

Enhanced critical current density in MgB₂ superconductor via Si and C coadditions.

Abstract

In this study, nanosize Silicon and Carbon (Si+C) were reacted with MgB₂ in order to enhance the critical current density. The polycrystalline bulks were synthesized by the direct in situ reaction method and their phase formation, crystal structure, and superconducting properties were evaluated. The enhanced relative peak intensity of Mg₂Si and MgB₄ indicates the formation of a large volume fraction of these two phases with increasing (Si+C) additions. The a-axis lattice parameter shrinks significantly while c-axis increases slightly. The estimated C doping level at B site increases, leading to a degradation of the superconducting transition temperature with increasing (Si+C) additions. By a reaction with (Si+C), the field dependence of critical current density is shown to enhance at both 5 K and 20 K.

Keyword: MgB₂; Carbon doping; Critical current density.