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Analysis of the Operating Characteristics of fault Current limited DC Circuit Breaker According to Superconducting Winding Type

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We proposed a current-limiting DC blocking technology with superconductors. In the case of the fault current, the fault current in the DC system is primarily limited by the superconductor. After that, the limited current is stably cut off by the DC circuit breaker.

In this paper, we analyzed the operating characteristics of DC circuit breaker according to the winding type of superconducting wire in the current-limiting part. The current-limit windings were selected as helical wire and spiral wire types. In the same length, spiral wires generate higher heat and magnetic fields than helical wires. However, spiral wire have higher inductance than helical wire rods, which delays the current limit. Therefore, in this paper, we analyzed the fault current limit rate, quench speed, and the DC breaker's breaking characteristics while changing the inductance according to the wire winding method. In addition, the power burden of each superconductor and DC circuit breaker was compared and analyzed. For simulation analysis, HFSS program was used to analyze the electromagnetic field analysis according to the winding type of the current-limit. Also, after the fault current is simulated using the EMTDC / PSCAD simulation, the breakdown behavior of the superconducting DC circuit breaker is analyzed.

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