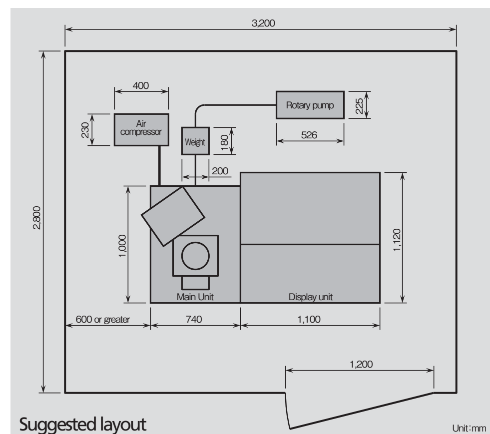
Main specifications

Spatial Resolution			1.2 nm @ 30 kV 3.0 nm @ 1 kV 2.0 nm @ 1 kV with deceleration mode *1 3.0 nm @ 15 kV Variable Pressure mode *2
Magnification			10～600,000 × (based on 4 "× 5 "picture) 18～1,000,000 × (800×600 pixels on display) 30～1,500,000 × (1,280×960 pixels on display)
Electron Optics	Electron gun		ZrO/W Schottky emission electron source
	Acceleration Voltage		0.5～30 kV (0.1 kV step)
	Landing Voltage		0.1～2.0 kV with deceleration mode *1
	Maximum Probe Current		> 200 nA
Detector			Evehart Thonley SE detector (Lower detector)
Variable Pressure Mode *2			Pressure Range：10～300 Pa
Specimen Stage	Control		5-Axis motorized stage
	Movement	X	0～100 mm
		Y	0～50 mm
		Z	3～65 mm
		T	-20～90 °
		R	360 °
	Specimen Size		up to 200 mm φ
			maximum 80 mm height
Monitor *3			23 inch LCD (1,920×1,080)
Display Mode	Large screen display		1,280×960 pixels
	Single image display		800×600 pixels
	Dual image display		640×480 pixels
	Quad image display		640×480 pixels
Image Data Saving	Pixel Size		640×480 1,280×960 2,560×1,920 5,120×3,840
Dimension and Weight	Main Unit		740(W) × 1,000(D) × 1,650(H) mm 550 kg
	Display		1,100(W) × 1,120(D) × 730(H) mm 290 kg
	Rotary Pump *3		526(W) × 225(D) × 306(H) mm 28 kg
	Air Compressor *3		400(W) × 230(D) × 520(H) mm 18 kg
	Weight		200(W) × 180(D) × 160(H) mm 40 kg
Optional Detectors	Top detector for high resolution imaging Through-the-Lens *1 Ultra Variable-Pressure Detector (UVD) Retractable five segment Backscatter Electron Detector (PD-BSD) *4 Energy Dispersive X-ray detector (EDS) Wavelength Dispersive X-ray detector (WDS) Electron Backscattered Diffraction Pattern detector (EBSD) CL detector STEM detector		

Automatic functions	Auto calibration function	
	Auto Start	
	Automatic ABCC	
	Automatic AFC	
	Automatic ASF	
	Auto Beam Blanking	
Operator assist functions	EM Wizard	Two separated mode selectable Assisting observation purpose
	Astigmatism learning	Astigmatism correction training
	Operation guide	Step-by-step operation flow guide
	Application assist	Pop-up help for suggesting cause and solution
	Tilt assist	Assisting tilt function for finding EBSD analysis available area
	Stage memory	
	Move stage	Acquired image only
	Image navigator	
	Condition save files	
	NTSC video output	
	Movie capture	
Optional Softwares	Live stereoscopic function	
	Tilt compensation fuction	
	CD measurement function	Offline CD measurement
	Zigzag capture	
	Stitch software	
Optional accessories	Cryo stage with sample preparation chamber	
	Heating stage	
	Cooling stage	
	Airlock	
	Plasma cleaner	
	Pico ampere meter	
	Faraday cup	
	Multi specimens holder	

＊1: Top detector is option, combined to deceleration function.
＊2: Variable Pressure mode is option.
＊3: option
＊4: PD-BSD is standard detector in Variable Pressure system.



