

MATERIALS SCIENCE AND ENGINEERING (MS&E) SEMINAR SERIES
Friday October 4, 2019 at 3:00pm in room ESB 207

“Unravelling the Bulk from the Surface of Mixed ionic-electronic conducting materials”

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Abstract: Perhaps one of the most fascinating and challenging aspects of materials design for solid state electrochemical systems is the inherent necessity to optimize both the bulk and surface properties of the materials. For mixed ionic-electronic conducting (MIEC) materials in the electrode of solid oxide fuel cells (SOFCs), the bulk dictates ionic and electronic transport, while the surface dictates the equally critical electrocatalytic performance. Linking the composition and structure of these materials to the performance characteristics requires analysis tools that can accurately characterize both bulk and surface. This is particularly challenging as the most active materials are multi-component oxides, that undergo substantial shifts in bulk structure under operating conditions, and where surface segregation of individual cations can lead to significant differences between surface and bulk composition. In-situ neutron diffraction provides a means to accurately determine the crystal structure and oxygen vacancy concentration and location at conditions similar to those encountered in working devices. In complement, high-sensitivity low energy ion scattering (HS-LEIS) accurately determines the outermost atomic composition of the materials. In combination, these tools provide insight into the rate limiting processes within the SOFC electrode.

Bio: Steven McIntosh is Professor of Chemical and Biomolecular Engineering at Lehigh University and Associate Director of the Lehigh Interdisciplinary Research Institute for Functional Materials and Devices. He received his BEng from the University of Edinburgh, and his MS and PhD in Chemical Engineering from the University of Pennsylvania. He spent a postdoctoral period in Inorganic Materials Science at the University of Twente. McIntosh’s research focuses on the development of functional materials for energy systems, with topics ranging from Solid Oxide Fuel Cell electrodes to biomineralization of quantum confined nanomaterials. McIntosh is a Fellow of the Royal Society of Chemistry, and recipient of the NSF CAREER award. He is an associate editor for RSC Advances and editor for the RSC Specialist Periodical Reports Electrochemistry

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