

Exploring electroanalytical opportunities at liquid-liquid interfaces

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One of the key benefits of electrochemistry performed at the interface established between two immiscible electrolyte solutions (ITIES) (i.e. at the liquid-liquid interface) is that it enables the non-redox detection of target species based on ion-transfer reactions. This means that there is no reliance on oxidation/reduction reactions, and any ionised species that interacts with the interface can be detected. In this presentation, the electrochemical behaviour of miniaturised liquid-liquid interfaces and of biomacromolecules at these interfaces will be discussed and evaluated for analytical detection purposes. We have carried out extensive studies of proteins at micron-sized ITIES, which revealed that protein adsorption can be exploited for analytical purposes. Recent studies indicate that such electrochemistry opens up a new way oligomerise and aggregate protein. The miniaturisation of the ITIES down to the nanoscale has been achieved by use of nanoporous membranes to pattern the ITIES, providing enhanced mass transport effects (diffusion) for improved analytical performances. Visualization of these nanoscale diffusion effects has been achieved by electrodeposition at the ITIES and by electrochemical microscopy. These and related results on the analytical opportunities of electrochemistry at the ITIES will be discussed.

Recent reviews for background:

- D.W.M. Arrigan, G. Herzog, M.D. Scanlon, J. Strutwolf, Bioanalytical applications of electrochemistry at liquid-liquid micro-interfaces, *Electroanalytical Chemistry, A Series of Advances*, A.J. Bard & C.G. Zoski (Eds.), vol. 25, 2013, CRC Press, p. 105.
- D.W.M. Arrigan, E. Alvarez de Eulate, Y. Liu, Electroanalytical opportunities derived from ion transfer at interfaces between immiscible electrolyte solutions, *Australian Journal of Chemistry*, 2016 in press, DOI: 10.1071/CH15796.
- D.W.M. Arrigan, Y. Liu, Electroanalytical ventures at nanoscale interfaces between immiscible liquids, *Annual Review of Analytical Chemistry*, 2016 in press, DOI: 10.1146/annurev-anchem-071015-041415.

Biography

Damien Arrigan studied analytical science (B.Sc.(Hons)) at the National Institute for Higher Education, Dublin (now Dublin City University), and worked in the biotechnology industry for two years before undertaking his Ph.D. in analytical chemistry at the National University of Ireland, Cork, with Professor G. Svehla. He subsequently held research and academic appointments at the National Microelectronics Research Centre, Cork (Ireland), University of Southampton (UK), University of Salford (UK), and Tyndall National Institute, Cork, (Ireland), before arriving in Australia, to Curtin University, at the end of 2009, where he holds a research academic appointment as Professor. His research interests are in analytical chemistry and its boundaries with electrochemistry, especially the development of new chemical/biochemical sensing and detection methods, and he teaches various aspects of analytical chemistry at undergraduate and honours degree levels.