SEARCH FOR HIGH TEMPERATURE STRUCTURAL PHASE TRANSITION IN NiCl$_2$-4SC(NH$_2$)$_2$

V. S. Zapf (NHMFL, LANL), Armando Paduan-Filho (Instituto de Fisica, Universidade de Sao Paulo, Brazil).

Introduction

The compound NiCl$_2$-4SC(NH$_2$)$_2$ (DTN) is a candidate for Bose-Einstein Condensation of magnons [1] and The tetragonal symmetry required to observe BEC in this material has been confirmed at room temperature using X-ray diffraction [2]. However, no structural investigations at low temperatures have been published to date. In this work we investigate whether any structural phase transitions are observable in the specific heat in the temperature range of a $^4$He cryostat. We were also motivated by the observation of a small feature near 100 K in ongoing resonant ultrasound measurements of this compound.

Experimental

We have measured the specific heat of a single crystal of DTN in zero field between 2 K and 300 K. The measurements were performed in a Quantum Design Physical Properties measurement system using a semi-adiabatic relaxation technique.

Results and Discussion

The specific heat as a function of temperature is shown in Fig. 1. The specific heat shows no sharp peaks or features between 1.8 K and 290 K.

![Fig. 1 Specific heat of NiCl$_2$-4SC(NH$_2$)$_2$.](image)

Conclusions

No phase transitions of any type can be observed in the NiCl$_2$-4SC(NH$_2$)$_2$ between room temperature and 2 K. The feature in resonant ultrasound near 100 K has since been determined to be an artifact. Resonant ultrasound measurements are in progress at lower temperatures and fields up to 20 T to search for potential distortions from the tetragonal structure due to magnetostriction effects in the magnetically ordered region of the phase diagram.

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References