

JEOL

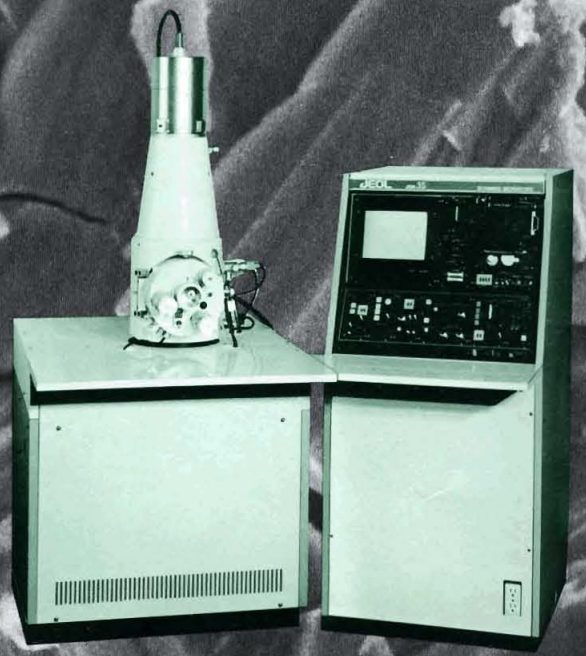
Multi-Purpose

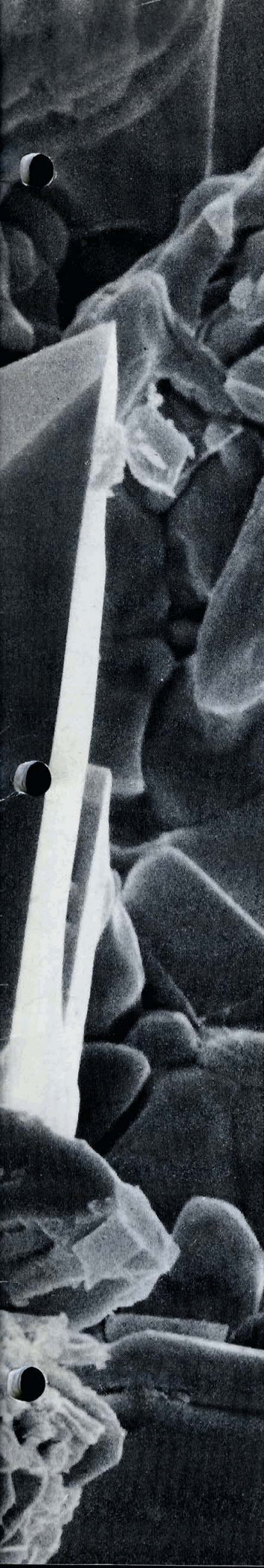
Scanning Microscope

JSM-35



JSM-35





A constant leader in the field of electron optics instrumentation, JEOL has already supplied more than 1000 scanning microscopes the world over. And to its powerful SEM line, JEOL has now added the high-performance multi-purpose JSM-35...a future-engineered instrument born out of JEOL's total experience in electron optics technology.

The JSM-35's basic design concepts include the ease of stably obtaining high performance, and truly user-oriented system expandability by the provision of over 60 attachments. Thus, the JSM-35 can be used for a wide variety of applications ranging from routine work such as quality control to the most advanced research.

No matter where it is employed, this all-solid-state modular instrument will assure the best of its performance... backed by JEOL's world-wide service network.

Complete Provision for Ultimate Performance with Exceptional Ease of Operation

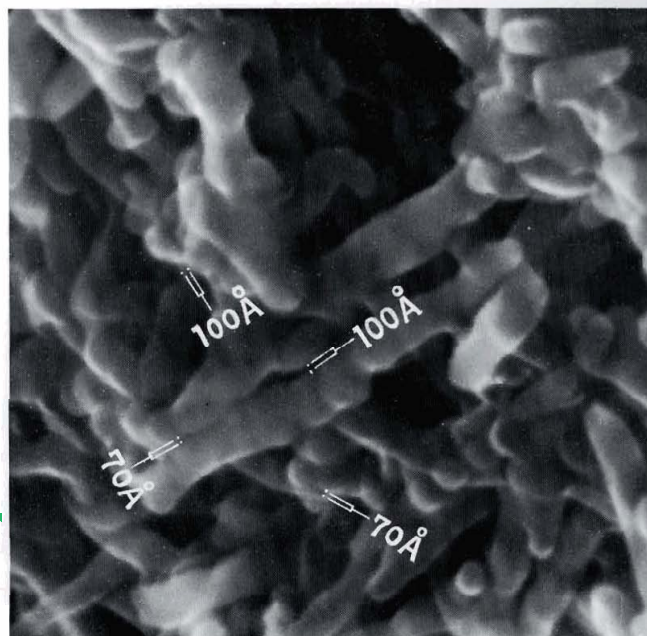
- HIGH RESOLUTION—THE INTEGRATION OF TECHNOLOGY IN SCANNING ELECTRON MICROSCOPY—substantiates the high performance and reliability of the JSM-35 multi-purpose scanning microscope.
- ▷ AUTOMATIC COMPENSATION FOR FOCUS AND MAGNIFICATION UPON ACCELERATING VOLTAGE CHANGE is provided over the entire range from 0 to 39 kV.
- ▶ A WIDE RANGE OF ACCELERATING VOLTAGES enables you to set the optimum condition for your specimen.
- SIMPLIFIED AND AUTOMATED OPERATIONAL SEQUENCE INCLUDING ASTIGMATISM CORRECTION AND CONTRAST & BRIGHTNESS CONTROL makes you a skilled operator from the outset.
- MAINTENANCE FREE ELECTRON OPTICAL COLUMN provides a guaranteed resolution of 100 Å routinely for at least 6 months without column cleaning.
- VERSATILE EUCENTRIC SWING-OUT GONIOMETER STAGE WITH AN AIR-LOCK MECHANISM (optional) permits the specimen chamber to be kept in a vacuum all the time, and allows large specimens to be accommodated merely by opening the stage.
- A FULL LINE OF MODULAR ATTACHMENTS FOR MATERIAL AND BIOLOGICAL RESEARCH, as well as for quality control, can be supplied to make the JSM-35 a real user-oriented system.
- TOTALLY IN-FOCUS IMAGE IS AVAILABLE WITH FULL FOCUS MODE BOTH FOR ELECTRON OPTICS AND ULTRAHIGH RESOLUTION CATHODE RAY TUBE, even when the specimen is tilted more than 60°.

HIGH RESOLUTION—100Å—GUARANTEED

The JSM-35 guarantees a high resolution of 100Å for secondary electron images at a working distance of 15 mm.

No other SEM can guarantee such high resolution at this long working distance which permits specimens to be tilted up to 60° with a satisfactory depth of field.

The world's largest SEM manufacturer, JEOL has always announced the guaranteed resolution of its instruments with complete confidence. See our images and compare with others'.

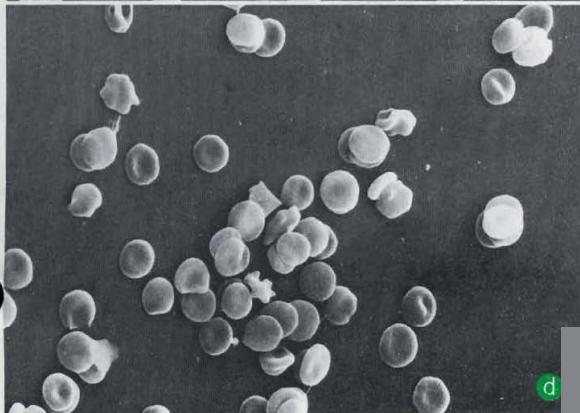
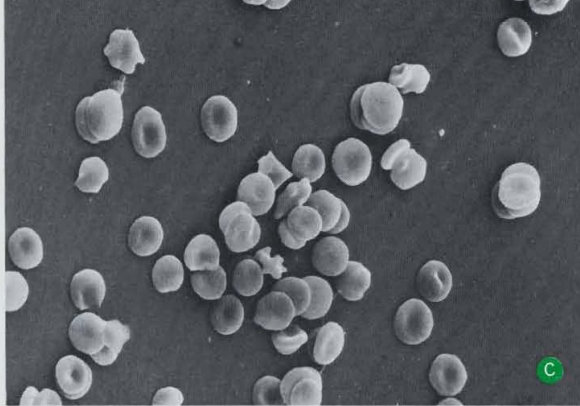
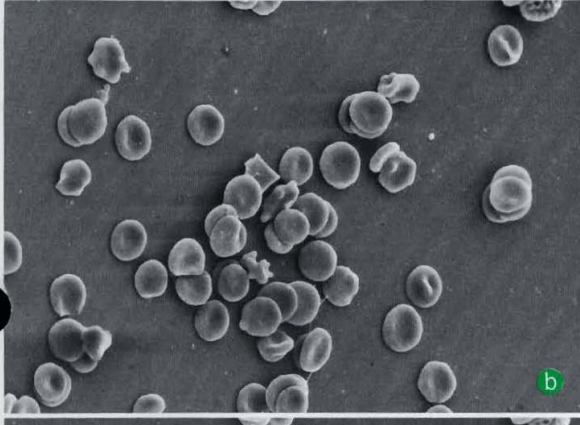
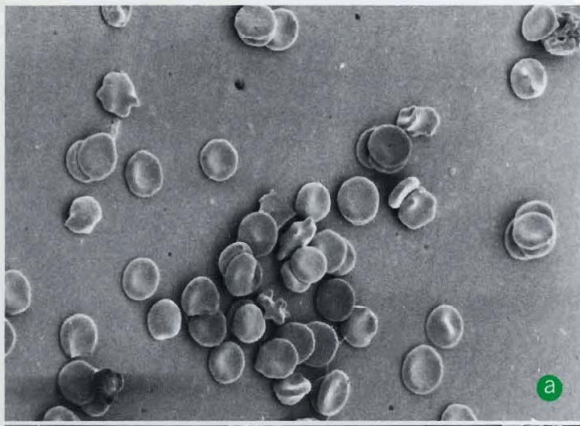


