One-year post-doctoral position

Financial support: C'Nano Ile-de-France, 2010

Gross Salary: ~ 2500 euros per month

Host Laboratories:
- Laboratory of Molecular Electrochemistry, University of Paris Diderot, Paris (Dr. B. Limoges, http://www.lemp7.cnrs.fr/)

- Chemistry of Condensed Matter Laboratory, University of Pierre et Marie Curie, Paris (Dr. C. Sanchez, http://www.labos.upmc.fr/lcmcp/)

Profile and requirements: The candidate should hold a doctoral degree in chemistry with skills in the synthesis and characterization of porous materials and/or electrochemistry

Starting date: January 2011

Description of the project:

Synthesis and characterization of three-dimensional nanostructured mesoporous electrodes

Over the last years, growing attention has been directed toward the immobilization of redox proteins or enzymes within optically transparent thin films of semiconductive mesoporous metal oxide deposited on electrode surfaces. These efforts have been motivated by the potential for developing unique spectroelectrochemical strategies for the characterization of redox proteins, as well as by the possibilities of developing new electrochemical biosensors. These novel protein host matrixes combine the attractive properties of transparency, high surface area, electrical semiconductivity, biocompatibility, ease of fabrication and high chemical, mechanical and thermal stability, with the possibility of direct electron transfer between the protein redox sites and the host mesoporous metal oxide. Recently, we demonstrated non-denaturing and high loading of cytochrome c within thin films (~100-200 nm) of periodically ordered nanocrystalline TiO_2 (pores < 10 nm) deposited on transparent electrodes via the evaporation-induced self-assembly technique (EISA). Once incorporated within the film, rapid reduction of cytochrome c can be monitored by spectroelectrochemistry upon polarization of the electrode at an appropriate potential.[1] However, due to the semi-conducting properties of the TiO_2 material, the potential window where electronic conduction in the material occurs is narrow and limited to potentials negative to -0.4 V. Such a property strongly limits forthcoming applications. To solve this problem, we envision the development of transparent nanostructured 3D-electrodes based on conductive doped metal oxide material such as ITO (Indium tin oxide). We thus expect to obtain a true 3D porous transparent electrode that should be usable over a wide range of potential and that should be useful for spectroelectrochemical studies of redox proteins.

[1] C. Renault, V. Balland, E. Martinez-Ferrero, L. Nicole, C. Sanchez and B. Limoges, *Chem. Commun.*, 2009, 7494-7496.

The conductive mesoporous electrodes will be synthesized and characterized (ellipsoporosimetry and thermal-ellipsometry) at the Laboratoire de Chimie de la Matière Condensée (Collège de France, University Pierre and Marie Curie) in the team of Dr. C. Sanchez, whereas the electronic conductivity and spectroelectrochemical properties of the as prepared electrodes will be studied at the Laboratory of Molecular Electrochemistry (University of Paris Diderot) in the team of Dr. B. Limoges.

If you are interested, please send your application containing CV and motivation letter to Dr. Véronique Balland (veronique.balland@univ-paris-diderot.fr) or Dr. Benoit Limoges (limoges@univ-paris-diderot.fr).

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