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Viscosity and Thermal Conductivity of Binary *n*-Heptane + *n*-Alkane Mixtures

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New absolute measurements of the viscosity of binary mixtures of *n*-heptane with *n*-hexane and *n*-nonane are presented. The measurements, performed in a vibrating-wire instrument, cover a temperature range 290–335 K and pressures up to 75 MPa. The concentrations studied are 40 and 70% by weight of *n*-heptane. The accuracy of the reported viscosity data is estimated to be ±0.5%. The present measurements, together with other *n*-heptane + *n*-alkane viscosity and thermal-conductivity measurements, are used to develop a consistent semiempirical scheme for the correlation and prediction of these mixture properties from those of the pure components.

KEY WORDS: *n*-heptane; *n*-hexane; *n*-nonane; prediction; thermal conductivity; vibrating wire; viscosity.

1. INTRODUCTION

In recent years, semiempirical schemes [1–3] based on considerations of the exact hard-sphere theory of transport properties have been applied for the correlation and prediction of the transport properties. For the liquid *n*-alkanes it has been shown [4] that the thermal conductivity, viscosity, and self-diffusion coefficients can, simultaneously, be successfully correlated over a temperature range 100–400 K and pressures up to 600 MPa, with an accuracy of ±6%. In the case of the transport properties of mixtures, a similar scheme [5, 6] has been applied for the correlation of the thermal conductivity of various binary liquid mixtures at atmospheric pressure, by adopting a simple mixing rule. It has thus recently been shown [7] that, according to this mixing rule, from atmospheric-pressure viscosity measure-

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ments of n-heptane + n-undecane, high-pressure viscosity measurements as well as the thermal conductivity of these mixtures can be predicted with an accuracy of $\pm 3\%$.

In this paper, new absolute measurements of the viscosity of binary mixtures of n-heptane with n-hexane and n-nonane are presented. At atmospheric pressure, the viscosity measurements cover a temperature range 295–335 K, while at 303.15 and 323.15 K the measurements extend

Table I. Viscosity of n-Heptane + n-Hexane Mixtures as a Function of Pressure (40%, by Weight, of n-Heptane)

Pressure P (MPa)	Temp. T (K)	Density $\rho(T, P)$ ($kg \cdot m^{-3}$)	Viscosity $\mu(T, P)$ ($\mu Pa \cdot s$)	Density $\rho(T_{nom}, P)$ ($kg \cdot m^{-3}$)	Viscosity $\mu(T_{nom}, P)$ ($\mu Pa \cdot s$)
				$T_{nom} = 303.15$ K	
0.10	303.332	660.2	316.7	660.4	317.2
5.57	303.332	665.5	334.6	665.6	335.1
10.54	303.314	670.0	351.7	670.2	352.2
15.60	303.314	674.5	368.6	674.6	369.1
20.67	303.292	678.8	386.7	678.9	387.2
25.74	303.286	682.9	403.9	683.0	404.3
30.90	303.314	687.0	421.5	687.1	422.0
35.87	303.268	690.8	438.9	690.8	439.4
40.94	303.274	694.4	457.2	694.5	457.6
46.00	303.280	698.0	475.9	698.1	476.4
51.17	303.301	701.5	493.6	701.6	494.1
55.83	303.307	704.5	510.5	704.6	511.2
61.20	303.295	707.9	530.3	708.0	531.0
65.96	303.280	710.8	547.5	710.9	548.1
71.74	303.298	714.2	569.2	714.3	569.9
				$T_{nom} = 323.15$ K	
0.10	323.144	642.4	262.9	642.4	262.9
5.38	323.150	648.1	278.6	648.1	278.6
10.44	323.156	653.3	294.1	653.3	294.1
15.50	323.162	658.3	309.3	658.3	309.3
20.77	323.184	663.3	325.1	663.3	325.2
25.74	323.205	667.8	339.6	667.8	339.8
30.80	323.208	672.2	355.0	672.2	355.2
35.77	323.205	676.3	369.8	676.3	370.0
40.83	323.196	680.3	385.0	680.3	385.1
45.70	323.184	683.9	399.6	684.0	399.7
50.76	323.193	687.6	415.6	687.6	415.8
56.03	323.174	691.2	430.8	691.2	430.9
60.90	323.159	694.4	445.7	694.4	445.7
64.24	323.132	696.6	455.2	696.6	455.1

up to 75 MPa. Moreover, in a recent paper [7] viscosity measurements of *n*-heptane + *n*-undecane have been reported. The thermal conductivity of binary mixtures of *n*-heptane with *n*-undecane and *n*-hexadecane has also been reported [8] at atmospheric pressure, over a temperature range 285–350 K. Therefore, these binary mixtures can be used for the examination of the application of the aforementioned scheme to the prediction of the thermal conductivity and viscosity of mixtures.

