Penn Engineering | Chemical and Biomolecular Engineering
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Fall 2022 CBE Seminar Series

"A Molecular Scale Understanding of Electrified Separations and Catalysis"

Wednesday
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3:30 PM
Wu and Chen Auditorium
Levine Hall

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Abstract

Of the four major energy-use sectors (transportation, residential, commercial, and industrial), the industrial sector accounts for the largest amount of energy use (~32 quad/year). This energy use results in nearly 1500 million metric tons of carbon dioxide emissions yearly [1]. The large carbon footprint is because coal, natural gas, and petroleum are the primary energy sources utilized. With rising concerns related to global carbon emissions, there is a strong interest in displacing most of this hydrocarbon demand with renewable derived electricity. However, displacing hydrocarbons directly with electricity is not always feasible, prompting the need to redesign many industrial separations and catalytic processes to enable widespread electrification.

Within the chemical commodity industry, movement away from thermocatalytic processes and toward electrocatalytic processes is one way to the electrify catalysis. Likewise, movement away from thermal distillation-based separations and toward membrane-based processes is one way to increase electrification associated with separations. However, there are many thermodynamics and kinetic-based challenges with transitioning toward these electrified processes. Thus, there is a growing need to understand at a molecular scale the efficiency and inefficiencies of these emerging technologies. The primary aim of this talk is to describe progress associated with electrification of industrial processes, and detail efforts by the Hatzell lab aimed at elucidating molecular scale insights related to transport and kinetics within these technologies. Specifically, we will highlight the critical challenges and opportunities for electrifying ammonia production, and the role of reverse osmosis membranes in treating more than seawater-based feed streams.

Bio

Dr. Marta Hatzell is an Associate Professor of Mechanical and Chemical and Biomolecular Engineering at Georgia Institute of Technology. Prior to starting at Georgia Tech, she was a Post-Doctoral researcher in the Department of Material Science and Engineering at the University of Illinois - Urbana-Campaign, and a graduate researcher at Penn State University in the Departments of Mechanical Engineering and Environmental Engineering. Dr. Hatzell's research group focuses on exploring the role photochemistry and electrochemistry may play in future sustainable food, energy, and water systems. She is an active member of the American Chemical Society, the Electrochemical Society, ASEEP, AICHE, and ASME. Dr. Hatzell has also been awarded the NSF Early CAREER award in 2019, the Alfred P. Sloan Fellowship in Chemistry in 2020, the ONR Young Investigator Award in 2020, the ECS Toyota Young Investigator award in 2021, and the Moore Inventor Fellow in 2021. She is currently a Co-PI and thrust leader on a Gen-4 NSF sponsored Engineering Research Center (CASFER) and serves as a topic editor for the ACS Energy Letters. Dr. Hatzell is also currently serving as a Scialog Negative Emissions Science Fellow through the Research Corporation for Science Advancement.