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The studies on local structure of iron for $FeTiTaO_6$

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Recently, rutile $FeTiTaO_6$ has attracted much attention for its ferroelectric relaxor behavior with a large dielectric permittivity value [1]. In this research, we investigate the structural and magnetic properties of $FeTiTaO_6$. The dependence of the magnetic properties on the temperature is studied in detailed by the analysis of local structure of iron using by Superconducting Quantum Interference Device (SQUID) and Mössbauer spectroscopy.

The crystal structure of $FeTiTaO_6$ was determined by the Rietveld refinement technique. The crystal structure of the sample at room temperature is determined to be a rutile structure with its lattice constants a_0 = 4.65 Å and c_0 = 3.02 Å. We measured the temperature dependence of the susceptibility from 3 to 400 K. The magnetic Néel temperature (T_N), which is defined as temperature of the maximum slope in dM/dT, is determined to be 40 K. Although saturation is not achieved, the M-H curve at 5 K show the magnetization value of 0.37 μ_B per formula unit for H = 70 kOe. In order to study the change of the detailed local structure, we have obtained Mössbauer spectra at various temperatures. The Mössbauer spectrum for the $FeTiTaO_6$ was composed of two six-line hyperfine patterns at 4.2 K. From the Mössbauer spectrum analysis, iron's ion states are found to be Fe^{3+}.

Reference

[1] R. Mani, S. N. Achary, K. R. Chakraborty, S. K. Deshpande, J. E. Joy, A. Nag, J. Gopalakrishnan, and A. K. Tyagi, Adv. Mater., **20**, 1348 (2008).