FlexSEM 1000 II Specifications

■Specifications

Item		Description
Model name		FlexSEM 1000 II
Model No.		SU1000
Secondary electron resolution※1		4.0 nm (Accelerating voltage 20 kV, WD = 5 mm, high-vacuum mode) 15.0 nm (Accelerating voltage 1 kV, WD = 5 mm, high-vacuum mode)
Backscattered electron resolution※1		5.0 nm (Accelerating voltage 20 kV, WD = 5 mm, VP mode)
Magnification		6x to 300,000x (magnification ratio of image※2) 16x to 800,000x (magnification ratio of display※3)
Accelerating voltage		0.3 kV to 20 kV
Variable pressure range		6 to 100 Pa (13 steps)
Image shift		± 50 μm(WD=10 mm)
Maximum specimen size		80 mm in diameter
Specimen stage	X	0 to 50 mm
	Y	0 to 40 mm
	Z	5 to 33 mm
	R	360°
	T	−15° to +90°
	Maximum observable range	64 mm in diameter (combined with Rotation)
	Motor drive	3-axis (X, Y, R)
Electron optics system	Electron gun	Precentered cartridge type tungsten hairpin filament
	Detecting system	Secondary electron detector, high-sensitivity semiconductive backscattered electron detector
	EDS analysis WD	WD=10 mm(T.O.A=30°)
Image display	Automatic axis alignment	Auto beam adjustment (AFS → ABA → AFC → ABCC), Auto optical axis alignment (current alignment), Auto beam brightness control
	Automatic image controller	Auto brightness & contrast control (ABCC), Auto focus control (AFC), Auto astigmatism correction & focus (ASF), Auto filament saturation (AFS), Auto beam alignment (ABA), Auto start (HV-ON → ABCC → AFC)
	Image saving	640 × 480 pixels, 1,280 × 960 pixels, 2,560 × 1,920 pixels, 5,120 × 3,840 pixels
	Image format	BMP, TIFF, JPEG
	Automatic data display	Image number, Accelerating voltage, magnification, micron marker, micron value, WD value, date, time, vacuum level, detector
	Image display mode	Main display: 1,280 × 960, sub display: 640 × 480 separate window of sub display: 1,280 × 960
Vacuum system	Type	Fully automatic valve system
	Turbo molecular pump	1 pump, 61 L/s
	Rotary pump※5	1 pump, 100 L/min (50 Hz), 120 L/min (60 Hz)
Other function		Raster rotation, dynamic focus, image enhancement, data input (measurement between two points, measurement of angle, characters), preset magnification, stage location navigation system (SEM MAP), beam marking, Report creator
Safety system		Protection function for the power failure,electric leakage and vacuuming operation are equipped.

■Recommended PC specifications

Item	Description
OS	Microsoft® Windows®10 Pro 64bit
CPU	Intel® Xeon® E3-1225 v5 with Intel HD Graphics PS30 or nigher compatible prosseor.
On-board memory	8 GB or more
Display resolution	1,920 × 1,080 pixels
Memory device	HDD, DVD-ROM drive

■Dimension & Weight

Item	Description
Main unit	450 (W) × 795 (D) × 690 (H) mm, 107 kg
Power box	450 (W) × 640 (D) × 450 (H) mm, 58 kg
Rotary pump	155 (W) × 414 (D) × 315 (H) mm, 22 kg
Weight	160 (W) × 200 (D) × 134 (H) mm, 26 kg

■Installation requirements

Item	Description
Temperature	15 to 30 ℃
Humidity	70% RH or less
Power	Single-phase AC 100 to 240 V (±10%)

■Accessories

Detector/various analyzers
Energy dispersive X-ray spectrometer (EDS)
Ultra variable-pressure detector (UVD-II)
Chamber scope
Camera navigation system
Specimen stage/holder
Multi sample holder
Software
SEM data manager
Hitachi map 3D
Multi Zigzag
Control system
Trackball
Joystick
Control panel

※1: When the main unit and power box are connected.
※2: Magnification is defined with a display size of 127 mm × 95 mm (4 × 5 picture size).
※3: Magnification is defined with a display size of 509.8 mm × 286.7 mm (1,920 × 1,080 pixels).
※5: Rotary pump may not be included with main unit depending on its destination.
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Science for a better tomorrow

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Notice: For correct operation, follow the instruction manual when using the instrument.

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HTD-E267 2019.1

Scanning Electron Microscope
FlexSEM 1000 II

HITACHI
Inspire the Next

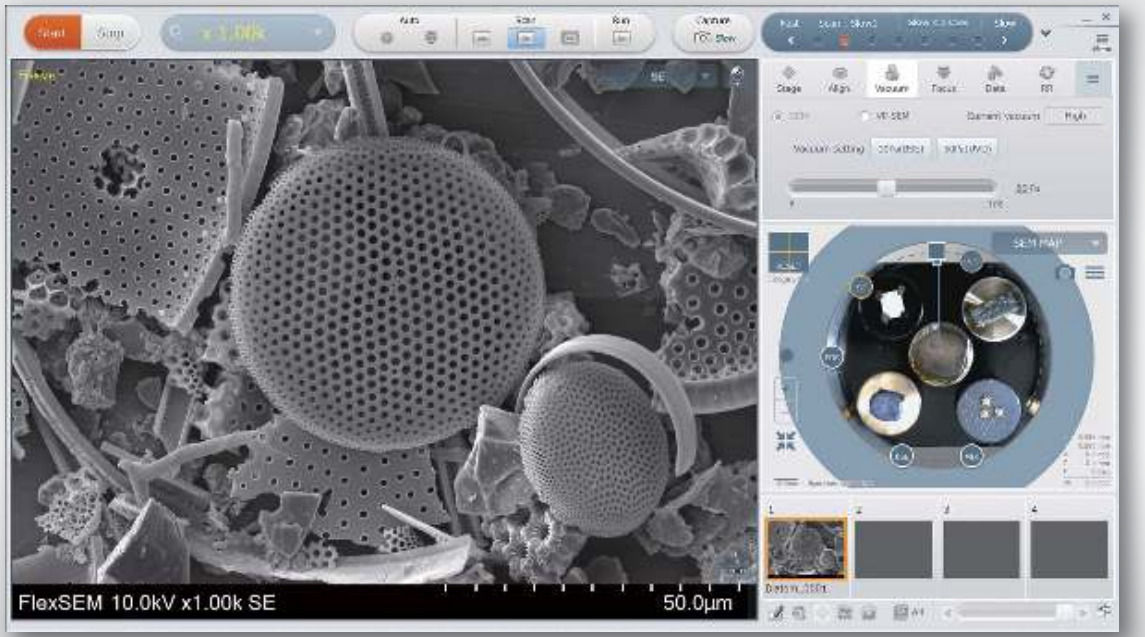
FlexSEM 1000 II
Scanning Electron Microscope

