

The critical current density of polycrystalline MgB₂ prepared by using boron mixture

ABSTRACT

In this study, boron powders with varying purity and form were mixed in different proportion to serve as precursors for reaction with Mg forming polycrystalline MgB₂ bulks. The inductively measured superconducting transition temperature, T_c and the critical current density, J_c were compared to that of samples prepared from the respective single boron. Overall, T_c remains largely unchanged for all samples. It was found that J_c at 6 K and 20 K did not degrade significantly up to 4.6 T as a result of adding impure boron as much as 10 wt.% indicating comparable J_c can be obtained without dependence of use of expensive high purity boron powder alone. The systematic decrease of J_c with increasing impure boron additions shows that a compromise between desired and cost reduction can be made by varying the boron powder proportion. Finally, samples prepared from the mixture of both impure crystalline and amorphous borons even show enhanced J_c up to 3 T at 20 K. The increase in J_c correlates with the retention of strain level in these samples probably resulted from the more similar reaction rate of the respective borons.

Keyword: Boron precursors, Critical current density, MgB₂, Strain