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Tue-Af-Po2.22-09 [82]: Characteristics research on BSCCO HTS tapes with short-circuit impulse current impact at LNG cooling ambient temperature

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The DC superconducting energy pipeline has the advantage of integration of power and fuel, in which the superconducting cables are cooled by liquefied natural gas (LNG) coolant. As one of the newly developing technology of superconductivity in power system, the integrated delivery has the superiority that its total efficiency of energy transportation could reach 96%, for the power loss is only 1/3 of that of separate delivery of power and fuel.

In order to guarantee the safe operation of the DC superconducting energy pipeline, it is important to study the ability of superconducting tapes to withstand the short-circuit impulse current at LNG temperature. A test platform has been established which consists of a closed and pressurized dewar, an impulse current source, an oscilloscope and a cryogenic auxiliary system. Heating LN by an electric heating resistor in the pressurized dewar, we achieve the ambient temperature of 85-90K, which is near to LNG temperature in the DC superconducting energy pipeline. Three kinds of BSCCO HTS tapes, which are Type H, HT-CA and HT-SS, have been tested under the impact of short-circuit impulse current by increasing the current amplitude gradually. The test results show that the HT-CA tape has the best ability to withstand short-circuit impulse current with amplitude of 1700A and lasting period of 7ms. There is no degradation for this kind of tape and it maintains perfect without any hurt by over heat. Moreover, the critical current does not decrease after withstanding the impulse current. This study contributes to the optimization and stable operation of the DC superconducting energy pipeline.

Primary authors: Dr SUN, Yuguang (Department of Electrical Engineering, Tsinghua University); Mr YAN, Zhiyong (Tsinghua University); Mr ZHAO, Guangrui (Department of Electrical Engineering, Tsinghua University); Prof. JIANG, Xiaohua (Department of Electrical Engineering, Tsinghua University)

Presenter: Mr ZHAO, Guangrui (Department of Electrical Engineering, Tsinghua University)

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