thermo scientific

DATASHEET

Helios G4 PFIB CXe DualBeam

Highest throughput, highest resolution large area sample preparation and analysis of Advanced Packaging Materials

Helios G4 PFIB CXe DualBeam provides unique capabilities to enable advanced failure analysis of 3D packages, damage free delayering of semiconductor devices in addition to a wide range of other large area FIB processing applications.

The Thermo Scientific™ Helios™ G4 PFIB CXe DualBeam™ is the fourth generation advanced PFIB DualBeam platform for large area sample preparation and analysis in semiconductor failure analysis, process development, process control, and materials characterization labs. The Helios G4 PFIB CXe system combines the unique Elstar™ electron column with UC+ technology for high-resolution, sub 500eV imaging and end-pointing with the high-performance PFIB2.0 Xenon plasma ion column, for fast, precise, and damage free large area sample cross-sectioning and deprocessing.

In addition to the industry leading SEM and FIB columns, the Helios G4 PFIB DualBeam incorporates a suite of innovative technologies and automation which enable simple and consistent sample preparation on even the most challenging samples.

Flexible and configurable DualBeam platform

Our DualBeam systems are unmatched when it comes to the high-speed creation of precise and consistent cross-sections and the preparation of high quality TEM samples. The Helios G4 PFIB CXe system expands on this leadership and can be configured with high performance options such as the EasyLift™ nanomanipulator, MultiChem™ gas delivery system and iFAST™ automation software.

Key benefits

High-performance Elstar electron column with UC+ monochromator technology for nanometer SEM image resolution and surface sensitivity

Highest throughput and quality relevant 3D characterization, cross-sectioning and micromachining using next generation 2.5µA Xenon Plasma FIB column (PFIB 2.0)

Highest quality Ga+ free sample preparation thanks to the PFIB 2.0 superior performance at all operating conditions with automated and guided sample preparation workflows

Exceptional low kV ion beam performance enables material sensitivity and low sample preparation damage

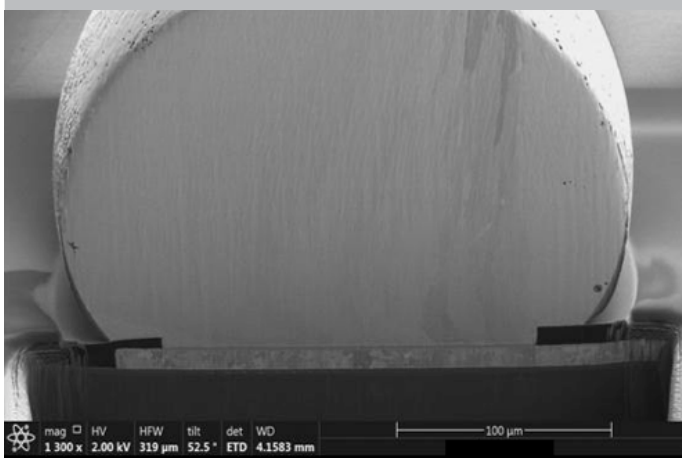
Optional MultiChem or GIS gas delivery systems provides the most advanced capabilities for electron and ion beam induced deposition and etching on FIB/SEM systems

Proprietary Dx and DE chemistries for deprocessing of copper metallization in regular and ultra low-k dielectrics

Plasma FIB based chemistries and recipes for milling advanced packaging materials

High-productivity curtain free preparation of large area cross-sections and highest quality TEM lamella with Auto Rocking Mill

