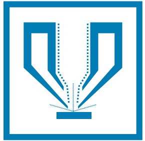
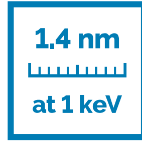
TESCAN
PERFORMANCE IN NANOSPACE

TESCAN S8000G

New generation of FIB-SEM microscope


Field-Free UHR

Ga FIB-SEM



Resolution

S8000
series

TESCAN

S 8000

TESCAN S8000G: New generation of FIB-SEM microscope for rising standards in sample preparation

TESCAN introduces the first member of a new family of micro scopes, the TESCAN S8000G. The 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 nanocharacterisation and the capability to perform complex nanoengineering tasks with extreme preci sion and incomparable ease.

Equipped with a new SEM column, the S8000G let you profit and enjoy the benefits and versatility that come with field-free ultra-high resolution imaging including the analysis of mag netic 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 S8000G a world-class instrument for sample prepara tion 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 those who pursue better understanding and breakthroughs in science and technology on daily basis.

Key Features

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.

- **Maximising the insight from your sample:**
  Superb image contrast and ultra-high resolution essential to resolve nano-sized features for the characterisation and analysis of nanostructures, nanoparticles, and nanomaterials as well as for failure analysis of microelectronic devices.

- **Enhanced surface sensitivity:**
  Detection system with angle-selective and energy-filtering capabilities gives you complete control on surface sensitivity and the option to explore with different contrast for sharpening your senses and deepening your insight.

- **Maximum protection for delicate specimens:**
  Excellent imaging performance at low beam energies ideal for imaging non-conducting samples and uncoated biological specimens. Variable pressure operations also available.

- **Best conditions for microanalysis:**
  High electron beam currents up to 400 nA are advantageous for microanalytical techniques such as as CL, EDS, WDS and EBSD.

- **Reliability and excellence performance in lengthy applications:**
  EquiPower™ lens technology assuring constant thermal power dissipation for excellent stability in time-consuming applica-tions such as FIB tomography or X-ray microanalysis.

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:**
  With ion beam currents up to 100 nA you can slash by half the time for completing your cross-sectioning and lamella lift-out processes.

- **Fast FIB nanotomography:**
  Dedicated software enables you to perform three-dimension-al sample reconstructions with extreme ease and speed, and provides you with unique ultra-structural information of your samples.

SOFTWARE

- **Boosting productivity and throughput:**
  Easy-to-learn and workflow-oriented software for maximum control in all your applications and minimum time-to-result.

Universality in sample imaging field-free ultra-high resolution

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. 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.

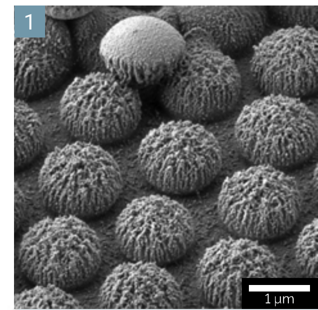


Fig. 1: Polystyrene spheres imaged at 500 eV tilted at 55°.

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 S8000G an ideal microscope for nanocharacterisation.

