
SESSION 6: GM & GM-Type Pulse Tube Cryocoolers

Paper No. 6-5 Wednesday Morning 10:00 AM

Development of High Cooling Capacity and High Efficiency 4.2 K Pulse Tube Cryocoolers

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Cryomech has been continuously improving both cooling capacity and energy efficiency of its 4.2 K two-stage pulse tube cryocoolers. The model PT425 was launched in March 2021, which can provide more than 2.7 W at 4.2 K on the 2nd stage with 55 W at 45 K on the 1st stage simultaneously operating on either 60 or 50 Hz power. The input powers are 13.0 kW (60 Hz) and 12.0 kW (50 Hz) at steady state. Its optimized design is based on the existing model PT420 (2.0 W at 4.2 K), without increasing the cryocooler's physical size and compressor model. It allows for swap-and-switch implementation on existing customer designs.

Meanwhile, a high efficiency 1.5 W/4.2 K two-stage pulse tube cryocooler has also been developed. The power consumption of our conventional 1.5 W/4.2 K pulse tube cryocooler (Cryomech model PT415) is 10.7 kW (60 Hz) and 9.2 kW (50 Hz) at steady state. The recently developed 1.5W/4.2 K cryocooler can provide more than 1.5 W at 4.2 K on the 2nd stage with 45 W at 45 K on the 1st stage simultaneously operating on either 60 or 50 Hz power. The power consumption is only 8.5 kW (60 Hz) and 7.3 kW (50 Hz) at steady state, which is very close to the energy efficiency of commercial 1.5 W/4.2 K G-M cryocoolers in the market.

The cooling performance and experimental results will be presented in this paper.