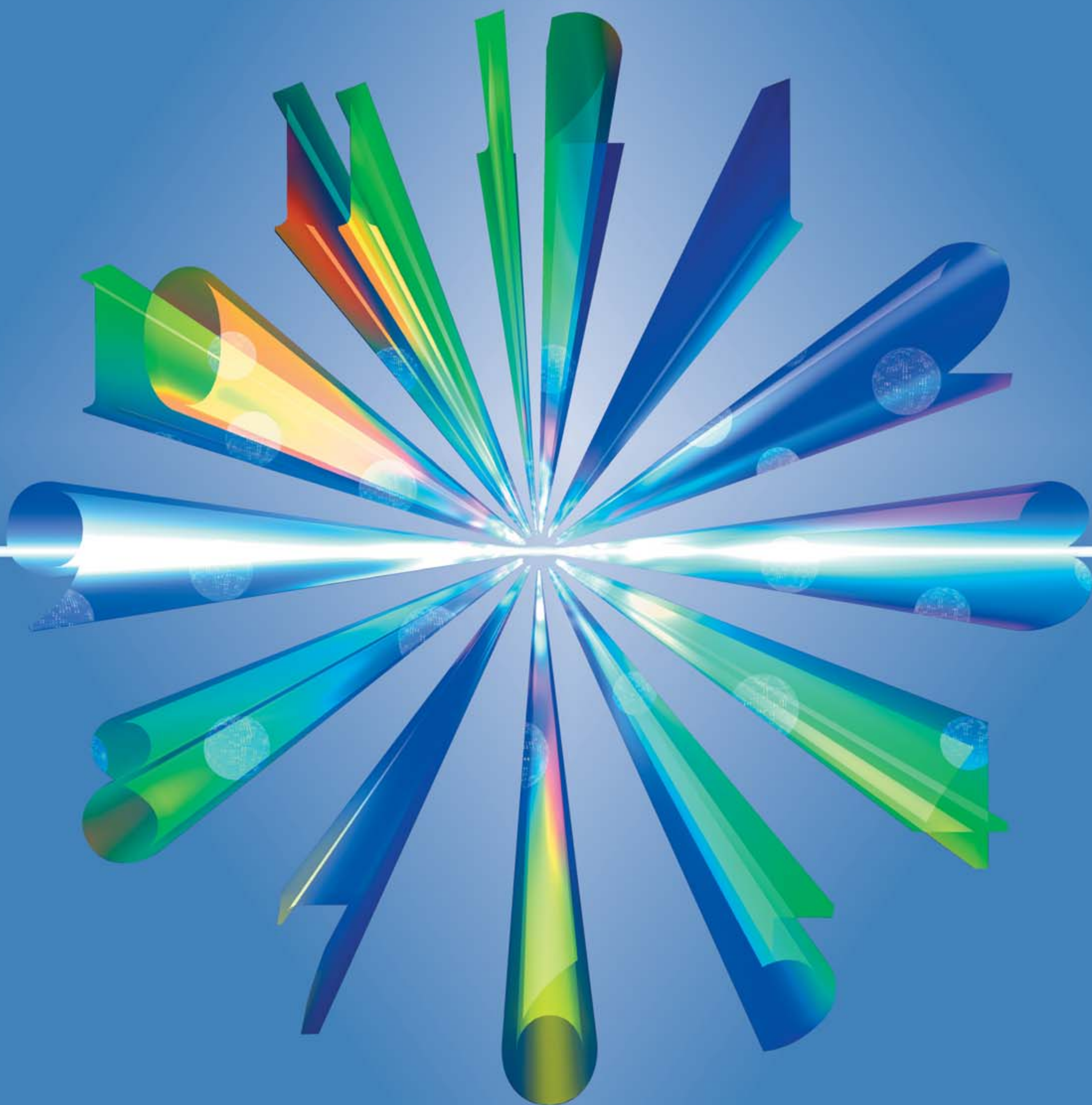
High Resolution Semi In-lens

JSM-6701F

Field Emission SEM



JEOL

Serving Advanced Technology

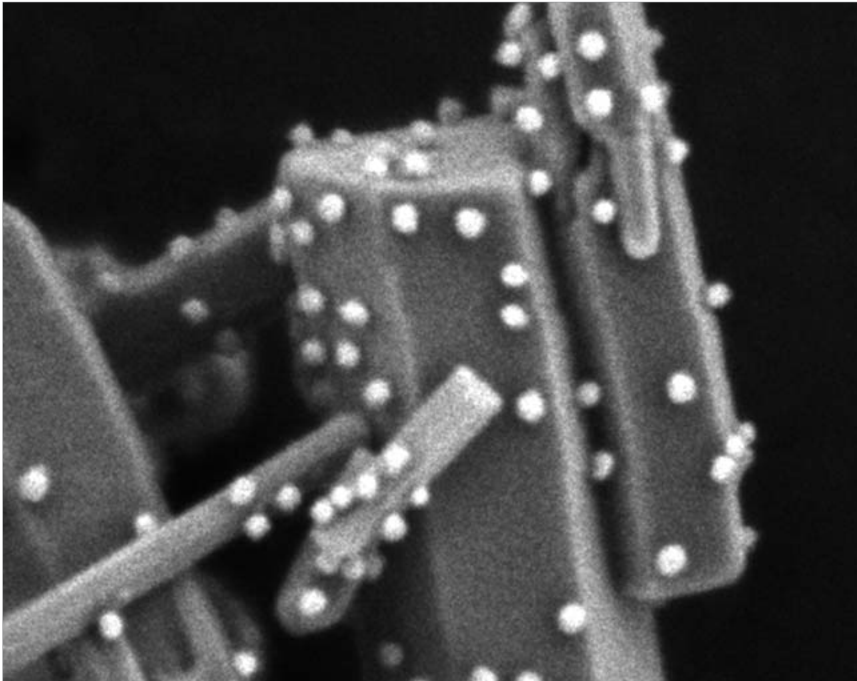
High Resolution Semi in-lens FE SEM

JSM-6701F

The JSM-6701F is an ultra high resolution FE SEM suitable for observation of fine structures such as multi-layered film and nano particles fabricated by the nano technology.

- High resolution: 1 nm (15 kV), 2.2 nm (1 kV)
- High resolution even at large probe current for analysis
- Completely automated electron optics
- Maximum 2 nA probe current without changing objective lens aperture size
- Specimen chamber for up to 200 mm diameter specimen
- High stability large eucentric specimen stage with motorized control
- Large specimen exchange air lock chamber
- One action specimen exchange mechanism
- Large LCD display with 1,280 × 1,024 pixel resolution
- Compatible with network

