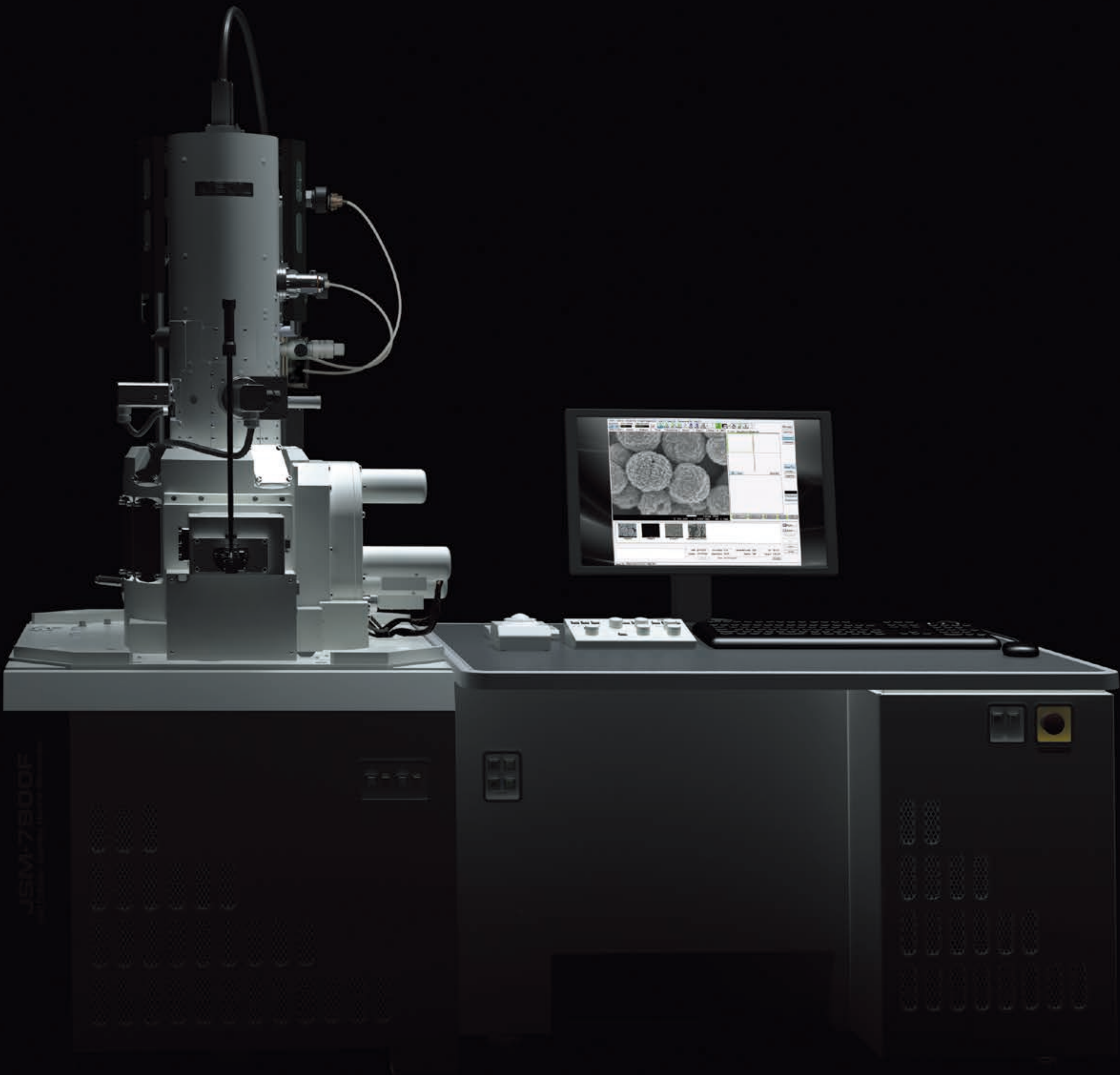
JSM-7800F

Field Emission Scanning Electron Microscope



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Extreme resolution

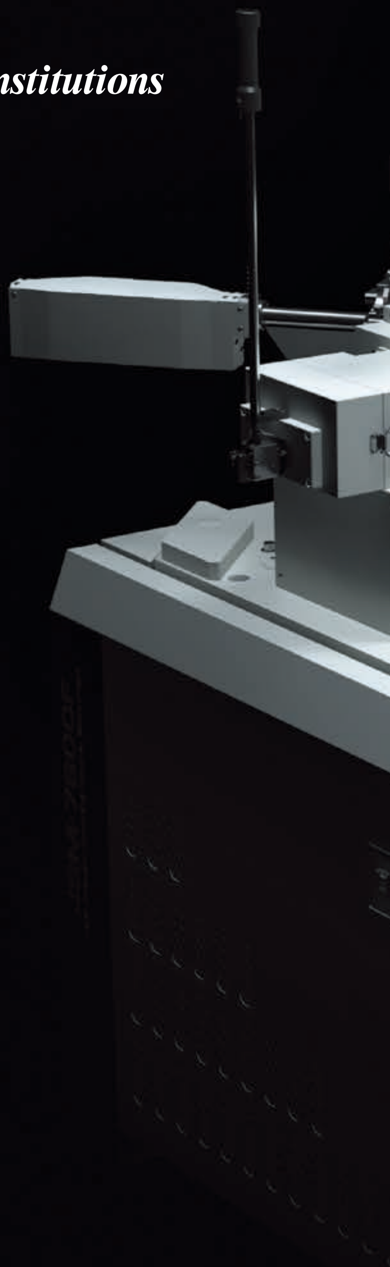
The super hybrid lens (SHL) provides extreme resolution of 0.8 nm at 15 kV and 1.2 nm at 1 kV.
With a very low incident electron energy, extremely fine surface structures are revealed.
The distribution of materials can be observed even below 1 keV by selecting backscattered electrons with the energy filter.

Fast and high precision analysis

The High Power Optics composed of the in-lens Schottky FEG and the aperture angle control lens keeps the electron probe small even at large probe currents.
