**Expert Specifications**

**EXP-Auto – Basic System**

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**Wafer Transfer Robot With Mapping Sensor**

- **Wafer size**: 6”, 8”, and 12”
- **Mapping sensor**: Two cassettes (For 6” and 8” cassette option)
- **Movement range**:
  - R axis: 470 mm (excluding end effector)
  - T axis: 370 degree (±185 degree from home position)
  - W axis: 370 degree (±185 degree from home position)
  - Z axis: 380 mm
- **Accuracy**:
  - X-Y: (± 0.1 mm), Z: (± 0.05 mm)
- **Wafer holding**: Vacuum chuck

**Aligner Module**

- **Wafer size**: 6”, 8”, and 12”
- **Accuracy**:
  - Centering: ± 0.035 mm
  - Rotation: ± 0.05 degree
- **Wafer holding**: PEEK holder with vacuum chuck

**Sample Rack**

- **Number of racks**:
  - Two racks (A and B) can be set. Each rack has 40 vial positions for 2mL vials. (with the Auto Vial Wash option, a different configuration is used)

**VPD Chamber With HF Generation Module**

- **Material**: PTFE and PC window
- **Size**: 350(W) x 100(H) x 350(D) (mm³)
- **Volume**: 8.5 L
- **Wafer holding**: PEEK pin
- **Door**: PTFE door with airtight seal, closed by pneumatic cylinder
- **VPD duration**: Time or EPD (EPD is an option)
- **HF leak detector**: > 0.5 ppm
- **HF solution tank**: 1,000 mL PFA bottle (When EXP-CS option is used, HF will be directly supplied from a user’s FAB)
- **HF vapor generator**: PFA micro-flow nebulizer and PVDF spray chamber
- **Ventilation**: Combination of N₂ gas purge and ventilation
- **MFC**:
  - N₂ (PFA nebulizer): 3 SLPM
  - N₂ (purging): 50 SLPM
  - O₂, N₂ (BEM option): 3 SLPM

**Operating PC and Software**

- **PC**: PC/AT compatible industrial PC
- **Operating software**: Windows 7 (English)
- **Monitor**: 17” TFT-LCD
Scan Stage, X-Y-Z Scanning Arm and Nozzle Module

**Wafer holding:** Vacuum chuck

**Material:** PEEK

**Stage speed:** 0 - 1,000 rpm

**Motor:** Step motor (scan stage)

**Accuracy:** ± 0.1 mm

**Scan mode:** Full, Radial, S-Sector, R-Sector, Edge (option)

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**Nozzle cleaning:**

- Flowing dual rinse system using one chemical and one DI water. The user supplies the DI water. The chemical is held in two 2L bottles which are automatically switched. The user must refill them at low levels. N₂ gas pressure delivers the chemicals to the rinse port. (With EXP-CS (auto chemical supply system option), the user supplies HF and H₂O₂ which are stored in a PTFE tank and mixed into a PTFE mixing tank by PFA syringe pumps. N₂ gas pressure delivers mixed chemicals to the rinse ports.)

**Scan solution container:**

- Two 90 mL PFA containers with level sensor. With EXP-MS (ICPMS interface option), one container becomes an overflow container. The scan solution is stored in two 0.5L PFA bottles and delivered by N₂ gas pressure. The two bottles are automatically switched. The user must refill them at low levels. (With EXP-CS (auto chemical supply system option), the user supplies HF and H₂O₂ which are stored in a PTFE tank and mixed into a PTFE mixing tank by PFA syringe pumps. N₂ gas pressure delivers mixed chemicals to the scan port.)

**Solution delivery:** Syringe pump, 2.5 mL (< 2% RSD)

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**Scan nozzle:** Special design PTFE, max. volume 1.5 mL (Patented)

- φ10mm single nozzle (for bare wafer, minimum volume 200μL)
- φ 20mm dual nozzle (for bulk etching, minimum volume 1,000μL)

**Scan solution volume measurement:**

- Photo sensor, < 3% at 1,000μL

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Radial scan results on VIS

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Radial results
Expert Options

**EXP-PP (PP panel upgrade)**
Upgrade the standard anti-corrosion coated panels to polypropylene panels.

**EXP-FOUP (FOUP opener)**
Equips one load port with a FOUP opener. Expert automatically clamps, docks and opens the FOUP door, and maps the wafer.
- a. Up to 2 load ports can be equipped
- b. Both load ports can have FOUP openers
- c. This option has a wafer mapping sensor at the load port door
- d. 12” FOSB can be used
- e. 6” or 8” wafer adapter (Brooks) is available for a 12” FOUP cassette

**EXP-CA (Manual cassette)**
One 6” or 8” cassette can be manually set at one of the load ports. The cassette holder is equipped with photo sensors to automatically detect the cassette size. The wafer transfer robot is equipped with a mapping sensor to automatically map the wafer.

