Bond frustration effect of Cr ions in magnetiochromite by Mössbauer spectroscopy

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Polycrystalline $MgCr_{1.98}{}^{57}Fe_{0.02}O_4$ compound was synthesized by sol-gel process. The crystal structure was found to be single-phase cubic spinel with space group of F$d3(-)m$. The lattice constant a_0 and the fractional coordinate (x) of the oxygen were determined to be 8.336 Å and 0.260, respectively. The Cr–Cr linkages in $ACr_{1.98}{}^{57}Fe_{0.02}O_4$ (A=Mg, Zn) have bond lengths of 2.945 and 2.947 Å, respectively. We have observed larger value of Néel temperature (T_N =12–12.5 K) in Mg, Zn chromite spinels than those of Cd, Hg-chromite spinel (T_N=6–8 K). Mössbauer spectra of $MgCr_{1.98}{}^{57}Fe_{0.02}O_4$ were taken from 4.2 to 295 K using a ^{57}Co source in a rhodium matrix. $MgCr_{1.98}{}^{57}Fe_{0.02}O_4$ Mössbauer spectra below T_N show the line broadening due to bond frustration. Above the Néel temperature, paramagnetic doublet is observed. The magnetic properties and Mössbauer results can be explained by the B–B exchange interaction and bond frustration in $MgCr_{1.98}{}^{57}Fe_{0.02}O_4$. © *2008 American Institute of Physics*. [DOI: 10.1063/1.2837652]