

THE METHODS OF HIGH-COERCIVITY STATE INDUCTION AND TEST OF MAGNETO-OPTICAL FIGURE OF MERIT IN EPITAXIAL MAGNETIC GARNET FILMS FOR THERMOMAGNETIC RECORDING

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One of the basic directions of development of modern applied magneto-optics is the magneto-optical recording of the information, in particular, the thermomagnetic recording. The major requirement to materials-carriers is the presence of high coercivity and low optical absorption. Therefore preparation of magneto-optical films with high figure of merit and great value of coercive force H_c is one of paramount problems of material science and technology of magnetic media. The epitaxial films of magnetic garnets are rather promising materials for specified application.

The purpose of the present work was the development of effective methods for control of optical absorption and high-coercivity state generation in magnetic garnet films for thermomagnetic recording. The work was spent in 3 stages:

- 1) The investigation of nature of high-coercivity state in the most technological compositions of magnetic garnet films;
- 2) On the basis of obtained results the methods of a high-coercivity state induction in epitaxial magnetic garnets were developed (among them, for example, the technological modes of growth, postepitaxial treatment, etc.).
- 3). The nature of additional optical absorption in magnetic garnet films was studied and express methods of its control were developed.

As objects of examination we used the following film compositions: $Y_3Fe_5O_{12}$, $(YSmLuCa)_3(FeGe)_5O_{12}$, $(YEuTmCa)_3(FeGe)_5O_{12}$, $(YBi)_3(FeGa)_5O_{12}$, $(YYbBi)_3(FeGa)_5O_{12}$, $(BiTm)_3(FeGa)_5O_{12}$, $(YPrLuBi)_3(FeGa)_5O_{12}$ and $(YBi)_3(FeGa)_5O_{12}:Ca^{2+}$. The ones were grown by a method of high-temperature liquid phase epitaxy on (111) and (210) substrates of $Gd_3Ga_5O_{12}$ and $(GdCa)_3(GaMgZr)_5O_{12}$ from fluxes: $PbO-B_2O_3$, $PbO-Bi_2O_3-B_2O_3$ and $CaCO_3-Bi_2O_3-V_2O_5$.

The measured values H_c were: 80 A/m – 250 A/m for films of (Ca, Ge) system and 30 A/m – 720 A/m for films of Bi-containing garnets. The nature of a high-coercivity state and additional optical absorption in the investigated films is discussed.

As a result of this work the following effective ways for generation of a high-coercivity state in magnetic garnet films have been developed:

- 1) Doping by Ca^{2+} ions;
- 2) Selection of a suitable relationship of ion concentrations (in particular, among Bi^{3+} and Yb^{3+} (Tm^{3+}) ions);
- 3) Postepitaxial treatment in a homopolar corona discharge. The virtues and demerits of these methods are analysed.

The methods of the optical check of Pb, Tm and Bi ion concentration in epitaxial films of magnetic garnets have been developed. Express tests of rejection of Bi-containing epitaxial magneto-optic garnet films and substrates for them have been designed also.