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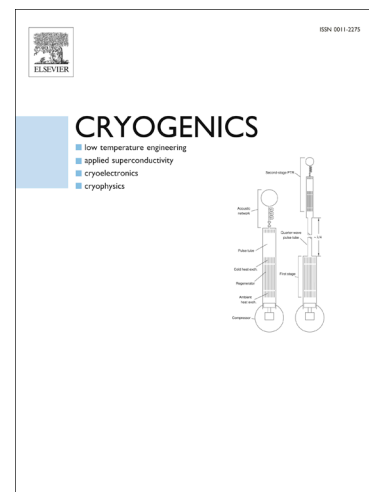
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Magneto-Transport Properties of $(\text{Cu})_x/\text{CuTl-1223}$ Nanoparticles-Superconductor Composites

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Abstract

Copper (Cu) nanoparticles and $\text{Cu}_{0.5}\text{Tl}_{0.5}\text{Ba}_2\text{Ca}_2\text{Cu}_3\text{O}_{10-\delta}$ (CuTl-1223) superconducting phase were synthesized by sol-gel and solid-state reaction, respectively. These metallic Cu nanoparticles were added in CuTl-1223 superconducting matrix to get $(\text{Cu})_x/\text{CuTl-1223}$; $x = 0 \sim 4.0$ wt. % nanoparticles-superconductor composites and their temperature dependent magneto-transport properties were studied. The zero-field-cooled (ZFC) and field-cooled (FC) temperature dependent magnetization (M-T) measurements of $(\text{Cu})_x/\text{CuTl-1223}$ samples showed an increase in transition temperature and in amplitude of diamagnetic signal after the inclusion of Cu nanoparticles in the host CuTl-1223 matrix. This improvement in these magneto-transport properties can be attributed to the increase in number of efficient pinning centres in CuTl-1223 matrix after addition of Cu nanoparticles. Magnetization hysteresis (M-H) loops were obtained at various operating temperatures from which the magnetization critical current density (J_c) was estimated using Bean's critical state model. M-H loops indicated the combined superconducting and ferromagnetic behaviour up to 90 K in all $(\text{Cu})_x/\text{CuTl-1223}$ samples. Improvement in J_c could also be due to increase in number of pinning centres with addition of Cu nanoparticles in CuTl-1223 matrix. Maximum improvement in magneto-transport properties of $(\text{Cu})_x/\text{CuTl-1223}$ samples was observed for

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