



# TESCAN VEGA

**Analytical SEM for routine materials characterization, research and quality control applications at the micron scale.**



Single Beam  
(SEM)



Tungsten  
Electron Source



Variable  
Pressure  
(MultiVac)



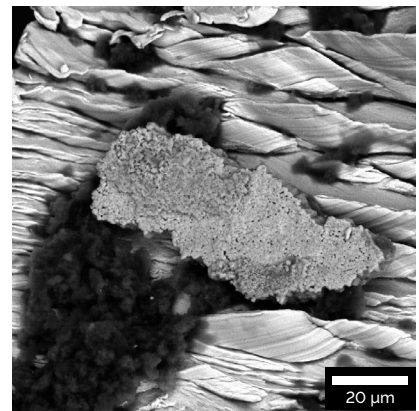
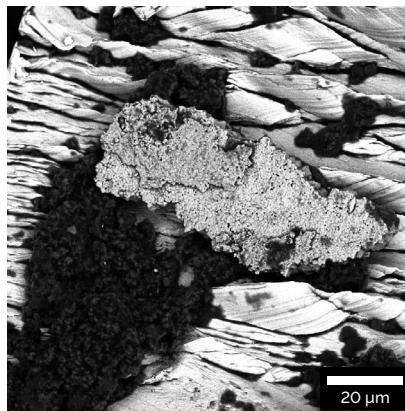
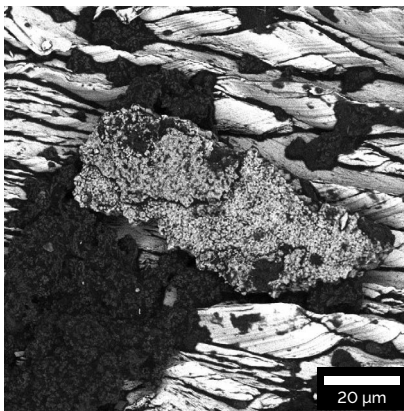
Integrated EDS  
(Essence™ EDS)

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## Optimum imaging and analytical conditions assured thanks to TESCAN's unique optics design powered by In-Flight Beam Tracing™

TESCAN VEGA features an innovative optics design that guarantees immediate and seamless selection of either imaging or analytical conditions as required, without the need for mechanical re-alignment of any in-column element. VEGA is equipped with a unique additional lens, the Intermediate Lens™, which is powered by TESCAN's In-Flight Beam Tracing™. This combination allows users to continuously increase beam current to a value that

optimizes signal to noise ratio for imaging at the desired magnifications and accelerating voltages. More importantly, switching between imaging and analytical conditions, which requires changing from low to high beam current, is a matter of a single click in the software.

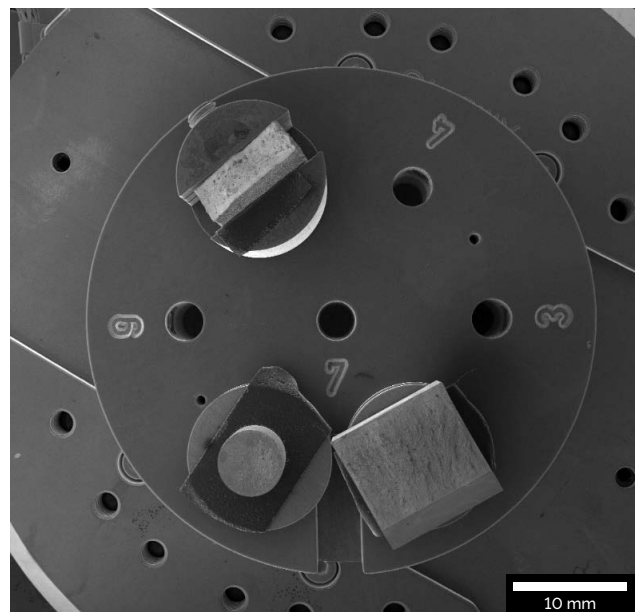


- ▲ Metal fracture with a surface contamination captured at 5, 10 and 30 keV respectively. BSE information differs significantly from the increased surface sensitivity characteristic of lower accelerating energies.

## Precise SEM navigation on the sample at magnifications as low as 2×

Precise navigation to the desired area of interest is guaranteed by TESCAN's unique Wide Field Optics™ mode, which provides the operator with a live SEM overview of the sample. Wide Field Optics™ provides a more intuitive navigation process, driven by unprecedented depth of focus along with a view of the sample's actual topography. Begin observation in the live SEM window at 2× magnification for a detailed overview, then continuously magnify directly over areas of interest. Live SEM overview can also be used with pre-tilted holders, such as those for EBSD, and supports scanning tilt correction for accurate navigation on tilted analytical samples.

