CHAPTER 14

Polymer–Solvent Interaction Parameter χ

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Many thermodynamic properties of polymer solutions such as solubilities, swelling equilibria, and the colligative properties can be expressed in terms of the polymer-solvent interaction parameter χ. This unitless quantity was originally introduced by P. J. Flory [1] and M. L. Huggins [2] as an exchange interaction parameter in their lattice model of polymer solutions. In their definition, the quantity $kT\chi$ (k is the Boltzmann constant; T, the absolute temperature) is the average change in energy when a solvent molecule is transferred from pure solvent to pure, amorphous polymer. The reader is referred to Flory [3] for details. However, as explained in the following section, for this compilation χ is defined empirically, independent of the Flory–Huggins or any other model.

Values of χ have been collected in the table below for binary mixtures of homopolymers and low molecular weight liquids. Interaction parameters for systems with two polymeric components, i.e., polymer blends, can be found in Chapter 19. Other tabulations of χ are available [119,120,136].

14.1 DEFINITION

The change in the Gibbs free energy for mixing two components at constant temperature T and pressure P depends on the heat ΔH_{mix} and entropy ΔS_{mix} of mixing through the general thermodynamic relation

$$\Delta G_{\text{mix}} = \Delta H_{\text{mix}} - T\Delta S_{\text{mix}}. \qquad (14.1)$$

In the case of n_2 moles of an amorphous polymer dissolving in n_1 moles of solvent, the combinatorial contribution to the entropy of mixing [1–3] is

$$\Delta S_{\text{mix}}^{(\text{comb})} = -R(n_1 \ln \phi_1 + n_2 \ln \phi_2). \qquad (14.2)$$

Here, R is the gas constant and ϕ_1 and ϕ_2 are the volume fractions of solvent and polymer, respectively, in the resulting solution. The volume fraction of polymer can be expressed in terms of the weight fraction w_2 of polymer and densities ρ_1 and ρ_2 of the pure components:

$$\phi_2 = 1 - \phi_1 = \frac{w_2 \rho_1}{\rho_2 + w_2(\rho_1 - \rho_2)}. \qquad (14.3)$$

That part of ΔG_{mix} that exceeds the contribution from the combinatorial entropy, namely,

$$\Delta G_{\text{mix}}^{\text{R}} = \Delta G_{\text{mix}} - (-T\Delta S_{\text{mix}}^{(\text{comb})}), \qquad (14.4)$$

is the residual free energy [4].

Many thermodynamic properties of interest can be directly related to the change that the chemical potential of the solvent undergoes on mixing,

$$\mu_1 - \mu_1^0 = \left(\frac{\partial \Delta G_{\text{mix}}}{\partial n_1}\right)_{T,P,n_2} \qquad (14.5)$$

Differentiation of Eq. (14.4) with respect to n_1 yields the residual chemical potential,

$$(\mu_1 - \mu_1^0)^R = (\mu_1 - \mu_1^0) - RT[\ln(1-\phi_2) + \phi_2(1 - 1/x)], \qquad (14.6)$$

where x is the ratio of the molar volume of polymer to that of solvent:

$$x = \frac{\rho_1 M_2}{\rho_2 M_1}. \qquad (14.7)$$

M_1 and M_2 are the (number-average) molecular weights. The unitless interaction parameter χ is defined for this compilation as a reduced residual chemical potential using Eq. (14.6):

$$\chi = \frac{(\mu_1 - \mu_1^0)^R}{\phi_2^2 RT} = \frac{(\mu_1 - \mu_1^0)}{\phi_2^2 RT} - \frac{\ln(1-\phi_2) + \phi_2(1 - 1/x)}{\phi_2^2}. \qquad (14.8)$$

14.2 METHODS OF MEASUREMENT

Most of the entries in the table below were obtained from osmotic pressure, vapor sorption, or inverse gas chromatography measurements [5].

Osmotic pressure measurements can be used to evaluate χ at small volume fractions of polymer. The osmotic pressure Π of a solution relative to pure solvent is related to the chemical potential and, with Eq. (14.8), to χ through the thermodynamic expression

$$\mu_1 - \mu_1^0 = -\Pi V_1, \qquad (14.9)$$

where V_1 is the molar volume of solvent. The interaction parameter in the limit of infinite dilution can also be determined from the second virial coefficient A_2, i.e., the slope of a plot of Π/RTc_2 versus the concentration $c_2 = \rho_2\phi_2$ (i.e., mass of polymer per volume of solution) at $c_2 = 0$:

$$\chi = \frac{1}{2} - A_2 V_1 \rho_2^2. \qquad (14.10)$$

Vapor sorption studies yield values of χ for solutions at intermediate-to-high polymer concentrations. The vapor pressure P_1 of solvent above a polymer solution relative to that of pure solvent P_1^0 at the same temperature is

$$(\mu_1 - \mu_1^0) = RT \ln \frac{P_1}{P_1^0}. \qquad (14.11)$$

Substitution for $(\mu_1 - \mu_1^0)$ in Eq. 14.8 from Eq. 14.11 yields χ.

Inverse gas chromatography can be used to obtain the polymer-solvent interaction parameter in the limit of $\phi_2 = 1$. Here χ is found from the retention volume of the low molecular-weight component in the vapor phase as it is eluted over the polymer which is the stationary component in a gas-phase chromatography experiment.

The Flory Θ-temperature affords another means of determining the interaction parameter. The Θ-temperature is defined [3] such that at $T = \Theta$ and $\phi_2 = 0$, $\chi = 1/2$. Θ-temperatures are tabulated in Chapter 15.