A large probe current allows you to analyze samples quickly without sacrificing the precision and quality of the analyses. A variety of analytical systems including EDS, WDS, and EBSD are available.
Distortion-free EBSD patterns are obtained for high precision crystal orientation analysis.

No limitation in specimens

The super hybrid lens is a field free lens at the analytical working distance.
Magnetic samples can be observed and analyzed at high magnifications.
Non-conductive samples are easily observed at low voltages with high resolution.



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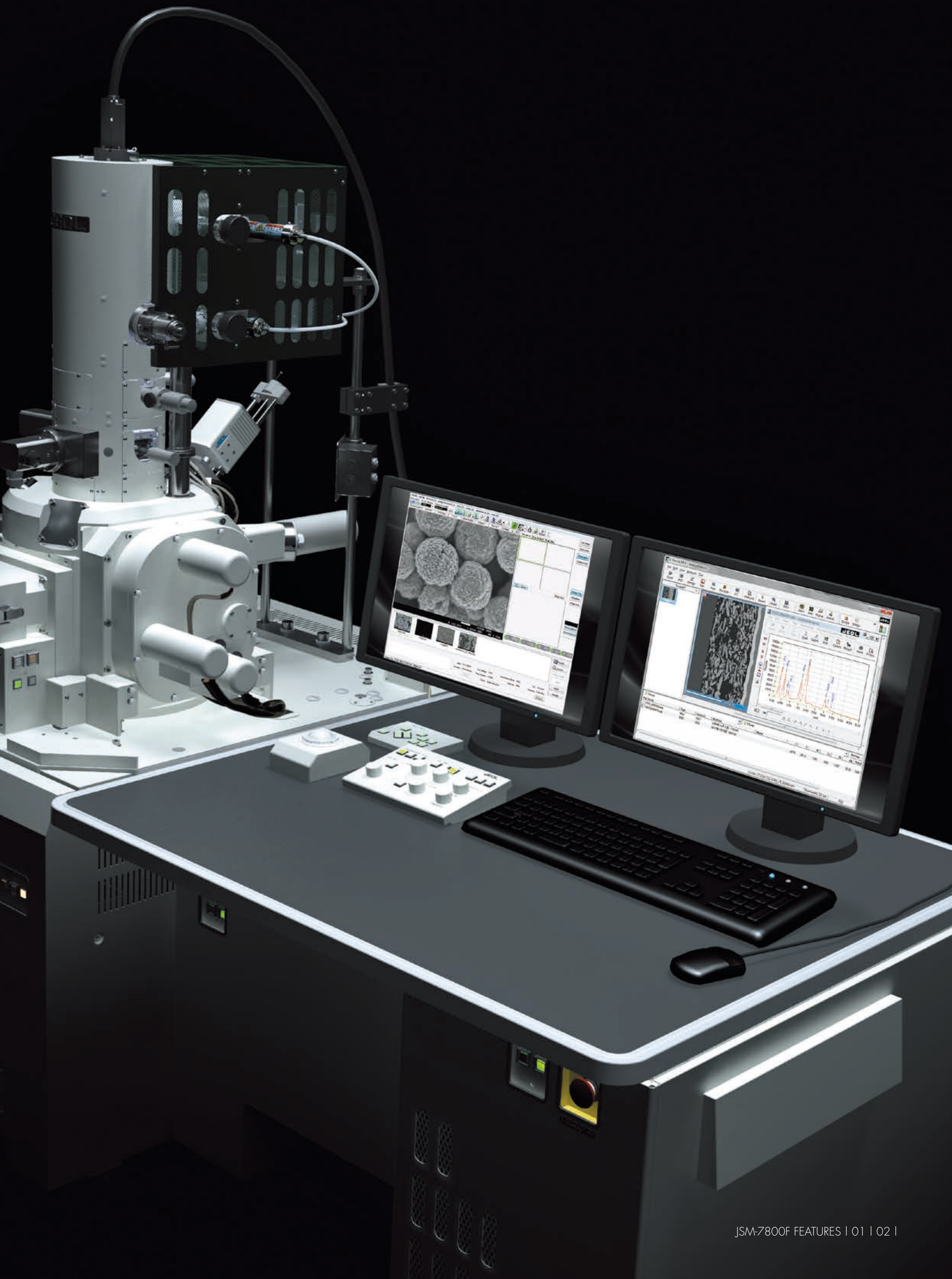


