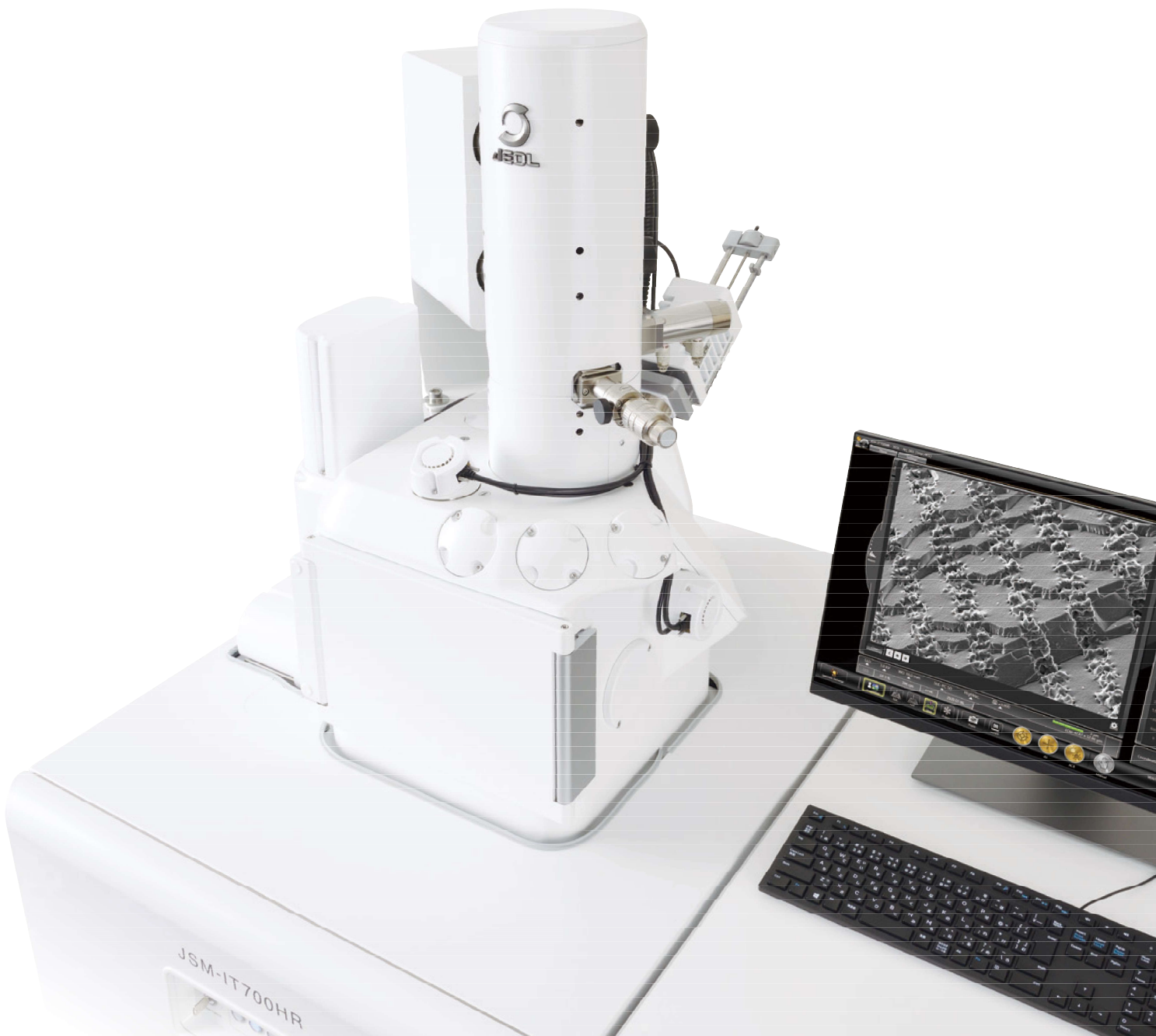




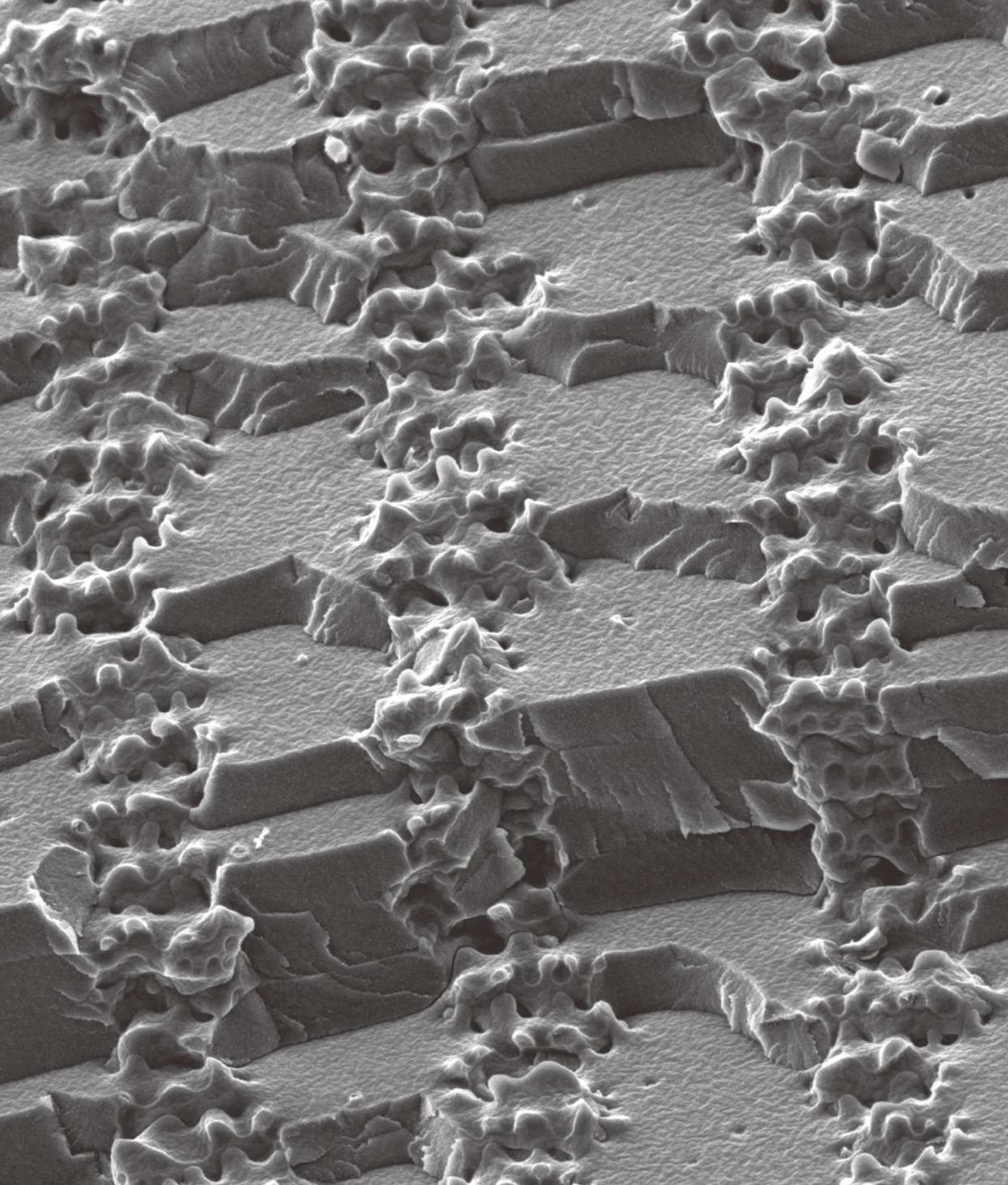
Scientific / Metrology Instruments  
Scanning Electron Microscope

Solutions for Innovation

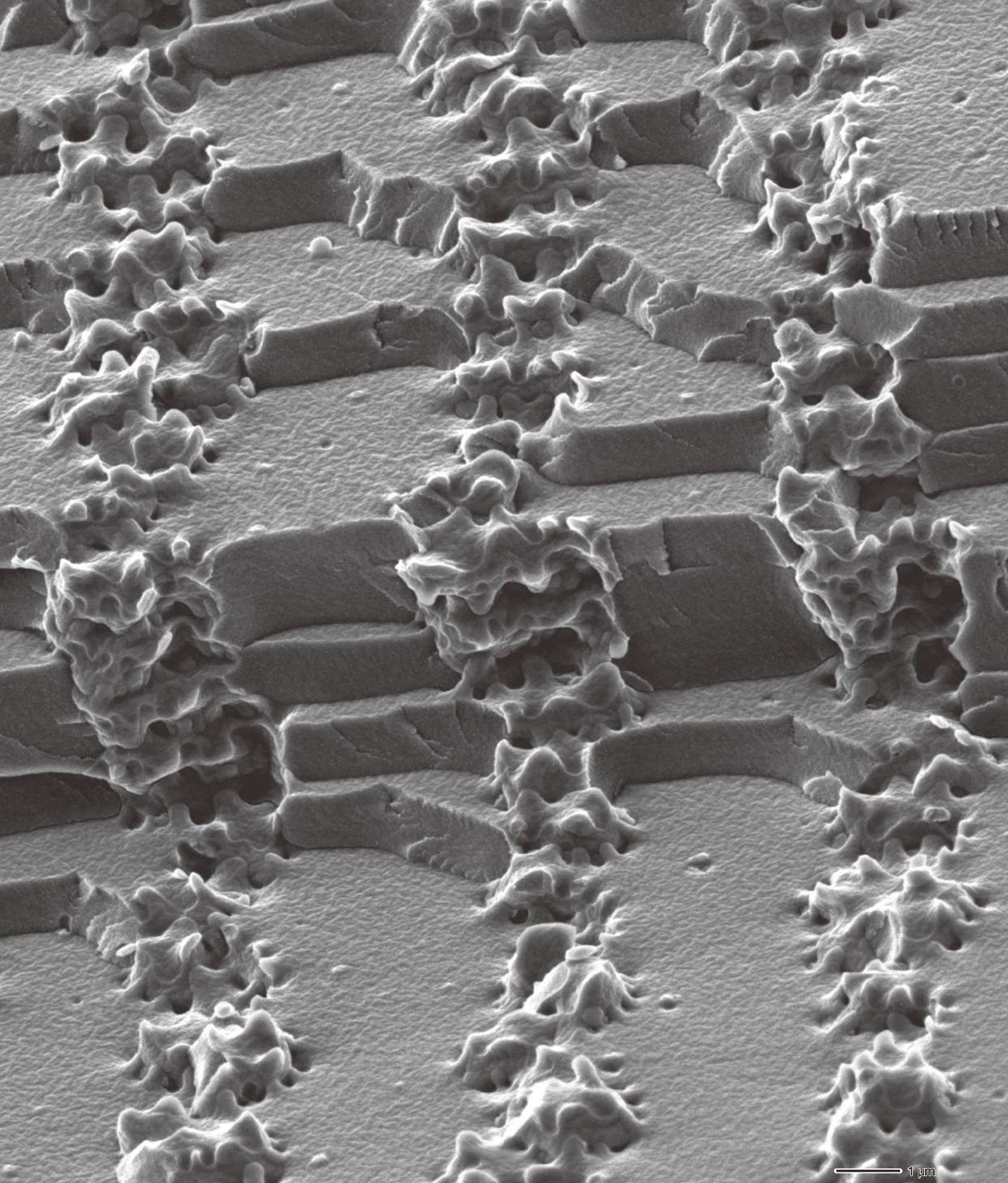
# JSM-IT700HR



JEOL Ltd.



