TESCAN SOLARIS X

A Plasma FIB-SEM platform for deep sectioning and the highest resolution end-pointing for package level failure analysis

TESCAN SOLARIS X extends the capabilities of FIB physical failure analysis to large-area and deep cross-sectioning (up to 1 mm) of packaged microelectromechanical and optoelectronic devices, by combining the high-throughput i-FIB+™ Xe plasma FIB column with the next generation triple-objective Triglav™ electron column.

Xe plasma FIB milling enables large-volume bulk material removal without the drawbacks of the traditionally used methods, which are often time-consuming, broadly destructive, dependent on operator skill, and can induce new heat/mechanical artifacts. Ion implantation and interaction volume of Xe ions is significantly smaller than those of Ga ions. In addition, the inert nature of Xe ions prevents the formation of intermetallic compounds that can result in changes to the physical properties of the specimen and interfere with electrical measurements.

The Triglav™ SEM column features TESCAN's proprietary triple objective TriLens™. This immersion-type ultra-high-resolution lens is ideal for imaging beam sensitive materials at low landing voltages. The field-free high-resolution analytical lens provides large field of view for smooth, fast, and easy navigation across a sample, plus live monitoring of FIB operations. The third objective lens enables a variety of display modes, and spot shape optimization at high electron beam currents to improve microanalysis spatial resolution.

The in-column detection system features TriSE™ and TriBE™ to enable optimization of secondary and backscattered electron contrast methods by take-off angle, thus maximizing information from the sample. In addition, surface sensitivity of backscattered electron acquisition can be enhanced by energy-filtering.

The TESCAN Essence™ graphical user interface, which includes the vector based DrawBeam™ FIB pattern generator utility, can be customized for specific application workflows and to accommodate user skill and/or preferences. Furthermore, a choice of software modules, wizards and recipes make FIB-SEM applications an easy and straightforward experience for both novice and expert users.

Key benefits:

- ✓ Artifact free large-area cross-sectioning for physical failure analysis of advanced packaging technologies
- ✓ Prepare large area FIB cross sections up to 1 mm in width
- ✓ Obtain low noise, low kV SEM images with fast acquisition times, even while the sample is tilted
- ✓ Live SEM monitoring during FIB milling for precise end-pointing at beam coincidence point
- ✓ Selective secondary and backscattered electron contrast methods with in-column TriSE™ and TriBE™ detectors
- ✓ Effective techniques and recipes for fast, artifact-free high current cross-sectioning of composite samples (OLED and TFT displays, MEMS devices, isolation dielectrics)
- ✓ Essence™ easy-to-use modular user interface

Cross-sectioning | TEM lamella preparation | IC planar delayering | FIB-SEM | i-FIB+™ Xe plasma FIB column | UHR SEM | In-column detectors | Triglav™ electron column | Resolution

Essential Specifications

Triglav™ UHR SEM column

- Schottky field electron emitter, lifetime 12 months guaranteed
- Proprietary triple objective TriLens™ allowing UHR, field-free and crossover-free modes
- In-column SE and axial BSE detectors with energy filtering capability
- Electron beam landing energy range: 200 eV–30 keV (<50 eV with BDM)*
- Spot optimization by electromagnetic beam aperture control
- Probe current: 2 pA–400 nA, continuously adjustable
- Maximum field of view: 4.3 mm at WD=5 mm, >10 mm at max. WD

i-FIB+™ Plasma Focused Ion Beam Column

- Xe plasma ion source (ECR type), source lifetime not limited
- 30 piezo-motorized apertures
- Electrostatic beam blanker with integrated Faraday cup
- Ion beam energy range: 3 keV–30 keV
- Probe current: 1 pA–3 µA
- Maximum Field of View: 1 mm

FIB-SEM Geometry

- Coincidence SEM working distance: 5 mm
- Coincidence angle: 55°

Electron Beam Resolution

- 1.2 nm @ 1 kV
- 0.9 nm @ 1 kV with sample bias (BDM*)
- 0.6 nm @ 15 keV
- 0.5 nm at 30 kV STEM*

Ion Beam Resolution

- 12 nm at 30 keV

Motorized, 5-Axis Goniometer Stage

- X & Y axis travel range: 130 mm
- Z axis travel range: 90 mm
- Tilt range: compucentric, -60° to +90°
- Rotation: compucentric, 360° (continuous)
- Max. specimen height: 90 mm (132 mm without stage rotation)
- Cradle stage*

Note: The range of movements is dependent on the configuration, WD or Z.

