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Thermodynamic Properties of Homogeneous Mixtures of Nitrogen and Water from 440 to 1000 K, up to 100 MPa and 0.8 mole fraction N_2

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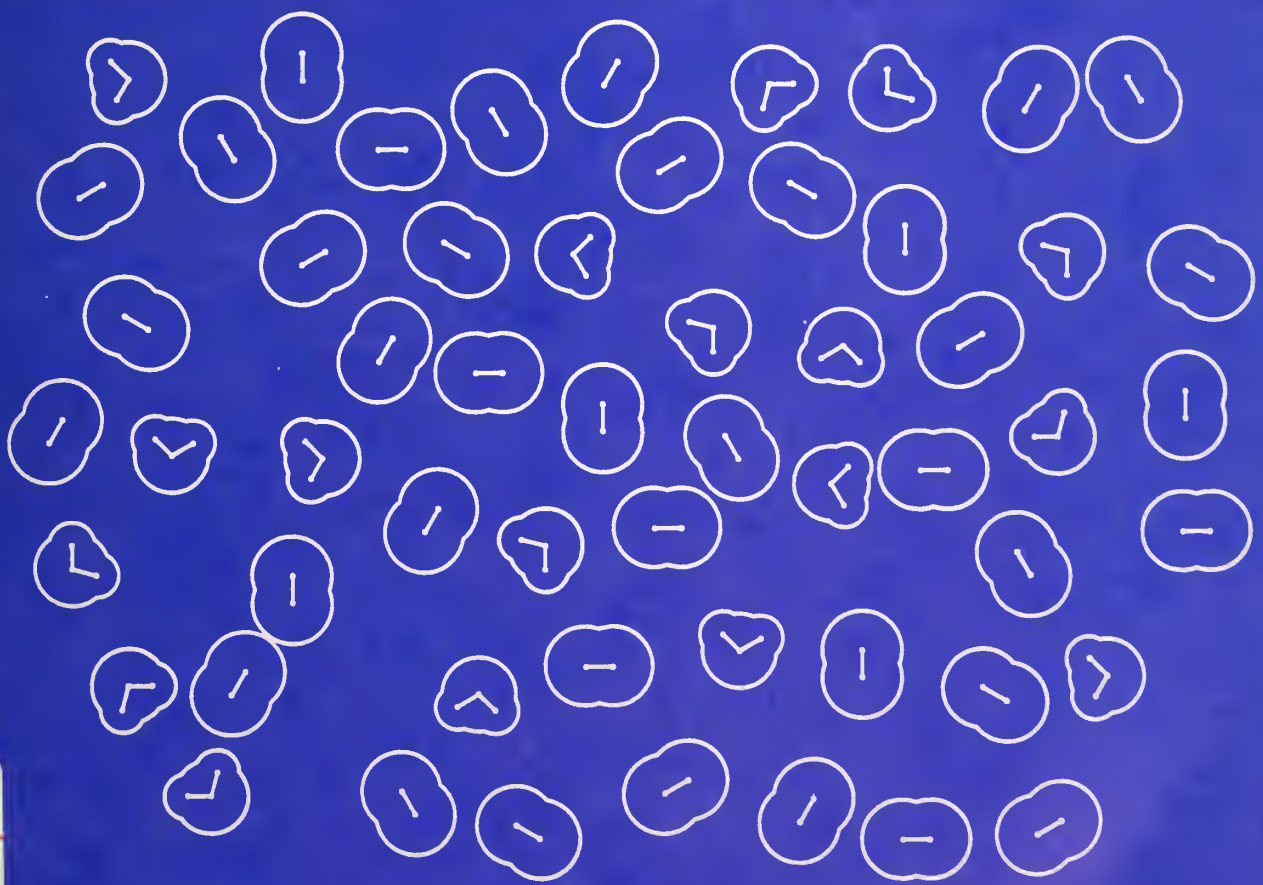

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Thermodynamic Properties of Homogeneous Mixtures of Nitrogen and Water from 440 to 1000 K, up to 100 MPa and 0.8 mole fraction N_2

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A generalized corresponding-states model of the Helmholtz free energy for fluid mixtures, with pure water as the reference fluid, has been used to model the solubility and thermodynamic properties of nitrogen in water in homogeneous ststes in a wide range of temperatures and pressures around the water critical point. The model predictions are compared with the literature data available in this range. Tabulated values of density, enthalpy, isobaric heat capacity and fugacity coefficients are presented at selected entries of pressure from 0.05 to 100 MPa, of temperature from 440 to 1000 K, and of nitrogen mole fractions up to 0.8. Also presented are tables of infinite-dilution (standard-state) properties of the nitrogen solute in the same pressure and temperature range.

Key words: corresponding states; density; enthalpy; fugacity; heat capacity; Henry's constant; mixture; nitrogen; solubility; standard states; steam; water.

Contents

List of Tables

List of Figures

List of symbols

A	molar Helmholtz free energy
a_{-1}, a_0, a_1	constants defining C_p^{perf} of nitrogen
C	molar heat capacity
C_{p2}	solute isobaric partial molar heat capacity
H	molar enthalpy
H_2	solute partial molar enthalpy
f	scale factor for temperature
f_i	fugacity of component i
h	scale factor for volume
j	mixing parameter for temperature
k	mixing parameter for volume
k_B	Boltzmann's constant
k_H	Henry's constant
p	pressure
R	molar gas constant
T	absolute temperature
V	molar volume
V_2	solute partial molar volume
x	mole fraction of nitrogen
z	compressibility factor pV/RT

Greek symbols

θ	shape factor for temperature
θ_0, θ_V, θ_T, θ_{VT}	constants in temperature shape factor expression
ρ	density
φ_i	fugacity coefficient of component i
ϕ	shape factor for volume
ϕ_0, ϕ_V, ϕ_T, ϕ_{VT}	constants in volume shape factor expression

Subscripts

i	component
1	solvent
2	solute
s	solute
w	water
liq	liquid, or the denser coexisting phase
vap	vapor, or the less dense coexisting phase

Superscripts

*	pure solvent
**	reference value
c	critical (pure fluid)
	pseudocritical or related reference state (fluid mixture)
E	excess
mol	molecular
perf	perfect-gas
res	residual

1. Introduction

The solubility of air constituents in water has been a topic of considerable practical interest for a long time. As a consequence, there is a rich and accurate data-base in the temperature range from the freezing point to the boiling point of water. For entries into the literature on this topic, we refer to the IUPAC Solubility Series [1], as well as to the reviews by Fernandez-Prini and Crovetto [2], and by Wilhelm et al. [3]. The emerging technology of supercritical water oxidation (SCWO) as well as the mounting interest in water as a reaction medium [4] are giving rise to demand for data on fugacity coefficients, density and enthalpy for systems such as air constituents in water at temperatures and pressures near and above those of the critical point of water, which is located at approximately 647 K and 22 MPa [5].

The phase diagram of the system water-nitrogen is of the type III-m in the classification of van Konynenburg and Scott [6], just like those of other air constituents in water, such as oxygen, argon and carbon dioxide. This implies that a gas-gas equilibrium line emerges from the critical point of steam, moving quickly to high pressures after passing through a minimum in temperature. This minimum is quite shallow, only a few kelvin, for the solutes nitrogen, oxygen and argon, but deep in the case of carbon dioxide as a solute.

For the system carbon dioxide in water, we recently developed a Helmholtz free energy formulation for use in the water-rich phase at near-critical and supercritical conditions [7]. We used a generalized principle of corresponding states with pure water as the reference fluid. The model has been described in detail in a recent publication [7], to which we refer for information and for computer codes. The model permits calculation of the critical line, phase boundaries, and all thermodynamic properties of interest.

In applications of SCWO, the thermodynamic properties of mixtures of air constituents and water are urgently needed. In view of the fact that the availability of data for the oxygen-water system is extremely limited, we have decided to first develop and test a model for the system nitrogen-water, for which five new data sets have become available in the past decade.

We discuss the data sources in Section 2. In Section 3, we give a concise summary of the thermodynamic model, describe how it was fitted to the data, and list the model parameters.

In Section 4, we compare with the available data, and discuss the mutual agreement or disagreement of the various data sources, as well as the adequacy of the model in the various ranges. We make some observations on the extraction of infinite-dilution properties, in particular the Henry constant, from experimental data.

In Section 6, we describe the range in which the model is valid, and estimate the accuracy in that range. We close with some concluding remarks in Section 7. Appendix A contains the tabular material, including the model parameters, and comparisons with available pVTx and solubility data. We also tabulate the predicted molar volume, enthalpy, and the fugacity coefficients of the two components in the range 440-1000 K in temperature, 0.05-100 MPa in pressure, and 0.05-0.8 in mole fraction of nitrogen. In addition, we present a table of infinite-dilution or standard state properties: partial molar volume, partial molar enthalpy, and fugacity coefficient of the nitrogen solute in the same temperature and pressure range as for the first set of tables.

2. Review of the Experimental Data

Early investigations of the phase behavior of nitrogen in near-critical and supercritical water are those of Tsiklis and coworkers [8]. These authors measured liquid-gas and gas-gas equilibrium in pressure-composition space at three temperatures, up to 385 ^{o}C and at pressures up to 400 MPa. These data have only been presented in graphical form, but some tabulated values are available for four points on the critical curve.

The principal data source for the high-temperature coexisting phases is the comprehensive study of Japas and Franck [9]. These authors measured liquid-gas and gas-gas phase separation for mixtures of thirteen different concentrations ("isopleths") between 523 and 673 K and from 20 to 270 MPa. A measured amount of a mixture of known composition was heated isochorically in a windowed autoclave of known volume. At the transition from the two-phase to the homogeneous state, the p-T isochore showed a change of slope. This observation provided pressure, temperature, composition and density of one point in the liquid, or high-density gas phase on the three-dimensional two-phase envelope. This determination was corroborated by a direct observation of the appearance of a second phase, or of critical opalescence. Over 60 phase boundary data were reported. In addition, at the temperature of 673 K, 65 pVx data points were obtained in the homogeneous phase, at compositions from 0.134 to 0.9 mole fraction of water. The authors claimed uncertainties on the level of $\pm$ 0.5 K in temperature, and $\pm$ 0.1 MPa in pressure. The critical curve was constructed as the envelope of the isopleths in p-T space. For nine points on this curve, pressure, molar volume, temperature and composition were listed. The authors confirmed the critical line of Tsiklis and coworkers [8], and also their finding that the gas-gas critical line has a minimum in temperature.

For temperatures below the critical point of water, Henry's constants were estimated by extrapolating gas solubilities measured as a function of pressure to the saturation pressure of pure water. The authors claimed only qualitative estimates [9], given the large uncertainty of the pressure extrapolation.

The pVTx data of Japas and Franck in the homogeneous phase have been recently supplemented by data from two different sources. One of us, Abdulagatov, with his coworkers [10] measured pVTx over the full composition range from 523 to 663 K and at pressures up to 70 MPa. The sample was confined to a 33 cm^3 cylindrical cell of a corrosion-resistant steel alloy, provided with a steel ball for stirring; the cell was separated from the rest of the fill and pressure measurement system by a diaphragm-type null indicator. The volume of the cell was determined by weighing with water, with an uncertainty of 0.1%. The volume was corrected for temperature expansion by means of the known expansion coefficient of the alloy. Pressure was measured by means of a dead-weight gage with a precision of 0.002 MPa. Pressures are listed to the nearest 0.01 MPa only, so that the uncertainty of pressures below 10 MPa is more than 0.1 %. The composition was determmined by analysis of samples taken from the cell, with an uncertainty of ± 0.002 in mole fraction. The uncertainties of pressure and density values are stated as ± 0.2 %, respectively, in the abstract to the paper. A total of 55 data were taken for the system nitrogen-water, for three different isotherms and more than a dozen different compositions.

Two of us, Watson and Fenghour, measured pVTx of nitrogen-water mixtures in a spherical pressure vessel connected by a line of very small dead volume to a mercury-operated gas-oil separator of novel design. The mercury level was automatically maintained at a fixed level at the sample side. The volume of the pressure vessel was determined with 10 ppm uncertainty, in the manner worked out by Moldover [11] for his spherical acoustic resonators. A total of 101 pVTx data at ten nitrogen mole fractions from 0.36 to 0.94 were measured, with one isochore for each mole fraction, with temperatures from 428 to 697 K, and with pressures up to 30 MPa. These authors claim an uncertainty in the density of less than 0.2%.

Nitrogen solubility data in water, a total of 31 points in the range of 336 to 636 K, were recently reported by Alvarez et al. [12]. These authors measured the composition of the liquid phase as a function of the pressure increment over that of saturated pure water. The temperature stability and precision were on the level of 0.2 K at the higher temperatures. Pressures were measured with an uncertainty no larger than 0.2%. The nitrogen mole fraction in the liquid phase was of the order of 10^{-4} to 10^{-2} and reported to 3 or 4

significant figures. The authors derived values of the Henry constant from their data, using approximations based on molecular theory in order to make the various nonideality corrections in the coexisting phases [12, 13] Wormald and Colling [14] measured the excess enthalpy of mixing of equimolar mixtures of nitrogen and steam in a flow calorimeter of a design suitable for supercritical aqueous mixtures. They took 74 data from 448 to 698 K, and at pressures up to 12.6 MPa. Wormald [13]ntly reevaluated and supplemented these data, to a total of 77 points, and estimated their uncertainty to be on the level of ± 1.5% in H^E.

Our model allows a check of the mutual consistency of these various data sources. The model is directly fitted to the liquid-phase compositions in the experiments that were used to determine Henry constants, and is then used to calculate the infinite-dilution values of the Henry constant without introducing additional approximations.

3. The Helmholtz Free Energy for the Mixture

3.1 Generalized Corresponding-States Model

The Helmholtz free energy model used here is inspired by the generalized principle of corresponding states, as developed by Rowlinson and Watson [16], Leland and coworkers [17, 18], and Ely and coworkers [19, 20]. Our application, being geared towards mixtures with water as the principal component, uses only one reference fluid, namely water. The NBS/NRC Helmholtz free energy of water and steam [21], in the dimensionless form of Kestin et al. is used as a formulation for the reference fluid [22].

A detailed description of this free energy formulation was given in a recent publication [7]. Here, we present a brief summary of the most important relations.

All thermodynamic properties of the binary mixture of mole fraction x of solute (s, component 2) in water (w, component 1) are derived from the molar Helmholtz free energy A(V, T, x), with V the molar volume and T the absolute temperature. The molar Helmholtz free energy is written as the sum of a perfect-gas part and a residual part, as follows

$$\begin{aligned} A(V, T, x)/RT \quad &= (1-x)\, A_w^{mol}(T)/RT + x\, A_s^{mol}(T)/RT \\ &\quad - 1 - \ln V/\Lambda^3 + x \ln x + (1 - x) \ln (1 - x) \\ &\quad + A^{res}(V, T, x)/RT \end{aligned} \tag{1}$$

The first line represents the contributions from the intramolecular rotational and vibrational degrees of freedom to the perfect-gas part of the Helmholtz free energy, the second line represents the perfect-gas translational and mixing contributions, and the third line the residual, or real-gas contributions [7, 16]. The symbol Λ represents the length $(h^2/2\pi mkT)^{1/2}$, with h Planck's constant.

According to the principle of generalized corresponding states, the residual molar Helmholtz free energy for a mixture with mole fraction x of solute, at temperature T and molar volume V, is mapped onto the residual molar Helmholtz free energy of pure water, A_w, at a displaced temperature T_w and a displaced molar volume V_w, by the relation

$$A^{res}(V, T, x) = f_x A_w^{res}(V_w = V/h_x, T_w = T/f_x) \tag{2}$$

with the scale factors for temperature, f_x, and for volume, h_x, being functions of V_w and T_w. The scale factors, in turn, are related to the shape factors θ_x, ϕ_x, by

$$\begin{aligned} f_x(V_w, T_w) &= (T_x^c/T_w^c)\, \theta_x(V_w, T_w) \\ h_x(V_w, T_w) &= (V_x^c/V_w^c)\, \phi_x(V_w, T_w) \end{aligned} \tag{3}$$

Here the superscript c on properties subcripted w indicates a value taken at the critical point of pure water. On mixture properties (those with subscript x) it indicates a composition-dependent reference curve, to be defined below. This reference curve reduces to the van der Waals pseudocritical curve in the original two-parameter corresponding states.

The functions $\theta_x(V_w, T_w)$ and $\phi_x(V_w, T_w)$ are shape factors [14, 18], slowly varying functions of T_w and V_w, which represent departures from the two-parameter law of corresponding states. The shape factors $\theta(V_w, T_w)$ and $\phi(V_w, T_w)$ of pure nitrogen, relative to water, are assumed to be of the form

$$\begin{aligned} \theta(V_w, T_w) &= 1 + \theta_V(V_w/V_w^c - 1) + \theta_T(T_w/T_w^c - 1) + \theta_{VT}(V_w/V_w^c - 1)(T_w/T_w^c - 1) \\ \phi(V_w, T_w) &= \phi_0 + \phi_V(V_w/V_w^c - 1) + \phi_T(T_w/T_w^c - 1) + \phi_{VT}(V_w/V_w^c - 1)(T_w/T_w^c - 1) \end{aligned} \tag{4}$$

Here θ_V, θ_T, θ_{VT} and ϕ_0, ϕ_V, ϕ_T and ϕ_{VT} are adjustable parameters, while ϕ_0 is set equal to $z^c_{N_2}/z^c_w$, the ratio of the critical compressibility factors of nitrogen and water.

The shape factors $\theta_x(V_w, T_w)$ and $\phi_x(V_w, T_w)$ for the mixture of composition x, mapped to T_w, V_w, are calculated from $\theta(V_w, T_w)$ and $\phi(V_w, T_w)$ by means of the following empirical interpolation equation

$$\theta_x = (1 - x)^2 + 2x\,(1 - x)\,\theta^{1/2} + x^2\,\theta$$
$$\phi_x = (1 - x) + x\,\phi \qquad (5)$$

Finally, it is necessary to specify the parameters V^c_x and T^c_x of the mixture of composition x, which reduce to the van der Waals pseudocritical parameters in his generalization of two-parameter corresponding states to mixtures. These are calculated from critical-point values of the pure components by means of the mixture rules

$$V^c_x = (1 - x)^2\,V^c_w + 2x(1-x)\,V^c_{ws} + x^2 V^c_s$$
$$T^c_x = (1 - x)^2\,T^c_w + 2x(1-x)\,T^c_{ws} + x^2 T^c_s \qquad (6)$$

The parameter T^c_s equals the critical temperature of nitrogen, T_c = 126.20 K. V^c_s equals $V^c_{N_2}/\phi_0$, with $V^c_{N_2}$, the critical volume of nitrogen, equal to 3.215 $dm^3\ kg^{-1}$. The parameters V^c_{ws}, T^c_{ws} are calculated from Lorentz-Berthelot type combining rules

$$V^c_{ws} = k\,[(V^c_w)^{1/3} + (V^c_s)^{1/3}]^3/2^3$$
$$T^c_{ws} = j\,[T^c_w\,T^c_s]^{1/2} \qquad (7)$$

where k and j are adjustable interaction parameters. In addition to the pure-component critical parameters, which are not adjusted, the model has eight adjustable parameters, six in the shape factors and two in the combining rules.

3.2 The Model Parameters

The model parameters of the system nitrogen-water were determined in the following steps. For the reference fluid, water, we used the full Helmholtz free energy which is the basis of the NBS/NRC Steam tables [21]. It was used in the dimensionless form of Kestin et al. [22]. The NBS/NRC equation is formulated on the International Practical Temperature Scale of 1968. Short of refitting this equation to the original data base transformed to the ITS-90, a task far exceeding the scope of this work, there is no good way of correcting the formulation while retaining consistency of the derived properties. Thus, strictly speaking, the work presented here is on the IPTS-68 scale, which differs from ITS-90 by a at most a few tenths of a kelvin in the present range of application. In practice, the departures of the data from the optimized model are such that considering the present model as formulated on ITS-90 introduces little additional error.

The perfect-gas properties and the critical parameters of nitrogen were obtained from the correlations of Stewart and Jacobsen [23] and of Jacobsen et al. [24]. They use multiparameter expressions valid over large ranges of temperature far exceeding the range of interest here. For our application, the perfect - gas heat capacity C_V^{perf} was obtained by fitting, in our temperature range, the values for this quantity tabulated in Ref. 21 by a quadratic function of temperature

$$C_V^{perf}/S^{**} \equiv C_V^{mol} + R = \\ = a_{-1}T^{**}/T + a_0 + a_1 T/T^{**}, \quad 400\ K < T < 1000\ K \tag{8}$$

The coefficients a_{-1}, a_0 and a_1 are listed in Table 1. Constants subscripted by two asterisks, such as S^{**} and T^{**}, are reference constants used to make the formulation of the Helmholtz free energy of steam dimensionless; they are given in Ref. 22. They show up in eqs (8) and (9) because all ideal-gas properties of water and nitrogen are mole-averaged in dimensionless form and converted to dimensioned units only at the last stage of calculation. Equation (8) represents the tabulated ideal-gas heat capacities to 0.1% from 400 to 900 K and to 2% at 1000 K. Equation (8) was integrated with respect to temperature, in order to obtain the perfect-gas part of the Helmholtz free energy

$$A^{perf}/A^{**} \equiv [A^{mol} - RT + \ln (V/\Lambda^3)]/A^{**} =$$
$$[a_{-1} + a_0 T^{**}/T)] \ln (T/T^{**}) + a_1 (T/T^{**})^2/2 \qquad (9)$$

No effort was made to define a zero point for the thermodynamic functions of pure nitrogen (and, a fortiori, for the mixture). The absolute values of the enthalpies tabulated in this paper have no meaning; only their differences do. The ideal-gas enthalpy difference between 300 and 800 K, according to eq. 9, agrees with that of the full expression of Jacobsen and coworkers to better than 1 part in 20 000.

The critical parameters of nitrogen were taken from Ref. 23; they are listed in Table 1, and they were used to fix the constant ϕ_0 in the shape factor for volume as $z^c_{N_2}/z^c_w$, the ratio of the critical compressibility factors of nitrogen and water. No effort was made to represent the region of phase coexistence of pure nitrogen, since this region is irrelevant in the present application to mixtures rich in water at conditions in a region around the critical point of water. The shape factors were adjusted so as to represent pVT data of nitrogen at the high temperatures of interest here to within a few percent in density. A difficulty in this application of the generalized corresponding states model is that the properties of nitrogen at the high temperatures and high pressures typical of, for instance, the Japas and Franck data, are mapped to steam states that are in part out of the range of the NBS/NRC reference equation for water and steam. As a consequence, the representation of pure nitrogen properties, and of nitrogen-rich states, deteriorates at pressures above 50 MPa. We do not report property values for pressures above 50 MPa at x = 0.8 or higher.We have checked that enthalpy differences for pure nitrogen predicted by our model agree with those reported by Jacobsen and coworkers to 2% in the worst case, in the range of 400 to 800 K, and of 0 to 10 MPa.

After the choice of ϕ_0, the next step was to try to fit the critical line data of Japas and Franck [7]. The techniques used for locating the critical line and the phase boundaries are described in Ref. 5. The parameters were varied, one or two at a time, in order to obtain a rough fit to the data. We experienced considerable difficulty. The measured critical line, starting at the critical point of water, moves through a shallow minimum in temperature, but the present model cannot reproduce this initial part of the critical line, and has an unphysical maximum temperature before it moves to temperatures below the critical temperature of steam. We have an indication that this is a feature of the model that occurs when the critical temperatures of the two components are far apart, and that it persists even when the shape factors are kept constant.

We did not press hard for a close representation of the critical line. Our prime interest was in the density and enthalpy in the homogeneous region; we have found that with the present form of the model, we could not fit this region well if we insisted on fitting the critical line.

The next step was a fit to the three sets of pVTx data, those of Japas and Franck [9], of Watson and Fenghour, and of Abdulagatov et al. [10]. We gave great emphasis to fitting the Watson-Fenghour data. First, parameters were varied in small groups. After an acceptable parameter set was obtained, further refinement of the parameter values was obtained by linearizing the fitting procedure around this set, as described in Ref. 7. In the linearization process, other properties, such as those representative of the critical line data, the solubility data of Alvarez et al.[12], and the excess enthalpy data of Wormald and Colling [14, 15] were included.

Excess enthalpies for mixtures at nitrogen mole fraction x were calculated by subtracting from the model enthalpy the mole fraction-averaged values of the enthalpy of water [12] and of the enthalpy of nitrogen, as predicted from our model. These calculations were performed at fixed temperature and pressure.

The final set of parameters for the model is listed in Table 1, Appendix A.

4. Comparison with the Experimental Data

4.1 PVTx Data

As explained in Section 2, there are three sets of PVTx data for nitrogen in water. The basis for our model was formed principally by those of Watson and Fenghour up to 30 MPa, and those of Abdulagatov et al. [10] up to 70 MPa. The data of Japas and Franck [9] were principally used to direct the high-pressure part of the model. We compare the measured pressures (well over 200 data points in this range) with the model prediction at given temperature, molar density and composition. The measured data, and the predicted values of the pressure, are listed in Tables 2a-c (Appendix A) for all data sources. The pressure differences, in %, are plotted versus pressure in figures 1a and 1b, versus nitrogen mole fraction in figure 1c, and versus temperature in figure 1d. Figure 1a shows the pressure departures in the range up to 45 MPa. We note, figure 1a, that the fit to the Watson-Fenghour data (Table 2a), in the range up to 30 MPa, is quite close, with a root-mean-square (rms) departure of 0.8% in pressure. The departures from the model are however, clearly systematic. The authors claim the uncertainty to be less than 0.2% in density, which would correspond with a similar uncertainty in in pressure. The rms of the fit is three times larger. There is no

indication of systematic differences between the three data sets in this plot, but one should realize that they cover different regions in ρTx space. Figure 1b presents the pressure departures in % in the range up to 100 MPa for the Abdulagatov [10] and the Japas-Franck [9] data. We did not include the Watson-Fenghour data in Fig. 1b, because the resolution of this figure is too small. The rms pressure deviation of the Abdulagatov data is 1.4 % and that of the Japas-Franck data, which span only one isotherm, is 3.7 %. Pressure deviations paint an unflattering picture in the high-pressure incompressible states; the root-mean-square density departure of the Japas-Franck data is only 2.3%. In figure 1c, we note that the Watson-Fenghour data are fitted about equally well over the composition range from x = 0.36 up to x = 0.8. The Abdulagatov data, see Table 2b and figures 1a and 1b, are fitted without obvious systematics, but not within their estimated uncertainty of 0.2%: the root-mean square pressure deviation is 1.4%. One Abdulagatov point, the last point in Table I, Ref. 10, was more than 7% out and we did not include it in this work.

The Japas and Franck data, all at 673 K, (Table 2c and figures 1a-1d) are reasonably well fitted, be it not to within the claimed tolerance of 0.5 K, 0.1 MPa. They agree with the other data sets in regions of overlap. Only in figure 1c, where the data are plotted versus composition, some systematic departures from the model are noticeable, such as the data near x = 0.35. In the case of the data near x = 0.35, we note that they do agree with those of Abdulagatov in the range of overlap in pressure up to 60 MPa. so that the systematics are likely to be due to the model.

We conclude that our model has been able to fit the experimental pVTx data within a tolerance of a few times the experimental uncertainty over the range of compositions up to 0.8 mole fraction of nitrogen, temperatures from 500 to 700 K, and pressure up to 70 MPa. The three sets of PVTx data are in satisfactory agreement in the range of overlap, but do show some systematic departures from the model in the composition dependence.

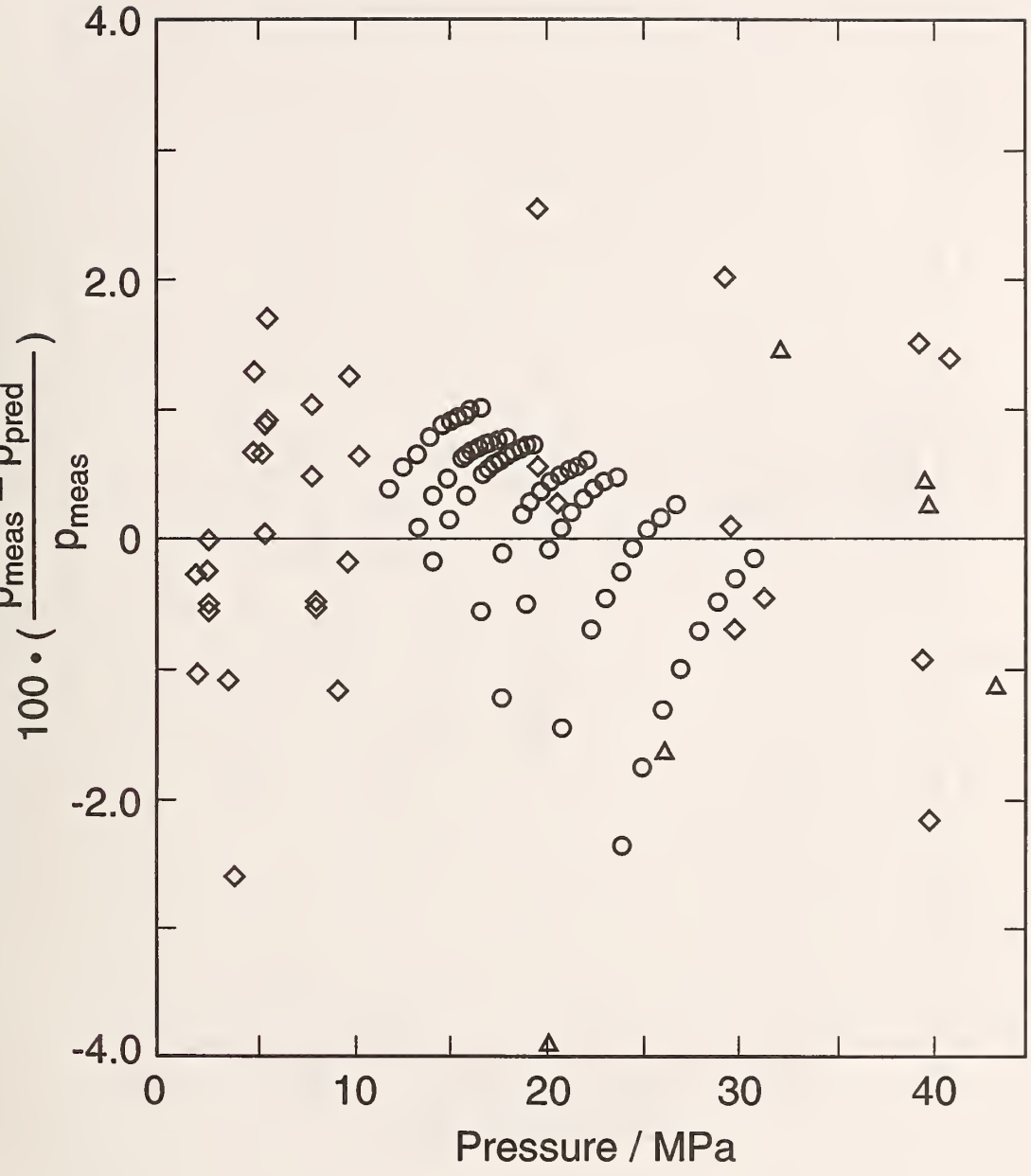

Figure 1a. The relative departures of the experimental pressures from the formulation in the pressure range up to 45 MPa. ○ Watson and Fenghour; ◇ Abdulagatov et al. [10]; Δ Japas and Franck [7].

