

Speed of Sound Measurement for HFO Refrigerants in the Liquid Phase

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The reliable Helmholtz energy equations of state are formulated with highly accurate and extensive thermophysical property data, and the liquid phase speed of sound is one of the essential thermophysical properties. On the other hand, hydrofluoroolefins (HFOs) are promising candidates for next-generation refrigerants, which are characterized by low global warming potential, low ozone depleting potential. In this study, speeds of sound in the liquid phase of HFO-1336mzz(Z), HFO-1233zd(E) and HFO-1224yd(Z) were measured by a pulsed ultrasonic sensor. The measurement was carried out at temperatures from 20° C to 100° C and pressures from near the saturation pressure to 10 MPa. Applying a pressure compensation based on an accurate equation of state for HFO-1336mzz(Z), this work attained high-precision measurement of speeds of sound in the liquid phase. The measurement results for HFO-1233zd(E) are in good agreement with the values of Lago et al.. However, differences of about 0.5% are observed from the NIST values, and this is probably due to the differences in sample purity.