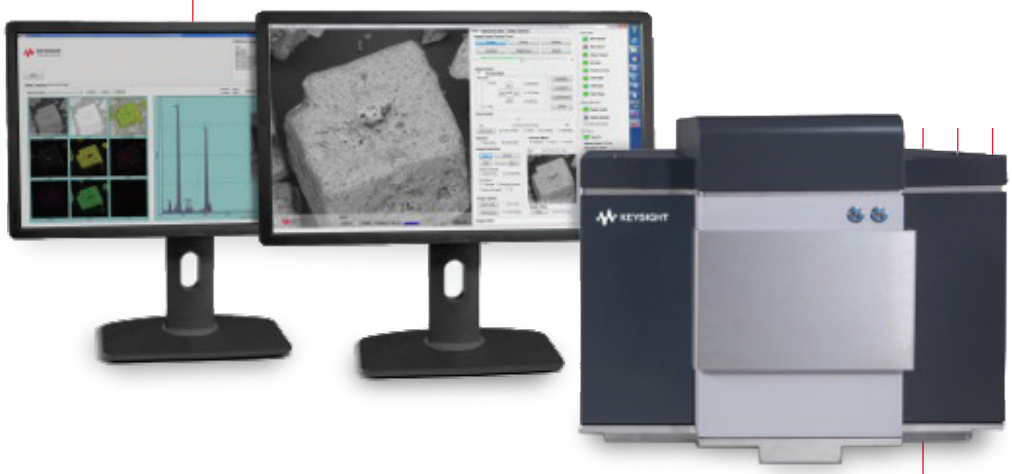
Keysight 8500B
Field-Emission Scanning Electron Microscope

Low-voltage high-resolution imaging with integrated energy dispersive spectroscopy



Data Sheet

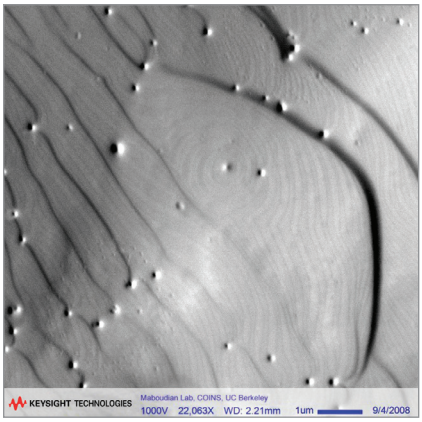
KEYSIGHT TECHNOLOGIES

Unlocking Measurement Insights

Overview

The new Keysight 8500B FE-SEM offers researchers a field-emission scanning electron microscope (FE-SEM) right in their own laboratory. This compact, innovative system is optimized for low-voltage imaging, extremely high surface contrast, and resolution typically found only in larger more expensive field-emission microscopes.

With a footprint of only 581x 670mm, the 8500B FE-SEM is easy to install and use. No dedicated facilities are required. The 8500B FE-SEM delivers consistent, reproducible performance and the industry's lowest cost of ownership for an FE-SEM.



Topographic image of a single crystal of 6H-SiC (courtesy of University of California, Berkeley).

Ultimate Ease of Use

The 8500B FE-SEM's powerful software package features an intuitive user interface designed for novice and expert users, an ideal choice for multiple-user environments. Password protection may be implemented to secure selected operating parameters and allow changes only by designated users.

Sample preparation and loading is both simple and fast. An X, Y, Z programmable stage lets users set specific coordinates, scan and then store the locations to repeat experiments with precision and confidence.

The electron source, the electron beam column, and the electron detector of the 8500B FE-SEM are all combined in a replaceable cartridge. When the longlasting electron source is finally depleted, the entire cartridge can be replaced to provide the 8500B FE-SEM with not only a new source of electrons, but a new prealigned electron beam column and a new microchannel plate detector.

Novel Design

Keysight's patented technology employed in the 8500B FE-SEM embodies the successful miniaturization of the core technology in conventional scanning electron microscopes. The electrostatic lens design delivers consistent, repeatable performance without constant retuning due to hysteresis effects in the magnetic lenses in conventional SEMs.

The 8500B FE-SEM is optimized for low-voltage imaging and sub-10 nm resolution. Its thermal field-emission electron source provides high signal-to-noise ratios and consistent, long-lasting performance, while secondary and backscatter electron detection provides a rich data set for each sample.

