

Effects of annealing temperature on magnesium deficient in MgB₂ superconductor

ABSTRACT

The Mg-deficient Mg_{0.8}B₂ superconductors were prepared using the solid-state reaction method at different annealing temperature between 650 °C and 800 °C. The x-ray diffraction patterns indicated that magnesium diboride (MgB₂) is a major phase and magnesium oxide (MgO) is the secondary phase. However, no unreacted Mg was detected by XRD at all annealing temperatures. The SEM images showed hexagonal grain structures with nano thickness distributions. The highest critical current density (J_c) at 5 K and 20 K was found in sample annealed at 700 °C. At 5 K and 6 T, the highest J_c achieved was 1.2×10^4 A/cm². At 20 K, the highest J_c achieved by 3.6×10^3 A/cm². The values of the onset superconducting transition temperature, T_c for all Mg_{0.8}B₂ were 37.0 K. The samples annealed at 700° C showed a sharper diamagnetic drop with $\Delta T_c = 3.0$ K compared to all samples.

Keyword: Superconductors; MgB₂; Mg-deficient; Solid-state reaction method