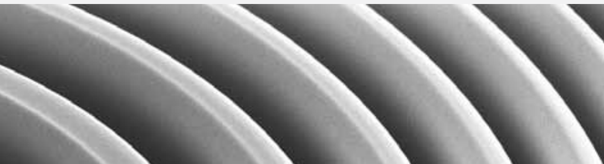

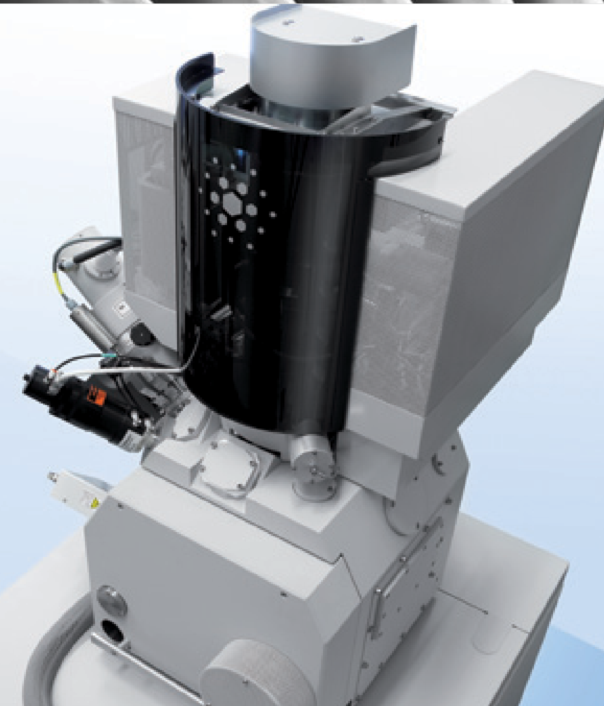

Helios NanoLab™

Resolution, accuracy, reproducibility, robustness and flexibility are pivotal characteristics for a leading-edge tool

The Helios NanoLab™ DualBeam™ offers the highest imaging, contrast, stability and speed performance for the largest range of SEM / FIB applications. It ensures the best resolution, reproducible metrology and control of the beam for writing purposes.

The outstanding imaging capabilities begin with its novel FESEM technology, featuring resolution in the sub-nanometer level at 15 kV and better than 1.5 nm at 1 kV without beam deceleration. Stunning image quality and contrast are further achieved with the through-the-lens detector. Its innovative design allows for superb imaging in SE and BSE modes over the entire energy range. When imaging for metrology purposes, Helios NanoLab introduces a significant breakthrough with electron beam electrostatic scanning, which furthers your pioneering accuracy perfomance.

Helios NanoLab goes even further to push the limits of 2D and 3D nanocharacterization with dedicated software, delivers the most integrated solutions for nanoprototyping, and re-writes the rules for electron beam lithography.

Addressing a wide range of cutting-edge nanowork, its extreme ease of use, stability and robustness, makes Helios the highest resolution NanoLab to date for scientists and technologists that strive for expanding the boundaries and achieving new results.

Key Benefits

- First Schottky FESEM to go sub-nanometer
- FIB largest range of current and energies coupled to outstanding resolution
- New integrated 16-bits digital pattern generator for electron and ion beams
- Thinnest samples prepared with very low damage, high speed and little effort
- Limits are pushed forward in 2D and 3D nano-characterization and -prototyping

Essential Specifications

Optics: DualBeam

- UHR immersion lens FE-SEM column with:
  - NG electron gun with Schottky thermal field emitter with hot-swap capability
  - 60 degree dual-objective lens with pole piece protection
  - Heated objective apertures
  - Electrostatic scanning
  - ConstantPower™ lens
- Sidewinder ion column:
  - Ga liquid metal ion source
  - Superior high current performance
  - Lowest FIB energy for ultimate sample quality
  - 15 apertures

Source lifetime

- Electron source: 12-month lifetime
- Ion source: 1000 hours guaranteed

Electron beam resolution @ optimum WD

- 0.9 nm @ 15 kV
- 1.4 nm @ 1 kV

Electron beam resolution @ coincident point

- 1.0 nm @ 15 kV
- 1.6 nm @ 5 kV
- 2.5 nm @ 1 kV

Ion beam resolution @ coincident point

- 5.0 nm @ 30 kV

Maximum horizontal field width

- E-beam: 1.5 mm at beam coincident point (WD 4 mm)
- I-beam: 2.5 mm at 5 kV at beam coincidence point

Accelerating voltage

- E-beam: 350 V - 30 kV
- I-beam: 0.5 - 30 kV

Probe current

- E-beam: ≤ 22 nA
- I-beam: 1.5 pA - 20 nA (15-position aperture strip)

Vacuum system

- 1 x 240 l/s TMP
- 1 x PVP (dry pump)
- 3 x IGP (total for electron column and ion column)
- Chamber vacuum: < $2.6*10^{-6}$ mbar `v(after 24h pumping)

Detectors

- NG in-lens detector (TLD) for secondary and back-scattered electrons
- Everhardt Thornley SED for secondary electrons
- IR camera for viewing sample/column
- Electron beam current measurement
- Ion beam current measurement*
- CDEM for secondary electron and secondary ion imaging*
- STEM detector*

