

Speed of Sound Measurements in Liquid and Supercritical Ethane

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Ethane is an important fluid with many applications. It occurs as a secondary component in natural gas or as a byproduct in petroleum refining and is used as basic component for ethylene production. Moreover, it is often employed as a reference fluid in thermophysical property research to develop equation of state models or to validate models for intermolecular forces, which are applied in molecular simulations. Therefore, the precise knowledge of the thermodynamic properties of ethane is desirable. There are several data sets for the speed of sound in ethane reported in the literature, but these data cover only parts of the technically interesting fluid region of the phase diagram. Especially at high pressures above 35 MPa and temperatures above 325 K the speed of sound has not been measured before. It is the aim of this work to fill this gap. Thus, the speed of sound in liquid and supercritical ethane was measured with a double-path-length pulse-echo technique. Measurements were taken on ten isotherms in the temperature range between 240 K and 420 K with pressures up to 100 MPa. The measurement uncertainties are estimated to be 3 mK for temperature, 0.005 % for pressure, and 0.03 % for speed of sound. The purity of the ethane sample was verified by analysis with a gas chromatograph. Comparisons with literature data and equation of state models demonstrate the high accuracy of our measurements. The new speed of sound data are represented by a correlation function, whose functional form was found by the method of structural optimization.