14.3 GENERAL FEATURES AND SIGNIFICANCE

For many systems, χ has been found to increase with polymer concentration and decrease with temperature with a dependence that is approximately linear with, but in general not proportional to, $1/T$. According to Eqs. 14.5 and 14.8, for a given volume fraction ϕ_2 of polymer, the smaller the value of χ, the greater the rate at which the free energy of the solution decreases with the addition of solvent. Consequently, liquids with the smallest χ's are usually the best solvents for a polymer. Negative values of χ often indicate strong polar attractions between polymer and solvent. Solutions for which χ increases with increasing temperature at constant ϕ_2 have a negative partial molar heat of mixing, $(\partial \Delta H_{\mathrm{mix}}/\partial n_1)_{P,T,n_2} < 0$, i.e., the addition of a small quantity of solvent to a solution is exothermic. In the limit of infinite molecular-weight polymer, $\chi = 1/2$ at the critical solution temperature which occurs at $\phi_2 \to 0$ and $T = \Theta$.

The interaction parameters tabulated in Table 14.1 have been collected either directly from the sources cited or from an earlier compilation [5]. For some entries, a range of χ values is given, representing measurements made over a range of temperatures or concentrations. In these cases, the first value in the range of χ's corresponds to the first temperature or concentration in the range of temperatures or concentrations, with χ varying monotonically between the extremes. For example, in the system poly(dimethyl siloxane)+benzene at 20 °C [6], χ is reported as "0.64–0.85" for ϕ_2 between 0.4 and 1 to indicate that $\chi = 0.64$ at $\phi_2 = 0.4$ and $\chi = 0.85$ at $\phi_2 = 1$.

The polymer–solvent interaction parameter is only slightly sensitive to the molecular weight provided that the molecular weight is high. Thus, studies using only low molecular weight polymers have not been used for the table. In those cases in which measurements were made with polymers of different molecular weights, only the results for the highest molecular weight material are reported in Table 14.1.

Measurements on dilute solutions, especially osmotic pressure measurements, can yield unusually accurate values for χ. These entries are recorded to the thousandth place. At the other extreme, the experimental uncertainty in χ is large for the larger values of χ obtained, for example, in inverse gas chromatography at $\phi_2 \to 1$; these entries are written to the nearest tenth.

The values of χ found in Table 14.1 were obtained using the volume fraction ϕ_2 as the measure of polymer concentration, consistent with Eq. 14.8. However, instead of χ, many of the studies cited in the table reported χ_{wt} or χ^*, interaction parameters which are based on the weight fraction (particularly in connection with inverse gas chromatographic studies) or the segment fraction (using the model of Flory for polymer solutions [137]), respectively. Since both χ_{wt} and χ^* differ from the volume-fraction based χ, these interaction parameters have been recalculated using Eq. 14.8 for Table 14.1 to give χ. Thus, for example, in the case of inverse gas chromatography, $\chi = \chi_{\mathrm{wt}} + \ln(\rho_1/\rho_2)$ in the limit $\phi_2 \to 1$, where ρ_1/ρ_2 is the ratio of the density of the solvent and to that of the liquid (as opposed to glassy or crystalline) polymer.

Related information can be found in Chapters 15–17, and 19.

TABLE 14.1. *Interaction parameters.*

Solvent	Temperature (°C)	Volume fraction, ϕ_2	χ	References
Cellulose acetate, 2.3 acetate groups per residue				
acetone	25 to 45	0	0.44	[7–9]
acetic acid	25 to 45	0	0.40	[9]
aniline	25 to 35	0	0.375 to 0.34	[7–9]
1,4-dioxane	25 to 45	0	0.38	[7–9]
methyl acetate	25 to 35	0	0.45	[7–9]
nitromethane	25 to 45	0	0.43	[7–9]
2-picoline	25	0	0.36	[7]
3-picoline	25	0	0.285	[7]
4-picoline	25	0	0.26	[7]
pyridine	25 to 45	0	0.28	[7–9]
Cellulose acetate, 2.5 acetate groups per residue				
acetone	30	0.2 to 0.4	0.30 to 0.51	[10]
1,4-dioxane	30	0.2 to 0.4	0.31 to 0.51	[10]
methyl acetate	30	0.2 to 0.4	0.43 to 0.59	[10]
pyridine	30	0.2 to 0.4	0.07 to 0.09	[10]
tetrahydrofuran	13	0	0.442	[11]
Cellulose acetate, 3.0 acetate groups per residue				
chloroform	25	0	0.34	[12]
	30	0.2 to 0.6	0.36 to 0.51	[13]
dichloromethane	25	0 to 0.6	0.3 to 0.49	[13]
Cellulose nitrate, 2.4 nitrate groups per residue				
acetone	25	0	0.27	[7]
	30	0 to 0.2	0.24 to 0.05	[10]
amyl acetate	25	0	0.02	[7]
2-butanone	25	0	0.21	[7]
butyl acetate	25	0	0.015	[7]
ethyl acetate	25	0	0.22	[7]
2-heptanone	25	0	0.02	[7]
2-hexanone	25	0	0.15	[7]
methyl acetate	25	0	0.30	[7]
	30	0 to 0.2	0.17 to −0.06	[10]
2-octanone	25	0	0.16	[7]
propyl acetate	25	0	0.13	[7]
Cellulose nitrate, 2.6 nitrate groups per residue				
acetone	20	0.2 to 0.8	0.14 to −1.24	[14]
acetonitrile	20	0.4 to 1	0.59 to −0.1	[14]
cyclopentanone	20	0.2 to 0.8	0.42 to −2.4	[14]
2,4-dimethyl-3-pentanone	20	0.2 to 0.6	0.62 to −1.7	[14]
1,4-dioxane	20	0.4 to 0.8	1.2 to −1.7	[14]
ethyl acetate	20	0.2 to 0.6	0.04 to −1.35	[15]
ethyl formate	20	0.2 to 0.8	−0.08 to −3.2	[15]
ethyl *n*-propyl ether	20	0.8	1.20	[14]
isoamyl acetate	20	0.2 to 0.6	−0.89 to −3.3	[15]
3-methylbutanone	20	0.2 to 0.6	−0.5 to −1.6	[14]
nitromethane	20	0.2 to 0.8	0.66 to 0.45	[14]
pinacolone	20	0.2 to 0.8	0.16 to −3.7	[14]
propyl acetate	20	0.2 to 0.8	−0.38 to −4.1	[15]
Ethyl cellulose, 2.3 ethyl groups per residue				
acetone	25	0	0.46	[7]
benzene	25	0	0.48	[7]
n-butyl acetate	25	0	0.24	[7]
carbon tetrachloride	25	0	0.46	[7]
chloroform	25	0	0.34	[7]
ethyl acetate	25	0	0.395	[7]

