Magnetic Phase Diagram of the Quasi-One Dimensional Antiferromagnet $BaCo_2V_2O_8$

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Introduction

$BaCo_2V_2O_8$ is one of the best realizations of the S = 1/2 quasi-one-dimensional *XXZ* antiferromagnet with an Ising-like anisotropy. The material has been extensively studied both experimentally [1–3] and theoretically [4], particularly with a magnetic field applied along the crystallographic *c* axis, the Ising anisotropy axis. For this field orientation, a transition occurs from a low-field Néel-ordered phase to a high-field incommensurate phase at 3.9 T at temperatures below 1.8 K [1–3]. The identification of these phases is based on an observation of incommensurate soft modes by ESR [1], neutron diffraction [3], magnetic torque [5], and a theoretical calculation [4]. Our magnetic-torque experiment in fields up to 27 T revealed the presence of a new phase between 19.7 T and the saturation field 23.7 T, presumably the spin-flopped phase predicted by theory [4]. It remains to be explored, however, what happens in the intermediate field region between the incommensurate phase and the high-field new phase.

Experimental

We have measured the specific heat on this material as a function of magnetic-field strength, field direction, and temperature in a superconducting magnet (SCM1), using a rotatable ac calorimeter [6]. The measurements were performed while sweeping the magnetic field mostly at a rate of 0.1 T/min at fixed temperatures down to 0.2 K.

Results and Discussion

We have observed a transition from a Néel-ordered phase to an incommensurate phase and a transition from the incommensurate phase to a disordered phase, from the specific heat measured as a function of field at 0.2 K. The critical fields agree with previous results of our magnetic torque measurements. Above these transitions, no anomaly has been observed up to 18 T, suggesting that the spins may be disordered in this region. Analysis of the specific heat as a function of field direction is in progress.

Acknowledgements

This work was supported by a Grant-in-Aid from the JSPS and by the NHMFL UCGP program.

References

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