The Effect of Temperature Dependence of AC Losses in a Bi-2223/Ag Insert of an 8-T Superconducting Magnet - DTU Orbit (09/11/2017)

The Effect of Temperature Dependence of AC Losses in a Bi-2223/Ag Insert of an 8-T Superconducting Magnet

A conduction-cooled split-gap superconducting magnet system with a center field of 8 T has been designed and fabricated in the Institute of Electrical Engineering, Chinese Academy of Sciences. The system consists of two Bi-2223/Ag coils and six NbTi coils. Due to a large aspect ratio of the high-temperature superconducting tape, there will be large ac losses when the magnet is ramped up and down. An accurate estimation of the total ac losses in the high-temperature superconducting coils is essential for the cryogenic system design. In the Bi-2223/Ag coils, the total ac losses mainly originate from two parts: One is transport loss caused by the variation of transport current with respect to time, and the other is magnetization loss due to alternating external magnetic field. In this paper, the effect of temperature variation on ac losses generated in the Bi-2223/Ag coils is studied. The magnetic field and temperature dependence relations of the critical current density .1c are considered. The calculations are carried out in three steps. First, to estimate the magnitude of ac losses rapidly in the Bi-2223/Ag coils, the ac losses are calculated when the Bi-2223/Ag and NbTi coils are simultaneously charged, in which the temperature distribution is not considered. Second, the temperature variation is considered to calculate the ac losses under the same operating conditions with those in the first case. Finally, the NbTi coils are charged first, followed by the Bi-2223/Ag coils; the ac losses calculated are less than those in the second case. Hence, it is a good way to reduce the ac losses by changing the charging sequences of the Bi-2223/Ag and NbTi cols. Afterward, the calculated results are compared with the experimental data, and they show a good agreement.

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