

*Ultra High Resolution FE SEM*

# **JSM-7500F/JSM-7500FA**

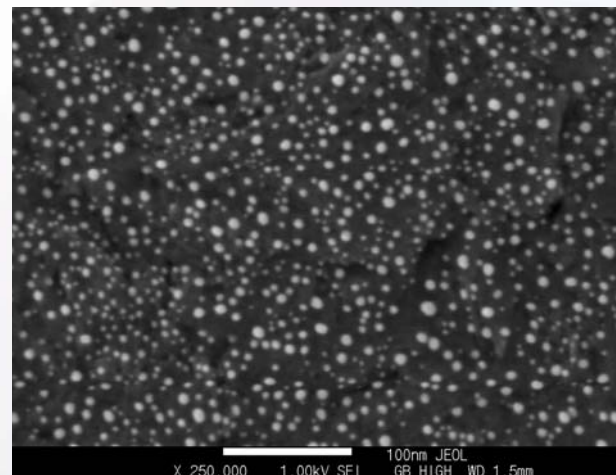
*Field Emission SEM/Analytical Field Emission SEM*



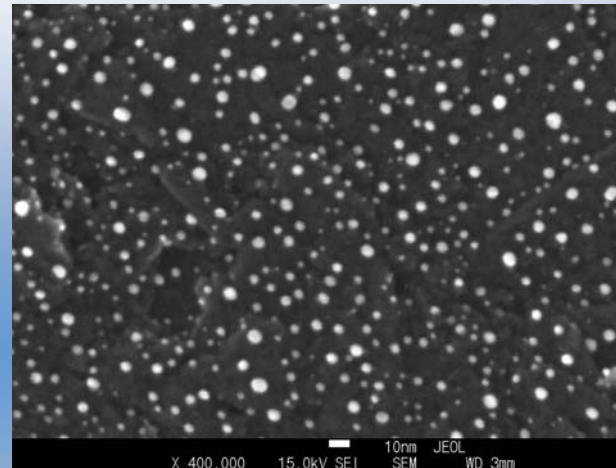
**JEOL**

*Serving Advanced Technology*

# Ultra High Resolution, Advanced GU



Evaporated gold particles 1kV original mag.  $\times 250,000$



Evaporated gold particles 15kV original mag.  $\times 400,000$

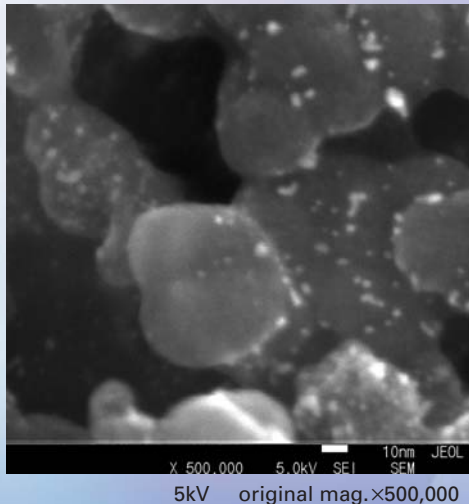
- Ultra high resolution FE SEM with simple operation. You do not have to worry about your skill level.
- Further simplified observation of insulating materials.  
(GB-mode, r-filter)
- Seamless integration for efficient observation and analysis.  
(New GUI)
- Integrates the SEM main console and EDS.  
(JSM-7500FA)
- Five-axis motor controlled stage is standard.  
(Trackball control).
- Dry vacuum system for clean specimen environment.  
(Liquid Nitrogen Trap, TMP)
- Eco friendly  
(Friendly to environment with the Eco mode)