High performance in a compact system for various methods of observations

FlexSEM 1000 II

With the highest in-class resolution of 4 nm,
the FlexSEM 1000 II offers user-friendly operation and sophisticated
automatic functions for a wide range of users, from beginners to experts.

※Screen shows simulated imege.



Specimen: diatom

＊The image on the screen includes options.

Scanning Electron Microscope FlexSEM 1000 II

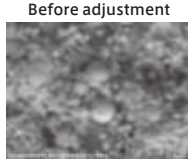
＊Optional

Multiple integrated features for intuitive operation.

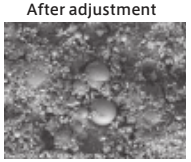
Specimen holder

Automated image corrections for easy operation

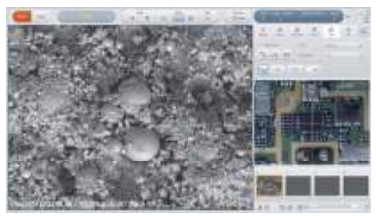
Before adjustment



After adjustment



User interface with improved software

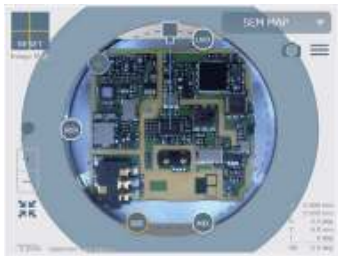


▸P9

Specimen: electronic circuit board

Extensive user operation support functions

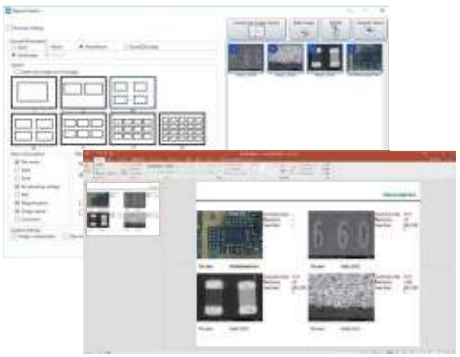
■Easy operation with use of camera navigation system*



▸P11

Specimen: electronic circuit board

■Generating reports easily with "Report Creator"



Simply select images and template to generate customize reports.

Compact design

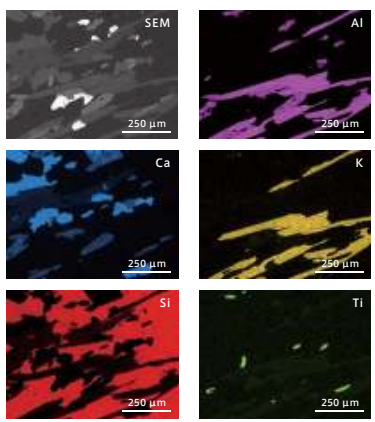
A space and energy saving system with performance comparable to larger scanning electron microscopes

※Screen shows simulated imege.

52% more space saving (compared to SU1510)
45% lighter (compared to SU1510)
Power source: 1 kVA (connect to outlet)

Upgradeable Options for various analytical needs

EDS analysis



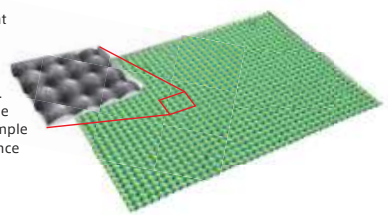
Magnification: 150x

Specimen: mineral

Specimen courtesy of Dr. Mamoru Adachi, the Nagoya University Museum

Three-Dimensional measurement by Hitachi map 3D

Hitachi map 3D is a measurement and three-dimensional model display software package designed for the use with Hitachi SEM images. Three-dimensional images can be generated without tilting the sample or worrying about image shift since the Hitachi map 3D utilizes the directional signal from Hitachi' s segmented quad BSE detector.

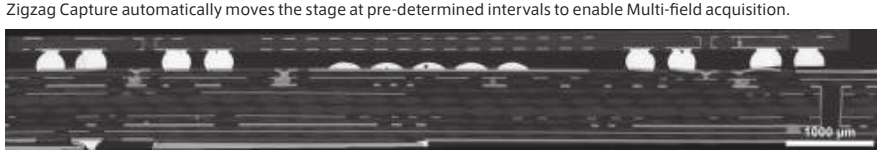


Parameters	Unit		
Projected area	%	51.0	41.8
Volume of void	%	11.7	73.6
Volume of material	%	88.3	26.4
Volume of void	nm³/µm²	10814105	27741380
Volume of material	nm³/µm²	81350583	9972952
Mean thickness of void	nm	10.8	27.7
Mean thickness of material	nm	81.4	9.97

Specimen: microlens

Wide area observation by image tiling (Zigzag Capture)

Zigzag Capture automatically moves the stage at pre-determined intervals to enable Multi-field acquisition.



