

Development of a high efficiency micro pulse tube cryocooler for 80 K

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A miniature Stirling-type pulse tube cryocooler was designed and manufactured. The performance test was carried out with a linear compressor with a piston diameter of 11 mm. The weight of the whole machine was about 1.2 kg. In this study, we utilized SAGE to investigate the impact of parameters such as frequency, transfer line length, and inertance tube length on the refrigeration performance. Through thermodynamic analysis, the energy flow and loss changes in the refrigerator are obtained, and the influence of these parameters on the refrigeration performance is quantified. Finally, the refrigeration characteristics of the cryocooler are tested and the influence of the above parameters on the refrigeration performance is verified by experiments. Through simulation-assisted optimization, experimental tests revealed that the cryocooler achieved a performance of 1.5W@80K at a hot-end temperature of 300K, with a relative Carnot efficiency reaching 10.63%.

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