MECHANICAL ENGINEERING STUDENT SEMINAR

Thursday, September 1st, 2022 at 14:00, D. Dan and Betty Kahn Building, Auditorium 1.

Producing Green Electricity and Clean Water Simultaneously: Desalination Fuel Cells

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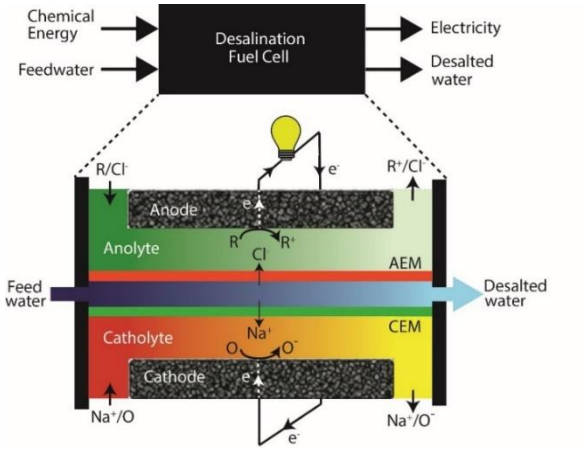
Population growth has led to increased freshwater demand, which has led to the increasing integration of non-natural water resources, such as by desalination. Conventional desalination technologies require significant amounts of energy, in the form of heat, high pressure, or electricity. The most commonly-used technology for water desalination is reverse osmosis (RO), which requires energy investment of 3-4 kWh/m^3 of treated seawater, which often comes from polluting fossil fuel sources. In an effort to transition to clean technologies, we developed a novel technology and termed the desalination fuel cell (DFC). DFCs utilize a green energy source, hydrogen gas, to drive continuous water desalination and electricity generation within a single electrochemical cell.

In this study, we manufactured a prototype DFC, characterized its performance in terms of desalination and electricity production, and quantified its thermodynamic energy efficiency (TEE), showing up to 95% is achievable. We also synthesized non-precious metal catalysts to overcome platinum poisoning, which we found to be the major source of voltage loss in our DFC. Finally, we demonstrate the capability of the DFC to treat hypersaline-brine streams, desalinating such feeds nearly completely while generating significant electricity of over 15 kWh/m^3 of treated water. We believe the DFC will extend the concept of the hydrogen economy to include combined water and electricity production.



Seminars Coordinator: Assoc. Prof. Matthew Suss.