

# Mössbauer Studies on Cation Distributions and Superexchange Interactions in $\text{Cu}_{0.2}\text{Fe}_{2.8}\text{O}_4$

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The cation distributions and the superexchange interactions of  $\text{Cu}_{0.2}\text{Fe}_{2.8}\text{O}_4$  have been studied by Mössbauer spectroscopy and X-ray diffraction. The crystal is found to have a cubic spinel structure with the lattice constant  $a_0 = 8.4007 \pm 0.0004 \text{ \AA}$ . The Mössbauer spectra show line broadening in the octahedral ( $B$ ) site, which is interpreted by probability distribution of cations. The dominant superexchange interaction is found to be an antiferromagnetic intersublattice  $A$ - $O$ - $B$  superexchange interaction, and its strength is  $J_{A-B} = -20.7 k_B$ . The intrasublattice  $A$ - $O$ - $A$  superexchange interaction is also antiferromagnetic and its strength is  $J_{A-A} = -9.3 k_B$ . The weakest superexchange interaction is the ferromagnetic  $B$ - $O$ - $B$  interaction:  $J_{B-B} = 0.7 k_B$ . The Debye temperatures of the tetrahedral and the octahedral sites are found to be  $\Theta_A = 459 \pm 5 \text{ K}$  and  $\Theta_B = 351 \pm 5 \text{ K}$ , respectively.

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