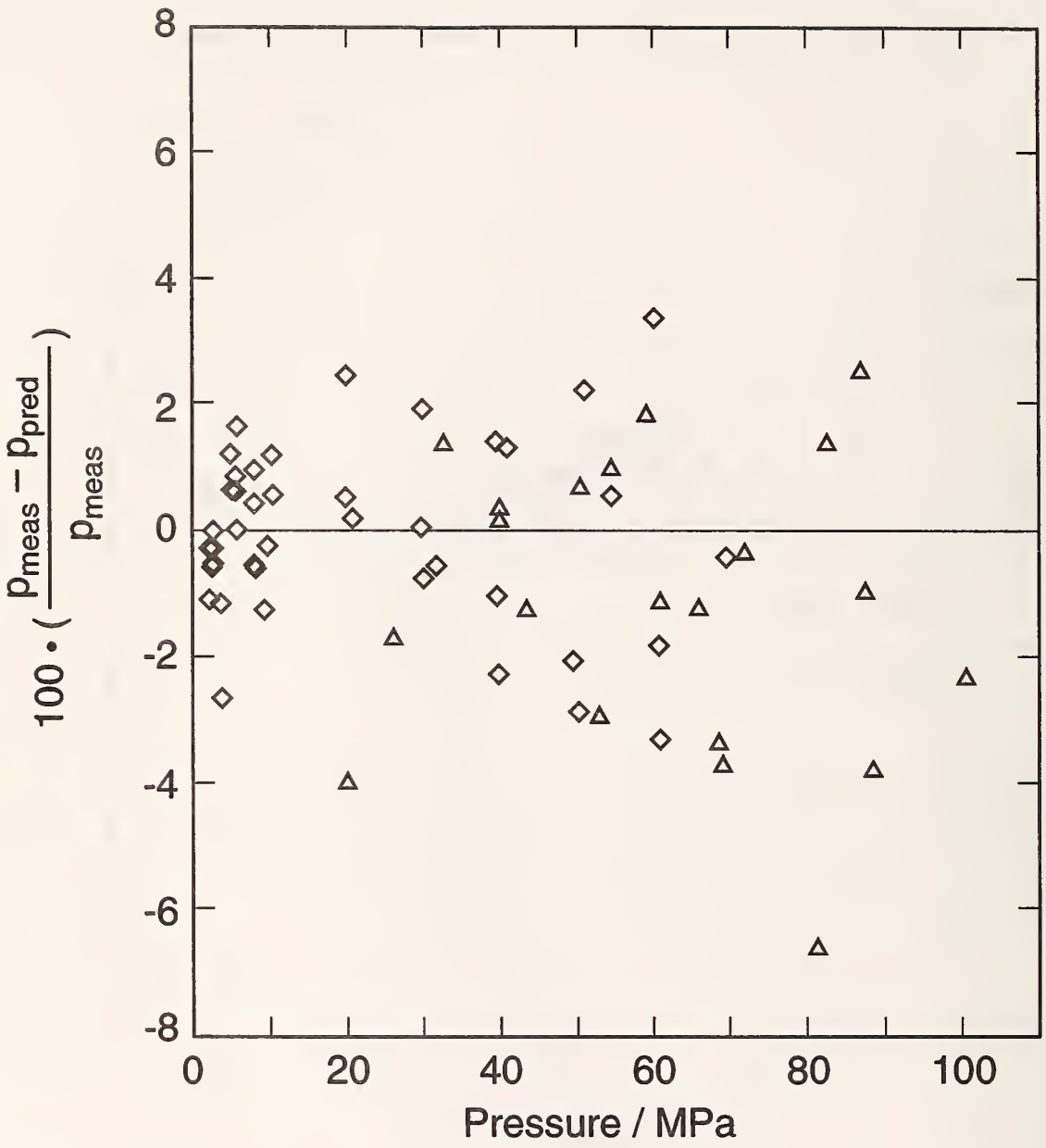

Figure 1b. The relative departures of the experimental densities from the formulation in the range up to 100 MPa. ◇ Abdulagatov et al. [10], Δ Japas and Franck [7]

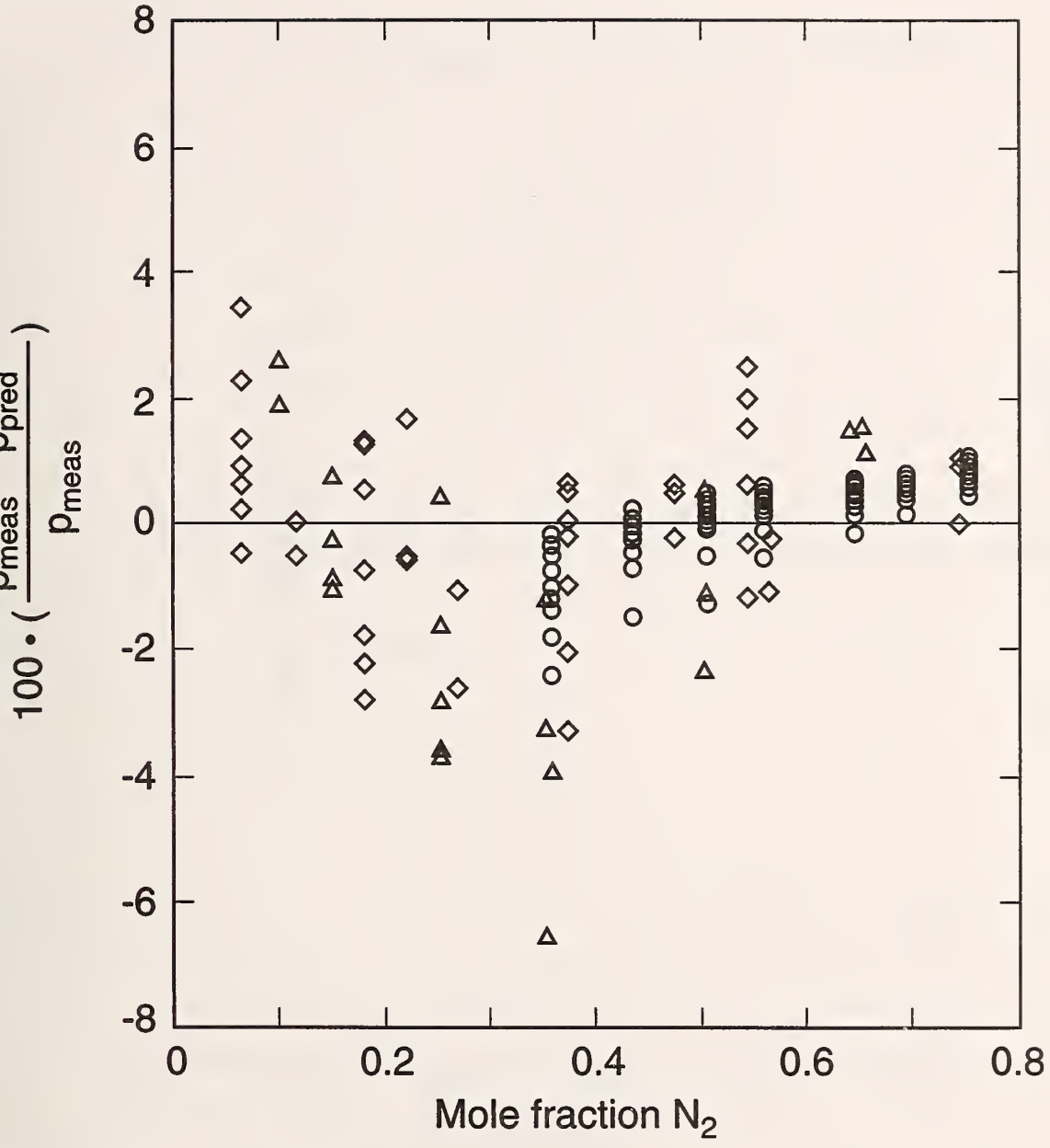

Figure 1c. The relative departures of the experimental pressures from the formulation, in the range up to 0.8 mole fraction of nitrogen. O Watson and Fenghour; ◇ Abdulagatov et al. [10]; Δ Japas and Franck [9].

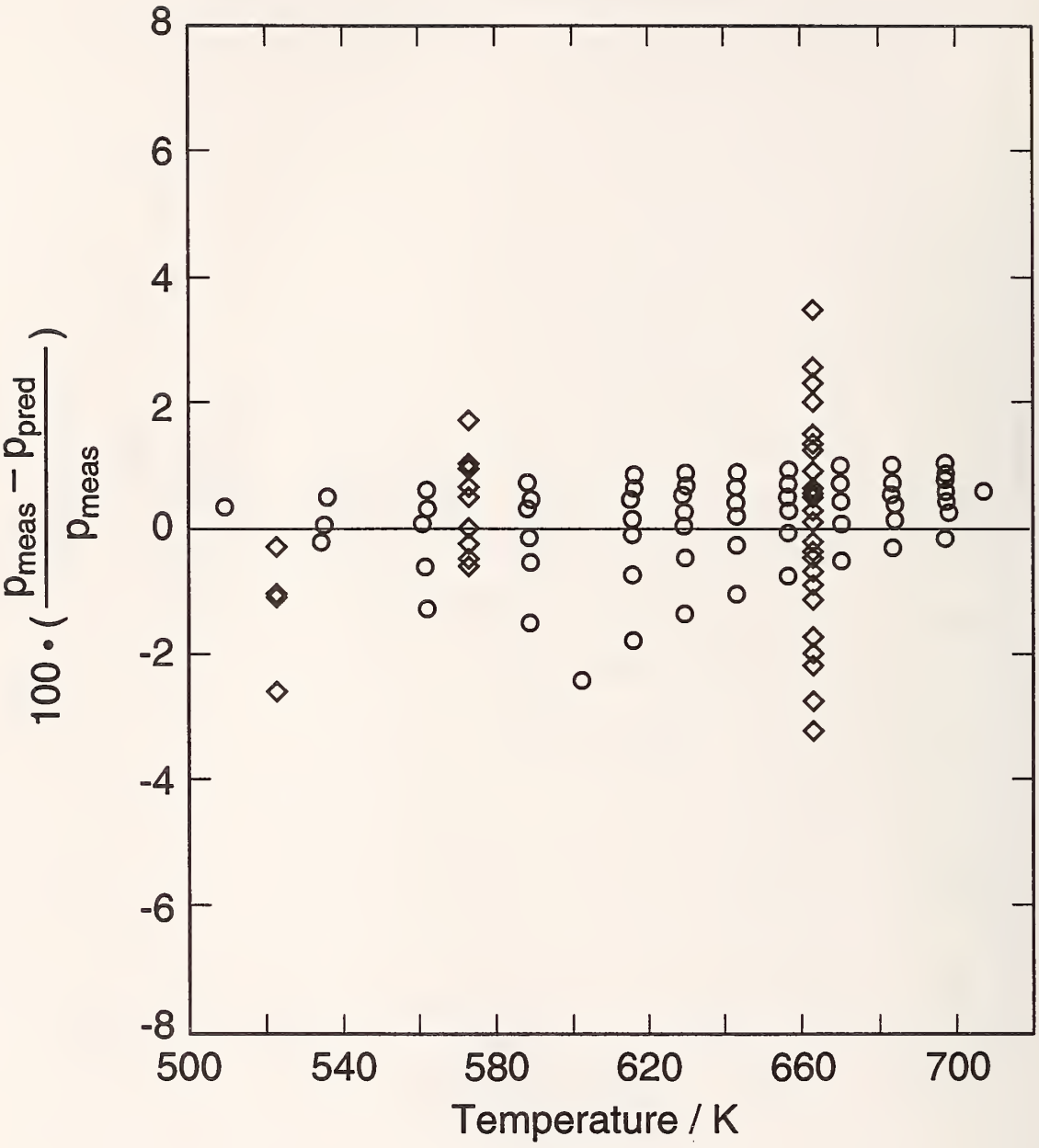

Figure 1d. The relative departures of the experimental pressures from the formulation, plotted as a function of temperature in the range 500-700 K. O Watson and Fenghour; ◇ Abdulagatov et al. [10]

4.2 Solubility Data

We have fitted the model to the directly measured solubility data of Alvarez et al. [10], which represent the composition of the liquid phase at coexistence, at nitrogen mole fractions generally below 0.01. As is evident from Table 3, Appendix A, our model fits these compositions generally within a few percent in the range from 460 to 636 K. Alvarez et al. give no estimate of the uncertainty of their measured mole fractions; in an earlier paper [25] from the same group, however, the reproducibility of the composition measurement was quoted as 0.5%. Alvarez et al., in various ways, [12, 13] calculated Henry's constants from these measured mole fractions. This calculation requires extrapolation to infinite dilution, which these authors achieved by making corrections based on molecular theory for departures from perfect-gas behavior in the vapor phase, and from mixture nonideality in the liquid phase. Especially the latter correction, which is applied to the activity coefficient of the liquid, is difficult to make, and becomes both substantial and uncertain as the critical point is approached [26]. A (classical) Helmholtz free energy model extrapolates simply to infinite dilution even near a critical point, without the critical anomalies peculiar to activity coefficients based on infinite-dilution reference states [26].

Henry's constant, defined as

$$k_H = \lim_{x=0} f_2/x_2 \qquad (10)$$

with f_2 the fugacity, x_2 ($\equiv x$) the mole fraction of the solute, nitrogen, is readily obtained from our model by calculating, at the given temperature and at a pressure slightly above the saturation pressure of pure water, the limiting value of f_2 as x_2 approaches the value 0. In practice, the limiting value is always reached for $x < 10^{-4}$, but we have used $x = 10^{-5}$ to be on the safe side. Figure 2 displays the two differently corrected sets of Henry constant data published by Alvarez et al. [12, 13], compared with our model calculation. We have used the linearized representation proposed by Japas and Levelt Sengers [27], and by Harvey and Levelt Sengers [28]. This representation was proposed because theory predicts it should be asymptotically linear near the solvent's critical point [27]. Later, Harvey et al. showed [28] that the slope of the straight line in the representation of figure. 2, observed over the full range of temperatures from the normal boiling point of water through the range of the original set of Henry's constants by Alvarez et al. [12], was larger than what was expected for the asymptotic slope. This asymptotic slope can be estimated from a variety of properties such as the

initial slopes of the critical line in p-x and T-x space, or the limiting slope of the distribution coefficient or K factor [27-30]. The estimates from the critical-line slope [29] and from the distribution coefficient [29] are included in figure 2. This figure, and also Table 3, show that our model represents the Henry constants of Alvarez et al. quite well in the range of intermediate temperatures (the higher liquid densities). Below 440 K departures are systematic. At the high temperatures approaching the critical point, (low densities), the model shows the expected decline of the slope towards the asymptotic value calculated independently from the critical-line slope and distribution coefficient [29]. Our model is very insensitive to the choice of parameters at temperatures above 600 K, so that there is little uncertainty about the location of the model curve. We suggest that at the high temperatures the first set of Henry's constants of Alvarez et al. [12] may have been undercorrected, and the second set
[11] overcorrected.

Japas and Franck [7] also reported Henry constant data derived from their two-phase measurements at saturation. They recognized the difficulty of correcting for departure from ideality, and therefore claim no more than qualitative features of their Henry's constants. We have therefore omitted their data from figure. 2.

4.3 Excess Enthalpies

The comparison of our model predictions with the excess enthalpies of Wormald and Colling [14, 15] is shown in figure.3. Note that these data were not included in the fit. From the enthalpy calculated for the mixture of the experimental composition at given pressure and temperature, we subtracted the mole-fraction-weighted enthalpies of pure steam and that of the model prediction for pure nitrogen at the same pressure and temperature. We obtain a quite satisfactory representation of these data. Since we also fit the PVTx data well in the range of Wormald's measurements, we have established consistency between the accurate PVTx and excess enthalpy data in the range of overlap.

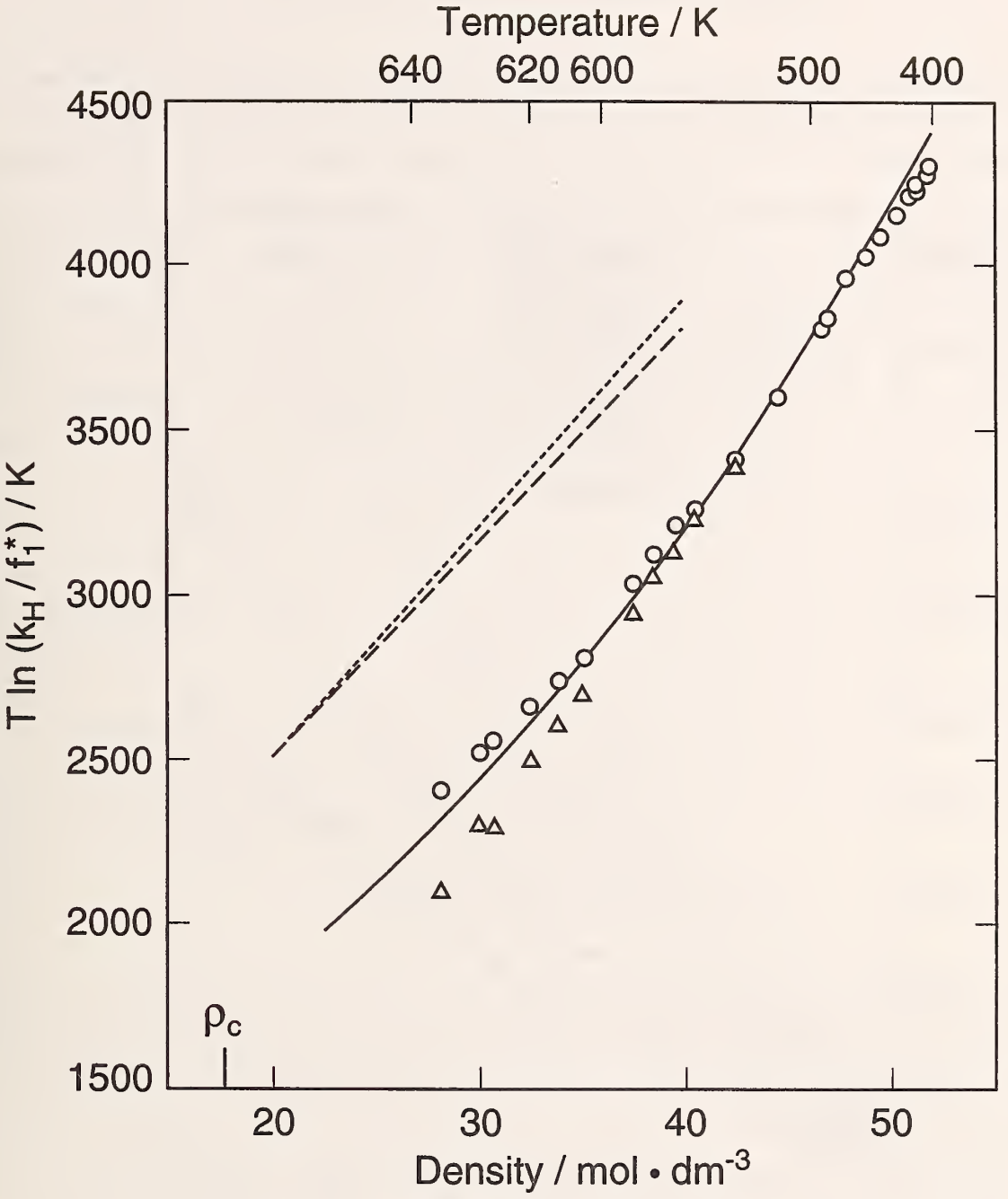

Figure 2. Henry's constant in the "linearized" representation of Refs 27-29. Data of Alvarez et al. corrected for nonideality in two different ways O Ref. 12; Δ Ref. 13. The limiting slope as calculated from the critical line is indicated by the short-dashed line, and that from the distribution coefficient by the long-dashed line [28, 29].

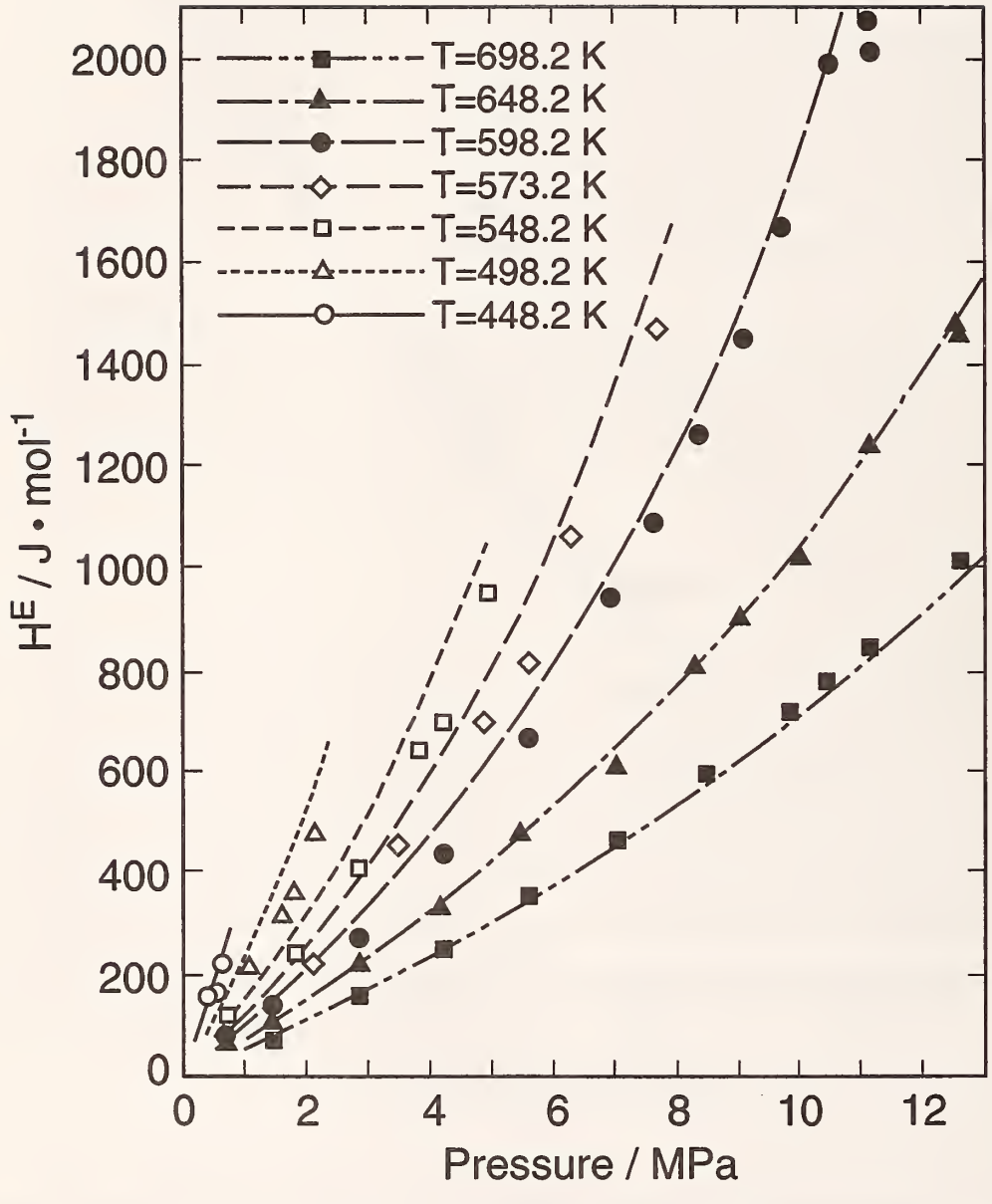

Figure 3. Excess enthalpies of equimolar nitrogen in water as a function of pressure. Data points of Wormald and Colling, Refs 12 and 13. Curves: prediction of the model.

5. Tabulation of the Thermodynamic Properties

The model for the Helmholtz free energy has been used to generate thermodynamic properties in tabular form. In Table 4, Appendix A, we present values for the molar volume V, the molar enthalpy H, and the fugacity coefficients φ_1 and φ_2 of the two components in the homogeneous phase, as functions of temperature, for chosen values of pressure and composition. There are six compositions from x = 0.05 to x = 0.8. Forty pressure entries are given, in the range from 0.05 to 100 MPa. The temperatures are in the range from 440 to 1000 K. The absolute values of the enthalpy have no special significance; only enthalpy differences are meaningful. There are no experimental data above 700 K, and we have indicated this boundary of experimental verification by the dashed lines in the table.

In Table 5, Appendix A, we list the infinite-dilution values or standard states for the solute nitrogen in water for the same values of pressure and temperature as in Table 4. Table 5 includes values at the (pure-water) phase boundaries; these values are indicated in italics. We present infinite-dilution values for the partial molar volume V_2, the partial molar enthalpy H_2, the partial molar heat capacity C_{p2} and the fugacity coefficient φ_2 of the solute.

The FORTRAN programs that were used to generate the results in Tables 2 - 5 are those listed in Ref. 7. The part of the computer program containing the input data necessary for the present application is listed in Appendix B.

6. Range and Reliability of the Model

We have set the range limitations on the model by the following considerations. With the application to relatively dilute aqueous mixtures in mind, and given the fact that there is only one reference fluid, pure water, we had anticipated a region of application roughly comparable with that of the carbon dioxide-water system [7], where the upper mole fraction was 35% of solute. The good fit to the PVTx and excess enthalpy data, even at high nitrogen mole fractions, came as somewhat of a surprise. Since we had made no great effort to fit the model to pure nitrogen data, we decided to define the upper limit of the composition range as x = 0.8. Even beyond that composition, the model will give reasonable values for one-phase properties. It is our expectation that in the range where there are data, the uncertainty in the density will mostly be no larger than 2%. Since we predict measured excess enthalpies at temperatures near and above the critical point of steam to within a few percent, we are confident that excess

enthalpies in the range where the PVTx fit is accurate (pressures up to 70 MPa), will be of comparable reliability. The temperature range has been set by the range needed in applications envisioned for SCWO. It should be strongly emphasized that there are no experimental data for the mixture above 700 K. Above this temperature, however, the model predictions appear well-behaved; moreover, even at 100 MPa, the density is still in a regime that has only moderate departures from the perfect-gas state. Nevertheless, above 700 K, our tables have no experimental support and should therefore be considered as giving estimates rather than verified predictions.

Contrary to the application to the carbon dioxide - water system, we have not been able to generate an acceptable critical line or reasonable phase boundaries. The model should therefore not be used for states near the critical line, and for calculation of phase boundaries. By applying the model within the boundaries of Table 4, no regions of poor or unacceptable behavior will be entered.

As a lower cut-off for the temperature, we have chosen 440 K because we have evidence from the Henry constant data that below this temperature the model becomes inadequate (Table 3). The shape factors have simple forms centered on the critical point of water, and accuracy must decline at large distances from this point.

7. Conclusions

We have presented a Helmholtz free energy formulation for the thermodynamic properties of the system nitrogen in water, for application in a large range of temperatures and pressures around the critical point of water.

The strong features of our model are the following. Since the model uses the full Helmholtz free energy of water and steam as a reference, it is accurate in dilute aqueous phases and can be used to obtain infinite-dilution limits or standard states of the solute. We have relied heavily on three sets of pVTx data in the near-critical and supercritical regime that we have proven to be mutually consistent. One of these sets is as yet unpublished. We therefore produce densities and enthalpies that are accurate in supercritical phases. This goal is difficult to achieve on the basis of commonly used engineering equations of the cubic type, or by existing scientific models for fluid mixtures. It is very difficult to represent the properties of pure water with such equations and models. A particular problem in representing the supercritical region is the very low value of the critical compressibility factor of water, z^c = 0.23. Few-parameter models usually have z^c values well over 0.3. If such models fit the

ritical temperature and presseure of water, densities in the supercritical regime will be 30% or more in error.

There is much speculation in the literature on supercritical fluids about the possible size of nonideality corrections in the dilute aqueous mixtures encountered in applications such as SCWO. Our model gives the most accurate estimates presently available for such systems.

The model fits the solubilities of nitrogen measured near the water vapor pressure curve accurately. It is a trivial effort to deduce the Henry constant from a Helmhol;tz free energy model, even at temperatures near the critical point. This is an alternative to making the large corrections for vapor imperfections and mixture nonidealities near the water critical point by means of approximate theoretical models.

A weakness of the present formulation is the poor location of the critical line and the phase boundaries. We are presently investigating whether this is an inherent feature of the model when the critical points of the two components are far apart, or whether a better choice of parameters or of interpolation equations can cure this problem. Our experience has alerted us to the fact that the phase behavior of generalized corresponding-states models has not been systematically explored. In view of the many new phase features displayed by equations-of-state of somewhat greater complexity [31] than 2- and 3-parameter cubic equations, such an exploration seems urgently needed.

8. Acknowledgments

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APPENDIX A. Tables

Model parameters, comparisons with experimental data,
and tabulations of thermodynamic properties of mixtures of nitrogen and water.