2. EXPERIMENTAL

The viscosity measurements were performed with the high-pressure vibrating-wire instrument described in detail elsewhere [9]. The viscosity of

Table II. Viscosity of *n*-Heptane + *n*-Hexane Mixtures as a Function of Pressure (70%, by Weight, of *n*-Heptane)

Pressure P (MPa)	Temp. T (K)	Density $\rho(T, P)$ $(kg \cdot m^{-3})$	Viscosity $\mu(T, P)$ $(\mu Pa \cdot s)$	Density $\rho(T_{nom}, P)$ $(kg \cdot m^{-3})$	Viscosity $\mu(T_{nom}, P)$ $(\mu Pa \cdot s)$
				$T_{nom} = 303.15$ K	
0.10	303.176	667.9	343.9	667.9	344.0
5.37	303.198	672.8	363.3	672.8	363.5
10.54	303.204	677.4	382.0	677.5	382.2
15.50	303.204	681.7	400.7	681.7	400.9
20.67	303.216	686.0	421.0	686.0	421.2
25.74	303.192	690.1	440.3	690.1	440.5
30.80	303.182	694.0	459.1	694.1	459.2
35.97	303.198	697.9	479.6	698.0	479.8
41.14	303.204	701.7	500.1	701.7	500.3
46.10	303.201	705.2	519.2	705.2	519.5
51.07	303.198	708.5	539.2	708.6	539.4
56.13	303.195	711.9	559.7	711.9	559.9
61.71	303.204	715.3	583.0	715.4	583.3
				$T_{nom} = 323.15$ K	
0.10	323.226	650.6	283.9	650.7	284.2
5.57	323.177	656.3	301.4	656.3	301.5
10.54	323.190	661.4	317.8	661.4	317.9
15.60	323.226	666.3	334.0	666.4	334.3
20.57	323.177	671.0	351.0	671.1	351.1
25.74	323.184	675.7	367.7	675.7	367.8
30.70	323.202	679.9	383.0	680.0	383.2
35.77	323.205	684.1	399.9	684.1	400.2
40.94	323.208	688.1	417.0	688.1	417.2
46.00	323.202	691.8	433.8	691.9	434.0
52.99	323.196	696.7	457.0	696.7	457.2

toluene was measured before and after each liquid to assure the continuing good operation of the instrument. The accuracy of the measurements is estimated to be $\pm 0.5\%$' an estimate confirmed by the measurements of the viscosity of toluene [9]. The samples of *n*-hexane, *n*-hexane, and *n*-nonane were all supplied by BDH Chemicals Ltd., with nominal purities better than 99.0, 99.5, and 99.0%, respectively. The density values of *n*-hexane used where those of Dymond et al. [10], while in the case of *n*-heptane and *n*-nonane, density values were obtained from Doolittle [11]. The density of

Table III. Viscosity of *n*-Heptane + *n*-Nonane Mixtures as a Function of Pressure (40%, by Weight, of *n*-Heptane)