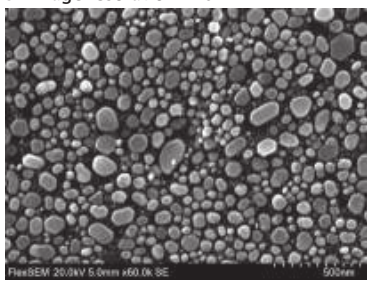
Specimen: electronic component (prepared with ion milling)

*Optional

Compact and high-performance electron optics

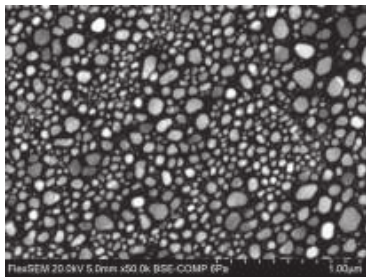
Equipped with a low-aberration objective lens, providing high resolution in a compact body.

SE image resolution: 4.0 nm



Accelerating voltage: 20.0 kV, Magnification: 60,000x

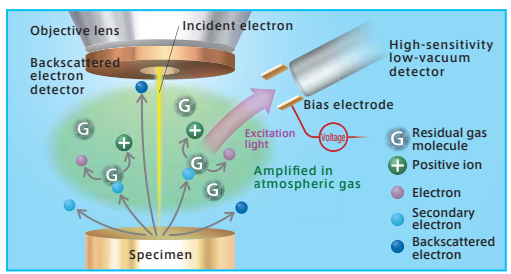
BSE image resolution: 5.0 nm



Accelerating voltage: 20.0 kV,
Magnification: 50,000x, Vacuum: 6 Pa
Specimen: evaporated Au particles

Non-conductive specimen observation

Observation of non-conductive specimens is available by using the VP mode with charge artifact reduction. High-contrast images are obtained due to improved sensitivity of the backscattered electron. Hitachi's ultra variable-pressure detector (UVD*) generates a secondary-electron-type image by detecting visible light excited by the electron-gas interaction.



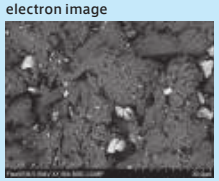
Detection principle of high-sensitivity low-vacuum detector (UVD)

Charge artifacts can occur in high vacuum causing image distortion, such as image drift, extreme contrast changes, and other false information. However, by controlling the electrostatic charge on the specimen using VP mode, a clear observation of the specimen's surface structure is possible.

High-vacuum secondary electron image

UVD image*

VP-mode backscattered electron image

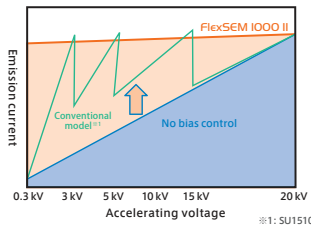


Specimen: polyvinyl alcohol

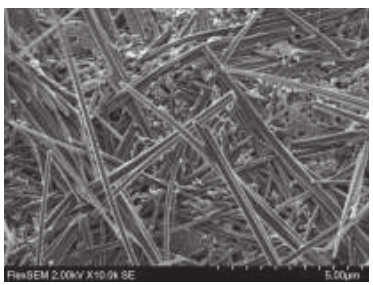
*Optional

High-contrast observation with the Beam Brightness system

"Beam Brightness" is a system to maintain high-emission current regardless of accelerating voltage.
With this system, high-contrast images can be obtained continuously, even at low accelerating voltage levels.



※1: SU1510



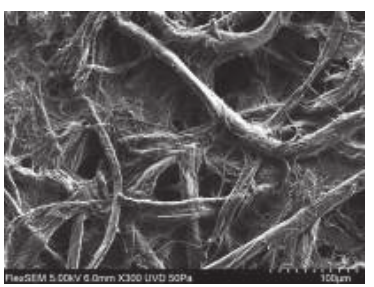
Accelerating voltage: 2.0 kV,
Magnification: 10,000x
Signal: secondary electron image
Specimen: tablet candy

Accelerating voltage: 3.0 kV,
Magnification: 500x
Signal: UVD
Specimen: superabsorbent polymer

New generation ultra variable-pressure detector (UVD-II)*1

The UVD-II, a ultra variable-pressure detector with improved signal detection capability, provides a signal-to-noise ratio approximately 1.5 times higher than the previous-generation UVD.

Accelerating voltage: 5.0 kV,
Magnification: 150x
Signal: UVD-II
Specimen: resin fracture

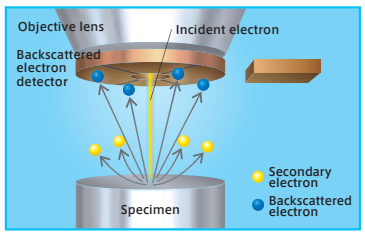


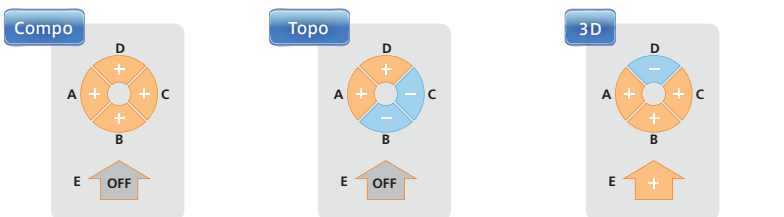
Accelerating voltage: 5.0 kV,
Magnification: 300x
Signal: UVD-II
Specimen: paper filter

