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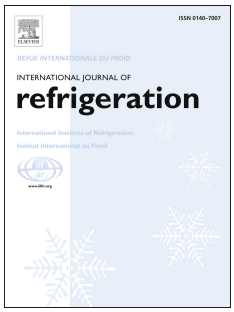

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Effect of different working gases on the performance of a small thermoacoustic Stirling engine

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Abstract

The performance of a small thermoacoustic Stirling heat engine (TASHE) was investigated with three kinds of working gases experimentally and numerically. The examined performances focused on the operating frequency, onset temperature, pressure amplitude and some temperature characteristics after onset. The working frequency with nitrogen, argon and helium as the working gas was 45 Hz, 42 Hz and 130 Hz, respectively. The engine worked with helium in a much wider range of mean pressure than with nitrogen and argon. There was an optimal mean pressure for the minimum onset temperature for each working media. Using nitrogen and argon as working gas rather than helium, another optimal mean pressure for the highest pressure ratio was obtained in the experiment. The loop dimension was indispensable in determining the frequency and the highest pressure ratio was observed in the resonator cavity.

Key words: Thermoacoustic Stirling engine; Working gases; Small-scale

1. Introduction

Thermoacoustic engines convert thermal energy from high temperature heat sources into acoustic power while rejecting waste heat to low temperature heat sources (Swift, 1995). Compared with the conventional engines or compressors that usually have pistons or rotating turbines, the thermoacoustic engines have no mechanical moving parts except the oscillating working media. In addition, the advantages such as simplicity, reliability, low cost, great potential of using low quality heat sources and environmentally-friendly gases help thermoacoustic devices develop worldwide.