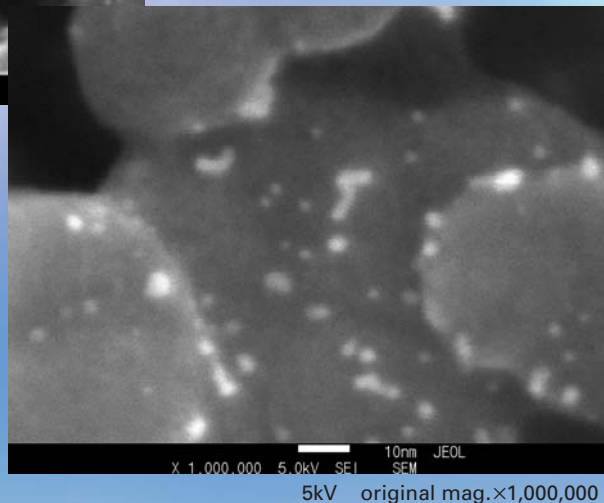


# I –For Efficient Observation & Analysis–

*The maximum magnification of  $\times 1,000,000$  reveals nano structures*



Pt catalyst on carbon



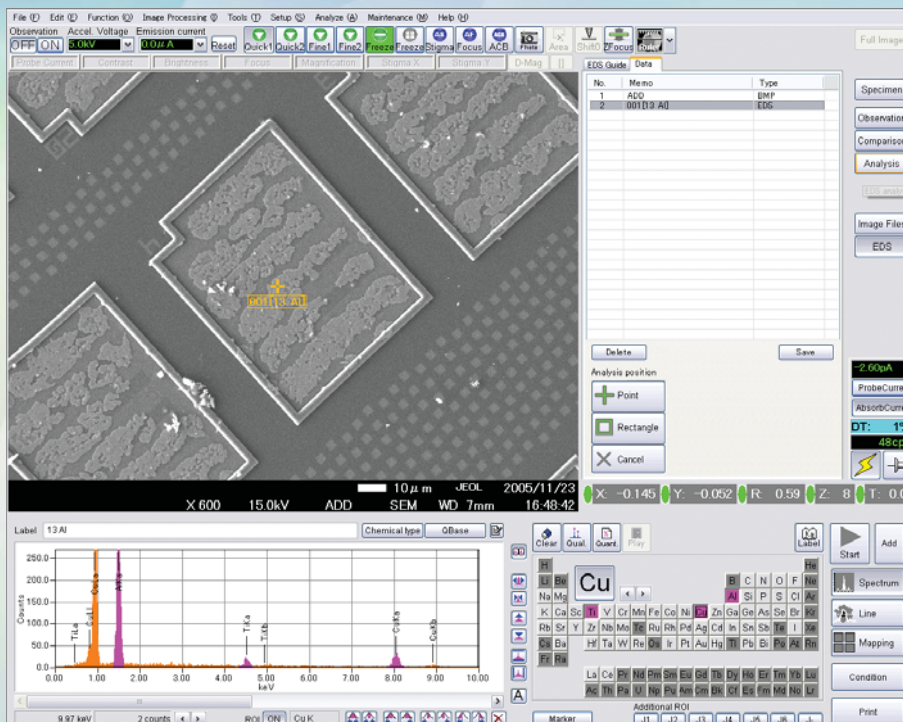
## JSM-7500F

The JSM-7500F is an ultra high resolution FE SEM equipped with a high brightness conical FE gun and a low aberration conical objective lens (semi in-lens).

The improved overall stability of the JSM-7500F enables you to readily observe your specimen at magnifications up to  $\times 1,000,000$  with the guaranteed resolution of 1 nm.

The energy filter (r-filter) makes it possible to observe the fine surface morphology of nano structures.

*EDS embedded Analytical FE SEM*



## JSM-7500FA

The JEOL EDS is embedded in the JSM-7500FA. The JSM-7500FA allows a quick start of elemental analysis on the SEM image, when the elemental analysis and the observation of composition contrast are required, in addition to the observation of fine surface structures. The analysis data are stored automatically with the SEM image, showing the analysis locations in the same folder.

Sophisticated integration of SEM with EDS results from JEOL's many years of experience as a leading maker of Scanning Electron Microscopes and Energy Dispersive X-ray Spectrometers.

# Easier Observation of Insulating Materials

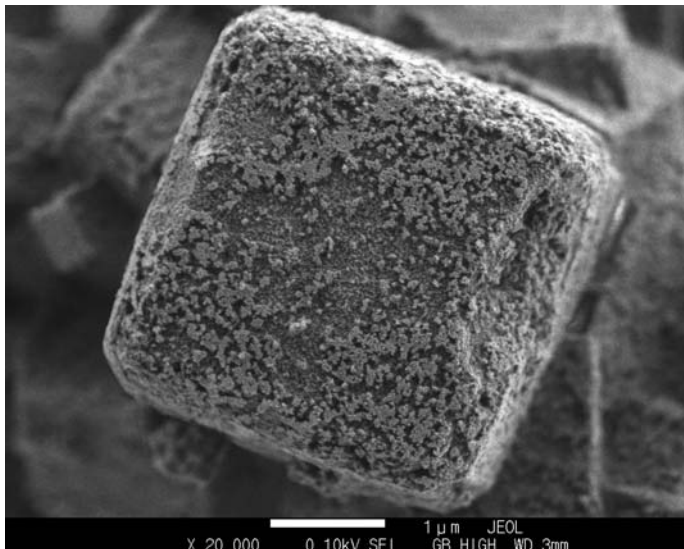
## Gentle Beam Mode

The Gentle Beam (GB) method decelerates incident electrons just before they hit the specimen to reduce the incident-electron penetration and the charging in the specimen to observe its top surface.

At the extremely low accelerating voltages between 100 V and 3 kV, the Gentle Beam produces high resolution comparable to that attainable at higher accelerating voltages. Thus, this method is suitable for observation of fine structures, especially on low-density materials.