- Overview image captured by Wide Field Optics™ mode showing the three samples placed on the SEM stage in the GM chamber.

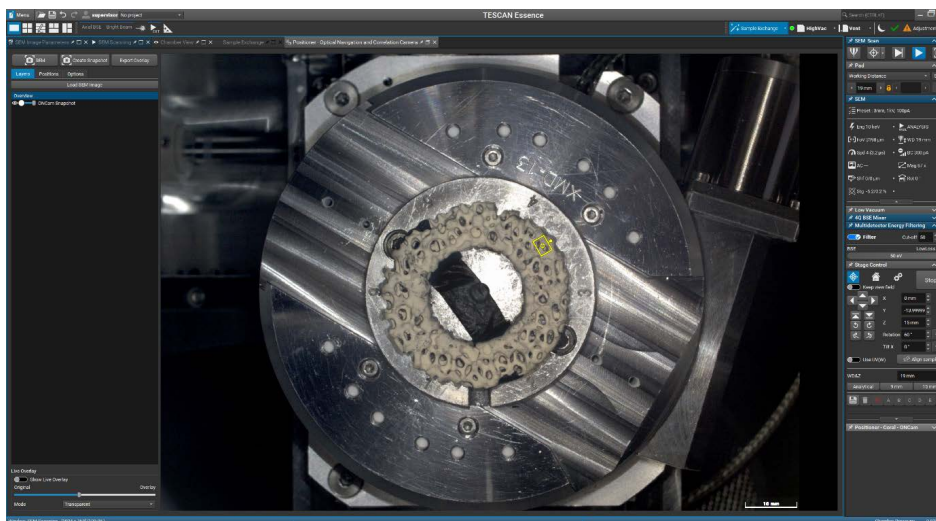




## Optical Navigation and Correlation camera (ONCam) for navigation on large samples and to features of interest according to their true color, appearance or marks that cannot be seen with SEM contrast methods alone

TESCAN's Optical Navigation and Correlation Camera (ONCam) is an option that provides intuitive, image-based sample navigation from within TESCANA's Essence™ software environment. ONCam is equipped with four independent LED segments that use ONCam's advanced minimum intensity stacking algorithm to eliminate reflections in the optical navigation image. This makes navigation on polished samples, such as metal cross-sections, more precise and

efficient. Extended field of view covering  $120 \times 120 \text{ mm}^2$  can capture navigation photos even for large samples such as cut-outs from metal or large materials test pieces. ONCam's interface provides correlative functionality via direct overlay of the SEM image on the ONCam capture, with adjustable transparency. Using both the ONCam capture and electron contrast images simultaneously assures navigation to the correct area of interest.

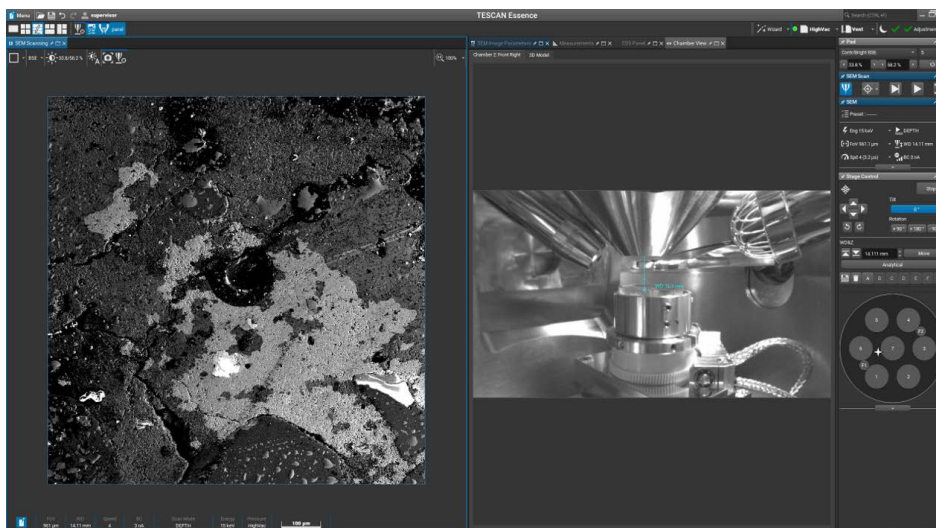


▲ Photo-realistic image of a ceramic foam captured with the Optical Navigation and Correlation camera (ONCam).

## Intuitive and modular Essence™ software designed for effortless operation regardless of a user's experience level.

TESCAN VEGA is operated from TESCANA's Essence™ multiuser software, which features many tools to streamline analytical work, like quick search function, undo commands

and presets. TESCANA's Essence™ is built to allow users to define workflows that match their level of experience and/or specific application need.