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



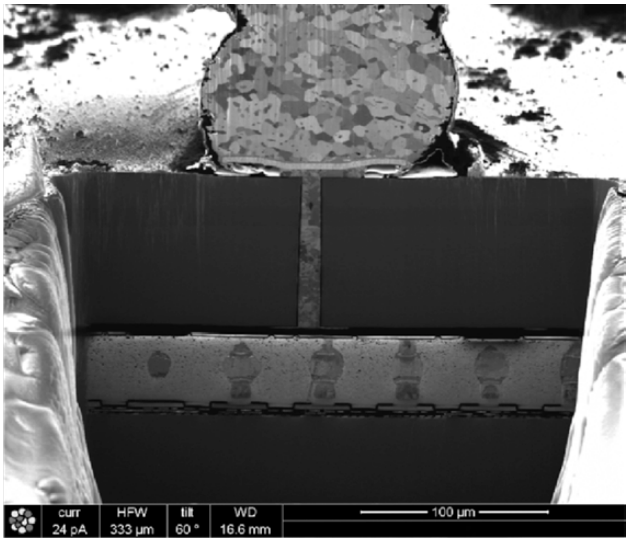


Figure 1. 300um × 300um Cross-section of a 2.5D stack

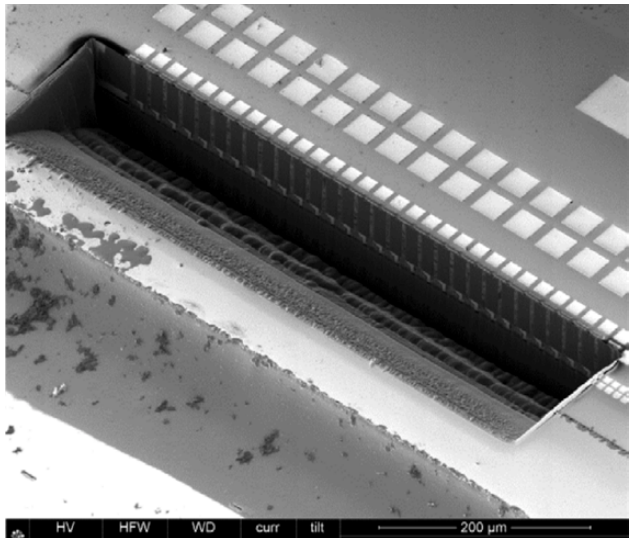


Figure 2. 800um wide cross-section of a 3D IC with Cu TSVs

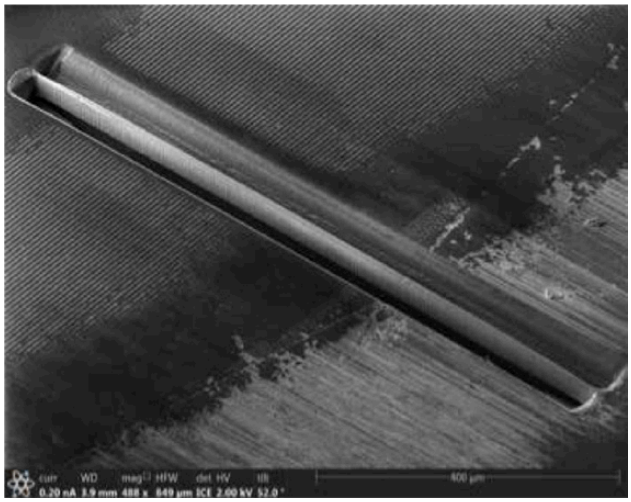


Figure 3. 900um × 14um × 27um large lamella

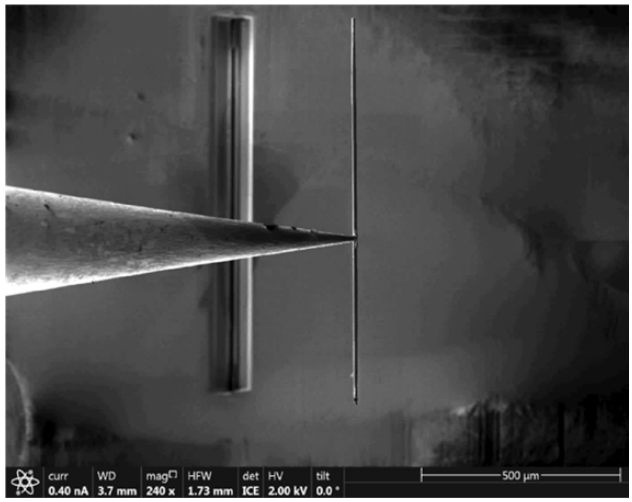
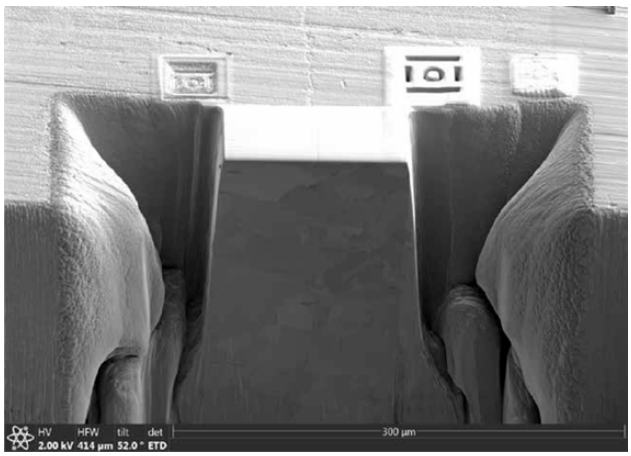