Vacuum Chamber

- Width: 340 mm
- Depth: 315 mm
- Ports: 20+
- Suspension type: active
- Extension for 6" and 8" wafers*
- Extension for 6", 8" and 12" wafers (with cradle stage)*
- Extension for parallel Raman microscope with spectrometer (RISE™)*
- Chamber view (IR) camera standard
- 2nd chamber view (IR) camera*
- Integrated plasma cleaner (Decontaminator)*

Vacuum System

- High vacuum: < $9x10^{-3}$ Pa
- Low vacuum*: 7–500 Pa
- Pump types: all oil-free
- Load lock*

Detectors and Analyzers

- pA meter incl. touch alarm function
- Everhart-Thornley chamber SE detector (SE)
- In-column SE/Mid-Angle BSE detector (InBeam SE/Mid-Angle BSE)
- In-column BSE detector with energy filtering (InBeam f-BSE)
- Scintillator type, low vacuum SE detector (LVSTD*)
- Secondary ion detector (SITD*)
- Low energy, scintillator type, retractable BSE with shutter (LE-BSE+)
- Retractable BSE, scintillator type (R-BSE)*
- High sensitivity, solid state, retractable, 4 quadrant BSE (LE 4Q BSE*)
- Water-cooled, scintillator type, retractable BSE, heat resistant <800°C*
- Aluminum-coated, scintillator type, retractable BSE for concurrent CL detection (Al-BSE*)
- Retractable panchromatic CL detector, 350–650 nm*
- Retractable panchromatic CL detector, 185–850 nm*
- Retractable, panchromatic Rainbow CL detector*
- Retractable STEM detector, BF, DF and HADF sectors, holders for up to 8 grids (R-STEM*)
- EDS* (3rd party)
- EBSD* (3rd party)
- WDS* (3rd party)
- TOF-SIMS* FIB-integrated secondary ion mass spectrometer
- Confocal Raman microscope with spectrometer (RISE™)*

**Optional equipment, +Minimum recommended optional equipment*

Gas Injection Systems

OptiGIS™+ a single line GIS (retractable):

- Platinum (standard)
- Up to 3 OptiGIS™ with selectable precursors available*

5-GIS*

- A multi-line GIS with 5 independent precursor reservoirs and capillaries, motorized XYZ navigation, occupies single chamber port.

Choice of precursors

- Platinum deposition (Pt)+
- Tungsten deposition (W)*
- Carbon deposition (C)*
- Insulator deposition (SiO_x)*
- Enhanced etch (H_2O)*
- Enhanced etch (XeF_2)*
- Proprietary precursors for planar IC delayering*
- Other precursors upon request

Accessories

- Fully integrated XYZ nanomanipulator+
- Rocking stage for curtaining removal polishing+
- True-X mask set for high quality cross section+
- 3rd party nanomanipulators upon request*
- Electron flood gun (for FIB charge neutralization)*
- EDS piezo shutter*

Scanning Systems

Independent scanning systems for SEM and FIB:

- Dwell time: 20 ns–10 ms, in steps or continuously adjustable
- Full frame, selected area, line or point
- Image shift, scan rotation, tilt correction
- Line or frame accumulation
- DrawBeam™ nanopatterning

Electron Beam

- Dynamic focus
- Drift-corrected frame accumulation (DCFA)

Image acquisition

- Max. frame size: 16k x 16k
- Aspect ratio: 1:1, 4:3 and 2:1
- Image stitching, panorama size not limited (requires Image Snapper*)
- Up to 8 channels can be acquired simultaneously
- Color mapping and multi-channel signal mixing
- Multitude of image formats incl. TIFF, PNG, BMP, JPEG and GIF
- Dynamic range: 8 or 16 bits

User Interface

- Keyboard and Mouse
- Trackball
- Control panel+
- TESCAN Essence™ graphical user interface

