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Synthesis and characterization of yttrium iron garnet nanoparticles doped with cobalt

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Abstract

In this work, we have synthesized and characterized yttrium iron garnet nanoparticles doped with cobalt. The X-ray diffraction data showed a single phase, belonging to the cubic structure of $\text{Y}_3\text{Fe}_5\text{O}_{12}$. Rietveld refinement revealed variation of the angles and interionic distances ($\text{Fe}^{3+}(a)\text{-O}^{2-}\text{-Y}^{3+}(c)$ and $\text{Fe}^{3+}(d)\text{-O}^{2-}\text{-Y}^{3+}(c)$) when Fe^{3+} ions are replaced by Co^{3+} ions in the tetrahedral (d) and octahedral (a) sites of YIG. In addition, the lattice parameter a , decreases from 12.3846 Å to 12.3830 Å with the increasing of cobalt concentration. The analysis by Infrared and Raman spectroscopies has shown a slight stretching at lower wave numbers as the dopant concentration increased. The magnetic measurements confirm the substitution of Fe^{3+} by Co^{3+} in the a -sites and d -sites with the reduction of the saturation magnetization from 26.63 emu/g to 24.92 emu/g, for $0.000 \leq y \leq 0.030$. Changes in the coercive field varying the dopant concentration were related to the particle size and pinning centers existence.

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