COLLOQUIA – TRINITY TERM 2018

VENUE:  Hume Rothery Lecture Theatre

Refreshments will be served in the Hume Rothery Building Reception Foyer from 3:30 p.m.

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<th>Colloquium Title and Abstract</th>
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| 0    | Thursday, 19 April | **Prof Jeremy Grossman, MIT**
Materials Design for Applications in Energy and Water

Current renewable energy conversion and storage technologies are too expensive, too inefficient, or both, substantially limiting their use and global impact. For clean water, the high cost and energy requirements of desalination limits its economic viability in many parts of the world, and cost-effective purification of contaminated water is a growing challenge. At the core of these challenges is a materials choice: many of the key mechanisms are dominated by the intrinsic properties of the active materials involved. Our imperative is thus to predict, identify and manufacture new materials and designs as comprehensively and rapidly as possible. Toward that end, we use a combination of computational and experimental approaches that serve to elucidate fundamental mechanisms that govern the efficiency in these materials in order to design and demonstrate new concepts and solutions. Examples of our recent work in the areas of thermal storage and water purification will be presented. |
| 1    | Thursday, 26 April | **Asst Prof Miguel Modestino, NYU Tandon School of Engineering, USA**
Artificial photosynthesis engineering: from materials self-assembly to device integration

Recent economic and environmental factors have propelled an interest towards the development of scalable technologies to increase the share of renewable sources into our energy portfolio. Artificial photosynthesis systems are a promising alternative as they can simultaneously capture and store solar energy in the form of a fuel.

Systems based on photoelectrochemical (PEC) cells can take low energy density reactants such as water and/or carbon dioxide and transform them into energy dense hydrogen or carbon containing fuels via light-driven processes. Devices based on PEC cells need to incorporate cost-effective components that can perform the light-absorption, catalytic reactions, ion transport and product separation processes. All of these processes need to take place in parallel, imposing strong interactions and interdependence between all of the components. |
The work presented here mainly focuses on the ionic transport and gas separation tasks which are central for the efficient solar-hydrogen production, as they link the electrochemical reaction sites and allow for the production of pure fuels. Specifically, both self-assembly aspects of membranes used within the context of artificial photosynthesis, as well as the development of integrated hydrogen generators will be discussed.

Early-stage solar-hydrogen generator prototypes will likely use Nafion® membranes to provide pathways for ion-conduction between reaction sites. The structure and transport properties of this material are affected by multiple interfaces with mesoscale assemblies of PEC units. X-ray scattering measurements in Nafion thin films demonstrate how wetting interactions and confinement effects can affect the internal structure and orientation of conducting domains in membranes and can be used to modulate its transport characteristics. Additionally to providing insights into the structural effects on transport properties of Nafion thin films; this presentation will discuss the development of a microfluidic electrolysis platform based on Nafion films as a reactive media. By incorporating microstructured interdigitated electrodes and Nafion thin films, the devices presented herein balance the ionic, water and gas transport processes in order to achieve efficient water splitting from humid air. Furthermore, integrating light absorbing components into this microfluidic platform can enable hydrogen production directly from sunlight and ambient air.

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| 2    | Wednesday, 2 May | **Professor Rik Drummond-Brydson, University of Leeds**  
Title – to be confirmed  
Abstract – to be confirmed                                                                                     |
| 5    | Thursday, 24 May | **Dr Kate Black, Liverpool**  
Title – to be confirmed  
Abstract – to be confirmed                                                                                     |