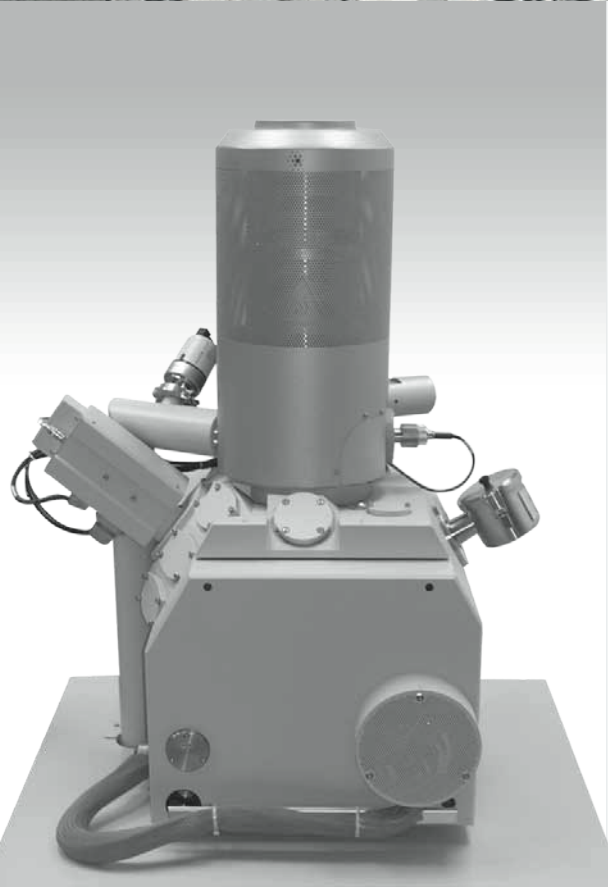


Nova™ NanoSEM 30 Series

The most versatile ultra-high resolution FESEM combining very low kV imaging and analytical capabilities with unique low vacuum performance to meet your most demanding nanoscale characterization requirements

The Nova™ NanoSEM 30 Series is a family of ultra-high resolution field-emission SEMs specifically configured to get the most information out of the largest selection of samples, down to the nanometer level. The Nova NanoSEM 30 Series dramatically expands the capabilities of its predecessor in low and very low kV characterization as well as in its analytical capabilities: access to sub-100 V imaging with high surface sensitivity, superb low kV BSE and faster analysis are now possible.

Featuring advanced optics that include a 2-mode final lens (immersion and field-free), SE/BSE in-lens detection (through-the-lens detector, TLD) and beam deceleration technologies, the Nova NanoSEM 30 Series is a complete solution for ultra-high resolution characterization at high and low voltage in high vacuum. This is complemented by the Nova NanoSEM 30 Series unique low vacuum characterization capabilities: thanks to its Helix™ detector technology, ultra-high resolution is achieved even on non-conductive nanomaterials and/or devices. Using low vacuum, electron-beam induced contamination resulting from previous sample processing steps is efficiently suppressed.

The Nova NanoSEM 30 Series also offers the most extensive set of tools for nanoprototyping, including an on-board digital pattern generator and dedicated patterning software, a high-speed electrostatic beam blanker, gas injection systems for direct electron beam writing of nanostructures, as well as a unique high-precision and -stability 150 mm piezo stage on the Nova NanoSEM 630.

Spectacular results have been obtained on a variety of challenging nanotechnology materials such as metals, magnetic materials, nanoparticles and powders, nanotubes and -wires, porous materials (e.g. silicon), plastic electronics, glass substrates, organic materials, diamond films, cross-sections etc. Add nanoanalysis capabilities such as EDS, EBSD or STEM BF / DF / HAADF, and you have in the Nova NanoSEM 30 Series a powerful solution for the most demanding characterization needs at the nanoscale.

Key benefits

- Field emission SEM with ultra-stable, high current Schottky gun
- Advanced optics and detection, including an immersion mode, beam deceleration, in-lens TLD-SE and -BSE, vCD and STEM for best selection of the information and image optimization
- Beam landing energy down to 50 V
- 1.6 nm @ 1 kV without beam deceleration
- World's only true high-resolution low vacuum FESEM: 1.8 nm @ 3 kV
- Up to 100 nA for analysis in high or low vacuum
- Integrated 12-bit scanning/patterning engine solution for e-beam prototyping included as standard
- Ultra-clean scroll- and turbo-pumped vacuum system
- 150 x 150 mm high precision and stability piezo stage (Nova NanoSEM 630)

