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Note

The Density of 1,1-Dichloro-1-Fluoroethane (HCFC 141b)

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In this Note we present the density of HCFC 141b, measured between 293.15 and 300.15 K, with an mechanical oscillator densimeter, with an uncertainty of 0.007%. The results are compared with the densities estimated by the reduced hard-sphere–DeSantis equation of state and with the experimental data obtained by several authors.

KEY WORDS: density; 1,1-dichloro-1-fluoroethane; equation of state; HCFC 141b.

The density of HCFC 141b was measured between 293.15 and 300.15 K (ITS 90) with a mechanical oscillator densimeter (Anton Paar type DMA 55) at atmospheric pressure with an uncertainty of 0.04 $kg \cdot m^{-3}$, or 0.007%. For this work the densimeter was calibrated with toluene and 2,2,4-trimethylpentane, between 293.15 and 323.15 K. Details of the calibrations and of the working equation for this apparatus are described in Refs. 1 and 2. The density of 2,2,4-trimethylpentane was obtained from the IUPAC recommendation [3].

The data obtained are compared with the densities estimated with the reduced hard-sphere–DeSantis equation of state (RHSDS), developed by Fialho [4], and with the experimental data obtained by different authors [5–7]. Table I shows the densities obtained in this work corrected for nominal temperatures, the predictions of the RHSDS, and the results obtained by other authors [6, 7]. The results in this work for temperatures

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Table I. Density of HCFC 141b at 0.1 MPa

T (K)	ρ (kg·m^{-3})			
	This work	RHSDS	Ref. 6^a	Ref. 7
273.15	1283.54	1289.21^a	1281.2	—
283.15	1263.48	1271.01	1262.5	—
288.15	1253.56	1261.78	—	—
293.15	1243.68	1252.49	1243.0	—
298.15	1233.86	1243.18	1233.2	1232
300.15	1229.94	1239.32	—	—
303.15	1224.07	1233.71	1223.2	—
313.15	—	1214.59^a	1203.7	—
323.15	—	1195.08^a	1183.7	—
333.15	—	1175.08^a	1162.4	—
343.15	—	1154.45^a	1141.4	—
353.15	—	1133.05^a	1118.8	—

^{a} Density of the liquid at the saturation vapor pressure.

below 293.15 K and higher than 300.15 K were obtained by extrapolation of the experimental dependence of the period of vibration of the oscillator in the densimeter cell [2]. It can be seen that the agreement between our experimental data and those of Kumagai Takahashi [6] is well within the claimed uncertainties. Although their data were obtained at the saturation

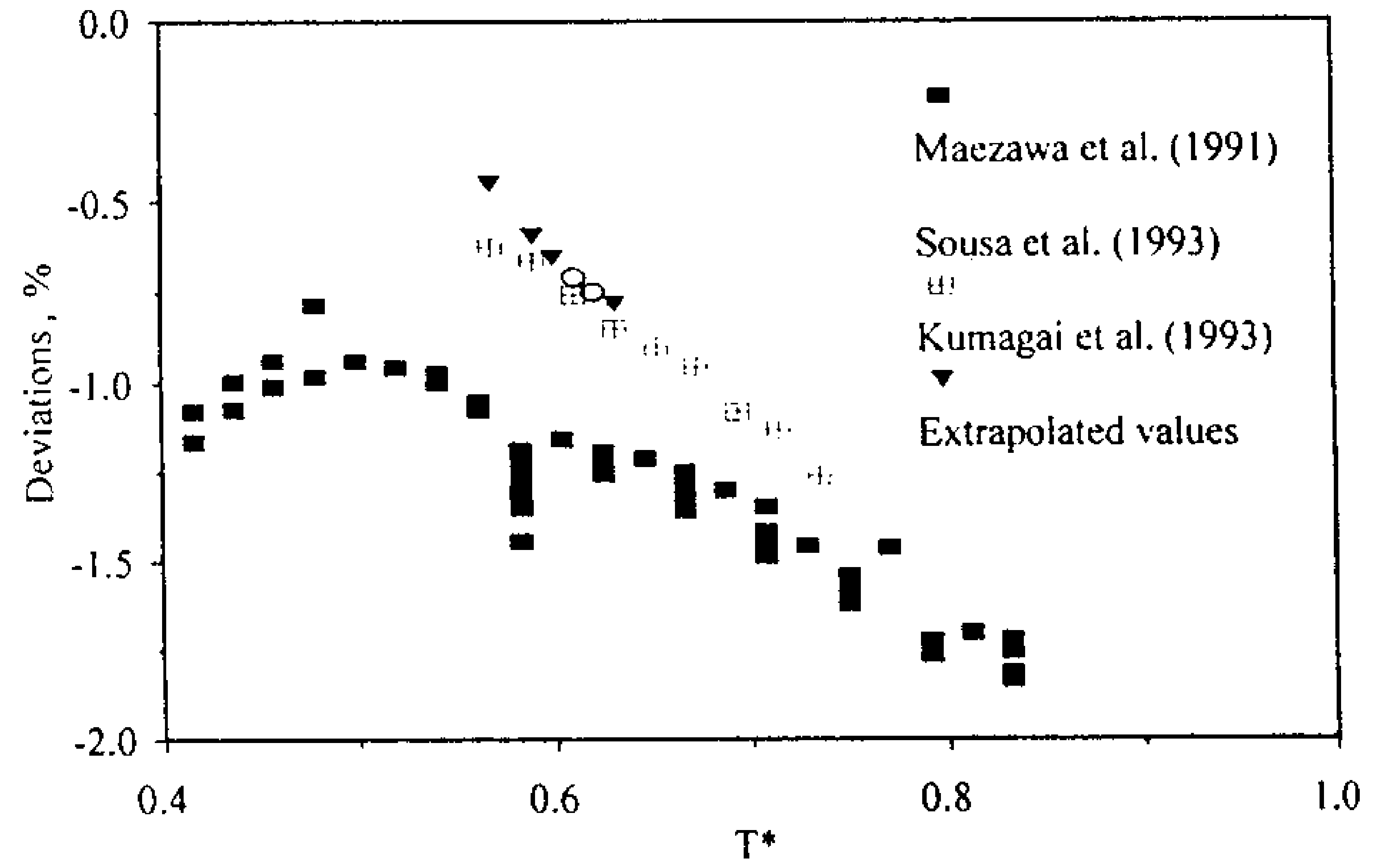

Fig. 1. Deviations of the density of HCFC 141b from the values predicted by the RHSDS. Deviations $= (\rho_{exp} - \rho_{RHSDS})/\rho_{RHSDS} \times 100$.

vapor pressure, which is very close to 0.1 MPa, this comparison does not introduce an error greater than the uncertainty of the experimental data obtained with the pycnometer method. The result of Sukornick [7] is 0.15% lower than our data.

To calculate the densities with the RHSDS at the same nominal temperatures and pressure as in the work by Kumagai and Takahashi [6], it is necessary to know the saturation vapor pressure. These values were obtained from the work of Maezewa et al. [5].

Figure 1 shows the deviations between the available experimental data and the data predicted by the RHSDS. The maximum deviation between our data and the RHSDS is −0.8%. The figure also shows that this EOS can predict the data obtained by Maezawa et al. [5] for the compressed liquid within −1.7% and the data of Kumagai Takahashi [6] for the liquid at the saturation vapor pressure within a maximum deviation of −1.3%. These results are very encouraging because, as described in Ref. 4, the critical parameters of HCFC 141b necessary to apply the theory were estimated [5].

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