New Formulation for the Viscosity of Propane

Eckhard Vogel[a)]
Institut für Chemie, Universität Rostock, D-18059 Rostock, Germany

Sebastian Herrmann
Fachgebiet Technische Thermodynamik, Hochschule Zittau/Görlitz, D-02763 Zittau, Germany

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A new viscosity formulation for propane, using the reference equation of state for its thermodynamic properties by Lemmon *et al.* [J. Chem. Eng. Data **54**, 3141 (2009)] and valid in the fluid region from the triple-point temperature to 650 K and pressures up to 100 MPa, is presented. At the beginning, a zero-density contribution and one for the critical enhancement, each based on the experimental data, were independently generated in parts. The higher-density contributions are correlated as a function of the reciprocal reduced temperature $\tau = T_c/T$ and of the reduced density $\delta = \rho/\rho_c$ (T_c—critical temperature, ρ_c—critical density). The final formulation includes 17 coefficients inferred by applying a state-of-the-art linear optimization algorithm. The evaluation and choice of the primary data sets are detailed due to its importance. The viscosity at low pressures $p \leq 0.2$ MPa is represented with an expanded uncertainty of 0.5% (coverage factor $k = 2$) for temperatures $273 \leq T/\mathrm{K} \leq 625$. The expanded uncertainty in the vapor phase at subcritical temperatures $T \geq 273$ K as well as in the supercritical thermodynamic region $T \leq 423$ K at pressures $p \leq 30$ MPa is assumed to be 1.5%. In the near-critical region ($1.001 < 1/\tau < 1.010$ and $0.8 < \delta < 1.2$), the expanded uncertainty increases with decreasing temperature up to 3.0%. It is further increased to 4.0% in regions of less reliable primary data sets and to 6.0% in ranges in which no primary data are available but the equation of state is valid. Tables of viscosity computed for the new formulation are given in an Appendix for the single-phase region, for the vapor–liquid phase boundary, and for the near-critical region. [http://dx.doi.org/10.1063/1.4966928]

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a)Electronic mail: eckhard.vogel@uni-rostock.de.