

Density Measurements Under Pressure for the Binary System Ethanol + Heptane at 298.15 K and at Pressures Up to 50 MPa

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The knowledge of the thermophysical properties of liquid mixtures, like non-polluting automotive fuels, under a broad range of operating conditions are of utmost importance for the petrochemical industry. Such fuels usually contain oxygenated compounds (alcohols, ethers) and hydrocarbon mixtures. From a practical point of view, the data are useful for the design and operation of mixing, storage and process equipment. One of the important fluid properties required in various engineering and scientific disciplines is the density. Despite this interest, density data of binary mixtures containing alcohol + hydrocarbon at pressures other than atmospheric pressure are very scarce in the literature. The density of the binary mixture ethanol + heptane has been measured under pressure and reported in this work. This system has been chosen in order to study the influence of pressure on the mixture density behaviour, but also because ethanol is coming to be a technically and industrially important compound in connection with reformulation of gasoline, in order to reduce pollution.

Density has been measured with a new vibrating-tube densitometer recently built at the University of Burgos. It consists mainly of the measuring cell DMA HPM, supplied by Anton Paar, Austria. This type of densitometer can be used to perform measurements in a broad range of temperature (from 263.15 K to 473.15 K) and pressure (from 0 to 140 MPa), and requires the construction and set-up of several pieces of equipment and peripherals. The temperature of the measuring cell is controlled by a thermostat Julabo F-25 and is measured with a platinum resistance thermometer. The pressurization of the fluid is performed with a piston pressure intensifier HiP, model 50-5.75-30. The pressure is measured with a pressure transducer WIKA CPH 6000. The DMA HPM measuring cell is connected to the Anton Paar mPDS 2000V3 evaluation unit, which evaluates the oscillation period from the measuring cell filled with the sample. Experimental densities for the compressed liquid phase of the binary system ethanol+heptane have been measured at 298.15 K. The measurements have been performed for eight different compositions as well as the pure compounds at ten isobars up to 50 MPa. For each composition, the experimental values were correlated using a Tait-type equation. Furthermore, the excess molar volume and the isothermal compressibility were calculated from the density data. We acknowledge support for this research to the Dirección General de Investigación, Ministerio de Educación y Ciencia, Spain, Project ENE2006-12620, and to the Consejería de Educación, Junta de Castilla y León, Spain, Project BU015A06.