SEMINAIRE Chimie Physique et Microbiologie pour l’Environnement

présenté par :

Dr. Micheal Scanlon
Ecole Polytechnique Fédérale de Lausanne (Suisse)

« Hard Science at Soft Interfaces: Advances in nanomaterial self-assembly and energy storage & conversion using fluid interfaces »

Mercredi 9 juillet 2014 à 16 h 00

Salle des conférences
LCPME 405, rue de Vandoeuvre
Villers-lès-Nancy

http://lcpme.cnrs-nancy.fr
Résumé

Hard Science at Soft Interfaces: advances in nanomaterial self-assembly and energy storage & conversion using fluid interfaces

The interface between two immiscible liquids, typically oil and water, is an extremely attractive scaffold at which to self-assemble films of nanoparticles owing to its defect-free pristine nature (facilitating reproducibly), transparency (advantageous for optical applications), self-healing dynamism (allowing self-assembly errors to be corrected rapidly) and mechanical flexibility (permitting planar, curved or 3D deformations). A new method to coat large, macroscopic droplets with films of “liquid gold” consisting of gold nanoparticles will be presented and their extensive potential applications discussed [1].

Charge transfer processes occurring at oil/water as ion or electron transfer, can be studied using all the (amperometry, voltammetry, etc.) available to study processes at solid electrodes (such as gold, glassy interfaces may be used to test the ability of advanced nanoparticles (such as Mo$_2$C grown on CNTs) or catalytic rafts” to catalyze energy-related reactions evolution reaction (HER) in the presence of a electron donor such as decamethylferrocene (DMFc) [2,3].

The photoproducts of a reaction can be separated by extraction across the polarized liquid-liquid interface providing a unique method to store solar energy. A solar energy conversion concept based on the photoinduced separation of a pair of redox species in a biphasic liquid cell will be presented. The redox pair is subsequently discharged in an electrochemical flow cell to generate electricity [4].

References

Presenter profile:
Dr. Micheál D. Scanlon graduated with a BSc. in Chemistry from University College Cork in 2005 and subsequently undertook his PhD studies in electrochemistry at the Tyndall National Institute, Cork, graduating in 2009. From 2009 to 2011 he completed postdoctoral research on the topic of biofuel cells as part of the FP7-funded 3D-nanobiodevice consortium at the University of Limerick, and since 2011 has been a postdoctoral researcher in the Laboratory of Physical and Analytical Electrochemistry (LEPA; http://lepa.epfl.ch) at Ecole Polytechnique Fédérale de Lausanne (EPFL) in Switzerland. He is a physical chemist, specialising in electrochemistry, with interests in utilizing liquid/liquid or “soft” interfaces as novel platforms for biosensor development, energy conversion & storage applications and liquid mirror fabrication.
SEMINAIRE Chimie Physique et Microbiologie pour l’Environnement
présenté par :

Dr. T. Jane Stockmann
Ecole Polytechnique Fédérale de Lausanne, Suisse

« Electrochemical assessment of water - ionic liquid biphasic systems towards nuclear waste reclamation »

Mercredi 9 juillet 2014 à 16 h 45

Salle des conférences
LCPME 405, rue de Vandoeuvre
Villers-lès-Nancy

http://lcpme.cnrs-nancy.fr
Résumé

Electrochemical assessment of water|ionic liquid biphasic systems towards nuclear waste reclamation
T. Jane Stockmann,a,b Yu Lu,a Jing Zhang,b Anne-Marie Montgomery,b Hubert H. Girault,a and Zhifeng Dingb,†
aLaboratoire d’Electrochimie Physique et Analytique, École Polytechnique Fédérale de Lausanne (EPFL), Station 6, CH-1015 Lausanne, Switzerland
bDepartment of Chemistry, The University of Western Ontario, 1151 Richmond Street, London, Ontario, Canada N6A 5B7
†Corresponding authors. Tel.: +1 519 661-2111 x86161; Fax: +1 519 661-3022;
Email address: zfding@uwo.ca; URL: http://publish.uwo.ca/~zfding/ (Z.Ding)

Room temperature ionic liquids (ILs) have proven to be valuable media in biphasic metal extraction processes. The simple combination of tetraalkylphosphonium cations, with the tetrakis(pentafluorophenyl)borate anion, generates highly hydrophobic ILs ideal for studies at micro interfaces between two immiscible electrolytic solutions (micro-ITIES)[1]. These ILs demonstrate wide water|IL polarizable potential windows (PPW) of more than 0.9 V, which is convenient for observing simple ion transfer (IT) as well as metal ion transfer through interfacial complexation via a ligand dissolved in the IL phase (a.k.a. facilitated ion transfer, FIT), the latter constituting electrochemical extraction. Using the theory of FIT pioneered by Kakuichi et al.[2] and Girault et al.[3], this technique can evaluate the overall complexation constant, $\beta$, and stoichiometry of electrochemically induced complexation reactions which, in turn, can be used to identify promising ligands and water|IL, biphasic systems. Herein, alkali metal ions were investigated as simple model systems for metal extraction in nuclear waste reclamation using phosphine oxide ligands; e.g. octyl(phenyl)-N,N-diisobutylcarbamoylmethyl-phosphine oxide (CMPO). Additionally, the determination of formal transfer potentials of free metals, which are typically outside the PPW, through the use of a 3 phase junction will also be discussed.