Dependence of Yttrium Iron Garnets Magnetic Domain Structure on Structural Parameters

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Comprehensive research of influence of the transition layer thickness, spatial distribution of macrodeformations and microdefect structure on the formation of crystalline and magnetic domain structure of epitaxial yttrium iron garnet films (YIG) of different thicknesses (Fig. 1) was carried out. Scanning atomic-force (Fig. 1), magnetic-force microscopy (Fig.1b) and high-resolution X-wave diffractometry (Fig.1c) was used. $Y_3Fe_5O_{12}$ epitaxial films with thicknesses of 2.3 (sample №1), 6.41 (№2) and 94.4 microns (№3), grown in SRC "Carat" on $Gd_3Ga_5O_{12}$ (111) substrates, were used as objects of research.

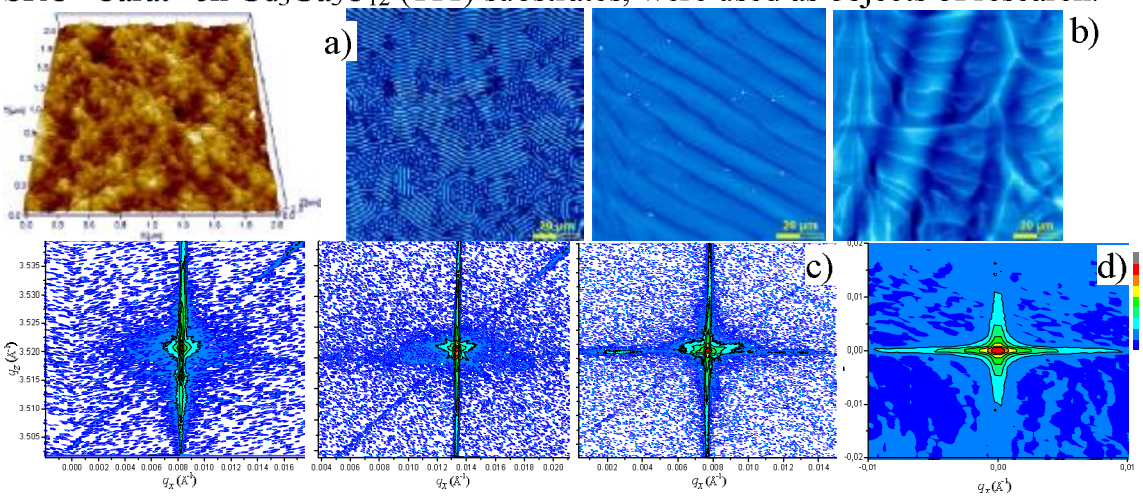

Fig. 1. YIG: a) AFM, sample №1; b) MFM, №1-№2; c)RSM, №1-№3; d) simulation.

Simulation of reciprocal space maps (RSM) (Fig. 1d) was carried out using equations of Krivoglaz kinematic theory [1]. The transition layer model is presented in the form of two sets of mismatch dislocations of different density that differ by directions of the Burgers vector. It was established that the thickness of film-substrate transition layer, dislocation density, lateral nonstoichiometry, character of macrodeformations distribution along the thickness and the presence of various types of microdefects has significant influence on the magnetic stripe domain structure (Fig.1b).

1. M. A. Krivoglaz, X-Ray and Neutron Diffraction in Nonideal Crystals. Springer, Berlin, 1996, 460 p.