

Speed of Sound Measurements of 2-Ethoxy-2-Methylpropane and 2-Methoxy-2-Methylbutane by Spontaneous Brillouin Light Scattering (BLS)

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Oxygenated compounds are increasingly added to gasoline to increase their octane number. It can also improve engine efficiencies and decrease NO_x, carbon monoxide and unburned hydrocarbons emission. Commonly used oxygenates include aliphatic alcohols and methyl ethers. 2-ethoxy-2-methylpropane (ETBE) and 2-methoxy-2-methylbutane (TAME) have been considered as the potential fuel additives as the replacement of 2-Methoxy-2-methylpropane (MTBE), so the knowledge of their thermophysical properties is very important. Speed of sound is one important acoustic property. It affects directly the fuel injection characteristics and the amount of NO_x emissions. Speed of sound also permits the estimation of other thermodynamic properties like isentropic and isothermal compressibility, isobaric thermal expansion coefficient, thermal pressure coefficient and the reduced bulk modulus. The speed of sound of ETBE and TAME were measured by employing a spontaneous Brillouin light scattering (BLS) technique. The standard experimental uncertainties in temperature and pressure are 0.016 K, 0.015MPa for $p < 5.5\text{MPa}$ and 0.03MPa for $p > 5.5\text{MPa}$, respectively. The relative expanded uncertainty in speed of sound was estimated to be less than 0.5% over the whole investigated thermodynamic range. The coverage factor of k was taken to be 2. The sound speed of saturated n-pentane was measured to verify the experimental system. The experimental results agree well with the sound speed calculated from the multi-parameters EOS proposed by R. Span and W. Wagner(2003). So the speed of sound of ETBE and TAME (mass fraction quoted from Aladdin, > 0.990, GC) were measured at temperatures ranging from 298.15 to 773.15 K and pressure up to 8.5 MPa, including saturated liquid/vapor, compressed liquid and supercritical region. More than 400 new experimental data on the speed of sound of ETBE and TAME were provided. The polynomial representations for sound speed were proposed by employing the experimental results.