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Quench and Recovery Characteristics of Racetrack Coil for Large-capacity Wind Generator

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Second generation (2G) high temperature superconducting (HTS) tapes are now capable of carrying very high transport current and promising for a wide range of applications. A large-capacity wind generator prototype has been developed using HTS tapes. The racetrack coils wound with 2G HTS tapes are used in the rotor, whereas the conventional technology is employed in the stator. The reliability of superconducting field winding is one of the most important factors for the developed wind generator. Racetrack coil can experience severe quench because of various disturbance, so it is necessary to investigate its stability and normal zone propagation characteristics. In this study, the minimum quench energy (MQE) and normal zone propagation velocity (NZPV) of racetrack coil are investigated using the voltage and temperature profiles in a conduction cooling system. Meanwhile, a numerical model is built to verify the measured results. The major innovation of this paper is the developed numerical model which combines COMSOL and MATLAB and couples electric field, magnetic field and thermal field. Moreover, this model can be used to predict the quench process of large racetrack coils. The detailed results about the experiments and the numerical analysis are presented and discussed in this paper.

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