Design of an HTS Fault Current Limiting Module for an MVDC Power Grid

Jooyeong So, Seyeon Lee, Woo-Seok Kim, Ji-Kwang Lee, Kyongdal Choi
1: Korea Polytechnic University, 2: Woosuk University

1. Introduction

We have studied a DC circuit breaker with an HTS fault current limiting module for an MVDC power grid.

Among several 2G REBCO conductors from different suppliers, we selected the most suitable conductor based on the short circuit test with sample conductors.

A stabilizer-free REBCO conductor was chosen for a fast reaction to the fault current. A design work for an MVDC class FCL module was carried out and verified by simulation.

2. SFCL for DCCB

A resistive type HTS current limiting module in series to the DCCB would reduce the burden of the DCCB when the fault occurs.

3. 2G HTS sample conductors

The amount of the stabilizer will affect the resistivity of the HTS conductor, so that it will define the general performance of the HTS fault current limiting module and the total amount of the HTS conductor.

We selected five different kinds of the HTS conductors to be tested for their overcurrent performances.

4. DC overcurrent test system

We prepared the DC overcurrent test system with a supercapacitor of 500 F for the short circuit test with the selected sample HTS conductors.

The amount of the stabilizer will affect the resistivity of the HTS conductor, which generated the fault current of 1,750 A.

The sample HTS conductors were attached on the FRP holder and immersed in the liquid nitrogen vessel for the short circuit test.

5. Overcurrent test Result

We prepared the DC overcurrent test system with a supercapacitor of 500 F for the short circuit test with the selected sample HTS conductors.

The maximum applied voltage on the supercapacitor was 14 V, which generated the fault current of 1,750 A.

The sample HTS conductors were attached on the FRP holder and immersed in the liquid nitrogen vessel for the short circuit test.

6. Design of fault current limiting module

A resistive type SFCL module to reduce the burden of a DC circuit breaker was designed with various kinds of 2G REBCO conductors and the current limiting performance was verified by simulation.

The SFCL module with Stabilizer-free HTS conductor shows faster reaction to the fault current and shorter duration time.

A scale-down SFCL module will be fabricated and tested in near future.

7. Conclusion

A resistive type SFCL module to reduce the burden of a 15 kV class DC circuit breaker was designed with various kind of 2G REBCO conductors and the current limiting performance was verified by simulation.

The SFCL module with Stabilizer-free HTS conductor shows faster reaction to the fault current and shorter duration time.

A scale-down SFCL module will be fabricated and tested in near future.