VEGA3

TESCAN

PERFORMANCE IN NANOSPACE

3rd Generation of VEGA SEMs

VEGA3 is a versatile thermionic emission SEM system intended for both high- and low-vacuum operations designed with respect to a wide range of SEM applications and needs in today's research and industry. VEGA3 provides users with the advantages of the latest technology, such as new improved high-performance electronics for faster image acquisition, an ultra-fast scanning system with compensation for static and dynamic image aberrations or scripting for user-defined applications, all while maintaining the best price to performance ratio.

High Resolution Imaging with LaB_6 Emitter

TESCAN offers LaB_6 (lanthanum hexaboride) electron source as an option. The LaB_6 provides higher current density at lower cathode temperatures compared to tungsten emitters. It offers greater brightness, a reasonably improved resolution over the whole range of accelerating voltages and a longer cathode lifetime. The LaB_6 emitter is the right choice for applications where large beam currents and improved resolution are required.

Modern Optics

- A unique four-lens **Wide Field Optics™** design with a proprietary Intermediate Lens (IML) offering a variety of working and displaying modes, for instance with enhanced field of view or depth of focus, etc.
- State-of-art design of the scanning coils and electronics enables an ultra-fast imaging rate down to 20 ns/pixel with minimized dynamic distortion effects.
- Real time **In-Flight Beam Tracing™** for high precision real-time computation of optical parameters.
- Column design without any mechanical centering elements enables fully automated column set-up and alignment.
- Unique live stereoscopic imaging using advanced **3D Beam Technology** opens up the micro and nano-world for an amazing 3D experience and 3D navigation.

Analytical Potential

- The SB chamber is equipped with a 3-axis motorized stage, all other VEGA chambers (LM, XM and GM) provide superior specimen handling using a 5-axis fully motorized compucentric stage and ideal geometry for EDX and EBSD.
- First-class YAG scintillator-based detector.
- Selection of optional detectors and accessories.
- Full operating vacuum can be reached within a few minutes with powerful turbomolecular and rotary fore vakuum pumps.
- Investigation of non-conductive samples in the variable pressure mode (UniVac) version.
- Several chamber suspension type options ensure effective reduction of ambient vibrations in the laboratory.Unique integrated active vibration isolation for analytical GM chamber delivered as standard.
- 3D measurements on a reconstructed surface by using the 3D metrology software.

Rapid Maintenance

Keeping the microscope in peak condition is now easy and requires a minimum of microscope downtime. Every detail has been carefully designed to maximize microscope performance and minimize operator's efforts.

Automated Procedures

Filament heating and alignment of the gun for optimal beam performance is performed automatically with just one click. There are many other procedures which reduce the time for tuning-up the microscope, including automated manipulator navigation and automated analyses. The SharkSEM remote control interface enables access to most of the microscope features, including microscope vacuum control, optics control, stage control, image acquisition, etc. The compact Python scripting library offers all these features.

VEGA3 Configurations

- **VEGA3 SB**
  A high vacuum model of SEM with 3-axis motorized stage for investigation of small conductive samples.

- **VEGA3 SB – EasyProbe**
  The EasyProbe is a favorable package of a scanning electron microscope fully integrated with a selected EDX microanalyser. EasyProbe is available in both high vacuum and variable pressure variant. The system is delivered with a touch screen.

- **VEGA3 LMH / XMH / GMH**
  The large / extra-large / giant-chamber models operate at high vacuum for the investigation of conductive samples with extraordinary imaging quality.

- **VEGA3 SBU / LMU / XMU / GMU**
  The variable-pressure SEMs supplement all the advantages of the high vacuum models with an extended facility for low vacuum operations, enabling the investigation of non-conductive specimens in their natural uncoated state.

- **About VEGA3 XM and GM configurations**
  The XM and GM configurations extend their analytical capabilities, providing the ability to perform fine sample surface observations even with extra-large specimens. In today's microscopy there are many applications where breaking off a small piece of the sample is not possible or highly inconvenient. Particularly in situations where further analysis of the sample is needed. That is the case in forensic applications where the samples are usually valuable pieces of evidence. Besides the ability to investigate the sample surface with extra-large specimens, the GM chamber extends the features of VEGA3 SEMs with great analytical potential. A Large number of ports enables all detectors and techniques (SE, BSE, LVSTD, EDX, EBSD).

