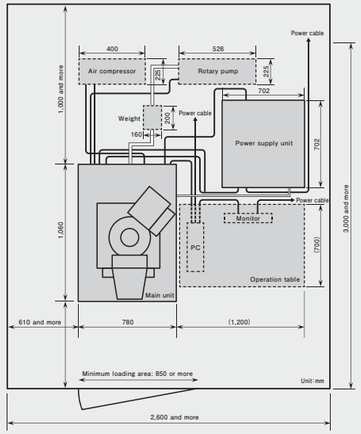
■ Main Specifications

Item			SU3900SE/SE Plus	SU3800SE/SE Plus
Electron Optics	Secondary Electron Image resolution		0.9 nm @30 kV	
			2.5 nm @1 kV	
			1.6 nm @1 kV (∗1)	
	Magnification		5× to 600,000× (Photograph Magnification)	
	Electron Gun		ZrO/W Schottky Emitter	
	Accelerating Voltage		0.5 kV to 30 kV	
	Landing Voltage(∗1)		0.1 kV to 2 kV	
	Probe Current		Max. 150 nA	
Specimen Stage	Stage Control		5-axis Motor Drive	
	Movable Range	X	0 to 150 mm	0 to 100 mm
		Y	0 to 150 mm	0 to 50 mm
		Z	3 to 85 mm	3 to 65 mm
		T	-20° to +90°	
		R	360°	
	Maximum Observable Range		φ203 mm (in combination with R) φ229 mm (∗2) (in combination with R)	φ130 mm (in combination with R)
	Maximum Observable Height		130 mm (WD=10 mm)	80 mm (WD=10 mm)
Specimen Chamber	Mountable Specimen Size		Max. φ 300 mm	Max. φ 200 mm
Variable Pressure (VP) mode	Pressure Range		6 to 150 Pa	
Detectors	Standard Detectors		Secondary Electron Detector (SED)	
			TOP detector (TD) Note: available only for SE Plus specification	
			4+1-segment Semiconductor Backscattered Electron Detector (BSED)	
	Optional Detector (∗2)		Ultra Variable-Pressure Detector (UVD)	
	Optional Accessories (∗3)		Energy Dispersive X-ray Spectrometer (EDS)	
			Electron Backscatter Diffraction Detector (EBSD)	
Image Display Modes	1 Screen Display Mode		1,280×960 pixels	
	2 Screen Display Mode		640×480 pixels	
	Pixel Size		640×480, 1,280×960, 2,560×1,920, 5,120×3,840 pixels	
Size and Weight (∗4)	Main Unit		780 (W) × 1,060 (D) × 1,718 (H) mm, 844 kg	780 (W) × 1,060 (D) × 1,634 (H) mm, 600 kg
	Power Supply Unit		702 (W) × 702 (D) × 663 (H) mm, 124 kg	
	Weight		160 (W) × 200 (D) × 134 (H) mm, 26 kg	
Utility Requirements	Temperature		15 to 25°C	
	Humidity		60 % (RH) or less (non-condensing)	
	Power Supply		AC100—115 V, 2 kVA	
	Grounding		D-type single grounding	
	Vacuum Pump		Rotary Pump	
	Air Compressor (∗5)		400 to 500 kPa	

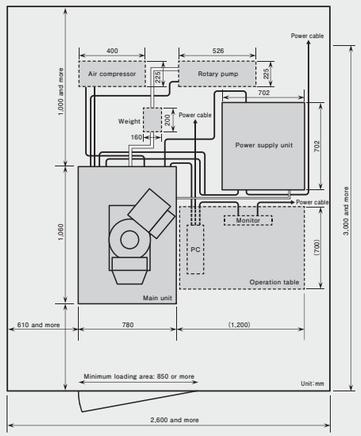
(∗1) with deceleration mode
(∗2) Optional
(∗3) Mountable Detectors
(∗4) Weight of standard unit and does not include options.
(∗5) When connected to customer's facilities.

■ Installation example diagram

◆SU3900SE/SE Plus



◆SU3800SE/SE Plus



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Scanning Electron Microscope
SU3900SE/SE Plus
SU3800SE/SE Plus

SE Series
SCANNING ELECTRON MICROSCOPE

Science for a better tomorrow

Performance for a wide variety of analytical requirements

The all-in-one Schottky SEM SU3900/SU3800SE series delivers high-resolution imaging capability for large specimens and variable pressure function versatility.

SU3900SE/SE Plus

＊Picture represents SU3900SE.

SU3800SE/SE Plus

＊Picture represents SU3800SE Plus.

1 Schottky SEM with large specimen chamber to expand application capabilities

- Supports up to 300 mm diameter/130 mm height specimens (available only for SU3900SE/SE Plus)
- A maximum weight of 5 kg using 5-axis stage (available only for SU3900SE/ SE Plus)
- Variable pressure function is standard.

＊Picture Includes optional accessories.