Nova NanoSEM 30 Series key features

Unique image optimization capabilities

High-performance 2-mode final lens

- With an immersion mode for ultra-high resolution performance, especially at longer working distances and on tilted samples
- With the field free mode for flexible high resolution work, including EBSD

Multiple detector systems for maximum analytical flexibility

- Side secondary electron Everhart Thornley detector - ETD
- In-lens secondary and backscatter electron detector - TLD
- Low-voltage high-contrast backscatter electron detector – vCD, with large collection angle – located below the lens and retractable
- Retractable STEM 14 segment BF / DF / HAADF
- Helix detector for ultra-high resolution at low pressure
- Low Vacuum Detector (LVD) for analytical work using high accelerating voltages over a wide range of pressures
- BSED/GAD for TV-rate backscatter at high and low pressures

Low-voltage high-contrast detector (vCD)

Sub-1 kV backscatter imaging. Paired with beam deceleration, the vCD allows extremely low kV imaging that can be optimized for topography, materials and/or crystallographic contrasts.

Beam deceleration with large stage bias range

A beam deceleration mode with a stage bias of 50 V to 4 kV offers the utmost flexibility for image optimization.

Outstanding Sample Management

150 x 150 mm high-precision and -stability piezo stage

- Ultra-high precision and repeatability, smooth movements, no backlash and a high tilt allowance
- Full chamber access with fast vent/pump-down times

Navigation montage

Built-in image stitching that allows the user to create low-magnification electron images (down to 1x) for use in automated sample navigation.

Working in an ultra-clean environment

FEI's vacuum technology, oil free pumps and the optional Cryo Cleaner offer an ultra-clean system without the addition of a load-lock.

Figure 1: Nova NanoSEM 30 Series platform

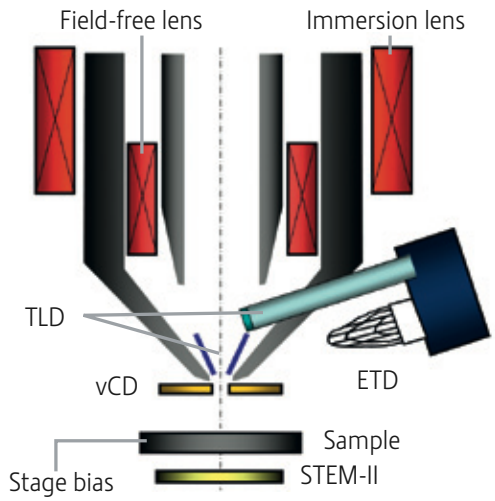


Figure 2: Nova NanoSEM 30 Series detection

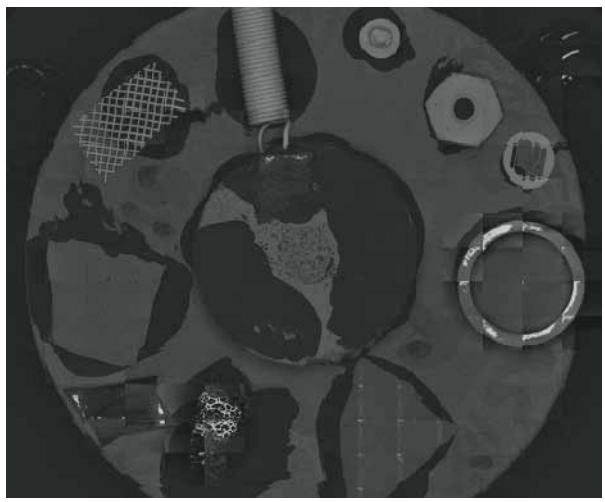


Figure 3: Navigation montage of a 32 mm stub

A truly complete solution for NanoPrototyping

Extended built-in patterning capabilities, including an integrated 12-bit digital pattern generator, dedicated fast beam blanker, user interface patterning page, FEI CAD-based prototyping module (GDSTODB), and gas injection units for direct deposition of materials.

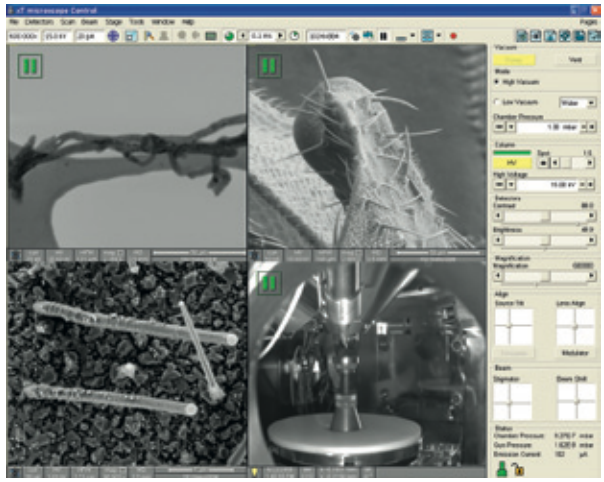


Figure 4: Nova NanoSEM 30 Series user interface

xT user interface

Easy-to-use graphical interface with versatile system controls for simplicity and ergonomic flexibility (mouse+keyboard and an optional manual user interface).