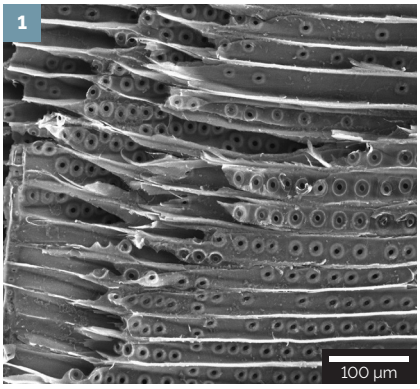

Fig. 1: Au-coated wood sample imaged at 20 keV

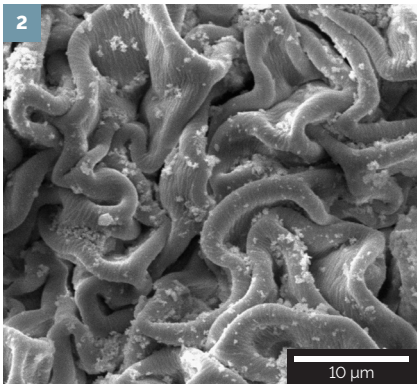

Fig. 2: Pharmaceutical sample imaged at 10 keV

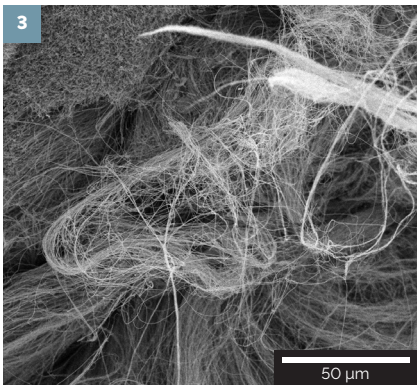

Fig. 3: Carbon nanotubes imaged at 5 keV

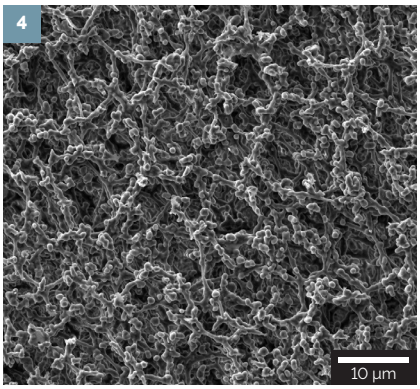

Fig. 4: Particles in a filter imaged at 5 keV

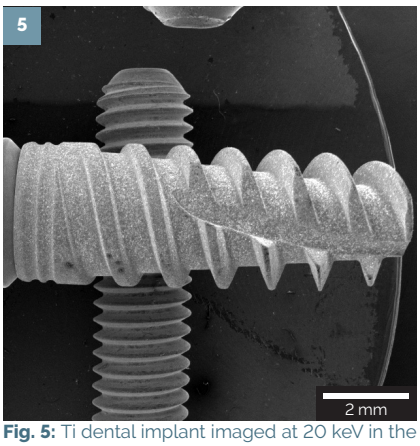

Fig. 5: Ti dental implant imaged at 20 keV in the WIDE FIELD mode

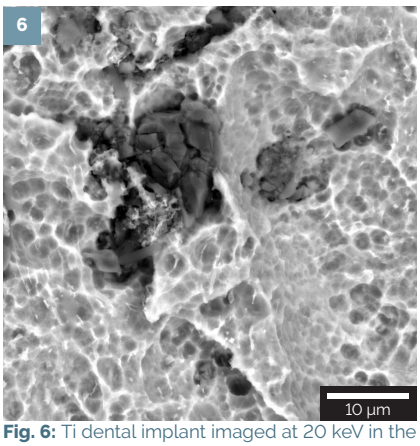

Fig. 6: Ti dental implant imaged at 20 keV in the RESOLUTION mode, with the BSE detector for material contrast

