MAGNETOREFRACTIVE EFFECT IN MAGNETIC NANOCOMPOSITES AND MULTILAYERED STRUCTURES

Yu.Boriskina[1,2], S. Erokhin[1,3], A. Vinogradov[2] , A. Lisyansky[3], M. Inoue[4], A. Granovsky[1*]

[1]Moscow State Univ., Faculty of Physics, Moscow, 119992, Russia
[2]Inst. of Theoretical and Applied Electrodynamics, Moscow, 125412, Russia
[3]Phys. Dep. Queens College of CUNY, Flushing, NY, 11367, USA
[4]Toyhashi Univ. of Technology, Toyohashi, 441-8580, Japan

The magnetorefractive effect (MRE) consists of linear on magnetoresistance changes of the permittivity of any magnetic material displaying giant, tunnel or colossal magnetoresistance. As a result, optical properties of such a material change under magnetization. MRE has been observed in all-metallic multilayered systems and granular alloys with giant magnetoresistance, in magnetic nanocomposites with tunnel-type magnetoresistance and in manganites with colossal magnetoresistance. This effect exists in a wide spectral range and is much larger than traditional magneto-optical phenomena. The MRE amplitude in reflection for most of studied magnetic nanocomposites (for example, Co-(Al-O), CoFe-MgF, Co-(Ti-O), CoFeZr-SiO_n) is between 0.1 and 1.5% depending on their magnetoresistance and optical constants. In the report we show that MRE may be significantly enhanced in multilayered structures due to multiple interference of light and light localization. We consider MRE in the following multilayered structures: (*i*) the single MRE layer as a magnetic defect in 1D photonic crystal (the MRE microcavity); (*ii*) the dielectric layer sandwiched by two MRE layers as a defect in 1D photonic crystal (the composite MRE microcavity); (*iii*) 1D photonic crystal made of insulator and MRE material; (*iv*) the three-layers Solsberry screen in which the resistive layer is made of MRE material. All calculations were carried out for the set of parameters corresponding to the experimental data for magnetic nanocomposites Co-(Al-O) but may be extended to other MRE materials such as manganites. For the case of magnetic nanocomposites the most promising structures are (*i*) and (*iv*), which provide a change of reflectivity under magnetization up to 60-70%.