

New Imaging Modalities in Helium Ion Microscopy

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Standard Helium Ion Microscopy (HIM) is providing best resolution gas field ion source based imaging and nanofabrication capabilities[1], but is lacking analytical capabilities. Elemental information in the HIM can be obtained using time-of-flight secondary ion mass spectrometry (TOF-SIMS). Here, the primary beam hits the sample in pulses as short as 20 ns. Ionized sputtered particles from the sample are then analyzed with respect to their TOF. A lateral resolution of 8 nm has been achieved [2]. I will present details of the implementation and show results obtained on materials for Li batteries [3] and Zn coated steel samples.

In a different approach we developed scanning transmission ion microscopy (STIM) to reveal buried and structural information of the investigated samples. The implementation is based on a new detector based on a combination of MCP stack and a solid state delay line detector. This moveable ≈ 4 Mpx detector has a spatially and time resolved count rate of 5 Mcps. It allows to record the scattering angle ($< 33^\circ$) and the energy of all transmitted particles [4]. In addition to mass-thickness contrast in bright and dark field also transmission channeling patterns can be obtained revealing the crystal structure of the sample.

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References

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