CIQTEK

SEM

SEM3200

Tungsten Filament
Scanning ElectronMicroscope

2016

CIQTEK was officially established.

2019

CIQTEK launched commercial **Scanning Electron Microscope,** which was recognized very well by the market.

2021

R&D overcame obstacles, and the 1st **Schottky Field Emission Scanning Electron Microscope** was launched.

2022

More models SEM2000, SEM3200 and SEM3300 were released, in which SEM3300 broke through the long standing resolution limit of **Tungsten Filament Scanning Electron Microscope**. In the same year, more than 100 units of Scanning Electron Microscopes were delivered.

2023

The **High-speed SEM** model HEM6000, the **Focused Ion Beam Scanning Electron Microscope** (FIB-SEM) model DB500 and **Ultra-high Resolution FESEM** model SEM5000X were released, the delivery of Electron Microscopes exceeded 200 units in a single year.

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Tungsten Filament Scanning Electron Microscope

SEM2100

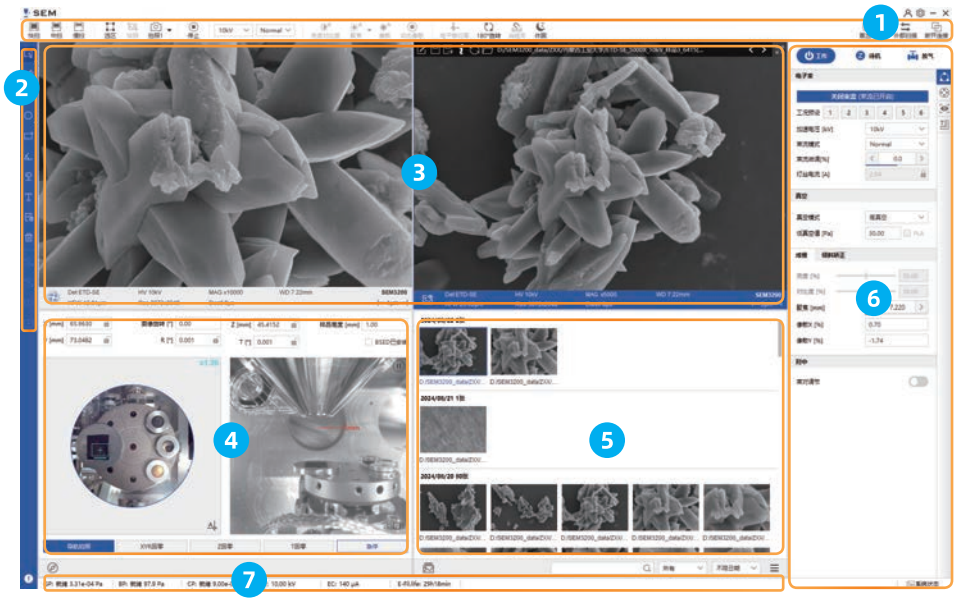
Simplicity does not compromise functionality

SEM2100 is an user-friendly and accessible **Tungsten Filament Scanning Electron Microscope** (SEM) which is designed for novice users. It features a simplified operating process, adheres to industry standards and user habits in its User Interface design. Despite its minimalist software interface, it provides a comprehensive range of automated functions, measurement and annotation tools, image post-processing management capabilities, optical image navigation, and more. This design concept perfectly embodies the idea which is "Simplicity does not compromise functionality".

- **Intuitive, concise and easy-to-use UI design**
- **Complete automation functions**
- **Various measuring and marking tools**
- **Integrated image post-processing functions**
- **Standard optical image navigation**
- **Safer to use**

Software

SEM2100



1 Top Toolbar
2 Left Toolbar
3 Main imaging channels
4 Navigation
5 Image gallery
6 Settings & configuration
7 Bottom status bar

Tungsten Filament Scanning Electron Microscope
SEM3200

High-performance & Universal

The SEM3200 is an excellent general-purpose **Tungsten Filament Scanning Electron Microscope** (SEM) with outstanding overall capabilities. Its unique Dual-anode electron gun structure ensures high resolution and improves image signal-to-noise ratio at low excitation voltages. Furthermore, it offers a wide range of optional accessories, making the SEM3200 a versatile analytical instrument with excellent expendabilities.

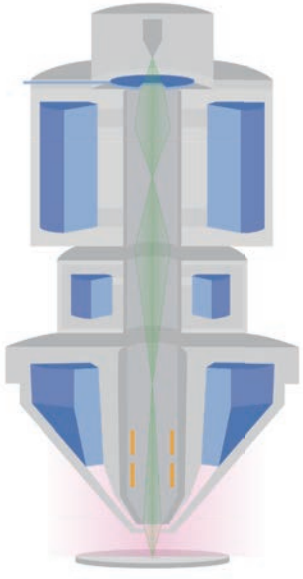
- **Outstanding performance under low voltage** (7 nm @ 3 kV)
- **Dual-anode electron gun**
- **Low Vacuum Mode**
- **Intelligence Assisted Image Astigmatism Correction**
- **Pre-aligned tungsten filament**
- **Excellent expandability**

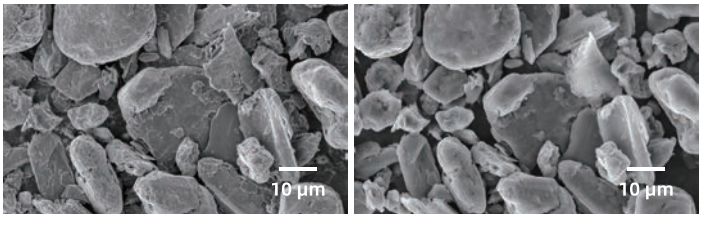
Dual-anode structure at electron gun

* Optional

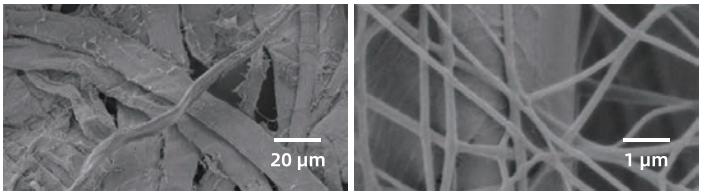
Intermittent anode

The intermittent anode is set up in between the cathode assembly and the anode. Under low excitation voltage, the extraction efficiency of the electron beam can be improved, the resolution can be increased by 10%, and the signal-to-noise ratio can be increased by 30%.





For carbon material samples, under low excitation voltages, the beam penetration depth is shallow, enabling the capturing of the true surface morphology information with richer details of the specimen.



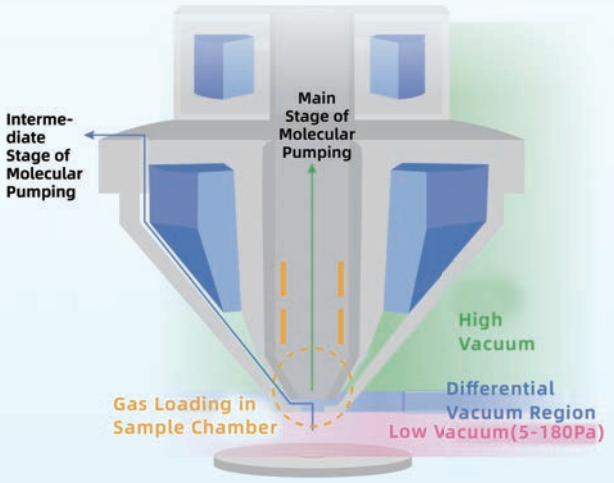
For polymer fiber samples, high excitation voltages cause beam damage to the specimen, while low voltage beam enables the preservation of surface details without damage.

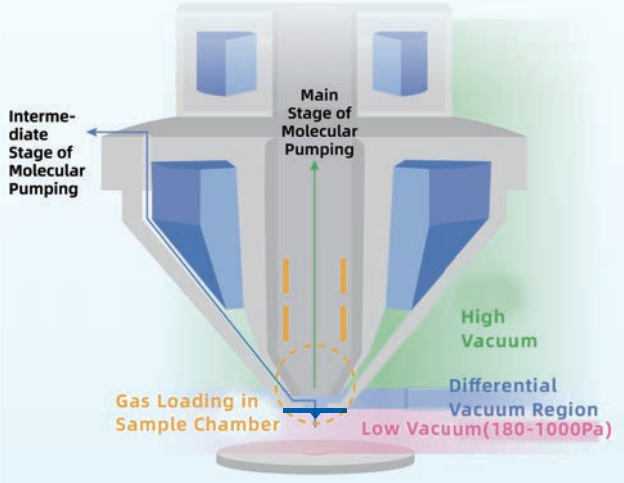
01

Low Vacuum Mode

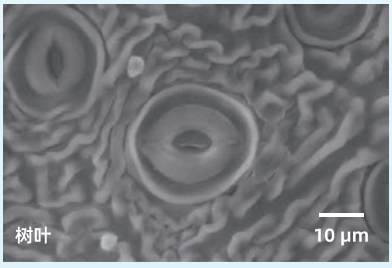
SEM3200

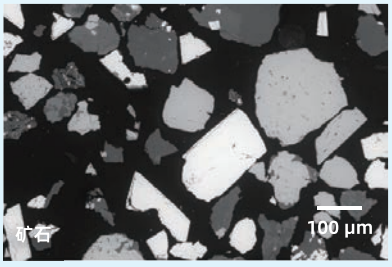
The microscope supports 2-stage low vacuum modes: 5~180 Pa chamber pressure can be reached without pressure limiting aperture, and 180~1000 Pa is achievable with PLA. The specially designed objective lens vacuum chamber minimizes electron mean free path in low vacuum, maintains the resolution to be at 3 nm @ 30 kV



