Electromechanical Performance of CORC® Cables and Wires under Axial Tension and Transverse Compression

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Abstract **- Advanced Conductor Technologies is developing high-temperature superconducting (HTS) Conductor on Round Core (CORC®) cables and wires from ReBCO tapes for high-field accelerator, fusion and scientific magnets. One of the concerns with operating any HTS conductor in magnets that operate at currents exceeding 10,000 A at fields of over 20 T in future accelerator magnets, or 50,000 A at fields over 12 T in fusion magnets, is the effect of mechanical stress and stress cycling on the conductor performance. Detailed mechanical tests of the conductor performance under axial and transverse stress relevant for magnet operation are thus required to develop robust magnet conductors.**

Here we present recent test results of critical current (I_c) degradation as a function of applied transverse compressive stress on CORC® cables and wires as well as axial tension on CORC® wires at 76 K. Additionally, fatigue cycling is performed at different stress levels up to 100,000 cycles to investigate I_c retention beyond the design life of modern user magnets and fusion devices. CORC® cables and wires presently exhibit excellent electrical performance in mechanical fatigue at transverse stress levels where I_c degraded by only 3 – 5%, and even after I_c degraded by as much as 20%. Fatigue cycling in axial tension is ongoing, and preliminary test results are also presented. Initial correlation between the effect of mechanical stress and the conductor layout allows further optimization of CORC® cables and wires. The study presented here expands on established framework for ongoing mechanical characterization and development of CORC® cables and wires and further quantifies their feasibility as a practical magnet conduct

Keywords (Index Terms) **– High-temperature conductors, coated conductors, electromechanical behavior, CORC cables, accelerator and fusion magnets.**

IEEE-CSC & ESAS SUPERCONDUCTIVITY NEWS FORUM (global edition), No. 46, February 2019.
Received December 02, 2018; selected December 20, 2018. Reference STP639; Category 5.
Presentation was given at CCA 2018, September 10 - 13, 2018, Vienna (Austria).