

Effects of Filament Size on Critical Current Density in Overpressure Processed Bi-2212 Round Wire

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Abstract— $\text{Bi}_2\text{Sr}_2\text{CaCu}_2\text{O}_x$ (Bi-2212) conductor is the only high temperature superconductor manufactured as a round wire and is a very promising conductor for very high field applications. One of the key design parameters of Bi-2212 wire is its filament size, which has been previously reported to affect the critical current density (J_c) and ac losses. Work with 1 bar heat treatment showed that the optimal filament diameter was about 15 μm but it was not well understood at that time that gas bubbles were the main current limiting mechanism. Here we investigated a recent Bi-2212 wire with a 121x18 filaments architecture with varying wire diameter (1.0 to 1.5 mm) using 50 bar overpressure processing. This wire is part of a 1.2 km piece length 1.0 mm diameter made by Oxford Superconducting Technology. We found that J_c is independent of the filament size in the range from 9 to 14 μm , although the n value increased with increasing filament size. A new record J_c (4.2 K, 15 T) of 4200 A/mm² and J_E (4.2 K, 15 T) of 830 A/mm² were achieved.

Keywords (Index Terms)— Superconductor, Bi-2212, critical current density, superconducting magnet.

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