2 High resolution for improved top-surface imaging

- Equipped with a new Schottky optics. Resolution: 0.9 nm/30 kV, 2.5 nm/1 kV
- Advanced model (SE Plus) available which improves performance at low accelerating voltages. Resolution: 1.6 nm/1 kV (irradiation voltage)
- High-sensitivity 4+1-segment Semiconductor BSE detector is included in standard configuration

3 Automation and support functions that improve usability

- Guided specimen exchange sequence for safe sample loading with ease.
- Auto alignment sequence for improved data repeatability.
- EM Flow Creator for workflow automation*

＊Optional

1 Schottky SEM with large specimen chamber expands application capabilities

SU3900SE/SU3800SE

Robust 5-axis stage for a variety of specimen size, shape and weight

The SU3900/SU3800SE series is equipped with a stage that supports large/heavy specimens. A maximum weight of 5 kg can be driven on 5-axis stage.

	SU3900SE	SU3800SE
Maximum Specimen size (diameter)	Φ300 mm	Φ200 mm
Maximum observable range (diameter)	Φ229 mm*	Φ130 mm
Maximum loadable weight *1*2	5 kg	2 kg
Maximum loadable height *2	130 mm	80 mm

*1 Using the heavy weight holder (optional).
*2 The weight and height that can be loaded differ depending on the dimensions of the specimen being loaded.

Example with 300 mm diameter wafer loaded (SU3900SE)

Specimen Exchange Chamber*

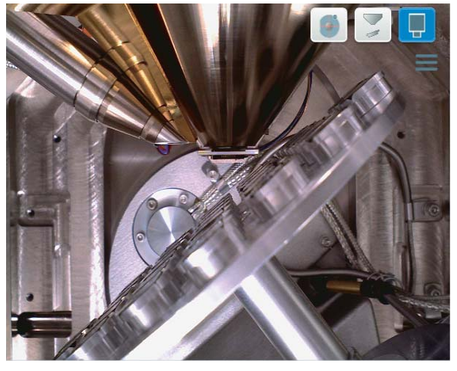
Exchange the specimen without venting the specimen chamber, improving throughput.

	SU3900SE	SU3800SE
Maximum Specimen size (diameter)	Φ127 mm	Φ102 mm
Maximum Specimen height	45 mm	20 mm

Chamber Scope*

Specimen condition can be viewed side-on, increasing the safety of stage movement. It is possible to magnify the chamber scope image and view the sample position more clearly.

○ The display is infrared(monochrome)/color convertible. Infrared monocrome type can be displayed simultaneously with SEM image observation.



Example of colored display mode

*Optional

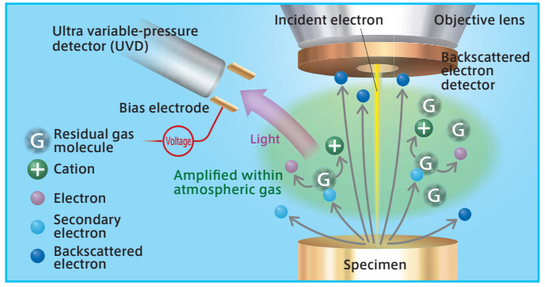
Wide Area Camera Navi*/SEM MAP

- The wide-area optical camera image can be smoothly switched to a high-magnification SEM image
- The optical camera image also follows the specimen rotation, allowing the specimen position to be determined easily

	SU3900SE	SU3800SE
Observable area (diameter)	Φ203 mm Φ229 mm*	Φ127 mm

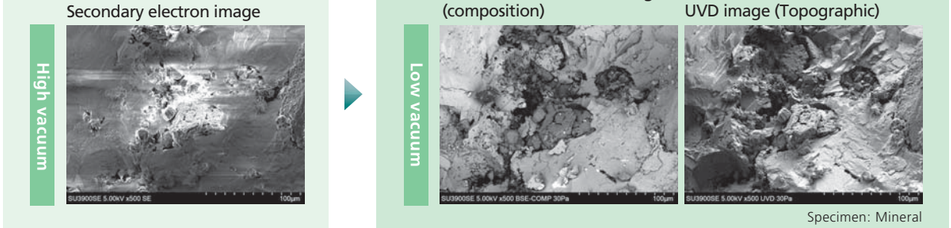
Non-conductive specimen observation with variable pressure mode and high sensitivity detectors*

Observation of non-conductive specimen is available by using variable pressure mode with charge artifact reduction. High contrast image is obtained due to improved sensitivity of backscattered electron. Hitachi ultra variable-pressure detector (UVD) generates a secondary electron image by detecting visible light from the electron-gas interaction.
Charge artifact can be caused by high vacuum creating image distortion such as extreme contrast changes. In variable pressure mode the backscattered image highlights composition contrast, while topographic information is captured by UVD image.



■ **Image artifacts caused by charging**

■ **Suppresses charge build-up and makes it possible to obtain composition information and topographic information**



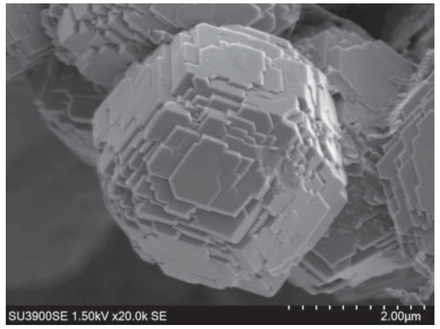
Specimen: Mineral

*Optional

High-resolution Observation

The SU3900/SU3800SE series microscopes are equipped with a new electron gun that allows high-resolution imaging.

