

1.5 W@47.7 K high frequency lightweight coaxial Pulse Tube Cryocooler

Abstract. Human space exploration is becoming more frequent with the rapid development of modern space technology. The pulse tube cryocooler is an indispensable part of the space probe, but the cost of launching space probes restricts their volume and weight. Therefore, it is particularly important to improve the performance of the pulse tube cryocooler under the premise of limited volume and weight. This paper develops on a single-stage, high frequency, lightweight coaxial pulse tube cryocooler. This cryocooler is driven by a linear compressor with a total mass of 2.5 kg, using the inertance tube and gas reservoir as phase shifters. The cold finger has a diameter of 14 mm and a length of 55 mm. At an operating frequency of 102 Hz, an input power of 100 W, a hot end temperature of 293 K and a charge pressure of 6 MPa, a minimum temperature of 31.7 K and a cooling capacity of 1.5 W at 47.7 K can be achieved. In this paper, the related parameters that affect the performance of the cryocooler are introduced in detail, which are mainly charge pressure, hot end temperature and cold finger direction.

Keywords: pulse tube cryocooler ·charge pressure ·lightweight ·coaxial ·102 Hz

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