APP1-5

AC loss calculations of superferric magnets using HTS coils wound with stacked coated conductors and wound with CORCÒ wires

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In order to reduce the electricity consumption of rapid cycling synchrotrons (RCSs), we consider to apply superferric magnets using HTS coils to them. Because magnets for RCSs are required to generate time-dependent magnetic fields, the reduction of ac losses is one of the important issues when using HTS coils for superferric magnets for RCSs. When we consider to wound HTS coils for superferric magnets with single conductors, there are several problems such as mechanical strength of single conductors and large inductance of HTS coils. Using assembled HTS conductors is one of the solutions of these problems, and we focused on stacked coated conductors and Conductor on Round Core (CORCÒ) wires [1].
In the analyses of superferric magnets for RCSs using HTS coils wound with stacked coated conductors, we use the method same as we developed before [2] with assumption that all coated conductors carry same current. In the case of HTS coils wound with CORCÒ wires, we approximate the one part of HTS coils as an infinitely-long CORCÒ wire exposed to the external magnetic field assumed to be uniform along the CORCÒ wire. In order to get this external magnetic field, we calculate the magnetic field in the one part of HTS coils which generated by magnetized iron yokes and current in the other parts of HTS coils. Then, we carry out the three-dimensional electromagnetic field analysis to calculate ac losses of an infinitely-long CORCÒ wires exposed to external magnetic fields and carrying current.
We design the superferric magnets using HTS coils wound with stacked coated conductors and wound with CORCÒ wires which generate magnetic field of about 1.4T in the beam region, and calculate ac losses of those magnets. The magnets are operated at frequency of 100 Hz, and temperature of 65-70 K. The ac loss distributions in the HTS coils of those magnets are compared and discussed based on magnetic field and current density distributions in the HTS coils. Influence of the CORCÒ wire's three-dimensional geometry on the ac loss is discussed.

This work was supported in part by the Ministry of Education, Culture, Sports, Science and Technology under the Innovative Nuclear Research and Development Program.

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Keywords: Rapid cycling synchrotron, Accelerator magnet, Assembled HTS conductor, AC loss