Research of a High Capacity Coaxial Pulse Tube Cryocooler Working at 170 K

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A high cooling capacity coaxial PTC working at middle temperature is designed by SAGE software, and the outer diameter and the length of the regenerator are 40mm and 32 mm, respectively. As the cold finger structure is short and thick, the jet flow from the inertial tube can obviously affect the flow field in the pulse tube and influence the cooling performance of the cold finger. In order to analyze the hot-side flow straightener on the fluid flow in the pulse tube and the cooling capacity of the PTC, a two-dimensional axisymmetric CFD model is built using FLUENT software to prove the importance of the flow straightener. A test system is built to investigate the cooling performance of the manufactured PTC and study the influence of the mesh number of the straightener on the cooling capacity. The experimental results show that when a 100ss mesh is applied in the hot-side flow straightener, the PTC achieves the best performance. With an electric power of 200W added to the compressor, the PTC obtains a no-load temperature of 59K and a cooling power of 45 W at 170 K, and the system efficiency can reach 22.5%.