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DATASHEET

Helios 5 PXL PFIB Wafer DualBeam

Plasma FIB and SEM system for in-line metrology, process monitoring, and large-area PFA and TEM prep

The Thermo Scientific Helios 5 PXL Wafer DualBeam is a Plasma FIB and SEM system for through-stack in-line metrology and structural verification of 3D structures.

The Thermo Scientific™ Helios™ 5 PXL Wafer DualBeam (WDB) enables in-line metrology and process monitoring for deep/buried structures. The system enables in-line metrology and process monitoring of High Aspect Ratio (HAR) 3D structures such as 3DNAND, DRAM, and Through Silicon Vias (TSVs). It also offers powerful capability for failure analysis of 3D packaged devices.

The Helios 5 PXL combines the innovative Thermo Scientific Elstar™ Electron Column with the industry leading high-performance PFIB2.0 xenon plasma ion column for high-resolution, high-contrast imaging and metrology. The system uses the high-performance PFIB to expose large area 3D structures with fast, precise wafer deprocessing, diagonal milling, or cross sectioning and then utilizes the nanometer scale SEM for high resolution and high contrast imaging and metrology. This patented technology which include precise in-situ endpointing and customized gas chemistry delivery, ensure precise planarity for successful layer-by-layer deprocessing, diagonal milling and cross sectioning to ensure a proper surface for accurate and precise metrology of through-stack 3D structures for top-to-bottom characterization and analysis.

Thermo Fisher Scientific also offers the PX version of the product which features all the capabilities of the Helios 5 PXL WDB without the Equipment Front End Module (EFEM) that accommodates Front Opening Unified Pod (FOUP) handling or open cassettes. This PX configuration is targeted for labs to match capabilities of the in-line system and take advantage of synergistic opportunities between the lab and fab.

The Helios 5 PXL WDB is Factory Host compatible for running operator-free recipe-driven operations to support the high-throughput requirements for FAB metrology and process development groups.

MultiChem Gas Delivery System

The Thermo Scientific MultiChem™ Gas Delivery System is a compact 6-injection-line gas delivery system with integrated process control capabilities and integrated gas chemistries for easy maintenance and consumables exchange. This advanced gas delivery system enables precise and repeatable removal of thin layers and bulk materials utilizing gas assisted etching and also enables deposition of high quality insulating material and low resistivity conductors using beam-induced deposition processes. The MultiChem System also supports the introduction of new gas chemistries for advanced R&D or automated process monitoring.

Key benefits

- **High-volume, high-speed milling and cross sectioning** with the xenon plasma FIB column
- **Proven low-kV ion-beam performance** to minimize material damage and surface sensitivity
- **Proprietary gas delivery system** with chemistries for high planarity layer-by-layer deprocessing of 3D NAND and advanced logic devices
- **Ultra-high beam currents** using plasma optimized chemisties for milling of advanced packaging materials
- **Nanometer-scale SEM image resolution** with the high-performance Elstar Electron Column with immersion lens and UC+ mono-chromator technology
- **Large area metrology and imaging data enabled** for complex features with fully customizable recipes created with Metrology Workstation
- **Full coverage of 300 mm automated wafer handling** with load lock
- **Precise, site-specific preparation of large area lamellae** with the optional EasyLift NanoManipulator
- **Backed by our world-class service, knowledge and expertise** in advanced metrology sample preparation and failure analysis

