Product Information
Version 5.0

ZEISS EVO Family

Your Modular SEM Platform for Intuitive Operation, Routine Investigations and Research Applications

Your Modular SEM Platform for Intuitive Operation, Routine Investigations and Research Applications

The instruments of the EVO family combine high performance scanning electron microscopy with an intuitive, user-friendly experience that appeals to both trained microscopists and new users. With its comprehensive range of available options, EVO can be tailored precisely to your requirements, whether you are in life sciences, material sciences, or routine industrial quality assurance and failure analysis.

Configure a versatile, multi-purpose solution for central microscopy facilities or industrial quality assurance laboratories. Choose from different chamber sizes and stage options that meet all your application requirements—even for large industrial parts and samples that can be a challenge to process with SEM.

Push your SEM investigations to maximum image quality by opting for the Lanthanum Hexaboride (LaB_6) emitter, a proven technology that delivers more beam brightness for superior image resolution and noise reduction.

Experience imaging and analytical excellence on non-conductive samples with variable pressure operation. Benefit from a design that accommodates multiple analytical detectors to support demanding microanalysis applications.

Simpler. More Intelligent. More Integrated.

Class-Leading Usability

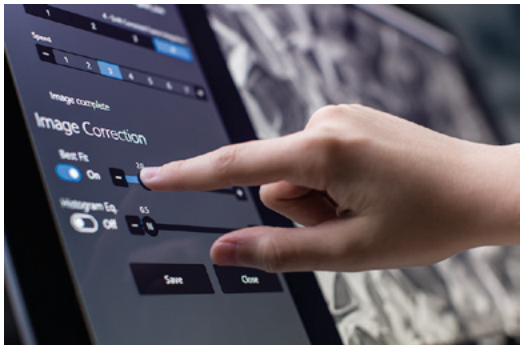
EVO caters to all users through implementation of two user interfaces: SmartSEM Touch and SmartSEM. SmartSEM Touch, which can run from a touchscreen, puts interactive workflow control directly at your fingertips. It is quick and easy to learn, dramatically reducing training effort and costs. Within minutes, even new users will begin capturing stunning images. This user interface also supports industrial operators who require automated workflows for repeatable inspection tasks. EVO's expert users will find all the functionality they need for advanced imaging by using the SmartSEM user interface, which runs directly from the instrument PC.

Excellent Image Quality

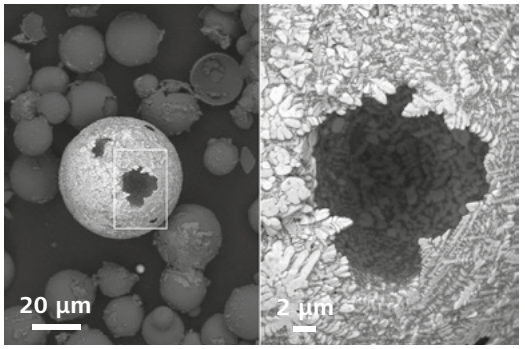
Image quality scales with how the sample is presented to the SEM. Variable pressure (VP) mode and our unique Variable Pressure and Current Cascade Secondary Electron (SE) detectors work together to deliver the best possible image quality for all non-conductive samples. And Extended Pressure mode, in combination with water vapor and C2DX detector, will safeguard data quality on hydrated and heavily contaminated samples, by allowing these samples to remain in their native state. Additionally, the LaB_6 emitter will give that extra bit of resolution, contrast and signal-to-noise that is particularly important when imaging and microanalysis get challenging.

Workflow Automation and Data Integrity

EVO plays well with others. Meaning: EVO can be configured to be part of a semi-automated multi-modal workflow, with tools for seamless relocation of regions of interest and integrity of data collected from multiple modalities. Combine EVO with Smartzoom 5, the ZEISS digital light microscope, or any other compound light microscope, and combine light and electron microscope data for material characterization or parts inspection. Or combine EVO with ZEISS light microscopes for correlative particle analysis.



SmartSEM touch provides even new users with the most intuitive access to imaging functions and predefined workflows.



Dual magnification, secondary electron images of a ferrocerium particle, acquired in high vacuum.

ZEISS EVO and the digital light microscope Smartzoom 5 combine to facilitate a correlative workflow.

Easy Operation for Both Experienced and Novice Users

No Sacrifice to SEM Productivity even in Multi-user Environments

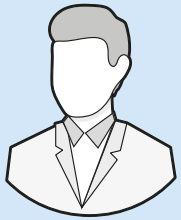
Depending on the actual laboratory environment, operation of the SEM can be the exclusive domain of expert electron microscopists. But this situation is challenged by the very common necessity that non-expert users, such as students, trainees, or quality engineers, also require data from the SEM. EVO takes both requirements into account, with user interface options that cater to the operational needs of experienced microscopists as well as non-micoscopists.

System administrator

This user is responsible for calibrating the system and preconfiguring parameters, and will have full access to the system controls.

Expert users
Preferred UI: SmartSEM

Expert users have access to custom image directories, advanced imaging parameters, and analysis functions. They can have their own custom profiles that are independent from other user profiles.



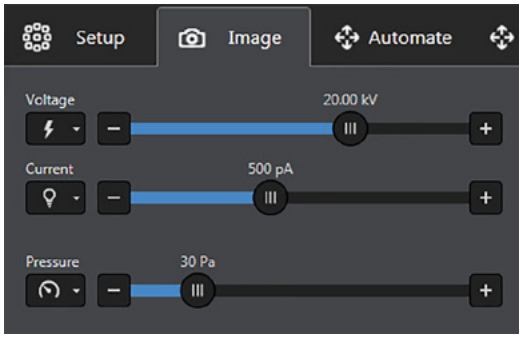
Novice users
Preferred UI: SmartSEM Touch

Novice users have access to custom image directories, predefined workflows and the most frequently used parameters—perfect for a beginner. They can have their own custom profiles that are independent from other user profiles.

EVO perfectly meets the needs of multi-user environments with interface controls and options for users of different experience levels and access privileges.

Intuitive Operation: SmartSEM Touch

SmartSEM is ZEISS' well-established operating system for experienced microscopists that provides user access to advanced microscope settings. And SmartSEM Touch is the highly simplified user interface developed specifically for the occasional operator who has very limited or no knowledge of operating an SEM. In as little as 20 minutes, novice users are up and running, producing their first SEM data. Laboratory managers can pre-configure parameters for recurring imaging routines, samples or parts, ensuring that novice users always use the exact same parameters for repeatable data acquisition.



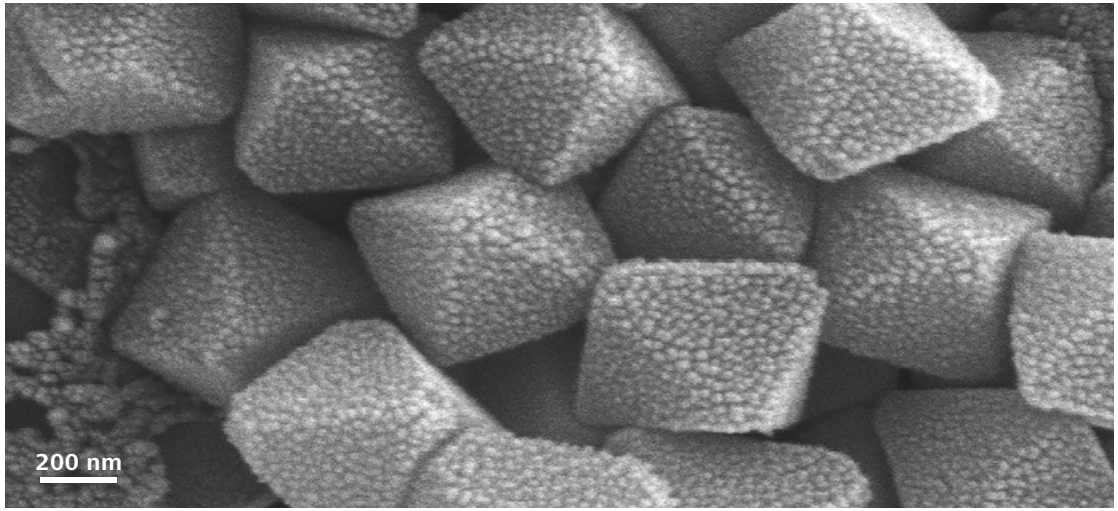
SmartSEM Touch: Intuitive user interface for access to presets, workflows, and imaging parameters

Class-Leading Data Quality

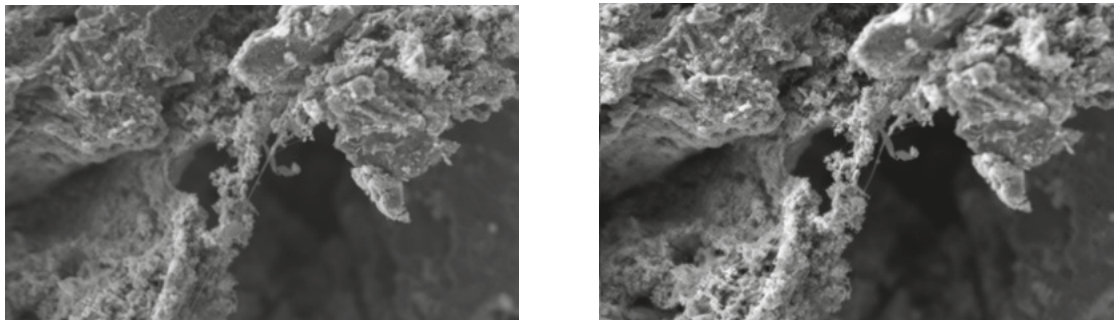
Better data with a lanthanum hexaboride (LaB_6) electron emitter

Electron emission from a lanthanum hexaboride cathode, rather than a traditional tungsten hairpin filament, provides the reassurance that every extra bit of image quality is there when you need it. While traditional thermal emission SEMs generate electrons from a superheated tungsten hairpin filament, there are distinct advantages to instead using a LaB_6 thermionic emitter. The pointed LaB_6 crystal emits approximately the same amount of electrons, but does so from a point source that is significantly smaller. The result is up to 10 times higher beam brightness. And that is a benefit you can put into action in two ways:

- At equivalent electron probe sizes (i.e. resolution), there is more probe current to work with, which makes image navigation and optimization much easier.
- Alternatively, at equivalent probe currents (signal-to-noise), the beam diameter is much smaller, resulting in enhanced image resolution.



Surface structure of framboidal pyrite. Imaging magnification of 100,000× translates to a horizontal field of view of approximately 3 µm. Image: courtesy of Joseph Dunlop, School of Earth & Environmental Sciences, University of Portsmouth.



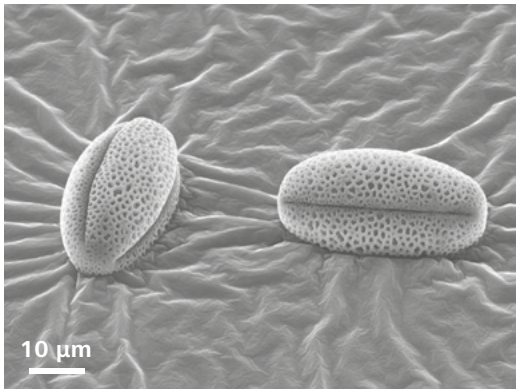
Catalyst particles imaged at high magnification and low kV (left Tungsten, right LaB_6). At challenging imaging conditions, LaB_6 users benefit from up to 10 times more beam brightness, resulting in improved image resolution and contrast. Horizontal field of view: 20 µm.

Sample Investigations with Challenging Requirements

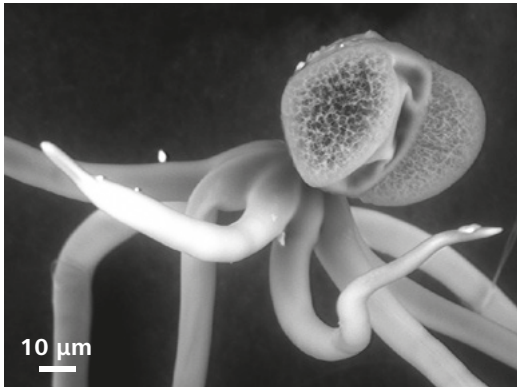
Wet or dirty samples? No problem!

EVO can be configured for operation at elevated vacuum chamber pressures with custom gases such as water vapor. This enables imaging samples in their natural hydrated state, without sample alteration that would affect data accuracy or even the information value. This extended pressure technology also prevents contamination from oily or uncleaned parts from making its way to the electron column, enabling you to safely examine parts for which a cleaning process would skew your investigative results.

Combine a Peltier cooling stage with the highly sensitive vacuum and humidity control of EVO and you will achieve stunning life science images. It's easy to move between vapor, liquid or ice, using the interactive phase diagram of water to control imaging conditions. You can perform both freezing and heating processes in the SEM vacuum chamber with the dovetail mounted stage that can be thermally controlled within the range of -30° to 50°C.



Freeze-dried pollen imaged at high vacuum conditions; SE detector, 10 kV



Tree pollen imaged with extended pressure and C2DX detector at near to 100% relative humidity.