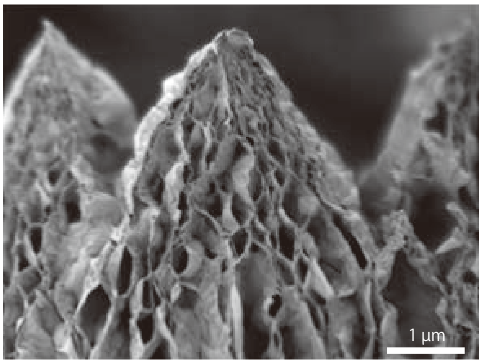
Extreme resolution

High Resolution without restriction on specimen or analysis

The super hybrid lens (SHL) with the Gentle Beam (GB) brings you closer to the nano-world. The super hybrid lens delivers superb high resolution even at extremely low incident electron energies for observation and analysis of nano-size structures. The super hybrid lens can be used to observe and analyze magnetic materials at high magnifications.

Observation of fine surface structure with the upper electron detector and GB

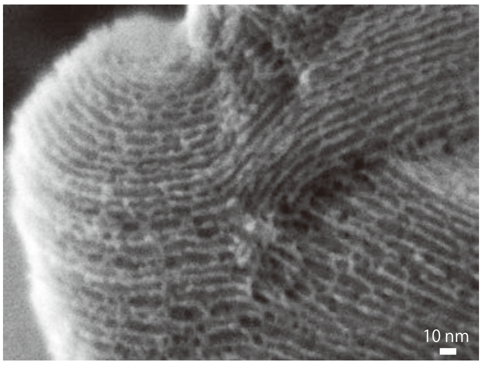
A bias voltage applied to a specimen holder improves resolution and improves detection efficiency of the upper electron detector.
0.08 kV was used for observation of Graphene. The super hybrid lens enables one to observe extremely fine structures at very low voltages.



Specimen: Graphene
Accelerating voltage: 0.08 kV (GB)
original magnification: ×20,000

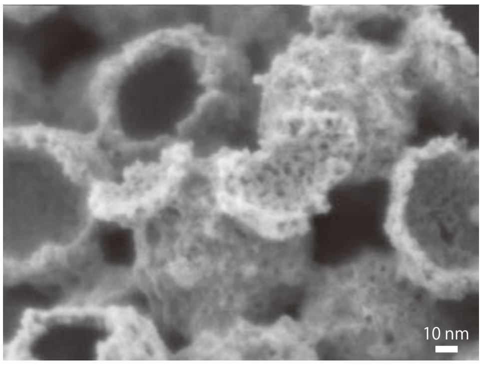
Ultra high resolution with the Gentle beam

An extremely low electron landing energy was used to observe very fine pores with a few nm diameters.



