Supplementary Materials

Non-Collinear Phase in Rare-Earth Iron Garnet Films near the Compensation Temperature

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An essential condition for liquid-phase epitaxy (LPE) of samples was the need to provide the possibility of magneto-optical observation of magnetic phases. This condition required the introduction of sufficiently large amount, on the order of 1 f.u., of magneto-optically active Bi^{3+} ions into the film composition. To ensure the inclusion of Bi^{3+} ions in such an amount, the Blenk-Nielson coefficients [19] were chosen in the range from 13 to 15 for R_1 and from 7 to 12 for R_4 (Table S1). The remaining coefficients R_2 and R_3 were selected in accordance with the required Ga concentration during the synthesis of films with given values of the magnetic compensation temperature. The melt composition for LPE synthesis films $(BiGd)_3(FeGa)_5O_{12}$ and $(BiYLu)_3(FeGa)_5O_{12}$ is given in Table S2. The optimal growth temperature T_{growth} and rate V_{growth} are presented in Table S1.

Table S1. Main LPE growth parameters.

No.	Sample	R_1	R_4	T_{growth}, °C	V_{growth}, mk/min	h, mkm
1	$(BiGd)_3(FeGa)_5O_{12}$	15.5	6.9	743.3	0.36	5.1
2	$(BiYLu)_3(FeGa)_5O_{12}$	14	12	816.5	0.62	4.9

Table S2. Melt composition in molar percent [mol%].

Sample	Bi_2O_3	PbO	Li_2CO_3	Fe_2O_3	Ga_2O_3	Al_2O_3	Y_2O_3	Lu_2O_3	Gd_2O_3
$(BiGd)_3(FeGa)_5O_{12}$	39.45	53.57	-	6.1	0.36	0.1	-	-	0.42
$(BiYLu)_3(FeGa)_5O_{12}$	68.25	-	19.58	10.2	1.81	-	0.34	0.51	-

Single-crystal substrates $(GdCa)_3(GaMgZr)_5O_{12}$ and $Gd_3Ga_5O_{12}$ were used for the epitaxial synthesis of $(BiGd)_3(FeGa)_5O_{12}$ and $(BiYLu)_3(FeGa)_5O_{12}$ films, respectively. All substrates had the (111) plane orientation.

The structural characterization of films were ascertained using X-ray diffraction (XRD) with Cu-Kα radiation (1.5406 Å). The mismatch parameter between the crystalline cells of the films and the substrates Δa did not exceed 0.008 Å for both compounds.

The crystalline quality of the synthesized films was also estimated from the half-width of the rocking curves FWHM, the value of which did not exceed 20″ for both compounds. As an example, Figure S1 shows the rocking curve for the film $(BiGd)_3(FeGa)_5O_{12}$ (888) peak with FWHM 16.92″.

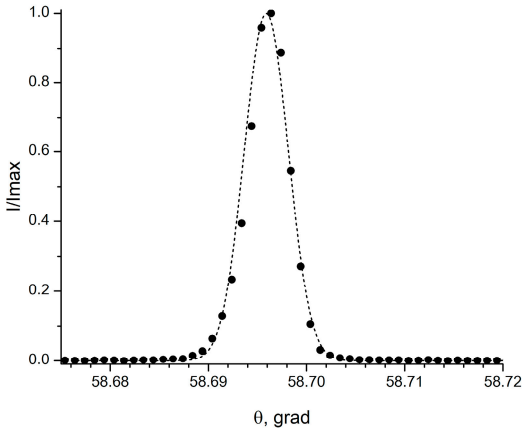

Figure S1. Rocking curve of the $(BiGd)_3(FeGa)_5O_{12}$ (888) peak.