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

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
18 October 2001 (18.10.2001)

PCT

(10) International Publication Number
WO 01/77402 A3

(51) International Patent Classification⁷: **H01J 37/34**

(21) International Application Number: PCT/CA01/00413

(22) International Filing Date: 30 March 2001 (30.03.2001)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
09/545,817 7 April 2000 (07.04.2000) US

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

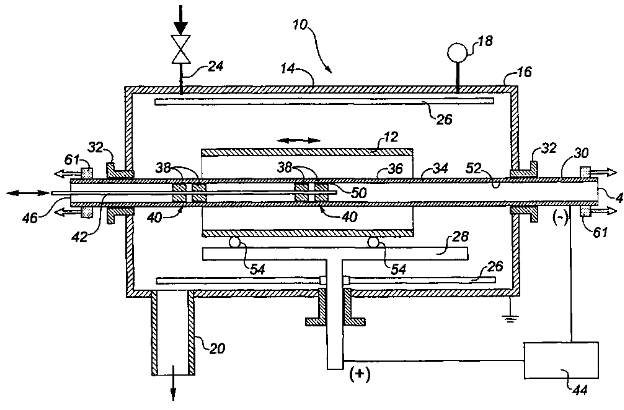
(84) Designated States *(regional)*: ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

Published:
— *with international search report*

(88) Date of publication of the international search report:
28 March 2002

[Continued on next page]

(54) Title: METHOD AND APPARATUS FOR MAGNETRON SPUTTERING



(57) Abstract: A cathode assembly for magnetron sputtering of a workpiece, and sputtering apparatus and methods of sputtering using same are provided. The cathode assembly includes a tubular cathode, which may be cylindrical in cross section along its length, or which may be curved or flexible, depending on the shape of workpiece that is to be sputtered, and which has a sputtering length of L_s. The cathode assembly also includes a magnet package, or a plurality of spaced magnet packages, each magnet package including either one magnet or a plurality of spaced magnets of alternating polarity, and having a magnet package length L_{pkg} which is less than L_s. The cathode assembly further includes one or more means for positioning, and preventing radial displacement of, the cathode along the axis of symmetry of the cathode. The magnet package is held within the cathode such that a driving force applied to the magnet package or to the cathode, or to both independently, imparts relative longitudinal movement between the magnet package and the cathode. The cathode assembly preferably includes cooling means. Furthermore, the magnet package(s) is preferably held within the cathode for shuttle movement. The cathode assembly allows for variations of one or more of the magnet package length, number, and spacing, and the relative displacement distance or shuttle distance, in order to tailor the erosion profile along the axis of symmetry of the cathode.

INTERNATIONAL SEARCH REPORT

International Application No
PCT/CA 01/00413

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 H01J37/34

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 H01J C23C

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 4 221 652 A (KURIYAMA NOBORU) 9 September 1980 (1980-09-09) cited in the application column 3, line 14 -column 5, line 41 figures 3,6	95,96, 115-117, 119, 123-125
A		1,19,41

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☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

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- "&" document member of the same patent family

Date of the actual completion of the international search
30 November 2001

Date of mailing of the international search report
06/12/2001

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Int ational Application No
PCT/CA 01/00413

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication,where appropriate, of the relevant passages	Relevant to claim No.
X	WALKER S J ET AL: "Magnetron sputtering of solar coatings inside tubes" JOURNAL OF VACUUM SCIENCE AND TECHNOLOGY, NEW YORK, NY, US, vol. 19, no. 3, September 1981 (1981-09), pages 700-703, XP002139700 ISSN: 0022-5355 cited in the application page 700, paragraph 1 -page 701, paragraph 1 figure 1 ---	95,96, 115-117, 119, 123-125
A	US 5 298 137 A (MARSHALL III JOHN) 29 March 1994 (1994-03-29) column 5, line 4 - line 28 column 10, line 11 - line 59 figures 1,8 ---	1,19
A	US 5 301 211 A (BRYAN WILLIAM J ET AL) 5 April 1994 (1994-04-05) column 3, line 21 -column 4, line 28 figure 1 -----	1,19

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INTERNATIONAL SEARCH REPORT

Information on patent family members

Int ational Application No
PCT/CA 01/00413

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 4221652 A	09-09-1980	JP 1049412 C	26-06-1981
		JP 51117933 A	16-10-1976
		JP 55026710 B	15-07-1980
US 5298137 A	29-03-1994	AU 664995 B2	14-12-1995
		AU 1797092 A	17-11-1992
		BR 9205911 A	27-12-1994
		CA 2108673 A1	20-10-1992
		EP 0581902 A1	09-02-1994
		JP 6508001 T	08-09-1994
		WO 9218663 A1	29-10-1992
US 5301211 A	05-04-1994	KR 9703774 B1	21-03-1997