Contribution ID: **400** Type: **Poster**

C2Po1F-01: Dynamic simulation and automatic control strategy design for the compressor system of 6kW Helium refrigerator

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

Comprehensive Research Facility for Fusion Technology (CRAFT) is a large-scale scientific engineering project led by the Institute of Plasma Physics, Chinese Academy of Sciences. The cryogenic system of the project includes four helium refrigerators, among which 6 kW@4.5k after the completion of the helium refrigeration unit, it will be used as a magnetic performance research and testing platform for CRAFT. The compressor system is one of the key components of the helium cryogenic system, providing stable and pure high-pressure helium gas for the cold box. The performance of the compressor control system directly affects the refrigeration performance of the refrigerator. The automatic control system can monitor and adjust the working status of the compressor unit in real time, improve the efficiency of the entire cryogenic system operation, and ensure the stability of the system operation. In order to design an automatic control strategy for the compressor system in a 6 kW@4.5k helium refrigerator unit, this paper uses the process simulation software EcosimPro to simulate 6 kW@4.5k A compressor system model was established for the refrigeration unit, and experimental simulations were designed to simulate the start stop sequence and operation process of the compressor unit and the gas storage recovery and purification system. The dynamic response characteristics of the compressor station system were obtained. And analyze the control process of the compressor system based on this model.By analyzing the process flow of a 6 kW@4.5k helium refrigerator, the control flow in the compressor system was studied, including the control flow of the compressor unit and the gas storage and recovery system. Based on the compressor system model established by EcosimPro, complete the automatic control strategy design for the compressor unit and auxiliary system in a 6 kW@4.5k helium refrigeration unit. At present, a preliminary compressor system model has been constructed, and through theoretical verification, the model can provide key basis for subsequent research.

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