

§22. Measurements of Coupling Losses in Superconducting Cable-in-Conduit Conductors Carrying Pulsive Transport Currents

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The treatment of strand surfaces of superconducting cable-in-conduit (CIC) conductors, such as coating or oxidization, reduces inter-strand coupling losses although it may cause the instability. Under the circumstances of their real applications, the contact resistance among strands is changed by the induced electromagnetic-force and consequently the loss property is expected to have the dependence of the forces.

The purpose of this paper is to measure the properties of inter-strand coupling losses in CIC conductors with transport current under the transverse magnetic field, and to elucidate the dependence of these losses on the electromagnetic-force to the strands. We developed new system to measure both the loss and the current distribution in the conductor¹⁾. By using this system, these measurements for IS-conductor of the poloidal field coil for LHD are carried out.

Figure 1 is the schematics of sample conductors and pick-up coil groups; each group consists of 12 coils surrounding conductors. Figure 2 shows an example of obtained dependences of normalized coupling losses on electromagnetic forces. The loss increases linearly with the force and its change is at most 30% for about 1MPa. We also notice that the loss depends on bias magnetic fields. This seems to be curious and may indicate the possibility of existence of other factors which predominates over it. We can deduce the transport-current distribution from the measured voltages of four pick-up coil groups. When the current is increasing up to a few kiloampere, the obtained results show the almost uniform distribution over the cross section of the conductor at four positions.

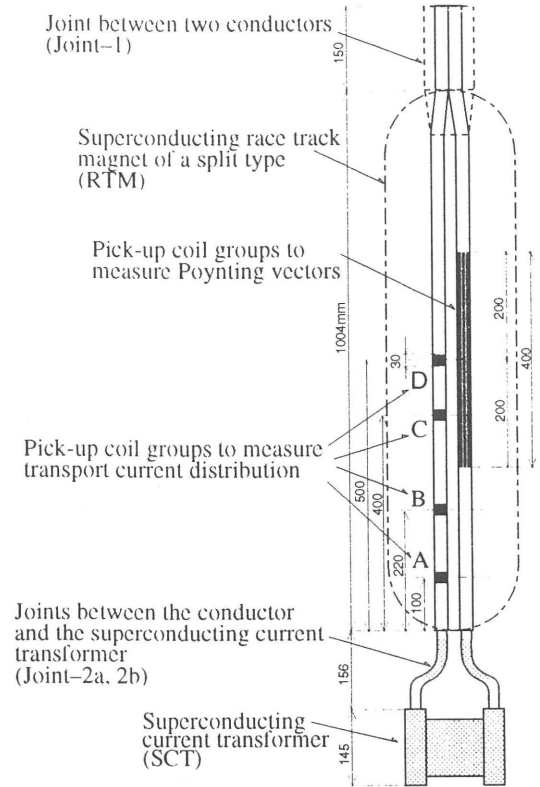


Fig. 1 Sample conductors and pick-up coils

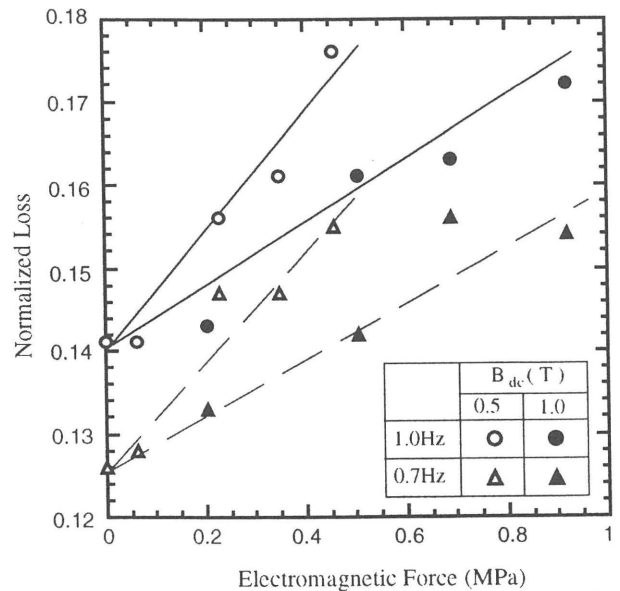


Fig. 2 The dependence of normalized coupling losses on electromagnetic forces

References

- 1) Sumiyoshi, F. et al. : IEEE Trans. Magn. MAG-32, (1996) 2838.