§5. Surface Characteristics on Strand in CIC Superconductors

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i) Introduction

Thousands of strands are generally bundled in cable-in-conduit conductors; for example the OV coil in LHD has 486 strands. It is thought that a crossing angle between contact strands at each contact location are not same but depends on twist pitches of sub-cables in the bundle.

We have studied contact resistance of the strands[1,2] that is an important element of current imbalance and a coupling loss. In this year, we measured the resistances with changing of the crossing angle of the contact strands.

ii) Measuring method

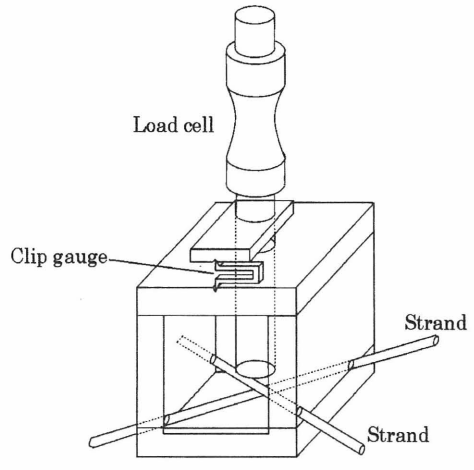

Fig. 1: Experimental setup.

Fig. 1 shows a schematic illustration of our experimental arrangement[2]. As shown in the figure, two NbTi/Cu wires are horizontally placed, and load is add to the cross point of the strands. And the contact resistance was measured by the four-wire method. The added load and deformation of the strands are also measured by a load cell and a clip gauge respectively. The contact angles in the experiment are 15, 30, and 66 degrees, and temperatures are approximately 300 K (in air) and 77 K (in liquid nitrogen).

iii) Measured results and summary

Fig. 2 shows the summarized measured results whose conditions are 77 K and the four-stacked strands. The right axis is a deformation of a single strand derived by the clip gauge data divided by the number of the stacked strands.

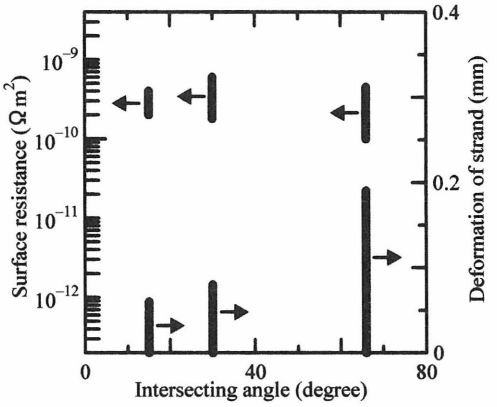

Fig. 2: Dependence of surface resistance on angles.

From the figure, the deformation of the strands strongly depends on the contact angles of the strands. On the other hand, the surface resistances hardly change with the change of the contact angles. Therefore, we think that once the surface resistance, whose contact angle is reasonable, is obtained, the resistance can be applied to different angles of the contact strands.

Those experimental results are going to be presented at the conference of 3).

Reference

1) T. Takao, et al., Proc. of 65th Meeting on Cryogenics and Superconductivity, p. 293, Fukui (2001, in Japanese).

2) T. Takao, et al., 'Contact resistance and compressive deformation of strands in cable-in-conduit conductors', Advances in Cryogenic Engineering (to be published in 2002).

3) K. Nakamura, et al., 'Influence of intersecting angles of strands on contact resistance in cable-in-conduit conductors', ASC2002, USA (to be presented in 2002).