Platinum catalyst particle

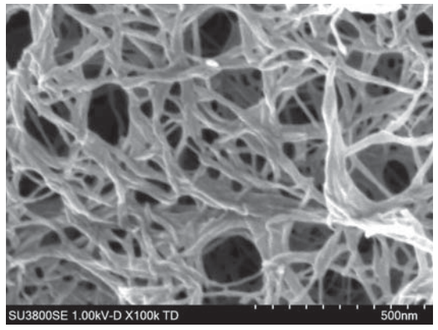


Zeolite particle

Top surface imaging using low accelerating voltage

The TOP detector employs surface sensitivity and high-resolution observation with stage deceleration function. This detector performs especially well in low-energy observations of light-element specimens that are easily damaged by electron beam irradiation.

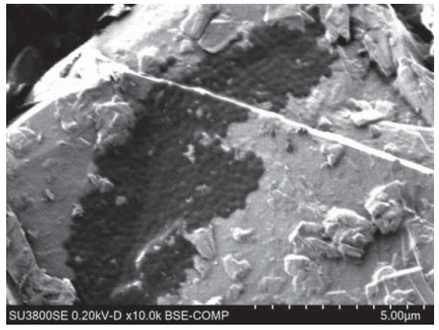
SE Plus



Cellulose nanofiber ＊Available only for SE Plus

By applying a low landing voltage at 1.0 kV, diameters of thin organic cellulose nanofibers are clearly confirmed.

SE Plus



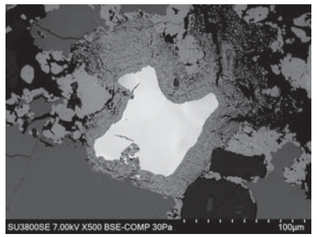
Lithium-ion battery anode material ＊Available only for SE Plus

By applying an ultralow landing voltage at 200 V, lithium-ion battery anode material and binder is clearly distinguished using static voltage contrast.

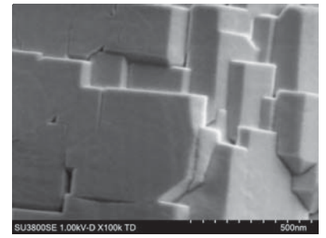
Versatile imaging capability supports various observation requirements

The SU3900/SU3800SE series microscopes can be equipped with a wide variety of detectors. A diverse range of observation images can be obtained. Detectors include a 4+1-segment Semiconductor backscattered electron detector (BSED) with improved sensitivity suitable for highlighting composition information, and an ultra variable-pressure detector (UVD) that acquires topographic information and CL information.

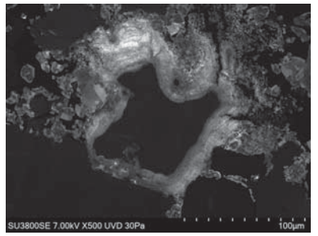
SE Plus



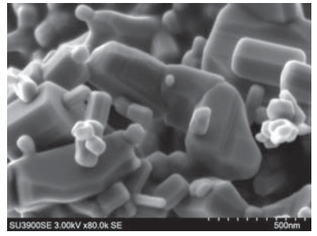
Black ore (BSE-COMPO image)



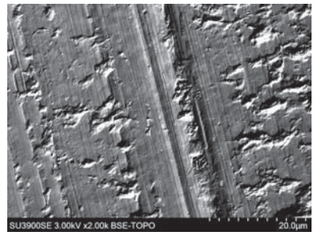
Zeolite (TOP image)



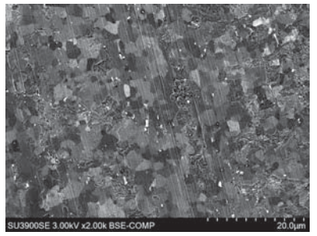
Black ore (UVD-CL image)



Zinc oxide particle (SE image)



Metal foil (BSE-TOPO image)



Metal foil (BSE-COMPO image)

＊Optional

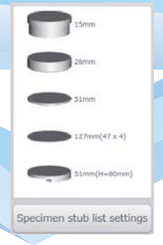
＊Optional

Specimen exchange

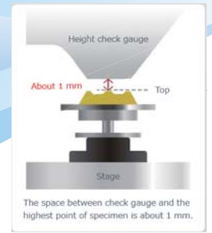
Safety and reliability

Specimen exchange sequence offers safety and reliability

❶ Select Specimen stage



❷ Confirm Specimen height

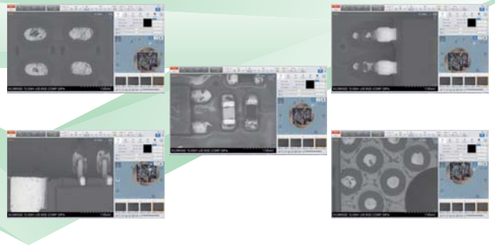


The space between check gauge and the highest point of specimen is about 1 mm.