Specimen: Meso-porous silica
Accelerating voltage: 1 kV (GB)
original magnification: ×400,000

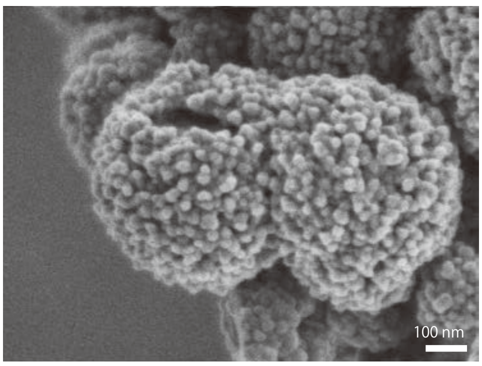
This specimen is porous carbon material. The extremely low energy incident electron probe clearly shows holes of a few nm.



Specimen: Au@Carbon
Accelerating voltage: 0.3 kV (300 V) (GB)
original magnification: ×500,000
The specimen courtesy of **Prof. Dr. Ferdi Schüth**
Department of Heterogeneous Catalysis
Max-Planck-Institut fur Kohlenforschung

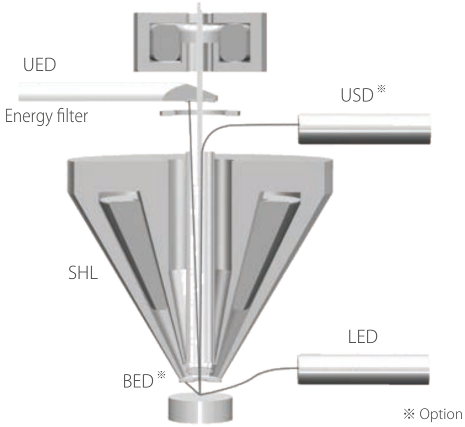
Magnetic materials

The super hybrid lens allows you to study magnetic materials at high magnifications.



Specimen: Fe_3O_4 Nano particles
Accelerating voltage: 1 kV (GB)
original magnification: ×100,000
Specimen courtesy of **Dr. Takanari Togashi, Prof. Tadafumi Adschiri,**
Advanced Institute for Material Research,
Tohoku University

Electron energy selective detection system



Four kinds of detectors and electron energy filter

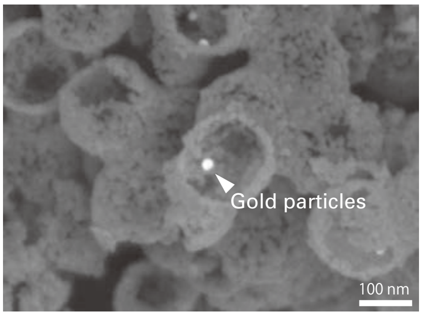
The energy filter is placed between the upper electron detector (UED) and the upper secondary electron detector (USD). Secondary electrons and backscattered electrons are separated and detected simultaneously with these two detectors.

Information selective upper detectors

The upper detector

The upper detector detects higher energy electrons which pass through the energy filter.

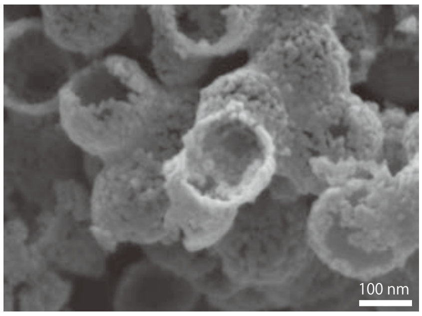
The contrast generated by the difference of density is observed.



Specimen: Au@TiO_2 catalyst
Accelerating voltage: 2 kV
original magnification: ×150,000
The specimen courtesy of Prof. Dr. Ferdi Schüth, Max-Planck-Institut Mülheim

The upper secondary electron detector

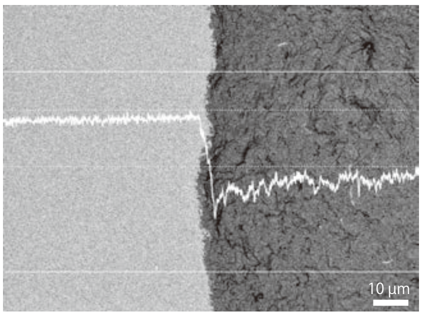
The upper secondary electron detector detects secondary electrons separated with the energy filter.



