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Electrochemistry-enabled Catalysis for Renewable Energy Storage and Water Remediation: Toward Sustainability and Circular Economy

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Abstract
Storing cheap renewable electricity into chemical bonds (*i.e.*, chemical energy storage) could be a transformative opportunity for long-duration energy storage that can address the intermittency of renewables and balance the mismatch between supply and demand at the grid. Currently, the chemical industry primarily consumes fossil feedstock as an energy source, which has been the standard for over a century. A paradigm shift is required to move towards a more sustainable route for chemical synthesis by electrifying and decarbonizing the modern chemical industry. As the cost of renewable electricity continues to decrease, there is a growing interest in fuels and chemicals electrosynthesis. This talk focuses on developing systems, catalysts, and processes to use renewable electricity as an energetic driving force to convert low energy molecules (*i.e.*, air and water) to high-value and high-energy molecules that can be utilized as either fuel, energy storers, and/or chemicals. If the system is demonstrated on a large scale could enable us to store and transport renewable energy in the form of liquid fuels over long distances and addresses our future's energy and environmental goals. I further discuss future directions and strategies to manage the carbon, nitrogen, and water cycles, enabling a circular economy, mitigating waste, and promoting sustainability with positive social and environmental impacts through wastewater treatment and also paves the way for nutrient recovery and recycling. My future research aims to develop next-generation sustainable industrial systems and processes that can aid in the transition to a net-zero-emission energy system and in meeting our world's growing clean energy and water demands. I have a strong passion for mentoring and teaching diverse students in an inclusive, welcoming, and collaborative environment. I strive to educate the next generation of scientists who can positively impact society.

Bio
Reza Nazemi is currently a postdoc associate in the Department of Chemical and Environmental Engineering at Yale University in the research group of Prof. Jaehong Kim. He was formerly a postdoc fellow in the School of Chemistry and Biochemistry at the Georgia Institute of Technology (Georgia Tech). He received his Ph.D. from the Woodruff School of Mechanical Engineering at Georgia Tech under the supervision of Prof. Mostafa El-Sayed in 2020. He received his M.S. degree (2015) in Mechanical Engineering from Michigan Technological University and B.S. degree (2013) in Aerospace Engineering from the Sharif University of Technology. His current research focuses on the design and development of systems and materials for clean energy generation and wastewater treatment. In addition, he leverages advanced spectroscopic and microscopic techniques to gain a mechanistic understanding of (photo)electrochemical reactions for sustainable fuel and fertilizer production. Reza has received multiple awards for his research, including the ACS Physical Chemistry Division Young Investigator Award (2021), Georgia Research Alliance Phase I grant (2020), and Amazon Catalyst at ECS (2018).

Department of Mechanical Engineering, Edward E. Whitacre Jr. College of Engineering
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2:00 – 3:00 PM
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