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- (71) Applicant (for all designated States except US): APPLIED MATERIALS, INC. [US/US]; 3050 Bowers Avenue, Santa Clara, CA 95054 (US).
- (72) Inventor; and
- (75) Inventor/Applicant (for US only): SHAMOUN, Bassam [US/US]; 39951 Fremont Blvd., #326, Fremont, CA 94538 (US).
- (74) Agents: PATTERSON, B. Todd et al.; Patterson & Sheridan, L.L.P., 3040 Post Oak Blvd., Suite 1500, Houston, Texas 77056-6582 (US).

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(54) Title: RF POWERED TARGET FOR INCREASING DEPOSITION UNIFORMITY IN SPUTTERING SYSTEMS

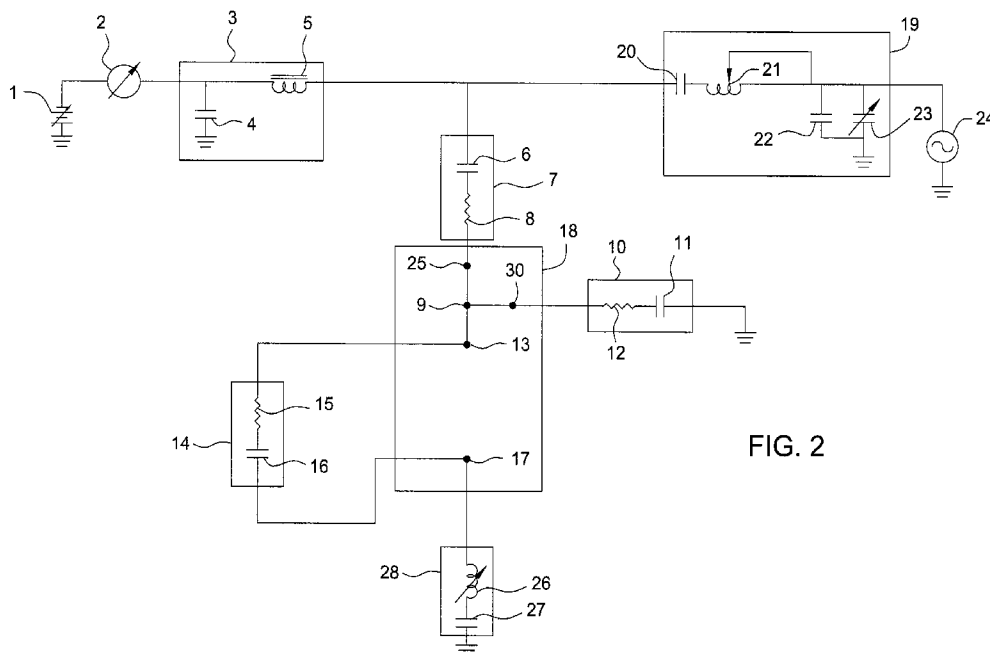


FIG. 2

(57) Abstract: A method and apparatus for sputter depositing a film on a substrate is disclosed. By providing a superimposed RF bias over a DC bias, plasma ionization is increased. In order to increase the resistive load across the substrate, an impedance circuit is provided between the substrate and the susceptor. The impedance circuit allows an insulating substrate to effectively function as an anode and connect to ground.

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INTERNATIONAL SEARCH REPORT

International application No.

