Vion Plasma FIB System

High-speed, Large-area Cross-sectioning and Material Removal

The new Vion™ PFIB is the first FEI product to incorporate plasma ion source technology. With over one microamp of beam current, it can remove material much faster (>20X) than FIBs based on liquid metal ion sources (LMISs) that typically max out at a few tens of nanoamps, while still preserving excellent milling precision and imaging resolution at low beam currents. The twenty times improvement in speed makes it practical to cross section and analyze critical new technologies that have become primary drivers of new product development in the semiconductor industry, such as through slilcon vias (TSVs) and stacked die used in 3D packaging.

Innovative Plasma FIB Source Technology

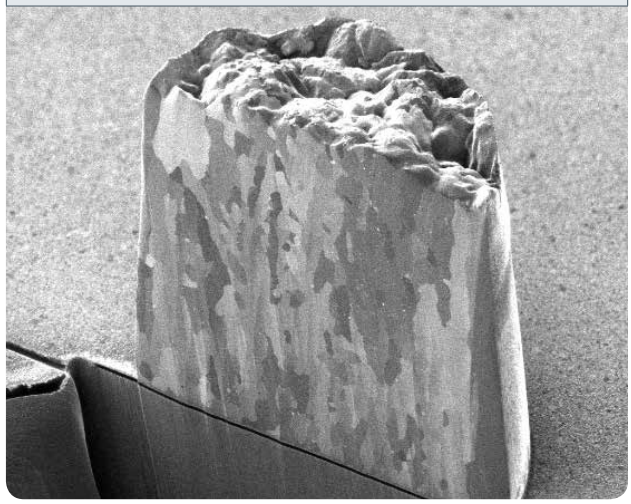
The Vion PFIB uses a radically different ion source technology than that used in the vast majoirty of FIB based systems today (the gallium LMIS). This new ion source and column, developed by FEI, enables highly precise high-speed cutting and milling. In addition, the PFIB can selectively deposit patterned conductors and insulators.

By combining high-speed milling with precise control, the system can be used in several ways in the development of manufacturing of semiconductor devices, such as:

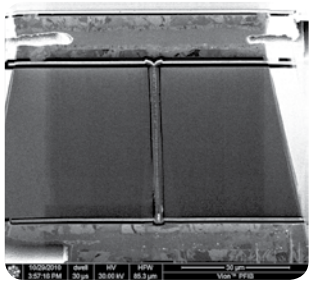
- Failure analysis of bumps, wire bonds, TSVs, and stacked die
- Surgically remove material to enable failure analysis and fault isolate on buried die
- For process monitoring and development at die/package level
- Defect analysis of packaged parts and MEMS devices

The Vion PFIB also has application in a wide range of Material Science and related Research fields, where the benefits of localized, site-specific sectioning with the Ga-FIB are appreciated, but the sections are too large to be completed in a timely manner. The PFIB enables sections even hundreds of microns across to be quickly prepared, enabling the analysis of metals, composites and coatings without the need for artefact-inducing mechanical polishing or similar preparation methods.

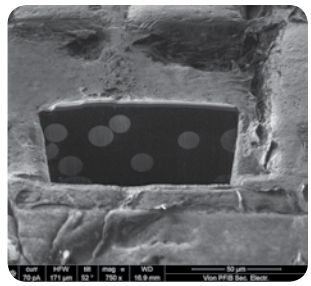
KEY BENEFITS
Increase your productivity with >20X faster milling than conventional Ga-FIB
Fast, accurate cross sectioning reveals defects and subsurface features
Wide range of milling and imaging beam currents (few pA to > 1 µA)
Use deposition chemistry to protect surface features
Optional charge neutralizer capability to enable sectioning on charging structures.
Optional backside silicon access with patented coaxial gas delivery nozzle
Common hardware and software architecture with other FEI FIB, SEM and DualBeams™



↑ An 80 µm wide and 100 µm tall bump cross-sectioned and imaged with Vion FIB in 20 minutes. Courtesy of SEMATECH.



↑ PFIB section and image through three-chip stack exposing interconnecting TSV. Courtesy of Fraunhofer-EMFT, Munich.



↑ After stress testing the reinforced polymer tensile test bar was sectioned and imaged by the Vion PFIB. One can observe the location and orientation of the fibers in the polymer matrix. Section width 120 µm.

Technical highlights

The Vion system consists of a large vacuum chamber and a focused-ion beam column with inductively coupled plasma (ICP) ion source. The ICP source provides 20-60 times higher beam currents than traditional gallium-based FIBs while maintaining low beam current capabilities. Additionally, various gases can be introduced in the chamber which change the beam interaction and cause deposition to occur (either insulator or conductor). With the introduction of other gases, the etch rate can be selectively modified for a preference of silicon over conductor or vice versa. Overall, the system is built using field proven components already used in other FEI FIB, SEM and DualBeam™ systems.

Key Options

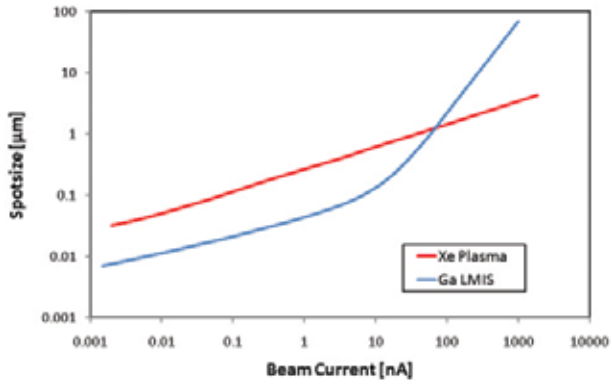
Hardware

- Deposition (metal, insulator) & etch (polyimide, silicon) chemistries
- Bulk-Si trenching
- NavCam
- IR Microscope
- Charge neutralizer (electron flood gun)

Software

- CAD Navigation
- iFast Developers Kit

SPECIFICATIONS	
Ion Source	Xe^+ inductively coupled plasma (ICP)
Acc. voltage	2-30 kV
Beam current	1.5 pA to 1.3 µA
Image resolution	< 25 nm
Stage	5-axis motorized eucentric
	X,Y motion 150 mm
	Tilt -10° to 60°
	Rotation 360°
Operating system	Windows® based



↑ Plasma FIB beam size progression continues from where the Ga LMIS beam size blows up due to spherical aberration effects.

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