

Annotation

This phase of the doctoral research focused on the synthesis and investigation of the physical properties of Thallium-based high-temperature superconducting compounds doped with Arsenic trioxide. The synthesis involved a two-step chemical process. In the initial stage, a polyphasic precursor material, $\text{Ba}_{1-x}\text{CaCu}_2\text{O}_{7-x}$, was prepared via the “in situ” polymerization method. In the subsequent stage, the final high-temperature compound was synthesized using the sealed quartz ampoule method under oxygen pressure via a solid-state reaction involving Thallium oxide and Arsenic trioxide (with a dopant concentration range of 0.5 – 2.0 wt%).

Experimental results demonstrated that the critical superconducting transition temperature, T_c , of the undoped sample was 107 K. The incorporation of the optimal amount of dopant increased the critical temperature of the superconducting phase from 107 K to 114.5 K. Furthermore, X-ray diffraction analysis revealed that doping with 0.5 wt% Arsenic oxide significantly improved both the phase purity of the final superconducting sample and the intergranular critical current density, J_c . This study provides a detailed account of the influence of doping on the formation mechanism and crystal structure of the superconducting phases.