**EXP-AD (6” or 8” adaptor)**
Uses a Brooks adaptor with the 12” FOUP. The adaptor allows the 12” FOUP opener (EXP-FOUP) to accept 6” or 8” wafers. Infopad pins or BCR/RFID option is required.

**EXP-RFID (RFID reader)**
Reads the ID of wafer cassettes equipped with RFID. The information is integrated into the Expert software. When used with the FOUP option (EXP-FOUP), the FOUP ID is read automatically (one RFID reader required for each FOUP opener). With EXP-MS (ICPMS interface option), the information is integrated into the ICPMS interface software.

**EXP-BCR (Barcode reader)**
Reads the ID of wafer cassettes with barcodes. The information is integrated into the Expert software. When used with the FOUP opener option (EXP-FOUP), the FOUP ID is automatically read (one Bar Code reader required for each FOUP opener). When used with ICPMS interface option (EXP-MS), the information is integrated into the ICPMS interface software.

**EXP-EPD (End point detection)**
Automatically detects etching completion. The EPD is integrated into the software and the VPD time setting is no longer required – this feature is vital in etching film of unknown thickness. When films like SiO, SiN, and Poly-Si are etched in the VPD chamber, EPD detects etching completion automatically. It should be noted that the actual thickness is not measured, EPD recognizes the completion of etching when the film thickness remains constant.

**EXP-MS (VPD and ICPMS interface system)**
Allows the automatic, coordinated operation of VPD and ICPMS systems. The integration with ICPMS reduces contamination risk and improves analysis quality. An autosampler is integrated into the Expert system. Expert etches the wafer’s films and recovers the metal impurities. After scanning the wafer, the solution is collected into a vial on the autosampler and automatically introduced to the ICPMS. The Expert software seamlessly controls Expert, ICPMS, and autosampler.
- a. Automatically creates the calibration curve and checks the correlation coefficient and minimum sensitivity for each element.
- b. Automatically recalibrates after any failed QC check.
- c. Automatically analyzes QC check solution at specified intervals.
- d. Automatically monitors internal standard to check aspiration and compensate for fluctuation of ICPMS sensitivity.
- e. Automatically checks scan solution for contamination and refreshes scan solution if determined level exceeds a specified value. (One of the two static rinse ports is replaced with an overflow container and the scan solution is delivered from two 1L PFA bottles. The solution is delivered by N₂ gas pressure and two bottles will be switched automatically. Scan solution should manually be refilled into the 1L PFA bottle.)
- f. After detecting a potential contamination (based upon user defined values), the system will automatically extend cleaning time for the scan nozzle to prevent cross contamination.
g. ICPMS results can be reported in a variety of formats such as counts, ppt, atom/cm², and atom/cm³.
h. Chemical mode allows offline ICPMS analysis of various samples.
i. Scan results (sector and radial) are displayed as a map.

The sample rack configuration is altered. Nine 2mL PTFE vials are integrated into the autosampler and washed by the auto vial washing module (EXP-VC). In addition, eight vials are added for chemical analysis mode and can be set for standard solution or samples (EXP-STD).

The ICPMS is not included. The user needs to specify the ICPMS make and model as the interface can be used with many different instruments.

EXP-STD (Standard solution delivery module)
Automatically delivers standard solution to the autosampler vials when analysis is required. The standard solutions are prepared in 500mL PFA bottles. This upgrade reduces reagent consumption due to evaporation, improves data quality (concentration of elements tends to be higher over time exposed), and minimizes the frequency with which standards should be refreshed. This option is available for ICPMS integration (EXP-MS).