Magnetic tape 100,000X

AUTOMATIC COMPENSATION FOR FOCUS AND MAGNIFICATION UPON ACCELERATING VOLTAGE CHANGE

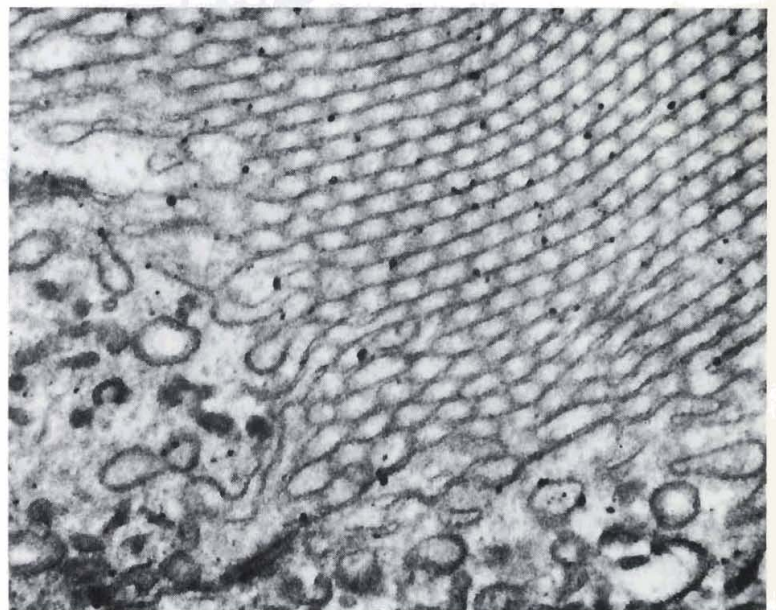
As will be mentioned in the opposite page, it is important for a multi-purpose scanning microscope to have a wide range of accelerating voltages. The JSM-35 is therefore provided with **automatic focus and magnification compensation** over entire **accelerating voltage range for operational convenience**. The image thus stays in focus and remains at the same magnification, even when the accelerating voltage is changed.

WIDELY VARIABLE ACCELERATING VOLTAGE



The scanning electron microscope, when intended as a multi-purpose type, must have a wider accelerating voltage range with minimal step intervals since specimens are too diverse to be examined with a small voltage range having limited steps. The JSM-35 Scanning Microscope covers from 0 to 39 kV in 1 kV steps, allowing the optimum conditions to be selected for individual specimens...for instance, higher ranges for transmission mode, X-ray analysis, etc. and lower ranges for biological and non-coating specimens, etc.

Transmitted Electron Image



Kidney, 39 kV 30,000X

Dependence of Image Quality on Accelerating Voltage

Red Blood Cells 1,000X

a. 3 kV b. 9 kV c. 13 kV d. 35 kV

SIMPLIFIED AND AUTOMATED SEQUENCE OF OPERATION

Skill is now not a factor for taking good pictures since major operations such as astigmatism correction and exposure setting are simplified and automated.

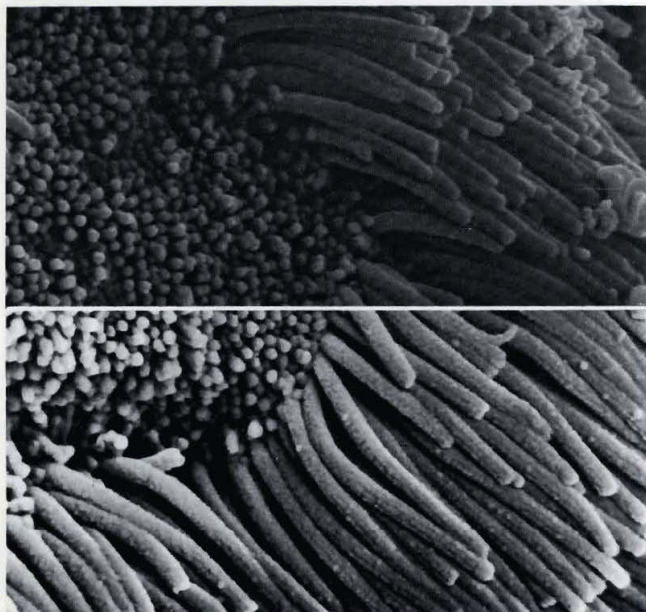
ASTIGMATISM MONITOR

Astigmatism correction is one of the most important operations to obtain quality micrographs at high magnifications. The JSM-35 is provided with an astigmatism monitor and "RAPID SCAN" which permit astigmatism correction and focusing to be performed using both under- and over-focused images displayed simultaneously on a single CRT.

AUTOMATIC CONTRAST & BRIGHTNESS CONTROL (ACB optional)

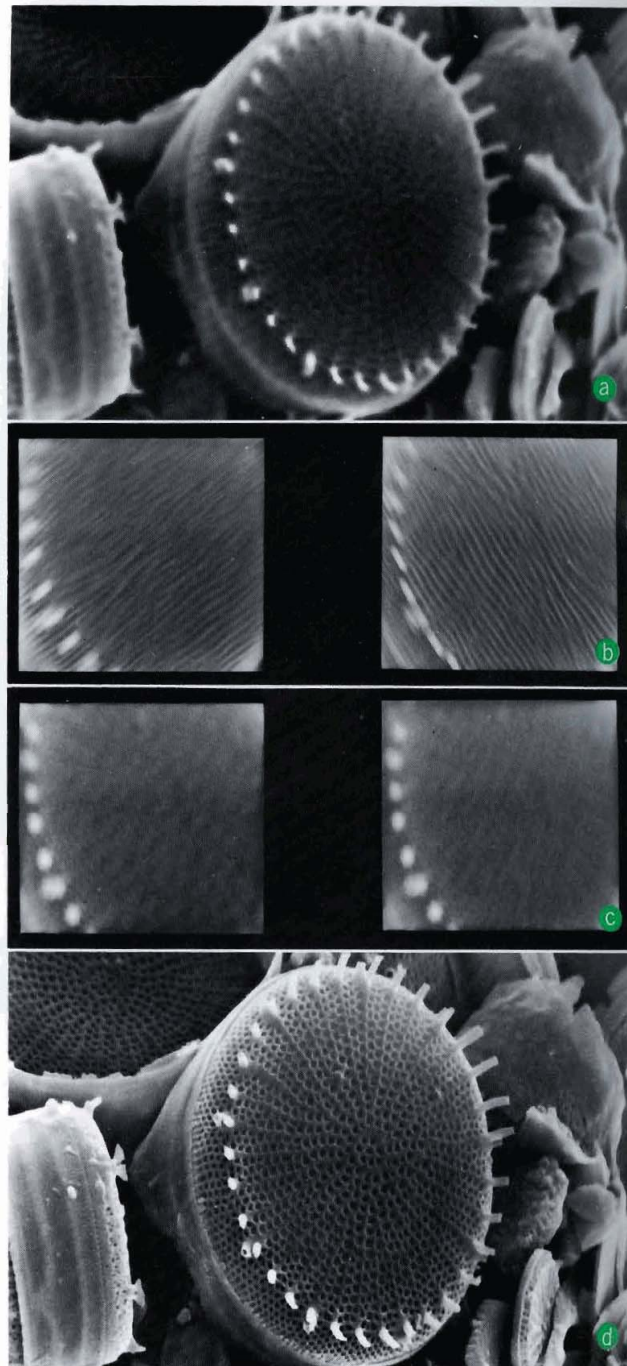
Contrast and brightness control following astigmatism correction, and focusing for photographing can also be performed automatically. In short, no operation is needed after focusing, except just pressing the "PHOTO" button which activates the shutter of the automatic camera, synchronized with the scan generator and photo recording circuit.

Automatic Contrast and Brightness Control



Trachea, rat 4,900X

Procedure of Astigmatism Correction



- a. Astigmatism monitor OFF, uncorrected
- b. Astigmatism monitor ON, uncorrected
- c. Astigmatism monitor ON, corrected
- d. Astigmatism monitor OFF, corrected

MAINTENANCE FREE ELECTRON OPTICAL COLUMN

The two-lens electron optical column with reserve capability guarantees a high resolution of 100 Å, with the aid of a specially designed micro-focus gun. The off-axis beam in the electron path is screened by apertures which are self-cleaned by the beam itself and a special cleaning mechanism. As a result, the guaranteed resolution can be routinely achieved for more than 6 months without column cleaning.

VERSATILE EUCENTRIC GONIOMETER STAGE

As the stage is provided with an airlock chamber (AGS optional), a specimen less than 33 mm in diameter and 20 mm in height can be loaded through the airlock chamber within 30 sec. pumping time. The specimen chamber is thus kept in a high vacuum, which minimizes contamination from the specimen itself and/or conductive point.

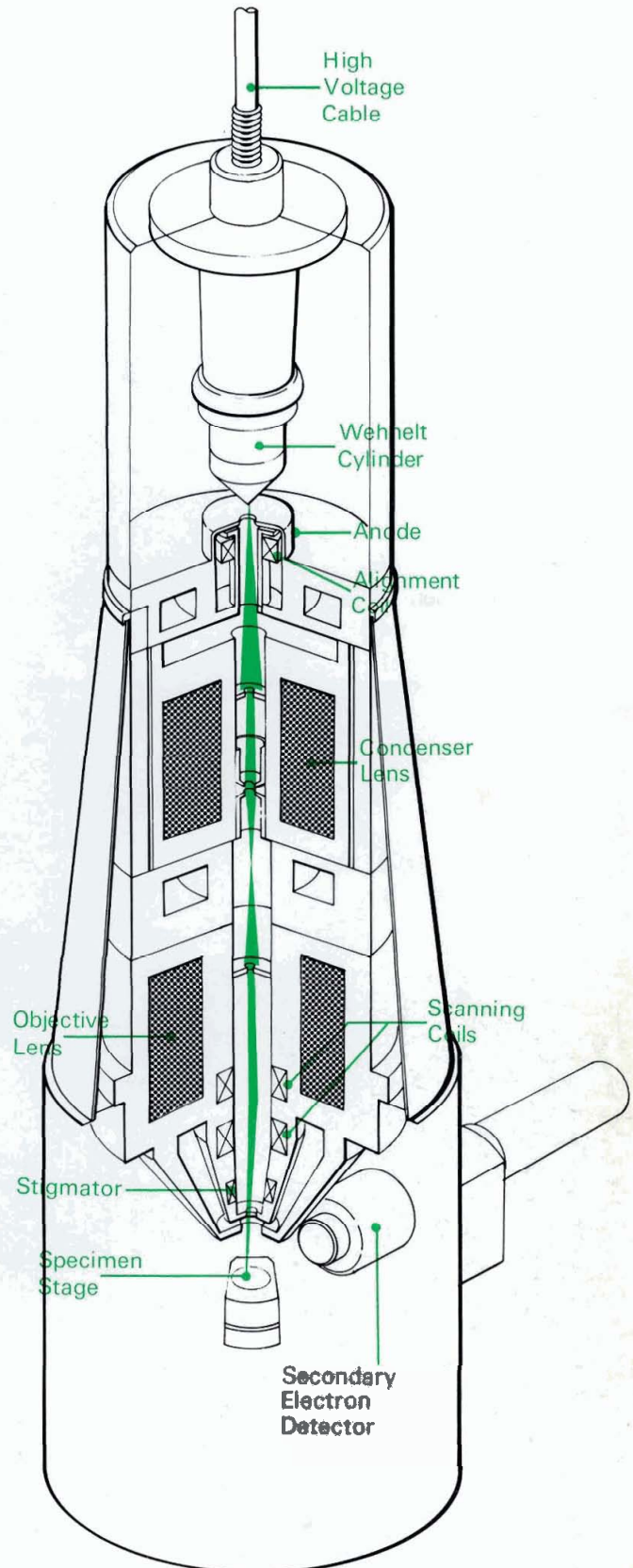
Extra-large specimens can be loaded by opening the swing-out stage. The airlock chamber is extremely useful also for the cryo technique for biological specimens which are dissected, fractured or coated with carbon and metal, if necessary. Since the stage is so versatile, any kind of examination—including cryoscan, X-ray analysis, and transmission microscopy—can be performed with the single stage.