Pressure P (MPa)	Temp. T (K)	Density $\rho(T, P)$ $(kg \cdot m^{-3})$	Viscosity $\mu(T, P)$ $(\mu Pa \cdot s)$	Density $\rho(T_{nom}, P)$ $(kg \cdot m^{-3})$	Viscosity $\mu(T_{nom}, P)$ $(\mu Pa \cdot s)$
				$T_{nom} = 303.15$ K	
0.10	303.185	695.9	499.7	696.0	499.9
5.57	303.198	700.5	531.1	700.5	531.4
10.54	303.152	704.6	558.3	704.6	558.3
15.50	303.146	708.5	587.2	708.5	587.2
20.67	303.170	712.4	617.0	712.4	617.1
25.74	303.198	716.2	645.8	716.2	646.1
30.90	303.228	719.9	675.4	719.9	675.7
35.97	303.182	723.5	706.8	723.5	707.0
41.14	303.176	727.0	739.3	727.0	739.5
46.10	303.204	730.2	770.3	730.2	770.7
51.17	303.204	733.4	802.0	733.4	802.4
56.24	303.198	736.5	833.8	736.5	834.2
61.30	303.192	739.5	868.4	739.5	868.8
66.37	303.185	742.3	900.7	742.3	901.0
71.74	303.152	745.2	937.4	745.2	937.4
				$T_{nom} = 323.15$ K	
0.10	322.994	680.1	403.2	680.0	402.4
5.22	323.074	684.9	426.8	684.9	426.4
10.54	323.086	689.7	451.8	689.8	451.5
15.50	323.071	694.2	474.8	694.2	474.3
20.57	323.071	698.7	499.1	698.6	498.6
25.53	323.071	702.7	523.0	702.6	522.5
30.50	323.065	706.6	546.5	706.6	546.0
35.87	323.034	710.7	572.8	710.6	572.1
41.04	323.016	714.5	597.5	714.4	596.6
46.00	322.988	717.9	622.6	717.8	621.5
51.07	322.988	721.2	647.9	721.1	646.6
56.03	323.016	724.3	673.3	724.2	672.2
61.30	323.028	727.5	699.9	727.4	698.9
66.77	323.104	730.5	726.7	730.5	726.3

the mixture was calculated from the densities of the pure components. The mixtures studied, 40 and 70% by weight of *n*-heptane, were prepared gravimetrically and the uncertainty in their composition was less than 0.005%.

3. RESULTS

Tables I–IV present the viscosity measurements of the binary mixtures of *n*-heptane with *n*-hexane and *n*-nonane at the measuring temperatures

Table IV. Viscosity of *n*-Heptane + *n*-Nonane Mixtures as a Function of Pressure (70%, by Weight, of *n*-Heptane)

Pressure P (MPa)	Temp. T (K)	Density $\rho(T, P)$ $(kg \cdot m^{-3})$	Viscosity $\mu(T, P)$ $(\mu Pa \cdot s)$	Density $\rho(T_{nom}, P)$ $(kg \cdot m^{-3})$	Viscosity $\mu(T_{nom}, P)$ $(\mu Pa \cdot s)$
				$T_{nom} = 303.15$ K	
0.10	303.347	685.5	432.4	685.6	433.2
5.47	303.320	690.2	457.7	690.3	458.4
10.54	303.307	694.5	482.0	694.6	482.7
15.50	303.326	698.5	506.4	698.7	507.2
20.57	303.314	702.6	532.1	702.7	532.9
25.63	303.311	706.5	556.6	706.6	557.4
30.70	303.320	710.3	581.6	710.4	582.5
35.87	303.314	714.0	607.4	714.1	608.3
40.23	303.323	717.1	630.0	717.2	631.0
46.10	303.320	721.1	660.2	721.2	661.2
51.07	303.332	724.3	685.9	724.5	687.0
56.13	303.332	727.6	713.4	727.7	714.5
61.30	303.314	730.7	742.0	730.8	743.1
66.27	303.298	733.6	767.7	733.7	768.8
71.84	303.365	736.6	797.5	736.8	799.0
				$T_{nom} = 323.15$ K	
0.10	323.138	669.4	353.8	669.4	353.8
5.27	323.208	674.5	374.0	674.5	374.2
10.54	323.196	679.5	395.1	679.5	395.3
15.60	323.138	684.3	415.6	684.3	415.6
20.67	323.177	688.8	436.3	688.8	436.5
25.64	323.177	693.1	456.7	693.1	456.8
30.90	323.220	697.3	477.0	697.4	477.4
35.87	323.254	701.2	497.6	701.3	498.2
40.94	323.181	705.0	519.7	705.1	519.9
46.10	323.184	708.7	541.2	708.7	541.4
50.97	323.184	711.9	562.1	712.0	562.3
55.83	323.190	715.0	582.0	715.1	582.3
57.86	323.190	716.3	591.1	716.3	591.4

around 303.15 and 323.15 K as a function of pressure. For each binary mixture two compositions were studied, 40 and 70%, by weight, of *n*-heptane. In these tables we provide also the viscosity adjusted to the nominal temperatures of 303.15 and 323.15 K, respectively, by means of a linear correction. Since, however, this correction is very small, less than 0.2%, the uncertainty introduced with this assumption is negligible. In Table V, the viscosity measurements at atmospheric pressure as a function of temperature are presented.

