Effect of sintering temperature on the superconducting properties of MgB2 superconductor co-added with a high concentration of Si and C

ABSTRACT

In this study, as much as 10 and 15 wt.% nanosized silicon and carbon (Si+C) were reacted with (Mg+2B) at 650°C and 850°C, respectively, for 1 hour. The phase formation, surface morphology and superconducting properties of these samples were evaluated. The relative peak intensity as calculated from the XRD patterns indicates the formation of large Mg2Si volume fraction at low sintering temperature. MgB4 phase was detected in the samples sintered at high temperature as a result of Mg deficiency. The C substitution level as estimated from the lattice parameters, was shown to increase in the samples reacted with a higher amount of (Si+C) at high temperature. Scanning electron micrograph showed that (Si+C) co-addition had refined the grain size and improved the grain coupling of MgB2. The superconducting transition temperature was found to decrease with increasing addition level. The superconducting transition width was also broadened because of a large volume fraction of secondary phases. The improved field dependent critical current density at both 5 K and 20 K is accounted to enhanced scattering by C substitution and grain boundary pinning.

Keyword: Carbon co-addition; Critical current density; MgB2; Silicon; Sintering temperature