Abstract Submitted to the
IICAM Workshop on Correlated Thermoelectricity
25 - 30 September, 2005
Hvar, Croatia

Specific heat of $Na_{0.3}CoO_2 \cdot 1.3H_2O$

Niels Oeschler[1], R. A. Fisher[1], N. E. Phillips[1], J. E. Gordon[2], M.-L. Foo[3], R. J. Cava[3]

[1] *Lawrence Berkeley National Laboratory and Department of Chemistry, University of California, Berkeley, CA, USA*
[2] *Physics Department, Amherst College, Amherst, MA, USA*
[3] *Department of Chemistry, Princeton University, Princeton, NJ, USA*

We present low-temperature specific heat results on the recently discovered superconductor $Na_{0.3}CoO_2 \cdot 1.3H_2O$. It exhibits a superconducting transition temperature of 4.5 K and an upper critical field around 9 T. Its crystal structure resembles that of the cuprates, however, the Co atoms are arranged in a triangular lattice. The Co spins are therefore magnetically frustrated.
The specific heat was measured from 0.8 K to 32 K in fields up to 9 T. The specific heat shows strong deviations from BCS behavior. The superconducting part of the specific heat below 1 K follows a $C/T \propto T$ dependence evident for line nodes of the superconducting order parameter on the Fermi surface. The total superconducting specific heat can be described with a two-gap model assuming one large gap with no nodes and a smaller gap with nodes. A residual Sommerfeld coefficient at $B = 0$ is observed. It can be understood in terms of a non-superconducting fraction of the sample or a contribution due to strong pair-breaking effects of the non-magnetic scattering centers. A field-independent onset of the transition temperature indicates unusually strong fluctuations in this system.

Keywords : specific heat, superconductivity, cobaltate