Chapter 21

VISCOSITY OF GAS

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ABSTRACT

Results for gas viscosity as function of temperature are presented for a wide range of organic and inorganic chemicals. The major chemicals include many compound types. The results are provided in easy-to-use tables that are especially applicable for rapid engineering usage with the personal computer or hand calculator. The agreement of correlation and data is quite good.

INTRODUCTION

Gas viscosity data are important in many engineering applications in the chemical processing and petroleum refining industries. The objective of this article is to provide the engineer with such viscosity data. The compilation of data is presented for a wide temperature range to enable the engineer to determine values at desired temperatures of interest.

GAS VISCOSITY CORRELATION

The correlation for gas viscosity as a function of temperature is given by the equation shown below:

$$n_{gas} = A + B\,T + C\,T^2 \qquad (21\text{-}1)$$

where n_{gas} = viscosity of gas, micropoise
A, B and C = regression coefficients for chemical compound
T = temperature, K

The results for gas viscosity at low pressure are given in Tables 21-1 and 21-2. The tabulations are arranged by chemical formula carbon number to provide ease of use in quickly locating data.

In preparing the compilation, a literature search was conducted to identify data source publications for organics (1-37) and inorganics (1-62). Both experimental values for the property under consideration and parameter values for estimation of the property are included in the source publications. The publications were screened for appropriate data. The compilation resulting from the screening is based on both experimental data and estimated values. In the absence of experimental data, estimates were primarily based on modified Chapman-Enskog method (29, Chung et al equation, intermolecular forces, collision diameter) and Reichenberg equation (29, corresponding state, group contribution). Experimental data and estimates were then regressed to provide the same equation for all compounds.

Very limited experimental data are available for highly polar and high molecular weight compounds. Thus, the values for these compounds should be considered rough approximations.

A comparison of correlation and experimental data is shown in Figure 21-1 for a representative chemical. The graph discloses good agreement of correlation and data.

EXAMPLES

The correlation results maybe used for prediction and calculation of gas viscosity. Examples are given below.

Example 1 Calculate the gas viscosity of n-hexane (C6H14) at a temperature of 300 K.

Substitution of the coefficients from the table and temperature into the correlation equation yields:

$n_{gas} = -8.2223 + 2.6229E\text{-}01*300 - 5.7366E\text{-}05*300^2$

$n_{gas} = 65.3$ micropoise

The calculated and data values compare favorably (65.3 vs 66.6, deviation = 1.95%).

Example 2 Calculate the gas viscosity of carbon tetrachloride (CCl4) at a temperature of 520 K.

Substitution of the coefficients from the table and temperature into the correlation equation yields:

$n_{gas} = -7.7453 + 3.9481E\text{-}01*520 - 1.1150E\text{-}02*520^2$

$n_{gas} = 169.3$ micropoise

The calculated and data values compare favorably (169.3 vs 167.0, deviation = 1.36%).

REFERENCES – ORGANIC COMPOUNDS

1-34. See **REFERENCES - ORGANIC COMPOUNDS** in **Chapter 1 CRITICAL PROPERTIES AND ACENTRIC FACTOR**

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