

Research Progress on Fabrication of Practical Superconducting Materials at NIN

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Abstract: Since the discovery of superconductivity in 1911, over a thousand superconducting materials have been reported, yet fewer than ten are used in practical applications. For high-current and high-field applications, these materials must be fabricated into long-length wires or tapes via complex techniques. The Superconducting Materials Research Center in Northwest Institute for Non-ferrous Metal Research (NIN) focuses on the powder-in-tube (PIT) technology for Bi-2223, Bi-2212, and MgB₂ conductors. Recent advances include spray pyrolysis as well as systematic optimization in Bi-based powders to improve phase purity for precursor powder preparation, cryogenic drawing, and ultrasonic-assisted drawing, combined with systematic optimization of processing parameters. These innovations have significantly enhanced transport performance and enabled stable long-length production. For Bi-2212, kilometer-level multifilament round wires with high engineering current density have been fabricated. MgB₂ conductors are being developed via both PIT and internal magnesium diffusion (IMD) methods, targeting efficient operation near liquid hydrogen temperatures. Ongoing work also includes PIT processing of novel superconductors such as PbMo₆S₈ and the development of innovative PIT-based processing methods to address current manufacturing challenges. This talk will present the performance characteristics, application prospects, and recent progress of these superconducting systems.

Key words: High-temperature superconductor; Powder-in-tube; Fabrication technology