Application of 3D Printing Technology in Thermoacoustic Stack Fabrication

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Abstract:
A thermoacoustic refrigerator uses an inert gas as the working fluid instead of refrigerants; thus, considered environmentally friendly. However, its performance is still low because the desired cooling at the stack is much lower than that it was designed for. The factor has been attributed mainly to the stack, the "heart" of the system. Stack finished product has been inconsistent due to the methods available to obtain the desired geometry and dimensions even with available optimized design parameters. This paper presents performance results from stacks fabricated using 3D printing technology which minimizes the error, disposes of irregularities and can reduce production time of the stack. The temperature difference across the stack is measured to determine the performance of the thermoacoustic refrigerator. Experiments were done at 400 Hz frequency with different stack plate spacing and plate thickness, placed in a 21-mm diameter resonator. Results show that the 0.7 mm stack plate spacing with a 0.5 mm plate thickness performed better compared to those with smaller spacing at the same thickness or with the same spacing but larger thickness. The outcomes of this study have shown the need for the fabrication technology to keep pace with optimized design to realize global efforts towards a sustainable environment.

Keywords: Thermoacoustic Refrigerator; Performance; Stack; 3D Printing

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