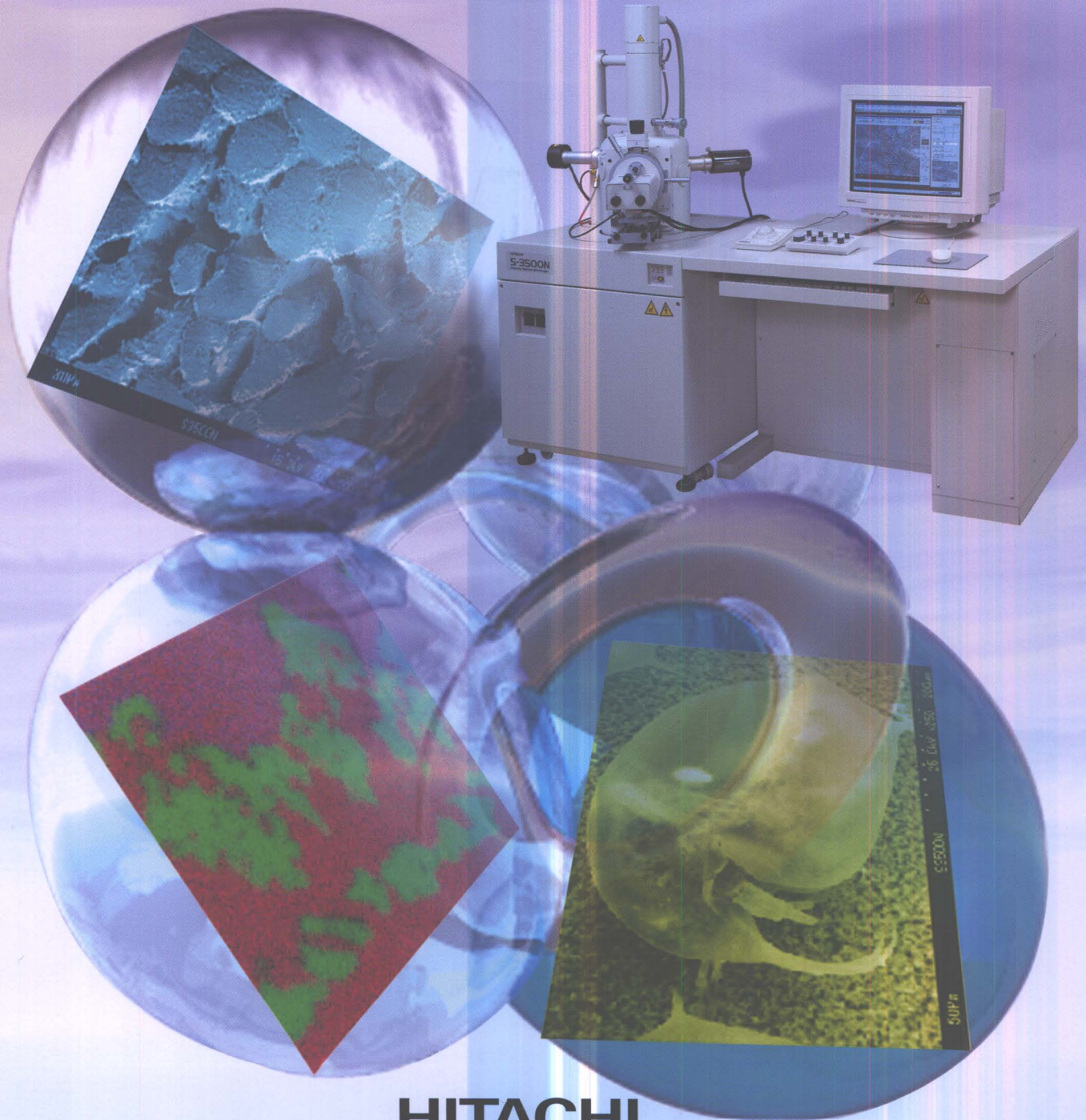


S-3500N/S-3500H

SCANNING ELECTRON MICROSCOPE



HITACHI

Windows NT®

S-3500N

Introduction:

When scientific minds meet simplicity of operation.....

The S-3500N and S-3500H are new SEM series developed by Hitachi using PC controlled electronics. The S-3500N is a Variable Pressure SEM, while the S-3500H is a conventional high Vacuum SEM. Both instruments use Windows NT®* and provides users with a comfortable working GUI environment. They have a high density frame memory of $2,560 \times 1,920$ pixels (maximum) and allows quality image recording and storage. Modern electron optical column, mechanical precision and intelligent electronics combine to produce quality images. Both instruments have been designed for exceptional ease-of-use. They are versatile with all the features a microscopist needs.

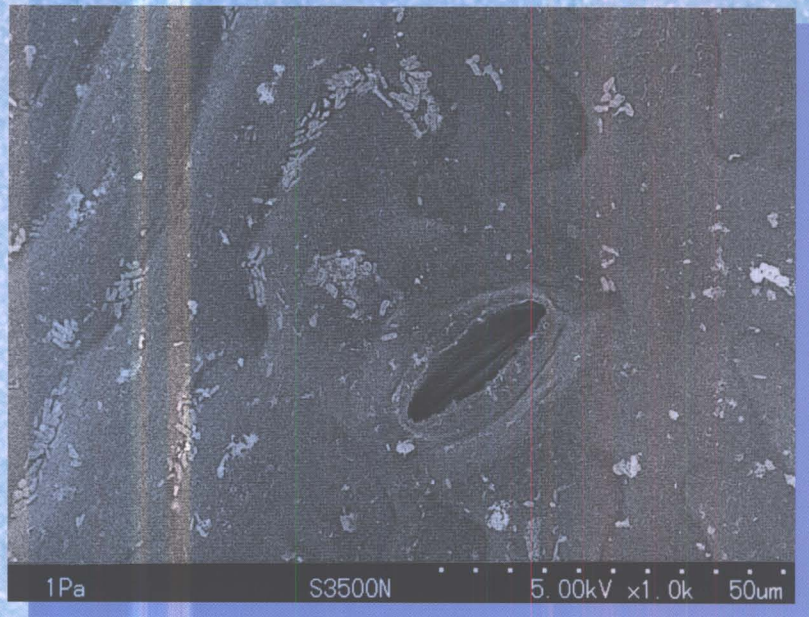
* Trademark of Microsoft Corporation, U.S.A.

Features:

- 1 High resolution imaging in both conventional high vacuum and unique variable pressure modes.**
 - 3.0 nm resolution guaranteed in high vacuum mode or 4.5 nm in VP-mode. (VP-mode: S-3500N only)
- 2 Unique VP-mode of operation**
 - The VP-mode allows microscopy of wet, oily and non-conductive samples in their natural state without the need of conventional sample preparation.
- 3 PC-controlled electronics**
 - Comfortable working GUI environment
 - Mouse driven menus for changing operating modes with pressure settings ranging from 1 Pa through 270 Pa in the sample chamber.
- 4 Wide range of optional accessories**
 - Super eucentric goniometer stage, cooling stage, etc.
- 5 Integration of EDX spectrometer utilizing a remote mouse and keyboard operation software available (option).**



Based PC-SEM S-3500H



Specimen: Stains of bacteria on the leaf of parsley, courtesy of Ph.D.Shigeko Ueda, Kagawa Nutrition University.



Photo includes optional items.

Windows NT® operating system

The S-3500 has been developed for interactive operation with CRT monitor display under a comfortable GUI environment. Shown below is a typical CRT monitor display using Windows NT®*. All control buttons are

logically grouped and laid out in a row. All of these controls can be clicked by the mouse.

