MASTER DE PHYSIQUE ET APPLICATIONS - 2ème année
Spécialité Sciences des Matériaux et Nano-objets
International Nanomat Master Program

Internship proposal 2011-2012

Laboratory: Réactivité de Surface, UMR 7197 / Institut des nanosciences de Paris, UMR 7588 / Synchrotron SOLEIL **Address : Univ. P. et M. Curie, 3 rue Galilée, Ivry/seine /4 Pl Jussieu, Paris 75005** **Laboratory director : Claire-Marie Pradier/ Bernard Perrin and Jacques Jupille**	*laboratory logo (optional)*
Internship supervisor : Vincent Humblot **Phone : 01 44 27 23 98** **e-mail: vincent.humblot@upmc.fr**	

Adsorption of peptides on gold surfaces, from UHV to "humid" conditions

Scientific project: Adsorption of peptides/proteins on metal or oxide surfaces is a key topic when considering the elaboration of biocompatible surfaces or when trying to inhibit surface biocorrosion or biofouling. Eventually, using chiral peptides widely opens the possible applications to chiral biorecognition.

In this context, understanding how peptides/proteins adsorb onto the surface (which group? which geometry?) and how they interact with each other is a prerequisite. Adsorption of several amino acids and peptides have been performed by the team, leading to valuable results but also to unsolved questions related to i) the nature of the molecule-surface bond and, ii) the role of a partial pressure of water on the peptide surface arrangement, which has to be considered for mimicking *in vivo* conditions.

Adsorption of tripeptides (IGF or GSH) on gold single crystals (Au(111) or Au(110)) has been carried out in the LRS and studied with surface science techniques (XPS, IRRAS and STM), under pure UHV conditions. Interesting correlations between the composition, the surface structure and the peptide layer growth mode have been made clear.

We would like, now, to understand the role played by the presence of water in the system. Thus we propose to study the influence of co-adsorbed water on the surface, and also to adsorb peptides or how the adsorption and geometry of peptides will be changed when the partial pressure of water is increased in the vacuum chamber. Adsorption of peptides, using a liquid electro-spray deposition device, should enable us to draw a parallel between peptides being adsorbed from gas phase in the presence of water, and peptides being deposited directly from solution vaporised under vacuum.

In a second part of the project, we want to increase our knowledge of the interaction between the peptide and the surface, and more specifically, the nature of the bonds involved in the anchoring process. To do so, we intend to perform Far-Infrared (Far-IR) experiments at the synchrotron SOLEIL. Far-IR works in a narrow range of frequency (typically 100 to 600 cm^{-1}) which is the absorption region where we can find the atom-metal bond (for instance the IR band for O-Cu is ~300 cm^{-1}).

1. Anne Vallée, Vincent Humblot, Christophe Méthivier and Claire-Marie Pradier
J. Phys. Chem. C, 2009, 113 (21), pp 9336–9344,
2. C. Methivier, V. Lebec, J. Landoulsi, C.-M. Pradier
J. Phys. Chem. C., ***2011***, *115, 4041–4046*

Techniques in use: Photoelectron Spectroscopy (XPS), Polarisation-Modulation Infrared Spectroscopy (PM-IRRAS), Far infrared Spectroscopy –Far-IR (at the synchrotron SMIS beamline),

Applicant skills: A student with background in chemistry/ surface physics… and a strong motivation for new and challenging subjects

Granted internship: yes (417 €/month)
C'nano IdF laboratory (France only) : yes
Possibility for a thesis: yes (type of grant : ED)