

## New Generation Ultra-High Resolution SEM Equipped with a New Xe Plasma FIB for Ultra-Fast and Gentle Sputtering

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Here we introduce the S9000X - a new generation TESCAN FIB-SEM system combining ultra-high resolution optics and stable analytical performance with ease of operation. The SEM column with high-resolution optics [1] and traditional analytical capabilities is based on the TRIGLAV™ column equipped with the next generation of electronics for more stable regulation of the instrument. The brand new Xe Plasma iFIB+ with many useful features offers excellence mainly in semiconductor applications. Last but not least, the instrument is controlled by the newly-developed, user-friendly TESCAN Essence™ software platform featuring automated wizards and processes.

The SEM column, which uses the triple objective lens system - Trilens™, is controlled by the newly-developed electronics with greater stability and more rapid operation comparing to microscopes of previous generations. The imaging system was optimized giving better contrast at all currents and the detection efficiency of detectors in SEM column was also enhanced (more than three-fold signal increase). Better surface sensitivity was reached using energy filtering of axial BSEs, and (with sample bias) detection of low-energy axial BSEs (less than 2 keV) is also enhanced. For heavily-charging samples it is possible to use low-vacuum mode in combination with magnetic-immersion lens. Finally, the resolution was improved to 0.6 nm in the transmission mode.

TESCAN S9000X introduces a new generation Xe Plasma FIB called iFIB+. New, ultra-stable HV supply and precise piezo-driven beam aperture changer allow fast switching between FIB presets. Semi-automated spot-optimizing wizard delivers user-friendly tuning of iFIB+ milling and polishing presets. Large-area cross-sectioning and other large-volume applications require a wide field of view, which is now more than 1 mm at 30 kV. Spot profile has been optimized at minimum beam energy 3 keV, thereby significantly improving performance in low-energy beam applications (e.g. IC delayering, large area cleaning for EBSD analysis or removal of amorphous layer from TEM lamella). For large area cross-sectioning or preparation of large lift-out samples for 3D Tomography, the maximum beam current is 2 µA. Although it is the highest plasma FIB current available on the market, the spot shape still remains well-defined under these fast sputtering conditions.

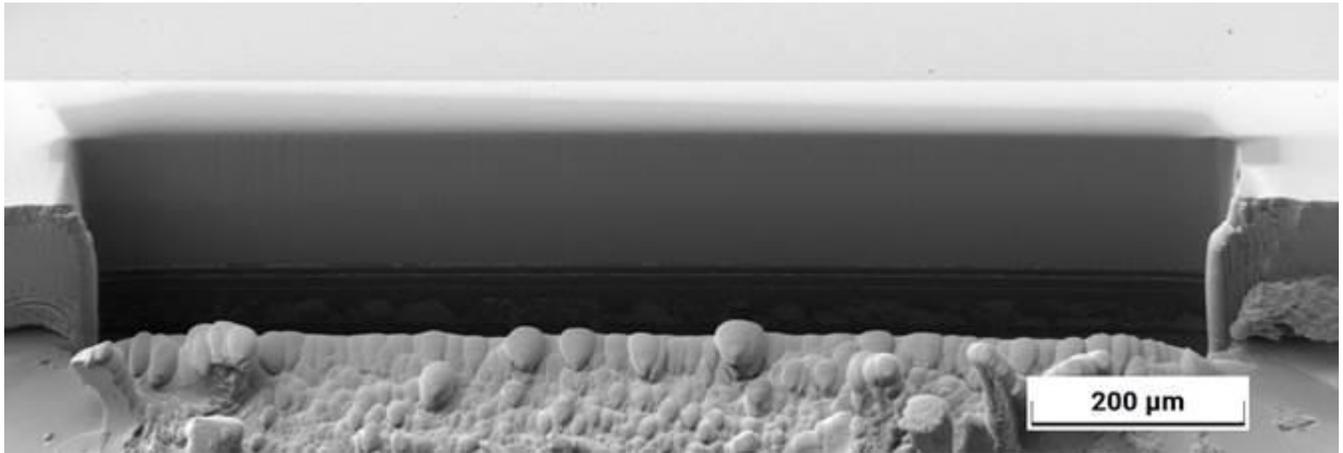
iFIB+ operation is integrated into the new TESCAN Essence™ software platform. The new automated software modules for sample processing are ideal for semiconductor applications such as large area cross-sectioning, IC delayering (see Figure 1) of latest technology nodes or large TEM sample preparation. The new multi-user GUI can be customized for application-specific layout and together with workflow-oriented wizards will maximize productivity across specified workflows. The platform also offers the advanced DrawBeam™ vector-based scanning generator for fast and precise FIB machining and Electron Beam Litography.

### References:

[1] J Jiruše *et al*, *Microscopy & Microanalysis*, 19 (Suppl 2), 2013, p. 1302.

[2] Z Shao, *PSD Lin, Rev. Sci. Instrum.* **60(11)**, 1989, p. 3434.

[3] J Jiruše *et al*, *Ultramicroscopy* **146**, 27 (2014)



**Figure 1.** Overview image of a 1 mm wide cross-section from failure analysis of an OLED display. SEM image acquired with the chamber SE detector at 2 keV.