Nanocomposites and nanomaterials

Effective dielectric permittivity of plasmonic nanocomposite materials

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In this work plasmonic nanocomposite materials consisting metallic nanoparticles embedded in a dielectric host material are investigated. They are promising materials for developing the elemental base of laser physics and opto- and microelectronics [1, 2]. Their record optical properties are based on the fact that, in the visible region of the spectrum, resonance bands of plasmon-polariton absorption are present and their characteristics depend on the filer and host material, on the size and shape of nanoparticles and their concentration, and also on the morphology of the composite material [3].

The effective dielectric permittivity of the plasmonic nanocomposites was theoretically simulated by Mie and Maxwell-Garnett effective medium theories varying the content of silver nanoparticles. This effective description is a prerequisite to consider plasmonic nanocomposites in the design of optical devices. We have shown that absorption of the plasmonic nanocomposite materials is very sensitive to both the parameters of the host matrix and inclusions. Therefore in the evaluation of the absorption of the nanocomposites it is necessary to take into account the spectral dependence of the complex refractive index both and the host matrix and the metallic inclusions.

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