Determination of Residual and Absolute Energy and Entropy Values from Isochoric Experimental Data

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Accurate *P-ρ-T* measurements, ideal gas properties, and $(dP/dT)_\rho$ values combined with experimental energy and entropy values are necessary for the validation, improvement and development of reference equations of state (EoS). This work presents a novel methodology to determine the energy and entropy values from isochoric data. A mathematical treatment that accounts for the noxious volume effects and *P-ρ-T* changes allows transforming the experimental (*dP/dT*) value into the true $(dP/dT)_\rho$. The resulting values fit to polynomials permit calculation of residual and absolute values for energy and entropy using analytic integration. Data treated simulate a residual gas (95 % C_1, 4 % C_2, 1 % C_3) and four synthetic natural gas-like mixtures. The experimental results are compared to RefProp 8.0 EoS predictions. The Helmholtz and Gibbs energy present the lowest deviations with ±0.2 % and ±0.1 %, respectively.