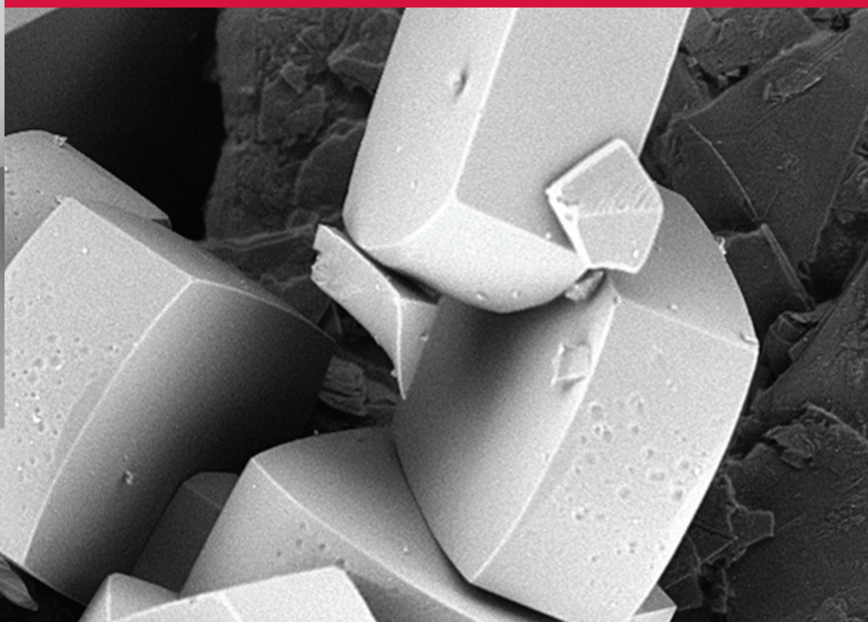
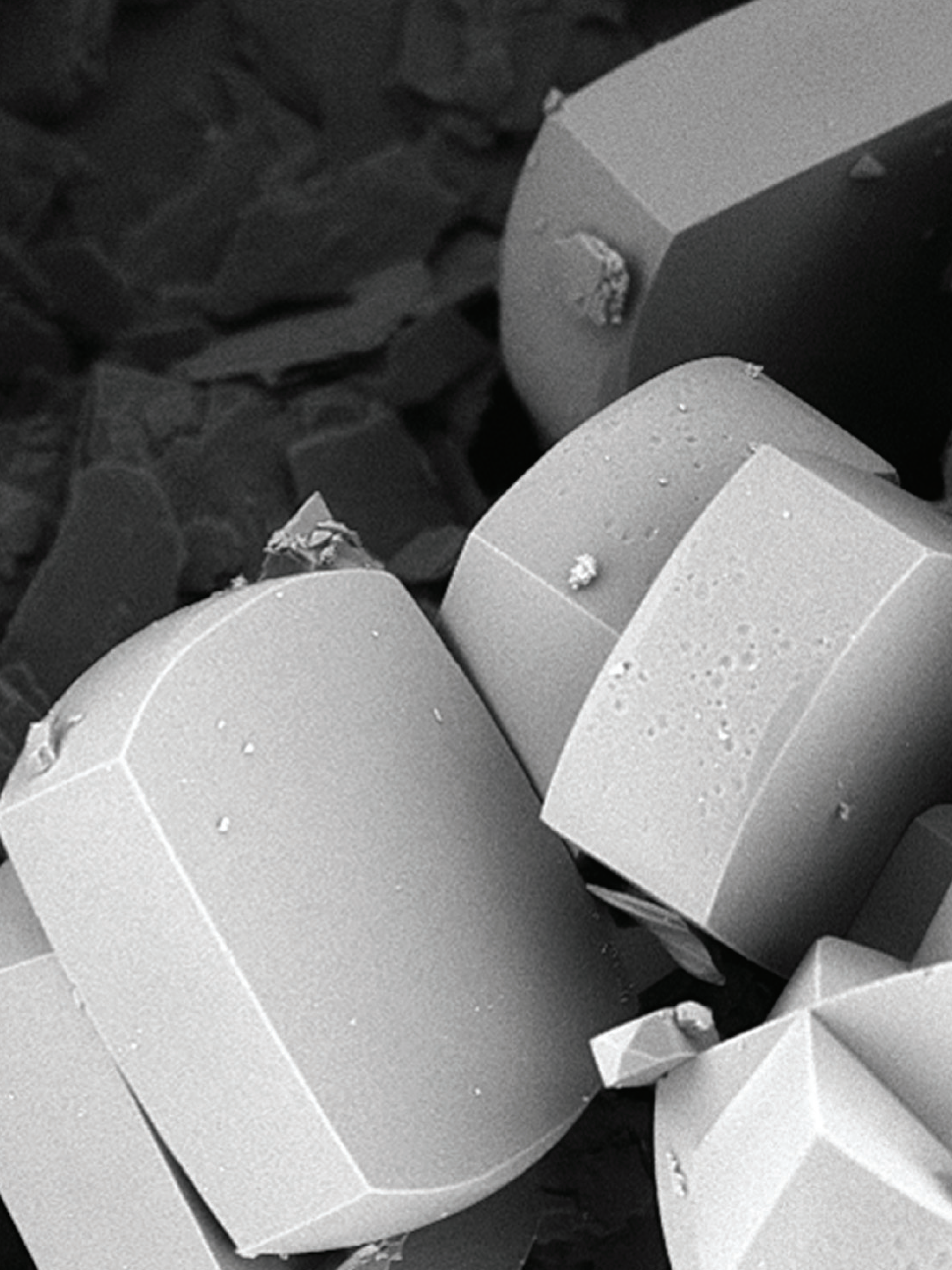
Nova NanoSEM

