Nanoplasmonics and surface enhanced spectroscopy

The fluorescence signal enhancement affected by localized surface plasmon resonance

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Interaction between dye molecules and plasmonic nanoparticles (PN), which possess the energy of localized surface plasmon resonance (LSPR) field, is attracting great interest of scientists because of its useful applications in biosensors, nonlinear optical materials and, also, it is widely used for the manipulation of the fluorescent signal (enhancement or quenching) [1]. Factors affecting the fluorescence intensity of a fluorophore placed near a PN are plasmon resonance energy transfer between nanostructured metal surface and the dye molecule, which is located near the surface, shape and size of PN, distance of dye molecules to the surface of PN, as well as such characteristics of the molecule as its quantum yield and time spent at the excited state [2]. In this work, using AFM, fluorescent spectroscopy and absorption spectroscopy, we have studied the intensity of fluorescent signal of organic dyes near PN, depending on the distance between the fluorophore and PN. The respective fluorescence spectra of R6G and porphyrin exhibit the different intensity of fluorescent signal of these dyes, which depends on the thickness of dielectric coating and wavelength positions of LSPR spectra of PN relatively to emission and excitation spectra of dye. Optimal distances between dyes and PN, which allow maximum enhancement of fluorescence, were provided using SiO_2 layer for R6G and LbL polyelectrolyte layers for porhyrin. Our results allow implementing the fluorescence signal enhancement technique using localized surface plasmon resonance phenomenon in highly conductive nanostructures such as gold or silver by controlling the distance between the PN and dye.

1. *Demchenko A.P.* Introduction to fluorescence sensing // Springer. – 2009. – 590 p.
2. *Chen Y., Munechika K., Ginger D.S.* Dependence of fluorescence intensity on the spectral overlap between fluorophores and plasmon resonant single silver nanoparticles // Nano Lett. – 2007. – Vol. 7. – P. 690-696.