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Ag-Nanoassemblies as SERS active hotspots for sensory applications

Nekane Guarrotxena

ICTP-CSIC, Spain

Abstract

Metal nanostructures strongly increase Raman signal intensities, making surface-enhanced Raman spectroscopy (SERS) a powerful analytical technique for ultrasensitive chemical and biochemical analysis. A key feature is that collective and resonant excitation (Surface Plasmon Resonance) of the free electrons in metal nanostructures can enhance the electromagnetic fields near the particle surface, large enough for single molecule detection. This enhancement effect is exceptionally strong at the interstitial site between plasmon-coupled metal nanoparticles, making dimer-like metal (Au, Ag) nanoparticles or small aggregates promising SERS active nanostructures for sensory applications. A current challenge in designing these SERS hotspots is to maximize their uniformity, reproducibility, stability and intensity. In this sense, a rational control of agglomeration and ligand exchange of linker-mediated nanoassembly is relevant for effective exploitation of structure-dependent material properties in sensing applications. While our recent work has shown important improvements in SERS nanostructures sensitivity (SERS-based sensors with fM protein detection level) by properly managing surface properties on AgNP assemblies, the current nanofabrication methods are still far from ideal in achieving these controls. An alternative to non-ideal NPs assembly would be an effective postsynthetic purification method for collecting efficient SERS structure of linked dimers from NP assemblies. So, given that interparticle junctions (hotspots) produce the strongest SERS signals, this communication reports a post-synthetic strategy which leads to effective enrichment of SERS active Ag dimer-assemblies with higher SERS intensities for novel applications, such as optical sensors.

Biography

Nekane Guarrotxena is a PhD from the University of Complutense, Madrid-Spain in 1994 and has been post-doctoral research at the Ecole Nationale Superieure d´Arts et Metiers, Paris-France (1994-1995) and the University of ScienceII, Montpellier-France (1995-1997). 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. Her research interest focuses on the synthesis and assembly of hybrid nanomaterials, nanoplasmonics, and their uses in nanobiotechnology applications (bioimaging, drug delivery, therapy and biosensing).