Development of Ti-sheathed MgB$_2$ Superconducting Wires with Very High Current-carrying Capability

HUI FANG, GAN LIANG, CAD HOYT, SHELLEY KEITH, Sam Houston State University, M. HANNA, M. ALESSANDRINI, F. YEN, B. LV, Z. TANG, K. SALAMA, University of Houston — Ti-sheathed MgB$_2$ wires with very high magnetic critical current density ($J_c$) have been fabricated with the in situ powder-in-tube method. The wires were characterized by magnetization, electrical resistivity, x-ray diffraction and scanning electron microscopy measurements. At 5 K, the magnetic $J_c$ measured in magnetic fields of 2 Tesla (T) and 5T are about $4.1 \times 10^5$ A/cm$^2$ and $7.8 \times 10^4$ A/cm$^2$, respectively. The $J_c$ value at 20 K and 0.5 T is $3.6 \times 10^5$ A/cm$^2$. The superconducting volume fraction for the core material of the MgB$_2$ wires is about 71%. These results show that the magnetic $J_c$ for the present Ti-sheathed MgB$_2$ wires is substantially higher (40%-300% higher) than the best magnetic $J_c$ results available for the Fe-sheathed MgB$_2$ wires made by similar processes. Because of such excellent $J_c$, it is anticipated that the Ti-sheathed MgB$_2$ wires developed by the present technique are very promising for future lightweight superconducting magnet applications.

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