Specific Heat and Entropy of a Three Electron Model in Bismuth Based Cuprate Superconductor

A theoretical study considering Bi2201, Bi2212 and Bi2223 bismuth based cuprates whose critical Temperatures (TC) are 20K, 95K and 110K with one, two and three CuO2 planes respectively; based on a three electron model in Bismuth based cuprates oxide shows that there is a direct correlation between energy of interaction and the number of CuO2 planes at the TC. The specific heat for a mole of Bismuth based cuprates at TC was found to be $7.471\times10^{-24}\mathrm{JK}^{-1}$ regardless of the number of CuO2 planes; though the specific heat per unit mass, Sommerfeld coefficient as well as entropy per unit mass decreased with an increase in the number of CuO2 planes. The entropy of a mole of Bismuth based cuprates at TC was found to be $5.603\times10^{-24}\mathrm{JK}^{-1}$ irrespective of the TC or mass. The peak Sommerfeld coefficient temperature was noted to occur at the ratio T/TC=0.66 in the bismuth based cuprates.

Keywords: Superconductivity, Sommerfeld coefficient, Specific heat, Entropy