

Determination of the relative influences of carbon doping and disorder on field and temperature dependent critical current density of MgB₂

ABSTRACT

SiC was mixed with Mg and B and reacted by either a one-step in situ or two-step method at 650 or 850 °C. By doing so, it was possible to determine the extent to which scattering via C doping influences the magnitude of field dependent critical current density, $J_c(H)$, compared to pinning via generation of microstructural disorder. The one-step reaction method leads to Mg₂Si formation and at the same time to more C doping of MgB₂ than the two-step method. Carbon increases both the irreversibility field, H_{irr} , and upper critical field, H_{c2} ($T < 28$ K). However, for the temperatures (6 and 20 K) and fields (up to 7 T) studied, pinning rather than scattering overwhelmingly dominates the magnitude of the field dependent critical current density.

Keyword: Carbon doping; Microstructural disorder; MgB₂