

The p-ρ-T Behavior of Propane from 265 to 500 K with Pressures to 36 MPa

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The pressure-density-temperature behavior of high-purity (99.999 %) propane was measured from 265 to 500 K with pressures to 36 MPa using a two-sinker densimeter. The measurements extend from low-density vapor to compressed liquid states, and the near-critical region was covered extensively. Vapor pressures from 270 to 369 K have also been measured. Uncertainty ($k = 2$) in density is $\pm (0.0025 \% + 0.0006 \text{ kg/m}^3)$ at 293 K, increasing to $\pm (0.02 \% + 0.001 \text{ kg/m}^3)$ at 500 K. The uncertainties in temperature and pressure are 0.004 K and 0.01 %, respectively. The apparatus is described and the uncertainties in the measurements and their traceability to fundamental SI quantities are discussed. The analysis accounts for the force transmission error in the magnetic suspension coupling of the densimeter and includes corrections for vertical density gradients in the measuring cell.

Propane is an excellent fluid for the development of standard reference equations of state, and these data, together with new C_v data measured at NIST and carefully selected literature data, have been used to develop an equation of state covering the entire fluid region from the triple point temperature of 85.48 K to 520 K with pressures to 1000 MPa. The C_v measurements and equation of state are described in companion papers.