Specimen: Au@TiO_2 catalyst
Accelerating voltage: 2 kV
original magnification: ×150,000
The specimen courtesy of Prof. Dr. Ferdi Schüth, Max-Planck-Institut Mülheim

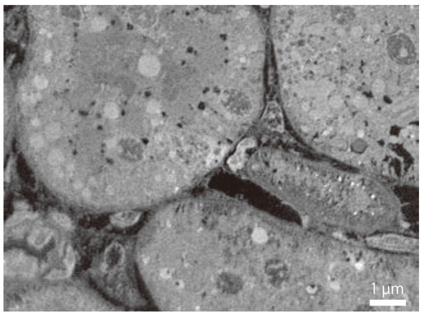
Upper detector and the energy filter to observe composition contrast

Diamond (left) and graphite (right) show the contrast due to the difference in density by detecting elastically scattered electrons selected with the energy filter.



Specimen: Diamond, Graphite
Accelerating voltage: 1 kV
original magnification: ×1,000
Density: Diamond 3.51 g/cm^{3}
Graphite 2.25 g/cm^{3}

At a very low landing electron energy an ultra-thin section of mouse kidney was observed without staining by detecting backscattered electrons.

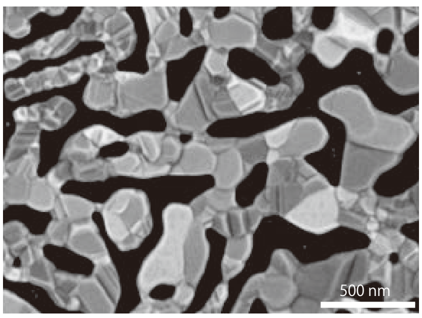


Specimen: Ultra-thin section of mouse kidney
Accelerating voltage: 1 kV
original magnification: ×1,500

Backscattered electron detector (BED)

The backscattered electron detector is a semiconductor detector placed directly above a specimen.

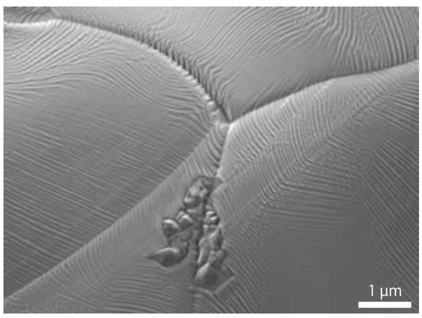
It detects low angle backscattered electrons at short working distance.



Specimen: Evaporated gold on carbon
Accelerating voltage: 3 kV

The lower electron detector (LED)

The lower electron detector is mounted on the specimen chamber and detects fine steps on specimen surface.



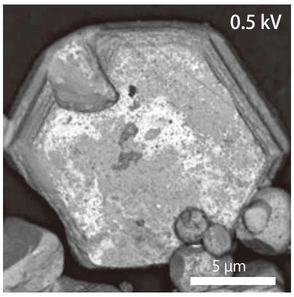
Specimen: Copper in silver
Accelerating voltage: 3 kV

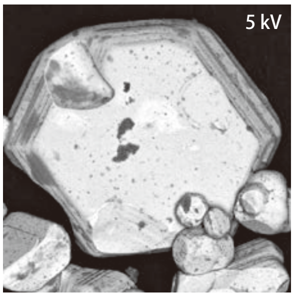
Elemental Analysis

Distribution of thin film revealed at low voltage

The distribution of very thin film on the surface of ZnS powders is visible more clearly at 0.5 kV than at 5 kV.