SEM imaging can be used for plant classification using pollen as systematic classifier. Typically, pollen are prepared with classical critical point-drying and sputter coating procedures. Environmental imaging enables the imaging of near native samples without any of the preparation typically used for topographic investigations. It is clearly visible that under environmental conditions, shrinking artifacts are reduced.

Can't coat? That's fine, too.

While there are times when non-conductive samples or parts move to the SEM after application of a conductive surface layer, there are also imaging and analysis workflows that don't allow for any alteration to the sample or part—including coating. This is particularly true for multi-modal workflows, where parts move from instrument to instrument in the course of an investigation. EVO's VP mode provides a solution to neutralize charge on non-conductive surfaces, but this alone is not always enough to extract the best possible data quality, particularly when imaging for surface morphology (with secondary electrons) and performing microanalysis. EVO's C2D detector and BeamSleeve technology work together with VP mode as key solutions that further ensure high quality SEM data from uncoated, non-conductive samples or parts when preparation of such parts would compromise the results of a multi-modal workflow.

Designed for Workflow Automation and Data Integrity

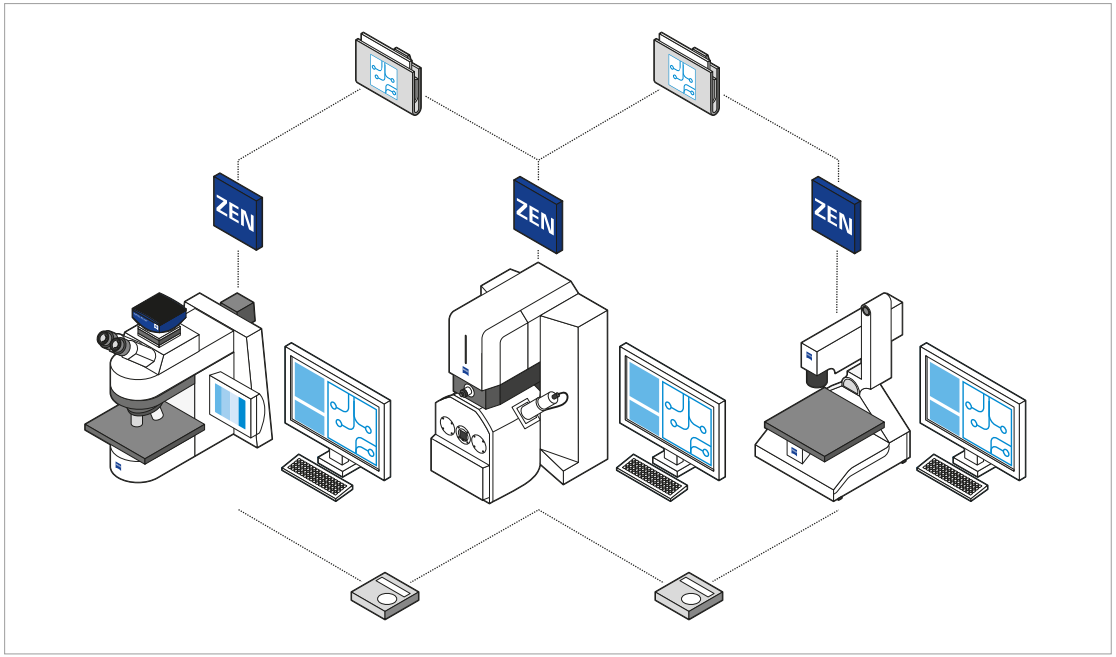
In many environments, whether academic or industrial, SEM material characterization is part of a workflow whereby samples are subjected to other imaging or analytical techniques, such as light microscopes or spectrometers. With ZEISS being the leading supplier of a wide range of microscopy and metrology systems, you can expect EVO to play extremely well with other ZEISS solutions.

Correlative Microscopy with Shuttle & Find

With Shuttle & Find, the ZEISS hardware and software interface for correlative microscopy, you can establish a highly-productive multi-modal workflow between (digital) light microscopes and EVO. Combine the unique optical contrast methods of your light microscope with the equally unique imaging and analytical methods of SEM to obtain complementary data, and hence more meaningful information about the material, quality or failure mechanism of your sample. Semi-automated relocation of regions of interest adds to ease of use and throughput. Shuttle & Find also stores data from multiple modalities in a single project folder.

ZEISS ZEN 2 core: Connected Laboratory Solution

ZEN 2 core is the image analysis software for EVO and other ZEISS microscopy solutions. Similar to SmartSEM Touch, the ZEN 2 core user interface is also optimized for ease-of-use and workflow automation. ZEN 2 core can archive data from any ZEISS system included in the multi-modal workflow to keep data together, from part to part, operator to operator, laboratory to laboratory or even location to location—meeting a key Industry 4.0 prerequisite for QA data integrity.

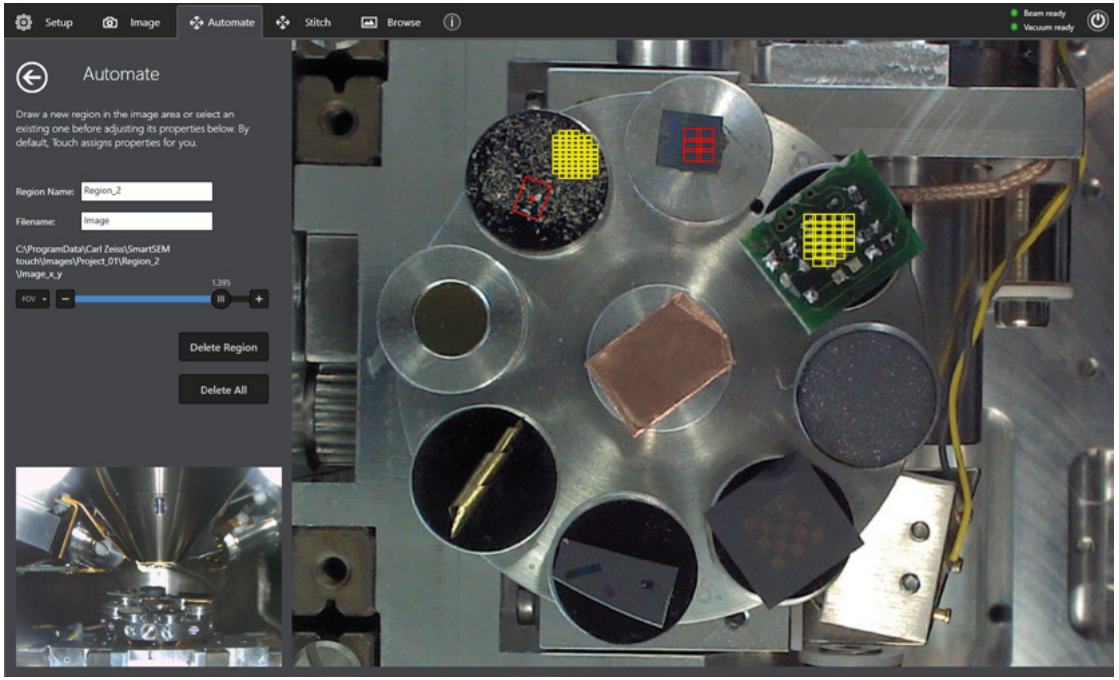


ZEN 2 core integrates EVO, compound light microscopes and digital microscopes into a correlative, multi-modal workflow.

Improved Productivity through Intelligent Navigation and Imaging

New ZEISS Navigation Camera

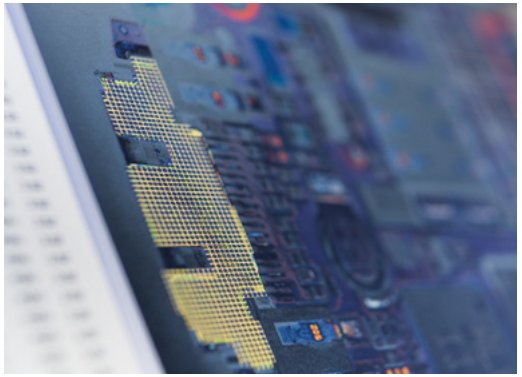
A camera can be mounted either to the chamber to monitor the position of the samples relative to the pole piece mounted backscattered detector (chamberscope); or on the vacuum chamber door (navigation camera) to enable a helicopter view of the arrangement of samples or parts on the sample holder. This view can then be used to set up predefined locations of interest identified from a light microscope image, and for easy navigation during the entire sample investigation process.



Navigation camera overview image with regions of interest marked for investigation

Automated Intelligent Imaging

EVO enables automated, unattended acquisition of images across sample batches. Available in SmartSEM, ZEISS Automated Intelligent Imaging is perfectly suited to routine inspection. It enables the user to define a boundary region, automatically generate regions of interest determined by the required field of view or magnification, and begin automated acquisition. Automated Intelligent Imaging will improve your sample throughput, boosting productivity and performance.



Automated Intelligent Imaging allows users to draw freeform areas of interest. ZEISS EVO then automatically acquires the dataset ready for review in ZEISS SmartBrowse.

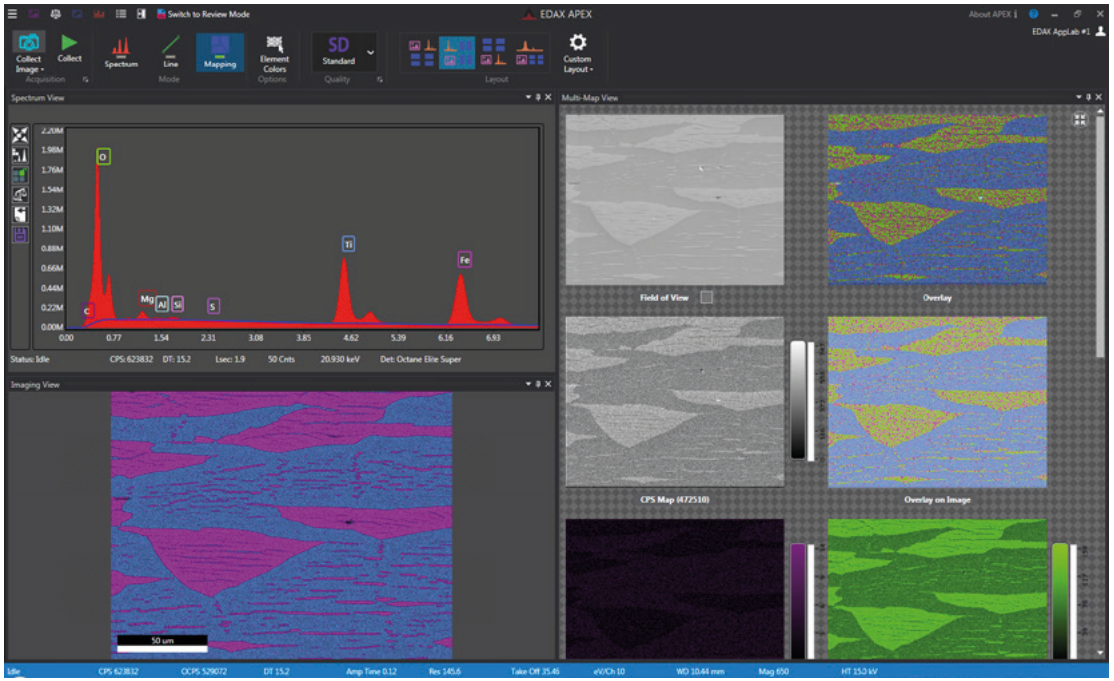
Integrated Energy Dispersive Spectroscopy Solution

EVO Element EDS

In addition to a wide choice of EDS solutions from suppliers such as Oxford Instruments, Bruker or EDAX, EVO can also be configured with the integrated EDS system, EVO Element. The integration improves usability by using only one PC to control both the EDS and the SEM. At the same time, parallel control is possible by having dedicated user interfaces for microscope and EDS control.

The EVO Element EDS solution is the integrated choice, with a price advantage due to this integration of components, and synergies in after-sales service and support. Particularly interesting for industrial customers, the ZEISS global service and application team will fully support the EVO Element system. There is no need to outsource support for the EDS system to a 3rd party.

The benefit of such synergistic effects is visible from a standard three-year warranty on all components of EVO Element, including the silicon-drift detector.



EVO Element: The integration improves usability by requiring only one PC to control both the EDS and the SEM.

GxP Compliance for Regulated Industries

Concern over digital data integrity is everywhere, with microscopy being no exception. The GxP module in ZEN 2 core meets the requirements of regulated industries, such as pharmaceutical or food, and helps you assure your systems are compliant with FDA CFR 21 Part 11 requirements. It is anticipated that other industries, like aerospace, also will require more stringent data regulation. So, when you select the EVO, you select the microscope that is already prepared for a more regulated future.

GxP Module

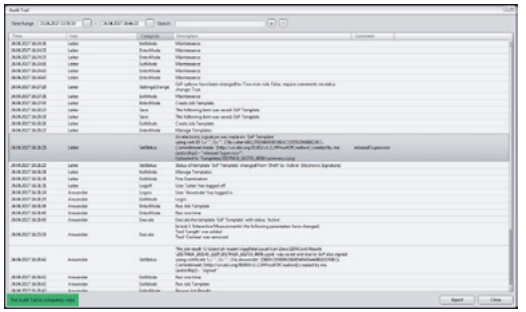
The GxP module meets the requirements of regulated industries, such as pharmaceutical or food, and helps you assure your systems are compliant with FDA CFR 21 Part 11 requirements. This module lets you audit every single step in your workflow. You have the advantage of using many different tools and functionalities in combination with the required qualification and validation activities to maintain CFR compliance for your images, tables and reports.