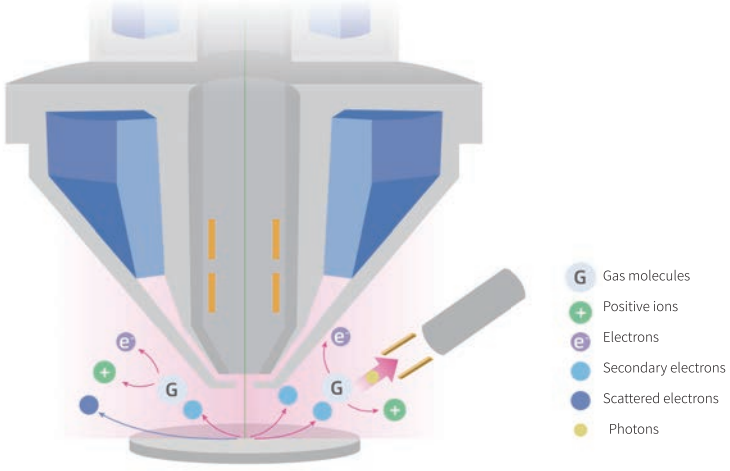


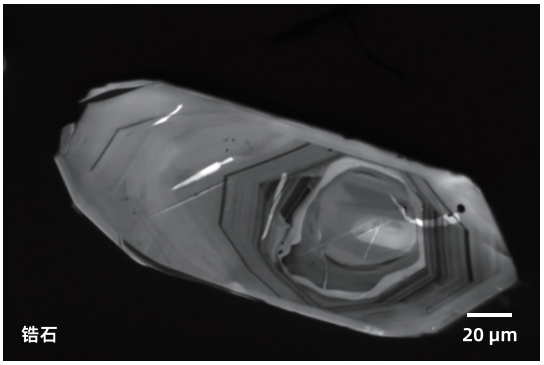
The incident electron beam ionizes the air molecules on top of the surface, producing electrons and ions, in which ions neutralize the charged particles generated on the sample surface, achieving the effect of charge mitigation





The secondary electron emission from the sample surface ionizes air molecules, generating electrons, ions, and photos signals simultaneously. The generated electrons then ionize other air molecules, and a large amount of photo signals produced then be captured by a Low Vacuum Detector (LVD)





In high vacuum mode, LVD directly detects the cathodoluminescence signal emitted from the specimen, that can be captured for cathodoluminescence imaging, with simultaneous imaging from BSED channel.

Tungsten Filament Scanning Electron Microscope

SEM3300

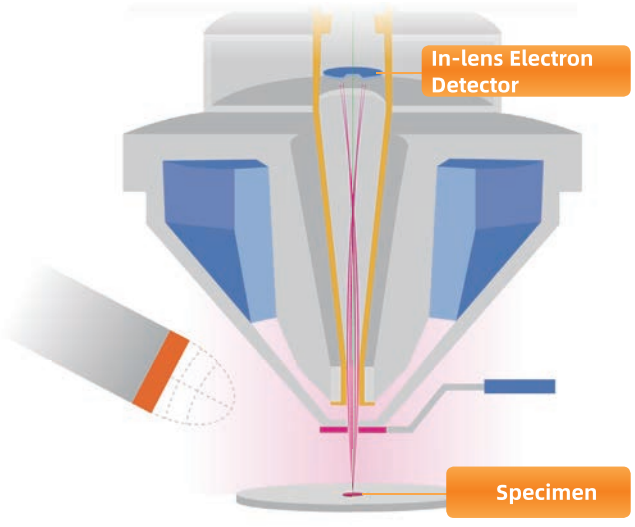
Next-Generation

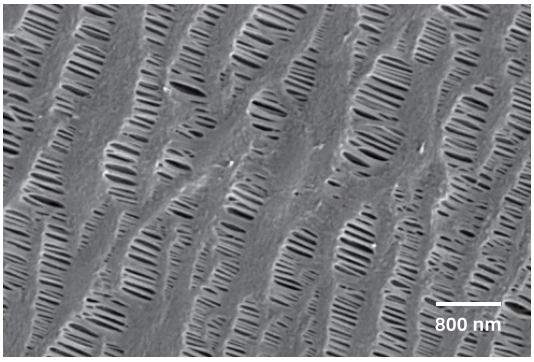
SEM3300 is a next-generation tungsten filament scanning electron microscope that incorporates technologies such as “Super-Tunnel”electron optics technologies, featured with an inlens electron detector, and an electrostatic & electromagnetic compound objective lens. By applying these technologies into the tungsten filament microscope, the long standing resolution limit of such SEM is surpassed, enabling the tungsten filament SEM to perform low-voltage analysis tasks that were previously only achievable with field emission SEM.

- 2.5 nm / 15 kV — **Tungsten filament SEM's resolution limit surpassed**
- **In-lens Electron Detector**
- **Electromagnetic & Electrostatic Combo Objective Lens**
- **Safer to use**
- **Excellent expandability**

In-lens Electron Detector

SEM3300





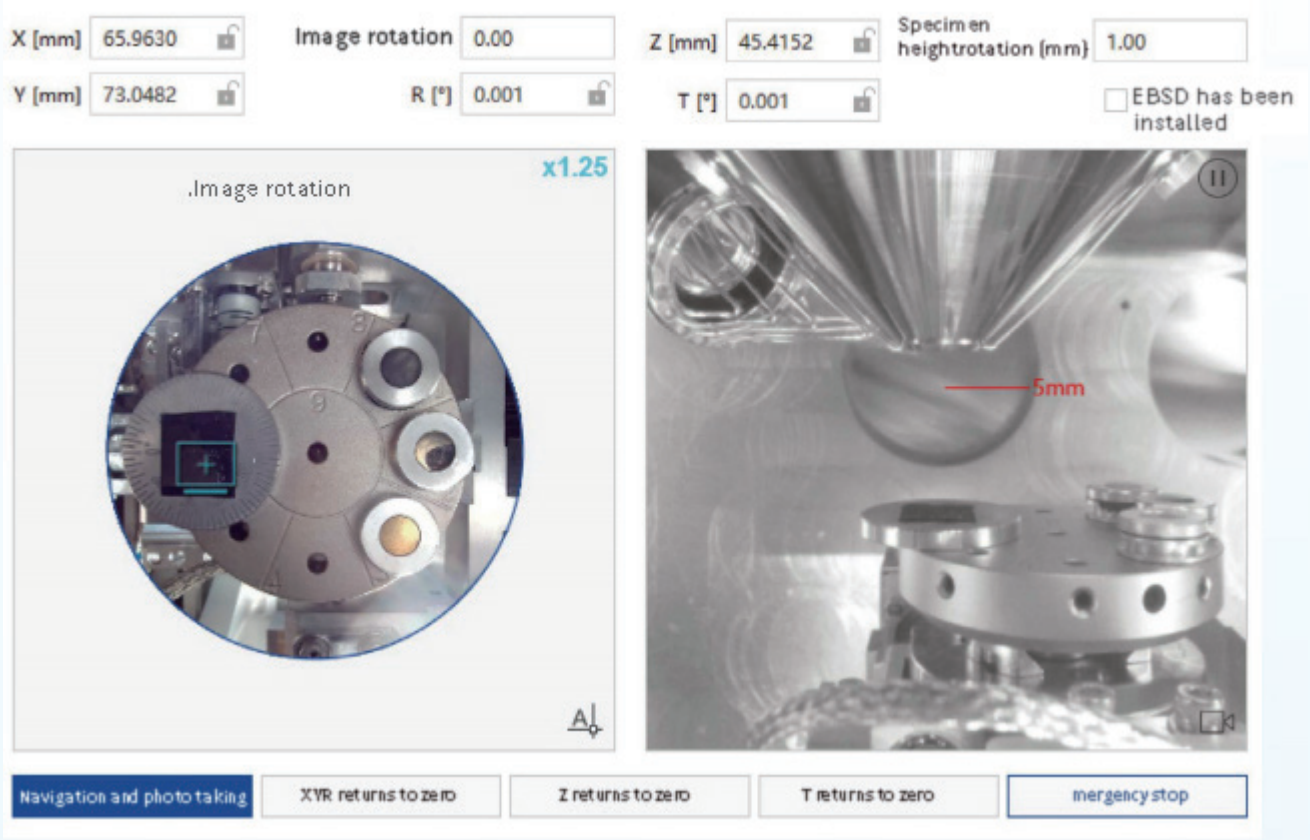
Images of lithium battery diaphragm taken at 1 kV with a magnification of 20,000 times on film, images taken with SEM3300

01

Accessibility

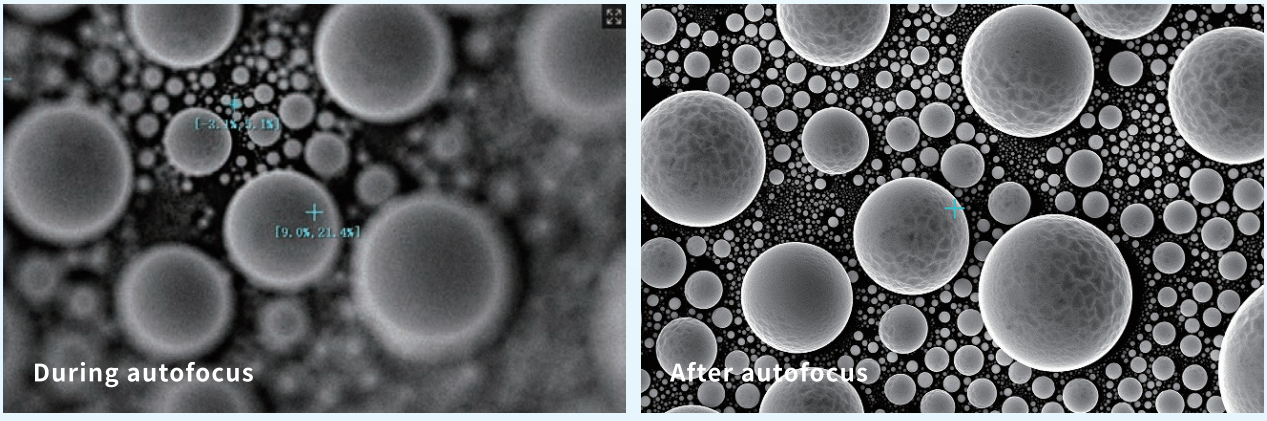
Optical Navigation

Using a vertically mounted chamber camera to capture optical images for specimen stage navigation allows for a more intuitive and accurate specimen positioning.



Intelligence Assisted Image Astigmatism Correction

Under this mode, the astigmatism value of X and Y varies with the pixels. The image clarity is maximized at the optimal astigmatism value, enabling rapid stigmator adjustment.

