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The electrical behavior of stacked coated conductors concerning the interlayer resistance

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The superconducting tape stack has increasing impact on the applied superconductivity community due to the high field and current applications such as plasma confining magnets. The interlayer resistance of the stack, however remains a problem for the Coated Conductors (CCs) due to the ceramic buffer layer, which causes totally different behavior of the stack of CCs and the traditional low temperature superconducting cables. The main scope of this paper is to clarify the transient process of overheat or overcurrent focusing on electromagnetic and thermal characteristics of interlayer contact surfaces. A finite element method (FEM) model is established in this paper to reveal the overheat and/or overcurrent process of the stacked CCs. The FEM model for numerical simulation is coupled to calculate the heat, current, and magnetic field distribution during the stacked CCs'quenching and recovery process. The interlayer resistance is emphatically investigated and discussed by setting different boundary constrains and assumptions to answer the question how low should the interlayer resistance be for certain applications. An optimal range of the stacked CCs'turn-to-turn contact resistance for manufacture is proposed referring to numerical simulation results and analyses. This FEM model can also be applied to analyze the transient quenching process of no-insulation coils.

Primary author: ZHOU, Hao (Department of Electrical Engineering, Shanghai Jiao Tong University)

Co-authors: JIN, Zhijian (Department of Electrical Engineering, Shanghai Jiao Tong University); LI, Xiaofen (Department of Electrical Engineering, Shanghai Jiao Tong University)

Presenter: ZHOU, Hao (Department of Electrical Engineering, Shanghai Jiao Tong University)

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