Microscope Control PC

- High Performance PC (Intel Core i7 or equivalent, 16 GB RAM, 2 TB HDD, Nvidia GTX 1060 or equivalent, Windows 10 Pro 64-bit
- (details available upon request)
- 32” QHD Monitor

TESCAN Essence™ Software

- Customizable GUI layout
- Multi-user account management
- Quick search bar
- Undo / Redo commands
- Single, dual, quad or hexa live image(s) display
- Multi-channel colored live image

Automated and semi-automated routines

- SEM & FIB emission control
- Electron gun alignment
- Contrast and brightness, autofocus
- In-Flight Beam Tracing™
- Electron beam spot optimization
- Ion beam spot profile optimization
- FIB-SEM intersection finder
- GIS nozzle positioning and temperature control

Advanced Essence™ modules

- Measurement, Tolerance measurement
- Image Processing
- Presets
- Histogram and LUT
- SharkSEM™ Basic (SEM Remote Control API)
- 3D Collision Model
- Object Area
- Positioner
- DrawBeam™ Live/Expert
- Switch-off Timer
- FIB-SEM Tomography*
- FIB-SEM Tomography Advanced*
- CORAL™*
- DrawBeam™ Automate*
- Image Snapper*
- Sample Observer*
- SharkSEM™ Advanced (Python scripting)*
- System Examiner*
- Synopsys Client*
- TESCAN Flow™ (offline processing)*

*Optional equipment, +Minimum recommended optional equipment

Microscope Installation

Installation Requirements[1]

- Power supply: 230 V ± 10% / 50 Hz (or 120 V/60 Hz-optional), power 2300 VA, 2kW UPS delivered with the system
- Compressed air: 6–7 bar (87–102 psi), clean, dry, oil free
- Compressed nitrogen for venting: 1–7 bar (15–102 psi), 99.99% purity (4.0 purity level)
- Compressed Xe: 300 kPa (3 Bars)
- Room for installation: min. 4.2 × 3.1 m; minimum door width 1.0 m

[1]Request site-survey by TESCAN authorized technician

Training:

- Introductory: by TESCAN engineer after installation
- Advanced (optional): at TESCAN facilities or on-site

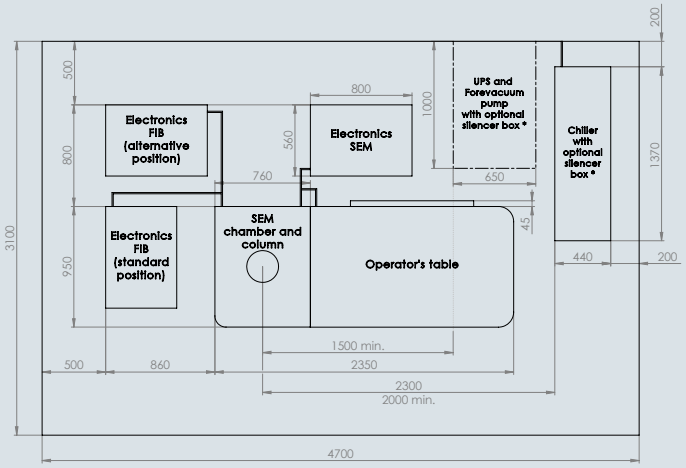
Environmental Requirements[2]

- Temperature of environment: 17–24°C with stability better than 2°C with a rate of change 1°C/hour
- Relative humidity: < 65 %
- Background magnetic field*: synchronous < 300 nT, asynchronous < 100 nT
- Vibrations: < 10 µm/s below 30 Hz, < 20 µm/s above 30 Hz
- Acoustic noise: Less than 60 dBC
- Altitude: max. 3000 m above sea level

[2]Specification of background magnetic field is subject to actual acceleration voltage. Specified values are for 20 kV acceleration voltage.

Footprint of the microscope (all dimensions in mm):

- If a forevacuum pump and a chiller unit is to be placed in the same room as TESCAN SOLARIS X microscope, then the forevacuum pump must be placed in silencer box supplied by TESCAN. The silencer box is optional and must be ordered separately.



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