Nanoplasmonics and surface enhanced spectroscopy

SERS substrates based on porous films with silver nanoparticle array for Rhodamine 6G

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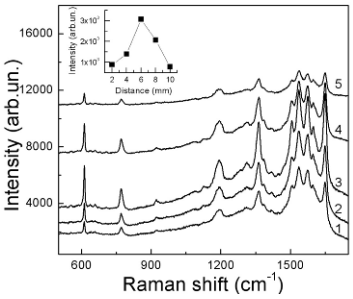
Nanocomposite porous films with silver nanoparticles (Ag NP) arrays (por-Ag films) are of particular interest as SERS spectroscopy substrates. Ag NP have advantages in comparison with Au NP in excitation of the local surface plasmon (LSP) resonance. "Hot spots" were formed in pores. These spots possess high values of local electromagnetic field that mostly provide Raman spectra enhance of analyte.

In literature SERS substrates based on films with Ag NP arrays are formed by pulsed laser deposition (PLD) technique at high argon pressure (50 – 100 Pa) from the forward flow of particles of erosion torch. Silver is subjected to oxidation with formation of compounds, which prevent adsorption of analyte.

In this work SERS substrates on the base of por-Ag films were formed by the PLD method from the back low energy flow of particles of torch on the substrates placed at the target plane in vacuum 10^{-2} Pa. The films were prepared with gradient thickness, Ag NP and pores sizes along the length of substrate correspondingly with maxima in the spectra of LSP absorption. The films were processed by solutions that consist of anions Cl^- with formation complex anion $[AgCl_2]^-$ for activation of SERS spectra. Micro-Raman spectra were measured using the triple spectrometer Horiba Jobin Yvon T64000 equipped with confocal optical microscope. As an optical excitation source the Ar-Kr laser line with λ_{ex} = 488.0 nm was used.



SERS spectra of Rhodamine 6G 10^{-9} M obtained on SERS substrates with por-Ag film prepared by PLD in five points with thickness increase from top (curve 5) to down (curve 1) were presented on Fig. In the insertion the dependence of SERS signal intensity at 612 cm^{-1} for mentioned five points (from 10 mm to 2mm) is shown. SERS substrates on the base of por-Ag film for Rhodamin 6G with concentration 10^{-10} M and enhance factor $\approx 10^7$ were developed.