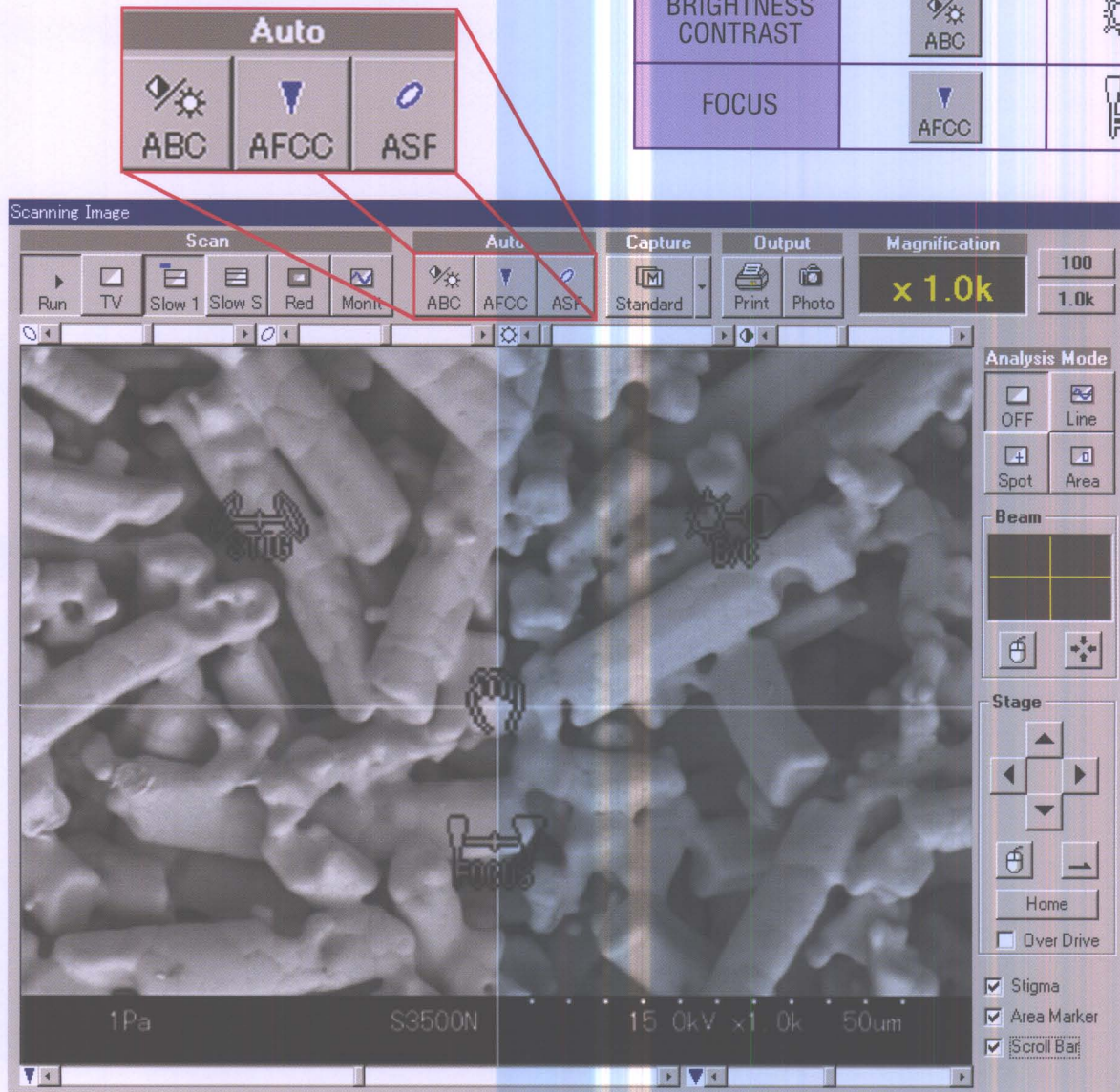
* Trademark of Microsoft Corporation, U.S.A.



- 1 Tool buttons
- 2 These buttons allow scan speed, autofocus, analytical mode selection.
- 3 Accelerating voltage can be applied and displayed here.
- 4 Magnification selection and display

- 5 SEM image display
- 6 This control permits image shift mode and motor drive operation.
- 7 Dialog box and other operating parameters can be set here.

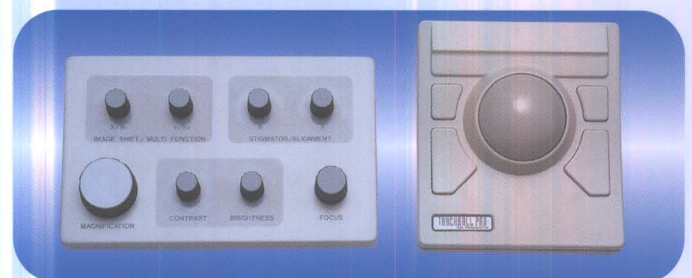
| FUNCTIONS | DISPLAY BUTTON | MOUSE CURSOR |
|------------------------|----------------|--------------|
| STIGMA | ASF | STIGMA |
| BRIGHTNESS CONTRAST | ABC | BWC |
| FOCUS | AFCC | FOCUS |



Both manual and automated operations are performed on the SEM image.

Image brightness, contrast, focus and astigmatism corrections are automatically performed by pressing the upper left buttons above the SEM image. Manual controls are also possible. The SEM image is divided into 4 areas. Each area is assigned for stigmation, image brightness & contrast, focus (coarse and fine) controls. These controls are operated by dragging the mouse. When the mouse cursor is positioned in each area of the SEM image, the cursor changes its shape to indicate the respective functions. There is a set of rotary controls provided. These controls allow magnification, image brightness and contrast, focus, image shift, stigmation,

