Contribution ID: **930** Contribution code: **FRI-OR7-801-04** Type: **Oral**

Design and experimental investigations on the helium circulating cooling system operating at around 20 K for a 10-Mvar class HTS dynamic synchronous condenser

Friday, 19 November 2021 10:45 (15 minutes)

A project to develop a 10-Mvar high temperature-superconducting (HTS) dynamic synchronous condenser is carried out by China Southern Power Grid Corporation. In order to cool the magnets to 20-30 K, a set of cryogenic system using circulating helium as the working fluid was developed, and it has been coupled and tested with the 10-Mvar class dynamic synchronous condenser. Six cryogenic coolers are used as the cold source to provide more than 240 W@20K cooling power. And they will be transferred to the circulating helium gas through the specific designed heat exchangers with an efficiency higher than 95%. Two cryogenic helium pumps are employed to overcome a pressure drop of about 5 kpa induced by the helium gas circulating in the transfer tubes about 10 meters. In addition, a set of pressure adjuster is also put forward to achieve pressure fluctuations below 0.2 bar, including the processes of start-up, operation and shut down. In the static tests coupled with the 10-Mvar class dynamic synchronous condenser, 5 days are needed to cool the entire magnets to approximately 26 K. Once the motor speeds up and reaches the design value of operation, this temperature rises slightly to about 27 K, which can also satisfy the demand of keeping the magnet in superconducting state. This paper will describe the design and optimization of the cooling system in detail as well.

Primary author: TAN, Jun (State Key Laboratory of Infrared Physics, Shanghai Institute of Technical Physics, Chinese Academy of Sciences)

Co-authors: XUE, Renjun (State Key Laboratory of Infrared Physics, Shanghai Institute of Technical Physics, Chinese Academy of Sciences); ZHAO, Bangjian (State Key Laboratory of Infrared Physics, Shanghai Institute of Technical Physics, Chinese Academy of Sciences); ZHAO, Yongjiang (State Key Laboratory of Infrared Physics, Shanghai Institute of Technical Physics, Chinese Academy of Sciences); TAN, Han (State Key Laboratory of Infrared Physics, Shanghai Institute of Technical Physics, Chinese Academy of Sciences); ZHANG, Tao (State Key Laboratory of Infrared Physics, Shanghai Institute of Technical Physics, Chinese Academy of Sciences); DANG, Haizheng (State Key Laboratory of Infrared Physics, Shanghai Institute of Technical Physics, Chinese Academy of Sciences)

Presenter: TAN, Jun (State Key Laboratory of Infrared Physics, Shanghai Institute of Technical Physics, Chinese Academy of Sciences)

Session Classification: FRI-OR7-801 Cryogenics