Nanoplasmonics and surface enhanced spectroscopy

SPPR enhancement of methylene blue fluorescence

Mogylnyi Igor [1], Lytvyn Vitalii, Lopatynskyi Andrii and Chegel Volodymyr

[1] *National Academy of Sciences of Ukraine, V. Lashkaryov Institute of Semiconductor Physics, 41 prospect Nauki, 03680 Kyiv, Ukraine*
E-mail: imogilnyu@gmail.com

Spectroscopy of surface plasmon polariton resonance (SPPR) is based on the sensitivity of the excitation conditions of surface electromagnetic waves generated at the surface of the noble metals to the state of the surface. Due to a significant increase in intensity of the electromagnetic field in terms of excitation of surface plasmon waves, SPPR-method can be used to ensure the conditions spectroscopy with surface enhancement [1].

In this work the SPPR-based sensor in the Kretschmann configuration with a specially designed measuring cell for registration of fluorophore (methylene blue) emission was used for the surface enhanced fluorescence measurements. Laser radiation with a wavelength of 650 nm excited surface plasmon polaritons under total internal reflection conditions on the 45 nm thick gold film. The SPPR-angle at which the surface plasma waves provided additional fluorophore excitation was determined, resulting in the emission enhancement of fluorophore molecules located on the modified surface of the gold film. The spectral distribution of the fluorophore emission was recorded with a spectrometer through the optical waveguide attached to the cell, using a cutoff interference filter for suppression of the exciting radiation.

To produce the samples we used LbL (layer-by-layer) method to create the dielectric layers for protection of emission decay, wich enabled changing the distance from the metal surface to the dye with a resolution of 1 nm. Fluorophore molecules was deposited onto the resulting dielectric layer using spin-coater. It was determined that methylene blue fluorescence intensity depends on the number of the deposited polymer layers and, respectively, on the distance between the dye molecules and the surface of the metal. The optimal parameters of the multilayer structure were found, that provide the fluorescence signal enhancement by a factor about of 20. Obtained results can be used in the development of the high-sensitivity bio- and chemosensors with surface enhancement of fluorescence.

1. *Dostálek J., Knoll W.* Biosensors based on surface plasmon-enhanced fluorescence spectroscopy (Review) // Biointerphases.-2008.-**3**, N 3.-P. FD12-FD22.