



# Magnetic Properties of $\text{YFe}_{0.7}\text{Mn}_{0.3}\text{O}_3$ Investigated with Mössbauer Spectroscopy

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## ABSTRACT

The polycrystalline  $\text{YFe}_{0.7}\text{Mn}_{0.3}\text{O}_3$  sample was synthesized by using standard solid state reaction method. The crystalline structure and magnetic properties of sample were investigated with X-ray diffractometer (XRD), vibrating sample magnetometer (VSM), and Mössbauer spectroscopy. From the refined XRD patterns at 295 K,  $\text{YFe}_{0.7}\text{Mn}_{0.3}\text{O}_3$  sample was found to be single-phased with the Bragg factor ( $R_B$ ) and structure factor ( $R_F$ ) of 3.88 and 3.67%, respectively. The  $\text{YFe}_{0.7}\text{Mn}_{0.3}\text{O}_3$  sample was determined to be orthorhombic with space group  $Pnma$ , and lattice constant  $a_0$ ,  $b_0$  and  $c_0$  of sample were 5.647, 7.544 and 5.273 Å, respectively. Based on the field-dependent magnetization curves of  $\text{YFe}_{0.7}\text{Mn}_{0.3}\text{O}_3$  sample up to 10 kOe at 295 K, the sample shows weak ferromagnetic behavior because of Fe–O–Fe and Fe–O–Mn. From the temperature dependence of magnetization curves under 100 Oe between 4.2 and 300 K,  $\text{YFe}_{0.7}\text{Mn}_{0.3}\text{O}_3$  sample show spin reorientation from antiferromagnetic to weak ferromagnetic around 265 K. We have obtained Mössbauer spectra of  $\text{YFe}_{0.7}\text{Mn}_{0.3}\text{O}_3$  sample at various temperature ranging from 4.2 to 295 K. Mössbauer spectra were least-square fitted as a function of the Fe atom distribution below Curie temperature ( $T_C$ ). From the analyzed Mössbauer spectra,  $\text{YFe}_{0.7}\text{Mn}_{0.3}\text{O}_3$  sample have shown abrupt changes in the magnitude and slope of hyperfine field ( $H_{hf}$ ) and electric quadrupole shift ( $E_Q$ ) around spin reorientation temperature. In addition, the obtained value of isomer shift ( $\delta$ ) show that the charge state of Fe ions is  $\text{Fe}^{3+}$  high spin.

**KEYWORDS:** Yttrium Orthoferrite, Spin Reorientation, Mössbauer Spectra.