

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
6 May 2005 (06.05.2005)

PCT

(10) International Publication Number
WO 2005/040459 A3

(51) International Patent Classification⁷: **C25D 5/02**,
5/48, 5/50, 3/38, H01L 21/445

(21) International Application Number:
PCT/US2004/033229

(22) International Filing Date: 8 October 2004 (08.10.2004)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
10/688,420 16 October 2003 (16.10.2003) US

(71) Applicant (for all designated States except US): **SEMI-TOOL, INC.** [US/US]; 655 West Reserve Drive, Kalispell, MT 59901 (US).

(72) Inventors; and

(75) Inventors/Applicants (for US only): **KLOCKE, John, L.** [US/US]; 368 Shelter Valley Drive, Kalispell, MT 59901 (US). **CHEN, Linlin** [CA/US]; 3213 Placid Springs Lane, Plano, TX 75025 (US).

(74) Agent: **CALDWELL, Lisa, M.**; Klarquist Sparkman, LLP, One World Trade Center, 121 SW Salmon Street, Suite 1600, Portland, OR 97204 (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, 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, IT, 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).

Published:

- with international search report
- with amended claims

(88) Date of publication of the international search report:
12 January 2006

Date of publication of the amended claims: 2 March 2006

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: ELECTROPLATING COMPOSITIONS AND METHODS FOR ELECTROPLATING

(57) Abstract: Disclosed are electroplating compositions and methods for filling recessed microstructures of a microelectronic workpiece (101), such as a semiconductor wafer, with metallization. The electroplating compositions may comprise a mixture of copper and sulfuric acid wherein the ratio of copper concentration to sulfuric acid concentration is equal to from about 0.3 to about 0.8 g/L (grams per liter of solution). The disclosed electroplating compositions may also comprise a mixture of copper and sulfuric acid wherein the copper concentration is near its solubility limit when the sulfuric acid concentration is from about 65 to about 150 g/L. Such electroplating compositions may also include conventional additives, such as accelerators, suppressors, halides and/or levelers. Methods for electrochemically depositing conductive materials in features, such as trenches and/or contact holes formed on semiconductor workpieces are disclosed, including methods suited for use in multiple anode reactors using the disclosed electroplating solutions.



WO 2005/040459 A3