GTEP Grand Technion Energy Program
תוכנית האנרגיה ע"ש גרנד

Technion Israel Institute of Technology

Dr. Stafford W. Sheehan

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Stafford W. Sheehan is founder and CEO of Catalytic Innovations (www.catalytic-innovation.com), a start-up company in the US that began in 2015 to commercialize sustainable electrolysis technologies. He was named one of Forbes Magazine's "30 under 30" in the energy sector in 2016 for his company's growth that year and leads his group as a semifinalist team in the NRG COSIA Carbon X-Prize, a $20M competition to develop technologies that reduce carbon dioxide emissions from power plants. He received his PhD in physical chemistry from Yale University working in the lab of Prof. Charles Schmuttenmaer as an NSF Graduate Research Fellow, and completed his undergraduate studies at Boston College under the supervision of Prof. Dunwei Wang studying photoelectrochemical cells.

Will lecture on:

Generating Renewable Fuel using Selective Electrochemical Oxidation

Widespread utilization of renewable energy is reliant on our ability to store electricity generated from intermittent sources, such as solar and wind. This can be accomplished sustainably and on large scales by electrolysis. In a typical electrolysis system, electricity is stored in the chemical bonds of hydrogen gas, which is formed by proton reduction at a cathode with concomitant oxygen production via the water oxidation half-reaction at an anode. While this technology has been in use in laboratories for decades, its successful implementation for widespread renewable energy storage and hydrogen production has not been realized due to the low cost of hydrogen derived from natural gas. Therefore, new value propositions and uses need to be found for this type of technology to achieve commercial deployment in the near-term. Using a polymer electrolyte membrane (PEM) electrolyzer, we show that this technology can be used to selectively remove organic contaminants from wastewater streams. This treats wastewater by oxidizing organic contaminants to generate carbon dioxide and pure hydrogen gas in a sustainable, renewable manner. By further studying mechanisms of small molecule oxidation in a three-electrode electrochemical cell, we are able to explain phenomena observed in commercial-scale electrolysis systems and guide our design to identify new efficient and selective catalysts for these processes made from platinum and iridium. Evidence for new iridium-catalyzed pathways for small molecule oxidation is shown in proof-of-concept experiments, and applied toward the treatment of effluent from dairy production processes in a commercial system.

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