Contribution ID: **1015** Contribution code: **FRI-OR6-603-07** Type: **Oral**

Measurement and Analyses of In-field Critical Currents in Multi-Filamentally Bi-2223 Tapes at Ultra-Low Electric-Field Criterion Down to at around 10^-13 V/m

Friday, 19 November 2021 09:00 (15 minutes)

We have succeeded in measuring critical current, Ic, in multi-filamentally Bi-2223 tapes at extremely low electric-field criterion down to at around 10^-13 V/m, at 5 K and external magnetic fields up to 4.5 T perpendicular to the tape surface which is comparable to the operation condition of Bi-2223 based insert magnet for 30 T-class NMR magnet in persistent mode operation. While the Ic of the Bi-2223 tape is usually evaluated by the transport measurements at electric-field criterion of 10^-4 V/m, the Ic at actual operation condition need to be clarified at around 10^-12 to 10^-13 V/m which is significantly lower than that of the transport measurements. One possible approach is to measure magnetization relaxation of the tape sample, however, the influence of the filament coupling and in-plane anisotropy in the tape are not understood. In this study, we developed a novel method based on in-field scanning Hall probe microscopy. From spatially resolved time dependent magnetic-field profile, we obtained local current density and electric-field from inverted Biot-Savart law and Faraday's law, respectively. From the comparison between our measurement and transport measurements [1], it has been shown that the magnetic field dependences are similar but the value of Ic at 10^-13 V/m is about 1/2 of that obtained by the transport measurements. For example, the Ic at 5 K and 4.5 T of perpendicular field is 226 A at 10-13 V/m, whereas 458 A at 10-4 V/m. Electric-field vs. current-density relationship can be also described reasonably well by the percolation transition model taking into account flux creep [2].
This work was supported by the Japan Science and Technology Agency (JST)-MIRAI Program, JPMJMI17A2 and JSPS KAKENHI Grant Numbers JP19H05617.

[1] M. Bonura et al., IEEE TAS, vol. 29, pp. 6400205 (2019)
[2] T. Kiss et al., Physica C, vol. 392-396, pp. 1053-1062, (2003)

Primary authors: WU, Zeyu (Kyushu University); KISS, Takanobu (Kyushu University); Ms TIAN, Shan (Kyushu University); Mr KISHIKAWA, Sohki (Kyushu University); HIGASHIKAWA, Kohei (Kyushu University); YANAGISAWA, Yoshinori (RIKEN); SHIMOYAMA, Jun-ichi (Aoyama Gakuin University)

Presenter: WU, Zeyu (Kyushu University)

Session Classification: FRI-OR6-603 High Tc Wires and Cables II