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Comparative Analysis of Superconducting Bulk-type magnet and Wire-type electromagnet Applicable to Mechanical DC Circuit Breakers

Sang-yong Park¹, Hui-Seok Gu¹, Hyo-sang Choi¹

Department of Electrical Engineering, Chosun University¹

The core technology of the DC grid system is to protect the system in the event of a transient and to cut-off the faults current in a trouble line, quickly.

We sat down to analyze to implement the DC breaking technology of mechanical DC circuit breaker on the faster and more safely. However, the mechanical DC circuit breakers have limitations on the opening speed and the components of the break contact. To solve this problem, we applied a superconducting electromagnet to a mechanical DC circuit breaker and proposed a method to reduce the DC Arc energy generated during the breaking operation.

In this paper, we proposed the application of superconducting bulk-type magnet and superconducting wire-type electromagnet to the conventional mechanical DC circuit breaker and analyzed the breaking characteristic. We designed a mechanical DC blocking contact, a superconducting bulk-type magnet, and a superconducting wire-type electromagnet through the Maxwell 3D program.

As a result, the Lorentz force was generated between the mechanical DC blocking contacts each applied the superconducting bulk-type magnet and wire-type electromagnets. The superconducting bulk-type magnets produced about 43.8 percent faster and the superconducting wire-type electromagnets produced about 87.2 percent faster DC Arc breaking speed.

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