Contribution ID: **63** Type: **Poster Presentation**

Investigation on the cold finger and compressor of a miniature pulse tube cryocooler

Pulse tube cryocoolers consist of compressors, cold fingers and phase shifting devices. The cooling performance of pulse tube cryocoolers mainly depend on the following two aspects, the dynamic behaviors of the compressors and the oscillating flow in the regenerators of the cold fingers, which are associated with the phase shifting performance of the phase shift devices.
In this paper, the influence of phase shifting devices on the performances of the compressor and cold finger of a miniature pulse tube cryocooler are investigated. A series of phase shifting devices are employed to adjust the working state of the compressor and cold finger. First, the phase shifting characteristics of the phase shifting devices are tested coupling with cold finger under different frequencies and working temperatures and cooling powers of the cold finger. Then, the performances of the compressor and cold finger are studied based on the experimental data. At last, a miniature pulse tube cryocooler is developed considering cooling performance, weight and reliability. The miniature pulse tube cryocooler can supply 1.5W@ 80K cooling power with an input power of 45W.

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Track Classification: CEC-04 - Cryocoolers (Aerospace)