

Table 3 Compressibility factor of nitrogen-ammonia system at 50°C

<i>P</i> , atm	<i>Z=PV/RT</i>								
	Composition, mol%								
	N ₂ NH ₃	100.0 0.0	N ₂ NH ₃	87.3 12.7	N ₂ NH ₃	77.0 23.0	N ₂ NH ₃	62.3 37.7	N ₂ NH ₃
0		1.0000		1.0000		1.0000		1.0000	
2		1.0000		0.9994		0.9984		0.9965	
4		0.9999		0.9988		0.9968		0.9930	
6		1.0000		0.9982		0.9952		0.9896	
8		1.0000		0.9976		0.9937		0.9865	
10		1.0000		0.9971		0.9922		0.9834	
12		1.0001		0.9965		0.9908		0.9805	
14		1.0001		0.9960		0.9894		0.9777	
16		1.0002		0.9955		0.9880		0.9751	
18		1.0002		0.9950		0.9867		0.9725	
20		1.0004		0.9944		0.9854		0.9701	
22		1.0005		0.9940		0.9842			
24		1.0006		0.9935		0.9830			
26		1.0007		0.9931		0.9818			
28		1.0010		0.6626		0.9807			
30		1.0012		0.9922		0.9796			
40		1.0023		0.9903					
50		1.0038		0.9886					

Table 3 (continued)

1/V, mol/l	<i>Z=PV/RT</i>								
	Composition, mol%								
	N ₂ NH ₃	100.0 0.0	N ₂ NH ₃	87.3 12.7	N ₂ NH ₃	77.0 23.0	N ₂ NH ₃	62.3 37.7	N ₂ NH ₃
0		1.0000		1.0000		1.0000		1.0000	
0.2		0.9999		0.9984		0.9958		0.9909	
0.4		1.0000		0.9969		0.9919		0.9828	
0.6		1.0003		0.9955		0.9882		0.9757	
0.8		1.0005		0.9941		0.9849		0.9696	
1.0		1.0009		0.9929		0.9818			
1.2		1.0015		0.9918					
1.4		1.0021		0.9907					
1.6		1.0028		0.9898					
1.8		1.0036		0.9889					
2.0		1.0045							

Table 4 Experimental equations of state for nitrogen-ammonia system at 50°C

Composition, mol%	$Z = 1 + B(1/V) + C(1/V)^2 + D(1/V)^3$,			1/V, mol/l Range of 1/V
	B	C	D	
N ₂ — NH ₃				
100.0 — 0.0	-0.00037	0.00131	—	up to 3.0
87.3 — 12.7	-0.0082	0.00114	—	up to 1.8
77.0 — 23.0	-0.0219	0.0034	—	up to 1.07
62.3 — 37.7	-0.0479	0.0123	—	up to 0.7
0.0 — 100.0	-0.2172	0.0628	-0.0566	up to 0.9

Composition, mol%	$Z = 1 + B'P + C'P^2 + D'P^3$,			P, atm Range of P
	B' · 10 ³	C · 10 ⁶	D' · 10 ⁶	
N ₂ — NH ₃				
100.0 — 0.0	-0.022	1.98	—	up to 100
87.3 — 12.7	-0.038	1.6	—	up to 48
77.0 — 23.0	-0.829	5.0	—	up to 28
62.3 — 37.7	-1.828	16.8	—	up to 18
0.0 — 100.0	-7.477	-34.6	-2.90	up to 19

They were compared with the values calculated theoretically as follows. The Lennard-Jones (12-6) potential function,

$$\varphi(r) = 4\epsilon[(r_0/r)^{12} - (r_0/r)^6], \quad (1)$$

was adopted on the intermolecular forces between argon and argon, argon and ammonia, nitrogen and nitrogen, and nitrogen and ammonia. The Stockmayer potential function,

$$\varphi(r, \theta_1, \theta_2, \phi_2 - \phi_1) = 4\epsilon[(r_0/r)^{12} - (r_0/r)^6] - (\mu^2/r^3) g(\theta_1, \theta_2, \phi_2 - \phi_1), \quad (2)$$

was adopted on the intermolecular forces between ammonia and ammonia. The figures of the parameters in the functions were given by Hirschfelder *et al.*⁶⁾ as below :

	r ₀ (Å)	b ₀ = (2/3)Nr ₀ ³ (cc/mol)	ε/k (K)	μ (debyes)
Ar — Ar	3.405	49.80	119.8	—
Ar — NH ₃	3.002	34.14	195.8	—
N ₂ — N ₂	3.698	63.78	95.05	—
N ₂ — NH ₃	3.126	38.54	190.5	—
NH ₃ — NH ₃	2.60	22.12	320	1.47

where the force constants between a polar (subscript *p*) and a non-polar molecule (subscript *n*) were obtained from the empirical combination laws represented by the following equations :

$$(r_0)_{np} = (1/2)[(r_0)_n + (r_0)_p] \xi^{-1/6} \quad (3)$$

$$\epsilon_{np} = (\epsilon_n \epsilon_p)^{1/2} \xi^2 \quad (4)$$

6) J. O. Hirschfelder, C. F. Curtiss and C. B. Bird, "Molecular Theory of Gases and Liquids", John Wiley and Sons, New York (1954)