Superior Imaging and Analytical Performance





FEI Nova NanoSEM™ scanning electron microscopes combine best-in-class imaging with superb analytical performance in one easy-to-use instrument. Specifically designed to simplify laboratory operations, the Nova NanoSEM enables you to increase productivity without compromising the image and analytical quality that you demand.

Gain an Advantage

Outstanding imaging. Powerful analytics. All combined with unmatched ease of use and performance to give you a research advantage.

<< Zeolite particles imaged in high-vacuum mode with charge filtering. Recent applications of zeolite particles include catalytic cracking and refining, and purifying natural gas and petroleum chemicals.

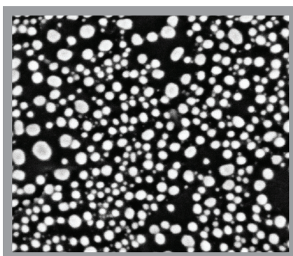
Research with No Compromises

Most SEMs are designed to deliver high-performance imaging or high-performance analytics. With the FEI Nova NanoSEM, you can have both. The Nova NanoSEM allows you to easily switch instrument conditions based on sample type or the type of analysis you want to perform. Expand your research capabilities and achieve better answers with access to the most comprehensive information available. And, ultimately, achieve better research results.

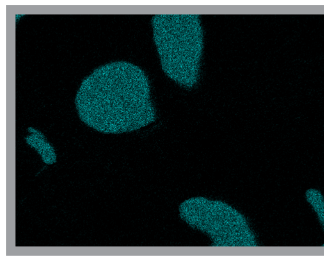
Best of Both Worlds

High-resolution imaging. Achieve 1.4 nanometer (nm) resolution in high-vacuum mode and 1.8 nm resolution in low-vacuum mode when using low-voltage [1 kV] operation. Gain the benefits of low-vacuum imaging with sub 2 nm resolution.

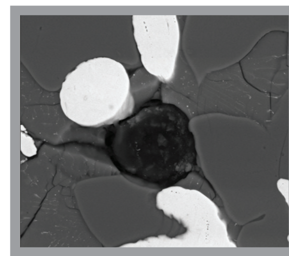
Powerful analysis. Gain top-quality analytical data on samples including glass, ceramics, and other non-conductive materials with high performance in low-vacuum mode.



Gold on carbon. Sample imaged in high-vacuum mode achieving better than 1.4 nm resolution.



