Measurements and Uncertainties of Biofuels Viscosities at High Pressure Using an Automated Viscometer

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The promotion of biofuels as a measure for decreasing dependency on oil products as well as CO_2 emissions has been adopted by the European Union, and it is also a support of the agriculture sector. There is a wide range of products of biological origin that can be added to traditional fuels, but the assurance of quality is an essential question and implies the selection of reference materials that must be well characterized. Therefore, there is a need for accurate values of thermophysical properties of the new blends of fuels. Our research group has a long experience in the measurement of thermodynamic properties, and now it is involved in the setup of a new technique for the measurement of the viscosities at high pressure. The technique is a falling-body viscometer. The dynamic viscosity is obtained through the falling-time of a body in a vertical tube which contains the liquid for which the viscosity is to be measured. The falling-time is determined using the signal detected by the coil detectors arranged along the tube, which have two circuits. The primary circuit is fed with a wave generator and the induced signal of the secondary circuit is detected by an oscilloscope. The equipment can operate at (0.1-140) MPa pressure range and a temperature range from -40°C to 250°C. The setup of the equipment is presented, including calibration with toluene and its validation with heptane. Rigorous uncertainty calculations were carried out and the estimated uncertainty of the dynamic viscosity was ± 3%. As a first characterization of a biofuel, the dynamic viscosity of 1-propanol is reported at a wide range of temperatures and pressures.

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