The Electrochemical "Dance" of Oil Droplets Bathed by Aqueous Solutions

Jay D. Wadhawan[1,2,*], Thomas S. Varley,[2] Nathan S. Lawrence[1]

[1]*School of Engineering, The University of Hull, Cottingham Road, Hull HU6 7RX, UK*
[2]*Department of Chemistry, The University of Hull, Cottingham Road, Hull HU6 7RX, UK*
**j.wadhawan@hull.ac.uk*

Liquid (or liquid-type) microdroplets are found in a variety of natural and artificial environments. Examples of the former range from biology to geology and include gametes, synaptic vesicles fluid inclusions; artificial environments likewise have broad industrial applications, such as micelles in chemical emulsions, atomisers, and in moltern metal manufacturing. This is a diverse utility of liquid droplets, and a key question revolves around how the (micro)chemical environment of the droplet impacts on its function application.

For electrochemical systems, sessile droplets bathed by a fluid environment give rise to the opportunity for reactions at the three phase boundary – the locus of the droplet edge in contact with both electrode and surrounding fluid, since this is where the current density is largest. But transport both within the droplet and bathing fluid can also play a role. Likewsie, effects due to reagent partitioning, and microscale convection can change the dynamics of droplet operations. These latter effects very much depend on the particular droplet chemistry.

This presentation will illustrate the interplay of factors affecting the dynamics of the electrochemical response of droplet-modified electrodes.

Acknowledgements
This work was funded by EPSRC (GR/N EP/G020833/1) and The University of Hull.

References
Two reviews illustrating the diversity of the electrochemistry of redox-active droplets immobililed on electrodes are:

1. C. E. Banks, T. J. Davies, R. G. Evans, G. Hignett, A. J. Wain, N. S. Lawrence, J. D. Wadhawan, F. Marken, R. G. Compton, Electrochemistry of immobilized redox droplets: concepts and applications, *Phys. Chem. Chem. Phys.*, 2003, **5**, 4053.
2. F. Marken, J. D. Wadhawan, Multiphase methods in organic electrosynthesis, *Acc. Chem. Res.*, 2019, **52**, 3325.