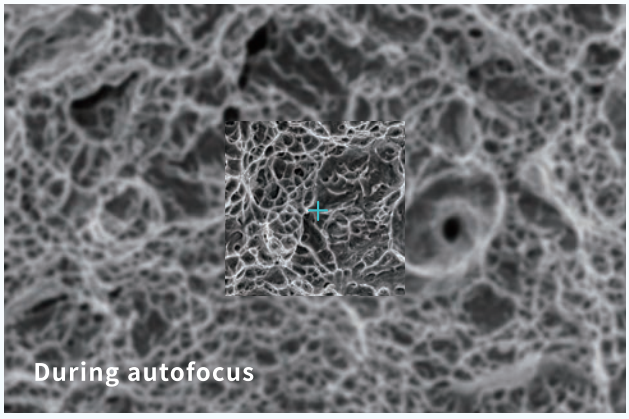


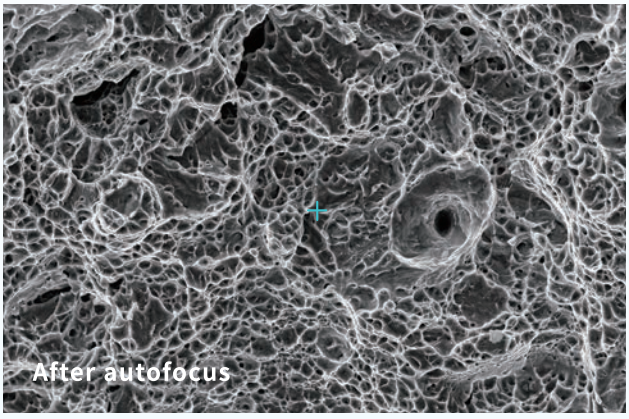
* Not available for SEM3300

Automated Functions

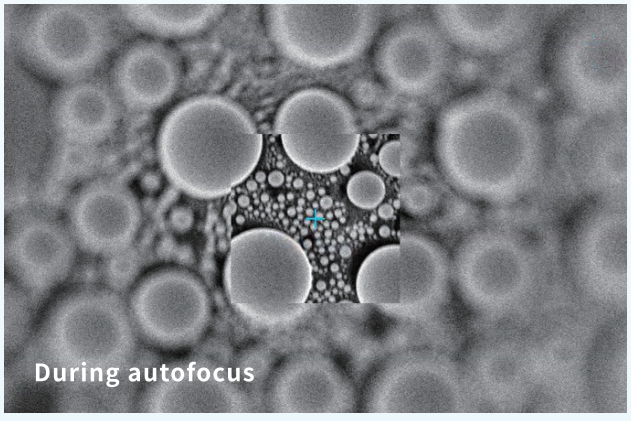
Improved Automatic Brightness & Contrast, Automatic Focus, and Automatic Astigmatism Correction enable one-click done imaging, enhancing work efficiency

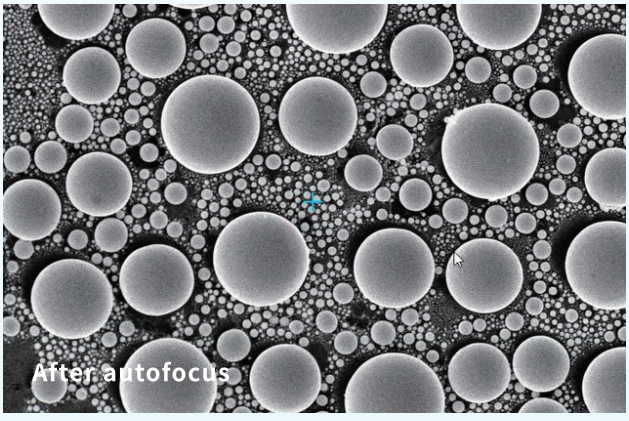
Automatic Focus



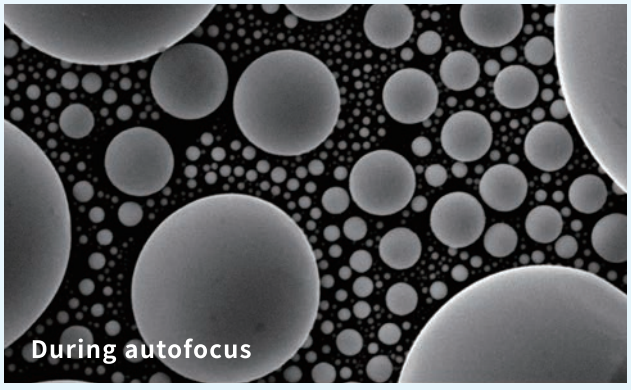


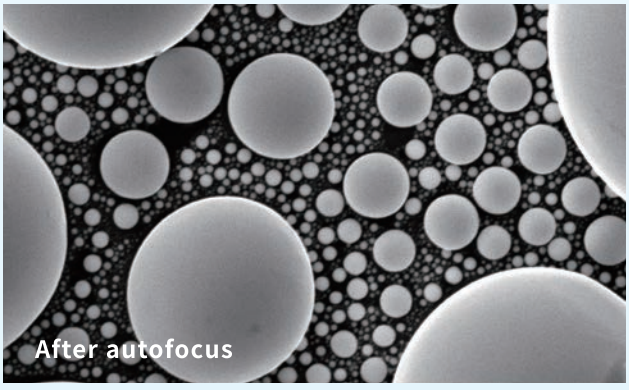
Automatic Astigmatism Correction





Automatic Brightness & Contrast





01

Safer to use

Infrared CCD

Real-time monitoring to chamber interior motion, using image recognition and motion capture technology.

Anti-collision (Software)

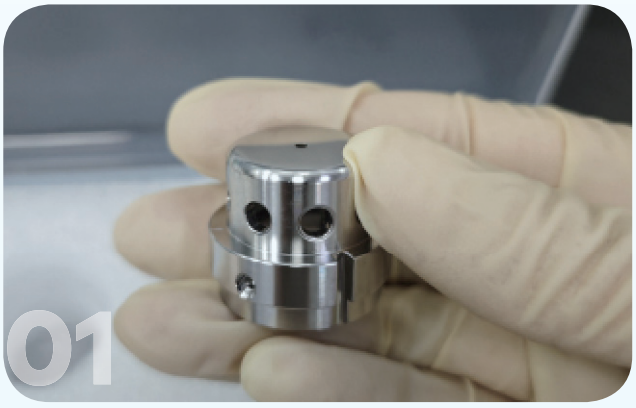
Manually input the sample height to accurately define the distance between the sample and the objective lens to prevent collisions.

Anti-collision (Hardware)

Shut off the power to stage motor at the moment of collision to minimize damage.

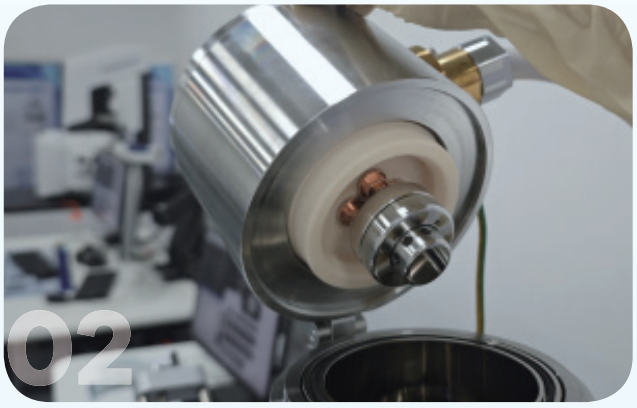
Effortless filament exchange

Pre-aligned replacement filament module ready to use



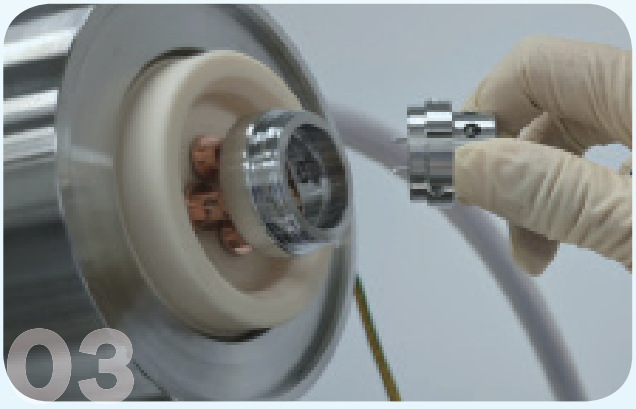
Pre-aligned replacement filament module ready to use

Integrated filament module, mechanical alignment free.



Vent the electron microscope to atmospheric conditions.

Press the "Vent" button on the software interface and wait for the venting process to complete. After venting, the electron gun head can be opened.



Replace the filament.

Remove the electron gun cover, flip open the electron gun head, and manually unscrew the filament housing. If the filament housing is still hot, wait for it to cool down before proceeding.

Flip close the electron gun head and evacuate.