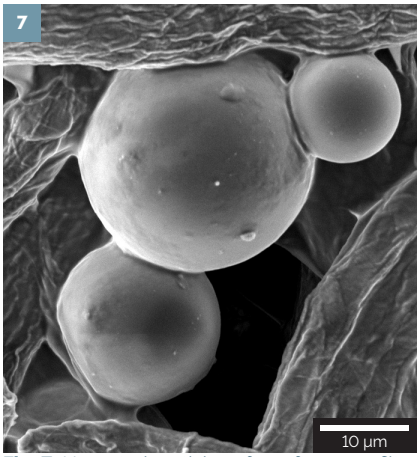

Fig. 7: Uncoated particles of a softener on filter paper imaged at 5 keV

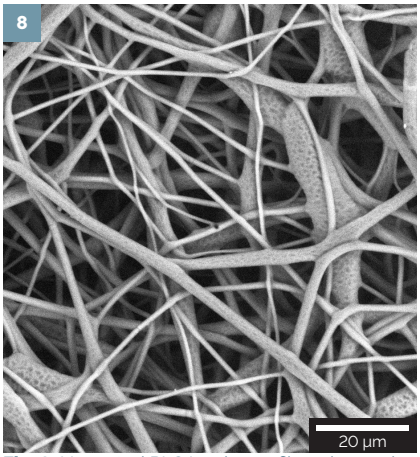

Fig. 8: Uncoated PLGA polymer fibers imaged at 10 keV in low vacuum mode

Software (Standard)	SBH EasyProbe/SBH	SBU EasyProbe/SBU	LMH/XMH/GMH	LMU/XMU/GMU
Image Processing	☑ / ☑	☑ / ☑	☑ / ☑ / ☑	☑ / ☑ / ☑
Analysis & Measurement	☑ / ☑	☑ / ☑	☑ / ☑ / ☑	☑ / ☑ / ☑
Object Area	☑ / ☑	☑ / ☑	☑ / ☑ / ☑	☑ / ☑ / ☑
Hardness	☑ / ☑	☑ / ☑	☑ / ☑ / ☑	☑ / ☑ / ☑
Tolerance	☑ / ☑	☑ / ☑	☑ / ☑ / ☑	☑ / ☑ / ☑
Multi Image Calibrator	☑ / ☑	☑ / ☑	☑ / ☑ / ☑	☑ / ☑ / ☑
Switch-Off Timer	☑ / ☑	☑ / ☑	☑ / ☑ / ☑	☑ / ☑ / ☑
3D Scanning	☑ / ☑	☑ / ☑	☑ / ☑ / ☑	☑ / ☑ / ☑
X-Positioner[1]	⊘ / ☑	⊘ / ☑	☑ / ☑ / ☑	☑ / ☑ / ☑
EasySEM™	☑ / ☑	☑ / ☑	☑ / ☑ / ☑	☑ / ☑ / ☑
Live Video	☑ / ☑	☑ / ☑	☑ / ☑ / ☑	☑ / ☑ / ☑
Histogram	☑ / ☑	☑ / ☑	☑ / ☑ / ☑	☑ / ☑ / ☑
Easy EDX Integration Software	☑ / ☑	☑ / ☑	☐ / ☐ / ☐	☐ / ☐ / ☐

Software (Optional)	SBH EasyProbe/SBH	SBU EasyProbe/SBU	LMH/XMH/GMH	LMU/XMU/GMU
Particles Basic	☐ / ☐	☐ / ☐	☐ / ☐ / ☐	☐ / ☐ / ☐
Particles Advanced[1]	⊘ / ☐	⊘ / ☐	☐ / ☐ / ☐	☐ / ☐ / ☐
Image Snapper[1]	⊘ / ☐	⊘ / ☐	☐ / ☐ / ☐	☐ / ☐ / ☐
DrawBeam Basic	⊘ / ☐	⊘ / ☐	☐ / ☐ / ☐	☐ / ☐ / ☐
DrawBeam Advanced	⊘ / ☐	⊘ / ☐	☐ / ☐ / ☐	☐ / ☐ / ☐
Sample Observer	☐ / ☐	☐ / ☐	☐ / ☐ / ☐	☐ / ☐ / ☐
System Examiner	☐ / ☐	☐ / ☐	☐ / ☐ / ☐	☐ / ☐ / ☐
TESCAN TRACE GSR[1]	⊘ / ☐	⊘ / ☐	☐ / ☐ / ☐	☐ / ☐ / ☐
EasyEDX Integration Software	☑ / ☐	☑ / ☐	☐ / ☐ / ☐	☐ / ☐ / ☐
3D Metrology (MeX)	☐ / ☐	☐ / ☐	☐ / ☐ / ☐	☐ / ☐ / ☐
Cell Counter	⊘ / ☐	⊘ / ☐	☐ / ☐ / ☐	☐ / ☐ / ☐
Coral	⊘ / ☐	⊘ / ☐	☐ / ☐ / ☐	☐ / ☐ / ☐
SYNOPSYS Avalon™	⊘ / ⊘	⊘ / ⊘	☐ / ☐ / ☐	☐ / ☐ / ☐

