THE MATERIALS SCIENCE AND ENGINEERING DEPARTMENT
WINTER COLLOQUIUM SERIES PRESENTS:

Professor Kimberly See

Professor of Chemistry in the Division of Chemistry and Chemical Engineering

California Institute of Technology

Multielectron Redox for High Energy Density Battery Cathodes

Rechargeable Li-ion batteries have revolutionized portable energy storage but the limitations imposed by intercalation chemistry, cost associated with precursors of active materials, and critical nature of crucial elements drive the need for new batteries. Our lab aims to develop energy dense chemistries that obviate the need for the critical and costly elements like Co and Ni in the cathode and Li as a working ion. The search for these so called “beyond Li-ion” technologies include systems based on alternative charge storage mechanisms that promise high theoretical capacity and energy density. This talk will focus on our efforts to go beyond Co- and Ni-containing cathodes. We will discuss how charge storage mechanisms beyond intercalation can be leveraged to yield Fe-based materials with high energy densities. Coupling anion redox to traditional transition metal-based redox enables high energy density, commensurate with state-of-the-art NMC cathodes. Importantly, we leverage sulfides to achieve anion redox due to their ability to form stable persulfide bonds in solids as a result of anion oxidation. We will discuss the impact anion redox has on both the physical and electronic structure of materials. We solidify our understanding of anion redox through systematic variation of the materials chemistry which leads to predictable effects on the anion redox processes. Using this information, we can design materials with features that promote anion oxidation.

Kimberly See is a Professor of Chemistry in the Division of Chemistry and Chemical Engineering at Caltech. She was born and raised in Colorado and received her B.S. in Chemistry from the Colorado School of Mines. Kim pursued her PhD in Chemistry at the University of California, Santa Barbara where she worked with Profs. Ram Seshadri and Galen Stucky. Kim was awarded the St. Elmo Brady Future Faculty Postdoctoral Fellowship at the University of Illinois at Urbana-Champaign and worked with Prof. Andrew Gewirth in the Department of Chemistry. Now, her group at Caltech studies new chemistry for next-generation energy storage with a focus on Earth abundant, inexpensive materials. She focuses on the electrochemistry associated with multivalent and multielectron processes.

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In person only; no Zoom

Questions? Contact allison.macknick@northwestern.edu

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