

EVALUATION OF *P-V-T* PROPERTIES DATA

The Most Probable Values of Compressibility Factor of Propane and Propene

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The critical evaluation of the *P-V-T* data of propane and propene have been carried out based upon the experimental data available in literatures. All of the experimental measurements under high pressure were evaluated in view of their reliability and the data were correlated with temperature and pressure. The most probable values and the supplementary values of the compressibility factor of propane and propene are presented in the form of numerical tables covering the range of temperature from 248.15 to 548.15 K and that of pressure up to 300×10^5 Pa for propane, and from 248.15 to 498.15 K and up to 600×10^5 Pa for propene. The estimated uncertainty of the tabulated values is also presented in the tables.

Introduction

The evaluation of *P-V-T* properties of fluids at high pressure has been made as part of the program of "High Pressure Data Center of Japan" organized in the Society of Material Science, Japan, with the sponsorship of the Agency of Science and Technology. In the program, the work for the evaluation of *P-V-T* properties of gaseous methane, ethane and ethene had already been made and reported previously in this journal^{1,2)}. Next to them, this work for propane and propene has also been performed in a similar manner to the above cases. The following members of the Committee and researchers attended for the discussion on the present work:

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- 1) J. Osugi, Y. Takezaki and T. Makita, *This Journal*, **41**, 60 (1971)
- 2) K. Date, K. Watanabe and M. Uematsu, *ibid.*, **43**, 92 (1973)

Survey and evaluation of *P-V-T* data

There exist eleven and seven measurements on the *P-V-T* relations of propane and propene, respectively, under high pressures. In Table 1, the authors, the temperature and pressure ranges, and reported numbers of isotherms are listed in the order of publishing year.

Table 1 Measurements of *P-V-T* properties of propane and propene under pressure

First author	Year	Temperature, °C	Pressure, bar	No. of isotherms	Ref. No.
Propane					
Sage	1934	21.1 to 104.4	1.7 to 206	6	3)
Beattie	1937	96.8 to 275	23 to 307	9	4)
Deschner	1940	30 to 366	1 to 141	12	5)
Lu	1940	-30.5 to 20.5	5.1 to 61	6	6)
Reamer	1949	37.7 to 237.7	1 to 689	9	7)
Cherney	1949	50 to 125	10.8 to 49.7	3	8)
Stewart	1958	-196	1962 to 19620	1	9)
Dittmar	1962	0 to 140	9.8 to 1029	15	10)
Seeman	1963	5 to 26	4.6 to 8.9	Satd. liq. line	11)
Kahre	1964	-40 to 76.7	10.2 to 96.5	8	12)
Sliwinski	1969	10.5 to 96.4	(No data)	Satd. vap. line	13)
Propene					
Vaughan	1940	0 to 300	2.3 to 82.8	14	14)
Farrington	1949	4.4 to 237	1 to 689	12	15)
Marchman	1949	30 to 250	5.1 to 217	10	16)
Michels	1953	25 to 150	6.5 to 2869	7	17)
Stewart	1958	-196	1962 to 19612	1	9)
Dittmar	1962	0 to 140	19.2 to 1028	15	10)
Robertson	1969	35 to 200	1000 to 10000	3	18)

The original papers were carefully read through and examined from the viewpoint of the reliability of the reported data, by the same operations as in the previous works^{3,2)}. The final evaluation was performed by the Committee members and several researchers in this field as described above.

As the results, the set of data for propene by Michels *et al.*¹⁷⁾ was considered to be the most reliable among them, and given the highest weight. The weight second to the above was given to two sets of data for propane by Reamer *et al.*⁷⁾ and Cherney *et al.*⁸⁾. The weight third to the above was given to the sets of data for propane by Beattie *et al.*⁴⁾ and for propene by Marchman *et al.*¹⁶⁾. The weight fourth

- 3) B. H. Sage, J. G. Schaafsma and W. N. Lacey, *Ind. Eng. Chem.*, **26**, 1218 (1934)
- 4) J. A. Beattie, W. C. Kay and J. Kaminsky, *J. Amer. Chem. Soc.*, **59**, 1589 (1937)
- 5) W. W. Deschner and G. G. Brown, *Ind. Eng. Chem.*, **32**, 836 (1940)
- 6) J. H. Burgoyne, *Proc. Roy. Soc.*, **A 176**, 280 (1940)
- 7) H. H. Reamer, B. H. Sage and W. N. Lacey, *ibid.*, **41**, 482 (1949)
- 8) B. J. Cherney, H. Marchman and R. York, Jr., *Ind. Eng. Chem.*, **41**, 2653 (1949)