LOEWENHARDT, Peter K.** [CA/US]; 5602 Selena Court, Pleasanton, California 94588 (US).

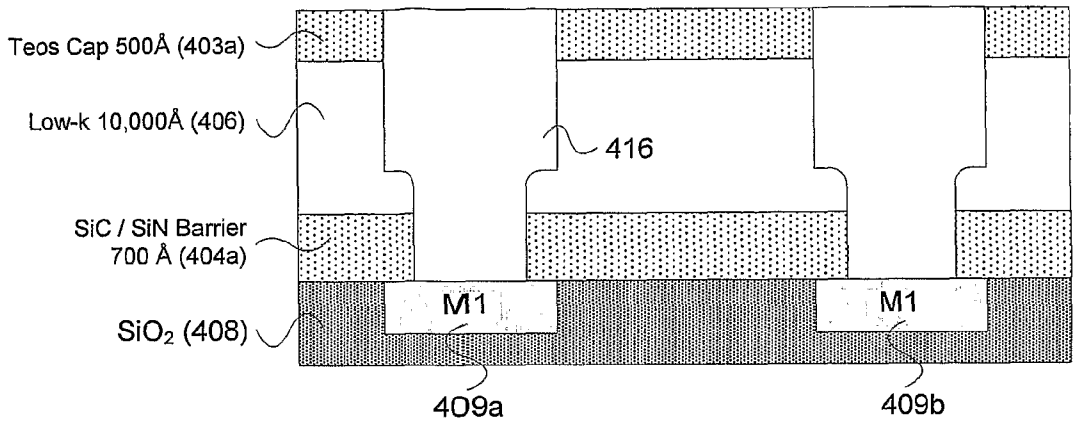
(74) Agent: **NGUYEN, Joseph, A**; 10121 Miller Avenue, Suite 201, Cupertino, California 95014 (US).

(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, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NA, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SM, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, 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, MC, 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).

[Continued on next page]

(54) Title: METHODS FOR THE OPTIMIZATION OF SUBSTRATE ETCHING IN A PLASMA PROCESSING SYSTEM



(57) Abstract: A method of etching a substrate in a plasma processing system is disclosed. The substrate has a semi-conductor layer, a first barrier layer disposed above the semi-conductor layer, a low-k layer disposed above the first barrier layer, a third hard mask layer disposed above the low-k layer; a second hard mask layer disposed above the third hard mask layer, and a first hard mask layer disposed above the second hard mask layer. The method includes alternatively etching the substrate with a first etchant and a second etchant, wherein the first etchant has a low selectivity to a first hard mask material of the first hard mask layer, a third hard mask material of the a third hard mask layer, and a first barrier layer material of the first barrier layer, but a high selectivity to a second hard mask material of the second hard mask layer; and wherein the second etchant has a high selectivity to the first hard mask material of the first hard mask layer, the third hard mask material of the third hard mask layer, and the first barrier layer material of the first barrier layer, and the first etchant has a low selectivity to the second hard mask material of the second hard mask layer.

WO 2005/091974 A2

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

(48) Date of publication of this corrected version:
24 November 2005

(15) Information about Correction:
see PCT Gazette No. 47/2005 of 24 November 2005, Section II

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.