▲ Essence™ software layout

## Ultimate safety of the chamber mounted detectors when the stage and sample are in motion is guaranteed with Essence™ 3D Collision model.

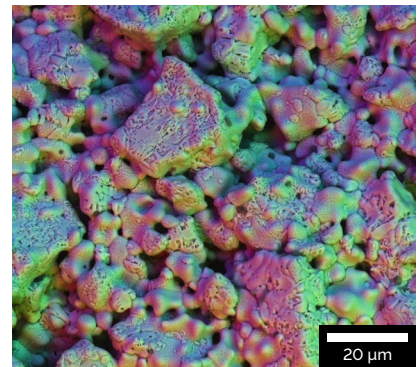
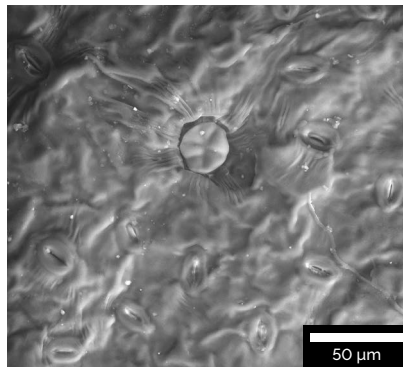
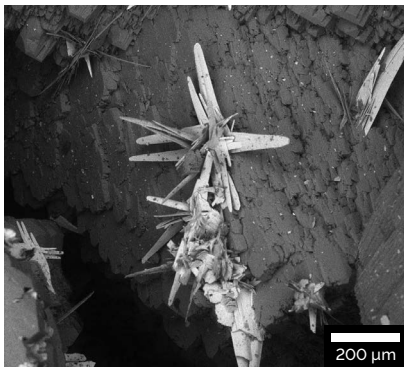
Additionally, Essence™ Collision model virtually replicates the chamber interior for a live visualization of hardware geometry, size and position of stage, samples and chamber mounted equipment. Essence™ Collision model predicts

the intended movements and interactions for a particular imaging or analytical routine to make it nearly impossible for samples to collide with any chamber mounted detector or third-party\* devices, like tensile or heating stages.

## SingleVac mode for observing charging and beam-sensitive samples.

TESCAN VEGA is delivered with SingleVac mode as standard. SingleVac uses a factory-preset pressure value to make observation of charging samples possible without requiring a conductive surface coating. SingleVac

can be accompanied by optional UniVac™ mode to allow continual adjustments to chamber pressure, up to 500 Pa for SE and BSE imaging of extreme charging, outgassing and beam sensitive materials.

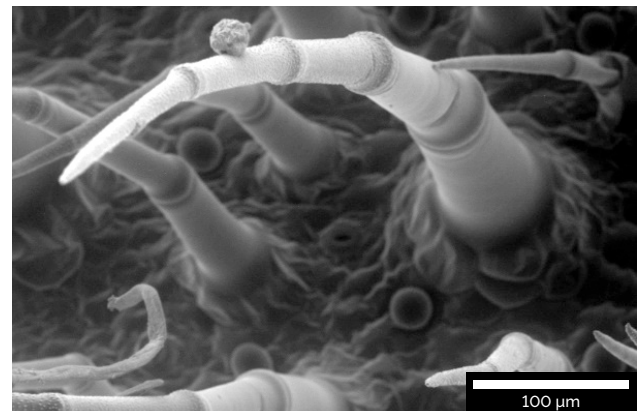
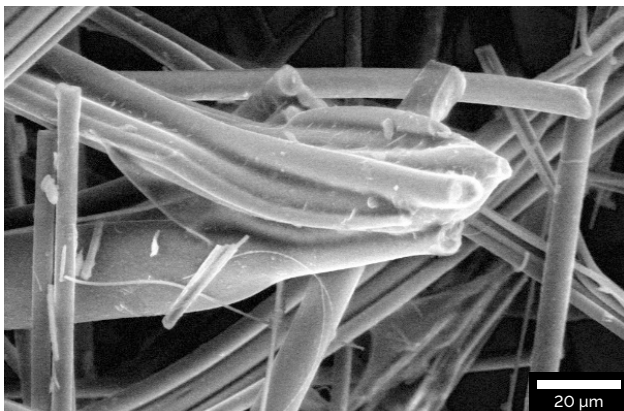


▲ Geological sample (left); Tree leaf (middle) and Ceramic (right) imaged with 4QBSE detector Color mode in SingleVac™ mode.

## MultiVac mode for achieving the finest topographic characterization of insulating, beam sensitive and outgassing samples, in low vacuum

TESCAN MultiVac is an optional mode which supports imaging of insulating samples without surface metal coating by enabling low vacuum and extended variable pressure up to 500 Pa. MultiVac includes a gaseous secondary electron detector (GSD) for the most efficient topographical

characterization of raw materials. Additionally, the GSD provides an H<sub>2</sub>O atmosphere which maximizes signal collection efficiency and significantly increases VEGA's low vacuum imaging throughput.



