Grand Technion Energy Program
תכנית האנרגיה ע"ש גרנד

TECHNION Israel Institute of Technology

**תכנית האנרגיה ע"ש גרנד מתכבדת להזמינך להרצאה סמינריונית שתינתן ע"י:**

# מתן כהן

## התכנית הבין-יחידתית לאנרגיה

**בנושא:**

# Development of High Performance Fuel Cell Membranes, Based on Electrospun Nafion Nanofibers

Proton exchange membrane fuel cells (PEMFCs) offer a highly-efficient direct method of converting chemical energy into electric current. They can be used in a variety of applications, including as an alternative to internal combustion engines.

Performance of a PEMFC greatly depends on its membrane, which must be highly conducting for protons while acting as a barrier for the fuel. The current benchmark material for PEMFCs is Nafion, which is a Teflon-based polymer, containing side chains with acidic sulfonate groups. High proton conductivity is achieved as Nafion is composed of elongated micelles which form well connected ion channels. However, this structure is thermodynamically unstable, and at high temperatures Nafion micelles are rearranged into less elongated (and less conductive) structures. Stability of the elongated structure may be increased by appropriate reinforcement or confinement. In particular, it was found that Nafion micelles tend to align parallel to interfaces.

One technique for Nafion alignment and confinement is electrospinning a Nafion solution to create nanofibers. A research group from the University of Pennsylvania, led by Yossef A. Elabd, has shown that the proton conductivity of Nafion fibers increases sharply with decreasing fiber diameter. Specifically, 400 nm fibers were shown to have a proton conductivity of 150 S/m, a 15-fold increase over bulk Nafion.

We are currently researching the applicability of composite membranes, where electrospun Nafion fibers are embedded in an inert matrix. The greatest challenge this work presents is aligning fibers in the direction perpendicular to the membrane plane. If successful, the research will yield Nafion membranes with both increased conductivity and thermal stability.

**מנחה: פרופ"ח ויאצ'סלב (סלבה) פרגר, הפקולטה להנדסה כימית**

**במסגרת עבודת מחקר לתואר מגיסטר**

ההרצאה תתקיים ביום ד', 29.8.18, בשעה 13:30, אולם 6, הפקולטה להנדסה כימית

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