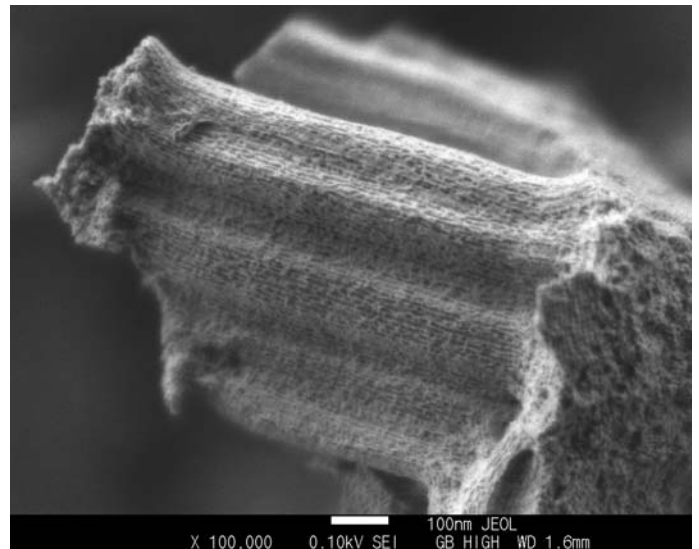
The GB mode can be used for observation of non-conductive materials at high magnification with effective detection of low angle backscattered electrons.

## Application of Gentle Beam



Glass (no coating)

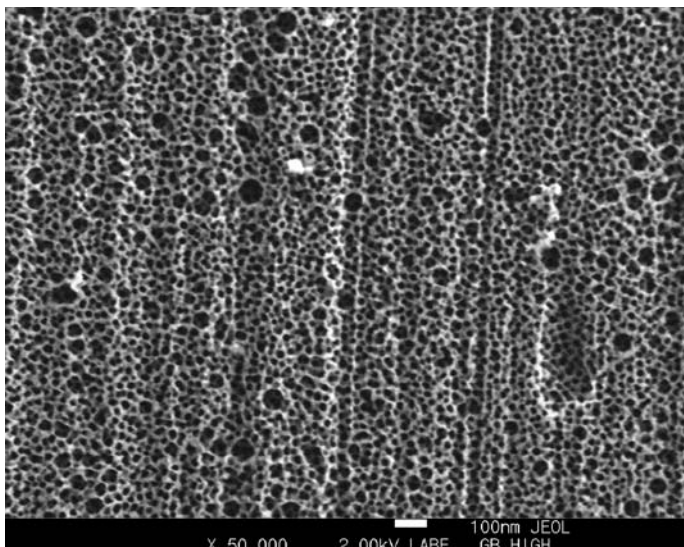
0.1kV original mag.  $\times 20,000$



Mesoporous silica (no coating)

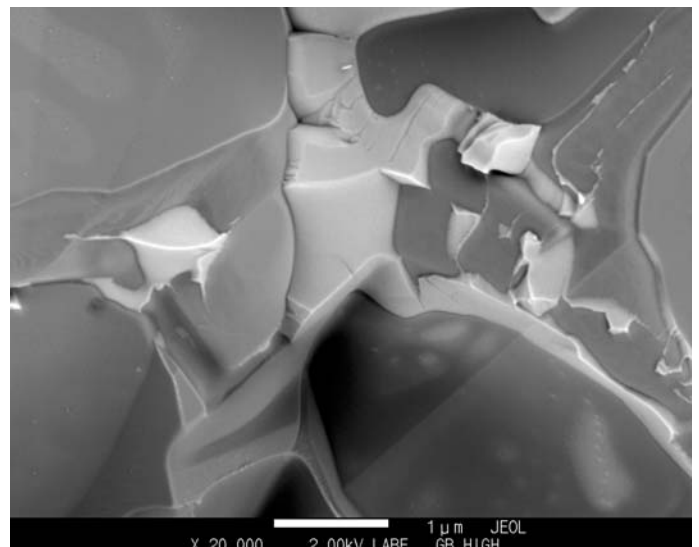
0.1kV original mag.  $\times 100,000$

Specimen courtesy : Associate Professor Kazuki Nakanishi, Division of Chemistry, Graduate School of Science, Kyoto University.



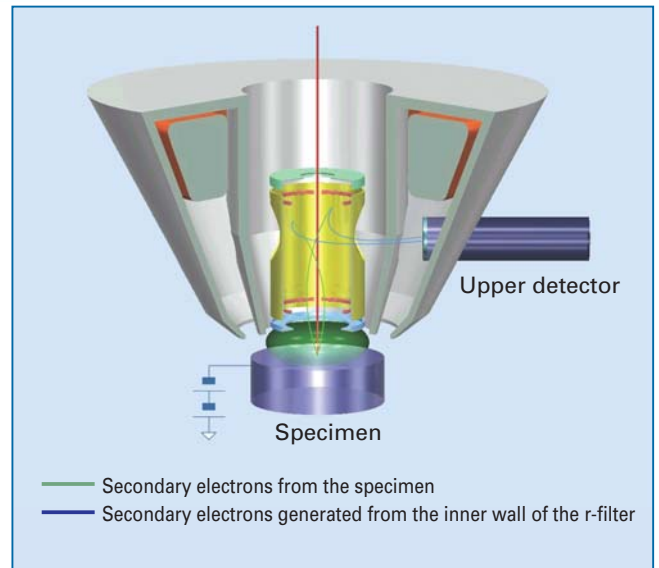
Aluminum oxide ( $\text{Al}_2\text{O}_3$ ) (no coating)

2kV original mag.  $\times 50,000$



Ceramic (no coating)

2kV original mag.  $\times 20,000$



The Gentle Beam decelerates incident electrons just before the specimen. The secondary electrons from the specimen are accelerated and hit the wall of the new r-filter and generate secondary electrons.



