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Venue: Bayliss Building, G.33

Abstract

Electrocatalysis, Liquid Optics, and Photo-Energy Conversion at Functionalised Soft Interfaces

Certain soft interfaces formed between aqueous and organic electrolyte solutions of low miscibility (*e.g.*, trifluorotoluene) are electrochemically active in that it is possible to precisely control the Galvani potential difference ($\Delta^w_o\phi$) between the two adjacent liquids (*i.e.*, to “polarise” or electrify the interface), and thus drive **charge transfer reactions**.¹ Different charge transfer reactions can be studied at soft interfaces such as ion transfer (from the water to oil phase or *vice versa*), electron transfer, or even photo-induced electron transfer.

The utility of these electrified soft interfaces can be hugely enhanced by functionalising them with either nanoparticles (NPs) or molecular species. Here I present our findings covering:

- **Electrocatalysis at soft interfaces:** By functionalising the soft interface with AuNPs or reduced graphene oxide (RGO) we can catalyse the biphasic O₂ reduction reaction by interfacial redox catalysis.^{2,3} Similarly, by immobilizing advanced catalysts, *e.g.*, MoS₂ NPs on RGO, we can catalyse the biphasic H₂ evolution reaction.⁴
- **Liquid mirrors & filters:** a novel biphasic strategy to functionalize soft interfaces with AuNPs allows us to tailor their properties as liquid mirrors or filters by controlling the AuNP size and spacing.⁵
- **Solar Energy conversion at soft interfaces:** Nature uses soft interfaces in plant cells during photosynthesis to convert and store solar energy. We explore a new paradigm in solar energy conversion by achieving efficient charge separation at soft interfaces, without solid electrodes, by modifying them with films of dyes, *i.e.*, porphyrins.



References

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2. E. Smirnov, P. Peljo, M.D. Scanlon, H.H. Girault, *Electrochimica Acta* 197 (2016) 362–373.
3. S. Rastgar, H. Deng, F. Cortés-Salazar, M.D. Scanlon, et al., *ChemElectroChem*, 1 (2014) 59-63.
4. X. Bian, M.D Scanlon, S. Wang, L. Liao, et al., *Chemical Science*, 4 (2013) 3432-3441.
5. E. Smirnov, P. Peljo, M.D. Scanlon, F. Gumy, H.H. Girault, *Nanoscale*, 8 (2016) 7723-7737.

Biography

Micheál D. Scanlon is a physical and analytical chemist who specializes in electrochemistry. In 2014 he was awarded funding through Science Foundation Ireland's Starting Investigator Research Grant scheme to pursue independent research in the Chemistry Department at University College Cork (UCC) in Ireland. To date he has published 32 articles, 2 reviews and 1 book chapter primarily on the fundamentals and applications of liquid-liquid electrochemistry, and has an H-index of 18 with over 1,000 citations. Dr Scanlon was a postdoctoral researcher in the groups of Prof. Edmond Magner at the University of Limerick (UL) in Ireland (2009-2011) and then Prof. Hubert Girault at École Polytechnique Fédérale de Lausanne (EPFL) in Switzerland (2011-2014). Prior to that, he completed his PhD studies at the Tyndall National Institute in Cork, Ireland, with Prof. Damien Arrigan (2009).