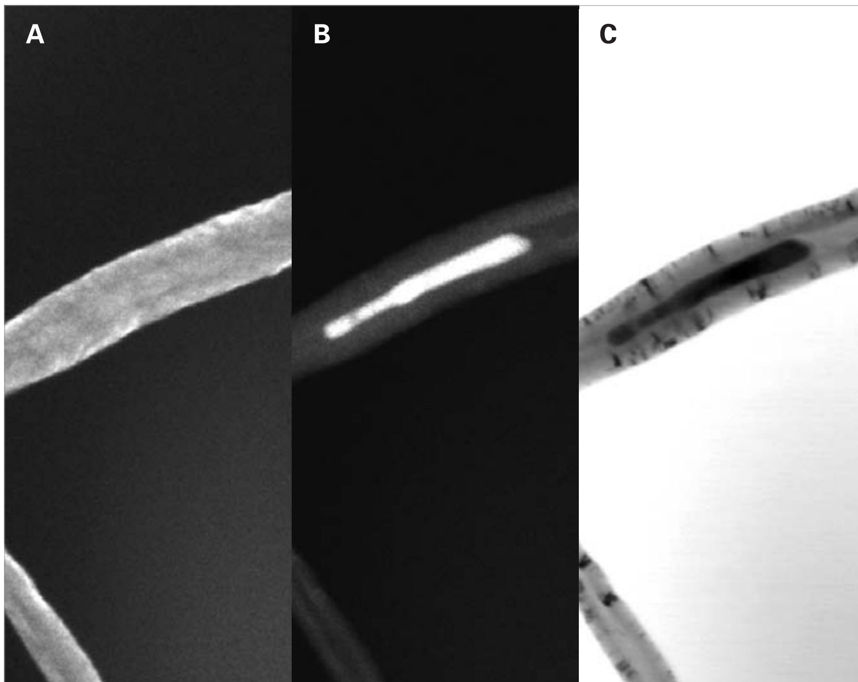
High Magnification Observation



Instrument: JSM-6701F

Accel.Volt(kV): 1.0
Photo Mag. ×200,000
Image: SEI
<SEI>

Specimen: Hydroxyapatite
(No conductive coating)



Instrument: JSM-6701F

Accel. Volt(kV) : 30.0
Photo Mag. ×200,000
Image: SEI, BEI, STEM

Specimen: Carbon nano tube

A: SEI
B : BEI
C : STEM

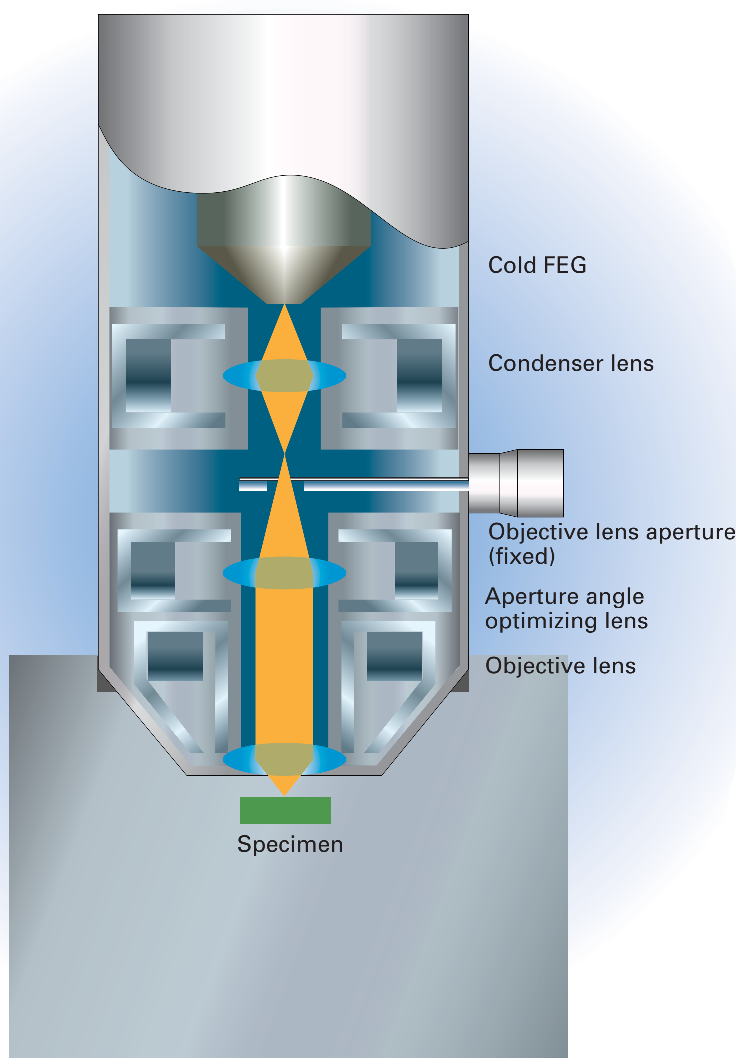
Report edited by SMile View

The JSM-6701F with the high resolution semi in-lens enables one to observe delicate specimens with minimum damage at very low accelerating voltages. At lower voltages, the fine surface structures can be observed more clearly than at higher voltages. Non-conductive specimens can be observed without a conductive coating on the specimens. The optional STEM (Scanning Transmission Electron Microscope) can reveal the internal structures of a thin specimen using high accelerating voltages.
The unique conical cold FEG of the JSM-6701F allows one to change the accelerating voltage by simply selecting a voltage on the operation menu. Alignment is automatically adjusted.

