Ionic bombardment of Ultrathin Materials

(MATériaux UltraMinces sous Bombardement Argon)

Contract : Temporary 12 months
Employer : Institut Lavoisier de Versailles (ILV, UMR 8180)
Université de Versailles Saint-Quentin en Yvelines / CNRS
Workplace : Versailles, France
Skill area : Material Science, Chemistry, Physics

A **postdoctoral** Research Fellow position (supported by the INC of CNRS www.inc.cnrs.fr) is available in the “Electrochemistry and Interfacial Physico-chemistry” (EPI) group at the Institut Lavoisier de Versailles (www.ilv.uvsq.fr)

The activities of the EPI group are related to the modification of oxide, semiconductor and metal surfaces by chemical and electrochemical processes coupled with advanced surface analysis characterization techniques (ESCA/XPS, ARXPS, AES, LEIS…) developed in its spectroscopy center CEFS2.

The proposed research project concerns a fine physico-chemical study of two dimensional (2D) materials such as graphene or transition metal dichalcogenides. The main purpose is the use of state-of-the-art **ionic bombardment** sources using argon ion beams under ultra-high vacuum to **modify** and **characterize ultrathin systems**. Thanks to an accurate control of the gun parameters and the understanding of the surface reactivity induced, the ultimate physico-chemical characterization as well as the possible functionalization of theses nano-objects (sheets, monolayers) are expected. Such fundamental and experimental work could generate a real breakthrough in the use of these extremely fine materials.

In particular, Gas Cluster Ion Beams (GCIB), in contrast with monoatomic ions, do not penetrate deeply into target materials. Therefore, the energy of their impact is dissipated within the first few nanometers of the surface, resulting in low sputtering yields and minimal surface damage. These asset make them compatible with low-dimensional material (nanoscale) analysis. However, the effects of these new generations of GCIB are not yet fully understood. Controlling the nature, the acceleration voltage, the exposure time, the raster size, the incidence angle between the beam and the surface; a very extensive range of interaction would be generated and might cause selective broken bonds, restructuration, reactivity of dangling bonds, new properties.

Depth profiling with a resolution in z less than a nanometer will highlight the feasibility of successive abrasion of atomic planes down the link with the substrate. The benefit of imaging techniques (AFM, MEB) in addition to XPS/AR-XPS/LEIS/REELS and nano-auger techniques within the laboratory make this challenging project feasible.

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Candidates profile:

The successful candidate should have a PhD degree in chemistry, physics or materials science and demonstrate knowledge in material science, thin films, and chemical/physical spectroscopies. A first experience with the XPS data treatment will be an advantage. A track-record of high-quality scientific publications is desirable. The initial duration of the post-doctoral fellowship is 12 months. Evaluation of submitted applications will begin in April 2020, and continue until the position is filled.

Keywords:
ultra-thin films, 2D Materials, XPS, ionic bombardment, depth profiling.

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