

Thermodynamic Properties of Three-Dimensional Orthogonal Dimer Model for $\text{SrCu}_2(\text{BO}_3)_2$

Shin MIYAHARA and Kazuo UEDA

Institute for Solid State Physics, University of Tokyo, 5-1-5 Kashiwanoha, Kashiwa, Chiba 277-8581

(Received February 7, 2000)

Effects of the inter-layer couplings for the orthogonal dimer system $\text{SrCu}_2(\text{BO}_3)_2$ are discussed. The spin-gap Δ of the three-dimensional model is independent of the inter-layer couplings when they are small. Therefore at low temperatures ($T < \Delta$) thermodynamic properties are described well by the two-dimensional model. On the other hand at high temperatures the mean-field type scaling ansatz is useful to discuss the magnetic susceptibility for weak inter-layer couplings. From fit of the magnetic susceptibility, the estimated coupling constants are $J = 85$ K for the nearest-neighbor couplings, $J' = 54$ K for the next-nearest-neighbor couplings, and $J'' = 8$ K for the inter-layer couplings. These parameters are consistent with the temperature dependence of the specific heat at low temperatures.

KEYWORDS: $\text{SrCu}_2(\text{BO}_3)_2$, uniform susceptibility, spin-gap, specific heat, inter-layer coupling, orthogonal dimer state, Shastry-Sutherland model