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Temperature Considered Active Feedback Control of No-Insulation HTS Magnet

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We propose a new active feedback control method to quickly charge no-insulation(NI) magnets, as well as sustaining thermal stability. The main feature of our suggested method is controlling ramping rate of the magnet to minimize consecutive Joule heating induced by the radial leakage current and resistive joint. The suggested method to be applicable for the iron core NI coils, dynamic inductance variation due to iron saturation is taken into account in the feedback diagram. With a constraint of maximum allowable Joule heating and power supply current, charging protocol is automatically decided by the designed feedback loop. To validate our suggested method, we fabricated an NI coil wound on the iron bobbin, and tested the coil in a conduction cooler. Measured temperature and magnetic field data are compared between two different ramping scenarios: (1) a linear ramping; and (2) a ramping with our suggested method. Finally, we demonstrate the effectiveness of our suggested method on reducing total charging time of both air and iron core NI coils.

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