Suggested layout

Notice: For correct operation, follow the instruction manual when using the instrument.
Specifications in this catalog are subject to change with or without notice, as Hitachi High-Technologies Corporation continues to develop the latest technologies and products for our customers.

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Hitachi High-Technologies Corporation

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www.hitachi-hightech.com

2015.06

Schottky FE-SEM
SU5000

HITACHI
Inspire the Next

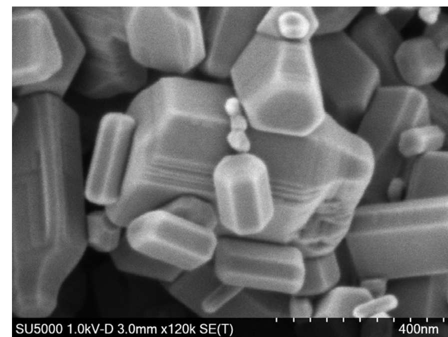
SU5000

FIELD EMISSION / VARIABLE PRESSURE SCANNING ELECTRON MICROSCOPE

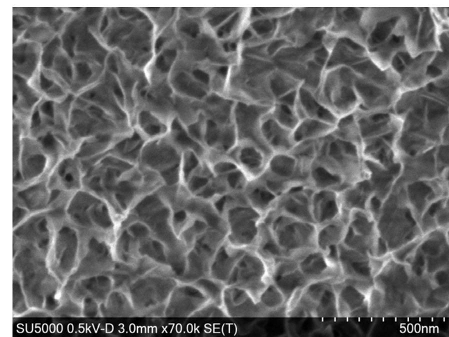
High resolution at low accelerating voltage

2.0 nm SE Image resolution at 1 kV

The SU5000 has a redesigned Schottky field emission electron gun, which produces a very fine electron beam, with high brightness and a narrow energy width. Combined with a new, low aberration objective lens, beam deceleration and an in-column detector, the SU5000 can capture high resolution images at voltages as low as 100 V.



Landing Voltage: 1 kV, Secondary Electron (SE) Image
Magnification: 120,000 x, Sample: Zinc oxide powder



Landing Voltage: 500 V, Secondary Electron (SE) Image
Magnification: 70,000 x, Sample: Anodized Aluminum oxide

High probe current with high performance

Advanced optics for >200 nA of probe current and simple switching between high and low vacuum modes

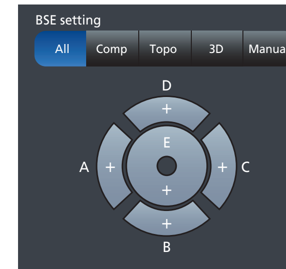
The SU5000's unique design allows for a simple transition between high vacuum and variable pressure modes. There is no need to physically change any pressure limiting apertures inside the chamber, so there is no risk of damaging anything. No aperture change also means no reduction in the imaging field of view or loss of probe current, when going from high vacuum to variable pressure. The SU5000 always provides >200 nA of current, perfect for EDX, WDX, EBSD, and CL.

	Low magnification : 10 x	Probe current: 50 nA Magnification : 50,000 x	Probe current: 200 nA Magnification : 50,000 x
HV High Vacuum < 7 x 10^{-4} Pa	SU5000 10.0kV 63.0mm x10 SE(L) 5.00mm	SU5000 30.0kV 10.0mm x50.0k SE(L) 1.00μm	SU5000 30.0kV 10.0mm x50.0k SE(L) 1.00μm
LV Low Vacuum 15 Pa	SU5000 10.0kV 63.0mm x10 UVD 15Pa 5.00mm	SU5000 30.0kV 10.1mm x50.0k UVD 15Pa 1.00μm	SU5000 30.0kV 10.0mm x50.0k UVD 15Pa 1.00μm
	No reduction in field of view between HV and LV modes	High probe current images shown at 50 nA and 200 nA for analytical work under both HV and LV modes	

