

Noble metal nanoparticles (NPs) in nanomedicine: preparation, sensing, imaging, labeling and therapy.

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Abstract

The high demand of multifunctional tools for effective labeling, imaging, sensing leading to both diagnostics and therapies, in nanomedicine, could be addressed by using multifunctional nanomaterials. Noble metal nanoparticles (NPs) are especially useful in this context. They exhibit optical excitations known as surface plasmons, extremely dependent on the NPs-surface, -shape, interNPs-gap, medium and ligands which make the basis for the molecular recognition, imaging and sensing sensitivity. Surface plasmons also induce large electromagnetic field enhancements, useful in Surface-enhanced Raman spectroscopy (SERS) technique. Such field enhancement, by a factor of ca. 10^{14} – 10^{15} , allows detection with high sensitivity (at the single molecule level); and due to the fingerprint capabilities of SERS, also with high selectivity. In fact, SERS combines elastically scattered visible light from the noble metal NPs themselves (that can be imaged using a dark-field optical microscope) with inelastic SERS effect due to adsorbed molecules providing a Raman spectrum leading to the identification of biomolecules (scattering), a useful applicability-process in optical and imaging fields. Plasmon resonance can also be rapidly converted to heat (absorption) with potential application in new areas such as therapy.

In this contribution, I will provide our own and up-to-date literature results regarding the promising use of noble metal nanoparticles (NPs) for biomedical applications. In particular, I will describe NPs synthesis, assembly and conjugation with biological and biocompatible ligands, plasmon-based labeling and imaging, sensing and therapy.

Biography



Dr. Nekane Guarrotxena earned her PhD in chemistry from the University of Complutense, Madrid-Spain in 1994. She held post-doctoral research positions at the Ecole Nationale Supérieure d'Arts et Métiers, Paris-France (1994-1995) and the University of Science II, Montpellier-France (1995-1997). She was the Vice-Director of the Institute of Polymer Science and Technology (ICTP)-CSIC (2001-2005). From 2008-2011, she was visiting professor in the Department of Chemistry, Biochemistry and Materials at University of California, Santa Barbara-USA and the CaSTL at University of California, Irvine-USA. She is currently Research Scientist at the Institute of Polymers Science and Technology, CSIC-Spain. She has been involved for several years on the dissemination of Science and Technology of Polymers-plastics (where she served as a member of Scientific Committee of Escuela de Plásticos y Caucho and FOCITEC or Association for the Promotion of Science and Technology). She is Editorial Board member of some materials science and chemistry journals and Organizing Committee member of Scientific Conferences. Her studies have been published in more than 55 peer-reviewed publications, 3 books (also co-editor) and 22 book chapters. Her research interest focuses on the synthesis and assembly of hybrid nanomaterials, nanoplasmonics, and their uses in nanobiotechnology applications (bioimaging, drug delivery, therapy and sensing).