

## **Progress, Problems, and Promise of Bi-2212**

E. Hellstrom, J. Jiang, J. Kvitkovic, C. Linville, J. Brown, J. Jones, D. Davis, Y. Kim, E. Martin, F. Kametani, C. Tarantini, U. Trociewitz, G. Miller, G. Bradford, S. Barua, L. English, C. Brady, and D. Larbalestier

Applied Superconductivity Center, National High Magnetic Field Laboratory, Tallahassee, Florida, USA

E-mail: [hellstrom@asc.magnet.fsu.edu](mailto:hellstrom@asc.magnet.fsu.edu)

**Abstract**—Round, multifilamentary Bi-2212 wire has very high critical current density that makes it a viable conductor for high-field magnets. It is made by the powder-in-tube process and is available in a variety of multifilamentary architectures including 37x18, 55x18, and 85x18. The talk will cover the progress that has been made increasing  $J_C$  and  $J_E$  in Bi-2212 wires, problems that currently limit its performance, and its promise for high-field magnets. A significant breakthrough was made in Bi-2212 processing in 2014. It applies 50 bar hydrostatic pressure when heat treating Bi-2212 wire, which eliminates bubbles that form in the Bi-2212 filaments due to the powder-in-tube fabrication of Bi-2212 wire. This process, called overpressure heat treatment, establishes reproducible, high  $J_C$  and  $J_E$  in long length wires that is not achievable when heat treating in 1 bar pressure. The record  $J_C$  and  $J_E$  in Bi-2212 wires with the overpressure heat treatment are 9050 and 1810 A/mm<sup>2</sup> (4.2 K, 5 T), respectively. Bi-2212 coils need a high temperature insulation that can withstand the heat treatment at 900 °C. The past insulation material was alumino-silicate fiber that can react with the Bi-2212 causing leakage. It is being replaced with pure alumina fiber that does not react with the Bi-2212 wire. A problem with Bi-2212 wire is that  $J_E$  and  $J_C$  have been degrading but, unfortunately, it is not known what causes the decrease. Unexpectedly, recent Rutherford cables, which were insulated with pure alumina fiber, leaked. We think this is due to problems in the Rutherford cable itself rather than to a reaction between the alumina fibers and the Rutherford cable. The Bi-2212 conductor is being wound into test coils designed for high field magnets. These include solenoid coils using Bi-2212 wire and Rutherford cable as well as canted cosine theta coils using Rutherford cable.

**Keywords (Index Terms)**—Bi-2212 round wire, Rutherford cable, overpressure heat treatment, HTS solenoid coils, alumina insulation, HTS canted cosine theta (CCT) coils

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