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THE VAPOUR PRESSURES AND SATURATED VAPOUR VOLUMES OF O-FLUOROTOLUENE IN THE TEMPERATURE RANGE 450-530 K

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SUMMARY

The vapour pressure of a degassed sample of O-fluorotoluene was measured in the temperature range 452.9K to 530.4K. Also the saturated vapour volume was measured in the same temperature range. The measured vapour pressures were fitted to two alternative vapour pressure equations by least squares procedures.

INTRODUCTION

Although the characterization of fluoro-compounds has been the object of intensive research since their discovery [1] very little work has been done on fluorotoluene. Ambrose and Ellender [2] studied the vapour pressure of octafluorotoluene. The purpose of this work is to measure the vapour pressure and correlate the data with equations of the form :

$$\text{Log } P = A + \frac{B}{T} \qquad (1)$$

$$\text{Log } P = A + \frac{B}{t + 230} \qquad (2)$$

Also the saturated vapour volume was measured.

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EXPERIMENTAL

Fluorotoluene was supplied by Koch-Light Laboratories Ltd., England, with stated purity of more than 97%. The sample was further purified by placing it in contact with activated molecular sieves to absorb traces of moisture and was then degassed by subjecting the sample to a cycle of freezing, pumping, melting and freezing.

The apparatus and methods used for the measurements have been described in previous publication [3] A known amount of the degassed sample was confined over mercury in a thick-walled glass capillary tube. The volume of the tube had been determined as a function of the distance from the sealed end so that the volume occupied by the sample could be calculated at any desired condition by measuring the length of the tube full of the sample. The length of the tube occupied by the sample was measured with a cathetometer reading to within 0.05 mm. The pressure was measured with a pressure transducer calibrated against a high precision dead-weight gauge. The temperature was measured with a platinum resistance thermometer made by Fluke. The absolute accuracy of the temperature measurement was estimated to be ± 0.2K and that of the pressure to be ± 1.0 kPa.

RESULTS

The experimental data for vapour pressure and saturated vapour volume were measured from 452.9K to 530.4K. The results are shown in Table 1 . The least square method was used to fit the vapour pressure data to the previous two equations and the constants were determined :

$$\text{Log } (P/\text{kPa}) = 6.4025 - \frac{1673.626}{(T/K)} \qquad (3)$$

$$\text{Log } (P/\text{kPa}) = 6.1 - \frac{1390.64}{230+(t/^{o}C)} \qquad (4)$$

The percentage deviation defined as :

$$\frac{P_{cal}\text{ (calculated)} - P_{exp}\text{ (experimental)}}{P_{exp}\text{(experimental)}} \times 100$$

was calculated using the above two equations. The values are shown in Table 1 .

DISCUSSION

As seen from Table 1 the two equations gave almost the same percentage deviation, which was for both equations less than 2%. So any of the equations can be used safely in the given temperature range. No data for O-Fluorotoluene was found in literature to test these equations. But from previous work done [4, 5, 6, 7] it can be trusted that the apparatus and technique are very good.

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TABLE 1

The Vapour Pressure and Saturated Vapour Volume for O-Fluorotoluene

T (K)	P_{exp} kPa	Equation (1)		Equation (2)		Saturated Vapour Molar Volume cc/g mole
		P_{cal}	%dev	P_{cal}	%dev	
452.9	512.15	509.48	-0.5	508.23	-0.8	5297.3
457.9	558.28	559.08	+0.1	558.45	+0.03	5257.6
464.42	630.10	629.20	-0.1	629.35	-0.1	4182.7
468.59	474.4	677.42	+0.5	678.04	+0.5	3381.0
492.2	1023.04	1005.04	-1.8	1007.3	-1.6	2896.4
484.8	1043.2	1047.25	+0.4	1049.51	+0.6	2709.2
503.6	1187.4	1199.93	+1.1	1201.84	+1.2	2533.0
506.5	1232.8	1253.67	+1.7	1255.31	+1.8	2367.8
513.4	1387.0	1388.65	+0.1	1389.31	+0.2	2169.6
516.3	1441.4	1448.45	+0.5	1448.54	+0.5	2070.4
519.4	1515.1	1514.44	-0.04	1513.79	+0.1	1916.3
522.8	1599.1	1589.30	-0.6	1587.70	-0.7	1795.1
525.5	1656.2	1650.64	-0.3	1648.16	-0.5	1718.0
530.4	1781.6	1766.34	-0.9	1671.97	-1.1	1596.9

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