# New r-Filter (Energy filter)

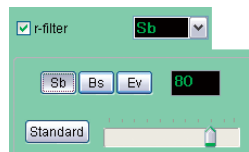
## New r-filter

The new r-filter is a unique energy filter composed of the secondary electron control electrode, the backscattered electron control electrode, and the filtering electrodes. The specimen generates electrons with a variety of energies when it is bombarded with incident electrons. The combination of multiple static fields of the new r-filter built into the JSM-7500F lets you freely select secondary electrons and backscattered electrons while keeping the incident electrons on the center of the electron optics.

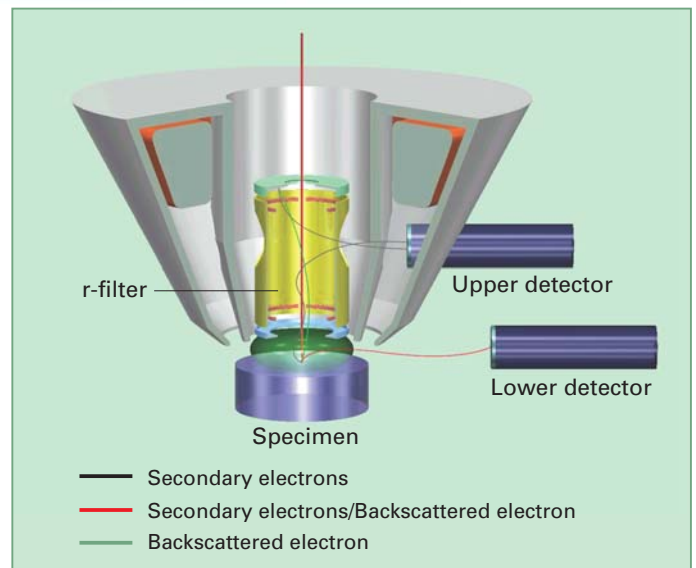
## Optimum filtering with one click

The new r-filter is operated with the easy-to-understand menu window.

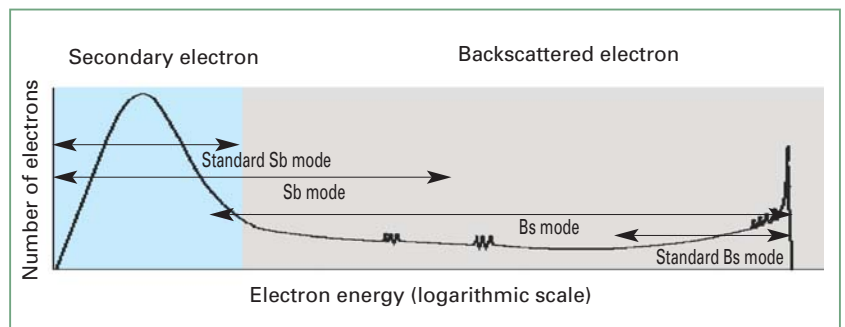
The Sb mode detects secondary electrons with variable mixture of backscattered electrons. The Bs mode detects backscattered electrons with variable mixture of secondary electrons. The mixing ratio can be freely adjusted. **Standard** button sets the mixing rate to minimum.



## Information selected by the new-filter



The new r-filter selectively detects secondary and backscattered electrons.



The energy ranges selected by the new-filter

### Standard Sb mode (Detection of secondary electrons)

The Standard Sb mode detects pure secondary electrons and is suitable for observation of fine surface morphologies enhanced by the edge effect.

Figure ①: You can clearly observe the surface morphologies on the tungsten and aluminum layers.

### Standard Bs mode (Detection of backscattered electrons)

The Standard Bs mode mainly detects the backscattered electrons, which shows the contrast of the composition.

Figure ②: The layer of tungsten, which is of higher atomic number, appears white. The layer of aluminum, which is of lower atomic number, appears darker with less contrast of the surface morphology. The contrast of composition variation is enhanced.

### Sb mode (Mainly Secondary electrons)

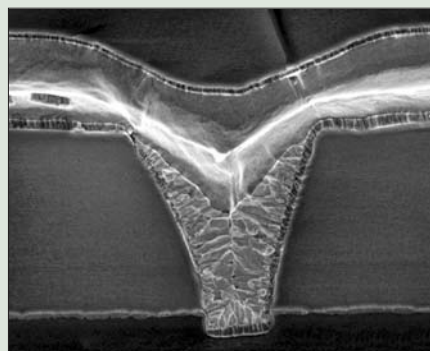
The Sb mode detects the secondary electrons mixed with a variable fraction of the backscattered electrons.

Figure ③: The grain boundaries appear clearer than in the SE mode image due to the composition contrast mixed with the morphology contrast of the secondary electron image.

