


Internship proposal 2009-20010

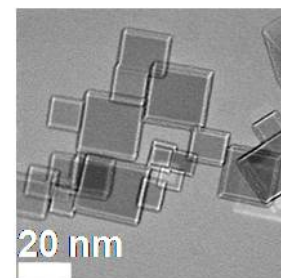
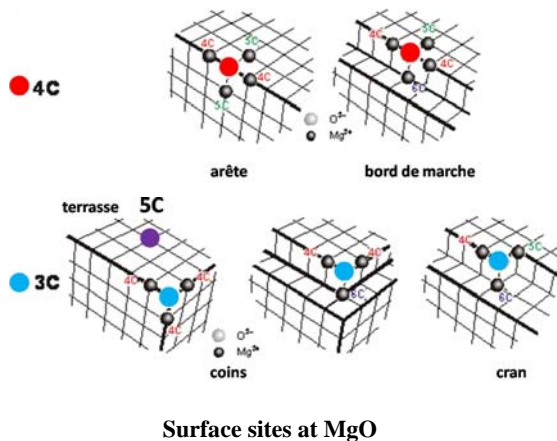
<p>Laboratory : INSP (Oxides in Low Dimensions)</p> <p>Address : Campus Boucicaut - 140 rue de Lourmel, 75015 Paris</p> <p>Laboratory director : Bernard PERRIN</p>	
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Synthesis of Au/MgO nanocubes as model catalysts

Scientific project:

Metal nanoparticles on oxide supports have been in the focus of research for many decades due to their exceptional catalytic properties associated with the dimensionality of the particles. Supported **gold** is a remarkable example of such behavior. It reveals distinct catalytic activity when the dimensions are reduced to nanometer scale, while in its bulk form it appears as catalytically inactive. In this context, Au/MgO became one of the most important model systems in surface science studies that are performed in ultra-high vacuum on gold on MgO thin films or single crystals. In order to get closer to real world, two exciting issues arise: (i) to obtain Au- nanoparticles supported on well-defined MgO nanocrystal powders and (ii) to study these in a range from ultra-high vacuum to ambient experimental conditions.

In this master thesis, we propose to synthesize and study Au nanoparticles supported on MgO nanocrystals of controlled structure. For the synthesis we will use the conventional metal combustion method since it results in perfectly cubic crystals with (100) facets when pure MgO is considered (see Figure on the left). Gold will be deposited on Mg metal before the synthesis and some test experiments have been already successfully performed. Transmission Electron Spectroscopy will serve to determine the size and shape of the MgO particles as well as to characterize the gold deposition. We will be particularly interested in those sites on MgO surface which possibly serve as Au-adsorption centers. According to results obtained on Au supported on MgO thin films, the low-coordinate sites (see Figure on the right) as well as surface oxygen vacancies are expected to be the most reactive for the adsorption of Au-atoms on MgO. This will be investigated by means of photoluminescence spectroscopy as well as by infrared spectroscopy upon gas adsorption.



TEM image of smoke MgO nanocubes

Techniques in use : Synthesis by conventional combustion method, TEM, IR, Photoluminescence

Applicant skills :

Granted internship : yes, offered by INSP

C'nano IdF laboratory (France only) : yes

Possibility for a thesis : yes , scholarship by French ministry.