

Reduction of Internal Porosity in $\text{Bi}_2\text{Sr}_2\text{CaCu}_2\text{O}_x$ Round Wires with Overpressure Processing

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Abstract — $\text{Bi}_2\text{Sr}_2\text{CaCu}_2\text{O}_x$ is the only cuprate superconductor that can be made into multi-filament round wires. Bi-2212 wires are made using the powder in tube process. The main obstacle to high engineering critical current density (J_E) is the low packing density (25%) of the 2212 powder within the filament which leads to gas-filled filament size bubbles acting like barrier against current transport. We reduced this internal porosity by applying an external over-pressure (OP) during the heat treatment to compensate the internal gas expansion and densify the filaments up to 98 % at an OP of 50 atm. The densification occurs at 821°C within 10 min. With an OP of 100 atm, J_E increased to 917 A/mm² at 4.2 K, 5 T, compared to a J_E around 200 A/mm² at 4.2 K, 5 T when long samples are heat treated in 1 atm. Bi-2212 is now a good candidate for magnet application above 20 T.