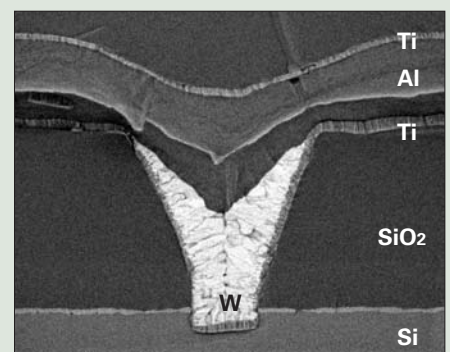
### Bs mode (Mainly Backscattered electrons)

The Bs mode detects the backscattered electrons mixed with a variable fraction of the secondary electrons to show a mixture of the composition contrast of the backscattered electrons and the surface morphologies enhanced by the edge effect of the secondary electrons.

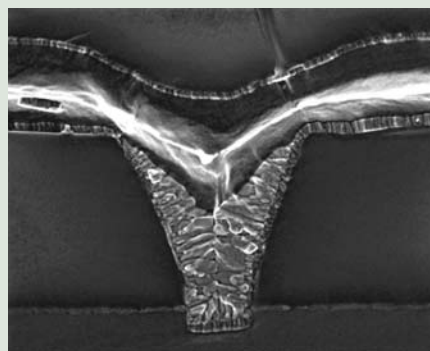
Figure ④: You can observe the contrast of composition difference between the tungsten and the aluminum layers, and the surface morphology on the aluminum layer.



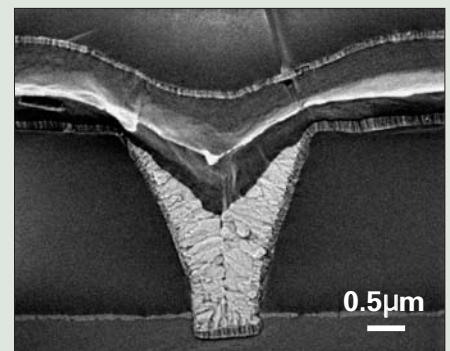
① Standard Sb mode



② Standard Bs mode



③ Sb mode



④ Bs mode

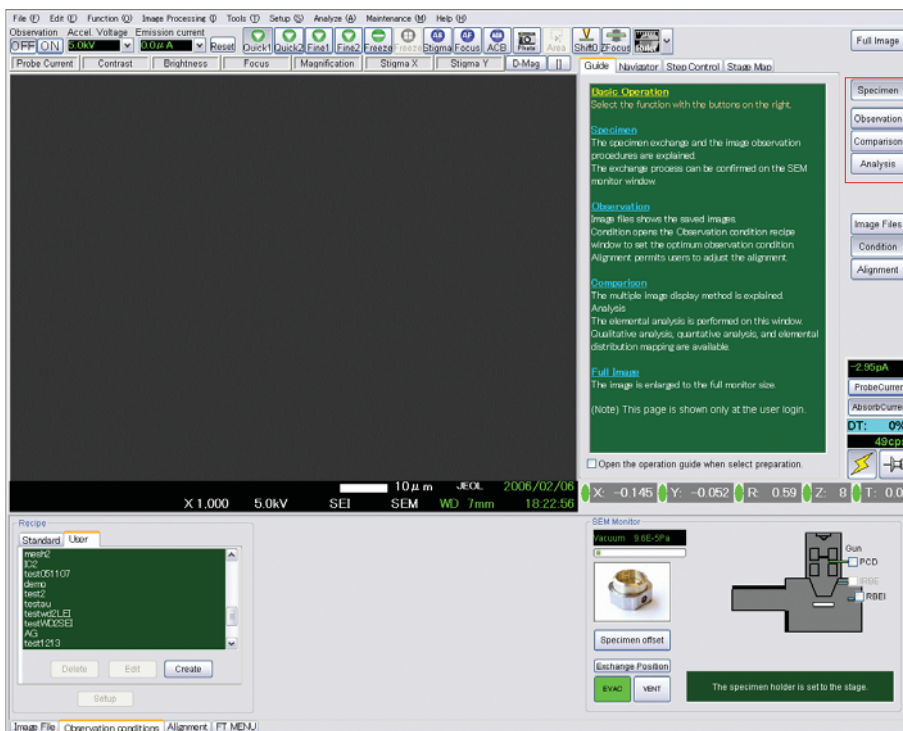
Information selected by the new r-filter.

# Seamless Integration for Efficient Observation

## New GUI for smooth operation—from specimen exchange, versatile imaging to analysis—

The JSM-7500F and JSM-7500FA incorporate the newly developed AIP signal-processor. Up to four live images can be displayed simultaneously. Up to four live images can be added and displayed. A series of operations—from specimen exchange, observation to report creation—can be made seamlessly. In addition, you can start the EDS analysis on the SEM image instantaneously.

### Specimen preparation screen (Insert a specimen.)



#### Help display

Clicking on the Guide tab displays the method of operation you selected.

#### Purpose button

Clicking on specimen preparation displays this monitor screen. You can switch the monitor screen from observation to elemental analysis.