Figure 4. 900um x 14um × 27um large lamella: liftout with EasyLift



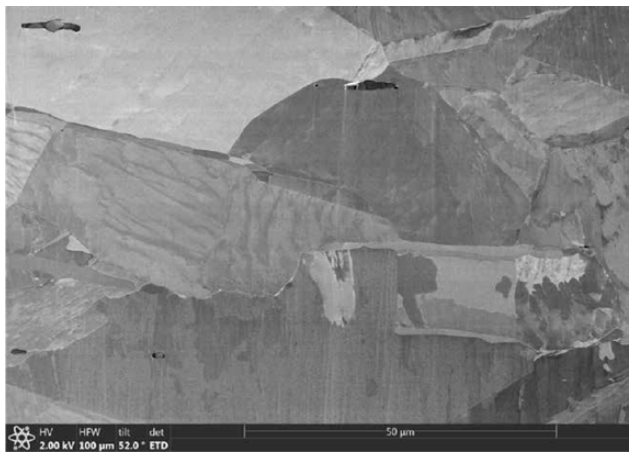


Figure 5. (above and right) Curtain free large area cross-sectioning with Auto Rocking Mill / polish

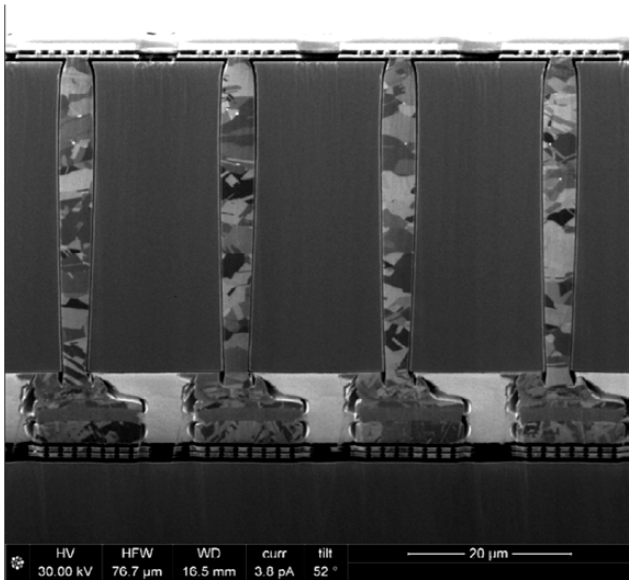


Figure 6. Multi-copper TSV cross-section

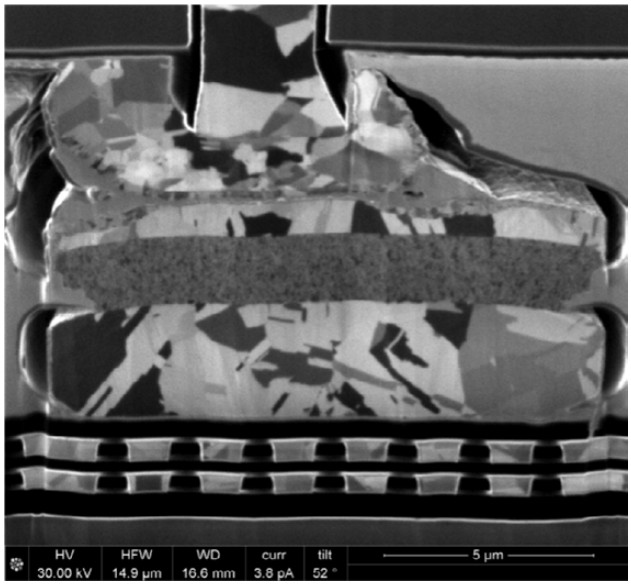
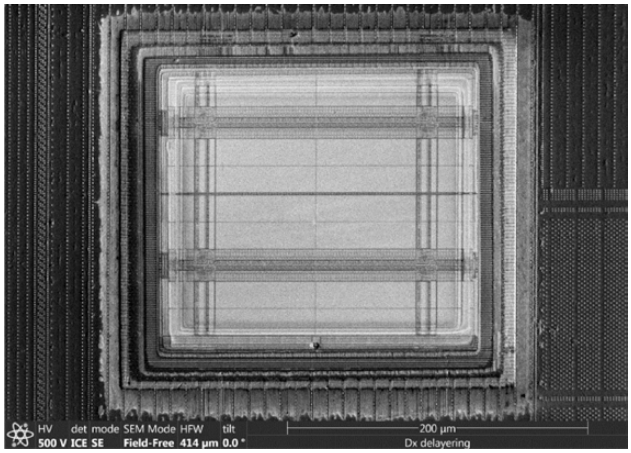


Figure 7. Zoomed-in view of Cu TSV and Cu bump contact



