

Record Engineering Current Density of 246 A/mm² at 17 T in HTS Conductor on Round Core (CORC) Cables Made at Advanced Conductor Technologies

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Abstract — Advanced high-energy physics magnets, high-field research magnets and fusion reactors require the development of high-temperature superconducting cables for magnetic fields exceeding 20 T, or allow for operating temperatures above the boiling point of liquid helium. Using ReBCO coated conductors, Advanced Conductor Technologies is developing Conductor on Round Core (CORC) cables that will enable this next generation of magnets. We will discuss some of the latest results of CORC magnet cable development at Advanced Conductor Technologies, which have reached a critical current of close to 7 kA in a 6 mm diameter CORC cable at 4.2 K and a background field of 17 T. This is a record engineering current density of 246 A/mm² at 17 T, or about 213 A/mm² at 20 T, making CORC cables a viable candidate for use in the next generation of accelerator magnets. This record current density was reached by winding the cable from a new generation of SuperPower tapes with 38 mm thin substrate. A new type of CORC cable termination was used for injecting the high currents into the cable. The tapes with thinner substrates not only reduce the cable thickness, but also limit the bending strain of the superconducting layer, minimizing the performance degradation of the tapes during cabling. The new terminals and the availability of tapes with even thinner substrates will allow us to raise the current density in CORC cables towards 400 A/mm² at 20 T before the end of 2015.

Keywords (Index Terms) — ReBCO coated conductors, Conductor on Round Core Cable (CORC), engineering current densities, in-field critical current densities.