PCT/US 07/61630

A. CLASSIFICATION OF SUBJECT MATTER IPC(8) - C23C 14/00, C23C 14/32 (2009.01) USPC - 204/192.1, 204/298.01 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(8) - C23C 14/00, C23C 14/32 (2009.01) USPC - 204/192.1; 204/298.01 Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched IPC(8) - C23C 14/00, C23C 14/32 (2009.01) USPC - 204/192.1; 204/298.01 (text search) Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) PubWEST, GooglePatents, GoogleScholar Search Terms Used: plasma, impedance, circuit, resistor, series, parallel, sputtering, susceptor, capacitors, inductor, RF, DC, filter, pressure, choke, tuning		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 6,858,112 B2 (Flamm et al.) 22 February 2005 (22.02.2005), Figure 1; col 4, ln 63-67; col 5, ln 1-5; col 8, ln 9-11; col 9, ln 27-32; col 10, ln 56-59; col 11, ln 4-10, ln 24-27; col 12, ln 44-49; col 13, ln 1-4, ln 46-49, ln 53-56; col 14, ln 17-20; col 15, ln 10-14, ln 42-47, ln 57-59; col 16, ln 14-16, ln 30-34; col 18, ln 8-11	1, 2, 4, 6, 11, 12, 21, 24-33
—		
Y		3, 5, 13, 22, 23
Y	US 6,971,391 B1 (Wang et al.) 06 December 2005 (06.12.2005); col 17, ln 52-55; col 29, ln 29-34; col 35, ln 53-56; col 39, ln 31-35; col 40, ln 37-39; col 49, ln 58-65	3, 5, 13, 22, 23
<input type="checkbox"/> Further documents are listed in the continuation of Box C. <input type="checkbox"/>		
* 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 another 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 "&" document member of the same patent family		
Date of the actual completion of the international search 28 December 2008 (28.12.2008)		Date of mailing of the international search report 09 JAN 2009
Name and mailing address of the ISA/US Mail Stop PCT, Attn: ISA/US, Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450 Facsimile No. 571-273-3201		Authorized officer: Lee W. Young PCT Helpdesk: 571-272-4300 PCT OSP: 571-272-7774

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US 07/61630

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

Three claim groups were found:
Group I: Claims 1-6, 11-13, 21-33
Group II: Claims 7-10, 14-20
Group III: Claims 34-39

-- see extra sheet

1. As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. As all searchable claims could be searched without effort justifying additional fees, this Authority did not invite payment of additional fees.
3. As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
4. No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:
Group I: Claims 1-6, 11-13, 21-33

- Remark on Protest**
- The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
 - The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
 - No protest accompanied the payment of additional search fees.

Continuation of Box No. III – Observations where unity of invention is lacking

This application contains the following inventions or groups of inventions which are not so linked as to form a single general inventive concept under PCT Rule 13.1. In order for all inventions to be examined, the appropriate additional examination fees must be paid.

Group I: is directed to a plasma apparatus comprising: a first impedance circuit coupled between ground and the plasma; and a second impedance circuit coupled between the plasma and a susceptor including increasing impedance between the plasma and the chamber shield; increasing a voltage drop between the plasma and the substrate .

Group II: is directed to a method of sputtering, comprising: providing a substrate; providing a susceptor for holding the substrate; controlling the impedance between the substrate and the susceptor; and sputtering to deposit a layer on the substrate.

Group III: is directed to a resistive load reducing apparatus, comprising: three impedance circuits; an RF power supply; a DC power supply; a low pass filter; and an RF matching circuit.

The inventions listed as Groups I-III do not relate to a single general inventive concept under PCT Rule 13.1 because, under PCT Rule 13.2, they lack the same or corresponding special technical features for the following reasons:

Group I does not include the inventive concept of controlling the impedance between the substrate and the susceptor, as required by Group II, or a resistive load reducing apparatus, comprising: three impedance circuits; an RF power supply; a DC power supply; a low pass filter; and an RF matching circuit, as required by group III.

Group II does not include the inventive concept of impedance circuits coupling plasma to susceptor and ground, as required by Group I, or a resistive load reducing apparatus, comprising: three impedance circuits; an RF power supply; a DC power supply; a low pass filter; and an RF matching circuit, as required by group III.

Group III does not include the inventive concept of impedance circuits coupling plasma to susceptor and ground, as required by Group I, or controlling the impedance between the substrate and the susceptor, as required by Group II, as required by Group II.

Groups I-III, therefore, lack unity under PCT Rule 13 because they do not share a same or corresponding special technical feature.