

Focussed Ion Beam FIB-SEM

Overview

The basic operating principle of an FIB system is similar to that of scanning electron microscopy, the major difference being the use of a gallium ion beam instead of an electron beam. The beam is raster-scanned over the sample, which is mounted in a vacuum chamber at pressures of approximately 5×10^{-6} mbar. When the beam strikes the sample, secondary electrons and secondary ions are emitted from its surface. The electron or ion intensity is monitored and used to generate an image of the surface. Secondary electrons are generated in much greater quantities than ions and provide images of better quality and resolution; consequently the secondary electron mode is used for most imaging applications.

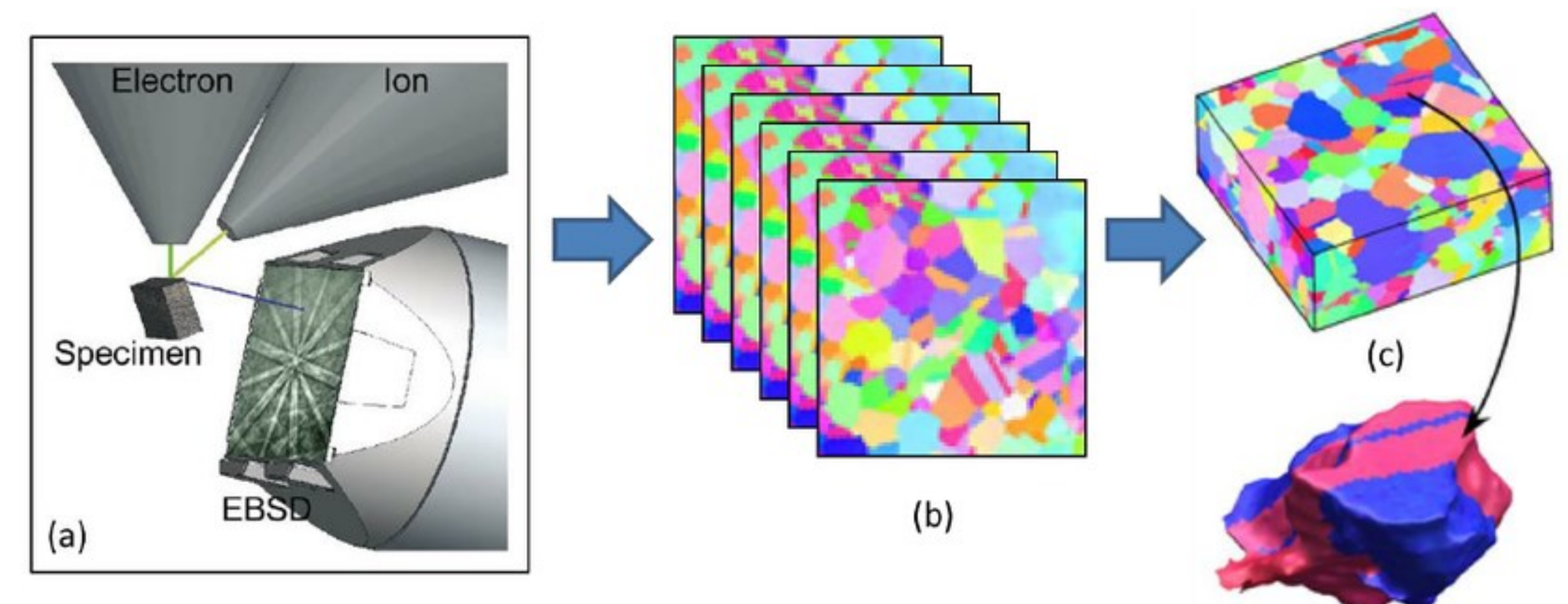
- Milling: Ion beams can be used to remove material from the surface of the sample. This process, called milling, is a major advantage of FIB as much of the constructional analysis and failure analysis of semiconductor devices is performed on cross-sections.
- Deposition: FIB can also be used to deposit metals such as platinum and insulators such as silicon oxide.

FEI (Thermo) Helios G4 CX DualBeam

- Electron optics
 - Dual-mode magnetic immersion / field free lens electron optics with ultra-high brightness NG emitter.
 - Source: Schottky field emitter
 - Acceleration Voltage: 200 V to 30 kV
 - Landing energies: Adjustable from 20 eV (optional) to 30 ke
 - Beam current: 0.8 pA – 22 nA
 - Resolution :
 - 0.8 nm at 15 kV (at eucentric WD / analytical WD)
 - 1.4 nm at 1 kV (at optimum WD)
 - Detection:
 - Secondary Electron (SE)
 - Back Scatter (BSE)
 - Directional Back Scatter(DBS)
 - Secondary electron/secondary ion (ICE)
 - Scanning TEM (STEM)
 - Energy-dispersive X-ray spectroscopy (EDS) Oxford X-maxN 50
 - Electron backscatter diffraction (EBSD) Oxford Symmetry
- Ion optics
 - Tomahawk field emission focused ion beam optics with liquid Gallium metal ion source, two-stage differential pumping and time of flight correction.
 - Voltage: 500 V to 30 kV
 - Beam current: 0.1 pA - 65 nA (15-position aperture strip)
 - Resolution:
 - 4.0 nm at 30 kV using preferred statistical method
 - 2.5 nm at 30 kV using selective edge method



- Gas Injection System
 - Platinum Deposition (Pt)
 - Selective Carbon Mill (H_2O)
 - Insulator Enhanced Etch (XeF_2)
 - Insulator Deposition (SiO_2)
- FEI EasyLift EX NanoManipulator
- Software and Automation
 - AutoSlice and View 4
 - AutoTEM 4
 - iFast Developers Kit Science Academic
 - NanoBuilder



Main Applications

- Imaging, Cross-section Imaging
- Patterning and prototyping
- TEM Specimen preparation
- 3D slice-and view imaging
- 3D EDS and EBSD analysis