MT 26
International Conference on Magnet Technology
Vancouver, Canada | 2019

Contribution ID: **1492** Type: **Contributed Oral Presentation**

Thu-Af-Or19-05: Controllable Critical Current Degradation of ReBCO CC by Post-Manufacturing Annealing

Thursday, 26 September 2019 15:00 (15 minutes)

ReBCO CC (Rare earth barium copper oxide coated conductor) is a viable candidate as a conductor for future high-field magnets due to its mechanical strength, high Tc, and favorable Jc vs. B dependence. In practice, some ReBCO coils, especially solenoids, only utilize a fraction of the full critical current throughout the winding due to the large (5-7) anisotropy of Ic, thereby developing undesired screening currents and detrimental quench behavior. By controllably deoxygenating as-manufactured tapes and creating a more homogenous distribution of effective Ic in the solenoid, a more reliable ReBCO CC magnet can be constructed. The phenomenon of critical current degradation in ReBCO due to variation of oxygen doping with temperatures is well known and has been previously studied, typically with the copper exterior removed. In our study, the effects of annealing as-manufactured ReBCO CC from various manufacturers are being explored by exposing short samples to various heat treatments to determine the Ic degradation dependence on temperature and duration. By subjecting ReBCO short samples to various heat treatments and characterizing the changes in superconducting properties, we wish to derive an empirical relation describing the critical current degradation of ReBCO CC so as to establish a repeatable methodology of degradation. By controllably removing oxygen from the ReBCO by post-manufacturing annealing, both critical current and critical temperature can be tuned for specific sections of a high-field ReBCO CC magnet, thereby reducing stress-inducing screening currents throughout the magnet, and promoting less localized quench behavior.

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Session Classification: Thu-Af-Or19 - High Tc Wires and Cables II