The viscosity measurements of these mixtures have been correlated with pressure along each isotherm, for the purpose of interpolation only, by a Tait-like equation as

$$\ln\left[\frac{\mu}{\mu_0}\right] = E \ln\left[\frac{D+P}{D+0.1}\right] \tag{1}$$

where μ_0 represents the experimental viscosity at atmospheric pressure. The values of the constants for each isotherm for both mixtures are shown in Table VI. In the same table, the standard deviation of each fit is shown. It can be seen that the maximum standard deviation is $\pm 0.15\%$. In the

Table V. Viscosity of Mixtures as a Function of Temperature at Atmospheric Pressure (Concentrations in Weight Percentage of *n*-Heptane)

40%			70%		
Temp. T (K)	Density ρ ($kg \cdot m^{-3}$)	Viscosity μ ($\mu Pa \cdot s$)	Temp. T (K)	Density ρ ($kg \cdot m^{-3}$)	Viscosity μ ($\mu Pa \cdot s$)
		n-Heptane + *n*-Hexane			
293.353	668.8	349.7	288.281	680.0	403.4
303.332	660.2	316.7	294.311	675.2	377.6
312.261	652.3	289.8	297.616	672.5	364.4
323.144	642.4	263.0	303.176	667.9	343.9
			313.278	659.3	311.4
			323.226	650.6	283.8
		n-Heptane + *n*-Nonane			
293.746	703.2	558.5	293.965	692.8	480.2
303.185	695.9	499.7	303.411	685.4	432.6
313.128	688.1	447.9	312.673	678.0	391.6
322.994	680.1	403.2	323.138	669.4	353.8
			333.254	660.8	320.1

same table the constants for our previous measurements of the viscosity of *n*-heptane + *n*-undecane mixtures [7] and of the pure components [12] are also included for comparison purposes. In Figs. 1 and 2 the deviations of the present experimental measurements of the viscosity, from those correlated by Eq. (1), are presented. It can be seen that the maximum deviation is less than ±0.2%.

The atmospheric-pressure measurements of both mixtures have also been correlated, for the purpose of interpolation only, by an equation of the form

$$\mu = Ae^{B/T} \tag{2}$$

Table VI. Coefficients of Eq. (1) (Concentrations in Weight Percentage of *n*-Heptane)

Temp. (K)	Conc. (%)	μ_0 (μPa·s)	E (–)	D (MPa)	σ (%)
		n-Heptane + *n*-Hexane			
303.15	40	317.16	1.242	118.7	±0.06
	70	344.00	1.282	121.0	±0.07
	100	370.70	1.398	133.2	±0.04
323.15	40	262.94	0.995	86.9	±0.07
	70	284.17	1.050	92.4	±0.07
	100	304.07	1.264	114.9	±0.08
		n-Heptane + *n*-Nonane			
303.15	0	617.03	2.564	242.2	±0.14
	40	499.90	1.485	135.9	±0.10
	70	433.15	1.329	122.4	±0.08
	100	370.70	1.398	133.2	±0.04
323.15	0	486.89	1.641	148.9	±0.11
	40	402.40	1.207	105.6	±0.07
	70	353.78	1.190	106.9	±0.06
	100	304.07	1.264	114.9	±0.08
		n-Heptane + *n*-Undecane			
303.15	0	990.53	2.916	256.3	±0.09
	40	635.93	1.982	183.8	±0.15
	70	487.81	1.536	142.9	±0.06
	100	370.70	1.398	133.2	±0.04
323.15	0	747.23	2.055	179.4	±0.07
	40	500.12	1.691	153.8	±0.09
	70	393.52	1.326	119.4	±0.05
	100	304.07	1.264	114.9	±0.08

