Development of Flexible HTS CORC® Wires and Terminations for High-field Magnet Applications

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The next generation of magnets for accelerators requires use of high-temperature superconductors (HTS) to enable operating fields of 20 T and beyond. Development of high-current HTS cables for accelerators come with major challenges, such as the requirements of high engineering current densities (J_e) at 20 T of 600 A/mm^2 and minimum cable bending diameters as small as 30 mm. Over the last year, the extensive development of Conductor on Round Core (CORCR) magnet cables and wires has resulted in round, multifilament, REBCO conductors; demonstrating a J_e beyond 300 Amm^{-2} at 4.2 K and 20 T (*) with a clear path to double the performance within the next few years. Thin CORCR wires made using 2 mm wide HTS tape deposited on 30 µm substrates are extremely flexible and can be bent to a radius of only 18 mm with minimal degradation. The enhanced current density and flexibility of CORCR wires has led to their incorporation in compact-magnet designs such as magnets wound in the canted-cosine- theta topology. In addition, carefully controlling how current is injected into CORCR conductors has enabled the development of compact high-current terminations that are robust and crucial to many applications.

* Van der Laan, D.C.; Weiss, J.D.; Noyes, P.D.; Trociewitz, U.P.; Godeke, A; Abraimov, D.V.; Francis, A.; Larbalestier, D.C. Record current density of 344 A/mm2 at 4.2 K and 17 T in CORCR accelerator magnet cables. **Supercond. Sci. Technol.** 29, 55009 (2016)

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