DEVELOPMENT OF STACK COMPONENT FOR THERMOACOUSTIC REFRIGERATOR USING 3D PRINTER

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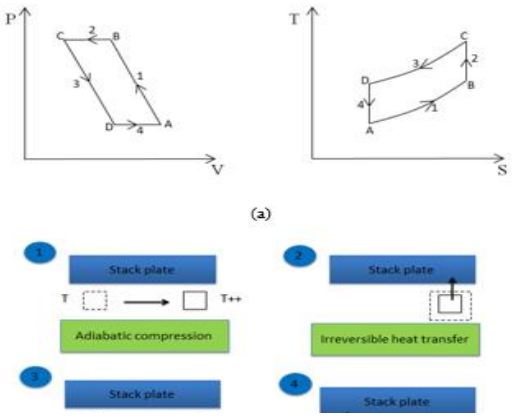
Product Background

- The development of thermoacoustic technology is motivated by the prospect that this technology will replace or reduce the dependence on the current vapor compression technology
- The thermoacoustic refrigerator is an innovative alternative for clean cooling
- The thermoacoustic effect is significant for intense sound waves in pressurized chamber. This effect can be utilized to produce a powerful engine, pulsating combustion, heat pumps, refrigerators, and mixture separators

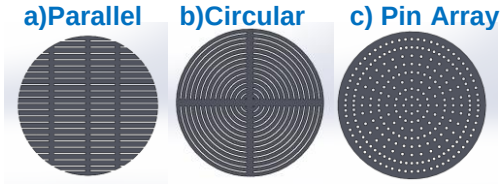


Fabrication of Stack Compenent Using 3D Printer

Property	Stack (Custome made)	Stack (Off-the-shelf)	Stack (3D Printed)
Material	Mylar	Ceramic	ABS
Thermal Conductivity (W/mK)	0.16	1.46	0.2376
Specific Heat ($Kkg^{-1}K$)	1100	1000	1000