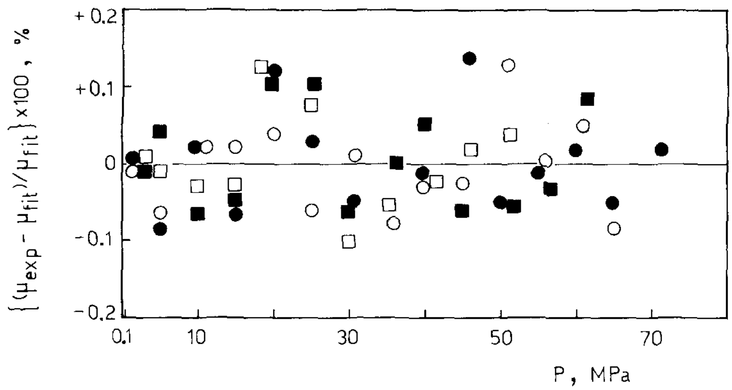

Fig. 1. Deviations of present experimental values of the viscosity of *n*-heptane + *n*-hexane mixtures from Eq. (1). 40%, by weight, of *n*-heptane: (●) 303.15 K; (○) 323.15 K. 70%, by weight, of *n*-heptane: (■) 303.15 K; (□) 323.15 K.

The values of the constants are shown in Table VII. In the same table, the standard deviation of each fit is shown. It can be seen that the maximum standard deviation is $\pm 0.19\%$. Also shown for comparison purposes, are the constants for our previous measurements of the viscosity *n*-heptane + *n*-undecane mixtures [7] and of the pure components [12].

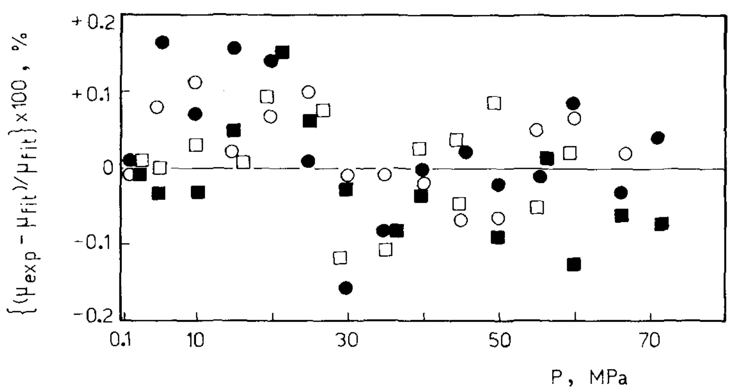

Fig. 2. Deviations of present experimental values of the viscosity of *n*-heptane + *n*-nonane mixtures from Eq. (1). 40%, by weight, of *n*-heptane: (●) 303.15 K; (○) 323.15 K. 70%, by weight, of *n*-heptane: (■) 303.15 K; (□) 323.15 K.

Table VII. Coefficients of Eq. (2) (Concentrations in Weight Percentage of *n*-Heptane)

Conc. (%)	A (μPa·s)	B (K)	σ (%)
	n-Heptane + *n*-Hexane		
40	15.75 ± 0.33	909.7 ± 6.3	±0.12
70	15.62 ± 0.03	937.4 ± 0.8	±0.02
100	15.20 ± 0.18	968.3 ± 3.8	±0.03
	n-Heptane + *n*-Nonane		
0	13.43 ± 0.03	1160.2 ± 0.6	±0.01
40	15.34 ± 0.22	1056.2 ± 4.3	±0.08
70	15.55 ± 0.35	1008.8 ± 6.9	±0.19
100	15.20 ± 0.18	968.3 ± 3.8	±0.03
	n-Heptane + *n*-Undecane		
0	11.05 ± 0.35	1362.4 ± 9.9	±0.17
40	13.02 ± 0.27	1179.2 ± 6.6	±0.19
70	15.23 ± 0.19	1050.5 ± 4.0	±0.10
100	15.20 ± 0.18	968.3 ± 3.8	±0.03

4. DISCUSSION

4.1. The Pure Liquids

Whereas the correlations of Eqs. (1) and (2) are suitable for interpolation, they have little or no value for extrapolation and prediction. For such purposes it has been shown [4] that a correlation in terms of the molar volume, V, is much more suitable. The hard-sphere model of the dense fluid state [2] suggests the form of such a correlation since it leads to the result that for a monatomic fluid the quantities, μ^* and λ^*, defined by the equations

$$\mu^* = 6.035 \times 10^8 \left[\frac{1}{MRT}\right]^{1/2} \mu V^{2/3} = F_\mu(V/V_0) \qquad (3)$$

$$\lambda^* = 1.936 \times 10^7 \left[\frac{M}{RT}\right]^{1/2} \lambda V^{2/3} = F_\lambda(V/V_0) \qquad (4)$$

are functions of the reduced molar volume (V/V_0) only, where V_0 is a characteristic molar volume of the fluid which is but weakly temperature dependent. In the above equations M represents the molar mass, R the universal gas constant, and T the absolute temperature, and all quantities are in SI units.

