Enhancement of critical current density for MgB2 prepared using carbon-encapsulated boron with co-addition of Dy2O3 and La2O3

ABSTRACT

In this work, magnesium diboride, MgB2 samples were prepared by using magnesium, Mg powder and carbon-encapsulated boron, B powder (1.35 wt% carbon) with addition of dysprosium oxide, Dy2O3 and lanthanum oxide, La2O3 as dopants. Different weight percentages with the ratio of x wt.% Dy2O3: x wt.% La2O3 were used where x = 0.00, 0.25, 0.50, 0.75, 1.00, respectively. X-ray diffraction (XRD) results confirmed MgB2 as the major phase for all the samples. Magnetization measurement showed a slight decrease of critical temperature, Tc from 38.1 K to 37.6 K with the co-addition of Dy2O3 and La2O3. Self-field critical current density, Jc at 20 K increased with the increasing of co-addition levels probably due to improved grain coupling. The highest self-field Jc obtained is 433 kA cm−2 with 1.00 wt% co-addition level. Field dependent Jc (≤4 T) at 20 K of the co-added samples is higher compared to that of the pure one. The present results show that a small amount of Dy2O3 and La2O3 co-addition into MgB2 is effective to enhance flux pinning and Jc.

Keyword: MgB2; Carbon-encapsulated boron; Dy2O3La2O3; Critical current density