

Opening the third dimension to your SEM with integrated fs-laser

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Background

Scientists and engineers in materials research laboratories performing sample preparation using focused ion beam (FIB) or plasma focused ion beam (PFIB) instruments face challenges in accessing deeply buried structural features and preparing large cross-sections and trenches at micro- and mesoscale sizes. Such preparation by FIB or PFIB is time-consuming and ineffective, as it occupies an expensive microscope that could be used for more efficient processes: high-quality imaging, high-precision analysis, and sample preparation for atomic-resolution imaging. There is a need for an effective solution for the rapid preparation of site-specific micro- and mesoscale samples.

Methods

In response to these challenges, the authors present a laser scanning electron microscope (LaserSEM) as a new Zeiss solution for fast and cost-efficient high-quality site-specific sample preparation. The Zeiss LaserSEM is a field-emission scanning electron microscope (FE-SEM) with an integrated fs-laser for large 3D volume sample fabrication. This solution enables to achieve a fast site-specific preparation from the meso- to the microscale. The Zeiss LaserSEM accelerates workflows such as 3D tomography on huge sections, preparation of arrays of pillars for micromechanical testing, or even multi-modal workflows e.g. correlative experiments between X-ray microscope (XRM) and scanning electron microscope (SEM).

Results

The examples of rapid access to undersurface features by fs-laser and Cut2ROI Workflow with the ability to identify, access, prepare, and analyze deeply buried sites with precise navigational guidance using the correlation between X-ray and electron microscopes from ZEISS are presented. The fs-laser processing recipes for different materials and their application for a large cross-sectioning with further energy dispersive spectroscopy (EDS) and electron back scatter diffraction (EBSD) analysis, as well as pillar preparation for nanoindentation, compression tests, and nanoCT, are presented.

Conclusion

Integration of fs-laser into SEM allows rapid access to deeply buried structures and fast large-volume material removal and achieves high resolution and contrast imaging with the benefits of Zeiss Gemini optics. ZEISS LaserSEM is a site-specific cross-section and micro/mesoscale fabrication solution that rapidly prepares samples by accurately removing millimeter volumes of material using integrated FE-SEM imaging to achieve accuracy.

Keywords:

LaserSEM, sample preparation, SEM