Broad Ion Beam Cross Sectioning

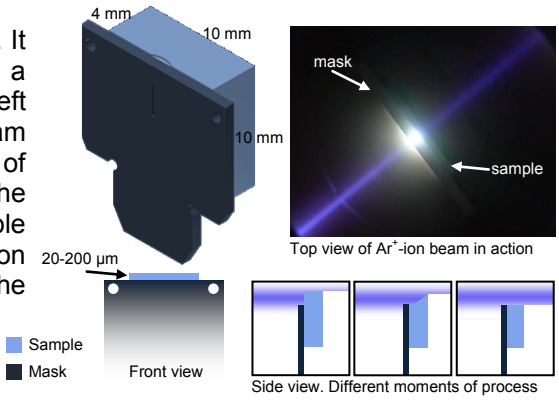
High quality cross sections for SEM

INTRODUCTION

Broad Ion Beam (BIB) cross sectioning is an advanced method for preparing accurate cross section surfaces for a wide variety of materials. With the use of an argon ion beam and a mask plate a clean planar cross-section can be achieved with minimal amount of artifacts on the cross-section surface. BIB excels in comparison to traditional methods such as mechanical polishing or microtome when cross-sectioning soft materials, very hard materials, porous materials or combinations of these. The BIB cross-sectioned surface area is approximately 1 mm in width and several hundred micrometers in length which is very large compared to those made with FIB (Focused Ion Beam).

THE BASICS OF THE METHOD

A sample is first cut and trimmed for suitable size and shape. It is then attached to a sample holder (titanium) which acts as a mask plate. A small part (20-200 µm) of the sample is left visible above the edge of the mask. The broad argon ion beam is aligned perpendicular on the edge of the mask so that half of the beam hits the sample and the other half hits the mask. The ions start removing material from the visible area of the sample while the mask plate protects the rest. Over time the ion bombardment results in a clean planar cross section area of the sample behind the mask plate edge.



ADVANTAGES AND FACTS

- ❑ High quality cross sections
- ❑ Material can be hard, soft, porous or combination of these
- ❑ Preserves internal structures
- ❑ Minimum strain and distortion on the cross-sectioned surface
- ❑ Does not leave abrasive artifacts on the surface
- ❑ Cracks and voids are not filled with polished material
- ❑ Large cross section area compared to FIB
- ❑ Does not require embedding
- ❑ No use of fluids

Gatan Ilion^{+TM} Advantage
Precision Cross Section System

- **Dual Ion Guns**: Argon ions
- **Beam Energy**: 100 eV to 6.0 keV
- **Milling Rate**: > 140 µm/hr (Si, 6 keV)
- **Cut Width**: 0.5 - 1.5 mm, adjustable
- **Milling Angle**: ± 10 degrees, adjustable
- **Sample rotation**: Ion beam active for - 30 to + 30 degrees from normal (plane direction). Decreases curtaining.
- **Sample Cooling System**: Liquid nitrogen — Minimum sample temperature: - 120 °C
- **Operating Pressure**: < 1 x 10^{-4} torr
- **Titanium Mask Plates**

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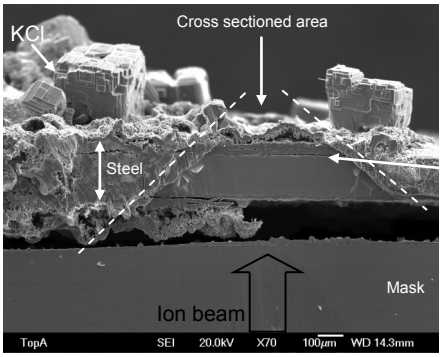
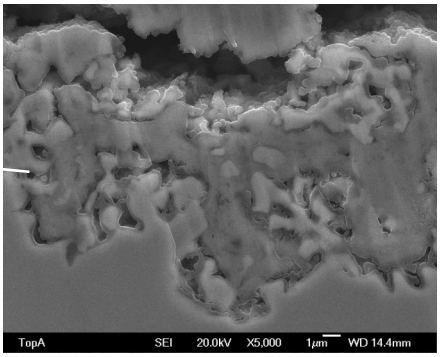
EXAMPLES

