Low-Temperature Heat Transport in the Quasi-Two-Dimensional Multiferroic $CuFeO_2$

X. M. Wang, C. Fan, Z. Y. Zhao, W. P. Ke, X. G. Liu, and X. F. Sun

Hefei National Laboratory for Physical Sciences at Microscale, University of Science and Technology of China, Hefei, Anhui, China

The delafossite-type $CuFeO_2$, belonging to the space group $R\bar{3}m$, has geometrically frustrated antiferromagnetic structure due to its layered triangular lattices of high-spin Fe^{3+} ions. In zero magnetic field, Fe^{3+} ions in ab plane form an Ising-like four-sublattice (4SL) antiferromagnetic ordering at low temperature. In applied magnetic field along the c axis, $CuFeO_2$ exhibits complex phase transitions. Especially, it shows a ferroelectric incommensurate (FEIC) phase and presents multiferroicity.[1,2]
We report a study of the low-temperature heat transport of $CuFeO_2$ single crystals. It is found that the zero-field $\kappa(T)$ shows a "dip"-like feature at ~ 11 K, which is related to the transition from the partially disordered phase to the 4SL state. The $\kappa(H)$ isotherms for H $\parallel$ c show a drastic suppression at 7 T and a step-like increase at 13 T, which corresponds to the transition from the 4SL phase to the FEIC phase and then to the five-sublattice (5SL) phase, respectively. Moreover, the $\kappa(H)$ shows irreversible behaviors at 7 T and 13 T because of the first order of these transitions.

[1]S. Seki *et al.*, Phys. Rev. Lett. **105**, 097207 (2010).
[2]Randy S. Fishman, Phys. Rev. Lett. **106**, 037206 (2011).