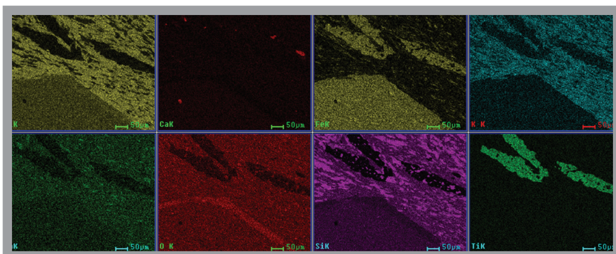
Ceramic sample. Low-vacuum EDX map showing Zirconium rich areas.



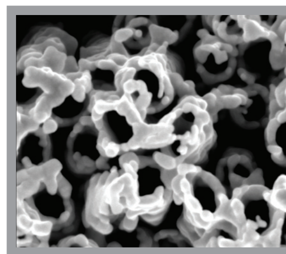
Ceramic sample. High-resolution image acquired in low-vacuum mode.

High-resolution bright field STEM image of a NiTiZr shape memory alloy. This material is a lightweight, solid-state alternative to conventional actuators such as hydraulic, pneumatic, and motor-based systems.

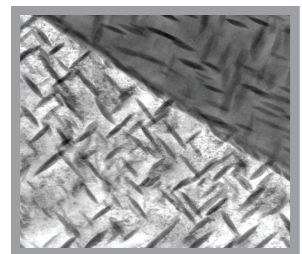
Superior image quality. Achieve high image quality across a wide range of samples. Accelerate EDS/EBSD/CL/analytical research with high-current beam and high resolution at both high and low voltages.



EDX map. High-resolution map acquired in 30 seconds using > 100 nanoamperes (nA) of beam current.



Titanium oxide nanotubes. High-resolution image acquired at 2 kV.



Shape memory alloy. Bright field STEM image.

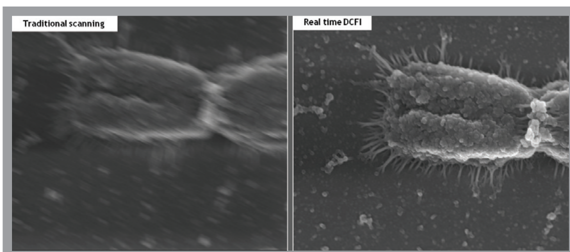
It's Easy to Use

The Nova NanoSEM allows researchers to achieve high-performance SEM analysis regardless of their experience level. Every researcher—not only the "microscopists"—can easily repeat analysis, acquire an accurate measurement, and characterize samples. Ease of use also enables researchers to maximize their research time. The Nova NanoSEM simplifies the process of setting parameters and swapping detectors, and it eliminates the need to coat samples, increasing productivity and optimizing precious time on an instrument.

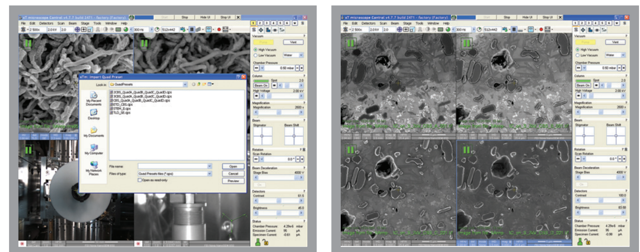
Optimize Productivity

Point-and-shoot functionality. Smart presets allow rapid data acquisition to provide answers quickly.

Quick save and recall. Tailor presets to users' preferences, save them, and quickly recall them to save time and improve repeatability.



DCFI. Automatic real-time alignment of each frame during integration ensures that no drift effects are present when imaging challenging samples or when imaging in difficult environments.



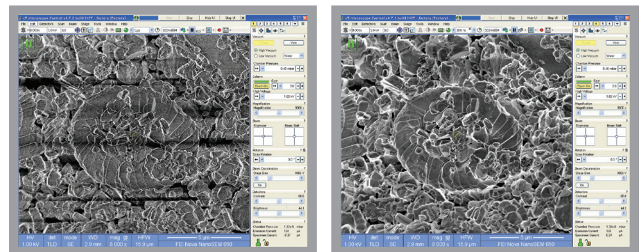
Quick presets. For example, operators can switch from SE + BSE imaging to four simultaneous images from the DBS detector using simple presets for screen layout and imaging conditions tailored to individual needs.

