Viscosity of Binary Mixtures of Methane and Butane from (200 to 423) K and Pressures between (10 and 31) MPa

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An apparatus to measure the viscosity of gases using a wire clamped at both ends has been constructed. The analysis includes methods that reduce the uncertainty of the reported viscosity. The performance of the apparatus and model have been verified by measuring the viscosity of pure gases methane, carbon dioxide, and nitrogen, and relative deviations from literature are all less than 1 %. Further, more stringent tests of the apparatus using the viscosity ratio of two gases show less than 0.4 % difference from literature. A commercial vibrating tube densimeter has been installed to enable the measurement of the density of the same mixture simultaneously with the viscosity measurement, which eliminates the reliance on an equation of state to calculate viscosity. The viscosity was obtained from both the steady state and ring-down (transient response) techniques and compared, and an analysis performed on the optimal regimes for each measurement method. In addition, a novel measurement technique is presented which allows accurate measurements of the transient response without requiring a fast data acquisition system. We also present results of the viscosity of a binary gas mixture of methane

and butane from (200 to 423) K and pressures between (10 and 31) MPa along with a comparison with literature values as deviations from the extended corresponding states model implemented in REFPROP 9.1.