



Contribution ID: 553

Type: **Contributed Oral Presentation**

Present Status of Turbo-Brayton Cycle Cooling System in Japan

Tuesday 11 July 2017 11:45 (15 minutes)

High temperature superconductive (HTS) power machines, such as a power cable, a transformer and a fault current limiter, have been tried to approach commercialization recently. In commercializing of HTS power machines, a cooling system shall have cooling capacity from 2kW to 10kW at 70 K, long maintenance interval and high efficiency (low input power). The HTS power machines are cooled by circulating of sub-cool liquid nitrogen and returned liquid nitrogen from HTS power machines will be cooled down using refrigerator. There are few kind of refrigerator for cryogenic field. A Stirling cycle refrigerator and a turbo-Brayton cycle refrigerator will be candidate to cool HTS power machines.

Taiyo Nippon Sanso Corporation had been developed a 2kW class turbo-Brayton cycle refrigerator in NEDO project from FY 2008 to FY 2012. The 2kW refrigerator is using Neon gas as working fluid. And an active magnetic bearing was adopted for turbo-compressor and turbine of the refrigerator. That is one of an advantage for applying HTS power machines. Because the magnetic bearing can levitate the shaft of the turbo machines therefore the refrigerator can become long term maintenance interval. After developing of 2kW refrigerator, 10kW turbo-Brayton refrigerator also has been developed for long length HTS power cable. Two types of refrigerator have operation experience about one year in field test.

Present status and technology detail of turbo-Brayton cooling system will be introduced in this presentation. And also subjects of turbo-Brayton cooling system for applying to electric propulsion aircrafts will be discussed.

Author: HIRAI, Hirokazu (Taiyo Nippon Sanso Corporation)

Co-authors: Dr IZUMI, Teruo (Advanced Industrial Science and Technology); Prof. IWAKUMA, Masataka (Kyushu University)

Presenter: HIRAI, Hirokazu (Taiyo Nippon Sanso Corporation)

Session Classification: M2OrC - Focused Symposia - Propulsion VI: Motors & Generators, Cryocool Technologies