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ABSTRACTS

HR-07. Hyperfine interaction analysis on multiferroic behavior characterizations in Fe doped $MnWO_4$ by using Mössbauer spectroscopy.

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Wolframite structured $MnWO_4$, which shows magnetic field (H) induced electric polarization (P) flop, has recently expected as a promising multiferroic material [1]. Even though H-induced P flop has been usually shown in rare-earth and manganese oxide based perovskite materials ($RMnO_3$) with $4f$ - $3d$ exchange interaction, $MnWO_4$ with only one magnetic ion (Mn^{2+}) also shows similar ferroelectric behavior. Accordingly, magnetic and electric configuration of divalent manganese ion must be understood. In this work, in order to reveal its physical nature, ^{57}Co Mössbauer spectroscopy was newly employed and extremely small quantities of Fe ion doped $Mn_{0.98}Fe_{0.02}WO_4$ poly-crystal powders were specially prepared by a solid state reaction. Mössbauer studies on the magnetic and electric configurations using Fe doping provide the scientific indirect evidences on the manganese movements.

Mössbauer spectra of $Mn_{0.98}Fe_{0.02}WO_4$ were recorded by varying ambient temperatures from 4.2 K to room temperature (295 K).The crystal structure of $MnWO_4$ was determined to be monoclinic, space group P2/c, with the lattice constants a=4.823 Å, b=5.757 Å, c=4.980 Å, and β=91.21°, Magnetic Néel temperature (T_N) was determined at 15 K. and the spectrum measured at 4.2 K (or 4.2 K Mössbauer spectrum) shows 8 – absorbed spectrum lines. It is considered that the strength of the quadrupole interaction caused by the electric field gradient is larger than the magnetic dipole interaction [in distorted oxygen octahedron of Fe ion]. This result gives the evidence that electric property appears in $MnWO_4$ powder sample. The analyzed parameters for 4.2 K Mössbauer spectrum of $Mn_{0.98}Fe_{0.02}WO_4$ were hyperfine field H_{hf} = 82.7 kOe, quadrupole splitting ΔE_Q = 1.62 mm/s, and isomer shift δ = 1.25 mm/s and the valance state of Fe ion was ferrous (Fe^{2+}).

[1] K. Taniguchi, N. Abe, T. Takenobu, Y. Iwasa, and T. Arima, Phys. Rev. Lett., **96**, 097203 (2006).