Investigation of Temporal Stability of a Persistent Current Mode Prototype MgB$_2$ Coil

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Abstract

A superconducting magnet commonly used in current MRI systems should be operated in the persistent current mode (PCM) to yield a high-resolution level that requires a magnetic field drift of less than 0.01 ppm/h. To acquire the required field homogeneity as a function of time, the availability and even reproducibility of a superconducting joint technique enabling the PCM of the magnet should be guaranteed quantitatively. Currently, a helium-free MgB$_2$ MRI magnet is being developed by the collaboration between Korea Advanced Technology Co. Ltd. (KAT) and Korea University, which is supported by the Materials and Components Technology Development Program of the Korean Evaluation Institute of Industrial Technology (KEIT), Korea. In this study, we report our progress on the development of a PCM prototype coil fabricated using MgB$_2$ wires manufactured by KAT. The temporal stability of the prototype MgB$_2$ coil was evaluated through the field decay tests at 4.2 K.

**Experimental setup**

- **MgB$_2$ mono-filament wire**
  - Specification of MgB$_2$ mono-filament wire

- **Insert direction of MgB$_2$ wire in joint**
  - Vertical type
  - Horizontal type

- **Manufacturing MgB$_2$ joint**
  - Cutting angle
  - Applied pressure

**Stress analysis**

- Stress analysis result (left) non-circular and (right) circular SUS cap >

**Results & discussion**

- **Cutting angle**
  - 13°
  - 30°
  - 45°
  - 90°

- **Applied pressure**
  - 2 ton
  - 5 ton
  - 9 ton

- **Future work**
  - Temporal stability of the 0.5-1/300-mm MgB$_2$ magnet operated in the persistent current mode will be evaluated.

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