Investigation of spin reorientation in YMn$_{1-x}$Fe$_x$O$_3$ ($x = 0.55, 0.6, 0.7, 0.8, 0.9, 1.0$) by Mössbauer spectroscopy. J. Lim$^1$, Y. Choi$^2$, B. Lee$^3$ and C. Kim$^1$

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The YMn$_{1-x}$Fe$_x$O$_3$ ($x = 0.55, 0.6, 0.7, 0.8, 0.9, 1.0$) polycrystalline samples were prepared by the solid-state-reaction method. The crystal structure and magnetic properties of samples were investigated with x-ray diffractometer (XRD), vibrating sample magnetometer (VSM), and Mössbauer spectroscopy. From the XRD patterns analyzed by Rietveld refinement at 295 K, all samples were single-phased with the Bragg factor ($R_B$) and structure factor ($R_F$) less than 5 % and confirmed to be orthorhombic with space group Pnma. With increasing Fe ion contents, the lattice parameter $a_0$ decreases whereas $b_0$ and $c_0$ increase. From the temperature dependence of magnetization curves under 100 Oe between 4.2 and 500 K, we observed the decrease of spin reorientation ($T_{SR}$) with increasing Fe ion contents. However, for $x = 1.0$ sample, showed the disappearance of $T_{SR}$. Mössbauer spectra of all samples were obtained at various temperature ranging from 4.2 to 500 K, and below $T_C$ were fitted by least-square method on the function of the Fe atom distribution. Isomer shift ($\delta$) values of all samples indicate that the charge states are Fe$^{3+}$. In addition, the magnitude and slope of the temperature dependence of the hyperfine field ($H_{hf}$), averaged electric quadrupole shift $<E_Q>$, and averaged isomer shift $<\delta>$ have shown abrupt changes around $T_{SR}$ due to the change in charge states of Mn ions.