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C3Po1B-03: Development of reverse-Brayton refrigeration system with scroll compressor package

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This paper describes the development of 2 kW class reverse-Brayton refrigeration system. The refrigeration cycle is designed to have cooling capacity of 2 kW at 77 K, with operating pressure of 0.5 and 1.0 MPa at low and high pressure side. Neon gas is adopted as a working fluid. The system is consist of scroll compressor package, plate heat exchangers and turbo expander. Especially, several helium scroll compressors, which are originally used for driving GM cryocooler, are packaged to produce the system pressure and flow rate. Three segments of plate heat exchanger are adopted cover wide temperature range and the refrigeration power is produced by turbo expander. The developed refrigeration system is successfully operated at wide temperature range including its target temperature. In experiments, all parameters such as pressure, temperature, mass flow rate and valve opening are measured during cool-down process and steady state. Cooling capacity is measured with heat load by electric heater. The developed refrigeration system shows cooling capacity of 1.83 ˜ 2.78 kW at 68 ˜ 102 K of cold-end temperature range.

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