CBE Fall 2023 Seminar Series

Renewable Energy Generation and Storage through Thermochemical Cycles - A Combined Theory and Experimental Approach

Monday,
September 25, 2023
10:30 AM
EB1 1011

Christopher Muhich

Arizona State University

Refreshments will be served from 11:40-12:00 in EB1 2014 (Student Lounge)

Economic conversion and storage of solar energy into electricity and chemicals is a Grand Challenge of Engineering in the 21st Century because it will underpin the transition away from the fossil chemical and energy landscape to a renewable and sustainable future. Thermochemical cycles provide a route to both converting solar heat into feed stock H2 and CO molecules by water and carbon dioxide splitting, and thermochemical energy storage. Thermochemical reduction/oxidation cycles exploit temperature dependent oxygen exchange between gas and metal oxides to convert heat to chemical energy, which can then be used to drive chemical reactions or merely as a storage device. In this lecture, we will use a combination of computational and experimental approaches to understand these cycles and the active materials. This understanding will be used to improve their efficiency and economic performance through materials and system design. Using state of the art atomistic simulations and thermodynamic modeling techniques we will develop a fundamental understanding of the atomic level thermodynamics controlling reduction and oxidation and then use this insight to design new materials. This will be coupled to system models which direct materials design. Lastly, experimental efforts are used to validate and enhance computational modeling.

NC STATE UNIVERSITY

Chemical and Biomolecular Engineering

Christopher Muhich

Christopher Muhich is an Assistant Professor of Chemical Engineering at Arizona State University. His research uses computational chemistry techniques to fundamentally understand and design materials to facilitate renewable energy generation and storage, and environmental remediation processes. Research efforts in his group include renewable energy storage and generation by chemical looping, and adsorbent and single atom catalysis design for remediation of nitrates, organohalides, and toxic oxoanions from drinking water. He earned a bachelor's degree in Chemical Engineering from the University of Michigan in 2009 before completing a doctorate at the University of Colorado at Boulder in 2014. After graduate school, he spent two years as a postdoctoral researcher at ETH Zurich (Swiss Federal Institute of Technology) before joining ASU in 2018.