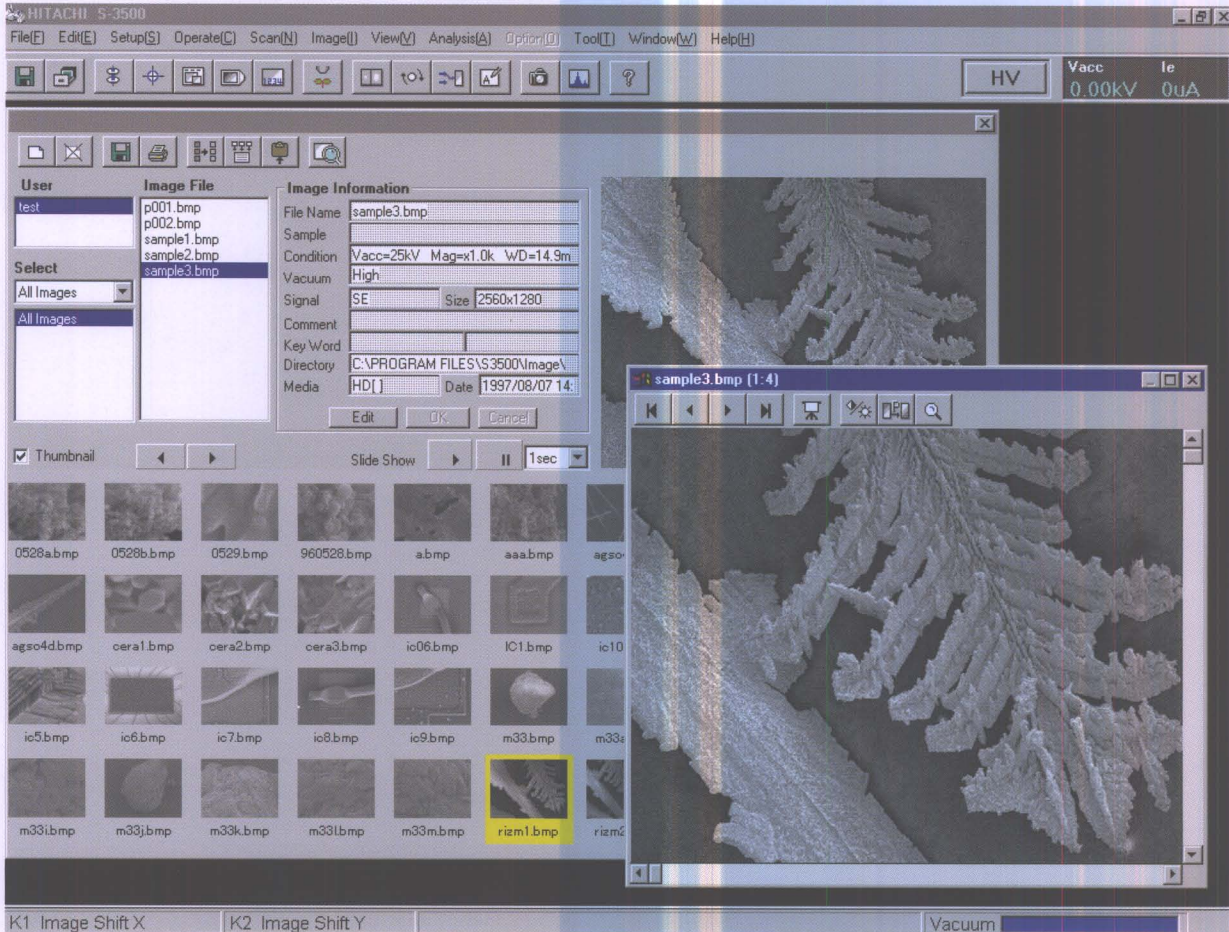
alignment, etc. just like conventional SEMs. The magnification control knob is the largest among these. Operators can quickly locate it without difficulty.



Filing/DTP/Networking

The stored images are indexed and displayed on the monitor in rows for quick review by operators or search of required images. There are simple image processing functions which include image brightness conversion, etc.

The system allows direct transfer of images to outside PCs or other recording media such as MO for further processing or recording purpose.



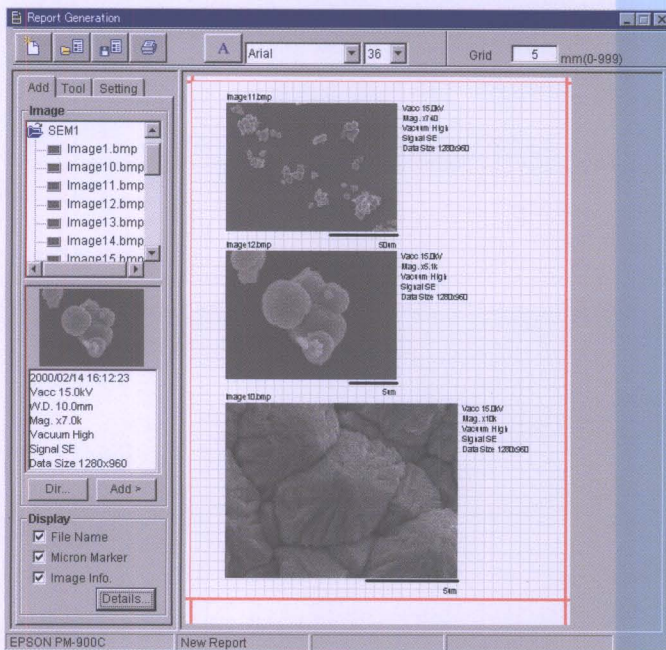
Quick report making

Using copying function on the Clipboard, reports can be made quickly and simply.

Report generation function

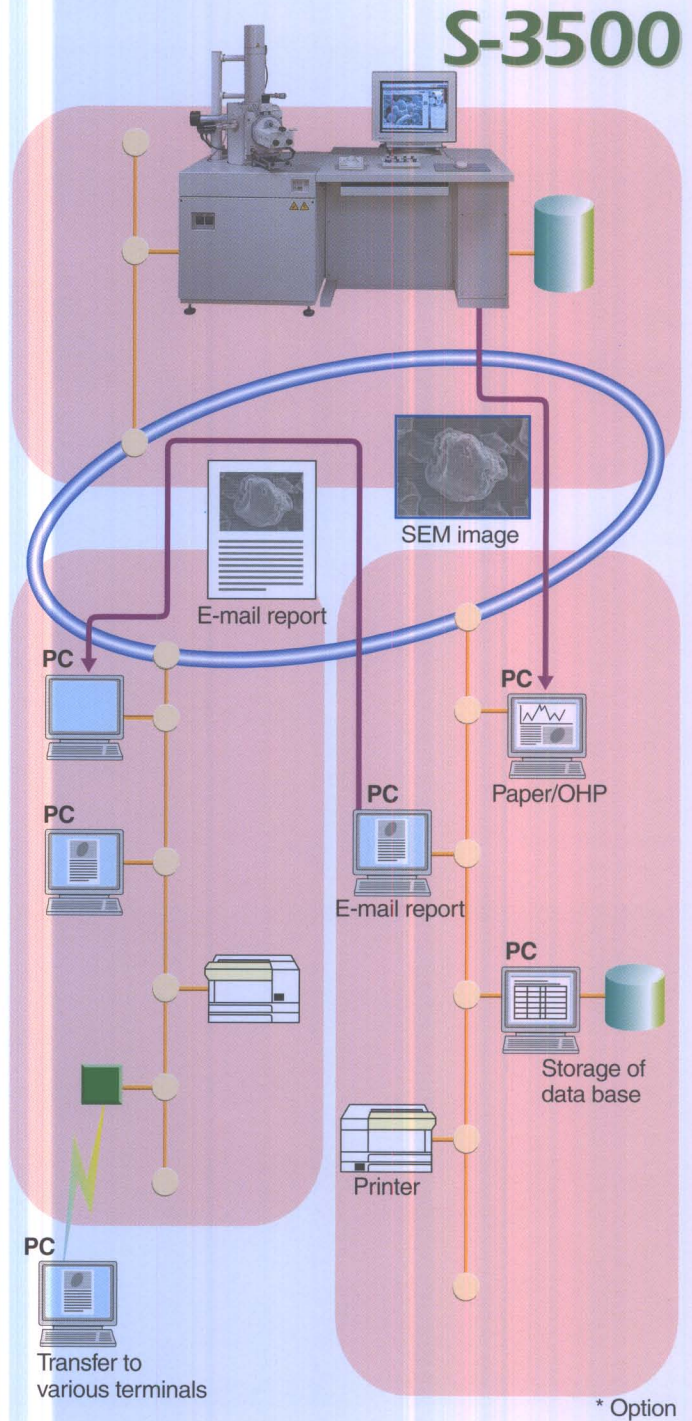
The S-3500 includes a Report Generator function, which can be utilized in various ways:

- Simple Report — By simply pasting images, or dragging the image files, into a template, reports can be produced and printed in just minutes.
- Processing Images — Once images are placed in a template, they can be processed (i.e. brightness/contrast), as well as reduced or enlarged. When an image size is adjusted, scales attached to the image are automatically adjusted as well.
- New Template Creation — Any number of templates created for report generation can be saved, enabling greater flexibility in presenting SEM data to your peers and managers.



Networking

The S-3500 has been designed to work with networking. The SEM images can be transferred to PCs and other servers. These images can be displayed on your monitor when needed.