TABLE 14.1. *Continued.*

Solvent	Temperature (°C)	Volume fraction, ϕ_2	χ	References
2-heptanone	25	0	0.38	[7]
methyl acetate	25	0	0.41	[7]
2-pentanone	25	0	0.37	[7]
n-pentyl acetate	25	0	0.28	[7]
n-propyl acetate	25	0	0.33	[7]
toluene	25	0	0.47	[7]
Hydroxypropyl cellulose				
acetone	25	0.60 to 0.90	0.58 to 0.83	[124]
ethanol	25	0.61 to 0.90	0.57 to 0.55	[124]
tetrahyrofuran	25	0.52 to 0.90	0.34 to 0.48	[124]
water	25	0 to 0.13	0.480 to 0.52	[122]
	25	0.51 to 1	0.63 to 1.55	[123]
	40	0 to 0.13	0.499 to 0.54	[122]
Polyacrylamide				
water	3	0.10	0.51	[111]
	25	0	0.495	[104]
	25	0.06	0.53	[109]
	60	0.08	0.49	[111]
0.2N HCl	20 to 61	0	0.499 to 0.491	[105]
Polyacrylonitrile				
dimethylformamide	14	0	0.2	[16]
Poly(*N*-acryloylpyrrolidine)				
ethanol	10 to 60	0.08	0.45	[111]
water	3	0.07	0.49	[111]
	30	0.12	0.53	[111]
	60	0.35	0.66	[111]
Poly(*cis*-1,4-butadiene)				
benzene	35	0.06 to 0.10	0.28	[125]
carbon tetrachloride	23.5	0.62 to 0.85	0.11 to 0.02	[106]
chloroform	23.5	0.60 to 0.80	−0.06 to −0.20	[106]
dichloromethane	23.5	0.69 to 0.85	0.32 to 0.21	[106]
cyclohexane	23.5	0.65 to 0.83	0.46 to 0.34	[106]
n-decane	35	0.16 to 0.23	0.46	[125]
n-hexadecane	35	0.26 to 0.30	0.54	[125]
n-hexane	23.5	0.67 to 0.88	0.61 to 0.45	[106]
n-octane	*ca.* 50	0.38 to 0.42	0.31 to 0.27	[108]
Polybutadiene, 10% *cis*, 21% *trans*, 69% vinyl				
acetone	40 to 100	1	1.64 to 1.32	[126]
acetonitrile	40 to 100	1	2.86 to 2.36	[126]
benzene	40 to 100	1	0.26 to 0.19	[126]
1-butanol	40 to 100	1	2.76 to 1.64	[126]
2-butanone	40 to 100	1	1.19 to 0.97	[126]
butyl acetate	40 to 100	1	0.52 to 0.44	[126]
butyronitrile	40 to 100	1	1.90 to 1.57	[126]
carbon tetrachloride	40 to 100	1	0.10 to 0.15	[126]
chloroform	40 to 100	1	0.05 to 0.07	[126]
1-chlorobutane	40 to 100	1	0.33 to 0.25	[126]
1-chloropentane	40 to 100	1	0.37 to 0.32	[126]
1-chloropropane	40 to 100	1	0.36 to 0.30	[126]
cyclohexane	40 to 100	1	0.22 to 0.15	[126]
ethanol	40 to 100	1	3.41 to 2.30	[126]
ethyl acetate	40 to 100	1	0.86 to 0.69	[126]
ethylcyclohexane	40 to 100	1	0.08 to 0.04	[126]
ethyl ether	40 to 100	1	0.42 to 0.40	[126]
n-heptane	40 to 100	1	0.36 to 0.31	[126]
1-heptene	40 to 100	1	0.25 to 0.23	[126]
n-hexane	40 to 100	1	0.37	[126]

