Scientific / Metrology Instruments

Schottky Field Emission Scanning Electron Microscope

Solutions for Innovation

Ultimate Analytical tool

JSM-7900F

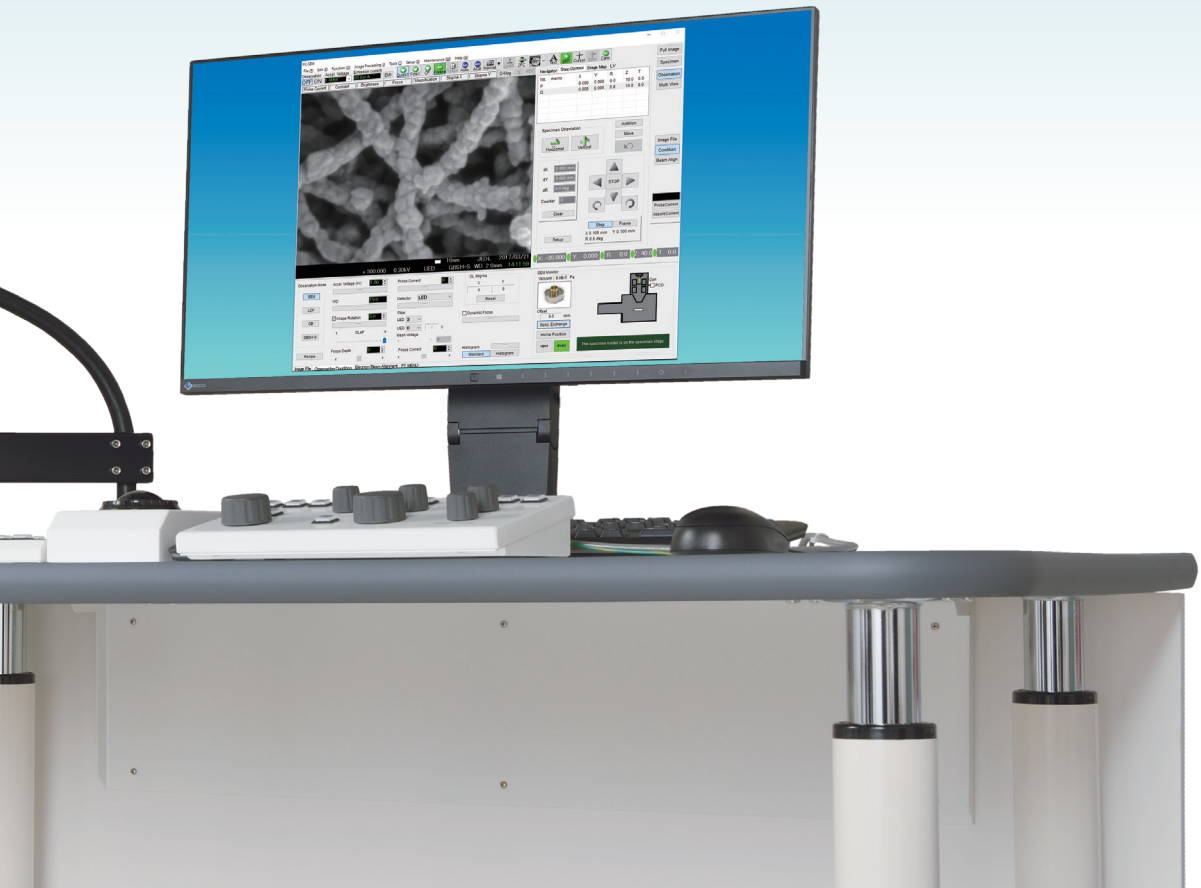
High-Performance FE-SEM successfully combining ultrahigh resolution and unprecedented ease of use.

JEOL Ltd.

Ultimate Analytical tool

Since the development of the first commercial SEM in 1966, JEOL has continued to be at the forefront of technology innovation and has continually contributed to the advancement of science through its SEM technology.

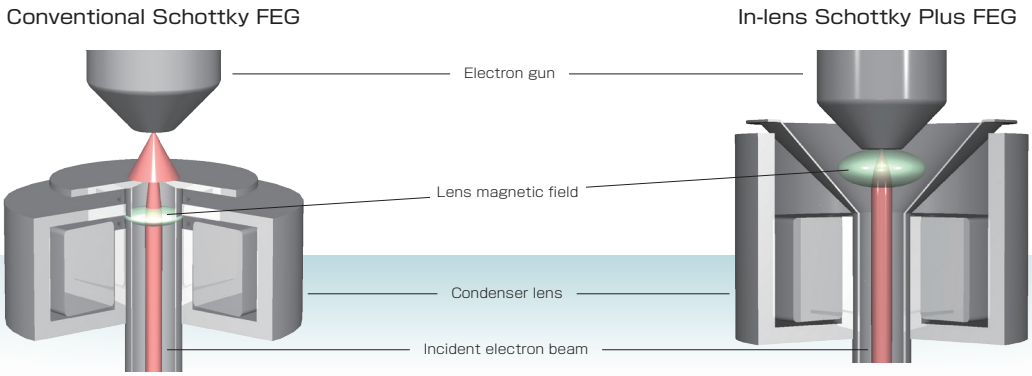
The JSM-7900F is a flagship model of a field emission scanning electron microscope (FE-SEM), which aims to facilitate research and technological breakthroughs for future generations. The JSM-7900F successfully combines ultrahigh-resolution imaging, ultrahigh spatial-resolution analysis and higher operability, as well as multi-purpose functions. This new-generation SEM provides the best data fidelity with the utmost ease of operation.



