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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) **Inventors; and**
- (75) **Inventors/Applicants (for US only):** **BANNA, Samer** [IL/US]; 3500 Palmilla Drive, #1012, San Jose, CA 95134 (US). **TODOROW, Valentin** [US/US]; 2473 Emerson Street, Palo Alto, CA 94301 (US). **RAMASWAMY, Kartik** [US/US]; 646 Tawnygate Way, San Jose, CA 95124 (US).
- (74) **Agent:** **TABOADA, Alan**; Moser IP Law Group, 1030 Broad Street, 2nd Floor, Shrewsbury, NJ 07702 (US).
- (81) **Designated States (unless otherwise indicated, for every kind of national protection available):** AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, 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, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, 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 (Art. 21(3))
- (88) **Date of publication of the international search report:**
1 April 2010

(54) **Title:** METHOD AND APPARATUS FOR PULSED PLASMA PROCESSING USING A TIME RESOLVED TUNING SCHEME FOR RF POWER DELIVERY

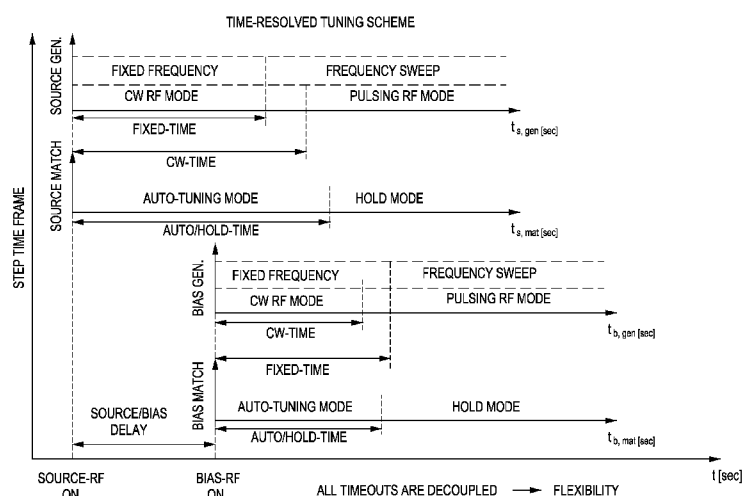


FIG. 2

(57) **Abstract:** Embodiments of the present invention generally provide methods and apparatus for pulsed plasma processing over a wide process window. In some embodiments, an apparatus may include an RF power supply having frequency tuning and a matching network coupled to the RF power supply that share a common sensor for reading reflected RF power reflected back to the RF power supply. In some embodiments, an apparatus may include an RF power supply having frequency tuning and a matching network coupled to the RF power supply that share a common sensor for reading reflected RF power reflected back to the RF power supply and a common controller for tuning each of the RF power supply and the matching network.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2009/043771**A. CLASSIFICATION OF SUBJECT MATTER*****H05H 1/36(2006.01)i, H01L 21/3065(2006.01)i***

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)

H05H 1/36; C03C 25/68; C23F 1001/00; H01J 7/24; H01L 21/306; H01L 21/461

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

Korean Utility models and applications for Utility models since 1975

Japanese Utility models and applications for Utility models since 1975

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

eKOMPASS(KIPO internal) & Keywords: sensor, plasma, matching network, RF power, frequency tuning

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y A	US 2004-0045506 A1 (JIAN J. CHEN et al.) 11 March 2004 See Figures 1, 4; and Paragraph [0031]-[0035], [0072]-[0079].	1-3,5 8-15
Y A	US 2004-0107906 A1 (KENNETH S. COLLINS et al.) 10 June 2004 See Paragraph [0028] and the Abstract.	1-3,5 8-15

☐ Further documents are listed in the continuation of Box C.☒ See patent family annex.

* 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 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

29 DECEMBER 2009 (29.12.2009)

Date of mailing of the international search report

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Korean Intellectual Property Office
Government Complex-Daejeon, 139 Seonsa-ro, Seo-
gu, Daejeon 302-701, Republic of Korea

Facsimile No. 82-42-472-7140

Authorized officer

KIM, Jong Hee

Telephone No. 82-42-481-8500



INTERNATIONAL SEARCH REPORT

International application No.

PCT/US2009/043771**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.: 4,6,7
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:

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 an additional fee, this Authority did not invite payment of any additional fee.
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.:

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.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/US2009/043771

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