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Investigations of surface morphology of Bi:YIG films and one-dimensional magneto-photonic crystals on their base

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This work is a continuation of the studies of the growth conditions influence on the optical (transmittance), magneto-optical (Faraday rotation), morphology and surface micro-relief of magneto-optical (MO) iron-garnet films, which are used as magneto-active layers in one dimensional magneto-photonic crystals (1D-MPC) [1]. The affect of growth conditions of the MO layers on topography of 1D-MPC has been studied by atomic force (AFM) and scanning electron microscopy (SEM). The structure of microcavity-type 1D-MPC was substrate/(TiO₂/SiO₂)^m/M1/M2(or M3)/(SiO₂/TiO₂)^m, where M1- M3 are MO layers of different compositions.

Bi, Gd, and Al- substituted iron-garnet films were synthesized by reactive ion beam sputtering in an argon-oxygen mixture with the following crystallization annealing at 650-710 C in the air. The influence the material of substrates, the partial pressure of oxygen in the mixture, the crystallization annealing heating rate and the ion processing of the surface layer of the MO film on the micro-topography of synthesized films and 1D-MPC were investigated. It has been found that the roughness *r* of MO films is the main factor which determines micro-relief of 1D-MPCs. The decrease of heating rate during crystallization annealing as well as the increase of oxygen content (up to 70 - 80%) leads to significantly reduction of the MO films roughness. We have also investigated the effect of MO film surfaces processing by Ar + ions with energies 500 - 2000 eV on the surface topology of the produced MO layers and 1D-MPCs.

1. Berzhansky V.N., Shaposhnikov A.N., Prokopov A.R., Karavainikov A.V., Mikhailova T.V., Baryakhtar V.G., Sharay I.V., Golub V.O., Salyuk O.Y. Morphology of Bi:YIG films crystallized at different heating rates. // Intern. Conf. "Functional Materials" (ICFM-2013), Yalta, Haspra, Ukraine, Sept. 29 – Oct. 5, 2013 : abstracts. – Simferopol : DIP, 2013. – P. 215.