Nanocomposites and nanomaterials

Numerical simulation and design of structures and composite materials with metallic nanoinclusions

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Nanostructured materials with metallic inclusions often exhibit anisotropic and optical properties that differ from those observed in the bulk materials. These unique materials and structures on their base can be used to create many novel devices, including sensitive chemical and biochemical sensors.

In present work we present the theoretical studies and numerical experiments of the spectral characteristics of nanocomposite materials and periodic structures on their base. Study DLC:Ag films consisting of nanosized metal particles embedded in a diamond carbon matrix has been conducted. Optical response including retarded electrodynamic multipole interactions of neighboring particles and the size, shape, and interparticle distance distributions in the sample were modeled using renormalized Maxwell-Garnett theory [1]. Resonance absorption of composite diffraction gratings and resonance phenomena taking place in the structure were researched by rigorous coupled-wave analysis [2]. The dependence of the optical characteristics of nanocomposite periodic structures on geometric parameters; sensitivity of different target analysts based on the geometry of nanostructures; optimizing parameters affecting the efficiency of the structure were studied.

1. *I. Yaremchuk, et al*. Spectroellipsometric characterization and modeling of plasmonic diamond-like carbon nanocomposite films with embedded Ag nanoparticles // *Nanoscale Research Letters*.- 2015.-**10**:157 (7p).

2. *I. Yaremchuk, T. Tamulevičius, V. Fitio, I. Gražulevičiūte, Ya. Bobitski, S. Tamulevičius*. Numerical implementation of the S-matrix algorithm for modeling of relief diffraction gratings. Journal of Modern Optics. -2014.-60. P. 1781–1788.