Title: Optical and magneto-optical studies of ferrimagnetic garnets for photonic and spintronic applications

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Abstract: This doctoral thesis is devoted to fabrication and systematic characterization of physical properties of thin films of iron garnets with potential applications in photonic and spintronic devices. Investigated samples were prepared by metallo-organic decomposition and pulsed laser deposition. The study was focused on structural and magnetic characterizaiton along with optical and magneto-optical properties. Obtained experimental results were further confronted with theoretical calculations. The application potencial of garnets for photonic devices was discussed based on determined Figure of Merit (Faraday rotation to optical loss ratio). High values were achieved for single crystal thin film of Ce doped yttrium iron garnet on galium gadolinium garnet substrate as well as for pollycrystalline Bi doped yttrium iron garned on silicon substrate. Furthermore, new rare-earth garnets were prepared with attempt to achieve perpendicular magnetic anisotropy of these film. This was achieved for three different materials, which were not studied in the form of thin films before. Temperature denepndence of pyhysical properties of selected garnets were probed in region from 15 to 340 K. These measurements revealed changes of mangetic anisotropy at low temperatures and further studied magneto-optical response in the vicinity of the compensation temperature. Finally, theoretical modeling of magneto-optical response was performed to explain its microscopic origin and separate the contribution of individual magnetic sublattices.

Keywords: Ferrimagnetic garnets Magneto-optical spectroscopy Pulsed laser deposition Thin films Metallo-organic decomposition