Post-doctoral fellowship- 18 months

plasmonic catalysis at the single molecule scale.

Fixed term full-time contract in the framework on the ANR 20-CE09-0006-01
Desirable starting: until end of 2022
Net salary: dependent on the candidate's experience between 1830 and 2154 €
Location : Lab. MONARIS , Sorbonne Université, Paris (FRANCE)
How to candidate : CV and cover letter by email at
adrien.girard@sorbonne-universite.fr

Post doc description

In the past years, a great deal of attention was paid to so-called "hot" electrons, high energy, out-of-equilibrium electrons resulting from the non-radiative decay of surface plasmons in plasmonic nano-particles (NPs) after subsequent light excitation. They are being currently exploited in photo-catalysis, where it has been suggested that the photo-excitation of plasmonic NPs can catalyse chemical reactions by coupling of the reactants to hot electrons. Recently, an alternative mechanism has been proposed to explain the photocatalytic activity of irradiated plasmonic NPs, based on photothermal heating. One of the current challenges is to identify experimental strategies to assess the relative importance of thermal and non-thermal effects under illumination, and to disentangle these contributions in relevant reactions.

At MONARIS we have developed in the past years mono (Au, Ag, Cu) and bimetallic (core-shell Ag@M, with M=Pt or Pd) nanocatalysts consisting of two metallic elements that exhibit synergistic effects between their physico-chemical properties and increased catalytic activity. We have obtained a good control of their forms (spheres, cuboctahedron, cube, hexagon...), size, size dispersion, and crystallinity (Fig.1). In parallel, we have developed an optical setup for single molecule catalysis, based on fluorescence super-resolution microscopy and spectroscopy. In this project, the post-doctoral fellow will focus on investigating the catalytic activity of the above-mentioned nanoparticles already developed, in-situ, at the single nanoparticle and single molecule scales. The person will focus on the effects of NP morphology and irradiation conditions. He will study in a temperature controlled microfluidic cell a model hot-electron driven fluorogenic reaction using single molecule Total Internal Reflection Fluorescence (TIRF) under different conditions to identify which of the thermal and non thermal process is at work. The post doc will be supported by a team composed of chemists and physicists at MONARIS. Nanomaterials production will be taken care of by the team, and the post-doc will focus on optical measurements of the plasmonic catalysis.

The candidate should have an expertise in nano-optics, low signal measurements. Experience with single molecule fluorescence would be appreciated.

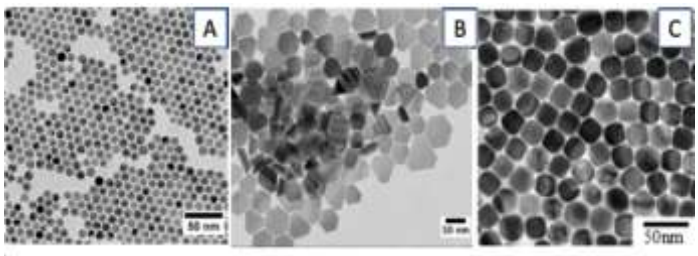

Fig. 1: Silver (A) and Copper (B, C) NPs of different shapes obtained by chemical synthesis process developed in MONARIS laboratory