Table 1

The Values of the Parameters in the Helmholtz Free Energy

Nitrogen

Critical parameters [21]

T_c	126.2 K (IPTS-68)
P_c	3.40 MPa
ρ_c	311 $kg \cdot m^{-3}$

Heat capacity parameters, eq. (8)

a_{-1}	0.576564
a_0	8.26099
a_1	2.58261
S^{**}	1.937034 $J \cdot K^{-1}\ mol^{-1}$

Mixture

ϕ_0	1.253	j	0.978
ϕ_V	-0.125	k	1.233
ϕ_T	-0.051		
ϕ_{VT}	0.067		
θ_V	-0.012		
θ_T	0.018		
θ_{VT}	-0.124		

Table 2a
pVTx measurements of Watson and Fenghour
At given x, T and ρ, measured and calculated pressures are compared

$x(N_2)$	T	ρ_{meas}	p_{meas}	p_{calc}	$100\ (p_{meas}-p_{calc})/p$
	K	mol dm^{-3}	MPa	MPa	
0.3593	602.47	5.9063	24.093	24.6668	-2.38
0.3593	615.86	5.9018	25.133	25.5812	-1.78
0.3593	629.27	5.8973	26.140	26.4878	-1.33
0.3593	642.94	5.8924	27.127	27.4021	-1.01
0.3593	656.21	5.8879	28.078	28.2824	-0.73
0.3593	670.04	5.8834	29.049	29.1933	-0.50
0.3593	683.69	5.8785	29.986	30.0823	-0.32
0.3593	697.44	5.8737	30.919	30.9707	-0.17
0.4358	589.02	4.8731	20.961	21.2692	-1.47
0.4358	615.91	4.8657	22.517	22.6786	-0.72
0.4358	629.35	4.8622	23.267	23.3749	-0.46
0.4358	642.88	4.8584	24.007	24.0693	-0.26
0.4358	656.59	4.8544	24.746	24.7667	-0.08
0.4358	670.56	4.8504	25.487	25.4723	0.06
0.4358	684.11	4.8466	26.190	26.1524	0.14
0.4358	697.87	4.8426	26.903	26.8374	0.24
0.5069	562.16	4.1959	17.859	18.0765	-1.22
0.5069	589.20	4.1895	19.147	19.2456	-0.52
0.5069	615.95	4.1832	20.367	20.3847	-0.09
0.5069	629.39	4.1801	20.964	20.9511	0.06
0.5069	643.08	4.1768	21.566	21.5236	0.20
0.5069	656.71	4.1734	22.155	22.0899	0.29
0.5069	670.43	4.1701	22.740	22.6564	0.37
0.5069	683.88	4.1668	23.305	23.2081	0.42
0.5069	697.51	4.1635	23.875	23.7642	0.46
0.5606	561.97	3.7936	16.761	16.8573	-0.57
0.5606	588.99	3.7879	17.856	17.8751	-0.11
0.5606	615.92	3.7821	18.909	18.8762	0.17
0.5606	629.33	3.7793	19.422	19.3701	0.27
0.5606	642.93	3.7764	19.940	19.8682	0.36
0.5606	656.47	3.7734	20.448	20.3600	0.43
0.5606	670.10	3.7705	20.953	20.8530	0.48
0.5606	683.04	3.7676	21.429	21.3185	0.52
0.5606	697.42	3.7645	21.956	21.8333	0.56
0.5606	706.65	3.7624	22.292	22.1616	0.59
0.6467	534.71	3.2939	14.253	14.2786	-0.18
0.6467	561.33	3.2891	15.137	15.1174	0.13
0.6467	588.44	3.2843	16.015	15.9619	0.33
0.6467	615.39	3.2793	16.877	16.7920	0.50
0.6467	628.75	3.2769	17.299	17.2002	0.57
0.6467	642.34	3.2743	17.722	17.6132	0.61
0.6467	656.10	3.2717	18.147	18.0296	0.65
0.6467	670.06	3.2690	18.576	18.4497	0.68
0.6467	683.69	3.2665	18.990	18.8583	0.69
0.6467	697.41	3.2638	19.407	19.2673	0.72
0.6962	535.69	3.0593	13.520	13.5084	0.09
0.6962	562.22	3.0549	14.312	14.2664	0.32
0.6962	589.32	3.0503	15.102	15.0320	0.46
0.6962	616.29	3.0457	15.884	15.7872	0.61
0.6962	629.67	3.0434	16.267	16.1591	0.66
0.6962	643.14	3.0411	16.647	16.5319	0.69
0.6962	656.72	3.0387	17.027	16.9058	0.71
0.6962	669.98	3.0364	17.398	17.2703	0.73
0.6962	683.18	3.0341	17.763	17.6311	0.74
0.6962	697.43	3.0315	18.158	18.0185	0.77

Table 2a.(cont.) pVTx measurements of Watson and Fenghour

$x(N_2)$	T / K	ρ_{meas} / mol dm^{-3}	p_{meas} / MPa	p_{calc} / MPa	$100\,(p_{meas}-p_{calc})/p$
0.7545	509.74	2.8271	12.017	11.9708	0.38
0.7545	536.34	2.8230	12.732	12.6622	0.55
0.7545	562.14	2.8190	13.413	13.3263	0.65
0.7545	588.65	2.8149	14.112	14.0026	0.78
0.7545	615.98	2.8106	14.822	14.6940	0.86
0.7545	629.55	2.8085	15.170	15.0353	0.89
0.7545	643.04	2.8063	15.514	15.3727	0.91
0.7545	656.84	2.8041	15.866	15.7169	0.94
0.7545	669.80	2.8020	16.200	16.0387	1.00
0.7545	683.25	2.7998	16.538	16.3716	1.01
0.7545	697.31	2.7975	16.891	16.7184	1.02
0.8148	482.99	2.6214	10.629	10.5868	0.40
0.8148	509.43	2.6177	11.281	11.2151	0.58
0.8148	535.60	2.6140	11.922	11.8313	0.76
0.8148	562.23	2.6103	12.558	12.4534	0.83
0.8148	589.01	2.6064	13.191	13.0737	0.89
0.8148	616.22	2.6025	13.842	13.6995	1.03
0.8148	629.69	2.6004	14.156	14.0072	1.05
0.8148	643.33	2.5985	14.474	14.3183	1.08
0.8148	656.88	2.5960	14.787	14.6226	1.11
0.8148	670.59	2.5944	15.104	14.9352	1.12
0.8148	684.21	2.5924	15.417	15.2424	1.13
0.8148	697.89	2.5903	15.731	15.5497	1.15
0.8897	456.21	2.4040	9.2810	9.2410	0.43
0.8897	483.09	2.4007	9.8750	9.8170	0.59
0.8897	509.42	2.3974	10.4530	10.3765	0.73
0.8897	535.46	2.3940	11.0220	10.9256	0.87
0.8897	562.15	2.3906	11.5930	11.4848	0.93
0.8897	589.07	2.3870	12.1680	12.0447	1.01
0.8897	615.71	2.3834	12.7460	12.5950	1.18
0.8897	642.91	2.3798	13.3190	13.1532	1.24
0.8897	656.49	2.3780	13.6040	13.4308	1.27
0.8897	670.08	2.3761	13.8870	13.7075	1.29
0.8897	683.77	2.3742	14.1730	13.9852	1.32
0.8897	697.28	2.3723	14.4530	14.2592	1.34
0.9501	428.74	2.2544	8.2080	8.1734	0.42
0.9501	455.80	2.2513	8.7600	8.7117	0.55
0.9501	482.37	2.2482	9.3020	9.2362	0.71
0.9501	508.96	2.2451	9.8440	9.7575	0.88
0.9501	535.25	2.2419	10.3740	10.2692	1.01
0.9501	562.08	2.2386	10.9090	10.7886	1.10
0.9501	589.05	2.2353	11.4500	11.3069	1.25
0.9501	616.06	2.2319	11.9890	11.8231	1.38
0.9501	642.97	2.2285	12.5160	12.3340	1.45
0.9501	670.10	2.2250	13.0440	12.8461	1.52
0.9501	697.22	2.2216	13.5700	13.3554	1.58
				rms % deviation	0.85

Table 2b
pVTx measurements of Abdulagatov et al. [10]
At given x, T and ρ, measured and calculated pressures are compared

$x(N_2)$	T	ρ_{meas}	p_{meas}	p_{calc}	$100(p_{meas}-p_{calc})/p$
	K	mol dm^{-3}	MPa	MPa	
0.0654	663.15	27.108	59.83	57.757	3.47
0.0654	663.15	24.510	50.81	49.637	2.31
0.0654	663.15	19.732	40.99	40.431	1.36
0.0654	663.15	12.356	31.53	31.679	-0.47
0.0654	663.15	5.453	20.68	20.629	0.25
0.0654	663.15	2.191	10.45	10.385	0.63
0.0654	663.15	1.087	5.62	5.569	0.91
0.1814	663.15	18.262	60.04	61.698	-2.76
0.1814	663.15	15.103	49.68	51.062	-2.78
0.1814	663.15	11.493	39.86	40.731	-2.19
0.1814	663.15	7.650	29.83	30.046	-0.72
0.1814	663.15	4.418	19.79	19.679	0.56
0.1814	663.15	1.977	10.00	9.875	1.25
0.1814	663.15	0.948	5.05	4.985	1.28
0.3738	663.15	12.625	60.80	62.776	-3.25
0.3738	663.15	10.340	49.43	50.423	-2.01
0.3738	663.15	8.211	39.55	39.929	-0.96
0.3738	663.15	6.009	29.64	29.616	0.08
0.3738	663.15	3.876	19.76	19.651	0.55
0.3738	663.15	1.867	9.82	9.839	-0.19
0.3738	663.15	0.933	5.06	5.026	0.67
0.5456	663.15	11.635	69.28	69.512	-0.33
0.5456	663.15	9.432	54.21	53.877	0.61
0.5456	663.15	7.021	39.40	38.816	1.48
0.5456	663.15	5.308	29.57	28.979	2.00
0.5456	663.15	3.540	19.74	19.240	2.53
0.5456	663.15	1.742	9.39	9.500	-1.17
0.1173	573.15	2.100	8.16	8.200	-0.50
0.1173	573.15	1.318	5.56	5.558	0.03
0.1173	573.15	0.573	2.58	2.593	-0.52
0.2219	573.15	1.977	8.17	8.214	-0.54
0.2219	573.15	1.290	5.72	5.623	1.70
0.2219	573.15	0.568	2.58	2.605	-0.97
0.4761	573.15	1.756	8.04	8.001	0.49
0.4761	573.15	1.190	5.53	5.494	0.65
0.4761	573.15	0.553	2.59	2.596	-0.25
0.7460	573.15	1.653	8.00	7.908	1.15
0.7460	573.15	1.150	5.54	5.491	0.89
0.7460	573.15	0.546	2.60	2.600	-0.02
0.8821	573.15	6.200	32.96	32.445	1.56
0.8821	573.15	4.814	24.84	24.522	1.28
0.8821	573.15	3.368	16.91	16.746	0.97
0.8821	573.15	2.090	10.11	10.199	-0.88
0.8821	573.15	1.073	5.07	5.168	-1.94
0.2684	523.15	1.000	3.92	4.022	-2.61
0.2684	523.15	0.502	2.08	2.102	-1.05
0.5660	523.15	0.849	3.58	3.619	-1.09
0.5660	523.15	0.490	2.11	2.106	0.20
0.8523	523.15	0.814	3.54	3.555	-0.41
0.9415	523.15	3.525	16.32	16.072	1.52
0.9415	523.15	2.658	11.97	11.951	0.16
0.9415	523.15	1.830	8.06	8.131	-0.88
0.9415	523.15	0.955	4.09	4.196	-2.58
				rms % deviation	1.45

Table 2c
pVTx measurements of Japas and Franck [9]
At given x, T and ρ, measured and calculated pressures are compared

$x(N_2)$	T	ρ_{meas}	p_{meas}	p_{calc}	$100(p_{meas}-p_{calc})/p$
	K	mol dm^3	MPa	MPa	
0.1000	673.0	40.0481	256.30	248.200	3.16
0.1000	673.0	37.0645	190.70	186.098	2.41
0.1000	673.0	34.5423	149.90	146.538	2.24
0.1000	673.0	27.9799	86.40	84.130	2.63
0.1005	673.0	21.9539	58.90	57.770	1.92
0.1505	673.0	36.5898	233.60	229.467	1.77
0.1505	673.0	33.2116	171.10	170.296	0.47
0.1505	673.0	29.6209	125.90	125.813	0.07
0.1510	673.0	24.8447	87.20	87.974	-0.89
0.1510	673.0	21.7865	71.80	71.987	-0.26
0.1510	673.0	19.1241	60.80	61.441	-1.05
0.1510	673.0	15.3610	50.20	49.806	0.78
0.2550	673.0	5.7637	26.20	26.628	-1.64
0.2530	673.0	9.1743	39.70	39.531	0.43
0.2520	673.0	12.9550	52.70	54.173	-2.80
0.2520	673.0	16.6861	68.70	71.167	-3.59
0.2510	673.0	20.2388	88.30	91.567	-3.70
0.2510	673.0	23.5960	113.00	117.405	-3.90
0.2510	673.0	26.6738	144.30	148.930	-3.21
0.2510	673.0	28.1611	173.80	167.571	3.58
0.2510	673.0	31.5956	217.70	220.983	-1.51
0.2510	673.0	34.2818	275.50	274.542	0.35
0.3510	673.0	30.0300	246.20	257.929	-4.76
0.3510	673.0	27.6319	204.80	213.302	-4.15
0.3510	673.0	26.0960	179.80	188.621	-4.91
0.3510	673.0	22.9358	136.00	146.258	-7.54
0.3520	673.0	21.0926	118.50	126.346	-6.62
0.3520	673.0	16.3934	81.00	86.262	-6.50
0.3530	673.0	13.9919	68.40	70.614	-3.24
0.3540	673.0	8.9767	43.30	43.807	-1.17
0.3590	673.0	4.0783	20.10	20.882	-3.89
0.5020	673.0	26.3505	254.70	259.776	-1.99
0.5020	673.0	24.3250	212.80	219.469	-3.13
0.5020	673.0	21.4179	164.50	171.119	-4.02
0.5030	673.0	18.6289	127.80	133.898	-4.77
0.5030	673.0	15.7183	100.20	102.476	-2.27
0.5050	673.0	11.3662	65.70	66.439	-1.12
0.5070	673.0	7.2046	39.85	39.759	0.23
0.6530	673.0	24.8324	286.10	288.165	-0.72
0.6530	673.0	23.4467	251.50	251.337	0.06
0.6530	673.0	21.3767	207.10	206.205	0.43
0.6530	673.0	19.9760	181.60	180.436	0.64
0.6540	673.0	17.8827	148.80	147.617	0.79
0.6540	673.0	15.6152	118.90	117.881	0.86
0.6560	673.0	12.0802	82.30	81.063	1.50
0.6580	673.0	8.7291	54.40	53.812	1.08
0.6420	673.0	5.5130	32.40	31.935	1.44
0.8660	673.0	5.5402	35.10	33.945	3.29
0.8590	673.0	9.4697	67.60	63.725	5.73
0.8560	673.0	11.9603	93.50	86.877	7.08
0.8560	673.0	13.6799	114.80	105.675	7.95
0.8555	673.0	16.1603	151.30	138.420	8.51
0.8550	673.0	18.5357	195.70	180.265	7.89
0.8545	673.0	19.5848	217.70	205.716	5.50
0.8540	673.0	20.3707	236.70	232.371	1.83
				rms dev	3.67 %

Table 3
Solubility of N_2 in H_2O, by Alvarez et al. [12]
Saturated liquid composition at T, p: x_{meas}, is compared with model prediction: x_{calc}
Model prediction for coexisting vapor composition y_{calc} is also given

T K	p MPa	x_{meas} Ref. 12	x_{calc} present	y_{calc} present	k_H GPa present	k_H GPa Ref.12
636.50	25.60	0.01076	0.011105	0.12247	0.499	0.356
630.50	22.87	0.00745	0.007678	0.11055	0.593	0.479
628.00	25.02	0.01092	0.010555	0.17317	0.632	0.465
620.10	20.72	0.00621	0.006070	0.13697	0.756	0.632
613.20	19.47	0.005597	0.005346	0.15713	0.868	0.731
606.30	18.60	0.005338	0.005008	0.18717	0.985	0.830
589.30	18.68	0.005469	0.005506	0.32452	1.308	1.205
582.10	17.03	0.004403	0.004568	0.33574	1.461	1.415
572.60	13.71	0.002772	0.002908	0.30233	1.682	1.680
565.50	11.92	0.002125	0.002170	0.28769	1.862	1.802
544.90	8.616	0.001200	0.001169	0.29444	2.468	2.33
521.90	5.168	0.000385	0.000385	0.21808	3.324	3.22
492.80	3.574	0.000272	0.000264	0.33288	4.760	4.57
488.80	4.020	0.000379	0.000368	0.44508	4.996	4.83
475.50	2.137	0.000082	0.000087	0.22263	5.853	6.03
460.80	1.764	0.000084	0.000082	0.31252	6.950	6.73
448.30	1.327	0.000057	0.000053	0.31588	8.021	7.44
432.90	1.274	0.000078	0.000067	0.50995	9.527	8.32
422.70	0.938	0.000051	0.000042	0.49260	10.64	9.16
415.40	2.298	0.000203	0.000154	0.82481	11.49	9.21
415.10	0.628	0.000026	0.000020	0.38765	11.52	9.59
405.20	0.810	0.000052	0.000038	0.64107	12.73	9.99
403.40	0.534	0.000025	0.000019	0.48688	12.96	10.52
396.50	1.628	0.000130	0.000091	0.85954	13.83	10.65
392.50	3.441	0.000277	0.000198	0.93839	14.33	10.91

Table 4

Volume, enthalpy, and fugacity coefficient for each component
for a range of temperatures, on isobars at six mole fractions
of nitrogen in water.
Entries below dashed line are in region where no data exist.

P = 0.05 MPa

x = 0.05					x = 0.10			
V	H	ϕ_1	ϕ_2	T	V	H	ϕ_1	ϕ_2
dm^3mol^{-1}	kJ mol^{-1}			K	dm^3mol^{-1}	kJ mol^{-1}		
72.94	48.66	0.9965	1.0046	440	72.97	46.65	0.9965	1.0038
76.29	49.36	0.9971	1.0036	460	76.32	47.34	0.9971	1.0030
79.64	50.06	0.9975	1.0029	480	79.67	48.04	0.9976	1.0024
82.99	50.76	0.9979	1.0023	500	83.01	48.73	0.9979	1.0020
86.33	51.46	0.9982	1.0019	520	86.35	49.43	0.9982	1.0016
89.67	52.17	0.9984	1.0016	540	89.69	50.13	0.9984	1.0014
93.01	52.88	0.9986	1.0013	560	93.02	50.84	0.9986	1.0012
96.35	53.60	0.9988	1.0011	580	96.36	51.55	0.9988	1.0010
99.68	54.32	0.9989	1.0010	600	99.69	52.26	0.9990	1.0009
108.02	56.14	0.9992	1.0007	650	108.02	54.06	0.9992	1.0006
116.34	57.98	0.9994	1.0005	700	116.35	55.89	0.9994	1.0005
124.67	59.86	0.9995	1.0004	750	124.67	57.75	0.9995	1.0004
132.99	61.76	0.9996	1.0003	800	133.00	59.63	0.9996	1.0003
149.63	65.66	0.9998	1.0002	900	149.64	63.49	0.9998	1.0002
166.27	69.68	0.9998	1.0002	1000	166.27	67.48	0.9998	1.0002

x = 0.20					x = 0.40			
V	H	ϕ_1	ϕ_2	T	V	H	ϕ_1	ϕ_2
dm^3mol^{-1}	kJ mol^{-1}			K	dm^3mol^{-1}	kJ mol^{-1}		
73.02	42.64	0.9967	1.0025	440	73.08	34.60	0.9973	1.0011
76.36	43.31	0.9973	1.0021	460	76.42	35.25	0.9977	1.0009
79.70	43.99	0.9977	1.0017	480	79.75	35.91	0.9981	1.0008
83.04	44.68	0.9980	1.0014	500	83.09	36.57	0.9983	1.0007
86.38	45.36	0.9983	1.0012	520	86.42	37.23	0.9985	1.0006
89.71	46.05	0.9985	1.0010	540	89.75	37.89	0.9987	1.0005
93.04	46.75	0.9987	1.0009	560	93.08	38.56	0.9989	1.0005
96.38	47.44	0.9989	1.0008	580	96.41	39.23	0.9990	1.0004
99.71	48.14	0.9990	1.0007	600	99.74	39.91	0.9991	1.0004
108.04	49.91	0.9992	1.0005	650	108.06	41.62	0.9993	1.0003
116.36	51.71	0.9994	1.0004	700	116.38	43.35	0.9995	1.0003
124.68	53.53	0.9995	1.0003	750	124.70	45.10	0.9996	1.0002
133.00	55.38	0.9996	1.0003	800	133.02	46.88	0.9997	1.0002
149.64	59.17	0.9998	1.0002	900	149.66	50.51	0.9998	1.0002
166.28	63.07	0.9998	1.0002	1000	166.29	54.24	0.9999	1.0001

x = 0.60					x = 0.80			
V	H	ϕ_1	ϕ_2	T	V	H	ϕ_1	ϕ_2
dm^3mol^{-1}	kJ mol^{-1}			K	dm^3mol^{-1}	kJ mol^{-1}		
73.13	26.55	0.9980	1.0004	440	73.16	18.50	0.9986	1.0001
76.46	27.18	0.9983	1.0004	460	76.49	19.11	0.9988	1.0001
79.79	27.81	0.9985	1.0003	480	79.81	19.72	0.9990	1.0001
83.12	28.45	0.9987	1.0003	500	83.14	20.33	0.9991	1.0001
86.45	29.09	0.9989	1.0003	520	86.47	20.95	0.9992	1.0001
89.78	29.73	0.9990	1.0003	540	89.80	21.57	0.9993	1.0001
93.11	30.38	0.9991	1.0003	560	93.12	22.19	0.9994	1.0001
96.43	31.02	0.9992	1.0002	580	96.45	22.81	0.9995	1.0001
99.76	31.68	0.9993	1.0002	600	99.78	23.44	0.9995	1.0001
108.08	33.32	0.9995	1.0002	650	108.09	25.02	0.9997	1.0001
116.40	34.98	0.9996	1.0002	700	116.41	26.61	0.9997	1.0001
124.72	36.66	0.9997	1.0002	750	124.73	28.23	0.9998	1.0001
133.03	38.37	0.9997	1.0002	800	133.04	29.86	0.9999	1.0001
149.67	41.85	0.9998	1.0001	900	149.67	33.19	0.9999	1.0001
166.30	45.42	0.9999	1.0001	1000	166.30	36.60	1.0000	1.0001

P = 0.1 MPa

x = 0.05					x = 0.10			
V	H	ϕ_1	ϕ_2	T	V	H	ϕ_1	ϕ_2
dm^3mol^{-1}	kJ mol^{-1}			K	dm^3mol^{-1}	kJ mol^{-1}		
36.36	48.61	0.9930	1.0093	440	36.38	46.61	0.9931	1.0077
38.05	49.32	0.9941	1.0073	460	38.07	47.31	0.9942	1.0061
39.73	50.02	0.9951	1.0058	480	39.76	48.01	0.9952	1.0049
41.42	50.73	0.9958	1.0047	500	41.44	48.70	0.9959	1.0040
43.10	51.43	0.9964	1.0038	520	43.11	49.41	0.9965	1.0033
44.77	52.15	0.9969	1.0032	540	44.79	50.11	0.9969	1.0028
46.45	52.86	0.9973	1.0027	560	46.46	50.82	0.9973	1.0024
48.12	53.58	0.9977	1.0023	580	48.13	51.53	0.9977	1.0020
49.80	54.30	0.9979	1.0020	600	49.81	52.24	0.9980	1.0018
53.97	56.12	0.9985	1.0014	650	53.98	54.05	0.9985	1.0013
58.14	57.97	0.9988	1.0011	700	58.15	55.88	0.9988	1.0010
62.31	59.85	0.9991	1.0008	750	62.32	57.74	0.9991	1.0008
66.48	61.75	0.9993	1.0007	800	66.48	59.63	0.9993	1.0007
74.80	65.65	0.9995	1.0005	900	74.81	63.49	0.9995	1.0005
83.13	69.68	0.9997	1.0004	1000	83.13	67.47	0.9997	1.0004

x = 0.20					x = 0.40			
V	H	ϕ_1	ϕ_2	T	V	H	ϕ_1	ϕ_2
dm^3mol^{-1}	kJ mol^{-1}			K	dm^3mol^{-1}	kJ mol^{-1}		
36.43	42.61	0.9935	1.0051	440	36.50	34.58	0.9947	1.0022
38.11	43.29	0.9946	1.0042	460	38.17	35.24	0.9955	1.0019
39.79	43.97	0.9954	1.0034	480	39.84	35.89	0.9962	1.0016
41.47	44.66	0.9961	1.0029	500	41.51	36.55	0.9967	1.0014
43.14	45.34	0.9966	1.0024	520	43.18	37.22	0.9971	1.0012
44.81	46.04	0.9971	1.0021	540	44.85	37.88	0.9975	1.0011
46.48	46.73	0.9974	1.0018	560	46.52	38.55	0.9978	1.0010
48.15	47.43	0.9978	1.0016	580	48.19	39.23	0.9980	1.0009
49.82	48.13	0.9980	1.0014	600	49.85	39.90	0.9983	1.0008
53.99	49.90	0.9985	1.0011	650	54.02	41.61	0.9987	1.0007
58.16	51.70	0.9989	1.0009	700	58.18	43.34	0.9990	1.0006
62.33	53.52	0.9991	1.0007	750	62.34	45.09	0.9992	1.0005
66.49	55.38	0.9993	1.0006	800	66.51	46.87	0.9994	1.0005
74.81	59.16	0.9996	1.0005	900	74.83	50.51	0.9996	1.0004
83.13	63.06	0.9997	1.0004	1000	83.14	54.24	0.9997	1.0003

x = 0.60					x = 0.80			
V	H	ϕ_1	ϕ_2	T	V	H	ϕ_1	ϕ_2
dm^3mol^{-1}	kJ mol^{-1}			K	dm^3mol^{-1}	kJ mol^{-1}		
36.55	26.54	0.9960	1.0008	440	36.57	18.49	0.9973	1.0003
38.21	27.17	0.9966	1.0008	460	38.24	19.10	0.9977	1.0003
39.88	27.81	0.9971	1.0007	480	39.90	19.72	0.9980	1.0003
41.55	28.44	0.9974	1.0007	500	41.57	20.33	0.9982	1.0003
43.21	29.08	0.9978	1.0006	520	43.23	20.95	0.9985	1.0003
44.88	29.73	0.9980	1.0006	540	44.90	21.57	0.9987	1.0003
46.54	30.37	0.9983	1.0005	560	46.56	22.19	0.9988	1.0003
48.21	31.02	0.9985	1.0005	580	48.23	22.81	0.9990	1.0003
49.88	31.67	0.9986	1.0005	600	49.89	23.44	0.9991	1.0003
54.04	33.31	0.9990	1.0004	650	54.05	25.02	0.9993	1.0003
58.20	34.98	0.9992	1.0004	700	58.21	26.61	0.9995	1.0003
62.36	36.66	0.9994	1.0004	750	62.37	28.23	0.9996	1.0003
66.52	38.37	0.9995	1.0003	800	66.53	29.86	0.9998	1.0003
74.84	41.85	0.9997	1.0003	900	74.84	33.19	0.9999	1.0002
83.15	45.42	0.9998	1.0003	1000	83.16	36.60	1.0000	1.0002

P = 0.15 MPa

x = 0.05					x = 0.10			
V	H	ϕ_1	ϕ_2	T	V	H	ϕ_1	ϕ_2
dm^3mol^{-1}	kJ mol^{-1}			K	dm^3mol^{-1}	kJ mol^{-1}		
24.16	48.57	0.9894	1.0142	440	24.19	46.57	0.9896	1.0116
25.30	49.28	0.9912	1.0111	460	25.32	47.27	0.9914	1.0092
26.43	49.99	0.9926	1.0088	480	26.45	47.97	0.9927	1.0074
27.56	50.70	0.9937	1.0071	500	27.58	48.68	0.9938	1.0061
28.69	51.41	0.9947	1.0058	520	28.70	49.38	0.9947	1.0050
29.81	52.12	0.9954	1.0048	540	29.82	50.09	0.9954	1.0042
30.93	52.84	0.9960	1.0041	560	30.94	50.80	0.9960	1.0036
32.05	53.56	0.9965	1.0035	580	32.06	51.51	0.9965	1.0031
33.17	54.28	0.9969	1.0030	600	33.18	52.23	0.9970	1.0027
35.96	56.11	0.9977	1.0021	650	35.96	54.04	0.9977	1.0020
38.74	57.96	0.9983	1.0016	700	38.75	55.87	0.9983	1.0015
41.52	59.84	0.9987	1.0013	750	41.53	57.73	0.9987	1.0012
44.30	61.74	0.9990	1.0010	800	44.31	59.62	0.9990	1.0010
49.86	65.65	0.9993	1.0008	900	49.86	63.48	0.9993	1.0008
55.41	69.67	0.9996	1.0006	1000	55.41	67.47	0.9996	1.0006

x = 0.20					x = 0.40			
V	H	ϕ_1	ϕ_2	T	V	H	ϕ_1	ϕ_2
dm^3mol^{-1}	kJ mol^{-1}			K	dm^3mol^{-1}	kJ mol^{-1}		
24.24	42.58	0.9903	1.0078	440	24.31	34.56	0.9921	1.0033
25.36	43.26	0.9919	1.0063	460	25.42	35.22	0.9933	1.0028
26.49	43.95	0.9931	1.0052	480	26.54	35.88	0.9943	1.0024
27.61	44.64	0.9941	1.0044	500	27.66	36.54	0.9951	1.0021
28.73	45.33	0.9950	1.0037	520	28.77	37.21	0.9957	1.0019
29.85	46.02	0.9956	1.0032	540	29.89	37.87	0.9962	1.0017
30.96	46.72	0.9962	1.0028	560	31.00	38.55	0.9967	1.0015
32.08	47.42	0.9967	1.0024	580	32.11	39.22	0.9971	1.0014
33.19	48.12	0.9971	1.0021	600	33.22	39.90	0.9974	1.0013
35.98	49.89	0.9978	1.0016	650	36.00	41.60	0.9981	1.0011
38.76	51.69	0.9983	1.0013	700	38.78	43.34	0.9985	1.0009
41.54	53.52	0.9987	1.0011	750	41.56	45.09	0.9988	1.0008
44.32	55.37	0.9990	1.0009	800	44.33	46.87	0.9991	1.0007
49.87	59.16	0.9994	1.0007	900	49.88	50.50	0.9994	1.0006
55.42	63.06	0.9996	1.0006	1000	55.43	54.24	0.9996	1.0005

x = 0.60					x = 0.80			
V	H	ϕ_1	ϕ_2	T	V	H	ϕ_1	ϕ_2
dm^3mol^{-1}	kJ mol^{-1}			K	dm^3mol^{-1}	kJ mol^{-1}		
24.35	26.53	0.9941	1.0013	440	24.38	18.49	0.9960	1.0005
25.46	27.17	0.9949	1.0012	460	25.49	19.10	0.9965	1.0005
26.58	27.80	0.9956	1.0011	480	26.60	19.71	0.9970	1.0005
27.69	28.44	0.9962	1.0010	500	27.71	20.33	0.9974	1.0005
28.80	29.08	0.9967	1.0009	520	28.82	20.94	0.9977	1.0005
29.91	29.72	0.9971	1.0009	540	29.93	21.56	0.9980	1.0005
31.02	30.37	0.9974	1.0008	560	31.04	22.19	0.9982	1.0005
32.14	31.02	0.9977	1.0008	580	32.15	22.81	0.9985	1.0005
33.25	31.67	0.9980	1.0008	600	33.26	23.44	0.9986	1.0005
36.02	33.31	0.9985	1.0007	650	36.04	25.02	0.9990	1.0004
38.80	34.98	0.9988	1.0006	700	38.81	26.61	0.9993	1.0004
41.57	36.66	0.9991	1.0006	750	41.58	28.23	0.9995	1.0004
44.35	38.37	0.9993	1.0005	800	44.36	29.86	0.9996	1.0004
49.89	41.85	0.9996	1.0005	900	49.90	33.19	0.9999	1.0003
55.44	45.42	0.9997	1.0004	1000	55.44	36.60	1.0000	1.0003

P = 0.2 MPa

x = 0.05					x = 0.10			
V	H	ϕ_1	ϕ_2	T	V	H	ϕ_1	ϕ_2
dm^3mol^{-1}	kJ mol^{-1}			K	dm^3mol^{-1}	kJ mol^{-1}		
18.06	48.52	0.9859	1.0192	440	18.09	46.53	0.9862	1.0157
18.92	49.23	0.9883	1.0149	460	18.95	47.24	0.9885	1.0124
19.78	49.95	0.9902	1.0118	480	19.80	47.94	0.9903	1.0100
20.63	50.66	0.9917	1.0096	500	20.65	48.65	0.9918	1.0081
21.48	51.38	0.9929	1.0078	520	21.50	49.36	0.9930	1.0068
22.33	52.10	0.9939	1.0065	540	22.34	50.07	0.9939	1.0057
23.17	52.82	0.9947	1.0055	560	23.18	50.78	0.9947	1.0048
24.01	53.54	0.9953	1.0047	580	24.02	51.49	0.9954	1.0042
24.85	54.26	0.9959	1.0040	600	24.86	52.21	0.9959	1.0036
26.95	56.09	0.9970	1.0029	650	26.96	54.02	0.9970	1.0026
29.04	57.95	0.9977	1.0022	700	29.05	55.86	0.9977	1.0020
31.13	59.83	0.9982	1.0017	750	31.14	57.72	0.9983	1.0016
33.22	61.74	0.9986	1.0014	800	33.22	59.61	0.9986	1.0014
37.39	65.64	0.9991	1.0010	900	37.39	63.48	0.9991	1.0010
41.55	69.67	0.9994	1.0008	1000	41.56	67.46	0.9994	1.0008

x = 0.20					x = 0.40			
V	H	ϕ_1	ϕ_2	T	V	H	ϕ_1	ϕ_2
dm^3mol^{-1}	kJ mol^{-1}			K	dm^3mol^{-1}	kJ mol^{-1}		
18.14	42.55	0.9871	1.0104	440	18.21	34.55	0.9895	1.0044
18.99	43.24	0.9892	1.0085	460	19.05	35.21	0.9911	1.0038
19.84	43.93	0.9909	1.0070	480	19.89	35.87	0.9924	1.0033
20.68	44.62	0.9922	1.0058	500	20.73	36.53	0.9934	1.0029
21.52	45.31	0.9933	1.0050	520	21.57	37.20	0.9943	1.0025
22.36	46.00	0.9942	1.0043	540	22.40	37.87	0.9950	1.0023
23.20	46.70	0.9949	1.0037	560	23.24	38.54	0.9956	1.0021
24.04	47.40	0.9956	1.0032	580	24.07	39.21	0.9961	1.0019
24.88	48.11	0.9961	1.0029	600	24.91	39.89	0.9966	1.0017
26.97	49.88	0.9971	1.0022	650	27.00	41.60	0.9974	1.0014
29.06	51.68	0.9978	1.0018	700	29.08	43.33	0.9980	1.0012
31.15	53.51	0.9983	1.0015	750	31.16	45.09	0.9985	1.0011
33.23	55.36	0.9987	1.0013	800	33.25	46.87	0.9988	1.0010
37.40	59.15	0.9991	1.0010	900	37.41	50.50	0.9992	1.0008
41.56	63.06	0.9994	1.0008	1000	41.57	54.24	0.9995	1.0007

x = 0.60					x = 0.80			
V	H	ϕ_1	ϕ_2	T	V	H	ϕ_1	ϕ_2
dm^3mol^{-1}	kJ mol^{-1}			K	dm^3mol^{-1}	kJ mol^{-1}		
18.25	26.52	0.9921	1.0017	440	18.28	18.49	0.9946	1.0006
19.09	27.16	0.9932	1.0016	460	19.12	19.10	0.9954	1.0006
19.93	27.79	0.9942	1.0015	480	19.95	19.71	0.9960	1.0007
20.76	28.43	0.9949	1.0013	500	20.78	20.33	0.9965	1.0007
21.60	29.07	0.9955	1.0013	520	21.62	20.94	0.9970	1.0007
22.43	29.72	0.9961	1.0012	540	22.45	21.56	0.9973	1.0007
23.26	30.36	0.9965	1.0011	560	23.28	22.18	0.9977	1.0006
24.10	31.01	0.9969	1.0011	580	24.11	22.81	0.9980	1.0006
24.93	31.66	0.9973	1.0010	600	24.95	23.44	0.9982	1.0006
27.02	33.31	0.9979	1.0009	650	27.03	25.02	0.9987	1.0006
29.10	34.97	0.9984	1.0008	700	29.11	26.61	0.9991	1.0006
31.18	36.66	0.9988	1.0008	750	31.19	28.23	0.9993	1.0006
33.26	38.37	0.9991	1.0007	800	33.27	29.86	0.9995	1.0005
37.42	41.85	0.9994	1.0006	900	37.43	33.19	0.9998	1.0005
41.58	45.42	0.9997	1.0005	1000	41.59	36.60	1.0000	1.0004

