Nanooptics and nanophotonics

Piezoelectric magneto-optical cells for light deflection

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The problem of effective control of optical beam at the nanoscale requires improved devices and methods for their implementation. The promising method for light intensity and deflection angle control is a piezoelectric strain of the magneto-optical operating element (cell), that changes magnetic anisotropy and magnetization of the cell similar as it does ordinary magnetic field. Magnetic, optical and electric characteristics of such elements, composed from rigidly coupled ferromagnetic and piezoelectric layers [1], were studied experimentally and theoretically. The films or plates of compositions $Y_3Fe_5O_{12}$, $Y(Eu,Dy)FeO_3$ and $FeBO_3$ were used for magneto-optical part of the above mentioned composition and $Pb(Zr_{0.52}Ti_{0.48})O_3$ for piezoelectric.

The magnetoelastic effect of strain remagnetization is manifested stronger in weakly anisotropic media. Since the magnetization vector was reoriented in other direction under applied stress the only low-frequency remagnetization (kHz band) was possible in ferrite materials. In antiferromagnetic orthoferrites the magnetization precession allowed to significantly increase the frequency threshold. The influence of scattering magnetostatic fields was noticeable when decreasing a spatial size of the cell less than a few hundreds nanometers. These and some other problems were considered in the frame of the energy balance model, that allowed to compare calculations with the experimental data and to make appropriate conclusions on the most relevant parameters of the composite structures.

Summarizing, it was also stated that mechanical stresses reduced the energy consumption on remagnetization and could sustain chosen distribution of magnetization. The efficiency of possible application of such composite structures in optoelectronics will be strongly dependent on its magnetoopical quality which still needs to be improved.

1. *Zavislyak I.V., Sohatsky V.P., Popov M.A., Srinivasan G.* Electric-field-induced reorientation and flip in domain magnetization and light diffraction in an yttrium-iron-garnet/lead-zirconate-titanate bilayer. // Phys.Rev.-2013.-**B87**.-P.134417.