UC San Diego
JACOBS SCHOOL OF ENGINEERING
NanoEngineering

UCSD NanoEngineering/Chemical Engineering

SEMINAR SERIES

Wednesday, February 14th, 2024
Seminar Presentation: 11:00am – 12:00pm
SME room 248

""*Mining" Wastewater and Plastic Waste as Useful Resources for Solar Fuel Generation"*

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Abstract: The water-energy-environment nexus is rooted in the fact that water, energy, and environment are interdependent systems. All stages of energy production utilize water. Likewise, energy is necessary to desalinate, treat, and distribute clean water. At the same time, energy production and water utilization processes can induce burden to our environment. Inevitable changes related to population growth, weather, and the environment affect the relationship between our natural resources and energy infrastructure. These challenges induce vulnerabilities within our nation's population and increase the urgency for action. Therefore, an integrated approach that addresses aforementioned challenges, carries great potential in providing solutions for these impending circumstances.

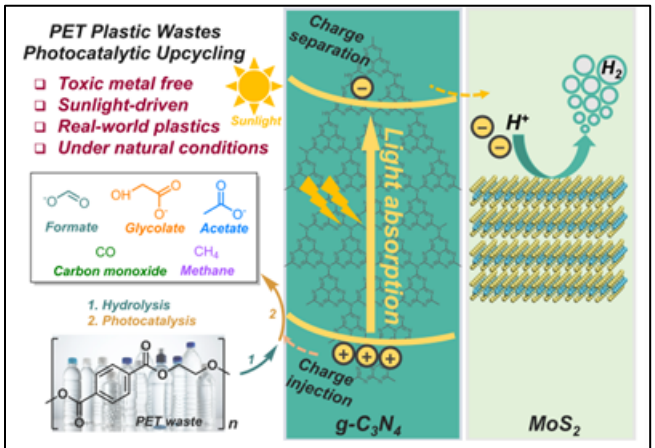

Figure 1. Schematic diagram of photocatalytic PET waste upcycling.

Artificial photosynthesis (APS) mimics nature by photoelectrochemically generating clean energy from water and sunlight. Challenges faced by current APS systems involve high costs, low efficiencies, and short lifetimes. Furthermore, most APS devices rely on clean water sources, limiting their potential for impact. In the first part, we will show a microbial photoelectrochemical system that can simultaneously treat wastewater while producing hydrogen. In the second part, we will demonstrate integrating plastic waste upcycling with hydrogen evolution is a promising way to mitigate the environmental issues caused by the nondegradable nature of plastic waste. Generating clean energy from concurrent wastes provides ideal solutions to the challenges faced by our nation and its energy infrastructure.

Biosketch: Prior to becoming a professor at San Diego State University, Dr. Gu built a solid background in developing materials and material interfaces for solar fuel generation and understanding interfacial charge transfer processes while completing her Ph.D. at Tulane University and postdoc at Princeton University and the National Renewable Energy Laboratory. Now, Dr. Gu and her research team focus on developing alternative anode reactions and catalysts for efficient solar energy conversion. This approach is similar to the natural photosynthetic process and thus, has been dubbed, "artificial photosynthesis". The ultimate goal of the efforts discussed herein involve developing a standalone hydrogen evolution system while addressing environment issues, such as treating wastewater or upcycling plastic wastes.