Ultrahigh spatial resolution

In-lens Schottky Plus FEG

The in-lens Schottky Plus field emission gun (FEG) offers improved brightness as a result of enhancements to the combination of the electron gun and low-aberration condenser lens. The electrons generated by the electron gun can be efficiently focused, enabling probe currents on the order of a few pA to several tens of nA even at low accelerating voltages. High-resolution observation is easy, with no need to exchange the objective aperture for tasks from fast elemental mapping to EBSD, CL or WDS analysis.



Super Hybrid Lens (SHL)

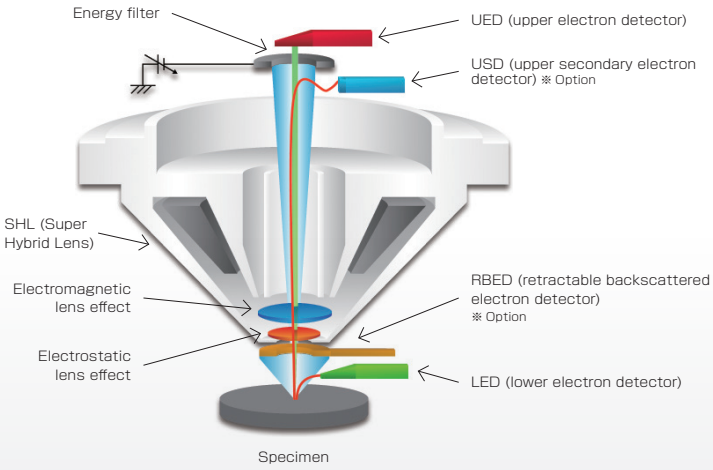
The JSM-7900F comes with JEOL's electrostatic/electromagnetic field superposed objective lens, "Super Hybrid Lens (SHL)". This powerful lens enables observation and analysis of any specimens at ultrahigh spatial-resolution, including magnetic and insulating materials.

GBSH-S (GENTLEBEAM™ Super High resolution)

GBSH enhances resolution at low accelerating voltages.
A newly developed GBSH-S enables the bias voltage up to 5 kV to be applied to the specimen stage.

Detector system

Simultaneous signal acquisition with up to four detectors is enabled.
The JSM-7900F comes with LED (lower electron detector) and UED (upper electron detector: in-lens detector). In addition, optional USD (upper secondary electron detector) and RBED (retractable backscattered electron detector) can be incorporated.



New backscattered electron detector ※ Option

A newly designed ultrahigh-sensitivity backscattered electron detector greatly improves signal to noise ratio for low BSE contrast materials. In particular, the contrast of a compositional image is dramatically enhanced at low accelerating voltages.

Aperture angle control lens (ACL)

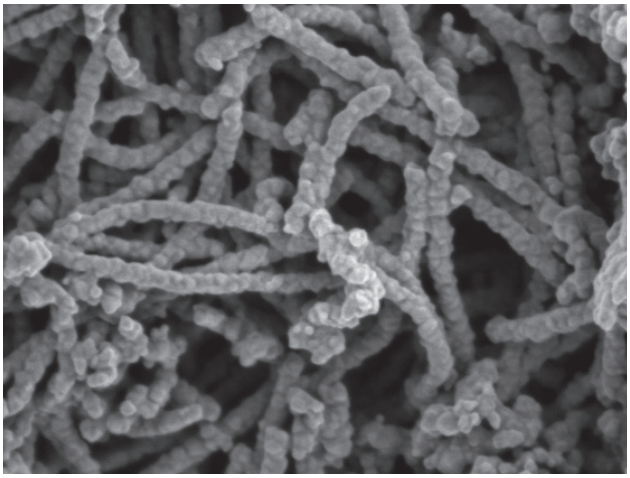
The aperture angle control lens (ACL), located above the objective lens, automatically optimizes the aperture angle of the objective lens over the whole current range. Even when the probe current is increased, ACL suppresses the spread of the incident electrons for always maintaining a smallest probe. ACL also controls the aperture angle for large variations of the probe current, enabling smooth SEM operations.

