Multiferroicity of Spin-1 Triangular Lattice Antiferromagnet $Sr_3NiNb_2O_9$

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Introduction

$Sr_3NiNb_2O_9$, a quasi-two dimensional triangular lattice magnet with spin S = 1, is a moderately geometrically frustrated system. It has been known that triangular lattice antiferromagnets show a variety of magnetic phases under magnetic field as well as multiferroicity [1 - 3]. We have measured DC magnetic susceptibility, dielectric constant and electric polarization of $Sr_3NiNb_2O_9$ to investigate its magnetic and electric ground states.

Experimental

DC susceptibility of polycrystalline $Sr_3NiNb_2O_9$ was measured with a commercial SQUID magnetometer (QD-MPMS). For electric properties of the sample, we measured the dielectric constant and pyroelectric current using the SCM2 magnet. Electric polarization was obtained by integrating the pyroelectric current as a function of time.

Results and Discussion

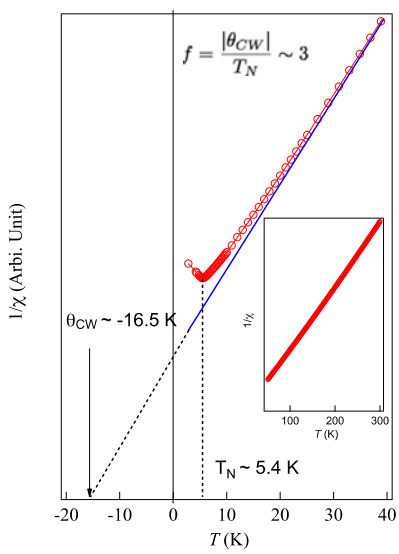

Fig. 2 Inverse DC magnetic susceptibility near the transition. The inset shows the data at wider temperature range.

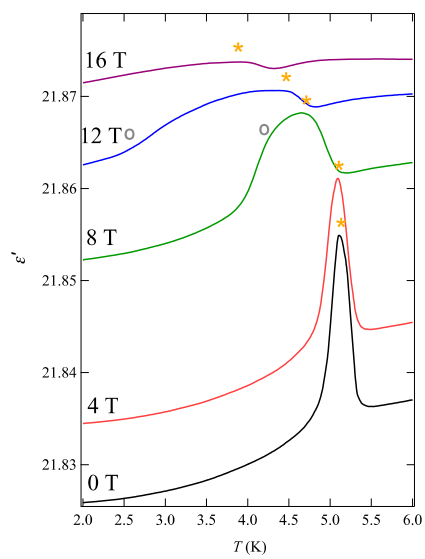

Fig. 1 Temperature-dependent real part of dielectric constant (ε') at different fields. Anomalies are marked with yellow asterisks and empty grey circles.

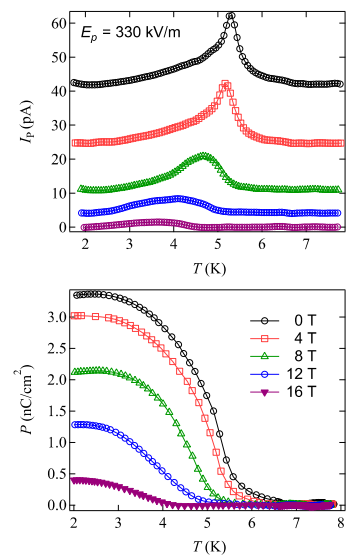

Fig. 3 Pyroelectric current (top) and polarization data (bottom) at different fields.

DC susceptibility follows Curie-Weiss law in a wide range of temperature (See Fig. 1 Inset). The negative Weiss constant (θ_{CW}) implies the minimum of the inverse DC susceptibility that occurs at 5.4 K (T_N) is from an antiferromagnetic ordering (See Fig. 1). We have observed dielectric constant anomalies at temperatures close to T_N which was obtained from DC susceptibility measurement at different fields. Pyroelectric current measurement shows the spontaneous and reversible polarization develops at T_N, which suggests that the nature of ferroelectric ground state in the antiferromagnetically ordered state. This Ferroelectricity is persistent under the magnetic field up to 16 T. Therefore, $Sr_3NiNb_2O_9$ shows multiferroicity like its sister compound $Ba_3NiNb_2O_9$ [3]

Acknowledgements

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References

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