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Specific heat of $YBa_2Cu_3O_{7-x}$ from 4·2 to 60 K

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Abstract. The specific heat of superconducting oxide compound, $YBa_2Cu_3O_{7-x}$, is studied using a quasi-adiabatic calorimeter from 4·2 to 60 K. The analysis of the specific heat data below 15 K gives a value of 17 mJ/mole K^2 for the electronic heat capacity coefficient. The value of $\theta_D(0)$ is determined to be 397 ± 8 K. The variation of θ_D with temperature was calculated in the temperature range 4·2 to 60 K.

Keywords. High temperature superconductors; Y-Ba-Cu-O system; specific heat.

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1. Introduction

With the discovery of high temperature superconductor, $YBa_2Cu_3O_{7-x}$ (Wu *et al* 1987), intense research is going on to understand the mechanism of superconductivity in these materials. It is of interest to study the specific heat of these materials, since such measurement gives information on thermal parameters relating the energy states. In this paper we report the measurement of specific heat of $YBa_2Cu_3O_{7-x}$ compound from 4·2 K to 60 K. Similar measurements have already been reported by others on this compound (Brill *et al* 1987; Junod *et al* 1987; Nambudripad and Dhar 1987; Inderhees *et al* 1987).

The method of synthesizing the sample is described elsewhere (Subba Rao *et al* 1987). Basically, the method is to mix the compounds $BaCO_3$, Y_2O_3 and CuO in proper ratio and heat to 950°C for 24 h twice. The black powder is pelletized and sintered at 950°C for 24 h, followed by a treatment in flowing oxygen for 24 h at 900°C and then for 24 h at 600°C and slow cooled to room temperature. X-ray diffraction measurements revealed that the samples were single phase materials exhibiting orthorhombic structure.

The resistivity and susceptibility measurements showed superconducting transition of these samples to be $90{\cdot}5 \pm 0{\cdot}5$ K (Srinivasan *et al* 1987). The specific heat was measured on two samples of masses 1·033 g and 0·6643 g from two different batches. The samples were taken in the form of pellets. The sample holder used was identical to that used by Gmelin and Ripka (1981). The calorimeter and its instrumentation described elsewhere, consists of a sapphire plate coated with a grid of Ni-Cr alloy which is used as sample heater. On this disc is placed a sapphire block with calibrated