Field of view movement

Wide range

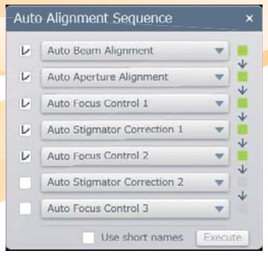
Camera Navi*/ SEM MAP covering entire observable region



Electron beam adjustment

Automatic adjustment

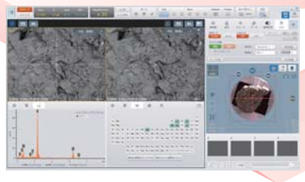
Auto alignment sequence function supporting stable data acquisition



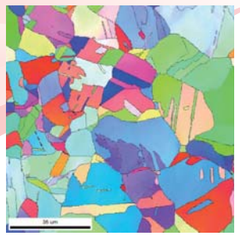
Data acquisition

Diverse data

SEM/EDS Integration system*



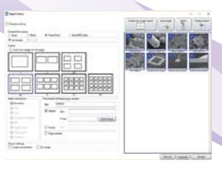
EBSD* (Crystal data analysis)



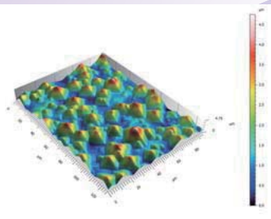
Analysis

Report

Batch output analysis data Report Creator



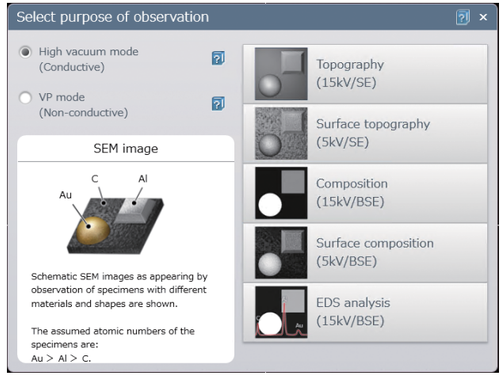
Hitachi map 3D* 3D model display and measurement software



*Optional

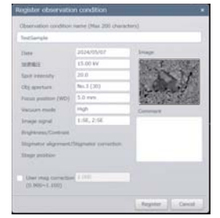
Supports fast routine measurements

■ **Parameters can be called up simply by selecting from a diverse set of parameters.**



Since the observation parameters are already optimized when the parameters are called up, the user is able to obtain the best images simply by adjusting the magnification and fine-tuning the focus and brightness/contrast.

■ **Users are able to register and call up their own parameters for each measurement Specimen.**

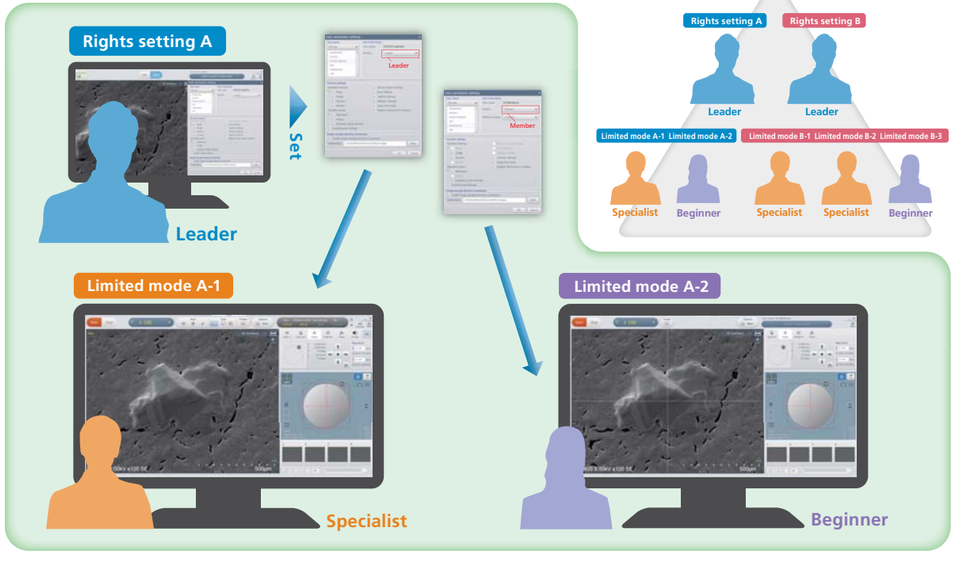


Observation parameter registration screen

Observation parameter read-out screen

User permission setting function

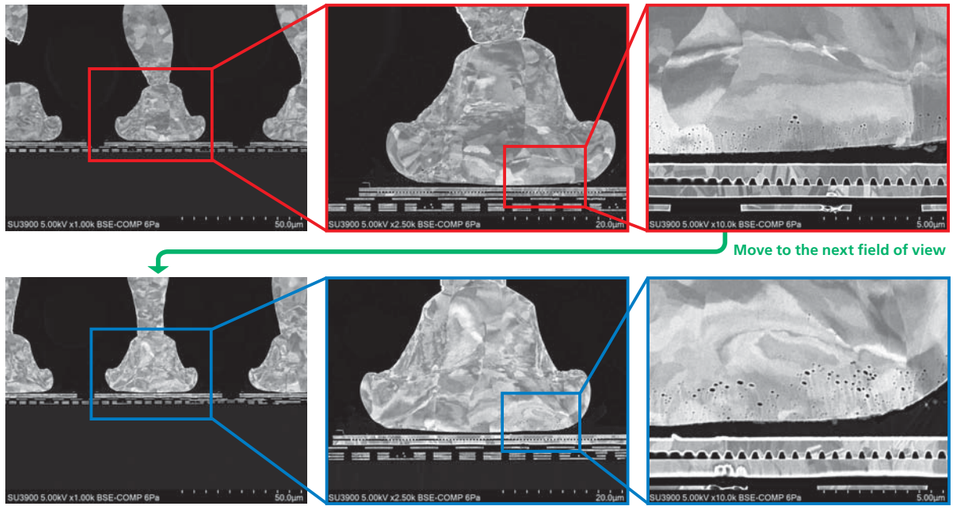
The functions that can be used by each user are restricted, and those that can be used by users with high-level privileges and users with low-level privileges. These can be customized by specifying usable functions by group in order to prevent device problems due to incorrect operation.



