

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

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
29 August 2002 (29.08.2002)

PCT

(10) International Publication Number
WO 02/067302 A3

(51) International Patent Classification⁷: H01L 21/02, 21/285

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(21) International Application Number: PCT/US02/04090

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(22) International Filing Date: 11 February 2002 (11.02.2002)

(25) Filing Language: English

(81) Designated States (*national*): AE, AG, AL, AM, AT (utility model), AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ (utility model), CZ, DE (utility model), DE, DK (utility model), DK, DM, DZ, EC, EE (utility model), EE, ES, FI (utility model), 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, NO, NZ, OM, PH, PL, PT, RO, RU, SD, SE, SG, SI, SK (utility model), SK, SL, TJ, TM, TN, TR, TT, TZ, UA, UG, UZ, VN, YU, ZA, ZM, ZW.

(26) Publication Language: English

(30) Priority Data: 09/789,335 20 February 2001 (20.02.2001) US

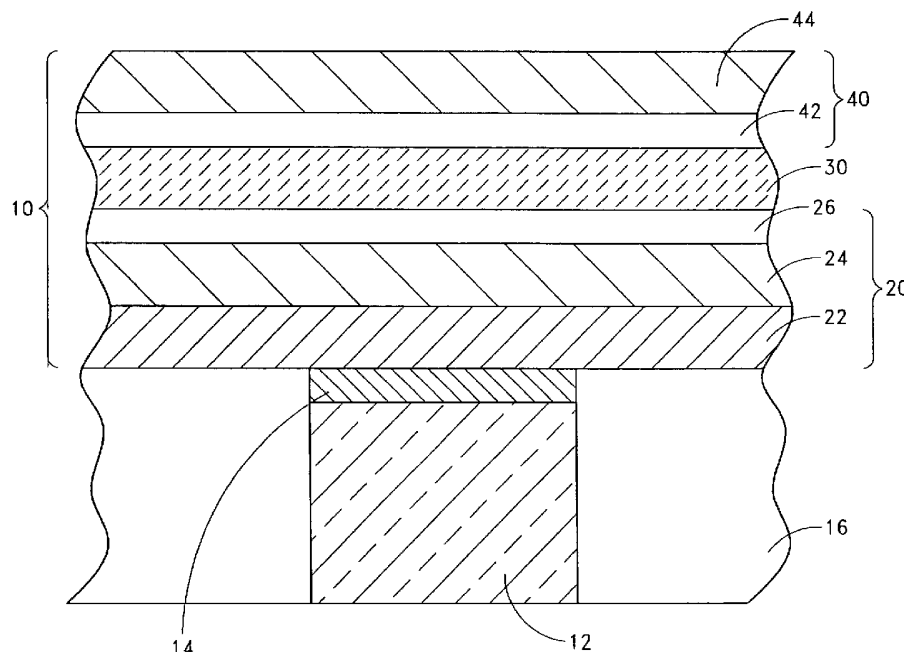
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(84) Designated States (*regional*): ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, TR), OAPI patent

[Continued on next page]

(54) Title: RHODIUM-RICH OXYGEN BARRIERS



(57) Abstract: Structures and methods are disclosed for forming capacitors for integrated circuits. The capacitor includes a rhodium-rich structure (24), a rhodium oxide layer (26) in direct contact with the rhodium-rich structure (24), a capacitor dielectric (30) in direct contact with the rhodium oxide layer (26) and a top electrode (40) over the capacitor. The rhodium-rich structure (24) can include rhodium alloys and the capacitor dielectric (30) preferably has a high dielectric constant.



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(BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR,
NE, SN, TD, TG).

(88) Date of publication of the international search report:
16 October 2003

Published:

— *with international search 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.

