



Contribution ID: 200

Type: **Poster Presentation of 1h45m**

Threshold value analysis of YBCO tapes under transient over-current impulse

Thursday 31 August 2017 13:45 (1h 45m)

The superconducting tapes are widely used in fault current limiters for AC power systems. However, they are still in the study in the HVDC situation as it has a lot of differences compared with the AC situation. In the AC situation we have 45ms-60ms to shut down the circuit breaker so the current flows through the superconducting tape would be two or three times of the critical current of the superconducting tapes. And the heat would be absorbed a lot by the liquid N₂ in this 45ms-60ms. Whereas we need the circuit breaker shut down in 4ms-10ms in HVDC situation. Less time means more over-current and less heat transfer. This paper would explore the threshold value of the YBCO tapes in DC over-current situation and the heat transfer law between the tapes and the liquid N₂. The experiment of the DC over-current impulse under the conditions of different times could obtain the relationships between time and the threshold value of over-current. The relationships between heat transfer and the threshold value could be obtained by the experiment under the different cooling conditions. Then we can get the heat transfer law in combination with the experiment results and the temperature-resistance curve. Then the threshold value of the over-current could be calculated at a given time and cooling conditions. The results have the reference for the design of the superconducting fault current limiter (SFCL).

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Session Classification: Thu-Af-Po4.08

Track Classification: F4 - ReBCO Wires and Cables