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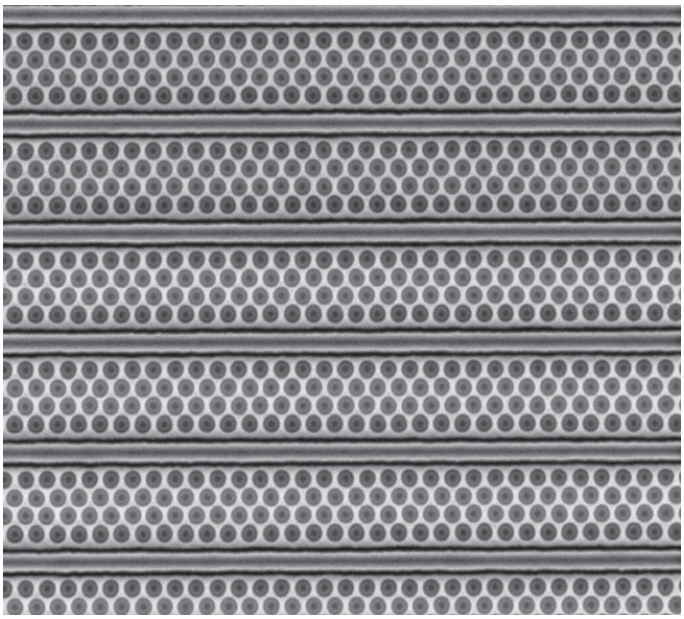
Metrology

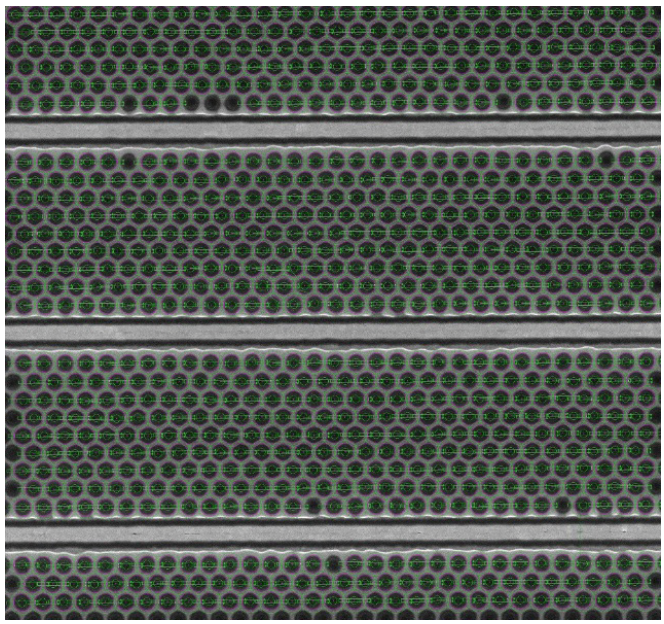
The Helios 5 PXL WDB is designed for unprecedented insight into HAR 3D structures with performance and ease of use for fabrication (FAB) and laboratory environments. The Helios 5 PXL WDB Metrology Workstation (MWS) allows for advanced metrology with a flexible user interface enabling customized and robust metrology recipes for complex features. Recipes can be created off-line without impact to system availability and eventually run on the system in a fully automated mode.

EasyLift NanoManipulator

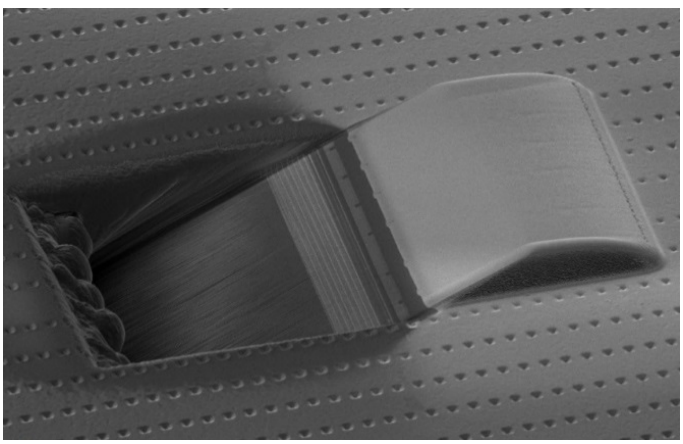
The EasyLift Nanomanipulator is an option on Helios 5 PXL for *in situ* lamella sample lift-out and attachment to grid while still in the chamber. The EasyLift is integrated with the microscope's existing xT software to provide a simple, intuitive method for lift-out and transfer of samples. Used in conjunction with Thermo Fisher's iFAST™ automation software, even novice operators can create large chunks for Tomography and advanced TEM prep with confidence.



