RANS TURBULENCE MODELS PERFORMANCE TO PREDICT HEAT TRANSFER CHARACTERISTICS OF LOW GWP FLUIDS FLOW IN MICROCHANNELS

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ABSTRACT

This paper evaluates the capacity of the following turbulence models: standard k - ε, RNG k - ε, k - ω standard, k - ω SST, Realizable k - ε and Low-Re k - ε to predict the fluid mechanics and heat transfer characteristics of low GWP fluid flow in a 1.1 mm ID microchannel. These turbulence models were evaluated for Reynolds Numbers up to 10^4. The numerical results for velocity profile, friction factors and Nusselt Numbers are validated with analytical and experimental data published in previous works for R134a, R1234yf, R1234ze(E) and R600a. Parametric behaviors of pressure drop and heat transfer coefficient are presented and analyzed. The results indicate that each of the models describes the qualitative behavior of flow and heat transfer processes. On the other hand, the quantitative results indicate that the Low-Re k - ε, k - ω and k - ω SST models demonstrate an acceptable prediction of some variable's behavior. Numerically, the Low-Re k - ε model presents an accurate prediction with the lowest mean absolute.

Keywords: Turbulence, Microchannels, Numerical, Pressure Drop, Heat Transfer.

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