***SEM-Essential in Daily Lab Operation  
JSM-IT700HR Makes it Easy.***



specimen: crystalline lens

*Nano-scaled materials are driving the current technological breakthroughs, and their observation and analysis is facilitated by a new and innovative SEM, JSM-IT700HR. Its new electron gun with spatial resolution of 1 nm and the largest probe current of 300 nA, combined with an exceptionally user friendly software interface significantly simplifies observation and analysis in SEM. The compact instrument design also features a large specimen chamber with multiple accessory ports as well as EDS integration. JSM-IT700HR Advanced SEM, Powerful and Simple to Use.*

# Compact High Resolution SEM



## *Easy to use*

### *— Built-in tools for a streamlined workflow!*

- **Zeromag** simplifies specimen navigation. Provides a seamless transition from an optical image to SEM image.
- **Live Analysis** for real-time monitoring of the elements in the field during
- **SMILE VIEW™ Lab** to manage the data and generate reports.
- **Auto functions** deliver sharp, high resolution images by Auto Focus, Auto and Auto Beam Alignment.



## *High definition • High brightness • High stability*

### *— Powerful analytical SEM performance*

- 15 fold increase in probe current compared to traditional SEM.
- Delivers high resolution even at large probe currents.



## *Large chamber for large specimens*

### *— Free from the limitation of specimen size*

- Large volume, high speed specimen exchange system.
- Simple, safe! Specimen Exchange Navi for step-by-step guide.
- Integrated camera available for monitoring specimen position.

image observation.

Stigma

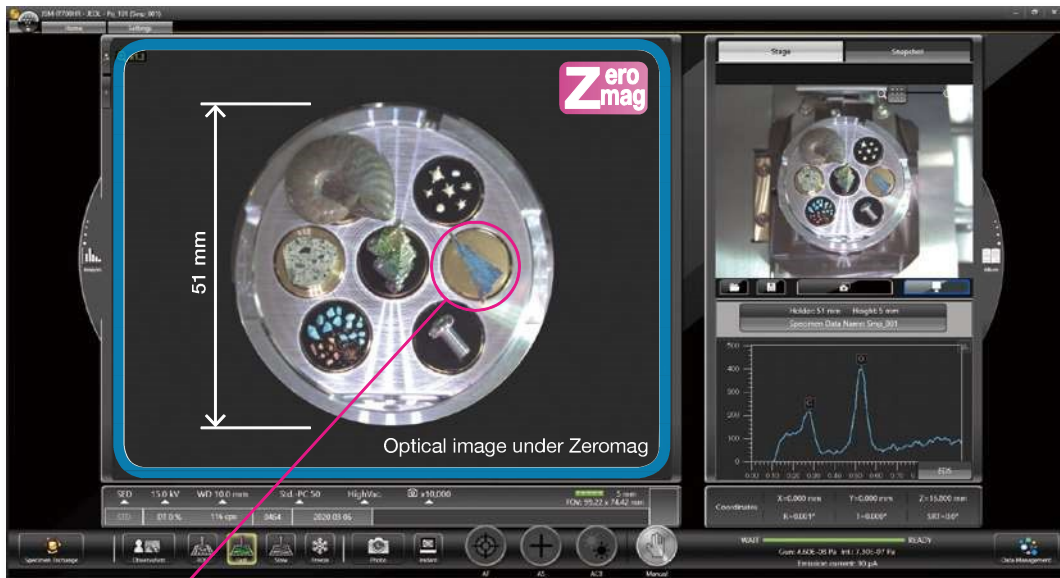




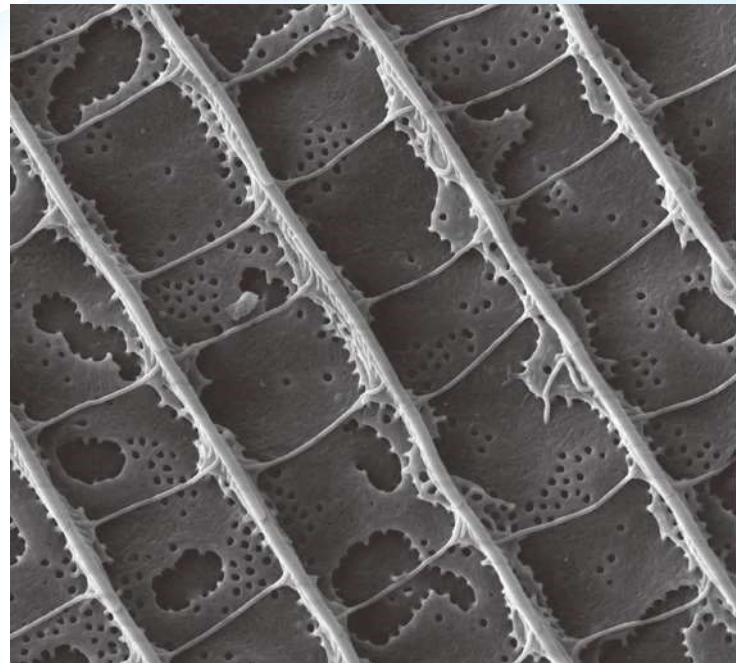
# ZeroMag

Magnify optical image, seamless transition to the

ZeroMag is designed to link the holder graphic or optical image\* with the SEM image. Using ZeroMag, field searching is easy.



×1,000

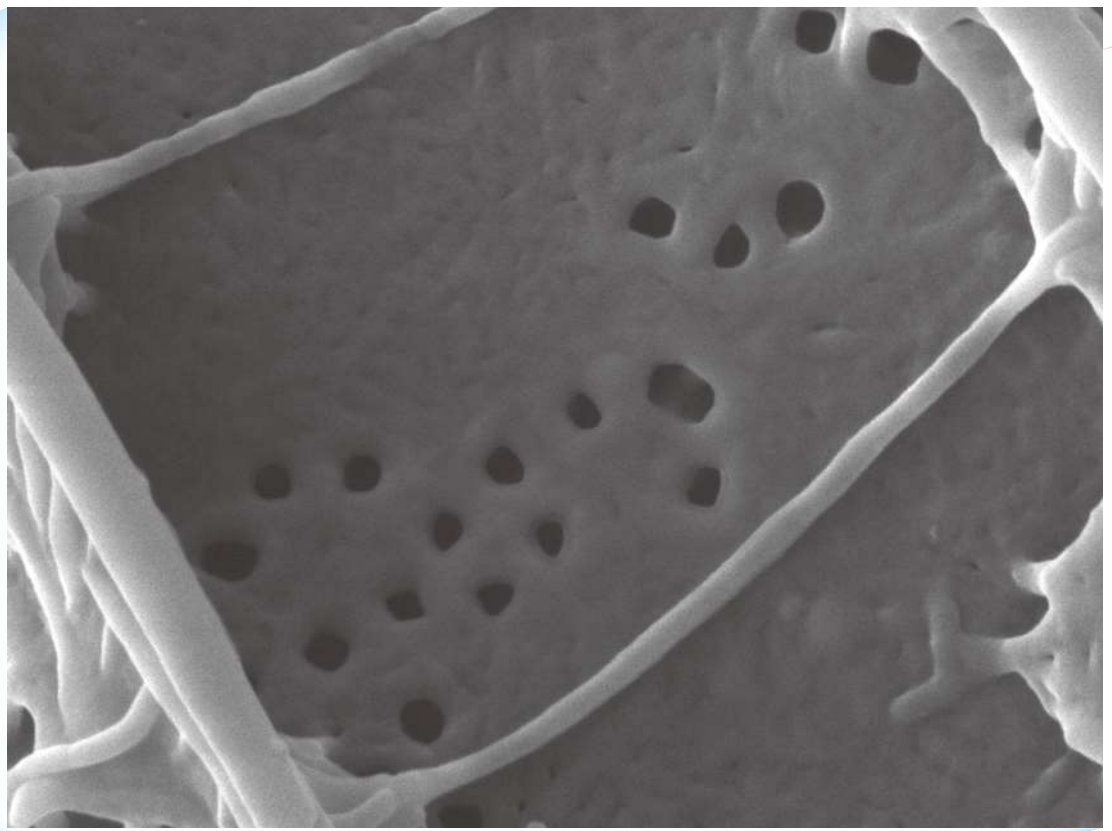


10 μm

# SEM image

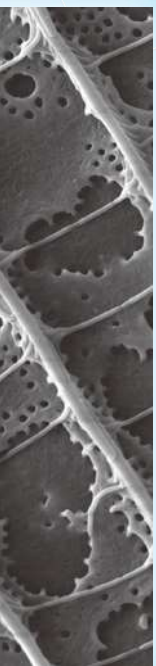
Specimen: Wing scale of butterfly, Accelerating voltage: 3 kV

×50,000



500 nm

×10,000



1 μm

\* Stage Navigation System (SNS) is necessary to display an optical image.