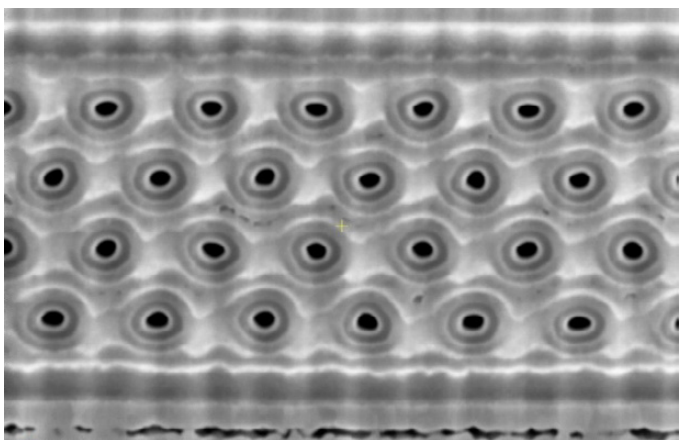
Deprocessing of an advanced-node 3D NAND sample.



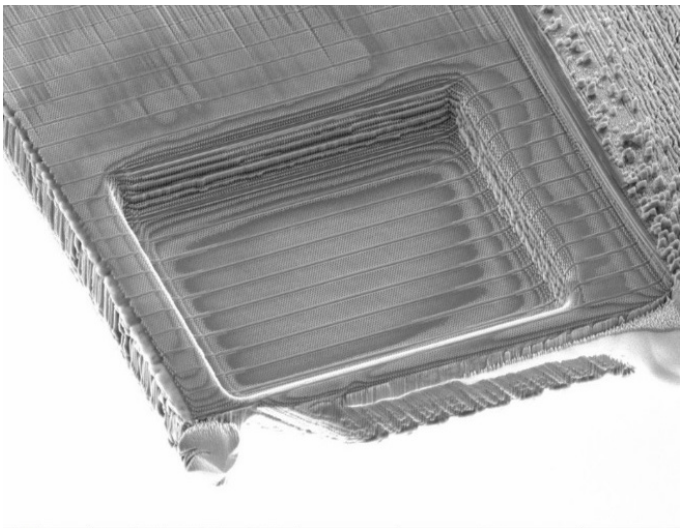
SEM Metrology on a 3D NAND deprocessed sample.



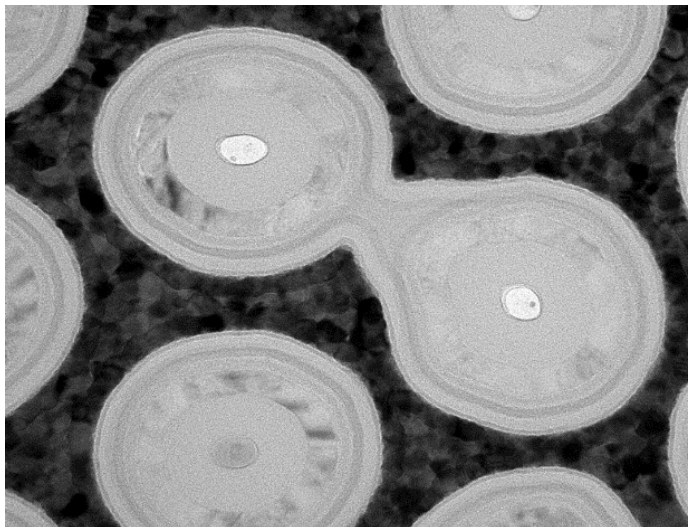
Wide-area diagonal mill of 3D NAND device.