#### One-action specimen exchange

You can surely exchange a specimen simply by inserting the specimen exchange rod to the specimen chamber through the airlock chamber. You do not have to open the specimen chamber every time you exchange it, reducing specimen contamination.

#### Automatic specimen exchange airlock chamber

The automatic specimen exchange airlock chamber can be used with all specimen stages. A specimen holder is automatically attached to the specimen stage by placing the specimen holder in the chamber.

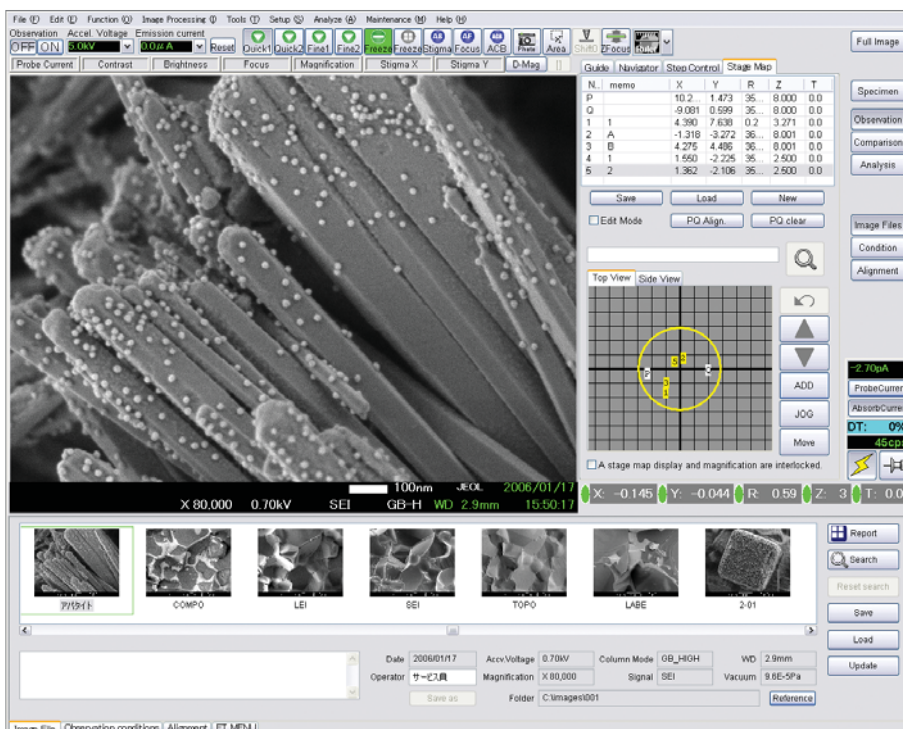
#### Specimen holder

When you select a specimen holder, the graphic display of the stage changes according to your selection. The safety mechanism for limiting the stage movement is also linked to the holder.

#### Operating conditions memory

You can select suitable operating conditions from your observation recipes.

### Observation mode screen (All functions necessary for observation are displayed.)



#### High-definition live image display

A high-definition display system acquires an image with 1280×960 pixels for live image display. Bright, clear images appear on the monitor screen.

#### Automatic functions

Focusing, brightness and contrast adjustment, and astigmatism correction can be automated, enhancing observation efficiency.

#### Five-axis motor controlled stage

The eucentric specimen stage is motor controlled for all five axes.

#### Stage Map

Stage Map displays the location of the specimen holder in the graphic display. You can move the specimen stage to any stored location by clicking or dragging it on the graphic display.

#### Image saving

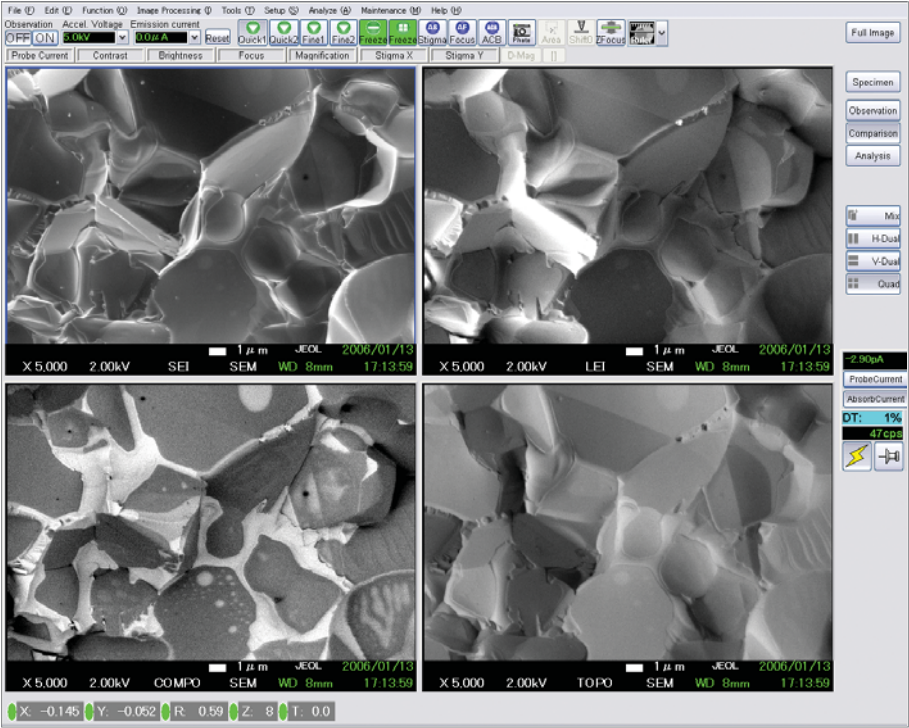
Clicking on the Photo icon acquires images. The index display shows the images you have saved. You can move back to the previously acquired location by selecting the thumbnail image and observe the image with the same conditions. When the image with EDS data is selected, the analysis results are displayed.

