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# C3Or2A-03: Performance Test and Analysis of a High-Capacity Stirling Type Pulse Tube Cryocooler with Orthogonal Room Temperature Displacers

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Stirling-type pulse tube cryocoolers are known for their compact design, reliability, and long operational life, but traditional systems are primarily limited to small-scale cooling applications. To meet the growing demand for high cooling capacity in fields such as superconducting power transmission, small-scale gas liquefaction, and BOG (Boil-Off Gas) management, this paper presents a single-stage Stirling-type pulse tube cryocooler with orthogonal room temperature displacers. This design enhances the reliability of the displacer, as it operates at room temperature, thus improving reliability, and optimizes acoustic field distribution, leading to significant performance improvements over traditional pulse tube cryocoolers. By combining theoretical analysis with experimental validation, we examined the effects of key parameters, including pressure ratio, frequency, and displacer stiffness, on cooling capacity across cold head operating temperatures from 40 K to 100 K, considering working at different ambient temperatures. Experimental results show that the optimized cryocooler achieves a minimum temperature of 36.5 K and a cooling capacity of 340 W at 77 K, with an input power of 4.5 kW, demonstrating a relative Carnot efficiency of approximately 21.2%. The cryocooler has a total weight of 82 kg, making it suitable for applications where weight is a crucial factor.

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