

Thermal Conductivity of Ethanol + Rape Oil Mixtures at High Temperatures and High Pressures

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The thermal conductivity of ethanol + rape oil mixtures have been measured with a hot-wire method. The measurements were made in the temperature range from 273 K to 373 K at pressures up to 30 MPa for the concentration from 0 to 100 wt % of ethanol. The total experimental uncertainty of pressure (P), temperature (T), concentration (x), and thermal conductivity (λ) were estimated to be 0.05 %, 15 mK, 0.01 %, and 1.6 %, respectively. To check the accuracy of the method, correct operation of the apparatus, and confirm the reliability of the measured values of thermal conductivity, the measurements were made on pure water, toluene, and air in the temperature range from 273 K to 363 K and at pressures up to 30 MPa. The results for thermal conductivity were compared with more accurate reported data and reference data. In general the agreement between the present thermal conductivity data and majority reported data is within our uncertainty (1.5 % to 2.0 %). The temperature, pressure, and concentration dependences of the mixtures will be discussed. The deviations, $\Delta\lambda = \lambda_{exp}(P,T) - x\lambda_{eth}(P,T) - (1-x)\lambda_{oil}(P,T)$, of the measured thermal conductivity data, $\lambda_{exp}(P,T)$, for the mixtures from the ideal mixtures values calculated using reference data for the pure components were analyzed. The measured thermal conductivity data for ethanol + rape oil mixture were used to develop correlation equation.