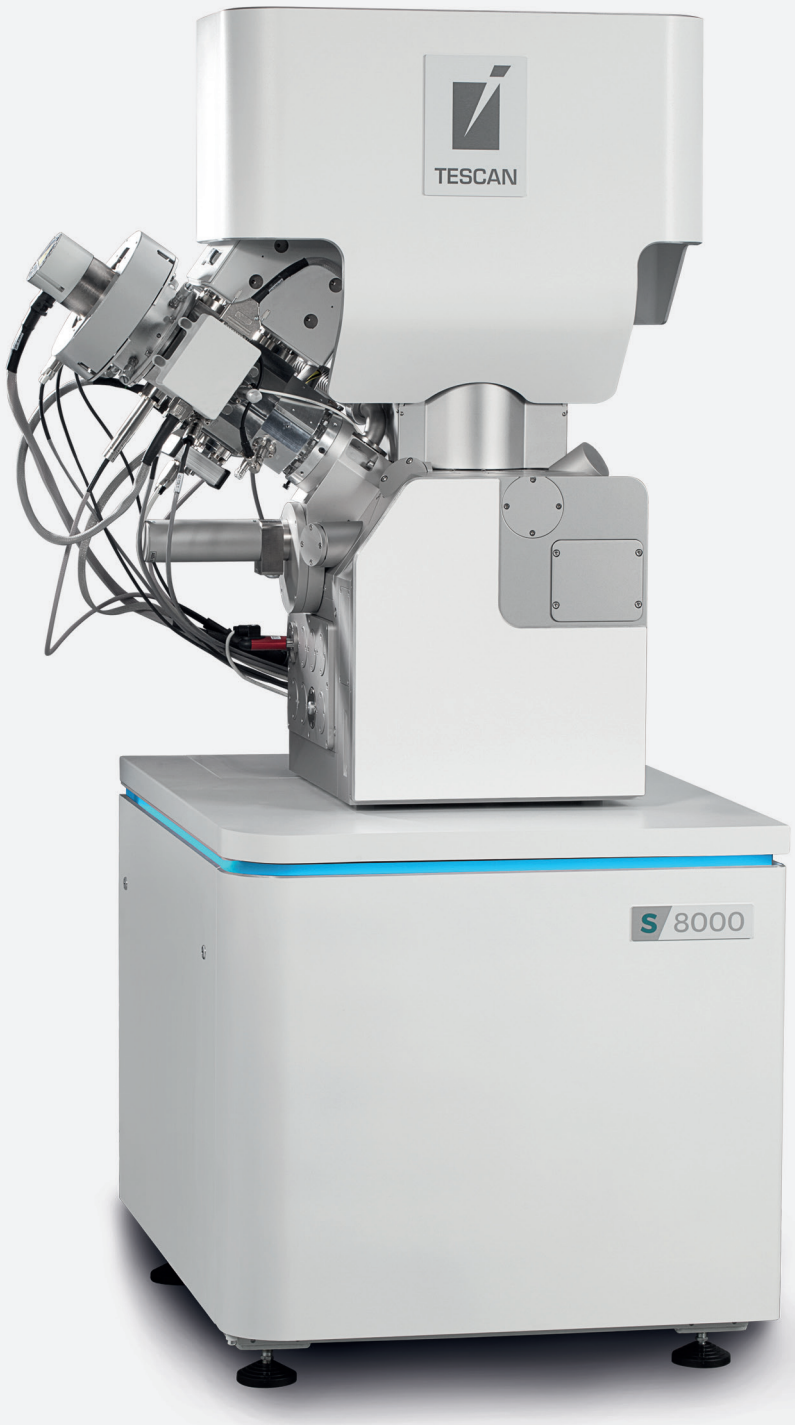
TESCAN

S8000G

New generation of FIB-SEM microscope



- Ga FIB-SEM
- BrightBeam™ SEM column
- Field-free UHR SEM
- Resolution 1.4 nm at 1 keV
- Resolution 0.9 nm at 15 keV
- Selective Signal Detection
- UniVac
- TEM lamella preparation
- Cross-sectioning
- FIB-SEM tomography

New generation of FIB-SEM microscope for rising standards in sample preparation

The TESCAN S8000G has all that it takes to meet the demands of today's research in both industry and academia. It delivers outstanding image quality with superb contrast ideal for nanocharacterization and the capability to perform complex nanoengineering tasks with extreme precision and incomparable ease.

