Thermal fluctuations of $(Tl_{0.5}Pb_{0.5})Sr_2(Ca_{0.9}Gd_{0.1})Cu_2O_z$ bulk superconductors

W. M. Woch[a], M. Chrobak[a], A. Kołodziejczyk[a], G. Gritzner[b]

[a]Solid State Physics Department, Faculty of Physics and Applied Computer Science, AGH University of Science and Technology, Mickiewicza 30, 30-059, Krakw, Poland

[b]Institute for Chemical Technology of Inorganic Materials, Johannes Kepler University, A4040 Linz, Austria

9.7 cm

The critical region around the superconducting transition temperature T_{c0} in the high temperature superconductors shows the competition between critical and stochastic gaussian fluctuations. In the paper the critical exponents λ of the conductivity have been calculated of the thallium based superconductors $(Tl_{0.5}Pb_{0.5})Sr_2(Ca_{0.9}Gd_{0.1})Cu_2O_z$ using the following formula [1]: $\Delta\sigma = K\varepsilon^{-\lambda}$ where $\varepsilon = (T - T_{c0})/T_{c0}$, K is a constant, $\Delta\sigma = \frac{1}{R} - \frac{1}{R_R}$ where $R_R = R0 + (dR/dT)T$. R_0 and dR/dT are constants. The dR/dT is calculated from R(T) curve in the temperature range well above the critical temperature T_{c0}. In the high temperature superconductors the short-lived Cooper pairs fluctuate in rather broad temperature region around the critical temperature mainly due to the very short coherence length. The experimental results were analyzed taking into account the stochastic gaussian fluctuations with the exponent $\lambda = 2 - d/2$ as well as the true critical fluctuations with the critical exponent $\lambda = \nu(2 + z + d + \eta)$, where $\nu = 2/3$, $z \cong 3/2$, $\eta \cong 0$ and d = 1, 2 or 3 is the dimension of the fluctuating system [2].

The critical exponent in the closest to T_{c0} temperature interval was calculated and the true critical fluctuations and the gaussian fluctuations in different temperature intervals have been determined.

[1] P. Pureur, R. Menegotto Costa, P. Rodrigues, Jr., J. Schaf, J.V. Kunzler, *Phys. Rev.* **B** 47 (1993) 11420.

[2] R. Menegotto Costa, P. Pureur, M. Gusmao, S. Senoussi, K. Behnia, *Phys. Rev.* **B** 64 2001 214513.

13.4 cm

Subject category :

1. Strongly Correlated Electrons and High Temperature Superconductivity

Presentation mode :

poster

Corresponding author :

W. M. Woch

Address for correspondence :

W. M. Woch
Solid State Physics Department
Faculty of Physics and Applied Computer Science
AGH University of Science and Technology
30 Mickiewicza Str
30-059 Cracow, Poland

Email address :

wmwoch@agh.edu.pl