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Development of an Iron-Based Superconductor Magnet: A Study on the 64 mm Diameter Iron-based Superconductors Coils

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Iron-based superconductors (IBSs) with their ultrahigh upper critical fields and low anisotropies have been expected for the high-field application in the future. In previous studies, the 7-filamentary Ba_{1-x}K_xFe₂As₂ (Ba122) tape which was produced by the Institute of Electrical Engineering, Chinese Academy of Sciences (IEE-CAS) was proven to be applicable to fabricate the high field insert coils. In this study, the research works are related with the development of an iron-based magnet. Firstly, the mechanical properties of the Ba122 tape will be tested to provide data references for the design of the IBS coils and magnet. The thermal stress characteristics of different Ba122 tapes with different winding technologies will be measured. The characteristics of the hard-way bending radius of Ba122 tape will be determined. Secondly, the design of 64 mm diameter double pancake (DPC) IBS high field insert coils were presented. The DPC IBS insert coils will be fabricated and tested under a 12 T background field at 4.2 K. In the fabrication process, the insert coils will be divided in groups according to the different technologies. The insulated and metal-insulated (MI) IBS coils will be developed and some of the DPC IBS insert coils will be fabricated via hot isostatic pressing. Finally, the design of an IBS solenoid operating under a conduction cooling system was presented in this study.

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