▲ SiO<sub>2</sub> fibers captured at 15 keV in MultiVac mode using the GSD detector (left). Trichome of a plant captured at 5 keV in MultiVac mode using GSD detector (right).

\*Compatibility only applies to 3<sup>rd</sup> party options already integrated in the collision model.

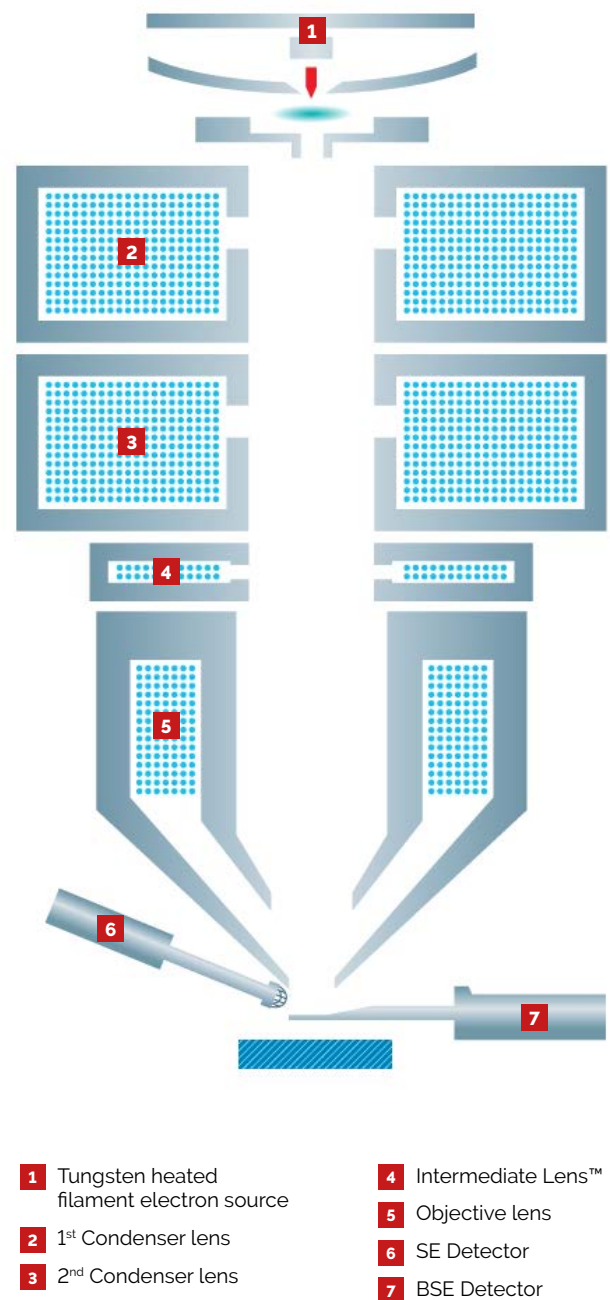
## Optional vacuum buffer significantly reduces vacuum rotary pump run-time to deliver both ecological and economic benefits.

VEGA's optional vacuum buffer system monitors the vacuum status and only switches the rotary pump on as required. This significantly reduces the rotary pump running time creating both economical and ecological advantages.

## Technology behind TESCAN VEGA

TESCAN VEGA is an analytical SEM with tungsten heated filament electron source. VEGA is equipped with two chamber mounted detectors: a secondary electron detector (SE) for topographical contrast and a backscattered electron detector (BSE) for material contrast. Choose the BSE detector from one of several options. The robust single crystal, YAG BSE detector delivers high material contrast even at the fastest scanning rates with unlimited lifetime. Another popular option is a four quadrant BSE detector (4Q BSE). This detector is appreciated by those whose investigations require take off angle-dependent signals. Each quadrant can be switched on or off according to the characterization requirements. This detector also provides access to predefined 4Q BSE observation modes such as COMPO for compositional observation and TOPO for topographical observation.

TESCAN VEGA also features an additional lens, the Intermediate Lens™ which provides access to unique observation modes. Wide-Field Optics™ mode provides users with an exceptionally clear overview of the sample at any time to facilitate precise and fast navigation to the correct region of interest. Depth mode extends the depth of focus, so that samples with extreme topography are imaged with all features in focus.