P = 0.3 MPa

x = 0.05

V	H	ϕ_1	ϕ_2	T
dm^3mol^{-1}	kJ mol^{-1}			K
11.96	48.42	0.9788	1.0297	440
12.55	49.15	0.9825	1.0229	460
13.13	49.88	0.9853	1.0181	480
13.70	50.60	0.9875	1.0146	500
14.27	51.33	0.9893	1.0119	520
14.84	52.05	0.9908	1.0099	540
15.41	52.77	0.9920	1.0083	560
15.97	53.50	0.9930	1.0071	580
16.54	54.23	0.9939	1.0061	600
17.94	56.07	0.9955	1.0043	650
19.34	57.92	0.9966	1.0033	700
20.74	59.81	0.9974	1.0026	750
22.13	61.72	0.9980	1.0021	800
24.92	65.63	0.9987	1.0016	900
27.70	69.66	0.9992	1.0013	1000

x = 0.10

V	H	ϕ_1	ϕ_2
dm^3mol^{-1}	kJ mol^{-1}		
11.99	46.45	0.9793	1.0241
12.57	47.17	0.9828	1.0189
13.15	47.88	0.9855	1.0152
13.72	48.60	0.9877	1.0124
14.29	49.31	0.9895	1.0102
14.86	50.02	0.9909	1.0086
15.42	50.74	0.9921	1.0073
15.99	51.46	0.9931	1.0063
16.55	52.18	0.9939	1.0055
17.95	54.00	0.9955	1.0040
19.35	55.84	0.9966	1.0031
20.74	57.71	0.9974	1.0025
22.14	59.60	0.9980	1.0021
24.92	63.47	0.9987	1.0016
27.70	67.46	0.9992	1.0013

x = 0.20

V	H	ϕ_1	ϕ_2	T
dm^3mol^{-1}	kJ mol^{-1}			K
12.04	42.49	0.9806	1.0159	440
12.61	43.18	0.9838	1.0129	460
13.18	43.88	0.9863	1.0106	480
13.75	44.58	0.9883	1.0088	500
14.32	45.27	0.9899	1.0075	520
14.88	45.97	0.9913	1.0064	540
15.44	46.67	0.9924	1.0056	560
16.01	47.38	0.9934	1.0049	580
16.57	48.08	0.9941	1.0043	600
17.96	49.86	0.9957	1.0033	650
19.36	51.67	0.9967	1.0027	700
20.75	53.50	0.9975	1.0022	750
22.15	55.35	0.9980	1.0019	800
24.93	59.14	0.9987	1.0015	900
27.70	63.05	0.9992	1.0012	1000

x = 0.40

V	H	ϕ_1	ϕ_2
dm^3mol^{-1}	kJ mol^{-1}		
12.11	34.52	0.9843	1.0067
12.68	35.18	0.9867	1.0057
13.24	35.84	0.9886	1.0050
13.80	36.51	0.9902	1.0043
14.36	37.18	0.9915	1.0038
14.92	37.85	0.9925	1.0034
15.48	38.52	0.9934	1.0031
16.04	39.20	0.9942	1.0028
16.60	39.88	0.9949	1.0026
17.99	41.59	0.9962	1.0022
19.38	43.32	0.9971	1.0019
20.77	45.08	0.9977	1.0017
22.16	46.86	0.9982	1.0015
24.94	50.49	0.9989	1.0012
27.72	54.23	0.9993	1.0011

x = 0.60

V	H	ϕ_1	ϕ_2	T
dm^3mol^{-1}	kJ mol^{-1}			K
12.16	26.51	0.9882	1.0026	440
12.72	27.14	0.9899	1.0024	460
13.27	27.78	0.9913	1.0022	480
13.83	28.42	0.9924	1.0020	500
14.39	29.06	0.9933	1.0019	520
14.95	29.71	0.9942	1.0018	540
15.50	30.35	0.9948	1.0017	560
16.06	31.00	0.9954	1.0016	580
16.62	31.66	0.9959	1.0015	600
18.01	33.30	0.9969	1.0014	650
19.40	34.97	0.9977	1.0013	700
20.79	36.65	0.9982	1.0012	750
22.17	38.36	0.9986	1.0011	800
24.95	41.84	0.9992	1.0009	900
27.72	45.42	0.9995	1.0008	1000

x = 0.80

V	H	ϕ_1	ϕ_2
dm^3mol^{-1}	kJ mol^{-1}		
12.18	18.48	0.9919	1.0010
12.74	19.09	0.9931	1.0010
13.30	19.70	0.9940	1.0010
13.85	20.32	0.9948	1.0010
14.41	20.94	0.9955	1.0010
14.97	21.56	0.9960	1.0010
15.52	22.18	0.9965	1.0010
16.08	22.81	0.9970	1.0010
16.63	23.43	0.9973	1.0010
18.02	25.01	0.9981	1.0009
19.41	26.61	0.9986	1.0009
20.80	28.23	0.9990	1.0008
22.18	29.86	0.9993	1.0008
24.96	33.19	0.9997	1.0007
27.73	36.60	1.0000	1.0006

P = 0.4 MPa

x = 0.05					x = 0.10			
V	H	ϕ_1	ϕ_2	T	V	H	ϕ_1	ϕ_2
dm^3mol^{-1}	kJ mol^{-1}			K	dm^3mol^{-1}	kJ mol^{-1}		
8.91	48.32	0.9717	1.0407	440	8.94	46.36	0.9723	1.0328
9.36	49.07	0.9766	1.0313	460	9.38	47.09	0.9770	1.0257
9.80	49.80	0.9804	1.0246	480	9.82	47.82	0.9807	1.0205
10.24	50.54	0.9834	1.0197	500	10.25	48.54	0.9836	1.0167
10.67	51.27	0.9858	1.0161	520	10.69	49.26	0.9860	1.0138
11.10	52.00	0.9878	1.0133	540	11.11	49.98	0.9879	1.0116
11.53	52.73	0.9894	1.0112	560	11.54	50.70	0.9895	1.0098
11.96	53.46	0.9907	1.0095	580	11.97	51.43	0.9908	1.0084
12.38	54.19	0.9919	1.0082	600	12.39	52.15	0.9919	1.0073
13.44	56.04	0.9940	1.0058	650	13.45	53.97	0.9941	1.0054
14.49	57.90	0.9955	1.0044	700	14.50	55.82	0.9955	1.0041
15.54	59.79	0.9965	1.0035	750	15.55	57.69	0.9966	1.0033
16.59	61.70	0.9973	1.0029	800	16.59	59.58	0.9973	1.0028
18.68	65.62	0.9983	1.0021	900	18.68	63.46	0.9983	1.0021
20.77	69.65	0.9989	1.0017	1000	20.77	67.45	0.9989	1.0017

x = 0.20					x = 0.40			
V	H	ϕ_1	ϕ_2	T	V	H	ϕ_1	ϕ_2
dm^3mol^{-1}	kJ mol^{-1}			K	dm^3mol^{-1}	kJ mol^{-1}		
8.99	42.43	0.9742	1.0215	440	9.06	34.49	0.9791	1.0090
9.43	43.13	0.9784	1.0173	460	9.49	35.15	0.9823	1.0077
9.86	43.83	0.9817	1.0142	480	9.91	35.82	0.9848	1.0066
10.29	44.54	0.9844	1.0119	500	10.34	36.49	0.9869	1.0058
10.71	45.24	0.9866	1.0101	520	10.76	37.16	0.9886	1.0052
11.14	45.94	0.9884	1.0086	540	11.18	37.83	0.9901	1.0046
11.56	46.64	0.9899	1.0075	560	11.60	38.50	0.9913	1.0042
11.99	47.35	0.9912	1.0066	580	12.02	39.18	0.9923	1.0038
12.41	48.06	0.9922	1.0058	600	12.44	39.86	0.9932	1.0035
13.46	49.84	0.9942	1.0045	650	13.49	41.58	0.9949	1.0029
14.51	51.65	0.9956	1.0036	700	14.53	43.31	0.9961	1.0025
15.56	53.48	0.9966	1.0030	750	15.58	45.07	0.9970	1.0022
16.60	55.34	0.9974	1.0026	800	16.62	46.85	0.9976	1.0020
18.69	59.14	0.9983	1.0020	900	18.70	50.49	0.9985	1.0017
20.78	63.04	0.9989	1.0017	1000	20.79	54.23	0.9991	1.0014

x = 0.60					x = 0.80			
V	H	ϕ_1	ϕ_2	T	V	H	ϕ_1	ϕ_2
dm^3mol^{-1}	kJ mol^{-1}			K	dm^3mol^{-1}	kJ mol^{-1}		
9.11	26.49	0.9843	1.0035	440	9.14	18.47	0.9893	1.0013
9.53	27.13	0.9865	1.0032	460	9.55	19.09	0.9908	1.0013
9.95	27.77	0.9884	1.0030	480	9.97	19.70	0.9920	1.0013
10.37	28.41	0.9899	1.0028	500	10.39	20.32	0.9931	1.0013
10.79	29.05	0.9911	1.0026	520	10.81	20.93	0.9940	1.0013
11.21	29.70	0.9922	1.0024	540	11.23	21.55	0.9947	1.0013
11.62	30.35	0.9931	1.0023	560	11.64	22.18	0.9954	1.0013
12.04	31.00	0.9939	1.0022	580	12.06	22.80	0.9959	1.0013
12.46	31.65	0.9946	1.0021	600	12.48	23.43	0.9964	1.0013
13.50	33.30	0.9959	1.0019	650	13.52	25.01	0.9974	1.0012
14.55	34.96	0.9969	1.0017	700	14.56	26.61	0.9981	1.0012
15.59	36.65	0.9976	1.0016	750	15.60	28.23	0.9987	1.0011
16.63	38.36	0.9982	1.0015	800	16.64	29.86	0.9991	1.0011
18.71	41.84	0.9989	1.0013	900	18.72	33.19	0.9996	1.0010
20.80	45.41	0.9994	1.0011	1000	20.80	36.60	1.0000	1.0009

P = 0.5 MPa

x = 0.05					x = 0.10			
V	H	ϕ_1	ϕ_2	T	V	H	ϕ_1	ϕ_2
dm^3mol^{-1}	kJ mol^{-1}			K	dm^3mol^{-1}	kJ mol^{-1}		
7.08	48.21	0.9645	1.0523	440	7.11	46.28	0.9653	1.0420
7.44	48.98	0.9707	1.0400	460	7.47	47.02	0.9712	1.0327
7.80	49.73	0.9754	1.0313	480	7.82	47.76	0.9758	1.0260
8.16	50.47	0.9792	1.0250	500	8.18	48.49	0.9795	1.0211
8.51	51.21	0.9822	1.0203	520	8.52	49.21	0.9825	1.0174
8.85	51.95	0.9847	1.0168	540	8.87	49.94	0.9849	1.0146
9.20	52.69	0.9867	1.0141	560	9.21	50.66	0.9869	1.0124
9.54	53.42	0.9884	1.0119	580	9.55	51.39	0.9885	1.0106
9.89	54.16	0.9899	1.0103	600	9.90	52.12	0.9899	1.0092
10.74	56.01	0.9925	1.0073	650	10.74	53.95	0.9926	1.0067
11.58	57.88	0.9944	1.0055	700	11.59	55.80	0.9944	1.0052
12.42	59.77	0.9957	1.0044	750	12.43	57.67	0.9957	1.0042
13.26	61.69	0.9966	1.0036	800	13.27	59.57	0.9967	1.0035
14.94	65.61	0.9979	1.0027	900	14.94	63.45	0.9979	1.0026
16.61	69.64	0.9987	1.0021	1000	16.61	67.44	0.9987	1.0022

x = 0.20					x = 0.40			
V	H	ϕ_1	ϕ_2	T	V	H	ϕ_1	ϕ_2
dm^3mol^{-1}	kJ mol^{-1}			K	dm^3mol^{-1}	kJ mol^{-1}		
7.16	42.37	0.9677	1.0272	440	7.23	34.46	0.9739	1.0113
7.51	43.08	0.9730	1.0219	460	7.58	35.12	0.9779	1.0097
7.86	43.79	0.9772	1.0180	480	7.92	35.79	0.9810	1.0083
8.21	44.49	0.9805	1.0150	500	8.26	36.46	0.9836	1.0073
8.55	45.20	0.9833	1.0127	520	8.60	37.14	0.9858	1.0065
8.89	45.91	0.9855	1.0109	540	8.93	37.81	0.9876	1.0058
9.24	46.61	0.9874	1.0094	560	9.27	38.49	0.9891	1.0053
9.58	47.32	0.9890	1.0082	580	9.61	39.17	0.9904	1.0048
9.91	48.03	0.9903	1.0073	600	9.94	39.85	0.9915	1.0044
10.76	49.82	0.9928	1.0056	650	10.78	41.56	0.9936	1.0037
11.60	51.64	0.9945	1.0045	700	11.62	43.30	0.9951	1.0032
12.44	53.47	0.9958	1.0037	750	12.46	45.06	0.9962	1.0028
13.28	55.33	0.9967	1.0032	800	13.29	46.84	0.9970	1.0025
14.95	59.13	0.9979	1.0025	900	14.96	50.48	0.9981	1.0021
16.62	63.04	0.9987	1.0021	1000	16.63	54.23	0.9988	1.0018

x = 0.60					x = 0.80			
V	H	ϕ_1	ϕ_2	T	V	H	ϕ_1	ϕ_2
dm^3mol^{-1}	kJ mol^{-1}			K	dm^3mol^{-1}	kJ mol^{-1}		
7.28	26.48	0.9804	1.0044	440	7.31	18.47	0.9866	1.0017
7.62	27.12	0.9832	1.0040	460	7.64	19.08	0.9885	1.0017
7.95	27.76	0.9855	1.0037	480	7.98	19.69	0.9901	1.0017
8.29	28.40	0.9874	1.0035	500	8.31	20.31	0.9914	1.0017
8.63	29.04	0.9889	1.0032	520	8.65	20.93	0.9925	1.0017
8.96	29.69	0.9903	1.0030	540	8.98	21.55	0.9934	1.0017
9.30	30.34	0.9914	1.0029	560	9.31	22.17	0.9942	1.0017
9.63	30.99	0.9924	1.0027	580	9.65	22.80	0.9950	1.0016
9.97	31.64	0.9933	1.0026	600	9.98	23.43	0.9956	1.0016
10.80	33.29	0.9949	1.0024	650	10.82	25.01	0.9968	1.0016
11.64	34.96	0.9961	1.0021	700	11.65	26.61	0.9977	1.0015
12.47	36.65	0.9970	1.0020	750	12.48	28.23	0.9984	1.0014
13.31	38.36	0.9977	1.0018	800	13.31	29.86	0.9989	1.0013
14.97	41.84	0.9986	1.0016	900	14.98	33.19	0.9996	1.0012
16.64	45.41	0.9992	1.0014	1000	16.64	36.60	1.0000	1.0011

P = 0.6 MPa

x = 0.05					x = 0.10			
V	H	ϕ_1	ϕ_2	T	V	H	ϕ_1	ϕ_2
dm^3mol^{-1}	kJ mol^{-1}			K	dm^3mol^{-1}	kJ mol^{-1}		
5.86	48.10	0.9573	1.0646	440	5.89	46.19	0.9583	1.0516
6.17	48.89	0.9647	1.0490	460	6.19	46.95	0.9654	1.0399
6.47	49.65	0.9705	1.0382	480	6.49	47.69	0.9710	1.0317
6.77	50.41	0.9750	1.0304	500	6.79	48.43	0.9754	1.0256
7.07	51.16	0.9787	1.0247	520	7.08	49.16	0.9790	1.0211
7.36	51.90	0.9816	1.0203	540	7.37	49.90	0.9819	1.0176
7.65	52.64	0.9841	1.0170	560	7.66	50.63	0.9843	1.0149
7.94	53.38	0.9861	1.0144	580	7.95	51.36	0.9863	1.0128
8.22	54.12	0.9878	1.0124	600	8.23	52.09	0.9879	1.0111
8.93	55.98	0.9911	1.0088	650	8.94	53.92	0.9911	1.0081
9.64	57.86	0.9933	1.0067	700	9.65	55.78	0.9933	1.0063
10.34	59.75	0.9948	1.0053	750	10.35	57.65	0.9949	1.0050
11.05	61.67	0.9960	1.0043	800	11.05	59.55	0.9960	1.0042
12.44	65.59	0.9975	1.0032	900	12.45	63.44	0.9975	1.0032
13.84	69.63	0.9984	1.0026	1000	13.84	67.43	0.9984	1.0026

x = 0.20					x = 0.40			
V	H	ϕ_1	ϕ_2	T	V	H	ϕ_1	ϕ_2
dm^3mol^{-1}	kJ mol^{-1}			K	dm^3mol^{-1}	kJ mol^{-1}		
5.94	42.30	0.9612	1.0332	440	6.01	34.42	0.9687	1.0137
6.24	43.03	0.9676	1.0266	460	6.30	35.10	0.9735	1.0117
6.53	43.74	0.9726	1.0218	480	6.59	35.77	0.9773	1.0101
6.82	44.45	0.9766	1.0181	500	6.87	36.44	0.9804	1.0088
7.11	45.16	0.9799	1.0153	520	7.15	37.12	0.9830	1.0078
7.40	45.87	0.9826	1.0131	540	7.44	37.79	0.9851	1.0070
7.68	46.58	0.9849	1.0113	560	7.72	38.47	0.9869	1.0063
7.97	47.30	0.9868	1.0099	580	8.00	39.15	0.9885	1.0058
8.25	48.01	0.9883	1.0088	600	8.28	39.83	0.9898	1.0053
8.96	49.81	0.9914	1.0067	650	8.98	41.55	0.9923	1.0044
9.66	51.62	0.9935	1.0054	700	9.68	43.29	0.9941	1.0038
10.36	53.46	0.9950	1.0045	750	10.38	45.05	0.9955	1.0034
11.06	55.32	0.9961	1.0039	800	11.08	46.84	0.9964	1.0030
12.45	59.12	0.9975	1.0030	900	12.47	50.48	0.9978	1.0025
13.85	63.03	0.9984	1.0025	1000	13.86	54.22	0.9986	1.0022

x = 0.60					x = 0.80			
V	H	ϕ_1	ϕ_2	T	V	H	ϕ_1	ϕ_2
dm^3mol^{-1}	kJ mol^{-1}			K	dm^3mol^{-1}	kJ mol^{-1}		
6.06	26.46	0.9765	1.0054	440	6.09	18.46	0.9840	1.0020
6.34	27.10	0.9798	1.0049	460	6.37	19.07	0.9862	1.0020
6.62	27.74	0.9826	1.0045	480	6.65	19.69	0.9881	1.0021
6.90	28.39	0.9848	1.0042	500	6.93	20.31	0.9897	1.0021
7.18	29.03	0.9867	1.0039	520	7.20	20.92	0.9910	1.0020
7.46	29.68	0.9884	1.0037	540	7.48	21.55	0.9921	1.0020
7.74	30.33	0.9897	1.0035	560	7.76	22.17	0.9931	1.0020
8.02	30.98	0.9909	1.0033	580	8.04	22.80	0.9940	1.0020
8.30	31.64	0.9919	1.0032	600	8.32	23.42	0.9947	1.0020
9.00	33.28	0.9939	1.0028	650	9.01	25.01	0.9962	1.0019
9.70	34.95	0.9954	1.0026	700	9.71	26.61	0.9972	1.0018
10.39	36.64	0.9964	1.0024	750	10.40	28.22	0.9980	1.0017
11.09	38.35	0.9973	1.0022	800	11.10	29.86	0.9986	1.0016
12.48	41.84	0.9984	1.0019	900	12.49	33.19	0.9995	1.0015
13.87	45.41	0.9991	1.0017	1000	13.87	36.60	1.0000	1.0013

P = 0.8 MPa

x = 0.05					x = 0.10			
V	H	ϕ_1	ϕ_2	T	V	H	ϕ_1	ϕ_2
dm^3mol^{-1}	kJ mol^{-1}			K	dm^3mol^{-1}	kJ mol^{-1}		
4.57	48.70	0.9528	1.0684	460	4.60	46.79	0.9537	1.0552
4.81	49.50	0.9605	1.0528	480	4.83	47.56	0.9612	1.0435
5.04	50.28	0.9666	1.0417	500	5.06	48.32	0.9672	1.0350
5.26	51.04	0.9715	1.0337	520	5.28	49.07	0.9719	1.0286
5.49	51.80	0.9755	1.0276	540	5.50	49.81	0.9758	1.0239
5.71	52.55	0.9788	1.0230	560	5.72	50.55	0.9790	1.0202
5.93	53.30	0.9815	1.0195	580	5.94	51.29	0.9817	1.0173
6.14	54.05	0.9838	1.0167	600	6.15	52.02	0.9839	1.0149
6.68	55.92	0.9881	1.0119	650	6.69	53.87	0.9882	1.0109
7.22	57.81	0.9910	1.0089	700	7.22	55.74	0.9911	1.0084
7.75	59.71	0.9931	1.0071	750	7.75	57.62	0.9932	1.0068
8.27	61.64	0.9947	1.0058	800	8.28	59.53	0.9947	1.0056
9.33	65.57	0.9967	1.0043	900	9.33	63.41	0.9967	1.0043
10.37	69.61	0.9979	1.0035	1000	10.38	67.41	0.9979	1.0035

x = 0.20					x = 0.40			
V	H	ϕ_1	ϕ_2	T	V	H	ϕ_1	ϕ_2
dm^3mol^{-1}	kJ mol^{-1}			K	dm^3mol^{-1}	kJ mol^{-1}		
4.42	42.18	0.9482	1.0455	440	4.49	34.36	0.9584	1.0185
4.64	42.92	0.9567	1.0363	460	4.71	35.04	0.9647	1.0157
4.87	43.65	0.9635	1.0295	480	4.92	35.72	0.9697	1.0135
5.09	44.37	0.9689	1.0245	500	5.14	36.40	0.9739	1.0119
5.31	45.09	0.9733	1.0206	520	5.35	37.08	0.9773	1.0105
5.53	45.81	0.9769	1.0176	540	5.57	37.76	0.9802	1.0094
5.74	46.52	0.9798	1.0153	560	5.78	38.44	0.9826	1.0085
5.96	47.24	0.9824	1.0134	580	5.99	39.12	0.9847	1.0078
6.17	47.96	0.9845	1.0118	600	6.20	39.80	0.9864	1.0071
6.71	49.77	0.9885	1.0090	650	6.73	41.53	0.9898	1.0059
7.23	51.59	0.9913	1.0073	700	7.26	43.27	0.9922	1.0051
7.76	53.43	0.9933	1.0060	750	7.78	45.04	0.9940	1.0045
8.29	55.29	0.9948	1.0052	800	8.30	46.82	0.9953	1.0040
9.34	59.10	0.9967	1.0041	900	9.35	50.47	0.9970	1.0034
10.38	63.02	0.9979	1.0034	1000	10.39	54.21	0.9981	1.0029

x = 0.60					x = 0.80			
V	H	ϕ_1	ϕ_2	T	V	H	ϕ_1	ϕ_2
dm^3mol^{-1}	kJ mol^{-1}			K	dm^3mol^{-1}	kJ mol^{-1}		
4.53	26.43	0.9688	1.0072	440	4.56	18.45	0.9787	1.0027
4.75	27.07	0.9732	1.0066	460	4.77	19.06	0.9817	1.0028
4.96	27.72	0.9768	1.0060	480	4.98	19.68	0.9842	1.0028
5.17	28.36	0.9798	1.0056	500	5.19	20.30	0.9863	1.0028
5.38	29.01	0.9824	1.0052	520	5.40	20.92	0.9880	1.0027
5.59	29.66	0.9845	1.0049	540	5.61	21.54	0.9895	1.0027
5.80	30.31	0.9863	1.0047	560	5.82	22.16	0.9908	1.0027
6.02	30.96	0.9879	1.0044	580	6.03	22.79	0.9920	1.0027
6.23	31.62	0.9893	1.0042	600	6.24	23.42	0.9930	1.0026
6.75	33.27	0.9919	1.0038	650	6.76	25.00	0.9949	1.0025
7.27	34.94	0.9938	1.0035	700	7.28	26.60	0.9963	1.0024
7.80	36.63	0.9953	1.0032	750	7.81	28.22	0.9974	1.0023
8.32	38.35	0.9964	1.0030	800	8.33	29.86	0.9982	1.0022
9.36	41.83	0.9979	1.0026	900	9.37	33.19	0.9993	1.0020
10.40	45.41	0.9988	1.0023	1000	10.41	36.60	1.0000	1.0018

P = 1.0 MPa

x = 0.05					x = 0.10			
V	H	ϕ_1	ϕ_2	T	V	H	ϕ_1	ϕ_2
$dm^3 mol^{-1}$	kJ mol^{-1}			K	$dm^3 mol^{-1}$	kJ mol^{-1}		
3.61	48.51	0.9407	1.0897	460	3.64	46.63	0.9419	1.0717
3.81	49.34	0.9505	1.0685	480	3.83	47.43	0.9514	1.0559
4.00	50.14	0.9582	1.0537	500	4.02	48.20	0.9589	1.0447
4.18	50.92	0.9644	1.0431	520	4.20	48.96	0.9649	1.0365
4.36	51.70	0.9694	1.0352	540	4.38	49.72	0.9698	1.0303
4.54	52.46	0.9735	1.0293	560	4.56	50.47	0.9738	1.0255
4.72	53.22	0.9769	1.0247	580	4.73	51.21	0.9771	1.0218
4.90	53.98	0.9797	1.0211	600	4.91	51.96	0.9799	1.0189
5.33	55.87	0.9851	1.0149	650	5.34	53.82	0.9852	1.0137
5.76	57.76	0.9888	1.0112	700	5.77	55.70	0.9889	1.0106
6.19	59.68	0.9914	1.0089	750	6.19	57.59	0.9915	1.0085
6.61	61.61	0.9933	1.0073	800	6.62	59.50	0.9934	1.0071
7.03	63.56	0.9948	1.0062	850	7.04	61.43	0.9948	1.0061
7.46	65.55	0.9958	1.0054	900	7.46	63.39	0.9959	1.0054
8.30	69.60	0.9974	1.0044	1000	8.30	67.40	0.9974	1.0044

x = 0.20					x = 0.40			
V	H	ϕ_1	ϕ_2	T	V	H	ϕ_1	ϕ_2
$dm^3 mol^{-1}$	kJ mol^{-1}			K	$dm^3 mol^{-1}$	kJ mol^{-1}		
				440	3.57	34.30	0.9481	1.0234
3.69	42.81	0.9458	1.0464	460	3.75	34.98	0.9559	1.0198
3.87	43.55	0.9543	1.0376	480	3.93	35.67	0.9622	1.0171
4.05	44.29	0.9611	1.0311	500	4.10	36.35	0.9674	1.0149
4.23	45.01	0.9666	1.0261	520	4.27	37.03	0.9717	1.0132
4.40	45.74	0.9711	1.0223	540	4.44	37.72	0.9753	1.0118
4.58	46.46	0.9748	1.0193	560	4.61	38.40	0.9783	1.0107
4.75	47.19	0.9780	1.0168	580	4.79	39.09	0.9808	1.0098
4.93	47.91	0.9806	1.0149	600	4.96	39.78	0.9830	1.0090
5.35	49.73	0.9856	1.0114	650	5.38	41.51	0.9873	1.0075
5.78	51.55	0.9891	1.0091	700	5.80	43.25	0.9903	1.0064
6.20	53.40	0.9916	1.0076	750	6.22	45.02	0.9925	1.0057
6.63	55.27	0.9935	1.0065	800	6.64	46.81	0.9941	1.0051
7.47	59.08	0.9959	1.0051	900	7.48	50.46	0.9963	1.0042
8.30	63.00	0.9974	1.0043	1000	8.32	54.21	0.9977	1.0036

x = 0.60					x = 0.80			
V	H	ϕ_1	ϕ_2	T	V	H	ϕ_1	ϕ_2
$dm^3 mol^{-1}$	kJ mol^{-1}			K	$dm^3 mol^{-1}$	kJ mol^{-1}		
3.62	26.40	0.9611	1.0091	440	3.65	18.43	0.9735	1.0034
3.79	27.04	0.9665	1.0083	460	3.82	19.05	0.9772	1.0035
3.96	27.69	0.9711	1.0076	480	3.99	19.67	0.9803	1.0035
4.13	28.34	0.9748	1.0071	500	4.15	20.29	0.9829	1.0035
4.30	28.99	0.9780	1.0066	520	4.32	20.91	0.9851	1.0035
4.47	29.64	0.9807	1.0062	540	4.49	21.53	0.9870	1.0034
4.64	30.29	0.9829	1.0059	560	4.66	22.16	0.9886	1.0034
4.81	30.95	0.9849	1.0056	580	4.83	22.78	0.9900	1.0033
4.98	31.61	0.9866	1.0053	600	4.99	23.41	0.9912	1.0033
5.40	33.26	0.9899	1.0048	650	5.41	25.00	0.9937	1.0032
5.82	34.93	0.9923	1.0044	700	5.83	26.60	0.9954	1.0030
6.24	36.63	0.9941	1.0040	750	6.25	28.22	0.9968	1.0029
6.65	38.34	0.9955	1.0037	800	6.66	29.86	0.9978	1.0027
7.49	41.83	0.9973	1.0032	900	7.50	33.19	0.9992	1.0025
8.32	45.41	0.9985	1.0028	1000	8.33	36.60	1.0000	1.0022