TABLE 14.1. *Continued.*

Solvent	Temperature (°C)	Volume fraction, ϕ_2	χ	References
1-hexene	40 to 100	1	0.32 to 0.28	[126]
methanol	40 to 100	1	3.85 to 2.70	[126]
methyl acetate	40 to 100	1	1.14 to 0.92	[126]
methylcyclohexane	40 to 100	1	0.17 to 0.13	[126]
methyl isobutyl ketone	40 to 100	1	0.95 to 0.72	[126]
n-octane	40 to 100	1	0.34 to 0.28	[126]
1-octene	40 to 100	1	0.23 to 0.21	[126]
n-pentane	40 to 100	1	0.44 to 0.36	[126]
3-pentanone	40 to 100	1	0.82 to 0.67	[126]
1-propanol	40 to 100	1	2.97 to 1.97	[126]
2-propanol	40 to 100	1	2.93 to 1.86	[126]
proprionitrile	40 to 100	1	2.25 to 1.82	[126]
n-propyl acetate	40 to 100	1	0.67 to 0.55	[126]
n-propyl ether	40 to 100	1	0.51 to 2.26	[126]
tetrahydrofuran	40 to 100	1	0.35 to 0.29	[126]
toluene	40 to 100	1	0.14 to 0.12	[126]
Poly(1-butene)				
benzene	135	1	0.49	[17]
cyclohexane	135	1	0.20	[17]
n-decane	115 to 135	1	0.30	[17]
2,5-dimethylhexane	115 to 135	1	0.36	[17]
2,4-dimethylpentane	115 to 135	1	0.40	[17]
2,3-dimethylpentane	115 to 135	1	0.35	[17]
3-ethylpentane	115 to 135	1	0.34	[17]
n-heptane	115 to 135	1	0.38	[17]
2-methylhexane	115 to 135	1	0.39	[17]
3-methylhexane	115 to 135	1	0.38	[17]
n-nonane	115 to 135	1	0.32	[17]
n-octane	115 to 135	1	0.36	[17]
toluene	135	1	0.47	[17]
2,2,4-trimethylpentane	115 to 135	1	0.35	[17]
Poly(butylene adipate)				
acetone	120	1	0.54	[18]
benzene	120	1	0.27	[18]
2-butanone	120	1	0.43	[18]
carbon tetrachloride	120	1	0.55	[18]
chloroform	120	1	−0.06	[18]
dichloromethane	120	1	0.70	[18]
ethyl acetate	120	1	0.43	[18]
n-heptane	120	1	1.5	[18]
n-hexane	120	1	1.4	[18]
n-pentane	120	1	1.3	[18]
Poly(*n*-butyl methacrylate)				
ethanol	27	0 to 1	0.492 to 1.29	[118]
	86	0 to 1	0.399 to 0.95	[118]
2-propanol	40	0 to 1	0.509 to 1.4	[118]
	80	0 to 1	0.477 to 1.0	[118]
Poly(ε-caprolactone)				
acetone	100 to 120	1	0.46 to 0.54	[18, 19]
benzene	100 to 120	1	0.06 to 0.11	[18, 19]
	70 to 140	1	−0.04 to 0.01	[114]
n-butane	100	1	1.22	[19]
1-butanol	100	1	0.59	[19]
2-butanone	100 to 120	1	0.36 to 0.45	[18, 19]
n-butyl acetate	70 to 140	1	0.21 to 0.26	[114]
	100	1	0.31	[19]

TABLE 14.1. *Continued.*

Solvent	Temperature (°C)	Volume fraction, ϕ_2	χ	References
carbon tetrachloride	100 to 120	1	0.25 to 0.37	[18, 19]
chlorobenzene	100	1	−0.08	[19]
	80 to 140	1	−0.18 to −0.06	[114]
1-chlorobutane	100	1	0.33	[19]
chloroform	100 to 120	1	−0.40 to −0.22	[18, 19]
chloromethane	100	1	0.16	[19]
1-chloropentane	100	1	0.33	[19]
cycloheptane	100	1	0.83	[19]
cyclohexane	100	1	0.88	[19]
cyclohexene	100	1	0.60	[19]
cyclooctane	100	1	0.83	[19]
cyclopentane	100	1	0.82	[19]
n-decane	100	1	1.44	[19]
1, 1-dichloroethane	100	1	−0.04	[19]
1,2-dichloroethane	100	1	−0.14	[19]
dichloromethane	100	1	−0.26	[19]
1,4-dioxane	100	1	0.13	[19]
ethanol	100	1	1.01	[19]
ethyl acetate	100 to 120	1	0.36 to 0.42	[18, 19]
	70 to 140	1	0.32 to 0.29	[114]
ethylbenzene	100	1	0.16	[19]
	70 to 140	1	0.10 to 0.14	[114]
n-heptane	100 to 120	1	1.2	[18, 19]
n-hexane	100 to 120	1	1.2	[18, 19]
methyl acetate	100	1	0.39	[19]
	70 to 140	1	0.35 to 0.32	[114]
n-nonane	100	1	1.37	[19]
n-octane	100	1	1.30	[19]
n-pentane	100 to 120	1	1.2	[18, 19]
1-pentanol	100	1	0.46	[19]
2-pentyl acetate	70 to 140	1	0.40 to 0.28	[114]
propane	100	1	1.21	[19]
1-propanol	100	1	0.72	[19]
propyl acetate	100	1	0.33	[19]
	70 to 140	1	0.29 to 0.24	[114]
n-propylbenzene	90 to 140	1	0.20 to 0.19	[114]
2-propylbenzene	80 to 140	1	0.10 to 0.13	[114]
tetrahydrofuran	100	1	0.13	[19]
toluene	100	1	0.08	[19]
	70 to 140	1	−0.01 to 0.07	[114]
1,1,1-trichloroethane	100	1	0.07	[19]
trichloroethylene	100	1	0.02	[19]
n-undecane	100	1	1.52	[19]
Polycarbonate				
benzene	179 to 253	1	0.49 to 0.39	[121]
cyclohexane	179 to 253	1	1.23 to 0.77	[121]
n-decane	179 to 253	1	1.67 to 1.52	[121]
n-dodecane	179 to 253	1	1.74 to 1.46	[121]
ethylbenzene	179 to 253	1	0.49 to 0.47	[121]
ethylcyclohexane	179 to 253	1	1.12 to 0.92	[121]
n-heptane	179 to 253	1	1.73 to 1.34	[121]
n-hexadecane	211 to 253	1	1.73 to 1.57	[121]
n-hexane	179 to 231	1	1.87 to 1.19	[121]
methylcyclohexane	179 to 253	1	1.19 to 0.82	[121]
n-nonane	179 to 253	1	1.69 to 1.43	[121]