Low vacuum function ※ Option

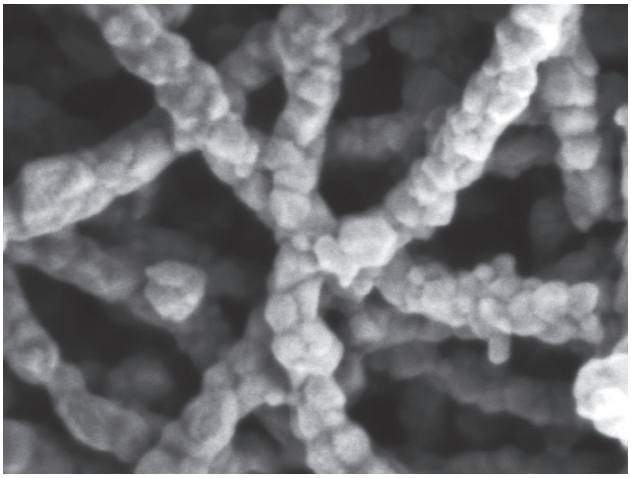
The low vacuum function allows simple observation and analysis with no conductive coating. Thus, the JSM-7900F maintains high resolution in low vacuum.

High spatial resolution observation

Oxide nanomaterials

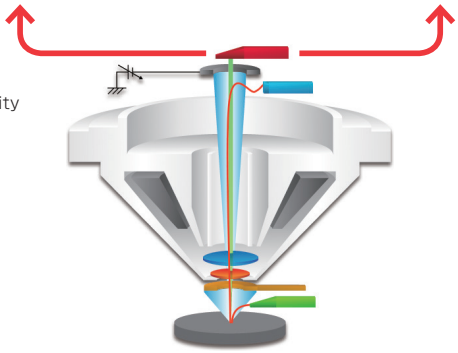


100 nm



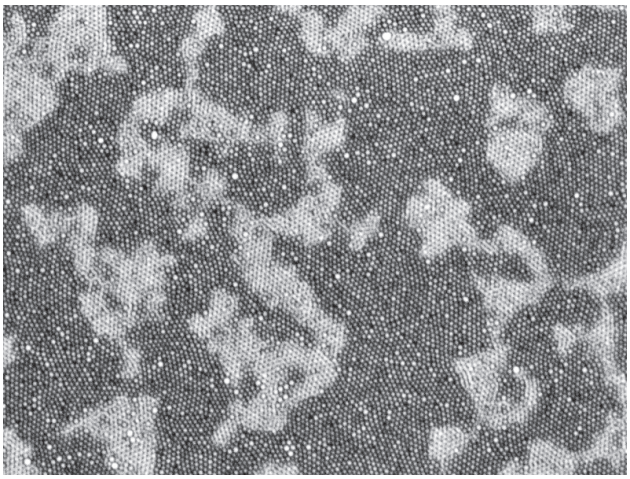
10 nm

Specimen: Nano rod of TiO_2*
Specimen courtesy: Shanghai Jiao Tong University
Professor Shunai Che
Acc. Vol.: 0.3 kV (GBSH)
Signal: Secondary electrons
Detector: UED
Magnification: ×120,000, ×300,000

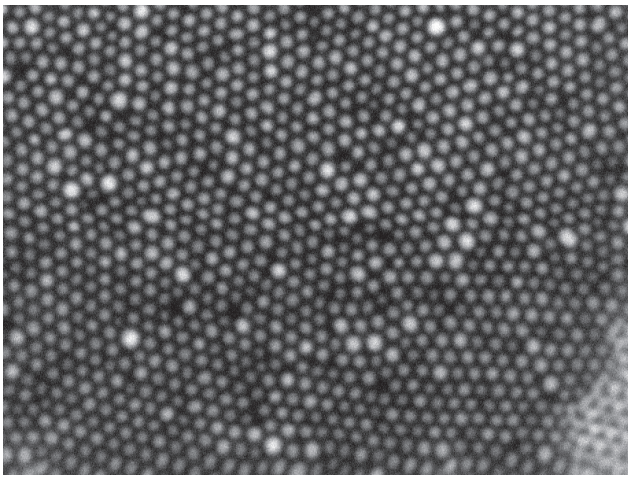


* Reference : S. Liu, L Han, Y. Duan, S. Asahina, O. Terasaki, Y. Cao, B. Liu, L. Ma, J. Zhang, S. Che*, " Synthesis of Chiral TiO_2 Nano fiber with Electron Transition-Based Optical Activity" Nature communications, 3, Article number 1215, 2012

