Developing a Surface Enhanced Raman Spectroscopy Substrate for Nanothermometry

A. These

Abstract

Plasmonic metal Nanoparticles (NPs) are employed in various areas ranging from sensing to medical applications and photovoltaics. They have optical resonances which highly increase absorption and scattering for certain frequencies of light. This leads to localized areas around the NPs that have strongly enhanced electric fields and intense thermal heating. These elevated temperatures around the NPs which can be beneficial or unfavourable depending on the application. In either case, information about the temperature profile is of great interest. The ratio of Stokes to anti-Stokes Raman intensities is Boltzmann distributed can be employed for measuring temperature around such particles. Therefore, Surface-Enhanced Raman Spectroscopy (SERS) can determine the temperature around such nano systems noninvasively and without system perturbation. We developed SERS substrates suitable for Nanothermometry by Stokes to anti-Stokes intensity ratio evaluation. Physical Vapor deposited gold nanospheres are hereby compared to commercial PelcoÂ® SERS substrates and nanodiscs created by electron beam lithography. We demonstrate that exciting plasmonic resonances of individual gold nanospheres does not lead to sufficient Raman enhancement. Interparticle coupling and/or sharp geometries are r-quired to create hot spots necessary for SERS. We additionally observed that absorbance spectra are a bad indicator to determine SERS enhancement factors and that Raman analyte materials highly influence the position of plasmonic peaks.