TABLE 14.1. *Continued.*

Solvent	Temperature (°C)	Volume fraction, ϕ_2	χ	References
n-octane	179 to 253	1	1.60 to 1.45	[121]
n-tetradecane	179 to 253	1	1.82 to 1.54	[121]
toluene	179 to 253	1	0.46 to 0.37	[121]
n-undecane	179 to 253	1	1.73 to 1.53	[121]
Polychloroprene				
acetone	100	1	0.87	[19]
benzene	100	1	0.18	[19]
n-butane	100	1	0.99	[19]
1-butanol	100	1	1.61	[19]
2-butanone	100	1	0.61	[19]
butyl acetate	100	1	0.44	[19]
carbon tetrachloride	100	1	0.23	[19]
chlorobenzene	100	1	0.10	[19]
1-chlorobutane	100	1	0.39	[19]
chloroform	100	1	0.28	[19]
chloromethane	100	1	0.52	[19]
1-chloropentane	100	1	0.33	[19]
cycloheptane	100	1	0.45	[19]
cyclohexane	100	1	0.55	[19]
cyclohexene	100	1	0.38	[19]
cyclooctane	100	1	0.40	[19]
cyclopentane	100	1	0.55	[19]
n-decane	100	1	0.94	[19]
1,1-dichloroethane	100	1	0.37	[19]
1,2-dichloroethane	100	1	0.48	[19]
dichloromethane	100	1	0.43	[19]
1,4-dioxane	100	1	0.46	[19]
ethanol	100	1	2.27	[19]
ethyl acetate	100	1	0.64	[19]
ethylbenzene	100	1	0.16	[19]
n-heptane	100	1	0.88	[19]
n-hexane	100	1	0.91	[19]
methyl acetate	100	1	0.81	[19]
n-nonane	100	1	0.92	[19]
n-octane	100	1	0.90	[19]
n-pentane	100	1	0.96	[19]
1-pentanol	100	1	1.41	[19]
propane	100	1	1.36	[19]
1-propanol	100	1	1.83	[19]
propyl acetate	100	1	0.51	[19]
tetrahydrofuran	100	1	0.06	[19]
1,1,1-trichloroethane	100	1	0.21	[19]
trichloroethylene	100	1	0.24	[19]
toluene	100	1	0.14	[19]
n-undecane	100	1	0.96	[19]
Poly(*o*-chlorostyrene)				
butyl acetate	30	0	0.490	[20]
chlorobenzene	30	0	0.472	[20]
toluene	30	0	0.470	[20]
Poly(*p*-chlorostyrene)				
butyl acetate	30	0	0.448	[20]
chlorobenzene	30	0	0.465	[20]
toluene	22	0.2 to 0.6	0.55	[21]
	30	0	0.489	[20]

TABLE 14.1. *Continued.*

Solvent	Temperature (°C)	Volume fraction, ϕ_2	χ	References
Poly(*N*, *N*-diethylacrylamide)				
ethanol	10 to 60	0.08	0.47	[111]
water	3	0.07	0.50	[111]
	30	0.05	0.62	[111]
	60	0.85	1.16	[111]
Poly(*N*,*N*-dimethylacrylamide)				
ethanol	10 to 60	0.08	0.40 to 0.41	[111]
water	3	0.07	0.48	[111]
	60	0.10	0.52	[111]
Poly(dimethyl siloxane)				
acetone	100	1	1.33	[19]
benzene	20	0.4 to 1	0.64 to 0.85	[6]
	25	0.2 to 1	0.56 to 0.82	[22–25]
	30	0.08 to 0.47	0.50 to 0.36	[116]
	30	0.88 to 1	0.745 to 0.759	[135]
	25 to 70	1	0.80 to 0.74	[25,26]
	40 to 100	1	0.79 to 0.58	[19,25]
n-butane	100	1	0.25	[19]
1-butanol	100	1	1.91	[19]
2-butanone	20	0.08 to 0.30	0.52 to 0.61	[27]
	25	0	0.50	[28]
	30	0.35 to 0.66	0.44 to 0.66	[138]
	50	0.08 to 0.29	0.50 to 0.58	[27]
butyl acetate	100	1	0.68	[19]
carbon dioxide ($20 < P < 62$ bar)	35	0.78 to 0.94	0.75	[117]
carbon dioxide ($P = 300$ bar)	45	0.67	0.45	[115]
carbon tetrachloride	100	1	0.36	[19]
chlorobenzene	20	0 to 0.2	0.475 to 0.54	[29]
	60	0 to 0.2	0.455 to 0.52	[29]
	100	1	0.76	[19]
1-chlorobutane	100	1	0.49	[19]
chloroform	100	1	0.60	[19]
chloromethane	100	1	0.44	[19]
1-chloropentane	100	1	0.48	[19]
cycloheptane	25 to 70	1	0.56 to 0.53	[26]
	100	1	0.42	[19]
cyclohexane	20	0 to 0.2	0.409 to 0.44	[29]
	25	0.2 to 0.6	0.46 to 0.50	[23]
	25 to 70	1	0.48	[26]
	30	0.35 to 0.95	0.42	[22]
	100	1	0.35	[19]
cyclohexene	100	1	0.36	[19]
cyclooctane	25 to 70	1	0.66 to 0.61	[26]
	100	1	0.50	[19]
cyclopentane	25 to 70	1	0.42 to 0.46	[26]
	100	1	0.28	[19]
n-decane	100	1	0.51	[19]
1,1-dichloroethane	100	1	0.60	[19]
1,2-dichloroethane	100	1	0.96	[19]
dichloromethane	100	1	0.69	[19]
2,6-dimethyl-4-heptanone	35	0.08 to 0.22	0.45 to 0.49	[27]
1,4-dioxane	25 to 70	1	1.32 to 1.18	[26]
	100	1	1.06	[19]