# Integrated EDS & Live Analy

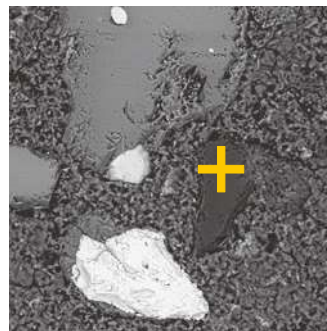
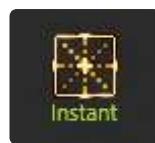
## Integration of observation and analysis

EDS analysis directly on the SEM observation screen for seamless transition from observation to analysis. Moreover, Live Analysis provides real-time monitoring of the spectra for characteristic X-rays.

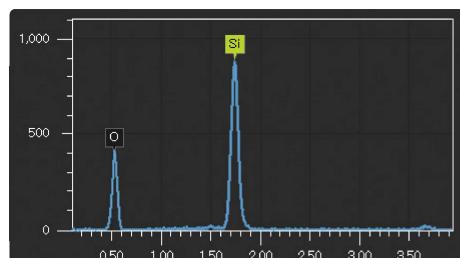
### EDS Functions

-  Instant analysis
-  Point analysis
-  Whole field or Area analysis\*
-  Map Area Map
-  Line analysis or Diagonal line analysis\*
-  Particle analysis
-  Polygon analysis
-  Ellipse analysis
-  Free line analysis

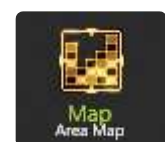
### Instant analysis



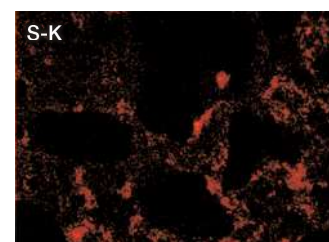
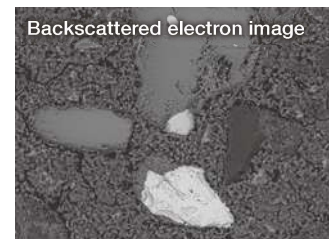
Click and hold for a quick survey of the elemental composition.



### Easy EDS mapping



Start the analysis instantly with 3 clicks

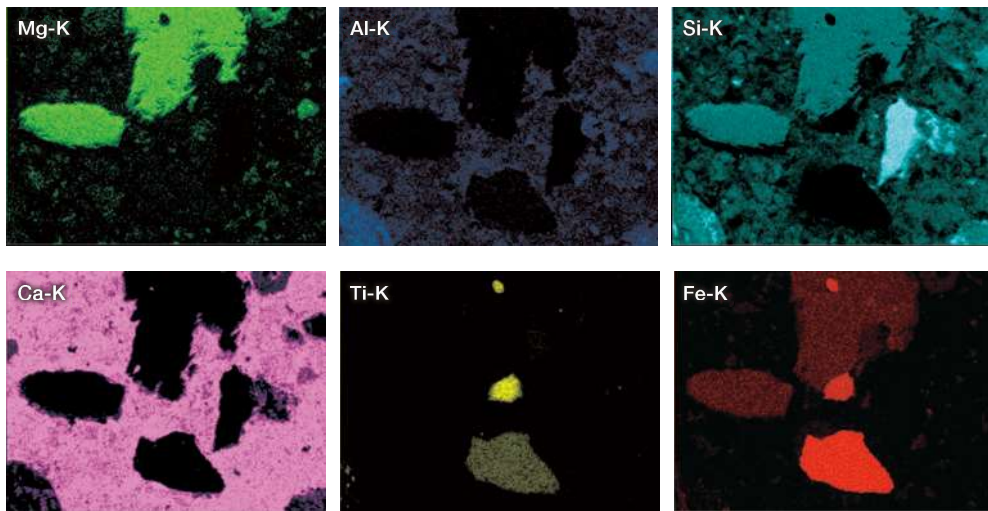
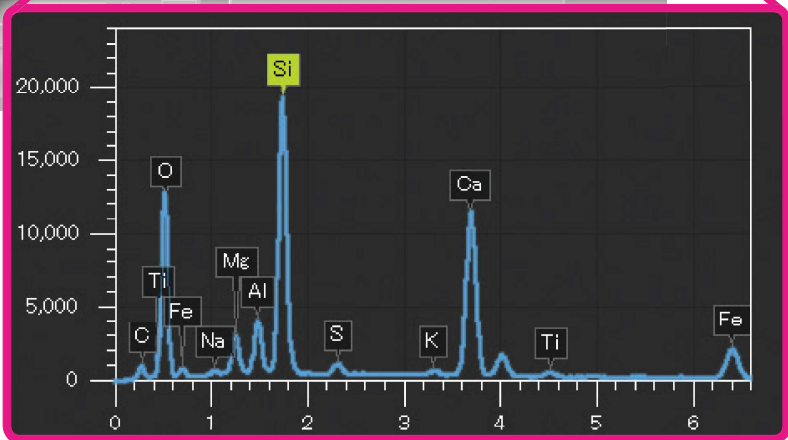


\* An icon has two functions and it is possible to switch between them by clicking.





**Display elements**  
 Major elements in the specified area are displayed. In addition, the elemental icon is highlighted when the element which is selected in advance is detected.



Specimen: Mechanically polished section of concrete  
 Accelerating voltage: 20 kV  
 Magnification: x300 Low-vacuum mode

50 µm



# SMILE VIEW™ Lab

## Fast and flexible report generation

SMILE VIEW™ Lab is a JEOL original data management tool, which links the optical image, SEM image and EDS analysis results. With one click, a report can be generated easily after the measurement. An off-line version of the software\*<sup>1</sup> is available to free up the SEM and enhance productivity.

### ① Select data

Just select the data needed for a report from the data list

### ② Transfer the data to a report template



SVL

Save the edited data

Analyze again

Can edit the size and color of spectra instantly

Feed back

Output as PDF, Power Point and Word\*<sup>2</sup>



### ③ Access to analysis data

The report can be edited and analyzed again because the generated report has been linked to the original data. Reanalysis is hassle free.

\*<sup>1</sup> Off-line data analysis software (option) is required. \*<sup>2</sup> Need to install Microsoft® Office.

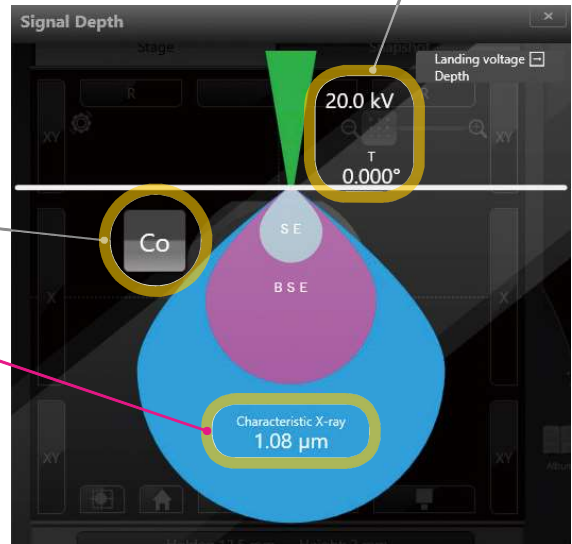


# Tools for speed

## Display the depth of signal NEW

A new function for displaying the generation depth of signal is built-in. Observing the analysis depth on the specimen is very effective for understanding the elemental results generated.

Auto display the operation conditions including accelerating voltage and tilt angle



Element

Generation region of characteristic X-rays

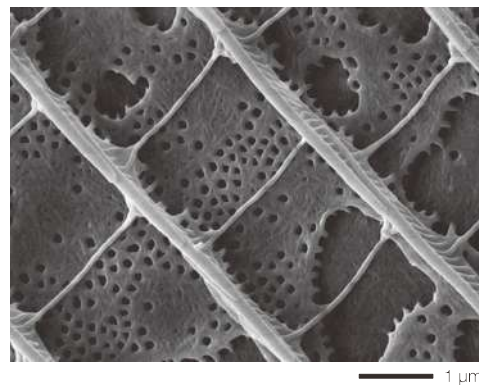
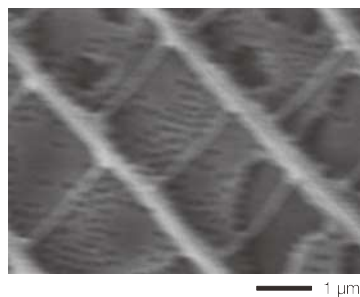
## Auto functions



In order to obtain clear SEM images, it is necessary to have correct beam alignment, focus and astigmatism. JSM-IT700HR optimizes all these adjustments automatically.

### Auto focus/stigma (AF/AS)

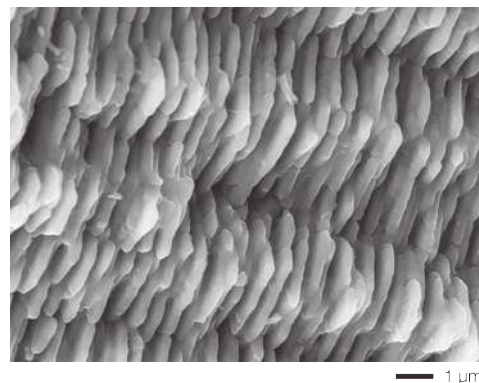
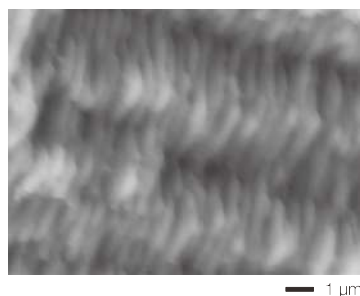
The focus and astigmatism are not corrected