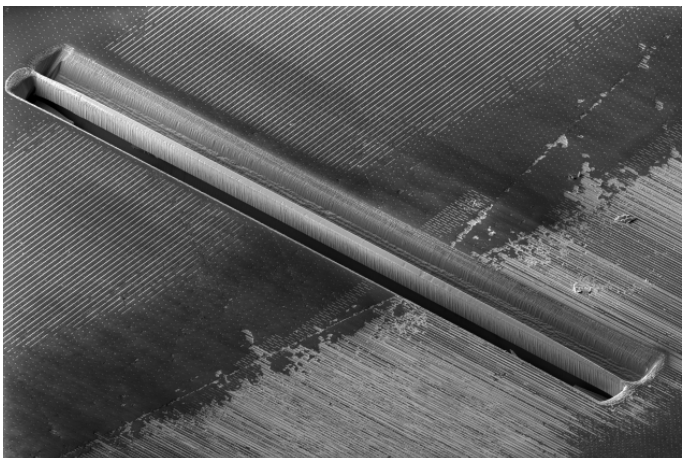
SEM inspection of diagonal unfilled structures on a 3D NAND device.



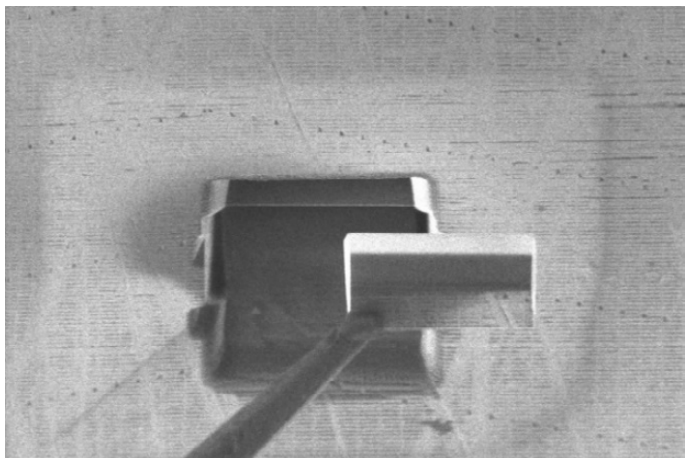
Planar lamella preparation of a 3D NAND device via deprocessing.



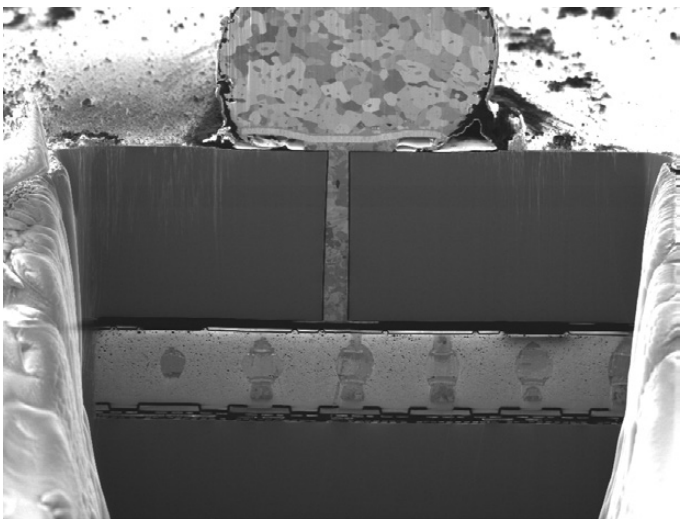
TEM imaging of PFIB planar lamella – 3D-NAND.



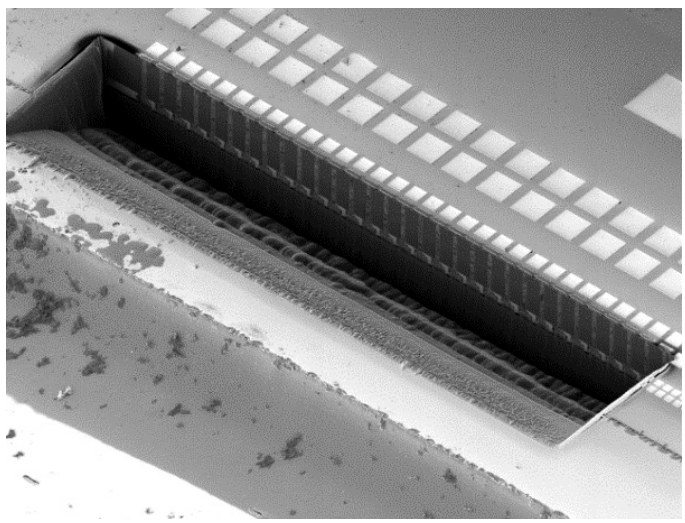
900 µm x 14 µm x 27 µm large lamella.