TABLE 14.1. *Continued.*

Solvent	Temperature (°C)	Volume fraction, ϕ_2	χ	References
ethyl acetate	100	1	0.82	[19]
ethanol	100	1	2.6	[19]
ethylbenzene	24	0.4 to 1	0.54 to 0.77	[6]
	25 to 70	1	0.83 to 0.78	[25]
	25 to 70	1	0.77 to 0.73	[26]
	100	1	0.62	[19]
n-heptane	20	0.4 to 1	0.46	[6]
	35	0.06 to 0.19	0.42	[30]
	50	0.06 to 0.16	0.43	[30]
	25 to 70	1	0.49	[25,26]
	100	1	0.35	[19]
3-heptanone	35	0.08 to 0.29	0.48 to 0.56	[27]
	50	0.08 to 0.26	0.47 to 0.53	[27]
hexamethyldisiloxane	23	0.4 to 1	0.30 to 0.25	[6]
	25 to 70	1	0.28 to 0.34	[26]
n-hexane	20	0.03 to 0.17	0.39 to 0.37	[30]
	30	0.86 to 1	0.387 to 0.397	[135]
	50	0.06 to 0.11	0.41	[30]
	25 to 70	1	0.46	[25,26]
	100	1	0.30	[19]
mesitylene	25 to 70	1	0.95 to 0.86	[26]
methyl acetate	100	1	1.01	[19]
2-methylbutane	25	1	0.39	[25]
	100	1	1.10	[19]
2-methylheptane	25 to 70	1	0.50	[25,26]
2-methylhexane	25 to 70	1	0.45	[25,26]
3-methylhexane	25 to 70	1	0.44	[26]
2-methylpentane	25 to 70	1	0.44	[25]
4-methyl-2-pentanone	20	0.10 to 0.22	0.49 to 0.55	[27]
	35	0.09 to 0.24	0.48 to 0.53	[27]
n-nonane	20	0.07 to 0.21	0.48 to 0.49	[30]
	50	0.07 to 0.21	0.46 to 0.49	[30]
	100	1	0.45	[19]
octamethylcyclotetrasiloxane	25	0.10 to 0.17	0.31 to 0.37	[31]
octamethyltrisiloxane	23	0.4 to 1	0.22 to 0.14	[6]
n-octane	20	0.4 to 1	0.50	[6]
	20	0.05 to 0.21	0.45 to 0.46	[30]
	50	0.06 to 0.19	0.43 to 0.45	[30]
	25 to 100	1	0.56 to 0.40	[19,25]
n-pentane	20	0.4 to 1	0.43 to 0.40	[6]
	25 to 70	1	0.42	[25]
	25 to 70	1	0.45 to 0.49	[26]
	100	1	0.31	[19]
1-pentanol	100	1	1.75	[19]
propane	100	1	0.21	[19]
1-propanol	100	1	2.06	[19]
propyl acetate	100	1	0.72	[19]
tetrahydrofuran	100	1	0.48	[19]
toluene	20	0 to 1	0.445 to 0.82	[6,29]
	25 to 70	1	0.80 to 0.75	[25]
	25 to 70	1	0.75 to 0.71	[26]
	100	1	0.59	[19]
	30	0.07 to 0.45	0.47 to 0.57	[116]

