

(19) World Intellectual Property Organization
International Bureau



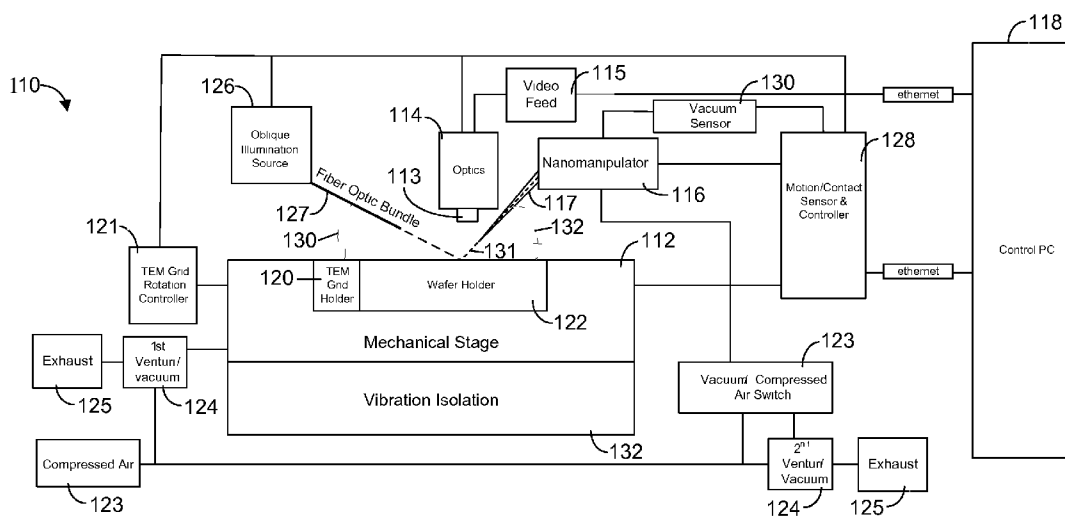
(43) International Publication Date
2 May 2008 (02.05.2008)

PCT

(10) International Publication Number
WO 2008/051880 A3

- (51) **International Patent Classification:**
GOIR 1/073 (2006.01) HOIL 21/66 (2006.01)
- (21) **International Application Number:**
PCT/US2007/082030
- (22) **International Filing Date:** 20 October 2007 (20.10.2007)
- (25) **Filing Language:** English
- (26) **Publication Language:** English
- (30) **Priority Data:**
60/853,183 20 October 2006 (20.10.2006) US
60/927,719 4 May 2007 (04.05.2007) US
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- (81) **Designated States (unless otherwise indicated, for every kind of national protection available):** AE, AG, AL, AM, 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, 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, HU, IE, IS, IT, LT, LU, LV, MC, MT, NL, 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
— with amended claims
- (88) **Date of publication of the international search report:**
3 July 2008
- Date of publication of the amended claims:** 4 September 2008

(54) **Title:** METHOD AND APPARATUS FOR SAMPLE EXTRACTION AND HANDLING



(57) **Abstract:** An improved method and apparatus for extracting and handling samples for S/TEM analysis. Preferred embodiments of the present invention make use of a micromanipulator and a hollow microprobe probe using vacuum pressure to adhere the microprobe tip to the sample. By applying a small vacuum pressure to the lamella through the microprobe tip, the lamella can be held more securely and its placement controlled more accurately than by using electrostatic force alone. By using a probe having a beveled tip and which can also be rotated around its long axis, the extracted sample can be placed down flat on a sample holder. This allows sample placement and orientation to be precisely controlled, thus greatly increasing predictability of analysis and throughput.

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AMENDED CLAIMS

received by the International Bureau on 30 June 2008 (30.06.08)

original claim 21 replaced by amended claim 21

positioning the probe so that the sample is generally above a desired position on the sample holder; and

lowering the probe until the sample comes in contact with the surface of the sample holder.

19. The method of claim 18 in which the probe angle is 45 degrees, the tip angle is 45 degrees, and the first rotational angle is 180 degrees.

20. The method of claim 13 in which extracting the sample does not take place inside an ion beam system.

21. The method of claim 13 further comprising, after placing the substrate with the lamella to be extracted on a moveable stage, moving the stage so that the approximate x-y coordinates of a lamella to be extracted are within the field of view of an optical microscope; directing a light source at the lamella at an acute angle relative to the substrate surface; rotating the stage so that the illumination from the light source is directed in a plane perpendicular to the vertical face of the lamella; and using computer-based image recognition software to identify the precise location of the lamella.

22. A method for extracting a sample from a substrate, the method comprising: mounting the substrate with the sample to be extracted on a moveable stage, the sample having a planar face to be used as a probe attachment site;

positioning the substrate relative to a microprobe having a cylindrical axis so that the cylindrical axis lies in a plane which is perpendicular to the sample face, said microprobe connected to a micromanipulator and mounted onto a probe stage that can rotate about the cylindrical axis of the probe, said microprobe having a generally flat tip which is beveled at an oblique tip angle with respect to the cylindrical axis of the microprobe; and said