Unique five segment BSE detector

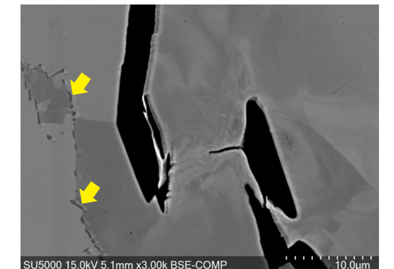
Hybrid concentric+Quad BSE detector distinguishes high angle, low angle and directional BSE signals

Concentric detectors can separate low and high angle BSEs, but have no directional information. 4-quadrant detectors are just the opposite. The SU5000's new hybrid BSED does both, revealing crystal orientation and surface (left) or compositional details (right), depending on the signal orientation to the electron beam axis.



BSED graphic showing the single inner segment and four independent outer segments

Accelerating Voltage: 15 kV, Outer segment/High angle BSE
Magnification: 7,000 x, Sample: Heat resistant steel
This accentuates the crystal orientation of the material

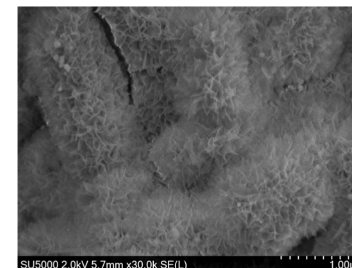


Accelerating Voltage: 15 kV, Inner segment/Low angle BSE
Magnification: 3,000 x, Sample: Heat resistant steel
This accentuates the chemical composition of the material

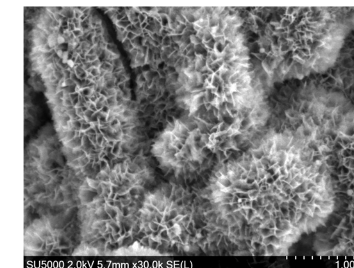
Charge Suppression Scan Technology

CS Scan for charge reduction and limiting radiation damage for beam sensitive samples

CS Scan changes the way the electron beam moves across the sample, reducing time the primary beam dwells at a location. This helps reduce sample charging and radiation damage on beam sensitive samples.



Accelerating Voltage:
2 kV, SE image
Magnification: 30,000 x
Sample: Aluminum electrolytic capacitor
Slow scan: 32 seconds
Without CS Scan

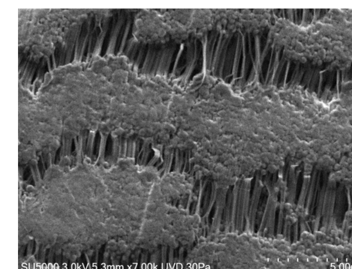


Accelerating Voltage:
2 kV, SE image
Magnification: 30,000 x
Sample: Aluminum electrolytic capacitor
Slow scan: 32 seconds
With CS Scan

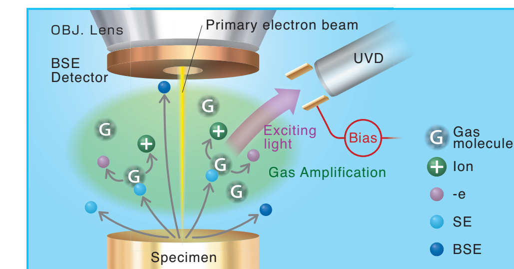
VP Mode Detection Technology

Ultra Variable-pressure Detector (UVD) for high quality, SE-like images in variable pressure mode

The UVD detects photons emitted from collisions between electrons and gas molecules in the sample chamber, creating images with excellent surface detail and topographic information in variable pressure mode. The UVD is efficient at low and high accelerating voltages, across the full pressure range of the microscope, making it a versatile tool for variable pressure imaging.