Specimen: Wing scale of butterfly, Accelerating voltage: 3 kV

### Auto Beam Alignment (ABA)

Axis of beam is not corrected



Specimen: Cleaved surface of ammonite, Accelerating voltage: 15 kV

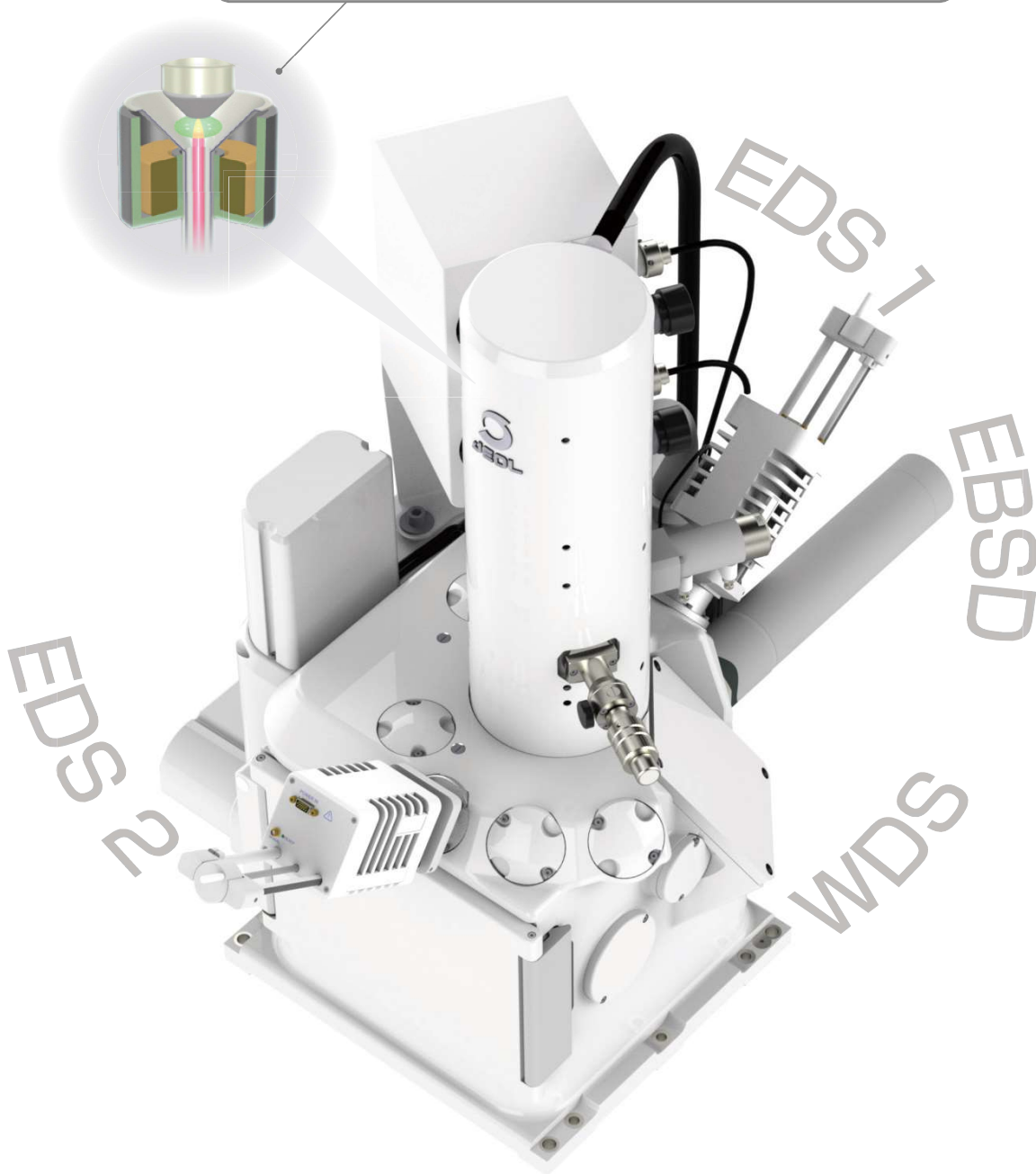




# High definition · High brightness

## In-lens Schottky field emission electron gun

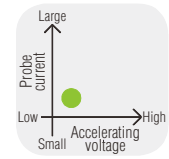
By integrating the Schottky electron gun and low aberration condenser lens, the electrons generated from electron gun have been effectively collected to provide high brightness. The resolution has been improved by optimizing the electron optical system and enhancing performance while reducing noise, which all relates to the high brightness electron gun.



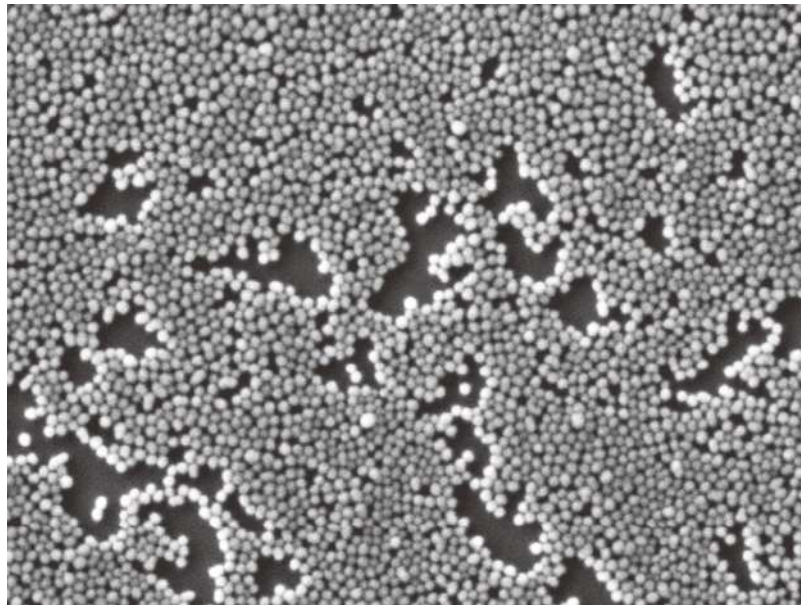
*There are 11 ports optimized for analysis on the multi-purpose chamber. For example, one EDS port is positioned coaxially to the EBSD port allowing simultaneous measurement. A second EDS port is mounted opposite the first for dual EDS minimizing shadows with topographic specimens.*

# • High stability

## Feature 1 High resolution at low accelerating voltage

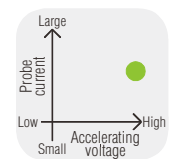


*Observe non-conductive specimens directly, such as soft materials. In-lens Schottky electron gun provides high resolution at low accelerating voltage.*



Specimen: Polystyrene particles, Accelerating voltage: 1.5 kV  500 nm

## Feature 2 High resolution at large probe current

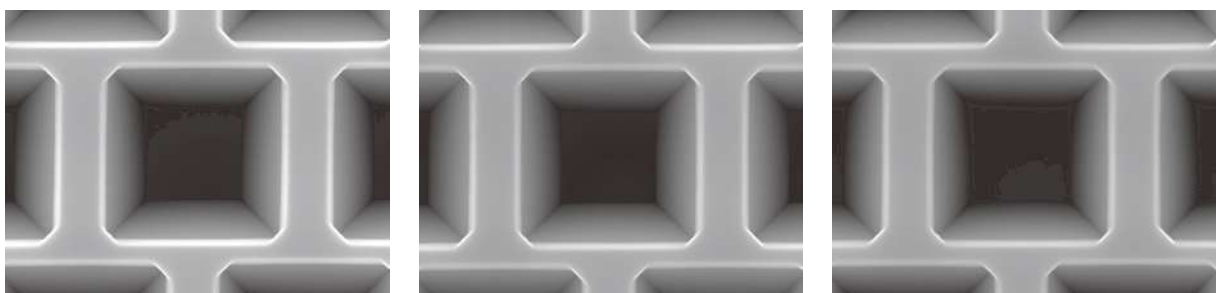


Small  Large

0.5 nA

1 nA

3 nA



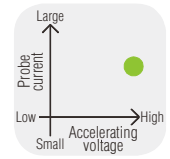
Specimen: Si pattern, Accelerating voltage: 15 kV, WD: 10 mm  1  $\mu$ m

*Maintain high resolution with increasing probe current due to the in-lens Schottky effect.*



Application 1

## Large area observation and analysis with montage function

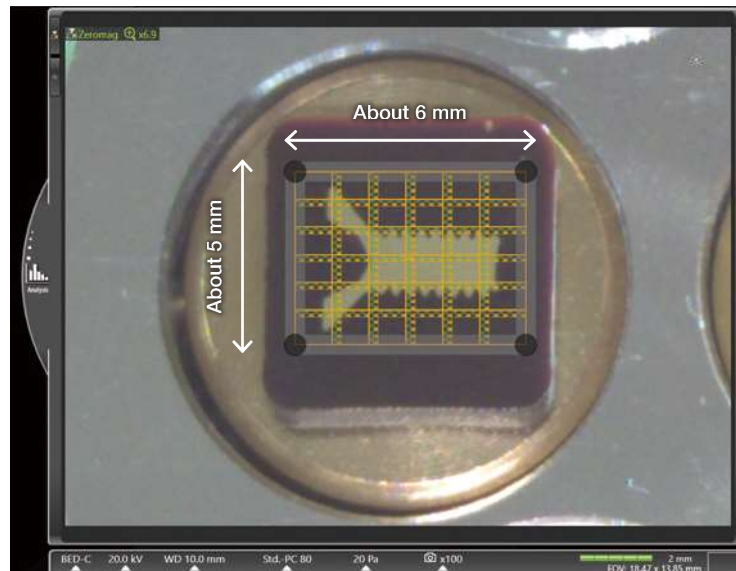


Montage is a function to connect all images in a large area as one high-definition image. This function is very useful for acquiring detailed information over a large area.

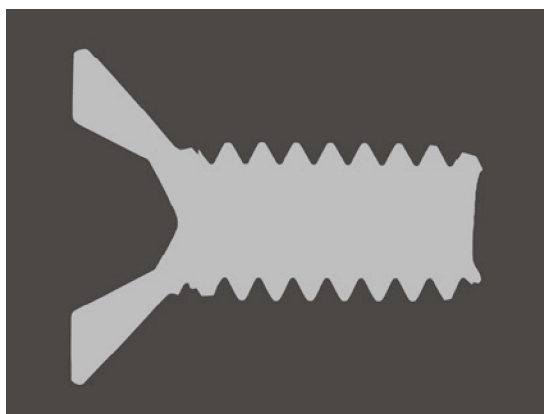
### Fast montage with high probe current. Start montage automatically through Zeromag

The in-lens Schottky field emission electron gun not only delivers high current but also high current stability. Ideal for long acquisition times with large area montage data sets.

