

# Nanoplasmonics and surface enhanced spectroscopy

## Surface Enhanced Raman Scattering spectrum of Ag nanoparticles shell matter

**I.M. Krishchenko, V.V. Strelchuk, O.F. Kolomys, P.M. Lytvyn, Iu.M. Nasieka, B.O. Golichenko, E.B. Kaganovich, S.A. Kravchenko, E.G. Manoilov**

*V.E. Lashkaryov Institute of Semiconductor Physics, NAS of Ukraine, 41, Pr. Nauki, Kyiv, Ukraine, E-mail: dept\_5@isp.kiev.ua*

The work is devoted to micro-Raman spectroscopy of silver nanoparticles (Ag NPs) shell matter. Ag NPs have advantages in comparison with Au ones in excitation of the local surface plasmon resonance, however, silver is unstable and subjected to oxidation with formation of compounds with oxygen, sulfur, carbon, chlorine and nitrogen. It leads to complication in interpretation of SERS analytes. Identification of oxidation products in Ag NP shell used for SERS spectroscopy is an actual task.

Nanocomposite porous films with Ag NPs arrays were prepared by the pulsed laser deposition from the back flux of erosion torch particles in argon atmosphere on the substrate placed at the target plane. Preparation conditions of the films were set by argon pressure, energy density and amount of laser pulses, substrate position relatively to the torch axis. The films were prepared with gradient thickness, variable Ag NP sizes and distance between them along the length of substrate correspondingly with maxima in the spectra of local surface plasmon absorption. Plasmon effects of the Raman scattering enhance in the matters of the Ag NP shell gave the opportunity to register the spectral bands caused by an extremely small quantity of silver compounds.

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  $\lambda_{\text{ex}} = 488.0$  nm was used. The Raman spectra were mainly analyzed being based on comparison with the basic spectra presented in [1].

The bands in the Raman spectra at 96 and 140  $\text{cm}^{-1}$  are caused by lattice vibrational modes of Ag-core nanoparticles. The registered Raman bands at 280, 348, 434-475, 664, 780, 970  $\text{cm}^{-1}$  and at 1165-1355, 1524-1585  $\text{cm}^{-1}$  are predominantly related to the compounds of silver with oxygen ( $\text{Ag}_2\text{O}$ ) and carbon ( $\text{Ag}_2\text{CO}_3$ ,  $\text{AgC}_2\text{H}_3\text{O}_2$ ).

1. *Martina I., Wiesinger R., Sembrih-Simbürger D., Schreiner M.*

Micro-Raman characterization of silver corrosion products: instrumental set up and reference database // R.-S.- 2012.-9.-P 1-8.