Heat Capacity of Saturated and Compressed Liquid Dimethyl Ether at Temperatures from (132 to 345) K and at Pressures to 35 MPa: Measurements and Derived Equation of State

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Molar heat capacities at constant volume (C_v) of dimethyl ether have been measured with an adiabatic calorimeter [1]. Temperatures range from the triple point to 345 K, and pressures up to 35 MPa. Measurements were conducted on the liquid in equilibrium with its vapor and on compressed liquid samples. The samples are of high purity, as verified by chemical analysis. Calorimetric quantities are reported for the two-phase ($C_v^{(2)}$), saturated-liquid (C_σ or C_x'), and single-phase (C_v) molar heat capacities. Low temperature $C_v^{(2)}$ data were employed to estimate vapor pressures for values less than 100 kPa by applying a thermodynamic relationship between the two-phase internal energy $U^{(2)}$ and the temperature derivatives of the vapor pressure. Vapor pressures were calculated at temperatures as low as the triple-point temperature. The principal sources of uncertainty are the temperature rise measurement and the change-of-volume work adjustment. The expanded relative uncertainty (with a coverage factor k=2 and thus a two-standard uncertainty estimate) is estimated to be 0.7 % for C_v , 0.5 % for $C_v^{(2)}$ and 0.7 % for C_σ . NIST's *ThermoData Engine* [2] software (TDE) was used to compare the new measurements with published data. Comparisons were facilitated by a simple 12-coefficient equation of state that was derived with TDE's multiproperty-fitting method by combining thermodynamic property measurements for heat capacity, density, vapor pressure, speed of sound, plus their standard uncertainties. The derived equation of state could be useful to practicing engineers for industrial process calculations.

References

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