

Specific heat anomaly in the 90 K superconductor $\text{HoBa}_2\text{Cu}_3\text{O}_{7-y}$

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Abstract. We report here the results of our heat capacity C_p measurements on a monophasic material $\text{HoBa}_2\text{Cu}_3\text{O}_{7-y}$. $\Delta C_p/T_c$, the jump in C_p at the superconducting transition temperature ($= 91 \text{ K}$) of the material is measured to be $31 \text{ mJ/mol}\cdot\text{K}^2$.

Keywords. $\text{HoBa}_2\text{Cu}_3\text{O}_{7-y}$; anomaly in heat capacity; high temperature superconductivity.

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1. Introduction

One of the most important questions regarding the recently discovered high T_c superconductors (Malik and Vijayaraghavan 1987), namely, of the $\text{YBa}_2\text{Cu}_3\text{O}_{7-y}$ -type and $\text{La}_{2-x}\text{M}_x\text{CuO}_{4-\delta}$ -type, is 'what is the mechanism of superconductivity' in these materials. Is a new mechanism of pairing at work which leads to such extraordinary high values of T_c ($= 90 \text{ K}$ in $\text{YBa}_2\text{Cu}_2\text{O}_{7-y}$ type materials)? Or is it that the usual phonon-mediated attractive coupling between the two partners of a Cooper pair is operating in these materials also? Various experiments have been performed on these materials to seek answers to such basic questions. Measurements of heat capacity C_p and the jump ΔC_p in C_p at the superconducting transition temperature of the material yield very useful information about the superconductivity behaviour. Not only does this measurement allow one to make a definite statement about the bulk nature of superconductivity but also leads to a better insight about its mechanism. C_p and ΔC_p have been measured for $\text{YBa}_2\text{Cu}_3\text{O}_{7-y}$ (Nevitt *et al* 1987) and $\text{La}_{1.8}\text{Sr}_{0.2}\text{CuO}_{4-\delta}$ (Dunlap *et al* 1987) and important conclusions have been drawn about the density of states at the Fermi level. Low temperature heat capacity measurements have been reported by Nambudripad and Dhar (1987) in $\text{YBa}_2\text{Cu}_3\text{O}_{7-y}$. In this brief report, we present preliminary results of our heat capacity measurements of a single phase material $\text{HoBa}_2\text{Cu}_3\text{O}_{7-y}$.

2. Experimental

Samples of $\text{HoBa}_2\text{Cu}_3\text{O}_{7-y}$ were prepared by sintering a mixture of Ho_2O_3 , BaCO_3 and CuO taken in the required proportion (to yield a composition $\text{HoBa}_2\text{Cu}_3\text{O}_{7-y}$). The mixture was ground very thoroughly for about an hour and calcined at 900°C for 12 h. The calcined mass so obtained was powdered, pelletized and sintered at