ZEN 2 core Provides the Following GxP Functionality:

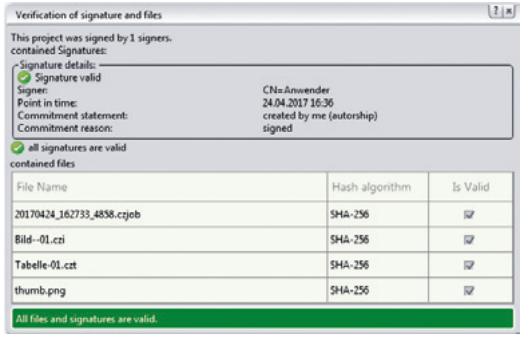
- Digital signature
- Audit trail
- Check sum
- User management
- Disaster recovery
- Release procedures of workflows

Attention for IQ/OQ

Regulation compliance requires more than GxP software functionality. GxP compliance also includes a meticulous process of qualifying the installation and operation of the analytical systems subjected to qualification (IQ/OQ). Contact your ZEISS representative to learn more about GxP compliance solutions, and the OQ and IQ services ZEISS can either provide or orchestrate.

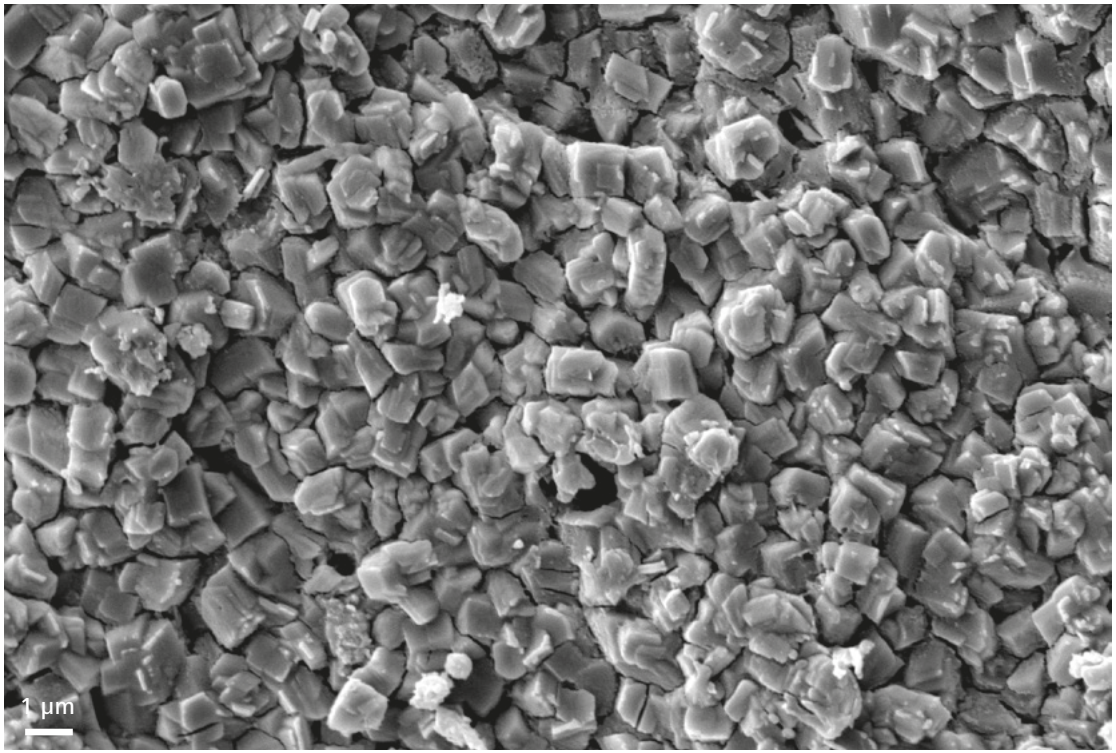


The GxP Module offers all functionalities that are needed for CFR compliance, such as an audit trail of all user activities.



Verification of signature and files

ZEISS EVO at Work: Manufacturing & Assembly Industries



Zinc-phosphate E-coating, imaged with SE detector in high vacuum. Horizontal field width approximately 20 µm.

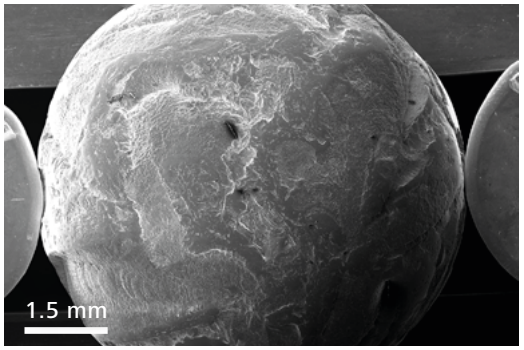
Typical Tasks and Applications

- Quality analysis / quality control
- Failure analysis / metallography
- Cleanliness inspection
- Morphological and chemical analysis of particles to meet ISP 16232 and VDA 19 part 1 & 2 standards
- Analysis of non-metallic inclusions

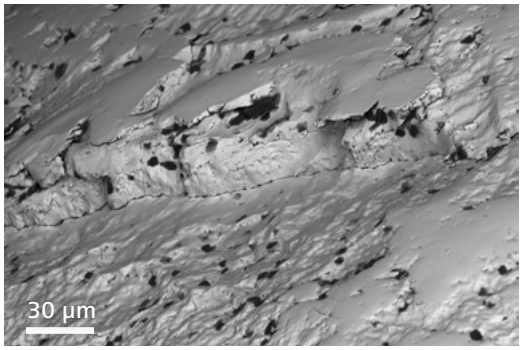
How You Benefit from ZEISS EVO

- Sample flexibility with three chamber size options; samples weighing up to 5 kg; samples up to height of 210 mm and width of 300 mm.
- Intelligent imaging and automated workflows for efficient user interaction
- Optimized settings for each sample type
- Variable pressure (VP) technology for imaging of non-conductive composite materials, fibers, polymers and textiles
- Enhanced data quality from VP imaging with the C2D secondary electron detector
- Fully integrated particle analysis and identification solution for advanced morphology and chemical analysis (SmartPI)

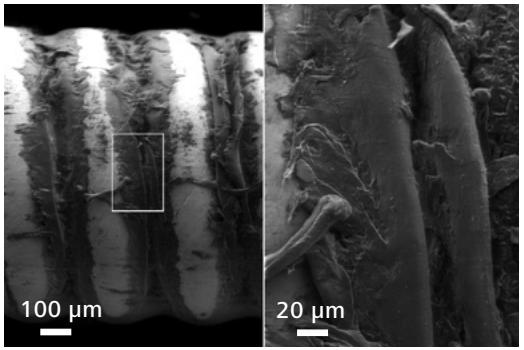
ZEISS EVO at Work: Manufacturing & Assembly Industries



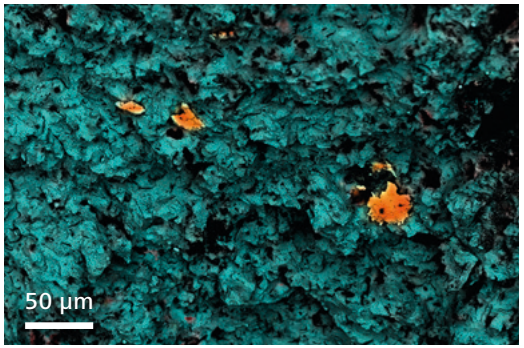
A stitched image shows high resolution and wide field of view of a ball bearing exhibiting characteristic wear patterns. Imaged at 20 kV with the SE detector.



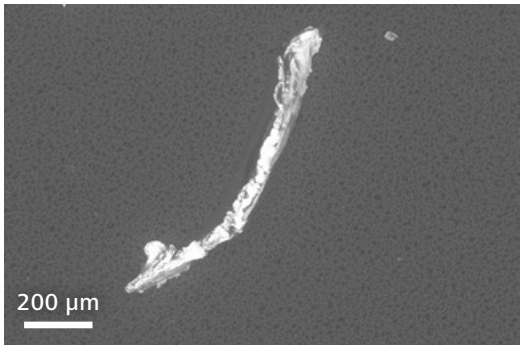
Surface of the ball bearing imaged with the BSE detector reveals cracking and flaking of the surface structure.



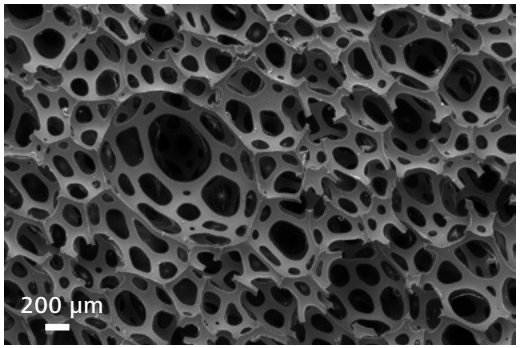
Guitar string showing the copper coil wound around a metal string, and coated with a polymer coating. Imaged in Variable Pressure mode with the C2D detector at 7 kV.



EDS map of fractured sample showing fragments of tin (orange) against the iron (blue) background. Sample: courtesy of J. Scott, West Mill Innovation, UK.

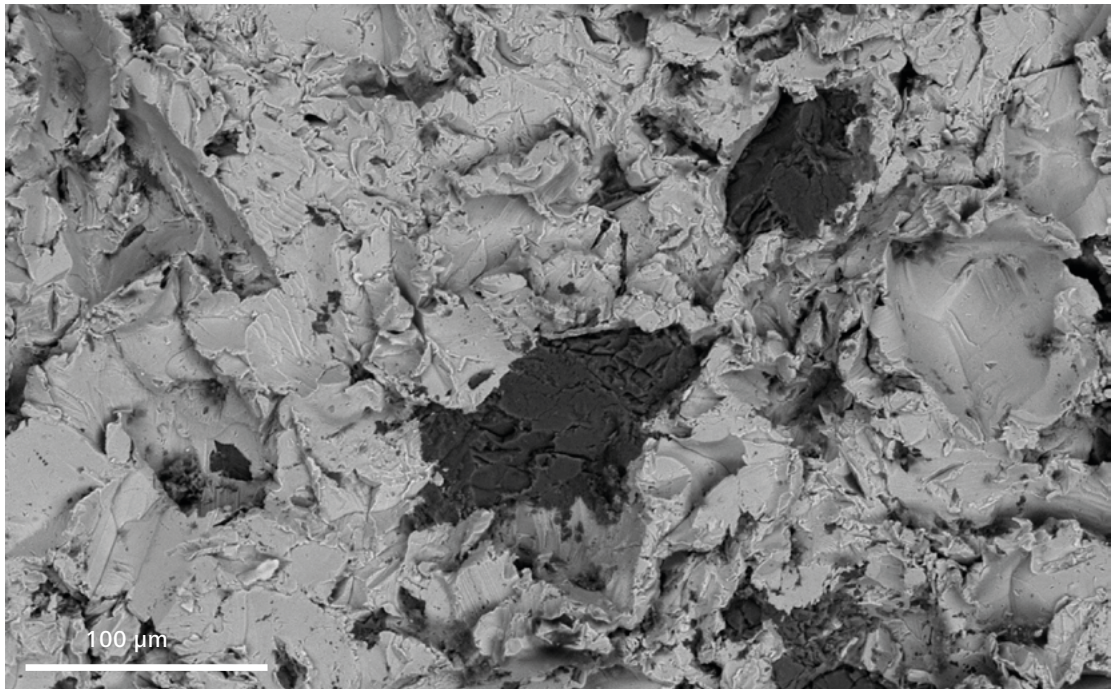


Particle from a particle filter imaged with the BSE detector during a quality control task to analyze the cleanliness of an industrial process.



Car seat cushion foam, imaged uncoated in Variable Pressure mode with the BSE detector.

ZEISS EVO at Work: Steel and Other Metals



Surface of S355 steel after grit blasting with F80 grit alumina. Imaged with the BSE detector on EVO 15. Sample: courtesy of TWI Ltd, UK

Typical Tasks and Applications

- Imaging and analysis of the structure, chemistry and crystallography of metallic samples and inclusions
- Phase, particle, weld and failure analysis

How You Benefit from ZEISS EVO

Obtain crisp, clear compositional and crystallographic information from ferritic, austenitic, martensitic or duplex steels and advanced alloys with EVO's best in class Backscattered Electron (BSE) detector.

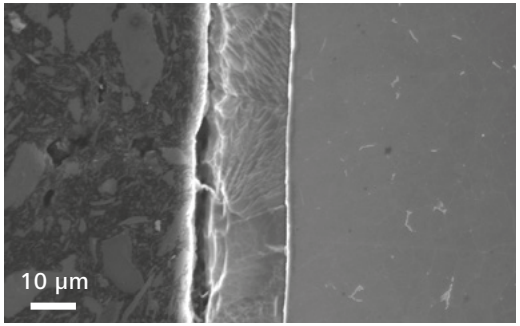
Take advantage of EVO's easy access chamber door and robust stage to add tensile testers, nanoindenters and heating modules for advanced characterization of metallic samples.

