

Effect of Semiconducting and Metallic Carbon Nanotubes Doping on Critical Properties of MgB₂ Superconductor

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We fabricated the MgB₂ bulk by using the in-situ process and evaluated the effect of doping of semiconducting CNT (S-CNT) and the mixture of metallic-semiconducting CNT (MS-CNT) on the microstructure and critical properties. The nominal compositions were MgB_{2-x}C_x with x = 0.1 and the compacts were sealed in a Ti tube and sintered at 800°C and 900°C in a flowing high purity Ar gas (99.9%) to prevent oxidation during the sintering process.

The critical temperature (T_c) of undoped sample was measured to be 37.2 K. The T_c of S-CNT and MS-CNT doped samples were measured to be 36.9 K and 37.4K at the sintering temperature of 800°C and 36.7 K and 36.9 K at 900°C, respectively. The critical current density (J_c) of the doped samples decreased more slowly with increasing magnetic field and had higher value at a high magnetic field than that of the undoped samples. In addition, the J_c degradation of MS-CNT doped sample sintered at 800°C was smaller than that of S-CNT doped samples with increasing magnetic field. On the other hand, for sintering temperature of 900°C, J_c variation with magnetic field showed countertrend behavior. These results are thought to be due to the difference of decomposition temperature and diameter of CNTs.

Keywords : Carbon nanotube, critical current density, in-situ process, MgB₂

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