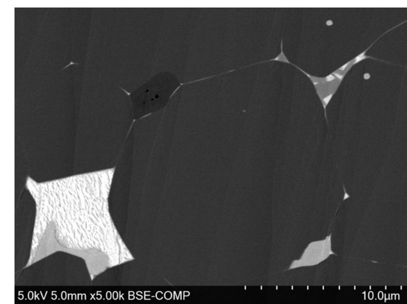
Accelerating Voltage: 3 kV, Variable Pressure, 30 Pa, UVD
Magnification: 7,000 x, Sample: PTFE



UVD Principle

" EM Wizard "

EM wizard is a completely new, knowledge-based system for SEM imaging that goes beyond basic pre-set conditions and recipes. Self-directed optical alignment, fast and accurate automated image adjustment functions and a simplified user interface redefine ease of use for a field emission SEM.



Elemental + Surface information

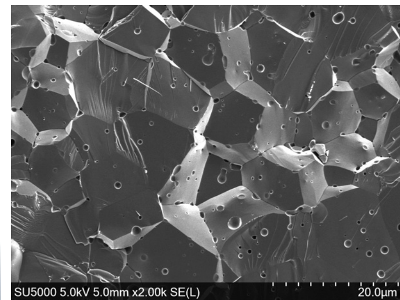
Specimen : Neodymium magnet

Any operator can acquire quality images with a few point-and-click selections, telling the SEM the intended purpose for observing the sample. Integrated visual applications assistance, practical guidance, tutorials and training tools inspire the user to learn more.

Novice or expert,
the results can now be the same.

Specimen : Ferrite core

Surface information

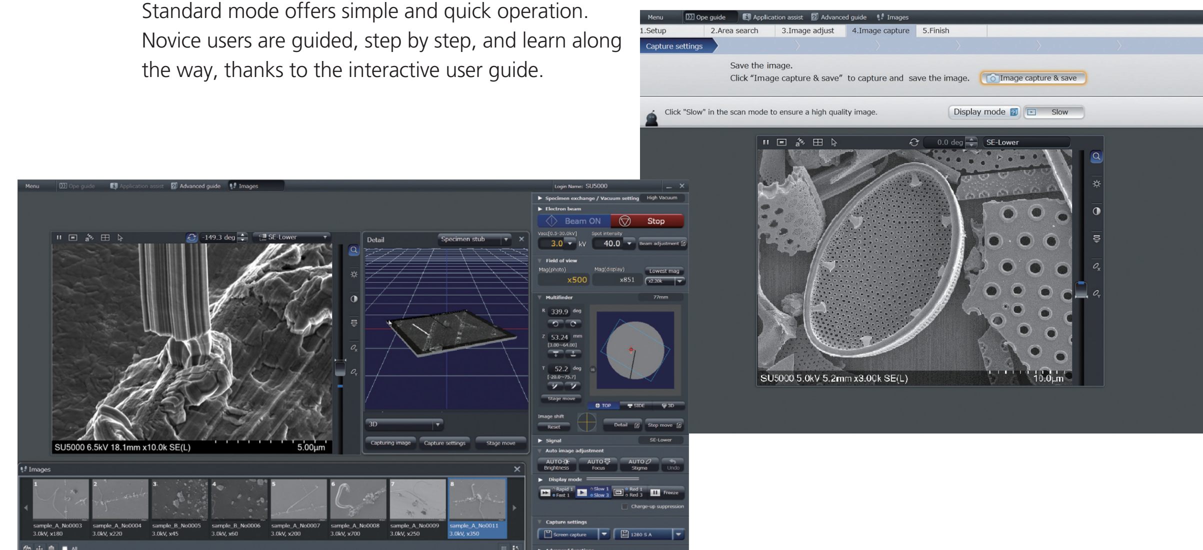


SEM image	Radar chart	Observation purpose
		Standard observation
		Surface information
		Elemental information
		Elemental + Surface information
		Element analysis+ Observation

*above table : BSD fitted configuration. BSD is option.

Intuitive user interface

Standard mode offers simple and quick operation. Novice users are guided, step by step, and learn along the way, thanks to the interactive user guide.



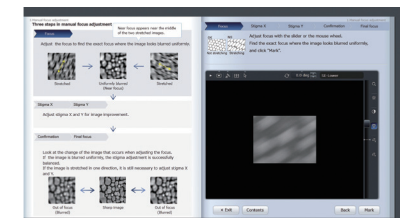
The advanced mode provides full access to all SEM controls the expert requires, with versatile control and display of multiple detector signals. The advanced 3D MultiFinder stage navigation safely carries out complex tilt and rotation stage movements, based on simple click and drag input. 3D MultiFinder also provides precise positioning of the sample's field of view for high tilt EBSD analysis.