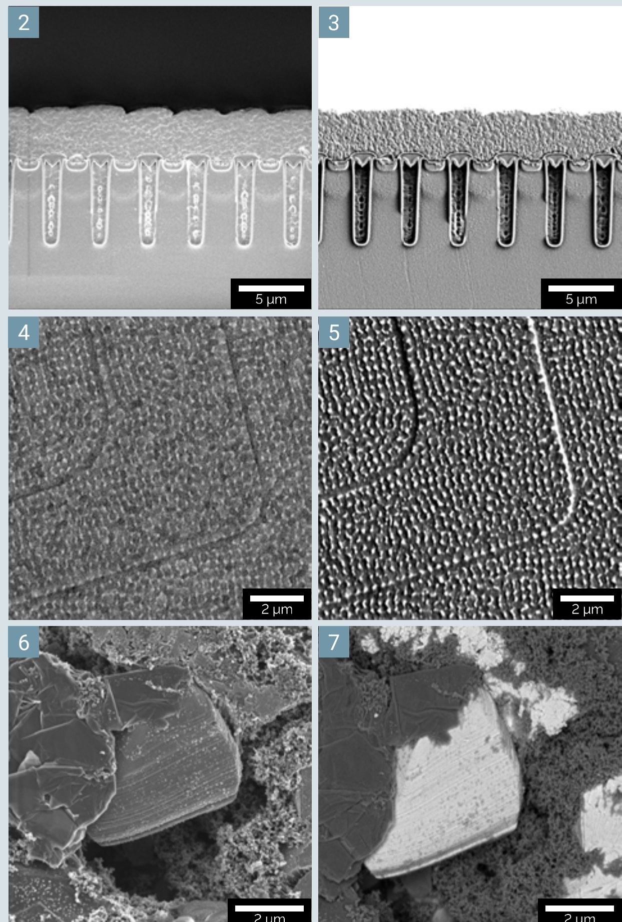


Fig: Imaging with different detectors: Cross-section of a microelectronic device imaged at 2 keV with the **(2)** Multidetector and **(3)** Axial detector. • Magnetic layers in display imaged at 3 keV with the **(4)** In-Chamber E-T and **(5)** Multidetector detector. • Cathode of a Li-ion battery imaged 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.

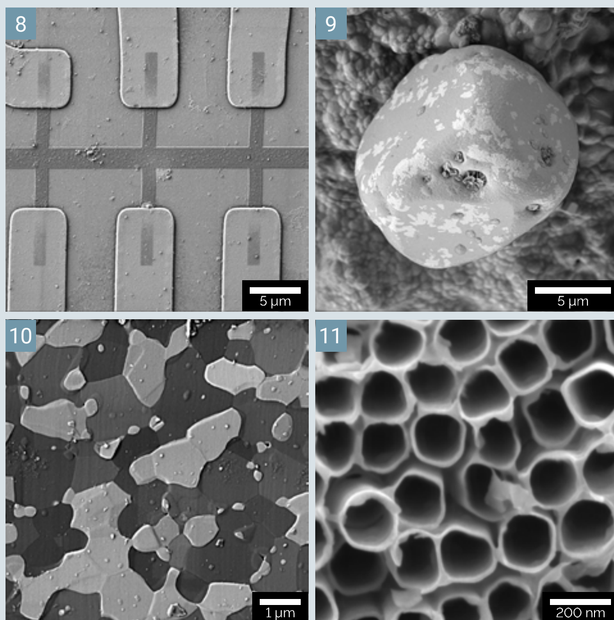


Fig: Material Sciences samples: (8) Graphene on Au contacts on a SiN substrate imaged at 500eV. **(9)** Ceramics with salt imaged at 500eV. **(10)** Surface of a Read/Write magnetic head imaged at 2keV. **(11)** TiO_2 nanotubes imaged at 500 eV in the beam deceleration mode.

Variety of Displaying Modes and Excellent Column Stability

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 S8000G that guarantees excellent SEM column thermal stability for maximum performance in time-consuming applications such as FIB-tomography and EDS mapping. Low vacuum operations for imaging hydrated biological specimens is also available.