P = 1.5 MPa

x = 0.05					x = 0.10			
V	H	ϕ_1	ϕ_2	T	V	H	ϕ_1	ϕ_2
dm^3mol^{-1}	kJ mol^{-1}			K	dm^3mol^{-1}	kJ mol^{-1}		
2.468	48.91	0.9251	1.1130	480	2.495	47.07	0.9267	1.0904
2.605	49.78	0.9370	1.0868	500	2.626	47.90	0.9381	1.0711
2.736	50.62	0.9464	1.0686	520	2.754	48.71	0.9472	1.0573
2.864	51.43	0.9540	1.0554	540	2.880	49.49	0.9546	1.0472
2.989	52.23	0.9602	1.0456	560	3.00	50.27	0.9606	1.0395
3.11	53.02	0.9653	1.0382	580	3.12	51.03	0.9657	1.0336
3.23	53.79	0.9696	1.0325	600	3.24	51.80	0.9699	1.0289
3.53	55.72	0.9777	1.0228	650	3.54	53.69	0.9778	1.0209
3.82	57.65	0.9832	1.0171	700	3.83	55.59	0.9833	1.0160
4.11	59.58	0.9872	1.0135	750	4.11	57.50	0.9872	1.0129
4.39	61.53	0.9900	1.0110	800	4.40	59.42	0.9900	1.0107
4.68	63.50	0.9922	1.0094	850	4.68	61.37	0.9922	1.0092
4.96	65.49	0.9938	1.0082	900	4.97	63.34	0.9938	1.0081
5.24	67.51	0.9951	1.0073	950	5.25	65.33	0.9951	1.0073
5.52	69.55	0.9961	1.0066	1000	5.53	67.36	0.9961	1.0066

x = 0.20					x = 0.40			
V	H	ϕ_1	ϕ_2	T	V	H	ϕ_1	ϕ_2
dm^3mol^{-1}	kJ mol^{-1}			K	dm^3mol^{-1}	kJ mol^{-1}		
				460	2.475	34.84	0.9341	1.0305
2.54	43.30	0.9314	1.0590	480	2.595	35.54	0.9435	1.0262
2.66	44.07	0.9416	1.0484	500	2.713	36.24	0.9512	1.0229
2.79	44.82	0.9499	1.0404	520	2.830	36.93	0.9576	1.0202
2.91	45.57	0.9566	1.0343	540	2.947	37.62	0.9630	1.0181
3.03	46.31	0.9623	1.0295	560	3.06	38.32	0.9675	1.0163
3.14	47.05	0.9670	1.0257	580	3.18	39.01	0.9713	1.0149
3.26	47.79	0.9709	1.0227	600	3.29	39.70	0.9746	1.0136
3.55	49.63	0.9785	1.0173	650	3.58	41.45	0.9809	1.0113
3.84	51.47	0.9837	1.0138	700	3.86	43.20	0.9854	1.0097
4.12	53.33	0.9874	1.0115	750	4.14	44.96	0.9887	1.0086
4.41	55.21	0.9902	1.0099	800	4.42	46.78	0.9912	1.0077
4.69	57.11	0.9923	1.0087	850	4.71	48.59	0.9930	1.0070
4.97	59.04	0.9939	1.0078	900	4.99	50.43	0.9945	1.0064
5.25	60.99	0.9951	1.0070	950	5.26	52.30	0.9956	1.0059
5.53	62.97	0.9961	1.0065	1000	5.54	54.19	0.9966	1.0055

x = 0.60					x = 0.80			
V	H	ϕ_1	ϕ_2	T	V	H	ϕ_1	ϕ_2
dm^3mol^{-1}	kJ mol^{-1}			K	dm^3mol^{-1}	kJ mol^{-1}		
2.401	26.32	0.9419	1.0140	440	2.430	18.40	0.9605	1.0053
2.517	26.97	0.9500	1.0127	460	2.544	19.02	0.9660	1.0053
2.632	27.63	0.9568	1.0116	480	2.657	19.64	0.9706	1.0053
2.747	28.28	0.9624	1.0108	500	2.769	20.26	0.9745	1.0053
2.861	28.94	0.9671	1.0101	520	2.882	20.89	0.9778	1.0053
2.975	29.59	0.9711	1.0095	540	2.994	21.51	0.9806	1.0052
3.09	30.25	0.9745	1.0089	560	3.11	22.14	0.9830	1.0052
3.20	30.91	0.9774	1.0085	580	3.22	22.77	0.9851	1.0051
3.32	31.57	0.9800	1.0081	600	3.33	23.40	0.9870	1.0050
3.60	33.23	0.9849	1.0072	650	3.61	24.99	0.9906	1.0048
3.88	34.91	0.9885	1.0066	700	3.89	26.59	0.9933	1.0046
4.16	36.61	0.9912	1.0061	750	4.17	28.21	0.9952	1.0043
4.44	38.32	0.9933	1.0056	800	4.45	29.85	0.9967	1.0041
5.00	41.82	0.9960	1.0049	900	5.00	33.19	0.9988	1.0037
5.55	45.40	0.9978	1.0043	1000	5.56	36.60	1.0001	1.0033

P = 2.0 MPa

x = 0.05					x = 0.10			
V	H	ϕ_1	ϕ_2	T	V	H	ϕ_1	ϕ_2
dm^3mol^{-1}	kJ mol^{-1}			K	dm^3mol^{-1}	kJ mol^{-1}		
				480	1.824	46.69	0.9015	1.1305
1.907	49.40	0.9155	1.1253	500	1.930	47.58	0.9171	1.1009
2.012	50.30	0.9282	1.0973	520	2.032	48.43	0.9294	1.0803
2.113	51.16	0.9385	1.0776	540	2.129	49.26	0.9393	1.0654
2.211	51.99	0.9468	1.0633	560	2.225	50.06	0.9475	1.0544
2.306	52.80	0.9537	1.0526	580	2.319	50.85	0.9542	1.0460
2.400	53.60	0.9595	1.0445	600	2.411	51.63	0.9598	1.0394
2.492	54.40	0.9643	1.0382	620	2.502	52.41	0.9646	1.0343
2.583	55.18	0.9684	1.0331	640	2.592	53.18	0.9687	1.0301
2.673	55.97	0.9720	1.0291	660	2.681	53.95	0.9722	1.0267
2.762	56.75	0.9750	1.0258	680	2.769	54.72	0.9752	1.0240
2.850	57.53	0.9777	1.0231	700	2.857	55.49	0.9778	1.0217
3.07	59.48	0.9829	1.0182	750	3.07	57.41	0.9830	1.0174
3.29	61.45	0.9867	1.0149	800	3.29	59.35	0.9867	1.0145
3.50	63.43	0.9896	1.0126	850	3.50	61.31	0.9896	1.0124
3.71	65.43	0.9917	1.0110	900	3.72	63.28	0.9918	1.0109
4.14	69.51	0.9948	1.0089	1000	4.14	67.32	0.9948	1.0089

x = 0.20					x = 0.40			
V	H	ϕ_1	ϕ_2	T	V	H	ϕ_1	ϕ_2
dm^3mol^{-1}	kJ mol^{-1}			K	dm^3mol^{-1}	kJ mol^{-1}		
1.869	43.04	0.9083	1.0825	480	1.929	35.41	0.9249	1.0357
1.968	43.85	0.9221	1.0669	500	2.020	36.12	0.9352	1.0311
2.063	44.63	0.9332	1.0555	520	2.110	36.83	0.9437	1.0274
2.157	45.40	0.9422	1.0469	540	2.199	37.53	0.9508	1.0245
2.249	46.16	0.9497	1.0402	560	2.287	38.23	0.9567	1.0221
2.340	46.91	0.9560	1.0350	580	2.374	38.93	0.9618	1.0201
2.430	47.66	0.9613	1.0308	600	2.461	39.63	0.9662	1.0184
2.519	48.41	0.9658	1.0274	620	2.548	40.33	0.9699	1.0170
2.608	49.15	0.9696	1.0246	640	2.634	41.04	0.9732	1.0158
2.695	49.90	0.9729	1.0223	660	2.720	41.74	0.9760	1.0148
2.783	50.64	0.9758	1.0203	680	2.806	42.45	0.9784	1.0139
2.870	51.39	0.9783	1.0187	700	2.891	43.16	0.9806	1.0131
3.09	53.26	0.9833	1.0155	750	3.10	44.94	0.9850	1.0115
3.30	55.15	0.9870	1.0133	800	3.32	46.74	0.9883	1.0103
3.51	57.06	0.9897	1.0117	850	3.53	48.56	0.9907	1.0094
3.72	59.00	0.9919	1.0104	900	3.74	50.41	0.9927	1.0086
4.15	62.94	0.9948	1.0087	1000	4.16	54.17	0.9954	1.0074

x = 0.60					x = 0.80			
V	H	ϕ_1	ϕ_2	T	V	H	ϕ_1	ϕ_2
dm^3mol^{-1}	kJ mol^{-1}			K	dm^3mol^{-1}	kJ mol^{-1}		
				440	1.821	18.36	0.9478	1.0072
1.880	26.90	0.9337	1.0172	460	1.907	18.99	0.9550	1.0072
1.967	27.56	0.9426	1.0158	480	1.992	19.61	0.9611	1.0072
2.055	28.22	0.9500	1.0146	500	2.077	20.24	0.9662	1.0072
2.141	28.88	0.9563	1.0136	520	2.162	20.86	0.9706	1.0071
2.227	29.55	0.9616	1.0128	540	2.246	21.49	0.9743	1.0070
2.313	30.21	0.9661	1.0121	560	2.331	22.12	0.9776	1.0069
2.399	30.87	0.9700	1.0114	580	2.415	22.75	0.9803	1.0068
2.484	31.53	0.9734	1.0109	600	2.500	23.39	0.9828	1.0067
2.697	33.20	0.9800	1.0098	650	2.710	24.98	0.9876	1.0064
2.908	34.89	0.9848	1.0089	700	2.919	26.59	0.9911	1.0061
3.12	36.59	0.9884	1.0081	750	3.13	28.21	0.9937	1.0058
3.33	38.31	0.9910	1.0075	800	3.34	29.85	0.9957	1.0055
3.75	41.81	0.9948	1.0065	900	3.75	33.19	0.9985	1.0050
4.17	45.39	0.9971	1.0058	1000	4.17	36.61	1.0002	1.0045

P = 3.0 MPa

x = 0.05					x = 0.10			
V	H	ϕ_1	ϕ_2	T	V	H	ϕ_1	ϕ_2
dm^3mol^{-1}	kJ mol^{-1}			K	dm^3mol^{-1}	kJ mol^{-1}		
1.284	49.59	0.8914	1.1667	520	1.306	47.85	0.8934	1.1334
1.360	50.56	0.9072	1.1292	540	1.378	48.76	0.9087	1.1064
1.431	51.48	0.9199	1.1032	560	1.446	49.63	0.9210	1.0871
1.500	52.36	0.9304	1.0845	580	1.513	50.47	0.9312	1.0728
1.566	53.21	0.9391	1.0706	600	1.578	51.29	0.9397	1.0619
1.631	54.05	0.9464	1.0600	620	1.641	52.10	0.9469	1.0534
1.695	54.87	0.9527	1.0517	640	1.704	52.90	0.9530	1.0467
1.757	55.68	0.9580	1.0452	660	1.765	53.70	0.9583	1.0413
1.819	56.49	0.9625	1.0399	680	1.826	54.49	0.9628	1.0369
1.880	57.29	0.9665	1.0356	700	1.887	55.27	0.9667	1.0333
2.030	59.29	0.9744	1.0278	750	2.035	57.24	0.9745	1.0266
2.177	61.28	0.9801	1.0228	800	2.182	59.20	0.9801	1.0221
2.323	63.29	0.9844	1.0193	850	2.327	61.18	0.9844	1.0190
2.467	65.31	0.9877	1.0168	900	2.471	63.18	0.9877	1.0167
2.610	67.35	0.9902	1.0149	950	2.614	65.19	0.9902	1.0149
2.753	69.41	0.9922	1.0135	1000	2.756	67.23	0.9922	1.0136

x = 0.20					x = 0.40			
V	H	ϕ_1	ϕ_2	T	V	H	ϕ_1	ϕ_2
dm^3mol^{-1}	kJ mol^{-1}			K	dm^3mol^{-1}	kJ mol^{-1}		
				480	1.264	35.14	0.8881	1.0559
1.272	43.38	0.8829	1.1086	500	1.327	35.88	0.9033	1.0484
1.340	44.22	0.8997	1.0887	520	1.389	36.61	0.9159	1.0425
1.407	45.04	0.9134	1.0741	540	1.450	37.34	0.9265	1.0379
1.472	45.84	0.9246	1.0630	560	1.511	38.06	0.9354	1.0341
1.535	46.63	0.9340	1.0545	580	1.571	38.77	0.9429	1.0310
1.598	47.40	0.9420	1.0478	600	1.630	39.49	0.9494	1.0284
1.659	48.17	0.9487	1.0423	620	1.689	40.20	0.9550	1.0262
1.720	48.94	0.9544	1.0379	640	1.748	40.91	0.9598	1.0243
1.781	49.70	0.9594	1.0343	660	1.806	41.63	0.9641	1.0227
1.840	50.46	0.9637	1.0312	680	1.864	42.34	0.9677	1.0213
1.900	51.22	0.9675	1.0287	700	1.922	43.06	0.9710	1.0201
2.046	53.12	0.9750	1.0237	750	2.065	44.86	0.9775	1.0176
2.191	55.04	0.9805	1.0203	800	2.208	46.67	0.9824	1.0157
2.335	56.96	0.9846	1.0178	850	2.350	48.51	0.9862	1.0142
2.478	58.91	0.9878	1.0159	900	2.491	50.36	0.9891	1.0130
2.762	62.87	0.9923	1.0132	1000	2.773	54.13	0.9932	1.0111

x = 0.60					x = 0.80			
V	H	ϕ_1	ϕ_2	T	V	H	ϕ_1	ϕ_2
dm^3mol^{-1}	kJ mol^{-1}			K	dm^3mol^{-1}	kJ mol^{-1}		
				440	1.212	18.30	0.9228	1.0112
1.243	26.76	0.9015	1.0267	460	1.270	18.93	0.9335	1.0112
1.303	27.43	0.9146	1.0244	480	1.327	19.56	0.9424	1.0111
1.362	28.11	0.9256	1.0226	500	1.385	20.19	0.9501	1.0110
1.421	28.78	0.9349	1.0210	520	1.442	20.82	0.9565	1.0109
1.480	29.45	0.9428	1.0197	540	1.499	21.46	0.9621	1.0108
1.538	30.12	0.9495	1.0185	560	1.555	22.09	0.9668	1.0106
1.596	30.79	0.9553	1.0175	580	1.612	22.72	0.9709	1.0104
1.653	31.46	0.9603	1.0167	600	1.669	23.36	0.9745	1.0102
1.796	33.14	0.9702	1.0149	650	1.809	24.96	0.9817	1.0098
1.939	34.84	0.9774	1.0135	700	1.950	26.57	0.9869	1.0093
2.080	36.55	0.9827	1.0123	750	2.090	28.20	0.9908	1.0088
2.221	38.28	0.9867	1.0114	800	2.230	29.85	0.9938	1.0083
2.502	41.79	0.9922	1.0099	900	2.508	33.19	0.9978	1.0075
2.781	45.38	0.9957	1.0087	1000	2.787	36.61	1.0003	1.0067

P = 4.0 MPa

x = 0.05					x = 0.10			
V	H	ϕ_1	ϕ_2	T	V	H	ϕ_1	ϕ_2
dm^3mol^{-1}	kJ mol^{-1}			K	dm^3mol^{-1}	kJ mol^{-1}		
0.915	48.78	0.8536	1.2582	520	0.940	47.21	0.8569	1.1991
0.980	49.91	0.8754	1.1931	540	1.000	48.22	0.8777	1.1549
1.039	50.93	0.8928	1.1505	560	1.056	49.17	0.8944	1.1245
1.095	51.89	0.9070	1.1210	580	1.109	50.07	0.9082	1.1027
1.149	52.80	0.9187	1.0997	600	1.161	50.94	0.9196	1.0865
1.200	53.68	0.9285	1.0839	620	1.211	51.79	0.9292	1.0742
1.250	54.54	0.9368	1.0718	640	1.260	52.62	0.9374	1.0645
1.299	55.39	0.9439	1.0624	660	1.308	53.44	0.9444	1.0568
1.347	56.22	0.9501	1.0549	680	1.355	54.25	0.9504	1.0506
1.394	57.05	0.9554	1.0488	700	1.401	55.06	0.9556	1.0455
1.510	59.09	0.9658	1.0379	750	1.516	57.06	0.9660	1.0362
1.623	61.12	0.9735	1.0309	800	1.628	59.05	0.9736	1.0300
1.734	63.15	0.9792	1.0261	850	1.738	61.05	0.9792	1.0257
1.843	65.19	0.9836	1.0227	900	1.847	63.07	0.9836	1.0226
1.952	67.24	0.9870	1.0202	950	1.955	65.10	0.9870	1.0202
2.060	69.32	0.9896	1.0183	1000	2.063	67.15	0.9896	1.0183

x = 0.20					x = 0.40			
V	H	ϕ_1	ϕ_2	T	V	H	ϕ_1	ϕ_2
dm^3mol^{-1}	kJ mol^{-1}			K	dm^3mol^{-1}	kJ mol^{-1}		
				500	0.980	35.64	0.8718	1.0670
0.978	43.79	0.8662	1.1264	520	1.028	36.40	0.8885	1.0586
1.031	44.67	0.8845	1.1043	540	1.076	37.14	0.9024	1.0520
1.083	45.51	0.8996	1.0879	560	1.123	37.88	0.9142	1.0467
1.133	46.33	0.9121	1.0755	580	1.169	38.61	0.9242	1.0424
1.181	47.14	0.9227	1.0659	600	1.214	39.34	0.9328	1.0388
1.229	47.93	0.9317	1.0582	620	1.259	40.07	0.9402	1.0357
1.276	48.72	0.9393	1.0520	640	1.304	40.79	0.9466	1.0331
1.323	49.50	0.9459	1.0469	660	1.349	41.51	0.9522	1.0309
1.369	50.28	0.9517	1.0426	680	1.393	42.24	0.9571	1.0289
1.414	51.05	0.9567	1.0391	700	1.437	42.96	0.9614	1.0272
1.527	52.98	0.9666	1.0323	750	1.546	44.78	0.9701	1.0238
1.637	54.92	0.9740	1.0275	800	1.654	46.60	0.9767	1.0212
1.746	56.86	0.9795	1.0241	850	1.761	48.45	0.9816	1.0192
1.855	58.82	0.9838	1.0215	900	1.868	50.31	0.9855	1.0175
1.962	60.80	0.9871	1.0194	950	1.974	52.19	0.9886	1.0162
2.069	62.80	0.9897	1.0178	1000	2.080	54.10	0.9910	1.0150

x = 0.60					x = 0.80			
V	H	ϕ_1	ϕ_2	T	V	H	ϕ_1	ϕ_2
dm^3mol^{-1}	kJ mol^{-1}			K	dm^3mol^{-1}	kJ mol^{-1}		
				460	0.952	18.87	0.9126	1.0153
0.971	27.30	0.8872	1.0335	480	0.995	19.51	0.9243	1.0152
1.016	27.99	0.9017	1.0309	500	1.039	20.15	0.9343	1.0150
1.061	28.67	0.9138	1.0287	520	1.082	20.78	0.9428	1.0148
1.106	29.36	0.9242	1.0268	540	1.125	21.42	0.9501	1.0146
1.150	30.03	0.9331	1.0252	560	1.168	22.06	0.9564	1.0144
1.194	30.71	0.9408	1.0238	580	1.211	22.70	0.9618	1.0141
1.238	31.39	0.9474	1.0226	600	1.253	23.34	0.9666	1.0138
1.346	33.09	0.9605	1.0201	650	1.359	24.94	0.9760	1.0132
1.454	34.79	0.9700	1.0182	700	1.465	26.56	0.9829	1.0125
1.561	36.51	0.9771	1.0166	750	1.570	28.19	0.9880	1.0118
1.667	38.25	0.9824	1.0153	800	1.676	29.84	0.9919	1.0112
1.878	41.77	0.9898	1.0132	900	1.885	33.19	0.9973	1.0100
2.089	45.37	0.9944	1.0116	1000	2.094	36.62	1.0006	1.0090

P = 5.0 MPa

x = 0.05					x = 0.10			
V	H	ϕ_1	ϕ_2	T	V	H	ϕ_1	ϕ_2
dm^3mol^{-1}	kJ mol^{-1}			K	dm^3mol^{-1}	kJ mol^{-1}		
0.748	49.17	0.8430	1.2740	540	0.771	47.64	0.8463	1.2129
0.802	50.33	0.8653	1.2072	560	0.820	48.68	0.8676	1.1677
0.851	51.39	0.8834	1.1632	580	0.866	49.65	0.8850	1.1363
0.897	52.37	0.8982	1.1326	600	0.910	50.57	0.8994	1.1136
0.941	53.30	0.9106	1.1103	620	0.952	51.46	0.9115	1.0966
0.983	54.21	0.9210	1.0937	640	0.993	52.32	0.9217	1.0835
1.024	55.09	0.9299	1.0808	660	1.032	53.17	0.9305	1.0733
1.064	55.95	0.9376	1.0708	680	1.072	54.01	0.9380	1.0651
1.103	56.80	0.9442	1.0627	700	1.110	54.84	0.9445	1.0584
1.198	58.89	0.9573	1.0485	750	1.204	56.88	0.9575	1.0462
1.290	60.95	0.9669	1.0394	800	1.295	58.90	0.9670	1.0382
1.380	63.00	0.9740	1.0332	850	1.385	60.93	0.9741	1.0327
1.469	65.07	0.9795	1.0288	900	1.473	62.96	0.9795	1.0286
1.557	67.14	0.9837	1.0256	950	1.561	65.00	0.9837	1.0256
1.644	69.23	0.9871	1.0231	1000	1.647	67.07	0.9871	1.0232

x = 0.20					x = 0.40			
V	H	ϕ_1	ϕ_2	T	V	H	ϕ_1	ϕ_2
dm^3mol^{-1}	kJ mol^{-1}			K	dm^3mol^{-1}	kJ mol^{-1}		
				520	0.812	36.18	0.8614	1.0757
0.805	44.27	0.8557	1.1379	540	0.851	36.95	0.8786	1.0670
0.849	45.17	0.8746	1.1152	560	0.890	37.70	0.8932	1.0600
0.891	46.03	0.8903	1.0982	580	0.928	38.45	0.9056	1.0543
0.931	46.87	0.9035	1.0852	600	0.965	39.19	0.9163	1.0496
0.971	47.69	0.9147	1.0750	620	1.002	39.93	0.9255	1.0456
1.010	48.50	0.9243	1.0668	640	1.038	40.67	0.9335	1.0422
1.048	49.30	0.9325	1.0601	660	1.075	41.40	0.9404	1.0393
1.086	50.09	0.9397	1.0545	680	1.110	42.13	0.9465	1.0368
1.123	50.88	0.9459	1.0499	700	1.146	42.86	0.9519	1.0346
1.215	52.84	0.9583	1.0411	750	1.234	44.70	0.9628	1.0302
1.305	54.80	0.9675	1.0350	800	1.322	46.54	0.9709	1.0269
1.393	56.76	0.9744	1.0306	850	1.408	48.39	0.9771	1.0242
1.481	58.73	0.9798	1.0272	900	1.494	50.26	0.9820	1.0221
1.567	60.73	0.9839	1.0246	950	1.580	52.15	0.9858	1.0204
1.654	62.74	0.9872	1.0225	1000	1.665	54.06	0.9888	1.0189

x = 0.60					x = 0.80			
V	H	ϕ_1	ϕ_2	T	V	H	ϕ_1	ϕ_2
dm^3mol^{-1}	kJ mol^{-1}			K	dm^3mol^{-1}	kJ mol^{-1}		
				460	0.761	18.81	0.8923	1.0196
				480	0.796	19.46	0.9068	1.0194
0.809	27.88	0.8782	1.0396	500	0.831	20.10	0.9190	1.0192
0.845	28.57	0.8932	1.0367	520	0.866	20.74	0.9295	1.0189
0.882	29.26	0.9060	1.0342	540	0.901	21.39	0.9385	1.0185
0.918	29.95	0.9170	1.0321	560	0.936	22.03	0.9462	1.0182
0.953	30.63	0.9265	1.0303	580	0.970	22.67	0.9530	1.0179
0.989	31.32	0.9347	1.0287	600	1.004	23.31	0.9588	1.0175
1.077	33.03	0.9510	1.0255	650	1.090	24.93	0.9705	1.0166
1.163	34.75	0.9628	1.0230	700	1.174	26.55	0.9790	1.0157
1.249	36.47	0.9716	1.0210	750	1.259	28.19	0.9854	1.0149
1.335	38.22	0.9782	1.0193	800	1.343	29.84	0.9902	1.0141
1.420	39.97	0.9834	1.0179	850	1.427	31.51	0.9939	1.0133
1.504	41.75	0.9874	1.0167	900	1.511	33.20	0.9968	1.0126
1.589	43.54	0.9905	1.0156	950	1.595	34.90	0.9991	1.0119
1.673	45.36	0.9931	1.0146	1000	1.678	36.62	1.0009	1.0113

P = 6.0 MPa

x = 0.05					x = 0.10			
V	H	ϕ_1	ϕ_2	T	V	H	ϕ_1	ϕ_2
dm^3mol^{-1}	kJ mol^{-1}			K	dm^3mol^{-1}	kJ mol^{-1}		
				540	0.616	47.00	0.8145	1.2836
0.642	49.68	0.8375	1.2765	560	0.662	48.15	0.8406	1.2179
0.687	50.84	0.8596	1.2125	580	0.703	49.20	0.8618	1.1742
0.728	51.91	0.8776	1.1697	600	0.742	50.18	0.8792	1.1435
0.767	52.91	0.8926	1.1396	620	0.779	51.12	0.8938	1.1210
0.804	53.86	0.9052	1.1174	640	0.814	52.02	0.9061	1.1040
0.840	54.77	0.9159	1.1007	660	0.849	52.90	0.9166	1.0908
0.874	55.67	0.9251	1.0877	680	0.883	53.76	0.9256	1.0803
0.908	56.54	0.9331	1.0774	700	0.915	54.61	0.9335	1.0718
0.990	58.68	0.9488	1.0595	750	0.996	56.69	0.9490	1.0566
1.068	60.78	0.9603	1.0481	800	1.073	58.75	0.9604	1.0467
1.145	62.86	0.9689	1.0405	850	1.149	60.80	0.9689	1.0398
1.220	64.94	0.9754	1.0351	900	1.224	62.85	0.9754	1.0348
1.294	67.03	0.9805	1.0311	950	1.297	64.91	0.9805	1.0311
1.367	69.14	0.9845	1.0281	1000	1.370	66.98	0.9845	1.0282

x = 0.20					x = 0.40			
V	H	ϕ_1	ϕ_2	T	V	H	ϕ_1	ϕ_2
dm^3mol^{-1}	kJ mol^{-1}			K	dm^3mol^{-1}	kJ mol^{-1}		
				520	0.668	35.96	0.8347	1.0939
0.653	43.86	0.8268	1.1757	540	0.702	36.75	0.8551	1.0828
0.692	44.81	0.8496	1.1451	560	0.735	37.52	0.8724	1.0739
0.729	45.72	0.8685	1.1228	580	0.767	38.29	0.8872	1.0667
0.764	46.59	0.8843	1.1059	600	0.799	39.05	0.8999	1.0608
0.799	47.44	0.8977	1.0928	620	0.830	39.80	0.9109	1.0559
0.832	48.27	0.9092	1.0823	640	0.861	40.54	0.9204	1.0516
0.865	49.09	0.9191	1.0739	660	0.892	41.29	0.9287	1.0481
0.897	49.90	0.9277	1.0669	680	0.922	42.03	0.9360	1.0449
0.929	50.70	0.9351	1.0611	700	0.952	42.77	0.9425	1.0422
1.007	52.70	0.9501	1.0502	750	1.027	44.62	0.9555	1.0368
1.083	54.68	0.9611	1.0427	800	1.100	46.47	0.9652	1.0326
1.158	56.66	0.9694	1.0372	850	1.173	48.33	0.9727	1.0294
1.231	58.65	0.9758	1.0331	900	1.245	50.21	0.9784	1.0268
1.304	60.65	0.9807	1.0298	950	1.316	52.11	0.9830	1.0246
1.377	62.67	0.9847	1.0273	1000	1.388	54.03	0.9866	1.0228

x = 0.60					x = 0.80			
V	H	ϕ_1	ϕ_2	T	V	H	ϕ_1	ϕ_2
dm^3mol^{-1}	kJ mol^{-1}			K	dm^3mol^{-1}	kJ mol^{-1}		
				460	0.634	18.76	0.8727	1.0241
				480	0.664	19.41	0.8897	1.0238
0.671	27.76	0.8552	1.0486	500	0.693	20.06	0.9042	1.0234
0.702	28.47	0.8730	1.0449	520	0.723	20.71	0.9165	1.0230
0.733	29.17	0.8881	1.0418	540	0.752	21.35	0.9272	1.0226
0.763	29.86	0.9012	1.0392	560	0.781	22.00	0.9364	1.0221
0.793	30.56	0.9124	1.0370	580	0.810	22.64	0.9443	1.0217
0.823	31.25	0.9222	1.0350	600	0.838	23.29	0.9513	1.0212
0.897	32.97	0.9416	1.0310	650	0.910	24.91	0.9651	1.0201
0.970	34.70	0.9557	1.0279	700	0.981	26.54	0.9752	1.0190
1.042	36.44	0.9662	1.0254	750	1.051	28.18	0.9828	1.0180
1.113	38.19	0.9741	1.0233	800	1.122	29.84	0.9885	1.0170
1.184	39.95	0.9802	1.0216	850	1.192	31.51	0.9929	1.0160
1.255	41.73	0.9850	1.0201	900	1.262	33.20	0.9964	1.0152
1.326	43.53	0.9888	1.0188	950	1.332	34.91	0.9991	1.0143
1.396	45.35	0.9918	1.0176	1000	1.401	36.63	1.0012	1.0136

P = 8.0 MPa

x = 0.05					x = 0.10			
V	H	ϕ_1	ϕ_2	T	V	H	ϕ_1	ϕ_2
dm^3mol^{-1}	kJ mol^{-1}			K	dm^3mol^{-1}	kJ mol^{-1}		
				560	0.460	46.98	0.7857	1.3479
0.478	49.62	0.8112	1.3411	580	0.497	48.24	0.8149	1.2667
0.515	50.91	0.8360	1.2610	600	0.531	49.36	0.8386	1.2136
0.549	52.05	0.8564	1.2085	620	0.562	50.41	0.8582	1.1766
0.580	53.12	0.8734	1.1719	640	0.591	51.39	0.8748	1.1496
0.609	54.12	0.8878	1.1452	660	0.619	52.34	0.8888	1.1292
0.637	55.08	0.9002	1.1251	680	0.646	53.25	0.9009	1.1134
0.664	56.01	0.9108	1.1095	700	0.672	54.15	0.9114	1.1008
0.729	58.26	0.9318	1.0829	750	0.735	56.32	0.9321	1.0787
0.791	60.43	0.9471	1.0666	800	0.796	58.44	0.9473	1.0645
0.850	62.57	0.9586	1.0557	850	0.855	60.54	0.9586	1.0547
0.908	64.69	0.9673	1.0481	900	0.912	62.62	0.9673	1.0477
0.965	66.82	0.9741	1.0426	950	0.968	64.71	0.9741	1.0425
1.021	68.95	0.9794	1.0383	1000	1.024	66.81	0.9794	1.0384

x = 0.20					x = 0.40			
V	H	ϕ_1	ϕ_2	T	V	H	ϕ_1	ϕ_2
dm^3mol^{-1}	kJ mol^{-1}			K	dm^3mol^{-1}	kJ mol^{-1}		
				540	0.515	36.34	0.8092	1.1167
0.496	44.06	0.7998	1.2145	560	0.541	37.16	0.8318	1.1037
0.526	45.06	0.8251	1.1783	580	0.566	37.96	0.8511	1.0932
0.555	46.01	0.8462	1.1518	600	0.591	38.75	0.8677	1.0846
0.583	46.92	0.8641	1.1317	620	0.616	39.53	0.8821	1.0775
0.610	47.81	0.8793	1.1161	640	0.640	40.29	0.8947	1.0714
0.636	48.67	0.8924	1.1036	660	0.664	41.06	0.9056	1.0663
0.662	49.52	0.9038	1.0934	680	0.687	41.82	0.9153	1.0619
0.686	50.35	0.9137	1.0850	700	0.710	42.57	0.9238	1.0580
0.747	52.41	0.9336	1.0694	750	0.767	44.45	0.9410	1.0503
0.806	54.43	0.9482	1.0587	800	0.823	46.33	0.9539	1.0445
0.863	56.45	0.9593	1.0510	850	0.879	48.22	0.9638	1.0400
0.920	58.47	0.9678	1.0452	900	0.933	50.12	0.9715	1.0363
0.975	60.50	0.9744	1.0407	950	0.988	52.03	0.9775	1.0333
1.030	62.54	0.9797	1.0371	1000	1.042	53.96	0.9824	1.0308

x = 0.60					x = 0.80			
V	H	ϕ_1	ϕ_2	T	V	H	ϕ_1	ϕ_2
dm^3mol^{-1}	kJ mol^{-1}			K	dm^3mol^{-1}	kJ mol^{-1}		
				480	0.498	19.32	0.8572	1.0328
				500	0.521	19.98	0.8758	1.0322
0.522	28.26	0.8338	1.0622	520	0.543	20.63	0.8917	1.0315
0.546	28.98	0.8534	1.0577	540	0.565	21.29	0.9055	1.0309
0.570	29.70	0.8704	1.0540	560	0.587	21.94	0.9174	1.0302
0.593	30.41	0.8850	1.0508	580	0.609	22.60	0.9278	1.0295
0.616	31.11	0.8978	1.0479	600	0.631	23.25	0.9368	1.0289
0.638	31.81	0.9090	1.0455	620	0.653	23.90	0.9447	1.0282
0.661	32.51	0.9188	1.0432	640	0.674	24.55	0.9517	1.0276
0.683	33.21	0.9274	1.0413	660	0.696	25.21	0.9578	1.0269
0.706	33.91	0.9350	1.0395	680	0.717	25.86	0.9633	1.0263
0.728	34.61	0.9417	1.0379	700	0.739	26.52	0.9681	1.0257
0.782	36.37	0.9555	1.0344	750	0.792	28.17	0.9780	1.0242
0.837	38.13	0.9660	1.0316	800	0.845	29.83	0.9855	1.0229
0.890	39.91	0.9741	1.0291	850	0.898	31.51	0.9912	1.0216
0.944	41.69	0.9804	1.0271	900	0.950	33.21	0.9957	1.0204
0.997	43.50	0.9854	1.0253	950	1.003	34.92	0.9993	1.0192
1.050	45.33	0.9894	1.0237	1000	1.055	36.65	1.0020	1.0182

