Nanocomposites and nanomaterials

The study of semiconductor nanoparticles using SERS spectroscopy

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Spectroscopy of the surface-enhanced Raman scattering (SERS) of light is an efficient analytical method that is intensively developed and, with time, finds wider and wider application for diagnostics of substances in chemistry, material science, medicine, biology, pharmacology, ecology, and so on [12]. Using SERS it is possible to perform analysis of substances available in super-low concentrations in solutions or after deposition of one or several monolayers on metal nanostructured substrates. Like the ordinary Raman spectroscopy, SERS is a non-destructive method, which allows to identify the component composition of substances as well as features of their molecular structure. It is noteworthy that SERS spectra of a studied substance can contain vibration modes that are inactive in ordinary Raman spectra, which provides additional information about its structure.

Traditionally by the method of SERS spectroscopy scientists investigate vibrational spectra of organic compounds. In our work ZnO nanoparticles were investigated. Nanoparticles were synthesized by colloidal method and then were deposited on an ordered array of gold nanostructures. For excitation of SERS spectra, we have used solid-state lasers with wavelengths of 532, 457 nm and a helium-neon laser with wavelength of 633 nm. It was shown that by matching the excitation laser frequency with the frequency of plasmon oscillations in gold nanostructures it was possible to register phonon bands of semiconductor nanoparticles. Whereas any phonon spectrum of ZnO nanoparticles were not registered from reference samples, which were made by deposition of semiconductor nanoparticles on glass substrates (without gold nanostructures), even when the concentration of the colloidal solution was increased by 3 orders.

1. *K. Kneipp, M. Moskovits, H. Kneipp (eds.). Surface Enhanced Raman Scattering // Physics and Applications.*Topics Appl. Phys. Springer - Verlag. -2006. **-103**.