Advanced guide

Guides the user step-by-step and educates the operator along the way.

Operation tutorial

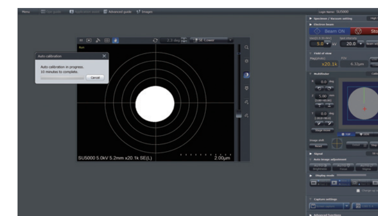
Teaches proper focus and astigmatism correction via simulations.



Powerful Automated Alignment

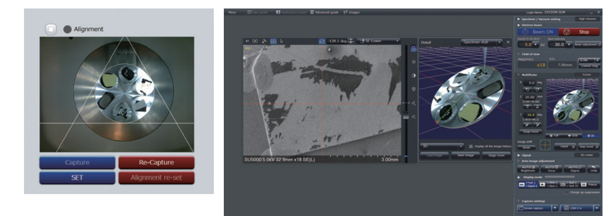
Auto calibration (US patent; #6864493)

Beam axis and astigmatism alignments are automatically calibrated, stored and then adjusted for a variety of SEM conditions, corresponding to different EM applications. It can also restore the SEM back to its "best condition" state whenever necessary.



Camera navigation

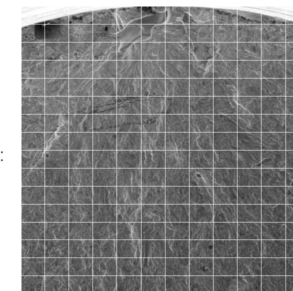
Camera navigation lets the operator quickly move the stage to an area of interest, using a low magnification digital image. The image is most often from the integrated navigation camera but can also be a low mag SEM image or imported from any digital camera source.



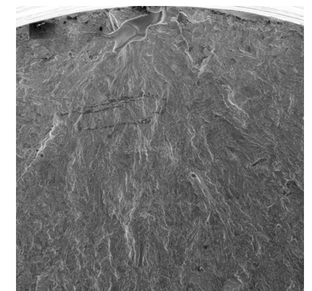
Large area SEM image*1

Multiple SEM images are automatically collected and saved to disk. Subsequent wide area SEM images are created by "stitching" together the stored images.

Metal cross section
Accelerating Voltage : 15 kV,
Magnification : 700 x



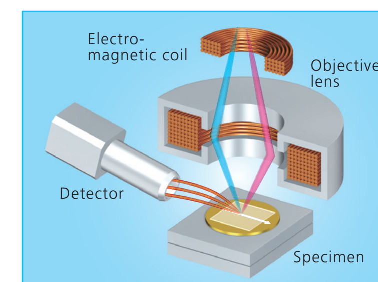
Total 192 images (16 x 12) automatically stored.

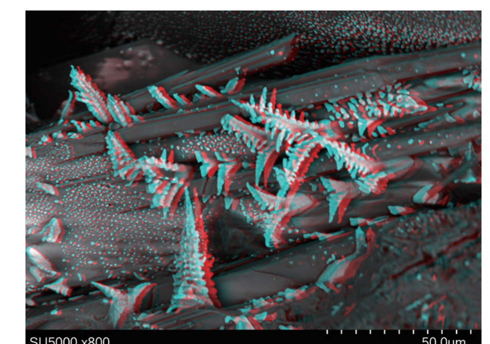


Wide area SEM image can be created after stitching 192 images.

Live Stereoscopic Imaging Function

Live stereoscopic imaging enables real-time 3-D SEM viewing, without tilting the specimen. Live stereoscopic images are generated by rapidly alternating the electron beam tilt angle, to yield left and right parallax images. The parallax images are then synchronized and observed directly with colored 3D eyeglasses.