DIVERSE APPLICATIONS

A full line of modular attachments gives the JSM-35 exceptional versatility and flexibility.

Two fully focusing wavelength dispersive spectrometers and its associated attachments make the JSM-35 a sophisticated, high performance electron probe microanalyzer.

The CRYO SCAN, a biological version of the JSM-35, pioneers a new world in scanning electron microscopy, especially in the biological field.



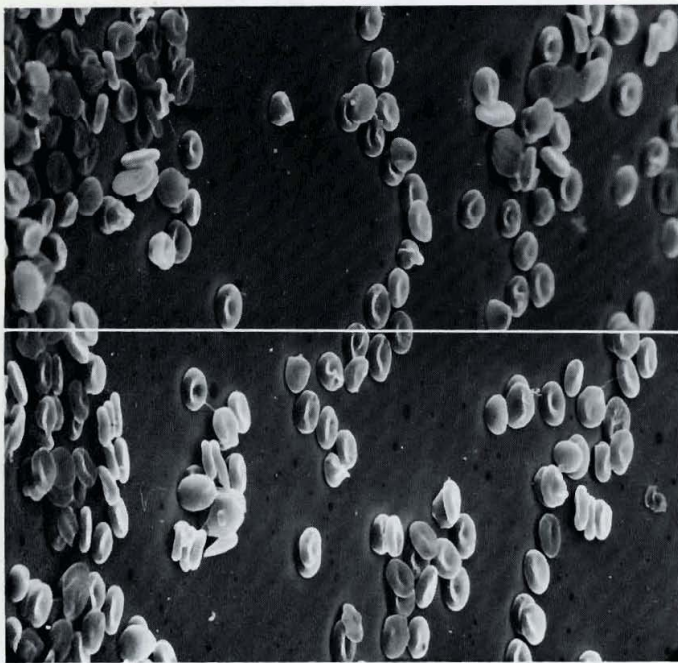
TOTALLY IN-FOCUS IMAGE WITH FULL FOCUS MODE

In case the electron probe scans the highly inclined specimen surface, the image is defocused at the upper and lower edges. On the JSM-35, this defocus can be corrected with its full focus capability. Furthermore, since the direction of correction is along the horizontal scanning line, correction can be readily performed by watching the scanning line. Other instruments in which the direction is vertical, require more than one full frame scan for correction purposes.

Corrections can be done independently of specimen orientation, with the aid of the scan rotation attachment (SRT optional).

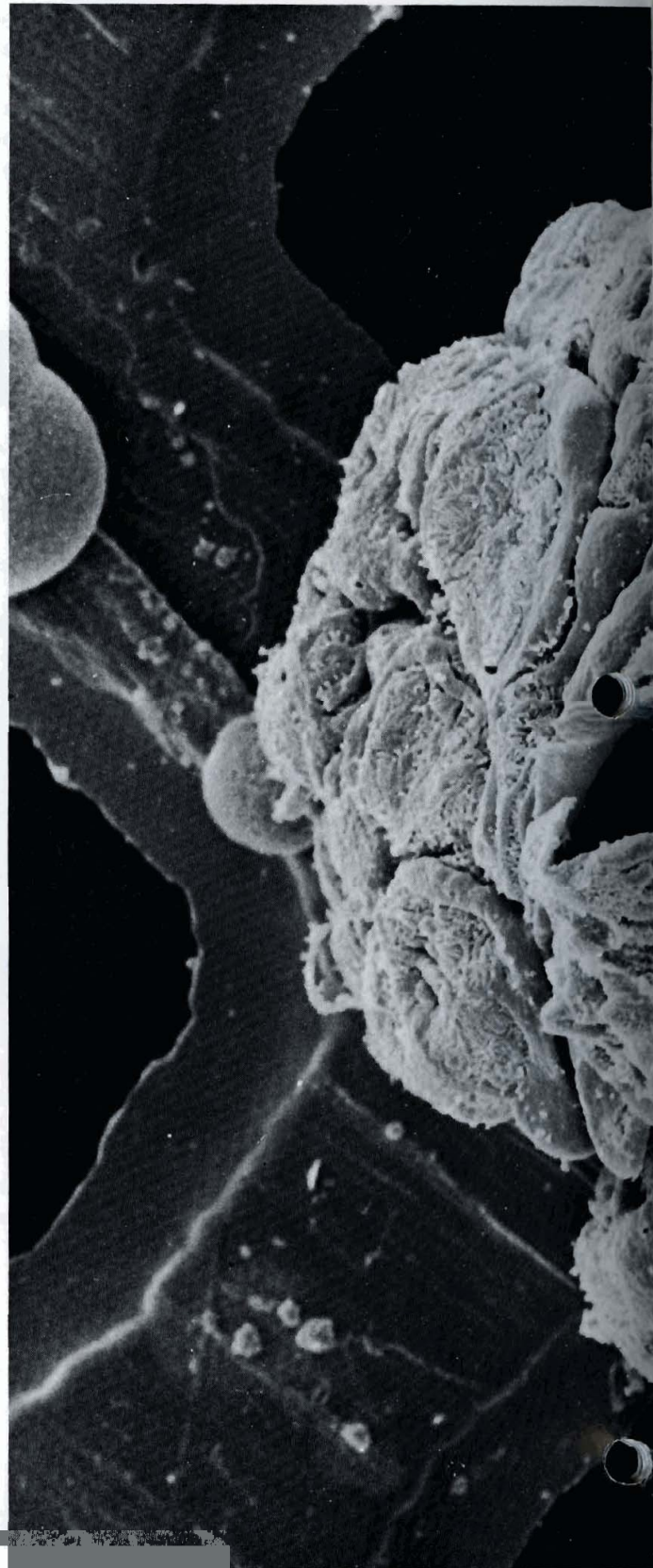
Full focus capability is also applied to the ULTRAHIGH RESOLUTION RECORDING CRT providing 2,500-line resolution per frame. The entire area of an image on the CRT can thus be sharply focused. The ultrahigh resolution CRT facilitates the making of a montage image in conjunction with distortion-free imaging capability.

Full Focus for Specimen Tilt



Red Blood Cells 1,000X

ON



*Glomerulus, rat Direct 500X Total 2,600X
Courtesy Dr. J. Tokunaga, Kyushu Dental College*

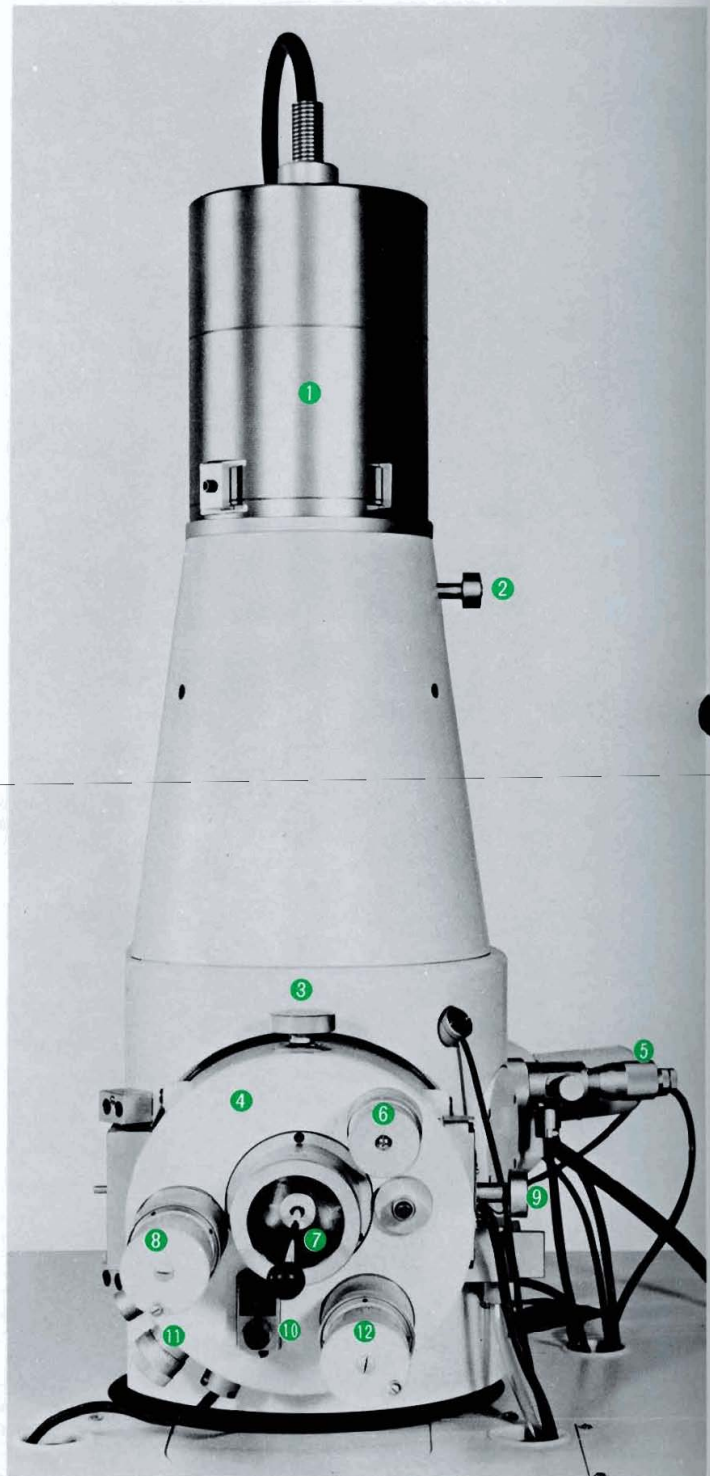


ELECTRON OPTICS

JEOL's years of experience in electron optics design have produced quality scanning microscopes with the world's highest resolution. The JSM-35's two-lens system with a microfocus gun assures a 100 Å or better resolution routinely, in conjunction with its unique maintenance-free column design. A mu-metal sleeve (MMS optional) allows the JSM-35 to be used even in a factory with a magnetic field of up to 10 milligauss.

