University

Department of Materials Science and Chemical Engineering

# In Person Departmental Colloquium

**Wednesday**
**February 22, 2023**
**1:00 – 2:00 p.m.**


## Professor Dario R. Dekel

Wolfson Department of Chemical Engineering
Technion – Israel Institute of Technology
Technion City, Haifa, Israel


## Anion-Exchange Membrane-based Fuel Cells and Water Electrolyzers – Blooming Technologies

**Join Us**
Old Engineering Building
Room 301
West Campus

# Anion-Exchange Membrane-based Fuel Cells and Water Electrolyzers – Blooming Technologies

***Professor Dario R. Dekel, Email: dario@technion.ac.il***

*Wolfson Department of Chemical Engineering, Technion – Israel Institute of Technology*
*Technion City, Haifa 3200003, Israel*

## Abstract

Amazing progress has been achieved in the past five years of intensive research on Anion-Exchange Membrane (AEM) Fuel Cells (AEMFCs) and Water Electrolyzers (AEMWEs), bringing the AEM-based technologies closer to the required levels for practical applications. In material-related space, recent studies reported novel techniques for characterizing AEMs and robust AEMs with ultra-high hydroxide conductivities of 300 mS/cm. In addition, new ionomeric materials and functional groups with increasing stability were introduced, and better Pt-free and PGM-free promising catalysts were developed. On the fuel cells front, new AEMFCs based on CRM-free catalysts were successfully demonstrated, cells with record high power density outputs were obtained, materials able to operate under high-temperature AEMFC (HT-AEMFC) operation mode were reported, simulated materials and conditions to achieve AEMFC lifetime of 5,000-15,000 hours were theoretically demonstrated for the first time, and cell lifetime of 2,000 hours of continuous operation was already experimentally proven. Initial studies have just started in the water electrolyzer front, but the technology already showed outstanding results with a promising future. Altogether, the research community has made impressive progress in such a short time. Having said that, we are not yet there; several remaining challenges should still be overcome to allow AEM-based technologies to be viable alternatives to mainstream PEM-based technologies. In this talk, I will present and discuss the status of the AEMFC and AEMWE technologies and discuss the main challenges and latest achievements done at Technion to overcome them.

## Biosketch

After receiving his Ph.D. from Technion – Israel Institute of Technology, Dr. Dekel managed 50 researchers to develop high-temperature batteries in Rafael Ltd. In 2007 Dr. Dekel co-founded CellEra Inc., a young startup company where, as VP R&D, he led 15 researchers to pioneer and developed the Anion-Exchange Membrane Fuel Cell (AEMFC) technology from materials level, to first kW-level stacks. After more than 25 years of industrial experience, Dr. Dekel joined Technion in 2015. Today he is a full Professor in the Wolfson Department of Chemical Engineering, where he currently leads one of the largest worldwide research groups entirely devoted to developing the AEMFC and AEM Water Electrolyzer (AEMWE) technologies. Prof. Dekel studies and develops materials, components, and processes for AEMFCs and AEMWEs, including development of anion-conducting polymers, anion-exchange membranes (AEMs), PGM and PGM-free electrocatalysts for hydrogen (and other fuels) oxidation and oxygen reduction reactions, ionomeric materials, electrodes, and cells. Prof. Dekel's publications span from fundamental studies on the main phenomena and challenges in the AEMFC and AEMWE fields through experimental and theoretical studies, all the way to applied work that sets many new directions for the future of these technologies. Prof. Dekel holds more than 100 papers and 30 patents on battery and fuel cell technologies and manages numerous industrial and government research grants from Israel, Europe, and the USA.