SolidWork Design of Stack

a)Parallel b)Circular c) Pin Array

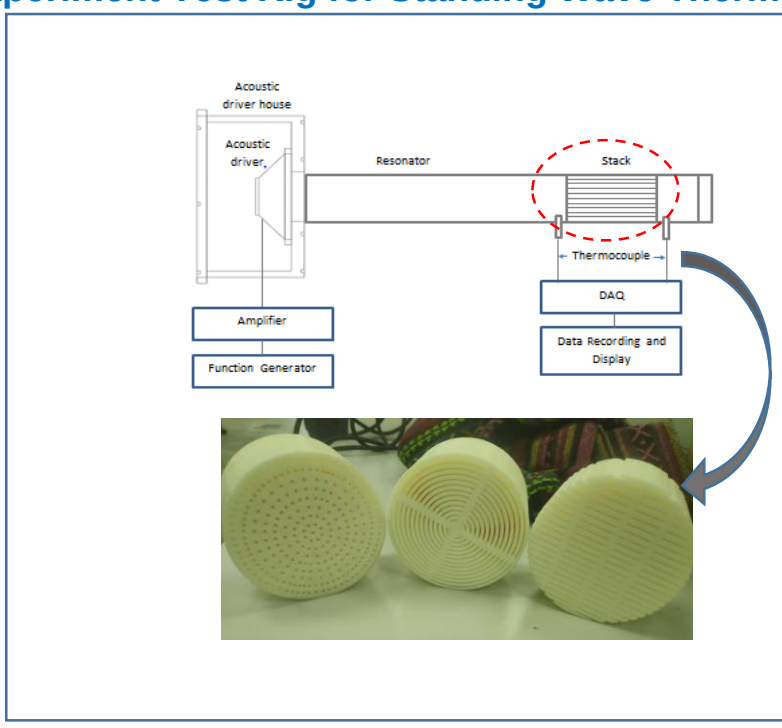


3D Printer Machine

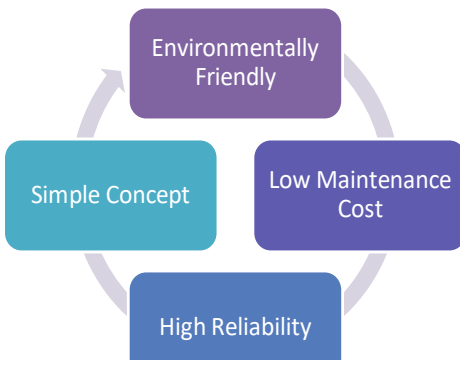
Actual Product

a)Parallel b)Circular c) Pin Array

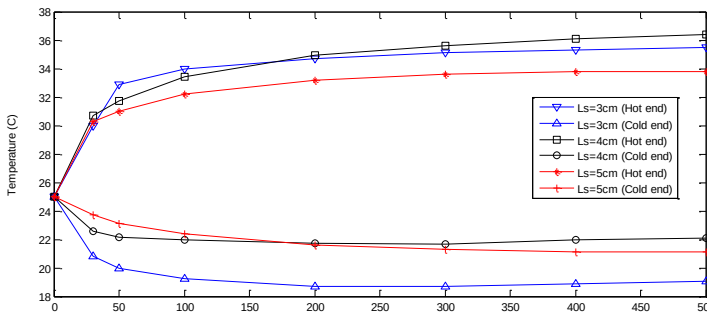
Experiment Test Rig for Standing Wave Thermoacoustic



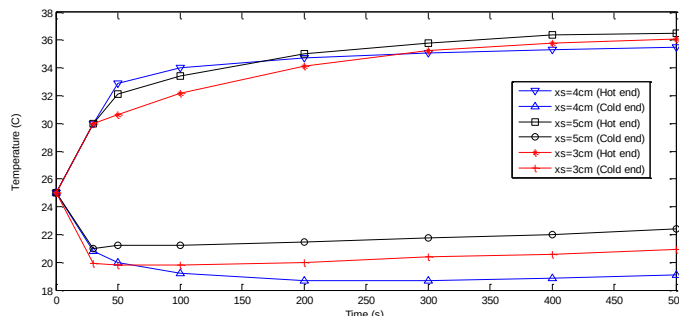
Benefits/Usefulness/Applicability



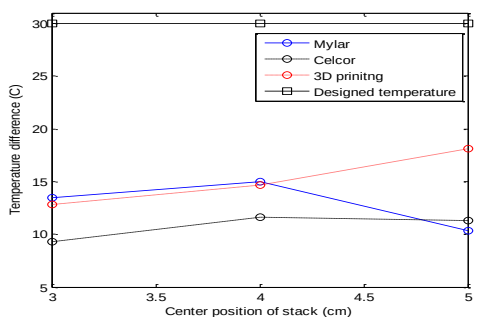
Result and Discussion



Time response of temperature with parallel (3D printed) stack with different stack length, L_s, at stack center position, x_s = 4 cm



Time response of temperature with parallel (3D-printed) stack with different stack center position, x_s , at stack length, L_s = 5 cm



The temperature difference of the stack for the length of the stack, L_s = 4 cm at different stack center position

Experiment was designed to achieve ΔT = 30 ˚C at atmospheric pressure

Mylar
ΔT = 15 ˚C
Lowest Tc = 19.2˚C
50%

Celcor
ΔT = 11.6 ˚C
Lowest Tc = 21.2˚C
38.6%

3D printing
ΔT = 18.1 ˚C
Lowest Tc = 18.7˚C
60.3 %

Conclusions

- 3D printed stack shows the best stack performance by achieving Tc = 18.9 ˚C and temperature difference ΔT = 18.1 ˚C about 60% from designed temperature difference due to the accuracy of the machine.
- The fabrication of the stack using 3D printing method shows a big potential

Acknowledgement

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Collaborator