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M2Po2C-05: Characterization of delamination behaviors in REBCO coated conductor tapes under transverse loading

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In the practical application of high temperature (HTS) REBCO coated conductor (CC) tapes, such as epoxy-impregnated or no-insulation (NI) coils, they can experience radial and transversely applied stress due to the large Lorentz force, thermal stress induced by the difference in coefficient of thermal expansion (CTE) among constituent layers which can result in delamination damage and negatively affect its performance during operation. To overcome this challenge, the delamination strength of CC tapes should be characterized mechanically and electromechanically, as delamination mechanisms often cause abrupt and irreversible degradation of the critical current (Ic). This study focuses on analyzing REBCO CC tapes subjected to transverse tensile/compressive stress at 77 K and self-field to understand the mechanisms behind delamination failure and identify the electromechanically weak points in the multilayered architecture of the practical REBCO tapes. The electromechanical delamination strength of two REBCO CC tape samples was determined using a wide Cu anvil and a continuous Ic measurement system, which precisely observes the Ic degradation behavior of the CC tape. The system allows continuous transverse loading to be applied to the sample while the current flow is simultaneously measured. This setup is crucial in preventing catastrophic failures, as even a slight change or damage in the CC tape can trigger a failure in its application. Statistical analysis was used to distinguish the intrinsic strength of the CC tapes from external factors. Delamination schematics were also generated based on the morphology of the delaminated sample, which further explains the rapid drop in Ic of each coil. It is crucial to prioritize the prevention of delamination in HTS REBCO CC tapes as it negatively impacts their performance during operation.
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