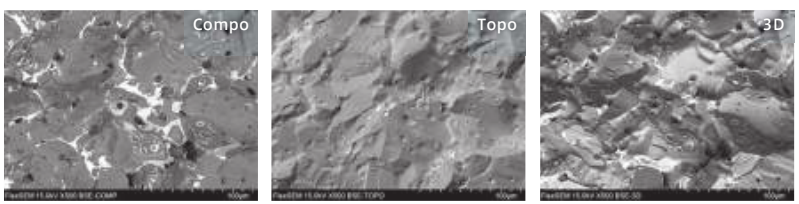
*1 Optional

High-sensitivity semiconductor backscattered electron detector

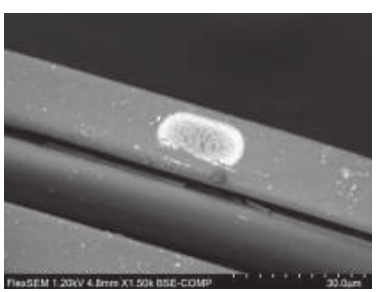
The semiconductor backscatter detector consists of five elements, enabling simultaneous signal collection from each segment. By changing their configuration, the detector takes images which emphasize composition information, shadow images which emphasize topographic information, and 3D images which emphasize both compositional and topographic information.



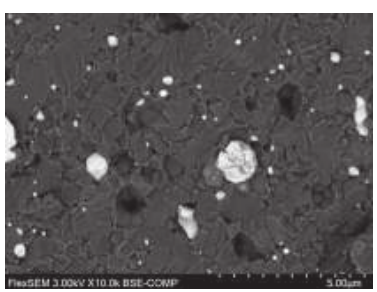




Accelerating voltage: 15.0 kV, Magnification: 500x, Specimen: varistor



Accelerating voltage: 1.2 kV, Magnification: 1,500x
Specimen: Photocatalytic fiber

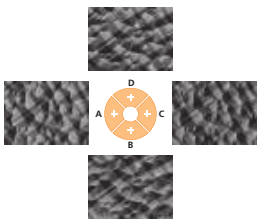


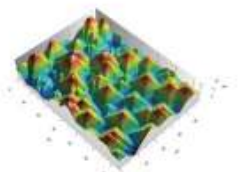
Accelerating voltage: 3.0 kV, Magnification: 10,000x
Specimen: Al-Ni composite material

3D surface reconstruction and height measurement of the specimen

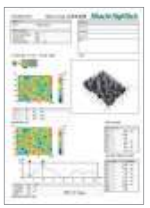
Hitachi map 3D captures all four directional images simultaneously with a high-speed, segmented Backscattered Electron Detector (BSED), supports various measurements such as height, area, and volume as well as ISO-compliant surface roughness. Moreover, report data can be output to several formats including RTF (Word-compatible), PDF, STL format (3D printer compatible), and more.

SEM Image (BSE images from 4 directions) | 3D Image | Report Output

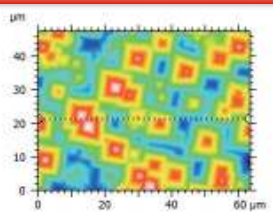




Accelerating voltage: 5.0 kV, Magnification: 2,000x, specimen: solar cell



Height and angle measurement of extracted cross-section



Parameter	Unit	0-1	2-3
Horizontal distance	μm	8.84	4.50
Height difference	μm	-7.91	-5.29

●Main specifications

3D Image Capture(Three-Dimensional data capture func+on)

Item	Description
Capture func+on	Automatic image data acquisition by Hitachi's segmented quad BSE detector
Capture pixel count	640x480, 1,280x960
Data capture +me (Scan speed)	10~320s

PC installation requirements

Item	Description
Windows versions	Windows® 7, 8, .x 10(x64 or x32)
Processor	Quadcore processor
RAM memory	8 GB or more
Graphic board	Open GL 2.0 or Direct 3D 9.0c
HDD free space	800 MB or more
Other	1 free USB port

Note:
"Windows" is a registered trademark of Microsoo Corpora+on in the United States and other countries.

Hitachi map 3D

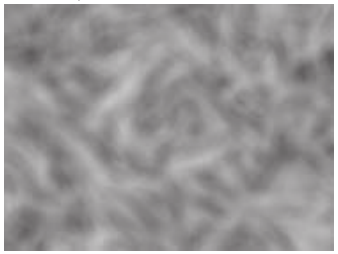
Item	Description
Import function	Automatic select and read function of four segment BSE image data
Measurement Performance	Measurement performance varies depending on calibration accuracy, the condition of the type of specimen, the observation mode, and the observation condition. Detectable angle range ±60° (reference)
Measurement function	Measurement based on the ISO, JIS, ASME, EUR, and GB standards
	Section profile display extracted between any area on the three dimensional image
	Distance of X and Y, length and any angle measurements between two points, surface area, and volume
	Distance of X, Y, and Z, length and many other measurement functions between 2 points specified on section profile
	Simple profile and surface roughness measurements
	Baseline (straight, curve), leveling, and multiple offsets
	Cutting surface, Color contour line, Bird' s-eye view, and pseudo color display
	Layout, templates, and image composition from multiple-image function
Three-dimensional display function	Rotation, zoom-in, and multiple rendering processes. Animation video record function of observation screen
Output function	Report/image: PDF, RTF/PNG, JPG, GIF, TIF, BMP, EMF
	3D image/movie: SUR, 3MF, STL, WRL, TXT/X3D/WMV, AVI

* Optional

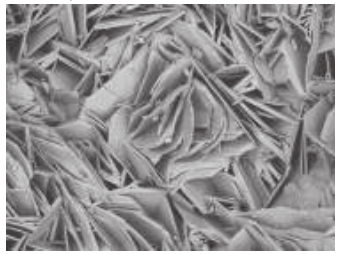
Automatic image corrections which do not require an expert

Improved high-speed automatic image correction algorithms shorten latency time by approximately 70% compared with conventional models*1, realizing high-throughput data acquisition minimizing or eliminating various image adjustments.

