

## Latest Development of High-field Magnets for Compact Fusion Reactors and Particle Accelerators from CORC® Cables and Wires

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**Abstract** – Advanced Conductor Technologies is developing CORC® cables and wires wound from REBCO coated conductors for use in compact fusion magnets and high-field particle accelerators. An overview of the latest CORC® conductor development and their implementation into prototype high-field magnets is presented.

A concept aimed at narrow Ohmic Heating coils in compact fusion reactors is described in which CORC® cables are wound into grooved mandrels. The concept doesn't require epoxy impregnation, thereby significantly easing magnet manufacturing. The CORC® cable is wound directly into grooved mandrels, where support against hoop stress is provided by the neighboring mandrel. Initial degradation-free tests at current ramp rates as high as 5 kA/s up to 10 kA and under mechanical cycling within a 12 T background magnetic field are discussed.

An overview of high current density CORC® wires with improved bending performance that allows bending to radii below 20–25 mm is provided. The CORC® wires are developed specifically for high-field accelerator magnets that ultimately would generate a dipole magnetic field of 20 T. An overview of the development of a 5 T canted-cosine-theta (CCT) magnet from the latest generation of CORC® wires at Berkeley National Laboratory will be provided.

The development of a Common Coil insert magnets, wound from a high-current CORC® cable using a novel winding approach, will be outlined. Insert coils are developed for operation within the 10 T LTS Common Coil insert at Brookhaven National Laboratory. The performance under quench at currents exceeding 12 kA at 6 T background field of the first, smaller Common Coil CORC® insert magnet is presented. An overview of a more powerful CORC® insert magnet, aimed to generate a dipole field of 3 T within the 10 T

**Common Coil outsert that will be tested near the summer of 2023, is also provided.**

***Keywords (Index Terms)* – CORC cable, high-temperature superconducting magnet, canted-cosine-theta magnet, compact fusion reactor, Ohmic heating coil**

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