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Design, Fabrication, and Test Results of an 18 T Metal Cladding GdBCO Magnet for Axion Detector

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An 18 T 70 mm cold bore high temperature superconducting (HTS) magnet was developed for axion detector system of Center for Axion and Precision Physics (CAPP) research center in Institute for Basic Science (IBS) in the Republic of Korea. No-insulation (NI) technique with metal cladding (MC) HTS tape was adopted for preventing damage from quenches. However, a NI magnet shows field lagging behavior due to leakage current flowing in the radial direction. In 2015, we proposed a new type of HTS tape as a name of "metal cladding" to reduce field charging time in NI magnet. Metal cladding HTS tape is surrounded by high resistive metal, and its NI magnet has high resistance between turns. Thus, field charging time could be remarkably reduced. We chose stainless steel (316L) as a cladding material because of its electrical and mechanical properties. A key parameter for axion detector magnet is to generate high and longitudinally uniform magnetic field in RF cavity. Magnetic field strength on -100 mm < z < 100 mm in coil bore space should be larger than 90 % of it at magnet center. Total 44 double pancake (DP) HTS coils are assembled and wound by HTS tapes of various widths of 4.1, 5.1, 6.1, 7.1, and 8.1 mm (multi-width). In this presentation, we report the magnet design, fabricating process, and test results in liquid nitrogen and liquid helium.

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