Filament exchange is a matter of a minute when the gun isolation valve (GIV optional) is used. The vacuum pumping sequence, including filament exchange, is of course automatically performed. A thin foil condenser lens aperture is heated by the beam itself, and objective lens apertures can be kept clean with a self-cleaning mechanism. The guaranteed resolution can thus be routinely obtained for at least 6 months without column cleaning. Three objective lens apertures of different sizes are interchangeable and X-Y adjustable (XYA optional) from outside of the vacuum. These different-sized objective apertures are essential to scanning electron microscopy in terms of resolution, depth of field, and X-ray analysis whether or not it uses an energy dispersive X-ray spectrometer.

The provision of X-Y adjustment for the objective lens apertures makes focusing easy at a high magnification, and minimizes the amount of astigmatism, which results in better resolution. Axis alignment can be done electromagnetically both for gun tilt and X-Y transverse, with no mechanical alignment.



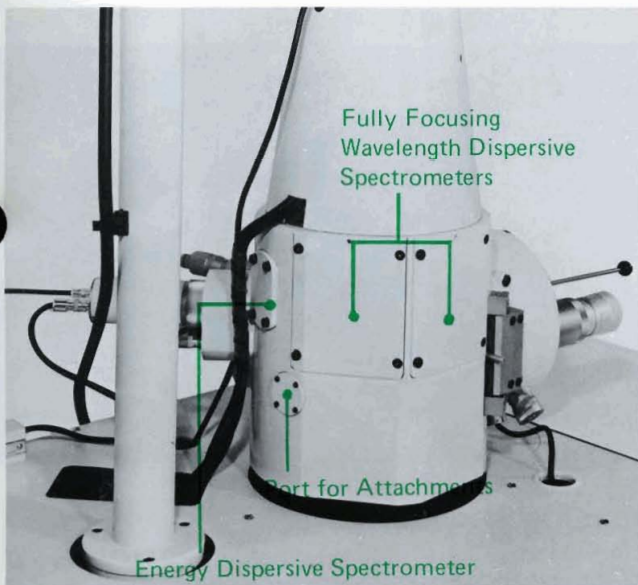
- | | |
|--|---------------------------------|
| 1. Anode Chamber | 7. Air-lock Chamber |
| 2. Gun Isolation Valve | 8. Y-axis (0-25mm) |
| 3. Z-axis (15mm-39mm) | 9. Air-lock Door |
| 4. Specimen Stage | 10. Rotation (360°) |
| 5. Self-cleaning Objective Lens Aperture | 11. Z-axis Fine (± 1.5 mm) |
| 6. Tilt (0-60°) | 12. X-axis (0-15mm) |

SPECIMEN CHAMBER AND STAGE

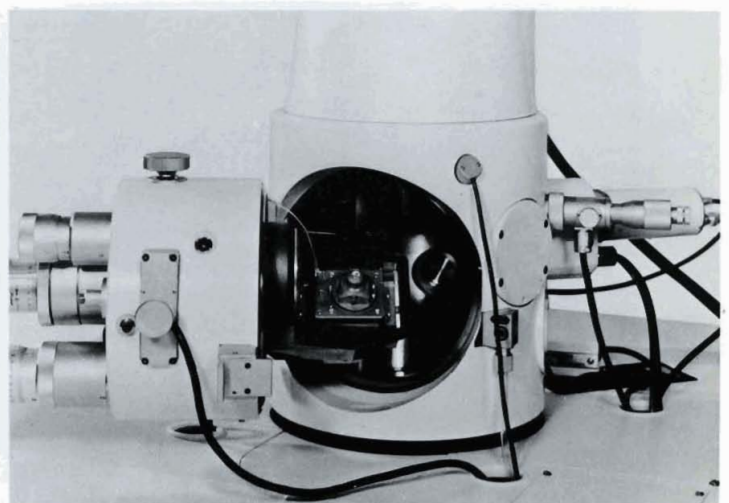
The roomy specimen chamber of the JSM-35 accepts a variety of attachments such as two fully focusing spectrometers, an energy dispersive spectrometer and a cryo-unit.

The eucentric specimen stage provides 0° to 60° tilt, 360° rotation (endless), 0 to 15 mm travel along the tilted plane on the X-axis, 0 to 25 mm travel on the Y-axis and 15 to 39 mm travel on the Z-axis (fine adjustment of ± 1.5 mm is optionally available). The image is kept in focus through any of the above stage motions. Focus compensation for W.D. changeover between 15 mm and 39 mm is provided. The versatile specimen stage accommodates an extra large specimen up to 76 mm in dia. and 20 mm in height by swinging out the stage. Moreover, no other stages are required when observing specimens for X-ray analysis, transmission microscopy, etc., as the standard stage can also accept such specimens.

The column and stage are suspended on anti-vibration mounting, and as the main console is separated from the operation console, it is not necessary to be concerned about the vibration from the operation console during photographing.



Standard specimen holder



Stage door opened for large size specimen

OPERATION SYSTEM

The JSM-35's automatic operation is indispensable not only for routine microscopy but also for research purposes, thus alleviating operator's fatigue. A manual override is provided of course; however, it is not intended to cover the ranges between the voltage steps, but is used only for very special purposes, at the discretion of the individual user.

Digital display and pushbutton arrangement realized by digitizing solid-state circuitry make the operation automatic and comprehensible.

1 Accelerating Voltage

Accelerating voltage can be changed from 0 to 39 kV in 1 kV steps and digitally displayed on the panel. Gun bias voltage is selectable in 10 steps to allow setting of optimum conditions according to the purpose of examination. The load current meter facilitates filament current setting.

2 Lens

The astigmatism monitor (or the full focus mode) and the auto-focus mode can be selected. An eight-pole electromagnetic stigmator control is provided besides condenser and objective lens controls.

3 Secondary Electron Image

The secondary electron collector controls the amount of signals, making it possible to change the ratio of secondary electrons to backscattered electrons. Image quality can thus be improved without any image processing. Image polarity and AC-DC selection switches are also provided.

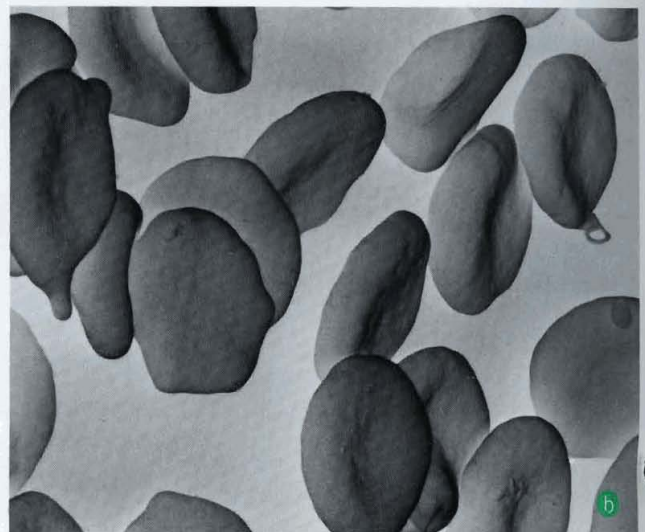


Image Polarity



Red blood cells

a. Positive



b. Negative

4 Magnification

Magnification can be changed from 10X to 180,000X in 4 steps by push-buttons, and in 24 fine steps between each two steps, independently of the accelerating voltage. Magnification reading is digitally indicated and no calibration is necessary even when the accelerating voltage and/or working distance is changed.

5 Scan Generator

Four scanning speeds are provided for observation. "RAPID 1" is for selected area rapid scan to facilitate astigmatism correction and fine focusing, "RAPID 2" for field selection, "SLOW 1" and "SLOW 2" for viewing, respectively. The photographing sequence is completed just by pushing the "PHOTO" button which activates the automatic camera and scan generator.

The horizontal and vertical scanning speeds for photographing can be independently preset. The number of scanning lines per frame is from 1 to 250,000.

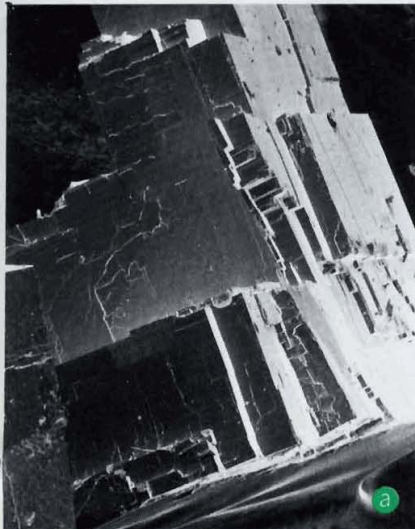
Selected area scan, line profile, spot displacement and line scan with brightness modulation are also provided. Especially, rapid scan line profile is quite useful for axis alignment, filament current setting, focusing and exposure setting.