Earlier studies have shown that if the results of Eqs. (3) and (4) are carried over to polyatomic fluids, the functions F_μ and F_λ are nearly universal among a large group of liquids, although the functions are not those predicted from the hard-sphere theory [2]. Recently these functions were obtained [4] as a result of a successful attempt of a simultaneous representation of the thermal conductivity, viscosity, and self-diffusion coefficients of liquid n-alkanes over the temperature range 100–400 K and pressures up to 600 MPa. In that study, it emerged that it is not the functions μ^* and λ^* which are universal, but a slightly modified version of them, namely,

$$\log \frac{\mu^*}{R_\mu} = 0.877 - 3.79208 V_r^{-1} + 16.4416 V_r^{-2} - 24.2509 V_r^{-3} + 16.354 V_r^{-4} \tag{5}$$

$$\log \frac{\lambda^*}{R_\lambda} = 1.0655 - 3.538 V_r^{-1} + 12.121 V_r^{-2} - 12.469 V_r^{-3} + 4.562 V_r^{-4} \tag{6}$$

in which

$$V_r = V/V_0 \tag{7}$$

and where R_μ and R_λ are factors introduced to account for deviations from the behavior of smooth hard spheres. These factors have been correlated [4, 6] as a function of the carbon number C, as

$$R_\mu = 0.9858 + 0.0164C + 0.001432C^2 \tag{8}$$

$$R_\lambda = 0.00225C^3 - 0.0774C^2 + 1.186C - 4.672 + 14.435C^{-1} - 16.009C^{-2} + 6.296C^{-3} \tag{9}$$

The characteristic molar volume V_0 of the series was also represented in terms of temperature and the carbon number. For n-alkanes with carbon numbers in the range C_5–C_{16}, the representation for V_0 (in $m^3 \cdot mol^{-1}$) is

$$10^6 V_0 = 106.677 - 13.655\theta + 1.6266\theta^2 + (C-6)(18.028 - 1.2\theta)(0.944 + 0.0035C) \tag{10}$$

where

$$\theta = T/100$$

This scheme, Eqs. (3)–(10), was found to correlate and predict the viscosity and thermal conductivity of *n*-alkanes in the temperature range 100–400 K and pressures up to 600 MPa, with an accuracy of $\pm 6\%$.

4.2. The Mixtures

In a recent paper [5] in order to correlate the thermal conductivity of mixtures at atmospheric pressure from the pure components, the following procedure was successfully adopted. It was postulated that the mixture can be considered as an equivalent liquid with a mole fraction average molar mass and a characteristic molar volume V_0^{mix}, given by the following mixing rule:

$$V_0^{\mathrm{mix}} = XV_0^{\mathrm{I}} + (1-X)\, V_0^{\mathrm{II}} - X(1-X)k \tag{11}$$

where V_0^{I} and V_0^{II} are the characteristic molar volumes of the pure components, and X the mole fraction. k was found to be a constant characteristic of the pure components, independent of temperature and composition, and determined by experimental measurements. Thus, since the characteristic molar volumes of the pure liquids can be determined by the aforementioned scheme, atmospheric pressure viscosity measurements can be used for the determination of the constant k. Therefore the characteristic molar volume can be calculated and Eqs. (3)–(11) can be used to predict both the viscosity and the thermal conductivity over the whole range of the experimental measurements. The advantage of this scheme is that only one or two measurements at one composition, one temperature, and of one of the two properties at atmospheric pressure, are sufficient to predict both the viscosity and the thermal conductivity of the mixtures over a very wide range of conditions and compositions. This scheme was successfully applied [7] for the prediction of the viscosity and thermal conductivity of *n*-heptane + *n*-undecane mixtures.