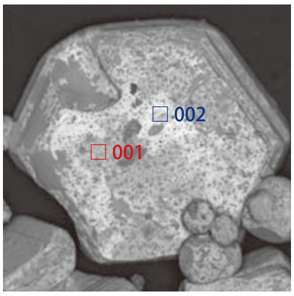
Specimen: ZnS powder

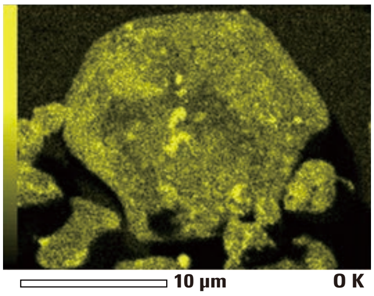




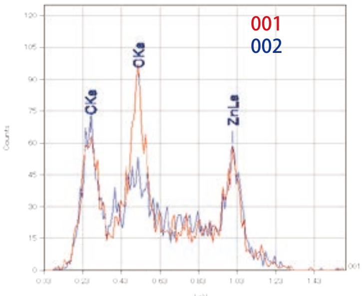
Elemental analysis of a very thin film at very low landing energy

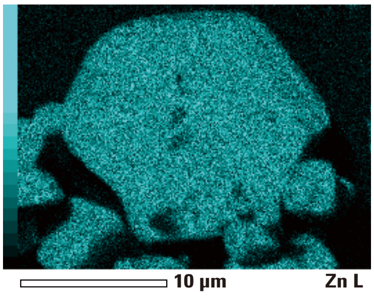
The qualitative analysis and elemental maps are acquired at 1.2 keV. The super hybrid lens with the gentle beam produces large probe current at low voltages. You can analyze thin film quickly.





Specimen: ZnS powder
Accelerating voltage: 1.2 kV (GB)
Probe current: 5 nA
Original magnification: ×5,000

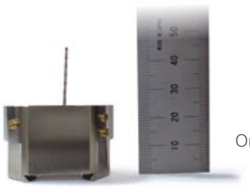




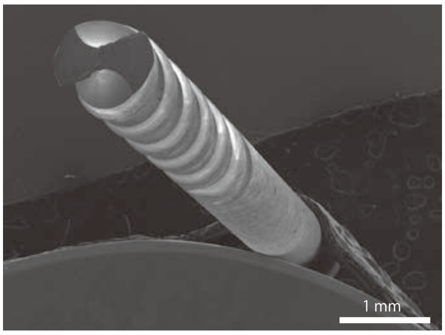
Large Depth of Focus (LDF) mode

Large depth of focus with LDF mode

The large depth of focus mode provides much larger depth of focus than a conventional SEM does. You can focus even on a very rough surface as a drill bit demonstrates on this example. The large depth of focus mode lets you observe a large area at high tilt angle with minimum image distortion. You can analyze a large area with EBSD as well as EDS for elemental mapping.



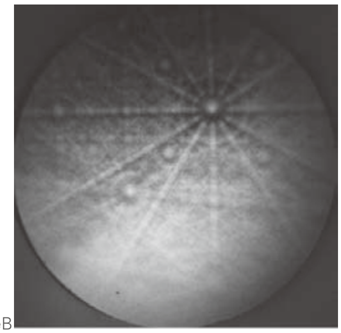
Specimen: Drill bit
LDF mode
Accelerating voltage: 15 kV
Original magnification: × 25
WD: 40 mm



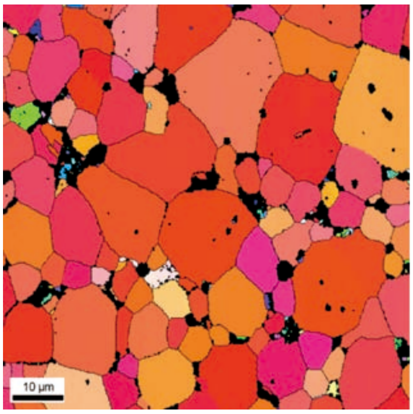
Crystal Orientation Analysis

Electron backscatter diffraction (EBSD) analysis of magnetic specimens

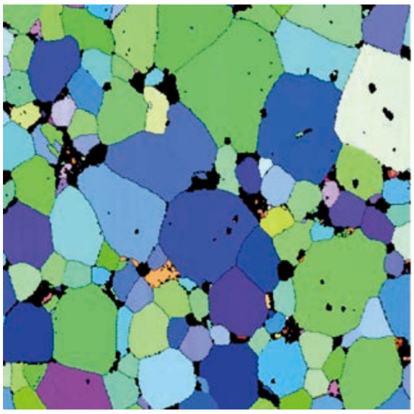
Neodymium magnet is used in hybrid cars. Neodymium magnet is rapidly oxidized after mechanical polishing.
The cross section polisher (CP) was used to make a specimen suitable for EBSD analysis.
The super hybrid lens does not form a magnetic field around a specimen at the working distance for EBSD analysis. You can obtain distortion-free EBSD patterns for high precision analysis.