Rapid Image Shift Mode

When searching a small object or area of interest, you may often find it at a peripheral area of the monitor screen. Before going to higher magnification, you have to bring it to the center of the screen. The Rapid Image Shift Mode is quite useful under such conditions. It

brings the masked object (or area) to the center of the screen (RISM) and magnifies it automatically as shown at the right (RISM & ZOOM). It is easy to mask the object using the mouse. The system works with the motor drive stage (option).

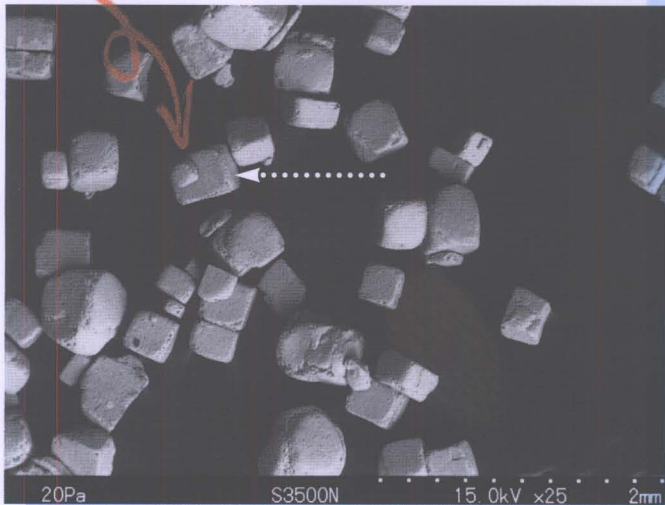
Here is the point of interest.



The first image

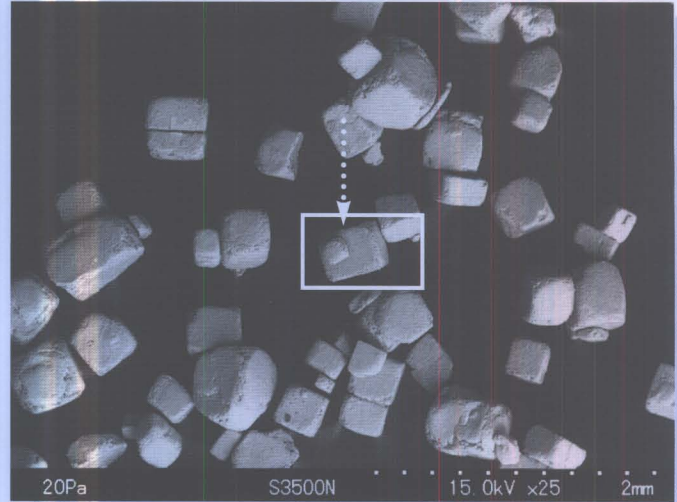
MOVE

Here is the point of interest.



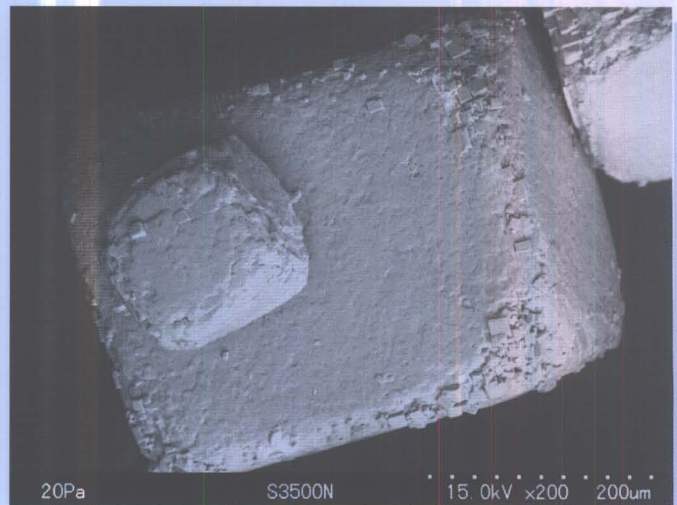
The second image after "MOVE"

RISM



The 3rd image after "RISM"

ZOOM



The 4th image after "ZOOM"

Image Navigation

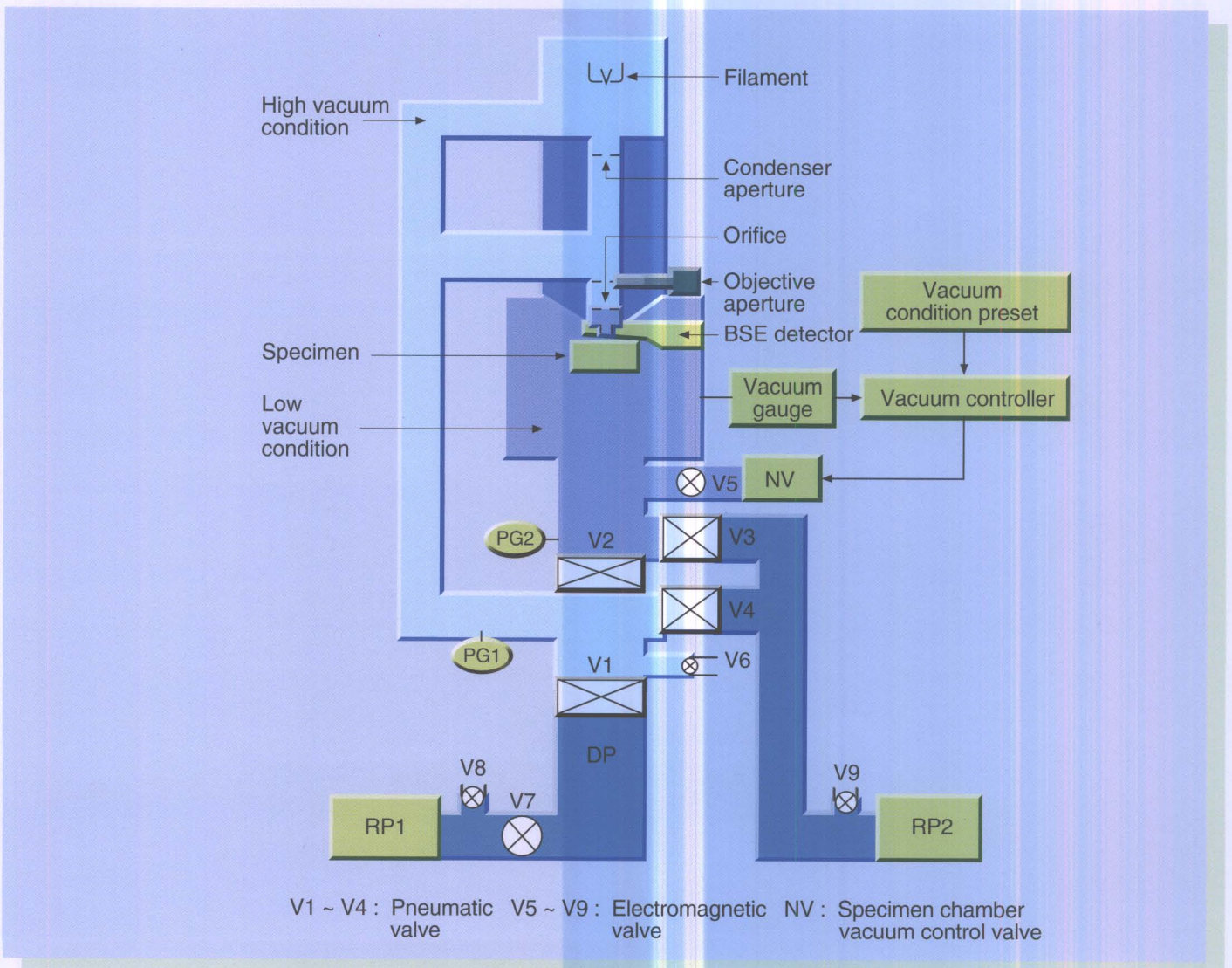
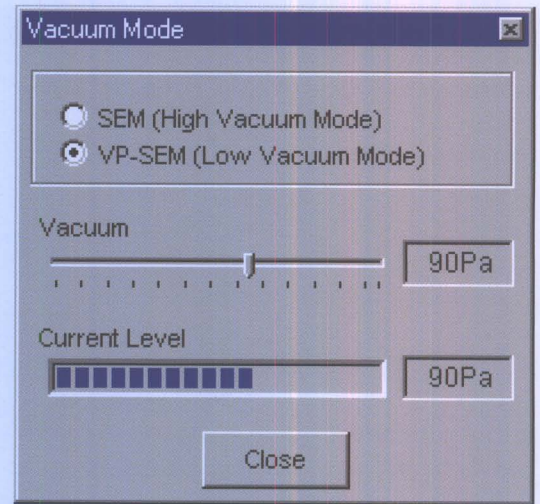
When working with SEMs, inexperienced operators often lose their way or forget what point (or points) on their sample they were looking at.

