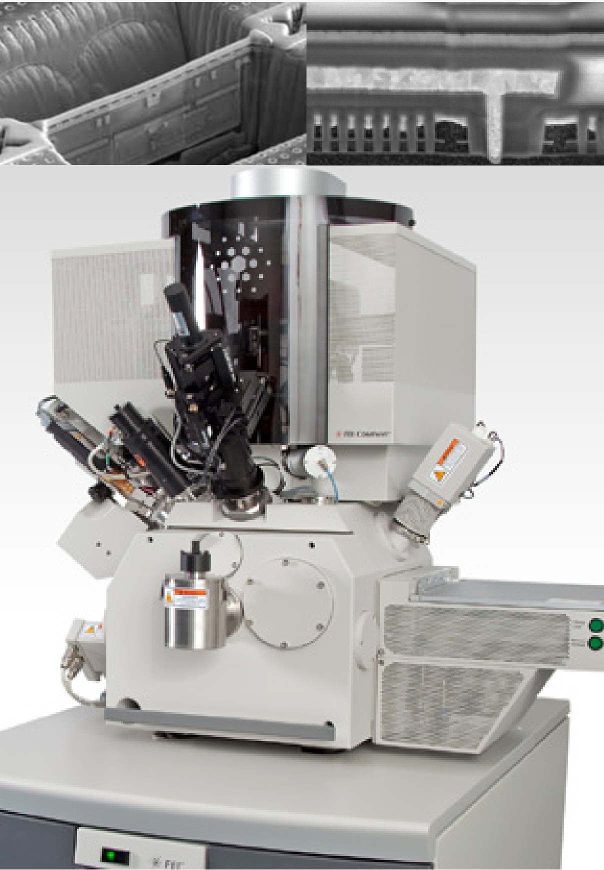
Product Data



Helios NanoLab™ 450S

Advanced DualBeam™ for Integrated S/TEM Sample Preparation, Imaging and Analysis

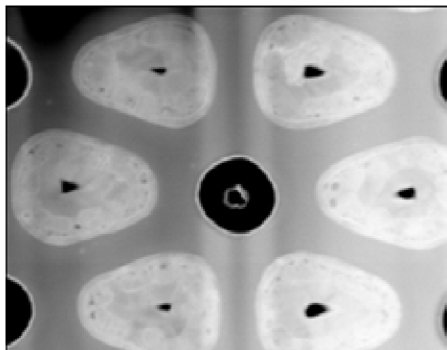
The Helios NanoLab series is the world's most advanced DualBeam platform for imaging, analysis, and TEM sample preparation in semiconductor failure analysis, process development and process control laboratories. All Helios NanoLab 50 series systems combine the innovative Elstar with UC technology electron column for high-resolution, high-contrast imaging with the high-performance Tomahawk™ ion column for fast, precise sample cross sectioning. The columns and flexible chamber have been optimized to provide the best combined performance available in any DualBeam (FIB/SEM) system. The Helios NanoLab 450S is ideally suited for high throughput, high-resolution S/TEM sample preparation, imaging and analysis. Its exclusive FlipStage and in-situ STEM detector can flip from sample preparation to STEM imaging in seconds without breaking vacuum or exposing the sample to the environment. The FilpStage mounts on a five-axis motorized stage that accommodates samples up to 80 mm in diameter with full coverage (larger with limited coverage) and industry-leading repeatability. Larger samples may be introduced through the chamber door.

Key Benefits

- Exclusive FlipStage™ for integrated sample preparation and STEM imaging
- New high-performance Elstar™ electron column with UC monochromator technology for sub-nanometer SEM and STEM image resolution
- Tomahawk™ ion column for highspeed, high-resolution milling and cross sectioning
- Low kV ion beam clean-up minimizes TEM sample damage
- Five-axis piezo-driven stage with loadlock provides full coverage of 80 mm sample
- Advanced design provides unprecedented stability and immunity to environmental interference
- Automated setup and operation for ease-of-use and reduced training
- Comprehensive preparation, imaging and analysis capabilities maximize utilization and reduce cost-of-ownership

