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Basic Study on Effect of a Heat Pipe on Cooling Characteristic Improvement in a Tri-axial HTS Cable

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The high T_c superconducting (HTS) tri-axial cable fits long-distance power transmission rather than the 3-in-One superconducting cable, since the tri-axial HTS cable has low ac loss and large cooling channel, and the tape length used for a cable is much shorter. We investigated a suitable cable structure of HTS tri-axial cable with counter cooling by liquid nitrogen for long-distance power transmission using the numerical analysis which considered the heat transfer from the cable outside and heat generation caused by to AC loss inside the cable. However, based on our numerical results, the length of the tri-axial cable can be operated in one cooling station is not sufficient for the submarine cable such as a power facilities in the offshore wind power system.

In this study, we proposed a new cooling method in order to achieve the further longer distance of the HTS cable. We analyzed the thermal and fluid characteristics of the tri-axial HTS cable using heat pipe to investigate the application effect of the heat pipe and the design guidelines of the tri-axial HTS cable using the heat pipe suitable for long distance cable.

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