

Abstract

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Superconducting Properties of (Tl_{1.6}Pb_{0.4})-2223 Substituted by Praseodymium

The lattice parameters, electrical resistivity, ac magnetic susceptibility, magnetoresistance and Hall effect have been measured for a newly developed compound obtained through partial substitution of Ca²⁺ ions by Pr³⁺ ones in (Tl_{1.6}Pb_{0.4}) Ba₂Ca₂Cu₃O_{10-?}. For such compound, the prepared samples are almost single phase of (Tl, Pb)-2223 tetragonal unit cell with a space group 14/mmm. An opposite behavior for both lattice parameters a and c was observed as the concentration of Pr-content was increased. Also, metallic tendency was observed from electrical resistivity measurements in the range of $0 < x < 0.15$ for temperature values above the superconducting transition temperature T_c. On the other hand, a semiconductor-like behavior was noticed for values $x > 0.15$. Suppression in the superconducting transition temperature was found as the Pr-content was increased. This suppression in superconductivity for the system evolved was discussed according to two models point of views; the Cooper-pair breaking and hole-filling models. The transverse magnetoresistance, below the superconducting transition temperature, was measured in a weak magnetic field up to 4.8 kG. Finally, the Hall voltage was measured at different temperature values above that of superconducting transition using five-probe technique. The Hall coefficient, Hall mobility and Hall angle were expressed as functions of both temperature and Pr-content.