

Verios G4 XHR SEM

Discover the world of Extreme High Resolution SEM

The Verios G4 XHR SEM offers sub-nanometer resolution over the full 1 keV to 30 keV energy range with excellent materials contrast. Its extraordinary low-voltage performance provides extremely precise, surface-specific information that has been unavailable previously from other techniques.

For materials scientists, the Verios enables important new insights by extending sub-nanometer characterization to novel materials being developed today (e.g., catalyst particles, nanotubes, porosities, interfaces, biological objects and other nanoscale structures). High-resolution, high-contrast images are obtained without the need to transition to TEM or other imaging techniques. Verios offers all the flexibility required from research applications to accommodate large specimens such as full wafers or metallurgical samples, perform fast analysis thanks to its high current mode or work on precise prototyping applications such as electron beam-induced direct deposition of materials or lithography.

In the semiconductor and data storage markets, the Verios's unprecedented performance significantly extends SEM capability, offering a complete solution for basic research, process and material development, process control and failure analysis. It delivers accurate, repeatable measurement results, even on extremely sensitive materials. The Verios features industry leading performance without compromising the high throughput, sample flexibility and ease of traditional SEM.

Key Benefits

Best-in-class Elstar™ Schottky Monochromated (UC+) FESEM technology and performance with sub-nanometer resolution from 1 to 30 keV

Innovative electron optics, including Thermo Scientific's patented UC+ gun (monochromator), ConstantPower™ lenses and electrostatic scanning for accurate and stable imaging

Consistent measurement results with the ability to calibrate to a NIST certified standard at high magnification

Easy access to beam landing energies as low as 20 eV with very high resolution for true surface characterization

Advanced suite of high-sensitivity, in-column & below-the-lens detectors and signal filtering for low dose operation and optimal contrast selection

Large chamber with a choice of two precise and stable piezo-driven stages

Unattended SEM operation with AutoScript 4, an optional Python-based application programming interface (API)

Multiple navigation packages available, including fast and robust bit cell counting and Maps

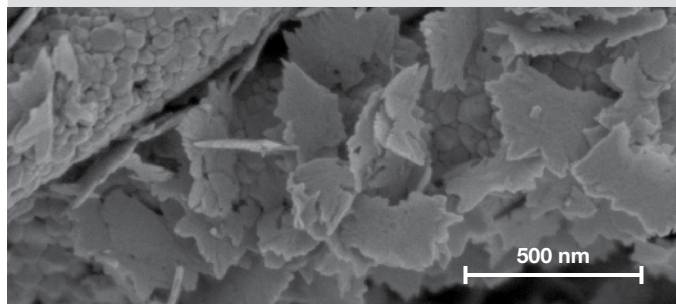


Figure 1. MoS₂ flakes on TiO₂ nanotubes imaged at a landing energy of 700 eV.

Boost Accuracy with Superior Performance

The outstanding imaging capabilities of the Verios begin with the Elstar™ FESEM column. On top of its integrated monochromator (UC+) and beam deceleration, which enables Verios's unique low kV performance, the Elstar features other unique technologies such as constant power lenses for higher thermal stability and electrostatic scanning for higher deflection linearity which leads to better measurement accuracy. Its traditional through-the-lens detector, set for highest collection efficiency of SE (secondary electrons) and on-axis BSE (backscattered electrons), is complemented by two new in-column detectors and signal filtering capabilities for stunning resolution and refined materials contrast. Furthermore, an optional STEM (scanning transmission electron mode) detector provides superior performance on thin S/TEM samples. Empowered by its revolutionary xT software platform, the Verios addresses both the occasional user with a simple yet robust interface, and the SEM expert who can rely on the instrument's flexibility and extended controls for XHR work.

