§20. Upgrading the NIFS Superconductor Test Facility for JT-60SA Conductors

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The superconductor test facility was constructed in 1992 at the National Institute for Fusion Science (NIFS) in order to develop a large aluminum stabilized superconductor for helical coils installed in the Large Helical Device. In the test facility, characteristics of the superconductor immersed in liquid helium can be investigated under a maximum magnetic field of 9 T generated by superconducting split coils. In addition, a DC power supply at the facility enables the superconductor to be excited up to 75 kA. In 2007, the collaborative project between NIFS and Japan Atomic Energy Agency (JAEA) started for the purpose of developing superconductors for equilibrium field (EF) coils of JT-60 Super Advanced (JT-60SA). The test facility of NIFS was utilized to test the superconductors in the project. The superconductors are a cable-in-conduit (CIC) conductor consisting of a NbTi multi-strand cable surrounded by a SS316L conduit, supercritical helium (SHe) flows inside of the CIC conductor [1]. Therefore the test facility has been upgraded to deal with the CIC conductor. In the upgrade, SHe cooling lines were set up with transfer tubes and a heat exchanger. The cooling line at the supply side is equipped with film heaters to control the SHe temperature. Additionally, an adiabatic vessel for the CIC conductor is installed in the facility so that the CIC conductor can be tested in gas helium.

Figure 2 shows the conductor test result to measure current sharing temperature (Tcs) by using the test facility. In the conductor test, the Tcs of the conductor was measured while changing the SHe temperature under the condition that the current value is 5 kA and the magnetic field is 6.2 T in the conductor. As a result, the conductor temperature was able to be controlled in increments of 0.05 K by using the film heaters in the conductor test. In addition, the critical current (Ic) of the test conductor was measured in the condition that the conductor temperature is controlled to be constant. From the test result, the conductor temperature was able to be controlled within ± 0.02 K. Consequently, the Tcs and Ic of the test conductor for the EF coil was able to be evaluated with the upgraded NIFS superconductor test facility.

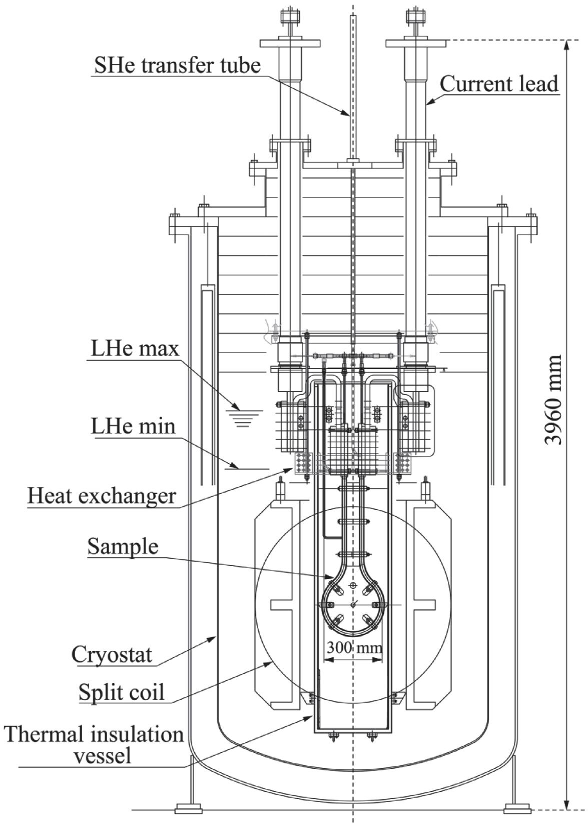

Fig. 1. Schematic view of the upgraded NIFS superconductor test facility

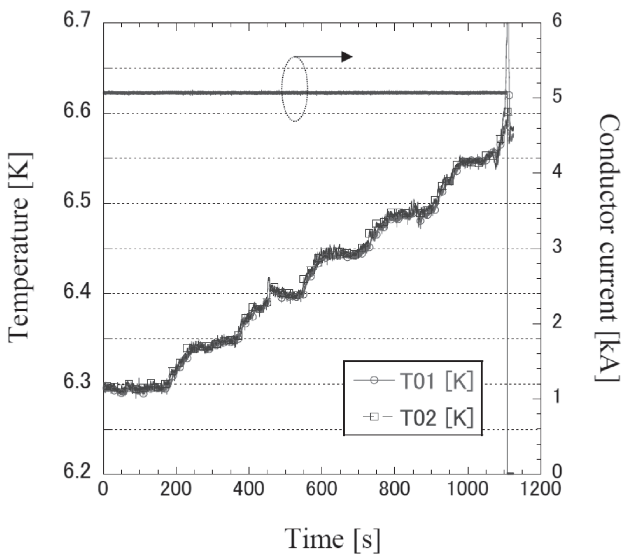

Fig. 2. Current value and temperature profiles of the conductor in the test to measure current sharing temperature (Tcs). T01 and T02 show the temperature measured by CERNOX thermometer, which is attached on a conduit on the test conductor.

1) K. Kizu, et al.: Abstracts of CSJ Conference, Vol. 78 (2008) p.36