

The Measurements of Saturation Vapor Pressures, and the Critical Pressure for Trifluoroiodomethane (CF₃I, R1311) and a Vapor Pressure Correlation

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Trifluoroiodomethane (CF₃I, R1311) is a low GWP (< 1) and low ODP (< 0.009) refrigerant which was initially explored in the late 1990's as a potential fire suppressant in the aerospace industry. ASHRAE has since then updated its classification as an A1 refrigerant, with low toxicity and no flame propagation. CF₃I could thus be a suitable component for refrigerant mixtures with HFCs, HFOs and other refrigerants which possess relatively high GWPs or high flammability. Therefore, accurate thermophysical properties for wider temperature ranges especially towards the creation of a more accurate equation of state are desirable. The saturation vapor pressure measurements for CF₃I were carried out for the temperature range of 240 K to its critical temperature. Two isochoric apparatus were employed to measure the vapor pressures. Measurements from 240 K to 300 K were carried out using a newly built isochoric setup giving uncertainties of ± 0.8 kPa and ± 30 mK. An existing isochoric apparatus was used for measurements above 300 K to the critical temperature at an uncertainty of ± 1.0 kPa and ± 5 mK, with a coverage factor of 2. Utilizing the latter together with a CF₃I sample charged at the critical density, the critical pressure was found to be 3971 kPa. Twelve pressure-temperature data points below 300 K and 17 data points for temperatures between 300 K and the critical temperature were then employed to formulate a saturation vapor pressure correlation using the Wagner "2.5,5" type equation. The fitted parameters for the correlation can predict vapor pressures within an absolute average deviation of 0.051% while the acentric factor is 0.1767.