§26. Joint Resistance Measurements of the Feeder Joint for JT-60SA EF Coils

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To evaluate the validity of feeder joint fabrication for the JT-60SA EF coil [1], resistance measurements of a feeder joint sample were conducted as a collaborative project between NIFS and JAEA. The feeder joint sample has a U-shaped configuration composed of the JT-60SA EF-H and EF-L conductors removing a jacket, as shown in Fig.1. Fig.2 shows the cross-section of the joint region. A saddle spacer of pure copper was located between the conductors removing Ni plating of NbTi strands. To reduce AC loss, the saddle spacer was divided into 7 sections in the longitudinal direction using PTFE spacers, the thickness of which was 1 mm. The conductors and spacer were electrically connected with solder and clamped with SUS. In addition, a central spiral was replaced with a SUS tube in the joint. The void fraction of the conductors in the joint was 25%, and the connected length was 160 mm.

Fabrication of the feeder joint is going to be conducted on-site after the EF coils were assembled to the JT-60SA device. Hence, fabrication method and tools were developed to conduct joint fabrication at a narrow workspace in the vertical direction [2].

The joint resistance of the sample was measured using the NIFS test facility for middle-sized superconducting conductors as shown in Fig.3 [3]. The measurement results are shown in Fig. 4. The joint resistance is proportional to an external field due to magnetic resistance of the saddle shaped-spacer. At the operating current of 5 kA under 0 T, the joint resistance was very small compared to other operating conditions. This is because the solder used in the joint became superconducting state at 5kA under 0 T. The resistance of the feeder joint at 2 T is 1.7 nΩ. The result is satisfied with the design requirement that is 5 nΩ at 2 T. From the measurement result of the joint sample, the validity of the joint fabrication for the EF coil was confirmed.

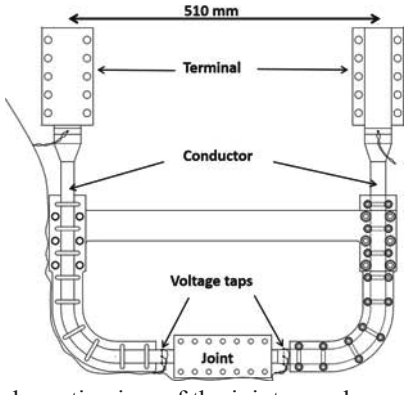

Fig. 1. Schematic view of the joint sample.

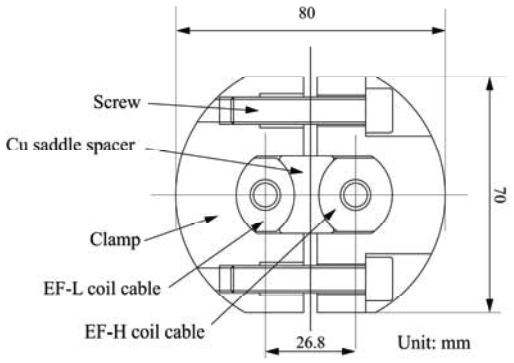

Fig. 2. Cross-section of the sample at the joint region.

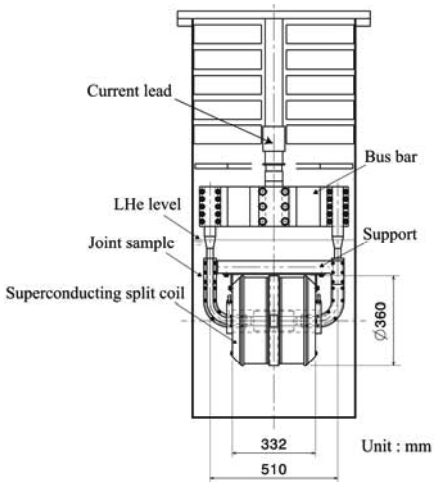

Fig. 3. Schematic view of the NIFS test facility for middle-sized superconducting conductors.

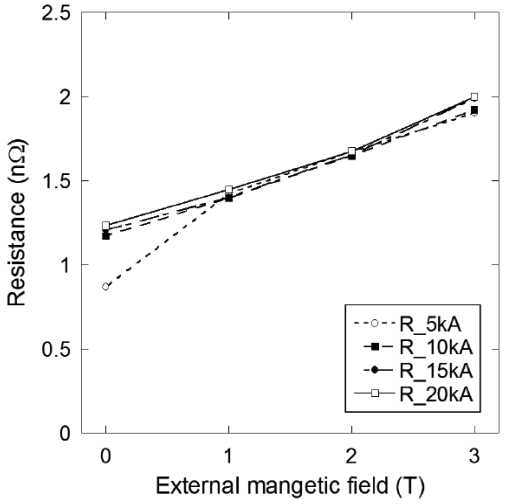

Fig. 4. Measurement results of joint resisntance.

1) Yoshida, K., : Physica C **470** (2010) 1727.
2) Kizu, K.,: Fusion Engineering and Design (2015) to be published.
3) Obana, T.,: IEEE Trans. Appl. Supercond. **20** (2010), pp. 1471–147