JEOL Technology
High Resolution Semi In-lens

Newly developed High Resolution Semi In-lens Objective Lens for JSM-6701F provides high resolution for a large specimen

The High Resolution Semi In-lens Objective Lens, which JEOL develops by improving the conventional objective lens, enables one to observe a relatively large specimen with high resolution. The resolution of 1.0 nm at 15 kV and 2.2 nm at 1 kV is guaranteed. High resolution is no longer limited to a very small specimen.



Cold FEG (Field emission gun)

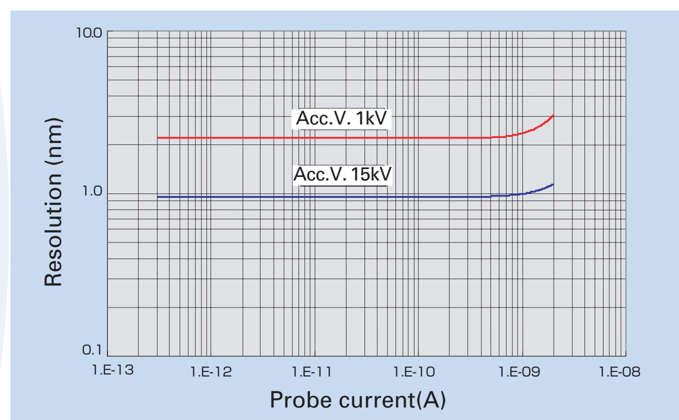
The cold FEG generates electrons with small energy spread. It is suitable for obtaining high resolution at lower accelerating voltages. The emitter works at room temperature so that a life time of a few years is expected.

Aperture angle optimizing lens

JEOL has developed the aperture angle optimizing lens. This lens is placed above the objective lens and optimizes the aperture angle of the objective lens for wide range of probe current .

Optimum probe current can be easily set

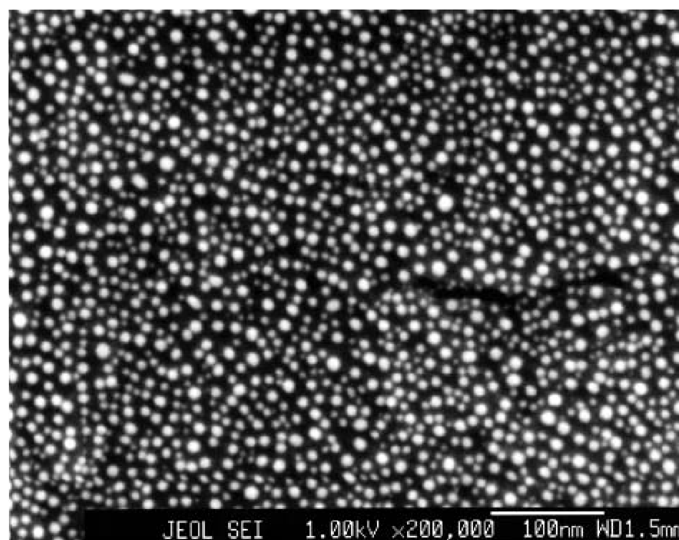
The JSM-6701F can vary the probe current from 1 pA to 2 nA continuously with a single objective lens aperture. High resolution can be obtained over the entire range of the probe current. A small current is suitable for a heat sensitive specimen. A large probe current, on the other hand, can be used for optimum contrast on a strong specimen without degrading sharpness.
A large probe current is used for EDS analyses for optimum X-ray detection efficiency without loosing sharpness. The high emission current stability is now obtained with improved vacuum in the gun chamber. EDS analyses are done with high precision.



High resolution over a wide probe current range

Completely automated electron optics

The conical type cold FEG developed by JEOL made the electron optics system completely automated. There is no need to worry about the alignment. The optics is automatically optimized when the accelerating voltage or probe current is changed. An optimum condition for a specimen or application is selected quickly.



