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Development of powder-in-tube-processed multifilamentary MgB₂ long wires with different reinforcement structure

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In this paper, we present recent progress of long multifilamentary MgB₂ wires and tapes in our group. Now we have fabricated the MgB₂ wires with unit length of 1500 m and diameter of 1.0 mm by in-situ Powder-in-Tube (PIT) method using Nb as the barrier and copper as the stabilizer. To improve the strength of wires, the Cu, Cu-Nb and NbTi core was used as the central filament. The Cu-Nb reinforcing core is more appropriate for manufacturing MgB₂ wires. It is observed that the Cu-Nb reinforced wire sintered at 750 °C for 2 h has the highest yield strength of 101.8 MPa. With the sintering temperature increasing, the yield strength of the Cu-Nb and NbTi reinforced wires increased while the value slightly decreased in the case of Cu reinforced one in this study. According to our calculations, those mechanical properties are suitable for the application requirements of superconducting magnets in low field with the critical engineering current I_c of 197 and 205 A (J_{ce} exceeding 1.7×10^4 and 1.8×10^4 A/cm²) before and after 70 MPa axial load on the wire at 20 K, 1.5 T respectively. The reasons leading to the enhancement of high field J_{ce} were discussed. The results show a good potential to fabricate high performance MgB₂ wires and tapes at ambient pressure on an industrial scale.

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