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DATASHEET

Scios 2 DualBeam System

The most versatile high-performance DualBeam instrument

The Scios 2 DualBeam System delivers best-in-class performance in sample preparation, subsurface and 3D characterization for the widest variety of samples.

The Thermo Scientifc™ Scios™ 2 DualBeam™ System is an ultra-highresolution analytical system that provides outstanding sample preparation and 3D characterization performance for the widest range of samples, including magnetic and nonconductive materials. With innovative features designed to increase throughput, precision, and ease of use, the Scios 2 DualBeam System is an ideal solution to meet the needs of scientists and engineers in advanced research and analysis across academic, government and industrial research environments.

High-quality TEM sample preparation

Scientists and engineers constantly face new challenges that require highly localized characterization of increasingly complex samples with ever smaller features. The latest technological innovations of the Scios 2 DualBeam System, in combination with the easiest-to-use, most comprehensive Thermo Scientific AutoTEM™ 4 Software (optional) and our application expertise, allow for fast and easy preparation of site-specific HR-S/TEM samples for a wide range of materials. In order to achieve the high-quality results, final polishing with low-energy ions is required to minimize surface damage on the sample. The Thermo Scientific Sidewinder™ HT Focused Ion Beam (FIB) column not only delivers high-resolution imaging and milling at high voltages, but has also good low-voltage performance, enabling the creation of highquality TEM lamella.

High-quality subsurface and 3D information

Subsurface or three-dimensional characterization is often required to better understand the structure and properties of a sample. The Scios 2 DualBeam System with optional Thermo Scientific Auto Slice & View™ 4 (AS&V4) Software allows for high-quality, fully automated acquisition of multi-modal 3D datasets, including, among others, BSE imaging for maximum materials contrast, Energy Dispersive Spectroscopy (EDS) for compositional information, and Electron Backscatter Diffraction (EBSD) to microstructural and crystallographic information. Combined with Thermo Scientific Avizo™ Software, it delivers a unique workflow solution for high-resolution, advanced 3D characterization and analysis at the nanometer scale.

Key benefits

Fast and easy preparation of high-quality, site-specific, TEM and atom probe samples using the Sidewinder HT ion column

Ultra-high resolution imaging using the Thermo Scientific NICol™ electron column with best-in-class performance on the widest range of samples, including magnetic and non-conductive materials

The most complete sample information with sharp, refined, and charge-free contrast obtained from a variety of integrated in-column and below-the-lens detectors

Access the high quality, multi-modal subsurface and 3D information with precise targeting of the region of interest using optional AS&V4 Software

Precise sample navigation tailored to individual application needs thanks to the high flexibility 110 mm stage and in-chamber Thermo Scientific Nav-Cam™ Camera

Artifact-free imaging and patterning with dedicated modes such as DCFI, Drift Suppression and Thermo Scientific SmartScan™ Modes

Optimize your solution to meet specific application requirements thanks to flexible DualBeam configuration

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Ultra-high resolution with the most complete sample information

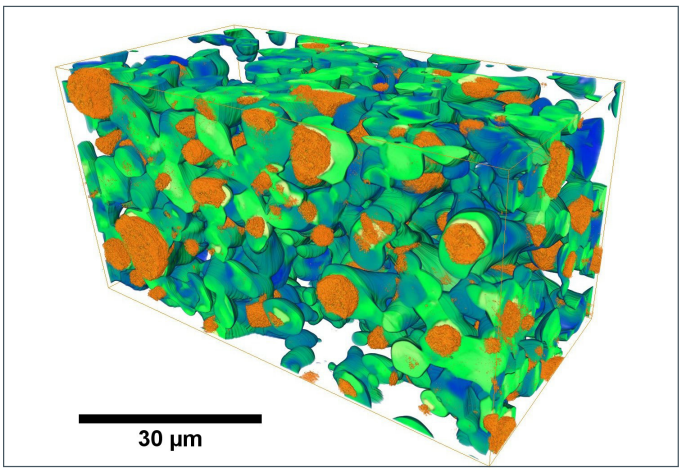
The innovative NICol electron column provides the foundation of the system's high-resolution imaging and detection capabilities. It offers excellent nanoscale details, using the widest range of working conditions, whether operating at 30 keV in STEM mode to access structural information or at lower energies to obtain charge-free, detailed information from the surface. With its unique in-lens Thermo Scientific Trinity™ detection technology, the system is designed for simultaneous acquisition of angular and energy-selective SE and BSE imaging. Fast access to the most detailed nanoscale information is guaranteed, not only top-down, but also on tilted specimens or cross-sections. Optional below-the-lens detectors and electron beam-deceleration mode ensure fast and easy simultaneous collection of all signals to reveal the smallest features in material surfaces or cross sections. Fast, accurate, and reproducible results are obtained thanks to unique NICol column design with full auto alignments.