Metal nanoparticles

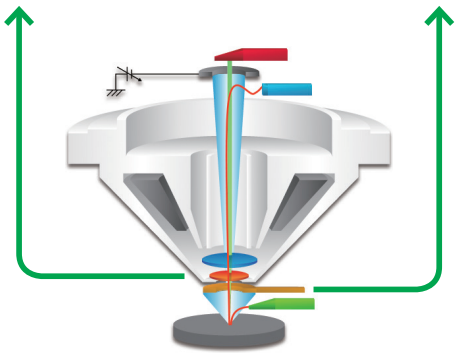


100 nm



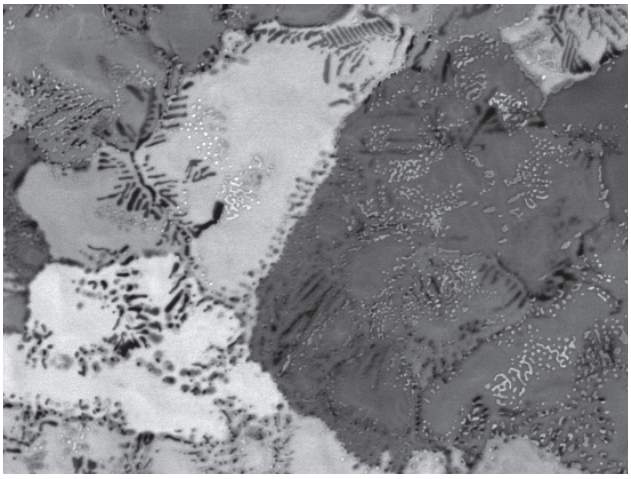
10 nm

Specimen: Ag nanoparticles
Specimen courtesy: Yamagata University
Prof. M. Kurihara and Assistant Prof. T. Togashi
Acc. Vol.: 5 kV (GBSH)
Signal: Backscattered electrons
Detector: RBED
Magnification: ×100,000, ×350,000



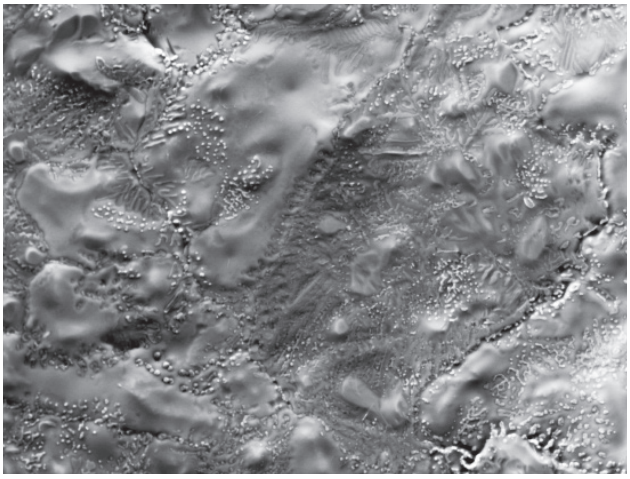
Signal differentiation
–Applications obtained by a variety of detectors–

Metal materials



1 μm

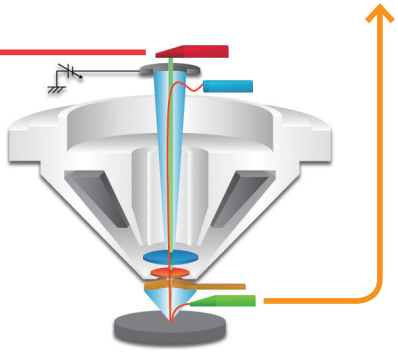
Compositional and crystalline information



Topographic information

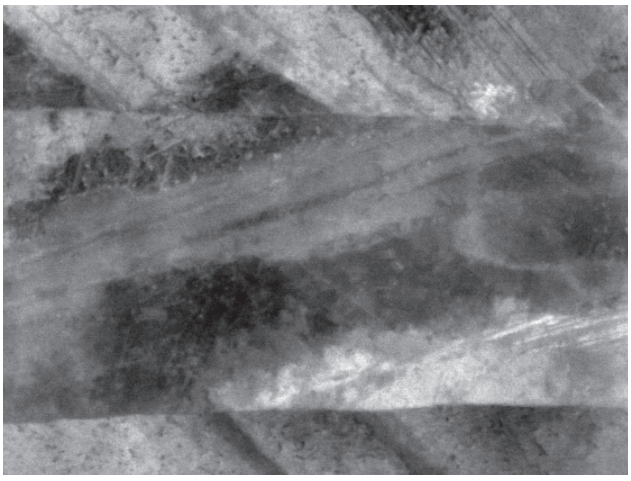
1 μm

Specimen: Solder of Ag, Sn and Cu
Acc. Vol.: 5 kV
Energy filter: -0.5 kV
Signal:
High angle backscattered electrons (with UED)
Secondary and backscattered electrons (with LED)
Detector: UED, LED
Magnification: ×7,000