Corroded steel

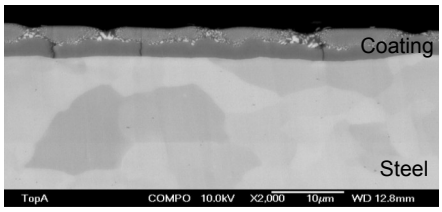
BIB provides a clear cross section and preserves the internal structure across a fragile corrosion layer without the need of embedding the sample. Since BIB is a dry method, none of the corrosion components are dissolved.

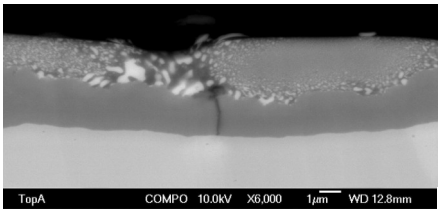




Zn-Al alloy coating

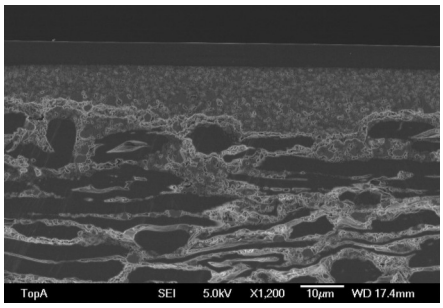
The phase structure of steel and the alloy coating are clearly visible on the cross section. The coating has a 2-layer structure.

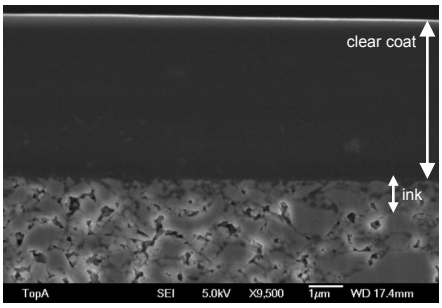




Paper coatings

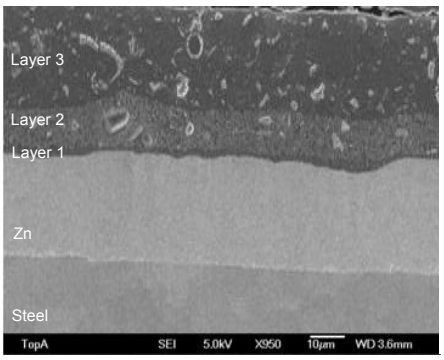
The ion beam is able to cut trough paper without deforming it or filling the pores. This allows for detailed studies of the pore structure, for example how deep ink will penetrate into the porous coating layer.

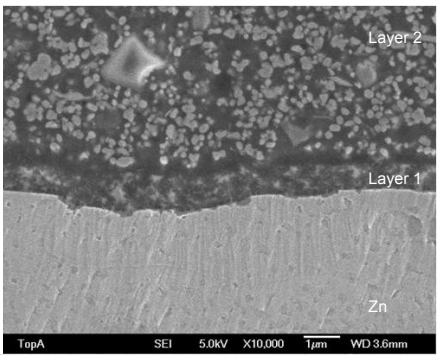




Paint layers

Paint layers can be cross-sectioned with BIB while preserving clear interfaces between the different layers and no mixing is occuring. Even <1 µm thick layers are clearly distinguishable. Also the fillers in the paint layer 2 can be clearly seen.





Other materials

- ❑ Wood
- ❑ Polymeres
- ❑ Electronics
- ❑ Ceramics
- ❑ Powders/Particles
- ❑ Composites
- ❑ Biomaterials

Applications

- ❑ Structural analyses
- ❑ Materials analyses
- ❑ Failure analyses
- ❑ Defect analyses

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