☑ standard, ☐ option, – not available, [1] Only possible with optional position readout stage for SB chamber

User-Friendly Software

- Multi-user environment localized in different languages
- Easy control of the SEM even for inexperienced users; four levels of user expertise/rights, including an EasySEM™ mode for quick routine investigations
- Image management and report creation
- Built-in self-diagnostics for system readiness checks
- Network operations and remote access/ diagnostics

Software Tools

Modular software architecture enables several extensions to be attached.

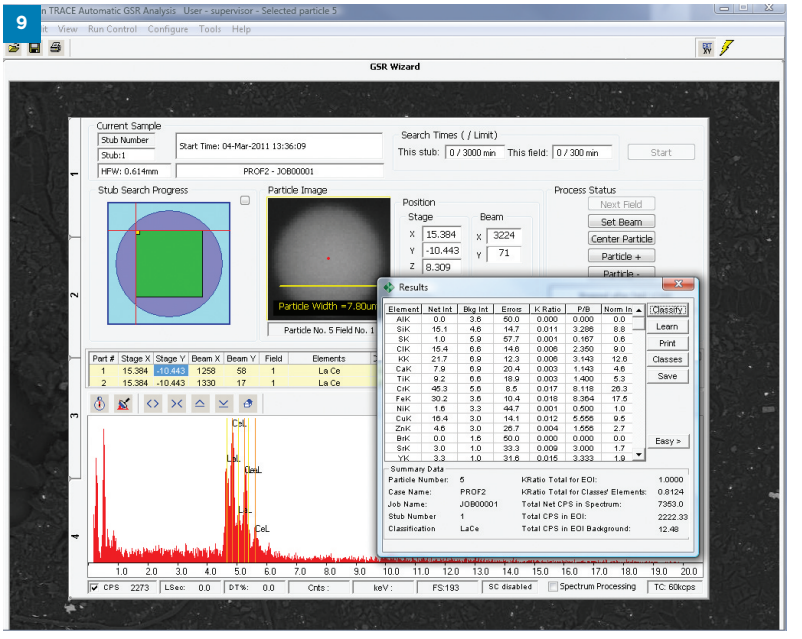

Fig. 9: Screenshot showing TESCAN TRACE GSR module.

Fast and Easy Way to Results

The intuitive EasySEM™ touch screen control interface enables rapid sample examination within minutes. A high level of system automation and self-diagnostics, running in the background, ensure valuable results even for inexperienced users. Optional fully integrated EasyEDX micro-analysis brings quantitative elemental analysis results directly into the live SEM image with only one touch. Point and area analysis as well as quantitative line profile and array mapping (up to 1024 points) functions are available.

Technical specifications

	SB Chamber	LM Chamber	XM Chamber	GM Chamber
Internal size	160 mm	230 mm	290 mm (w) × 340 mm (d)	340 mm (w) × 315 mm (d)
Door	120 mm (width)	148 mm (width)	290 mm (w) × 322 mm (h)	340 mm (w) × 320 mm (h)
Number of ports	10	11+	12+	20+
Chamber and Column Suspension	Mechanical – by means of rubber elements	Pneumatic or optionally Mechanic (rubber elements - not available for LaB_6 option) Integrated active vibration isolation	Pneumatic or optionally Integrated active vibration isolation	Integrated active vibration isolation

