

# Manifestation of improvement in regenerator performance of a low and high-frequency pulse tube cryocooler using layered pattern

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**Cryogenics** = Temperature < 123 K (-150 °C)

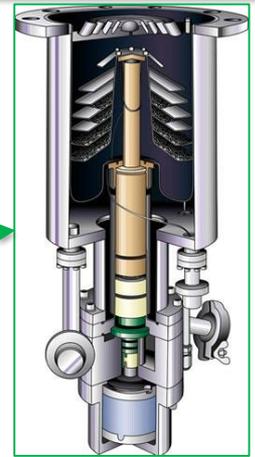
**Cryocooler** = Refrigerator working within cryogenic temperature...up to 4 K and below at times...

Based on various factors, types of cryocoolers

Wide Applications

- GM type cryocooler (low freq.)
- Stirling type cryocooler (high freq.)
- JT- cryocooler
- **Pulse tube cryocooler (PTC)**

- Cryopumps
- Cooling super-conducting coils and infrared sensors
- Space and Military equipment
- Magnetic Resonance Imaging (MRI) etc.



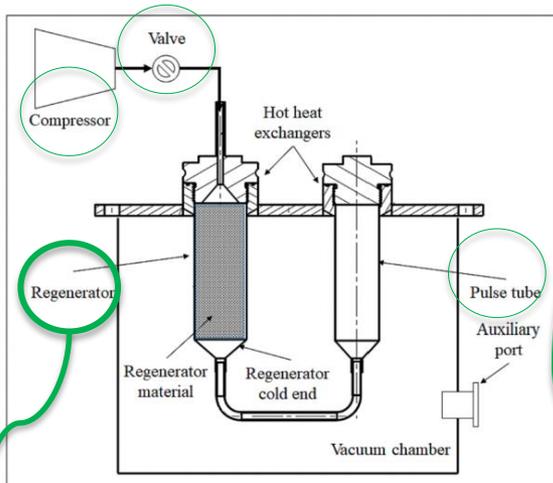
Source: Thermal Science and Engineering Progress, Vol. 45, pp. 102113, October 2023

Published Paper Link: <https://www.sciencedirect.com/science/article/abs/pii/S2451904923004651>

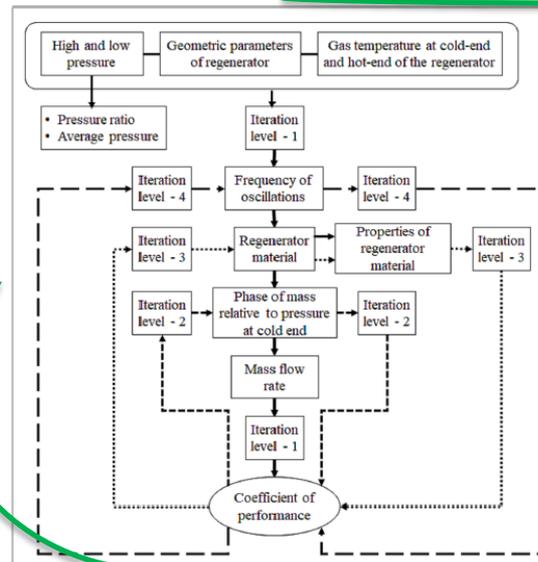
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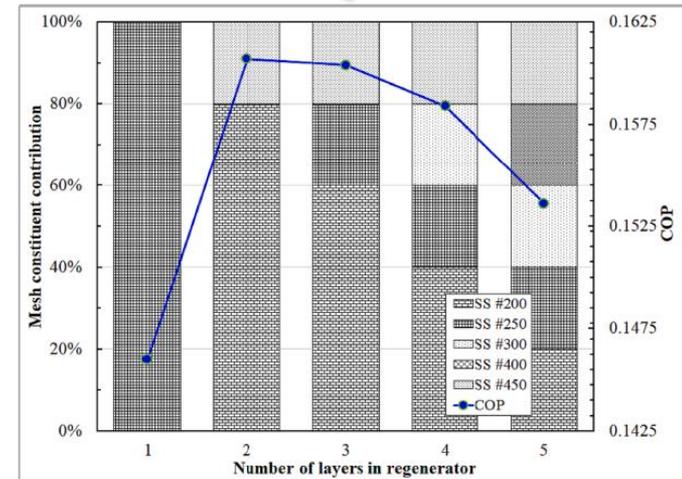
Simplified schematic showing main four components of a GM type PTC



Algorithm to optimize regenerator



Improvement in performance by using layered pattern



- It is a heat exchanger, often terms as a heart of a cryocooler
- Pivotal in achieving low temperature
- Should have high heat capacity and heat transfer characteristics, low pressure drop
- Different types of material in different configurations are used
  - SS/phosphor-bronze/Cu mesh, lead granules, rare earth materials (  $\text{Er}_3\text{Ni}$ ,  $\text{HoCu}_2$ ...)
- **Present work highlights improvement in PTC regenerator performance by using multiple material methodically...**

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