

## **SUPERCONDUCTIVITY AND TRANSPORT CRITICAL CURRENT DENSITY IN $Tl_{1-x}Pb_xSr_{1.8}Sb_{0.2}CaCu_2O_7$ CERAMICS**

W.F.Abdullah<sup>a</sup>, M.H. Jumali<sup>b</sup>, A.K.Yahya<sup>a\*</sup>

<sup>a</sup>Faculty of Applied Sciences,  
Universiti Teknologi MARA,  
40450 Shah Alam, Selangor.

<sup>b</sup>School of Applied Physics,  
Universiti Kebangsaan Malaysia,  
43600 Bangi, Selangor.  
Email : ahmad191@salam.uitm.edu.my

### **ABSTRACT**

Superconducting properties of  $Tl_{1-x}Pb_xSr_{1.8}Sb_{0.2}CaCu_2O_7$  ( $x = 0.1 - 0.6$ ) ceramics prepared using solid-state synthesis have been investigated.  $Tl_{1-x}Pb_xSr_{1.8}Sb_{0.2}CaCu_2O_7$  ( $x = 0.1 - 0.5$ ) showed metallic normal state behavior and an increase in  $T_{c\ zero}$  from 26 K at  $x = 0.1$  to a maximum value of 80 K at  $x = 0.5$ . Further substitution of Pb to  $x = 0.6$  caused a decrease in  $T_{c\ zero}$  to 27 K. The transport critical current density,  $J_c$  measured in zero magnetic field for  $Tl_{1-x}Pb_xSr_{1.8}Sb_{0.2}CaCu_2O_7$  ( $x = 0.2 - 0.4$ ) between 20 K and 80 K was determined by the four-point probe measurement using the  $1\mu Vcm^{-1}$  criterion.  $J_c$  increases when the temperature is reduced for all samples ( $x = 0.2 - 0.4$ ). The results of the electrical measurements and powder X-ray diffractions analysis are presented. The significance of each elemental substitution at different atomic sites are suggested. Effects of Pb and Sb substitution are discussed in terms of average Cu valence. Behavior of transport critical current density  $J_c$  with temperature was explained using a self-field approximation.

<http://journal.massshp.net/wp-content/uploads/Journal/2004/W.F.Abdullah%2041-46.pdf>

### **REFERENCES**

- [1] Z.Z.Sheng, A.M. Hermann, D.C. Vier, S.Schultz, S.B.Oseroff, D.J.George and R.M. Hazen, *Phys. Rev* **B 38** (1988) 7074
- [2] W.H.Lee and B.C. Huang, *Physica C* (1997) 114
- [3] A.K.Ganguli, K.S.Nanjundaswamy and C.N.R.Rao, *Physica C* **156** (1988) 788
- [4] M.A. Subramaniam, C.C. Torardi, J.Gopalakrishnan, P.L Gai, J.C. Calabrese, T.R. Askew, R.B. Flippen and A.M. Sleight, *Science* **242** (1988) 249
- [5] Haldar P., Sridhar S., Roig-Janiki A., Kennedy W., Wu D. H., Zahopoulos C., and Giessen B. C., *J. Superconductivity* **1** (1988) 211
- [6] R.S.Liu *J.Solid State Chem* **86** (1990) 334
- [7] S.Nakajima, M.Kikuchi, Y.Syono, T.Oku, D.Shindo, K.Hiraga, N.Kobayashi, H.Iwasaki, and Y.Muto, *Physica C* **158** (1989) 471
- [8] Z.Z Sheng Y.F.Li and D.O. Pederson, *Solid State Comm.* **V80, N11** (1991)913.
- [9] A.Kilic, K.Kilic and S.Senoussi *J.Appl.Physics* 84 (1998) 3254