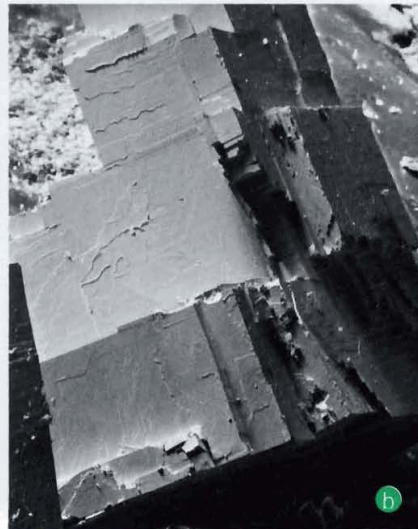
6 Vacuum and Safety Systems

The completely automated vacuum system is provided with a manual override. The system is controlled by pneumatic valves. All operations including specimen and filament exchange can be performed by the touch of a button. A safety system is provided against any possible failure during round-the-clock operation.

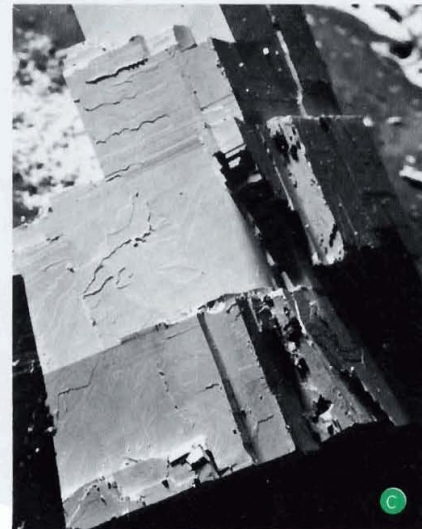
Secondary Electron Collector Control



Galena a. Secondary E.I.

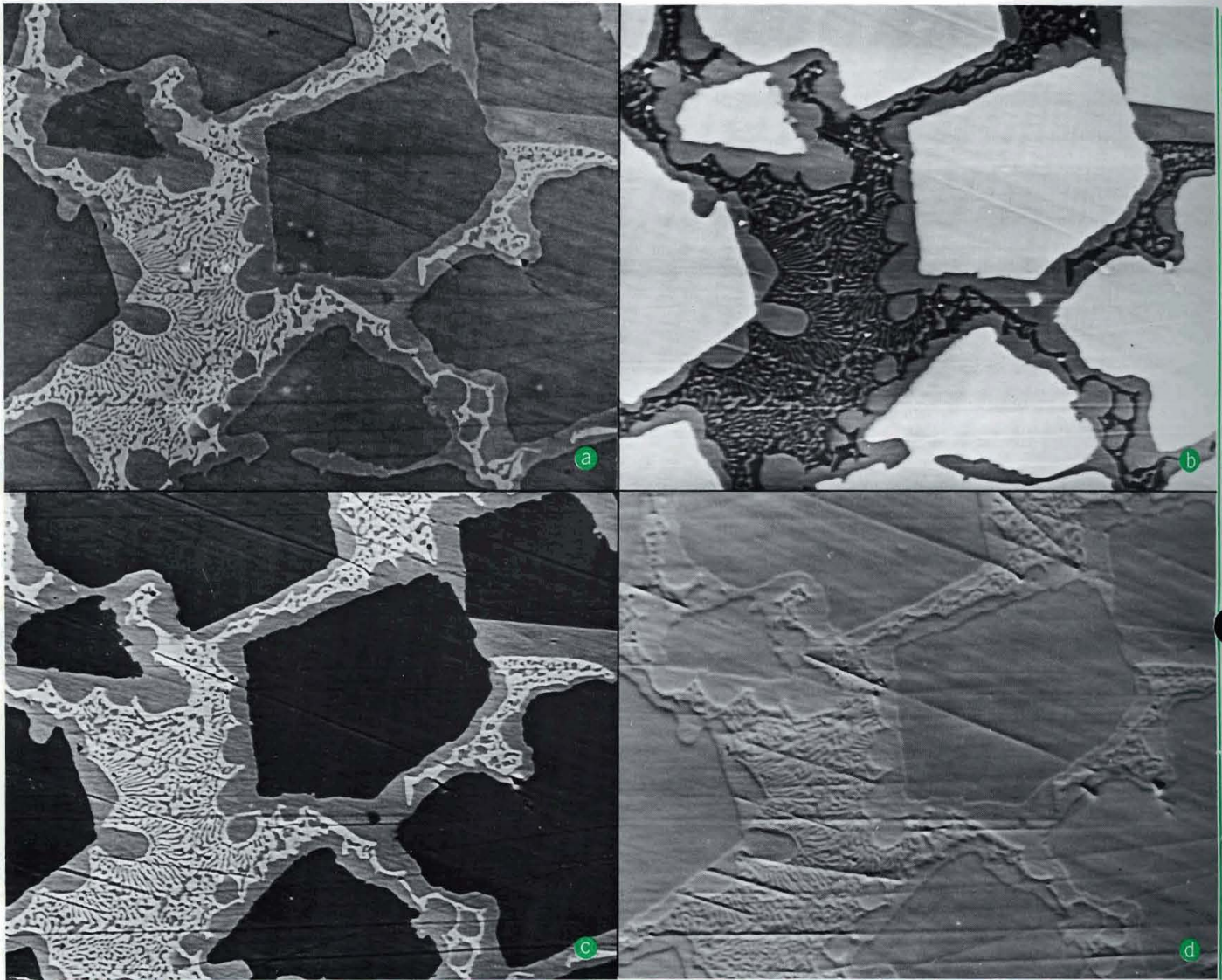


b. Mixed I.



c. Backscattered E.I.

DISPLAY SYSTEM



Multi Display Device a. Secondary E.I. b. Absorbed E.I. c. Backscattered E.I. (Composition) d. Backscattered E.I. (Topography)

● Indicator and Exposure Meter

Principal conditions such as magnification and accelerating voltage are digitally displayed as well as the working distance. To obtain the optimum exposure condition, both the brightness and contrast levels are indicated on their respective meters.

② Automatic Contrast and Brightness Control (ACB optional)

In any mode available with the JSM-35, the contrast and brightness are automatically controlled for both viewing and recording of CRT images, as the unit incorporates its own amplifier to be controlled.

No adjustment is needed even after conditions such as specimen position displacement, tilt angle, working distance, etc. are changed. Consequently, the adjustment of contrast and brightness is no longer required in the operational sequence.

● Large Display CRT and Ultrahigh Resolution Recording CRT (UHR optional)

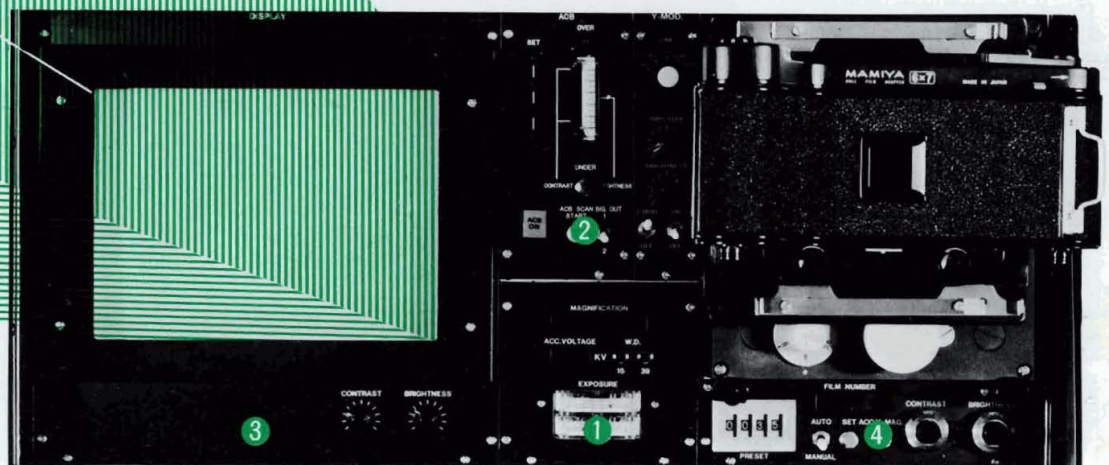
A comfortably located 10" CRT ensures untiring operation. Crispy edge sharpness obtained with the ultrahigh resolution recording CRT allows micrographs to be enlarged more than 2.5 times.

- * The Multiple Display Device (MDD optional) makes it possible to display either two or four different images on the CRT simultaneously. Although the original size of each image is small, the images can be enlarged without losing its sharpness, with the aid of the Ultrahigh Resolution CRT.
- * A TV image (DU10 optional) can be displayed on the standard CRT. The TV scan is quite useful for selection of a specimen field, observation of dynamic specimen transformation, and for instruction of a large number of people.

④ Automatic Camera and Photo Recording System

The automatic camera is activated by pushing the "PHOTO" button. No other operation is necessary for photographing. Various types of camera backs—for 70 mm, 35 mm and Polaroid film, etc.—are supplied on request. On each micrograph, a photo number (4 digits), magnification and accelerating voltage can be printed, and the photo number advances automatically (a manual override also provided).

- * Alphanumeric Display (ANDD optional) is also available.



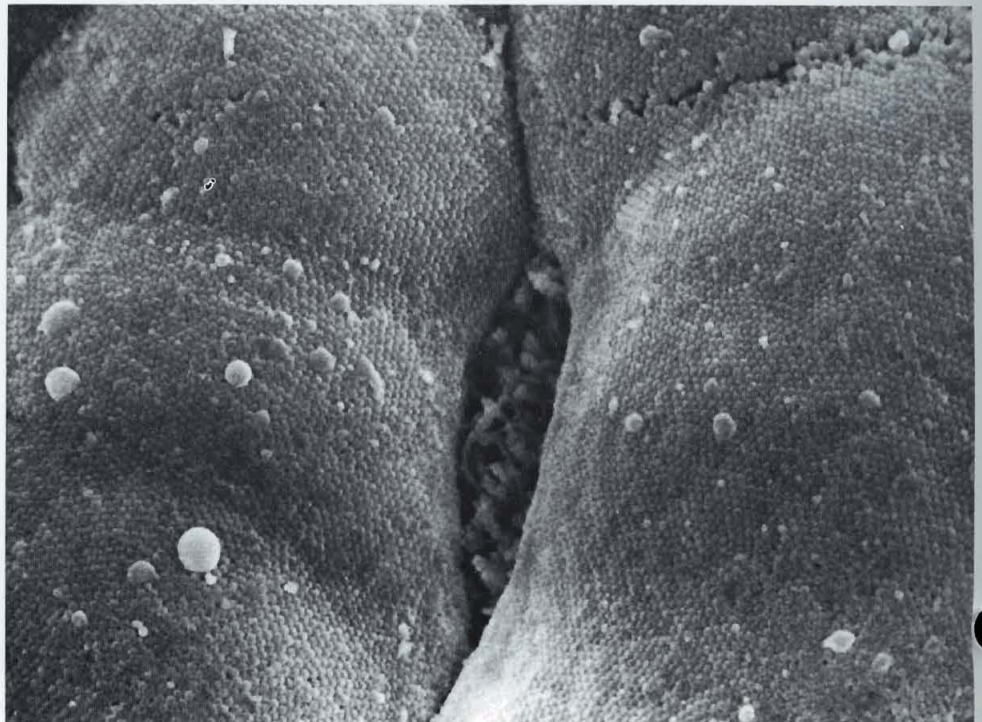
JSM-35 AS A CRYOSCAN

In scanning electron microscopy, it is now an important subject to observe a biological specimen in a native state. Thus, attention is now being directed toward the method of rapidly freezing and directly observing a specimen, without specimen preparations, such as fixation, dehydration and drying.

