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## C1Po1B-03: Influence of the structure of multi-bypass configuration regenerator on the performance of Pulse Tube Cryocooler

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As the fundamental component of the pulse tube cryocooler, the functionality of the regenerator exerts a direct influence on the overall performance of the cryocooler. In the design of a pulse tube cryocooler, two principal structural options for the regenerator are available, contingent on the specific requirements. One option is a non-variable cross-section structure, while the other is a variable cross-section structure. The advantage of the variable cross-section structure is that it allows the pulse tube cryocooler to increase the cold end heat exchanger at the variable cross-section for cooling, thereby enabling the cryocooler to operate in different temperature zones. Furthermore, the structure of the variable cross-section must incorporate a multi-bypass configuration at the variable cross-section region of the regenerator, with the objective of enhancing the phase modulation capacity of the inertial tube. Consequently, the mass of gas entering the cold end heat exchanger is reduced, which in turn diminishes the cooling capacity. The variable section structure presented in this paper is based on the design and processing experience of the single-stage pulse tube cryocooler. The design parameters are as follows: the diameter of the primary regenerator is 16 mm, with a filling length of 40 mm; the diameter of the secondary regenerator is 10 mm, with a length of 30 mm; and the packing of the regenerator is comprised of #500 and #635 stainless steel screens. The cryocooler was subjected to testing under varying charge pressures. At an input power of 100 W, a charge pressure of 4.2 MPa, a hot end temperature of 300 K and an operating frequency of 92 Hz, a minimum temperature of 32.16 K and a cooling capacity of 1 W at 44.44 K can be achieved.

Keywords: multi-bypass · regenerator · cold end heat exchanger · 4.2 MPa · 92 Hz

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