*1 Optional

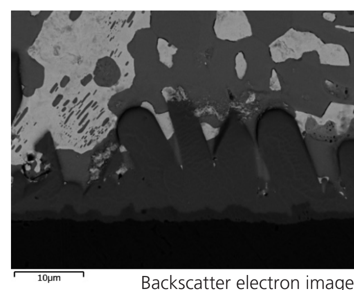
Analytical Versatility — Multi-functional Specimen Chamber

The large SU5000 analytical chamber has 11 ports to accommodate various accessories and supports simultaneous EDX, WDX, and EBSD. The drawer style chamber with door mounted stage provides for safe and easy sample exchanges, with a fast 3 minute pump down time.

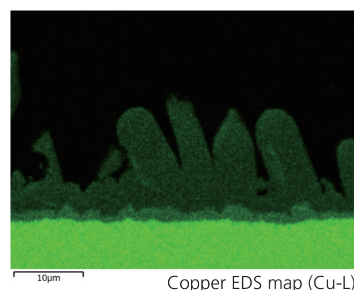
EDS[*1]

Sample: Bonding solder (Cross-section)
Accelerating voltage: 15 kV, Ip: 2 nA
Acquisition time: 5 min

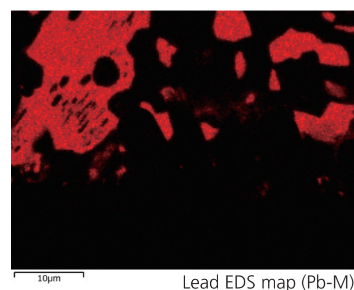
The pictured EDX and EBSD and WDX components are optional



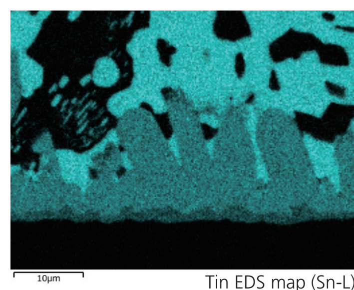
Backscatter electron image



Copper EDS map (Cu-L)



Lead EDS map (Pb-M)

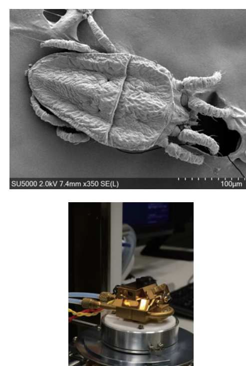


Tin EDS map (Sn-L)

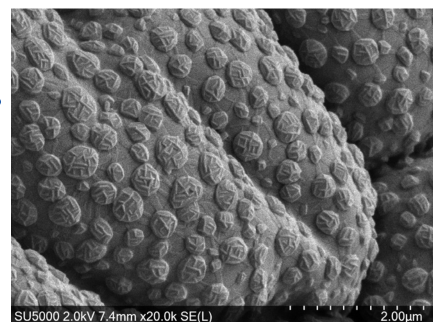
Cryo stage[*1]

Cryo preparation for SEM is a common form of observation for "beam sensitive" specimens.

The pictured Cryo-SEM system is optional

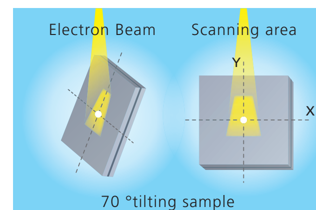


Cryo stage attachment

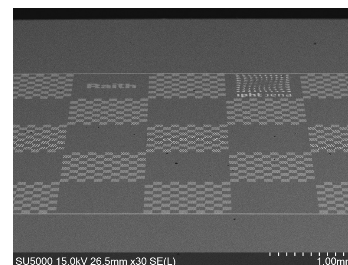


Accelerating Voltage: 2 kV, SE image
Magnification: 2,000 x, Sample: Brevipalpus (Mite)
Cryo temperature: -120 ℃
Brevipalupus species have different surface contours.
Sample courtesy of USDA, ARS - Beltsville, MD
Drs. Gary Bauchan & Ronald Ochoa