Key Features

- Resolution and imaging comparable to that of conventional much larger FE-SEMs
- Topographic imaging mode to resolve sub-nanometer features with depths of field unachievable with traditional SEMs
- Keysight's patented miniature electrostatic lens design ensures repeatable performance without constant re-tuning
- Variable low voltage greatly reduces charging and the need for sample coating
- A fully integrated EDS system with qualitative and quantitative elemental analysis: choose standardless quantitative analysis, analysis with standards or a combination of standardless and standardized quantitative analysis
- Keysight's patented event-streamed spectrum imaging provides ultra-fast mapping and saves the full spectrum at every pixel for analysis and display
- Export EDS results for off-line analysis
- Changing samples is easy and fast with a pump-down time of less than 3 minutes
- Programmable X, Y, Z stage allows users to set precise coordinates, scan, and save information for later work sessions

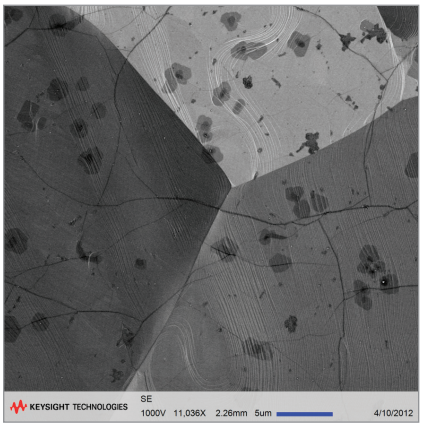
Enhanced Imaging

With multiple imaging techniques for improving surface contrast and increasing depth of field, the 8500B FE-SEM allows nanoscale features to be observed on a wide variety of nanostructured materials, including polymers, thin films, biomaterials, and other energy-sensitive samples on any substrate, even glass.

The system's continuously variable imaging voltage is tunable from 500 to 2000 volts as an operational parameter rather than a setup choice. Operating at a low voltage essentially eliminates charging of non-conductive samples: there is no need to coat samples or operate at a low vacuum, which can mask nanoscale features and degrade resolution.

The 8500B FE-SEM utilizes a four-segment microchannel plate (MCP) detector to provide topographic imaging. This detector collects both backscattered and secondary electrons. It may be operated either in standard mode, adding together all the channels, or in topographic mode in which opposite sides of the detector are dynamically subtracted. This technique has been demonstrated to clearly resolve sub-nanometer atomic steps on the surface of crystalline substances such as polytypes of silicon carbide.

BSE image of uncoated pollen.



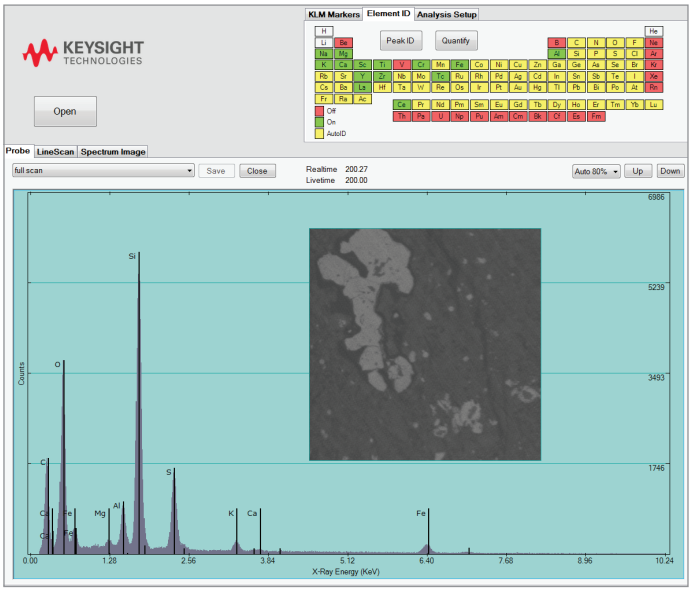
SE image of CVD graphene on Cu foil.