	Specimen stage in SB Chamber	Specimen stage in LM Chamber	Specimen stage in XM Chamber	Specimen stage in GM Chamber
Type	eucentric 3-axis motor.	compucentric	compucentric	compucentric
Movements	without /with position readout* X = 45 / 35 mm - mot. Y = 45 / 35 mm - mot. Z = 27 / 27 mm - man. Z' = 6 / 6 mm - man. Rotation: 360° Tilt: -90° to +90° - man.	X = 80 mm Y = 60 mm Z = 47 mm Rotation: 360° cont. Tilt: -80° to +80°	X = 130 mm Y = 130 mm Z = 100 mm Rotation: 360° cont. Tilt: -30° to +90°	X = 130 mm Y = 130 mm Z = 100 mm Rotation: 360° cont. Tilt: -80° to +90°
Max.Specimen height	36 / 34 mm	54 mm (with rotation stage) 81 mm (without rotation stage)	106 mm (with rotation stage) 147 mm (without rotation stage)	106 mm (with rotation stage) 147 mm (without rotation stage)

*Not available for SB EasyProbe options

Detectors*	SBH EasyProbe/ SBH	SBU EasyProbe/ SBU	LMH/ XMH/GMH	LMU/ XMU/GMU
SE detector	☑ / ☑	☑ / ☑	☑ / ☑ / ☑	☑ / ☑ / ☑
Fixed BSE	⊘ / ☐	⊘ / ☐	☐ / ⊘ / ⊘	☐ / ⊘ / ⊘
Retractable BSE Detector[1]	☐ / ☐	☑ / ☑	☐ / ☐ / ☐	☑ / ☑ / ☑
Retractable Dual Scintillator BSE Detector[1]	⊘ / ☐	⊘ / ☐	☐ / ☐ / ☐	☐ / ☐ / ☐
Retractable 4-Quadrant BSE Detector[1]	⊘ / ☐	⊘ / ☐	☐ / ☐ / ☐	☐ / ☐ / ☐
Low Vacuum Secondary Electron TESCAN Detector (LVSTD)[2]	⊘ / ⊘	⊘ / ☐	⊘ / ⊘ / ⊘	☐ / ☐ / ☐
STEM Detector	⊘ / ☐	⊘ / ☐	☐ / ☐ / ☐	☐ / ☐ / ☐
HADF R-STEM Detector (motor.)	⊘ / ⊘	⊘ / ⊘	☐ / ☐ / ☐	☐ / ☐ / ☐
CL Detector[1,3]	⊘ / ☐	⊘ / ☐	☐ / ☐ / ☐	☐ / ☐ / ☐
Rainbow CL Detector[1,3]	⊘ / ☐	⊘ / ☐	☐ / ☐ / ☐	☐ / ☐ / ☐
Al-coated BSE Detector[1]	⊘ / ⊘	⊘ / ⊘	☐ / ☐ / ☐	☐ / ☐ / ☐
BSE/CL Detector	⊘ / ⊘	⊘ / ⊘	☐ / ☐ / ⊘	☐ / ☐ / ⊘
EBIC	⊘ / ☐	⊘ / ☐	☐ / ☐ / ☐	☐ / ☐ / ☐
EasyEDX[4]	☑ / ☐	☑ / ☐	☐ / ☐ / ☐	☐ / ☐ / ☐
EDX[4]	⊘ / ☐	⊘ / ☐	☐ / ☐ / ☐	☐ / ☐ / ☐
WDX[4, 5]	⊘ / ⊘	⊘ / ⊘	☐ / ☐ / ☐	☐ / ☐ / ☐
EBSD[4]	⊘ / ☐	⊘ / ☐	☐ / ☐ / ☐	☐ / ☐ / ☐

[1]Motorised mechanics as an option for LM/XM chambers and standard for GM/AMU chambers. [2]Up to 500 Pa, and, in addition for LM/XM/GM chambers: up to 1000 Pa (N_2 conditions) / up to 1000 Pa (water vapour/N_2 conditions). [3]Compact version available specially designed for simultaneous CL and BSE detection. [4]Fully integrated third party products. [5]Integrated active vibration isolation necessary.

