Study on helium vapor cooled current lead with HTS wire for the Super-KEKB IR correctors

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The compact current lead unit to accommodate 8 leads of about 50 A has been studied in our research program to energize the 40 superconducting (SC) correctors in the proposed Super-KEKB interaction region (IR) magnet system. The leads are conventional vapor cooled design and are optimized with the finite element method (FEM). After the fabrication and assembling, cryogenic test on one unit was carried out to assess the thermal and electrical performance. The heat leaks to the liquid helium have been concluded and the temperature distribution over the lead length has been figured out, which are in agreement with the simulation results. In this paper the validation of the FEM analysis by the cryogenic experiment will be introduced. To further reduce the heat leak of the leads, high temperature superconducting (HTS) wire (2nd Generation with excellent soldering characteristics) is proposed for the cold ends of the leads. The thin HTS wire will be soldered against the wall of the lead and take place of brass to carry current when it is below 70 K. The HTS lead has been studied by the ANSYS simulation. Compared with the conventional lead, the heat leak of the HTS lead was reduced by the presence of the HTS wire. The detailed benefits revealed by the numerical analysis will be presented. The HTS lead structures will also be discussed in this paper.