Fully Integrated EDS

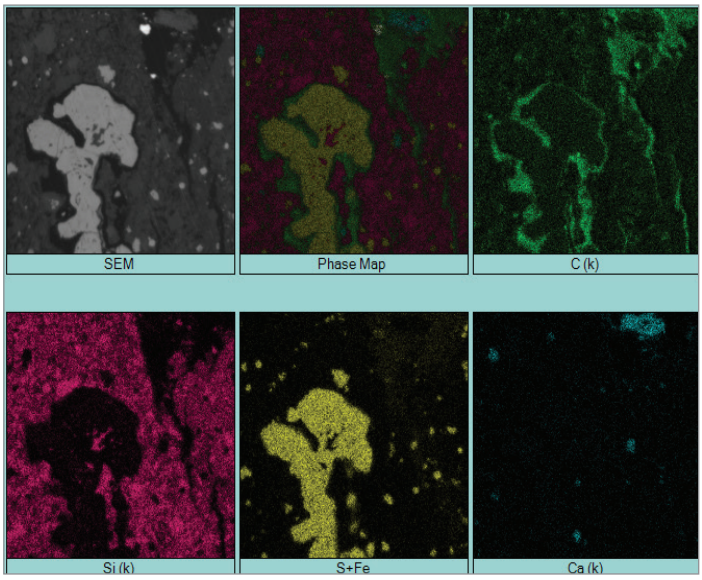
The EDS system of the 8500B FE-SEM is a configurable option that features a silicon-drift x-ray detector, digital multichannel analyzer and an intuitive software interface. The system collects, displays, and analyzes x-ray microanalysis data with an easy-to-use toolset that is integrated with the imaging toolset.

Perform quantitative analysis on a selected area, line, point or multiple points. Select standardless quantitative analysis, analysis with standards or a combination of standardless and standardized quantitative analysis. Results are analyzed and displayed in real time and can be exported for further off-line analysis.

Keysight's patented event-streamed spectrum imaging saves the full spectrum at every pixel for analysis and display. Dynamic element mapping allows real-time selection or editing of elements and processing parameters during spectrum image collection.



Spectrum of gas shale with KLM markers



Spectrum image of gas shale sample

8500B FE-SEM Specifications

Performance	
Beam voltage	500 to 2,000 V
Beam current	0.2 to 1 nA
Resolution	< 10 nm at 1,000 V
Magnification	250 to 200,000X*
Scan field	1 x 1 mm (max)
Electron source	Schottky field emission
Detector modes	SE, BSE, Topo
Piezo motorized stage	1 µm accuracy; X, Y, Z travel 50 x 50 x 15 mm
Sample parameters	
Sample size	100 x 60 mm (max); 30 mm thick (max)
Viewable area	50 x 30 mm (max)
Sample mounts	Standard SEM stubs
Imaging	
Image formats	JPEG, TIFF, BMP, PNG
Image resolution	User selectable up to 2048 x 2048 pixels
Scan rate	Slow scan to video rate
Noise reduction	Frame and pixel averaging
Optional EDS	
Detector	Peltier-cooled silicon drift with 25 mm^2 sensor Resolution of 134eV or better FWHM at Mn Ka
Element detection	Carbon to Americium
Analysis	Automatic, manual or mixed peak ID Quantitative (ZAF) analysis with and without standards and mixed
Spectrum imaging	Ultra-fast acquisition Resolution up to 2048 x 2048 pixels
Save/Export file formats	JPEG, TIFF, BMP, MSA and Excel
Sample size	25 mm diameter (max); 15 mm thick (max)
Landing energy range	500–15,000 V
System control	
PC	Windows 7 with 2 flat-panel displays
Vacuum system	
Chamber vacuum	$1e^{-4}$ Torr
Pumpdown time	< 3 minutes from standby mode
Turbo pump	80 liters per second
UHV pump	Ion pump with gettering
Dimensions; weight	
Microscope	581 (W) x 670 (D) x 469 (H) mm; 87 kg
Pump unit	203 (W) x 254 (D) x 203 (H) mm; 4 kg
Installation/operating requirements (compressed air, dry nitrogen,** and water are not required)	
Power	100/120/220-240 VAC; 50/60 Hz and outlet for PC and displays
Operating temperature	5 to 35 °C
Humidity	Up to 80% RH

* Electron optical magnifi cation relative to a 205 x 205 mm displayed image size.
** A N_2 vent port is configured and available.

KEYSIGHT TECHNOLOGIES
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Nano Mechanical Systems from Keysight Technologies

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