EVO's class leading EDS geometry provides for high throughput, high accuracy X-ray analysis.

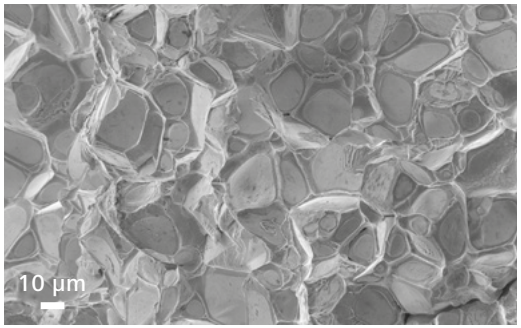
In addition, its flexible port configurations provide for coplanar EBSD for microstructural characterization of grain boundaries, phase identification, strain and slip system activity.

Unparalleled beam stability allows stable operation for long EDS and EBSD collection runs on large area samples, to consistently deliver reliable and repeatable results.

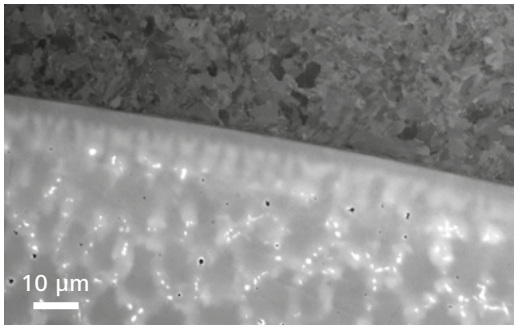
ZEISS EVO at Work: Steel and Other Metals



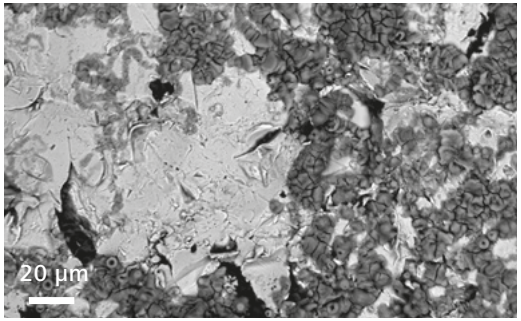
Cross section of galvanised mild steel, imaged using the SE detector on EVO 15. Left: mounting resin; middle: zinc layer; right: mild steel.



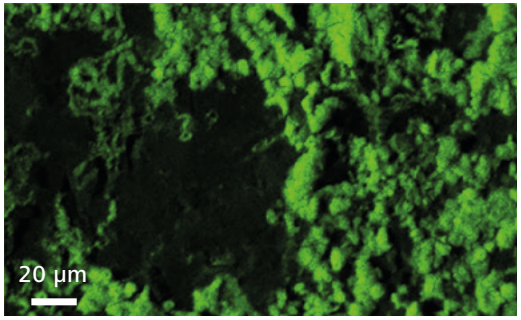
Advanced alloy material shows tungsten core material surrounded by a steel matrix. Imaged at 7 kV with the C2D detector.



Alloy 625 weld overlay on 8630 steel viewed using BSD detector on a ZEISS EVO 15. Sample provided by TWI Ltd.



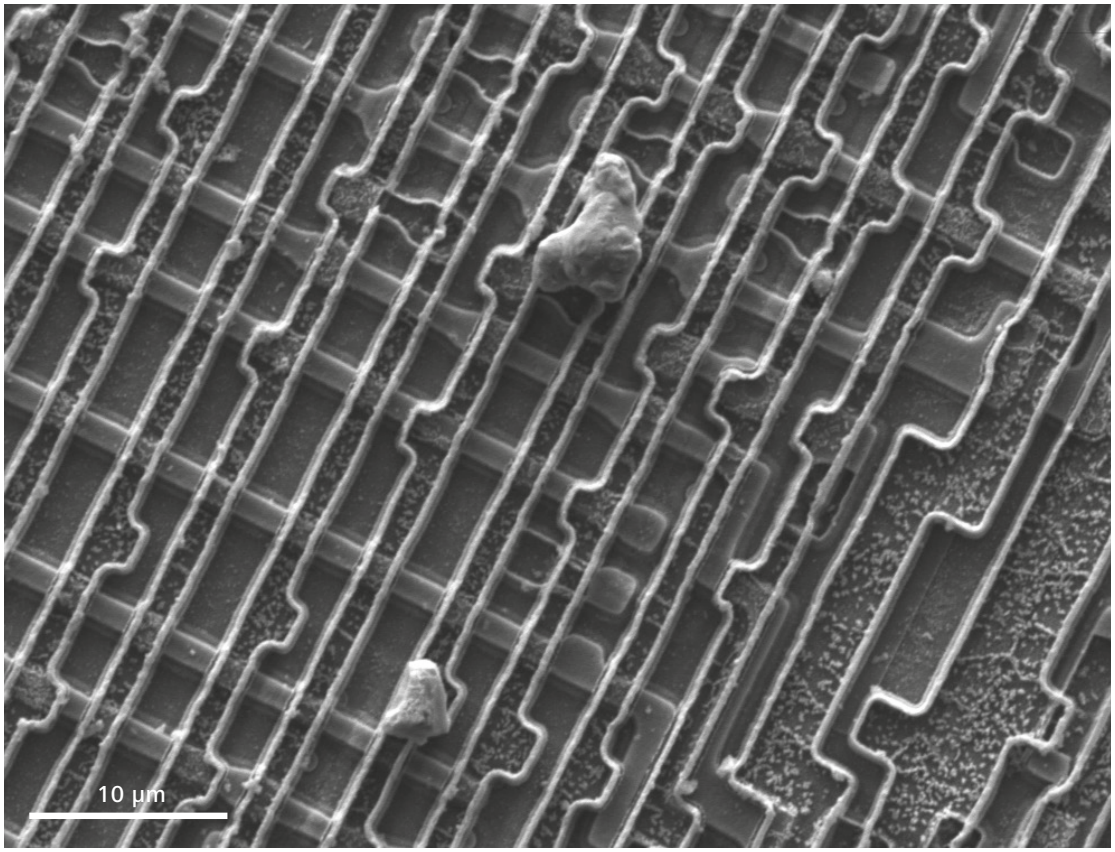
Corroded region of mild steel, imaged with BSE detector in a ZEISS EVO 15



Corroded mild steel oxygen map. Region of interest corresponds to backscattered electron image to left.

Surface of titanium alloy (Ti-6Al-4V) additively manufactured using selective laser melting, showing fully melted regions alongside unmelted Ti-6Al-4V particles and other material. Imaged with BSE detector on ZEISS EVO 15. Sample provided by TWI Ltd.

ZEISS EVO at Work: Semiconductors & Electronics



Debris and contamination is evident on the surface of an integrated circuit. Imaged with the SE detector in high vacuum at 10kV.

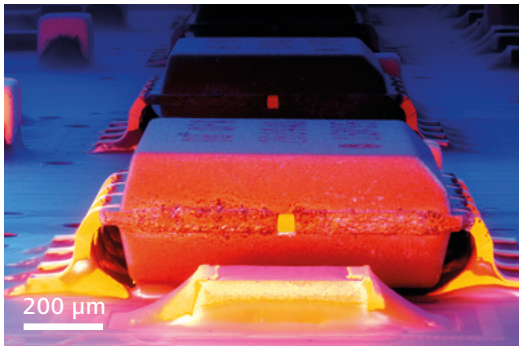
Typical Tasks and Applications

- Visual inspection of electronic components, integrated circuits, MEMS devices and solar cells
- Copper wire surface and crystal structure investigation
- Metal corrosion investigations
- Cross-sectional failure analysis
- Bonding foot inspections
- Capacitor surface imaging

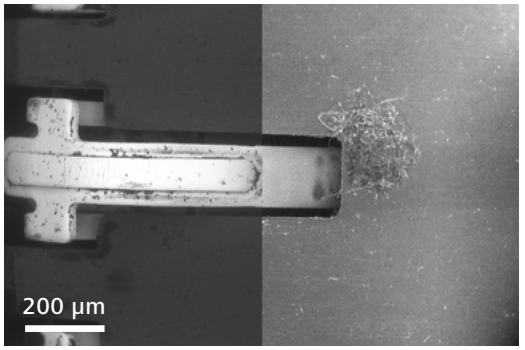
How You Benefit from ZEISS EVO

The range of detectors, including BSE and C2D, provide superb high contrast topographic and compositional imaging in VP mode for semiconductor materials without charging artifacts.
The optional Beam Deceleration system provides highest resolution at lowest accelerating voltages, allowing you to visualize true surface details of solar cells and integrated circuits.
The flexibility of EVO allows many third-party testing and analysis modules to be utilized, including EBIC and nanoprobes for characterizing p-n junctions and IC failure analysis.

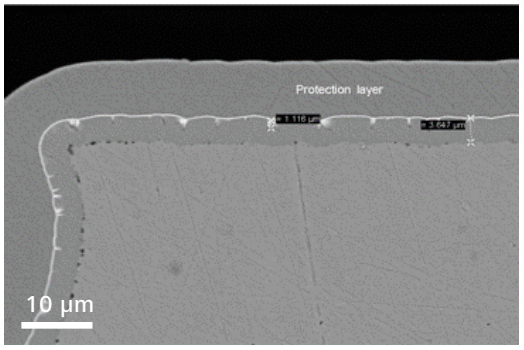
ZEISS EVO at Work: Semiconductors & Electronics



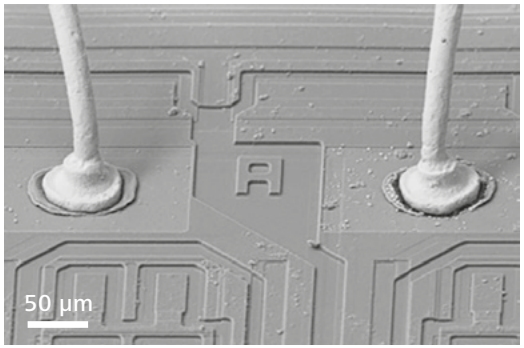
False-colored image of components mounted on a PCB aids visualization during routine inspection.



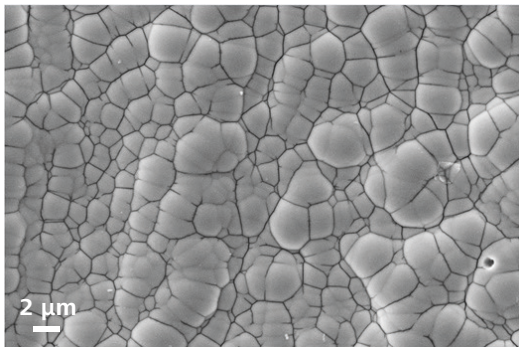
BSE image (left) and SE image (right) of the gold on nickel plated SIM card contact and the UL94V high temperature liquid crystal polymer (LCP) housing.



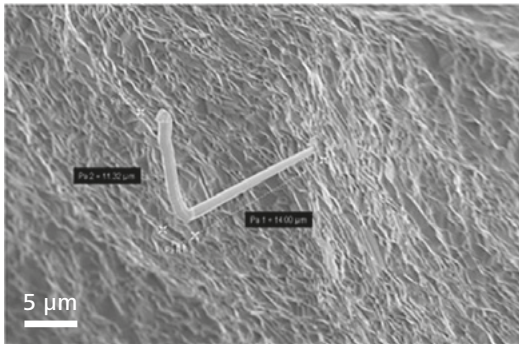
BSE image of a cross section, revealing the different compositional layers.



Wire bond inspection using secondary electron imaging in high vacuum or variable pressure mode.

