Measurement, Correlation, and Modeling of the Viscosity of Saturated Liquid R227ea, R245ca, and R245fa

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Fluorinated propane isomers are being investigated as potential substitutes for CFC-11 and CFC-114. Complementing earlier viscosity measurements on R236ea and R236fa, further measurements were carried out in two modified and recalibrated capillary viscometers on saturated liquid R227ea (1,1,1,2,3,3,3-heptafluoropropane), R245ca (1,1,2,2,3-pentafluoropropane), and R245fa (1,1,1,3,3-pentafluoropropane) in the combined temperature range 248 - 348 K. The uncertainty of the results is estimated at ±3%.

Literature viscosity data are still very scarce for these fluorinated propane isomers. The experimental results are compared with values predicted via the extended corresponding states model in NIST Standard Reference Database 23 (REFPROP). The agreement ranges generally within the estimated uncertainty of the experimental results. The viscosity data of all five measured fluids are also analyzed in terms of the rough hard-sphere model which may also provide for reliable extrapolations beyond the range of the experimental data, especially to higher densities and/or lower temperatures. Derived values for the roughness factor R_η and the temperature dependence of the close-packed volume $V_0(T)$ are examined to see if they do reflect the molecular constitution of the homologous compounds correctly.