The magnetic properties for FeTiTaO$_6$

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FeTiTaO$_6$ has attracted much attention for its ferroelectric relaxor behavior with a large dielectric permittivity value [1]. J. Gopalakrishnan et al. claimed that the FeTiTaO$_6$ shows no evidence for long-range magnetic ordering. In this research, we investigate the structural and magnetic properties of FeTiTaO$_6$. The magnetic structure of FeTiTaO$_6$ is studied using by Superconducting Quantum Interference Device (SQUID) and Mössbauer spectroscopy.

The crystal structure of FeTiTaO$_6$ was determined by the Rietveld refinement technique. From these analysis of the XRD patterns of FeTiTaO$_6$, 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, $c_0 = 3.02$. The $c/a$ ratio (0.649) remains nearly the same as in the parent rutile TiO$_2$ (0.644). 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. In order to study the detailed local structure, we have obtained $^{57}$Co Mössbauer spectra at various temperatures. The Mössbauer spectrum for the FeTiTaO$_6$ was composed of two six-line hyperfine patterns below 40 K. The magnetic hyperfine field for FeTiTaO$_6$ is determined to be 472 kOe at 4.2 K. The Mössbauer spectra show the clear evidence for FeTiTaO$_6$ has magnetic ordering below 40 K.

![Figure 1: The Mössbauer spectra at various temperatures for FeTiTaO$_6$](image1)

![Figure 2: The temperature dependence of magnetic susceptibility for FeTiTaO$_6$](image2)

Reference