SYNTHESIS AND CHARACTERISATION OF THE CERAMIC SUPERCONDUCTOR IN THE $(Tl,Cu)(Sr,Yb)_2CaCu_2O_{7-\delta}$ SYSTEM

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ABSTRACT

SYNTHESIS AND CHARACTERISATION OF THE CERAMIC SUPERCONDUCTOR IN THE $(Tl,Cu)(Sr,Yb)_2CaCu_2O_{7-\delta}$ SYSTEM

Samples with compositions of $(Tl_{1-y}Cu_y)(Sr_{1.8}Yb_{0.2})CaCu_2O_{7-\delta}$ (y=0.0 to 0.6) have been prepared and characterized using conventional solid-state synthesis method. Results of critical temperature (T_c) measurements, room-temperature resistivity measurements, powder X-ray diffraction (XRD) analysis, and microstructure investigation using scanning electron microscope (SEM) are presented. Temperature dependent electric resistance measurements on the series showed that the normal state behavior and superconducting properties can be controlled by adjusting Cu concentration. For the series, normal state resistance changes from metallic behavior (y=0.0-0.4) to semi-metallic behavior (y=0.5) and insulating behavior (y=0.6). $T_{c\ zero}$ gradually increased from 53.9 K (y=0.0) to a maximum value of 83.6 K at y=0.4 before decreasing with further Cu substitution. Powder X-ray diffraction patterns showed all samples consists of major 1212 phase and minor 1201 phase. The effects of Cu substitutions are discussed in terms of T_c, Tl1212 phase formation and the concept of average copper valence.