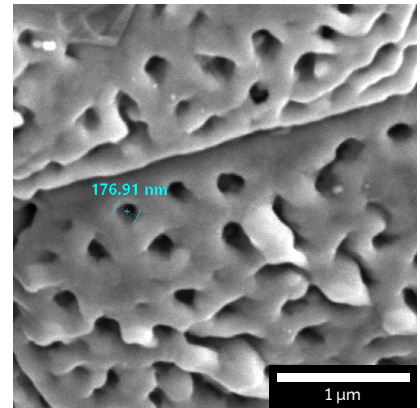
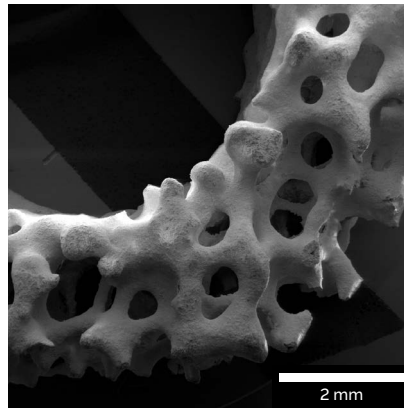
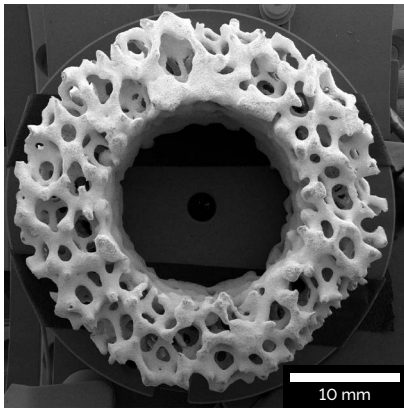
## Engineered for maximum ease of use and reduced time to data

All SEM operation is accomplished from a single, intuitive user interface. Navigation and imaging are entirely software-driven, allowing users to obtain crisp images with minimal effort. TESCAN Wide Field Optics™, In-Flight Beam Tracing™ and optional fully integrated Essence EDS™ all work together in a single, live view window of the SEM software to improve imaging results, speed analytical work and reduce time to data.

Use Wide Field Optics™ to navigate to the desired region of interest with a single click, then zoom in to individual features of interest while maintaining a clear and accurate

image of the sample. Any features that appear transparent at high beam voltage can be resolved by simply reducing the beam voltage — without requiring mechanical aperture changes. TESCAN's optics design, which utilizes two condenser lenses and a unique Intermediate Lens™ that supports both wide field imaging and optimized imaging conditions based on TESCAN's In-Flight Beam Tracing™ simulations and calculations that improve low keV performance. Finally, with the optional fully integrated Essence™ EDS, users are a click away from their elemental analysis results.

