

The Study of the Jahn-Teller Effect in $\text{Co}_{0.9}\text{Fe}_{0.1}\text{Cr}_2\text{S}_4$

Jung Chul SUR and Sang Youl LEE*

Department of Physics, Wonkwang University, Iri 570-749

Chul Sung KIM

Department of Physics, Kookmin University, Seoul 136-702

X. Z. ZHOU and A. H. MORRISH

Department of Physics, University of Manitoba, Winnipeg R3T 2N2, Canada

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Mössbauer spectra of $\text{Co}_{0.9}\text{Fe}_{0.1}\text{Cr}_2\text{S}_4$ taken between 4.2 K and room temperature reveal that there is a Jahn-Teller distortion below the magnetic ordering temperature, which causes a quadrupole shift to appear which increases with decreasing temperature. The magnetic hyperfine field has a maximum at 80 K and then decreases with decreasing temperature.

In order to fit the eight-line spectra at low temperature, we diagonalized a 4×4 magnetic hyperfine and quadrupole interaction matrix using a computer. θ , the polar angle of the magnetic hyperfine field with respect to the principal axes of the electric field gradient (EFG) tensor, remains zero for all temperatures whereas η , the asymmetry of the EFG, fairly constant with variations in the temperature, namely, about 0.0~0.2.