Molar Heat Capacity at Constant Volume [C_v] for n-Butane at Temperatures from 142 to 342 K at Pressures to 33 MPa

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Measurements of the molar heat capacity at constant volume [C_v] are presented. Temperatures ranged from 142 to 342 K for pressures up to 33 MPa. Measurements were conducted on liquid in equilibrium with its vapor and compressed liquid samples. The high purity of the samples was verified by chemical analysis.

In the adiabatic technique used, the heat capacity is derived from the ratio of the heat applied to the sample in an adiabatic cell and the resulting temperature rise. Temperature and pressure are recorded prior to and after a heating interval. The density is determined from the sample mass and the volume function of the calorimeter cell. Calorimetric results were obtained for two-phase [$C_v^{(2)}$] , saturated liquid [C_σ or C'_x] , and single-phase [C_v] molar heat capacities as functions of measured temperature, pressure, and density. In total, 87 two-phase and saturated liquid and 151 single-phase heat capacities are presented. They were obtained on two samples at nine different filling densities. For the validation of the analysis of uncertainties, steady-state density measurements were conducted for the same samples at the same densities as the heat capacity experiments. For both the steady-state and the transient methods, (p,T)-conditions were matched on five of the nine isochores. The densities measured coincide within their combined uncertainties, demonstrating that the sample in the calorimeter cell is in thermodynamic equilibrium prior to and after a heating interval.

Comparisons are given with heat capacity data found in the literature and the equation of state by Younglove and Ely (1987). Results agree within their combined uncertainties. The principal sources of uncertainty for the presented heat capacities are the estimated temperature rise and the change-of-volume work adjustment. The expanded uncertainty for C_v is estimated to be 0.7%, for $C_v^{(2)}$ it is 0.5%, and for C_σ it is 0.7%.

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