

Fabrication and Characteristics of HTS Magnet Generating 0.9 T at 4.2 K

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An asymmetric HTS magnet composed of four double pancake coils was fabricated and tested at 4.2 K. Then the tested result was compared to the simulation result obtained by using OPERA-2D software. Two double pancake coils (DPC) located at the bottom (DPC #1) and the top (DPC #4) of the magnet had dimensions of 98 mm OD, 50 mm ID and 6.8 mm height, and 108 mm OD and 50 mm ID and 6.8 mm height. The coils were fabricated by using 37-filamentary vanish-coated Bi-2223 tapes with I_c of 32 A at 77 K and under the self-field, which were prepared at NST. Four pancake coils of two DPC located at the middle part of the magnet had OD of 108, 129, 129 and 98 mm, and height of 3.7 mm. The coils were fabricated by using 37-filamentary Ag-0.64%Mn/Ag sheathed Bi-2223 tapes with I_c of 32 A at 77 K and under the self-field, which were prepared at KERI. Each pancake was separated from neighboring pancakes by 0.4-mm thick FRP spacers. During the measurement of I-V characteristics of each DPC and generating field by increasing the applied current in a speed of 60 A/min, a voltage drop appeared at DPC #1 at first and then at DPC #4, but did not at DPC #2 and #3 up to 90 A. I_c 's at 4.2 K of DPC #1 and #4 in a criterion of $1 \mu\text{V}/\text{cm}$ were evaluated to be 72.2 and 80.0 A. The OPERA-2D simulation on field distribution indicated that maximum radial component (B_r) of the field applied to each coil by the magnet itself was 0.61 T at DPC #1, 0.23 T at DPC #2, 0.14 T at DPC #3 and 0.60 T at DPC #4. Thus the large difference in I_c in each coil was attributed to that in B_r experienced by each coil. I_c of overall magnet was evaluated to be 82.9 A. Total field at I_c was evaluated to 0.97 at the center of the magnet and 1.18 T at the inner wall, and was in an excellent consistency with the simulation result. The magnet could be operated without voltage drop at 75 A. Total field at 75 A was 0.88 T at the center and 1.07 T at the inner wall.

keywords : HTS magnet, Bi-2223 tapes, operational characteristics