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SUPERCONDUCTIVITY OF $Tl_{0.8}Bi_{0.2}Sr_2Ca_{0.8}Y_{0.2}Cu_2O_\delta$ CERAMICS PREPARED VIA CO-PRECIPITATION METHOD

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ABSTRACT

In this paper, synthesis of $Tl_{0.8}Bi_{0.2}Sr_2Ca_{0.8}Y_{0.2}Cu_2O_7$ superconductors via co-precipitation route is reported. Acetates of thallium, bismuth, strontium, calcium, yttrium and copper were mixed according to required stoichiometric ratios and reacted to form oxalates precipitates. The precipitates were subjected to various heating conditions for best conversion to oxides and carbonates. The co-precipitated powders were placed in an open crucible (CPR2 sample), in a closed crucible (CPR1 sample) and pressed into pellet form (CPR3 sample) before calcination at 600^{o}C. CPR4 sample was prepared using excess thallium acetate in the starting solution composition and CPR5 sample was prepared by direct addition of Tl_2O_3 powder to the co-precipitated powder before sintering. All the samples were sintered at 980^{o}C for 5 minutes in flowing oxygen. Temperature dependent electrical resistance (dc) measurements showed semiconductor-like normal state behavior for CPR1, CPR2 and CPR3 with T_{conset} between 94 K – 108 K and $T_{c\ zero}$ between 29 K – 70 K. Addition of 10 wgt% excess Tl_2O_3 (CPR5 sample) increased $T_{c\ zero}$ to 74 K and showed semiconductor-semimetallic normal state behavior. CPR4 which was prepared with excess thallium acetate showed metallic normal state behavior and $T_{c\ zero}$ of 80 K. The values of transport critical current density (J_c) of the samples determined by four-point-probe measurement using the 1μVcm^{-1} criterion are reported. X-Ray diffraction analysis showed formation of dominant 1212 phase in all co- precipitated samples. The effects of preparation procedures and addition of extra thallium in the starting composition on superconducting properties and Tl1212 phase formation are discussed.

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