Before adjustment



After adjustment



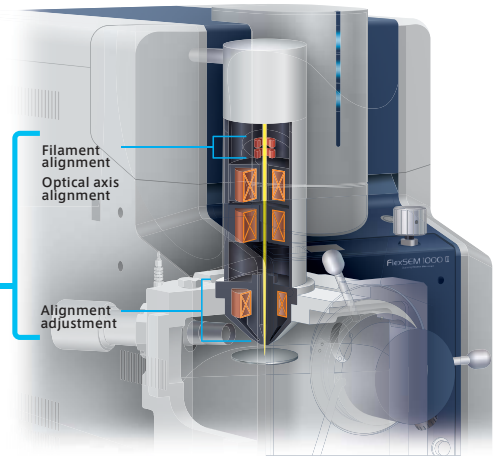
Specimen:
tuff volcanic ash
Specimen courtesy of professor emeritus Masahiro Kitada, Tokyo University of the Arts

*1: SU1510

Auto axis alignment

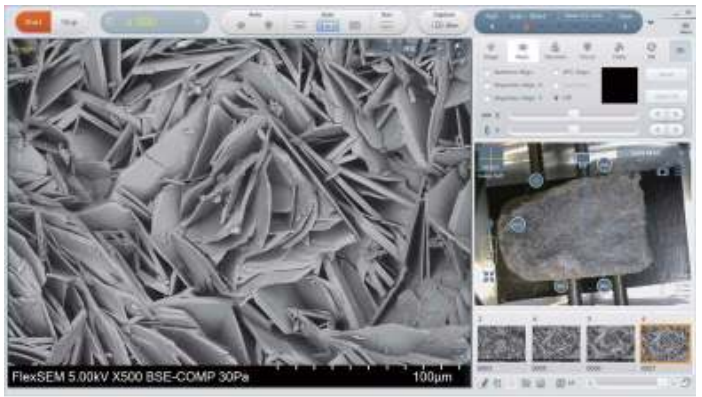
Multiple alignments, including optical axis and gun alignments after filament replacement, are automatically controlled. This prevents misalignment of the optical axis or field of view and helps obtaining high-quality images repeatedly without relying solely on the user's skills.

Auto beam adjustment



User interface with improved software

New graphical user interface supports touchscreen capability for all operations, including stage control and observation conditions. The size of the main window has been increased to 1,280 x 960 pixels, with the subwindow displaying our new navigation system, SEM MAP. SEM MAP visually displays stage location and confirms the current observation point with respect to the entire sample. Additionally, the subwindow can be switched from SEM MAP to display different signals, to be displayed and captured simultaneously.



Specimen: tuff volcanic ash

Mouse-driven smart functions

RISM*

Function to center the region of interest by clicking any point on the live image.

Click to move to the center of the screen

Function to move the field of view by clicking and dragging any point on the live image.

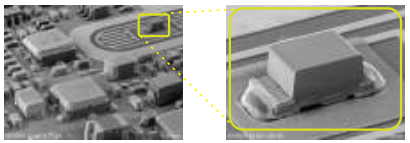
Dragging freely

*Rapid Image Shift Mode

ZOOM

Click and drag over any point on the live image moves the field of view with the selected area to the center and increases the magnification automatically.

Circle the point to enlarge at the center

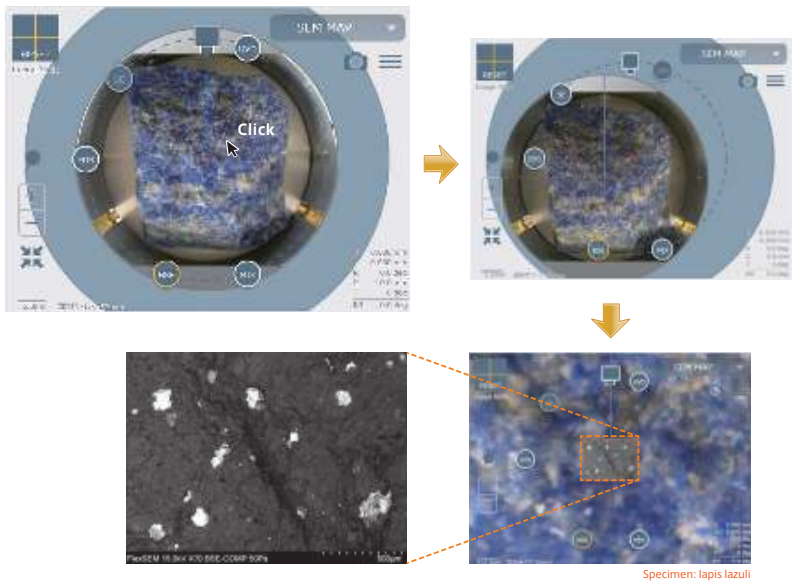


Specimen: electronic circuit board

Intuitive searching of a desired field of view by camera navigation system*

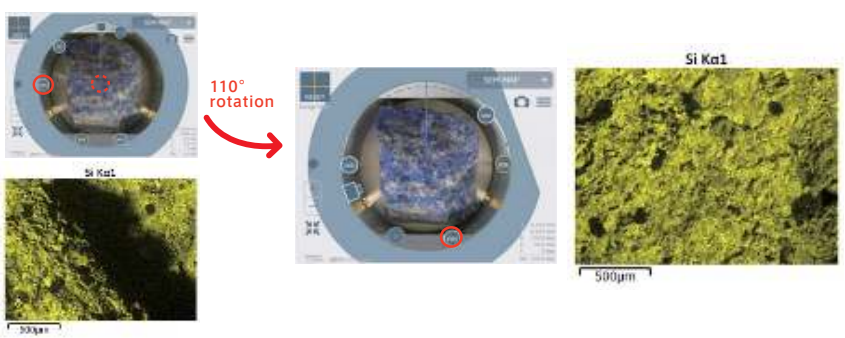
Easy to search a field of view with the integrated camera navigation system

Navigate to any location via SEM MAP and quickly reach your observation area simply by clicking on the optical image. The optical image from the built-in camera (or from an external source) can be zoomed in and out, or switched with a high-resolution SEM image.



