MT 26
International Conference
on Magnet Technology
Vancouver, Canada | 2019

Contribution ID: **1241** Type: **Poster Presentation**

Thu-Mo-Po4.08-06 [58]: Electromagnetic Design of an HTS Claw Pole Wind Generator

Thursday, 26 September 2019 08:45 (2 hours)

Nowadays, wind energy is developing rapidly as it is clean and renewable and the offshore wind energy is one of the most popular ones for its abundant source. To avoid frequent maintenance of the offshore wind turbine system, a large direct-drive generator is needed. Due to the advantages of the higher magnetic field in the high temperature superconducting (HTS) machine compared to that of the regular one, it becomes a great candidate for offshore wind power application for its large torque density. However, the cost of the HTS material is very high and it limits the industrialization of the HTS wind generator.
In this paper, a 10 MW HTS claw pole wind generator is designed. This generator adopts claw pole machine topology with HTS toroidal winding. Two excitation coils are used to create a magnetic field that is directed to the air gap by the C-type teeth. Compared to the conventional HTS generator, its structure is simpler with a stationary cryogenic system and it consumes less HTS materials as it has a relatively shorter end winding. What's more, the excitation magnetic field in the core is still, which means it will have lower core losses.
The design and optimization of the HTS axial-flux generator are investigated by finite-element analysis. Firstly, the basic electromagnetic performance of this new topology is calculated by the finite-element method. Then, several optimizations such as decreasing its torque ripple are conducted and clarified by the finite-element analysis. At last, its electromagnetic performance is compared with the existing three-phase HTS synchronous generator. The comparison results show that the HTS material used reduces by 30% in this topology, which means a big decrease in the cost of the wind turbine system.

[1] Keysan O , Mueller M A . A Homopolar HTSG Topology for Large Direct-Drive Wind Turbines[J]. IEEE Transactions on Applied Superconductivity, 2011, 21(5):3523-3531.

Primary author: ZHANG, Yuanzhi (Huazhong University of Science and Technology)

Co-authors: GAO, Yuting (Huazhong University of Science and Technology); CHENG, Yi (Huazhong University of Science and Technology); Prof. QU, Ronghai (Huazhong University of Science and Technology)

Presenters: ZHANG, Yuanzhi (Huazhong University of Science and Technology); GAO, Yuting (Huazhong University of Science and Technology); CHENG, Yi (Huazhong University of Science and Technology)

Session Classification: Thu-Mo-Po4.08 - Wind, Wave, Tidal Generators - I