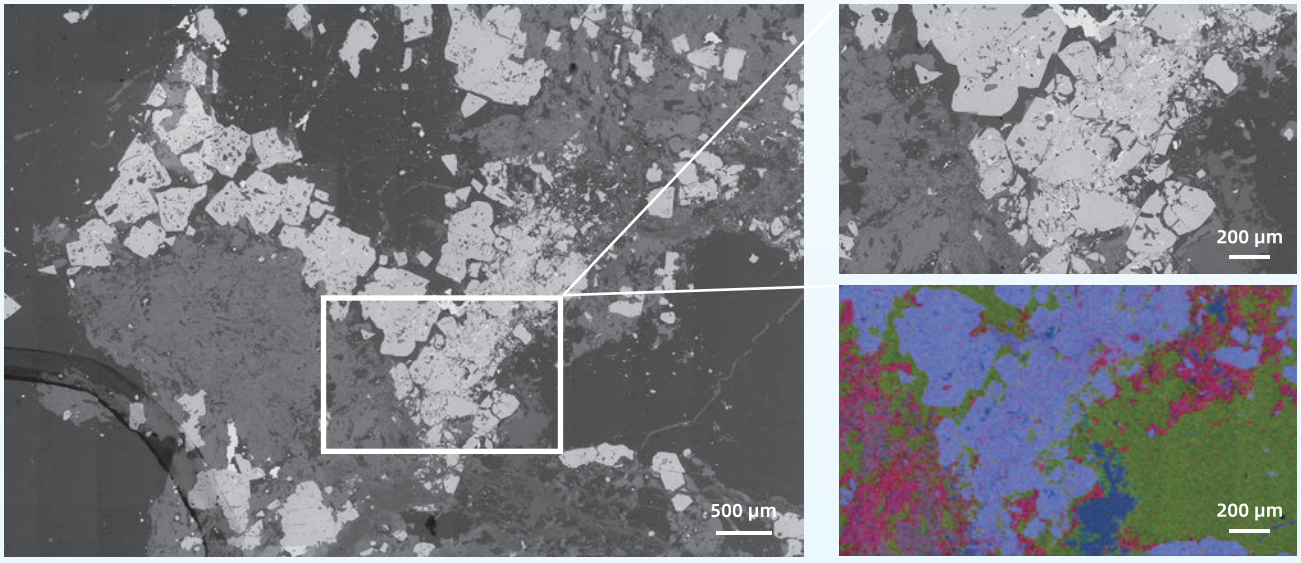
After closing the electron gun head, press "operate" button to initiate the evacuation process.

Trackball & Knob Control Panel

* Optional

AutoMap

* Optional

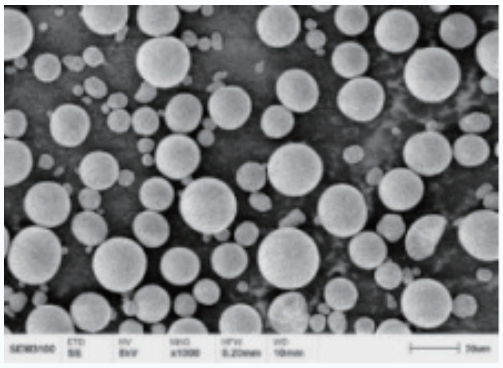


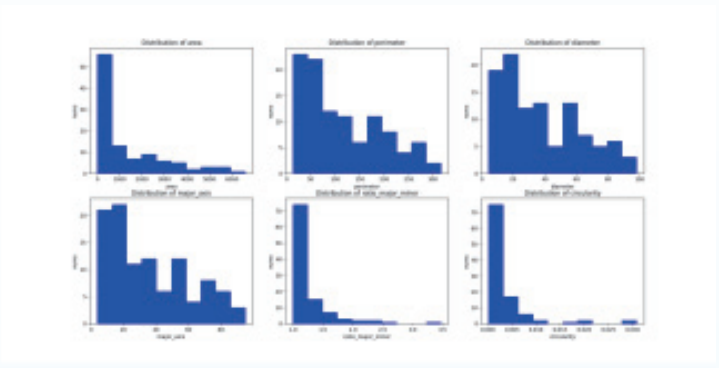
- Maximum Field of View exceeds 100 mm²
- Support for individual frame image size up to 48k, and stitched images up to eight trillion pixels
- Patented algorithms for local and macro optimal solutions, achieving the best stitching results (* Patent No.: 202210372676.8)
- Pre-defined imaging settings for unattended continuous image acquisition and real-time stitching
- Automatic focusing, Automatic stigmator, and Automatic brightness & contrast adjustment during image acquisition
- Offline data browsing, stitched images can be imported into other image post-processing software
- Built-in various image measurement tools

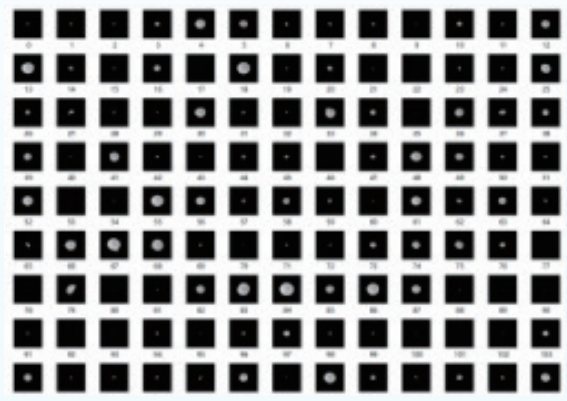
02

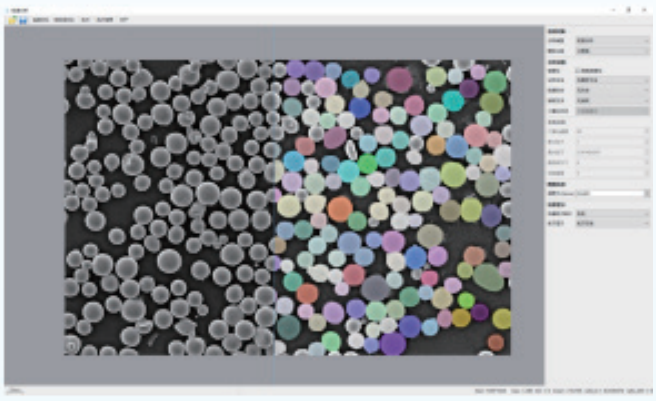
Particle & Pore analysis software（Particle）

* Optional







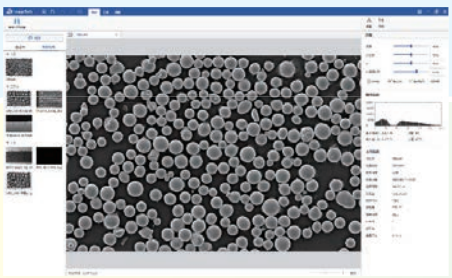


The software employs various target detection and segmentation algorithms, suitable for different types of particle and pore samples. It enables quantitative analysis of particle and pore statistics and can be applied in fields such as materials science, geology, and environmental science.

- Uses Mask-RCNN, an object detection and instance segmentation algorithm that accurately identifies particles in an image without the need for parameter tuning.
- 4. Utilizes classical watershed algorithm and ensemble contour non-convex cutting method for precise segmentation of adhesive and overlapping particles.
- 5. Offers two modes: particle statistics and pore analysis.
- 6. Provides multiple morphological information statistics and exportation, such as particle counting, average area, particle size, pore volume, etc.
- Mask-RCNN: Mask Region-based Convolutional Neural Network is a deep learning model used for object detection and instance segmentation.

Image post-processing software

- Operates offline, allowing for data processing anytime, anywhere.
- Gamma correction.
- Automatic brightness and contrast adjustment.
- Automatic AI noise reduction.
- Histogram analysis.
- Resolution calculation.
- Image measurement and annotation.
- Compatible with various image formats, such as TIFF/PNG/JPG/BMP.

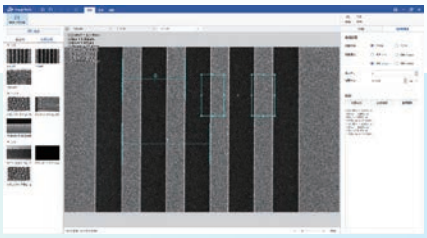


Performs online or offline image post-processing on images captured by electron microscopes and integrates commonly used EM image processing functions, convenient measurement and annotation tools.

AutoMeasure

* Optional

- Gradient calculation for all pixels within the selected frame, enabling more precise edge detection.
- Multiple edge detection modes, such as line, space, and pitch.
- Compatibility with various image formats, including TIFF, PNG, JPG, and BMP.
- Built-in image post-processing functions.



Automatic recognition of line width edges, resulting in more accurate measurements and higher consistency. Supports multiple edge detection modes, such as Line, Space, Pitch, etc. Compatible with multiple image formats and equipped with various commonly used image post-processing functions. The software is easy to use, efficient, and accurate.

Software Development Kit（SDK）

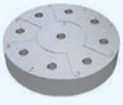
* Optional

- Support for popular programming languages, such as C++, Python, C#, etc.
- Well-defined interface specifications and documentation.
- Provided C++ and Python code examples for integration and usage.
- Full control over the functions of the scanning electron microscope.

Provides a set of interfaces for controlling the scanning electron microscope, including image acquisition, operating condition settings, power on/off, stage control, etc. Concise interface definitions allow for rapid development of specific electron microscope operation scripts and software, enabling automated tracking of regions of interest, industrial automation data acquisition, image drift correction, and other functions. Can be used for software development in specialized areas such as diatom analysis, steel impurity inspection, cleanliness analysis, raw material control, etc.

Multiple sample holders available (customizable)

Standard configuration

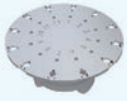


Standard 9-position holder.

Specifications: 9 position, diameter of 50 mm.

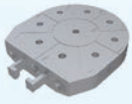
Quick-exchange deceleration mode compatible sample holder.

Specifications: 8 position, diameter of 50 mm.



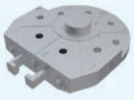
6-inches wafer sample holder.

Specifications: 6 inches.



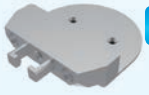
Quick-exchange 9-position sample holder.

Specifications: 9 position, diameter of 50 mm, supports sample height of 5 mm.



Quick-exchange 9-position holder.

Specifications: 9 position, diameter of 50 mm, supports sample height of 14 mm.



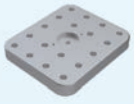
Quick-exchange flat sample holder.

Specifications: diameter of 50 mm, supports sample height of 20 mm.

Custom configuration

Custom configuration.

Custom quick-exchange EBSD 70° sample holder.



Custom 19-position sample holder.

Specifications: size of 81x70x11 mm^3.

Custom quick-exchange cross-section sample holder.

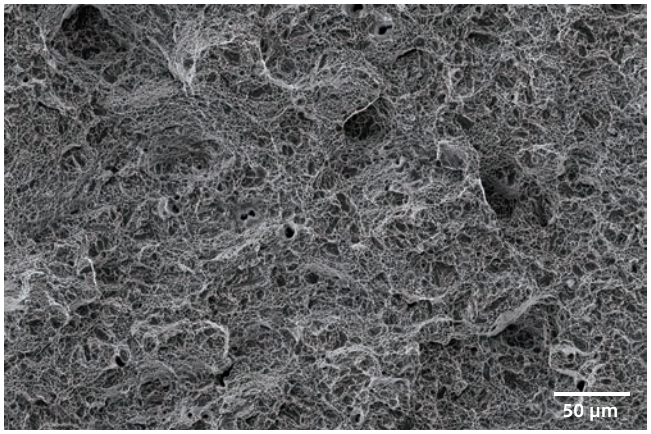
Specifications: diameter of 50 mm, supports sample height of 14 mm.

