|  |  |  |
| --- | --- | --- |
|  |  | הטכניון - מכון טכנולוגי לישראל  TECHNION - ISRAEL INSTITUTE OF TECHNOLOGY |
| הפקולטה להנדסה כימית  ע"ש וולפסון |  |  |
| The Wolfson Department of Chemical Engineering |  |  |

**Wolfson Department of Chemical Engineering Seminar**

**Thursday, September 5th, 2024 at 13:30**

[**https://technion.zoom.us/j/96298325147**](https://technion.zoom.us/j/96298325147)

**High-temperature Anion Exchange Membrane Fuel Cells**

**John Douglin**

**PhD Final Seminar**

Advisor: Prof. Dario R. Dekel

Department of Chemical Engineering, Technion-Israel Institute for Technology

Given the increasing global demand for clean energy alternatives the large-scale deployment of fuel cells (FCs) could create a more energy efficient society. Hydrogen (), an abundant commodity and powerful energy carrier, is seen by many as the energy alternative of the future. -powered FCs can be employed in a variety of applications including transportation, building applications, and energy grid storage schemes. The caveat is that state-of-the-art polymer-based FCs rely on proton-exchange membranes that operate in strongly acidic environments necessitating high-cost materials (Pt or other precious metal catalysts and perfluorosulfonic acid polymer membranes etc.), while falling short in terms of performance and durability. The transition to an alkaline environment provides numerous benefits including the use of non-precious and critical raw materials as we demonstrated at an unconventional cell temperature of 95 [1]. Encouraged by this outcome, we embarked on a curiosity-inspired journey initiated by a “What if?” question and demonstrated the potential of high-temperature anion exchange membrane fuel cells (HT-AEMFCs, operating temperature ≥ 100 ) [2,3]. Further studies employing impedance spectroscopy genetic programming led to a deeper understanding of resistive losses [4] and using co-physical vapor deposition to synthesize planar smooth ionomerless catalyst layers facilitated rapid translation between rotating disk electrode studies and AEMFCs while simultaneously satisfying the US Department of Energy’s performance and platinum group metal loading and cost targets [5]. Additional studies with lightly branched anion exchange membranes polymer architectures [6] and modified catalyst supports [7,8] exhibited simplified water management, high performance and improved durability as temperature increased. This work shows the versatility of AEMFCs to overcome the challenges of existing polymer-based FCs and further establishes HT-AEMFCs as major game-changers in the sustainable energy economy.