

Fabrication details for the KSTAR magnetic diagnostics

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1. INTRODUCTION

The engineering design of magnetic diagnostics for the initial operation of KSTAR tokamak has been completed[1,2]. Many samples for the magnetic diagnostics include Rogowski coils, flux/voltage loops, saddle loops, magnetic field pick-up probes, and so on have been successfully fabricated. Performance tests of the fabricated samples were carried out in a magnetic diagnostics test chamber[3,4] and installation exercises were simulated in a magnetic diagnostics installation chamber (MDIC), which is similar size with the KSTAR in-vessel vacuum chamber. Recently, the final products of the Rogowski coils and many magnetic field pick-up probes were fabricated. Proper combined MgO cables were selected for the flux/voltage loops, saddle loops and locked-mode coils. The fabrication details of the final products for the KSTAR magnetic diagnostics and installation exercise are presented.

2. FABRICATION DETAILS

Three Rogowski coils will be installed inside of the KSTAR vacuum vessel so that total 6 Rogowski coils were successfully fabricated. 1.55-mm diameter MgO insulated coaxial cable was wounded tightly over a 12.7-mm diameter stainless steel tube, which houses the return conductor as shown in Fig. 1. Skilled craftsman with special winding tool performed coil winding so that excellent winding uniformity was achieved and the position of the return conductor was fixed by using ceramic beads. The coil will be permanently attached on the interior of the vacuum vessel by using clips.

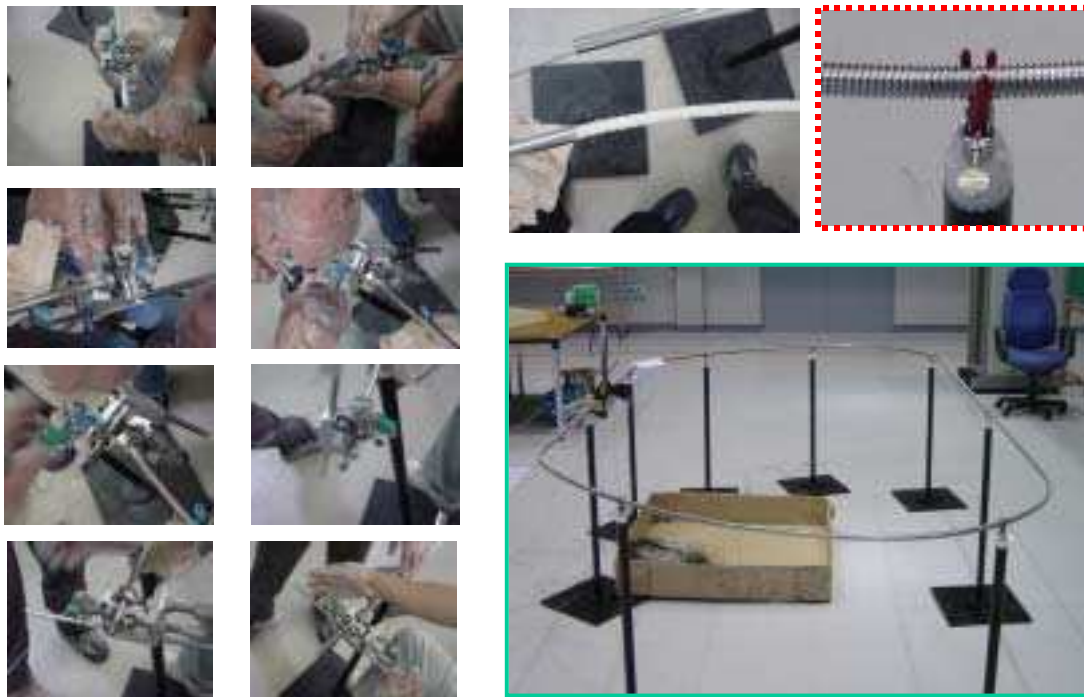


Fig. 1. Fabrication procedures for KSTAR Rogowski coil.

Combined MgO cables were finally selected for the flux/voltage loops, saddle loops and locked-mode coils. The combined MgO cable consists of 5 mm and 1.55 mm diameter MgO insulated coaxial cables. The main loops will be used 5 mm diameter MgO cable and 1.55 mm MgO insulated coaxial cable will be used for twisting and line extension to feedthrough. Figure 2 shows the fabricated MgO insulated coaxial cables.



Fig. 2. Fabricated combined MgO insulated coaxial cables.

The magnetic field probes were fabricated by 1.55 mm diameter MgO insulated cable. Figure 3 shows fabrication procedures for the B_z and B_r+B_z coils and finally fabricated ones. The B_z probe was wound in two layers with 44 turns in each layer and its thickness, width, and length are 26 mm, 60 mm, and 110 mm, respectively. The B_r+B_z probe consists of two dimensional probes and its thickness, width, and length are 26 mm, 82 mm, and 125 mm, respectively. B_z probe was wound in two layers with 44.5 (1st layer) and 43.5 (2nd layer) turns, and both layers of the B_r probe were 6 turns.



Fig. 3. Fabrication procedures and fabricated B_r and B_r+B_z probes.

3. INSTALLATION EXERCISES

Installation verification with several samples were carried out in a magnetic diagnostics installation chamber (MDIC), which is similar geometry with the KSTAR in-vessel vacuum chamber as shown in Fig. 4.



Fig. 4. Installation verification on MDIC.

4. SUMMARY

Fabrication details of the Rogowski coils and magnetic field probes for the KSTAR magnetic diagnostics and installation exercise in the MDIC with several samples were discussed and this experience and result will be applied to real KSTAR vacuum vessel.

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