Custom 9-position mold sample holder.

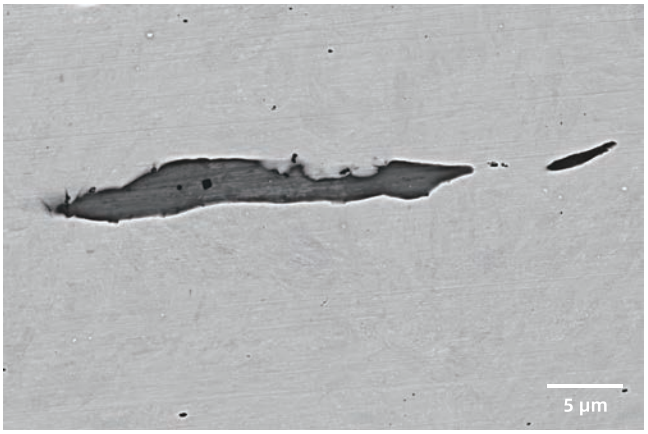
Specifications: custom diameter 25 molds, 9 to them with dimensions of 86x86x10 mm^3.

Customized sample holders available according to various application scenarios.

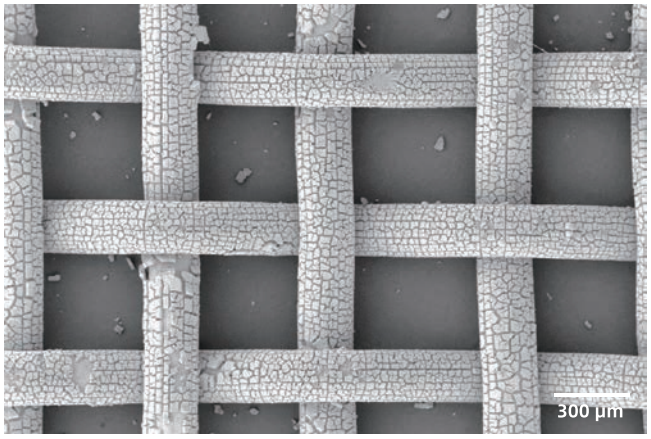
Metallurgy



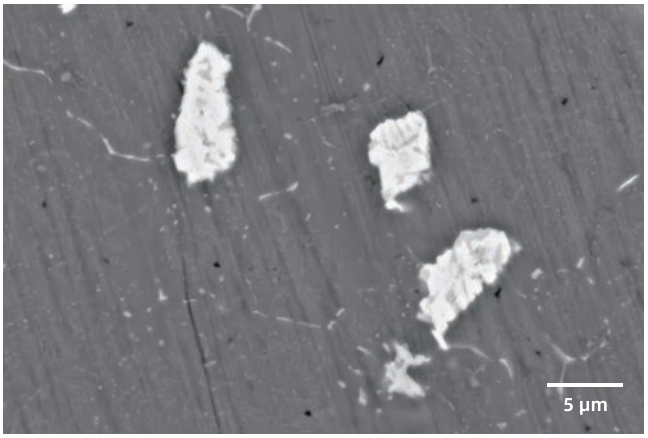
SEM2100/ Metal fracture/20 kV/ETD



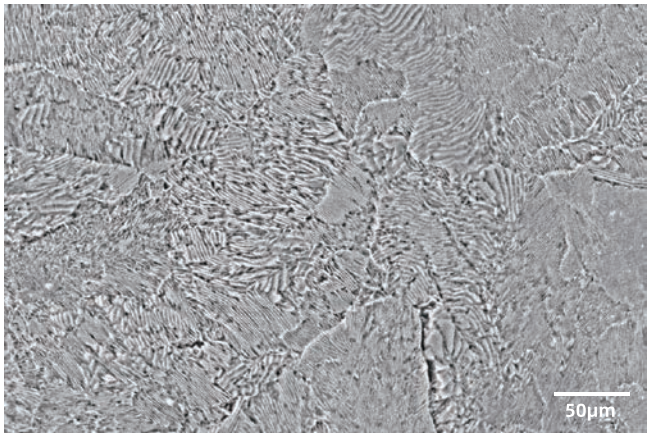
SEM3200/Steel inclusions/15 kV/BSED



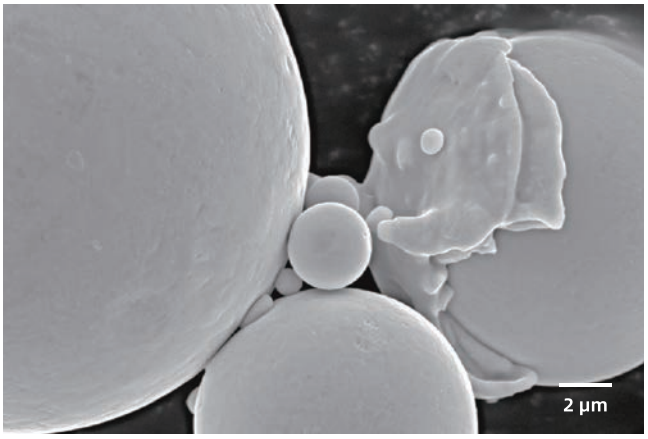
SEM3300/Nickel mesh/5 kV/ETD



SEM3200/2A12Aluminum alloy precipitation phase/15 kV/BSED

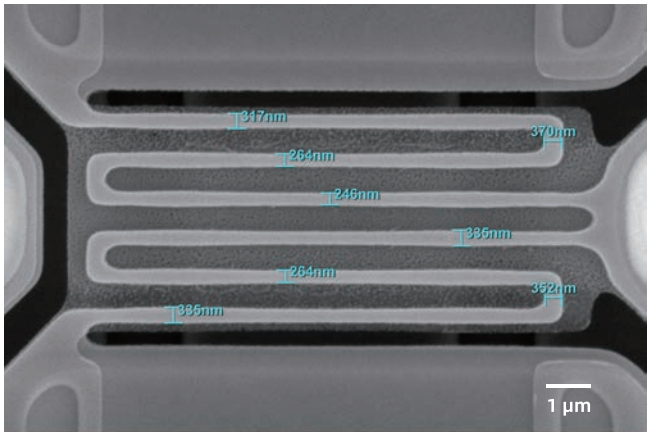


SEM3200/Metallographic structure/10 kV/ETD

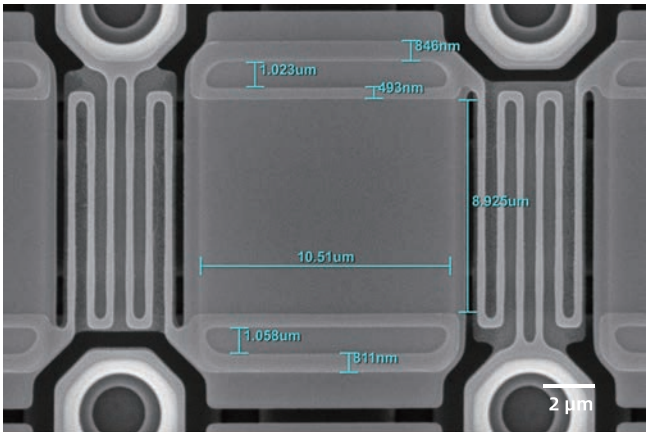


SEM3200/Tin powder/15 kV/ETD

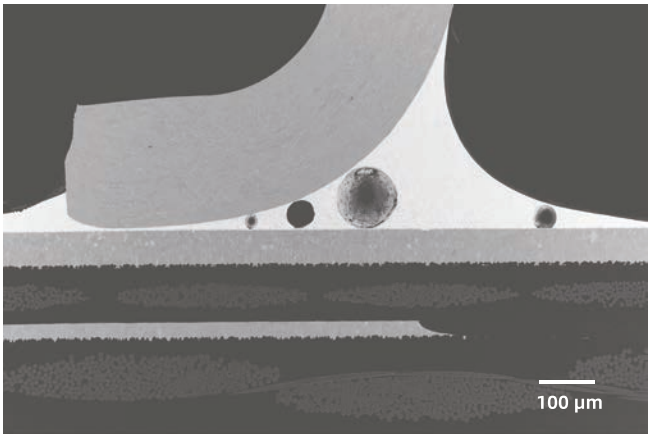
Semiconductor



SEM3200/Ordinary chip 1/10 kV/ETD

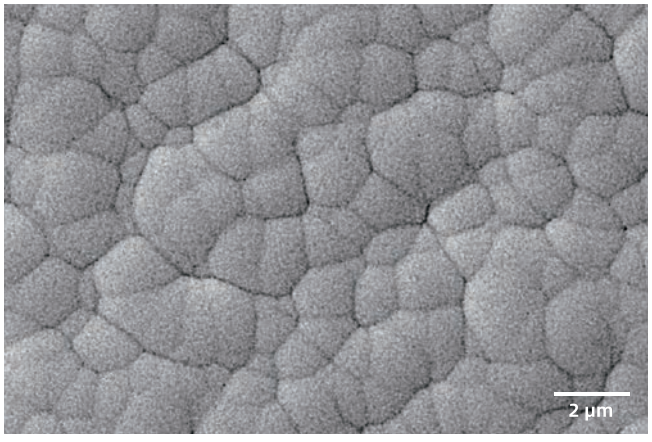


SEM3200/Ordinary chip 2/10 kV/ETD

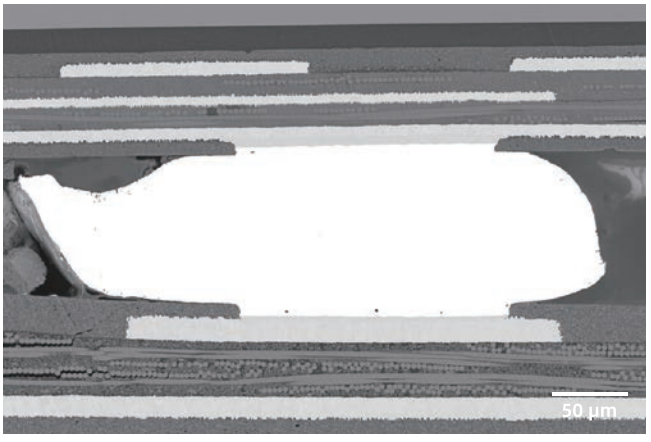


SEM2100/PCB board (car light) /10 kV/BSED

SEM2100/ IC Chip /15 kV/BSED

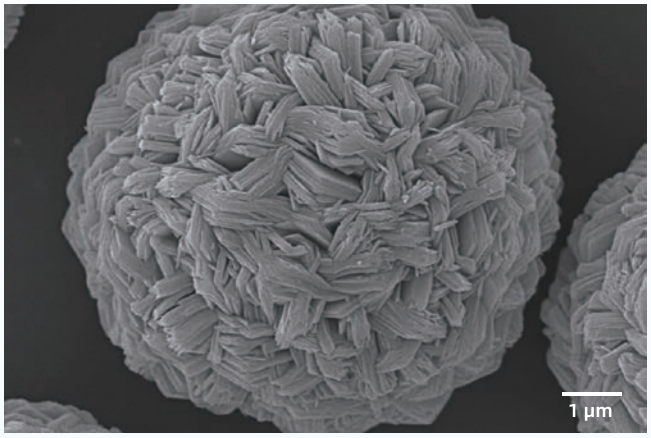


SEM2100/Nickel Palladium /15 kV/ETD

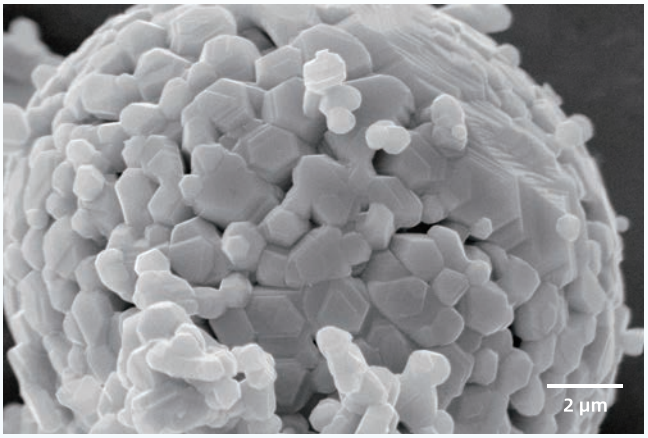


SEM3200/ Chip cross section /15 kV/BSED

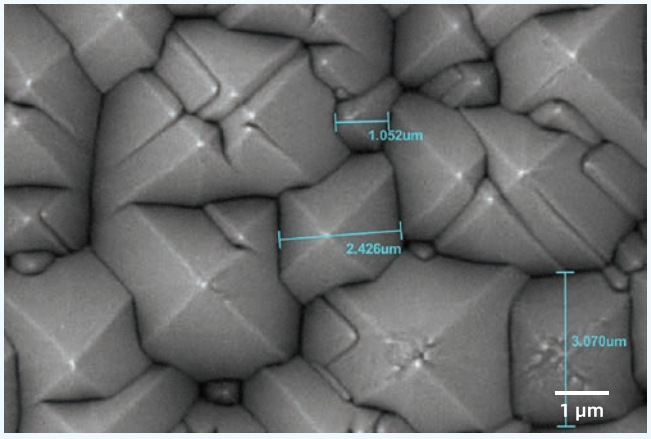
New energy materials



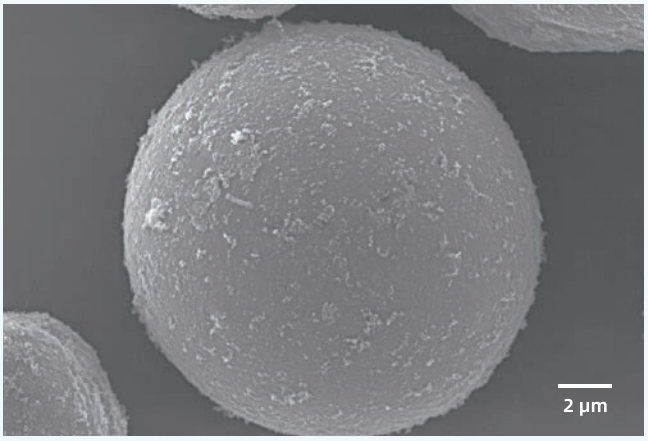
SEM2100/Ternary cathode precursor /15 kV/ETD



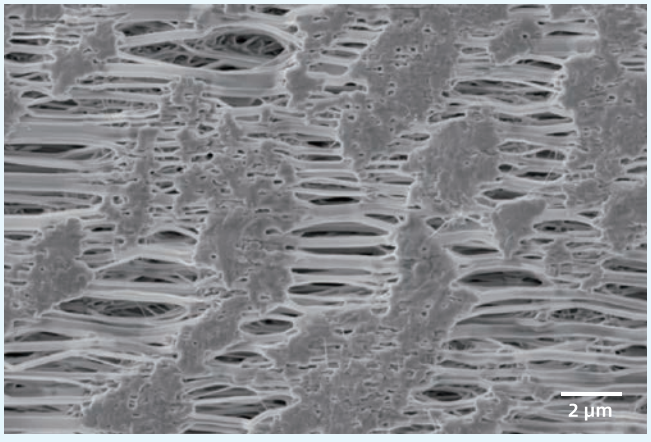
SEM3200/Positive electrode - lithium cobalt oxide /15 kV/ETD