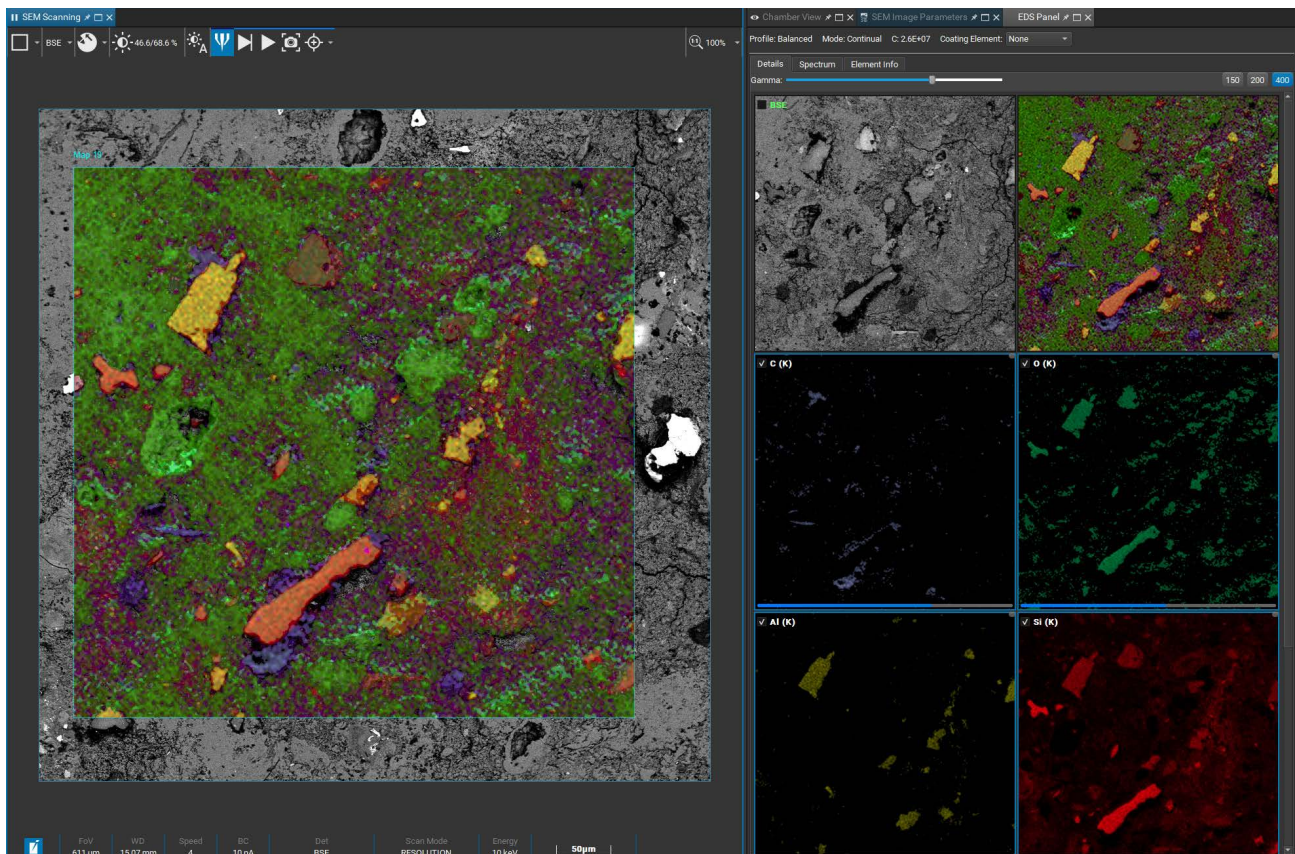




- ▲ Precise and intuitive navigation is simple using TESCAN Wide Field Optics™. Start with an overview image, then click to magnify features of interest while maintaining high resolution and sharp focus.

TESCAN VEGA can reach these optimum imaging conditions quickly and effortlessly with a single click in the software GUI. TESCAN In-Flight Beam Tracing™ assures optimal imaging conditions for maximum contrast from your sample throughout the entire range of acceleration voltages.

Speed your time to analytical data thanks to the optional integrated Essence™ EDS, which delivers the advantage of combining SEM imaging and elemental composition acquisition in a single live view window of Essence microscope control software.



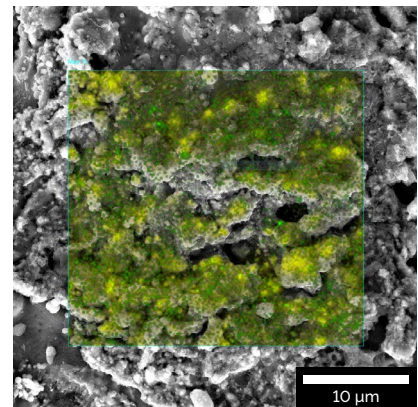
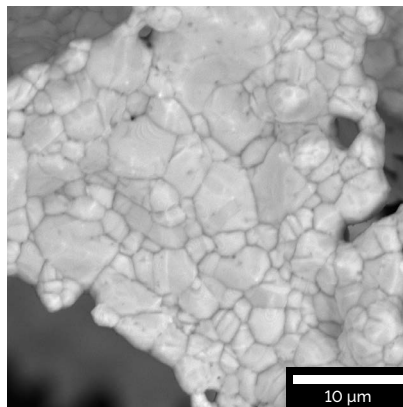
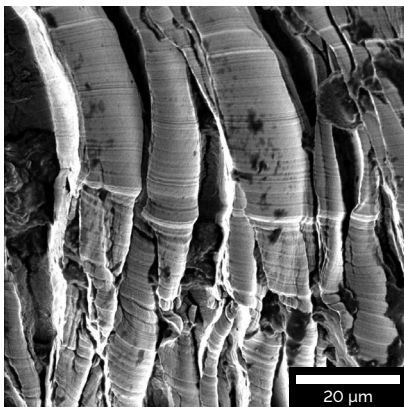
- ▲ EDS elemental map of ancient plaster captured with Essence™ EDS defined directly in a live window of the SEM.

# Applications – Ideal for:

## Routine study and industrial inspection of metal samples at the micron scale

Routine metal sample inspections with SEM are often part of the quality analysis process. TESCAN VEGA can help to evaluate failure types when the metal piece is fractured in testing or in use. Also, the porosity, grain size and grain structure of metal foams and metal printed materials can be evaluated during the additive manufacturing process. VEGA's unique DEPTH mode provides greater depth

of focus to capture features that are outside of the SEM focal plane. Use the optional Essence™ EDS to further evaluate metal composition, homogeneity or extent of corrosion. TESCAN VEGA SEM provides an intuitive, fast, and repeatable path to accurate data, which is essential in metal processing industry quality control, failure analysis and research labs.