P = 10.0 MPa

x = 0.05					x = 0.10			
V	H	ϕ_1	ϕ_2	T	V	H	ϕ_1	ϕ_2
dm^3mol^{-1}	kJ mol^{-1}			K	dm^3mol^{-1}	kJ mol^{-1}		
0.348	48.14	0.7612	1.5362	580	0.371	47.13	0.7672	1.3908
0.385	49.75	0.7938	1.3849	600	0.402	48.46	0.7977	1.3018
0.416	51.11	0.8199	1.2959	620	0.430	49.64	0.8226	1.2435
0.444	52.31	0.8416	1.2378	640	0.456	50.72	0.8435	1.2028
0.470	53.42	0.8597	1.1973	660	0.480	51.75	0.8612	1.1730
0.495	54.47	0.8753	1.1678	680	0.504	52.72	0.8763	1.1505
0.518	55.46	0.8886	1.1455	700	0.526	53.67	0.8894	1.1328
0.540	56.43	0.9002	1.1281	720	0.548	54.59	0.9008	1.1188
0.562	57.36	0.9103	1.1143	740	0.569	55.49	0.9108	1.1074
0.583	58.28	0.9192	1.1032	760	0.589	56.38	0.9196	1.0980
0.604	59.19	0.9270	1.0940	780	0.610	57.26	0.9273	1.0901
0.624	60.08	0.9340	1.0863	800	0.629	58.13	0.9342	1.0834
0.673	62.27	0.9483	1.0719	850	0.678	60.27	0.9484	1.0705
0.721	64.44	0.9592	1.0618	900	0.725	62.40	0.9593	1.0613
0.767	66.60	0.9677	1.0545	950	0.771	64.52	0.9677	1.0544
0.813	68.76	0.9743	1.0490	1000	0.816	66.65	0.9743	1.0491

x = 0.20					x = 0.40			
V	H	ϕ_1	ϕ_2	T	V	H	ϕ_1	ϕ_2
dm^3mol^{-1}	kJ mol^{-1}			K	dm^3mol^{-1}	kJ mol^{-1}		
				560	0.425	36.79	0.7923	1.1360
0.404	44.37	0.7820	1.2439	580	0.446	37.63	0.8159	1.1217
0.429	45.40	0.8084	1.2046	600	0.467	38.45	0.8363	1.1100
0.453	46.39	0.8307	1.1756	620	0.487	39.25	0.8540	1.1004
0.476	47.33	0.8497	1.1535	640	0.507	40.05	0.8694	1.0924
0.499	48.23	0.8660	1.1361	660	0.527	40.83	0.8830	1.0855
0.520	49.12	0.8802	1.1222	680	0.546	41.61	0.8949	1.0796
0.541	49.99	0.8925	1.1108	700	0.565	42.38	0.9054	1.0746
0.561	50.85	0.9033	1.1013	720	0.584	43.15	0.9147	1.0701
0.581	51.69	0.9129	1.0933	740	0.603	43.91	0.9229	1.0662
0.601	52.53	0.9213	1.0865	760	0.621	44.68	0.9303	1.0627
0.620	53.36	0.9288	1.0807	780	0.639	45.44	0.9369	1.0596
0.640	54.19	0.9355	1.0756	800	0.657	46.20	0.9428	1.0568
0.687	56.24	0.9492	1.0654	850	0.702	48.11	0.9551	1.0509
0.733	58.29	0.9598	1.0578	900	0.747	50.02	0.9646	1.0461
0.778	60.34	0.9681	1.0519	950	0.791	51.95	0.9722	1.0423
0.823	62.41	0.9747	1.0472	1000	0.834	53.89	0.9782	1.0390

x = 0.60					x = 0.80			
V	H	ϕ_1	ϕ_2	T	V	H	ϕ_1	ϕ_2
dm^3mol^{-1}	kJ mol^{-1}			K	dm^3mol^{-1}	kJ mol^{-1}		
				480	0.399	19.23	0.8267	1.0422
				500	0.418	19.90	0.8490	1.0413
0.415	28.06	0.7965	1.0803	520	0.436	20.57	0.8683	1.0404
0.435	28.80	0.8202	1.0744	540	0.454	21.23	0.8850	1.0394
0.454	29.53	0.8408	1.0694	560	0.472	21.89	0.8994	1.0385
0.473	30.26	0.8587	1.0651	580	0.489	22.55	0.9120	1.0376
0.492	30.98	0.8743	1.0614	600	0.507	23.21	0.9231	1.0367
0.538	32.76	0.9054	1.0539	650	0.550	24.85	0.9452	1.0346
0.583	34.53	0.9282	1.0482	700	0.594	26.50	0.9614	1.0325
0.627	36.30	0.9453	1.0437	750	0.636	28.16	0.9735	1.0306
0.671	38.08	0.9582	1.0399	800	0.679	29.83	0.9827	1.0288
0.714	39.86	0.9682	1.0368	850	0.721	31.52	0.9898	1.0272
0.757	41.66	0.9760	1.0342	900	0.763	33.21	0.9953	1.0256
0.800	43.48	0.9822	1.0318	950	0.806	34.93	0.9996	1.0242
0.843	45.31	0.9871	1.0298	1000	0.848	36.66	1.0030	1.0229

P = 15 MPa

x = 0.05					x = 0.10			
V	H	ϕ_1	ϕ_2	T	V	H	ϕ_1	ϕ_2
dm^3mol^{-1}	$kJ\ mol^{-1}$			K	dm^3mol^{-1}	$kJ\ mol^{-1}$		
				600	0.2252	45.69	0.6931	1.6640
0.2312	48.15	0.7264	1.6683	620	0.2516	47.41	0.7331	1.4868
0.2586	49.96	0.7611	1.4834	640	0.2742	48.86	0.7654	1.3820
0.2816	51.45	0.7894	1.3761	660	0.2944	50.13	0.7923	1.3131
0.302	52.77	0.8131	1.3062	680	0.313	51.31	0.8152	1.2645
0.321	53.98	0.8333	1.2573	700	0.330	52.40	0.8349	1.2286
0.339	55.10	0.8508	1.2215	720	0.347	53.45	0.8519	1.2012
0.355	56.17	0.8660	1.1943	740	0.363	54.46	0.8669	1.1796
0.371	57.20	0.8793	1.1730	760	0.378	55.43	0.8800	1.1622
0.387	58.19	0.8911	1.1559	780	0.393	56.38	0.8916	1.1479
0.402	59.16	0.9015	1.1420	800	0.407	57.32	0.9019	1.1360
0.437	61.52	0.9228	1.1164	850	0.442	59.60	0.9230	1.1135
0.471	63.80	0.9392	1.0991	900	0.476	61.83	0.9393	1.0977
0.504	66.06	0.9518	1.0867	950	0.508	64.03	0.9519	1.0862
0.536	68.29	0.9618	1.0775	1000	0.540	66.22	0.9618	1.0773

x = 0.20					x = 0.40			
V	H	ϕ_1	ϕ_2	T	V	H	ϕ_1	ϕ_2
dm^3mol^{-1}	$kJ\ mol^{-1}$			K	dm^3mol^{-1}	$kJ\ mol^{-1}$		
				580	0.287	36.80	0.7329	1.2017
0.261	43.76	0.7156	1.3758	600	0.302	37.70	0.7617	1.1806
0.280	44.96	0.7488	1.3119	620	0.317	38.57	0.7869	1.1635
0.298	46.06	0.7770	1.2661	640	0.331	39.43	0.8090	1.1494
0.315	47.11	0.8012	1.2318	660	0.345	40.26	0.8285	1.1376
0.331	48.10	0.8221	1.2051	680	0.359	41.09	0.8457	1.1275
0.347	49.06	0.8403	1.1840	700	0.372	41.90	0.8609	1.1189
0.362	50.00	0.8563	1.1667	720	0.385	42.70	0.8745	1.1113
0.376	50.91	0.8704	1.1525	740	0.398	43.50	0.8866	1.1047
0.391	51.81	0.8829	1.1405	760	0.411	44.30	0.8974	1.0989
0.405	52.69	0.8940	1.1303	780	0.424	45.09	0.9070	1.0937
0.418	53.57	0.9040	1.1215	800	0.437	45.87	0.9157	1.0891
0.452	55.72	0.9245	1.1042	850	0.468	47.83	0.9338	1.0794
0.484	57.85	0.9403	1.0914	900	0.498	49.79	0.9480	1.0717
0.515	59.96	0.9526	1.0816	950	0.528	51.75	0.9591	1.0654
0.546	62.08	0.9624	1.0739	1000	0.558	53.72	0.9680	1.0601

x = 0.60					x = 0.80			
V	H	ϕ_1	ϕ_2	T	V	H	ϕ_1	ϕ_2
dm^3mol^{-1}	$kJ\ mol^{-1}$			K	dm^3mol^{-1}	$kJ\ mol^{-1}$		
				500	0.281	19.73	0.7890	1.0652
				520	0.293	20.42	0.8154	1.0635
0.287	28.37	0.7440	1.1187	540	0.306	21.10	0.8384	1.0618
0.301	29.14	0.7723	1.1102	560	0.318	21.78	0.8585	1.0602
0.314	29.90	0.7972	1.1030	580	0.330	22.45	0.8762	1.0586
0.327	30.65	0.8191	1.0967	600	0.342	23.12	0.8918	1.0571
0.340	31.40	0.8385	1.0913	620	0.354	23.79	0.9054	1.0556
0.352	32.14	0.8556	1.0865	640	0.365	24.46	0.9175	1.0541
0.365	32.87	0.8707	1.0822	660	0.377	25.13	0.9282	1.0527
0.377	33.60	0.8842	1.0783	680	0.389	25.80	0.9378	1.0514
0.390	34.33	0.8962	1.0749	700	0.400	26.47	0.9463	1.0501
0.420	36.14	0.9208	1.0675	750	0.429	28.15	0.9637	1.0469
0.450	37.95	0.9397	1.0615	800	0.458	29.84	0.9769	1.0441
0.479	39.77	0.9543	1.0565	850	0.486	31.53	0.9871	1.0415
0.508	41.59	0.9657	1.0523	900	0.514	33.24	0.9950	1.0390
0.537	43.42	0.9747	1.0486	950	0.543	34.97	1.0012	1.0368
0.566	45.27	0.9820	1.0454	1000	0.571	36.71	1.0061	1.0347

P = 20 MPa

x = 0.05					x = 0.10			
V	H	ϕ_1	ϕ_2	T	V	H	ϕ_1	ϕ_2
dm^3mol^{-1}	kJ mol^{-1}			K	dm^3mol^{-1}	kJ mol^{-1}		
				620	0.1577	44.58	0.6415	1.9478
0.1590	46.79	0.6780	1.9872	640	0.1807	46.65	0.6873	1.6703
0.1838	49.05	0.7184	1.6772	660	0.1999	48.31	0.7242	1.5171
0.2038	50.81	0.7511	1.5143	680	0.2167	49.74	0.7550	1.4200
0.2212	52.31	0.7785	1.4135	700	0.2321	51.04	0.7813	1.3531
0.237	53.65	0.8020	1.3452	720	0.246	52.24	0.8039	1.3045
0.251	54.88	0.8222	1.2960	740	0.260	53.36	0.8237	1.2676
0.265	56.04	0.8400	1.2592	760	0.272	54.44	0.8411	1.2388
0.278	57.15	0.8556	1.2306	780	0.285	55.48	0.8564	1.2157
0.290	58.21	0.8694	1.2078	800	0.296	56.49	0.8700	1.1968
0.319	60.74	0.8977	1.1673	850	0.325	58.91	0.8981	1.1619
0.347	63.15	0.9194	1.1408	900	0.351	61.25	0.9196	1.1381
0.373	65.50	0.9362	1.1222	950	0.377	63.54	0.9363	1.1209
0.398	67.81	0.9495	1.1084	1000	0.401	65.80	0.9495	1.1078

x = 0.20					x = 0.40			
V	H	ϕ_1	ϕ_2	T	V	H	ϕ_1	ϕ_2
dm^3mol^{-1}	kJ mol^{-1}			K	dm^3mol^{-1}	kJ mol^{-1}		
				580	0.2079	35.99	0.6578	1.2938
				600	0.2203	36.97	0.6935	1.2607
0.1931	43.41	0.6701	1.4978	620	0.2322	37.91	0.7251	1.2343
0.2088	44.73	0.7071	1.4122	640	0.2436	38.82	0.7529	1.2128
0.2234	45.93	0.7387	1.3513	660	0.2548	39.71	0.7776	1.1949
0.2370	47.05	0.7660	1.3059	680	0.2656	40.58	0.7995	1.1798
0.2499	48.11	0.7898	1.2709	700	0.2763	41.43	0.8190	1.1670
0.262	49.13	0.8108	1.2431	720	0.287	42.28	0.8364	1.1559
0.274	50.12	0.8292	1.2205	740	0.297	43.11	0.8520	1.1462
0.286	51.08	0.8456	1.2018	760	0.307	43.93	0.8660	1.1377
0.297	52.02	0.8602	1.1861	780	0.317	44.75	0.8785	1.1301
0.308	52.95	0.8732	1.1728	800	0.327	45.56	0.8898	1.1234
0.334	55.20	0.9002	1.1467	850	0.350	47.57	0.9135	1.1094
0.360	57.41	0.9211	1.1278	900	0.374	49.57	0.9320	1.0984
0.384	59.59	0.9375	1.1135	950	0.397	51.57	0.9467	1.0895
0.408	61.75	0.9505	1.1022	1000	0.420	53.57	0.9584	1.0821

x = 0.60					x = 0.80			
V	H	ϕ_1	ϕ_2	T	V	H	ϕ_1	ϕ_2
dm^3mol^{-1}	kJ mol^{-1}			K	dm^3mol^{-1}	kJ mol^{-1}		
				520	0.2225	20.29	0.7698	1.0878
				540	0.2319	20.99	0.7980	1.0853
0.2247	28.78	0.7118	1.1537	560	0.2411	21.68	0.8228	1.0829
0.2351	29.58	0.7423	1.1432	580	0.2503	22.37	0.8448	1.0805
0.2452	30.36	0.7694	1.1341	600	0.2594	23.05	0.8642	1.0783
0.2552	31.13	0.7936	1.1262	620	0.2684	23.74	0.8814	1.0761
0.2650	31.89	0.8150	1.1193	640	0.2773	24.42	0.8967	1.0740
0.2747	32.65	0.8342	1.1132	660	0.2862	25.09	0.9102	1.0720
0.2842	33.40	0.8512	1.1077	680	0.2951	25.77	0.9223	1.0700
0.2937	34.14	0.8665	1.1028	700	0.3039	26.45	0.9331	1.0682
0.317	36.00	0.8982	1.0923	750	0.326	28.15	0.9553	1.0638
0.340	37.84	0.9225	1.0838	800	0.347	29.85	0.9723	1.0598
0.362	39.68	0.9414	1.0769	850	0.369	31.55	0.9854	1.0561
0.384	41.52	0.9562	1.0709	900	0.390	33.27	0.9956	1.0527
0.406	43.37	0.9680	1.0658	950	0.411	35.01	1.0036	1.0496
0.428	45.24	0.9774	1.0614	1000	0.432	36.76	1.0099	1.0468

P = 25 MPa

x = 0.05					x = 0.10			
V	H	ϕ_1	ϕ_2	T	V	H	ϕ_1	ϕ_2
dm^3mol^{-1}	kJ mol^{-1}			K	dm^3mol^{-1}	kJ mol^{-1}		
0.0891	41.80	0.5869	3.5560	640	0.1230	44.01	0.6091	2.1737
0.1214	45.96	0.6460	2.2647	660	0.1424	46.25	0.6570	1.8263
0.1430	48.49	0.6893	1.8495	680	0.1586	48.04	0.6960	1.6361
0.1604	50.43	0.7244	1.6394	700	0.1729	49.58	0.7289	1.5165
0.1753	52.06	0.7539	1.5121	720	0.1859	50.96	0.7571	1.4345
0.1887	53.50	0.7793	1.4269	740	0.1979	52.23	0.7816	1.3750
0.2010	54.82	0.8013	1.3662	760	0.2091	53.42	0.8031	1.3301
0.2126	56.05	0.8207	1.3207	780	0.2198	54.55	0.8221	1.2949
0.2234	57.22	0.8379	1.2856	800	0.2300	55.64	0.8389	1.2667
0.2487	59.94	0.8731	1.2252	850	0.2541	58.22	0.8736	1.2160
0.2720	62.49	0.8999	1.1871	900	0.2766	60.67	0.9003	1.1823
0.2939	64.94	0.9209	1.1609	950	0.2979	63.04	0.9210	1.1584
0.3149	67.33	0.9374	1.1418	1000	0.3184	65.37	0.9375	1.1405

x = 0.20					x = 0.40			
V	H	ϕ_1	ϕ_2	T	V	H	ϕ_1	ϕ_2
dm^3mol^{-1}	kJ mol^{-1}			K	dm^3mol^{-1}	kJ mol^{-1}		
0.1254	39.98	0.5424	1.9944	600	0.1723	36.28	0.6323	1.3495
0.1416	41.79	0.5959	1.7503	620	0.1823	37.28	0.6688	1.3120
0.1559	43.34	0.6408	1.6002	640	0.1919	38.25	0.7014	1.2818
0.1689	44.72	0.6792	1.4993	660	0.2013	39.19	0.7305	1.2569
0.1810	45.97	0.7124	1.4272	680	0.2103	40.10	0.7565	1.2361
0.1923	47.15	0.7415	1.3732	700	0.2192	40.99	0.7797	1.2185
0.2030	48.26	0.7670	1.3313	720	0.2278	41.86	0.8006	1.2033
0.2132	49.33	0.7895	1.2980	740	0.2363	42.73	0.8194	1.1902
0.2231	50.35	0.8096	1.2708	760	0.2446	43.58	0.8362	1.1787
0.2327	51.35	0.8274	1.2483	780	0.2528	44.42	0.8514	1.1686
0.2419	52.32	0.8434	1.2293	800	0.2608	45.25	0.8651	1.1596
0.264	54.68	0.8767	1.1929	850	0.280	47.32	0.8940	1.1408
0.285	56.97	0.9024	1.1669	900	0.300	49.36	0.9167	1.1262
0.305	59.21	0.9227	1.1473	950	0.318	51.39	0.9347	1.1144
0.325	61.43	0.9388	1.1322	1000	0.337	53.42	0.9491	1.1047

x = 0.60					x = 0.80			
V	H	ϕ_1	ϕ_2	T	V	H	ϕ_1	ϕ_2
dm^3mol^{-1}	kJ mol^{-1}			K	dm^3mol^{-1}	kJ mol^{-1}		
				520	0.1805	20.19	0.7308	1.1133
				540	0.1881	20.90	0.7631	1.1098
0.1800	28.46	0.6589	1.1992	560	0.1956	21.61	0.7918	1.1064
0.1884	29.28	0.6938	1.1851	580	0.2030	22.31	0.8174	1.1032
0.1967	30.09	0.7250	1.1731	600	0.2103	23.00	0.8401	1.1002
0.2049	30.89	0.7531	1.1626	620	0.2176	23.69	0.8603	1.0973
0.2129	31.67	0.7782	1.1535	640	0.2248	24.38	0.8784	1.0945
0.2208	32.45	0.8008	1.1454	660	0.2320	25.07	0.8945	1.0918
0.2286	33.21	0.8210	1.1381	680	0.2391	25.75	0.9088	1.0892
0.2363	33.98	0.8392	1.1316	700	0.2462	26.44	0.9217	1.0867
0.255	35.86	0.8772	1.1179	750	0.264	28.15	0.9483	1.0810
0.274	37.73	0.9065	1.1068	800	0.281	29.86	0.9687	1.0758
0.292	39.60	0.9294	1.0977	850	0.298	31.58	0.9845	1.0710
0.310	41.46	0.9475	1.0900	900	0.315	33.31	0.9968	1.0667
0.328	43.33	0.9618	1.0834	950	0.332	35.05	1.0065	1.0627
0.345	45.21	0.9733	1.0777	1000	0.349	36.81	1.0141	1.0591

P = 30 MPa

x = 0.05					x = 0.10			
V	H	ϕ_1	ϕ_2	T	V	H	ϕ_1	ϕ_2
dm^3mol^{-1}	kJ mol^{-1}			K	dm^3mol^{-1}	kJ mol^{-1}		
0.0777	41.98	0.5715	3.620	660	0.1043	43.97	0.5916	2.305
0.1014	45.76	0.6276	2.432	680	0.1201	46.21	0.6388	1.940
0.1193	48.33	0.6710	1.978	700	0.1337	48.04	0.6781	1.732
0.1340	50.34	0.7068	1.7417	720	0.1458	49.63	0.7117	1.5981
0.1469	52.04	0.7373	1.5969	740	0.1569	51.06	0.7407	1.5058
0.1584	53.54	0.7636	1.4995	760	0.1671	52.37	0.7662	1.4383
0.1690	54.92	0.7867	1.4298	780	0.1768	53.61	0.7887	1.3870
0.1790	56.20	0.8071	1.3775	800	0.1860	54.78	0.8086	1.3468
0.2016	59.13	0.8489	1.2909	850	0.2073	57.52	0.8497	1.2762
0.2222	61.82	0.8809	1.2382	900	0.2270	60.08	0.8813	1.2306
0.2414	64.37	0.9058	1.2029	950	0.2455	62.55	0.9061	1.1987
0.2596	66.85	0.9255	1.1777	1000	0.2633	64.95	0.9256	1.1753

x = 0.20					x = 0.40			
V	H	ϕ_1	ϕ_2	T	V	H	ϕ_1	ϕ_2
dm^3mol^{-1}	kJ mol^{-1}			K	dm^3mol^{-1}	kJ mol^{-1}		
				620	0.1499	36.70	0.6184	1.3958
0.1217	41.96	0.5794	1.8373	640	0.1582	37.71	0.6547	1.3558
0.1334	43.51	0.6236	1.6798	660	0.1662	38.69	0.6874	1.3231
0.1443	44.91	0.6620	1.5711	680	0.1740	39.64	0.7168	1.2959
0.1544	46.19	0.6956	1.4920	700	0.1816	40.57	0.7433	1.2730
0.1639	47.40	0.7253	1.4321	720	0.1890	41.48	0.7672	1.2534
0.1730	48.54	0.7516	1.3853	740	0.1963	42.37	0.7887	1.2365
0.1817	49.63	0.7750	1.3477	760	0.2034	43.24	0.8082	1.2217
0.1901	50.69	0.7959	1.3169	780	0.2104	44.11	0.8258	1.2088
0.1982	51.71	0.8147	1.2913	800	0.2173	44.97	0.8417	1.1973
0.2175	54.17	0.8538	1.2427	850	0.2340	47.08	0.8754	1.1735
0.2358	56.54	0.8843	1.2085	900	0.2504	49.16	0.9021	1.1550
0.2533	58.84	0.9083	1.1831	950	0.2663	51.22	0.9233	1.1402
0.2702	61.11	0.9274	1.1636	1000	0.2819	53.28	0.9403	1.1280

x = 0.60					x = 0.80			
V	H	ϕ_1	ϕ_2	T	V	H	ϕ_1	ϕ_2
dm^3mol^{-1}	kJ mol^{-1}			K	dm^3mol^{-1}	kJ mol^{-1}		
				540	0.1592	20.84	0.7331	1.1352
				560	0.1655	21.55	0.7650	1.1309
0.1579	29.03	0.6511	1.2286	580	0.1717	22.26	0.7935	1.1267
0.1649	29.86	0.6856	1.2134	600	0.1778	22.96	0.8190	1.1228
0.1718	30.67	0.7168	1.2003	620	0.1839	23.66	0.8419	1.1191
0.1786	31.47	0.7450	1.1887	640	0.1899	24.36	0.8624	1.1155
0.1853	32.27	0.7705	1.1786	660	0.1959	25.05	0.8807	1.1121
0.1919	33.05	0.7934	1.1695	680	0.2019	25.75	0.8972	1.1089
0.1984	33.83	0.8142	1.1613	700	0.2078	26.44	0.9119	1.1058
0.214	35.74	0.8577	1.1441	750	0.222	28.16	0.9425	1.0986
0.230	37.64	0.8917	1.1303	800	0.237	29.89	0.9661	1.0921
0.245	39.53	0.9183	1.1190	850	0.251	31.62	0.9844	1.0862
0.260	41.41	0.9394	1.1095	900	0.266	33.36	0.9987	1.0809
0.275	43.30	0.9562	1.1013	950	0.280	35.10	1.0100	1.0760
0.290	45.19	0.9697	1.0943	1000	0.294	36.87	1.0188	1.0715

P = 40 MPa

x = 0.05					x = 0.10			
V	H	ϕ_1	ϕ_2	T	V	H	ϕ_1	ϕ_2
dm^3mol^{-1}	kJ mol^{-1}			K	dm^3mol^{-1}	kJ mol^{-1}		
0.0439	36.44	0.4507	8.034	660	0.0630	39.71	0.4772	3.892
0.0560	40.26	0.5142	4.809	680	0.0754	42.55	0.5348	2.898
0.0704	43.80	0.5704	3.230	700	0.0869	44.93	0.5844	2.366
0.0838	46.64	0.6175	2.493	720	0.0974	46.95	0.6270	2.053
0.0955	48.94	0.6574	2.105	740	0.1069	48.70	0.6641	1.8528
0.1059	50.87	0.6918	1.8724	760	0.1157	50.28	0.6966	1.7154
0.1153	52.57	0.7218	1.7200	780	0.1239	51.72	0.7254	1.6160
0.1240	54.11	0.7482	1.6131	800	0.1316	53.07	0.7510	1.5410
0.1433	57.48	0.8025	1.4490	850	0.1494	56.13	0.8040	1.4160
0.1604	60.48	0.8440	1.3566	900	0.1655	58.93	0.8449	1.3396
0.1762	63.25	0.8766	1.2977	950	0.1805	61.57	0.8771	1.2881
0.1909	65.89	0.9024	1.2570	1000	0.1946	64.11	0.9027	1.2512

x = 0.20					x = 0.40			
V	H	ϕ_1	ϕ_2	T	V	H	ϕ_1	ϕ_2
dm^3mol^{-1}	kJ mol^{-1}			K	dm^3mol^{-1}	kJ mol^{-1}		
				620	0.1111	35.69	0.5343	1.5783
				640	0.1175	36.78	0.5754	1.5165
0.0919	41.27	0.5267	2.1392	660	0.1237	37.83	0.6130	1.4664
0.1006	42.90	0.5723	1.9291	680	0.1298	38.84	0.6475	1.4250
0.1089	44.38	0.6130	1.7814	700	0.1357	39.82	0.6789	1.3902
0.1167	45.75	0.6493	1.6729	720	0.1414	40.78	0.7075	1.3607
0.1240	47.04	0.6818	1.5904	740	0.1471	41.72	0.7336	1.3354
0.1311	48.25	0.7109	1.5258	760	0.1526	42.64	0.7574	1.3133
0.1379	49.42	0.7371	1.4739	780	0.1580	43.55	0.7791	1.2941
0.1445	50.54	0.7608	1.4315	800	0.1634	44.44	0.7989	1.2771
0.1600	53.19	0.8105	1.3530	850	0.1764	46.63	0.8411	1.2422
0.1745	55.71	0.8496	1.2993	900	0.1890	48.78	0.8748	1.2153
0.1884	58.13	0.8806	1.2603	950	0.2013	50.91	0.9019	1.1939
0.2017	60.50	0.9055	1.2307	1000	0.2133	53.02	0.9238	1.1764

x = 0.60					x = 0.80			
V	H	ϕ_1	ϕ_2	T	V	H	ϕ_1	ϕ_2
dm^3mol^{-1}	kJ mol^{-1}			K	dm^3mol^{-1}	kJ mol^{-1}		
				540	0.1238	20.77	0.6867	1.1886
				560	0.1285	21.50	0.7232	1.1820
				580	0.1331	22.22	0.7562	1.1758
0.1261	29.48	0.6203	1.2975	600	0.1377	22.94	0.7855	1.1702
0.1314	30.32	0.6560	1.2787	620	0.1423	23.65	0.8125	1.1647
0.1365	31.15	0.6886	1.2622	640	0.1468	24.36	0.8369	1.1594
0.1416	31.97	0.7185	1.2476	660	0.1513	25.06	0.8589	1.1545
0.1466	32.78	0.7456	1.2347	680	0.1558	25.76	0.8786	1.1498
0.1516	33.58	0.7705	1.2230	700	0.1602	26.46	0.8966	1.1453
0.1637	35.55	0.8233	1.1985	750	0.1713	28.21	0.9341	1.1350
0.1756	37.49	0.8652	1.1790	800	0.1822	29.95	0.9634	1.1258
0.1873	39.42	0.8985	1.1630	850	0.1931	31.70	0.9862	1.1175
0.1987	41.33	0.9251	1.1495	900	0.2038	33.45	1.0042	1.1100
0.2101	43.25	0.9465	1.1381	950	0.2145	35.21	1.0183	1.1032
0.2212	45.17	0.9637	1.1282	1000	0.2252	36.99	1.0294	1.0970

P = 50 MPa

x = 0.05					x = 0.10			
V	H	ϕ_1	ϕ_2	T	V	H	ϕ_1	ϕ_2
dm^3mol^{-1}	$kJ\ mol^{-1}$			K	dm^3mol^{-1}	$kJ\ mol^{-1}$		
0.0366	34.64	0.3788	10.644	660	0.0476	37.13	0.3986	5.656
0.0422	37.45	0.4348	7.284	680	0.0552	39.80	0.4545	4.168
0.0498	40.46	0.4897	5.031	700	0.0633	42.29	0.5068	3.251
0.0587	43.38	0.5407	3.670	720	0.0715	44.52	0.5542	2.685
0.0678	46.00	0.5864	2.886	740	0.0793	46.52	0.5966	2.324
0.0766	48.27	0.6268	2.421	760	0.0867	48.30	0.6343	2.081
0.0847	50.27	0.6623	2.128	780	0.0937	49.93	0.6681	1.9106
0.0923	52.05	0.6939	1.9319	800	0.1003	51.43	0.6983	1.7852
0.1091	55.87	0.7590	1.6478	850	0.1155	54.81	0.7614	1.5839
0.1240	59.16	0.8093	1.4986	900	0.1292	57.83	0.8107	1.4662
0.1374	62.15	0.8488	1.4077	950	0.1419	60.63	0.8497	1.3895
0.1499	64.95	0.8803	1.3468	1000	0.1538	63.30	0.8809	1.3357

x = 0.20					x = 0.40			
V	H	ϕ_1	ϕ_2	T	V	H	ϕ_1	ϕ_2
dm^3mol^{-1}	$kJ\ mol^{-1}$			K	dm^3mol^{-1}	$kJ\ mol^{-1}$		
				640	0.0946	36.03	0.5129	1.6902
0.0705	39.45	0.4514	2.695	660	0.0996	37.12	0.5532	1.6213
0.0773	41.20	0.4997	2.365	680	0.1045	38.18	0.5906	1.5644
0.0839	42.81	0.5440	2.132	700	0.1092	39.20	0.6252	1.5167
0.0902	44.30	0.5844	1.9620	720	0.1139	40.20	0.6571	1.4763
0.0963	45.69	0.6211	1.8341	740	0.1185	41.17	0.6865	1.4416
0.1022	47.01	0.6545	1.7351	760	0.1230	42.13	0.7136	1.4116
0.1078	48.26	0.6848	1.6565	780	0.1274	43.07	0.7384	1.3854
0.1133	49.46	0.7123	1.5930	800	0.1318	43.99	0.7612	1.3623
0.1262	52.28	0.7709	1.4774	850	0.1424	46.25	0.8104	1.3152
0.1384	54.93	0.8174	1.4001	900	0.1527	48.46	0.8502	1.2790
0.1499	57.47	0.8547	1.3448	950	0.1627	50.63	0.8824	1.2504
0.1609	59.93	0.8848	1.3035	1000	0.1725	52.79	0.9087	1.2271

x = 0.60				
V	H	ϕ_1	ϕ_2	T
dm^3mol^{-1}	$kJ\ mol^{-1}$			K
0.1038	29.21	0.5696	1.3860	600
0.1079	30.08	0.6080	1.3612	620
0.1120	30.93	0.6437	1.3394	640
0.1161	31.76	0.6765	1.3201	660
0.1201	32.59	0.7069	1.3030	680
0.1241	33.41	0.7347	1.2876	700
0.1280	34.21	0.7603	1.2737	720
0.1319	35.01	0.7838	1.2611	740
0.1358	35.81	0.8053	1.2497	760
0.1396	36.60	0.8250	1.2392	780
0.1434	37.39	0.8431	1.2296	800
0.1528	39.34	0.8818	1.2086	850
0.1620	41.29	0.9132	1.1911	900
0.1711	43.23	0.9385	1.1761	950
0.1801	45.17	0.9590	1.1633	1000