Evaporated Au particles

JEOL Technology

High Definition Image on the Monitor

An image with 1,280 x 1,024 pixels is displayed for a high quality image generated by the newly developed Strongly excited conical objective lens. Every detail visible on a hard copy image is observed on the monitor. Manual control knobs for frequent operation and a joy stick for specimen stage control are provided so that the most of the monitor surface is reserved for a high definition image.

Specimen : $NaTaO_3$ La photocatalyst

Specimen courtesy of Professor A. Kudo,
Faculty of Science Division, Tokyo University of Science

JEOL Technology

Large Specimen Chamber for up to 200mm Specimen

The new JSM-6701F chamber has been designed to accept a wide variety of specimens ranging in size from a single cross section to a 203.2mm(8-inch) wafer. Furthermore, the chamber has been configured with several extra ports to accommodate a large number of attachments.

Specimen stage

The type IA specimen stage, which has a improved stability against floor vibration, provides stable high-magnification images. The traverse of the eucentric specimen stage is 70mm × 50mm, which can smoothly handle a large specimen. The type IA specimen stage is provided with 3 axes (X-Y-R) motor control. The motor control for the Z and tilt axes are optionally available.

One action specimen exchange

The standard specimen exchange chamber can handle up to a 150mm diameter specimen. The newly developed One Action Specimen Exchange mechanism is simple and fail-safe. An optional specimen exchange chamber for a 40mm height specimen is available for the type IA and type II specimen stages. The optional automated specimen exchange chamber for a 200mm diameter specimen is available for the type II and type III specimen stages.

Liquid nitrogen cold trap

Contamination is the rate-limiting step to resolution. Because the JSM-6701F utilizes a airlock specimen exchange system a liquid nitrogen cold trap positioned directly above the specimen virtually eliminates contamination thus assuring the best possible resolution.

Move a specimen as you wish

Motor control with convenient software

The motor controlled specimen stage is driven by a joy stick. The convenient software such as Click Center, Stage Navigator, Eucentric Rotation, and Step Move assures you high efficiency. Specimen coordinates can be stored and stored locations are displayed on the specimen stage graphics for easy view of distribution of areas of interest.

Click center

A click on an image moves the point to the center of the image.

Stage navigator

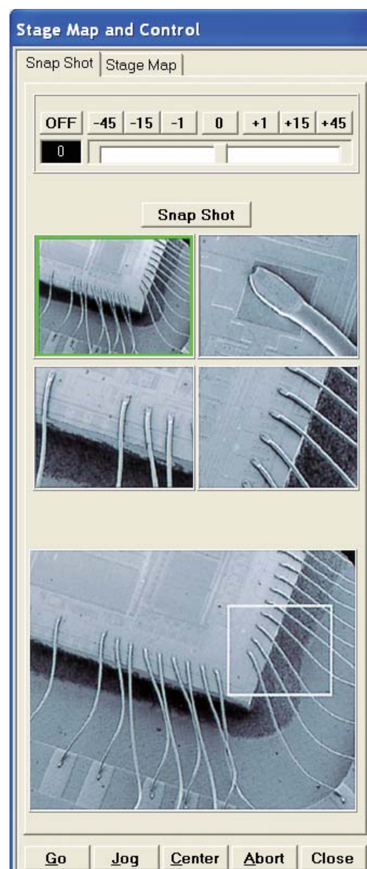
Up to four areas of interest can be quickly displayed on the stage navigator. Each image can be used for stage navigation.

Eucentric rotation

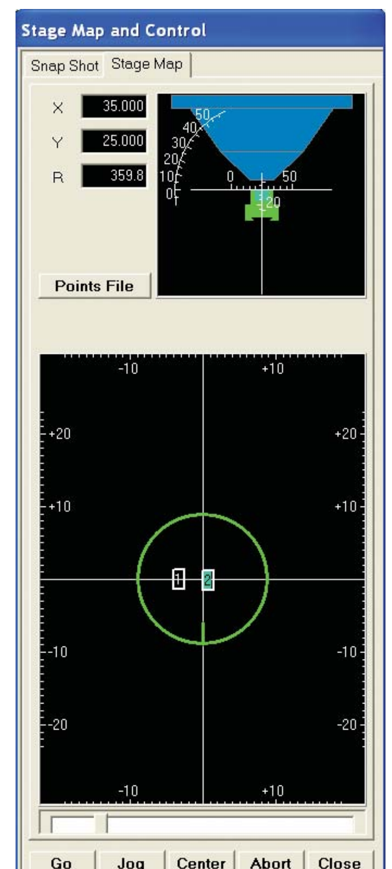
The specimen stage can be rotated around a currently viewed area.

