

Pulse Tube Cryocooler

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⇒ Pulse tube cryocooler technology to make and maintain thermal environment of extremely low temperature of 120 K (-153°C)

Client / Market

- Transparent electrode, flexible display, TFT backplane manufacturer

Necessity of this Technology

- For a focal plane array infrared detector used for precise thermal diagnosis and forward observation infrared system, cooling in extremely low temperature is crucial for clear imaging and high resolution time.
- A high-performance compressor is needed to develop a small size pulse tube cryocooler with low vibration and high management reliability.
- In particular, development of linear compressor is required in advance, and system technologies such as optimal function combination of the compressor and the expander.

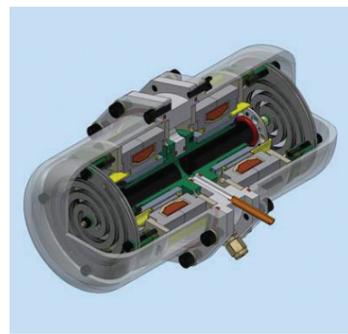
Technical Differentiation

- Thermal load issue following high density integration solved
- Contributed to low vibration and miniaturization
- Realized pulse tube cryocooler design and production technology to replace the Stirling cryocooler
- Overcame limitations regarding size and energy efficiency of cryocooler
- Completed the production of prototype of 100 W linear compressor (Size: diameter 100 mm/length 250 mm)
- Completed making of components like linear motor, cylinder/piston, gas flow line and prototype
- Verified the components making and assembly symmetry for reducing the vibration from the counter-direction moving piston
- Proposed the design to reduce the volume of the gas storage by putting the heat exchanger in the gas storage

Excellence of Technology

- Designed/Produced a coaxial pulse tube expander to replace existing Stirling cryocooler

Pulse Tube Cryocooler System



DESIRED PARTNERSHIP

Technology Transfer

Licensing

Joint Research

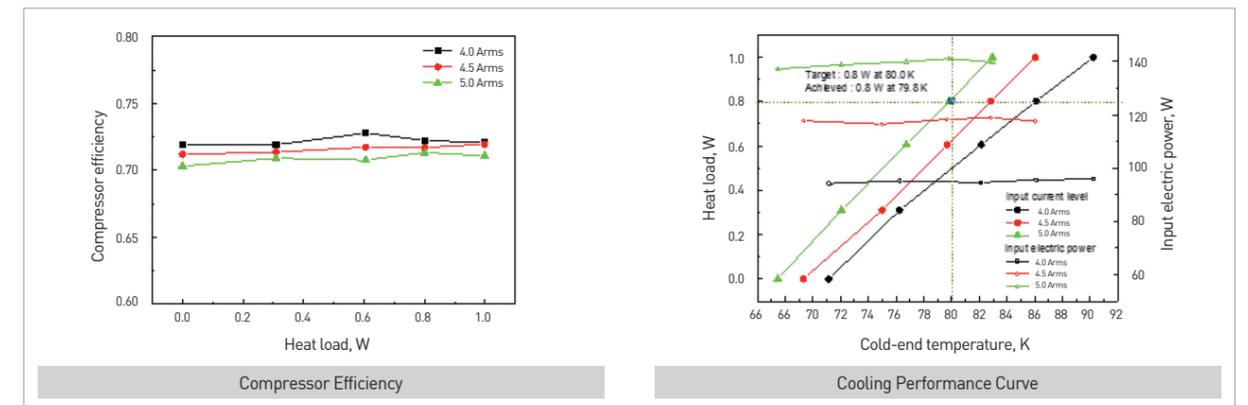
Other



TECHNOLOGY READINESS LEVEL [TRL]

Research, basic explanation | Project concept or idea development | Technology idea verification | Prototype development | Trial product production/evaluation in similar environment | Pilot field demonstration | Development and optimization of commercial model | Commercial product demonstration | Mass production and initial market launch

- Selected the design that separates the pulse tube and the regenerator to reduce the loss from temperature difference in the coaxial pulse tube expander, and made the outer pin on the high temperature part for effective heat transfer of the heat exchanger
- Improved the cooling speed delay issue by miniaturizing the lower temperature part of the expander (expander external diameter 15 mm)
- Achieved 70% efficiency of linear compressor and 0.8W (@79.8 K) expander cooling capacity



Current Intellectual Property Right Status

PATENT

- Pulse Tube Refrigerator Having Gas Storage Unit to Which Exchanger Is Attached (KR1421045)
- Heat Exchanger for Pulse Tube Refrigerator and Method for Manufacturing the Same (KR1517786)

KNOW-HOW

- Liner compressor design technology
- Linear motor electromagnetic field analysis technology
- Flexure spring design/analysis technology
- Pulse tube cryocooler performance test technology