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

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
2 April 2009 (02.04.2009)

PCT

(10) International Publication Number
WO 2009/042997 A4

(51) International Patent Classification:
H01L 21/68 (2006.01) *H01L 21/205* (2006.01)
H01L 21/3065 (2006.01)

(21) International Application Number:
PCT/US2008/078110

(22) International Filing Date:
29 September 2008 (29.09.2008)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
60/976,149 28 September 2007 (28.09.2007) US

(71) Applicant *(for all designated States except US)*: **LAM RESEARCH CORPORATION** [US/US]; 4650 Cushing Parkway, Fremont, California 94538 (US).

(72) Inventor; and

(75) Inventor/Applicant *(for US only)*: **BAILEY, Andrew D., III** [US/US]; 4650 Cushing Parkway, Fremont, CA 94538 (US).

(74) Agent: **NGUYEN, Joseph A.**; P.O. Box 700640, San Jose, CA 95170 (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, 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))*

— *with amended claims and statement (Art. 19(1))*

(88) Date of publication of the international search report:
16 July 2009

[Continued on next page]

(54) Title: WAFER BOW METROLOGY ARRANGEMENTS AND METHODS THEREOF

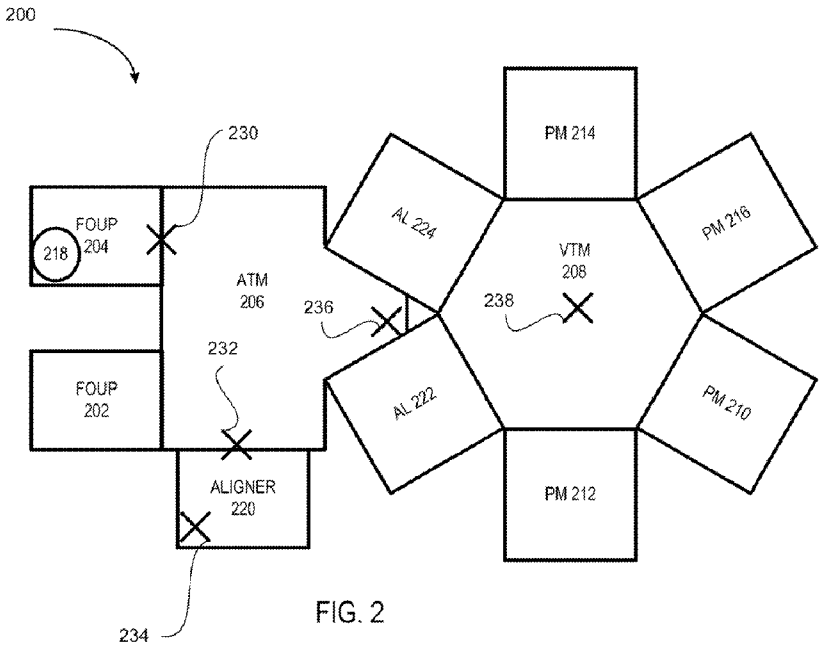

FIG. 2

(57) Abstract: An arrangement for quantifying a wafer bow. The arrangement is positioned within a plasma processing system is provided. The arrangement includes a support mechanism for holding a wafer. The arrangement also includes a first set of sensors, which is configured to collect a first set of measurement data for a plurality of data points on the wafer. The first set of measurement data indicates a minimum gap between the first set of sensors and the wafer. The first set of sensors is positioned in a first location, which is outside of a set of process modules of the plasma processing system.

WO 2009/042997 A4

WO 2009/042997 A4

Date of publication of the amended claims and statement: 3
September 2009

AMENDED CLAIMS

[received by the International Bureau on 07 July 2009 (07.07.2009)]

What is claimed is:

1. An arrangement for quantifying a wafer bow, said arrangement being positioned within a plasma processing system, comprising:

a support mechanism for holding a wafer; and

a first set of sensors, said first set of sensors being configured to collect a first set of measurement data for a plurality of data points on said wafer, said first set of measurement data indicating a set of distance data between said first set of sensors and said wafer, said first set of sensors being positioned in a first location, said first location being outside of a set of process modules of said plasma processing system, wherein said first set of sensors is moving in a first direction while said wafer is stationary, wherein said first direction includes one of a z direction and a rotating direction.

