SERS Monitoring of Quorum Sensing in Bacteria Colonies

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Metal nanoparticles display very interesting optical properties, related to localized surface plasmon resonances (LSPR), which give rise to well-defined absorption and scattering peaks in the visible and near-IR spectral range. Such resonances can be tuned through the size and shape of the nanoparticles, but are also extremely sensitive towards dielectric changes in the near proximity of the particles surface. Therefore, metal nanoparticles have been proposed as ideal candidates for biosensing applications. Additionally, surface plasmon resonances are characterized by large electric fields at the surface, which are responsible for the so-called surface enhanced Raman scattering (SERS) effect, which has rendered Raman spectroscopy a powerful analytical technique that allows ultrasensitive chemical or biochemical analysis, since the Raman scattering cross sections can be enhanced up to 10 orders of magnitude, so that very small amounts of analyte can be detected.

In this communication, we present several examples of novel strategies to employ nanostructured materials comprising gold nanoparticles embedded in porous oxides or polymers, as substrates for ultrasensitive detection of various analytes, including biorelevant molecules such as bacterial quorum sensing markers, which require the design of novel techniques for trapping them close to the metal nanostructures or to avoid signal contamination by larger biomolecules. Hybrid colloidal nanomaterials will also be introduced as SERS-encoded tags for cell identification and bioimaging.

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