With the CRYOSCAN, the specimen is introduced into an airlock chamber without being exposed to air. In the airlock chamber, freeze-etching, dissecting or fracturing and metal coating is done as required. In performing etching, the CRYOSCAN allows only the specimen surface to be externally sublimated, with the specimen itself kept at a temperature (less than -130°C) that is not affected by ice recrystallization, whereas with other instruments, the specimen temperature needs to be elevated for sublimation of the specimen surface. Thus, the CRYOSCAN allows specimen deformation to be minimized in the etching processes such as ice recrystallization.

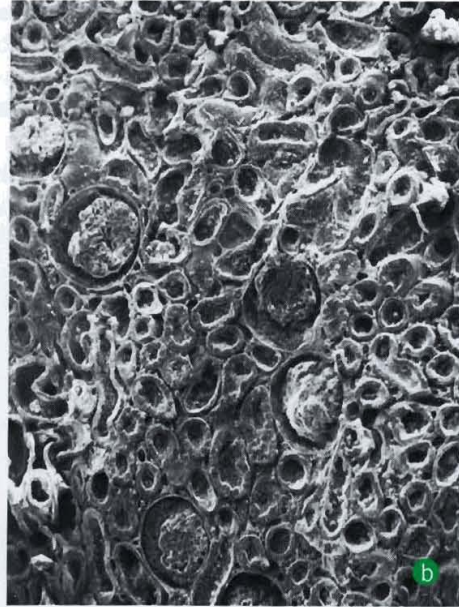
The metal coating mechanism (optional) incorporated into the airlock chamber is capable of coating the frozen specimen surface with metal, greatly improving image quality at high magnifications. Since these processes are done by a single unit, there is no need to exchange sub-systems.

The use of a micro-manipulator will permit latent areas on the specimen surface to be revealed with a micron-order accuracy, while observing the specimen.



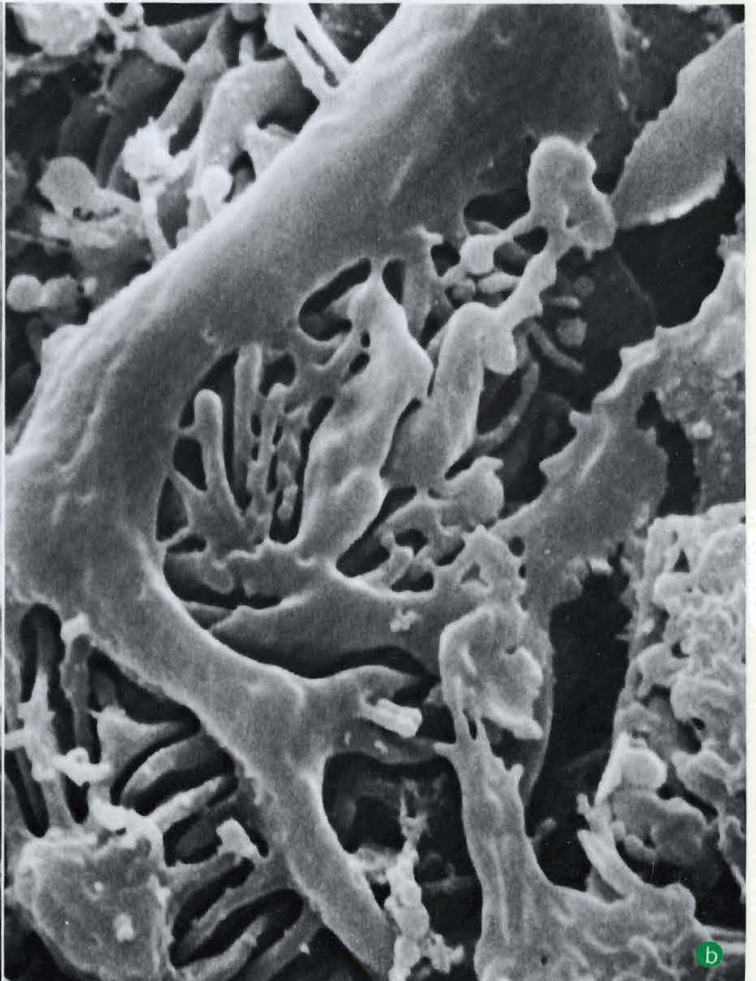
Rat Intestine 15,000X
The specimen was coated with gold after being freeze-d and etched.

Freeze Etching Technique



Kidney, rat 100X
a. Freeze fracture b. Etched freeze fracture

Coating after Freeze Etching



Kidney, rat 15,000X

a. Before coating

b. Coated with gold

JSM-35 AS AN ELECTRON PROBE MICROANALYZER

The JSM-35 can be converted into a complete electron probe microanalyzer by adding two well-proven fully focusing wavelength dispersive X-ray spectrometers (same as the JXA-50A's) fitted with an optical microscope and an energy dispersive X-ray spectrometer.

Elements from ${}_5\text{B}$ (${}_4\text{Be}$ optional) to U can be analyzed qualitatively and quantitatively with the two wavelength dispersive spectrometers. The spectrometers are driven by a pulse motor, and the analyzing crystal is changed by push-button motor control.

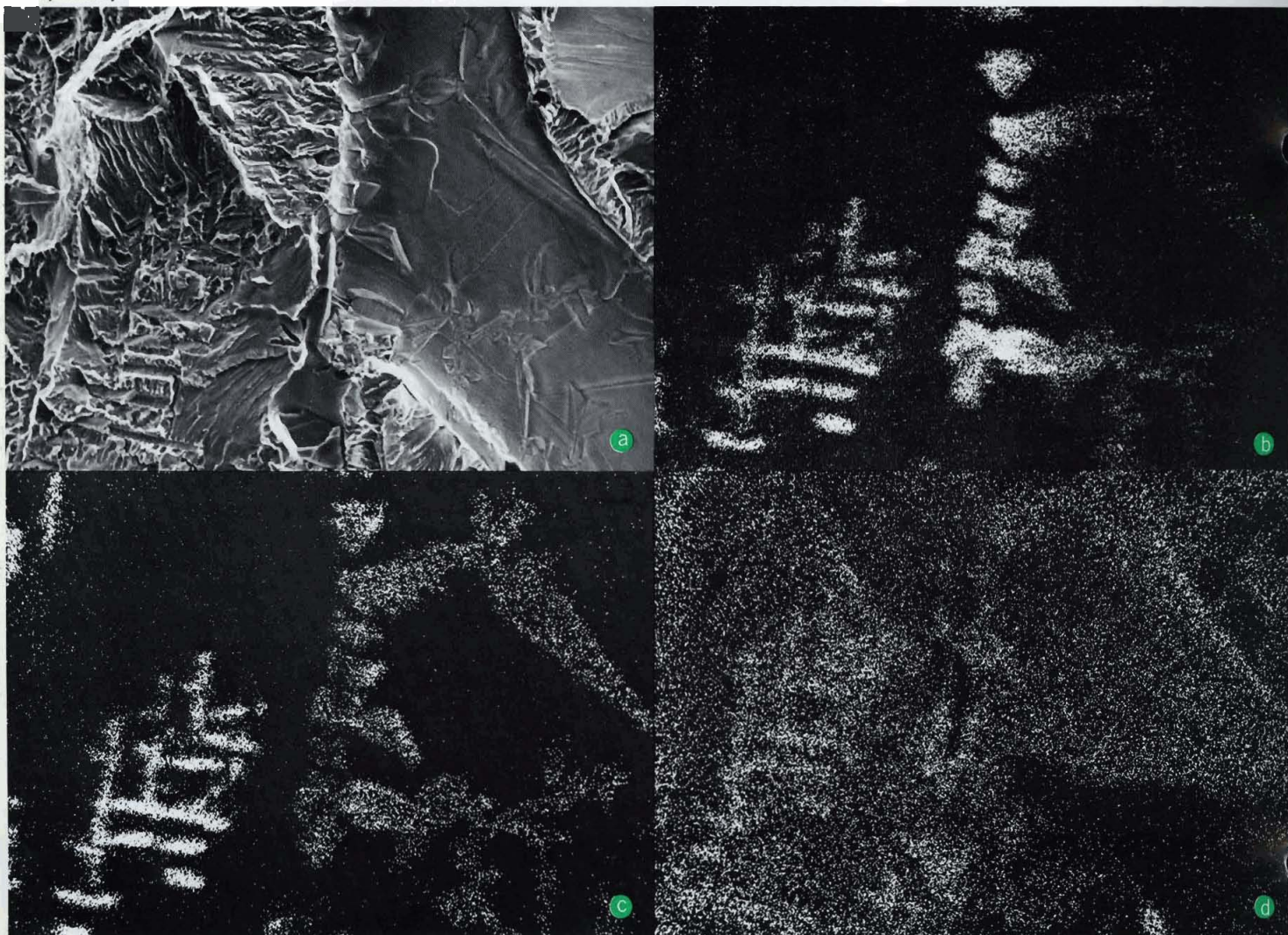
The optical microscope with a polarizer and an analyzer is used for observation of the desired specimen field during electron beam bombardment.

Specimens with rough surfaces such as a fracture surface, can be readily analyzed by the secondary electron image capability and the superb peak-to-background ratio and spectrum resolution of the wavelength dispersive X-ray spectrometers.

