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Critical Current Properties of HTS Twisted Stacked-Tape Cable in Subcooled Liquid Nitrogen

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Railway Technical Research Institute has developed superconducting cable applications for railway systems in Japan. Railway feeders of superconducting cables could significantly reduce the voltage decay. Therefore, DC HTS Electrification has various advantages, such as the reduction of transmission losses, the improvement of the regeneration factor, and the reduction of substations. From a practical application perspective in a railway system, a Twisted Stacked-Tape Cable (TSTC) has been focused on with its compact size and bendability. A 2 m long, 32-YBCO-tape (4 mm width) TSTC conductor with a 200 mm twist pitch was investigated at various temperatures near 77 K using subcooled liquid nitrogen. The measured critical current of the straight cable was 1.45 kA at 77 K which agrees with the expected values estimated from the self-field. By controlling the equilibrium vapor pressure, the temperature was changed from 64 K to 85 K. The critical currents of the TSTC conductor were varied from 3.65 kA at 64 K to 0.42 kA at 85 K by the vapor pressure of nitrogen bath. Temperature dependence agrees with that of 4 mm YBCO tape. These results encourage a compact Twisted Stacked-Tape Cable application in railway systems.

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