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

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The superconduting 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 superconduting tape would be two or three times of the critical current of the superconduting tapes. And the heat would be absorpted 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 expriment 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 expriment under the different cooling conditions. Than we can get the heat transfer law in combination with the expriment results and the temperature-resistance curve. Than 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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