TABLE 14.1. *Continued.*

Solvent	Temperature (°C)	Volume fraction, ϕ_2	χ	References
1,1,1-trichloroethane	100	1	0.37	[19]
trichloroethylene	100	1	0.53	[19]
2,2,4-trimethylpentane	25 to 70	1	0.44	[25,26]
n-undecane	100	1	0.58	[19]
m-xylene	25 to 70	1	0.82 to 0.76	[26]
o-xylene	25 to 70	1	0.86 to 0.80	[26]
p-xylene	25	0.6 to 1	0.58 to 0.78	[6]
	25 to 70	1	0.80 to 0.77	[25,26]
Poly(1,3-dioxocane)				
tetrahydrofuran	25	0	0.38	[128]
toluene	25	0	0.37	[112]
Polyepichlorohydrin				
acetone	100	1	0.28	[19]
benzene	100	1	0.25	[19]
n-butane	100	1	1.65	[19]
1-butanol	100	1	1.12	[19]
2-butanone	100	1	0.20	[19]
butyl acetate	100	1	0.36	[19]
carbon tetrachloride	100	1	0.69	[19]
chlorobenzene	100	1	0.24	[19]
1-chlorobutane	100	1	0.62	[19]
chloroform	100	1	0.25	[19]
chloromethane	100	1	0.36	[19]
1-chloropentane	100	1	0.65	[19]
cycloheptane	100	1	1.19	[19]
cyclohexane	100	1	1.25	[19]
cyclohexene	100	1	0.84	[19]
cyclooctane	100	1	1.20	[19]
cyclopentane	100	1	1.16	[19]
n-decane	100	1	2.12	[19]
1,1-dichloroethane	100	1	0.33	[19]
1,2,-dichloroethane	100	1	0.20	[19]
dichloromethane	100	1	0.18	[19]
1,4-dioxane	100	1	0.04	[19]
ethanol	100	1	1.58	[19]
ethyl acetate	100	1	0.35	[19]
ethylbenzene	100	1	0.44	[19]
n-heptane	100	1	1.79	[19]
n-hexane	100	1	1.72	[19]
methyl acetate	100	1	0.39	[19]
n-nonane	100	1	1.99	[19]
n-octane	100	1	1.89	[19]
n-pentane	100	1	1.64	[19]
1-pentanol	100	1	1.03	[19]
propane	100	1	1.71	[19]
1-propanol	100	1	1.22	[19]
propyl acetate	100	1	0.33	[19]
tetrahydrofuran	100	1	0.01	[19]
1, 1, 1-trichloroethane	100	1	0.46	[19]
trichloroethylene	100	1	0.53	[19]
toluene	100	1	0.31	[19]
n-undecane	100	1	2.24	[19]

TABLE 14.1. *Continued.*

Solvent	Temperature (°C)	Volume fraction, ϕ_2	χ	References
Poly(*N*-ethylacrylamide)				
ethanol	10 to 60	0.08	0.39 to 0.40	[111]
water	3	0.05	0.42	[111]
	30	0.06	0.46	[111]
	60	0.10	0.51	[111]
Polyethylene, low density				
benzene	125 to 135	1	0.43 to 0.36	[32,33]
1-butanol	135	1	1.38	[32]
carbon tetrachloride	135	1	0.24	[32]
chlorobenzene	135	1	0.34	[32]
1-chlorobutane	135	1	0.44	[32]
chloroform	135	1	0.41	[32]
cyclohexane	125 to 135	1	0.18	[32,33]
cyclohexanol	135	1	1.22	[32]
cis-decahydronaphthalene	120 to 145	1	0.03	[34]
trans-decahydronaphthalene	120 to 145	1	0.01	[34]
n-decane	120 to 145	1	0.25 to 0.29	[32,34]
2,4-dimethylhexane	120 to 145	1	0.33	[34]
2,5-dimethylhexane	120 to 145	1	0.35	[34]
3,4-dimethylhexane	120 to 145	1	0.25	[34]
n-dodecane	110 to 145	1	0.18	[35]
	120 to 145	1	0.24	[34]
ethylbenzene	120 to 145	1	0.33	[34]
n-heptane	109	0.2 to 0.6	0.29 to 0.34	[36]
mesitylene	120 to 145	1	0.24	[34]
3-methylheptane	120 to 145	1	0.30	[34]
3-methylhexane	120 to 145	1	0.34	[34]
n-nonane	120 to 145	1	0.28	[32,34]
n-octane	120 to 145	1	0.30	[34]
1-octene	135	1	0.31	[32]
2-pentanone	135	1	0.88	[32]
phenol	135	1	1.5	[32]
1,2,3,4-tetrahydronaphthalene	105	0	0.495	[37]
	120 to 145	1	0.28	[34]
toluene	120 to 145	1	0.34	[34]
2,2,4-trimethylhexane	120 to 145	1	0.28	[34]
2,2,4-trimethylpentane	120 to 145	1	0.34	[34]
m-xylene	120 to 145	1	0.29	[34]
p-xylene	81	0	0.45	[38]
	120 to 145	1	0.28	[34]
xylene	73 to 92	0	0.49	[39,40]
Polyethylene, high density				
cis-decahydronaphthalene	149	1	0.07	[34]
trans-decahydronapthalene	149	1	0.05	[34]
n-decane	145 to 190	1	0.18	[35]
	149	1	0.31	[34]
	185	1	0.12	[41]
2,4-dimethylhexane	149	1	0.38	[34]
2,5-dimethylhexane	149	1	0.40	[34]
3,4-dimethylhexane	149	1	0.31	[34]
n-dodecane	149	1	0.28	[34]
ethylbenzene	149	1	0.37	[34]
mesitylene	149	1	0.28	[34]
2-methylheptane	149	1	0.39	[34]
3-methylhexane	149	1	0.40	[34]
n-nonane	149	1	0.34	[34]
n-octane	149	1	0.36	[34]