EXP-BEM (Bulk-Si and Poly-Si etching module)
This option introduces an oxygen gas into the VPD chamber with HF vapor enabling etching of poly-Si, WSi, Ti, TiN films, and bulk-Si layers. The dual scan nozzle recovers metal impurities from the etched surface. The PEEK pins in the VPD chamber are replaced with a cooled PFA coated carbon plate. O₂ gas leak detector is included. This option requires O₂ gas to generate the ozone gas.

EXP-VPD (Deep bulk etching)
Uses a special VPD chamber for better homogeneity in deep bulk etching (1um). (Standard bulk etching 0.1 um)

EXP-DR (Wafer drying module)
The Expert is equipped with a system that measures scan solution volume. The Wafer Drying option automatically transfers a wafer to the drying module if a difference in scan solution volume is detected. The upgrade provides significant safety enhancement in preventing exposure to HF.

In addition, this option is also used for drying a chemical solution on a wafer to remove Si matrix after bulk etching or other processes with high Si matrix – integral to TRXRF sample preparation. The Wafer drying module is also used for local bulk etching.

The drying chamber has a PFA coated carbon hotplate.

- a. Material: Polycarbonate
- b. Wafer Stage: PFA coated carbon hotplate (12”), Max. temp. 200°C
- c. Wafer loading pines: PEEK
- d. Door: Open and close automatically
- e. Drying Time: User defined

EXP-CS (Auto chemical supply system)
Replaces the scan solution and nozzle rinse solution supply bottles with chemical reservoirs and pumps for direct chemical supply from the FAB. Chemicals (HF, H₂O₂, and DIW) from FAB are delivered to PTFE reservoir tanks – from which a chemical pump delivers an exact amount to a mixing tank. The mixed solution is supplied to the scan and rinse ports by N₂ gas pressure. (If a FAB does not have a chemical supply, Expert can use concentrated HF and H₂O₂ solution in a bottle for this option.)

The standard Expert system uses PFA bottles with optical sensors for both scan solution and rinse solution. Both bottles switch automatically, but the user needs to prepare both chemicals and refill each bottle at low solution levels.

EXP-EG (Edge scan module)
Enables a simultaneous scan of both the front and back of a wafer 1mm from the edge.

EXP-VC (Auto vial washing module)
Automatically washes the vials used for scan solution collection. The standard system requires manual preparation for the vials on the autosampler prior to operation. This option eliminates manual preparation of the empty vials. This system should be integrated with the ICPMS interface option (EXP-MS).

EXP-BL (Wafer weight measurement module)
Automatic, accurate calculation of etch rate. As bulk etching is performed, the wafer weight will decrease. A balance with minimum reading of 0.1mg is integrated into Expert – measurement of the wafer weight and change in weight allows accurate calculation of etch rate.
**Expert Utilities and Layout**

**EXP-OHT (Integration with OHT)**
Allows the automatic handoff of a carrier between AMHS equipment (OHT – Overhead Hoist Transportation) and Expert. Expert communicates through parallel I/O as defined by SEMI E84. Barcode reader (EXP-BCR) or RFID (EXP-RFID) option is required.

**EXP-SECS (SECS communication tool)**
Enables communication with CIM HOST using the SECS communication protocol defined in SEMI-E30, E87, E40, and E94. The recipe and wafer information specified in the CIM-HOST initiates the operation of Expert. The VPD, scan, and analysis by ICPMS are performed automatically. The ICPMS analysis results are automatically transferred to CIM-HOST. In order to meet a user’s configuration, detailed specifications should be discussed.

**EXP-ASAS (Automated standard addition system)**
Automatically adds internal standard solution to a sample. This option is installed between Expert and ICPMS; it measures the sample uptake rate and adds internal standard into the sample line at a constant ratio. The typical addition rate is 1 µl/min. The internal standard compensates for matrix suppression or enhancement that occurs in ICPMS analysis. This option is recommended for higher silicon matrix samples such as SiN, Poly-Si, and Bulk-Si. This option is also able to monitor the nebulizer flow rate and ensure compliance / functionality.

Additional (2nd) EXP-ASAS can make calibration standard for ICPMS (VPD and ICPMS interface option, EXP-MS, is required). It should be noted that this option cannot be used when the sample uptake rate of ICPMS is less than 100 µL/min.