Application and service support

Industry leading application and service support, including training, online user support, user meetings and remote system diagnostics (RAPID).

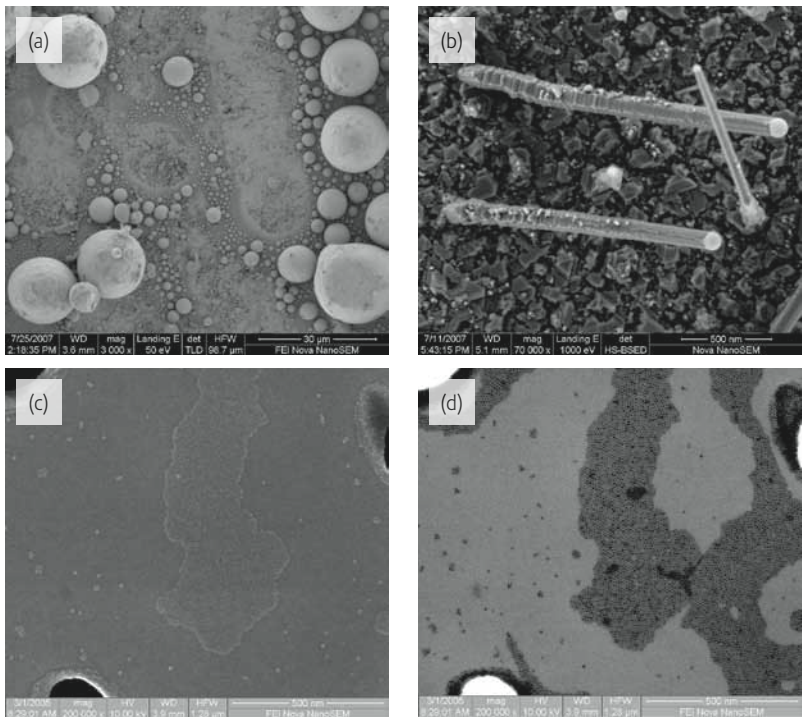
Figure 5: RAPID remote diagnostics

Figure 6:
High resolution characterization in high vacuum:

(a) High surface sensitivity obtained with a beam landing energy of 50 V and the TLD-SE, as shown with these tin balls on a carbon substrate. The horizontal field width (HFW) is 98.7 µm.

(b) Topographic and materials contrast at low kV obtained with a beam landing energy of 1 kV and the vCD. The HFW is 2.15 µm.
Image courtesy of E. Tutuc, University of Texas at Austin.

(c, d) High resolution images of $MnFe_2O_4$, observed at 10 kV. (c) shows topographical information from the TLD-SE detector and (d) compositional information from the STEM detector. The horizontal field width is 1.28 µm.

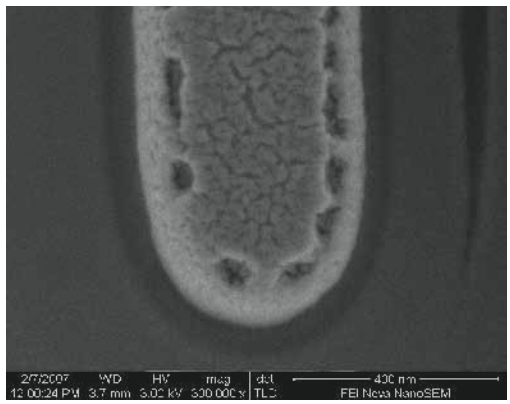


Nova NanoSEM 30 Series application examples

Ultra-high resolution in high vacuum

Top-down view of a depassivated integrated circuit, with rich surface details. This images was produced using a landing energy of 1 kV, the in-lens detector (TLD) and the beam deceleration mode.