This is simply corrected by having a relatively low mag. image of the sample on display. Operators can specify the area of interest on the low mag. image. Then, the specified area can be magnified for close study. This design helps operators with locating viewing positions on the sample and guiding them to these positions effortlessly.

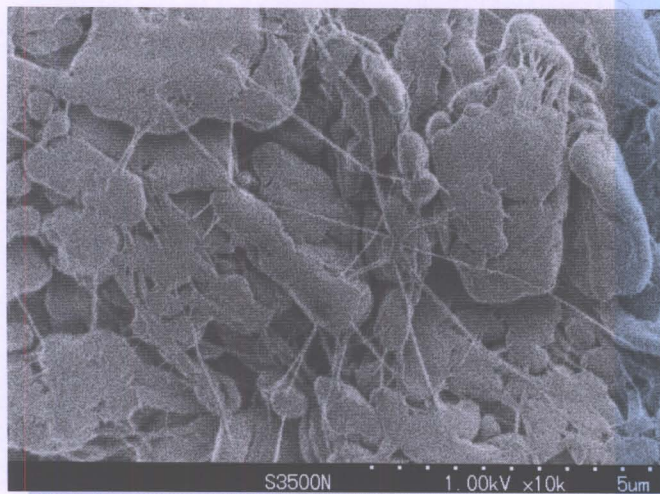


Vacuum System (VP-mode: S-3500N only)

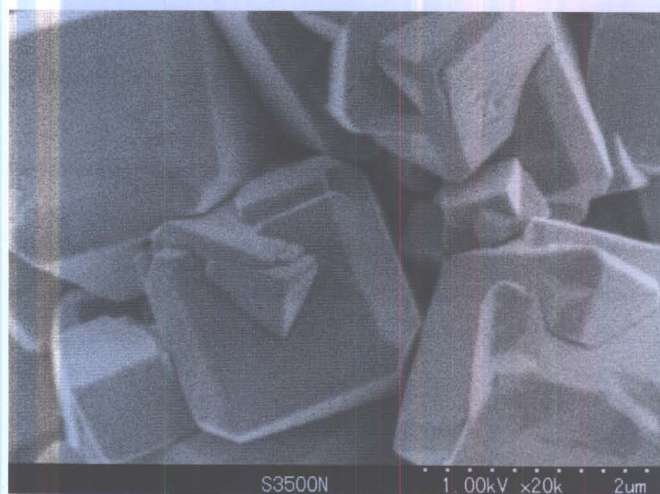
The vacuum system of the S-3500 is composed of two (2) rotary pumps and one (1) diffusion pump. The column and specimen chamber are separated by a small aperture to facilitate differential pumping. The low vacuum condition in the specimen chamber is monitored and controlled by a vacuum gauge in combination with automated needle valve. There is no need for the operator to continuously manipulate the needle valve for specimen outgassing. In the VP-mode, the operating vacuum condition is shown on the CRT and recorded on the image in a digital format. The vacuum system diagram is shown below.



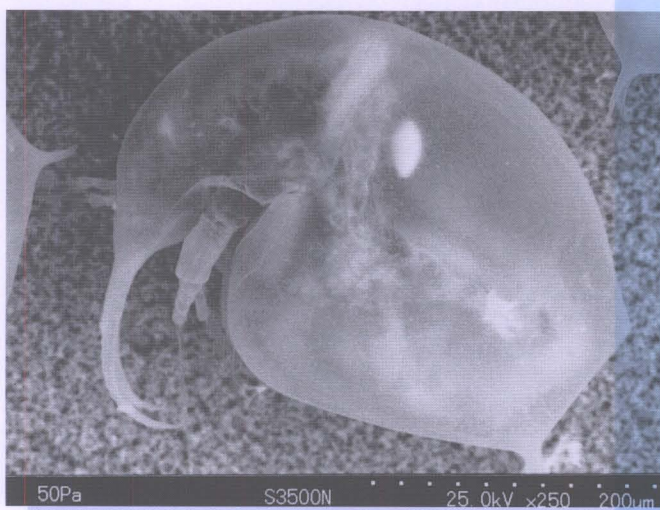
Applications



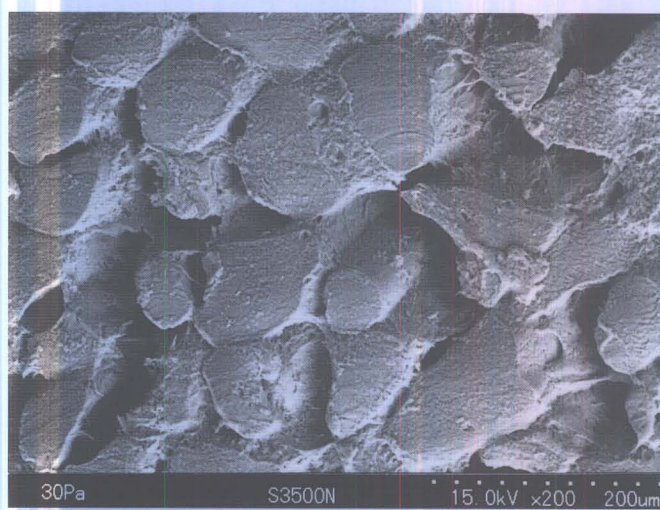
Specimen: Fine powder of Fluo-Resin, uncoated



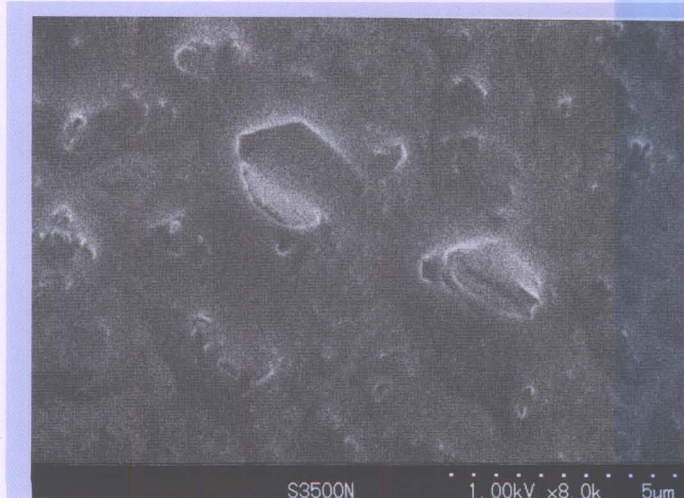
Specimen: Antimicrobial zeolite, uncoated
Courtesy of Mr. Shigeki Tokutake, Sinanen Zeomic Co., Ltd., Japan.



