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Current- transport properties of HTS-FAIR conductor at variable temperatures in high magnetic field

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Research and development of large-current High-Temperature Superconducting (HTS) conductors toward the application to magnets of experimental nuclear fusion devices are in progress at NIFS. As a candidate, the FAIR conductor [1] has been developed. Using a number of HTS REBCO tapes, we have been optimizing the manufacturing process of the conductor by repeating current-transport tests in liquid nitrogen with no external magnetic field. As the next step, the characteristics in variable temperatures at high magnetic field are being examined. In this study, we fabricated current-feeding terminals using a new fabrication method and performed current transport experiments of the FAIR conductor at variable temperatures in magnetic field using a variable-temperature insert. For the terminals, we cut the REBCO tapes into stepwise shapes, sandwiched halved cylindrical copper blocks, and jointed two conductors using low-melting-temperature solder. By measuring the joint resistance of the prototype terminal in liquid nitrogen, it was confirmed that the connection had low resistance to be applied. Moreover, we have introduced variable-temperature insert to adjust the sample temperature by flowing coolant helium gas from the variable-temperature cryogenic system installed in the superconducting magnet research laboratory in NIFS. The variable temperature insert is mounted in the split coil which can generate magnetic field up to 9 T. The transport current can be applied to the testing conductor up to 20 kA. The details of the experimental results will be discussed.

[1] Toshiyuki Mito et al 2020 J. Phys. Commun. 4 035009

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