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30 kA級大電流高温超伝導導体試験
Test of a 30-kA class large-current high-temperature superconductor

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1. Introduction

A 100-kA class high-temperature superconducting (HTS) conductor is being developed at NIFS as one of the magnet options for the helical DEMO reactor FFHR-d1 [1]. An advantage of using HTS is that segmented fabrication of the huge and continuous helical coils be possible [2, 3].

We fabricated and tested a 30-kA class HTS conductor sample as collaboration with Tohoku University.

2. Experiments and Results

Figure 1 shows a cross-sectional image of the 30-kA class HTS conductor sample. We used 20 GdBCO tapes (10 layers and 2 rows) simply stacked in a copper jacket, which was then installed in a stainless-steel jacket assembled by bolts. Additionally, an FRP jacket surrounded the stainless-steel jacket for thermal insulation. Both ends of the sample conductor were joined with each other by a bridge-type mechanical lap joint developed by Tohoku University [4]. Thus, the sample formed a short circuit with a race-track-shape. The sample was excited by the field cooling method; the transport current was induced by changing the bias magnetic field.

Figure 2 shows an example of the excitation results. From the top, we plot the central magnetic field of the bias coil, the current excited in the sample (measured by a Hall probe), the voltage of the joint section and the temperature at the sample center. While keeping the temperature at 20 K, the central magnetic field was changed from 8 T to 6.1 T. Then, a 40 kA current was induced stably. After the external magnetic field becomes constant, the conductor current decays gradually. The joint resistance of this sample was unexpectedly high and the time constant was a little shorter than 90 s. Presently, the measured critical current is being analyzed by the characteristics of a single GdBCO tape. The joint will be improved and the second experiment will soon be carried out.

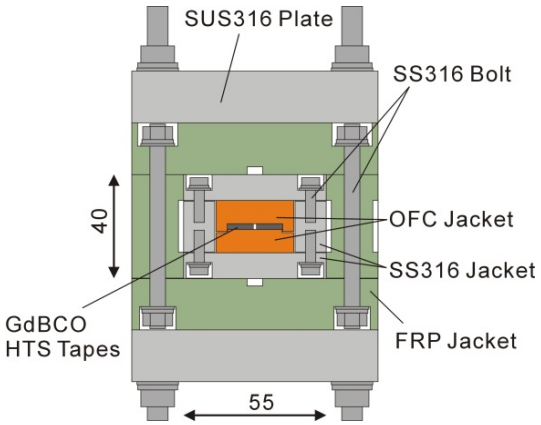

Fig. 1 Cross-sectional image of the 30-kA class GdBCO HTS conductor.

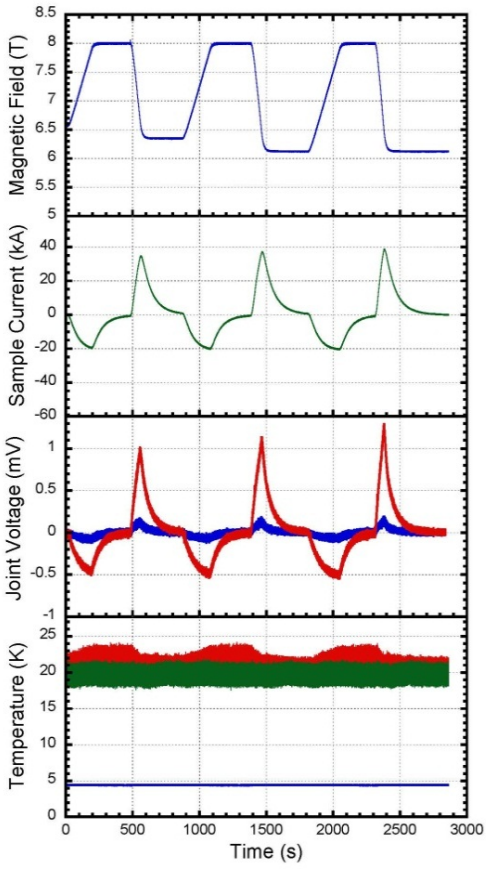

Fig. 2 Example of excitation results.

References

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