TESCAN AMBER

A field-free UHR-SEM combined with the most precise FIB for sample preparation, sub-surface and 3D analysis capabilities to take your materials nanocharacterization further

TESCAN AMBER is designed with a focus on versatility, covering both sample characterization at the nanoscale, and everyday FIB applications in the materials research lab. The synergy of its field free ultra-high-resolution SEM and state-of-the art Ga+ FIB, makes TESCAN AMBER a preferred solution for high precision micro-sample preparation and advanced materials characterization.

The field-free UHR-SEM BrightBeam™ delivers ultra-high-resolution imaging and analytical performance over the widest range of materials, whether metallic, magnetic, non-conductive or beam sensitive.

The Orage™ FIB column was designed to meet increasingly stringent focused ion beam sample preparation requirements. With its ultimate FIB resolution and a broad range of beam current choices, the Orage™ FIB column on TESCAN AMBER routinely delivers the highest quality prepared samples. Optional automation modules for batch processing and multi-site operations facilitate unattended execution of predefined operations like creating micro-mechanical test sample arrays or preparing TEM lamella at multiple sample locations.

In-column SE and BSE detectors are optimized for high quality imaging at the FIB-SEM coincident point. TESCAN AMBER's proprietary geometry for microanalytical tools offers unprecedented analytical potential, not only for microanalysis, but also for multimodal FIB-SEM nanoscale tomography.

Furthermore, Wide Field Optics™ offers extremely large fields of view at the lowest magnifications, making navigation to your region of interest fast and easy using the live SEM image.

Powered by TESCAN Essence™, our modular customizable graphical user interface, TESCAN AMBER easily transforms from a multi-user, multi-purpose workstation, to a dedicated tool for advanced FIB operations.

Key benefits:

- ✓ Ultra-high resolution field-free SEM imaging and nanoanalysis
- ✓ The highest precision micro sample preparation
- ✓ Excellent low-keV ion beam performance
- ✓ Multi-site FIB process automation
- ✓ Multimodal FIB-SEM nanotomography
- ✓ Extended field of view and easy navigation
- ✓ Easy-to-use modular software interface

BrightBeam™ electron column

Field-free UHR SEM

1.3 nm at 1 keV
Low-kV resolution

In-column detectors

Microanalysis

Variable pressure

Ga FIB
Orage™ Ga FIB column

TEM Lamella preparation

FIB-SEM tomography

Essential Specifications

BrightBeam™ Field-Free UHR-SEM Column

- Schottky field electron emitter, expected lifetime min. 2 years
- Combined magnetic and electrostatic objective lens
- In-column potential tube
- Dual in-column SE and BSE detection
- Electron beam landing energy range: 50 eV–30 keV (<50 eV with sample bias BDM)*
- Spot optimization by electromagnetic beam aperture control
- Probe current: 2 pA–400 nA, continuously adjustable
- Maximum Field of View: 7 mm at WD=6 mm, >50 mm at max. WD

Orage™ Focused Ion Beam Column

- Gallium liquid metal ion source, lifetime min. 3000 µAh guaranteed
- 30 piezo-motorized apertures
- Electrostatic beam blanker with integrated Faraday cup
- Ion beam energy range: 500 eV–30 keV
- Probe current: < 1 pA–100 nA
- Maximum field of view: 1 mm @ 10 keV

FIB-SEM Geometry

- Coincidence SEM working distance: 6 mm
- Coincidence angle: 55°

Electron Beam Resolution

- 1.5 nm at 1 keV (field-free)
- 1.3 nm at 1 keV (with sample bias (BDM))*
- 0.9 nm at 15 keV (field-free)
- 0.8 nm at 30 keV STEM* (field-free)

Ion Beam Resolution

- 2.5 nm at 30 keV

Motorized, 5-Axis Compucentric Stage

- X & Y axis travel range: 130 mm
- Z axis travel range: 90 mm
- Tilt range: compucentric, -60° to +90°
- Rotation: compucentric, 360 degrees (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 detector (E-T)
- In-column SE detector (MD)
- In-column axial BSE/SE detector (Axial)
- Scintillator type, low vacuum SE detector (LVSTD)*
- Secondary ion detector (SITD*)
- Retractable BSE, scintillator type (R-BSE)+
- Low energy, scintillator type, retractable BSE with shutter (LE-BSE)*
- Low energy, 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 4-channel color 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™)*

Gas Injection Systems

OptiGIS™+: a single line GIS (retractable):

- Platinum+
- Up to 3 OptiGIS™ with selectable precursors available*

5-GIS *: a multi-line GIS with 5 independent precursor reservoirs and capillaries, 3-axis motorized, occupies single chamber port.