*Optional

Automatic Wide Area Observation of Semiconductor Devices

Semiconductor devices require support for large specimens, such as chiplet substrates, and observation of specific locations such as bonds for quality management. Here, we show an example of automatic image capture using EM Flow Creator* which is described later. This can reduce manual work by automating routine operations, including identification of bonding areas using a pattern matching function for cross-sectional areas fabricated by ion milling. It also performs automatic imaging at multiple positions at a specific magnification by moving to the next field of view after a series of data-acquisition steps is complete and capturing the same image.

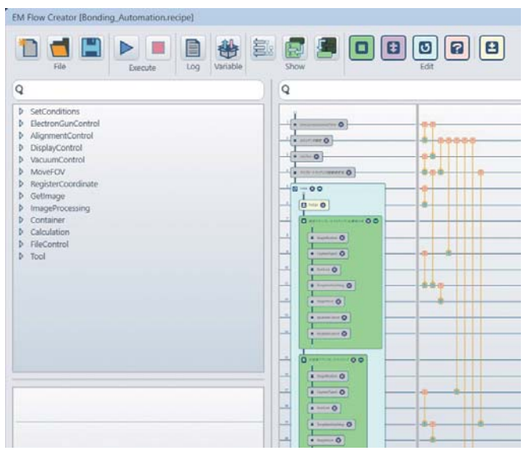


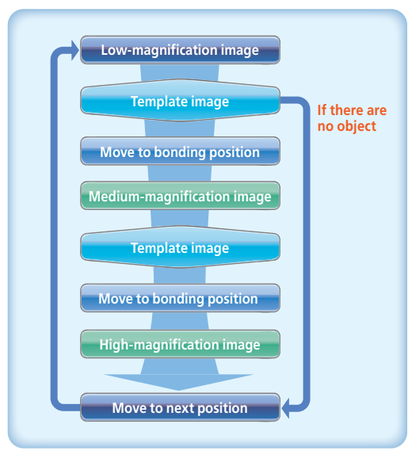
Metal wire bonding

Support Function for Automatic Operations

• EM Flow Creator*

EM Flow Creator is a function that supports automation of operations such as sequential image capture. A series of observation recipes can be created by turning parameter settings such as magnification and stage position, and SEM functions such as focus and contrast adjustment, into blocks that can be combined. Recipes can be created by dragging and dropping blocks into an arrangement like a flowchart. Automatic observation is possible by executing a created recipe.



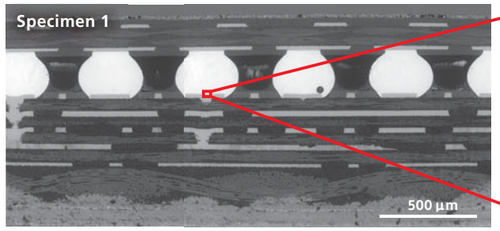


*Optional

Uniform Analysis from Preprocessing to Observation

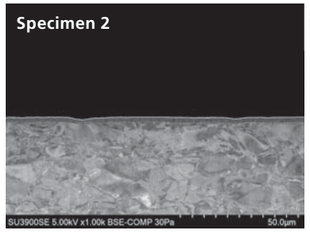
By using a multi-specimen holder* that enables ion-milling processing and cross-section preparation for multiple specimens at once, specimen preprocessing and observation were performed on three different specimens. Three specimens with the prepared cross section can be loaded at the same time into the SE series microscopes and observed without processing by using the low-vacuum function.

*Only applies to ArBlade 5000. Used in combination with ACS function through Windows PC control. Holder that enables milling processing and cross-section preparation of up to three Specimens at once simply by executing predefined machining settings.

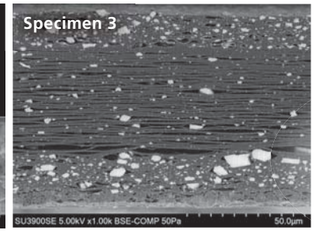


Printed circuit board (wide-area machining)

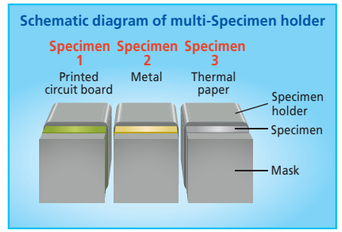
Printed circuit board



Coated metal plate



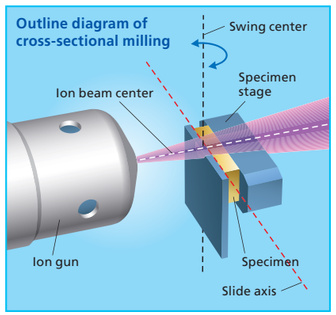
Thermal paper



Specimen Preprocessing Unit Used for Measurement

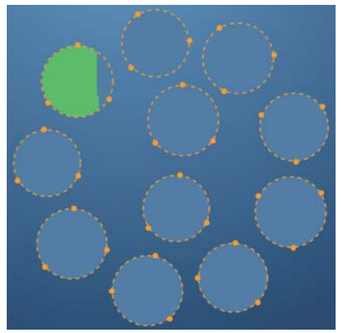
ACS (Advanced Control Software) function

