Bio

My work in the Complex and Correlated Materials Group focuses on developing structure-property relationships in inorganic materials that may be of interest for energy applications. This is accomplished through a combination of synthesis and detailed characterization of physical properties. I synthesize single crystals and polycrystalline materials using a variety of techniques (flux growth, optical floating zone furnaces, Bridgman growth, solid-state reactions, arc melting). Structural characterization is performed using x-ray diffraction and scanning electronic microscopy, while a variety of thermodynamic, transport and magnetic properties are also measured using in-house equipment. My research is driven by a desire to understand emergent phenomena in materials with competing interactions and complex ground states. In turn, we want to be able to manipulate the physical properties dictated by these ground states, for instance in the areas of superconductivity and thermoelectrics. Lately, I have had a growing interest in magnetism, and I find materials that display a coupling between magnetism, transport, and the underlying crystal structure to be particularly interesting.

Collaborations with theorists and neutron scatterers allow for a deeper understanding of the materials physics being investigated in our group. For instance, in the area of thermoelectric materials we study how phonons propagate heat through a crystalline lattice, and neutron scattering allows us to probe the influence of the phonon dispersions on the thermal conductivity. Similarly, theorists performing density functional calculations provide unique insights into transport by elucidating the roles of the electronic dispersions. In both of these cases, having well-characterized single crystals greatly enhances the collaborations.

Key words: single crystal growth, electrical and thermal transport, thermoelectric, superconductor, Hall effect and carrier mobility, Seebeck coefficient

Publications:
ResearcherID: https://www.researcherid.com/rid/E-5897-2011
Google Scholar: https://scholar.google.com/citations?user=Mrr0x4gAAAAJ&hl=en

Education:
Ph.D. (Chemical Engineering, minor in Material Science), Caltech, 2010
M.S. (Chemical Engineering), Caltech, 2007
B.S. (Chemical Engineering, Env. Eng. Minor), Pennsylvania State University 2004

Research Positions:

2013 – Present, Research Staff Scientist, Materials Science and Technology Division, Oak Ridge National Laboratory, Oak Ridge, TN

2010 – 2013, Postdoctoral Fellow, Materials Science and Technology Division, Oak Ridge National Laboratory, Oak Ridge, TN

Awards

Demetriades - Tsafka - Kokkalis Prize in the area of Environmentally Benign Renewable Energy Sources, California Institute of Technology, (Jun., 2010)

2010 Goldsmid Award for Excellence in Research in Thermoelectrics by a Graduate Student, awarded by the International Thermoelectric Society (May, 2010)