Choice of Precursors

- Platinum deposition (Pt)+
- Tungsten deposition (W)*
- Carbon deposition (C)*
- Insulator deposition (SiO_x)*
- Enhanced etch (H_2O)*

Optional equipment , + Minimum recommended optional equipment

- Enhanced etch (XeF_2)*
- Other precursors upon request*

Accessories

- Fully integrated XYZ nanomanipulator*
- 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 and frame accumulation
- DrawBeam™ digital nanopatterning engine, 16-bit DAC

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 and FIB emission control
- Electron gun and column 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 Expert
- Switch-off Timer
- FIB-SEM Tomography*
- FIB-SEM Tomography Advanced*
- AutoSlicer*
- CORAL*
- DrawBeam Automate*
- Image Snapper*
- Sample Observer*
- SharkSEM Advanced (Python scripting)*
- System Examiner*
- Synopsys Client*
- TESCAN Flow™ (offline processing)*

Microscope Installation

Installation Requirements[1]

- Power supply: 230 V ± 10% / 50 Hz (or 120 V/60 Hz-optional), power 2300 VA, 2 kW 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)
- Room for installation: min. 4.2 × 3.1 m; minimum door width 1.0 m

**Optional equipment , + Minimum recommended optional equipment*

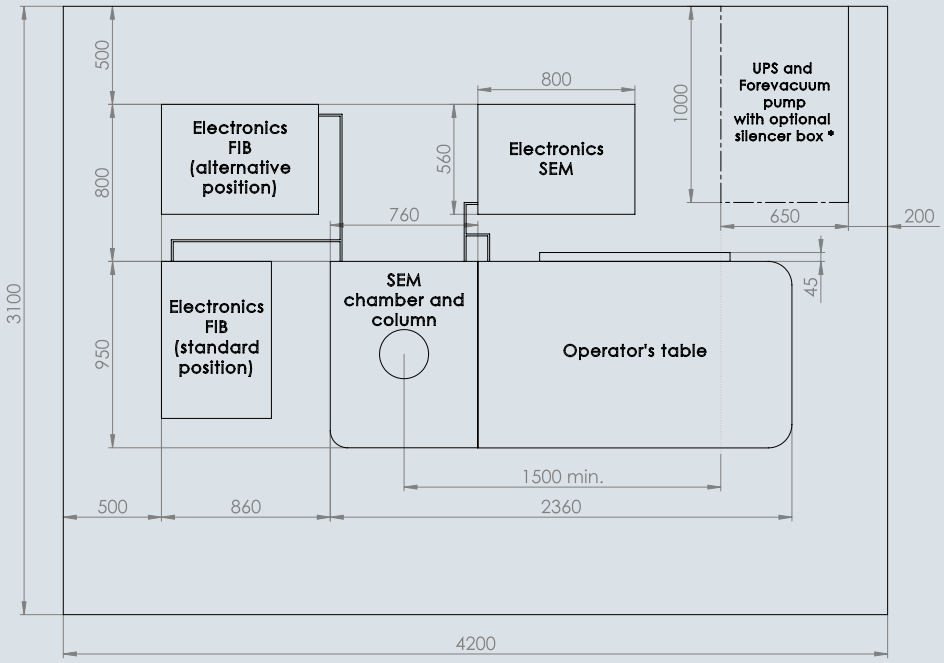
Environmental Requirements[1]

- 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

[1]Request site-survey by TESCAN authorized technician
Specification of background magnetic field is subject to actual acceleration voltage. Specified values are for 20 kV acceleration voltage.

Training

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



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 AMBER microscope, then the forevacuum pump must be placed in silencer box supplied by TESCAN. The silencer box is optional and must be ordered separately.

TESCAN ORSAY HOLDING, a. s.
Libušina tř. 21, 623 00 Brno - Kohoutovice / Czech Republic
(phone) +420 530 353 411 / (email) sales@tescan.com / marketing@tescan.com