

## Effect of graphene addition on the transport critical current density of bulk (Tl<sub>0.85</sub>Cr<sub>0.15</sub>) Sr<sub>2</sub>CaCu<sub>2</sub>O<sub>7- $\delta$</sub> superconductor

### ABSTRACT

In this work, the effect of graphene addition on the transport critical current density of (Tl<sub>0.85</sub>Cr<sub>0.15</sub>) Sr<sub>2</sub>CaCu<sub>2</sub>O<sub>7- $\delta$</sub>  (Tl-1212) superconductor was investigated. Thallium-based high temperature superconductor (HTS) with nominal starting composition (Tl<sub>0.85</sub>Cr<sub>0.15</sub>) Sr<sub>2</sub>CaCu<sub>2</sub>O<sub>7- $\delta$</sub>  was prepared using high purity oxide powders via solid state reaction method. 0.001 – 0.005 wt.% of graphene were added into Tl-1212 superconductors. The characteristic of the samples were determined by powder X-ray diffraction method, scanning electron microscopy (SEM), energy dispersive X-Ray analysis (EDX), electrical resistance measurements and transport critical current density measurements. The zero-resistance temperature,  $T_{c-zero}$  was found to decrease from 95 K to 84 K with the increase of graphene. The temperature dependence transport critical current density ( $J_c$ ) of the pure and graphene added bulk samples were investigated.  $J_c$  of the non-added bulk sample was 1320 mA/cm<sup>2</sup> at 30 K while the  $J_c$  of sample with 0.001 wt.% graphene was 3660 mA/cm<sup>2</sup> at 30 K. Results showed that the  $J_c$  of the Tl-1212 samples decreased with increasing graphene addition. Graphene acted as impurity which is believed to perform the flux pinning effect to Tl-1212. Thus, the  $J_c$  of Tl-1212 superconductors was enhanced. The phase formation and morphology of samples Tl-1212 were also discussed in this paper.

**Keyword:** Superconductivity; Tl-1212 Superconductor; Transport Critical Current Density; Graphene