Title: Spectroscopic studies of new generation of optical and magneto-optical materials

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Abstract:

In recent years, novel optical and magneto-optical devices have been proposed. This ranges from integrated photonic devices such as 3D holographic displays to magnetic recording, non-reciprocal photonic devices such as optical isolators and circulators or high-energy X-ray/gamma ray detectors. These devices, however, require suitable materials with tunable optical and magneto-optical properties. Presented thesis aims to systematically study such materials, namely $Gd_xFe_{(100-x)}$, magnetic garnets ($Y_{3-x}Bi_xFe_5O_{12}$, $Nd_2BiFe_{(5-x)}Ga_xO_{12}$, $Nd_{0.5}Bi_{2.5}Fe_{(5-x)}Ga_xO_{12}$) and $Ce_{(0.95-x)}Hf_xCo_{0.05}O_{(2-\delta)}$. Systematic study is carried out by the combination of experimental methods of spectroscopic ellipsometry, magneto-optical Kerr effect spectroscopy and Faraday effect spectroscopy. Experimental data are confronted to theoretical calculations based on Yeh 4x4 matrix formalism. As a result, full permittivity tensor spectra of presented materials are derived and analyzed in terms of microscopic theory. This allows understanding and optimization of physical properties of studied materials which is important when increasing the application potential and suitability for variety of devices.

Keywords: Spectroscopy, Ellipsometry, Kerr effect, Faraday effect, Permittivity tensor