

New Formulation for the Viscosity of Isobutane

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A new viscosity formulation for isobutane, valid in the fluid region from the triple point to 650 K and to 100 MPa, is presented. It employs the reference equation of state by Bucker and Wagner [J. Phys. Chem. Ref. Data **35**, 929 (2006)] and uses the residual quantity concept, in which the contributions for the zero-density viscosity and for the initial-density dependence were separately generated, while those for the critical enhancement and for the higher-density terms were pretreated. The contributions are formulated as a function of the reciprocal reduced temperature τ and the reduced density δ . The primary datasets used when developing the individual contributions were carefully evaluated. The final formulation includes 16 coefficients fitted with a state-of-the-art linear optimization algorithm. The expanded uncertainty (coverage factor $k = 2$) is estimated to be 0.5% at low pressures $p \leq 0.2$ MPa and at temperatures $298 \leq T/\text{K} \leq 627$. In the vapor phase at subcritical temperatures $T \geq 298$ K as well as in the supercritical region $T \leq 498$ K at pressures $p \leq 30$ MPa, the expanded uncertainty is given as 1.5%. It is increased to 4.0% and 6.0%, respectively, in regions where less reliable primary data exist. Moreover, it is assumed to amount to 6.0% in ranges in which primary viscosity datasets are not available, but the equation of state is valid. In the near-critical region, a value of the expanded uncertainty was not given because of a weakness of the reference equation of state and due to a possibly too small result for the critical enhancement of the viscosity experimentally found. Viscosity tables for the new formulation are given for the single-phase region, for the vapor-liquid phase boundary, and for the near-critical region. *Published by AIP Publishing on behalf of the National Institute of Standards and Technology.* <https://doi.org/10.1063/1.5057413>

Key words: correlation; critical enhancement; fluid phase; isobutane; viscosity; viscosity tables.

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