P = 60 MPa

x = 0.05					x = 0.10			
V	H	ϕ_1	ϕ_2	T	V	H	ϕ_1	ϕ_2
dm^3mol^{-1}	kJ mol^{-1}			K	dm^3mol^{-1}	kJ mol^{-1}		
0.0335	33.76	0.3317	12.317	660				
0.0370	36.12	0.3817	9.041	680	0.0458	38.10	0.3979	5.396
0.0414	38.63	0.4321	6.636	700	0.0514	40.42	0.4480	4.220
0.0470	41.21	0.4814	4.958	720	0.0573	42.64	0.4958	3.427
0.0533	43.73	0.5281	3.845	740	0.0634	44.70	0.5401	2.894
0.0599	46.08	0.5711	3.125	760	0.0694	46.59	0.5808	2.527
0.0664	48.22	0.6101	2.655	780	0.0752	48.34	0.6178	2.268
0.0728	50.16	0.6453	2.338	800	0.0807	49.95	0.6514	2.079
0.0874	54.35	0.7191	1.8912	850	0.0938	53.58	0.7226	1.7806
0.1003	57.91	0.7769	1.6662	900	0.1056	56.79	0.7790	1.6111
0.1121	61.09	0.8227	1.5340	950	0.1166	59.75	0.8241	1.5033
0.1230	64.04	0.8594	1.4478	1000	0.1270	62.54	0.8603	1.4292

x = 0.20					x = 0.40			
V	H	ϕ_1	ϕ_2	T	V	H	ϕ_1	ϕ_2
dm^3mol^{-1}	kJ mol^{-1}			K	dm^3mol^{-1}	kJ mol^{-1}		
				660	0.0844	36.56	0.5054	1.7855
0.0638	39.87	0.4434	2.8454	680	0.0884	37.65	0.5444	1.7124
0.0690	41.53	0.4887	2.5251	700	0.0924	38.70	0.5809	1.6510
0.0742	43.09	0.5309	2.2887	720	0.0963	39.73	0.6150	1.5990
0.0792	44.55	0.5700	2.1099	740	0.1001	40.73	0.6467	1.5545
0.0841	45.93	0.6060	1.9716	760	0.1038	41.71	0.6761	1.5159
0.0888	47.25	0.6391	1.8623	780	0.1075	42.67	0.7033	1.4822
0.0934	48.51	0.6695	1.7742	800	0.1112	43.62	0.7285	1.4526
0.1044	51.47	0.7351	1.6155	850	0.1201	45.93	0.7833	1.3922
0.1148	54.23	0.7880	1.5106	900	0.1288	48.19	0.8282	1.3460
0.1247	56.86	0.8308	1.4366	950	0.1372	50.40	0.8650	1.3095
0.1341	59.39	0.8656	1.3819	1000	0.1455	52.59	0.8951	1.2801

x = 0.60				
V	H	ϕ_1	ϕ_2	T
dm^3mol^{-1}	kJ mol^{-1}			K
0.0928	29.91	0.5703	1.4478	620
0.0962	30.78	0.6079	1.4204	640
0.0996	31.63	0.6429	1.3962	660
0.1029	32.46	0.6754	1.3746	680
0.1062	33.29	0.7055	1.3552	700
0.1094	34.11	0.7334	1.3378	720
0.1127	34.92	0.7591	1.3219	740
0.1159	35.73	0.7828	1.3075	760
0.1191	36.53	0.8047	1.2943	780
0.1222	37.33	0.8248	1.2822	800
0.1300	39.31	0.8683	1.2558	850
0.1378	41.27	0.9037	1.2339	900
0.1454	43.23	0.9325	1.2153	950
0.1529	45.18	0.9558	1.1994	1000

P = 70 MPa

x = 0.05					x = 0.10			
V	H	ϕ_1	ϕ_2	T	V	H	ϕ_1	ϕ_2
dm^3mol^{-1}	kJ mol^{-1}			K	dm^3mol^{-1}	kJ mol^{-1}		
0.0295	31.18	0.2550	17.818	640				
0.0315	33.22	0.2986	13.642	660				
0.0341	35.35	0.3441	10.408	680	0.0408	37.03	0.3575	6.4859
0.0372	37.57	0.3906	7.950	700	0.0448	39.18	0.4045	5.1508
0.0410	39.87	0.4371	6.128	720	0.0491	41.28	0.4506	4.1935
0.0454	42.17	0.4825	4.818	740	0.0538	43.30	0.4948	3.5124
0.0502	44.43	0.5256	3.899	760	0.0585	45.21	0.5364	3.0262
0.0553	46.57	0.5660	3.262	780	0.0633	47.00	0.5750	2.6744
0.0604	48.57	0.6033	2.817	800	0.0679	48.68	0.6108	2.4148
0.0728	52.98	0.6833	2.178	850	0.0791	52.47	0.6879	2.0046
0.0841	56.74	0.7472	1.8600	900	0.0894	55.84	0.7500	1.7740
0.0945	60.10	0.7984	1.6773	950	0.0991	58.93	0.8003	1.6296
0.1042	63.19	0.8398	1.5605	1000	0.1081	61.82	0.8411	1.5317

x = 0.20					x = 0.			
V	H	ϕ_1	ϕ_2		V	H	ϕ_1	ϕ_2
dm^3mol^{-1}	kJ mol^{-1}			K	dm^3mol^{-1}	kJ mol^{-1}		
				660	0.0741	36.12	0.4672	1.9579
0.0554	38.87	0.4004	3.344	680	0.0775	37.23	0.5069	1.8680
0.0596	40.53	0.4450	2.943	700	0.0809	38.30	0.5446	1.7925
0.0638	42.11	0.4875	2.641	720	0.0842	39.35	0.5800	1.7284
0.0679	43.60	0.5276	2.410	740	0.0874	40.37	0.6133	1.6734
0.0720	45.03	0.5651	2.230	760	0.0906	41.37	0.6444	1.6257
0.0761	46.38	0.6000	2.088	780	0.0938	42.35	0.6734	1.5842
0.0800	47.69	0.6324	1.9727	800	0.0969	43.31	0.7003	1.5476
0.0895	50.75	0.7033	1.7661	850	0.1046	45.67	0.7597	1.4731
0.0985	53.60	0.7613	1.6305	900	0.1120	47.96	0.8089	1.4162
0.1070	56.30	0.8088	1.5355	950	0.1193	50.21	0.8495	1.3714
0.1153	58.91	0.8478	1.4657	1000	0.1264	52.43	0.8831	1.3352

x = 0.60				
V	H	ϕ_1	ϕ_2	T
dm^3mol^{-1}	kJ mol^{-1}			K
0.0852	30.69	0.5792	1.5059	640
0.0880	31.55	0.6157	1.4764	660
0.0909	32.39	0.6499	1.4500	680
0.0937	33.23	0.6817	1.4264	700
0.0964	34.06	0.7113	1.4051	720
0.0992	34.88	0.7388	1.3858	740
0.1019	35.70	0.7642	1.3682	760
0.1046	36.50	0.7878	1.3522	780
0.1073	37.31	0.8096	1.3374	800
0.1140	39.30	0.8571	1.3053	850
0.1206	41.28	0.8959	1.2786	900
0.1271	43.25	0.9282	1.2557	950
0.1336	45.22	0.9542	1.2363	1000

P = 80 MPa

x = 0.05					x = 0.10			
V	H	ϕ_1	ϕ_2	T	V	H	ϕ_1	ϕ_2
dm^3mol^{-1}	kJ mol^{-1}			K	dm^3mol^{-1}	kJ mol^{-1}		
0.0285	30.93	0.2339	18.958	640				
0.0302	32.85	0.2740	14.826	660				
0.0322	34.83	0.3162	11.591	680	0.0376	36.32	0.3276	7.472
0.0346	36.88	0.3596	9.086	700	0.0407	38.32	0.3717	6.023
0.0374	38.99	0.4035	7.173	720	0.0440	40.31	0.4157	4.943
0.0407	41.12	0.4470	5.736	740	0.0476	42.25	0.4587	4.144
0.0443	43.24	0.4893	4.676	760	0.0514	44.13	0.5001	3.553
0.0483	45.30	0.5297	3.902	780	0.0553	45.92	0.5393	3.113
0.0524	47.28	0.5678	3.341	800	0.0592	47.62	0.5761	2.783
0.0627	51.78	0.6517	2.503	850	0.0687	51.51	0.6572	2.253
0.0726	55.69	0.7203	2.079	900	0.0778	54.99	0.7239	1.954
0.0818	59.19	0.7761	1.838	950	0.0863	58.18	0.7786	1.768
0.0904	62.39	0.8217	1.685	1000	0.0944	61.17	0.8234	1.643

x = 0.20					x = 0.40			
V	H	ϕ_1	ϕ_2	T	V	H	ϕ_1	ϕ_2
dm^3mol^{-1}	kJ mol^{-1}			K	dm^3mol^{-1}	kJ mol^{-1}		
				660	0.0667	35.78	0.4365	2.138
0.0498	38.11	0.3673	3.851	680	0.0697	36.90	0.4765	2.031
0.0532	39.75	0.4106	3.375	700	0.0726	37.99	0.5147	1.941
0.0567	41.33	0.4526	3.011	720	0.0754	39.05	0.5510	1.864
0.0602	42.83	0.4927	2.730	740	0.0782	40.08	0.5853	1.798
0.0637	44.28	0.5309	2.508	760	0.0810	41.09	0.6175	1.741
0.0671	45.66	0.5668	2.330	780	0.0838	42.09	0.6479	1.691
0.0705	46.99	0.6005	2.187	800	0.0865	43.07	0.6762	1.647
0.0787	50.12	0.6753	1.928	850	0.0932	45.46	0.7392	1.558
0.0866	53.04	0.7374	1.759	900	0.0997	47.78	0.7919	1.490
0.0941	55.81	0.7889	1.641	950	0.1060	50.05	0.8359	1.436
0.1014	58.47	0.8316	1.555	1000	0.1123	52.30	0.8725	1.393

x = 0.60				
V	H	ϕ_1	ϕ_2	T
dm^3mol^{-1}	kJ mol^{-1}			K
0.0771	30.64	0.5565	1.595	640
0.0796	31.51	0.5941	1.560	660
0.0820	32.37	0.6295	1.529	680
0.0845	33.21	0.6627	1.501	700
0.0869	34.05	0.6937	1.475	720
0.0893	34.88	0.7226	1.452	740
0.0916	35.70	0.7495	1.431	760
0.0940	36.51	0.7745	1.412	780
0.0963	37.32	0.7977	1.395	800
0.1022	39.33	0.8485	1.356	850
0.1079	41.32	0.8904	1.325	900
0.1136	43.30	0.9249	1.298	950
0.1192	45.29	0.9534	1.275	1000

P = 90 MPa

x = 0.05					x = 0.10			
V	H	ϕ_1	ϕ_2	T	V	H	ϕ_1	ϕ_2
dm^3mol^{-1}	kJ mol^{-1}			K	dm^3mol^{-1}	kJ mol^{-1}		
0.0277	30.74	0.218	20.101	640				
0.0292	32.58	0.255	15.960	660				
0.0308	34.47	0.295	12.690	680	0.0354	35.81	0.3048	8.396
0.0328	36.40	0.336	10.127	700	0.0379	37.71	0.3464	6.852
0.0351	38.38	0.377	8.134	720	0.0406	39.60	0.3884	5.671
0.0376	40.37	0.419	6.600	740	0.0435	41.47	0.4301	4.773
0.0405	42.38	0.460	5.431	760	0.0466	43.29	0.4707	4.091
0.0436	44.35	0.500	4.549	780	0.0498	45.05	0.5097	3.572
0.0469	46.28	0.538	3.886	800	0.0530	46.75	0.5469	3.174
0.0556	50.77	0.624	2.857	850	0.0612	50.68	0.6304	2.522
0.0641	54.77	0.696	2.321	900	0.0691	54.24	0.7006	2.150
0.0723	58.36	0.756	2.014	950	0.0767	57.51	0.7589	1.919
0.0800	61.66	0.805	1.822	1000	0.0839	60.57	0.8071	1.764

x = 0.20					x = 0.40			
V	H	ϕ_1	ϕ_2	T	V	H	ϕ_1	ϕ_2
dm^3mol^{-1}	kJ mol^{-1}			K	dm^3mol^{-1}	kJ mol^{-1}		
0.0458	37.54	0.341	4.361	680	0.0638	36.64	0.4515	2.202
0.0487	39.15	0.383	3.816	700	0.0663	37.74	0.4900	2.096
0.0516	40.71	0.424	3.393	720	0.0688	38.81	0.5267	2.006
0.0546	42.21	0.464	3.063	740	0.0713	39.86	0.5617	1.929
0.0576	43.66	0.502	2.799	760	0.0737	40.88	0.5949	1.862
0.0605	45.06	0.539	2.587	780	0.0762	41.89	0.6262	1.803
0.0635	46.40	0.573	2.414	800	0.0786	42.88	0.6557	1.752
0.0707	49.58	0.651	2.102	850	0.0845	45.29	0.7215	1.646
0.0776	52.56	0.716	1.897	900	0.0902	47.63	0.7772	1.566
0.0843	55.37	0.771	1.754	950	0.0959	49.93	0.8240	1.503
0.0908	58.08	0.817	1.650	1000	0.1014	52.20	0.8633	1.452

x = 0.60				
V	H	ϕ_1	ϕ_2	T
dm^3mol^{-1}	kJ mol^{-1}			K
				600
				620
				640
0.0731	31.51	0.577	1.648	660
0.0753	32.37	0.613	1.612	680
0.0774	33.23	0.647	1.579	700
0.0796	34.07	0.680	1.549	720
0.0817	34.90	0.710	1.522	740
0.0838	35.73	0.738	1.497	760
0.0858	36.55	0.764	1.475	780
0.0879	37.36	0.789	1.454	800
0.0930	39.38	0.842	1.410	850
0.0981	41.38	0.887	1.372	900
0.1031	43.38	0.924	1.341	950
0.1081	45.37	0.954	1.315	1000

P = 100 MPa

x = 0.05					x = 0.10			
V	H	ϕ_1	ϕ_2	T	V	H	ϕ_1	ϕ_2
dm^3mol^{-1}	kJ mol^{-1}			K	dm^3mol^{-1}	kJ mol^{-1}		
0.0270	30.61	0.205	21.277	640				
0.0283	32.39	0.241	17.086	660				
0.0298	34.20	0.278	13.756	680	0.0338	35.43	0.2869	9.291
0.0314	36.05	0.317	11.121	700	0.0358	37.26	0.3265	7.655
0.0333	37.93	0.357	9.048	720	0.0381	39.07	0.3668	6.384
0.0354	39.83	0.397	7.426	740	0.0405	40.87	0.4070	5.399
0.0378	41.74	0.437	6.166	760	0.0431	42.64	0.4467	4.635
0.0403	43.63	0.476	5.191	780	0.0458	44.37	0.4853	4.043
0.0431	45.49	0.513	4.441	800	0.0485	46.04	0.5224	3.581
0.0503	49.93	0.600	3.234	850	0.0556	49.98	0.6073	2.809
0.0578	53.96	0.675	2.584	900	0.0626	53.58	0.6800	2.361
0.0650	57.62	0.738	2.206	950	0.0693	56.91	0.7412	2.081
0.0720	60.99	0.790	1.970	1000	0.0758	60.03	0.7924	1.893

x = 0.20					x = 0.40			
V	H	ϕ_1	ϕ_2	T	V	H	ϕ_1	ϕ_2
dm^3mol^{-1}	kJ mol^{-1}			K	dm^3mol^{-1}	kJ mol^{-1}		
				680	0.0592	36.44	0.4310	2.380
0.0453	38.68	0.361	4.267	700	0.0614	37.55	0.4694	2.259
0.0478	40.22	0.401	3.787	720	0.0637	38.62	0.5065	2.155
0.0504	41.71	0.441	3.407	740	0.0659	39.68	0.5420	2.066
0.0530	43.16	0.479	3.102	760	0.0681	40.71	0.5758	1.988
0.0556	44.56	0.515	2.855	780	0.0702	41.73	0.6078	1.920
0.0581	45.91	0.550	2.653	800	0.0724	42.73	0.6381	1.861
0.0645	49.12	0.629	2.285	850	0.0776	45.16	0.7064	1.739
0.0707	52.14	0.697	2.043	900	0.0828	47.53	0.7646	1.646
0.0767	54.99	0.755	1.874	950	0.0879	49.84	0.8139	1.573
0.0825	57.74	0.804	1.751	1000	0.0928	52.13	0.8554	1.515

x = 0.60				
V	H	ϕ_1	ϕ_2	T
dm^3mol^{-1}	kJ mol^{-1}			K
0.0680	31.54	0.560	1.747	660
0.0700	32.41	0.597	1.704	680
0.0719	33.27	0.632	1.666	700
0.0738	34.11	0.665	1.631	720
0.0757	34.95	0.700	1.594	740
0.0775	35.78	0.729	1.566	760
0.0794	36.61	0.756	1.540	780
0.0812	37.43	0.782	1.516	800
0.0858	39.45	0.838	1.465	850
0.0904	41.47	0.885	1.422	900
0.0948	43.47	0.924	1.386	950
0.0993	45.46	0.956	1.356	1000

Table 5

Infinite-dilution (standard state) values of
partial molar volume V_2, enthalpy H_2, and heat capacity C_{p2},
and fugacity coefficient φ_2 of nitrogen in water,
for the same pressures and temperatures as in Table 4.
Values in italics refer to the liquid state.

P = 0.05 MPa					P = 0.10 MPa			
V_2	H_2	Cp_2	ϕ_2	T	V_2	H_2	Cp_2	ϕ_2
$dm^3\ mol^{-1}$	$kJ\ mol^{-1}$	$kJ\ mol^{-1}K^{-1}$		K	$dm^3\ mol^{-1}$	$kJ\ mol^{-1}$	$kJ\ mol^{-1}K^{-1}$	
73.6	10.57	0.028	1.0056	440	37.0	10.70	0.026	1.0114
76.8	11.13	0.028	1.0043	460	38.6	11.23	0.027	1.0087
80.1	11.70	0.029	1.0034	480	40.2	11.78	0.028	1.0069
83.4	12.28	0.029	1.0027	500	41.8	12.34	0.028	1.0055
86.7	12.86	0.029	1.0022	520	43.4	12.91	0.029	1.0044
90.0	13.45	0.029	1.0018	540	45.1	13.49	0.029	1.0036
93.3	14.04	0.030	1.0015	560	46.7	14.07	0.029	1.0030
96.6	14.63	0.030	1.0012	580	48.4	14.66	0.030	1.0026
99.9	15.23	0.030	1.0011	600	50.0	15.25	0.030	1.0022
103.2	15.83	0.030	1.0009	620	51.6	15.85	0.030	1.0019
106.5	16.43	0.030	1.0008	640	53.3	16.45	0.030	1.0016
109.8	17.04	0.030	1.0007	660	54.9	17.06	0.030	1.0014
113.1	17.65	0.030	1.0006	680	56.6	17.66	0.030	1.0012
116.5	18.26	0.031	1.0005	700	58.3	18.27	0.031	1.0011
119.8	18.88	0.031	1.0005	720	59.9	18.89	0.031	1.0010
123.1	19.49	0.031	1.0004	740	61.6	19.50	0.031	1.0009
126.4	20.11	0.031	1.0004	760	63.2	20.12	0.031	1.0008
129.8	20.74	0.031	1.0003	780	64.9	20.75	0.031	1.0007
133.1	21.36	0.031	1.0003	800	66.6	21.37	0.031	1.0007
141.4	22.94	0.032	1.0003	850	70.7	22.95	0.032	1.0006
149.7	24.53	0.032	1.0002	900	74.9	24.54	0.032	1.0005
158.0	26.15	0.032	1.0002	950	79.0	26.15	0.032	1.0004
166.3	27.78	0.033	1.0002	1000	83.2	27.78	0.033	1.0004

P = 0.15 MPa					P = 0.20 MPa			
V_2	H_2	Cp_2	ϕ_2	T	V_2	H_2	Cp_2	ϕ_2
$dm^3\ mol^{-1}$	$kJ\ mol^{-1}$	$kJ\ mol^{-1}K^{-1}$		K	$dm^3\ mol^{-1}$	$kJ\ mol^{-1}$	$kJ\ mol^{-1}K^{-1}$	
24.81	10.83	0.024	1.0174	440	18.73	10.97	.022	1.0236
25.85	11.33	0.026	1.0133	460	19.48	11.44	0.024	1.0180
26.89	11.86	0.027	1.0104	480	20.24	11.94	0.026	1.0140
27.95	12.40	0.028	1.0083	500	21.02	12.47	0.027	1.0112
29.02	12.96	0.028	1.0067	520	21.82	13.01	0.028	1.0090
30.10	13.53	0.029	1.0055	540	22.62	13.57	0.028	1.0074
31.1	14.11	0.029	1.0046	560	23.43	14.14	0.029	1.0062
32.3	14.69	0.029	1.0039	580	24.24	14.72	0.029	1.0052
33.4	15.28	0.030	1.0033	600	25.05	15.31	0.029	1.0044
34.5	15.87	0.030	1.0028	620	25.87	15.90	0.030	1.0038
35.6	16.47	0.030	1.0025	640	26.69	16.49	0.030	1.0033
36.7	17.07	0.030	1.0022	660	27.52	17.09	0.030	1.0029
37.8	17.68	0.030	1.0019	680	28.34	17.69	0.030	1.0026
38.9	18.29	0.030	1.0017	700	29.17	18.30	0.030	1.0023
40.0	18.90	0.031	1.0015	720	29.99	18.91	0.031	1.0020
41.1	19.51	0.031	1.0014	740	30.8	19.53	0.031	1.0018
42.2	20.13	0.031	1.0012	760	31.6	20.14	0.031	1.0017
43.3	20.75	0.031	1.0011	780	32.5	20.76	0.031	1.0015
44.4	21.38	0.031	1.0010	800	33.3	21.39	0.031	1.0014
47.2	22.95	0.032	1.0009	850	35.4	22.96	0.032	1.0012
49.9	24.54	0.032	1.0008	900	37.4	24.55	0.032	1.0010
52.7	26.15	0.032	1.0007	950	39.5	26.16	0.032	1.0009
55.5	27.78	0.033	1.0006	1000	41.6	27.79	0.033	1.0008

P = 0.25 MPa					P = 0.30 MPa			
V_2	H_2	Cp_2	ϕ_2	T	V_2	H_2	Cp_2	ϕ_2
$dm^3\ mol^{-1}$	$kJ\ mol^{-1}$	$kJ\ mol^{-1}K^{-1}$		K	$dm^3\ mol^{-1}$	$kJ\ mol^{-1}$	$kJ\ mol^{-1}K^{-1}$	
15.08	11.12	0.020	1.0300	440	12.66	11.27	0.018	1.0366
15.66	11.55	0.023	1.0228	460	13.12	11.66	0.021	1.0278
16.26	12.03	0.025	1.0178	480	13.60	12.12	0.024	1.0216
16.87	12.54	0.026	1.0141	500	14.10	12.61	0.025	1.0171
17.50	13.07	0.027	1.0114	520	14.62	13.13	0.027	1.0138
18.13	13.62	0.028	1.0093	540	15.14	13.66	0.027	1.0113
18.77	14.18	0.028	1.0078	560	15.67	14.22	0.028	1.0094
19.42	14.75	0.029	1.0065	580	16.20	14.78	0.029	1.0079
20.07	15.33	0.029	1.0056	600	16.74	15.36	0.029	1.0067
20.72	15.92	0.029	1.0048	620	17.28	15.94	0.029	1.0058
21.37	16.51	0.030	1.0041	640	17.83	16.53	0.030	1.0050
22.03	17.11	0.030	1.0036	660	18.37	17.12	0.030	1.0044
22.69	17.71	0.030	1.0032	680	18.92	17.72	0.030	1.0039
23.35	18.31	0.030	1.0029	700	19.47	18.33	0.030	1.0034
24.01	18.92	0.031	1.0026	720	20.02	18.93	0.030	1.0031
24.67	19.54	0.031	1.0023	740	20.57	19.55	0.031	1.0028
25.33	20.15	0.031	1.0021	760	21.12	20.16	0.031	1.0025
25.99	20.77	0.031	1.0019	780	21.67	20.78	0.031	1.0023
26.65	21.39	0.031	1.0018	800	22.22	21.40	0.031	1.0022
28.31	22.96	0.032	1.0015	850	23.60	22.97	0.032	1.0018
29.97	24.55	0.032	1.0013	900	24.98	24.56	0.032	1.0016
31.63	26.16	0.032	1.0011	950	26.37	26.17	0.032	1.0014
33.29	27.79	0.033	1.0010	1000	27.75	27.79	0.033	1.0012

P = 0.40 MPa					P = 0.50 MPa			
V_2	H_2	Cp_2	ϕ_2	T	V_2	H_2	Cp_2	ϕ_2
$dm^3\ mol^{-1}$	$kJ\ mol^{-1}$	$kJ\ mol^{-1}K^{-1}$		K	$dm^3\ mol^{-1}$	$kJ\ mol^{-1}$	$kJ\ mol^{-1}K^{-1}$	
9.64	11.60	0.012	1.0505	440	7.84	11.96	0.006	1.0654
9.95	11.91	0.018	1.0380	460	8.06	12.17	0.014	1.0489
10.29	12.30	0.021	1.0294	480	8.30	12.50	0.019	1.0375
10.64	12.75	0.024	1.0232	500	8.57	12.90	0.022	1.0295
11.02	13.24	0.025	1.0186	520	8.86	13.36	0.024	1.0236
11.40	13.76	0.026	1.0152	540	9.16	13.86	0.025	1.0192
11.79	14.30	0.027	1.0126	560	9.46	14.38	0.027	1.0159
12.19	14.85	0.028	1.0106	580	9.78	14.91	0.027	1.0133
12.58	15.41	0.028	1.0090	600	10.09	15.47	0.028	1.0113
12.99	15.99	0.029	1.0077	620	10.41	16.04	0.029	1.0097
13.39	16.57	0.029	1.0067	640	10.73	16.61	0.029	1.0084
13.80	17.16	0.030	1.0059	660	11.06	17.19	0.029	1.0074
14.21	17.75	0.030	1.0052	680	11.38	17.78	0.030	1.0065
14.62	18.35	0.030	1.0046	700	11.71	18.38	0.030	1.0058
15.03	18.96	0.030	1.0041	720	12.04	18.98	0.030	1.0052
15.44	19.57	0.031	1.0038	740	12.36	19.59	0.030	1.0047
15.85	20.18	0.031	1.0034	760	12.69	20.20	0.031	1.0043
16.26	20.80	0.031	1.0031	780	13.02	20.81	0.031	1.0039
16.68	21.42	0.031	1.0029	800	13.35	21.43	0.031	1.0036
17.71	22.98	0.032	1.0024	850	14.18	22.99	0.031	1.0030
18.75	24.57	0.032	1.0021	900	15.01	24.58	0.032	1.0026
19.78	26.17	0.032	1.0018	950	15.83	26.18	0.032	1.0023
20.82	27.80	0.033	1.0017	1000	16.66	27.81	0.033	1.0021

P = 0.60 MPa					P = 0.70 MPa			
V_2	H_2	Cp_2	ϕ_2	T	V_2	H_2	Cp_2	ϕ_2
$dm^3\ mol^{-1}$	$kJ\ mol^{-1}$	$kJ\ mol^{-1}K^{-1}$		K	$dm^3\ mol^{-1}$	$kJ\ mol^{-1}$	$kJ\ mol^{-1}K^{-1}$	
6.65	12.36	0.000	1.0813	440	5.81	12.79	-0.008	1.0983
6.80	12.45	0.009	1.0603	460	5.91	12.76	0.004	1.0724
6.98	12.71	0.016	1.0461	480	6.05	12.93	0.012	1.0549
7.20	13.07	0.020	1.0360	500	6.21	13.24	0.017	1.0428
7.42	13.49	0.022	1.0288	520	6.40	13.62	0.021	1.0340
7.67	13.96	0.024	1.0234	540	6.60	14.06	0.023	1.0276
7.92	14.46	0.026	1.0193	560	6.81	14.54	0.025	1.0227
8.17	14.98	0.027	1.0161	580	7.02	15.05	0.026	1.0190
8.43	15.53	0.028	1.0137	600	7.24	15.58	0.027	1.0161
8.69	16.08	0.028	1.0117	620	7.47	16.13	0.028	1.0138
8.96	16.65	0.029	1.0102	640	7.69	16.69	0.028	1.0119
9.23	17.23	0.029	1.0089	660	7.92	17.27	0.029	1.0104
9.50	17.81	0.029	1.0079	680	8.15	17.85	0.029	1.0092
9.77	18.41	0.030	1.0070	700	8.38	18.43	0.030	1.0082
10.04	19.01	0.030	1.0063	720	8.62	19.03	0.030	1.0074
10.31	19.61	0.030	1.0057	740	8.85	19.63	0.030	1.0066
10.59	20.22	0.031	1.0052	760	9.08	20.24	0.030	1.0061
10.86	20.83	0.031	1.0047	780	9.32	20.85	0.031	1.0056
11.13	21.45	0.031	1.0044	800	9.55	21.46	0.031	1.0051
11.82	23.01	0.031	1.0037	850	10.14	23.02	0.031	1.0043
12.51	24.59	0.032	1.0032	900	10.73	24.60	0.032	1.0037
13.20	26.19	0.032	1.0028	950	11.32	26.20	0.032	1.0033
13.89	27.81	0.033	1.0025	1000	11.91	27.82	0.033	1.0030