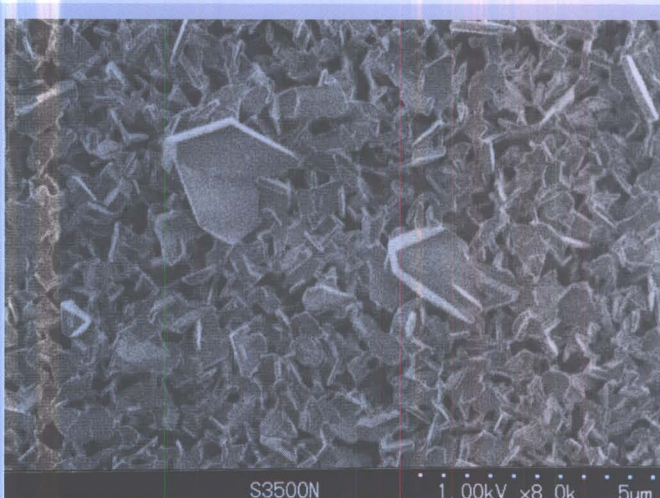
Specimen: Daphnia
Specimen stage temperature: -10°C



Specimen: Sliced ham
Specimen stage temperature: -10°C



Specimen stage temperature: Ambient
Specimen: Anthracene thin film deposited by vacuum evaporation, courtesy of Tsukuba Research Laboratory, Stanley Electric Co., Ltd., Japan



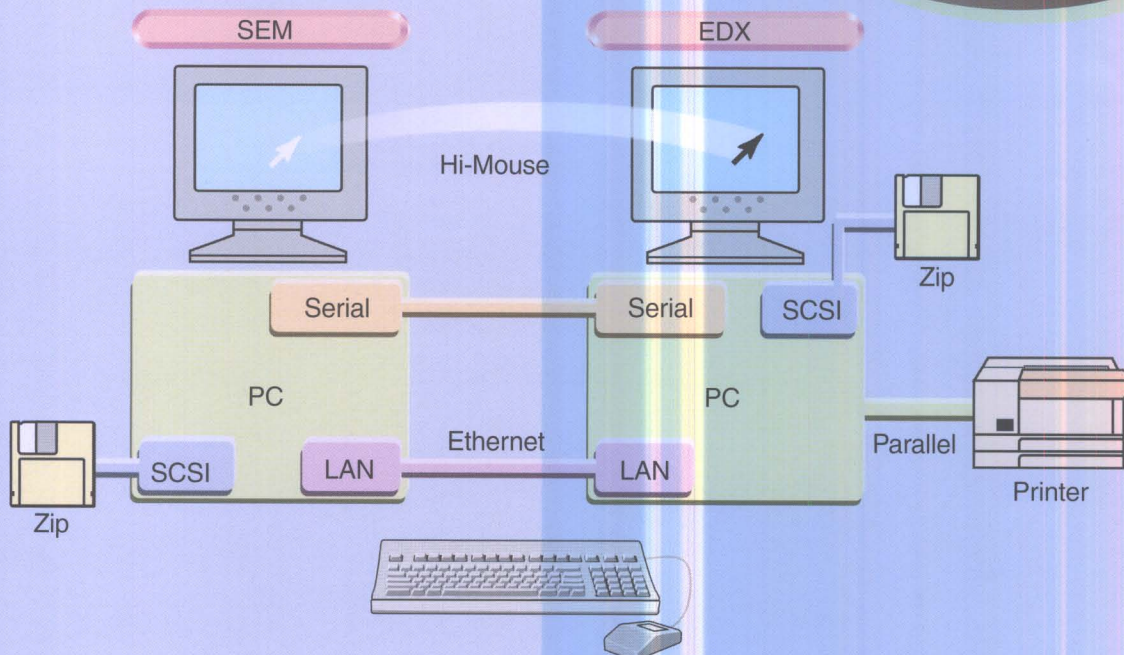
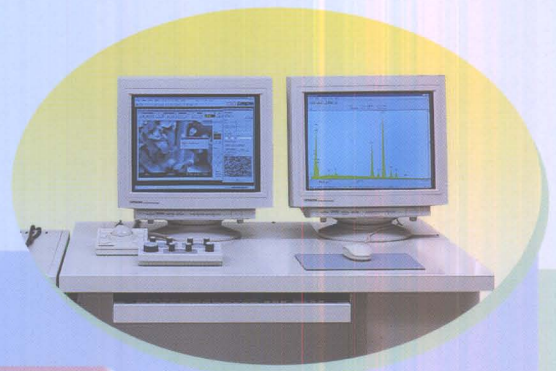
Specimen stage temperature: -20°C

Elemental microanalysis

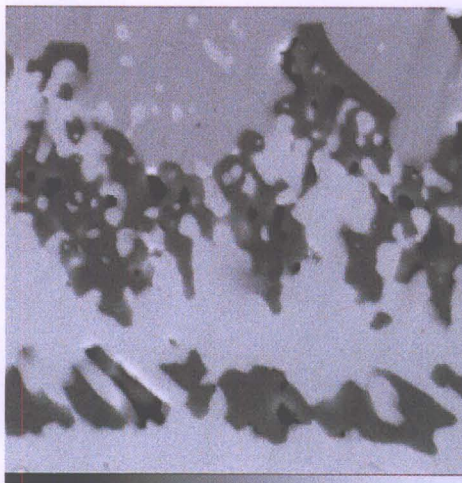


The S-3500 allows accommodation of an energy dispersive X-ray spectrometer (EDX) as an option and permits elemental microanalysis. The S-3500 is unique in that it allows driving both the SEM and EDX systems with one mouse and keyboard control using a Hitachi Hi-Mouse software and hardware system at option. Shown below is an integrated SEM/EDX system.

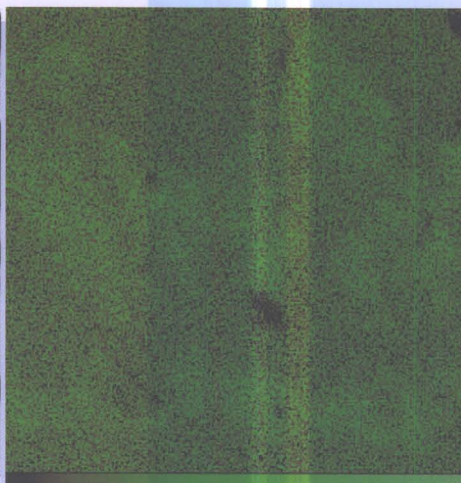
Hitachi SEM/EDX integrated system using Hi-Mouse



