

Advances in a Resonance Tube-Coupled Duplex Stirling Cooler

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A resonance tube-coupled duplex Stirling cooler is thermally driven and thus possesses remarkable advantages of high exergy efficiency, high reliability and resilience. This novel configuration has been preliminarily validated through experiments. Although later a numerical optimization has been conducted and an intriguing heat-to-cooling-power exergy efficiency of 26.8% was obtained, experimental verification is lacking. Based on recent progresses in both free piston Stirling heat engine and cryocooler operating around 50 Hz, the duplex system was optimized accordingly. A special concern was imposed on the resonance tube and several types of resonance tube were investigated. Among the numerical results, by using a converging-and-diverging resonance tube, a heat-to-cooling-power exergy of 28% and a cooling power of 1.0 kW were obtained at 110 K with a mean pressure of 5 MPa, hot temperature of 923 K, ambient temperature of 303 K, operating frequency of 50 Hz.