



Mössbauer Studies and Magnetic Properties of $Y_{3-x}Ce_xFe_5O_{12}$

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Abstract. Magnetic and crystallographic properties of $Y_{3-x}Ce_xFe_5O_{12}$ ($x = 0.0, 0.1, \text{ and } 0.3$) have been studied with X-ray diffraction, vibrating sample magnetometer (VSM), and Mössbauer spectroscopy. A small coercivity ($H_c = 5.8$ Oe), was obtained for the sample $Y_{2.9}Ce_{0.1}Fe_5O_{12}$, which is comparable to that of an undoped sample $Y_3Fe_5O_{12}$ ($H_c = 54.1$ Oe). Mössbauer spectra of $Y_{3-x}Ce_xFe_5O_{12}$ were measured at various absorber temperatures from 4.2 K to Néel temperature. It is found that Debye temperatures of octahedral (16a) and tetrahedral (24d) site for $Y_{2.9}Ce_{0.1}Fe_5O_{12}$ are $\Theta_a = 353$, $\Theta_d = 464$ K, respectively, and for $Y_{2.7}Ce_{0.3}Fe_5O_{12}$, $\Theta_a = 380$, $\Theta_d = 444$ K, respectively. The intersublattice a - d superexchange interaction was found to be antiferromagnetic with the strength of $J_{a-d} = -21.42 k_B$, while the intrasublattice interactions a - a , d - d were found to be ferromagnetic with strengths of $J_{a-a} = 4.50 k_B$ and $J_{d-d} = 0.02 k_B$, respectively, in the sample $Y_{2.9}Ce_{0.1}Fe_5O_{12}$.

Key words: superexchange interaction, Mössbauer spectroscopy, Debye temperature, coercivity, Ce doped garnet.