Specimen: lapis lazuli

SEM MAP interface is designed to easily grasp the relationship between any of the SEM detectors and the specimen. All of the detector locations are indicated on the SEM MAP display, designating their position around the specimen as it is rotated.



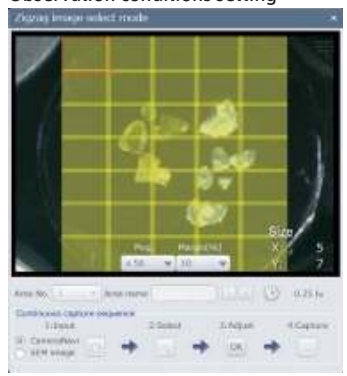
Wide area observation by Multi Zigzag*

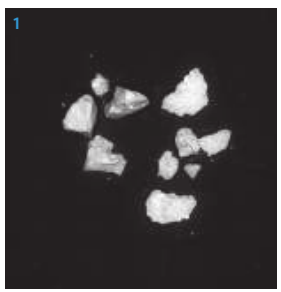
Wide area observation of multiple areas on optical camera image or SEM image

Multi Zigzag (sequential field-of-view image capturing) is a function that generates a low-magnification image out of multiple high-magnification images taken with different fields of views.
This enables wide-area observation with low-magnification/high-resolution images that are difficult to capture manually by using a SEM. In addition to the conventional Zigzag functions, multiple areas over multiple specimens can be defined in Multi Zigzag.

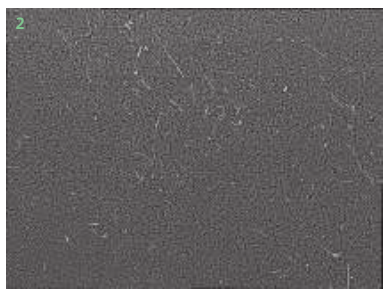
Area definition

Observation conditions setting

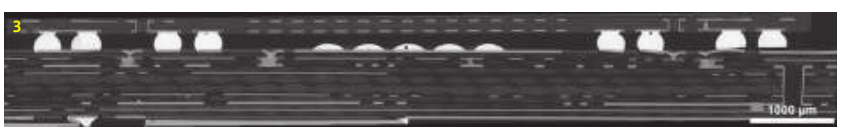




Signal: backscattered electron Specimen: mineral
Number of images taken:
35 (7 vertically x 5 horizontally)



Signal: backscattered electron Specimen: asbestos
Number of images taken:
60 (10 vertically x 6 horizontally)

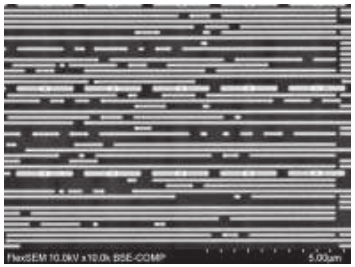


Signal: backscattered electron Specimen: electronic component
Number of images taken: 54 (18 vertically x 3 horizontally)
Milling unit: ArBlade®5000

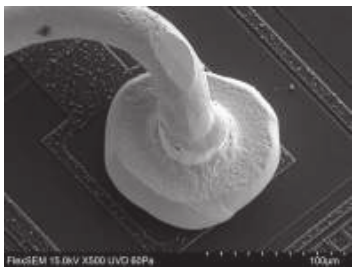
*Optional

Application Examples (uncoated observation)

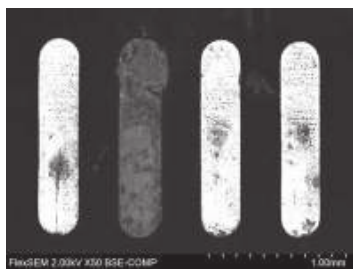
Electronic components



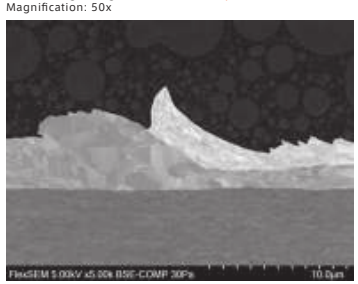
Accelerating voltage: 10.0 kV,
Magnification: 10,000x
Specimen: semiconductor device



Accelerating voltage: 15.0 kV,
Magnification: 500x(UVD used)
Specimen: wire bonding

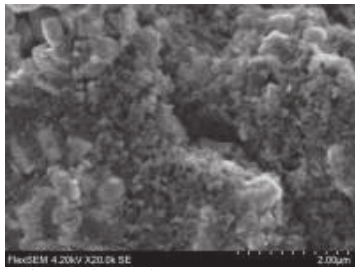


Accelerating voltage: 2.0 kV,
Magnification: 50x
Specimen: metal terminal

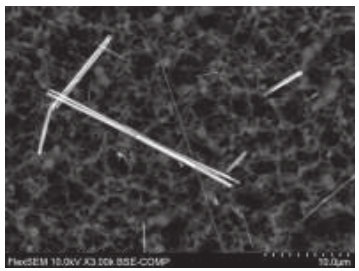


Accelerating voltage: 5.0 kV,
Magnification: 5,000x (Ion milling used)
Specimen: Au bonding

