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M3Or4P-06: FEM analysis of Magnetization AC loss in REBCO coated conductor tape and helical wound tape conductors

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This study presents a finite element method (FEM) analysis of magnetization AC loss in REBCO coated conductor tape and helical wound tape conductors. AC loss is a significant factor that limits the practical application of superconducting cables and coils, and it is crucial to accurately predict and minimize the loss for the practical application of superconducting systems. The FEM analysis was carried out using the commercial software package COMSOL Multiphysics, which can accurately simulate the AC loss behavior in superconductors. The simulation model was compared to analytic models and to previous experimental results. The simulation results calculate both the hysteretic and individual tape eddy current loss. We simulated a flat tape in a perpendicularly applied field of magnitude 0.5 T and a with a sinusoidal oscillation in time. Our second simulation was to the same tape, but with a field that varied along the tape width sinusoidally as well. Finally, we modeled a helically wrapped tape in a field applied along the helical axis. We used a diluted superconductor approach for the FEM modeling. Various twist pitch values were explored, and the results were compared to the analytical expectation of loss reduction by $2/\pi$ from that of flat tapes in fully perpendicular fields.

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