SEMINAR
Wednesday 25/4/18 11:00 am
Building 211, seminar room

SPEAKER:

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Electrochemistry and Energy
Technion

TOPIC:

Nano-structuring of carbon electrocatalysts

Carbon materials are a wonderful example of precious metal-free electrocatalysts. In the alkaline oxygen reduction reaction (ORR), for example, many carbons compete successfully with the best platinum catalysts. Their high porosity exposes many active sites, yet creates a tortuous pathway through which reagents (O2) and products (OH–) cannot diffuse fast enough. To this end, many seek “hierarchically” porous carbon, containing a random combination of micropores (for maximum active site exposure) with meso- and macro-pores, for improved flow. Hierarchical porosity is hard to produce. The ‘brute force’ method involves sequential templating, yielding well-designed, yet highly expensive structures. At the other extreme, the ‘serendipitous’ approach relies on pyrolyzing various biomass types (from bacteria to oxen), occasionally stumbling on excellent electrocatalysts. We seek the golden path: starting from simple and well-crafted precursors and/or templates, and driving towards full control of structure, composition, and activity. We study simple yet carefully designed salts and metal-organic frameworks (MOFs), whose structure includes both self-templating elements (e.g. nanoparticle forming elements) and all chemical components of the ultimate carbon. Upon pyrolysis, a range of tunable nanometric structures are produced, self-templating the carbon structure. By careful design of MOF structure and synthetic conditions, we obtain excellent ORR electrocatalysts with high degree of functional control.