

CHEMICAL ENGINEERING

DISTINGUISHED YOUNG SCHOLARS SERIES



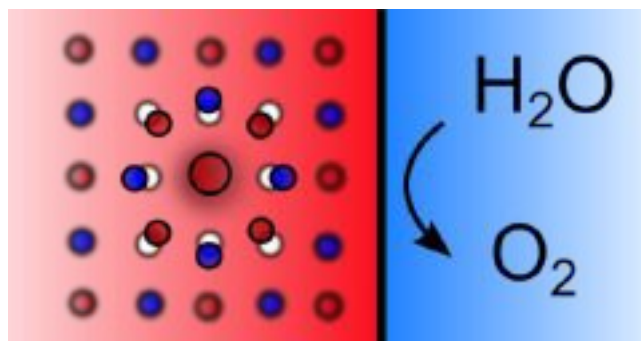
ALEX RETTIE

Monday, August 14, 2017

Postdoctoral Fellow
Argonne National Lab

Towards Solar Fuels: Unravelling Charge Transport in Metal Oxide Photoelectrodes

ABSTRACT: The photoelectrochemical production of solar fuels through water splitting or CO₂ reduction relies on the development of suitable photoanodes for water oxidation. Metal oxides, such as bismuth vanadate (BiVO₄) are promising, but are often limited by slow charge transport, a property that is poorly understood and difficult to measure. To this end I will describe the first synthesis of doped single crystals of BiVO₄ and their electronic transport and photoelectrochemical properties [1]. We were able to demonstrate that, unlike conventional semiconductors, material aspects of BiVO₄ (and other metal oxides) favor the formation of slow moving, self-trapped charge carriers: small polarons [2]. Our high quality samples serve as a model system to probe anisotropy and the consequences of small-polaron formation on the electronic band structure, especially regarding mid-gap states. Based on this knowledge, I will outline the key points of small-polaron theory relevant to engineers and chemists and describe future opportunities within this framework to efficiently produce fuels from sunlight [3].



1. A.J.E. Rettie et al., J. Am. Chem. Soc., 2013, 135 (30), p 11389.
2. A.J.E. Rettie et al., Appl. Phys. Lett., 2015, 106, 022106.
3. A.J.E. Rettie et al., J. Phys. Chem. Lett., 2016, 7, p 471.

LECTURE 4:00 - 5:00 (PAA) A110
Happy Hour in Benson Hall Lobby Following



CHEMICAL ENGINEERING
UNIVERSITY of WASHINGTON

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BIOGRAPHY: Alex Rettie obtained his Ph.D. (Chemical Engineering) from the University of Texas at Austin in 2015 under the supervision of Prof. C. B. Mullins, where he studied metal oxides for photoelectrochemical water splitting. Currently he is a post-doctoral researcher at Argonne National Laboratory with Prof. M. G. Kanatzidis working on the exploratory synthesis of superconductors and neutron detection materials. He received undergraduate training in chemical engineering at the University of Edinburgh, Scotland, UK.