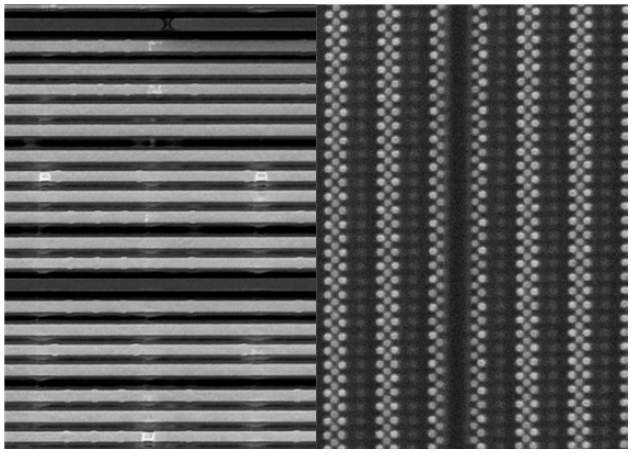
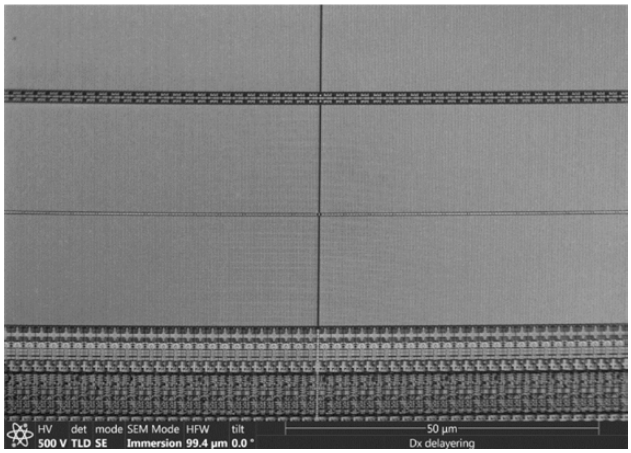


Figure 8. (above and right) Deprocessing with Dx for Passive Voltage Contract (PVC) based image analysis - 200um×200um are 1× node device



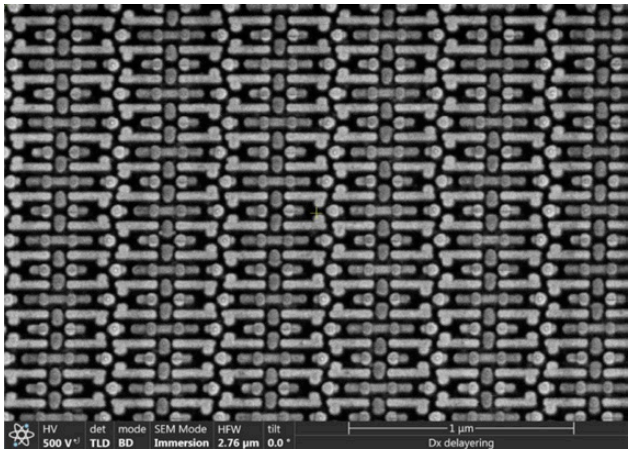


Figure 9. (above and right) Deprocessing with Dx for electrical fault Isolation with SEM based nanoProbing or Atomic Force Probing (AFP)

