CALIBRATION OF A CERNOX™ THERMOMETER MAGNETORESISTANCE USING A PULSED MAGNETIC FIELD

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Introduction

A Lakeshore Cernox™ 1030BC thermometer to be used as the platform thermometer on a heat capacity stage was calibrated at temperatures from 20 K down to 0.5 K in magnetic fields up to 45 T using the mid-pulse magnet at the NHMFL Los Alamos. The resulting heat capacity system will be used in the 33 T resistive and 45 T hybrid magnet at the NHMFL Tallahassee to measure heat capacity of high TC compounds.

Experimental

The Cernox™ thermometer was mounted with the excitation current perpendicular to the magnetic field and cooled to 20 K. Using the NHMFL Los Alamos digital lockin amplifier the thermometer was excited with a current of 10µA at a frequency of 100 KHz. Data was taken at a rate of 1 MHz as the magnet was pulsed to 45 T. The short time of the magnetic field pulse (around 50 mS) ensures that the thermometer under test remains isothermal while the data is taken. Data is taken for two magnetic field pulses at each temperature the first the 20 T and the second to 45 T. Overlaying the resulting data ensures that there is no magnetically induced heating effect during the pulse.

Results and Discussion

The data below 2.5 K was shown to have significant heating problems above 30 T, probably because the thermometer has poor thermal contact to the main mass of the probe. The data is incorporated into a suite of LabView™ programs to enable “on the fly” corrections of temperature due to magnetic field.

Both Fig. 1 and Fig. 2 show good agreement with previously published data [1].

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References