The present high-pressure viscosity measurements of *n*-heptane with *n*-hexane and *n*-nonane can be used together with our previously reported [7] high-pressure viscosity measurements of *n*-heptane + *n*-undecane mixtures and the thermal-conductivity measurements of *n*-heptane with *n*-undecane and *n*-hexadecane [8], to examine the power of this scheme. We have thus preferred to slightly modify Eq. (11) in order to cover all these mixtures as

$$V_0^{\mathrm{mix}} = XV_0^{\mathrm{I}} + (1-X)\, V_0^{\mathrm{II}} - X(1-X)\, k'(C-7) \tag{12}$$

where C represents the carbon number of the *n*-alkane in the *n*-heptane + *n*-alkane mixtures. From the atmospheric-pressure viscosity measurements

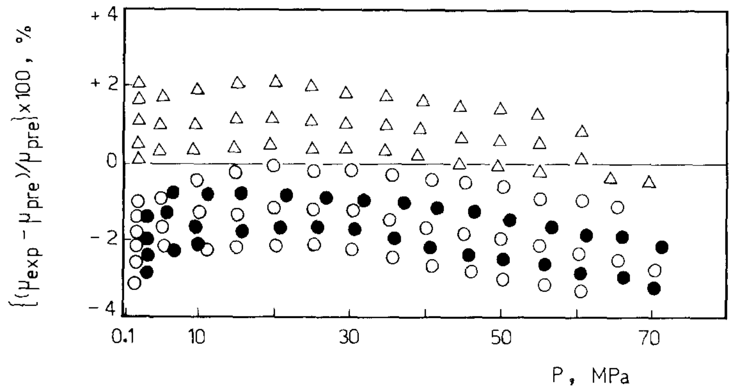

Fig. 3. Deviations of experimental values of the viscosity of *n*-heptane + *n*-alkane mixtures from the scheme of Eqs. (3)–(10) and (12). (○) *n*-heptane + *n*-hexane mixtures; (●) *n*-heptane + *n*-nonane mixtures; (△) *n*-heptane + *n*-undecane mixtures [7].

of *n*-heptane + *n*-hexane and *n*-heptane + *n*-undecane mixtures, the value of k' was calculated to be equal to $0.7 \times 10^{-6}\ m^3 \cdot mol^{-1}$. Thus, Eqs. (3)–(10) and (12) can be used to calculate the viscosity and the thermal conductivity of all aforementioned mixtures, at any composition, temperature, and pressure (provided the density is available). Figure 3 shows the deviations of the experimental measurements of the viscosity of these mixtures as a function of pressure, from the predicted values, while in Fig. 4 the

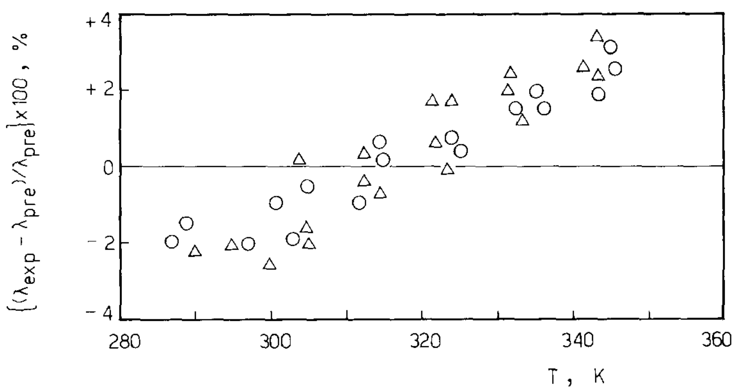

Fig. 4. Deviations of experimental values of the thermal conductivity of *n*-heptane + *n*-alkane mixtures from the scheme of Eqs. (3)–(10) and (12). (○) *n*-heptane + *n*-undecane mixtures [8]; (△) *n*-heptane + *n*-hexadecane mixtures [8].

deviations of the experimental measurements of the thermal conductivity of these mixtures as a function of temperature, from the predicted values, are also shown. It can be seen that in both cases, the maximum deviation is ±3.5%. Thus, the power of this scheme is demonstrated.

5. CONCLUSIONS

New absolute measurements of the viscosity of binary mixtures of *n*-heptane with *n*-hexane and *n*-nonane are presented. At atmospheric pressure, the viscosity measurements cover a temperature range 290–335 K, while at 303.15 and 323.15 K the measurements extend up to 75 MPa. The accuracy of the measurements is estimated to be ±0.5%.

A recently developed semiempirical scheme is applied for the prediction of the viscosity and the thermal conductivity of *n*-heptane + *n*-alkane mixtures over a wide range of compositions and conditions, based only on some atmospheric pressure measurements of the viscosity. The accuracy of this scheme was found to be better than ±3.5%.

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