Electron optics

- Elstar extreme high-resolution field emission SEM column with:
 - Immersion magnetic objective lens
 - High-stability Schottky field emission gun to provide stable high-resolution analytical currents
 - UC+ monochromator technology
 - 60 degree dual objective lens with pole piece protection allows tilting larger samples
 - Automated heated apertures to ensure cleanliness and touch free aperture exchange
 - Electrostatic scanning for higher deflection linearity and speed
 - ConstantPower™ lens technology for higher thermal stability
 - Integrated Fast Beam Blanker*
 - Beam deceleration with stage bias from 0 V to -4 kV
 - Minimum source lifetime: 12 months

Electron beam resolution

- 0.6 nm at 30 kV STEM *
- 0.6 nm at 2-15 kV
- 0.7 nm at 1 kV
- 1.0 nm at 500 V

Electron beam parameter space

- Electron beam current range: 0.8 pA to 100 nA
- Accelerating voltage range: 350 V – 30 kV
- Landing energy range: 20 eV – 30 keV
- Maximum horizontal field width: 2.3 mm at 4 mm WD



Detectors

- Elstar in-lens SE/BSE detector (TLD-SE, TLD-BSE)
- Elstar in-column SE/BSE detector (ICD)
- Elstar in-column BSE detector (MD)
- Everhart-Thornley SE detector (ETD)
- IR camera for viewing sample/column
- In-chamber Nav-Cam™ sample navigation camera
- Retractable low voltage, high contrast directional solid-state backscatter electron detector (DBS)*
- Retractable STEM 3+ detector with BF/ DF/ HAADF segments*
- Integrated beam current measurement

Stage and sample

Model	Verios G4 UC	Verios G4 HP
Type	Door mounted, high precision 5-axis motorized stage, with XYR axis piezo driven	Chamber mounted, ultra stable 5 axis all piezo motorized stage.
Sample loading	Through chamber door	Through automated load lock
XY	150 × 150 mm ²	100 × 100 mm ²
Repeatability	< 1.0 μm	< 0.5 μm
Motorized Z	10 mm	≥ 20 mm
Rotation	360° (endless)	360° (endless)
Tilt	-10° / +60°	-10° / +60°
Max. sample height	55 mm to eucentric point (WD = 4 mm)	19 mm to eucentric point, including shuttle, via load lock 27.8 mm to eucentric point, via chamber door
Max. sample weight	500 g at 0° tilt, including sample holder	200 g for full motion range, including sample holder
Max. sample size	150 mm diameter with full rotation (larger samples possible with limited stage travel or rotation)	100 mm diameter with full rotation (larger samples possible with limited stage travel or rotation)

Vacuum system

- Complete oil-free vacuum system
- Chamber vacuum: < 2.6 × 10⁻⁶ mbar (after 24 h pumping)
- Evacuation time: < 5 minutes
- Optional CryoCleaner cold trap

Chamber

- Eucentric point and analytical working distance: 4 mm
- Ports: 21
- Inside width: 379 mm
- Integrated plasma cleaner

Sample holders

- High-resolution multi-stub mount holder
- STEM holder, included with retractable STEM3+ detector*
- Vise specimen holder to clamp irregular, large or heavy specimens to the specimen stage*
- Various wafer and custom holder(s) available by request*

System control

- 64-bit GUI with Windows 7, keyboard, optical mouse
- Up to four live images showing independent beams and/or signals. Live color signal mixing
- Local language support: Check with your local Thermo Scientific Sales representatives for available language packs
- Two 24-inch widescreen monitors (1920×1200 pixels) for system GUI and full-screen image
- Microscope controlling and support computers seamlessly sharing one keyboard, mouse and monitors
- Joystick*
- Multifunctional control panel*
- Remote control and imaging*
- Image registration enabling sample navigation in an imported image

Image processor

- Dwell time range from 25 ns – 25 ms/pixel
- Up to 6144 × 4096 pixels
- File type: TIFF (8, 16, 24-bit), BMP or JPEG standard
- Single-frame or 4-view image display
- SmartSCAN™ (256 frame average or integration, line integration and averaging, interlaced scanning)
- DCFI (Drift Compensated Frame Integration)

System options

- Integrated Fast Beam Blanker
- QuickLoader™: load lock for fast sample transfer (Verios G4 UC only) *
- Joystick
- Analysis: EDS, EBSD, parallel beam WDS, CL, Raman
- Integrated 16-bit patterning engine
- Electron beam lithography modules from Raith, Nability or other vendors*
- Thermo Fisher acoustic enclosure
- Specimen holder kit
- Acoustic enclosure for vacuum pump
- Oil-free pre-vacuum option (dual scroll pumps)
- GIS (Gas Injection System)
- Cryo SEM: Sample transfer and preparation, cryo stage
- NIST certified magnification calibration sample