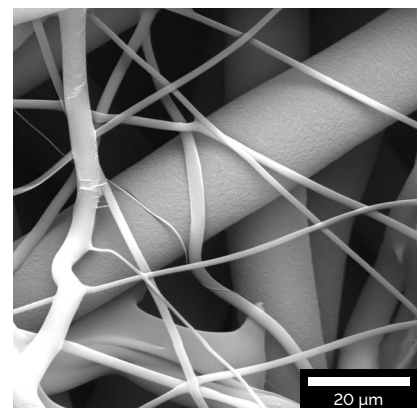
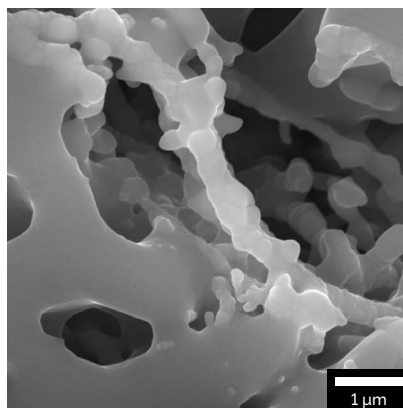
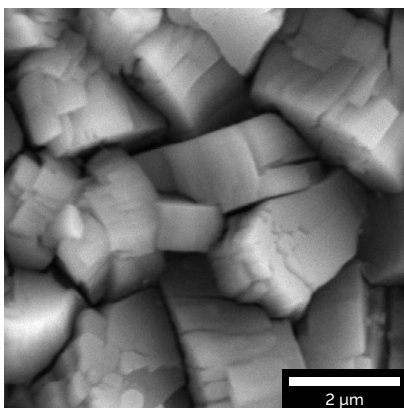


- ▲ Surface of a fractured metal piece imaged with SE detector (left); grains in metal foam imaged with BSE detector (middle); EDS maps acquired with Essence™ EDS of W (yellow) and Ti (green) overlaid on the SE image of the metal alloy (right)

## Quality analysis of particles, agglomerates and other materials at the micron scale

TESCAN VEGA is a versatile instrument which can be used in a variety of applications in quality control, failure analysis

and research labs. Both surface coated and uncoated samples can be observed and analyzed in high vacuum



- ▲ ZnP particles on Al substrate (left); ZrO<sub>2</sub> nanofiber reinforced ceramics (middle); and non-woven textile fibers imaged with BSE detector (right).



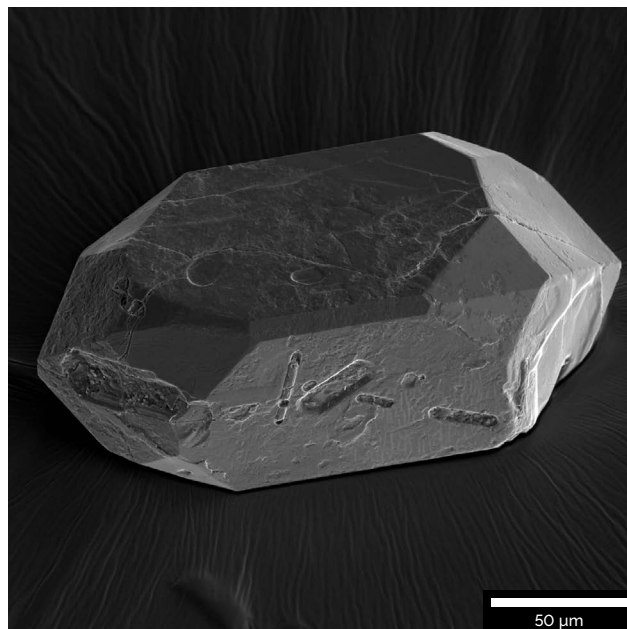
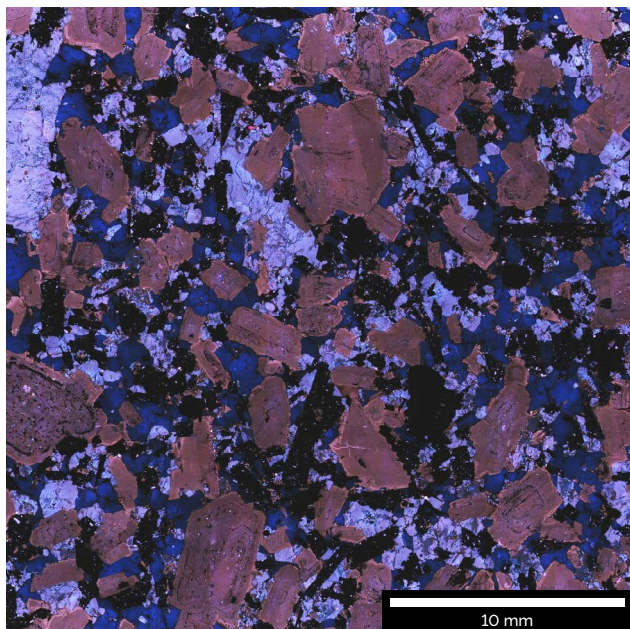
mode or low vacuum mode, respectively. For instance, the structure of various powder-based materials and coating materials can be studied to identify size and morphology

in order to assess their quality. Ceramic materials including those which are modified with additives, such as nanofibers, can also be analyzed for their porosity and morphology.

