



Contribution ID: 456 Contribution code: WED-OR3-503-02

Type: Oral

Development of Bi-2223 magnet for magnetic refrigeration system

Wednesday, November 17, 2021 4:15 PM (15 minutes)

We have started to develop a magnetic refrigeration system for hydrogen liquefaction. This system has a superconducting magnet, in which an active magnetic regenerative (AMR) bed moves inside. During steady-state operation, there is a possibility that the superconducting magnet is conduction cooled by the cold of liquefied hydrogen. However, since it is in the development stage, the magnet is cooled using a cryocooler. Considering the applicability to the 20 K operation and the required magnetic field of 4-5 T into account, we have developed a high-T_c superconducting (HTS) magnet using Bi-2223. This Bi-2223 magnet is composed of 24 epoxy-impregnated double pancake (DP) coils. To minimize the magnetic field at both ends, two bucking coils consisting of four DP coils are placed at both ends. It is designed to generate 4.7 T in a 120 mm bore at 300 A operation current. Each DP was tested in liquid nitrogen (LN₂) bath to verify its performance before being stacked. So far, the fabrication and the LN₂ test of the magnet have been completed. At present, the magnet test under the cryocooled condition is being prepared. The design, fabrication, and test results of the Bi-2223 magnet will be reported.

Acknowledgement: This work was supported by JST-Mirai Program Grant Number JPMJMI18A3, Japan.

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Session Classification: WED-OR3-503 Magnet System, Novel and Other Applications