For thin section specimens, X-ray analysis with the energy dispersive spectrometer can be performed quite effectively due to the JSM-35's high voltage range up to 39 kV.

The four-crystal fully focusing X-ray spectrometer (FCS optional) is available, with which elements ranging from B to U can be analyzed.

X-ray Analysis on Fracture Surface

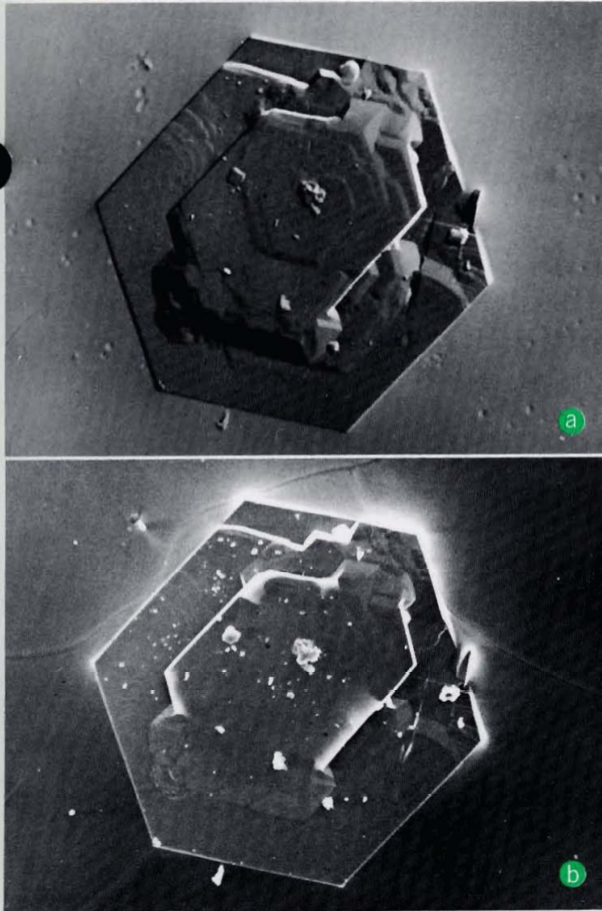


a. Secondary E.I. b. C $K\alpha$ X-ray Image
c. Ti $K\alpha$ X-ray Image d. Nb $L\alpha$ X-ray Image

INVESTIGATE YOUR IMAGES FURTHER

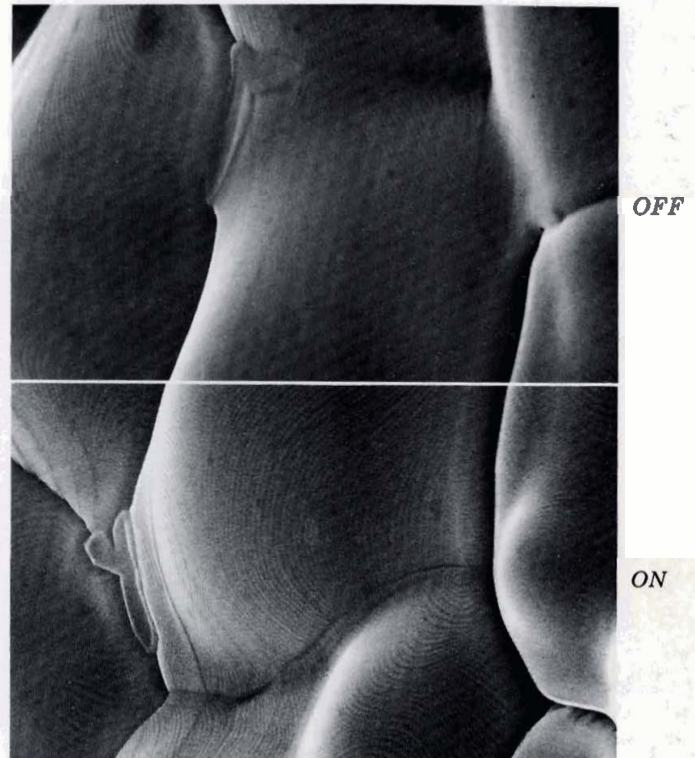
All images obtained are not the best unless the scanning microscope is equipped with attachments needed to improve the images. To improve the image quality or to reveal further details of a specimen, various types of modular attachments are provided for the JSM-35 Scanning Microscope.

BEI (Topography)



A topography image obtained with a JEOL-patented stereo pair backscattered electron detector (BEI optional) gives a better sensitivity for differences of the depth, as well as for the compositional differences.

Video Control Amplifier

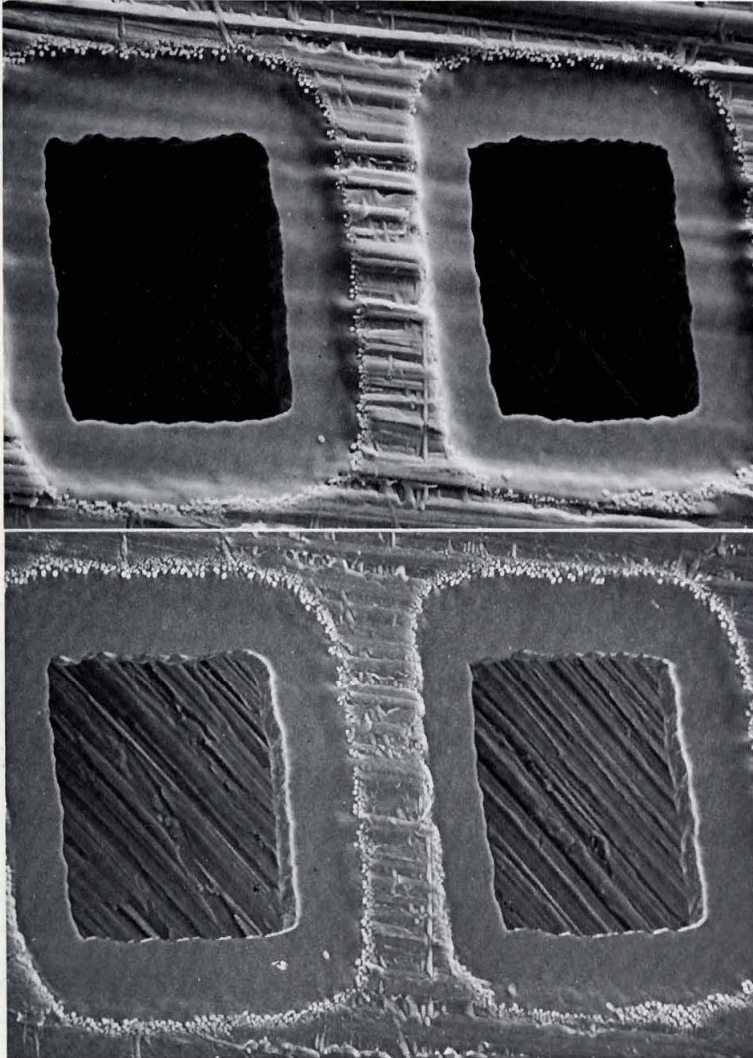


The Video Control Amplifier (VCA optional) presents surface details in relief and enhances the edge sharpness by controlling the video signal.

Boron nitride
a. Backscattered E.I. (Topography) b. Secondary E.I.

INVESTIGATE YOUR IMAGES FURTHER

Gamma Control

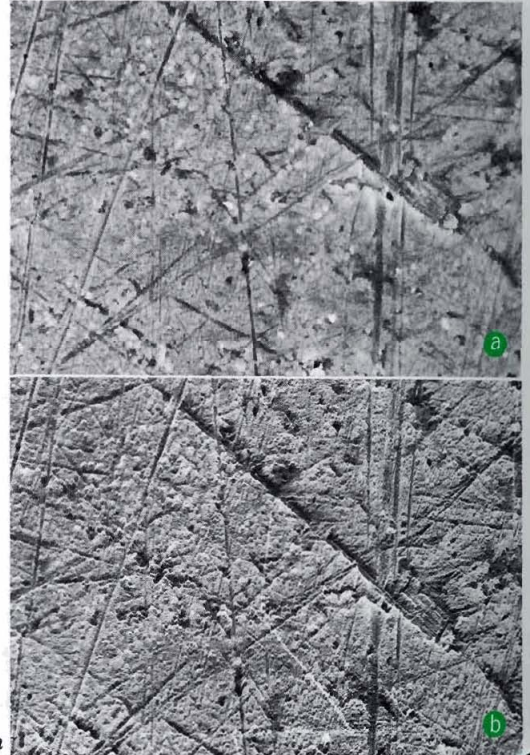


OFF

ON

The Gamma Control (GMC optional) permits the contrast in the low signal region to be emphasized while attenuating the highlight regions. The gamma curve can be changed in 4 steps. The regions to be controlled can be monitored.

Y-modulation



a. Brightness Modulation b. Y-modulation

For very flat specimens, Y-modulation Device (YMD optional) is quite useful for revealing surface details.