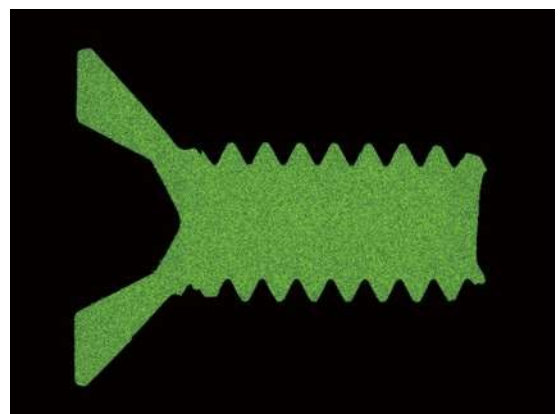
#### Set montage on Zeromag



SEM image



EDS map image (Cu-K)



Montage result: 6x6 (Left: Backscattered electron image Right: Cu element map)

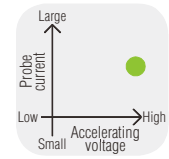
Specimen: Flat milled section of brass screw\*, Accelerating voltage: 20 kV, Low vacuum mode (20 Pa), Imaging area: 6.4 mm x 4.8 mm

\* Flat milling fabrication was performed by IB-19530CP after mechanical polishing.

## Application 2 Particle analysis



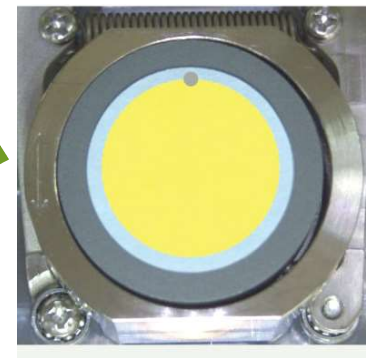
Particle analysis is a method to automatically analyze the number of particles, particle diameter, and the element information of particles by specifying the brightness of the backscattered electron image. The large probe current enables high speed analysis.



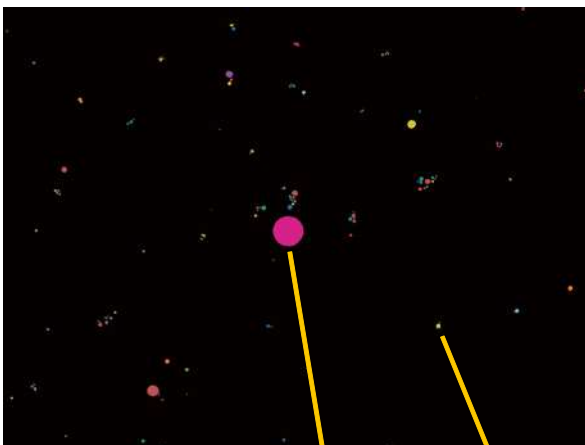
### The automatic analysis of fine particles collected on the surface of a filter

EDS elemental analysis of every particle, which is extracted as a measurement object from the specimen, can be accomplished automatically. The recorded particle shape information, including the particle diameter and area, plus EDS analysis results of every particle are processed statistically.

Specify the analysis area



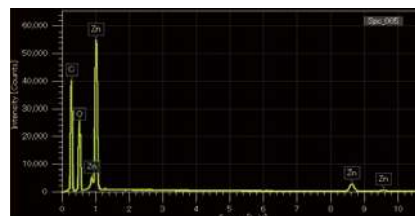
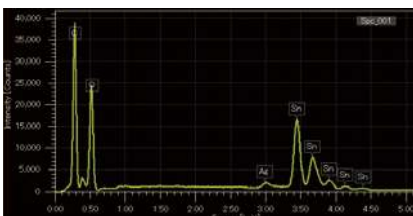
Identify the particles from the backscattered electron image



List of analysis result

Particle ID	Element	Area (μm²)	Volume (μm³)	Weight (%)	Count
Part 4.1	Si	0.001	0.001	0.00	0.00
Part 4.2	Si	0.001	0.001	0.00	0.00
Part 4.3	Si	0.001	0.001	0.00	0.00
Part 4.4	Si	0.001	0.001	0.00	0.00
Part 4.5	Si	0.001	0.001	0.00	0.00
Part 4.6	Si	0.001	0.001	0.00	0.00
Part 4.7	Si	0.001	0.001	0.00	0.00
Part 4.8	Si	0.001	0.001	0.00	0.00
Part 4.9	Si	0.001	0.001	0.00	0.00
Part 4.10	Si	0.001	0.001	0.00	0.00
Part 4.11	Si	0.001	0.001	0.00	0.00
Part 4.12	Si	0.001	0.001	0.00	0.00
Part 4.13	Si	0.001	0.001	0.00	0.00
Part 4.14	Si	0.001	0.001	0.00	0.00
Part 4.15	Si	0.001	0.001	0.00	0.00
Part 4.16	Si	0.001	0.001	0.00	0.00
Part 4.17	Si	0.001	0.001	0.00	0.00
Part 4.18	Si	0.001	0.001	0.00	0.00
Part 4.19	Si	0.001	0.001	0.00	0.00
Part 4.20	Si	0.001	0.001	0.00	0.00

Specimen: Metal particles on a filter  
Accelerating voltage: 15 kV,  
Vacuum degree: 100 Pa

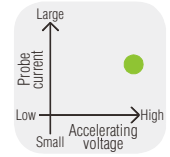


#### Features

- Specify the analysis area on the optical image
- Auto-extract and auto-analyze the objects in the specified area
- Set as a Recipe



## Application 3 Crystal orientation analysis by EBSD



EBSD (Electron Back Scatter Diffraction) detector can be attached to the SEM, and the diffraction patterns will be projected on the detector plane. Analyzing these diffraction patterns provides understanding of the crystal orientation. A crystal orientation map with high S/N can be obtained quickly with large probe current.

### Cross section of Au wire milled by CP\*1

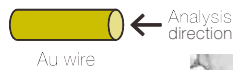
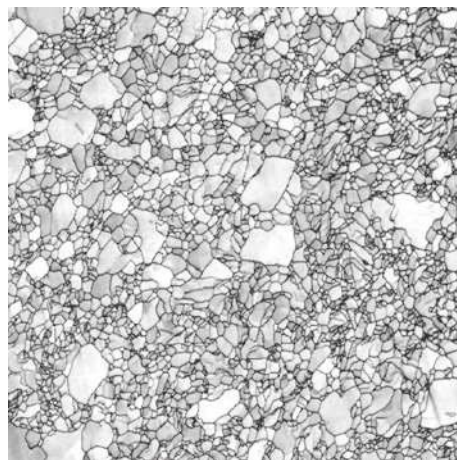


Image Quality\*2 Map

EBSD map image (direction: Direction 3)



Accelerating voltage: 15 kV, Probe current: 5 nA, Magnification: x3,000

10 μm

### Cross section of Au wire milled by CP\*1 along longitudinal direction

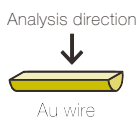
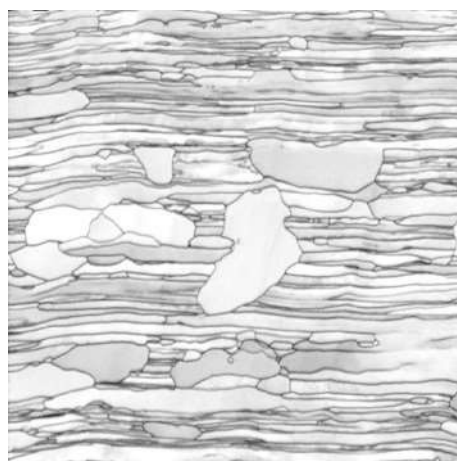


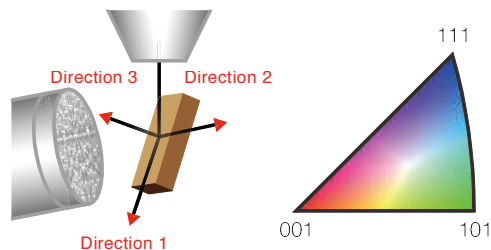
Image Quality\*2 Map

EBSD map image (direction: Direction 3)



Accelerating voltage: 15 kV, Probe current: 5 nA, Magnification: x3,000

10 μm



\*1 CP: CROSS SECTION POLISHER™  
\*2 Image Quality: sharpness of pattern





# Direct analysis of a large specimen



## Directly introduce a large specimen into the chamber

The large chamber can easily fit a specimen as large as 200 mm in diameter, a height of 90 mm. Positioning and observation is easy with the high speed, high precision motor stage with a maximum load of 2 kg.

## High speed vacuum system

Chamber evacuation in less than 3 minutes\*. In addition, using LLC (option) to exchange specimen enables further improvement of the specimen exchange speed or cleaner vacuum evacuation.

\* The real-time for vacuum depends on the specimen and environment.

## Specimen exchange

### Drawout type

With one-touch, the specimen which is difficult to introduce into the chamber based on the shape or size, can be easily introduced using drawout exchange system with high speed evacuation. Drawout reponds to the specimen with various shapes.

### Load lock chamber (LLC)

Option

Load lock chamber (LLC: pre-evacuation chamber) allows for even faster specimen exchange or keeping the chamber clean overall.





# Simple! Specimen Exchange

The target can be confirmed after specimen exchange.

Following the navigation, the process from opening the chamber to starting the



Set specimen height

## Easy specimen exchange

Following the navigation, after venting the chamber, the stage moves to the specimen exchange position automatically and then the specimen can be exchanged safely. The height of specimen should be measured before introducing into the chamber.

## Input the specimen height

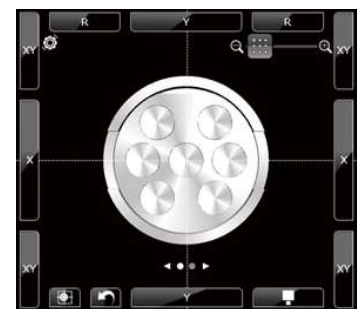
Inputting the specimen height activates the stage fail-safe. Specimens with various shapes can be observed and analyzed safely.



# Safety! Features for Navigation

## Holder graphic

The holder graphic confirms the position of the specimen. Based on the tilt and rotation, the holder graphic displays the current position of specimen.