The TESCAN S8000G, fitted with a new SEM column, provides the benefit of versatility packaged with field-free ultra-high resolution imaging, including the analysis of magnetic samples and live SEM monitoring of your FIB operations. On the other hand, the synergy of a novel FIB column fitted with state-of-the-art ion optics and the gas injection system, makes the TESCAN S8000G a world-class instrument for sample preparation and nanopatterning.

Modular and workflow-oriented software assures maximum control in all your applications and no trade-offs between complex technology and user-friendliness. The TESCAN S8000G is ideal for high-end FIB-SEM applications and, the analytical platform of choice, for all who pursue a better understanding and breakthroughs in science and technology on daily basis.

SEM COLUMN

- **Versatile system for unlimited applications**

  The BrightBeam™ SEM column delivers field-free ultra-high resolution imaging (0.9 nm at 15 keV, 1.4 nm at 1 keV) while maintaining universality in sample imaging and analysis.

- **Maximizing the insight from your sample**

  Superb image contrast and ultra-high resolution essential to resolve nano-sized features for the characterization and analysis of nanostructures, nanoparticles, and nanomaterials as well as failure analysis of microelectronic devices.

- **Enhanced surface sensitivity**

  Detection system with angle-selective and energy-filtering capabilities give complete control of surface sensitivity and the option to explore with different contrast.

- **Maximum protection for delicate specimens**

  Excellent imaging performance at low-beam energies ideal for imaging non-conducting samples and uncoated biological specimens. A low vacuum mode is also available.

- **Best conditions for microanalysis**

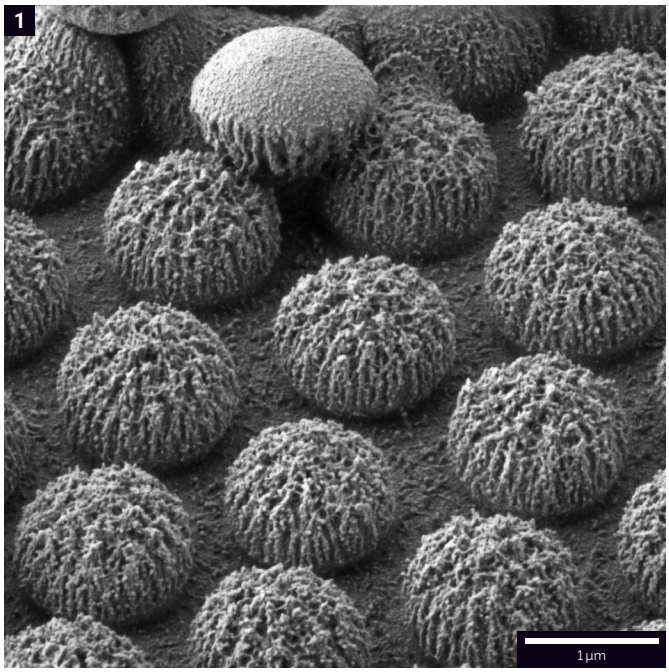
  High electron beam currents up to 400 nA are advantageous for microanalytical techniques such as as CL, EDX, WDX and EBSD.

- **Reliability and excellence performance in lengthy applications**

  EquiPower™ lens technology assures constant thermal power dissipation for excellent stability in time-consuming applications such as FIB tomography or X-ray microanalysis.

