Design, Fabrication, and Testing of a 2 T No-Insulation GdBCO Magnet Cooled by Hybrid-Type Cooling System for an HTS Wind Turbine Generator

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Abstract: Herein, we report our recent progress on the core technology development of the second generation high temperature superconducting magnet for a megawatt-class wind turbine generator. One of the most innovative aspects of this work is the use of a hybrid-type cooling system. This new type of cryogenic system, which outperforms the conventional counterparts used in a rotating machine, allows the superconducting device to be cost-effective with a high operational reliability. For a feasibility study on this new cooling system, we designed, fabricated, and tested a 2 T GdBCO magnet cooled by a hybrid-type cooling system utilizing both the liquid neon and solid nitrogen cooling systems. The magnet consisted of an assembly of stacked GdBCO double pancake coils, each of which was wound without turn-to-turn insulation. In this study, the cooling performance and thermal/electrical stabilities of the no-insulation GdBCO magnet with the hybrid-type cooling system were evaluated by cool-down, warm-up, and charging-discharging tests. Furthermore, heat-transfer analysis of the GdBCO magnet was carried out using the finite element method.

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