

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
11 October 2001 (11.10.2001)

PCT

(10) International Publication Number
WO 01/75930 A3

- (51) International Patent Classification⁷: **H01J 37/32**
- (21) International Application Number: **PCT/US01/10183**
- (22) International Filing Date: **28 March 2001 (28.03.2001)**
- (25) Filing Language: **English**
- (26) Publication Language: **English**
- (30) Priority Data:
2000-99728 31 March 2000 (31.03.2000) JP
09/608,883 30 June 2000 (30.06.2000) US
09/676,462 29 September 2000 (29.09.2000) US
- (71) Applicant (for all designated States except US): **LAM RESEARCH CORPORATION** [US/US]; 4650 Cushing Parkway, Fremont, CA 94538 (US).
- (74) Agent: **MARTINE, Peter, B.**; Martine Penilla & Kim, LLP, Suite 170, 710 Lakeway Drive, Sunnyvale, CA 94085 (US).
- (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).

- (72) Inventor; and
(75) Inventor/Applicant (for US only): **NAKAJIMA, Shu** [JP/JP]; 3148-17 Akabane, Chigasaki-shi, Kanagawa-ken 253-0001 (JP).

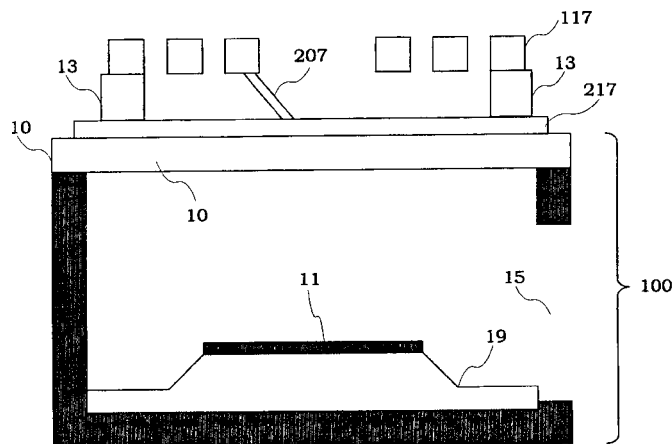
Published:

— with international search report

- (88) Date of publication of the international search report:
23 May 2002

[Continued on next page]

(54) Title: APPARATUS AND METHODS FOR ACTIVELY CONTROLLING RF PEAK-TO-PEAK VOLTAGE IN AN INDUCTIVELY COUPLED PLASMA ETCHING SYSTEM



(57) Abstract: An inductively coupled plasma etching apparatus includes a chamber (100) and a window (10) for sealing a top opening of the chamber. The window (10) has an inner surface that is exposed to an internal region of the chamber (100). A metal plate (217), which acts as a Faraday shield, is disposed above and spaced apart from the window (10). A coil (117) is disposed above and spaced apart from the metal plate (217). The coil (117) is conductively connected to the metal plate (217) at a connection location (see connector 207) that is configured to generate a peak-to-peak voltage on the metal plate that optimally reduces sputtering of the inner surface of the window (10) while substantially simultaneously preventing deposition of etch byproducts on the inner surface of the window. In another embodiment, the apparatus includes a controller for externally applying a peak-to-peak voltage to the metal plate (217). The controller includes an oscillation circuit, a matching circuit, an RF generator, and a feedback control for monitoring the applied peak-to-peak voltage. Methods for optimizing operation of an inductively coupled plasma etching apparatus also are described.



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.