Universality in sample imaging with field-free ultra-high resolution

The TESCAN S8000G delivers outstanding imaging capabilities as a result of a state-of-the-art electron optics based on an electrostatic-magnetic objective lens and a robust detection system comprised of in-beam detectors. The TESCAN S8000G achieves field-free ultra-high resolution imaging; the sample is not immersed in a magnetic field when imaged, therefore, high-resolution images of both magnetic or non-magnetic samples can be obtained as well as simultaneous SEM imaging during FIB milling for task monitoring. S8000G delivers sub-nanometre SEM resolution of 0.9 nm at 15 keV and 1.7 nm at 1 keV. Beam performance and resolution at low landing energies can be further improved by means of beam deceleration achieving 1.4 nm at 1 keV.



▲ **Fig. 1:** Polystyrene spheres imaged at 500 eV tilted at 55°.

FIB COLUMN

■ **World-class quality in sample preparation**

Novel Orage™ FIB column featuring cutting-edge ion optics achieves ultra-high resolution over the entire beam energy range and excellent performance at low energies for preparing damage-free, ultra-thin TEM specimens.

■ **Accelerating your FIB nanomachining**

Ion beam currents up to 100 nA cut completion time in half for cross-sectioning and lamella lift-out processes.

■ **Fast FIB nanotomography**

Dedicated software enables easy and quick three-dimensional sample reconstructions that provide unique ultra-structural sample information.

SOFTWARE

■ **Boosting productivity and throughput**

Easy-to-learn, workflow-oriented software for maximum control of all applications with minimum time-to-result.

▶ **Fig.: Material Sciences samples: (8)** Graphene on Au contacts on a SiN substrate imaged at 500eV. **(9)** Ceramics with salt imaged at 500eV. **(10)** Surface of a Read/Write magnetic head imaged at 2keV. **(11)** TiO_2 nanotubes imaged at 500 eV in the beam deceleration mode.

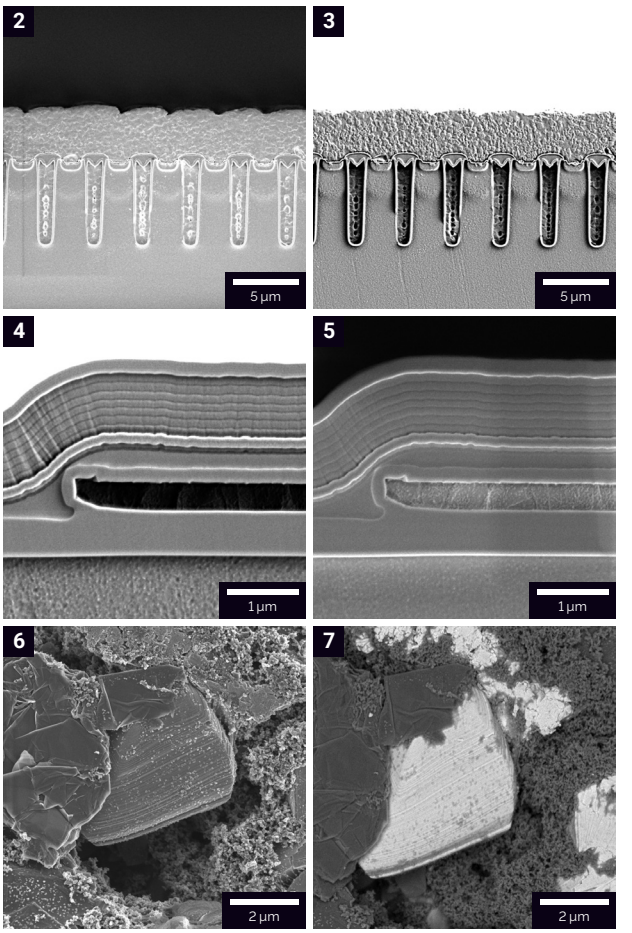
▶ **Fig.: Biological samples: (12)** Bacterial cellulose imaged uncoated at 1keV. **(13)** Mould imaged uncoated at 800eV **(14)** Diatoms imaged uncoated at 1keV. **(15)** Moth imaged at 1keV in the OVERVIEW mode for large field of view undistorted images, FOV 3 mm.

