Speed of Sound Measurements and Derived Thermodynamic Properties of Gaseous Propylene

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Propylene is expected to be a long-term alternative refrigerant which has low global warming potential. In this paper, the speed of sound in gaseous propylene with mole purity of 99.99% was measured along eight isotherms from 260 to 330 K and pressures up to 1 MPa using a cylindrical resonator. The length and radius of the cylindrical resonator were calibrated with argon. The longitudinal frequency modes (200), (300) and (400) were used to calculate the speed of sound. The perturbations from the thermal and viscosity boundary layer, fill duct, shell motion and vibrational relaxation were considered and corrected in the frequency measurements. The experimental uncertainties in the temperature, pressure and speed of sound were estimated to be not more than ±5 mK, ±200 Pa, and 0.01%, respectively. The ideal-gas heat capacities and the acoustic virial coefficients of propylene were deduced from the speed of sound data. The density virial coefficients were obtained from the acoustic data and the square-well intermolecular model. Moreover, the thermodynamic properties of the propylene, including the compressibility factors and the isobaric and isochoric heat capacities which relate with speed of sound were calculated by a numerical integration method in the region where the speed of sound was measured.