Metal Site Preference in the Multiferroic $Al_{1-x}Ga_xFeO_3$ System

Multiferroic materials have great potential for being introduced into next generation technologies, especially memory devices. The properties of the multiferroic $AFeO_3$ (*Pna2₁*; A = Al, Ga) system depend on the amount of anti-site disorder present, which is affected by both the composition and the method of synthesis. $Al_{1-x}Ga_xFeO_3$ ($0 \leq x \leq 1$) was synthesized by the ceramic method and studied by X-ray absorption near-edge spectroscopy (XANES). Al $L_{2,3}$-, Ga K-, and Fe K-edge spectra were collected to examine how the average metal coordination number (CN) changes with composition. Examination of XANES spectra from $Al_{1-x}Ga_xFeO_3$ indicate that Al and Fe prefer to reside in the octahedral sites, while Ga prefers to reside in the tetrahedral site. The Fe K-edge spectra also show that more Fe is present in the tetrahedral site in $AlFeO_3$ than in $GaFeO_3$, implying more anti-site disorder is present in $AlFeO_3$.