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Wed-Mo-Po.12-04: Optimizing Operating Frequency for Charging No-Insulated HTS Magnets Using Transformer-Rectifier Flux Pumps

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No-insulated (NI) high-temperature superconducting (HTS) magnets exhibit several advantages over conventional insulated (INS) magnets. The inherent turn-to-turn resistance of NI magnets facilitates the dissipation of localized hotspots, significantly reducing the risk of quenching and improving thermal management. These characteristics make NI magnets especially attractive for high-field applications.

Flux pumping offers an efficient method for inductively magnetizing superconducting coils while providing thermal, electrical, and mechanical isolation between the cryogenic environment and the power supply. This approach reduces cryogenic loading and allows for more flexible arrangements in superconducting magnet systems.

However, charging NI magnets using a transformer-rectifier flux pump presents challenges, particularly related to the operating frequency of the transformer. This paper examines the charging characteristics of NI HTS magnets with a transformer-rectifier flux pump, emphasizing the identification of an optimal operating frequency to balance efficiency and system stability. Experimental studies explore the relationships among frequency, inductive impedance, and charging performance. Key parameters, including charging efficiency, thermal behavior, and magnet performance under various operating conditions, are analyzed to provide insights into achieving reliable and efficient operation of NI magnets.

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