#### Report creation

You can create a report simply by selecting a thumbnail image and paste it on the layout sheet.



Comparison screen



Simultaneous acquisition of four different images

The comparison mode simultaneously displays four different live images from the followings: a) image obtained with the upper detector, b) image obtained with the lower detector, c) composition image formed by backscattered electrons, d) topographic image formed by backscattered electrons, d) STEM image.

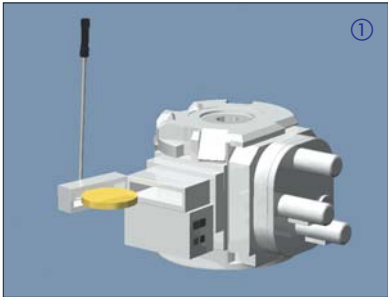
Furthermore, four different images can be simultaneously acquired with high definition, at one-time scan. This is effective for reducing beam damage and specimen contamination. All images are high definition (1280× 960 pixels).

|                         |                                |
|-------------------------|--------------------------------|
| SEI<br>(upper detector) | SEI or BEI<br>(lower detector) |
| BEI<br>(composition)    | BEI<br>(topography)            |

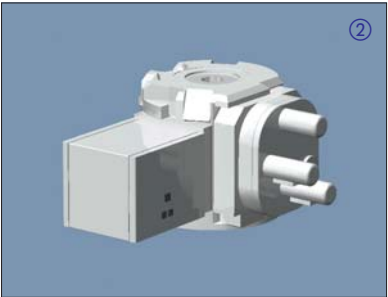
Ceramic

Flexible specimen movement

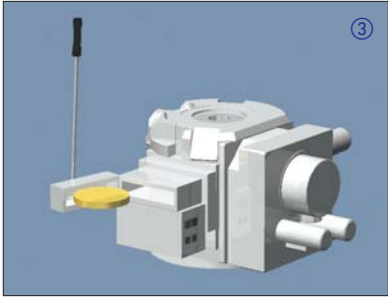
The JSM-7500F and JSM-7500FA come with a five-axis motor controlled stage. This stage has further improved its stability against floor vibration. The high sensitivity trackball enables you to move the specimen stage freely with your finger touch at any magnification. The specimen stage control software is provided for saving the specimen stage coordinates, and for moving the specimen stage stepwise as well as continuously.



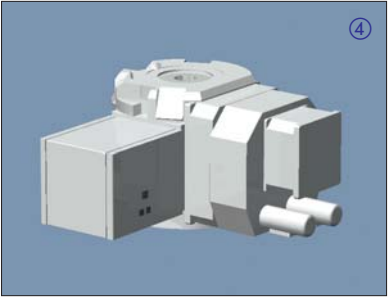
Type I specimen exchange chamber/  
Type IA specimen stage



Auto specimen exchange chamber/  
Type IA specimen stage



Type I specimen exchange chamber/  
Type II specimen stage



Auto specimen exchange chamber/  
Type III specimen stage

| Stage                               | Type IA stage<br>X=70mm, Y=50mm | Type II stage<br>X=110mm, Y=80mm | Type III stage<br>X=140mm, Y=80mm |
|-------------------------------------|---------------------------------|----------------------------------|-----------------------------------|
| Exchange                            |                                 |                                  |                                   |
| Type I airlock<br>Max.6-inch        | ①<br>86mmφ cover                | ③<br>152.4mmφ cover              | 152.4mmφ cover                    |
| Type II airlock<br>Max.4-inch×40mmH | 86mmφ cover                     | 100mmφ cover                     | —                                 |
| Auto airlock<br>Max.8-inch          | ②<br>86mmφ cover                | 152.4mmφ cover                   | ④<br>203.2mmφ cover               |

Coverage indicated above is achieved with X-Y and rotation.