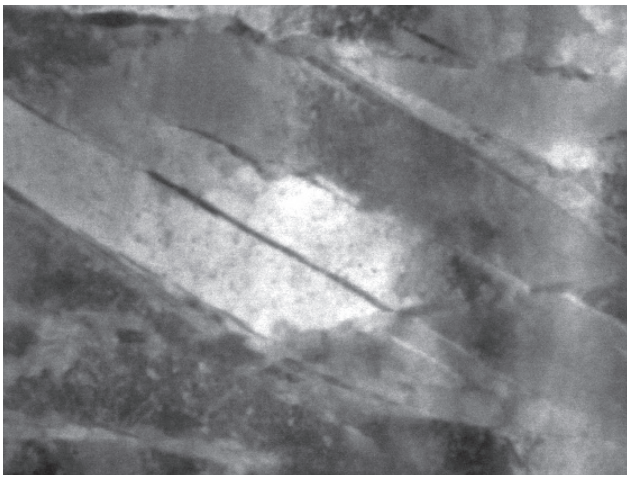


Simultaneous signal acquisition

Steel materials

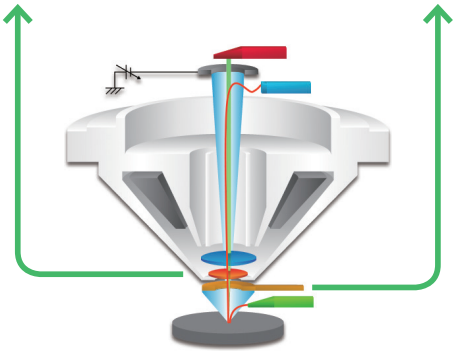


100 nm



100 nm

Specimen: Cross section of stainless steel interconnect milled by CP
Acc. Vol.: 7 kV (GBSH)
Signal: Low angle backscattered electrons
Detector: RBED
Magnification: ×120,000, ×200,000

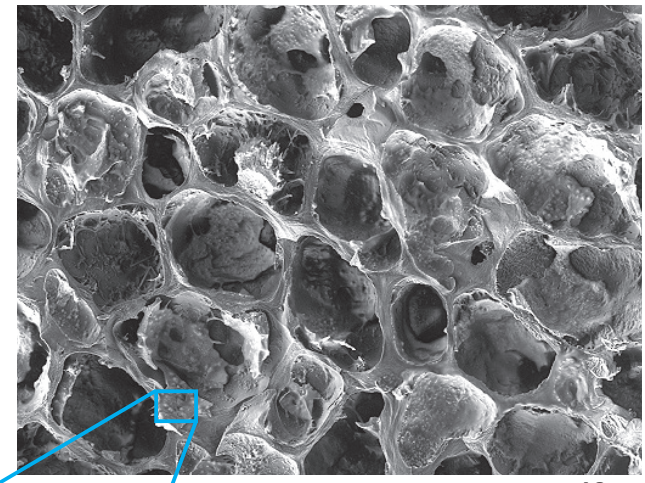


Low vacuum function

Food

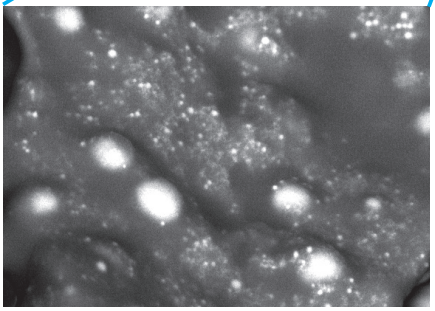
Specimen: Fractured surface of coffee bean
Acc. Vol.: 5 kV
Vacuum: 150 Pa
Magnification: ×500

High vacuum (10^{-5} Pa) — 10 μm

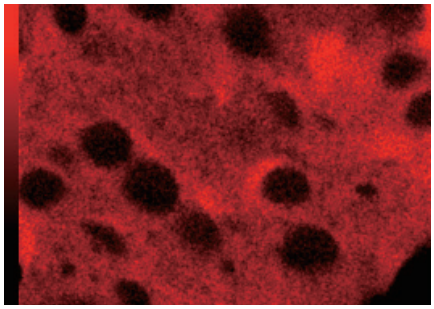


Low vacuum (150 Pa) — 10 μm

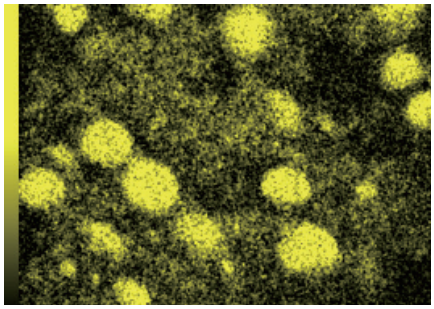
【EDS analytical conditions】
Acc. Vol.: 5 kV, Vacuum: 150 Pa, Magnification: ×900, JED 100 mm^2 EDS detector used



3 μm



C K — 3 μm



Mg K — 3 μm

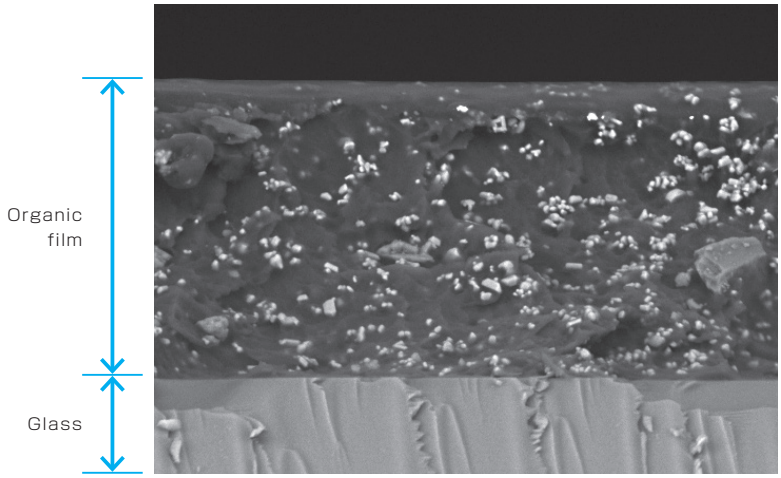
The low vacuum function easily suppresses charging of an insulating specimen.

