

Enhance your materials analysis with Auto Cross Section Software for Thermo Scientific FIB-SEMs

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Focused ion beam scanning electron microscopes (FIB-SEMs), such as the Thermo Scientific™ Scios™ 3 FIB-SEM, are frequently used for the preparation of cross-sections; the FIB is used to remove bulk material while the SEM can visualize the process and the resulting cross-sectioned surfaces. This reveals features that are otherwise hidden under the surface of the sample, helping to unravel critical characteristics of materials. Thermo Scientific Auto Cross Section (AXS) Software is a dedicated solution for automated FIB cross-sectioning and site imaging with SEM at multiple scales and resolutions. It can be used to define multiple sites on multiple specimens, to perform the subsequent automated cross-sectioning/imaging, and it will save the recorded SEM images produced during the process.

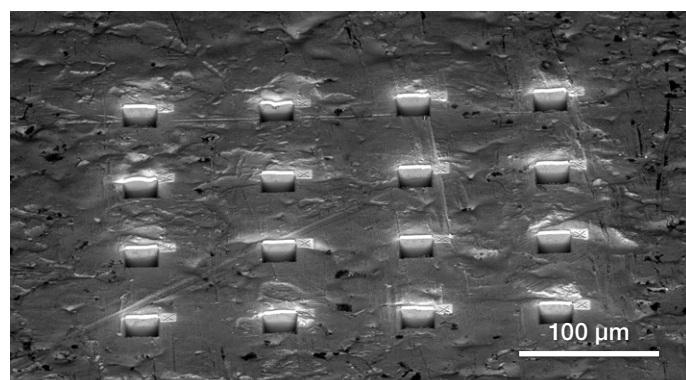


Figure 1. Scanning electron microscopy image of a cross-section array created on a Zn-Mg-Al-coated low-carbon steel. Cross-sections were generated automatically with AXS Software in a Scios 3 FIB-SEM.

In this way, AXS Software provides significant time-saving and efficiency improvements, enabling industrial and academic users to complete their tasks more quickly in order to focus on the critical analysis that follows. It also removes the complexity of operating a FIB-SEM instrument, allowing even users with minimal experience to acquire high-quality data.

Automation routines guarantee reproducibility and consistency, helping to ensure that each cross-section is prepared accurately for reliable and consistent results. Additionally, automation can reduce user bias and error while also improving safety, making the entire cross-sectioning workflow more dependable and secure, especially in industrial environments.

Zinc-based automotive coating

Zinc-based coatings are extensively utilized in the automotive industry to enhance corrosion resistance and to extend the durability of steel components that are exposed to harsh atmospheric conditions. These coatings act as protective layers, preventing the oxidation of the underlying steel, and are applied through methods such as hot-dip galvanization and electroplating.

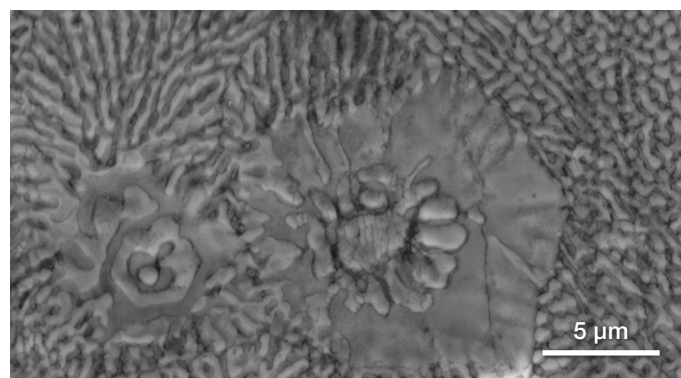


Figure 2. SEM imaging showing the surface features of a Zn-Mg-Al automotive coating.

Microstructural analysis of Zn-Al-Mg coatings is often challenging due to the complexity and varying scales of the developed structures. For instance, primary zinc dendrites can be large, with diameters exceeding 100 μm , while the eutectic phase structures can be significantly smaller, with diameters around 100 nm. Therefore, it is essential to have access to an array of large cross-section SEM images (Figure 1 and 3) at multiple magnifications and at high resolution (Figure 4).

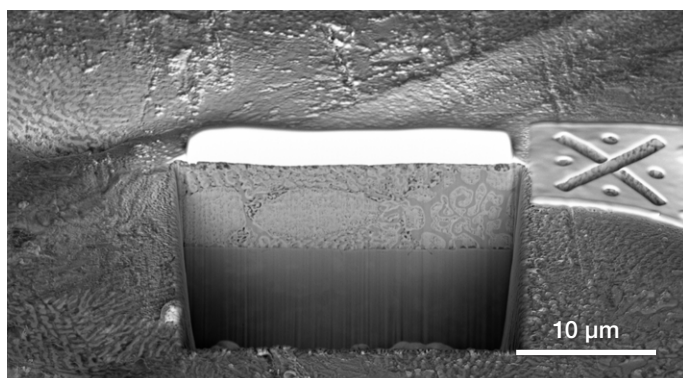


Figure 3. SEM image showing a cross-section automatically created by AXS Software on a Zn-Mg-Al-coated low-carbon steel.

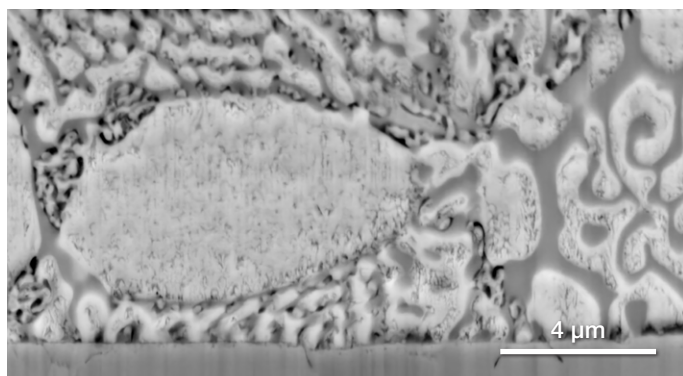


Figure 4. SEM tilt-corrected image showing microstructural features of the Zn-Mg-Al coating on the low-carbon steel substrate.

Understanding the performance of these coatings depends on a comprehensive assessment of their material quality and adhesion to the steel substrate. Cross-sectioning with FIB-SEM offers a detailed view into their composition, which ultimately helps enable stringent control over final products. Failures in adhesion can lead to compromised protection, diminished functionality, or aesthetic defects. Addressing these failures requires identification of root causes in order to implement corrective measures and prevent recurrence.

Conclusions

Thermo Scientific Auto Cross Section Software, powered by the outstanding performance of the Scios 3 FIB-SEM, provides a precise and efficient solution for the analysis of zinc-based coatings. By enabling detailed cross-sectional imaging and analysis, the software aids in the assessment of coating thickness and uniformity, the evaluation of adhesion quality, and the detection of defects and inconsistencies. This method can help ensure the reliability and longevity of zinc-coated steel components in the automotive industry, facilitating proactive quality control and maintenance.

Learn more about AXS Software and automated cross-sectioning with FIB-SEM at thermofisher.com/scios3