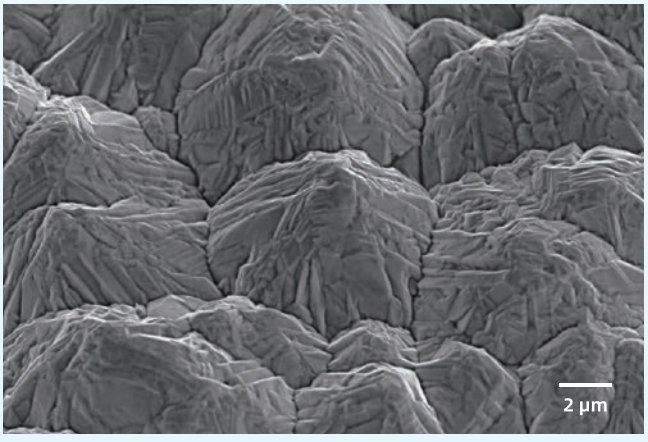
SEM3300/Solar cell /3 kV/ETD



SEM3200/Lithium battery negative electrode - hard carbon /10 kV/ETD

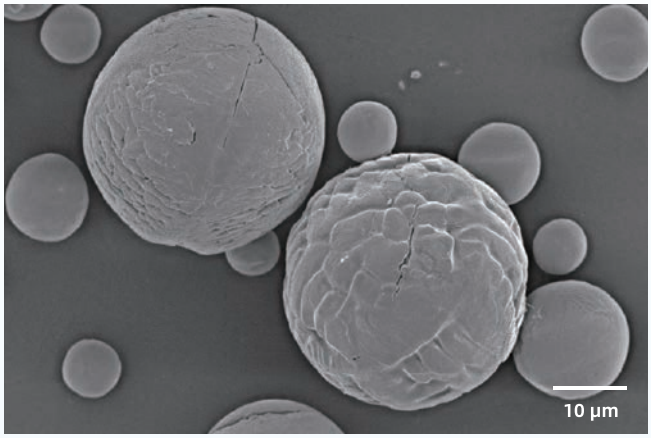


SEM2100/Dry stretching diaphragm /3 kV/ETD

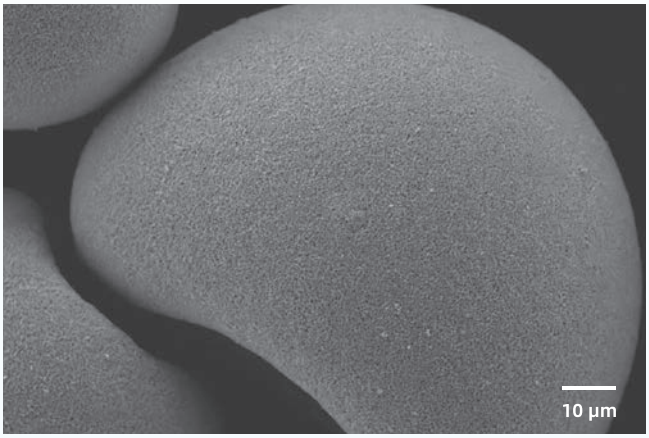


SEM3200/Conductive collector fluid- Raw foil /10 kV/ETD

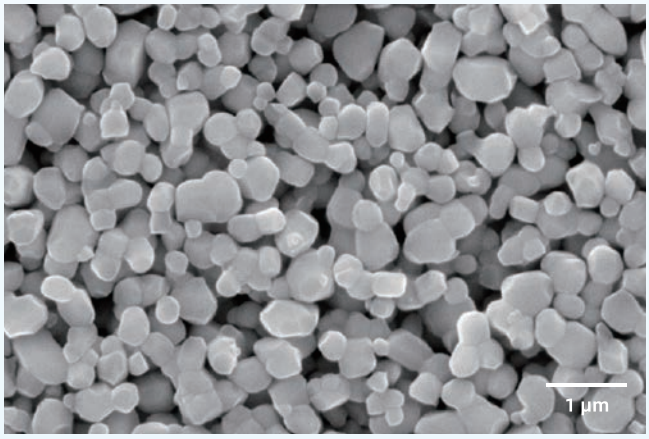
Ceramic



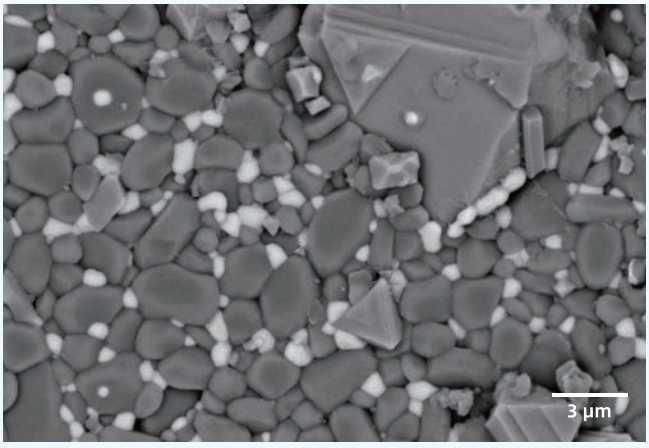
SEM3200/Aluminum oxide /5 kV/ETD



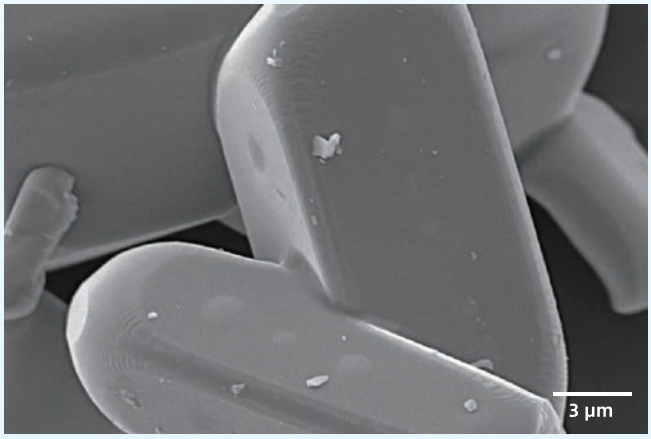
SEM2100/Zinc oxide /10 kV/ETD



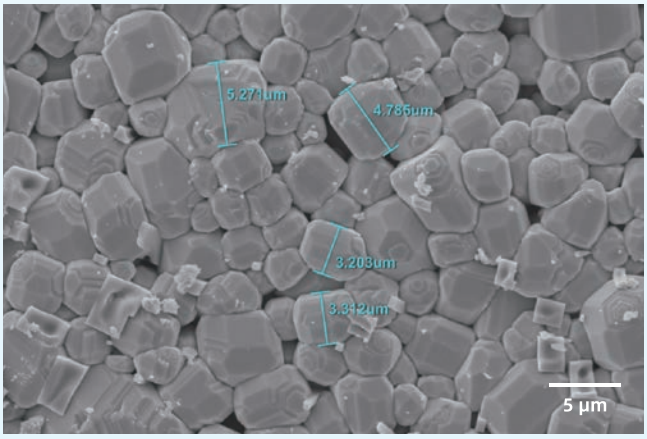
SEM3200/Powder - Barium titanate /25 kV/ETD



