MAGNETIC PROPERTIES OF $GaFeO_3$ PREPARED BY SLOW-COOL AND QUENCHED HEAT TREATMENT METHOD

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The ferromagnetic and piezo electric material $GaFeO_3$ was prepared by solid reaction method. The crystallographic and hyperfine magnetic structure of the samples was studied by x-ray and neutron diffraction and Mössbauer spectroscopy. In order to investigate the structure, x-ray and neutron diffraction patterns were analyzed by Rietveld refinement. Samples have found to be a orthorhombic structure corresponding to $Pc2_1n$ space group which can be described as a double combination of hexagonal and cubic close packing of oxygen ions. In the case of slow cool heat treatment, a= 8.7423 b= 9.3913 c= 5.0812 Å and quenched method, a= 8.7440 b= 9.3887 c= 5.0806 Å, respectively. The crystal unit cell size is not a great difference between two cooling methods but the change of hyperfine structure between samples at magnetic transition temperature have been clarified by Mössbauer measurement. Also, magnetic transition temperature was 210 K in the quenched case and increased to 260 K as slow cooling. We suggest that the change of hyperfine structure and magnetic transition originates from various distributions of magnetic Fe ion and nonmagnetic Ga ion at four cation sites, symmetry of nearest neighbor oxygen ion around each cation and strength of exchange interaction between magnetic ions.

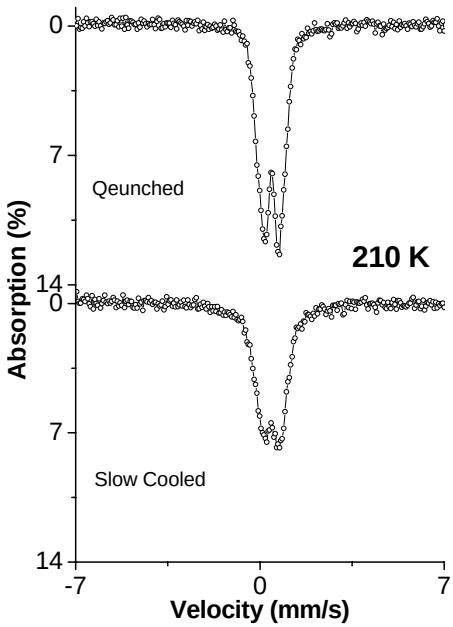

Fig. 1 Mössbauer spectra of $GaFeO_3$ at 210 K.

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