PremC
Conferences, Events & Workshops
ANNIC 2016
APPLIED NANOTECHNOLOGY AND NANOSCIENCE INTERNATIONAL CONFERENCE
NOV 9-11, 2016
BARCELONA

Plasmonic nanostructures for catalysis and sensing

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Over the years, colloidal plasmonic nanoparticles have emerged as important building blocks of modern nanoscience and nanotechnology to deal with a wide range of applications including electronics, energy, medicine, catalysis, biosensing, imaging and therapy. The size- and shape-dependent optical properties of plasmonic nanoparticles make crucial the development of synthetic routes which lead to uniform nanoparticles with well-defined morphologies. On the other hand the assembly of nanoparticles has quickly evolved due to the resulting collective properties, which are highly enhanced over those of the individual particles. In this communication we report the fabrication of different SERS-active platforms based on plasmonic nanoparticles and assembies for catalysis and sensing. For instance, we will show a robust and recyclable "dip-catalyst" based on a gold nanoparticle (Au NP)–loaded filter paper composite, prepared by dip-coating. While acting as catalysts, the composites display excellent SERS efficiency, allowing the real-time monitoring of chemical reactions. Besides we present the self-assembly of highly uniform Au octahedra into uniform supercrystals (Figure 1) with the use of microevaporation, microfluidic technique, which controls the evaporation process spatially and temporally. Moreover, these plasmonic substrates made of supercrystals exhibit high and uniform SERS signals over extended areas with intensities increasing with the Au nanoparticle size. Finally, we demonstrate the fabrication of a novel plasmonic system based on Pd which show tunable optical response in the NIR region as well as good capabilities for catalysis and H_2 sensing.