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Magnetoplasmonic heterostructures for theranostic applications

Magnetic nanostructures have demonstrated their enormous potential in a wide range of technological applications such as magnetic recording media, catalysis, spintronics and biomedicine. In the latest years the interest of magnetic nanoparticles relies on their use as heat mediators for magnetic fluid hyperthermia, where the nanostructures dissipate heat in the presence of alternating magnetic fields. Similarly, plasmonic nanostructures also exhibit encouraging properties in plasmonic absorption hyperthermia, where plasmonic nanostructures generate heat when irradiated with laser light. Thus, combining both properties in a single entity, i.e. magnetoplasmonic nanostructures, may open new ways in the design of biomedical nanoplatfoms combining both properties. Here we present two approaches for the design of magnetoplasmonic nanostructures for biomedical applications using bottom-up and top-down approaches. Magnetic-plasmonic nanoparticles of different sizes and morphologies based on Fe_3O_4 and Au were synthesized by thermal decomposition (bottom-up). This method allows the synthesis of particles with high crystallinity, defined shape and narrow size distribution. Colloidal lithography (top-down) was used to develop magnetoplasmonic nanodomes based on Au and Fe. Both types of structures exhibit appealing magnetic properties at room temperature and clear plasmonic resonances. Hyperthermia measurements show that these nanostructures can be used as heat mediators in magnetic and plasmonic modes. Moreover, the combination or magnetic and plasmonic moieties confers the system additional functionalities like the capability to act as contrast agent for x-ray computed tomography and optical imaging (Au) or as magnetic resonance imaging, MRI (Fe and Fe_3O_4). This combination of properties paves the way to use these hybrid nanostructures as potential theranostic (therapy-diagnostic) agents.

Biography

Alejandro G Roca has obtained his PhD in 2009 working at the ICMM-CSIC, Madrid, Spain. During his Postdoctoral stage, after working two years as a Postdoc at INA and ICMA (Zaragoza, Spain) he joined the Condense Matter Physics group at The University of York from 2010 to 2012. He came back to Spain and joined the Magnetic Nanostructures Group at the Catalan Institute of Nanoscience and Nanotechnology where he is currently working. He has acquired a highly multidisciplinary experience in nanoparticle synthesis, magnetism and biomedical applications. He is co-author of more than 40 publications and filed two patents.

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