Top view

## Option

### Stage navigation system (SNS)

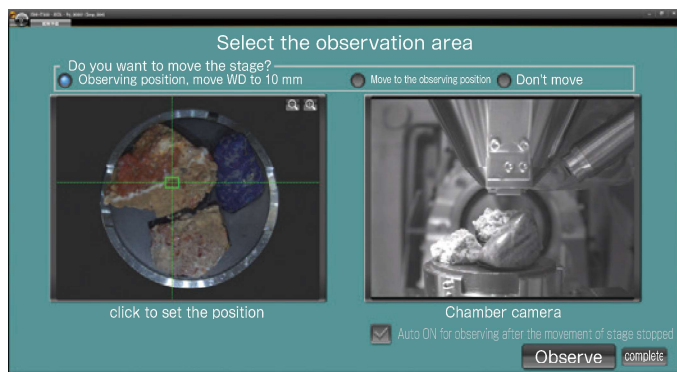
Navigate from the optical image of the specimen. Zeromag links the optical image with SEM image and EDS data for clear picture of analysis locations.

Range of optical image: 10 × 10 cm  
Number of pixels: 5,000,000 pixels. Digital zoom: ×20



# Navi

observation is safe, simple and reliable.



Navigation follow



## Set the condition during vacuum evacuation. Save time!

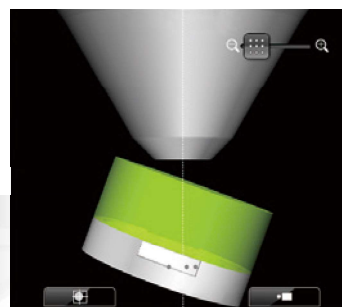
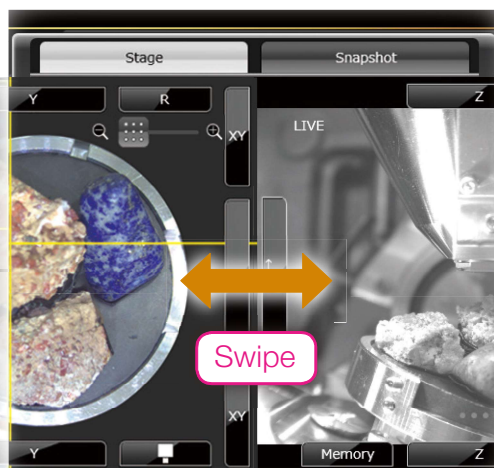
During the evacuation cycle, capture the optical image\*, navigate to the field of interest and set the operating conditions from a Recipe.

\* SNS (option) is required to take the optical image

## Display the image of target field at the specified magnification automatically when the evacuation finished

By the time the chamber is evacuated, the specimen is positioned to the field of interest, the SEM conditions are set and the image is automatically adjusted and displayed.

Switch from holder graphic, SNS and CS with a swipe.



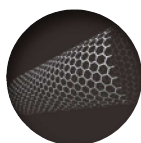
Height



Option

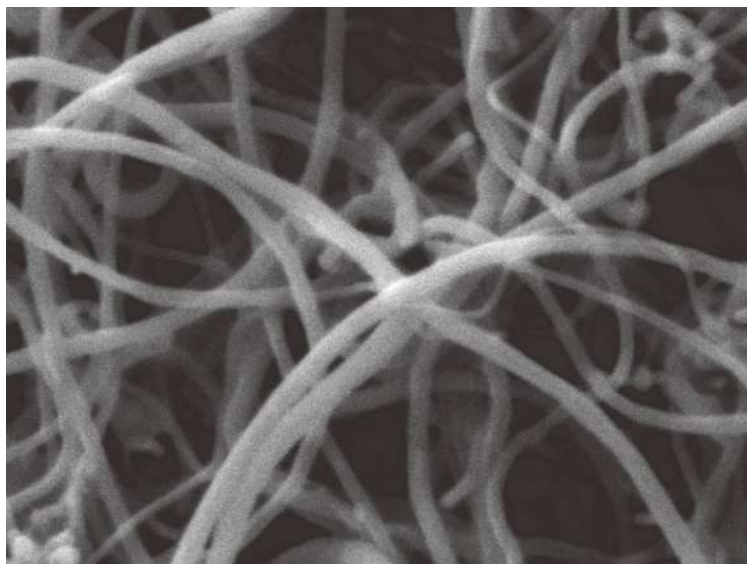
## Chamber scope (CS)

Check the specimen position inside the chamber. Digital zoom for easy observation.



## Nanomaterials

Carbon nanotube



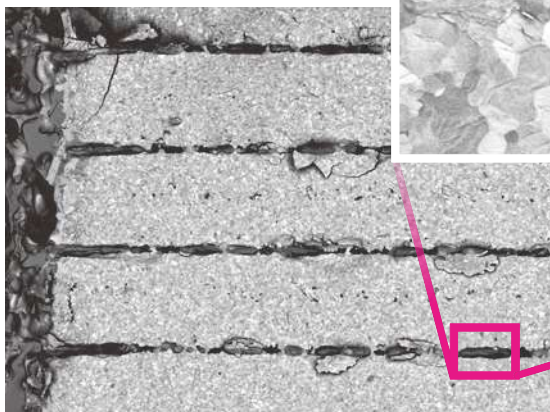
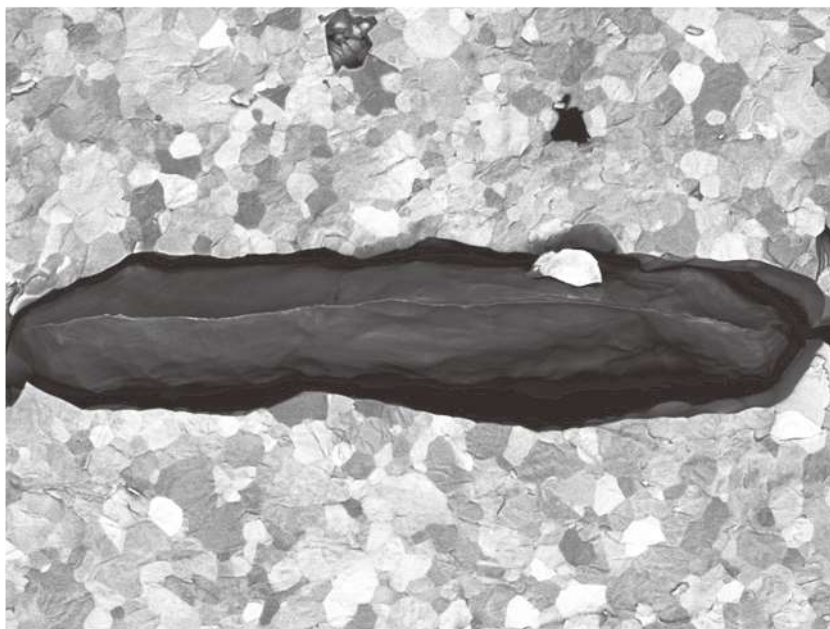
Observation at low accelerating voltage clearly reveals the surface structure.

Accelerating voltage: 2 kV, Signal: Secondary electrons, Magnification:  $\times 100,000$



## Electronic products

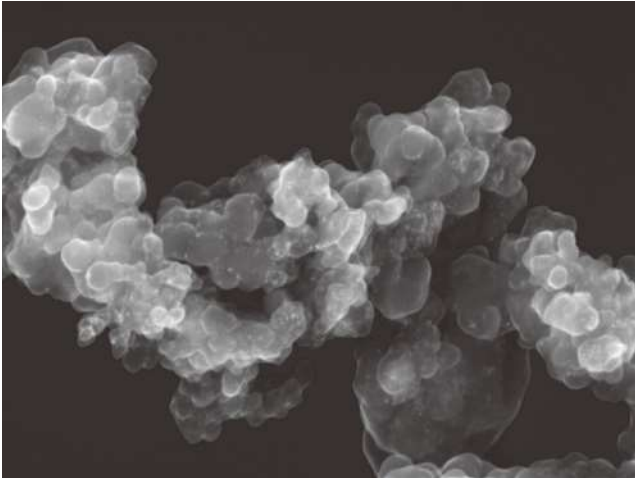
Fractured surface of ceramic capacitor



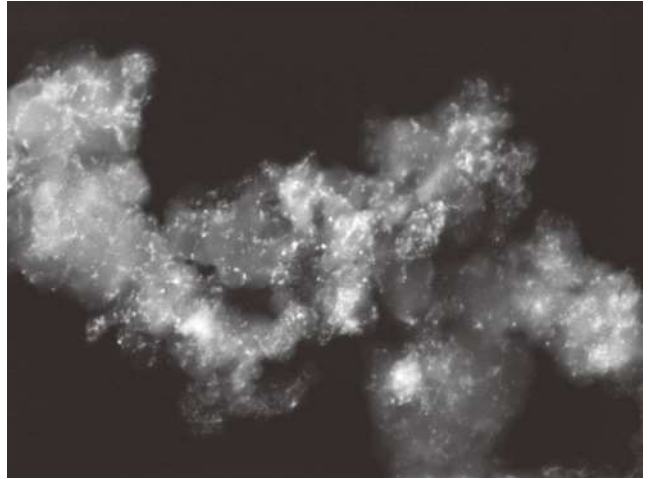
Accelerating voltage: 5 kV, Signal: Backscattered electrons, Magnification:  $\times 1,000$  (left)  $\times 10,000$  (right)

