Superconductivity for Sustainable Energy Systems and Particle Accelerators

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Low cost and large-scale manufacturing of high-temperature superconducting multifilamentary coated conductors

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High critical currents and magnetic field resilience of tape-based high-temperature superconductors (HTS) enable magnets to be constructed with fields above 20 T. However, high-field magnets are often required to operate with pulsed and varying magnetic fields, which results in problematic AC losses. Additionally, highly uneven local mechanical straining of the superconducting tape, due to induced screening currents may be a concern. These issues may be resolved by dividing the superconducting layer into individual narrow conductors, so-called filamentization, in combination with twisting of the tapes.

In the Eurostars project 'Filaments4Fusion' we are demonstrating a low cost and large-scale production method of such filamentized superconductor tapes. The aim is to move this method towards a commercial production making low cost tapes available for magnet producers.

In this work, we present preliminary results from the project with the inclined substrate deposition (ISD) of superconducting rare-earth barium-copper-oxide (REBCO) coatings produced by THEVA on 3D filamentized Hastelloy substrates from SUBRA. We present analysis of the superconducting performance of long length samples with different filamentization structures, and finally demonstrate the reduction of AC loss in short test cables made from filamentized and twisted tapes.

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