Low vacuum function –Observation at high magnification–

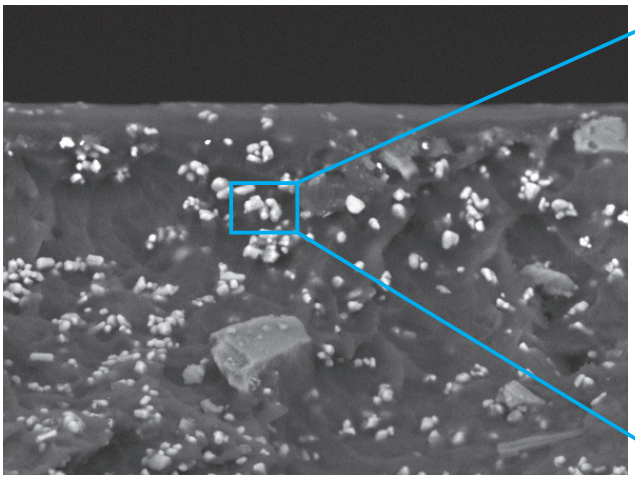
Glass

Specimen: Fractured surface of organic film on glass
Acc. Vol.: 5 kV
Vacuum: 150 Pa
Signal: Backscattered electrons
Detector: LVBED
Magnification: ×7,000, ×10,000, ×100,000

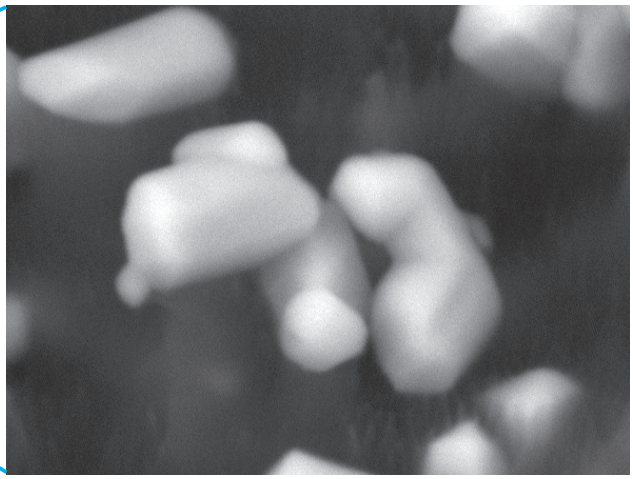
The JSM-7900F provides high spatial resolution even in low vacuum. These images demonstrate that inorganic fillers contained in an organic film on a glass are clearly observed.



Magnification: ×7,000 — 1 μm



Magnification: ×10,000 — 1 μm



Magnification: ×100,000 — 100 nm

Improved operability

Neo Engine

The JSM-7900F is equipped with a new electron-optical control system, "Neo Engine/New Electron Optical Engine", which accumulates JEOL's superb electron optical technologies. Neo Engine achieves further ease of operations of automatic functions.

New platform

New exterior design, with no operation console, dramatically reduces the instrument footprint. Thus, the JSM-7900F accommodates a variety of installation environments.

New specimen exchange system

A newly designed specimen exchange system (load lock) is adopted for simple specimen exchange, higher throughput, and higher durability.

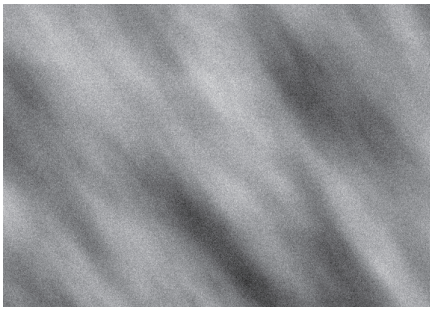
SMILENAVI

SMILENAVI is an operation navigation system, which is developed for beginners to grasp basic SEM operations efficiently.

Operability –Extended automatic functions–

Minerals

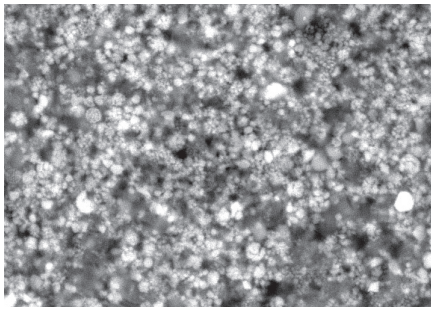
Specimen: Cross section of mineral (resin-embedded) milled by CP, Acc. Vol.: 5 kV, Detector: RBED, Magnification: ×100,000



100 nm

Auto

Automatic functions, with greatly improved precision, allow for beginners to easily acquire a high-magnification image.



