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Thermal insulation test of newly designed cryogenic pipes for the superconducting DC power transmission system in Ishikari, Japan

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Superconducting power transmission systems have been developed intensively and applied to actual power grids at several places in the world in recent years. This is because the system is recognized as one of the most efficient ways of power transmission in the world. In Japan a DC superconducting power transmission project, which consists of construction and operation of two DC superconducting power transmission lines of 500 m and 2000 m, was launched in 2013 in the Ishikari area as one of the national projects of Japan. This project is called Ishikari project. Firstly, the power transmission by the 500 m transmission line, which will connect a solar power plant and an Internet data center, will be started by the end of FY 2014.

In the case of superconducting power transmission, heat leak along a cryogenic pipe is one of the main sources of the transmission loss, in particular, for long transmission lines. Therefore, the development of cryogenic pipes with efficient thermal insulation performance is crucial to make the efficiency of the system higher. We have developed a new cryogenic pipe for the Ishikari project, which comprises of two inner pipes, one for installation of a cable and the other for return of the liquid nitrogen, respectively. The pipe in which the cable is installed is surrounded by a thermal shield, which is thermally anchored to the pipe for the liquid nitrogen return. This makes reduction of the heat leak to the pipe in which the cable is installed possible. We have tested the efficiency of the thermal insulation of cryogenic pipes with different structures design. The result of the test will be reported in the conference.

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