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## **C1Po1C-02: A new approach for low input and high capacity 4 K Gifford-McMahon cryocooler**

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Regenerative 4 K cryocoolers, such as Gifford-McMahon (G-M) and G-M type pulse tube cryocoolers, have been required for superconducting applications. A problem with these cryocoolers is the low efficiency to achieve the attainable temperature of 4 K. An electrical input of 6-7 kW is required to achieve a cooling capacity of one watt level at 4 K. To solve this problem, a new operating method, a two-stage G-M cold head driven by two 2 kW compressors connected in parallel, has been carried out. This is because we found that the specific mass flow, mass flow divided by electrical input, (g/s)/kW, of the low input compressor, such as the 2-kW class, is larger than that of the high input compressor, such as the 7-kW class. The comparison of the experimental results of the cooling capacity at 4.2 K was 1.7 W at 4.2 kW input (two 2 kW compressors) and 2.1 W at 7.0 kW input (single 7 kW compressor). The calculated relative Carnot efficiency at 4.2 K of the G-M cryocooler driven by two 2 kW compressors was 2.8%, compared to 1.4 times that of the single 7 kW compressor. From these results, this method is considered to be a new approach to achieve the low input and high capacity 4 K G-M cryocoolers.

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