ArBlade 5000

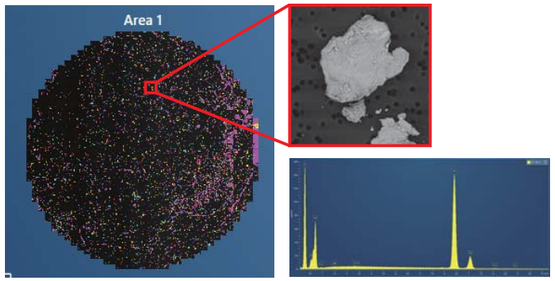


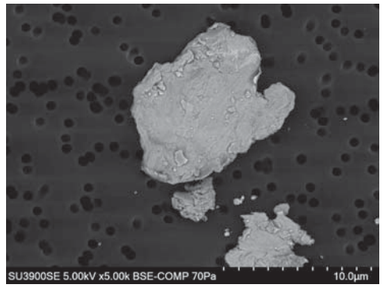
Detection of Foreign Matter During Manufacturing by EDS Particle Analysis

Cleanliness control is important when manufacturing automotive parts and lithium-ion batteries. Defect detection by SEM/EDS is widely used for analysis of foreign matter contamination. Below is an example analysis of simulated foreign matter captured by a 47 mm diameter filter. The SU3900SE can load up to 11 sheets of 47 mm diameter filters and can also perform long-duration continuous measurements using the Schottky electron gun which offers excellent irradiation current stability. By using AztecFeature developed by Oxford Instruments, metal particles for analysis are automatically detected based on an arbitrarily set contrast threshold value and EDS analysis is performed. The acquired particle information can be divided into classes based on arbitrary shape and composition information. Furthermore, reports can be output by AZtecClean in a format compliant with the ISO 16232 standard for part cleanliness inspections. The SU3900SE with AZtecFeature allows batch analysis of multiple specimens and can analyze foreign matter in manufacturing processes with good throughput.



Example of 47 mm diameter X 11 Specimen holder (SU3900SE)

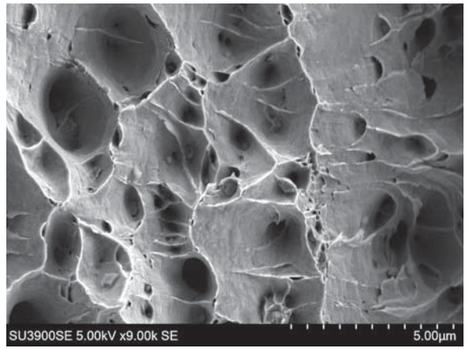




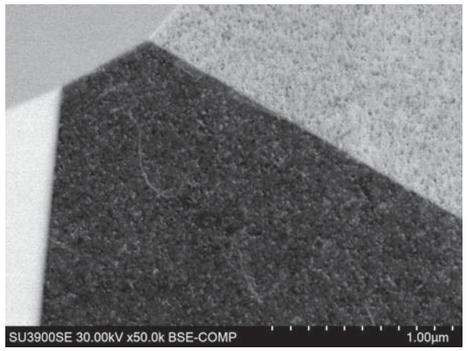
Report by AztecClean

Class / length (µm)	Subclass / length (µm)	<5	5.00-15.00	15.00-25.00	25.00-50.00	50.00-100.00	100.00-150.00	150.00-200.00	200.00-400.00	400.00-600.00	600.00-1000.00	1000.00-1500.00	1500.00-2000.00	2000.00-3000.00	>=3000	Total
All particles		0	1004	8803	5685	982	189	62	105	27	8	4	1	0	0	16870
Fe alloys		0	6	21	13	4	0	0	0	0	0	0	0	0	0	44
	Fe-Cr-Ni	0	2	1	1	0	0	0	0	0	0	0	0	0	0	4
	Fe-Cu	0	2	8	4	2	0	0	0	0	0	0	0	0	0	16
	high Fe	0	2	12	8	2	0	0	0	0	0	0	0	0	0	24
Cu alloys		0	1	14	2	0	0	0	0	0	0	0	0	0	0	17
	Cu-Fe	0	0	2	0	0	0	0	0	0	0	0	0	0	0	2
	Cu	0	1	12	2	0	0	0	0	0	0	0	0	0	0	15
Non-ferrous alloys		0	7	28	21	4	1	0	0	0	0	0	0	0	0	61
	Al	0	3	18	19	3	1	0	0	0	0	0	0	0	0	44
	Ni-Cu	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
	Zn	0	3	2	0	1	0	0	0	0	0	0	0	0	0	6
	Ti	0	0	7	2	0	0	0	0	0	0	0	0	0	0	9
	V	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1

Metals

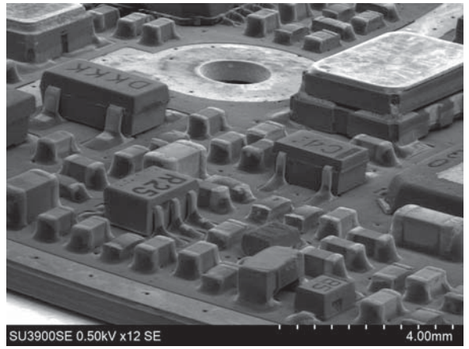


Fracture surface of iron wire
Microcavitation due to ductile failure can be seen.

