Viscosity of Associated Liquids. 2. Methylamine

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The viscosity of methylamine is represented by the expression log η = 1.635 + 203.2(T - 69.87) in cP, with a relative uncertainty of 0.18% from -70 to 30 °C. (T is the temperature in K.)

In a previous paper (*1*) we reported an apparent inconsistency between the data for the viscosity of methylamine and that of certain other hydrogen-bonded liquids; specifically, we noted that when out data were fitted by the Fulcher equation (*2*)

$$\log \eta = A + B/(T - T_0)$$

(where A, B, and T_0 are empirical constants, T_0 being related to the glass transition temperation) the value of T_0 obtained for methylamine, 102.0 K, seemed too large when compared to those obtained for the related liquids ammonia (50.7 K) and methanol (48.6 K).

We have now carried out further measurements of the viscosity of methylamine over a wider temperature range, -70 to +30 °C. The original range was -70 to -10 °C only. The new measurements were done in part with the same and other similar viscometer, and in part with sealed Ostwald viscometers. The experimental details are as described (*1*).

The results are listed in Table I. The new set of constants to fit the Fulcher equation to all our data are A = 1.635, B = 203.2, and T_0 = 69.87 K and the relative standard error of estimate for viscosity over the range -70 to +30°C is 0.18%.

Table I. Viscosity of Methylamine at Various Temperatures[a]

t, °C	η, cP	t, °C	η, cP	t, °C	η, cP
29.3	0.173	-14.8	0.283	-45.2	0.445
27.2	0.176	-15.2	0.281	-50.1	0.486
24.8	0.179	-18.1	0.295	-50.6	0.495
22.1	0.184	-20.1	0.301	-50.7	0.494
18.5	0.190	-24.6	0.381	-55.3	0.541
15.5	0.196	-25.2	0.319	-58.4	0.582
12.5	0.202	-27.4	0.337	-60.2	0.605
10.1	0.206	-30.2	0.350	-60.7	0.614
9.9	0.206	-32.0	0.358	-65.2	0.681
7.7	0.212	-35.2	0.375	-66.8	0.713
5.4	0.217	-37.4	0.385	-68.0	0.740
0.1	0.231	-40.1	0.405	-68.8	0.755
-9.6	0.256	-42.7	0.425	-70.7	0.805
-10.1	0.266	-44.1	0.437		

[a] Pressure is 1 atm in hydrogen for all the data at temperatures below -15 °C, and the vapor pressure of methylamine at the higher temperatures.

Literature Cited

(1) R. C. Makhija and R. A. Stairs, *Can. J. Chem.*, **48**, 1214 (1970). (N.B.: p 1217, column 2, line 7; the two negative signs should be deleted.)
(2) G. S. Fulcher, *J. Am. Ceram. Soc.*, **8**, 339 (1925).

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Gas–Liquid Equilibrium in Mixtures of Methane plus 9,10-Dihydrophenanthrene at Elevated Temperatures and Pressures

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Gas–liquid equilibrium in mixtures of methane and 9,10-dihydrophenanthrene was studied at four temperatures from 190 to 430 °C in a flow apparatus. The pressures of the measurements were from 20 to 250 atm at each of the three lower temperatures and to 150 atm at the highest temperature.

Introduction

Gas–liquid equilibrium data on mixtures of light gases and heavy hydrocarbon solvents are of industrial and technological interest. Information on the solubility of the gases in the saturated liquid and the concentration of oil vapor in the saturated gas is needed for process design and analysis. The needed information in some form of correlation must be developed from experimental data.

Experimental information is extremely scarce on mixtures of heavy aromatic hydrocarbons containing more than two rings. Sebastian et al. (*1*) reported gas–liquid equilibrium data on hydrogen plus 9,10-dihydrophenanthrene. Lee-Bechtold et al. (*2*) studied thermodynamic properties of 9,10-dihydrophenanthrene (abbreviated as NTDP from here on) at temperatures up to 145 °C. No previous study for the present mixture system has been reported in the literature.

Experimental Section

The experimental apparatus and procedure of this study were described by Simnick and co-workers (*3*). A minor change has been made in the apparatus with the addition of a Heise gauge (Model CMM) which reads pressures below 34 atm to an increased accuracy of ±0.03 atm.

Methane gas was supplied by Matheson with a minimum purity of 99%. NTDP was purchased from Aldrich Chemical Co. and from Columbia Co. with a reported purity of 97%. It was further purified before use by zone refining to a purity of 99+% as determined from gas-chromatographic analysis.

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