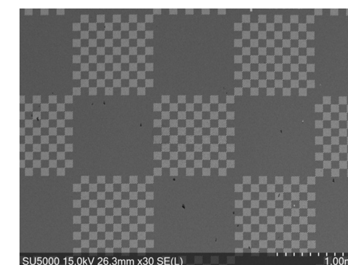
EBSD[*1]



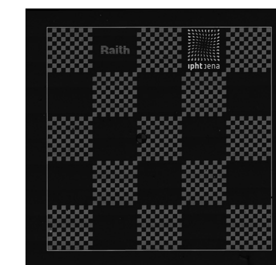
EBSD requires a sample to be tilted to 70 deg. This high tilt condition causes substantial trapezoidal image distortion of rectangular areas, due to changes in focus, magnification, beam rotation and other factors. Traditional routines, such as dynamic tilt and focus compensation, attempt to correct for these distortions, but close inspection reveals that spatial inaccuracies remain. Hitachi has developed a new solution that corrects for all conditions to maintain the precise shape and dimensions of the original area. For EBSD, this is essential for reliable grain measurements and accurate stitching of multi-field orientation maps.



70 deg tilt
Without tilt compensation
Magnification: 30 x

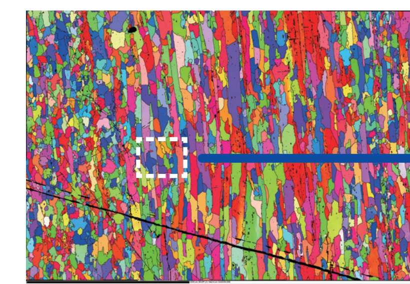


70 deg tilt image
With tilt compensation
Magnification: 30 x



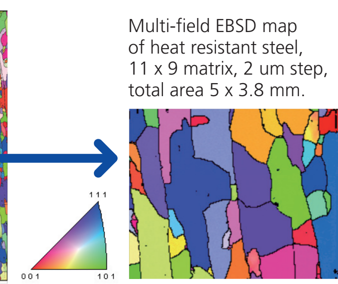
10 x 8 montage at 70 deg tilt.
Total Area is Approx. 6 mm x 6 mm
Showing precisely corrected trapezoid and accurate stitching.

BC map



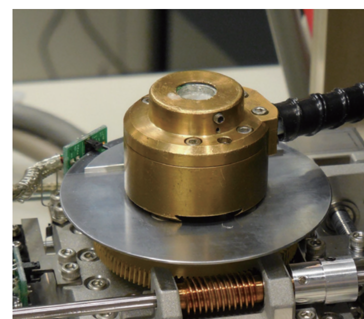
IPF-Z map

Multi-field EBSD map of heat resistant steel, 11 x 9 matrix, 2 um step, total area 5 x 3.8 mm.

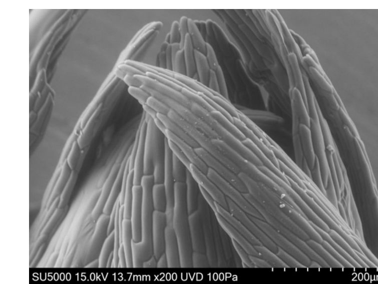


Cooling stage[*1]

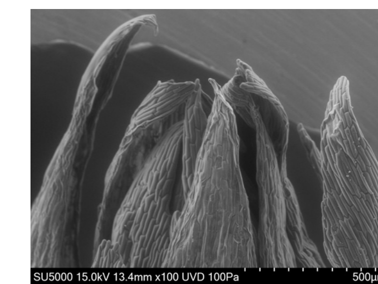
Peltier cooling of specimens (0 to -50 ℃) can be utilized to slow the evaporation process under vacuum, thus allowing ample time to locate the area of interest and generate images.



The pictured peltier cooling stage device is optional



Accelerating Voltage: 15 kV, UVD image
Sample: Asparagus
Temperature: -20 ℃, Vacuum: 100 Pa,
Observing after 10 minutes evacuation



Accelerating Voltage: 15 kV, UVD image
Sample: Asparagus
Temperature: Ambient, Vacuum: 100 Pa,
Observing after 3 minutes evacuation