§23. Measurements of Self Magnetic Field Generated by Cable-in-conduit Conductors for JT-60SA EF-H and EF-L Coils

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The collaborative project between the National Institute for Fusion Science (NIFS) and Japan Atomic Energy Agency (JAEA) has been conducted since 2007 for the purpose of evaluating the performance of Cable-In-Conduit (CIC) conductors utilized in Equilibrium Field for High magnetic field (EF-H) coils and Equilibrium Field for Low magnetic field (EF-L) coils of JT-60 Super Advanced (JT-60SA) [1]. Two types of CIC conductors are used in JT-60SA EF coils because of the difference in maximum magnetic field to which the coils are subjected. The EF-H coil conductor consists of 450 NbTi strands, and the EF-L coil conductor is composed of 216 NbTi strands and 108 copper wires. Both conductors are equipped with a central spiral, and are not wrapped with sub-wrapping tapes. The short conductor sample of the EF-H coil is shown in Fig. 1. The configuration of the sample is a racket shape of 300 mm in diameter at the circular part. The short conductor sample of the EF-L coil is the same configuration as that of the EF-H coil.

The self magnetic field measurement of the CIC conductor was taken with Hall sensors while measuring Tcs of the conductor in the NIFS test facility. The Hall sensors are located around the CIC conductor, as shown in Fig. 2. Using the Hall sensors (B01-B06), magnetic fields in the x-direction were measured to reduce the influence of the external magnetic field generated by the split coil in the test facility.The direction of the external magnetic field was mainly the y-direction due to the configuration of the split coil.

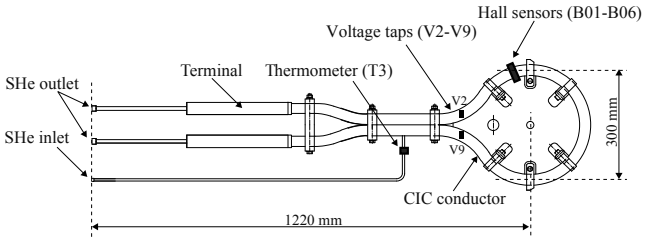

Fig. 1. Schematic view of the short conductor sample

The measurements were taken under the following conditions: The transport current was 20.0 kA; the external magnetic fields at the circular part of the samples were 6.2 T for the EF-H coil and 4.8 T for the EF-L coil; initial temperature was about 6.0 K. Fig. 3 shows the variation of the x-directional self magnetic fields of the EF-H and EF-L coils' short samples during Tcs measurements. In both short samples, the self magnetic fields did not vary much until normal propagation occurred. The variations of the magnetic field were only a few milli-Tesla. However, there was a small difference between the EF-H and the EF-L coil's short samples.

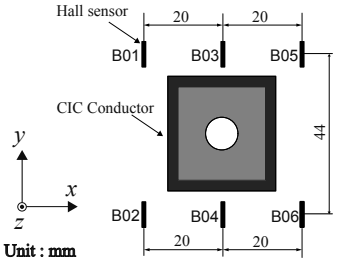

Fig. 2. Layout of the Hall sensors surrounding the conductor

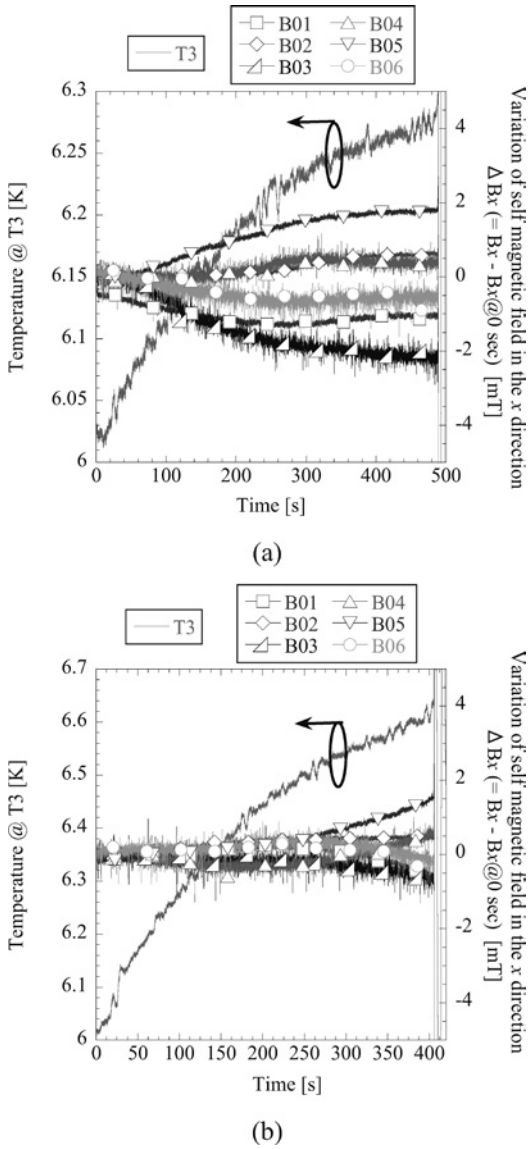

Fig. 3. Variation of the self magnetic field in the x-direction ΔBx(Bx–Bx@0sec) during the Tcs measurements. (a) EF-H coil conductor. (b) EF-L coil conductor.

1) Yoshida, K.,: Physica C **470** (2010) 1727.