Transport Critical Current Density of $\text{Bi}_{1.6}\text{Pb}_{0.4}\text{Sr}_2\text{Ca}_2\text{Cu}_3\text{O}_{10}$ /Ag Superconductor Tapes with Addition of 50 and 70 nm MgO

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MgO nanoparticles with average particle size 50 and 70 nm were added into $\text{Bi}_{1.6}\text{Pb}_{0.4}\text{Sr}_2\text{Ca}_2\text{Cu}_3\text{O}_{10}(\text{MgO})_x/\text{Ag}$ superconductor tapes and sintered at 845 °C for 50 and 100 h. The effect of sintering time on the transport critical current density (J_c) was investigated. J_c of the tapes were measured in zero-field between 30 and 77 K and under magnetic fields at 77 K. The phase and microstructure of the tapes were examined by X-ray diffraction method and scanning electron microscopy, respectively. All tapes showed plate-like grains and a larger plate-like grain was observed in the tapes sintered for 100 h. J_c of the MgO added tapes was higher than those of the non-added tapes. J_c of the non-added tape sintered for 100 h was 10820 A/cm² at 30 K and 1262 A/cm² at 77 K. J_c of the tapes sintered for 100 h was higher than the tapes sintered for 50 h. The 50 nm MgO added tapes showed a higher J_c than the 70 nm MgO added tapes. J_c for the 100 h sintered MgO (50 nm) added tape was 22710 and 3070 A/cm² at 30 and 77 K, respectively which are higher than that of the 100 h sintered MgO (70 nm) added tape. The improved J_c was attributed to the increase in flux pinning potential and improvement in the microstructure due to the addition of nano-sized MgO. This work showed the importance of the size of the added nanoparticles to the transport current properties of these superconductors.

Keywords: nano MgO; size effect; transport critical current density; flux pinning

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