2. The arrangement of claim 1 wherein said support mechanism is one of

a robotic arm, and

an electrostatic chuck.

3. The arrangement of claim 1 wherein said location of said first set of sensors is positioned at one of

between a front opening unified pod (FOUP) and an atmospheric transfer module (ATM),

between said ATM and an aligner,

within said aligner,

between said ATM and an airlock module,

between said airlock module and a vacuum transfer module (VTM), and

within said VTM.

4. The arrangement of claim 1 wherein said first set of sensors is a single sensor.

5. The arrangement of claim 1 wherein said first set of sensors include an array of sensors.

6. The arrangement of claim 1 wherein said wafer is moving in a first direction while said first set of sensors is stationary, wherein said first direction includes one of a z direction and a rotating direction.

7. (Cancelled)

8. The arrangement of claim 1 wherein said wafer is rotating while said first set of sensors is moving in said z direction.

9. The arrangement of claim 1 wherein said first set of sensors is collecting said first set of measurement data when another wafer is being processed in a process module of said set of process modules.

10. The arrangement of claim 1 further includes a second set of sensors,

said second set of sensors being configured for collecting a second set of measurement data, wherein said second set of measurement data include at least one data point of said plurality of data points measured by said first set of sensors, and

said second set of sensors being positioned in a second location within said plasma processing system, said second location being opposite of said first position, wherein a gap exists between said first set of sensors and said second set of sensors, thereby enabling said wafer to be positioned between said first set of sensors and said second set of sensors.

11. The arrangement of claim 10 wherein said second set of sensors is directly parallel to said first set of sensors.

12. The arrangement of claim 11 wherein a wafer thickness for said wafer is determined by comparing said first set of measurement data to said second set of measurement data.

13. A method for quantifying a wafer bow within a plasma processing system, comprising:

transferring a wafer into said plasma processing system;

collecting measurement data for a plurality of data points on said wafer, said measurement data indicating a set of distance data between a set of sensors and said wafer, said set of sensors being positioned outside of a set of process modules of said plasma processing system, wherein said set of sensors is moving in a first direction while said wafer is stationary, wherein said first direction includes one of a z direction and a rotating direction; and

if said measurement data is within a set of pre-determined range, said wafer is moved into a process module of said set of process modules for processing, wherein said measurement data is utilized to adjust a recipe for processing said wafer.

14. The method of claim 13 further include, if said measurement data is outside of said set of pre-determined range, removing said wafer from said plasma processing system.

15. The method of claim 13 wherein said collecting of measurement data is performed at a location outside of said set of process modules, said location being one of

between a front opening unified pod (FOUP) and an atmospheric transfer module (ATM),

between said ATM and an aligner,

within said aligner,

between said ATM and an airlock module,

between said airlock module and a vacuum transfer module (VTM), and

within said VTM.

16. The method of claim 13 wherein said measurement data is employed to determine thickness of said wafer, said measurement data being collected by positioning a first subset of sensors of said set of sensors above said wafer and a second subset of sensors of said set of sensors below said wafer, wherein a first set of measurement data collected by said first subset of sensors is compared against a second set of measurement data collected by said second subset of sensors to determine said thickness of said wafer.

17. The method of claim 16 wherein said second set of measurement data include at least one data point of a plurality of data points measured by said first set of sensors.

18. The method of claim 13 wherein said wafer is moving in a first direction while said set of sensors is stationary, wherein said first direction includes one of a z direction and a rotating direction.

19. (Cancelled)

20. The method of claim 13 wherein said wafer is rotating while said first set of sensors is moving in said z direction.

STATEMENT UNDER ARTICLE 19 (1)

Claims 7 and 19 are cancelled.

Claims 2-6 and 9-18 are unchanged.

Claims 1, 8, 13, and 20 are replaced by amended claims 1, 8, 13, and 20 bearing the same numbers.

After entry of this amendment, claims 1-6, 8-18, and 20 are pending. No new subject matter has been added.