The effects of C substitution and disorder on the field dependent critical current density in MgB2 with nano-SiC additions.

ABSTRACT

In this work, nano sized SiC powders were mixed with Mg and B and reacted by either a one-step insitu or two-step method resulted in different level of C substitution. X-ray diffraction shows the presence of Mg2Si signifying that the reaction between SiC and Mg occurred leading to the release of C in samples reacted in one-step method. Moreover, the much reduced value of a-axis indicates C substitution took place. Resistivity measurements showed higher intragrain scattering owing to a higher density of defects and/or impurities. These samples also show higher Hirr and Hc2 at 20 K in comparison to samples with mainly unreacted SiC (hence lower C substitution). More importantly, their Jc's are more insensitive to high magnetic field (>4 T) at 6 K. However, at 20 K the effect of C content on Jc(H) is less pronounced. Finally, the order of magnitude of Jc(H) at both 6 K and 20 K is rather dominated by pinning.

Keyword: MgB2; Carbon substitution; Upper critical field; Critical current density.