M2 internship proposal

Investigation of AuAg Nanoparticles at the atomic scale: from gas-phase synthesis to Transmission Electronic Microscopy (TEM) analysis

Owing to their multifunctional character, bimetallic nanoparticles (NPs) are being used in an increasing number of applications. Not only do they offer the combined properties of the two metals they are made of, but they can also develop completely new properties through alloying effects. The fields of application of these nanoscale objects are therefore numerous and include catalysis, optics, magnetic recording, drug delivery, hyperthermia, bactericidal actions, etc.

For these applications the development of scalable nanomaterial fabrication techniques allowing the synthesis of nanoparticles with controllable size, composition and morphology is of utmost importance. In this regard, inert-gas condensation approaches are ideally suited, as they allow single-step NP deposition at room temperature under high-vacuum conditions, resulting in high chemical purity due to the absence of organic solvents. Furthermore, by using this versatile magnetron sputtering synthesis method, NPs with well-defined size, chemical composition, crystalline structure and morphology can be achieved.

During this internship, we will focus on the AuAg system, which presents a great interest in many domains as optics, sensing, water splitting, catalysis, and constitute a good model system for studying e.g. the elementary mechanisms modifying the chemical order under environment.

The objective here is to explore the effects of gas-phase deposition conditions on the AuAg nanoparticles population (size and density), chemical distribution and on their morphology. The morphological and structural properties of the NPs will be studied through advanced Transmission Electronic Microscopy (TEM) based techniques down to the atomic scale.

Candidates should have a background in condensed matter physics, physical chemistry and a genuine interest in experimental physics. This internship may be followed by a Ph.D. grant.

Keywords: bi-metallic nanoparticles, gas phase synthesis, Transmission Electronic Microscopy

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