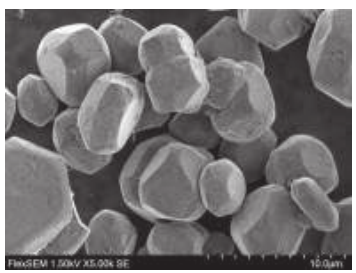
Environmental & energy material



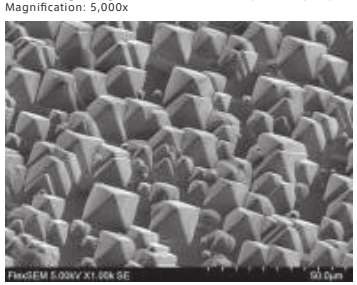
Accelerating voltage: 4.2 kV,
Magnification: 20,000x
Specimen: lithium-ion battery (positive electrode)



Accelerating voltage: 10.0 kV,
Magnification: 3,000x
Specimen: asbestos

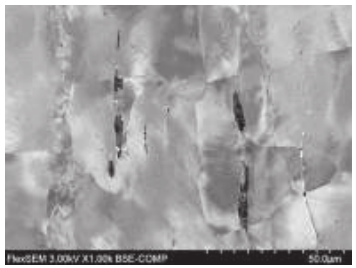


Accelerating voltage: 1.5 kV,
Magnification: 5,000x
Specimen: phosphor

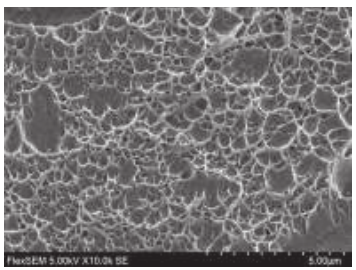


Accelerating voltage: 5.0 kV,
Magnification: 1,000x
Specimen: solar cell

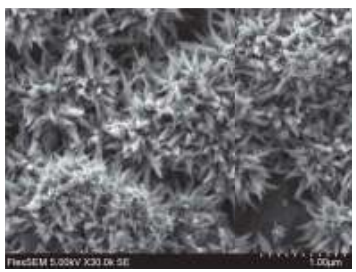
Metallurgy



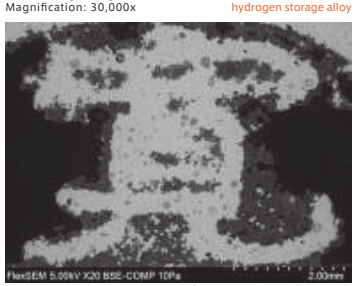
Accelerating voltage: 5.0 kV,
Magnification: 1,000x (Ion milling used)
Specimen: steel (SUM23)



Accelerating voltage: 5.0 kV,
Magnification: 10,000x
Specimen: fracture surface of metal

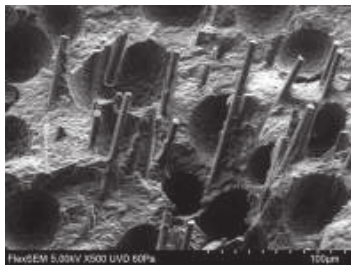


Accelerating voltage: 5.0 kV,
Magnification: 30,000x
Specimen: hydrogen storage alloy

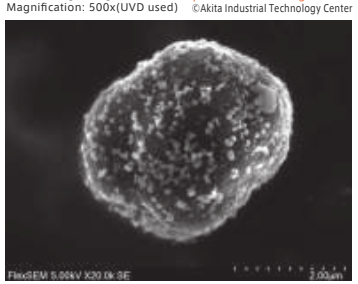


Accelerating voltage: 5.0 kV, Magnification: 20x(Ion milling used)
Specimen: kanei-tsuho (coin from Edo period in Japan)
Sample courtesy of professor emeritus Masahiro Kitada, Tokyo University of the Arts

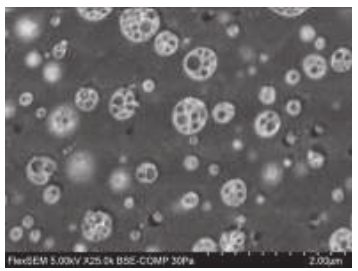
Polymer materials



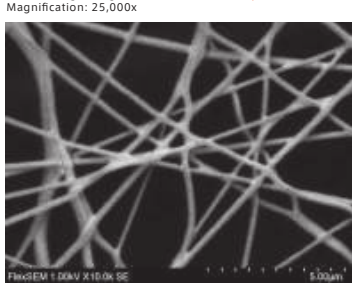
Accelerating voltage: 5.0 kV,
Magnification: 500x(UVD used)
Specimen: resin with glass fiber
©Akita Industrial Technology Center



Accelerating voltage: 5.0 kV,
Magnification: 20,000x
Specimen: toner particle

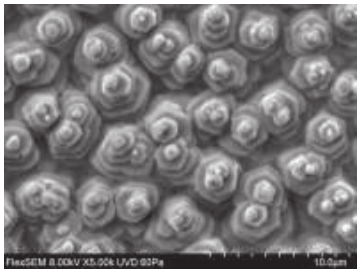


Accelerating voltage: 5.0 kV,
Magnification: 25,000x
Specimen: ABS resin

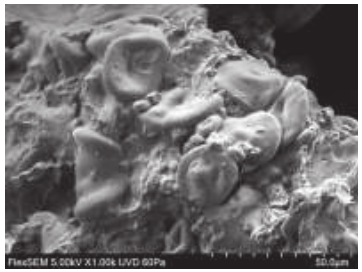


Accelerating voltage: 1.0 kV,
Magnification: 10,000x
Specimen: nanofiber
Sample courtesy of Nafias corporation