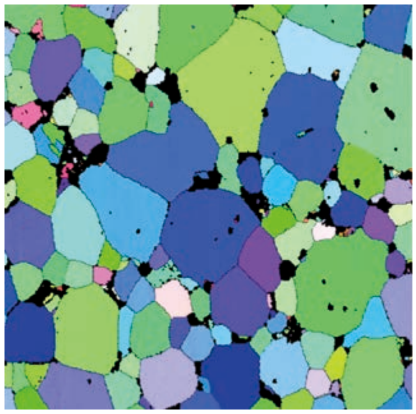
EBSD pattern from NdFeB



IPF Map (ND)

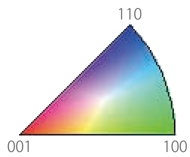


IPF Map (TD)



IPF Map (RD)

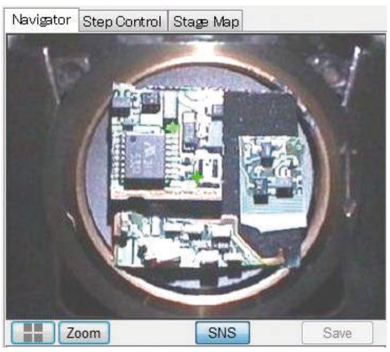
Number of points: 161548
Phases: Nd2Fe14B_4
Dimensions: X Max: 111.75 microns,
Y Max: 77.94 microns
Step: 0.25 microns



Stage navigation system (SNS)

Survey specimen quickly

The image is linked to the X and Y coordinates of the specimen stage. You can move the specimen stage to any point by selecting a point on the image. You can select an area of interest easily and move the specimen stage quickly even on a large specimen on which you cannot observe the entire area at the lowest magnification of the SEM.



JSM-7800F
Specifications

Standard Specifications

• Resolution	0.8 nm (15 kV), 1.2 nm (1 kV)、3.0 nm (5 nA, WD10 mm, 15 kV)
• Image type	Secondary-electron image, Backscattered-electron image
• Accelerating voltage	0.01 kV to 30 kV
• Probe current	A few pA to 200 nA
• Magnification	× 25 to × 1,000,000
• Electron gun	In-lens Schottky field-emission gun
• Aperture angle control lens	Built-in
• Objective lens	Super Hybrid Lens (SHL)
• Objective lens aperture	4 steps, XY fine-movement capability
• Auto functions	Focus, Stigmator, Brightness, Contrast
• Recipe functions	Standard operation conditions, User operation conditions

• Specimen stage	Fully eucentric goniometer stage
X	70 mm
Y	50 mm
WD (Z)	2 mm to 41 mm
Tilt	-5 to +70°
Rotation	360°
Motor control	5 axes
• Specimen holders	For 12.5 mm diameter × 10 mm thick For 32 mm diameter × 20 mm thick
• Specimen exchange chamber	Load lock chamber Type 2 (100 mm diameter × 40 mm height)
• Evacuation system	SIP, TMP, RP

Options

• Energy dispersive X-ray spectrometer (EDS)
• Wavelength dispersive X-ray spectrometer (WDS)
• Electron backscatter diffraction (EBSD)
• Backscattered electron detector (BED)
• Upper secondary electron detector (USD)
• Stage navigation system (SNS)

• Chamber camera	
• Specimen holder	A variety of optional specimen holders are available
• Specimen stage	Type 2 (110 mm × 80 mm) Type 3 (140 mm × 80 mm)
• Specimen exchange chamber	Type 1 (up to 150 mm diameter specimen) Auto load lock chamber (up to 200 mm diameter specimen)

Installation Requirements

• Power	Single phase, 100 V AC, 50/60 Hz, 4 kVA maximum Approximately 1.3 kVA Approximately 0.8 kVA (Energy saving mode)
• Grounding	Less than 100 Ω
• Coolong water	20 °C ± 5 °C

• Dry nitrogen gas	0.45 MPa to 0.55 MPa
• Installation room	Floor space: 3,000 × 3,000 mm or more Ceiling height: 2.300 mm or more Door width: 1,000 mm (W) × 2,000 mm (H) or larger Temperature: 15 to 25 °C, Humidity: 60% or less

**Specifications subject to change without notice.*

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