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

**Wolfson Department of Chemical Engineering Seminar**

**Monday, April 25th, 2022 at 13:30**

**Room #6**

**Ratchet based ion pumps**

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Even though highly selective ion pumps can be found in every living cell membrane, artificial, membrane-based ion selective separation is a longstanding unmet challenge in science and engineering. The development of a membrane-based ion separation technology can drive a dramatic progress in a wide range of applications such as: water treatment, bio-medical devices, extraction of precious metals from sea water, chemical sensors, solar fuels and more. In this contribution we report the experimental demonstration of ion pumps based on an electronic flashing ratchet mechanism.1

Electronic flashing ratchets are devices that utilize a temporal modulation of a spatially asymmetric electric field to drive steady state current. Like peristaltic pumps, where the pump mechanism is not in direct contact with the pumped fluid, electronic ratchets induce a net current with no direct charge transport between the power source and the pumped charge carriers. Thus, electronic ratchets can be used to pump ions in steady state with no electrochemical reactions between the power source and the pumped ions resulting in an “all electric” ion pump.

Ratchet-based ion pumps (RBIPs) were fabricated by coating the two surfaces of nano-porous alumina wafers with gold, thus forming nano-porous capacitor-like devices. The electric field within the nano-pores is modulated by oscillating the capacitor voltage. Thus, when immersed in a solution, ions within the pores experience a modulating electric field resulting in ratchet-based ion pumping. In this talk we will discuss our effort to demonstrate ratchet-based ion pumps and show how this effect can be used to selectively pump ions in different directions according to their diffusion coefficients.