

## **Effect of sintering temperature on the superconducting properties of MgB<sub>2</sub> 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 Mg<sub>2</sub>Si volume fraction at low sintering temperature. MgB<sub>4</sub> 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 MgB<sub>2</sub>. 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; MgB<sub>2</sub>; Silicon; Sintering temperature