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Experimental Analysis of Charging Characteristics of an HTS Field Coil with Contactless HTS Excitation Device Considering Various HTS Loads

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High-temperature superconducting (HTS) synchronous motors conventionally require current leads to inject the large DC currents into HTS field coils. However heat losses are generated on these current leads due to mechanical connection between the HTS field coils and power supply. For that reason, rotary HTS flux pump is used to remove the physical connection. However, HTS flux pump has spatial limitation due to the size of the HTS synchronous motor. Therefore, in this paper, the charging characteristics of HTS field coils are experimentally analyzed to verify the efficient method for charging the HTS coils when a contactless HTS excitation device (CHED) is used. The CHED is composed of eight HTS strands which are connected in series and eight neodymium permanent magnets (N50). The magnetic field of N50 is about 0.3 T. Air gap between the HTS strand and N50 is 8 mm. In order to verify the proper charging method, two cases of experiments are performed. First, the HTS loads are connected in series and they are charged by eight HTS series-connected strands of the CHED. Second, the HTS loads are connected in parallel and each coil is charged by four HTS series-connected strands of the CHED. In those experiments, the current flowing through the HTS load is measured with rotor speed range, from 100 to 300 rpm.

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