Ceramic coating on steel imaged at 2 kV. SEM imaging of ceramic coatings can provide insight into failure mechanisms, crack formation and analysis, and coating conformity as well as identify the phases present.

Automatically align and calibrate. Optimize laboratory productivity by quickly making the system ready for the next user and application.

Smart navigation features. The Nav-Cam™ automatically links the macro scale with the nano scale to ensure that the operator is never lost in the sample. Smart features simplify repeat analysis and reduce time spent on navigation by 15 to 20 percent.

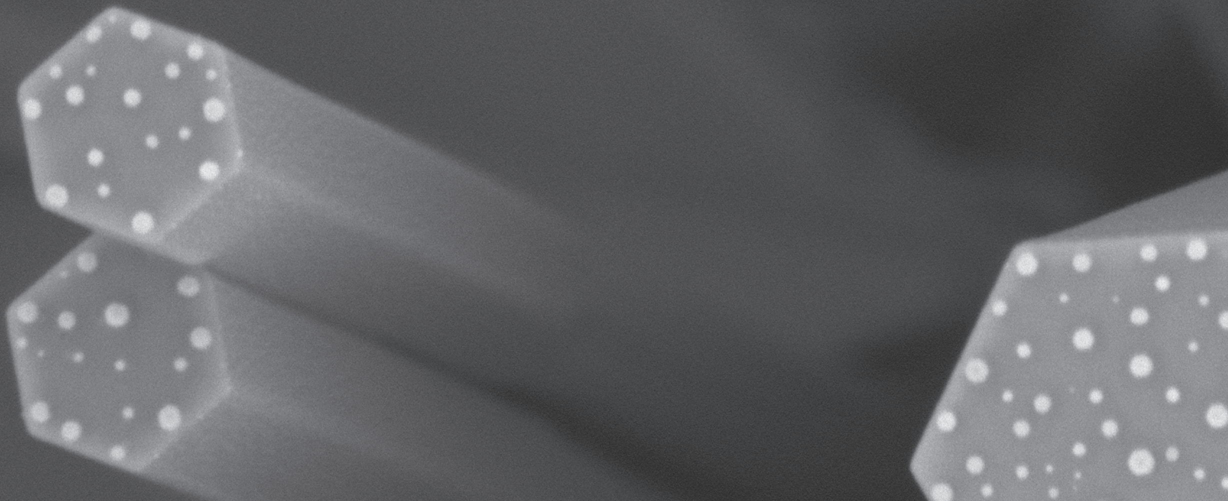
Simplified organization. Arrange user presets by sample type, operator, and application to control analysis quality and help ensure replicable results—even with multiple operators and differing experience levels.



User Interface. Optimizing imaging conditions on difficult samples, such as this easily charging uncoated chalk, is achieved easily. An operator can reference a new preset and achieve optimal results with a single click of a mouse. Slow scanning (left image) shows charge buildup, while interlaced scanning (right image) allows for the charge to dissipate, achieving optimal charge-free imaging in a single click.

Best-in-Class Performance

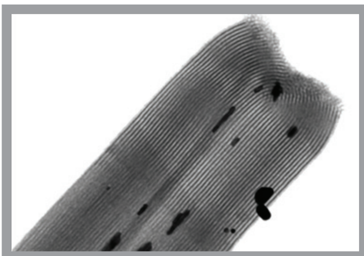
Nova NanoSEM is precisely designed to deliver the highest quality results in the least amount of time. With materials that are sensitive to beam damage or contamination, the Nova NanoSEM maximizes the amount of data captured per scan before the sample becomes unusable. For example, with functionalized Zinc Oxide nanorods, data delivered by the Nova NanoSEM's superior imaging and analysis features help answer questions such as "What is the size and distribution of catalyst particles on the nanorods?"



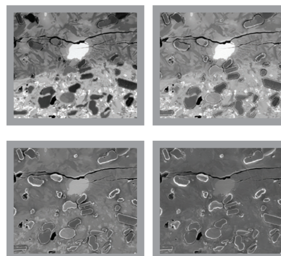
Sensitivity with Flexibility

Powerful beam deceleration technology. Achieve high resolution with low beam currents, minimizing damage to sensitive samples.

