Effect of indium addition on the structure and magnetic properties of YIG

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Abstract
In this work, we report the structure and magnetic properties of a series of single-phase indium-substituted yttrium iron garnet (In-YIG) nanoparticles with nominal composition of $Y_3In_xFe_5O_{12}$ ($x=0.1, 0.2, 0.3$ and $0.4$) prepared by conventional mixed oxideroute. Based on XRD results, the lattice parameters of the samples increased with increase in In$^{3+}$ content due to its larger ionic radius. M"ossbauer results confirmed the substitution of In$^{3+}$ for Fe$^{3+}$ in [a] site of YIG structure. Furthermore, the magnitudes of the magnetic hyperfine field (MHF) were seen to be reduced due to indium substitution. Moreover, an increasing trend was observed for saturation magnetization ($M_s$) of the samples with $x=0.2$ owing to the substitution of non-magnetic In$^{3+}$ for Fe$^{3+}$. However, the observed initial drop of $M_s$ for the sample with $x=0.2$ compared to that with $x=0.1$ is possibly attributed to the dominance of spin canting over the net magnetization rise caused by In$^{3+}$ in [a] sites.