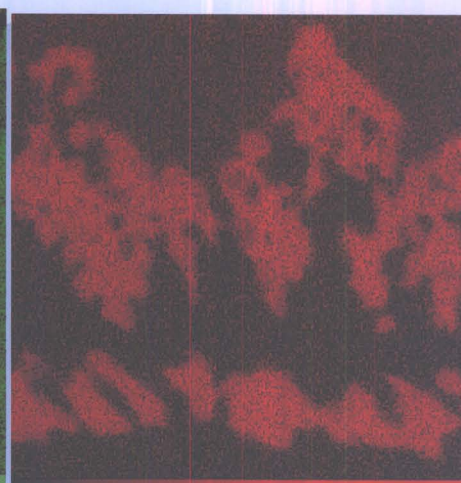
Analytical Applications



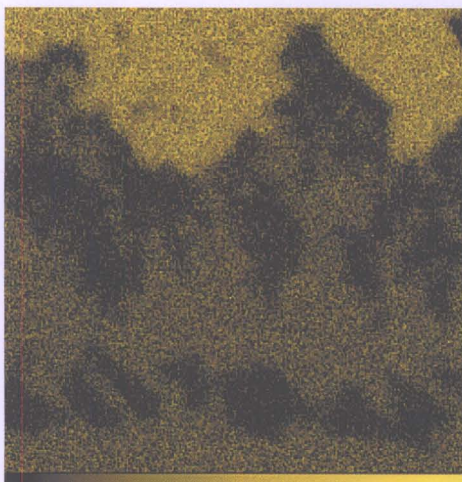
SEM image



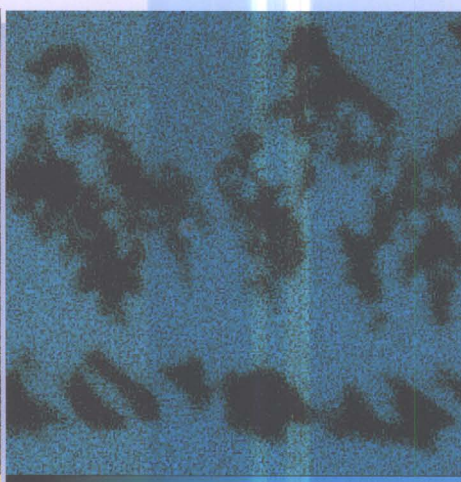
80 Kα



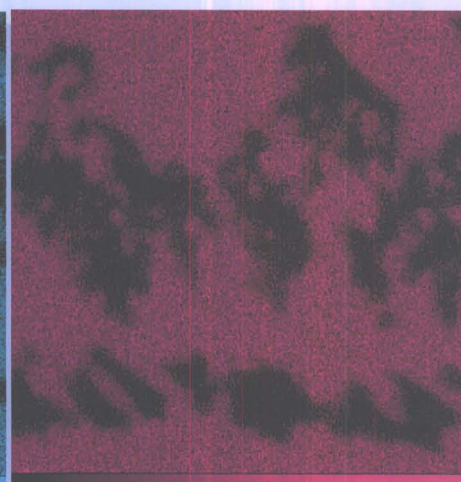
29 Cu Kα



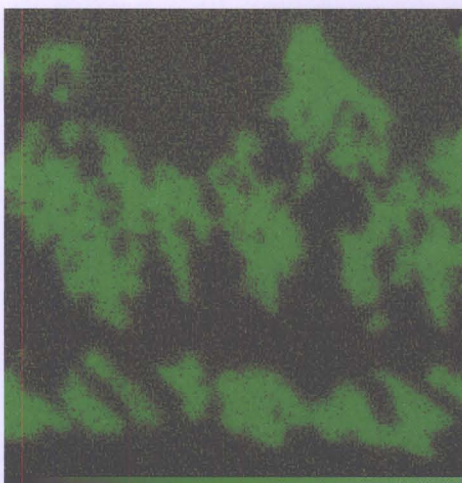
39 Y Lα 1



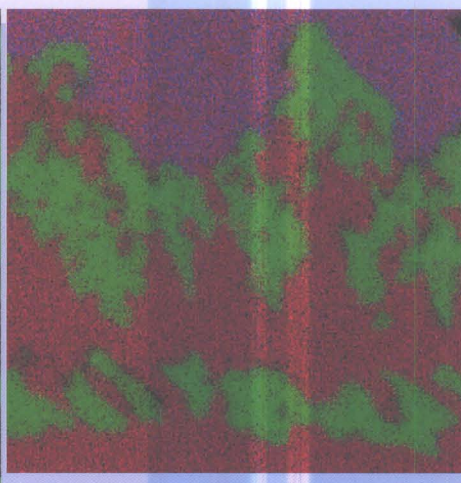
56 Ba Lα 1



78 Pt Mα



29 Cu Lα 1



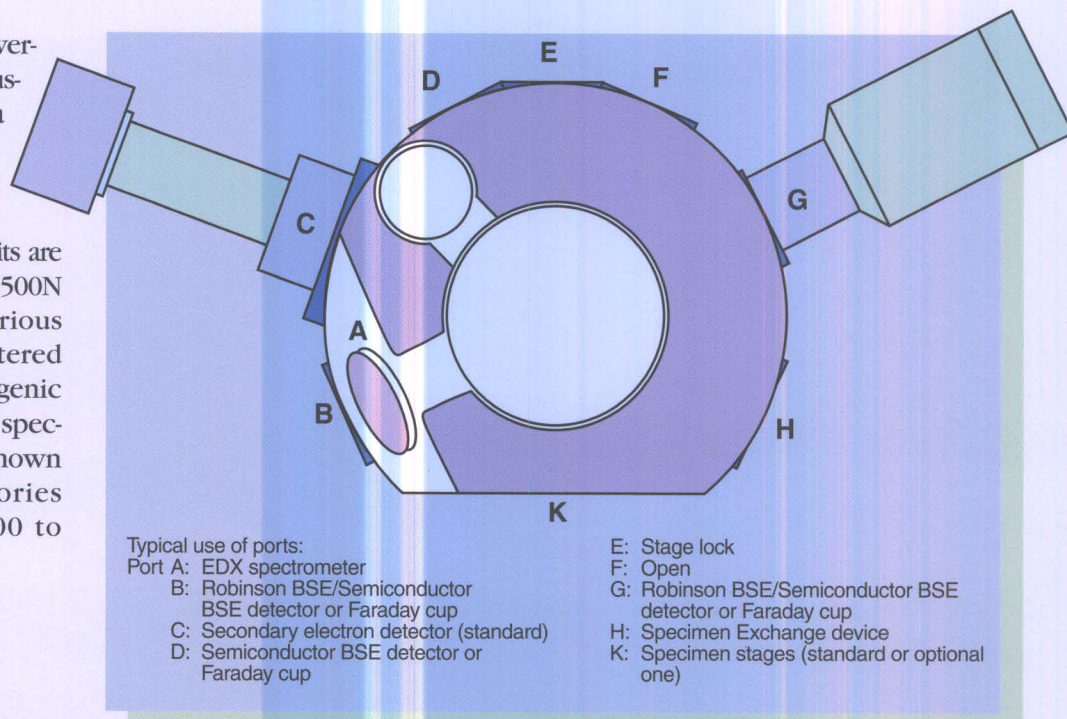
Red: Pt, Green: Cu, Blue: Y

9.0 μm

Specimen: Yttrium high temperature superconductor, courtesy of Mr. S. Nagaya, Research Engineer of Electric Power Research & Development Center, Chubu Electric Power Co., Inc., Japan

Versatile Sample Chamber

The S-3500 has a large and versatile specimen chamber as illustrated at the right. There are a number of stages including a large 100 mm × 50 mm eucentric stage available at option. Motorized stage drive units are also available at option. The S-3500N allows accommodation of various accessories such as backscattered electron detector (BSE), cryogenic system, energy dispersive X-ray spectrometer and many others as shown at the right. These accessories extend the use of the S-3500 to many applications.



Versatile Specimen stages

There are various specimen stages available at option. Users may choose any one of these stages for their specific samples and type of applications.

- **Super eucentric stage**

This stage is ideal for stereoscopic observation of powders, fibers, etc. Maximum sample thickness is 6 mm.