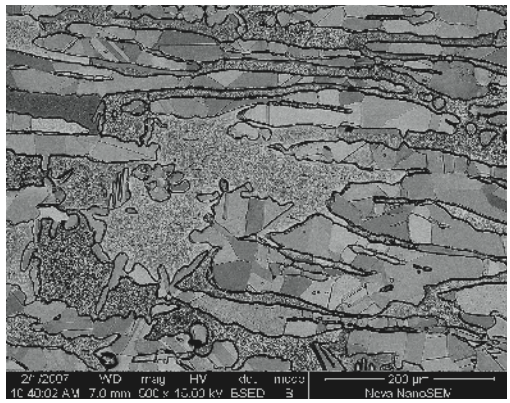
Courtesy of Freescale



A detector suite to best select the information of interest

Surface of a metal, obtained using the vCD and beam deceleration. In this mode, crystallographic materials and topographic information are acquired using the same image.

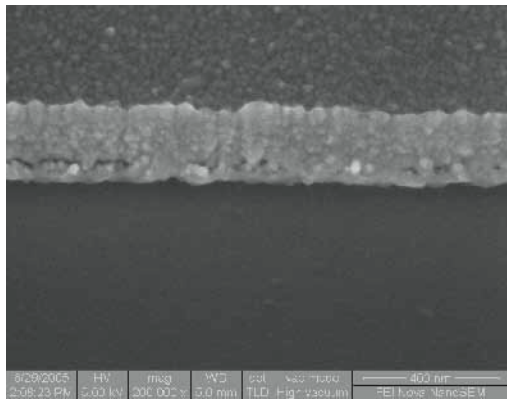
Courtesy of Outokumpu



High-resolution imaging on magnetic materials

300 nm thick Ni layer on top of GaN on sapphire substrate, imaged in immersion mode at 5 kV. The horizontal field width (HFW) is 3 µm.

High resolution images can be obtained from most magnetic samples by the Nova NanoSEM 30 Series in field-free or immersion mode.



Ultra-high resolution imaging in transmission

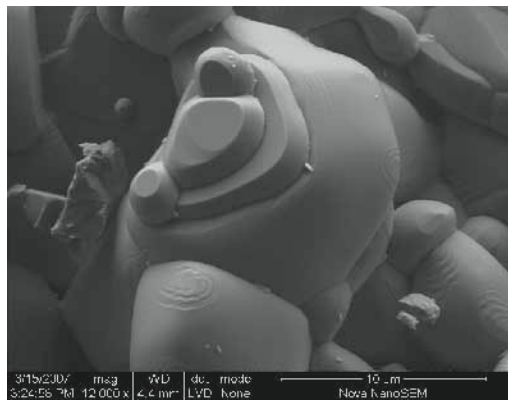
Carbon nanotube, STEM-BF. The horizontal field width is 500 nm.

The Nova NanoSEM STEM-II offers the possibility to simultaneously collect information in bright field, dark field and HAADF. The outer ring has 12 segments for adjusting angle-specific contrast.

Low vacuum for charging-free imaging of uncoated materials

Uncoated foam, using the LVD detector at a HFW of 25 µm.

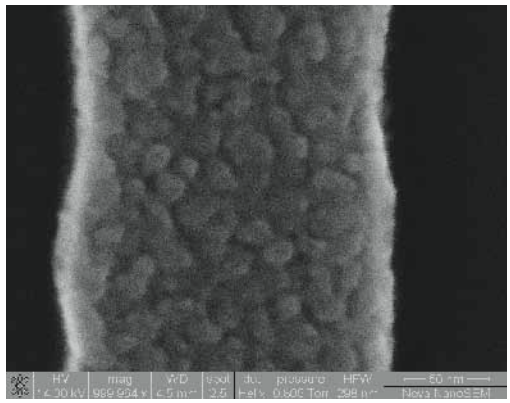
Courtesy of Saint Gobain C.R.E.E.E.



Ultra-high resolution in low vacuum on highly charging materials

Cr-on-quartz photolithographic mask, using the Helix detector with 14 keV, 0.8 Torr H_2O, HFW 298 nm.

Toth, Knowles & Thiel (2006) Appl. Phys. Letters 88 Article 023105.
Toth, Lobo, Lysaght, Vladar and Postek (2009) J. Appl. Phys., to be published.



Analysis on highly charging materials

EBSD maps of copper dielectric. While the analysis in high vacuum showed severe drift artifacts, low vacuum produced drift-free EBSD map acquisition.

Direct prototyping

Direct electron beam induced deposition of platinum pillars with a base diameter of 25 nm. The pillars are obtained by decomposing a gas blown at the surface of the sample, brought by a gas injector (GIS), using the electron beam. Platinum, tungsten, gold, carbon and other materials can be deposited to create complex 3D structures.