Step move

The specimen stage is moved by an interval which is specified by a user. The interval can be relative distance to a current image area or an absolute distance.



Navigator



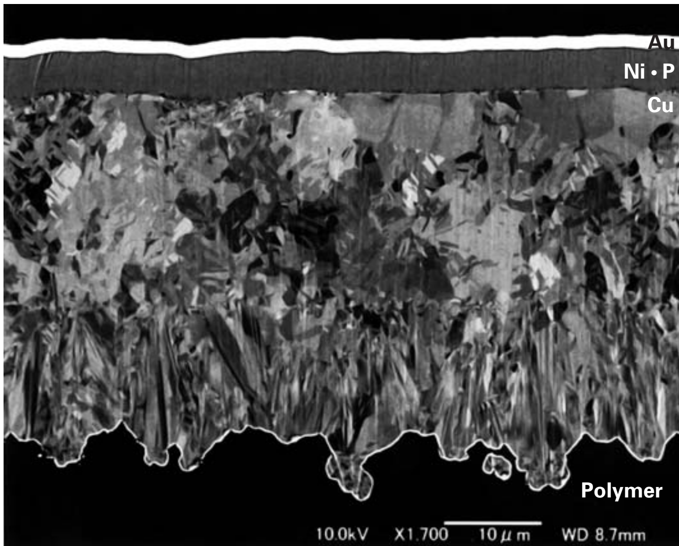
Stage map (Stored coordinates)

JEOL Technology

Expand High Resolution FE SEM to High Performance Analytical FE SEM (options)

Backscattered electron detector

JEOL semiconductor backscattered electron detector can separate composition contrast and topographic contrast. The composition contrast is informative to be used with EDS. Channeling contrast showing crystal orientation can be observed by this detector.



Backscattered electron image (Card edge connector. Channeling contrast is visible in the copper layer.)

YAG backscattered electron detector

YAG backscattered electron detector can not separate composition contrast and topographic contrast. YAG detector is more sensitive at lower accelerating voltages than the semiconductor backscattered electron detector.

WebSEM

WebSEM makes the operation of the JSM-6701F from remote locations through network, for example, operation of JSM-6701F placed in a clean room from out side of the clean room.

EDS

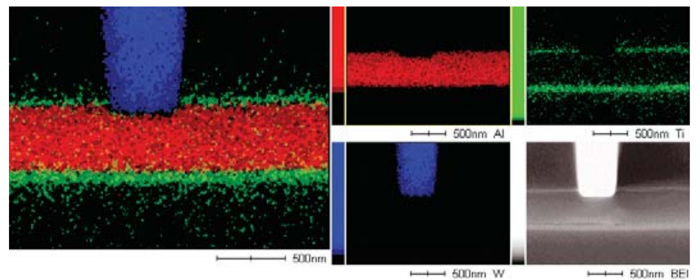
The JSM-6701F can produce a stable probe current for qualitative, quantitative, and elemental map analyses. The JSM-6700F is equipped with a current fluctuation monitor and can send emission current reading to an EDS analyzer for automated compensation of probe current fluctuation.

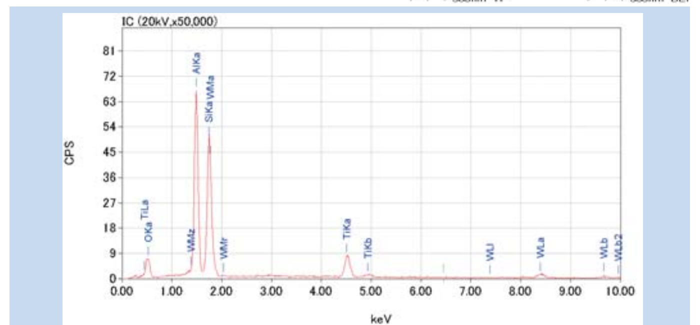
Probe current detector

The probe current can be monitored by adding the optional probe current detector and a current meter.

