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
Lecture Hall 6, Wolfson Department of Chemical Engineering,
Wednesday January 24th at 1:30pm

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Recent Advances in Electrocatalysis of Oxygen Reduction in Fuel Cells using Metallo-corroles

According to the most optimistic assessments, we will see the complete drain of our planet's fossil fuel reserves during our lifetime. Hence, we must expedite the development of alternative energy technologies and sustainable energy harvesting technologies. In recent years, several global events have taken place, showing the commitment of the developed world for cleaner and better ways to power our industry, homes and vehicles. One of the key initiatives, taken by some of the leading countries, is the transfer of their energy markets to what they call: Hydrogen Economy. This relatively new concept includes the harvesting of energy from natural clean sources (wind, sun, hydro, etc.), chemical storage of the energy surplus produced during peak hours in hydrogen and its use. Fuel Cells technology play a key role in this new economy. In our work at BIU, we develop advanced materials and fuel for fuel cells technologies, in order to accommodate the future needs of our society. In this talk, I will share some of our most recent findings relating to the development of precious metal group-free molecular catalysts for oxygen reduction: one of the bottle necks of this technology.

In recent years we have been exploring a relatively new and exciting family of transition metal complexes as catalysts for oxygen reduction. We used advanced synthesis techniques in order to change the parameters that may influence their catalytic activity: the metal centre, the substituents in their meso-position and the substituents in their beta-position, as well as the effect of their interaction with different carbonaceous supports. In this talk we will summarize this work and give a clear direction and insight into the design and utilization of this class of catalysts, and will show some of the best performing, non-pyrolyzed, molecular catalysts for oxygen reduction to-date. We will show that the metal centre has great affect over the ORR electrocatlysis, and that it changes in the order of Co > Fe > Ni > Mn > Cu, this effect will be rationalized using molecular modelling performed by us. In addition, we studied the effect of electron-withdrawing substituents on different position and we will show that although there is some effect on glassy carbon electrodes, once the corroles are incorporated in high surface area carbon (BP2000), this effect vanishes. We will also share some of our latest results on 3D structures of these molecular complexes and the cooperative effect, which raises their electrocatalytic performance when compared to a single molecule.

Refreshments will be served at 1:15pm