Robust detection system with superb analytical performance

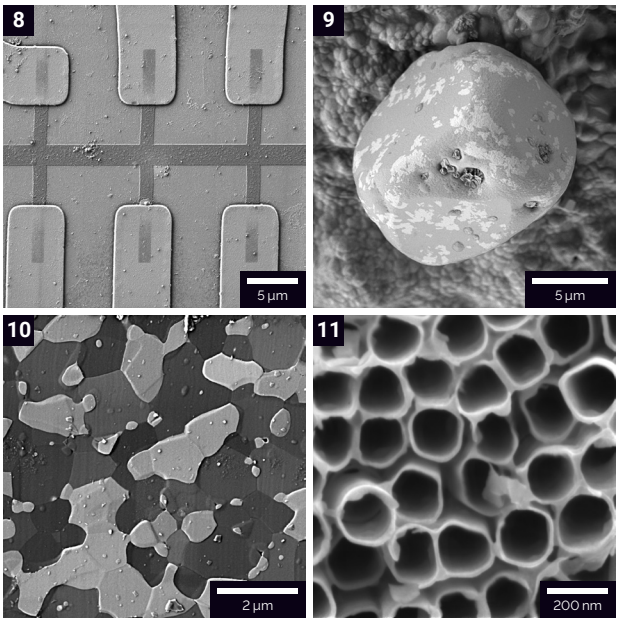
The detection system comprising an In-Chamber E-T detector, and the novels Axial detector and Multidetector with angle-selective and energy filtering capabilities, respectively results in superb image quality with enhanced contrast. Multiple electron signals can simultaneously be collected, including angle-selective BSEs carrying different degrees of material and topography contrast, and, low-loss BSE for maximum surface sensitivity at low beam energies. The high-resolution imaging, combined with the different signals, provides the superb contrast and surface sensitivity that makes the TESCAN S8000G an ideal microscope for nanocharacterization.

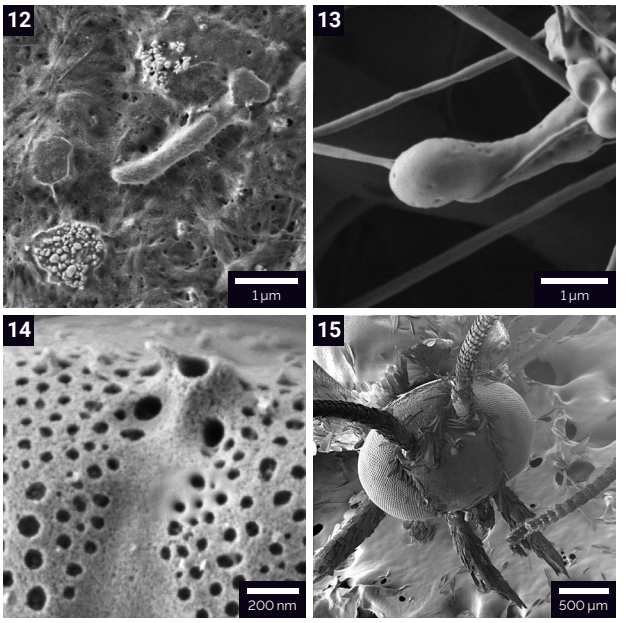
Variety of displaying modes and excellent column stability

The TESCAN Wide Field Optics™ design with a proprietary intermediate lens enables various working and display modes. The objective lens design improves resolution, especially at low beam energies (< 2 keV) delivering superb imaging of beam-sensitive and non-conductive samples both organic (uncoated biological samples) and inorganic (low-k dielectric materials, photoresists, etc). EquiPower™ is yet another valuable technology featured in the TESCAN S8000G that guarantees excellent SEM column thermal stability for maximum performance in time-consuming applications such as FIB-tomography and EDX mapping. Low vacuum operations for imaging hydrated biological specimens is also available.