Nano-Manipulator

This manipulator controls its probe by a computer to process a specimen while observing it. Multiple probes can be mounted and used if required.

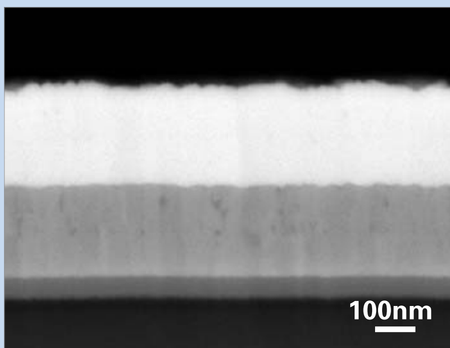




EDS elemental map (Cross section of IC device)

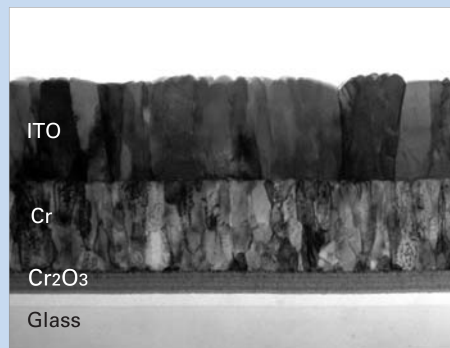
Scanning transmission electron detector

This detector allows switching between a bright-field image and a dark-field image. It is possible to observe internal structures or crystal structures of thin specimens.

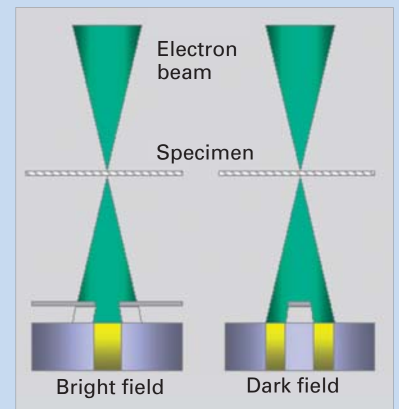


BEI (Compo)

