MASTER DE PHYSIQUE ET APPLICATIONS
Spécialité Sciences des Matériaux et Nano-objets

International Nanomat Master Program

Master thesis proposal (M2) 2015-2016

Laboratory : Institut des NanoSciences de Paris and Laboratoire Mixte CNRS/Saint-Gobain, Surface du Verre et Interfaces
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Nanoplasmonics of supported particles

Nanoplasmonics, *i.e.* the study of optical properties of nanometric-sized metallic objects is a rich and vivid scientific field owing to potential applications (color filters, light trapping in photovoltaics, molecule detection…). Its richness lies in the extreme sensitivity of localized surface plasmons to the morphology of objects. It can therefore be used to probe particles well beyond the diffraction limit in a non-destructive way in any transparent medium with an extreme sensitivity to size, shape and environment. The INSP/SVI groups have developed over the past years an original approach to probe *in situ* and in real time the vacuum growth of particles on oxide substrates using UV-vis differential reflectivity [1,2,3]. Combined with suitable dielectric modelings, fine details of physics of growth processes as well as of light-induced polarization could be revealed (Fig) [1,3]. Starting with silver as a test bed, the aim of this internship is two-fold:

- to extend the approach towards particle/gas interaction, with the final goal of locating adsorbates or quantifying charge transfer [4], two pending questions in catalysis chemistry;
- to apply and extend developed modelings [1] in the case of core-shell particles to better understand polarization processes.

The applicant will participate to experiments of differential reflectivity run in an ultra-high vacuum system and contribute to model development. Measurements of photoemission and near-field microscopies will supplement the optical approach on chemical and structural points of view.

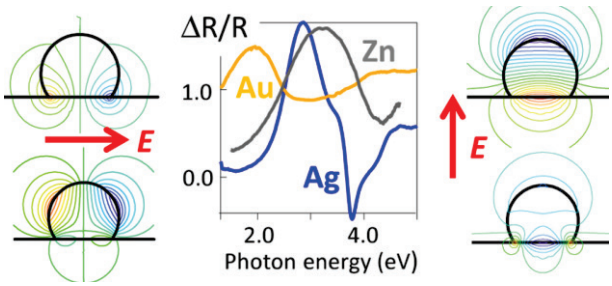

Fig: Differential reflectivity spectra for various metal on alumina and simulated absorption modes

References

[1] http://web.phys.ntnu.no/~ingves/Software/GranFilm/Current/
[2] R. Lazzari and J. Jupille, 23 (2012) 135707 and 22 (2011) 445703
[3] R. Lazzari, I. Simonsen et al., J. Phys. Chem. C. 118 (2014) 732
[4] C. Goldman, R. Lazzari et al., ACS Nano 7 (2015) 7572

Techniques in use : UV-vis differential reflectivity, dielectric simulations, photoemission, STM
Applicant skills : knowledge in optics and condensed matter physics
Keywords : plasmonics, nanoparticles

Granted internship : yes (~400€/month)
Matisse labex team : yes
Possibility for a thesis : yes, ANR grant within I. Simonsen's Industrial Chair with Saint-Gobain , starting in September , 2016