

***Effects of Structural Asymmetry on  
Regenerator Temperature Non-Uniformity  
in a High-Power Stirling-Type  
Pulse Tube Cryocooler***

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High-power Stirling-type pulse tube cryocoolers (SPTC) has the advantages of compact structure, low maintenance and long service life, and are expected to be an ideal candidate for high temperature superconductivity (HTS) application. The regenerator temperature non-uniformity which significantly deteriorates the cooling performance is still a key problem for the high-power SPTC. Previous studies mainly focused on combinations of regenerator filling to reduce the temperature non-uniformity. However, the physics of regenerator temperature non-uniformity are still unclear. In this study, the effects of asymmetry of inertance tube, cold end heat exchanger and aftercooler on the regenerator temperature non-uniformity have been extensively investigated on a self-made high-power Stirling-type pulse tube cryocooler working at liquid nitrogen temperatures. Experimental results show that the structure of the aftercooler has a great influence on the temperature non-uniformity of the regenerator. When the water inlet and the outlet direction of the aftercooler are adjusted, the circumferential temperature distribution in the middle of regenerator also changes greatly. The non-uniform cooling water temperature is verified to be an inducement for the non-uniformity temperature in the regenerator. These results would be helpful for further geometry optimization and performance improvement of high-power SPTCs.