

Theoretical and experimental investigations on stirling-type pulse tube cryocoolers with u-type configuration to achieve temperature below 20 k

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Abstract

To achieve lower temperatures is a subject of recent research and development activities in the field of pulse tube cryocoolers. To reach a temperature of 20 K, multi-staging is necessary in Stirling-type pulse tube cryocoolers. In the present work, Sage software is used to design a three-stage gas-coupled as well as thermal-coupled pulse tube cryocooler. A single-stage and a two-stage pulse tube cryocoolers are developed, tested and are coupled by a thermal link to build up a three-stage thermal-coupled pulse tube cryocooler. The lowest temperature of 19.61 K is obtained with a cooling capacity of 220 mW at 30 K at the third stage operating at 17 bar charge pressure and 68 Hz frequency. The phase-shifting mechanism used is a double inlet valve at the third stage while the inertance tube is used for the other stages.

Keywords

Multi-staging, Stirling-type pulse tube cryocooler, U-type, double inlet valve