Thermodynamic Properties of an Interaction between Cooper Pairs and Electrons in Bismuth Based Cuprate Superconductivity

Odhiambo O. J.[1], Sakwa W. T.[2], Ayodo K. Y.3, Makokha W. J.[1]
[1]Kibabii University, Department of Science Technology and Engineering
[2] Masinde Muliro University of Science and Technology, Department of Physics
[3] Kaimosi Friends University College, Department of Physical Sciences
Corresponding e-mail: jodhiambo@kibu.ac.ke

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Abstract
A theoretical study considering Bi2201, Bi2212 and Bi2223 bismuth based cuprates whose critical Temperatures (T_C) are 20K, 95K and 110K with one, two and three CuO_2 planes respectively; based on an interaction of Cooper pair and an electron in Bismuth based cuprates oxide shows that there is a direct correlation between energy of interaction and the number of CuO_2 planes at the T_C. The specific heat for a mole of Bismuth based cuprates at T_C was found to be $7.471\times10^{-24}JK^{-1}$ regardless of the number of CuO_2 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 CuO_2 planes. The entropy of a mole of Bismuth based cuprates at T_C was found to be $5.603\times10^{-24}JK^{-1}$ irrespective of the T_C or mass. The peak Sommerfeld coefficient temperature was noted to occur at the ratio $T/T_C=0.66$ in the bismuth based cuprates.

Key Words *— Superconductivity, Sommerfeld Coefficient, Specific Heat, Entropy*