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Performance Analysis of Joule-Thomson Cooler Supplied with Gas Mixtures

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Joule-Thomson (J-T) cryo-coolers working in closed cycles and supplied with gas mixtures are the subject of intensive research in different laboratories. The replacement of pure nitrogen by nitrogen-hydrocarbon mixtures allows to improve both thermodynamic parameters and economy of the refrigerators. It is possible to avoid high pressures in the heat exchanger and to use standard refrigeration compressor instead of gas bottles or high-pressure oil free compressor. Closed cycle and mixture filled Joule-Thomson cryogenic refrigerator providing 50 W of cooling power at temperature range 90-100 K has been designed and manufactured. Thermodynamic analysis including the optimization of the cryo-cooler mixture has been performed with ASPEN HYSYS software. Preliminary tests has shown instability of the cooler working parameters. The paper describes the design of the cryo-cooler and provides thermodynamic analysis of the system. The test results are presented and discussed.

Primary author: Dr PIOTROWSKA, Agnieszka (Wroclaw University of Technology)

Co-authors: Prof. CHOROWSKI, Maciej (Wroclaw University of Technology); Mr DOROSZ, Pawel (Wroclaw University of Technology)

Presenter: Dr PIOTROWSKA, Agnieszka (Wroclaw University of Technology)

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