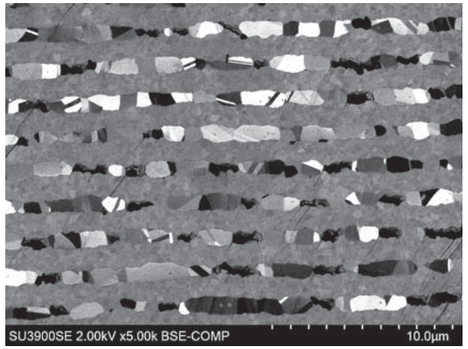


SUS316L
Line-like contrast suggestive of dislocations can be seen.

Electronic components

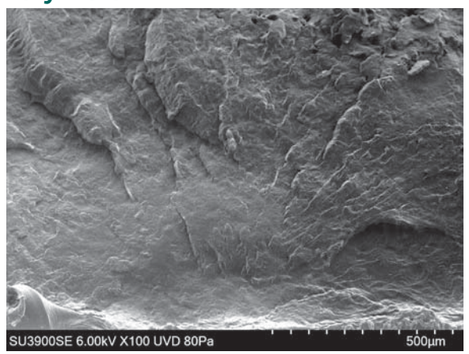


Printed circuit board
The 3D shapes and positions of mounted components can be seen using low magnification/high-tilt observation

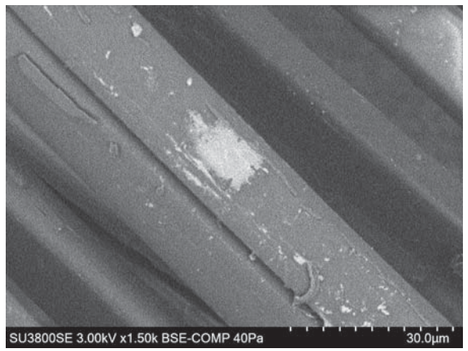


Cross section of layered ceramic capacitor
The composition and crystal contrast of nickel electrodes/dielectric layer can be observed.

Polymers



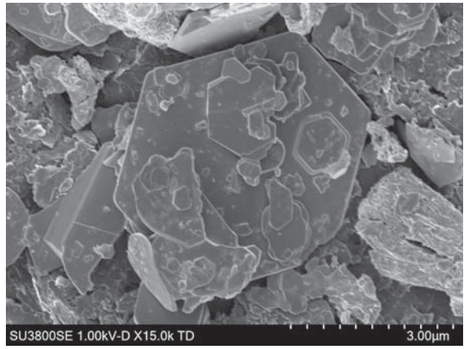
Fracture surface of resin material
A river pattern of fracture origination points can be seen.



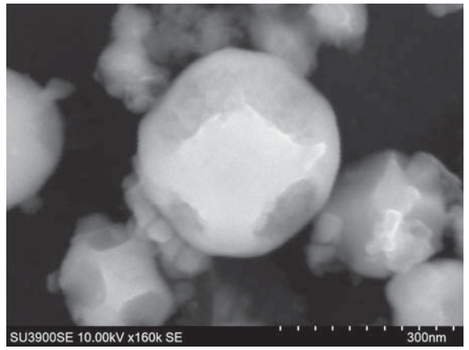
Photocatalyst fibers
Composition contrast of catalyst particles (titanium oxide) can be seen.

Inorganic materials

SE Plus



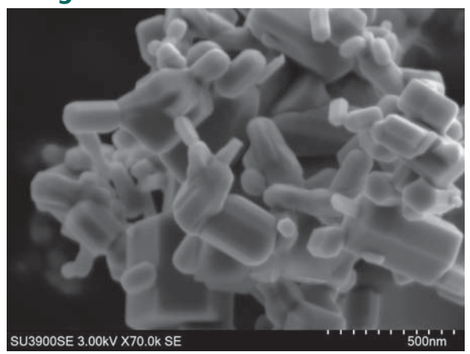
Tungsten disulfide particles
Stacked plate-like particles can be seen at the top surface.



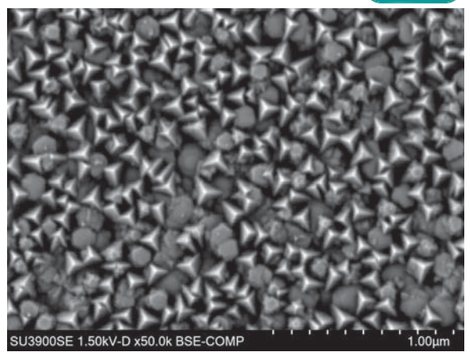
Iron particles
The fine particle shape of pure iron can be determined.

