Experimental Compressed Liquid Density Measurements and Correlation of the Binary Mixture {3,3,3-Trifuoropropene (R1243zf) + Isobutane (R600a)}

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In the context of evolving regulations such as the F-gas Regulation and the Kigali Amendment to the Montreal Protocol, the exploration of alternatives to fluorinated greenhouse gases in air conditioning and refrigeration has garnered significant attention. Essential attributes sought in viable refrigerants encompass low Global Warming Potential (GWP), thermodynamic cycle efficiency, non-flammability, non-toxicity, material compatibility, and cost-effectiveness. Hydrofluoroolefins (HFOs) have emerged as promising replacements for hydrofluorocarbons (HFCs) and hydrochlorofluorocarbons (HCFCs) in HVAC and refrigeration systems. Simultaneously, the quest for low GWP refrigerants has prompted a revaluation of hydrocarbons (HCs) like propane (R290) and isobutane (R600a), renowned for their efficiency, minimal charge requirements, and affordability, despite their flammability. While extensive data and reliable Equations of State (EoS) are available for HCs, HFOs and their mixtures with HCs lack comprehensive information. This study contributes empirical measurements on the compressed liquid density of the {3,3,3-trifluoropropene (R1243zf) + isobutane (R600a)} binary system. Utilizing a vibrating tube densimeter, measurements were conducted on three mixture compositions within the temperature range of 283.15 K to 353.15 K and at pressures ranging from near saturation to 35 MPa. The obtained dataset, combined with existing literature data, served as the basis for a new mixture model developed using the Helmholtz-energy-explicit EoS. This model accurately represents the behaviour of the binary mixture, enhancing the available understanding of its thermodynamic properties.