- **80 × 40 large traverse stage**

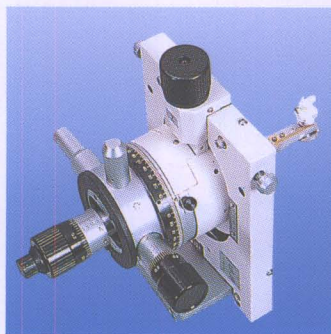
This stage is recommended for microscopy of mechanical parts, fractured and other large bulky samples.

- **100 × 50 large eucentric stage**

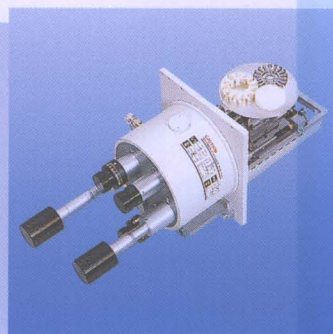
This stage allows accommodation of large samples and translation of 100 × 50 mm. It is recommended for X-ray microanalysis and stereoscopic work on large samples.

- **Cooling stage**

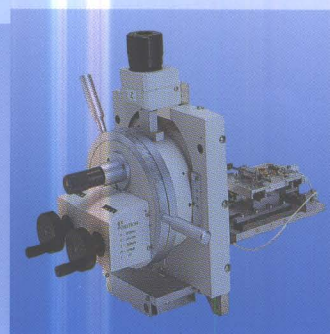
The cooling stage allows temperatures from -20°C to 10°C. At low temperatures, evaporation of water is suppressed to maintain specimens in their natural state.



Super eucentric stage



80 × 40 large traverse stage



100 × 50 large eucentric stage



Cooling stage and power control unit

Specifications

| | |
|--------------------------------|---|
| Resolution | 3.0 nm (at 25 kV, secondary electron image) 20 nm (at 3 kV, secondary electron image) 4.5 nm (at 25 kV, backscattered electron image) |
| Magnification | ×15 ~ ×300,000 (65 steps) |
| Accelerating voltage | 0.3 ~ 30 kV |
| Variable pressure range | 1 ~ 270 Pa |

Electron optics

| | |
|-------------------------|--|
| Electron gun | Tungsten hairpin filament |
| Gun bias voltage | Linked to accelerating voltage, Variable voltage supply (Dual bias function) |

Image shift ±20 μm (at W.D.=15 mm)

BSE detector Scintillator type

Specimen size 150 mm dia. (for a standard specimen chamber)
200 mm dia. (for a large specimen chamber)

Specimen stages (Choice of one)

(1) Super eucentric stage

X: 32 mm, Y: 32 mm, Z: 5 ~ 35 mm,
T: -90° ~ +90°, R: 360°

(2) Large eucentric stage

X: 100 mm, Y: 50 mm, Z: 5 ~ 40 mm,
T: 0 ~ 60°, R: 360°

(3) Large eucentric stage with motor drive unit for 5-axes

(4) Standard stage X: 80 mm, Y: 40 mm, Z: 5 ~ 35 mm,
T: -20° ~ +90°, R: 360°

(5) Cooling stage Temperature: -20 ~ +10°C
X: 15 mm, Y: 15 mm, Z: 15 ~ 35 mm,
T: -45° ~ +45°, R: None

Motor drive unit for 2 axes for the above (2) and (4) (option) X and Y axes only

Viewing monitor Large color XGA monitor
(1,024 × 768 pixels)

Operation/display PC/AT compatible, OS: Windows NT®*
Operation table Mouse, Full-Keyboard, and Function Rotary Knobs

Comment input Built-in, 56 × 28 characters (maximum)

Graphic input Built-in

Data framing for characters Built-in

Automated functions Auto brightness & contrast, Autofocus, Autostigmation & focus, Auto gun alignment, Auto filament saturation, Auto start, Auto photo mode and Full automated operation

Frame memory 640 × 480 pixels
1,280 × 960 pixels
2,560 × 1,920 pixels

Image processing Recursive filter, frame integration, 4-split screen image display, gray scale conversion (LUT)

X-ray analysis Working distance: 15 mm
X-ray take-off angle: 35°
X-ray mode: builtin

* Trademark of Microsoft Corporation, U.S.A.

Dimensions & weight

| | |
|-----------------------|--|
| Column | 70 (W) × 70 (D) × 150 (H) cm, 320 kg |
| Display | 100 (W) × 86 (D) × 120 (H) cm, 180 kg |
| Rotary pump | 23 (W) × 50 (D) × 45 (H) cm, 27 kg × 2 |
| Air compressor | 23 (W) × 39 (D) × 56 (H) cm, 20 kg |

Note: Photo CRT unit is an optional item.

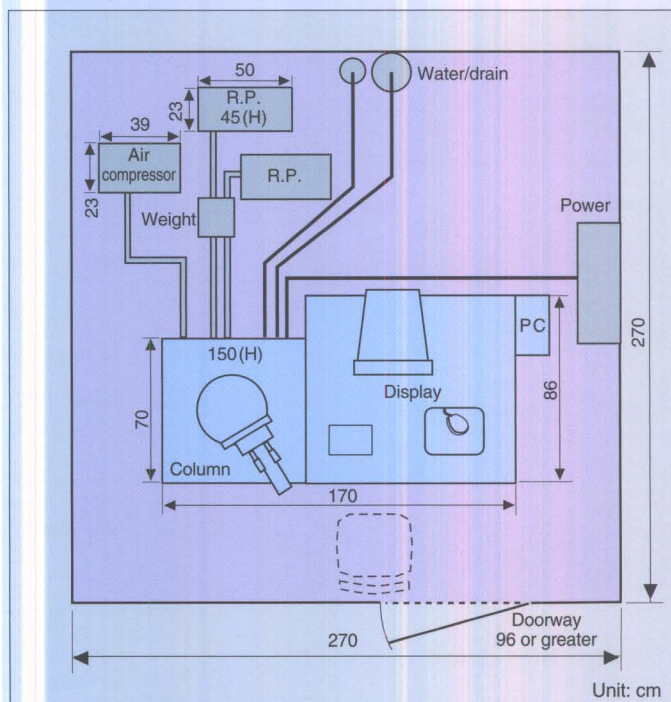
Optional accessories

Cryogenic system, Tensile stage, Specimen current image unit, Wafer holder, Motor drive unit for 2-axes, Sample manipulator, Universal video amplifier, Annular 4-quadrant semiconductor BSE detector, EBIC imaging unit, Faraday cup, RS-232C interface, Energy dispersive X-ray spectrometer, Wavelength dispersive X-ray spectrometer (for a large specimen chamber only), Photo CRT unit, Recording cameras, Video printer, Closed water circulator, Measurement function, Hi-mouse, Ethernet interface, YAG BSE detector

Installation requirements

| | |
|--------------------------|---|
| Room temperature | 15 ~ 30°C |
| Relative humidity | 70% or less |
| Power | Single phase AC 100, 110, 115, 200, 220 or 240 V ±10%, 50/60 Hz, 3.0 kVA |
| Water | Flow: 1 ~ 1.5 l/min. Pressure: $5 \times 10^4 \sim 1 \times 10^5$ Pa Temperature: 10 to 20 degrees C Faucet: Rc 3/8 threaded taper pipe Drain: Natural drain of 20 mm dia. × 1 (on the floor level) |

Typical installation room layout





Reliable products and systems of proven quality for high customer satisfaction.



Instruments, Hitachi, Ltd. is promoting environmental consciousness throughout its manufacturing operations.

NOTICE: For proper operation, follow the instruction manual when using the instrument.

Specifications in this catalog are subject to change with or without notice, as Hitachi continues to develop the latest technologies and products for our customers.

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