Inorganic materials

SE Plus

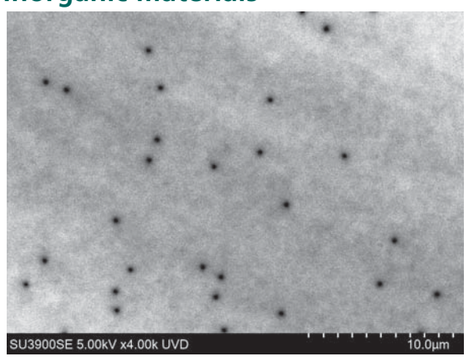


Zinc oxide particles
Fine particles with sizes of about 50 nm and 3D shape can be seen.

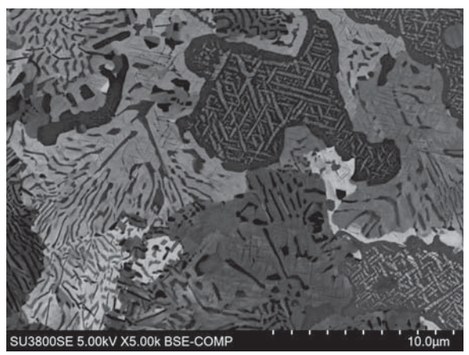


High-entropy carbide film
Distribution of particles with different compositions/shapes can be seen.

Inorganic materials

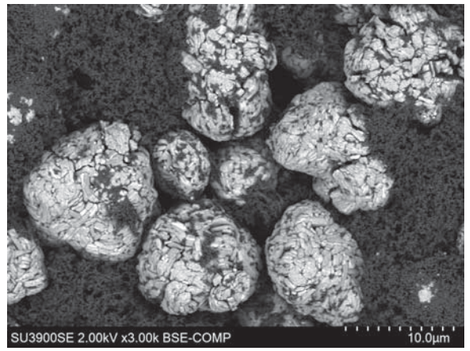


Gallium nitride substrate
Black dots indicating threading dislocations can be seen using CL signal (UVD-CL).

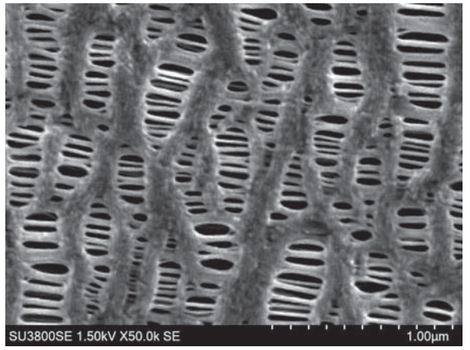


Platinum palladium alloy
Composition and crystal contrast can be clearly seen.

Batteries

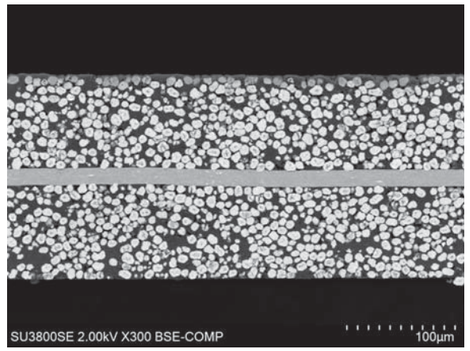


Lithium-ion battery cathode material
Distributions of cathode material particles and surrounding binder can be seen.

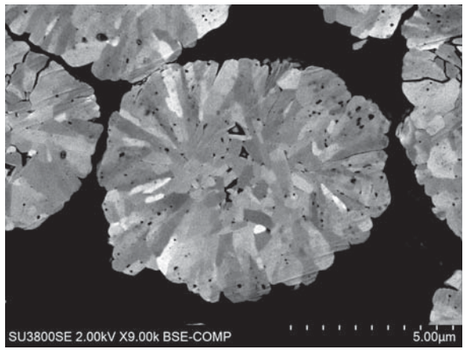


Separator
Fine pores in the network can be seen.

Batteries



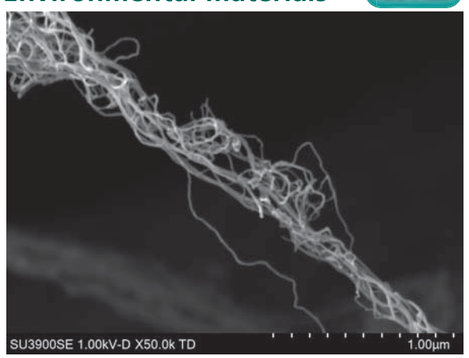
Cross section of a lithium-ion battery electrode sheet
Distributions of cathode material and binders can be confirmed over a wide area.



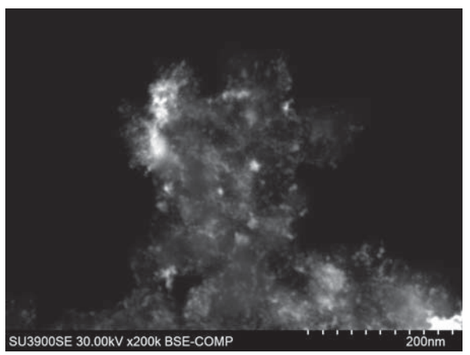
Cross section of a lithium-ion battery cathode
Crystal contrast of cathode material particles can be seen.

Environmental materials

SE Plus



Carbon nanotubes
Structure of interwoven tubes with widths around 10 nm can be seen.



Fuel-cell catalyst particles
Platinum particles in the catalyst can be seen with high contrast.