Accessories*	SBH EasyProbe/ SBH	SBU EasyProbe/ SBU	LMH/ XMH/GMH	LMU/ XMU/GMU
pA Meter	☑ / ☑	☑ / ☑	☑ / ☑ / ☑	☑ / ☑ / ☑
Touch Alarm	☑ / ☑	☑ / ☑	☑ / ☑ / ☑	☑ / ☑ / ☑
IR TV Camera	☐ / ☐	☐ / ☐	☑ / ☑ / ☑	☑ / ☑ / ☑
Peltier Cooling Stage	⊘ / ⊘	⊘ / ⊘	☐ / ☐ / ☐	☐ / ☐ / ☐
Water Vapor Inlet	⊘ / ⊘	⊘ / ⊘	☐ / ☐ / ☐	☐ / ☐ / ☐
Beam Blanker for SEM column	☐ / ☐	☐ / ☐	☐ / ☐ / ☐	☐ / ☐ / ☐
Load Lock**	⊘ / ⊘	⊘ / ⊘	☐ / ☐ / ☐	☐ / ☐ / ☐
Control Panel	☐ / ☐	☐ / ☐	☐ / ☐ / ☐	☐ / ☐ / ☐
Optical Stage Navigation	⊘ / ⊘	⊘ / ⊘	☐ / ☐ / ☐	☐ / ☐ / ☐
Nanomanipulators	⊘ / ⊘	⊘ / ⊘	☐ / ☐ / ☐	☐ / ☐ / ☐

☑ standard, ☐ option, ⊘ not available,
*Possible combinations of optional detectors and other accessories must be discussed with TESCAN
**Manual and motorised options available

Technical specifications

	SB EasyProbe/SB	LM/XM/GM
Electron Gun	Tungsten heated cathode	Tungsten heated cathode / optionally LaB_6
Resolution		
In high-vacuum mode SE	3 nm at 30 keV 8 nm at 3 keV	3 nm at 30 keV / 2 nm at 30 keV[1] 8 nm at 3 keV / 5 nm at 3 keV[1]
In low vacuum mode BSE, LVSTD[3]	3.5 nm at 30 keV	3.5 nm at 30 keV / 2.5 nm at 30 keV[1]
Chamber vacuum		
Chamber – High – vacuum mode	< 9 × 10^{-3} Pa[2]	< 9 × 10^{-3} Pa[2]
Chamber – Medium – vacuum mode[4]	3 – 150 Pa	3 – 150 Pa
Chamber – Low – vacuum mode	3 – 500 Pa[5] < 9 × 10^{-3} Pa[2]	3 – 500 Pa[5] (optionally: 3 – 2000 Pa[5]) < 9 × 10^{-3} Pa[2]
Column vacuum	–	< 3 × 10^{-5} Pa
Gun vacuum for LaB_6		
Magnification continuous from	3 × – 1,000,000 × (for 5" image width in Continual Wide Field/Resolution)	2 × – 1,000,000 × (LM), 1 × – 1,000,000 × (XM/GM)
Electron optics working modes		
High-vacuum mode	Resolution, Depth, Field, Wide Field, Channelling	
Low-vacuum mode	Resolution, Depth	
Field of view	7.7 mm at $WD_{analytical}$ 10 mm 24 mm at WD 30 mm	
Electron Beam Energy	200 eV to 30 keV	
Probe current	1 pA to 2 µA	
Scanning speed	From 20 ns to 10 ms per pixel adjustable in steps or continuously	
Scanning features	Focus window (shape, size and position continuously adjustable), Dynamic Focus – in plane tilted or folded plane up to ± 70 deg, Point & Line Scan, Image rotation, Image shift, Tilt compensation, 3D Beam – defined tilting scanning axis around XY axis, Life Stereoscopic Imaging, Other scanning shapes available through the optional DrawBeam software	
Image size	16,384 ×16,384 pixels, adjustable separately for live image (in 3 steps) and for stored images (11 steps), selectable square or 4:3 or 2:1 rectangle. Unlimited large panorama image size (up to storage capacity).	
Microscope control	All microscope functions are controlled by keyboard, mouse and trackball via the program VegaTC using Windows™ platform. Control panel and touchscreen optionally available.	
Automatic procedures	In-Flight Beam Tracing™ beam optimization, Spot Size a Beam Current Continual, WD (focus) & Stigmator, Contrast & Brightness, Scanning Speed (according to Signal- Noise Ratio), Gun Heating, Gun Centering, Column Centering, Vacuum Control, Compensation for kV, Look-Up Table, Auto-diagnostics	
Remote control	Via TCP/IP, open protocol	

[1] with LaB_6 option, [2] a pressure of < 5 × 10^{-4} Pa can be displayed with an optional WRG vacuum gauge (on request) , [3] LVSTD not available for EasyProbe, [4] not available with LaB_6 option, [5] with a low vacuum aperture inserted

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