Chamber

- 4 mm E- and I-beam coincidence point = analytical WD
- Angle between electron and ion columns: 52°

5-axis UHR motorized stage

- XY: 150 mm, piezo-driven
- Z > = 10 mm
- T = -10° to +60°
- R = n x 360° (endless), piezo-driven
- Tilt accuracy (between 50° to 54°) 0.1°
- X, Y repeatability 1.0 µm

Sample sizes

- Maximum size: 150 mm diameter with full rotation (larger samples possible with limited rotation)
- Maximum thickness: 20 mm (for 7 mm WD)
- Weight: 500 g (including the sample holder)

Sample holders

- Multi-stub holder (includes pre-tilt mounts)
- Plate for mounting multiple packages or wafer pieces (mounts onto multi-stub holder)
- Single stub mount, mounts directly onto stage
- FIB/TEM specimen kit (with two TEM grid holders and a sample loading base)
- Various wafer and custom holder(s) available by request

Image processor

- Dwell time range from 0.025 to 25000 µs/pixel
- Up to 4096 x 3536 pixels
- File type: TIFF (8, 16, 24 bit), BMP or JPEG
- Single-frame or 4-quad image display
- 256-frame average or integration

System control

- 32-bit GUI with Windows® XP, keyboard, optical mouse
- Two 19-inch LCD displays, SVGA 1280 x 1024
- MagicSwitch™ (software-controlled switchbox)
- Joystick*
- Multifunctional control panel*

* optional

Supporting software

- "Beams per quad" graphical user interface concept
- SPI™ - simultaneous patterning and imaging
- Patterns supported: lines, boxes, open boxes, polygons, circles, cross-section and cleaning cross-section
- Pattern based on current and imported image
- Directly imported BMP file for 3D milling
- Material file support for "minimum loop time", beam tuning and independent overlaps

Common accessories

- Up to 5 gas injectors for enhanced etch or deposition (other accessories may limit number of GIS available)
- Gas chemistry options:
  - Platinum metal deposition
  - Tungsten metal deposition
  - Carbon deposition
  - Insulator deposition II
  - Gold deposition
  - Enhanced Etch™ (iodine)
  - Insulator enhanced etch (XeF2)
  - Delineation Etch™
  - Selective carbon mill (SCM)
  - Empty crucibles for FEI approved
  - User supplied materials
  - In situ sample liftout system (Omniprobe™ 100.7 or AutoProbe)
  - Charge Neutralizer
  - Fast Beam Blanker
  - EDX integration kit (EDAX/Oxford Instruments)
  - EDX options

Consumables (partial list)

- Replacement Ga-ion source
- Replacement Schottky electron source module
- Aperture strips for electron and ion column
- CDEM detector
- Gas chemistry crucible

Software options

- AutoFIB™ functionality for multi-site sample preparation
- AutoTEM™ wizard - automated sample preparation with section wizard
- AutoSlice and View™ – automated sequential mill and view to collect series of slice images for 3D reconstruction
- EBS3™ – automated sequential mill and acquire EBSD maps to collect series of slice maps for 3D reconstruction
- Tomography 3D reconstruction software
- CoppeRx™ proprietary milling strategy
- FEI-Knights technology CAD navigation
- Web-enabled data archive software
- Image analysis software

Warranty and training

- 1 year warranty
- 2 coupons for applications training class (at factory)
- Choice of service maintenance contracts
- Choice of operation / application training contracts

Documentation

- Operating instructions handbook
- On-line help

Installation requirements

[Refer to preinstall guide for additional data]

- Power: voltage 230 V (+6%, -10%), frequency: 50 or 60 Hz (±1%),consumption: < 3.0 kVA for basic microscope
- Earth resistance: < 0.1 Ω
- Environment: temperature 20 °C ± 3 °C, relative humidity below 80% RH, stray AC magnetic fields

  < 100 nT a-synchronous

  < 300 nT synchronous
- Door width: 120 cm
- Weight: column console 750 kg
- Dry nitrogen: system (0.7 - 0.8 bar, max 10 l/min during vent); dry pump (1.0 bar, 2 l/min)
- Compressed air 4 - 6 bar - clean, dry and oil-free
- System chiller
- Acoustics: < 68 dBC (site survey required as acoustic spectrum relevant)
- Floor vibrations: site survey required as floor spectrum relevant
- Vibration isolation table available as option

Floorplan

900 mm 35.4″ | 800 mm 31.5″ | 600 mm 23.6″ | 600 mm 23.6″

3500 mm 137.8″

600 mm 23.6″

1400 mm 55.1″

30 mm 1.2″

870 mm 34.2″

600 mm 23.6″

DESK

MECHANICAL CONSOLE

E CONSOLE

600 mm 23.6″

600 mm 23.9″

800 mm 31.5″

EM41160

900 mm 35.4″ | 1006 mm 39.6″ | 900 mm 35.4″ | 800 mm 31.5″ | 600 mm 23.6″

4206 mm 165.5″

0 200 400 600 800 1000 1200 1400 1600 1800 2000mm

SPACE REQUIRED FOR SERVICE

SPACE REQUIRED FOR CUSTOMERS

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