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Structural Design and Analysis of Cryogenic System for 3.5 T HTS Magnetic Separation Facility

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with the development of the preparation technology of high temperature superconducting (HTS) materials, the mechanical properties of HTS materials have been further improved and great progress has been made in practical applications. A 3.5 T HTS magnetic separation facility was designed and manufactured in China. A G-M cryocooler, as the cold source of the cryogenic system was used for providing the cooling capacity to maintain the magnet and its related components work temperature. To ensure the cooling effect, it was unavoidable to design and analyze for the conduction cooling system of the 3.5 T HTS magnetic separation. This paper focuses on the structural design and analysis of the conduction cooling system. Structural designed parameters of components were listed and the finite element (FE) analysis was completed based on theoretical heat losses and the cryocooler cooling capacity. The maximum von-mises stress of each component did not exceed the material allowable stress. Finally, a cooling experiment was carried out after the facility assembly, it indicated that the highest temperature of the magnet and the thermal shield were much lower than design requirements.

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