Life Science

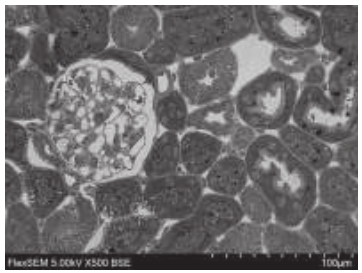


Accelerating voltage: 8.0 kV,
Magnification: 5,000x
Specimen: abalone's shell



Accelerating voltage: 5.0 kV,
Magnification: 1,000x
Specimen: pancake

Accelerating voltage: 3.0 kV,
Magnification: 150x
Specimen: Peyer's patch of small intestine
Sample courtesy of associate professor Daisuke Koga, Department of Microscopic Anatomy and Cell Biology, Asahikawa Medical College



Accelerating voltage: 5.0 kV,
Magnification: 500x
Specimen: kidney section of a mouse (resin-embedded)

Smooth and quick analysis by using camera navigation system*

FlexSEM incorporates observation to analysis smoothly by using the camera navigation system in conjunction with EDS. Correlative results from the acquisition of high-resolution SEM images and mapping images from an ultra-wide area can be displayed.

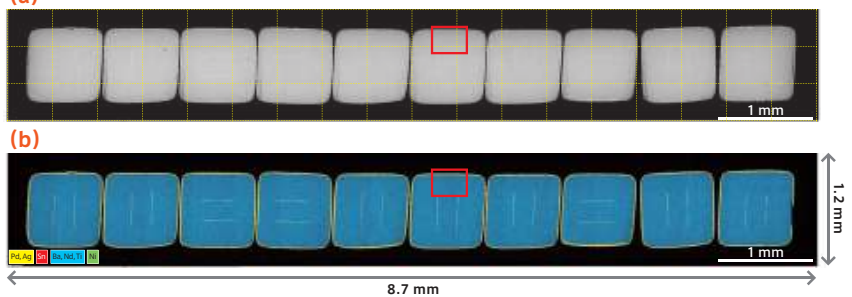
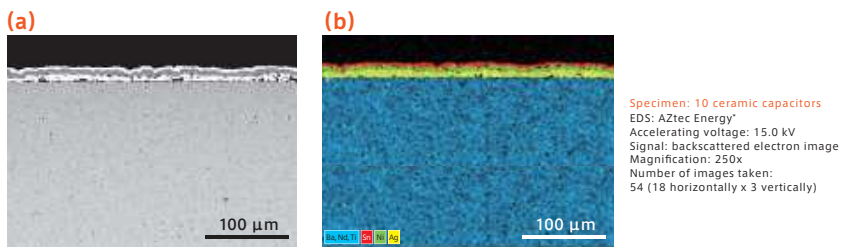


Figure 1: Result of wide area observation and analysis of cross-section of the ceramic capacitor
(a) SEM image (b) EDS layer image



Specimen: 10 ceramic capacitors
EDS: AZtec Energy*
Accelerating voltage: 15.0 kV
Signal: backscattered electron image
Magnification: 250x
Number of images taken:
54 (18 horizontally x 3 vertically)

Figure 2: Enlarged image
(a) SEM image (b) EDS layer image

Main energy dispersive X-ray analyzer

Product name	AZtecOne/AZtecEnergy	Quantax80	Element
			
Type of detector	Silicon drift detector	Silicon drift detector	Silicon nitride SDD detector
Detection area	30 mm^2	30 mm^2	30 mm^2
Energy resolution	158 eV(Cu-Kα)	148 eV(Cu-Kα)	129 eV(Mn-Kα)
Detectable element	B^5～U^{92}	B^5～Cf^{98}	Be^4～Am^{95}
Manufacturer	Oxford Instruments plc.	Bruker Nano GmbH	AMETEK Inc.

*Optional

Easy maintenance

Pre-centered filament cartridges which require no adjustment are included as standard.
A step-by-step guide and automated axis-alignment function make for easy filament replacement.

Filament replacement

step 1 | **Press AIR button and wait until the chamber reaches atmosphere.**

After the specimen chamber reaches atmosphere, wait 30 minutes in order to let the filament cool completely before removing it.

step 2 | **Open the electron gun and remove the filament.**

step 3 | **Replace the filament with a new one.**

・Spacer that comes with cartridge filament must be installed.
・Clean if necessary.

step 4 | **Attach the filament and close the electron gun.**

・Make sure that no dust enters the electron gun or inside the column.

step 5 | **Set the calibration specimen.**

step 6 | **Select a button for auto alignment or manual alignment.**

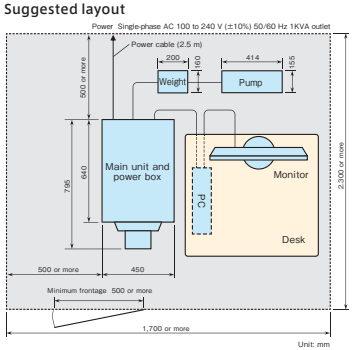
Compact and flexible layout

Compact design that can be installed in small space. The main unit can be placed either on a power box or tabletop, and observation can be done as a part of routine work, without sitting down in a chair.

■Main unit & power box combined

※Scereen shows simulated image.

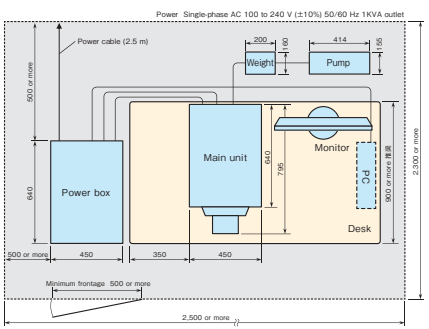
Suggested layout



■Main unit & power box separated

※Scereen shows simulated image.

Suggested layout



Note 1: Minimum load weight of the desk must be 200 kg.
Note 2: Relocation of the main unit to the desk should be handled by service engineers.