Advanced detection system. Collect more information than traditional SEM instruments. FEI's proprietary DBS detector captures information from every angle to make every electron count.



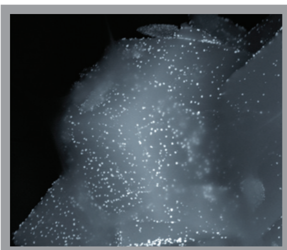
Mesoporous silica. Bright field STEM image showing 4 nm pores together with catalyst particles.



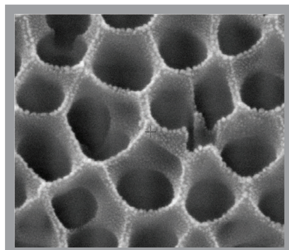
Hydroxyapatite. Four individual images of ceramic coating on steel acquired simultaneously using the DBS detector. Topographic, material, and orientation contrasts—all easily achieved.

Zinc Oxide Nanorods with Palladium particles on the surface imaged at 500 V in high vacuum. The addition of Palladium increases the sensitivity to hydrogen for sensor applications.

Configuration flexibility. From high vacuum to low vacuum and high voltage to low voltage, get the sharpest, high-contrast, low-noise images over a full range of real-world samples.



Gaseous analytical detector (GAD). Allows for high-resolution BSE imaging and analysis of these catalyst particles in low vacuum.



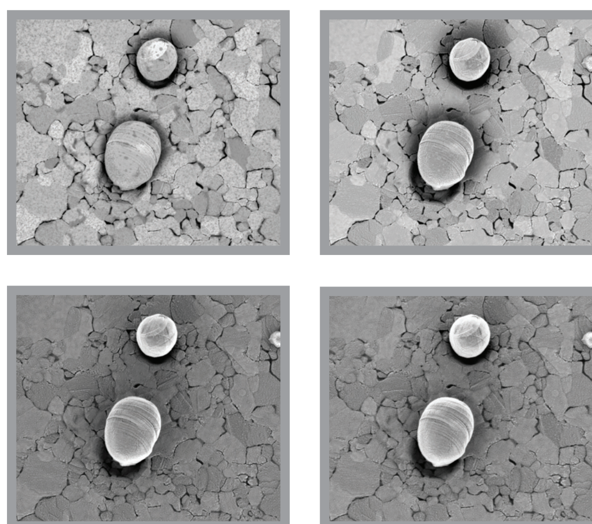
Al_2O_3. This is an ultrahigh-resolution image of the surface of Al_2O_3 acquired in low vacuum with the FEI Helix™ detector.

Nova NanoSEM. Superior imaging and analytical performance.

Technology Innovation Enhances Performance

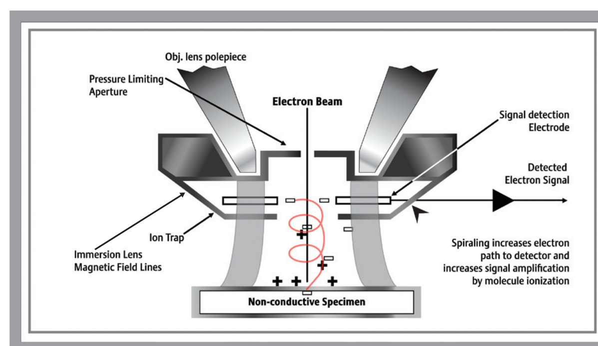
FEI technology innovation gives the Nova NanoSEM unique capabilities that enhance performance and deliver reliable, accurate results that other SEM systems cannot match.

Directional backscatter detector. A directional backscatter (DBS) detector simplifies interpretation of various contrast mechanisms. Backscattered electrons (BSEs) carry topographic, channeling, and compositional information. BSEs exiting the sample surface at high angles, close to the beam axis, carry more sample composition information. BSEs at lower angles, closer to the sample surface plane, provide more topographic information. The Detector includes four annular segments concentric with the beam, allowing it to discriminate BSEs by angle and capture comprehensive information in one scan. Select any or all segments, in any combination, to create the image that best meets analytical requirements while improving time to data, minimizing sample damage, and gaining unique insights into the sample.



Gold sample. Gold sample image acquired at 1 kV. Simultaneous detection is achieved easily using four annular rings of the DBS detector. This reveals orientation and topographic information as shown.

