



- (51) International Patent Classification:  
*H01L 21/304* (2006.01) *H01L 21/66* (2006.01)
- (21) International Application Number:  
PCT/US2012/034712
- (22) International Filing Date:  
23 April 2012 (23.04.2012)
- (25) Filing Language: English
- (26) Publication Language: English
- (30) Priority Data:  
13/095,822 27 April 2011 (27.04.2011) US
- (71) Applicant (for all designated States except US): **APPLIED MATERIALS, INC.** [US/US]; 3050 Bowers Avenue, Santa Clara, California 95054 (US).
- (72) Inventors; and
- (75) Inventors/Applicants (for US only): **IRAVANI, Hassan G.** [IR/US]; 6041 Hawkcreek Place, San Jose, California 95123 (US). **XU, Kun** [US/US]; 2828 Kilkare Road, Sunol, California 94586 (US). **SWEDEK, Boguslaw A.** [PL/US]; 10315 A El Prado Way, Cupertino, California 95014 (US). **CARLSSON, Ingemar** [SE/US]; 3474 Spring Creek Lane, Cupertino, California 95014 (US). **SHEN, Shih-Haur** [CN/US]; 530 La Conner Dr., #31, Sunnyvale, California 94087 (US). **TU, Wen-Chiang** [US/US]; 777 West Middlefield Road, Mountain View, California 904043 (US). **GAGE, David Maxwell** [US/US]; 1649 Belleville Way, Apt. B, Sunnyvale, California 94087 (US). **WANG, James C.** [US/US]; 18430 Montpere Way, Saratoga, California 95070 (US).
- (74) Agent: **GOREN, David J.**; Fish & Richardson P.C., P. O. Box 1022, Minneapolis, Minnesota 55440-1022 (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, QA, RO, RS, RU, RW, 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, RW, 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).

**Declarations under Rule 4.17:**

- as to the applicant's entitlement to claim the priority of the earlier application (Rule 4.17(iii))

**Published:**

- with international search report (Art. 21(3))
- before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))

- (88) Date of publication of the international search report:  
27 December 2012

(54) Title: EDDY CURRENT MONITORING OF METAL RESIDUE OR METAL PILLARS

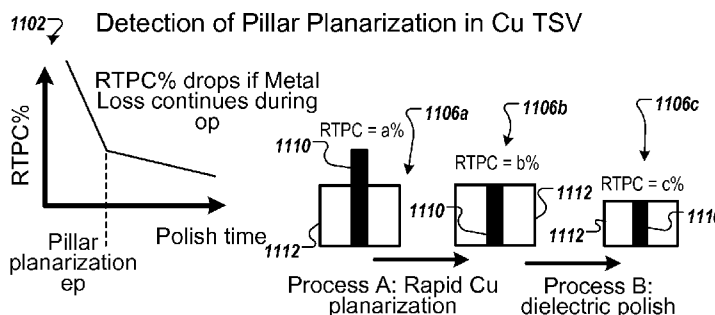


FIG. 11

(57) Abstract: A method of chemical mechanical polishing a substrate includes polishing a metal layer on the substrate at a polishing station, monitoring thickness of the metal layer during polishing at the polishing station with an eddy current monitoring system, and halting polishing when the eddy current monitoring system indicates that residue of the metal layer is removed from an underlying layer and a top surface of the underlying layer is exposed.



## INTERNATIONAL SEARCH REPORT

International application No.  
**PCT/US2012/034712****A. CLASSIFICATION OF SUBJECT MATTER****H01L 21/304(2006.01)i, H01L 21/66(2006.01)i**

According to International Patent Classification (IPC) or to both national classification and IPC

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)

H01L 21/304; C09K 13/00; G01N 27/72; C03C 15/00; B24B 49/12; G01B 7/10; H01L 21/461; H01L 21/00

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Korean utility models and applications for utility models

Japanese utility models and applications for utility models

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

eKOMPASS(KIPO internal) &amp; Keywords: CMP, metal layer, monitoring, thickness, eddy current, barrier, dielectric

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2002-0055192 A1 (FRED C. REDEKER et al.) 09 May 2002 See abstract; figures 3A-13; paragraphs [0009]-[0014], [0031]-[0070].	1-15
A	US 05343146 A (FRANK J. KOCH et al.) 30 August 1994 See figures 4a-7; and column 8 line 12 - column 12 line 27.	1-15
A	US 2006-0021974 A1 (FENG Q. LIU et al.) 02 February 2006 See abstract; figures 3-8D; and paragraphs [0039]-[0065], [0096]-[0121].	1-15
A	US 7264537 B1 (THOMAS LAURSEN et al.) 04 September 2007 See abstract; figures 1-4; and column 2 line 51 - column 7, line 33.	1-15

 Further documents are listed in the continuation of Box C. See patent family annex.

\* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&amp;" document member of the same patent family

Date of the actual completion of the international search

31 OCTOBER 2012 (31.10.2012)

Date of mailing of the international search report

**01 NOVEMBER 2012 (01.11.2012)**

Name and mailing address of the ISA/KR

Korean Intellectual Property Office  
189 Cheongsa-ro, Seo-gu, Daejeon Metropolitan  
City, 302-701, Republic of Korea

Facsimile No. 82-42-472-7140

Authorized officer

CHOI, SANGWON

Telephone No. 82-42-481-5695



**INTERNATIONAL SEARCH REPORT**

Information on patent family members

International application No.

**PCT/US2012/034712**

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2002-0055192 A1	09.05.2002	US 2003-0176081 A1 US 6602724 B2 US 6869332 B2	18.09.2003 05.08.2003 22.03.2005
US 05343146 A	30.08.1994	GB 2271641 A JP 02698749 B2 JP 06-317401 A JP 2698749 B2 US 09E35703E E US RE035703E E	20.04.1994 19.09.1997 15.11.1994 19.01.1998 30.12.1997 30.12.1997
US 2006-0021974 A1	02.02.2006	CN 1906333 A CN 1906333 C0 JP 04633064 B2 JP 2007-519828 A JP 2007-519828 T JP 4633064 B2 KR 10-2006-0129415 A US 2005-0233578 A1 US 7390744 B2 WO 2005-075711 A1 WO 2006-081470 A1	31.01.2007 31.01.2007 26.11.2010 19.07.2007 19.07.2007 23.02.2011 15.12.2006 20.10.2005 24.06.2008 18.08.2005 03.08.2006
US 7264537 B1	04.09.2007	None	