INTERNATIONAL SEARCH REPORT

Intern Application No

PCT/US 02/04090

A. CLASSIFICATION OF SUBJECT MATTER
 IPC 7 H01L21/02 H01L21/285

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)

IPC 7 H01L

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

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

EPO-Internal, WPI Data, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5 807 774 A (VIJAY DILIP P ET AL) 15 September 1998 (1998-09-15) abstract; claim 1; figure 1 column 3 -column 5 ---	1, 18, 23, 25, 31
X	US 5 751 540 A (CHUNG IL-SUB ET AL) 12 May 1998 (1998-05-12) abstract; claims; figure 2 column 2 -column 3; claims --- -/--	1-54



Further documents are listed in the continuation of box C.



Patent family members are listed in annex.

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Date of the actual completion of the international search

7 March 2003

Date of mailing of the international search report

21/03/2003

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INTERNATIONAL SEARCH REPORT

Intern: Application No

PCT/US 02/04090

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	<p>YAMAMICHI S ET AL: "A STACKED CAPACITOR TECHNOLOGY WITH ECR PLASMA MOCVD BBA,SR)TIO3 AND RUO2/RU/TIN/TISIX STORAGE NODES FOR GB-SCALE DRAM'S" IEEE TRANSACTIONS ON ELECTRON DEVICES, IEEE INC. NEW YORK, US, vol. 44, no. 7, 1 July 1997 (1997-07-01), pages 1076-1083, XP000658199 ISSN: 0018-9383 abstract page 1077; figure 1</p>	1, 18, 23, 25, 31
X	<p>BHATT H D ET AL: "NOVEL HIGH TEMPERATURE MULTILAYER ELECTRODE-BARRIER STRUCTURE FOR HIGH-DENSITY FERROELECTRIC MEMORIES" APPLIED PHYSICS LETTERS, AMERICAN INSTITUTE OF PHYSICS. NEW YORK, US, vol. 71, no. 5, 4 August 1997 (1997-08-04), pages 719-721, XP000699640 ISSN: 0003-6951 abstract page 719, column 1; figure 1B page 721, column 2</p>	1, 18, 23, 25, 31
X	<p>WO 00 13215 A (MICRON TECHNOLOGY INC) 9 March 2000 (2000-03-09) page 7, line 16 - line 26; figure 1 abstract</p>	18-22
A	<p>US 5 576 928 A (GNADE BRUCE E ET AL) 19 November 1996 (1996-11-19) abstract; claims column 9 -column 16; figure 23</p>	1-54
A	<p>TAYLOR D J ET AL: "FATIGUE OF ORGANOMETALLIC CHEMICAL VAPOR DEPOSITED PBZRXTI1-XO3 THIN FILMS WITH RU/RUO2 AND PT/PT ELECTRODES" THIN SOLID FILMS, ELSEVIER-SEQUOIA S.A. LAUSANNE, CH, vol. 263, no. 2, 15 July 1995 (1995-07-15), pages 221-230, XP000523135 ISSN: 0040-6090 the whole document</p>	1-54
E	<p>US 6 518 610 B2 (YANG ET AL) 11 February 2003 (2003-02-11) the whole document</p>	1-54

INTERNATIONAL SEARCH REPORT

Intern: Application No

PCT/US 02/04090

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
US 5807774	A	15-09-1998	JP 10173142 A	26-06-1998
US 5751540	A	12-05-1998	JP 8264735 A	11-10-1996
			NL 1002665 C2	05-02-1998
			NL 1002665 A1	24-09-1996
WO 0013215	A	09-03-2000	US 6197628 B1	06-03-2001
			AU 5346799 A	21-03-2000
			EP 1114449 A1	11-07-2001
			JP 2002524847 T	06-08-2002
			TW 436957 B	28-05-2001
			WO 0013215 A1	09-03-2000
US 5576928	A	19-11-1996	US 5566045 A	15-10-1996
			US 5619393 A	08-04-1997
			US 5581436 A	03-12-1996
US 6518610	B2	22-08-2002	US 2002113260 A1	22-08-2002
			WO 02067302 A2	29-08-2002
			US 2002190303 A1	19-12-2002