Hyperfine interaction analysis on the multiferroic properties of Fe doped $MnWO_4$ using Mössbauer spectroscopy

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We have investigated the hyperfine interaction and multiferroic properties of Fe doped $Mn_{0.98}Fe_{0.02}WO_4$ polycrystalline powders using Mössbauer spectroscopy. The crystal structures are determined to be monoclinic, space group $P2/c$, with the lattice constants $a=4.827$ Å, $b=5.756$ Å, $c=4.994$ Å, and $\beta=88.86°$. The Mössbauer spectra below Néel temperature (15 K) show the eight-absorbed spectrum lines. It suggests that the electric quadrupole interaction is as large as the magnetic dipole interaction. From the Mössbauer spectra of 4.2 K, we have obtained hyperfine field (H_{hf}) to be 72.1 kOe, quadrupole splitting (ΔE_Q) to be 2.0 mm/s, and the asymmetry parameter (η) of an electric field gradient (EFG) to be 0. However, η at 9 K is 0.30. Also, the observed EFG is asymmetric in the noncollinear spin spiral configuration ranging from 9 to 13 K, indicating that EFG shows the indirect evidence of a spontaneous polarization. [DOI: 10.1063/1.2838460]