Study of the Effects of the SiC Doping on the Critical Current Density of the Ti-sheathed MgB$_2$ Superconducting Wires

GAN LIANG, HUI FANG, SHELLEY KEITH, CAD HOYT, Sam Houston State University, MINA HANNA, F. YEN, B. IV, M. ALESSANDRINI, K. SALAMA — The effects of the SiC doping on the magnetic critical current density ($J_c$) of the Ti-sheathed MgB$_2$ superconducting wires were studied for the first time. Two groups of Ti-sheathed MgB$_2$ wire samples were prepared and studied: for the first group, the size of the SiC particles was 20 nm and the concentrations were 5%, 10%, and 15%; for the second group, the concentration of the SiC dopant was 10% and the sizes of the SiC particles were 20 nm, 45 nm, and 100-200 nm. Contrary to the $J_c$ results reported on the SiC-doped Fe-sheathed MgB$_2$ wires, we found that the $J_c$ for the SiC-doped Ti-sheathed MgB$_2$ wires decreases with both the concentration and particle size of the SiC dopant. We found that only for the wires with 100-200 nm SiC size, the $J_c$ is greater than that of the undoped MgB$_2$ wires. This unusual dependence of $J_c$ on the size and concentration of the SiC dopant is discussed in association with the results from the magnetization, electrical resistivity, x-ray diffraction and scanning electron microscopy measurements.

This Work was partially supported by the 2006 SHSU EGR grant and by the State of Texas through TCSUH.