HIGHLANDS IN CHEMISTRY SEMINAR SERIES

FENG LIN

VIRGINIA TECH

"Investigating Solid–Liquid Interfaces and Defect Chemistry in Electrochemical Energy Materials"

OCTOBER 23, 2020

2:30PM

ZOOM

FACULTY HOST:
ALAN ESKER

Our research program, established in Fall 2016, focuses on understanding how electrochemical interfaces and defect chemistry govern the nucleation and propagation of redox reactions in solids, with a strong focus on tackling fundamental materials chemistry challenges using advanced synchrotron X-ray analytical techniques. We aim to advance fundamental insights that can broadly and positively impact the development of materials electrochemistry for next-generation energy solutions including batteries, renewable fuels, and smart windows. To date, we have made major progress in probing how local chemical and structural heterogeneities, such as grain boundaries, dislocations, point defects, and electrochemical interfaces, govern the redox reactions in redox-active solids. Such progress has allowed us to design and synthesize a vast array of new energy materials for low-cost, sustainable, high-performance electrochemical energy systems. We will start the presentation by providing an overview of our research endeavors to spotlight the essential contributions made by the Lin Lab members. Then we will highlight two coherent topics that were published during the COVID-19 pandemic. First, we will present our study on determining the atomic and molecular origins of surface-mediated electrochemical processes through probing the metal ion speciation and interfacial structural transformations under electrochemical operating conditions. Second, we will report our study on controlling the charge nucleation and propagation in solids by engineering nanoscale defect chemistry. We will show that a precise control of crystallographic defects and their distribution can potentially promote and homogenize redox reactions in battery materials, creating a new path towards developing ultrafast charging batteries. Finally, we will demonstrate how these studies create a platform for tackling frontier materials chemistry challenges in our next chapter of research.

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