Northeastern University
College of Engineering

November 12, 2025 | 108 Snell Engineering Center | 12:00PM

Distinguished Seminar Speaker

Electrosynthesis of Conducting Polymer Thin Films at a Polarizable Liquid|Liquid Interface

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Abstract: The broken symmetry of a liquid|liquid interface is ideal for the electrosynthesis of dimensionally confined nanomaterials, i.e., thin films. Certain liquid|liquid interfaces are electrochemically active. Tuning the electric field provides a powerful external stimulus to overcome kinetic barriers to interfacial electrosynthesis. For example, the rate of thin film formation can be controlled by electric field driven motion of ions (such as the oxidant) to the interface. In this presentation, I will discuss recent breakthroughs in the electrosynthesis of commercially vital conducting polymer thin films, such as biocompatible poly(3,4-ethylenedioxythiophene (PEDOT) [JACS, (2024), 146, 28941; JACS, (2022), 144, 4853], as well as metallic nanoparticle/PEDOT and carbon nanotube/PEDOT nanocomposites, at a polarized liquid|liquid interface. The concept involves controlling interfacial electron transfer between an aqueous oxidant, such as Ce4+, and an organic soluble monomer, such as EDOT, at the liquid|liquid interface. Such control is possible by using (i) a 4-electrode electrochemical cell in conjunction with a potentiostat or (ii) an electrodeless approach by chemically establishing a distribution potential. The latter allows ease of scale-up of the thin films. Once formed, the free-floating thin films can be transferred to any solid surface for ex situ applications, for example in supercapacitor devices for energy conversion and storage or as biocompatible substrates in cell- and organoid-related studies for tissue engineering.

Biography: Professor Micheál D. Scanlon graduated with a bachelor's degree in chemistry from University College Cork (UCC), Ireland, in 2005. He then went on to do a PhD in electrochemistry (2005-2009) at the Tyndall National Institute, Cork, Ireland, under the mentorship of Professor Damien W.M. Arrigan. Following that he carried out postdoctoral research under the supervision of Professor Edmond Magner at the University of Limerick (UL), Ireland from 2009 to 2011, and under the supervision of Professor Hubert H. Girault at École Polytechnique Fédérale de Lausanne (EPFL), Switzerland, from 2011 to 2014. He established his own independent research group in 2014 in the Department of Chemistry at UCC upon winning a Science Foundation Ireland Starting Investigator Research Grant. He was awarded a European Research Council (ERC) Starting Grant in 2016. Subsequently, he was hired as an Associate Professor B in the Department of Chemical Sciences at UL in 2017 and joined the Bernal Institute at UL as a principal investigator. He has since been promoted to Associate Professor A (2020) and Professor (2022). At UL he has built an activity around electrochemistry at polarizable liquid|liquid interfaces to pioneer new approaches to the (photo)electrocatalysis of energy related reactions, the electrosynthesis of conducting polymer thin films and their nanocomposites, and the bioelectrochemistry of the model enzyme Cytochrome c (for more details see https://www.scanlonelectrochemlab.com/). He has published 1 book chapter and over 70 articles to date, in leading journals such as the Journal of the American Chemical Society, Chemical Science, Science Advances, and Angewandte Chemie International Edition. He is currently the Irish regional representative of the International Society of Electrochemistry.

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