---

### Catalyst Pt on carbon



100 nm

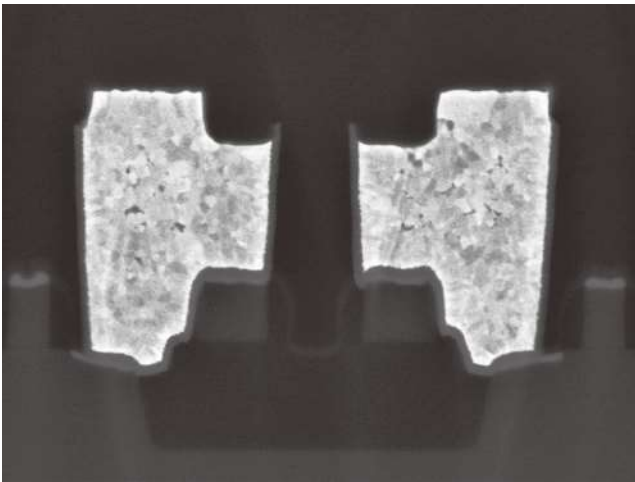


100 nm

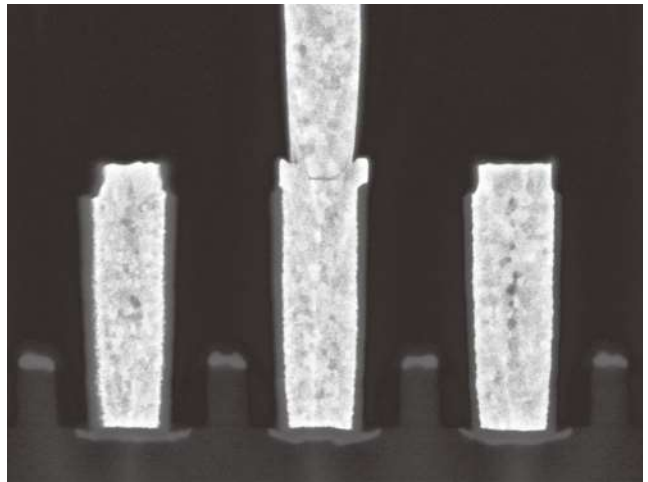
Accelerating voltage: 10 kV, Signal: Secondary electrons (left), Backscattered electrons (right), Magnification:  $\times 100,000$

---

### CP-milled section of semiconductor SRAM



200 nm



200 nm

Accelerating voltage: 5 kV, Signal: Backscattered electrons, Magnification:  $\times 60,000$  (left, right)



IB-19520CCP

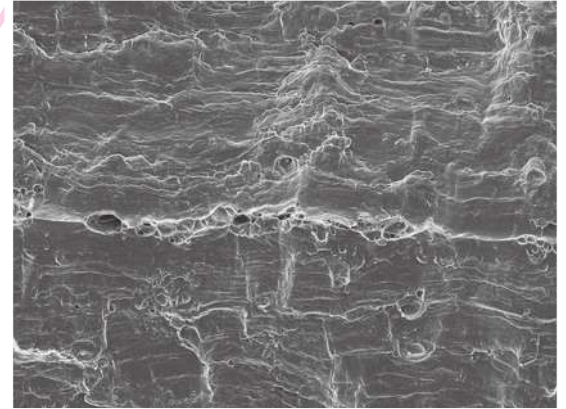
CP is an instrument for preparing a cross section of a specimen using a broad Ar ion-beam and shield plate. In recent years, CP has been widely used to prepare cross sections of metal, ceramics, plastic, and other materials.



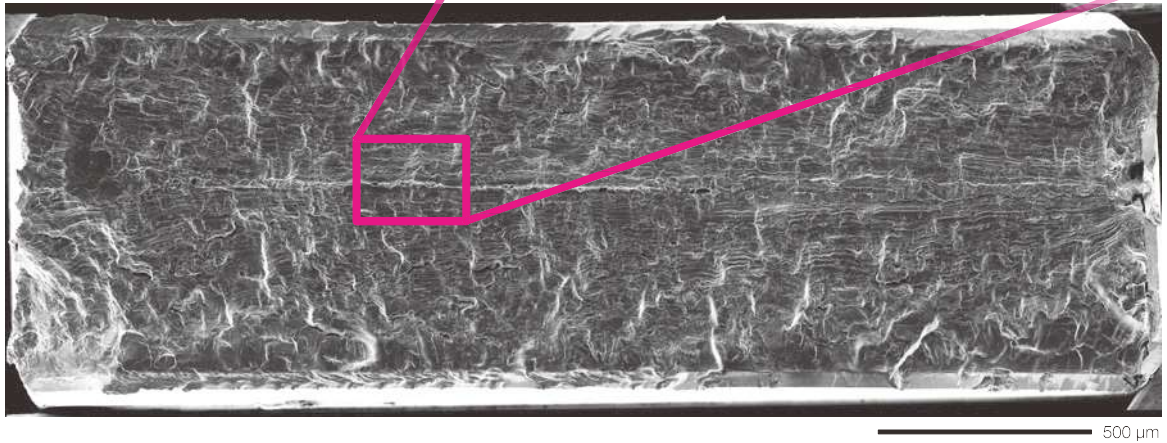
# Metals

## Large area montage analysis

By observing the entire area of a fracture surface, a detailed analysis of the fracture mechanism can be made. In this specimen, typical fatigue failure, such as the striation pattern and dimple microvoids, are observed.



## Fracture surface of stainless



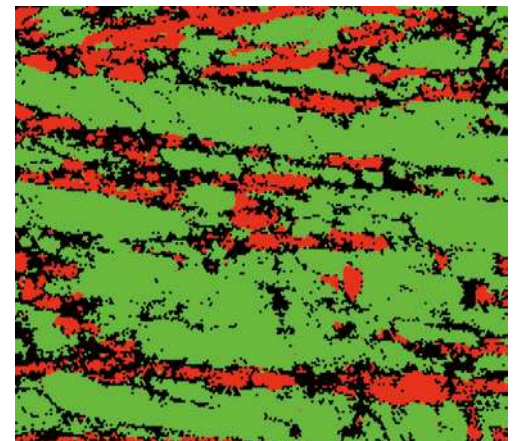
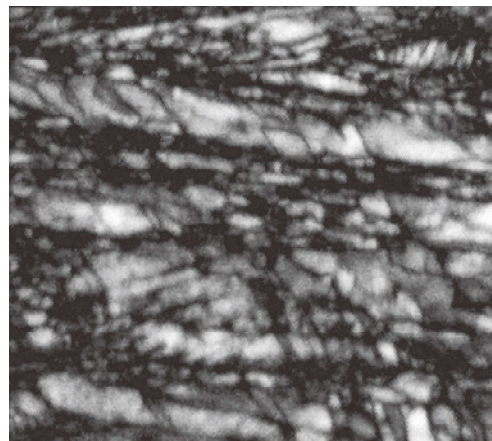
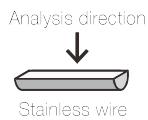
Accelerating voltage: 15 kV, Signal: Secondary electrons, Magnification:  $\times 500$ , Montage result:  $13 \times 6$

## High magnification EBSD analysis

CP-milled section of stainless wire along the longitudinal direction

Image Quality Map

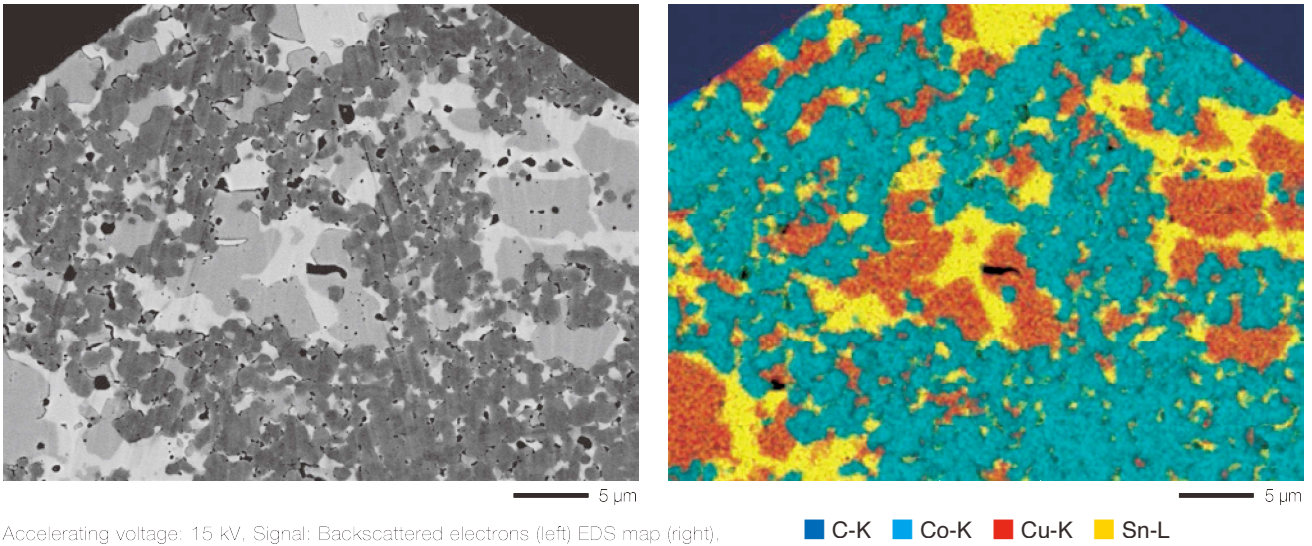
Phase map image



■  $\alpha$ -Fe ■  $\gamma$ -Fe

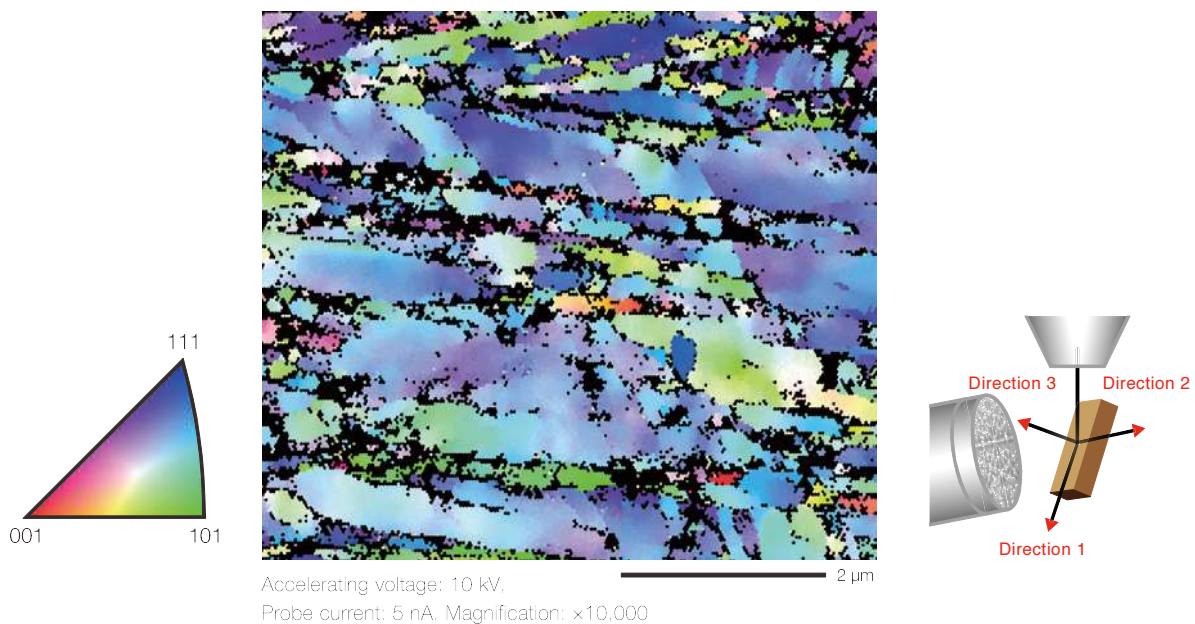
## Elemental analysis: EDS map

CP-milled section of precision cutting blade



Using overlay map, the distribution of heavy metal elements in the precision cutting blade is made clear.

