5 T SUPERCONDUCTING DIPOLE MAGNET

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Abstract

In this report, the recent developemnt of 5 T superconducting accelerator magnets for the TRISTAN proton ring is described. Three 1 m test dipole magnets have been constracted. The training was obviousely reduced with application of higher prestress at the clamping.

Introduction

For the second phase program of the TRISTAN project, the installation of a superconducting proton ring of several handreds GeV is being proposed[1] to perform a colliding beam experiment between electron and proton. A couple of 5 T NbTi/Cu dipoles have been constructed to study the production procedure and operational performance.[2),3),4)]

1 m model magnet

Using the same production procedure of two 1 m model magnets,[3] the third 1 m model magnet has been constructed. The coil was wound in double shells using Rutherfored type compacted strand cable, which is the NbTi keystoned flat cable containing 27 strands of 0.71 mm in diameter. The cable was insulated with Kapton and small amount of Epoxy resin. The insulations of four layer of 25 μ Kapton and two layer of 50 μ thick Kapton with gap were enough to insulate turn to turn under the pressure of 13 kg/mm^2. Advantage to use Kapton insulation other than glass tape insulation was pointed out below.

i) The coil was more tightly wound especially at the coil end part.
ii) The thickness of insulation was controlled easily and accurately.
iii) The thickness of insulation was reduced small amount and extra two turns were added for the each half coil of the third magnet.

The results of the magent training experiment are protted in Fig. 1.

The training was obiously reduced with application of higher prestress at the clamping and of higher tension to wind a coil tightly using the Kapton insulated cable.

Full size dipole magnet

Based on experience in this series of 1 m long TRISTAN test dipole, now we are developing a 5 m 5 T full size dipole magnet. The aim of this development is to confirm the specification and parfomance of a practical accelerator magnet. Table 1 shows the principal parameters of the full size dipole magnet. Already we wound the double shell coils of this magnet. The full size dipole magnet will be assembled and installed in a horizontal cryostat with in several months.

References

1) Y. Kimura; "TRISTAN", Invited Paper at KIth International Conference on High Energy Accelerators, CERN, July 7-11, 1980.
2) H. Hirabayashi; IEEE Trans. MAG-17, 728 (1981).
3) S. Mitsunobu, K. Hosoyama, A. Yamamoto, J. Kishiro, T. Kohriki, T. Kubo, H. Hirabayashi and Y. Kimura; IEEE Trans. NS-28, 3266 (1981).
4) K. Hosoyama, et al.; "A NbTi superconducting Magnet installed in a pressurized helium II Cooling both" to be published in J.J.A.P. (1982).

Table 1

Parameters of TRISTAN Full Scale Dipole Magnet (SD-FA-3100)

Coil Inner Diameter	140 mm
Warm Bore Diameter	90 mm
Coil Length	5100 mm
Magnetic Length	4820 mm
Coil Weight	2 Ton
Total Weight	9.5 Ton
Central Field	5 T
Current at 5 T	4870 A
Stored Energy	1.6 MJ
Inductance	135 mH
Bursting Force	220 Ton/m

Fig. 1 TRISTAN test dipole training curve.