MT 26
International Conference on Magnet Technology
Vancouver, Canada | 2019

Contribution ID: **1341** Type: **Contributed Oral Presentation**

Thu-Af-Or23-03: Operation and Performance Evaluation of a Conduction-Cooled 400 MHz/66-mm Metal-Clad No-Insulation All-REBCO NMR Magnet

Thursday, 26 September 2019 17:00 (15 minutes)

Since 2014, an R&D program has been conducted to design, construct, and operate a 400 MHz 66 mm room-temperature bore all-REBCO magnet for high resolution NMR application. It is a collaborative program led by the Korea Basic Science Institute (KBSI) in participation of the Korea Institute of Machinery and Materials, Kunsan National University, National High Magnetic Field Laboratory, Seoul National University, and SuNAM Co., Ltd. The metal-clad no-insulation winding technique was adopted to reduce charging-delay without sacrificing the self-protecting feature of the magnet. Once successfully fabricated in 2018, the magnet was cooled down to the target operating temperature of < 20 K and charged to its rated field of 9.4 T at a nominal operating current of 187 A. After the charging test, we performed field-shimming by use of multi-layered ferromagnetic-shims and room-temperature active shims, after which a field uniformity of 0.2 ppm within 10 mm DSV (diameter spherical volume) was obtained. The well-known field-locking technique was also adopted to improve temporal field stability. Based on our own experience, we discussed a potential of our conduction-cooled no-insulation approach for GHz-class NMR magnets.

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Session Classification: Thu-Af-Or23 - Magnets for NMR and Medical Applications