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The critical current properties of 19-filaments MgB₂ wires by an internal Mg diffusion process

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MgB₂ is considered as a promising candidate for engineering applications in the temperature range of 20-30 K due to its low cost of raw materials and strong intergrain connection. It was found that highly dense MgB₂ wires fabricated by internal Mg diffusion (IMD) have apparently higher current densities than the powder-in-tube (PIT) produced ones. Therefore, IMD also allows a higher engineering current density (J_e), which is one of the most important parameters for practical superconducting systems. We have fabricated 19-filaments MgB₂ wires using an internal Mg diffusion (IMD) process. The microstructure and transport performance of this 19-filaments IMD wire were investigated. For the IMD-processed MgB₂ wire fabricated by C-coated nano-sized B powder with 1.0 mm diameter, the critical current is about 546 A at 4.2 K and 4 T, which is far higher than that of the undoped sample. The best J_e is 6.9×10^4 A/cm² at 4.2 K and 4 T. The obtained results show that the C-doped IMD wires with excellent superconductivity and mechanical property can compete with the conventional PIT wires in practical application.

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