SEMINAR SERIES

Time-of-flight Secondary Ion Mass Spectrometry (TOF-SIMS)

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Steve Harvey received B.S. and M.S. degrees, both in ceramic engineering, from Alfred University. He received his Ph.D. in materials science from Northwestern University in 2008. In 2011, he completed his postdoctoral stay as an Alexander Von Humboldt research fellow in Aachen Germany and has been at NREL ever since. His Ph.D. work focused on making correlations between bulk defect chemistry and surface electronics properties of transparent conducting oxides. His postdoctoral work focused on investigating cation diffusion in mixed-conducting oxides. His work at NREL since 2014 has focused on using time-of-flight secondary ion mass spectrometry to enable more efficient and reliable photovoltaic materials across multiple technologies.

Time-of-flght secondary ion spectrometry (TOF-SIMS) is a powerful analytical technique to investigate the distribution of dopants and impurities in solid materials. TOF-SIMS is capable of detection limits in the ppm to ppb range, as well as chemical imaging and 3-D tomography at 100-nm lateral resolution. In this talk, I will briefly introduce the fundamentals of the technique and show some examples from recent work that highlight its versatility. These examples include investigating the defect chemistry and diffusion of $Ba_{0.5}Sr_{0.5}Co_{0.8}Fe_{0.2}O_{(3-\delta)}$ (BSCF) and CdTe. Multi-scale, multi-technique investigations of photovoltaics module failure including TOF-SIMS can enable insights into the root-cause mechanisms of module degradation at the nanoscale that is observed at the length scale of meters.

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