Magnetic Microstructure of Dispersed Yttrium Iron Garnet Obtained by Sol-Gel Method

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Ferrimagnetic garnets are very well suited for magnetism studies, as these materials have a uniquely defined cation distribution. However, to improve their present applications a full understanding of their magnetic properties is required. Magnetic properties depend critically on the structure and microstructure of the materials [1]. We have synthesized $Y_3Fe_5O_{12}$ with a single garnet phase sample by a sol–gel method. This method enables to get finely dispersed polycrystalline porous material with a homogeneous size particles.

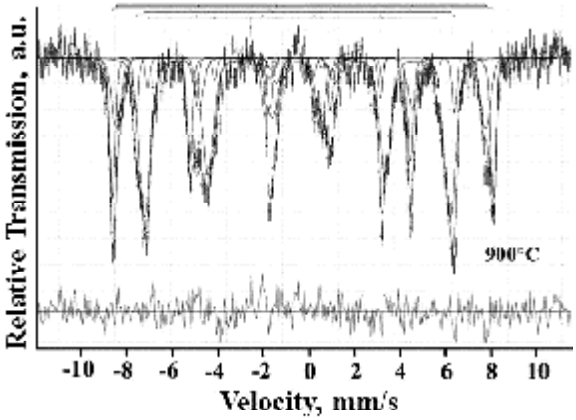

Fig. 1. ^{57}Fe Mössbauer spectrum recorded from the YIG particles prepared at 900 °C.

Annealing at 900 °C in air leads to the formation of the garnet single-phase system in which iron ions are in two non-equivalent a-positions and in three non-equivalent d-positions. The presence of a significant number of non-equivalent positions of Fe^{3+} ions can be associated with the distortion of oxygen octahedrons and tetrahedrons, respectively. Annealing of system at 1000 °C and 1100 °C has not made any significant changes of the magnetic microstructure. Slight decrease of line width of some sextets of the Mössbauer spectrum is apparently caused by decrease of the number of oxygen vacancies as a result of increasing the annealing temperature, which is confirmed by the growth of the magnetic field at the iron nuclei in a-position from 474 kOe to 480 kOe.

1. Sanchez R.D., Rivas J., Vaqueiro P., Lopez-Quintela M.A., Caeiro D. Particle size effects on magnetic properties of yttrium iron garnets prepared by a sol–gel method // Journal of Magnetism and Magnetic Materials. – 2002. – №247. – P.92 – g 98.