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Cold inertance tube for 4 K Stirling type pulse tube cryocoolers

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The losses in the regenerator are minimized when the amplitude of the mass flow is minimized for a given acoustic power which requires that the mass flow lags the pressure by about 30° at the cold end of regenerator. The phase shift provided by an inertance tube is strongly influenced by the temperature of the inertance tube and the acoustic power at the cold end of the regenerator. For a 4 K Stirling type pulse tube cryocooler, the acoustic power at the cold end of the regenerator decreases significantly with the temperature thereby it's difficult to achieve ideal phase relationship with ambient inertance tube as phase shifter. While cold inertance tube provide a larger phase shift in that the viscosity of the working fluid decreases and the density increases as the temperature decreases. However, use of cold inertance tube increases additional heat load to the regenerator. Therefore it's of great significance to determine when a cold inertance tube should be used. In this paper effect of temperature of inertance tube is calculated for a 4 K Stirling type pulse tube cryocooler with different acoustic powers at the cold end. A comparison of ambient temperature inertance tube and cold inertance tube is made and the results are presented.

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