Productivity for all users

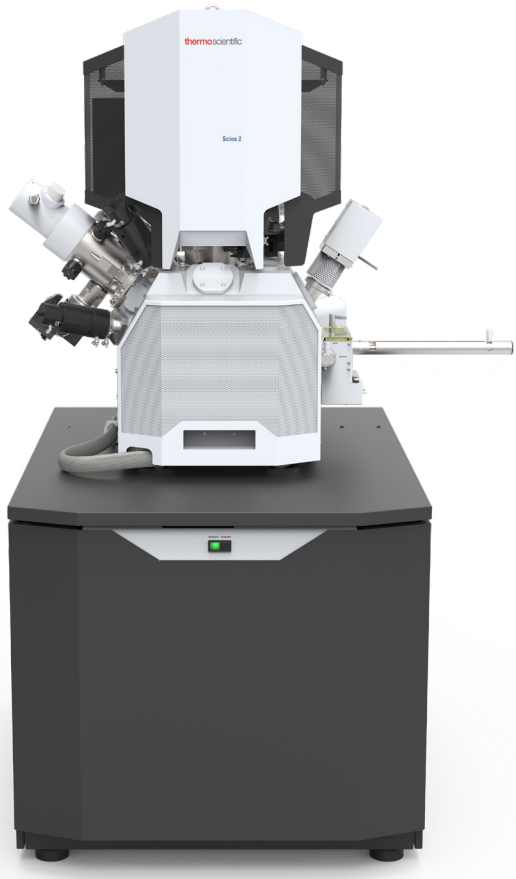
The Scios 2 DualBeam System will benefit researchers of all experience levels with its streamlined performance, allowing users to obtain high-quality, reproducible results faster and easier. It offers user guidance, making it easy for novice users to be productive quickly. In addition, features such as "undo" and "redo" encourage greater experimentation with peace of mind.

Enabling real-world experimentation

Designed for the most challenging electron microscopy tasks in Materials Science, the Scios 2 DualBeam System can be equipped with µHeater, a fully integrated, extremely fast, MEMS-based heating stage for sample characterization in closer to realworld working conditions. The 110 mm stage tilts up to 90° and provides a long, eucentric working distance for great flexibility. The Scios 2 DualBeam System has optional Low Vacuum mode and easily accommodates a wide range of sample types and data collection. It combines expanded deposition and etching capabilities, enhanced sample flexibility and control to create the most versatile high-performance FIB/SEM instrument, all backed by our expert application and service support.



3D reconstruction of W-Mo-Cu sample using a combination of BSE (green-blue) and EDS (orange) data, which has been produced with a Scios DualBeam System, AS&V4 and Avizo software.



Electron optics

The NICol column is an ultra-high resolution non-immersion field emission-SEM column, with:

- High-stability Schottky field emission gun to provide stable high-resolution analytical currents
- 60° dual objective lens, allowing for tilting of larger samples
- Automated heated apertures to ensure cleanliness and touch-free aperture exchange
- Continuous beam current control and optimized aperture angle
- Easy gun installation and maintenance—auto bakeout, auto start, no mechanical alignments
- Double stage scanning deflection
- Dual objective lens, combining electromagnetic and electrostatic lenses
- Fast Electron Beam Blanker*
- User guidance and column presets
- Minimum source lifetime: 24 months

Electron beam resolution

Optimum WD

- 0.7 nm at 30 keV STEM
- 1.4 nm at 1 keV
- 1.2 nm at 1 keV with beam deceleration*

Electron beam parameter space
- Beam current range: 1 pA to 400 nA
- Landing energy range: 20* eV – 30 keV
- Accelerating voltage range: 200 V – 30 kV
- Maximum horizontal field width: 3.0 mm at 7 mm WD and 7.0 mm at 60 mm WD
- Extra wide field of view (1×) available through standard navigation montage

Ion optics

Sidewinder ion column with excellent high-current performance
- Acceleration voltage: 500 V – 30 kV
- Beam current range: 1.5 pA – 65 nA
- 15-position aperture strip
- Drift suppression mode as standard for non-conductive samples
- Minimum source lifetime: 1,000 hours
- Ion beam resolution: 3.0 nm at 30kV using selective edge method

Detectors
- Trinity Detection System (in-lens and in-column)
  - T1 segmented lower in-lens detector
  - T2 upper in-lens detector
  - T3 retractable in-column detector*
  - Up to four simultaneously detected signals
- Everhart-Thornley SE Detector (ETD)
- High-performance ion conversion and electron (ICE) detector for secondary ions (SI) and electrons (SE)*
- Retractable low-voltage, high-contrast, segmented solid-state backscatter electron detector (DBS)*
- Retractable STEM 3+ detector with BF/ DF/ HAADF segments*
- IR camera for viewing sample and chamber
- In-chamber Nav-Cam sample navigation camera*
- Integrated beam current measurement

