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DATASHEET

Helios G4 EXL

Shrinking geometries and the wide-spread transition to new device architectures has significantly increased the volume of TEM analysis required for process development and yield ramp at the 7nm node. This critical data is needed to diagnose the root cause of defects and evaluate process maturity on the path to high volume manufacturing.

The Thermo Scientific™ Helios™ G4 EXL is the newest generation of Thermo Fisher Scientific's full-wafer DualBeam™ System and has been designed to satisfy 7nm node and beyond TEM sample preparation challenges. This system is capable of producing sub 10nm thick lamella samples in exactly the right location to capture point defects and isolate pre-defined structures for monitoring.

This system includes the Thermo Scientific Phoenix™ focused ion beam column that enables revolutionary low kV performance for bleeding edge TEM sample preparation. The high-performance Elstar electron column now includes the same UC monochromatic technology found on small chamber systems for improved resolution and TEM sample end-pointing.

Significant automation enhancements make generation of ultra-thin TEM samples routine and consistent. Thermo Scientific iFast™ automation software combines wafer and defect navigation with recipe definition and execution in a single, fully-integrated program, ensuring efficiency and consistency among operators with varying levels of expertise. *In situ* TEM sample preparation has been greatly simplified with Thermo Scientific Auto LX™ Software, a technology for automated sample liftout and placement on the TEM grid. Auto LX Software includes workflows for both planar and inverted TEM sample preparation. Additionally, a fully automated *ex situ* TEM sample preparation workflow allows 50nm thin samples with tight thickness control and precise lamella placement.

The addition of the FOUP loader allows the Helios G4 EXL to be located inside the semiconductor wafer factory and integrated with factory automation. Moving the Helios G4 EXL inside the fab and closer to the wafer process line can deliver critical TEM analysis up to three times faster than laboratory-based analysis of cleaved wafer pieces, enabling acceleration of the development of new processes and the yield ramp to high-volume production.

Key Benefits

- Ultra-thin TEM lamella preparation to support the 7nm node and beyond
- iFast semiconductor wafer navigation software integrates sample plan and defect navigation into the iFast automated recipe framework
- Auto LX software and EasyLift NanoManipulator provide seamless automated in situ TEM lamella lift-out
- MultiChem gas delivery system provides the most advanced capabilities for electron and ion beam induced deposition and etching on DualBeams
- STEM III detector provides outstanding resolution and contrast on thin TEM samples
- Integrated acoustic enclosure allows installation in noisy environments
- The automated FOUP loader allows the system to be located inside a semiconductor wafer factory and integrated with factory automation

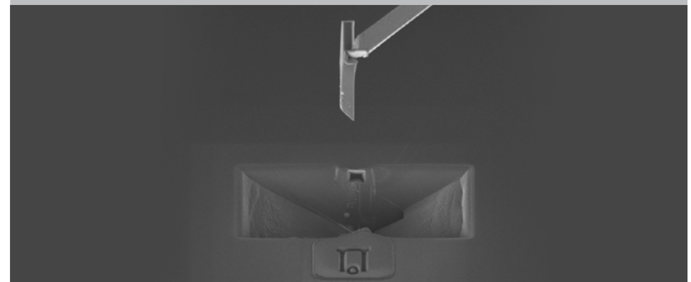

Figure 1. Optional Auto LX software automates sample liftout

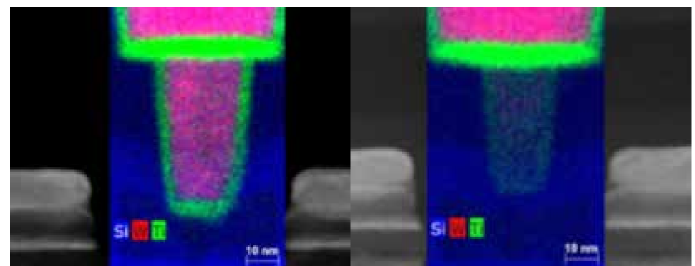

Figure 2. TEM EDS map showing incomplete contact (right image). TEM sample created with iFAST automation.

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Elstar UHR Immersion Lens FESEM Column
- Elstar electron gun with:
  - Ultra-stable Schottky field emitter gun with UC+ monochromator technology
- Electron beam resolution:
  - 1.0 nm @ 15 kV
  - 0.9 nm @ 1 kV
- Electron source lifetime: 12 months

Phoenix Ion Column
- Superior high current performance, with up to 65 nA max beam current
- Lowest voltage (500 V) for ultimate sample preparation quality
- Ion beam resolution @ coincident point:
  - 4.0 nm @ 30 kV using preferred statistical method
- Ion source: 1000 hours guaranteed

Detectors
- Elstar in-lens SE detector (TLD-SE)
- Elstar in-lens BSE detector (TLD-BSE)
- High performance ion conversion and electron (ICE)detector for secondary ions (SI) and electrons (SE)

Sample Handling
- 300mm five-axis stage
- Automated FOUP Loader for automated loading of 300mm wafers
  - ISO Class 1 EFEM with pre-aligner
  - GEM300 factory automation functionality

Key Accessories
- EasyLift integrated in situ TEM lamella sample lift-out
- Beam chemistry
  - Range of deposition and etch chemistries
  - Chemistries can be delivered with MultiChem and/or conventional gas injection
- Optical microscope with 920um FOV
- 30 kV STEM detector with BF/DF/HAADF segments (option)
- Oxford EDS (option)

Software Options
- iFast Semiconductor Wafer Navigation
  - Auto LX for automated In-situ TEM sample liftout (option)
  - Integrated defect navigation based on KLARF 1.2 and 1.8 standards
  - User defined wafer maps & site plans
- Stand-alone cell navigator (MultiChem compatible)
- CAD navigation
- Thermo Scientific Microscope Data Services™ Software
  - Web database program that provides an intuitive view into the status and performance of processes run on the Helios G4 EX and EXL with iFast software.
- Thermo Scientific RAPID™ remote diagnostic support

Installation and facilities requirements
Available upon request

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

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