**EXP-WF (Wafer Flip)**
Allows the wafer transfer robot to flip a wafer, exposing the backside for measurement. **Note:** the wafer transfer robot touches the front side of the wafer.

**EXP-AR (Aqua Regia Scan Solution)**
This option allows aqua regia scan solution to achieve better recovery of noble metals. A special cover is attached to the overflow container to avoid evaporation. A special cover is also used for the scan stage to enhance evacuation of the scan solution. (The cover must be manually removed for sector scan)

**EXP-DIL (Scan Solution Dilution Module)**
Automatically dilutes high concentrations of scan solution before ICPMS analysis. This option requires ICPMS integration (EXP-MS) and auto vial washing (EXP-VC).

**EXP-OD (Ozone gas destruction module)**
Reduces the concentration of exhaust O₃ below 0.05ppm. This is for use with EXP-BEM option – which generates exhaust O₃ concentration of 1.5ppm.

Size : 2,000 (W) x 2,500 (D) x 2,200 (H) mm³
Weight : 1,400 kg
N₂ (>99.995%) : 0.4 - 0.6 MPa, 50 L/min (max), 1 line, 1/4” Swagelok fitting
Air : 0.4 - 0.6 MPa, 50 L/min (max), 1 line, 1/4” Swagelok fitting
Power : 200 - 220VAC, 6 kW, Single phase, 50/60 Hz
DIW : 0.1- 0.2 MPa, 0.1 L/min (max), 1/4” Pillar fitting (If dual piping is required, outer connection is 1/2” ferrule)
Ventilation : > 360 m³/hour, O.D. 150 mm x 2 ducts > 100 m³/hour, O.D. 100 mm x 1 duct (BEM option)
Waste : 1 line, 1 1/4” (30A) Flange fitting
Vacuum : < - 80 kPa, 3/8” Swagelok fitting
Environment : Class 1,000 cleanroom
Temperature : 18°C – 25°C
Humidity : 35 – 85% (no condensation)

Option Utilities

**O₂ (>99.5%)**
0.4 - 0.6 MPa, 5 L/min (max), 1 line, 1/4” Swagelok fitting

**HF (≈49%)**
0.15 - 0.3 MPa, 0.1 L/min (max), 1/4” Pillar fitting (if dual piping is required, outer connection is 1/2” ferrule)

**H₂O₂ (≈35%)**
0.15 - 0.3 MPa, 0.1 L/min (max), 1/4” Pillar fitting (if dual piping is required, outer connection is 1/2” ferrule)
Delivery & Payment

The standard delivery time is 5 months. The delivery time can be delayed up to 6 months according to the user’s request. Other delivery times are negotiable.

Payment Terms:
- Remittance by T/T
- 30% upon order
- 60% upon shipment
- 10% after completing the installation

Warranty

The Expert includes a manufacturer’s warranty (IAS Japan) as below. ESI will provide service and support in accordance with the user’s service plan.

IAS warrants any IAS unit manufactured or supplied by IAS for a period beginning on the date of shipment and ending on the sooner to occur of:

(a) the date that is twelve (12) months from the completion date of installation, or
(b) the date that is fifteen (15) months from the date of shipment.

Units found in the reasonable judgment of IAS to be defective in material or workmanship will be repaired or replaced by IAS without charge for parts and labor. IAS reserves the right to change or improve the design of any unit without assuming any obligation to modify any unit previously manufactured.

This warranty does not cover any unit that has been subject to misuse, neglect, negligence, or accident. The warranty does not apply to any damage to the unit that is the result of improper installation or maintenance, or to any unit that has been operated or maintained in any way contrary to the instructions specified in the IAS’s instruction and operation manual.

Any attempt to repair or alter any IAS unit by anyone other than by IAS authorized personnel or agents will void this warranty. If any non-IAS component is installed in the IAS manufactured unit without the approval of IAS, the warranty will be voided. In addition, this warranty does not extend to repairs made necessary by the use of parts, accessories or fluids which are either incompatible with the unit or adversely affect its operation, performance or durability. IAS’s obligation under this warranty is strictly and exclusively limited to repair or replacement of defective IAS parts, and no claim of breach of warranty shall be cause for cancellation or recession of the contract of sale of any unit.

Training

The training will be held at user site after completing the installation. The training covers basic operation and daily maintenance.

This specification may change without any notice.

Expert Layout