

Nanocomposites and nanomaterials

Influence of YIP phase on magnetic properties of YIG nanoparticles prepared by sol-gel method

I.I. Syvorotka^{1,2}, **S.B. Ubizskii**², **D.Yu. Sugak**^{1,2}, **L.O. Vasylechko**²,
S.T. Hurskyy², **I.M. Syvorotka**¹

¹ *Scientific Research Company “Carat”, Sryiska Str., 202, Lviv, Ukraine*
E-mail: syvorotka.jr@gmail.com

² *Lviv Polytechnic National University, Bandera Str., 12, Lviv, Ukraine*

Yttrium iron garnet $Y_3Fe_5O_{12}$ (YIG) is a known material that can be used in optical communication, magneto-optical devices and in microwave technology [1]. However, the presence of undesirable phases in YIG nanopowders or ceramic, in the particularity of yttrium orthoferrite $YFeO_3$ (YIP), negatively affects on the YIG properties, mainly induce magnetic losses which would reduce the devices performance.

The studied YIP, YIP-YIG and YIG nanopowders have been synthesized by two well-known modifications of sol-gel methods based glycol and citrate compounds. The following substances were used in these methods: iron nitrate nonahydrate $Fe(NO_3)_3 \cdot 9H_2O$, yttrium nitrate hexahydrate $Y(NO_3)_3 \cdot 6H_2O$, yttrium oxide Y_2O_3 , nitric acid HNO_3 65%, acetic acid CH_3COOH , citric acid $C_6H_8O_7$, ethylene glycol $(CH_2OH)_2$ and distilled water H_2O .

Phase composition, crystal structure and microstructural characteristics of the samples were studied by means of X-ray powder diffraction (XRD) techniques. The average size of crystallites was estimated from the XRD reflexes line broadening by using the well-known Scherrer's relation, as well as by Williamson-Hall analysis.

Ferromagnetic resonance (FMR) was studies in perpendicularly applied magnetic field at X-band frequency by short-cut stripe resonator method using wideband radio-spectrometer. The magnetization loops and temperature dependences of saturation magnetization were measured by vibration sample magnetometer (VSM) method.

Conditions of the YIP phase formation at the synthesis of YIG nanopowders by sol-gel method and the influence of this phase on magnetic properties such as magnetization and FMR of YIG nanopowders are discussed on the base of obtained results.

1. *Vincent G. Harris, Microwave Magnetic Materials /in: Handbook of Magnetic Materials (Ed. by K.H.J. Buschow), vol. 20 (2012).– P. 1-63.*