High Resolution Imaging and Analytics for Nanoscience

Frederick Pearsall, William Harris, Fang Zhou

Troubleshooting and quality control for various nanofabrication processes almost always requires a field emission SEM (FE-SEM), either after optical imaging, or in lieu of it. This is especially true for electron beam lithography users with tighter critical dimension requirements; they require SEM characterization at basically every step. For arrays and other photonic samples, SEM and/or AFM characterization is necessary to determine pitch, height and diameter of different photonic particles or pillars.

Carl Zeiss Microscopy offers a wide portfolio of electron microscopes, raising the bar for surface-sensitive, distortion-free high-resolution imaging, and demanding analytical tasks. Critical workflows for the nanofabrication and lithography community must allow the user to image, characterize, and analyze their samples both qualitatively and quantitatively, while maintaining a high standard of usability.

This talk will highlight classically-challenging imaging applications including magnetic, non-conductive, and beam-sensitive samples. Resolved magnetic grain structure of a hard disc platter, using low angle back-scatter detector is demonstrated. An additional sample-biasing technique, Tandem Deceleration, is also shown for comparison to visualize its usage to produce an extra boost in imaging resolution.

The importance of the flexibility and modularity of today's scanning electron microscopes will be discussed, leveraging the range of in chamber, STEM, and Inlens column detectors along with flexibility in EBSD, EDS, CL, other analytical detectors, and in situ atomic force microscopy in a SEM. Critically, these options facilitate a larger user base of researchers and increases the amount of quantitative information that can be obtained from all kinds of fab samples. Finally, unique multi-scale imaging workflows using correlative microscopy capabilities will be discussed.

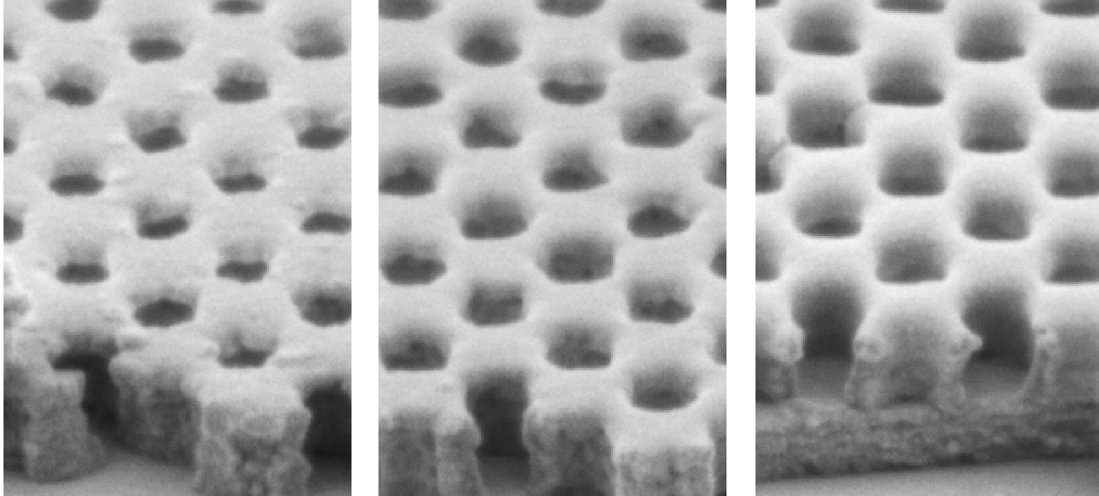

Figure 1 E-beam exposed resist layers at 300 V. Reference, pre-exposed at 300V, and pre-exposed at 800V samples are shown left, middle, and right respectively. There is clearly damage when 800 V is used, evidence of the fact that this material is very sensitive to e-beam exposure. *Courtesy of Dr. Langer, Globalfoundries Dresden*

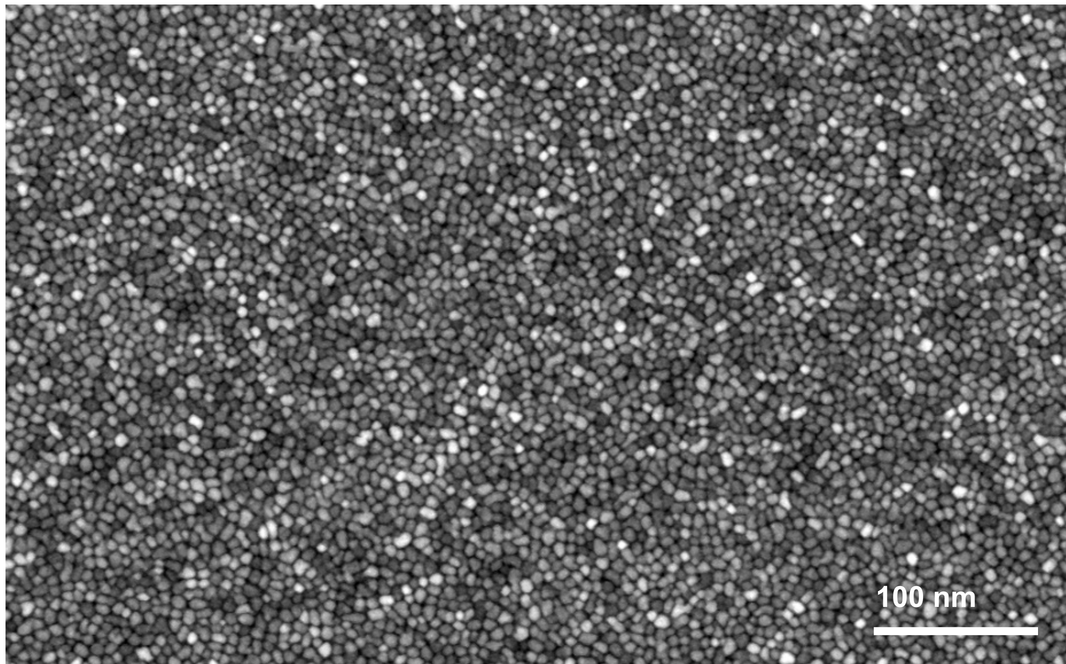

Figure 2 Highly resolved magnetic grain structure of a hard disc platter. Data density is dependent on grain size which can be dteremined by varying grey levels of channeling contrast.