Multi-layer films on a glass substrate



STEM image



JSM-6701F

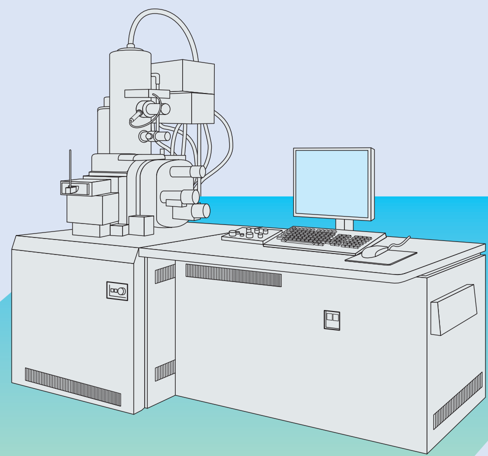
Principal Specifications

Resolution	1.0nm (15kV), 2.2nm (1kV)
Electron gun	Cold field emission electron gun
Accelerating voltage	0.5kV to 30kV
Magnification	×25 to ×650,000
Probe current	10^{-13}A to 2×10^{-9}A
Alignment of optics	Electro magnetic
Objective lens	Low-aberration objective lens
Objective lens aperture	Fixed
Specimen chamber	For 200mm diameter specimen
Exchange chamber	For 150mm or 200mm specimen
Specimen stage	Eucentric type (I A)
	X-Y : 70×50mm, Rotation : 360°
	WD (Z) : 1.5 to 25mm, Tilt : −5 to +60°
Motor control	3 axes (XYR), (T, Z : option)
Control software	Continuous move (linked to mag.)
	Eucentric rotation
	Stage navigator
	Step move
	Click center
Position memory	Provided
Stage graphic	Provided
OS	Windows XP
Computer	IBM PC/AT compatible
	RAM 256MB or more
Monitor	17 inch LCD
Live image	1280×1024 pixels
Stored image	1280×1024, 2560×2048 pixels
Manual knobs	Provided
Stored image display	Index display provided
Network	Provided
Image process	2 divided display (vertical, horizontal),
	4 divided display, Pseudo color, LUT
Auto functions	Focus, Exposure, Stigmator
Pressure in Gun	10^{-8}Pa order
Pump Gun	Sputter Ion Pump 3 units
Specimen	Series DP-DP system

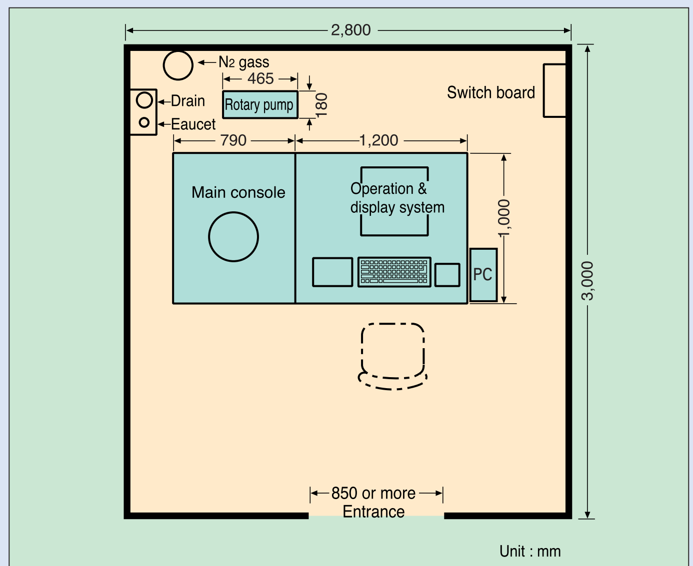
Windows is registered trademark of Microsoft Co.

Principal Options

- Lower Detector
- Liquid Nitrogen Trap
- Semiconductor Backscattered Electron Detector
- YAG Backscattered Electron Detector
- Centarus Backscattered Electron Detector
- Energy Dispersive X-ray Spectrometer
- Probe current detector
- Type II Specimen Stage (X-Y : 110 × 80mm)
- Type III Specimen Stage (X-Y : 140 × 80mm)
- Type II Specimen Exchange Chamber (100mmϕ × 40mmH)
- Auto Specimen Exchange Chamber (200mmϕ × 10mmH)
- Specimen Holder for Cross Section Observation
- Specimen Holder for Wafer
- Specimen Holder for Hard Drive Disk
- Cryo Unit
- Nano-Manipulator
- Scanning Transmission Electron Detector



Example of Installation Layout



Installation Requirements

Power	Single phase, 200V AC, 50/60Hz
	6kVA, voltage regulation within ±10%
Grounding terminal	One, 100Ω or less
Cooling water	
Faucet	One, 14mm OD or JIS B0203 Rc1/4(ISO7/1Rc1/4)
Flow rate	2.4L/min or more
Pressure	0.1 to 0.25 MPa (gauge pressure)
Temperature	20±5°C
Drain	One, 25mm ID or JIS B0203 Rc1/4 (ISO7/1 Rc1/4)
Dry N_2 gas	Should be provided by customer
Pressure	0.4 to 0.5 MPa (gauge pressure)
Environment	
Temperature	20±5°C
Humidity	60% or less
Stray AC magnetic field	0.3μT (p-p) or less (50/60 Hz sine wave,
	WD=3mm, Acc. V.=15kV)
Floor vibration	3μm (p-p) or less at sine wave of over 5Hz
	frequency
Floor space	3,000×2,800mm or more
Door width	850(W)×2,000(H)mm or more

**Specifications subject to change without prior notice.*

High technology for quality assurance and the environmei

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