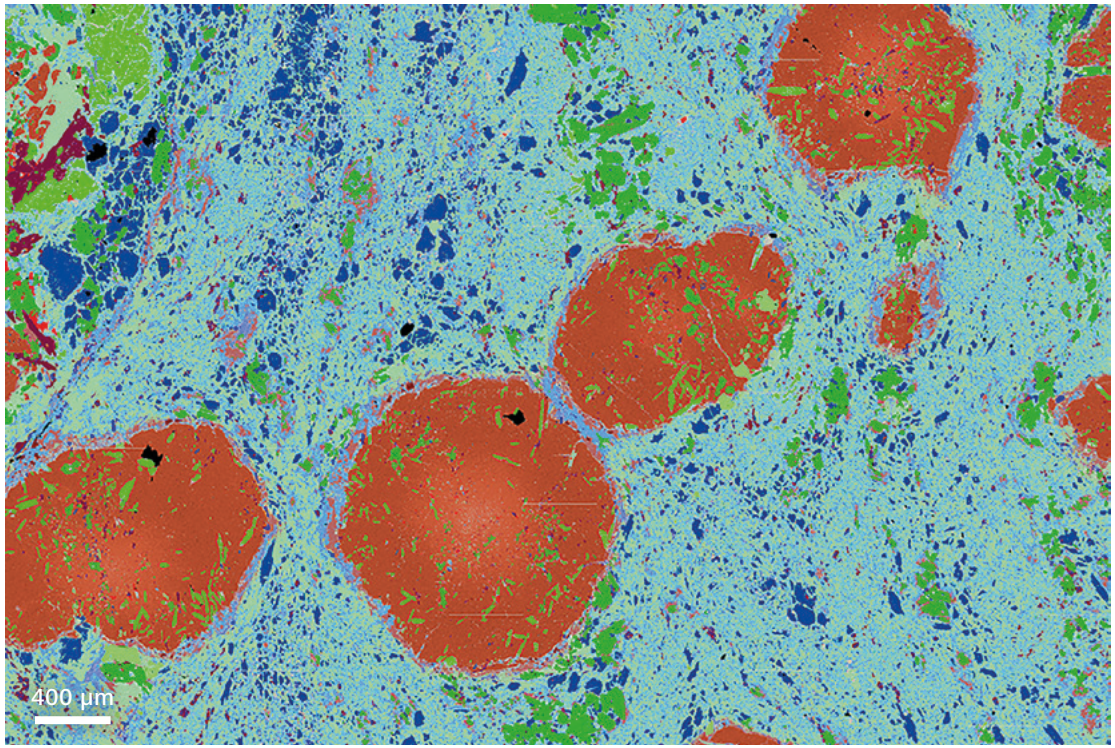


Corroded Nickel layer imaged with secondary electrons.



SE image revealing whisker growth on an electronic device.

ZEISS EVO at Work: Raw Materials



Mineralogic mineral map of blueschist. Sample: courtesy of S. Owen

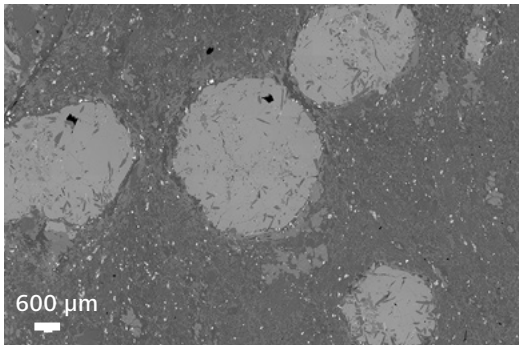
Typical Tasks and Applications

- Morphology, mineralogy and compositional analysis of geological samples
- Imaging and analysis of the structure metals, fractures, and nonmetallic inclusions
- Morphological and compositional analysis of raw chemicals and active ingredients during micronization and granulation processes

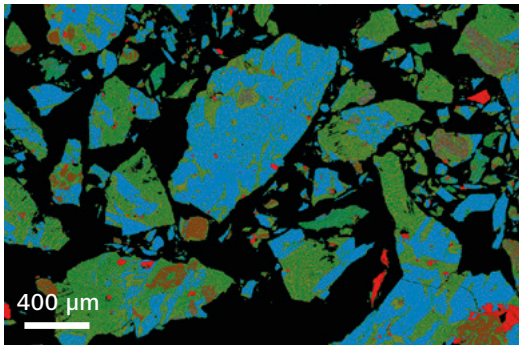
How You Benefit from ZEISS EVO

The high stability analytical design, three chamber sizes, flexible port configuration options and compatible, integrated mineral analysis software make EVO—without question—the best instrument for natural resource characterization.
Image core samples in VP mode with both the C2D and BSE detector to obtain maximum structural and compositional information.
Obtain clear compositional and crystallographic information from duplex steels and advanced alloys with EVO's best in class BSE detector.
Boost the performance of EVO with the ZEISS cathodoluminescence (CL) detector for clear, streak-free imaging of carbonates.

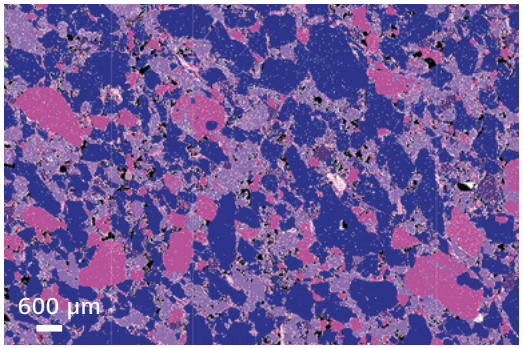
ZEISS EVO at Work: Raw Materials



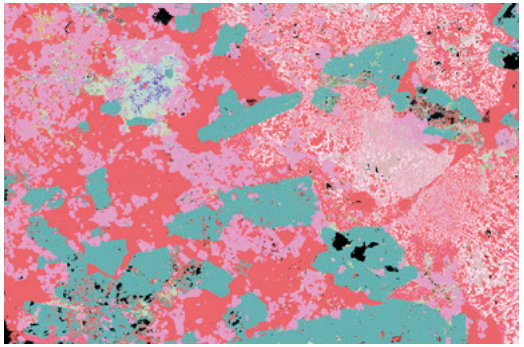
Blueschist imaged with the BSE detector.



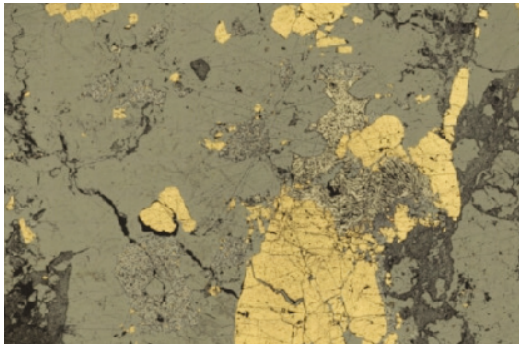
Residual copper slag particle from large Zambian copper smelter. Courtesy of Petrolab, UK



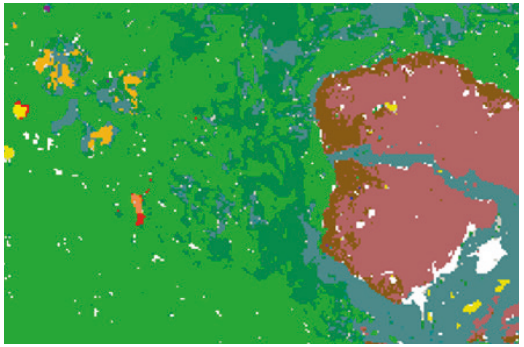
ZEISS Mineralogic mineral map of sandstone reservoir rock



Peralkaline Granite, Northern Quebec, Canada, containing rare earth elements, including a fluorite vein that crosscuts the sample and zoned zircons.

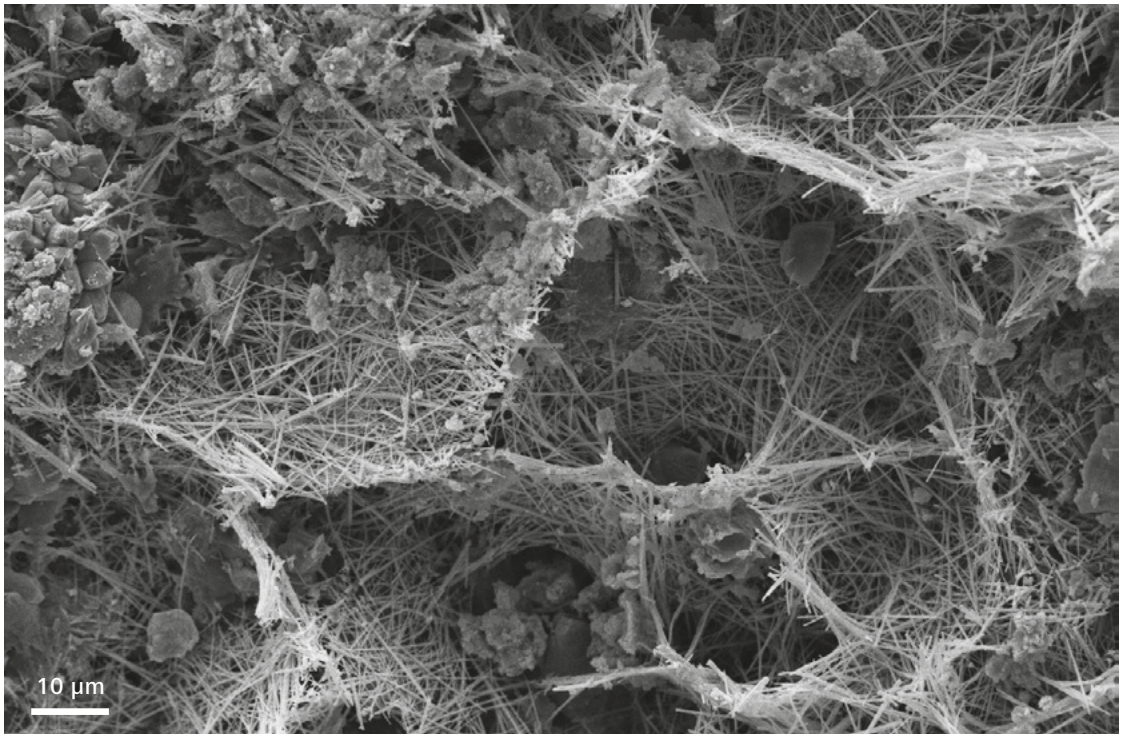


Analysis of metals with Mineralogic Mining. Gold mineralization in association with sulfide veining, in particular with sphalerite. Courtesy of Prof. Simon Dominy, Curtin University, Australia



High resolution map of a PGE-rich podiform chromite prospect. Courtesy of Dr. Chris Brough and University of Cardiff, Wales

ZEISS EVO at Work: Materials Science Research



Self-healing concrete, 12kV, HV mode. The SE detector reveals the mineral expansion and crack-bridging network of self-healing concrete. Image: courtesy of Tanvir Qureshi, University of Cambridge, UK.

Typical Tasks and Applications

- Characterization of both conductive and non-conductive material samples for research purposes

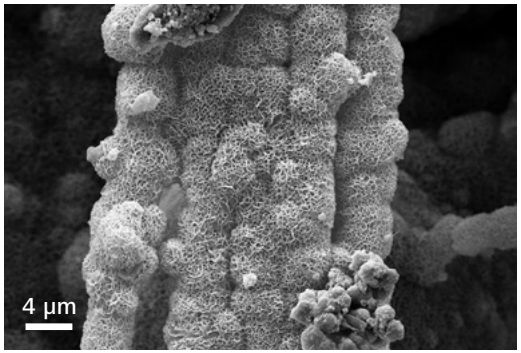
How You Benefit from ZEISS EVO

EVO has been designed to accept a wide range of imaging detectors. Equipped with SE and BSE detectors, Beam Deceleration and coplanar EDS and EBSD geometry, EVO is a flexible research tool for materials analysis.

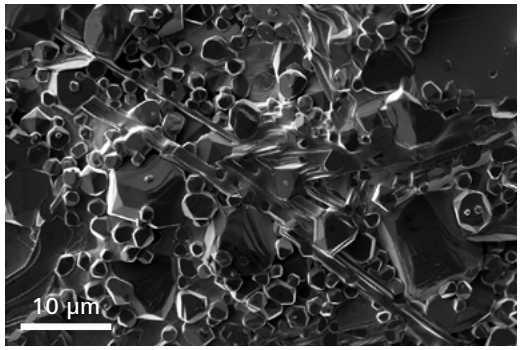
Switching between high vacuum and variable pressure modes of operation is quick and easy, allowing investigations of both conductive and non-conductive samples.

The latest ZEISS detector technology, including Cascade Current Detector (C2D) and Extended Range Cascade Current Detector (C2DX), provides outstanding imaging of polymers, plastics, fibers and composites when operating in extended pressure mode and a water vapor environment.

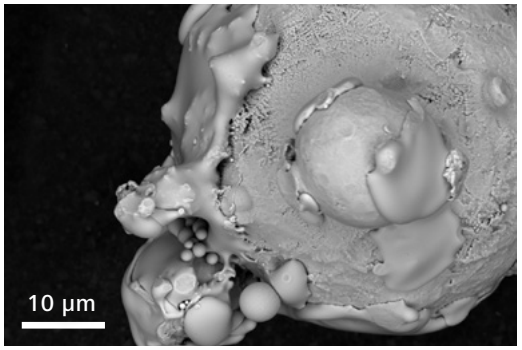
ZEISS EVO at Work: Materials Science Research



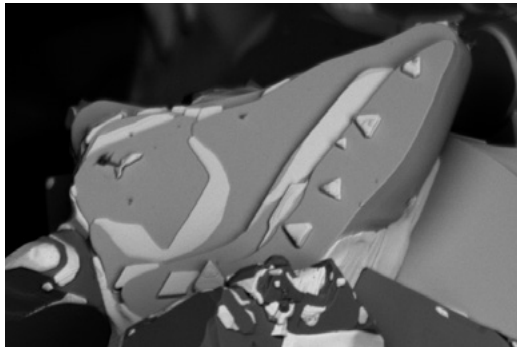
Expansion and crack bridging network of self-healing minerals, imaged using SE detector at 12 kV shows flower-like hydro-magnesite structures is formed.