SEM3200/Ceramic substrate /10 kV/BSED

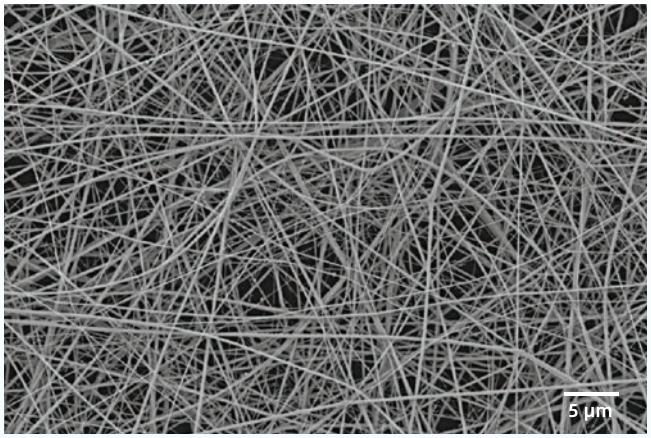


SEM2100/Ceramic powder /10 kV/ETD



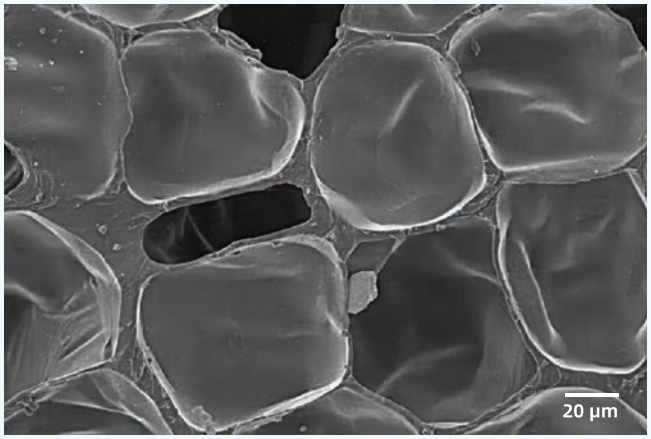
SEM3200/Electronic ceramics /10 kV/ETD

Polymer and fiber materials

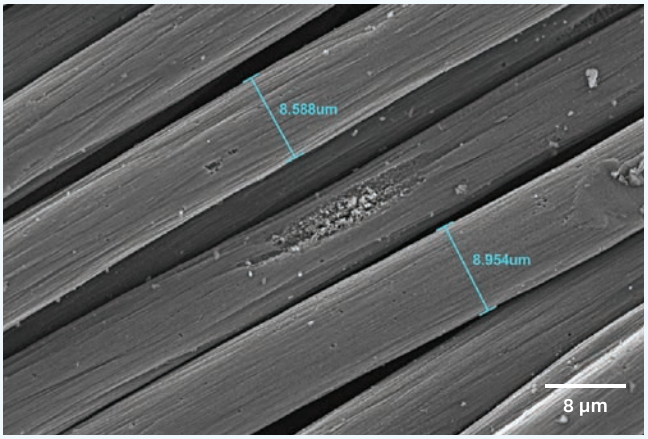


SEM3200/Electrospinning /5 kV/ETD

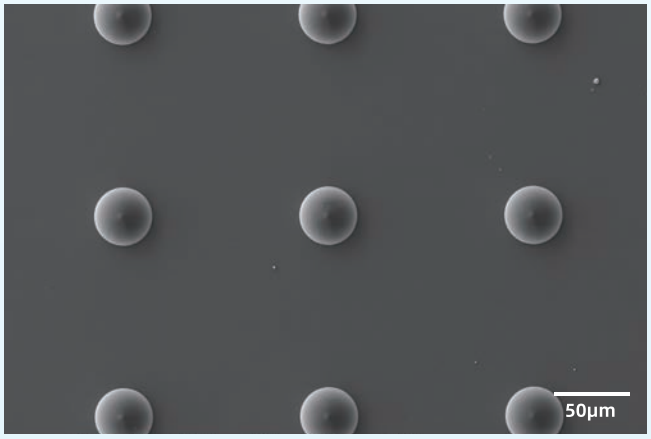
SEM2100/Fiber cross-section /7 kV/BSED



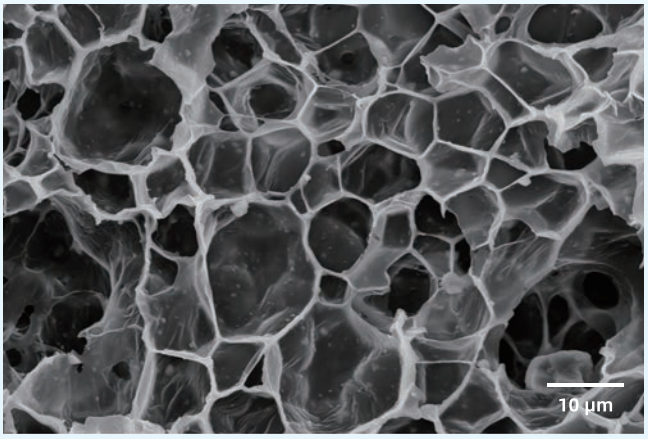
SEM3200/Polymer film /5 kV/ETD



SEM2100/Textile fibers /10 kV/ETD

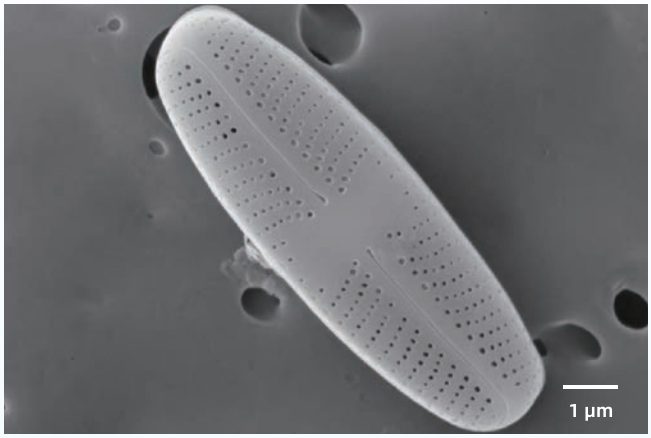


SEM2100/Polymer lens array /15 kV/ETD

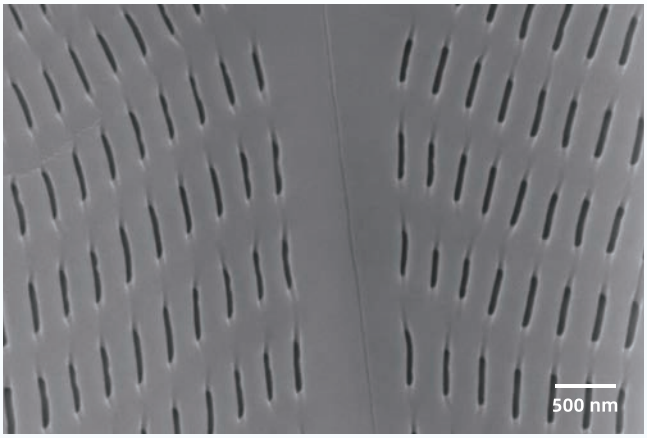


SEM3200/Polymer foam /15 kV/ETD

Biomedical

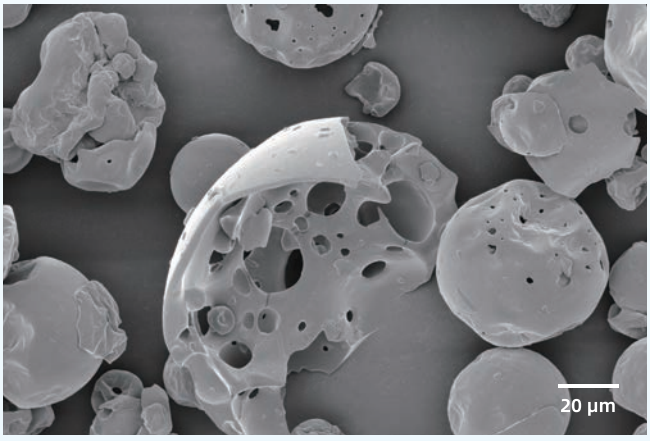


SEM3200/ Biomedical /15 kV/ETD

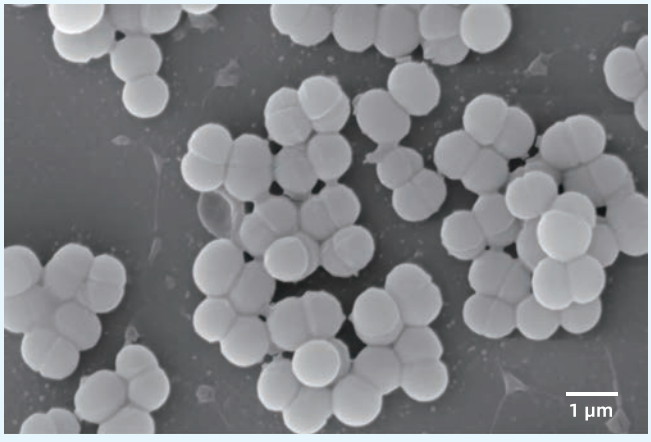


SEM3200/ Diatoms /10 kV/ETD

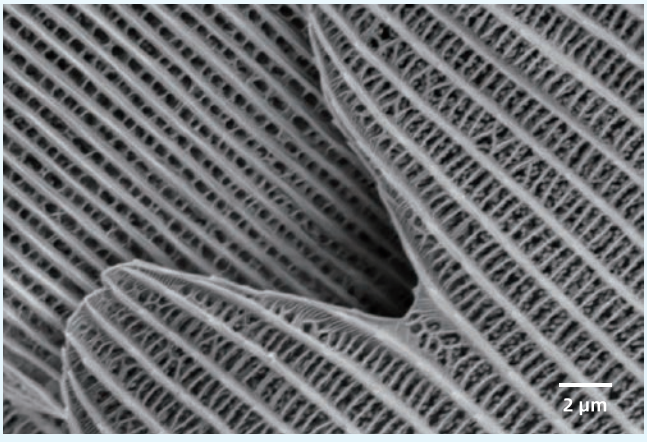
SEM3200/ Staphylococcus aureus /15 kV/ETD



SEM2100/ Taxillus herbaceus raw powder /3 kV/ETD

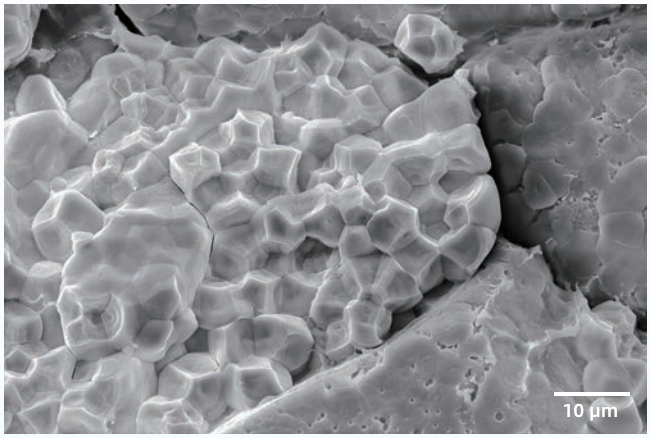


SEM2100/ Streptococcus genus /15 kV/ETD

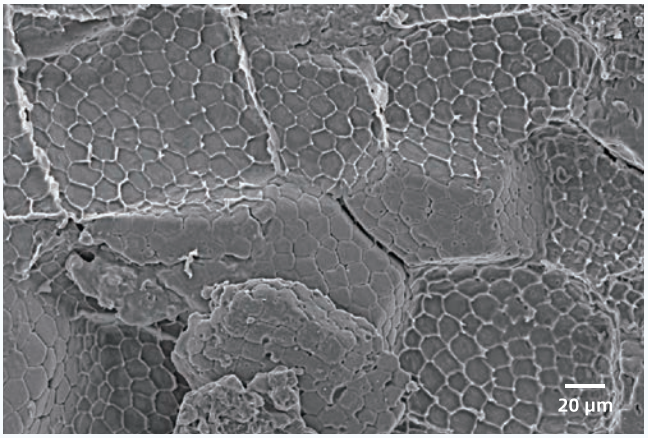


SEM2100/ Danaus genutia (Red Pierrot) butterfly /3 kV/ETD

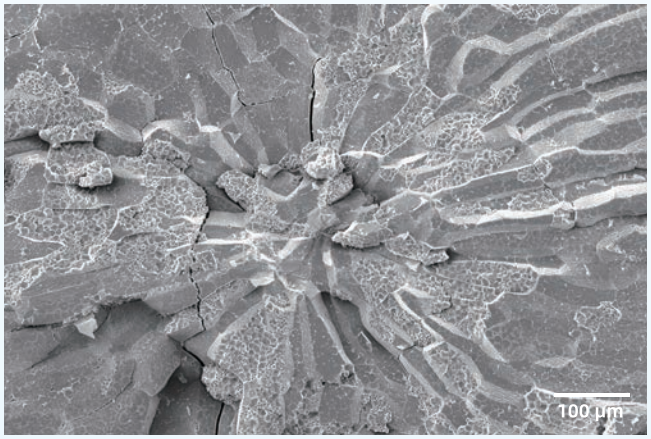
Food



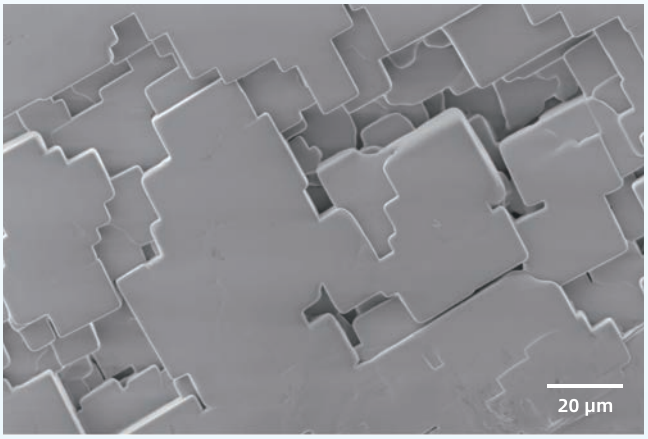
SEM2100/ New rice endosperm starch granules /10 kV/ ETD



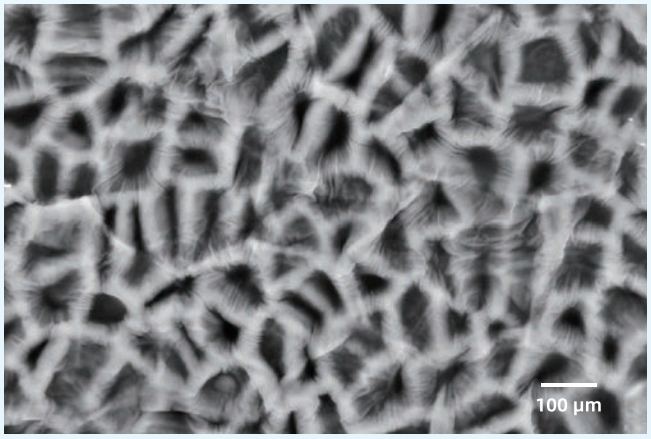
SEM3200/ Corn starch /10 kV/ETD



SEM3200/ Rice /10 kV/ETD



SEM2100/ Salt /1 kV/ETD



