Contribution ID: **206** Type: **Poster**

C2Po1F-07: Simulation and optimization of reliquefication refrigerator for cryogenic liquid

Tuesday 20 May 2025 09:15 (1h 45m)

Boil-off gas (BOG) in cryogenic vessels must be vented to keep the pressure below the limit and preserve the safety of the tank. Since liquefaction consumes a lot of energy, it is not economical to vent it directly. Undoubtedly, providing refrigeration power to reliquefy the evaporated gas or subcool the cryogenic fluid is a superior scheme. Therefore, an efficient cryogenic refrigerator is essential to provide sufficient refrigeration power, and the performance of the refrigeration system is determined by the design of the refrigeration cycle, and the operating parameters. In this paper, we optimized the configuration and process parameters of the turbine-Brayton cycle in the temperature range of LNG, liquid nitrogen, and liquid hydrogen. The refrigeration cycles are established in Aspen HYSYS, and the optimization is performed in MATLAB using the genetic algorithm. Reasonable constraint parameters and variables are given for the optimizations. The optimal process parameters were obtained by 3 independent optimizations. The performance of the three cycles in different temperature ranges was compared in detail. The results show that the new process has significant advantages over the base cycle. The refrigeration system can be easily scaled and combined so that it can be arranged in scenarios with different refrigeration requirements. This paper will provide an important reference for zero-boil-off storage of large cryogenic tanks.

Authors: CHAO, Baohua (Technical Institute of Physics and Chemistry;University of Chinese Academy of Sciences); Dr WANG, Jin Zhen (Technical Institute of Physics and Chemistry, CAS); CHEN, Huaiyu (Technical Institute of Physics and Chemistry, Chinese Academy of Sciences); SHANG, Jin; LV, Cui

Co-author: WU, Jihao

Presenters: WU, Jihao; Dr WANG, Jin Zhen (Technical Institute of Physics and Chemistry, CAS)

Session Classification: C2Po1F - Large Scale Cryogenic Systems IV: Operation & Design IV