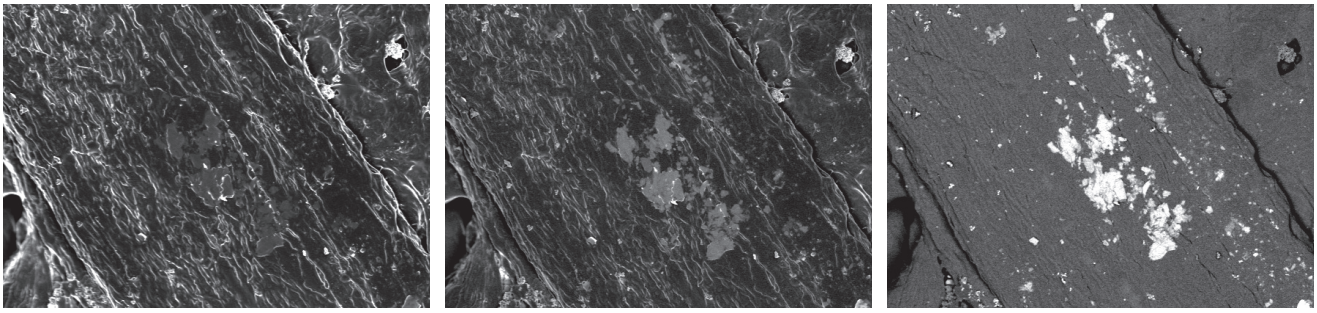
100 nm

Operability –Extended automatic functions–

Soft materials

Specimen: Name card, Acc. Vol.: 15 kV, Detector: UED, Magnification: ×3,500

3 μm



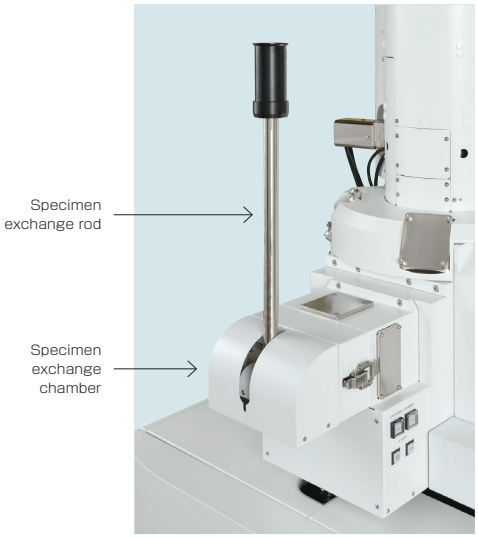
Filter set: +0.3 kV | Filter set: -0.1 kV | Filter set: -1 kV

Secondary electrons ← → Backscattered electrons

Seamless energy selection using a new energy filter

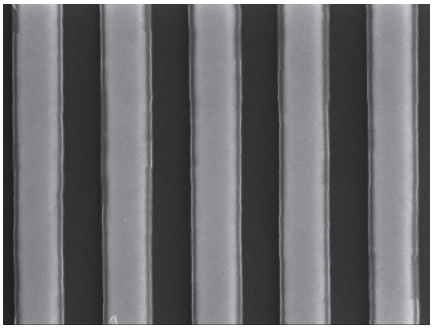
Operability –New specimen exchange system–

A new specimen exchange system is adopted. The new system achieves simpler and smoother specimen transfer via guided operations. This capability enables fast specimen exchange for beginners to experts.

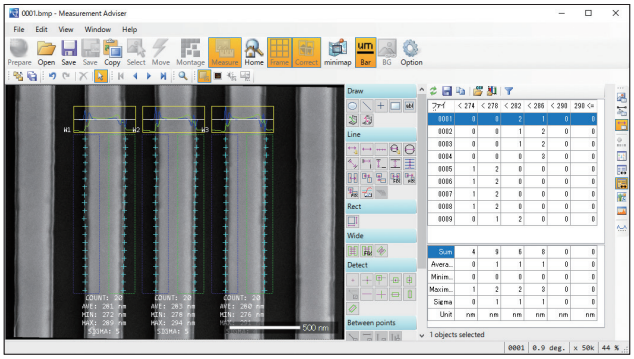


Operability –SEM Supporter for image acquisition support–

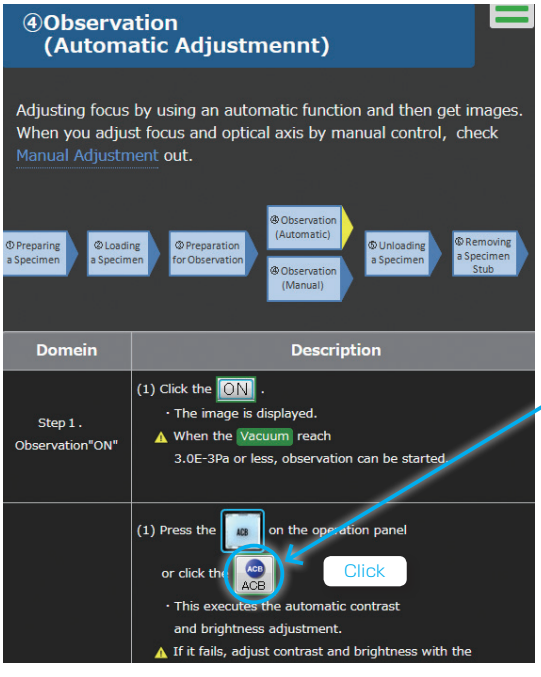
The SEM Supporter of SYSTEM IN FRONTIER INC. enables automatic line width measurement (metrology) utilizing the contrast of SEM images.