Elstar Electron Column

The innovative Elstar electron column with UC monochromator technology, newly introduced in the Magellan™ XHR SEM, provides the foundation of the systems' unprecedented high-resolution imaging capability. Helios NanoLab systems are capable of 0.8 nm STEM resolution. Uncompromised SEM resolution of 0.8nm at both DualBeam coincidence and optimum working distances. Imaging performance is further enhanced by advanced scanning and through-the-lens signal detection systems that provide dramatic improvements in contrast and signal-to-noise ratio. Double magnetic shielding increases the systems' immunity to environmental fields. Constant power lens technology eliminates thermal instabilities caused by routine changes in lens power.



Plan view STEM imaging is a powerful technique to investigate the interfaces around many contacts. This thin section is viewed with annular dark field mode.

Tomahawk Ion Column

The Tomahawk ion column combines high-resolution with exceptional low voltage performance. Not only does it enable excellent ion image resolution (4.5 nm @ 30 kV, coincident WD), it also provides the most precise ion milling, helping to insure that valuable defect information is not destroyed by the cross sectioning operation.

A full range of beam chemistry options supports accelerated milling, selective milling, deposition and enhanced imaging with both ion and electron beams. Integrated Preparation, Imaging and Analysis The Helios NanoLab 450S is the ideal platform for S/TEM sample preparation and imaging. The in-situ STEM detector permits real time monitoring of the STEM image while thinning, for ultimate control of the preparation process and localization. The Tomohawk ion column's ability to maintain small beam diameter at less than 1 kV enables low-energy, grazing-incidence final clean-up to remove surface damage induced by higher-energy milling. The 450S provides STEM capability at accelerating voltages up to 30 kV, or the sample may be transferred to a high voltage S/TEM for ultra high resolution imaging and analysis. Extensive automation permits unattended preparation of multiple site-specific S/TEM samples in a single session at a cost-per-sample competitive with conventional SEM bulk sample preparations. Optional X-ray (EDS or WDS) spectrometers offer compositional analysis in thin samples with resolution down to 30 nm. Automated slice and view capability can acquire a sequence of cross sectional images and reconstruct a three-dimensional model of the cross-sectioned volume that can be viewed and virtually resectioned in any direction.

Specifications

- Electron source
  - Schottky thermal field emitter, over 1 year lifetime
- Ion source
  - Gallium liquid metal, 1000 hours
- Landing Voltage
  - 50 V - 30 kV SEM
  - 500 V - 30 kV FIB
- STEM resolution
  - 0.8 nm
- SEM resolution
  - Optimal WD
    0.8 nm @ 15 kV
    0.8 nm @ 2 kV
    0.9 nm @ 1 kV
    1.5 nm @ 200 V with beam decleration
  - Coincident WD
    0.8 nm @ 15 kV
    0.9 nm @ 5 kV
    1.2 nm @ 1 kV
- Ion beam resolution at coincident point
  - 4.5 nm @ 30 kV using preferred statistical method
  - 2.5 nm @ 30 kV using selective edge method
- EDS resolution
  - < 30 nm on thinned samples
- Stage
  - FlipStage with in-situ STEM detector and Omniprobe sample extractor
  - 5 axis all piezo motorized
  - 100 mm XY motion
  - Loadlock (80 mm max. diameter)
- Sample types
  - Wafer pieces, packaged parts, TEM
  - grids, whole wafers up to 100 mm
- Max. sample size
  - 80 mm diameter with full travel
- User interface
  - Windows® GUI with integrated SEM, FIB, GIS, simultaneous patterning and imaging mode

Key Options

- Gas chemistry
  - Range of deposition and etch chemistries
- Software
  - AutoFIB™, AutoTEM™, AutoSlice&View™, Knights Camelot CAD Navigation, FEI Navigator™
- Hardware
  - EDS, WDS, EBSP analysis

See Beyond at FEI.com

World Headquarters
Phone: +1.503.726.7500

FEI Europe
Phone: +31.40.23.56000

FEI Japan
Phone: +81.3.3740.0970

FEI Asia
Phone: +65.6272.0050

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