

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
13 October 2005 (13.10.2005)

PCT

(10) International Publication Number
WO 2005/095263 A3

(51) International Patent Classification:

B81C 1/00 (2006.01) **C23C 14/16** (2006.01)
C23C 16/06 (2006.01) **C23C 14/54** (2006.01)
C30B 23/00 (2006.01) **C30B 29/02** (2006.01)
C30B 25/00 (2006.01)

(21) International Application Number:

PCT/US2005/009763

(22) International Filing Date: 24 March 2005 (24.03.2005)

(25) Filing Language:

English

(26) Publication Language:

English

(30) Priority Data:

60/555,759 24 March 2004 (24.03.2004) US

(71) Applicant (for all designated States except US): **H. C. STARCK INC.** [US/US]; 45 Industrial Place, Newton, MA 02461 (US).

(72) Inventors; and

(75) Inventors/Applicants (for US only): **NARAYAN, Jagdish** [US/US]; 4917 Springwood Drive, Raleigh, NC 27613 (US). **KUMAR, Prabhat** [US/US]; 31 Pinewood Drive, Framingham, MA 01701 (US). **WU, Richard** [US/US]; 3 Rosemary Lane, Chelmsford, MA 01824 (US).

(74) Agents: **GIL, Joseph, C.** et al.; Bayer MaterialScience LLC, 100 Bayer Road, Pittsburgh, PA 15205 (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).

Published:

- with international search report
- before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments

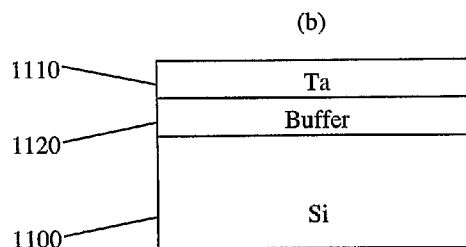
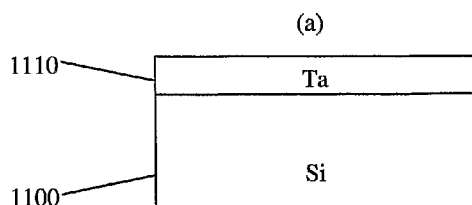
(88) Date of publication of the international search report:

11 May 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: METHODS OF FORMING ALPHA AND BETA TANTALUM FILMS WITH CONTROLLED AND NEW MICROSTRUCTURES

Schematic cross-section view of formation Ta films **1110** on silicon substrate **1100** without buffer (Figure 1(a)) and with buffer layer **1120** (Figure 1(b)).(Narayan)



(57) Abstract: Thin tantalum films having novel microstructures are provided. The films have microstructures such as nanocrystalline, single crystal and amorphous. These films provide excellent diffusion barrier properties and are useful in microelectronic devices. Methods of forming the films using pulsed laser deposition (PLD) and molecular beam epitaxy (MBE) deposition methods are also provided, as are microelectronic devices incorporating these films.

WO 2005/095263 A3