SEM3200/ Rapeseed /20 kV/Low vacuum 60 Pa/BSED

SEM3200/Red bean cross-section /20 kV/Low vacuum 70 Pa/BSED

Specifications

	Specifications	SEM2100	SEM3200	SEM3300
Electron Optics	Resolution	3.9 nm @ 20kV, SE 4.5 nm @ 20kV, BSE	3 nm @ 30 kV, SE 7 nm @ 3 kV, SE 4 nm @ 30 kV, BSE 3 nm @ 30 kV, SE, 30 Pa	2.5 nm @ 15 kV, SE 4 nm @ 3 kV, SE 5 nm @ 1.0 kV, SE
	Accelerating voltage	0.5 kV ~ 30 kV	0.2 kV ~ 30 kV	0.1 kV ~ 30 kV
	Magnification（Polaroid）	1 x ~ 300,000 x	1 x ~ 300,000 x	1 x ~ 300,000 x
Specimen Chamber	Low Vacuum	None	5~1000 Pa（Optional）	None
	Camera	optical navigation + chamber monitoring		
	Stage type	3-Axis, XYZ axis vacuum compatible motorized	5-Axis vacuum compatible motorized	
	XY Range	125 mm	125 mm	
	Z Range	50 mm	50 mm	
	T Range	/	-10° ~90°	
	R Range	/	360°	
Detector	In-lens Electron Detector (Inlens)	/	/	●
	Everhart-Thornley Detector(ETD)	●	●	●
	Retractable Back-Scattered Electron Detector (BSED)	○	○	○
	Energy Dispersive Spectrometer (EDS)	○	○	○
	Electron Backscattered Diffraction Pattern (EBSD)	○	○	○
Optional	Specimen exchange loadlock	○	○	○
	Trackball & Knob Control Panel	○	○	○
User Interface	Operating System	Windows		
	Navigation	Optical navigation, gesture quick navigation, trackball(optional)		
	Automatic Functions	Auto brightness & contrast, auto focus, auto stigmator		

● Standard configuration. ○ Optional / None

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