## Nanoplasmonics and surface enhanced spectroscopy

# Optimization of metal multilayer-dielectric structure for plasmonic holography

**S.G. Ilchenko, R.A. Lymarenko, V.B. Taranenko**

*International center "Institute of Applied Optics" National Academy of Sciences of Ukraine. Kudryavska str.10G, Kyiv, 04053, Ukraine.*

*E-mail: ilchenko@iao.kiev.ua*

We consider the enhancement and localization of optical field in metal multilayer-dielectric structure. Such structure represents a slab with quasi half-wavelength resonators. For the theoretical modeling we use the S-matrix method [1]. From the modeling we obtain dependences of the optical field enhancement and localization on the incident angle, optical thicknesses of the metal and dielectric layers. We calculate the field distribution for s- and p-polarization in different configurations, and show the possibility of the enhancement and localization not only for the evanescent field in dielectric-air interface but also inside a thin dielectric layer. This effect can be used for an advanced polarization hologram recording by high local field. We present the research for two mechanisms of the field enhancement: due to the quasi-half-wavelength resonances and the surface plasmon resonance, as well as for their interaction. The parameters' variation for both mechanisms shows that such enhancement has narrow resonance, which depends on the incident angle [2].

The structures described can lead to the creation of enhanced and localized waves. Our calculations give the possible values of the amplification coefficient for s- and p-polarization ranging from 300 to 1000. In addition, we obtain the values of spatial and angular localization for resonance conditions.

We proposed the control of the width of the resonance angle by choice of the optimal proportion of the thicknesses of the dielectric layers with high and low refractive indexes. Thickness of the last dielectric layer can be optimized for different structures other layers and can vary in a wide range. This gives the opportunity to replace last dielectric layer with light sensitive polymer for hologram recoding.

1. *Alex J. Yuffa, John A. Scales*. Object-oriented electrodynamics S-matrix code with modern applications. // Journal of Computational Physics. – 2012. - 231, N 14. - P. 4823-48-35.
2. *Ilchenko S. G., Lymarenko R. A., Taranenko V. B.* Metal-Multilayer-Dielectric Structure for Enhancement of s- and p-Polarized Evanescent Waves // Nanoscale Research Letters. - 2016. - 11:42 (1 February 2016)