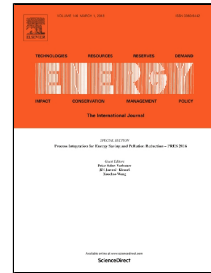


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Kun Liang



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Kun Liang

Department of Engineering and Design, University of Sussex, Brighton BN1 9QT, UK

Tel: +44 1273 678573. Email address: kun.liang@sussex.ac.uk

Abstract

Compared with conventional reciprocating compressor for vapour compression refrigeration (VCR) system, linear compressor offers higher energy efficiency and oil-free operation, which allows the use of mini/micro-channel heat exchangers. However, there are key challenges when oil-free linear compressors are used for household refrigeration with typical high pressure ratios (above 10), such as high clearance loss, high piston offset, and very non-linear gas spring. Previous papers by the author have demonstrated the feasibility of oil-free linear compressor for electronics cooling at lower pressure ratios (below 3.5). This paper presented comprehensive analysis of these issues as a key step towards developing oil-free linear compressor for household refrigeration. The model of non-linear gas spring at high pressure ratios is validated by measurements of a previous prototype linear compressor with minimum flow. Piston offset can be effectively controlled by solenoid valve at 1 Hz. Gas leakage increases by a factor of 2.5 if the piston is fully eccentric in the cylinder. The gas leakage loss can be 27% of power input for pressure ratio of 13.6 using R600a.

Keywords: linear compressor, household refrigeration, resonant frequency, gas spring, gas leakage, high pressure ratio

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