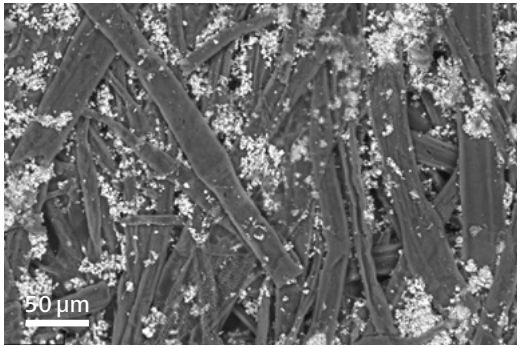
Aerospace composite material imaged with the C2D detector at 10 kV in VP mode.



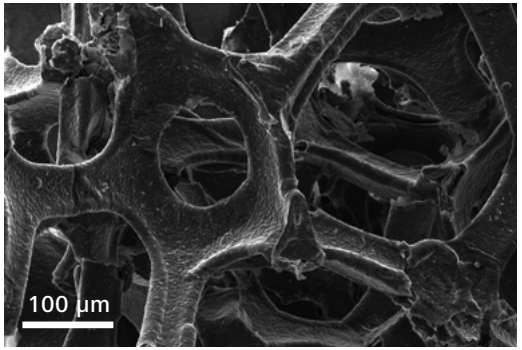
SE image of stellite particles, a non-magnetic and corrosion resistant cobalt alloy, used in hardfacing and acid-resistant machine parts. Imaged at 15 kV with the BSE detector.



A BiCaCo ceramic is imaged with the low-kV BSE detector at an energy of 5 kV, strong material contrast is delivered by BSEs.

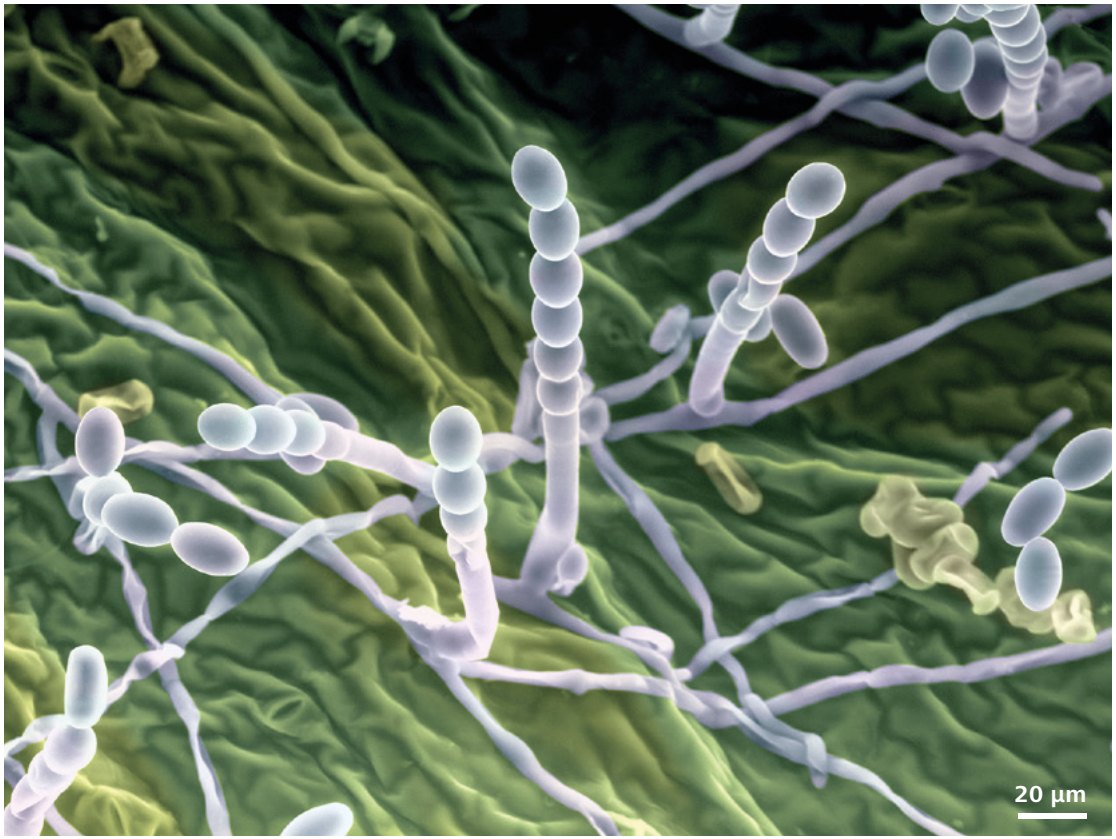


Printer paper imaged at 20 kV and 40 Pa air with the BSE detector.



Graphene foam structure from a battery assembly, imaged in high vacuum with SE detector.

ZEISS EVO at Work: Life Sciences



False-colored image of mildew on the surface of a leaf. Imaged with C2DX detector at 570 Pa water vapor at 1°C, 20 kV.

Typical Tasks and Applications

- Research into plants, animals and micro-organisms

How You Benefit from ZEISS EVO

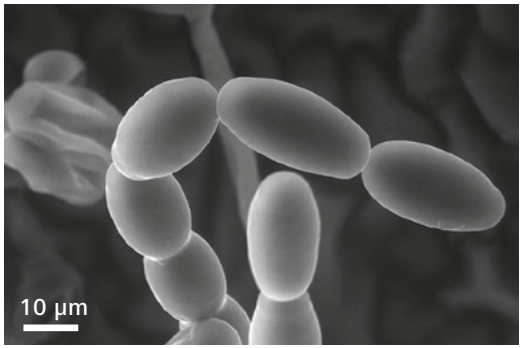
EVO is a true environmental SEM, allowing specimens to be examined in their natural state under a range of water and air conditions. EVO supports cryo and STEM imaging.

The suite of variable pressure and extended pressure detectors including BSE, VPSE-G4, C2D and C2DX, offer unparalleled imaging of biological specimens.

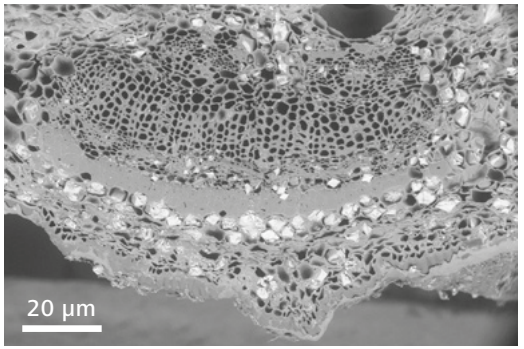
Image delicate hydrated biological specimens with the C2DX detector, which delivers excellent images at high pressures in water vapor.

Obtain highly detailed images of tissue samples without the need for active cooling by imaging samples in dynamic equilibrium in water vapor with the BSE detector and EVO.

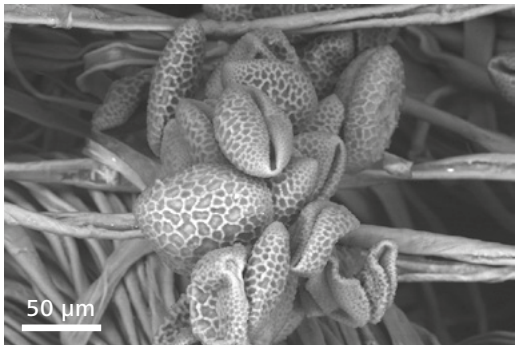
ZEISS EVO at Work: Life Sciences



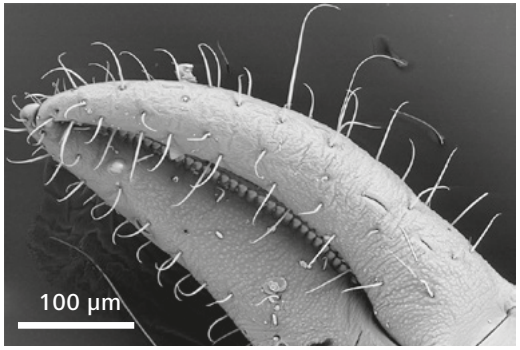
Mildew on the surface of a leaf. The mildew was not critical point-dried or coated. Imaged with C2DX detector at 570 Pa water vapor at 1°C, 20 kV.



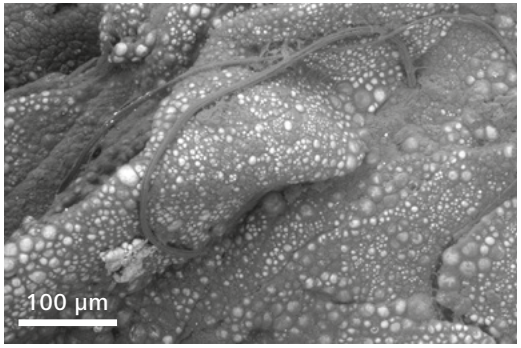
Cellular structure of cross-section of orange, imaged with the BSE detector at 5 kV and 110 Pa variable pressure mode.



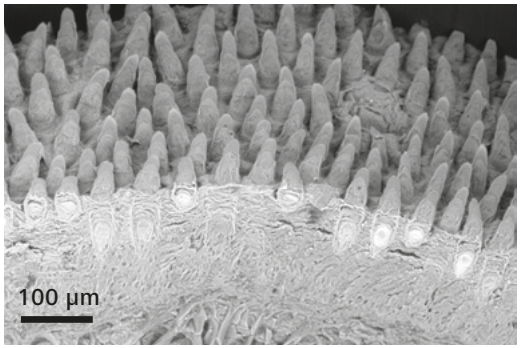
Pollen imaged at extended pressure does not require time-consuming sample preparation workflows. Imaged with BSE detector at 5 kV, 30 Pa air.



Detail of a pseudoscorpion, imaged with BSE detector under high vacuum at 20 kV.

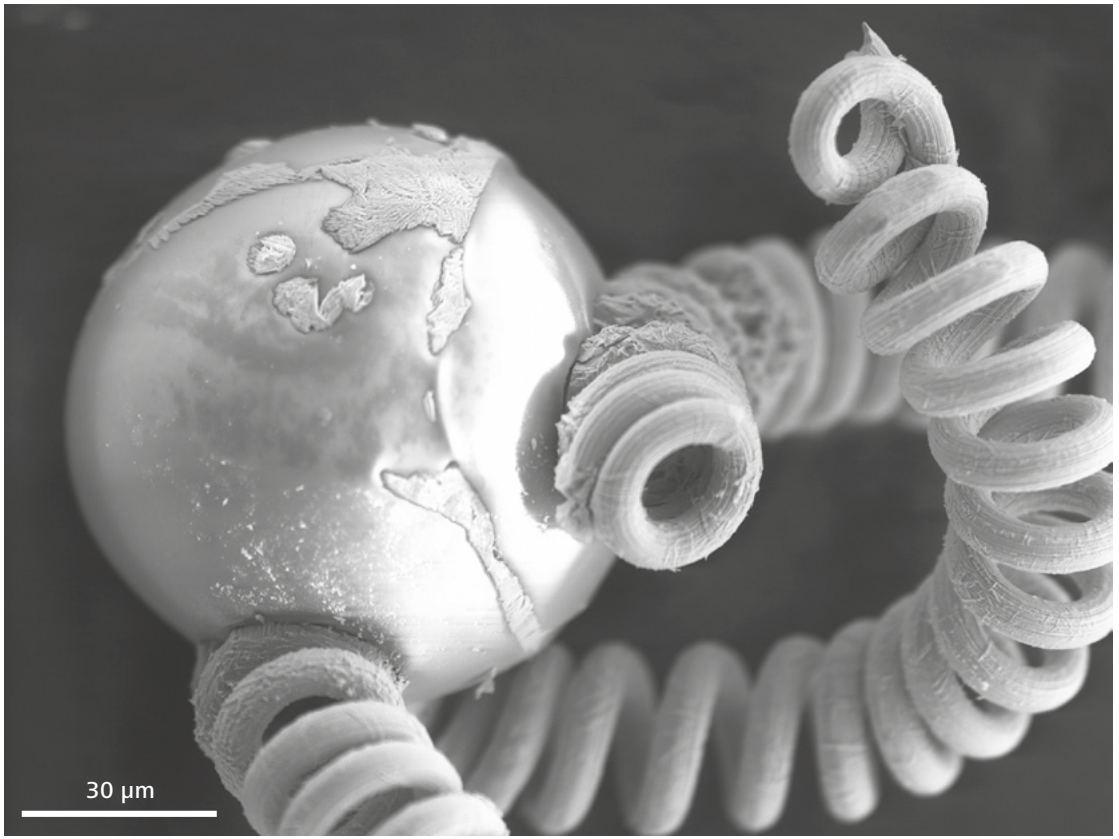


Brown adipose tissue (BAT) from a kidney tissue sample, imaged without cooling in dynamic equilibrium in water vapor. Imaged with the BSE detector at 285 Pa variable pressure mode. Sample: courtesy of R. Reimer, Heinrich Pette Institute, Germany.



A cross-section of mouse tongue, imaged with the BSE detector at 266 Pa variable pressure mode. Sample: courtesy of R. Reimer, Heinrich Pette Institute, Germany.

ZEISS EVO at Work: Forensics



Molten glass solidified on a tungsten fragment indicate the bulb was active at the time of the incident. Imaged with the C2D detector at 20 kV, 30 Pa.

