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Deep-Ultra-Violet Atom-Probe Tomography Using Automation to Understand Operational Parameter Space: A Progress Report

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The interaction between laser-pulsed radiation and APT specimens can be complex [1,2], but from a microscopy perspective, the key considerations really only depend on the microscopy outcomes: time-to-knowledge and information content of the characterization. Commercially available atom probes have provided infrared, green, blue, and ultra-violet (UV) options for laser-pulsed acquisition, with the LEAP® 4000/5000 platforms utilizing 355-nm light. The newest atom probes, the LEAP 6000 and Invizo™ 6000, utilize deep-ultra-violet (DUV) 266-nm light [3].

Published studies investigating the correlations between acquisition parameters and survivability have been rather limited [4,5]. In a previous study, we focused on the survivability of a silicon sample containing a 12-nm silicon-oxide layer as a good indicator of general trade-offs between variables like detection rate (DR), pulse frequency, and laser pulse energy (LPE) for survivability [4]. We showed that the total rate of atom removal (DR and pulse frequency) was the key variable, while the LPE energy and its role in reducing the evaporation field was also important, but secondary. Although not an aim of the study, the fastest acquisition rates which provided high (>80%) survivability were performed at 0.4% DR and 625 kHz at 355-nm (the only wavelength evaluated in that study).

In this presentation, we report on progress evaluating a similar analysis space of this same sample using DUV and the automated features available on the 6000 atom probe platforms as an on-going study. As of the writing of this abstract, we have collected some intriguing data. Both the Invizo 6000 and LEAP 6000 platforms show high survivability and improved evaporation-field matching at DRs of 6% and 2% respectively. These high data collection rates and survivability lead to fewer background counts, relative to signal, and result in better time-to-knowledge. Coupled with improved evaporation-field matching, this leads to better reconstructions and improved spatial precision of results for DUV atom probe data [3].

References:

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