Faraday rotator based on dysprosium ions-doped aluminophosphate glass

Mihail Elisa*[1], R. Stefan[1], B. A. Bava[1], B. A. Bava[2], L. Boroica[2], M. Valeanu[3], V. Kuncser[3], A. C. Galca[3], and A. Beldiceanu[4]

[1]National Institute of R D for Optoelectronics INOE 2000 (INOE 2000) – 409 Atomistilor Str., PO Box MG-5, Code 77125, Jud. Ilfov, Magurele, Romania

[2]National Institute for Laser, Plasma and Radiation Physics (INFLPR) – National Institute for Laser, Plasma and Radiation Physics Str. Atomistilor, Nr. 409 PO Box MG-36, 077125 Magurele, Bucharest, Romania

[3]National Institute of Materials Physics – 105 bis Atomistilor Str, 077125 Magurele, Jud. Ilfov, Romania

[4]S.C. ProOptica S.A. – 67 Patrascu Gheorghe Str., 031593, Bucharest, Romania

Abstract

The work is dedicated to the investigation of optical, structural, magnetic and magneto-optical properties of an aluminophosphate glass doped with Dy3+ ions, having magneto-optical properties, applied as Faraday rotator in the visible domain [1, 2]. The glass is prepared by a non-conventional wet method of processing the starting reagents followed by melting-stirring and annealing of the glass. The vitreous material belongs to the 16Li2O-8Al2O3-6BaO-60P2O5-10Dy2O3 system. In order to prepare a glass having a high optical homogeneity, the melt batch was mechanical stirred aiming at reducing the gaseous inclusions and striae. The final heat treatment on the glass was directed toward releasing of remnant stress aroused during the molding stage. Optical homogeneity was measured by polariscopic, polarimetry and interferometry methods revealing an optical quality glass. Electrical conductance measurements in dependence on time revealed a high chemical strength of the glass. Optical absorption of the doped glass in the visible domain showed in evidence specific lines to dysprosium ions and structural investigations made by means of FTIR and Raman spectroscopy put in evidence the vitreous network forming role of phosphorous pentoxide. Ellipsometry measurements on the bulk doped glass in the visible domain demonstrated the decrease of absorption coefficient and refractive index values on wavelength. Magnetic and magneto-optical properties revealed paramagnetic features of the doped glass as well as a Verdet constant of about -0.05 min/Oecm at 600 nm wavelength.

References

- M. Valeanu, M. Sofronie, A.C. Galca, F. Tolea, M. Elisa, B. Sava, L. Boroica and V. Kuncser, Relationship between magnetism and magneto-optical effects in new aluminophosphate glasses. J. Phys. D: Appl. Phys., 2016. 49 (7): p. 075001 (10pp)
- M. Sofronie, M. Elisa, B. A. Sava, L. Boroica, M. Valeanu, V. Kuncser, Rapid determination of Faraday rotation in optical glasses by means of secondary Faraday modulator, Rev. Sci. Instr., 2015. 86 (5): p. 053905-1÷053905-7

*Speaker

Keywords: Rare earth ions, doped glass, phosphate glass, magnetic properties, magneto optical properties