# Programme

**Mardi 8 juillet 2014**

4 allée Emile Monso, Toulouse
Salle des thèses

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| 8H45 – 9H00 | Accueil, café |
| 9H00 – 9H45 | - ***Interfaces and Chemo- Mechanical Phenomena in NanoCeramic Coatings and Thin Films***<br>**Brian W. Sheldon**, Professor, School of Engineering<br>Brown University, Providence, Rhode Island USA |
| 9H45 – 10H00 | Discussion |
| 10H00 – 10H45 | - ***Wetting phenomena on phobic surfaces***<br>**Andreas G. Boudouvis**, Professor & Dean, School of Chemical Engineering<br>National Technical University of Athens, Greece |
| 10H45 – 11H00 | Discussion |
| 11H00 | Fin du colloque |

# Interfaces and Chemo- Mechanical Phenomena in NanoCeramic Coatings and Thin Films

**Brian W. Sheldon**

Professor
School of Engineering, Brown University
Providence, Rhode Island USA

Ceramic coatings and thin films are used for a wide range of applications, from aerospace to energy to microelectronics to biomedical implants. Our research is focused on a variety of chemo-mechanics phenomena in these types of materials. In this seminar, recent work will be presented on the following topics:

- In non-stoichiometric oxides (e.g., ceria and titania) in situ stress measurements during oxidation / reduction cycling have been used to provide important information about defect chemistry and transport processes. Grain boundary effects dominate these effects in both titania and ceria. This is the first work that uses compositional stresses to understand defect chemistry and transport properties in these types of materials.
- Both grain boundary chemistry and surface roughness are critical in nanocrystalline diamond films. In these materials, reactions at grain boundaries (particularly with hydrogen) can induce stresses of up to several GPa. Surface roughness and chemistry can also be engineered to improve both friction and biological responses.
- In Li ion battery (LIB) electrodes, Li insertion and removal can lead to significant stresses. One concern is the mechanical stability of interfaces in composite electrode structures. Here, we have used in situ stress measurements in patterned Si films as a model composite system, to study the response of bi-material interfaces during electrochemical cycling. A second critical area in battery applications is the solid-electrolyte interphase (SEI) layer, where we have recently shown that substantial near-surface stresses occur during SEI formation on graphitic carbon anodes. These results suggest that stresses can be engineered during SEI formation, to enhance the stability of these critical passivation layers.
- The fracture toughness of ceramic coatings that are reinforced with carbon nanotubes is largely dictated by the behavior of interfaces. Recent work here focuses on the use of novel in situ mechanical testing to provide key information about interface properties.

ENSIACET, salle des thèses, mardi 08 juillet 09 :00 – 11 :00
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# Wetting phenomena on phobic surfaces

**Andreas G. Boudouvis**

Professor & Dean
School of Chemical Engineering
National Technical University of Athens, Greece

Wetting phenomena in conjunction with the study and fabrication of (hydro)phobic surfaces is a field of intensive research in the last decade, due to the exploitation of the phenomena and the implementation of such surfaces in applications ranging from self-cleaning, anti-icing and anti-fouling surfaces to microfluidic devices.

The seminar will focus on: 1) Equilibrium wetting transitions of droplets on pillared surfaces based on the computations of the energy barrier between the Cassie-Baxter (CB) and the Wenzel (W) states. CB is realized when a droplet sits on top of the protrusions, it manifests superhydrophobic behavior and encompasses large apparent contact angles and low contact angle hysteresis. The CB equilibrium state is often metastable and can possibly lead to the W state, where the droplet collapses, wetting also the lateral walls of the protrusions. The strong droplet pinning and high contact angle hysteresis are undesirable attributes of the W state for applications that require robust hydrophobic behavior and therefore, a possible transition from CB to W (CB-W) should be inhibited. 2) Electrowetting on dielectric surfaces, which amounts to reversible altering of the wetting properties of surfaces using electric fields. Associated limiting phenomena, namely contact angle saturation as applied voltage increases past a threshold, are illuminated by means of computer-aided analysis and experiments. It is proposed that saturation is associated with local dielectric breakdown, due to high values of the electric field strength at the contact line, which causes local switching of the dielectric to a conductor.

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