Adventures at the Atomic Scale: Defect Chemistry using Atom Probe Tomography

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Abstract

Developing materials for optical and electrical applications often requires an understanding of the relationships between processing and point defects. Atomic scale relationships such as these are frequently elusive due to a lack of characterization techniques with the necessary spatial resolutions and chemical sensitivities. In this work, examples of nanoscale and atomic scale characterization of oxide and semiconductor point defects determined through atom probe tomography (APT) will be shown. Specifically, oxygen stoichiometries in oxygen and proton conducting oxides can be directly related to the electrical conductivities where grain boundaries dominate transport. The relationship between ordered defect pair point defect chemistries and the resulting optoelectronic properties in thin film photovoltaic absorber layers will also be illustrated.

Biography

Dr. Brian Gorman earned his PhD in Ceramic Engineering from the University of Missouri-Rolla under the guidance of Dr. Harlan U. Anderson. His PhD focused on the processing – structure – property relationships in thin film electrolyte solid oxide fuel cells. Following his PhD work, Dr. Gorman was employed at Texas Instruments where he developed processing and characterization techniques for low-k dielectrics for CMOS and ferroelectric RAM devices. He was also employed at Los Alamos National Laboratory where he worked on radiation tolerant ceramics for nuclear waste disposal. In 2009, he joined the faculty at the Colorado School of Mines, the Colorado Center for Advanced Ceramics, and the National Renewable Energy Laboratory. His research interests are currently focused on atomic processing – structure – electronic property relationships in ceramics and semiconductor devices.