הפקולטה להנדסת מכונות
Faculty of Mechanical Engineering

הטכניון מכון טכנולוגי לישראל
TECHNION Israel Institute of Technology

סמינריון

הנך מוזמן/ת להרצאה סמינריונית של הפקולטה להנדסת מכונות שתתקיים ביום ה' 10.09.2020

(כ״א באלול, תש״פ), בשעה 13:30 באמצעות הזום :

https://technion.zoom.us/j/99910753461

מרצה : ליהי עמית

מנחה : פרופ״מ מתיו סאס

על הנושא:

A Multiphase, Single Flow and Membraneless Flow Battery Towards next-generation energy storage devices

The seminar will be given in English

תקציר ההרצאה :

Electrochemical flow systems such as redox flow batteries (RFBs) are a promising solution for energy storage, although widespread adoption is inhibited by relatively high capital and levelized costs of storage. The battery's ion-exchange membrane, the component that separates the anolyte and catholyte in the cell, is often the single most expensive component of a battery stack. Established strategies employed by membraneless RFBs include laminar flow separation, utilization of a non-selective separator, employing immiscible flows, and complexing agents. Zinc-bromine batteries are often designed to operate without a membrane by leveraging bromine complexing agents (BCAs). These sequester the majority of the bromine in an organic phase with reduced activity. An emulsion is therefore formed, consisting of a continuous, bromine-poor aqueous phase and a dispersed, bromine-rich organic phase of low volume fraction.

We proposed and explored a novel membraneless and separatorless zinc-bromine RFB architecture, which employs a single, multiphase flow between anode and cathode. We investigated battery performance via measured polarization curves and plating efficiency when using an emulsion of ≥95% aqueous phase and ≤5% organic phase by volume. Using our custom-built battery cell, we measured discharge polarization curves and showed that by increasing the electrolyte organic phase volume fraction, ψ, from 1% to 5%, we can improve the battery currents from 90 mA/cm^2 to 270 mA/cm^2 for 2 M bromine concentration. Further, we quantified the battery's performance during charge by measuring plating efficiency, showing the plating efficiency can reach nearly 90% for 50 mAh/cm^2 loadings. This can be significantly improved in the future by increasing the bromine storage capacity in the electrolyte tank. The results demonstrate the feasibility and promise of our proposed cell architecture, provide a fundamental characterization of the cell, and allow us to posit future directions towards enhanced battery performance.

בברכה,

פרופ״מ מתיו סאס

מרכז הסמינרים