Typical Tasks and Applications

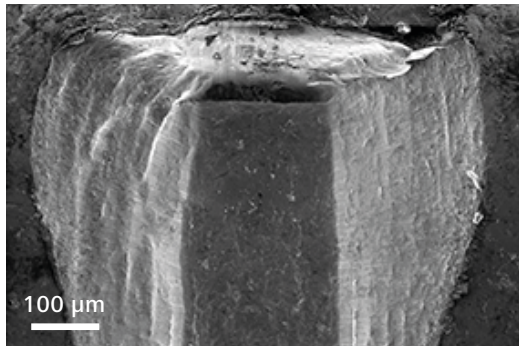
- Gunshot residue (GSR)
- Paint and glass analysis
- Bank note and coin forgery
- Hair and fiber comparisons
- Forensic toxicology

How You Benefit from ZEISS EVO

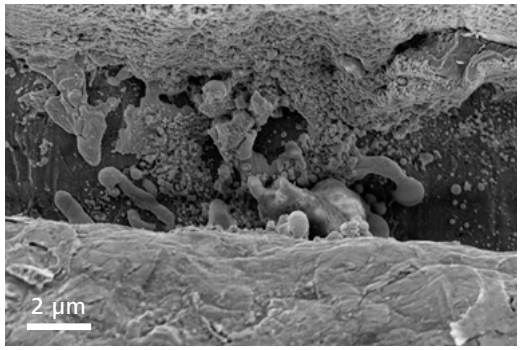
With its range of variable pressure and extended pressure detectors, EVO delivers consistent crisp imaging of samples with minimal sample preparation.

EVO's class leading EDS geometry provides for high throughput GSR analysis. EVO is compatible with third-party specialized GSR analysis software. EVO offers the added benefit of environmental electron microscopy so that samples can be imaged in their original condition.

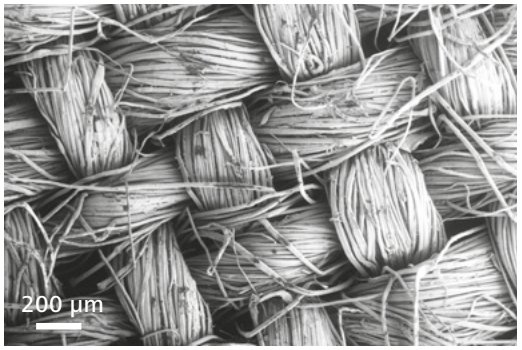
ZEISS EVO at Work: Forensics



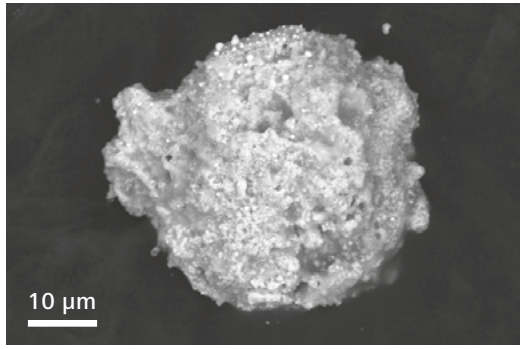
The mark from a firing pin on a gun casing can be used to help identify the weapon used. Imaged with the SE detector at 10 kV.



Solidified molten fragments from a catastrophic explosive event can be used to determine its source.



The C2D produces excellent images of uncoated samples in variable pressure mode, perfectly suited to forensic fiber comparisons.



BSD image of gunshot residue (GSR) particle at 20 kV. Sample: courtesy of I. Tough, Robert Gordon University, Aberdeen, UK.

Expand Your Possibilities: The EVO Family

Flexible Chamber and Stage Design

A choice of three chamber sizes and two stages lets you arrive at a tailor-made solution to your SEM imaging and microanalysis requirements. How much space do you need? Choose the design to not only accommodate the largest samples or parts you may experience in your work environment, but also with the space around the exterior of the vacuum chamber to fit cameras or detectors.

Standard stage

Large Z stage

The EVO stages offer large weight bearing capabilities independent of the chamber type. The flexible stage design allows you to add or remove spacers, and even remove the Z tilt and rotate module, to offer full x, y movement of the complete base platform.

	ZEISS EVO 10	ZEISS EVO 15	ZEISS EVO 25
	Choose EVO 10—with optional backscatter detector and Element EDS system—to be your entry point to scanning electron microscopy, at a remarkably affordable price. Even this smallest of EVO vacuum chambers is well differentiated from tabletop SEMs. Your investment in EVO now assures that you are ready for applications that require more space and ports than you anticipate today.	EVO 15 demonstrates the flexibility concept of the EVO family and excels in analytical applications. Opt for the larger vacuum chamber of the EVO 15, and add variable pressure for imaging and analysis of non-conductive samples or parts, and you have a versatile, multi-purpose solution for central microscopy facilities or industrial quality assurance laboratories.	EVO 25 is the industrial workhorse solution with enough space to accommodate even the largest parts and assemblies. Expand EVO 25 capabilities further with an optional 80 mm Z travel stage that can handle weights up to 2 kg even with tilt. Additionally, the large chamber will accommodate multiple analytical detectors for the most demanding microanalysis applications.
Maximum specimen heights (mm)	100	135	210
Maximum specimen diameter (mm)	200	250	300
Motorized stage travel XYZ (mm)	80 x 100 x 35	125 x 125 x 50	130 x 130 x 50 (or 80)

Expand Your Possibilities: Choose Your Vacuum System

Any electron microscope requires vacuum for the electron beam to not only travel through the optical column, but also within the vacuum chamber to reach the sample or part located on the specimen stage. However, EVO has been designed to allow up to 3000 Pa in the vacuum chamber. This extends the application of the EVO to imaging and microanalysis of non-conductive samples using variable pressure mode, which is important for samples or parts that cannot be coated with a thin, conductive carbon or metal film. And it allows EVO to easily accommodate hydrated and heavily contaminated samples (e.g. oily) when equipped with optional through-the-lens (TTL) differential pumping to enable extended pressure mode.

High Vacuum only

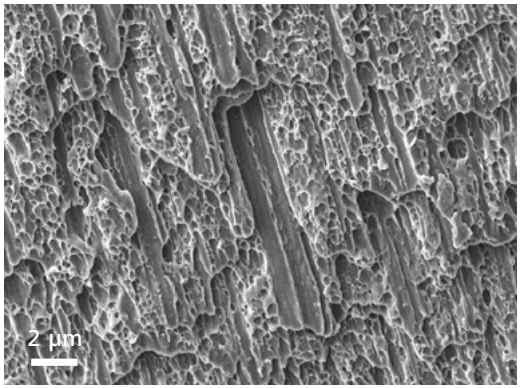
High vacuum in the order of 10^{-5} mbar typically means samples or parts are presented to the SEM with a conductive surface – native in the case of metals, or applied as a thin carbon or metal film on the surface of non-conductive samples. High vacuum delivers the best quality image and analysis data as the electron beam remains coherent when traveling in high vacuum through the column to the vacuum chamber.

Variable Pressure (VP mode)

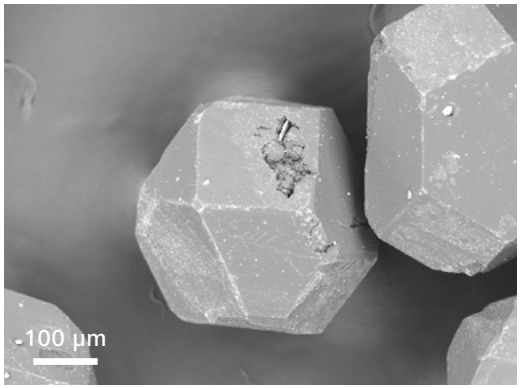
When high quality imaging and analysis are needed on uncoated, non-conductive samples or parts, such as those being imaged in a multi-modal workflow, choose EVO with VP mode. VP mode uses a gas in the vacuum chamber to trigger a process of gas ionization that will neutralize charge build-up on the surfaces of non-conductive materials.

Extended Pressure (environmental mode)

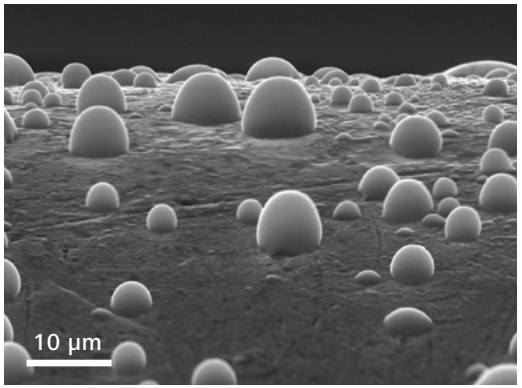
Variable pressure also can be taken to the extreme, by choosing through-the-lens (TTL) pumping and water vapor in the specimen chamber, to work at even higher gas pressures. This allows imaging at relative humidity up to 100% of hydrated samples in their natural state. This vacuum configuration is also recommended for heavily contaminated parts, where through-the-lens pumping will prevent contamination from reaching the optical column.



Stainless steel fracture surface, imaged with secondary electrons in high vacuum; horizontal field of view 20 µm.



Synthetic diamond revealing a defect and inclusion, imaged with the BSE detector in Variable Pressure mode.



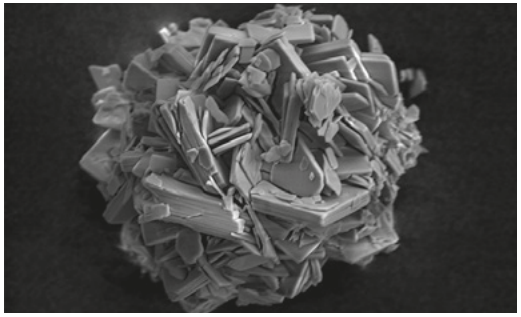
Water droplets imaged on a Teflon® sample using ZEISS EVO with C2DX detector. Beam voltage: 20 kV; chamber pressure: 630 Pa; water vapor at 0.9°C

Expand Your Possibilities: Choose Your Detectors

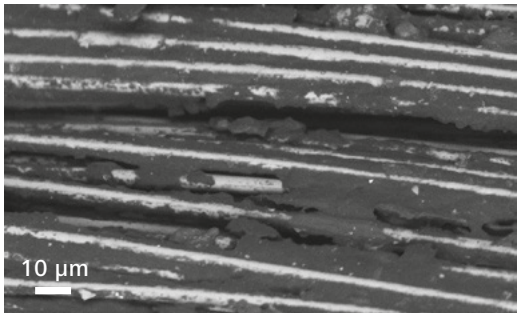
Secondary Electron Detectors
Standard on every EVO is the traditional scintillator-type Everhart-Thornley secondary electron detector with a biased grid, for use in high vacuum.
For secondary electron detection from non-conductive samples or parts in VP mode, add the C2D or VPSE detector.
For secondary electron detection at extended pressures in a gaseous (water vapor) environment, choose the C2DX detector.

Backscattered Electron Detectors
Opt for the 4 quadrant BSE detector for both high vacuum and variable pressure. The quadrants can be selected individually, mixed or subtracted to accentuate surface morphology from the angular nature of backscattered emission.
Choose a 5 quadrant solid state BSE detector, which adds a 5th element to the side of the detector, for optimized shallow-angle backscattered imaging of sample surfaces.
A scintillator backscattered electron detector (YAG BSE) for high vacuum operation provides you with fast scan rate response times.

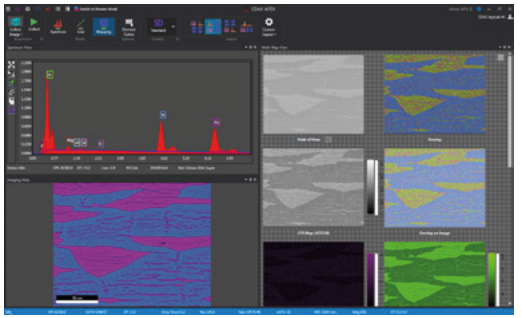
Energy Dispersive Spectroscopy (EDX)
EVO Element is the integrated EDS solution with an easy-to-use graphical user interface and excellent low-kV X-ray count sensitivity. The integration improves usability by requiring only one PC to control both the EDS and the SEM. EVO Element is supported by the ZEISS service organization.
Or, you may select an EDS solution from any of the leading suppliers. All offer an interface to EVO for transferring SEM parameters required to quantify x-ray spectral data.



C2D imaging with drastically reduced charging effect



Backscattered electron image of filler material (dark) in a woven fiber tissue (bright).



