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Fri-Mo-Po.08-09: REBCO multi-filamentary tape electromagnetic characteristics and insert magnets design and development

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REBCO high-temperature superconductor has been widely used in high magnetic field applications, because of the excellent critical current properties and high critical temperature. However, REBCO tape has a huge width-to-thickness ratio (typically in the range of 1000-10000) to cause too high power dissipation in the applications. One of the effective ways to reduce AC loss is to divide the superconducting layer in the REBCO tape into filaments. The current-carrying properties degradation behavior of the prepared multi-filamentary tape is the focus of attention. In this study, REBCO multi-filamentary tapes with different numbers of filaments (2-filament, 6-filament, and 10-filament) by cutting the copper-stabilizing layers and superconducting layers through a self-developed reel-to-reel ultraviolet picosecond laser cutting device. The findings indicate that the cut groove has a depth of approximately 30 μm and the width of the groove on the superconducting layer measures around 15 μm . The authors then systematically characterized the cut multi-core materials and found that ultraviolet picosecond laser cutting does not cause substantial degradation in the IC. The authors found that cutting multi-core material resulted in a significant reduction in AC loss. The high-field interpolated superconducting coil has good high-field current-carrying and low-temperature characteristics after copper plating post-processing and is verified. This study solves the preparation process problem of REBCO high-temperature superconducting multi-core materials and researches the materials' low-temperature and high-field performance characterization. The research results show that the preparation process of multi-core belts has practical potential.

Author: ZHANG, Zhan (Institute of Energy(IE) Hefei Comprehensive National Science Center(HCNSC))

Co-authors: ZHOU, Chao (University of Twente); Dr WEI, Shaoqing (Institute of High Energy Physics); Mr LI, Zuoguang (Institute of High Energy Physics)

Presenter: ZHANG, Zhan (Institute of Energy(IE) Hefei Comprehensive National Science Center(HCNSC))

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