**Principal Specifications**

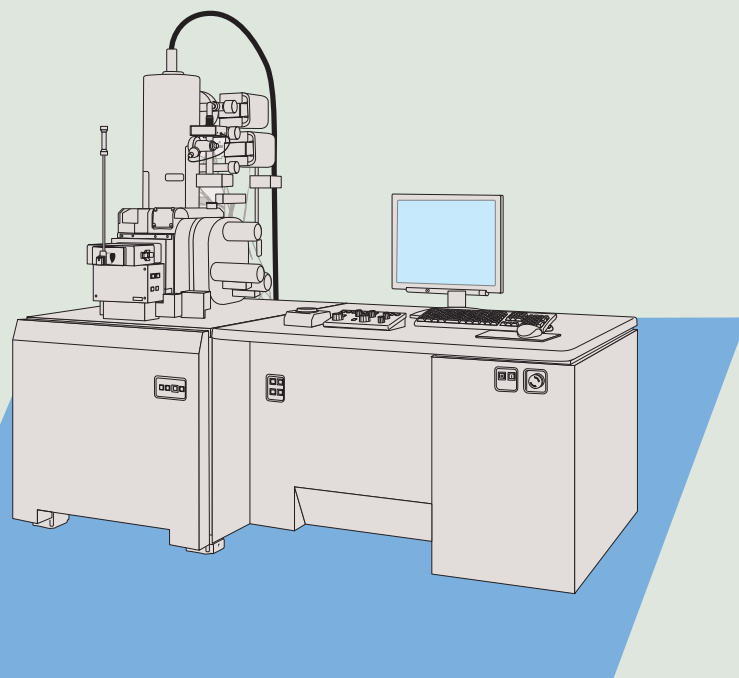
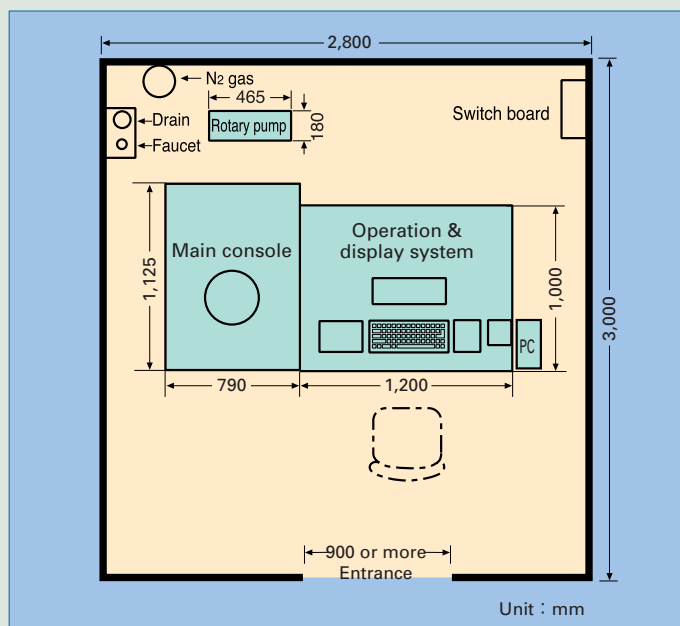
|                                |  |               |               |
|--------------------------------|--|---------------|---------------|
| Resolution                     | 1.0nm (15kV), 1.4nm (1kV)  |               |               |
| Magnification                  | × 25 to × 1,000,000  |               |               |
| Accelerating voltage           | 0.1kV to 30kV  |               |               |
| Probe current                  | 1pA to 2nA   |               |               |
| Aperture angle optimizing lens | Built-in   |               |               |
| Detectors                      | Upper detector, Lower detector   |               |               |
| Energy filter                  | New r-filter   |               |               |
| Gentle Beam                    | Built-in   |               |               |
| Digital image                  | 1,280×960 pixels, 2,560×1,920 pixels, 5,120×3,840 pixels   |               |               |
| Specimen exchange chamber      | One-action specimen exchange mechanism built-in  |               |               |
| Specimen stage                 | Eucentric, 5 axes motor control  |               |               |
| Type                           | IA   | II            | III           |
| X-Y                            | 70mm×50mm  | 110mm×80mm    | 140mm×80mm    |
| Tilt                           | −5 to +70°   | −5 to +60°    | −5 to +60°    |
| Rotation                       | 360°   | 360°          | 360°          |
| WD                             | 1.5mm to 25mm  | 1.5mm to 25mm | 1.5mm to 25mm |
| Evacuation system              | Three SIPs, TMP, RP, Fore-line trap  |               |               |
| Eco design                     | During normal operation : 1.2kVA<br>During the sleep mode : 1kVA<br>During the evacuation system OFF : 0.76kVA |               |               |

**CO<sub>2</sub> Emission**

|  | CO <sub>2</sub> /hour | CO <sub>2</sub> /year |
|--|-----------------------|-----------------------|
| ● During normal operation                        | 0.481kg               | 4,214kg               |
| ● During the sleep mode                          | 0.411kg               | —                     |
| ● During the evacuation system OFF (Ion pump ON) | 0.286kg               | —                     |

**Principal Options**

- Retractable Backscattered Electron Detector
- In-lens Backscattered Electron Detector
- Energy Dispersive X-ray Spectrometer (EDS)
- Electron Back Scatter Diffraction (EBSD)
- Transmission Electron Detector
- Liquid Nitrogen Trap

**Example of Installation Layout**

\*Specifications subject to change without notice.



High technology for quality assurance and the environment.

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