EVO Element: spectrum view, imaging view, and multi-map view

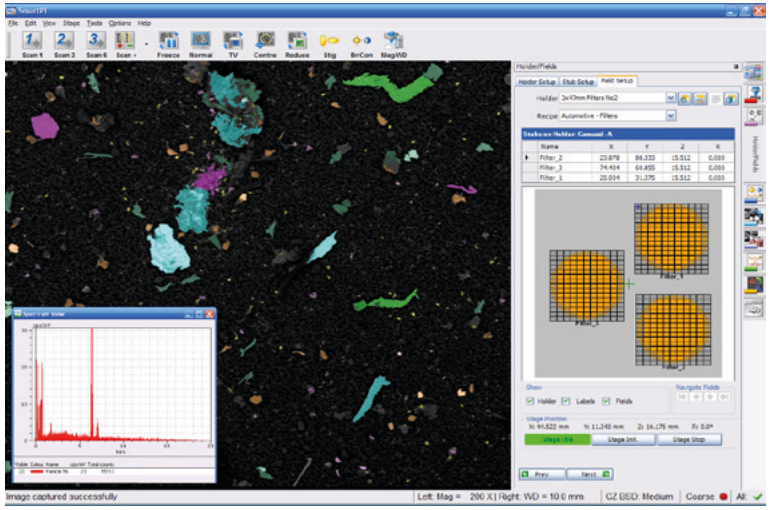
Expand Your Possibilities: Automated Particle Analysis

ZEISS SmartPI

Whether your work is in manufacturing cleanliness, engine wear prediction, steel production or environmental management, count on ZEISS turnkey particle analysis solutions to deliver thorough, actionable data.

SmartPI (Smart Particle Investigator) is a powerful, automated particle analysis tool for EVO. It automatically detects, analyzes, and then characterizes designated particles in your sample. Gain additional productivity from your EVO through automated analysis, for example, by running it fully unattended overnight and on weekends. Generate standard reports automatically, or manually review your data. Advanced particle analysis allows you to optimize industrial processes by quantifying samples rapidly and objectively. Application specific plug-ins provide pre-built recipes and report templates tailored specifically to the industry in which you work. SmartPI is fully compatible with CAPA, the ZEISS correlative particle analysis solution for advanced industrial cleanliness applications.

SmartPI is ISO 16232 and VDA 19 part 1 & 2 compliant.



SmartPI with EDS: Rapid particle identification and classification.

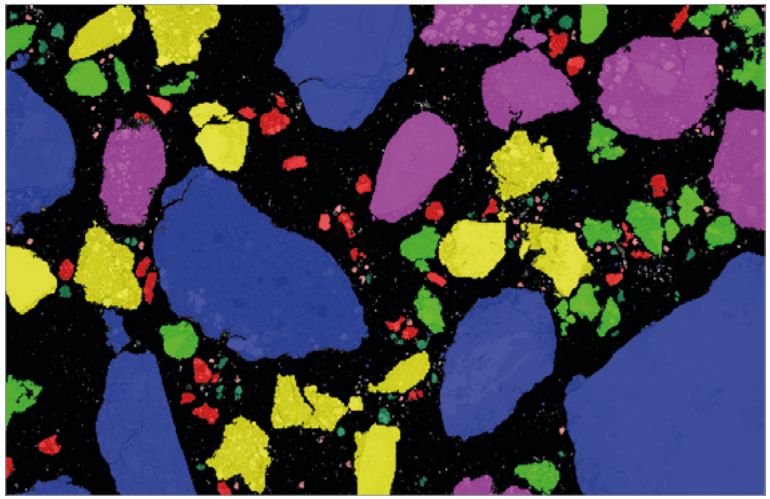


Image from ZEISS SmartPI, displaying particles of different size ranges, with particles of a defined size range identified by a unique color.

Use SmartPI to automatically locate and characterize particles, and then identify them using image analysis and EDS.

Catalog particles in a database along with a full suite of supplemental multi-modal data –ready for review and reporting.

Expand Your Possibilities: Automated Mineralogy

Automated Mineralogy

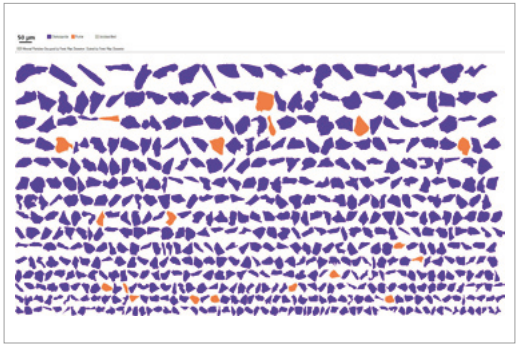
ZEISS Mineralogic combines an advanced mineral analysis engine with a range of application-specific outputs to your EVO, enabling you to characterize and quantify even the most challenging geological samples with submicron precision.

Oil & Gas

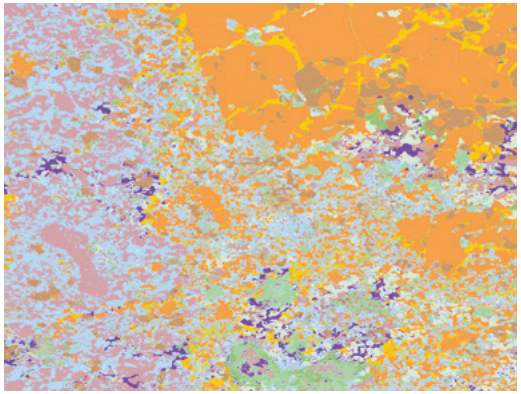
Use Mineralogic Reservoir as a part of your digital rock petrophysics workflow suite to gain a deeper understanding of your reservoir. This lets you automatically map and characterize minerals, porosity and organics. Tailor your system to analyze any type of rock, from conventional sandstone reservoirs to highly heterogeneous shale and mudrocks. Your automated petrological system provides unique insights into reservoir rocks, playing a vital role in characterizing samples from the centimeter to the nanometer scale.

Mining

Mineralogic Mining provides quantitative mineralogy for geometallurgy, optimization of mineral processing plant and ore characterization. Generate valuable understanding to support process modelling and decision-making, thereby reducing risks and costs. Target process improvements with quantitative mineralogy, elemental deportment, grain size distribution, and liberation and locking characteristics. Your automated mineralogy system is an essential part of the modern mining operation.



Mineral particles images of heavy mineral sand feed, sorted by Feret max diameter.



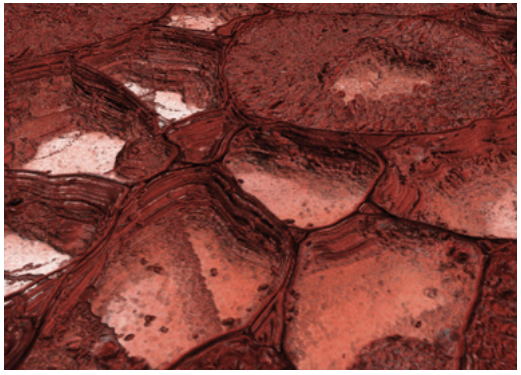
High resolution mineral map. Ni-Cu ore, Fraser Mine, Sudbury. Courtesy: University of Leicester, UK

Expand Your Possibilities: Software for Further Understanding

ZEISS SmartBrowse: Post Image Acquisition
Use SmartBrowse, the contextual imaging tool for post image acquisition processing, to present images taken with multiple detectors at different magnifications as a single, interactive image. With this patented software from ZEISS, you get complete contextual understanding of your images, both in terms of scale and imaging parameters. With SmartBrowse you can use a photograph or optical image of your sample to navigate through your captured micrographs. SmartBrowse indicates when additional image information is available for a selected field. The complementary information produced by multiple detectors for the same field build a unique and comprehensive set of data layers.

SmartBrowsecollects the acquired dataset and displays it as a clickable, scaleablemap providing contextual viewing that helps you to better understand your sample.

ZEISS Atlas 5: Master Multi-scale Challenges
Turn your EVO into a solution for rapid, automated mapping of large areas. With a 16 bit scan generator and dual super-sampling signal acquisition hardware, you can acquire single images up to 32 k × 32 k pixels, with dwell times from 100 ns to >100 s, adjustable in 100 ns increments. This solution lets you create large image montages resulting in a large field of view image with SEM nanometer scale resolution. The optional Atlas 5 Array Tomography module is specifically designed for automated imaging of serial sections of biological tissue to enable 3D visualizations of large volumes.



3D visualization (Medicagosp., root nodules, serial sections, 25 nm pixel size) shows 3D spatial symbiotic relationships between nitrogen-fixing bacteria rhizobia and the host legume plant. Sample: courtesy of J. Sherrier, J. Caplan and S. Modla, University of Delaware, US.

ZEN 2 starter: Free Microscope Software
ZEN 2 starter is the free version of ZEN 2 core imaging software. Use it as a viewer for your EVO data on an unlimited number of off-line PCs. Explore the features available in ZEN 2 core for advanced image analysis and archiving of data acquired from your EVO. ZEN 2 starter is a great introduction to our powerful ZEN 2 core imaging software for connected microscopy. Featuring the ZEISS Shuttle & Find module, ZEN 2 core allows you to combine your EVO with other systems in a multi-scale, multi-modal or correlative workflow.

Download ZEN 2 starter:
www.zeiss.com/zen2starter

ZEN

Technical Specifications

			ZEISS EVO 10	ZEISS EVO 15	ZEISS EVO 25
Resolution	2 nm, 3 nm	@ 30 kV SE with LaB_6, W			
	6 nm, 8 nm	@ 3 kV SE with LaB_6, W			
	9 nm, 20 nm	@ 1 kV SE with LaB_6, W			
Acceleration Voltage	0.2 to 30 kV				
Probe Current	0.5 pA to 5 µA				
Magnification			< 7 – 1,000,000×	< 5 – 1,000,000×	< 5 – 1,000,000×
Field of View	6 mm at Analytical Working Distance (AWD)				
X-ray Analysis	8.5 mm AWD and 35° take-off angle				
OptiBeam[1] **Modes**	Resolution, Depth, Analysis, Field, Fisheye[2]				
Pressure Range	10 – 133 Pa (EasyVP) 10 - 400 Pa (Variable Pressure)				
	10 – 3000 Pa (Extended Pressure)				
Available Detectors	SE – Everhart-Thornley Secondary Electron Detector (supplied as standard)			CCD – Charge Coupled Device for Raman spectroscopy	
	HDBSD – Solid State Backscattered Electron, 4 or 5 quadrants YAG-BSD – YAG Crystal Backscattered Electron Detector				
	VPSE-G4 – Variable Pressure Secondary Electron Detector C2D – Cascade Current Detector Detector C2DX – Extended Range Cascade Current Detector				
	SCD – Specimen Current Detector				
	STEM – Scanning Transmission Electron Microscopy Detector				
	CL – Cathodoluminescence Detector				
	EVO Element – Energy Dispersive Spectrometer (EDS)				
	WDS – Wavelength Dispersive Spectrometer				
	EBSD – Electron Backscatter Diffraction Detector				

Technical Specifications

		ZEISS EVO 10	ZEISS EVO 15	ZEISS EVO 25
Chamber Dimensions		310 mm (Ø) × 220 mm (h)	365 mm (Ø) × 275 mm (h)	420 mm (Ø) × 330 mm (h)
5-Axes Motorized Specimen Stage	Stage control by mouse or optional joystick and control panel	X = 80 mm, Y = 100 mm, Z = 35 mm, T = -10° to 90°, R = 360° (continuous)	X = 125 mm, Y = 125 mm, Z = 50 mm T = -10° to 90°, R = 360° (continuous)	X = 130 mm, Y = 130 mm, Z = 50 mm or 80 mm T = -10° to 90°, R = 360° (continuous)
Maximum Specimen Height		100 mm	145 mm	210 mm
Future Assured Upgraded Paths[2]	BeamSleeve, Extended Pressure, Water vapor VP and EP gas			
Image Framestore	32,000 × 24,000 pixels, signal acquisition by integration and averaging (scan speed 2 or above)			
System Control	SmartSEM[3] GUI operated by mouse and keyboard			
	SmartSEM Touch[2] GUI operated by 23" touchscreen, mouse and optional hardware control panel			
	Hardware control panel with rotary controls for improved manual feedback and more intuitive control during imaging			
	Ease of use features – auto saturation, auto align, sample selection & automated imaging			
	Windows® 10 multilingual operating system			
Utility Requirements	100 – 240 V, 50 or 60 Hz single phase, no water cooling requirement			

[1] Optibeam – active column control for best resolution, best depth of field or best field of view
[2] Optional upgrade
[3] SmartSEM – Sixth generation SEM control Graphical User Interface

Count on Service in the True Sense of the Word

Because the ZEISS microscope system is one of your most important tools, we make sure it is always ready to perform. What's more, we'll see to it that you are employing all the options that get the best from your microscope. You can choose from a range of service products, each delivered by highly qualified ZEISS specialists who will support you long beyond the purchase of your system. Our aim is to enable you to experience those special moments that inspire your work.

Repair. Maintain. Optimize.
Attain maximum uptime with your microscope. A ZEISS Protect Service Agreement lets you budget for operating costs, all the while reducing costly downtime and achieving the best results through the improved performance of your system. Choose from service agreements designed to give you a range of options and control levels. We'll work with you to select the service program that addresses your system needs and usage requirements, in line with your organization's standard practices.

Our service on-demand also brings you distinct advantages. ZEISS service staff will analyze issues at hand and resolve them – whether using remote maintenance software or working on site.

Enhance Your Microscope System.
Your ZEISS microscope system is designed for a variety of updates: open interfaces allow you to maintain a high technological level at all times. As a result you'll work more efficiently now, while extending the productive lifetime of your microscope as new update possibilities come on stream.

Profit from the optimized performance of your microscope system with services from ZEISS – now and for years to come.

>> www.zeiss.com/microservice

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