【SEM observation】
Specimen: Specimen for metrology (MRS5)
Acc. Vol.: 10 kV
Magnification: ×50,000



Operability – SMILENAVI –



SMILENAVI

GUI screen

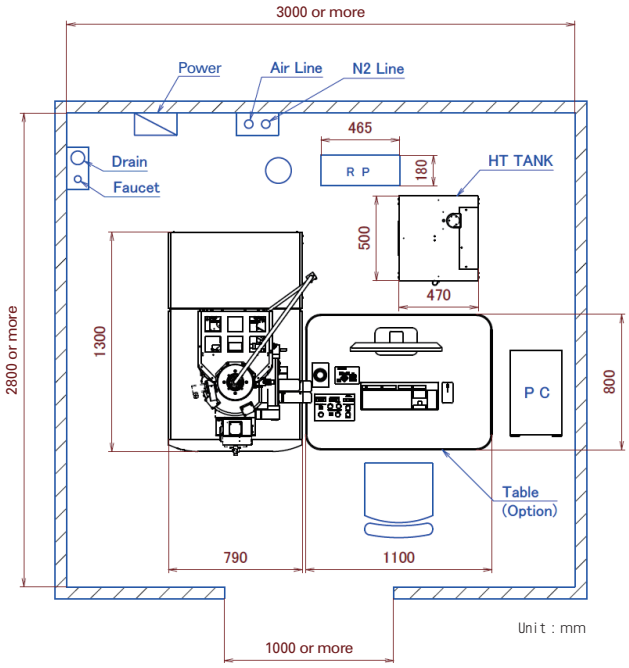
SMILENAVI is an assistant tool designed for beginners to allow smooth SEM basic operations. When the operator clicks an icon button according to the SMILENAVI flowchart, the SEM GUI screen is linked to the click operation for guiding the operations.

Specifications

Specifications	
Resolution	1.1 nm (0.5 kV)*1, 1.0 nm*2 0.7 nm (1 kV)*1, 0.7 nm*2 0.7 nm (15 kV)*1, 0.6 nm*2 3.0 nm (5 kV, WD : 10 mm, 5 nA)*1 *1: Gap method, *2: Edge method
Magnification	Photo magnification: ×25 to 1,000,000 (120 × 90 mm) Display magnification: ×75 to 3,000,000 (1,280 × 960 pixels)
Accelerating voltage	0.01 to 30 kV
Probe current	A few pA to 500 nA
Detector (standard)	Upper electron detector (UED), Lower electron detector (LED)
Electron gun	In-lens Schottky Plus field emission electron gun
Aperture angle control lens	Built-in
Objective lens	Super Hybrid Lens (SHL)
Automatic function	Focus, Astigmatism correction, Brightness, Contrast
Large depth of focus (LDF)	Built-in
Specimen stage	Full eucentric goniometer stage
Specimen movement	X : 70 mm, Y : 50 mm, Z: 2 to 41 mm Tilt: -5 to 70° , Rotation: -360°
Motor control	5-axis motor control
Specimen exchange chamber	Maximum dia.: 100 mm⌀ Maximum height: 40 mm H
Vacuum system	SIP, TMP, RP

Principal Options
Energy dispersive X-ray spectrometer (EDS)
Wavelength dispersive X-ray spectrometer (WDS)
Soft X-ray emission spectrometer (SXES)
Electron backscatter diffraction system (EBSD)
Retractable backscattered electron detector (RBED)
Upper secondary electron detector (USD)
Stage navigation system (SNS)
Chamber camera
Table

Installation Requirements	
Power	Single phase: 100 V AC, 50/60 Hz, 3.0 kVA (max.) For normal use: Approx. 1.1 kVA Energy saving mode (Vacuum system OFF): Approx. 0.6 kVA Allowable power input fluctuation: ±10 %
Grounding terminal	100 Ω or less, One
Cooling water	Faucet: ISO 7/1 Rc 1/4, One Flow rate: 0.6 to 1.1 L/min Pressure: 0.05 to 0.25 MPa (gauge pressure) Temperature: 20 ± 5℃ Drain: ISO 7/1 Rc 1/4, One
Dry nitrogen gas	Pressure: 0.45 to 0.55 MPa
Dry compressed air	Pressure: 0.45 to 0.55 MPa
Installation room	Room temperature: 20 ± 5℃ Humidity: 60% or less (no condensation) Footprint: 3,000 mm × 2,800 mm or more Effective ceiling height: 2,700 mm or more Door size: 1,000 mm (W) × 2,000 mm (H) or more



＊Specifications subject to change without notice.

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