Transport Properties of IMD-processed 100 m Class 6-filament MgB₂ Wire and Solenoid Coil

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Abstract—100 m long 6-filament MgB₂ wire was successfully fabricated using the internal magnesium diffusion (IMD) process [1]. We investigated the transport properties and the uniformity of this long multifilament IMD wire. The MgB₂ layer and the sub-filament region are regular, and the $J_c$ values have a fairly homogenous distribution throughout the wire, suggesting that there were no obvious defects along the length of the wire. A layer $J_c$ as high as $1.2 \times 10^5 \text{ A/cm}^2$ at 4.2 K and 8 T was obtained, which was comparable to the highest value of the long multifilament IMD wire reported so far. We also made and tested two IMD-processed MgB₂ solenoid coils using 26 m long 6-filament wires. The coils were prepared by using a wind-and-react method and cooled by liquid helium. The coil $I_c$ values measured at 4.2 K are almost equal to the estimated $I_c$ values of short length wire, suggesting that the long multi-filamentary wire has sufficient longitudinal homogeneity. These results indicate that the long multifilament IMD-processed MgB₂ superconducting wire is suitable for practical applications.


Keywords (Index Terms)—MgB₂ wire and coil, internal magnesium diffusion, uniformity, transport properties.