"Thermal Fluids Analysis of Choked Flow in a FAME-MLL Ejector"

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**ABSTRACT:**

This interdisciplinary TFAWS paper will present thermal and fluid flow analysis of the choked flow limit of a Fatty Acid Methyl Ester Methyl Linoleate (FAME-MLL) ejector. The unique aspect of this study is that it presents thermal fluids analysis of a commonly used device, the ejector, but with a unique working fluid, FAME-MLL. The FAME-MLL is a supercritical bio-diesel natural refrigerant working fluid used in a the topping cycle of a cascaded NH3/FAME-MLL vapor compression refrigeration systems developed for use in high pressure, high temperature environments such as Venus to provide active thermal control as presented in [1]. The use of ejectors in vapor compression refrigeration cycles is proliferate in the refrigeration industry by increases the cycle COP (i.e. reduce power requirement on FAME-MLL compressor) by compressing a low pressure fluid with a high pressure fluid. The flow across the ejector is typically quantified by an entrainment ratio, w = entrained flow rate / primary flow rate. The analysis was carried out using MATLAB and COOLPROP. COOLPROP is the thermophysical properties database used to compute the FAME-MLL thermal-fluids property data. The current paper examines the compressible flow choked flow limits of the FAME-MLL for various entrainment ratios. Results for critical pressure ratio, choked mass flow rate and choke flow curves performance are presented herein. The results of the paper are useful for the design of an ejector based vapor compression refrigeration system as they shed light on typical operational parameter ranges which can be expected during operation.

[1] Anderson, Kevin R., Thomas J. Gross, Christopher McNamara, and Ariel Gatti. "Thermodynamic Analysis of a Cascade Refrigeration Cycle for Venus Lander Electronics Cooling." Journal of Thermophysics and Heat Transfer 33, no. 3 (2019): 762-772.

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