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Study on the Quench Protection of the HTS magnet with iron core for a 1MW DC Induction Heater

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The energy efficiency of novel high temperature superconductor (HTS) direct current (DC) induction heating method can approach to 90%, due to the loss-free of superconducting coil in DC operation. Now a MW-scaled HTS DC induction heater is designed and manufactured. The magnet is coulped with iron core, which helps to guide the magnetic flux and generate more suitable magnetic field for preheating. The inductance of magnet with iron is 98 H, which is greater than conventional magnet. Due to the considerable amount of energy stored during persistent mode operation, the protection system is very important. In this paper, a passive protection system is developed for the HTS magnet of the 1 MW DC induction heater . The protection circuit is presented and the Matlab/Simulink-based quench model is developed to optimize the design parameters of the protection circuit. Experiments with different magnet operating current and dump resistor are carried out. The results show that the proposed scheme performs desired characteristics and that the dissipation efficiency and velocity vary depending upon different values of dump resistor. Finally optimization parameters of protecting system are obtained.

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