Contribution ID: **257** Contribution code: **THU-OR4-401-07** Type: **Oral**

Development of a persistent-mode 400 MHz (9.39 T) LTS/Bi2223 NMR magnet with a Bi2223 superconducting joint

Thursday, 18 November 2021 17:30 (15 minutes)

We aim to develop a high-resolution 1.3 GHz (30.5 T) nuclear magnetic resonance (NMR) LTS/HTS magnet operated in the persistent-mode. For this magnet, superconducting joints between HTS tapes are indispensable. We have already developed a persistent-mode 400 MHz (9.39 T) LTS/REBa₂Cu₃O_{*y*} (REBCO, RE = Rare Earth) NMR magnet with superconducting joints between REBCO tapes. The operational data revealed that the REBCO superconducting joints perfectly functioned in the persistent-mode NMR magnet.
On the other hand, the 1.3 GHz NMR magnet also needs superconducting joints connecting (Bi,Pb)₂Sr₂Ca<sub> (Bi2223) tapes. In our recent study, novel superconducting joint technology for commercial Bi2223 tapes was developed using intermediate Bi2223 joint layers. Small joint samples showed high critical current properties and low joint resistances typically less than 10^{−12} Omega; [1–3]. However, the performance of the joint has not been evaluated in a persistent-mode NMR magnet thus far. In the present study, we have been developing a world-first persistent-mode 400 MHz LTS/Bi2223 NMR magnet with the Bi2223 superconducting joint. The Bi2223 inner coil wound with one Ni-alloy reinforced Bi2223 tape was terminated with our joint technology. The coil was successfully operated in self-field at 4.2 K in the persistent-mode prior to the construction of the whole magnet. Evaluation of the performance of the Bi2223 joint will be performed through the 400 MHz NMR magnet operation.
[1] Y. Takeda et al., Appl. Phys. Express 12 (2019) 023003.
[2] Y. Takeda et al., presented at ASC2020, Wk1LPo3F-02.
[3] K. Kobayashi et al., presented at ASC2020, Wk2LOr1A-05.
This work was supported by JST-Mirai Program Grant Number JPMJMI17A2 and Special Postdoctoral Researcher Program at RIKEN, Japan.

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Session Classification: THU-OR4-401 Magnets for Medical, Biological, and Analytical Applications