P = 0.80 MPa					P = 0.90 MPa			
V_2	H_2	Cp_2	ϕ_2	T	V_2	H_2	Cp_2	ϕ_2
$dm^3\ mol^{-1}$	$kJ\ mol^{-1}$	$kJ\ mol^{-1}K^{-1}$		K	$dm^3\ mol^{-1}$	$kJ\ mol^{-1}$	$kJ\ mol^{-1}K^{-1}$	
0.046	*29.86*	*0.132*	*10786.*	*440*	*0.046*	*29.86*	*0.132*	*9647.*
0.046	*30.34*	*0.134*	*10344.*	*443.59*				
5.198	13.20	-0.014	1.1097	443.59				
				448.54	*0.047*	*31.01*	*0.138*	*8710.*
				448.54	4.716	13.58	-0.018	1.1179
5.24	13.09	-0.001	1.0851	460	4.73	13.44	-0.007	1.0986
5.34	13.17	0.009	1.0642	480	4.80	13.43	0.005	1.0739
5.48	13.41	0.015	1.0498	500	4.91	13.60	0.012	1.0570
5.63	13.76	0.019	1.0395	520	5.04	13.90	0.017	1.0450
5.80	14.17	0.022	1.0319	540	5.18	14.28	0.021	1.0363
5.98	14.63	0.024	1.0262	560	5.34	14.72	0.023	1.0298
6.17	15.12	0.025	1.0219	580	5.50	15.20	0.025	1.0248
6.35	15.64	0.026	1.0185	600	5.66	15.70	0.026	1.0209
6.55	16.18	0.027	1.0158	620	5.83	16.23	0.027	1.0179
6.74	16.74	0.028	1.0137	640	6.01	16.78	0.028	1.0155
6.94	17.30	0.029	1.0120	660	6.18	17.34	0.028	1.0135
7.14	17.88	0.029	1.0106	680	6.36	17.91	0.029	1.0119
7.35	18.46	0.029	1.0094	700	6.54	18.49	0.029	1.0106
7.55	19.05	0.030	1.0084	720	6.72	19.08	0.030	1.0095
7.75	19.65	0.030	1.0076	740	6.90	19.67	0.030	1.0086
7.95	20.26	0.030	1.0069	760	7.08	20.27	0.030	1.0078
8.16	20.86	0.031	1.0064	780	7.26	20.88	0.030	1.0072
8.36	21.48	0.031	1.0059	800	7.44	21.49	0.031	1.0066
8.88	23.03	0.031	1.0049	850	7.90	23.04	0.031	1.0055
9.39	24.61	0.032	1.0042	900	8.35	24.62	0.032	1.0048
9.91	26.21	0.032	1.0038	950	8.81	26.21	0.032	1.0042
10.43	27.83	0.033	1.0034	1000	9.28	27.83	0.033	1.0038

P = 1.0 MPa					P = 1.5 MPa			
V_2	H_2	Cp_2	ϕ_2	T	V_2	H_2	Cp_2	ϕ_2
$dm^3\ mol^{-1}$	kJ mol^{-1}	kJ $mol^{-1}K^{-1}$		K	$dm^3\ mol^{-1}$	kJ mol^{-1}	kJ $mol^{-1}K^{-1}$	
0.046	*29.86*	*0.132*	*8728.*	*440*	*0.046*	*29.84*	*0.132*	*5925.*
				460	*0.049*	*32.62*	*0.147*	*4654.*
0.048	*31.64*	*0.142*	*7451.*	*453.07*				
4.33	13.94	-0.022	1.1258	453.07				
				471.48	*0.052*	*34.37*	*0.1604*	*4042.*
				471.48	3.14	15.62	-0.042	1.1628
4.33	13.82	-0.014	1.1128	460				
4.37	13.70	0.000	1.0840	480	3.12	15.32	-0.029	1.1423
4.46	13.80	0.009	1.0645	500	3.12	14.96	-0.009	1.1064
4.56	14.05	0.015	1.0508	520	3.15	14.91	0.003	1.0821
4.69	14.40	0.019	1.0408	540	3.21	15.05	0.011	1.0650
4.82	14.81	0.022	1.0334	560	3.28	15.32	0.016	1.0526
4.96	15.27	0.024	1.0278	580	3.36	15.68	0.020	1.0434
5.11	15.77	0.025	1.0234	600	3.45	16.10	0.022	1.0363
5.26	16.28	0.026	1.0200	620	3.55	16.56	0.024	1.0308
5.42	16.82	0.027	1.0173	640	3.65	17.05	0.025	1.0265
5.57	17.38	0.028	1.0151	660	3.75	17.57	0.026	1.0231
5.73	17.94	0.029	1.0133	680	3.85	18.11	0.027	1.0203
5.89	18.52	0.029	1.0118	700	3.95	18.66	0.028	1.0180
6.29	19.99	0.030	1.0091	750	4.22	20.10	0.029	1.0139
6.70	21.51	0.031	1.0074	800	4.48	21.59	0.030	1.0112
7.11	23.05	0.031	1.0062	850	4.76	23.12	0.031	1.0094
7.52	24.63	0.032	1.0053	900	5.03	24.68	0.031	1.0081
7.94	26.22	0.032	1.0047	950	5.30	26.26	0.032	1.0072
8.35	27.84	0.033	1.0043	1000	5.58	27.87	0.032	1.0065

P = 2.0 MPa					P = 2.5 MPa			
V_2	H_2	Cp_2	ϕ_2	T	V_2	H_2	Cp_2	ϕ_2
$dm^3\ mol^{-1}$	kJ mol^{-1}	kJ $mol^{-1}K^{-1}$		K	$dm^3\ mol^{-1}$	kJ mol^{-1}	kJ $mol^{-1}K^{-1}$	
0.046	*29.83*	*0.131*	*4500.*	*440*	*0.046*	*29.82*	*0.132*	*3635.*
0.049	*32.60*	*0.147*	*3533.*	*460*	*0.049*	*32.58*	*0.146*	*2855.*
0.054	*35.73*	*0.168*	*2760.*	*480*	*0.054*	*35.70*	*0.168*	*2230.*
0.055	*36.69*	*0.176*	*2571.*	*485.57*				
2.523	17.16	-0.065	1.1969	485.57				
				497.14	*0.059*	*38.78*	*0.194*	*1793.*
				497.14	2.148	18.65	-0.089	1.2293
2.479	16.45	-0.037	1.1569	500	2.133	18.41	-0.080	1.2188
2.465	15.96	-0.014	1.1184	520	2.073	17.27	-0.038	1.1609
2.483	15.83	0.000	1.0923	540	2.059	16.75	-0.015	1.1231
2.521	15.91	0.008	1.0738	560	2.071	16.59	-0.001	1.0971
2.571	16.14	0.014	1.0602	580	2.099	16.66	0.007	1.0785
2.629	16.46	0.018	1.0501	600	2.138	16.87	0.013	1.0648
2.694	16.86	0.021	1.0423	620	2.183	17.19	0.018	1.0544
2.762	17.30	0.023	1.0362	640	2.234	17.57	0.021	1.0464
2.834	17.78	0.025	1.0314	660	2.288	18.00	0.023	1.0401
2.908	18.29	0.026	1.0275	680	2.345	18.47	0.024	1.0350
2.984	18.81	0.027	1.0244	700	2.403	18.97	0.026	1.0310
3.178	20.21	0.029	1.0187	750	2.555	20.32	0.028	1.0237
3.377	21.67	0.030	1.0151	800	2.713	21.75	0.029	1.0190
3.579	23.18	0.031	1.0126	850	2.873	23.24	0.030	1.0159
3.78	24.73	0.031	1.0109	900	3.04	24.78	0.031	1.0137
4.19	27.91	0.032	1.0087	1000	3.36	27.94	0.032	1.0109

P = 3.0 MPa					P = 4.0 MPa			
V_2	H_2	Cp_2	ϕ_2	T	V_2	H_2	Cp_2	ϕ_2
$dm^3\ mol^{-1}$	$kJ\ mol^{-1}$	$kJ\ mol^{-1}K^{-1}$		K	$dm^3\ mol^{-1}$	$kJ\ mol^{-1}$	$kJ\ mol^{-1}K^{-1}$	
0.046	*29.80*	*0.130*	*3056.*	*440*	*0.045*	*29.78*	*0.130*	*2328.*
0.049	*32.56*	*0.146*	*2400.*	*460*	*0.049*	*32.51*	*0.145*	*1829.*
0.054	*35.67*	*0.166*	*1875.*	*480*	*0.053*	*35.60*	*0.165*	*1429.*
0.059	*39.29*	*0.198*	*1454.*	*500*	*0.059*	*39.19*	*0.196*	*1109.*
				520	*0.067*	*43.53*	*0.243*	*850.5*
0.062	*40.74*	*0.212*	*1325.*	*507.04*				
1.895	20.10	-0.116	1.2609	507.04				
				523.54	*0.068*	*44.41*	*0.254*	*809.9*
				523.54	1.578	23.03	-0.179	1.3227
1.833	18.90	-0.073	1.2111	520				
1.788	17.86	-0.035	1.1582	540	1.486	20.82	-0.099	1.2451
1.778	17.39	-0.014	1.1230	560	1.433	19.39	-0.050	1.1840
1.789	17.25	-0.001	1.0984	580	1.414	18.68	-0.023	1.1436
1.813	17.33	0.008	1.0805	600	1.415	18.39	-0.007	1.1155
1.845	17.54	0.014	1.0672	620	1.428	18.36	0.003	1.0951
1.883	17.86	0.018	1.0570	640	1.449	18.50	0.010	1.0799
1.925	18.24	0.020	1.0491	660	1.475	18.76	0.015	1.0682
1.970	18.67	0.023	1.0428	680	1.504	19.10	0.019	1.0591
2.017	19.14	0.024	1.0377	700	1.536	19.50	0.021	1.0519
2.141	20.43	0.027	1.0288	750	1.623	20.68	0.025	1.0393
2.270	21.84	0.029	1.0231	800	1.717	22.01	0.028	1.0314
2.403	23.31	0.030	1.0193	850	1.815	23.44	0.029	1.0261
2.537	24.83	0.031	1.0166	900	1.914	24.94	0.030	1.0225
2.809	27.98	0.032	1.0132	1000	2.117	28.05	0.032	1.0178

P = 5.0 MPa					P = 6.0 MPa			
V_2	H_2	Cp_2	ϕ_2	T	V_2	H_2	Cp_2	ϕ_2
$dm^3\ mol^{-1}$	$kJ\ mol^{-1}$	$kJ\ mol^{-1}K^{-1}$		K	$dm^3\ mol^{-1}$	$kJ\ mol^{-1}$	$kJ\ mol^{-1}K^{-1}$	
0.045	*29.75*	*0.129*	*1889.*	*440*	*0.045*	*29.72*	*0.129*	*1596.*
0.049	*32.47*	*0.144*	*1484.*	*460*	*0.049*	*32.43*	*0.143*	*1254.*
0.053	*35.54*	*0.164*	*1161.*	*480*	*0.053*	*35.47*	*0.162*	*981.3*
0.059	*39.09*	*0.193*	*901.1*	*500*	*0.058*	*38.99*	*0.191*	*762.3*
0.066	*43.38*	*0.239*	*691.9*	*520*	*0.066*	*43.22*	*0.235*	*586.0*
				540	*0.076*	*48.59*	*0.310*	*443.3*
0.075	*47.96*	*0.302*	*544.6*	*537.13*				
1.391	26.07	-0.257	1.3845	537.13				
				548.77	*0.082*	*51.52*	*0.361*	*389.3*
				548.77	1.274	29.32	-0.355	1.4478
1.367	25.38	-0.229	1.3645	540				
1.256	22.16	-0.111	1.2614	560	1.178	26.16	-0.223	1.3629
1.206	20.53	-0.057	1.1981	580	1.087	22.98	-0.110	1.2648
1.187	19.71	-0.028	1.1561	600	1.046	21.36	-0.058	1.2036
1.184	19.34	-0.010	1.1266	620	1.029	20.52	-0.029	1.1624
1.192	19.26	0.001	1.1052	640	1.026	20.14	-0.011	1.1332
1.207	19.36	0.008	1.0891	660	1.032	20.04	0.000	1.1118
1.227	19.58	0.014	1.0767	680	1.044	20.12	0.008	1.0957
1.249	19.90	0.018	1.0670	700	1.059	20.34	0.013	1.0831
1.314	20.94	0.023	1.0503	750	1.109	21.22	0.021	1.0618
1.386	22.20	0.027	1.0400	800	1.166	22.40	0.025	1.0489
1.463	23.58	0.029	1.0332	850	1.228	23.73	0.028	1.0405
1.541	25.05	0.030	1.0285	900	1.293	25.16	0.029	1.0347
1.702	28.13	0.032	1.0226	1000	1.426	28.21	0.031	1.0275

P = 8.0 MPa					P = 10.0 MPa			
V_2	H_2	Cp_2	ϕ_2	T	V_2	H_2	Cp_2	ϕ_2
$dm^3\ mol^{-1}$	$kJ\ mol^{-1}$	$kJ\ mol^{-1}K^{-1}$		K	$dm^3\ mol^{-1}$	$kJ\ mol^{-1}$	$kJ\ mol^{-1}K^{-1}$	
0.045	*29.67*	*0.127*	*1228.5*	*440*	*0.045*	*29.62*	*0.126*	*1008.1*
0.048	*32.35*	*0.141*	*966.3*	*460*	*0.048*	*32.27*	*0.140*	*793.5*
0.053	*35.35*	*0.160*	*756.8*	*480*	*0.052*	*35.23*	*0.158*	*622.1*
0.058	*38.81*	*0.187*	*588.7*	*500*	*0.057*	*38.63*	*0.184*	*484.6*
0.081	*51.30*	*0.349*	*297.4*	*550*	*0.080*	*50.68*	*0.330*	*246.6*
0.098	*59.02*	*0.525*	*223.4431*	*568.19*				
1.151	36.79	-0.644	1.5831	568.19				
				584.18	*0.120*	*67.69*	*0.798*	*141.3*
				584.18	1.118	46.34	-1.151	1.7378
1.018	31.11	-0.359	1.4573	580				
0.907	26.16	-0.168	1.3282	600	0.900	34.84	-0.461	1.5195
0.855	23.70	-0.088	1.2507	620	0.786	28.61	-0.208	1.3718
0.831	22.39	-0.047	1.1997	640	0.733	25.56	-0.109	1.2847
0.822	21.71	-0.023	1.1641	660	0.707	23.93	-0.060	1.2279
0.821	21.41	-0.008	1.1382	680	0.695	23.05	-0.031	1.1884
0.827	21.36	0.002	1.1187	700	0.692	22.61	-0.014	1.1596
0.854	21.85	0.016	1.0867	750	0.704	22.58	0.009	1.1140
0.893	22.83	0.022	1.0679	800	0.730	23.31	0.019	1.0883
0.936	24.05	0.026	1.0558	850	0.762	24.39	0.024	1.0722
0.983	25.41	0.028	1.0477	900	0.798	25.67	0.027	1.0613
1.031	26.86	0.030	1.0419	950	0.835	27.07	0.029	1.0537
1.081	28.38	0.031	1.0375	1000	0.874	28.55	0.030	1.0480

P = 12 MPa					P = 14 MPa			
V_2	H_2	Cp_2	ϕ_2	T	V_2	H_2	Cp_2	ϕ_2
$dm^3\ mol^{-1}$	$kJ\ mol^{-1}$	$kJ\ mol^{-1}K^{-1}$		K	$dm^3\ mol^{-1}$	$kJ\ mol^{-1}$	$kJ\ mol^{-1}K^{-1}$	
0.045	*29.58*	*0.125*	*861.4*	*440*	*0.044*	*29.53*	*0.124*	*756.9*
0.048	*32.20*	*0.138*	*678.5*	*460*	*0.048*	*32.13*	*0.137*	*596.5*
0.052	*35.12*	*0.155*	*532.4*	*480*	*0.052*	*35.01*	*0.153*	*468.5*
0.057	*38.45*	*0.179*	*415.3*	*500*	*0.057*	*38.29*	*0.176*	*366.0*
0.078	*50.11*	*0.314*	*212.8*	*550*	*0.077*	*49.58*	*0.300*	*188.7*
				600	*0.145*	*77.29*	*1.175*	*82.3*
0.149	*78.55*	*1.298*	*94.70*	*597.86*				
1.153	59.43	-2.118	1.9231	597.86				
				609.85	*0.193*	*93.44*	*2.337*	*65.8*
				609.85	1.261	78.85	-4.179	2.1560
1.088	55.36	-1.729	1.8662	600				
0.796	36.93	-0.494	1.5492	620	0.925	54.04	-1.456	1.8433
0.693	30.23	-0.224	1.3972	640	0.702	37.57	-0.466	1.5538
0.644	26.94	-0.119	1.3072	660	0.617	31.13	-0.219	1.4085
0.620	25.15	-0.066	1.2482	680	0.576	27.88	-0.118	1.3207
0.608	24.16	-0.036	1.2069	700	0.554	26.09	-0.066	1.2622
0.607	23.43	0.000	1.1443	750	0.539	24.41	-0.011	1.1780
0.623	23.85	0.015	1.1103	800	0.548	24.45	0.009	1.1341
0.647	24.77	0.022	1.0895	850	0.565	25.18	0.019	1.1080
0.675	25.96	0.025	1.0757	900	0.588	26.27	0.024	1.0909
0.705	27.30	0.028	1.0661	950	0.613	27.54	0.027	1.0790
0.737	28.74	0.030	1.0589	1000	0.639	28.94	0.029	1.0703

P = 16 MPa					P = 18 MPa			
V_2	H_2	Cp_2	ϕ_2	T	V_2	H_2	Cp_2	ϕ_2
$dm^3\ mol^{-1}$	$kJ\ mol^{-1}$	$kJ\ mol^{-1}K^{-1}$		K	$dm^3\ mol^{-1}$	$kJ\ mol^{-1}$	$kJ\ mol^{-1}K^{-1}$	
0.044	*29.49*	*0.123*	*678.7*	*440*	*0.044*	*29.45*	*0.122*	*618.2*
0.047	*32.06*	*0.134*	*535.3*	*460*	*0.047*	*31.99*	*0.133*	*487.9*
0.051	*34.91*	*0.151*	*420.8*	*480*	*0.051*	*34.81*	*0.149*	*383.9*
0.056	*38.13*	*0.173*	*329.1*	*500*	*0.056*	*37.98*	*0.170*	*300.6*
0.062	*41.88*	*0.204*	*255.4*	*520*	*0.062*	*41.65*	*0.199*	*233.7*
0.070	*46.40*	*0.252*	*196.0*	*540*	*0.069*	*46.04*	*0.244*	*179.8*
0.082	*52.18*	*0.333*	*147.9*	*560*	*0.080*	*51.58*	*0.317*	*136.2*
0.100	*60.27*	*0.499*	*108.7*	*580*	*0.097*	*59.15*	*0.458*	*100.7*
0.136	*73.98*	*0.969*	*76.2*	*600*	*0.128*	*71.29*	*0.823*	*71.4*
0.269	*116.56*	*4.935*	*46.6744*	*620.54*				
1.482	110.88	-9.374	2.4619	620.54				
				630.19	*0.425*	*160.30*	*13.873*	*33.13*
				630.19	1.942	173.30	-26.743	2.9166
0.777	50.61	-1.093	1.7901	640	1.007	80.38	[illegible]05	2.2062
0.620	37.27	-0.405	1.5424	660	0.660	46.86	[illegible].792	1.7287
0.554	31.52	-0.201	1.4101	680	0.552	36.49	-0.336	1.5231
0.520	28.51	-0.111	1.3277	700	0.501	31.60	-0.175	1.4059
0.502	26.82	-0.063	1.2717	720	0.475	28.93	-0.099	1.3303
0.494	25.86	-0.035	1.2315	740	0.461	27.40	-0.057	1.2778
0.490	25.35	-0.017	1.2014	760	0.453	26.53	-0.032	1.2395
0.490	25.14	-0.005	1.1782	780	0.451	26.07	-0.015	1.2104
0.492	25.12	0.003	1.1598	800	0.451	25.88	-0.004	1.1877
0.505	25.64	0.016	1.1276	850	0.459	26.13	0.012	1.1484
0.523	26.60	0.022	1.1068	900	0.473	26.95	0.020	1.1235
0.566	29.15	0.028	1.0821	1000	0.509	29.38	0.027	1.0943

P = 20 MPa					P = 22 MPa			
V_2	H_2	Cp_2	ϕ_2	T	V_2	H_2	Cp_2	ϕ_2
$dm^3\ mol^{-1}$	$kJ\ mol^{-1}$	$kJ\ mol^{-1}K^{-1}$		K	$dm^3\ mol^{-1}$	$kJ\ mol^{-1}$	$kJ\ mol^{-1}K^{-1}$	
0.044	*29.40*	*0.121*	*570.0*	*440*	0.044	29.37	0.121	530.8
0.047	*31.93*	*0.132*	*450.1*	*460*	0.047	31.87	0.131	419.4
0.051	*34.71*	*0.147*	*354.4*	*480*	0.050	34.62	0.145	330.5
0.055	*37.83*	*0.167*	*277.9*	*500*	0.055	37.69	0.164	259.4
0.061	*41.43*	*0.194*	*216.4*	*520*	0.060	41.22	0.190	202.4
0.068	*45.70*	*0.235*	*166.9*	*540*	0.068	45.38	0.229	156.4
0.079	*51.02*	*0.301*	*126.8*	*560*	0.077	50.50	0.289	119.2
0.094	*58.14*	*0.425*	*94.3*	*580*	0.092	57.23	0.396	89.1
0.122	*69.05*	*0.715*	*67.6*	*600*	0.117	67.15	0.631	64.5
0.189	*91.70*	*1.876*	*45.0*	*620*	0.170	85.75	1.415	43.9
				640	*0.454*	*164.88*	*12.525*	*24.6*
0.918	*283.29*	*75.652*	*22.7905*	*638.95*				
3.223	347.98	-137.362	3.6870	638.95				
2.421	253.20	-60.804	3.3880	640				
0.758	63.70	-1.767	2.0090	660	0.992	100.26	-5.267	2.4944
0.570	43.54	-0.575	1.6702	680	0.613	54.05	-1.029	1.8697
0.495	35.58	-0.272	1.5010	700	0.501	40.82	-0.422	1.6186
0.458	31.52	-0.149	1.3987	720	0.449	34.71	-0.218	1.4792
0.437	29.23	-0.086	1.3304	740	0.421	31.39	-0.124	1.3903
0.426	27.89	-0.050	1.2818	760	0.406	29.46	-0.073	1.3290
0.420	27.13	-0.028	1.2456	780	0.397	28.32	-0.043	1.2843
0.418	26.73	-0.013	1.2178	800	0.393	27.68	-0.023	1.2505
0.422	26.67	0.008	1.1705	850	0.393	27.26	0.003	1.1940
0.433	27.34	0.018	1.1411	900	0.401	27.75	0.015	1.1595
0.464	29.61	0.026	1.1069	1000	0.427	29.86	0.025	1.1200

P = 24 MPa					P = 26 MPa			
V_2	H_2	Cp_2	ϕ_2	T	V_2	H_2	Cp_2	ϕ_2
$dm^3\ mol^{-1}$	$kJ\ mol^{-1}$	$kJ\ mol^{-1}K^{-1}$		K	$dm^3\ mol^{-1}$	$kJ\ mol^{-1}$	$kJ\ mol^{-1}K^{-1}$	
0.043	29.33	0.120	498.4	440	0.043	29.29	0.119	471.1
0.047	31.81	0.130	394.0	460	0.046	31.75	0.128	372.7
0.050	34.53	0.143	310.8	480	0.050	34.44	0.142	294.2
0.054	37.56	0.161	244.2	500	0.054	37.43	0.159	231.4
0.060	41.02	0.186	190.7	520	0.059	40.83	0.182	181.0
0.067	45.07	0.222	147.72	540	0.066	44.79	0.215	140.46
0.076	50.01	0.277	112.98	560	0.075	49.56	0.266	107.74
0.090	56.39	0.371	84.83	580	0.088	55.63	0.349	81.25
0.112	65.50	0.566	61.87	600	0.108	64.05	0.514	59.69
0.157	81.28	1.129	42.83	620	0.146	77.76	0.935	41.92
0.315	127.37	5.021	25.99	640	0.253	110.09	2.911	26.67
1.810	232.90	-34.063	3.6665	660	2.343	505.00	60.889	9.2964
0.695	70.91	-2.000	2.1563	680	0.842	100.67	-4.377	2.6044
0.519	47.86	-0.662	1.7672	700	0.553	57.56	-1.058	1.9600
0.448	38.68	-0.315	1.5748	720	0.454	43.65	-0.453	1.6897
0.412	33.97	-0.174	1.4590	740	0.407	37.04	-0.239	1.5381
0.391	31.28	-0.102	1.3818	760	0.381	33.38	-0.138	1.4410
0.379	29.68	-0.061	1.3269	780	0.366	31.22	-0.083	1.3737
0.373	28.73	-0.036	1.2860	800	0.357	29.91	-0.050	1.3245
0.369	27.90	-0.002	1.2190	850	0.349	28.60	-0.009	1.2455
0.375	28.19	0.012	1.1788	900	0.353	28.66	0.009	1.1991
0.385	29.01	0.020	1.1523	950	0.361	29.35	0.018	1.1688
0.397	30.12	0.024	1.1335	1000	0.371	30.39	0.023	1.1475

P = 30 MPa					P = 40 MPa			
V_2	H_2	Cp_2	ϕ_2	T	V_2	H_2	Cp_2	ϕ_2
$dm^3\ mol^{-1}$	$kJ\ mol^{-1}$	$kJ\ mol^{-1}K^{-1}$		K	$dm^3\ mol^{-1}$	$kJ\ mol^{-1}$	$kJ\ mol^{-1}K^{-1}$	
0.043	29.22	0.116	428.1	440	0.042	29.07	0.113	360.8
0.046	31.64	0.125	339.0	460	0.045	31.40	0.121	286.3
0.049	34.28	0.138	268.0	480	0.048	33.91	0.131	227.1
0.053	37.19	0.154	211.2	500	0.052	36.65	0.144	179.8
0.058	40.47	0.175	165.7	520	0.056	39.69	0.160	141.9
0.065	44.25	0.205	129.05	540	0.062	43.11	0.182	111.40
0.073	48.73	0.247	99.51	560	0.068	47.03	0.212	86.86
0.084	54.28	0.314	75.63	580	0.077	51.65	0.253	67.06
0.101	61.63	0.434	56.26	600	0.090	57.29	0.316	51.07
0.131	72.51	0.692	40.44	620	0.108	64.56	0.421	38.13
0.194	92.52	1.477	27.26	640	0.137	74.70	0.615	27.63
0.437	153.52	6.262	15.53	660	0.191	90.61	1.029	19.06
1.306	236.68	-13.282	4.885	680	0.312	118.52	1.792	12.03
0.673	90.69	-2.850	2.576	700	0.537	148.65	0.289	6.634
0.488	57.85	-0.931	2.003	720	0.571	118.22	-2.398	3.749
0.411	45.07	-0.434	1.7372	740	0.459	79.41	-1.400	2.637
0.371	38.60	-0.238	1.5832	760	0.382	59.18	-0.712	2.144
0.348	34.90	-0.141	1.4826	780	0.336	48.49	-0.396	1.8761
0.334	32.66	-0.087	1.4121	800	0.309	42.31	-0.238	1.7097
0.319	30.16	-0.024	1.3036	850	0.285	36.86	-0.084	1.4835
0.318	29.69	0.001	1.2425	900	0.265	32.86	-0.024	1.3702
0.323	30.11	0.014	1.2036	950	0.263	32.33	0.000	1.3028
0.331	30.98	0.020	1.1768	1000	0.266	32.66	0.012	1.2583

P = 50 MPa					P = 60 MPa			
V_2	H_2	Cp_2	ϕ_2	T	V_2	H_2	Cp_2	ϕ_2
$dm^3\ mol^{-1}$	$kJ\ mol^{-1}$	$kJ\ mol^{-1}K^{-1}$		K	$dm^3\ mol^{-1}$	$kJ\ mol^{-1}$	$kJ\ mol^{-1}K^{-1}$	
0.041	28.95	0.110	323.6	440	0.041	28.85	0.107	301.8
0.044	31.20	0.116	257.3	460	0.043	31.03	0.112	240.3
0.047	33.61	0.125	204.6	480	0.046	33.35	0.120	191.5
0.050	36.20	0.136	162.60	500	0.049	35.83	0.128	152.7
0.054	39.04	0.149	128.95	520	0.053	38.51	0.140	121.6
0.059	42.19	0.166	101.93	540	0.057	41.43	0.153	96.64
0.065	45.71	0.187	80.18	560	0.062	44.65	0.169	76.56
0.072	49.71	0.215	62.64	580	0.068	48.22	0.189	60.38
0.082	54.37	0.252	48.49	600	0.076	52.23	0.213	47.32
0.095	59.92	0.306	37.08	620	0.086	56.79	0.244	36.79
0.113	66.77	0.385	27.88	640	0.099	62.06	0.284	28.31
0.140	75.61	0.506	20.47	660	0.116	68.22	0.334	21.51
0.184	87.32	0.669	14.54	680	0.141	75.46	0.389	16.07
0.254	101.74	0.721	9.884	700	0.175	83.61	0.415	11.78
0.343	111.60	0.112	6.461	720	0.219	91.25	0.315	8.473
0.389	103.33	-0.860	4.305	740	0.264	94.55	-0.023	6.060
0.370	83.55	-0.980	3.139	760	0.292	89.79	-0.431	4.434
0.332	66.73	-0.691	2.519	780	0.294	79.09	-0.588	3.416
0.300	55.53	-0.445	2.162	800	0.280	67.81	-0.519	2.792
0.255	41.87	-0.157	1.725	850	0.240	49.45	-0.236	2.041
0.245	38.81	-0.064	1.530	900	0.219	41.53	-0.100	1.727
0.230	35.05	-0.019	1.421	950	0.208	38.19	-0.041	1.561
0.228	34.66	0.001	1.352	1000	0.204	36.95	-0.012	1.461

P = 80 MPa					P = 100 MPa			
V_2	H_2	Cp_2	ϕ_2	T	V_2	H_2	Cp_2	ϕ_2
$dm^3\ mol^{-1}$	$kJ\ mol^{-1}$	$kJ\ mol^{-1}K^{-1}$		K	$dm^3\ mol^{-1}$	$kJ\ mol^{-1}$	$kJ\ mol^{-1}K^{-1}$	
0.040	28.71	0.102	281.9	440	0.038	28.64	0.097	279.1
0.042	30.78	0.105	225.0	460	0.040	30.61	0.101	223.0
0.044	32.95	0.112	180.0	480	0.043	32.66	0.105	178.8
0.047	35.24	0.117	144.1	500	0.045	34.81	0.110	143.8
0.050	37.67	0.125	115.55	520	0.048	37.06	0.115	115.78
0.053	40.27	0.135	92.62	540	0.051	39.44	0.122	93.37
0.057	43.06	0.145	74.17	560	0.054	41.95	0.129	75.35
0.062	46.06	0.156	59.30	580	0.058	44.59	0.136	60.82
0.068	49.30	0.168	47.30	600	0.062	47.37	0.142	49.08
0.075	52.78	0.181	37.60	620	0.067	50.27	0.148	39.57
0.083	56.52	0.194	29.78	640	0.073	53.29	0.153	31.89
0.093	60.52	0.206	23.48	660	0.080	56.40	0.157	25.67
0.105	64.74	0.215	18.42	680	0.088	59.53	0.156	20.65
0.119	69.06	0.215	14.385	700	0.097	62.62	0.151	16.60
0.137	73.19	0.194	11.193	720	0.107	65.52	0.138	13.36
0.156	76.58	0.138	8.701	740	0.118	68.06	0.114	10.777
0.176	78.39	0.036	6.794	760	0.129	69.97	0.075	8.730
0.193	77.80	-0.096	5.372	780	0.141	70.97	0.023	7.123
0.204	74.65	-0.211	4.340	800	0.151	70.83	-0.038	5.876
0.205	61.53	-0.261	2.883	850	0.166	65.61	-0.153	3.891
0.192	50.97	-0.160	2.239	900	0.166	57.61	-0.152	2.888
0.181	45.04	-0.084	1.912	950	0.161	51.19	-0.103	2.356
0.175	42.07	-0.040	1.723	1000	0.156	47.16	-0.060	2.049

APPENDIX B. The FORTRAN Code for the Model Parameters

The FORTRAN programs used for the generation of the tables and the calculation of the various properties are those described in ref. 5 with the following changes to DATA statements:

In the subroutine BLOCKDATA use the following lines in place of the similar lines from the listing:

```
      DATA PH0,FTT,FVV,PHC,THC/1.253D0,0.978D0,1.233D0,.067D0,-.124D0/
      DATA PHD,PHT,THD,THT/-0.125D0,-0.051D0,-.012D0,.018D0/

      DATA TI1,PI1,DI1/126.20D0,3.400D0,311.D0/
     *, WM0,WM1,R/18.0152D0,28.01D0,8.31441D0/, Z0/.317763D0/
```

In the subroutine FZ1 use the following DATA statement to define the parameters of the ideal gas properties of N2:

```
      DATA A0/ 0.576564D0,-8.26099D0,-1.291303D0/
```

The rather simplified program should not be used blindly since accurate information is not available as to the location of phase boundaries.

The phase for which calculations will be made is determined by the initial guess for the densities.

*U.S. G.P.O.:1993-341-832:81070

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