## Morphological and elemental characterization of geological samples at the micron scale

TESCAN VEGA is an ideal tool for daily work on geological samples due to both its imaging and its analytical capabilities. The most common application is imaging of polished petrographic samples, which capitalizes on VEGA's sensitive and fast backscattered electron acquisition using TESCANA's YAG-based BSE detector. This complements the analytical capability brought by the optional Integrated TESCANA Essence™ EDS, which provides instant access to elemental analyses in the live SEM window, eliminating

the need to switch to third party software to obtain spectra, elemental maps or profiles. Furthermore, TESCANA's color and panchromatic cathodoluminescence detectors are used to reveal compositional and structural variations in minerals, often as a step preceding geochronological dating or other high-resolution analytical techniques. TESCANA VEGA SEM is also the ideal instrument for morphological analysis of the samples, which is important for imaging of crystal aggregates or micro fossils.

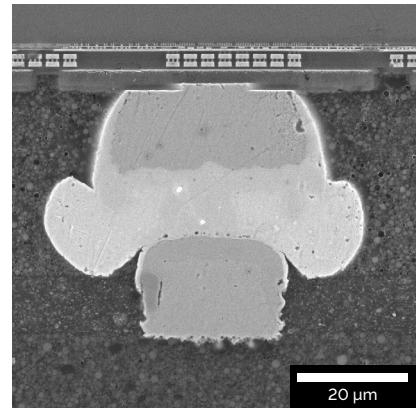
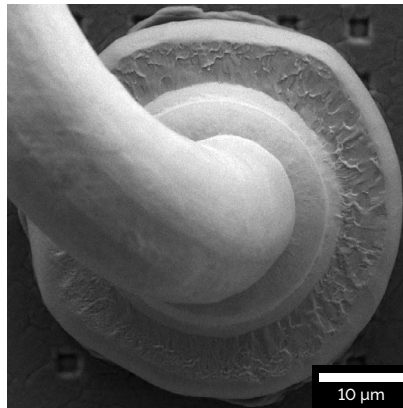
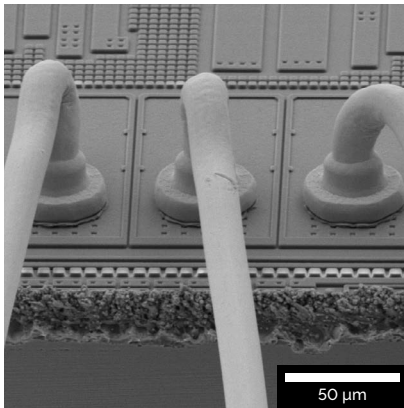


▲ Granitic rock imaged by TESCANA Rainbow color cathodoluminescence detector (left); Free bipyramidal zircon crystal (right).

## Quality analysis of semiconductor devices at the micron scale

In the field of electronics and semiconductor microchip production, TESCANA VEGA's microanalytical capabilities are very efficient for inspection and failure analysis of a variety of semiconductor devices. Wide Field Optics™ mode provides the overview image of the entire chip, which aids navigation to the correct area of interest. There are three main applications of interest. Wire bonding is inspected for delamination, bond pad cracking or corrosion. Mechanically-prepared cross sections can also be analyzed and

evaluated at the micron scale. In this instance, layers are often measured and analyzed with EDS. TESCANA VEGA is used in quality assurance labs where semiconductor packaging quality is assessed, e.g. by inspection of solder ball and intermetallic materials. These applications can be made effortlessly through VEGA SEM efficiencies realized by combining SEM imaging with the optional EDS in a single Essence™ software window.



▲ Overview of wire bonding (left); wire bonding detail (middle) and mechanically polished cross-section of solder ball (right)

## Technical Specifications / Electron Optics:

**Electron Gun:** Heated tungsten filament cathode

**Electron Optics:** Wide Field Optics™ Technology with Intermediate Lens™ and In-Flight Beam Tracing™

<b>Resolution:</b>	<b>High Vacuum Mode:</b>	<b>Low Vacuum Mode:</b>
	3 nm at 30 keV	3.5 nm at 30 keV with BSE detector*
	8 nm at 3 keV	3.5 nm at 30 keV with LVSTD detector*
		* optional detectors

**Maximum Field of View:** >50 mm at max WD

## TESCAN ORSAY HOLDING, a. s.

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