

Study on a Single-Stage 120Hz Pulse Tube Cryocooler

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Abstract - Miniaturization of pulse tube cryocoolers is required for some particular applications where size and mass for devices are limited. In order to pack more cooling power in a small volume, higher operating frequencies are commonly used for Stirling-type pulse tube cryocoolers. To maintain a high efficiency of regenerator with a higher frequency, a higher charging pressure and smaller hydraulic diameters of regenerator material and shorter lengths of regenerator should be applied. A rapid growth of research and development on pulse tube cryocoolers operating at a high frequency over 100Hz in the last 3 years has occurred. In this study, a single stage pulse tube cryocooler with 120Hz to provide 10W of lift at 80K has been developed by using the numerical model, known as REGEN 3.2. Experiments performed on this cryocooler driven by a CFIC linear compressor shows that a no-load temperature of 49.6K was achieved and the net refrigeration power at 78.5K was 8.0W. Effect of pulse tube orientation was tested, and copper velvet as regenerator matrix was proposed for high frequency operation.

Keywords - high frequency, pulse tube cryocooler, orientation, copper velvet

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