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Target specifications

- Electron source
  - Schottky thermal field emitter, over one year lifetime
  - E-beam current: 0.8 pA up to 100 nA
- Ion source
  - Inductively coupled Xe+ Plasma (ICP), >4000 hours
  - PFIB Beam Current: 1pA to 2.5uA
- Landing Voltage
  - 20 V - 30 kV SEM
  - 2kV - 30 kV PFIB
- SEM resolution (Optimal WD)
  - 0.6 nm @ 2-15 kV
  - 0.7 nm @ 1 kV with beam deceleration
  - 1.0 nm @ 500 V with beam deceleration
  - Coincident WD
  - 0.6 nm @ 15 kV
  - 1.2 nm @ 1 kV
- FIB resolution coincident WD
  - 20 nm @ 30 kV using preferred statistical method
  - 10 nm @ 30 kV using selective edge method
- EDS spatial resolution
  - < 30 nm on thinned samples

Gas delivery

- MultiChem integrated gas delivery system
  - Up to 6 chemistries can be installed
  - Up to 2 external gases can be installed
- GIS gas delivery system
  - Up to 4 independent GIS units can be installed
- *In situ* Chunk or TEM lamella Sample liftout
  - Easylift LT or EX nanomanipulator

Stage and navigation

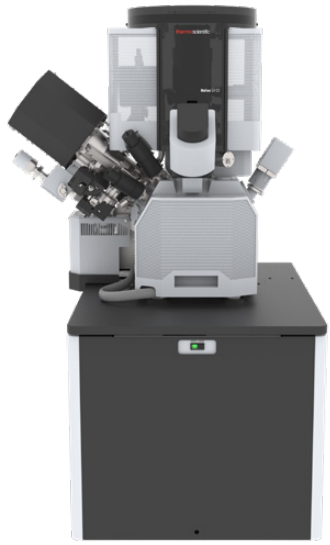
- Flexible 5-axis motorized stage:
  - X, Y range: 110 mm
  - Z range: 65 mm
  - Tilt: -40° to +65°
  - Rotation: 360° (endless)
  - X,Y repeatability: 3.0 µm
  - Max sample height: 85mm
  - Max sample size: 110mm with full rotation (larger samples possible with limited rotation)
  - Compucentric rotation and tilt
- NavCam+
- Sample types
  - Wafer pieces, packaged parts, system modules

Software

- User interface
  - Windows® 7 GUI with integrated SEM, FIB, GIS, simultaneous patterning and imaging mode
- Auto Rocking Mill, Auto Chunking, Guided TEM prep and Auto Deprocessing

Key options

- MultiChem chemistries
  - Milling/Deprocessing: Dielectric-etch, Polyimide-etch, Dx, DE low-k Dielectric Etch
  - Conductor Deposition: Platinum, Tungsten, Carbon
  - Insulator Dep – IDEP2
- GIS chemistries
  - Milling/Deprocessing: Dielectric-etch, Polyimide-etch, Dx, DE low-k Dielectric Etch
  - Conductor Deposition: Platinum, Tungsten, Carbon
  - Insulator Dep – IDEP3
  - Silicon Trenching Option with Co-axial nozzle for High Speed Trenching & Sample Prep



Application software options

- iFast Developers Kit Professional automation software
- Auto Slice&View™ software
- WaferNav
- EBS3™ and EDS3™
- NEXS CAD Navigation, Synopsys Avalon Connectivity

Hardware options

- EBSD, EDS, WDS, SIMS analysis
- Bulk Silicon Trenching
- Wide Area Bulk Silicon Trenching
- Quick Loader

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

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