▲ **Fig.: Imaging with different detectors:** Cross-section of a microelectronic device imaged at 2 keV with the **(2)** Multidetector and **(3)** E-T detector. • Cross-section of a trench insulated gate bipolar transistor semiconductor device imaged with the **(4)** E-T detector and the **(5)** Multidetector clearly show different material layers. • Cathode of a Li-ion battery imaged at 2keV with the **(6)** Multidetector with the grid OFF for detecting SE signal and **(7)** with the grid ON for detecting BSE signal. Signals from the three detectors, the In-Chamber E-T, Multidetector and the Axial detector can be acquired simultaneously.





Orage™ FIB column: anticipating the future, expanding your possibilities today

The outstanding imaging and nano-engineering capabilities are equally remarkable attributes that the TESCAN S8000G can offer. The TESCAN S8000G features the Orage™ FIB column, the next generation of Ga source FIB column with cutting-edge ion optics that delivers ultra-fine resolution throughout the entire range of beam energies along with excellent low-energy beam performance.

World-class quality in sample preparation

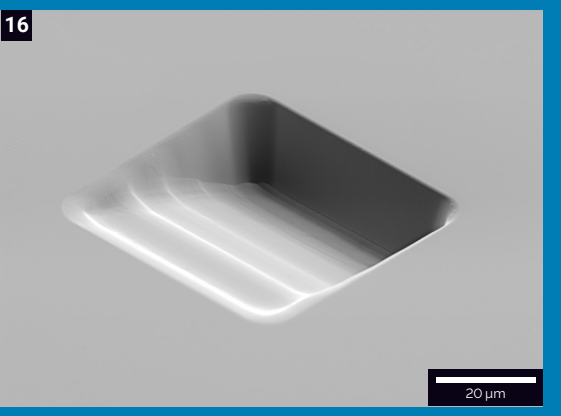
Significantly better resolution and excellent performance at low-beam energies are advantages and a guarantee of quality for performing delicate milling tasks and challenging nanopatterning applications that require ultimate precision. This includes the preparation of ultra-thin TEM specimens of thicknesses of less than 15 nm, which need to be thinned at low-ion beam energies in order to minimize amorphous damage on surface layers.

Accelerating your FIB nanomachining

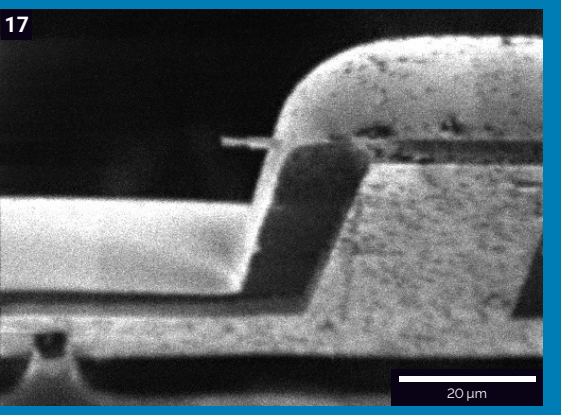
The Orage™ column achieves ion-beam currents up to 100 nA enabling fast sputtering rates for increased volume analytical capabilities including fast preparation of large-area cross-sections and fast FIB-tomography. This results in superior throughput and minimum time-to-result.

Because simplicity is the key to success

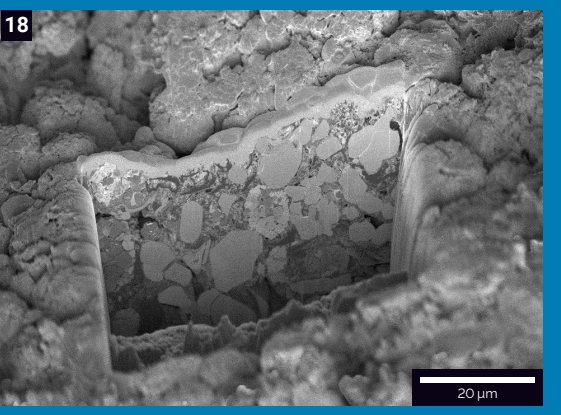
The S8000G includes outstanding hardware capabilities as well as a powerful and user-friendly software. Special attention was given to designing a simple workflow and GUI with wizards that transform the user experience into a smooth and easy operation regardless of the complexity of the application. There are no trade-offs when it comes to the TESCAN S8000G. It remains an easy-to-learn system that both expert and inexperienced users can operate with ease.