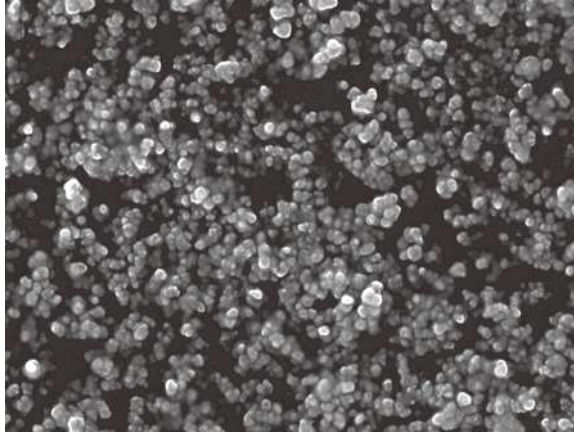
EBSD map image (direction: Direction 3)





## Soft materials

Carbon black in the rubber



Accelerating voltage: 15 kV,  
Signal: Secondary electrons, Magnification:  $\times 20,000$

Plastic glove

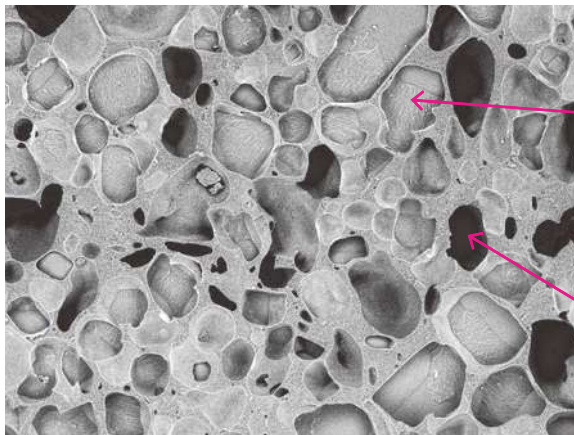


Accelerating voltage: 5 kV, Signal: Low vacuum backscattered electrons, Magnification:  $\times 30,000$



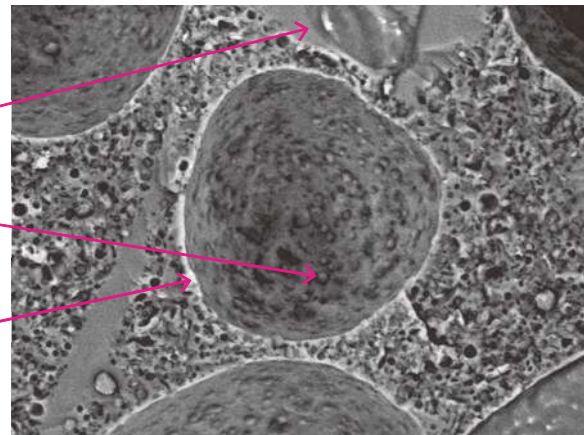
## Food

Ice cream



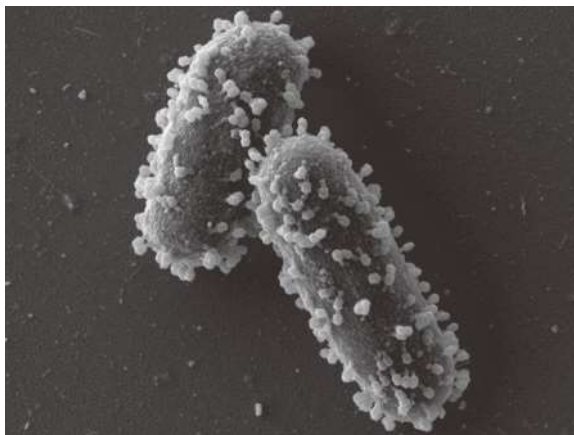
Accelerating voltage: 7 kV,  
Signal: Low vacuum backscattered electrons, Magnification:  $\times 300$  (left)  $\times 30,000$  (right)

Ice  
Fat globules  
Void

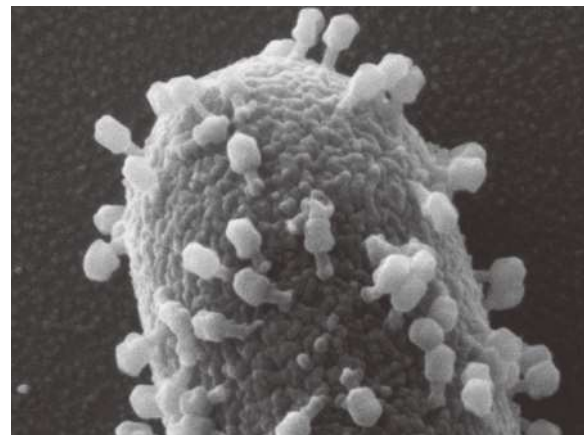


## Biology

E. coli and T4 phage

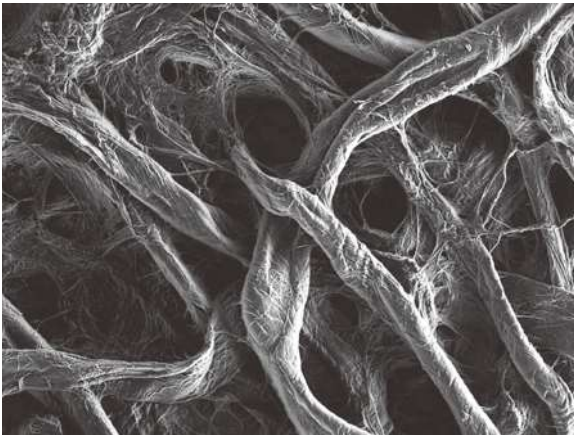


Accelerating voltage: 2.5 kV,  
Signal: Secondary electrons, Magnification:  $\times 25,000$  (left)  $\times 80,000$  (right)

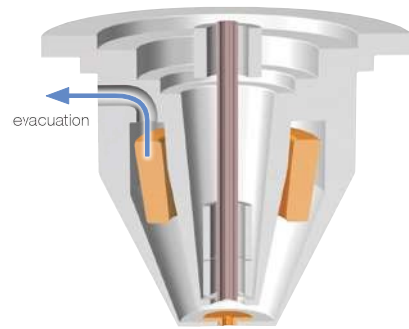




### Membrane on a chicken eggshell



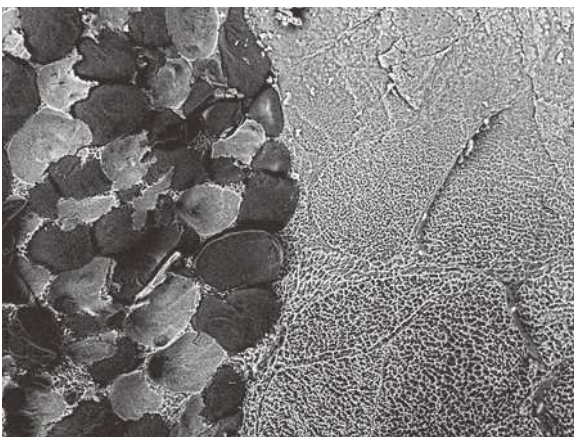
Accelerating voltage: 5 kV,  
Signal: Low-vacuum secondary electrons, Magnification:  $\times 500$



### Low-vacuum mode

Low vacuum mode allows for observation of non-conductive materials without treatment. Evacuation at the objective lens improves image quality in low vacuum mode.

### Fat globules and muscle fiber of chicken



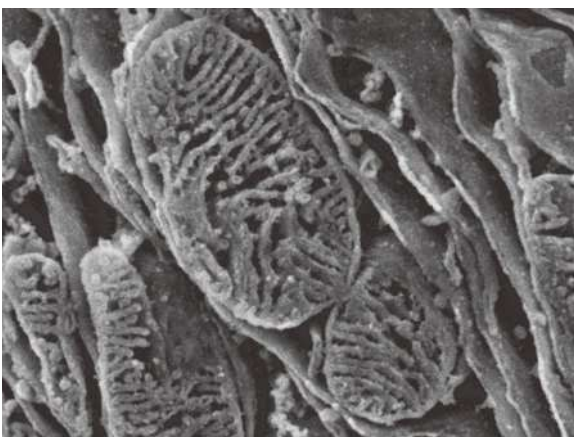
Accelerating voltage: 10 kV,  
Signal: Low-vacuum backscattered electrons, Magnification:  $\times 300$



### LV cryo-holder

LV cryo-holder keeps a specimen frozen without water loss. A hydrous specimen like food can be observed. It is possible to visualize the texture by understanding the size of ice and the diameter of muscle fibers.

### Mitochondria of mouse kidney



Accelerating voltage: 2.5 kV,  
Signal: Secondary electrons, Magnification:  $\times 50,000$



### JFD-320 Freeze Drying Device

This freeze drying device minimizes the effect of surface tension, suitable for drying hydrous specimens.

Specimen preparation of E. coli and T4 phage:  
Critical point drying after Glutaraldehyde and OsO<sub>4</sub> treatment.

Specimen preparation of mouse mitochondria:  
Freeze drying after OsO<sub>4</sub> maceration treatment.

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