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Development of Regression Model for the compressor of Mixed Refrigerant J-T cryocooler

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Content :

Joule-Thompson Cryocooler works on Vapour Compression Refrigeration (VCR) cycle to produce cold. J-T Cryocoolers are similar to conventional refrigerator with working fluid which is appropriate to produce cryogenic temperatures. Use of mixtures in J-T cryocoolers is getting popular because of various advantages that it offers, most appealing of it being the reduction in the pressure ratio. Such cryocoolers are referred to as Mixed Refrigerant Joule Thompson Cryocooler or MRJT. Compressor used for MRJT can be a normal refrigeration compressor which is available of the shelf and cost efficient. Due to pressure ratio of about 10 during the transient phase there is a large rise in temperature of the compressor because of heat of compression. To prevent this it is proposed have two stage compression process instead single stage compression process. A simple steady state theoretical model is developed for hermitic compressor using fundamental principles of thermodynamics and experimental data for (MRJT) Cryocooler. The compressor overall efficiency and polytropic index of the gas mixture are modelled as operating parameters. Expressions relating overall efficiency of the compressor and polytropic index are expressed as a function of operating parameters using regression model. The data for development of regression model was obtained experimentally.

Keywords: Cryocooler, Compressor, MRJT

Summary :

Analysis of Compressor of a Mixed Refrigerant J-T cryocooler is done using regression model. Experimental data is used to develop the regression model. Overall efficiency of the compressor and polytropic index of working fluid are modelled. developed model is used to convert single stage compression process to two stage compression process to avoid excessive heating.

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