Density of 1-Iodopropane and 1-Iodobutane within the Temperature Range from (253.15 to 383.15) K

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The density ρ values of 1-iodopropane and 1-iodoobutane have been measured within the temperature range from (253.15 to 383.15) K.

Introduction

This work is part of a project of the Laboratory of Molecular Acoustics to provide thermophysical properties of monohaloalkanes and binary mixtures containing monohaloalkanes. The thermophysical properties of monohaloalkanes have been extensively studied with the aim of a better understanding of the intermolecular interactions. New measurements have been made for the density for 1-iodopropane and 1-iodobutane at temperatures from (253.15 to 383.15) K.

Materials

The materials used in this study (1-iodopropane and 1-iodobutane) with a mole fraction purity of 0.99 and 0.98, respectively, were supplied by Acros Organics.

Measurements. Density measurements were carried out using a 52.4890 cm^3 (at 298.15 K) pycnometer. The mass of the pycnometer was determined using an analytical balance with a precision of $\pm 3 \cdot 10^{-4}$ g. The pycnometer was calibrated with bi-distilled water. The position of the liquid level in the pycnometer was recorded with the traveling microscope, which could be read to $\pm$ 0.01 mm. A refrigerated thermostat (Kriovist, Termex Russia) was used to thermostat the pycnometer from (253.15 to 313.15) K. For measurements from (323.15 to 383.15) K, a thermostat (VIS-T, Termex Russia) was used. The temperature was measured with a 100 Ω platinum resistance thermometer and a digital thermometer bridge (Terkon, Termex Russia) on the ITS-90 scale. The total uncertainty in the temperature measurement is within $\pm$ 0.01 K. The estimated uncertainty of the density measurements was $\pm$ 0.005 %.

Results

The experimental values of density for 1-iodopropane and 1-iodobutane as a function of temperature are listed in Table 1. These results were fit as a function of temperature by

$$\rho/(\mathrm{kg \cdot m^{-3}}) = A_0 + A_1(T/\mathrm{K}) + A_2(T/\mathrm{K})^2 \qquad (1)$$

where the coefficients A_0, A_1, and A_2 were determined by regression to minimize the standard deviation σ, defined by

$$\sigma(\rho) = [\{\sum_{i=1}^{n} (\rho_{\mathrm{obs}} - \rho_{\mathrm{cal}})^2\}/\{(n-p)\}]^{1/2} \qquad (2)$$

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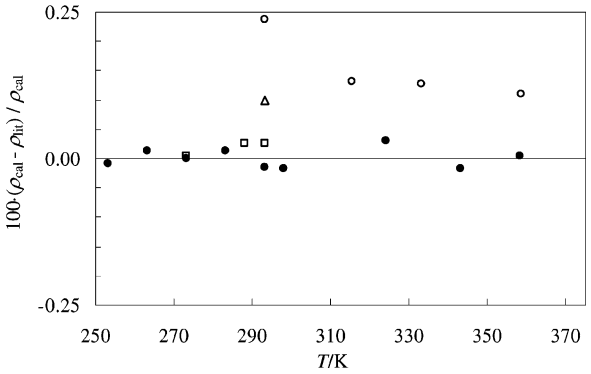

Figure 1. Deviation of literature density ρ of 1-bromopropane from eq 1 as a function of temperature: ●, this work; ○, ref 1; △, ref 2; □, ref 3.

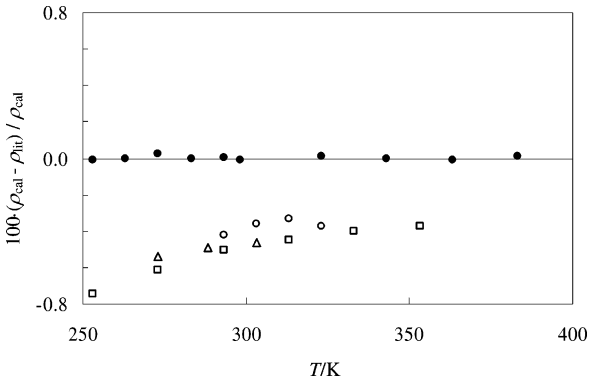

Figure 2. Deviation of literature density ρ of 1-bromobutane from eq 1 as a function of temperature: ●, this work; △, ref 4; ○, ref 5; □, ref 6.

Table 1. Experimental Values of Density ρ of Liquid 1-Iodopropane and 1-Iodobutane at Various Temperatures

1-iodopropane		1-iodobutane	
T/K	ρ/(kg·m^{-3})	T/K	ρ/(kg·m^{-3})
253.15	1820.9	253.15	1670.9
263.15	1802.5	263.15	1655.2
273.15	1784.5	273.15	1639.1
283.15	1765.9	283.15	1623.7
293.15	1747.8	293.15	1607.6
324.15	1688.3	298.15	1599.8
343.15	1652.2	323.15	1558.7
358.15	1622.3	343.15	1525.7
		363.15	1492.0
		383.15	1457.2

where ρ_{obs} and ρ_{cal} are the observed and calculated quantities, n is the total number of experimental points, and p is the number

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Table 2. Values of the Parameters of Equation 1 for Density ρ for 1-Iodopropane and 1-Iodobutane from (253.15 to 383.15) K and Standard Deviation σ

liquid	A_0	A_1	A_2	σ
1-iodopropane	2216.15	−1.3308	−0.0009	0.33
1-iodobutane	2016.40	−1.1835	−0.0007	0.22

of parameters. The values of parameters A_0, A_1, and A_2 of eq 1 and standard deviation $\sigma(\rho)$ are given in Table 2. Deviation of literature[1−6] density ρ of 1-iodopropane and 1-iodobutane from eq 1 as a function of temperature is presented in Figures 1 and 2. Bridgman[7] reported data on the density of 1-iodopropane (1778.0 kg·m^{-3} at 0 °C and 1691.8 at 50 °C) and of 1-iodobutane (1644.3 kg·m^{-3} at 0 °C and 1564.8 at 50 °C) received by extrapolation from a single-phase area on a line of saturation. The average deviation of these data from our values is ± 0.3 %.

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