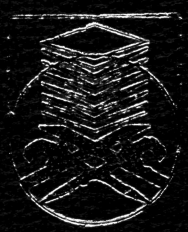
EFFECTS OF Tl AND Sr-SITE SUBSTITUTIONS ON $TlSr_2CaCu_2O_7$ SUPERCONDUCTORS



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ABSTRACT

In this project, the formation of superconducting phases prepared from nominal starting compositions of $Tl_{0.8}Pb_{0.2}Sr_2(Sr_{1-x}Ti_x)Cu_2O_7$ (x = 0.0 to 0.7) and $TlSr_{2-x}Ti_xCaCu_2O_7$ (x = 0 to 0.2) have been investigated. $Tl_{0.8}Pb_{0.2}Sr_2(Sr_{1-x}Ti_x)Cu_2O_7$ formed non-superconducting single phased Tl1202 (x = 0 to 0.4) and minor Tl1212 phase (x = 0.5 to 0.7). $TlSr_{2-x}Ti_xCaCu_2O_7$ (x = 0 to 0.6) formed mixed Tl1201 and Tl1212 phases and was superconducting for x= 0.2 with $T_{c\ onset}$ of 43 K and 66 K and $T_{c\ zero}$ of 34 K. The lattice parameters calculated from XRD for both compositions did not show any systematic change with Ti substitution. The location of Ti for $Tl_{0.8}Pb_{0.2}Sr_2(Sr_{1-x}Ti_x)Cu_2O_7$ and $TlSr_{2-x}Ti_xCaCu_2O_7$ is complicated due to formation of mixed phases.

CHAPTER I

INTRODUCTION

The discovery of superconductivity at temperatures above 77 K is amongst one of the important scientific events of the past decade. The potential scientific and commercial importance of this discovery, largely underlie the degree of excitement and fervour of the field. Superconductors are elements, inter-metallic alloys, or compounds that will conduct electricity without resistance below a certain temperature. Superconductivity has been found in at least 26 metallic elements and in thousands of alloys and compounds.

The extremely high superconducting transition temperatures of the ceramic superconductors have received particular attention. In high-temperature superconductors, yttrium and barium, or lanthanum and strontium are sandwiched between layers of copper and oxygen atoms (Wu et. al., 1987). The ceramic superconductor $YBa_2Cu_3O_{7-\delta}$ (Y123) is an acronym for a well-known ceramic superconductor composed of Yttrium, Barium, Copper and Oxygen. This was the first high temperature ceramic superconductor discovered that has a transition temperature well above the boiling point of liquid nitrogen that is a commonly available coolant.