Helix and gaseous analytical detectors. FEI Helix and gaseous analytical detectors are specifically designed for low-vacuum applications to deliver uncompromised analytical and imaging performance when characterizing non-conductive samples. The Helix detector balances the need for short working distances, to minimize beam diameter in immersion mode, against the requirement for long gas path lengths for emitted secondary electrons to provide sufficient signal amplification. Secondary electrons and additional electrons created by ionizing gas molecules are forced by the lens field to follow a longer spiral path, increasing the number of ionizations in the cascade amplification process and hence the signal gain.



Helix. Schematic drawing showing operation of the Helix detector.

The GAD reduces the scattering of beam electrons in low-vacuum imaging and analysis. Scattered beam electrons land on the sample surface outside of the beam impact area, adding background to images and generating characteristic X-rays that are not indicative of sample composition at the beam location. The cone-shaped GAD extends from the bottom of the pole piece, surrounding the beam and extending the higher-vacuum region of the lens interior closer to the sample surface. This positioning significantly reduces the distance that the beam travels through the low vacuum of the sample environment, the number of beam electrons scattered, and the distance they land outside of the beam spot.

Advanced navigation. Nav-Cam and correlative navigation solutions enable fast, easy navigation around a sample. The Nav-Cam is mounted on the chamber so that it can be used in a repeatable position over the sample. After mounting the sample holder on the stage, capture and save an image, which is presented on the system display. To position a feature under the beam, use the mouse to designate a target on the Nav-Cam display. A green box on the Nav-Cam image continuously indicates the current position and orientation of the scanned area.

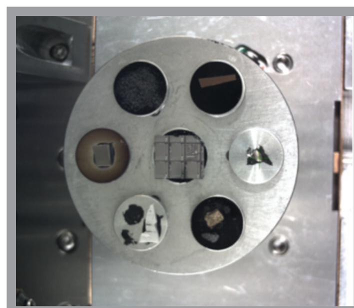
Correlative navigation software allows the use of an image file from another imaging device, such as a light microscope, for navigation. Once the file is imported into the software, a fast visual calibration procedure registers the external image with the SEM display. After registration you can move automatically to any location by simply designating the target in the external image.

Plasma cleaner and cryo trap. Dark rectangles caused by volatile contaminants in the chamber atmosphere that appear at the location of the scanned area after image acquisition can easily obscure fine details of the sample surface. This is especially true when operating at low beam energies. The Nova NanoSEM plasma cleaner uses energetic particles to remove contamination from chamber surfaces. It can also be applied briefly to the sample itself to remove contamination. The cryo trap is designed to attract and immobilize contaminants to a cryogenically cooled surface positioned near the sample.

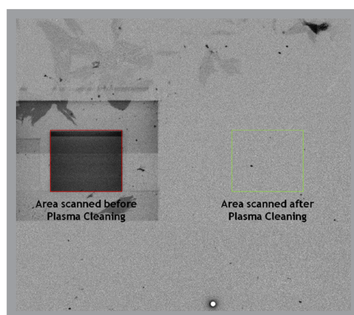
For More Information

Visit **FEI.com/NovaNanoSEM**

Nav-Cam. The fixed position of the Nav-Cam enables repeatable navigation without realignment.



Nav-Cam. A 5-megapixel color image of the stage enables easy sample identification with zoom.



Plasma cleaning. Ultralow-energy imaging is easily achieved with this technology, producing the finest surface detail without damaging the sample.

About FEI Company

With more than 60 years of microscopy innovation and leadership, FEI provides the widest range of electron, ion, and digital light microscopy instrument, workflow, and application expertise in the industry. FEI solutions help customers worldwide answer questions, make breakthrough discoveries, accelerate time to market, and achieve competitive advantage. Rich problem-solving experience from across the electronics, life sciences, materials science, and natural resources markets enables FEI to bring fresh perspectives to customers' challenges, whether small and simple or large and complex. FEI people and solutions drive research, propel progress, and ultimately help change the world.

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TÜV Certification for design, manufacture, installation, and support of focused ion- and electron-beam microscopes for the Electronics, Life Sciences, Research, and Natural Resources markets.