Nanoscale Chemical Phenomena using HIM-SIMS

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The key to advancing materials in energy and environmental sectors is to understand and subsequently control both: the structure as well as chemistry of surfaces and interfaces. However, significant instrumentation gaps hamper simultaneous chemical and physical characterization of materials with high spatial resolution and chemical sensitivity. Multimodal chemical imaging methodology transcends inherent individual instrument limitations, however, data volumes and complicated analysis originating from a combinatorial approach of using a breadth of instrumentation may hamper throughput.

This work will illustrate recent nanoscale results on imaging and chemical analysis of conductive and nonconductive surfaces using a tool that combines imaging and milling – a Helium Ion Microscope (HIM) and chemical sensitivity – a secondary ion mass spectrometer (SIMS) techniques. Data will be presented on conductive and non-conductive chemical standards as well as real organic-inorganic perovskite (HOIPs) materials. Ionization efficiency, sputtering, fragment detection, and other salient features of the tool will also be presented and discussed. Overall, a combined HIM-SIMS platform offers significant potential to visualize and map active interfaces, by intertwining imaging, nanoscale elemental characterization, and data analytics; to better grasp the physical properties of materials and the mechanistic physics-chemistry interplay behind their properties.

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