Influence of Ag Nanoparticle Additions on the Superconducting Properties of MgB_2 Materials

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The development of MgB_2 wires/tapes has been taken a growing interest in the practical applications by many advantages, such as the rapid and reliable compound synthesis, the commercial availability of MgB_2 powder, and the relative simplicity in structure and components. The high critical current density of the developing MgB_2 wires/tapes can be one of key factors for applications in the presence of magnetic fields. To enhance the current carrying capability of MgB_2 wires/tapes, we should add some pinning centers in these materials. High temperature exposure to Ag metal is common in the fabrication of high-T_c tapes and wires (PIT BSCCO tapes), where Ag is generally thought to favorable. The Ag nanoparticles in the MgB_2 matrix can act as pinning centers and improve the connectivity of MgB_2 powders in the fabricated MgB_2/Ag wires/tapes. Therefore, a series of superconducting MgB_2 materials, containing Ag nanoparticle additions with 10 to 50 wt.%, has been studied. Bulk samples of MgB_2/Ag were prepared with wt.% Ag nanoparticles added using a simple solid-state reaction route. 10 to 50 wt.% Ag nanoparticle added MgB_2 powders were first cold pressed into a pellet form. The pellets were then sealed in stainless steel tube and sintered at 850°C for two hours with Ar atmosphere. Characterization methods included X-ray diffraction, SEM, and studied of the magnetization M. The isothermal magnetizations M(H) of a series of samples were measured at temperatures between 5 and 50 K in fields up to 6 T, employing a PPMS-9 (Quantum Design). The critical current density (Jc) values have been obtained from the M(H) data, using Bean model, for the bulk samples of MgB_2/Ag. We discuss the influence of Ag nanoparticle additions on the superconducting properties of MgB_2 bulk superconductors. These and other results will be discussed.

keywords : MgB_2 powders, Ag nanoparticle, sintering or non-sintering, critical currents, magnetization