§20. Development of Basic Technique of dc Fault Current Limiter for Practical Superconducting Systems

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It is effective to use a dc fault current limiter (FCL) in DC networks, consist of a superconducting transmission line and/or superconducting coil, etc., to keep stability of the system by preventing noise from a power supply as well as an accident electric current. So in this research we performed a basic study on the current-limiting characteristic by use of high- T_c superconducting coil. In this report, we will describe the detail of the experimental set ups and the obtained data.

The circuit used for measurement is indicated in fig. 1. Two BSCCO coils having different inductances were used. The appearance of the coils is shown in fig. 2. The inductances of coil L1 and L2 are 1.29 mH and 0.60mH respectively. We use a no fuse breaker to switch over from the right circuit to the left circuit. At first we pass a fixed electric current into the right circuit from a direct-current source. Then we turn switch to the left circuit to give a pulsed current as shown in fig. 3 (without L). The excited voltages were measured by an oscilloscope (Techtronics TPS2014B) at three positions : V_1 at the both ends of the shunt resistance (0.25 m Ω), V₂ is the line voltage (the voltage between terminals of the current source) and V_L is the coil voltage. We have performed the experiment with various combination of coils, such as (1) without any coil, (2) connect only L1, (3) connect only L2, (4) connect L1 and L2 in series, and (5) connect L1 and L2 in parallel. We carried out the experiment with setting current values, I_{set}, of 50A, 100A, and 150A.



Fig. 1. Schematic description of electric circuit used in the present study.



Fig. 2. Photograph of two coils, L1 and L2, used in the present study, in which the coils were connected in series.

Figure 3 compares the current limiting experiment at $I_{set} = 50A$ for without coil and with coil L2, as an example. Vertical axis is the current value calculated from V_1 , and a transverse axis is time. The peak observed in the without coil condition was successfully cut off by introducing the superconducting coil.

In fig.4, we show a typical result measured when L1 and L2 were connected in parallel. Further experiment and the analysis of the result will be done in near future.

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Fig. 3 The current limiting experiment at I_{set} = 50A for without coil and with coil L1.



Fig.4 The time dependence of V_2 and V_L when L1 and L2 were connected in parallel and I_{sets} = 100A was applied.