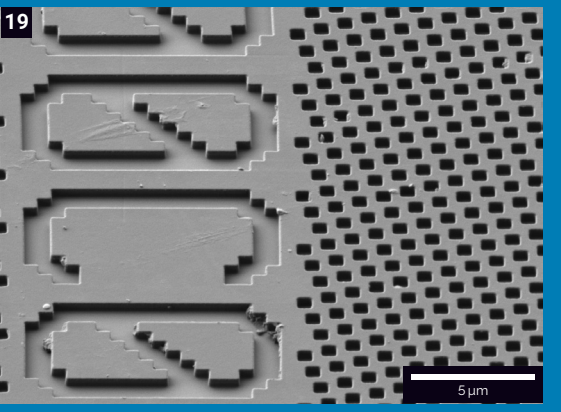
▲ **Fig. 16:** Cross-section 50 µm wide, 17.2 µm-deep prepared with an ion beam current of 85 nA at 30 keV. Preparation time: 17 mins.



▲ **Fig. 17:** 1keV FIB image of a lamella on the TEM grid.



▲ **Fig. 18:** A 50 µm-long cross-section prepared in a Li-ion battery cathode.



▲ **Fig. 19:** Delicate lithography resist imaged at 500 eV.

Technical Specifications

Electron Optics:

Electron Gun:	High brightness Schottky emitter	
Electron Optics:	BrightBeam™ column with combined electrostatic-magnetic objective lens and Wide Field Optics™	
Resolution:	**Standard mode:** 0.9 nm at 15 keV 1.7 nm at 1 keV 2.0 nm at 500 eV **Low Vacuum Mode:** **BSE:** 2.0 nm at 30 keV **LVSTD:** 1.5 nm at 30 keV	**Beam Deceleration mode (option):** 1.4 nm at 1 keV 1.6 nm at 200 eV **STEM (option):** 0.9 nm at 30 keV
Maximum Field of View:	7.0 mm at $WD_{Analytical}$ 6 mm 21.0 mm at WD 30 mm	
Electron Beam Energy:	200 eV to 30 keV / down to 50 eV with BDT option	
Probe Current:	2 pA to 400 nA	

Ion Optics:

Ion Column:	Orage™ High-resolution Ga FIB column
Ion Gun:	Ga Liquid Metal Ion Source
Resolution:	< 2.5 nm at 30 keV (at SEM-FIB coincidence point)
Ion Beam Energy:	0.5 keV to 30 keV
Probe Current:	< 1 pA to 100 nA
SEM-FIB Coincidence at:	WD 6 mm for SEM - WD 12 mm for FIB
SEM-FIB Angle:	55°

Detectors, Chamber and Sample Stage

Detectors (standard):	Multidetector (In-Beam) Axial detector (In-Beam) E-T detector (In-Chamber) Retractable BSE (In-Chamber)
Optional detectors include:	4Q BSE, Water-cooled BSE, LE-BSE, LVSTD, SITD, HADF R-STEM, CL, EDS, WDS, EBSD, TOF-SIMS, Raman Spectrometer (RISE)
Chamber:	Internal dimensions: 340 mm (width) × 315 mm (depth) × 320 mm (height) Number of ports: 20 Chamber and Column Suspension: active vibration isolation (integrated)
Specimen Stage:	Compucentric, fully motorized X/Y = 130 mm, Z = 90 mm Rotation = 360° continuous, Tilt = -60° to +90°
Accessories:	**Standard:** Decontaminator / plasma cleaner **Optional:** Peltier Cooling stage, Optical Stage Navigation, Nanomanipulators, Load Lock (Automatic, Manual), Control Panel, Cradle Stage, Flood gun for FIB charge compensation, Rocking stage, EDX Piezo shutter