Stage and sample

Flexible 5-axis motorized stage:
- XY range: 110 mm
- Z range: 65 mm
- Rotation: 360° (endless)
- Tilt range: -15° to +90°
- XY repeatability: 3 µm
- Max sample height: Clearance 85 mm to eucentric point
- Max sample weight at 0° tilt: 5 kg (including sample holder)
- Max sample size: 110 mm with full rotation (larger samples possible with limited rotation)
- Compucentric rotation and tilt

Vacuum system
- Complete oil-free vacuum system
- Chamber vacuum: < 6.3×10^{-6} mbar (after 72 hours pumping)
- Evacuation time: < 3.5 minutes
- Optional low-vacuum mode: up to 500 Pa chamber pressure

Chamber
- E- and I-beam coincidence point at analytical WD (7 mm SEM)
- Ports: 21
- Inside width: 379 mm

Sample holders
- Standard multi-purpose holder, uniquely mounts directly onto the stage, hosts up to 18 standard stubs (Ø12 mm), three pre-tilted stubs, two vertical and two pre-tilted row-bar holders* (38° and 90°) and does not require tools to mount a sample
- Each optional row-bar accommodates 6 STEM grids
- 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 Fisher Sales representatives for available language packs
- 24-inch widescreen monitor 1920 × 1200 pixels (second monitor optional)
- Joystick*
- Multifunctional control panel*
- Remote control and imaging*

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
- SmartSCAN System (256 frame average or integration, line integration and averaging, interlaced scanning)
- DCFI (Drift Compensated Frame Integration)

Supporting software
- “Beam per view” graphical user interface concept, with up to 4 simultaneously active quads
- Thermo Scientific SPI™ (simultaneous FIB patterning and SEM imaging), iSPI™ (intermittent SEM imaging and FIB patterning), iRTM™ (integrated real time monitor) and FIB immersion modes for advanced, real-time SEM and FIB process monitoring and endpointing
- Patterns supported: rectangle, line, circle, cleaning cross-section, regular cross-section, polygon, bitmap, stream file, exclusion zones, arrays
- Directly imported BMP file or stream file for 3D milling and deposition
- Material file support for “minimum loop time”, beam tuning and independent overlaps
- Image registration enabling sample navigation in an imported image
- Sample navigation on an optical image
- Undo / Redo functionality
- User Guidance for most common DualBeam System operations / applications

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Accessories*

- Gas injection: up to 4 units (other accessories may limit number of GIS available) for beam-induced deposition and etching from a choice of > 10 precursors:
  - Platinum deposition
  - Tungsten deposition
  - Carbon deposition
  - Insulator deposition II
  - Gold deposition
  - Enhanced Etch™ process (iodine, patented)
  - Insulator enhanced etch (XeF2)
  - Delineation Etch™ process (patented)
  - Selective carbon mill (patented)
  - Empty crucibles for approved user-supplied materials
  - More beam chemistries available upon request
- Thermo Scientific EasyLift™ System for precise *in situ* sample manipulation
- FIB Charge Neutralizer
- µHeater: high-vacuum compatible, ultra-fast heating stage up to 1200°C
- Analysis: EDS, EBSD, WDS, CL
- Thermo Scientific QuickLoader™ tool: Loadlock for fast sample exchange without breaking system vacuum
- Cryo-solutions for DualBeam Systems:
  - Exclusive CryoMAT for material science cryo applications
  - Solutions from external vendors
- Acoustic enclosure
- Thermo Scientific CryoCleaner™ System
- Integrated plasma cleaner

Software options

- AutoTEM 4 Software for fastest and easiest highly automated STEM sample preparation
- AS&V4 Software: automated sequential mill and view to collect series of slice images, EDS or EBSD maps for 3D reconstruction
- Avizo Software for 3D reconstruction and analysis
- Thermo Scientific MAPS™ software for automatic acquisition of large images and optional correlative work
- Thermo Scientific NanoBuilder™ software: advanced proprietary CAD based (GDSII) solutions for FIB and beam deposition optimized nanoprototyping of complex structures
- iFast advanced automation suite for DualBeam instruments
- Web-enabled data archive software
- Advanced image analysis software

Warranty and training

- 1-year warranty
- Choice of service maintenance contracts
- Choice of operation/application training contracts

Documentation and support

- Online user guidance
- User operation manual
- Prepared for Thermo Scientific RAPID™ remote diagnostic support
- Free access to online resources

*Optional

Find out more at **thermofisher.com/EM-Sales**

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