Nanoplasmonics and surface enhanced spectroscopy

Nonlinear properties of plasmon-waveguide modes in resonant multilayer structure

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The resonant multilayer structure [1] with photorefractive layer is discussed. It is deriven, that the system of equations, describing the reflectance coefficient, depends on intensity of incident laser beam. Solution for both stationary and dynamic cases were obtained. In multilayer structure with nonlinear layer we observe hysteresis in reflectance [2]. The effect of self-modulation of reflectance coefficient is also described.

We performed the theoretical analysis of the peculiarities of hybrid plasmon-waveguide modes in symmetric multilayer structure. It is shown that the hybrid modes can excite the surface plasmon which converts localized mode to the plane wave.

The influence of complex part of electrical permittivity of layer on the narrow resonance in coefficient of reflection is also the subject for research. We suppose that replacing the metal layer by a dumping layer, e.g. zeolite, leads to SPR like behavior. This may allow to obtain the dispersion curve with the properties that are suitable for the development of a sensor which is polarization sensitive for refractive index change.

Also, we demonstrate the possibility of practical applications the proposed structure as an angular selector in lasers.

1. *Ilchenko S.G., Lymarenko R.A, Taranenko V.B.* Using Metal-Multilayer-Dielectric Structure to Increase Sensitivity of Surface Plasmon Resonance Sensor // Nanoscale Research Lett. -2017.-**12**:295.

2. *Bazhenov V.Yu., Soskin M.S., Taranenko V.B.* Spatial hysteresis and switching waves in a nonlinear planar waveguide // Quantum Electronics -1986. - **16**, N 11.-P. 1534-1536.