## Nanoplasmonics and surface enhanced spectroscopy

# Efficient nanostructures of core-sell ($SiO_2$-Au) type for surface enhanced Raman scattering

**O.M. Hreshchuk[1], V.O. Yukhymchuk[1], M.Ya. Valakh[1], N.A. Matveevskaya[2]**

[1] *V. Lashkaryov Institute of Semiconductor Physics, NAS of Ukraine; 41, Prospect Nauky, 03028 Kyiv, Ukraine,*
*E-mail: Hreshchuk@gmail.com*

[2] *State Scientific Institution of NAS of Ukraine "Institute for Single Crystals", 60, Prospect Lenina, 61178 Kharkiv, Ukraine.*

Developed in this work are efficient SERS (surface enhanced Raman scattering) substrates that are films with nanoparticles of the "core – shell" type, where the core is made of $SiO_2$, while the shell – of gold nanoparticles. Application of scanning electron microscopy and optical absorption enabled authors to find correlation between surface morphology of nanostructures and position of the plasmon absorption band. It helped to adjust the latter to the wavelength of exciting laser radiation.

To efficiently apply SERS, it is necessary to develop special metal substrates made from gold or silver, which should possess the following parameters: long-term stability, simplicity of preparation, considerable enhancement of the Raman signal from substances deposited on them [1-2].

To obtain the plasmon absorption peak at the vicinity of the wavelength for exciting laser radiation, mean sizes of Au nanocrystals formed on $SiO_2$ surface were varied between 5 up to 15 nm. The nanoparticles formed in this manner were deposited on glass substrates. The diameters of $SiO_2$ nanospheres lie within the range 160 to 210 nm, while gold nanoparticles covering their surface have diameters from 10 to 15 nm. The nanospheres with gold nanoparticles deposited on the surface of glass substrate are localized rather densely, which results in closing the Au nanoparticles and formation of the so-called "hot spots".

Our analysis of the Raman spectra inherent to Rhodamine 6G molecules deposited on SERS substrates showed that the latter are 5 orders more efficient in Raman signal enhancement than the substrates with $SiO_2$ nano-spheres not covered with gold nanoparticles.

1. *Cialla D., März A., Böhme R. etc*. Surface-enhanced Raman spectroscopy (SERS): progress and trends // Anal Bioanal Chem.-2012.
2. *Le Ru E.C. and Etchegoin P. G.* Principles of Surface-Enhanced Raman Spectroscopy and related plasmonic effects // Elsevier.-2009.