

Gaseous Speed of Sound Measurements for R600a, R744 and Mixtures of R600a/R744 using a Cylindrical Resonator

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The speed-of-sound data was measured in gaseous R600a, R744 and binary mixtures of R600a/R744 with R600a mole fractions of $x_1=0.47$ and $x_1=0.26$ along three isotherms from (310 to 330) K and at pressures up to 1000 kPa using a cylindrical resonator. The CO₂ sample was obtained from Beiwen Gas Corp. with a stated mole purity of 99.995%, and the isobutane sample was obtained from Kedi Gas Corp. with a stated mole purity of 99.99%. The cylindrical resonator length and radius were calibrated with pure argon. The pure longitudinal frequency modes (200), (300) and (400) were used to calculate the speed of sound. The perturbations from the thermal and viscosity boundary layers, the shell motion, the fill duct and the vibration relaxation were considered and corrected in the frequency measurements. The experimental uncertainties in the temperature, pressure and speed of sound were estimated to be less than 5 mK, 200 Pa and 0.02%, respectively. The acoustic virial coefficients were deduced from the speed of sound data. The second virial coefficients were then obtained from the acoustic virial coefficients and the square-well intermolecular model.