Simultaneous Measurement of the Viscosity and Density of Poly(ethyleneglycol) 200 Saturated with Supercritical CO_2

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A new vibrating-wire instrument has recently been used to perform simultaneous measurements of the viscosity and density of various pure liquids over wide ranges of temperature and pressure, with a high accuracy. The technique makes use of the buoyancy force acting on a solid sinker to determine the fluid density, this force being detected by means of a vibrating-wire sensor, operated in the forced mode of oscillation, placed inside the measuring cell. A complete theoretical description of the resonance characteristics of the vibrating-wire, enables the calculation of the density and viscosity of the surrounding fluid, from their measurement.

The present communication is devoted to: (i) describe the modifications made to the apparatus, in order to enable its utilization to perform measurements in fluid mixtures containing supercritical fluids; and, (ii) to present the preliminary results obtained with a commercial linear olygomer - poly(ethyleneglycol) 200 - saturated with CO_2, at three temperatures, $313 \leq T \leq 348$ K, and pressures up to 25 MPa. The available results show an initial sharp viscosity reduction with increasing pressure, followed by a nearly invariant zone, which extends up to 25 MPa. This behavior, which is quantitatively temperature dependent, is presumably closely related to the solubility of CO_2 as a function of pressure. The density seems to show a somewhat more complicated pattern of evolution with increasing pressure, but its overall variation is relatively small.

The final aim of the work is to analyze the effect of the addition of supercritical fluids on polymer viscosity, and is part of a program to study the use of supercritical fluids as polymer processing aids, alternatives to conventional solvents and plasticizers.