doi:10.1017/S1431927618006062
Microsc. Microanal. 24 (Suppl 1), 2018
© Microscopy Society of America 2018

S9000X – Next Generation of Ultra-High Resolution SEM for Enhanced Analysis and Xe Plasma FIB for Ultra-Fast and Gentle Sputtering

Miloslav Havelka[1], Jaroslav Jiruše[1], Tomáš Hrnčíř[1], Jan Polster[1], Rostislav Váňa[2] and Samuel Záchej[2]

[1.] TESCAN Brno, Physics Department, Brno, Czech Republic
[2.] TESCAN Brno, R&D Applications, Brno, Czech Republic

Recent developments in nanotechnology require a highly-reliable SEM combining ultra-high resolution optics and stable analytical performance with ease of operation. Here we introduce the S9000X – a new generation of TESCAN FIB-SEM system. The system is based on the TRIGLAV™ column (with high-resolution optics [1] and traditional analytical capabilities) and comes fitted with the brand new Xe Plasma iFIB+. The instrument is controlled by the newly-developed, user-friendly TESCAN Essence™ software platform featuring automated wizards and processes. Last but not least is the next generation of electronics for more stable regulation of the instrument.

TRIGLAV™ SEM column uses the triple objective lens system – Trilens™. The single-pole, first objective lens creates a strong magnetic field around the sample to decrease optical aberrations for ultra-high resolution. The analytical, second objective lens allows magnetic-field-free mode for use with analytical detectors and for versatile use together with new iFIB+. The third objective lens provides increased field of view, increased depth of focus and optimized aperture at high currents. Improved stability and the newly-developed electronics allows the user to set parameters much more rapidly than on microscopes of previous generations. Moreover, the imaging system was optimized giving better contrast at all currents and improved resolution (0.6 nm) in transmission mode.

The detection system was optimized to increase the detection efficiency of detectors in SEM column (more than three-fold signal increase). Another exciting possibility is energy filtering of axial BSEs, that gives better surface sensitivity and (with sample bias) enhanced detection of low-energy axial BSEs (less than 2 keV). For heavily-charging samples it is possible to use low-vacuum mode.

TESCAN S9000X introduces a new generation Xe Plasma FIB called iFIB+. For large area cross-sectioning or preparation of large lift-out samples for 3D Tomography, the maximum beam current has been increased to 3 μA. Although it is the highest plasma FIB current available on the market, the spot shape is still well-defined under these fast sputtering conditions. Field of view at 30 kV has been enlarged to more than 900 μm. The minimum beam energy has been reduced to 500 eV, therefore iFIB+ brings significantly improved performance for low-energy beam applications (e.g. IC delayering, large area cleaning for EBSD analysis or removal of amorphous layer from TEM lamella). New, ultra-stable HV supply and precise piezo-driven beam aperture changer allow fast switching between FIB presets. Semi-automated spot-optimizing wizard brings user-friendly tuning of iFIB+ milling conditions. The operation of iFIB+ is closely related to the new automated software modules for sample processing and it is 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 simplified, multi-user GUI with a layout manager allows fast access to main functions, is easy to learn and can be customized for every user. Application specific layout together with workflow-oriented wizards will maximize productivity across specified workflows. The new TESCAN Essence™

https://doi.org/10.1017/S1431927618006062 Published online by Cambridge University Press

software platform also offers the advanced DrawBeam^{TM} 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)

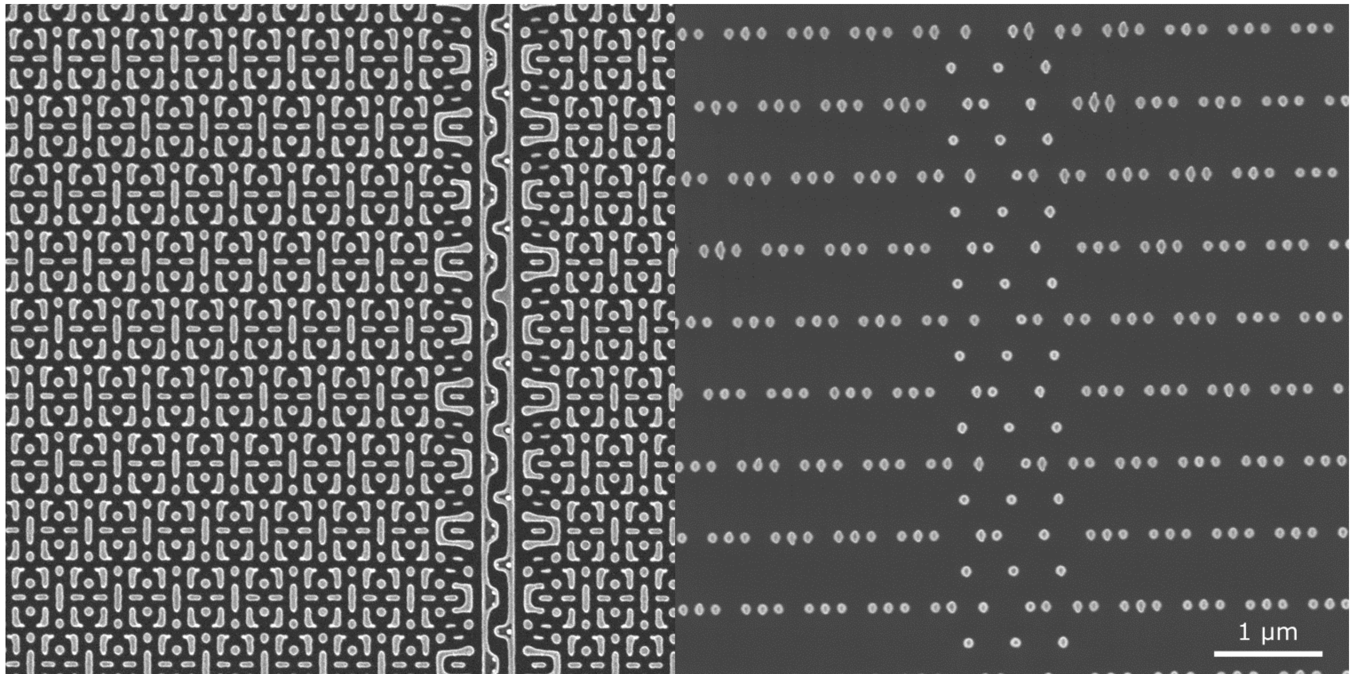

Figure 1. An image of two different structures uncovered from semiconductor chip after delayering. Left – transistor contact layer; right – interconnect layer (via) between two metal layers. Beam deceleration mode, landing energy 500 eV.

https://doi.org/10.1017/S1431927618006062 Published online by Cambridge University Press