

Abstract

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Thermal expansion measurements of (Cu_{0.25}Tl_{0.75})-1234 added by MgO - nano particles

The effect of nano-size MgO (40–60 nm) addition on both granular structure and volume thermal expansion measurements of polycrystalline (Cu_{0.25}Tl_{0.75})-1234 was studied. The MgO-content x varied from 0.0 to 1.0 wt.% of the sample total mass. Granular investigation using scanning electron microscope revealed that both number and size of voids decreased as x increased from 0 wt.% to 0.6 wt.%. These results were supported by porosity calculation of the samples. The volume thermal expansion was calculated using X-ray powder diffraction from room temperature down to 80 K. The volume thermal expansion coefficient, at room temperature decreased, from $9.3 \times 10^{-5} \text{ K}^{-1}$ to $7.2 \times 10^{-5} \text{ K}^{-1}$ as MgO-concentration increased from 0.0 wt.% to 0.6 wt.% before it increased to $8.9 \times 10^{-5} \text{ K}^{-1}$ for MgO-concentration = 1 wt.%. The Debye temperatures, calculated from the volume thermal expansion coefficient measurements, were reported as a function of MgO-concentration and superconducting transition temperature.