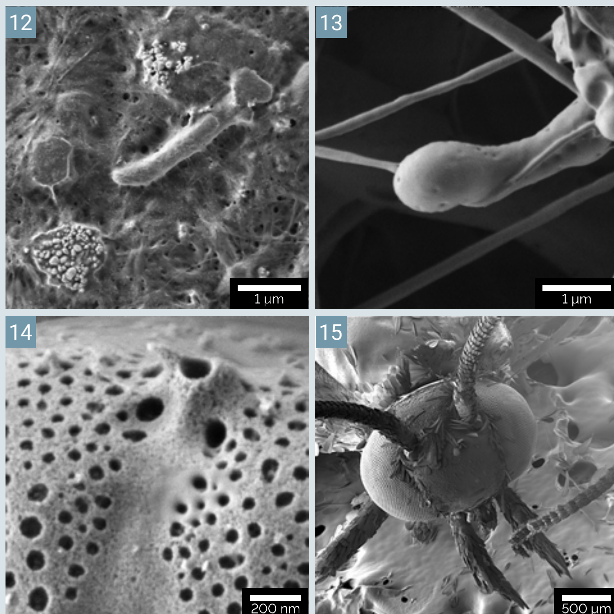


Fig: Biological samples: (12) Bacterial cellulose imaged uncoated at 1keV. **(13)** Mould imaged uncoated at 800eV. **(14)** Diatoms imaged uncoated at 1keV. **(15)** Moth imaged at 1keV in the OVERVIEW mode for large field of view undistorted images, FOV 3 mm.

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

The outstanding imaging capabilities are just one part of what S8000G can offer; its capabilities for nanoengineering are equally remarkable. S8000G features the Orage™ FIB column, the next generation of Ga source FIB column with cutting-edge ion optics delivering ultra-fine resolution throughout the entire range of beam energies, and excellent low-energy beam performance.

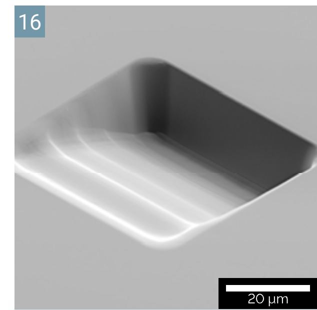


Fig. 16: Cross-section 50 µm wide, 17.2 µm deep prepared with an ion beam current of 85 nA at 30 keV. Preparation time: 17 mins.

World-class quality in sample preparation

Significant better resolution and excellent performance at low beam energies is an advantage and quality guarantee 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 minimise amorphous damage on surface layers.

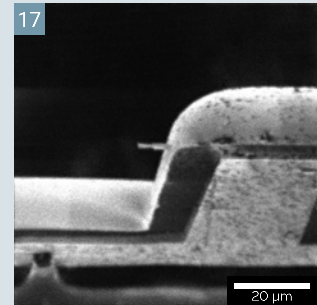


Fig. 17: 1keV FIB image of a lamella on the TEM grid.

Accelerating your FIB nanomachining

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

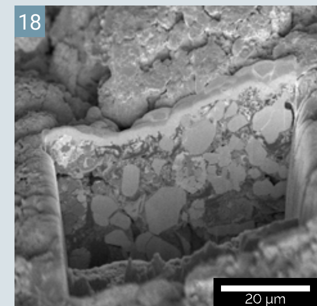


Fig. 18: A 50 µm-long cross-section prepared in a Li-ion battery cathode.

Because simplicity is the key to success

A powerful and yet user-friendly software comes to enable the outstanding hardware capabilities of S8000G. Special attention has been put on designing a simple and workflow-oriented graphic user interface with wizards that transform user operations into smooth experiences regardless the complexity degree of their applications. There is no trade-offs when it comes to operation; S8000G remains an easy-to-learn system, thus not only an expert user but also – and mainly – an occasional or inexperienced user will profit from it with the same ease.

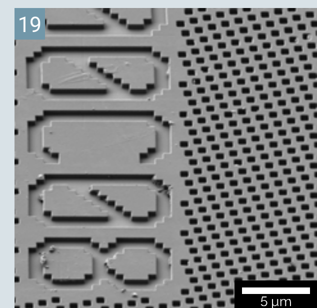


Fig. 19: Delicate lithography resist imaged at 500 eV.

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 / 1.4 nm at 1 keV* 2.0 nm at 500 eV / 1.6 nm at 200 eV*
STEM (option)	0.9 nm at 30 keV
Low Vacuum Mode	**BSE:** 2.0 nm at 30 keV **LVSTD:** 1.5 nm at 30 keV
Maximum Field of View:	7.0 mm at $WD_{Analytical}$ 6 mm 21 mm at WD 30 mm
Electron beam energy:	50 eV to 30 keV
Probe Current:	< 1 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)
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 motorised X/Y = 130 mm, Z = 90 mm Rotation = 360° continuous, Tilt = -60° to +90°

*With the beam deceleration technology (option)

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