50-µm-wide chunk lift out with the EasyLift NanoManipulator.



300 µm x 300 µm cross section of a 2.5D stack.



600 µm x 100 µm large-area cross section of 3D IC with Cu TSVs.

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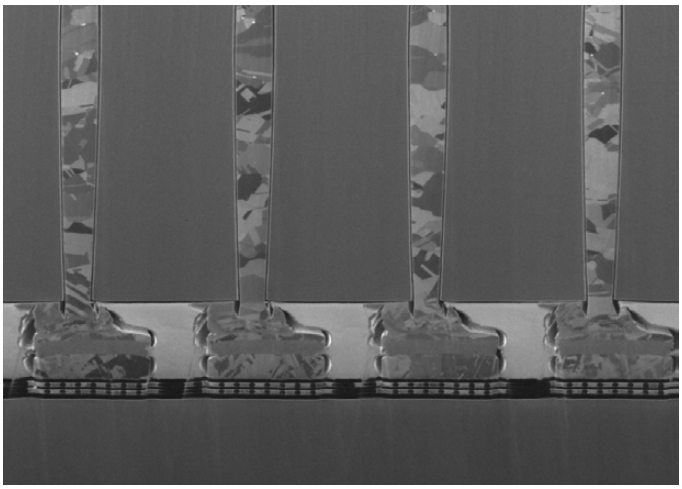
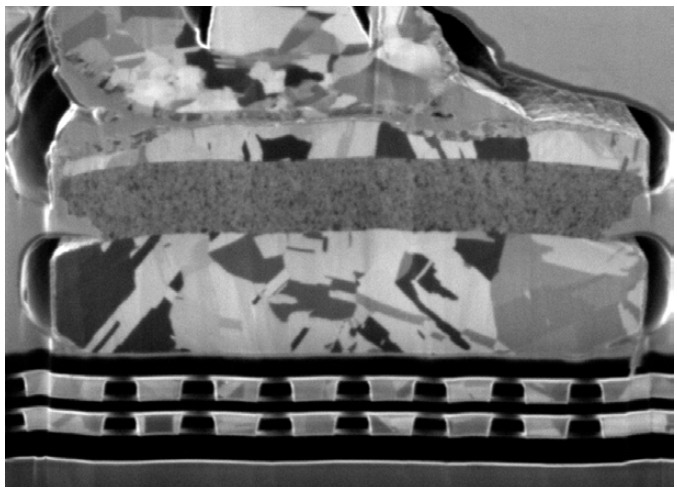


Close-up view of copper TSVs.



Close-up view of of copper TSV and copper bump contact.

Specifications

- Xe+ Plasma FIB Column:
  - PFIB Beam Current from 1pA to 2.6uA
  - Inductively coupled Xe+ Plasma (ICP) >4000 hours
- Elstar UHR Immersion Lens FESEM Column:
  - Elstar electron gun with:
    - Ultra-stable Schottky field emitter gun with UC+ monochromator technology
  - Electron beam resolution:
    - 0.9 nm @ 15 kV
    - 1.0 nm @ 1 kV
  - Electron source lifetime: 12 months
- Gas Delivery:
  - MultiChem Integrated Gas Delivery System
    - Slots for up to 6 individual chemistries
  - Single gas injection system
    - Port for up to 3 independent GIS units
- Wafer Handling:
  - Automated handling of 300mm FOUP with EFEM (GEM300 compliant)
  - Manual loading of 300mm, 200mm & 150mm wafers
- Additional options:
  - CAD Navigation Compatibility (NEXS and Synopsys Camelot)
  - Retractable Directional BackScatter Detector (RDBS)*

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

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