Model	Attachments	Descriptions
35-GIV*	Gun Isolation Valve	For filament exchange without breaking the vacuum in the column.
35-MMS*	Mu-Metal Sleeve	10 milligauss of AC magnetic field allowable.
35-AGS*	Airlock Chamber for Goniometer Stage	For specimen exchange without breaking the vacuum in the specimen chamber.
35-XYA*	X-Y Movable Aperture	Adjustable in X and Y directions.
35-ACB	Automatic Contrast and Brightness Control	Applicable to any mode available.
35-UHR	Ultrahigh Resolution CRT	2,500-line resolution CRT with full focus.
35-IMS	Image Selector	2 outputs selectable from 7 inputs; X-ray imaging and ratemeter display possible.
35-SRT	Scan Rotation and Tilt Correction Unit	Image rotation 0 to 360°, tilt correction 0 to 45°.
35-DU7	7" Display Unit	Additional standard size display.
35-DU10	10" Display Unit	Additional large size display with super-rapid scan capability.
35-PNU	Photo Numbering Unit	Accl. voltage, mag. and 4 digits of photo No. can be printed.
35-ANDD	Alphanumeric Display Device	Micron mark, accl. voltage, mag, working distance and film No. can be displayed.
35-MDD	Multi Display Device	Either two or four images can be displayed simultaneously.
35-DSD	Digital Scanning Device	For image analysis, microfabrication, etc.
35-GMC	Gamma Control Circuit	4 gamma curves and a monitor mode available.
35-VCA	Video Control Amplifier	For revealing fine details in flat area.
35-YMD	Y-Modulation Device	No. of lines changeable in 4 steps
35-TVS	TV Scanning Device	Observation and recording for specimen dynamic transformation.
50A-WFM	Wave Form Monitor	Sony-Tektronix 323 oscilloscope, band width DC~4 MHz.
35-LBG	Lanthanum Hexaboride Gun	Brighter & long-life emission source (to be ordered with LNB & IVG).
50A-LNB	Liquid Nitrogen Baffle	For better and cleaner vacuum.
35-IVG	Ionization Vacuum Gauge	Detectable range 10^{-4} ~ 10^{-6} Torr.
35-AEI	Absorbed Current Amplifier	Min. signal intensity 10^{-10} A range.
35-BEI	Backscattered Electron Detector	Composition and topography obtainable; Si P-N junction detector (JEOL Patented).
35-TED	Transmitted Electron Detector	Bright field, dark field and scanning diffraction obtainable.
50A-SDU	Supplementary Detection Unit	Same as standard detector assembly; simultaneous display of two images.
50A-EMF	Electromotive Force Amplifier	Amplifier for electromotive force image (to be ordered with SHIC).
35-SHIC	Specimen Holder for Integrated Circuit	TO-5 for 12 terminals and dual-in-line for 16 terminals.
35-BBD	Beam Blanking Device	Band width DC~1 MHz.
35-CLD	Cathodoluminescence Detector	Detector for visible cathodoluminescence.
35-CLD-IR	Infrared Cathodoluminescence Detector	Detectable range 5,000~12,000Å, max. intensity at 8,000Å.
35-CRU	Cryo Unit	Temperature less than -130°C; cold knife built-in; evaporator attachable.
35-CS	Cooling Stage	Specifications upon request.
35-HS1	Heating Stage	Specifications upon request.
35-TH	Tensile Holder	Specifications upon request.
35-TS	Tensile Stage	Specifications upon request.
35-DDS**	Dual Dispersive Spectrometer	Fully focusing type; detectable elements Be - U.
50A-DDX	Dual X-ray Counting System	Complete system for two spectrometers.
35-SDS**	Single Dispersive Spectrometer	Fully focusing type; detectable elements Be - U.
50A-SDX	Single X-ray Counting System	Complete system for a spectrometer.
35-OM	Optical Microscope	Retractable; permits observation during electron beam bombardment; mag. 300X
35-GSAZ*	Goniometer Stage with Fine Z-control	For X-ray analysis.
50A-CR3	3-pen Chart Recorder	For line scanning and peak profile; CR4 available.
35-AEM	Micromicro Ammeter	Input current range 10^{-5} ~ 10^{-12} A.
35-DMA	Digital Micro Ammeter	Input current range 1×10^{-5} to 1×10^{-12} A.
35-BST	Beam Stabilizer	Probe current stability 1×10^{-3} /hr.
35-LNT	Liquid Nitrogen Trap	Contamination rate reducible to 1/10~1/20.
50A-SSD	Specimen Scanning Device	Step scanning; scan speed 1~400 μm/min; step interval 1~400 μm/step.
35-FCS	4-Crystal X-ray Spectrometer	Fully focusing type; detectable elements B - U.
35-NDS	Non-Dispersive Spectrometer	Energy dispersive type.
50A-MRH	Mamiya 6 x 7 Roll Film Holder	
50A-PRH	Polaroid 545 Film Holder	
50A-SDT	Step-Down Transformer	Input voltage 240, 200 and 120V; output voltage 110, 105, 100, 95 and 90V.
JEE-4B, -4C	Vacuum Evaporator	Vacuum pressure 2×10^{-5} Torr (-4B) and 2×10^{-6} Torr (-4C).
EE-RTS	Rotating and Tilting Specimen Stage	For carbon and metal coating; motor-driven rotation.

* Retrofittable ** GSAZ Goniometer Stage required.

Specifications

Performance

Resolution: 100Å guaranteed in the secondary electron mode.

Magnification: 10X~180,000X (with automatic compensation for changes in accelerating voltage and working distance)

Image mode: Secondary electron, backscattered electron (scintillator and PMT)—standard.

Backscattered electron (pair of Si P-N junction), absorbed electron, transmitted electron, voltage contrast, electromotive force, X-rays cathodoluminescence, selected area channeling pattern—optional.

Electron optical system

Accelerating voltage: 0~39 kV in 1 kV step.

Probe current: 10^{-12} ~ 10^{-7} A.

Electron beam monitor: Built-in.

Overload indicator: Built-in.

Lens system: Two stages (condenser and objective lenses).

Objective lens aperture: 0.1, 0.2 and 0.6mm in dia. Externally interchangeable and adjustable. Cleaning mechanism is provided. (X-Y adjustable—optional)

Working distance: 15 and 39mm (with automatic magnification compensation), displayed on indicator.

Stigmator: Electromagnetic, 8 pole.

Astigmatism monitor and full focus coil: Built-in.

Beam alignment coils: Tilt and X-Y translation.

Image fine shift: Electromagnetic, $\pm 30\mu\text{m}$ in X and Y directions.

Specimen stage

Eucentric goniometer stage

Specimen movements:

X direction: 0~15mm along tilted plane.

Y direction: 0~25mm.

Z direction: 15~39mm (fine adjustment ± 1.5 mm—optional).

Rotation: 360° (endless).

Tilt: 0~60°.

Specimen size: 10mm dia. x 10mm hgt. or 33mm dia. x 20mm hgt.

Specimen exchange: (76mm dia. x 20mm hgt. specimen holder—optional).
Stage open type—standard.
Airlock system—optional.

Detector system

Secondary electron detector: Scintillator-photomultiplier type.

Collector: -500V~+500V.

Level control: AC and DC.

Image polarity: Normal and inverse.

Scanning system

Scanning mode: Full frame, selected area, line scan (brightness modulation feasible) and spot—standard.
Y-modulation—optional.

Scanning speed:

	Push-button	Horizontal msec	Vertical sec	
For observation	RAPID 1	1	0.1	Selected area scan
	RAPID 2	1	1	
	SLOW 1	10	5	Full frame scan
	SLOW 2	40	25	
For photography	PHOTO*	2~500** (10 steps)	0.5~500** (10 steps)	

* Single scanning.

** Independently selectable

Magnification: 10X~180,000X.

Selected area scanning: 30 x 120mm maximum on CRT.
10 x 10mm minimum on CRT.

Display tubes: 10" CRT: For observation, high resolution, long persistence.
7" CRT: For photography, high resolution, short persistence.
Ultrahigh resolution CRT—optional.

Photo recording system:

Exposure meter:

Indicates image contrast and brightness (signal level) separately.

Automatic contrast and brightness control—optional.

Film number: Automatically advances (0000-9999) with manual override.

Data printing system: Accelerating voltage, magnification and film number—standard. Alphanumeric display—optional.

Vacuum system

Vacuum operation: Fully automatic with manual override.
 Working pressure: 1×10^{-5} Torr or better.
 Vacuum valves: Pneumatic and electromagnetic.
 Gun isolation valve: Optional.
 Oil rotary pumps: 75 l/min, two sets.
 Oil diffusion pump: 400 l/sec, one set.
 Air compressor: Built-in, one set.

Safety devices

Protections against vacuum, water, power failures and a safety mechanism for round-the-clock operation are provided.

Accessories

- Gun filaments
- Condenser lens apertures
- Objective lens apertures
- Standard tool kit
- Special tool kit
- Vacuum grease
- Conductive paint
- Specimen pedestals
- Circuit tester
- Chair for operator

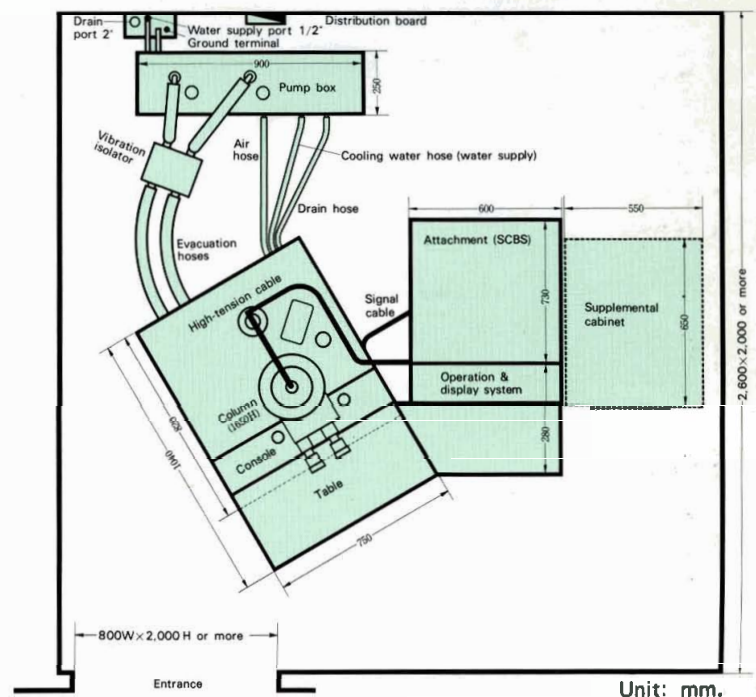
Installation Requirements

Power and water
 Power: Single phase, 100V, 20A, 50/60 Hz.
 Ground terminal: 1, less than 100Ω.
 Cooling water
 Flow rate: Approx. 3.5 l/min.
 Pressure: Approx. 0.8 kg/cm².
 Faucet: 1, 16mm OD.
 Drain: 1.
 Environment
 Room temperature: 20 ± 5°C.
 Humidity: Below 60%.
 Allowable AC magnetic field: 3 milligauss.
 10 milligauss with mu-metal Sleeve—optional.

Minimum floor space: 2,600mm x 2,600mm.

Dimensions and weight (mm and kg)

	Width	Depth	Height	Weight
Column and vacuum system	750 (30")	1,100 (44")	1,700 (67")	400 (890 lbs.)
Operation and display system	600 (24")	1,010 (40")	1,200 (47")	130 (290 lbs.)
Pump box	900 (36")	250 (10")	500 (20")	100 (220 lbs.)



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