TABLE 14.1. *Continued.*

Solvent	Temperature (°C)	Volume fraction, ϕ_2	χ	References
1,2,3,4-tetrahydronaphthalene	149	1	0.32	[34]
toluene	149	1	0.39	[34]
2,2,4-trimethylhexane	149	1	0.35	[34]
2,2,4-trimethylpentane	149	1	0.40	[34]
m-xylene	149	1	0.34	[34]
o-xylene	110	0	0.31	[37]
p-xylene	105	0	0.22	[37]
	149	1	0.32	[34]
xylene	85	0	0.34	[39]
Poly(ethylene adipate)				
acetone	120	1	0.53	[18]
benzene	120	1	0.58	[18]
2-butanone	120	1	0.88	[18]
carbon tetrachloride	120	1	0.88	[18]
chloroform	120	1	0.29	[18]
dichloromethane	120	1	0.96	[18]
ethyl acetate	120	1	0.55	[18]
n-heptane	120	1	2.1	[18]
n-hexane	120	1	2.0	[18]
n-pentane	120	1	1.8	[18]
Poly(ethylene oxide)				
acetone	100	1	0.47	[19]
benzene	50	0.2 to 0.6	0.18 to 0.10	[42]
	70	0.2 to 0.8	0.19 to 0.09	[42]
	100	1	0.13	[19]
n-butane	100	1	1.64	[19]
1-butanol	100	1	0.41	[19]
2-butanone	100	1	0.43	[19]
butyl acetate	100	1	0.48	[19]
carbon tetrachloride	100	1	0.38	[19]
chlorobenzene	100	1	−0.04	[19]
1-chlorobutane	100	1	0.57	[19]
chloroform	100	1	−0.55	[19]
chloromethane	100	1	0.12	[19]
1-chloropentane	100	1	0.63	[19]
cycloheptane	100	1	1.23	[19]
cyclohexane	100	1	1.23	[19]
cyclohexene	100	1	0.85	[19]
cyclooctane	100	1	1.26	[19]
cyclopentane	100	1	1.12	[19]
n-decane	100	1	2.10	[19]
1,1-dichloroethane	100	1	−0.04	[19]
1,2-dichloroethane	100	1	−0.31	[19]
dichloromethane	100	1	−0.51	[19]
1,4-dioxane	100	1	0.20	[19]
ethanol	100	1	0.70	[19]
ethyl acetate	100	1	0.39	[19]
ethylbenzene	100	1	0.40	[19]
n-heptane	100	1	1.75	[19]
n-hexane	100	1	1.70	[19]
methyl acetate	100	1	0.36	[19]
n-nonane	100	1	1.97	[19]
n-octane	100	1	1.85	[19]
n-pentane	100	1	1.66	[19]
1-pentanol	100	1	0.34	[19]
propane	100	1	2.17	[19]

TABLE 14.1. *Continued.*

Solvent	Temperature (°C)	Volume fraction, ϕ_2	χ	References
1-propanol	100	1	0.47	[19]
propyl acetate	100	1	0.43	[19]
tetrahydrofuran	100	1	0.30	[19]
1,1,1-trichloroethane	100	1	0.20	[19]
trichloroethylene	100	1	0.08	[19]
toluene	100	1	0.26	[19]
n-undecane	100	1	2.22	[19]
Poly(ethylene succinate)				
acetone	120	1	0.61	[18]
benzene	120	1	0.79	[18]
2-butanone	120	1	0.69	[18]
carbon tetrachloride	120	1	1.32	[18]
chloroform	120	1	0.49	[18]
dichloromethane	120	1	1.09	[18]
ethyl acetate	120	1	0.70	[18]
n-heptane	120	1	1.9	[18]
n-hexane	120	1	1.9	[18]
n-pentane	120	1	2.6	[18]
Poly(hexamethylene sebacate)				
acetone	120	1	0.82	[18]
benzene	120	1	0.21	[18]
2-butanone	120	1	0.58	[18]
carbon tetrachloride	120	1	0.37	[18]
chloroform	120	1	0.06	[18]
dichloromethane	120	1	0.81	[18]
ethyl acetate	120	1	0.57	[18]
n-heptane	120	1	1.0	[18]
n-hexane	120	1	1.2	[18]
n-pentane	120	1	1.1	[18]
Poly(2-hydroxyethyl methacrylate)				
di(ethylene glycol)	25	0 to 0.35	0.49 to 0.40	[43]
Poly(4-hydroxystyrene)				
acetone	170 to 190	1	0.25 to 0.58	[110]
2-butanone	170 to 190	1	0.52 to 0.62	[110]
n-butyl acetate	170 to 190	1	1.47 to 1.20	[110]
chlorobenzene	190	1	1.99	[110]
dioxane	190	1	−0.03	[110]
ethyl acetate	170 to 190	1	1.06 to 1.07	[110]
2-methyl-1-propanol	190	1	1.10	[110]
3-pentanone	170 to 190	1	1.08 to 0.76	[110]
1-propanol	190	1	1.01	[110]
2-propanol	170 to 190	1	0.96 to 0.84	[110]
n-propyl acetate	170 to 190	1	1.22 to 1.10	[110]
tetrahydrofuran	170 to 190	1	0.21 to 0.27	[110]
toluene	170 to 190	1	2.20 to 2.22	[110]
Polyisobutylene				
acetone	100	1	1.90	[44]
benzene	10	0.4 to 0.8	0.67 to 0.92	[45]
	25	0 to 1	0.498 to 1.06	[45–47]
	25 to 65	1	0.88 to 0.61	[48–51]
	27	0.6 to 1	0.73 to 1.07	[52]
	30	0	0.495	[53]
	40	0.6 to 0.8	0.70 to 0.80	[45]
	50	0 to 0.2	0.485 to 0.583	[47]
	100	1	0.70	[44]
	37 to 200	1	1.18 to 0.70	[107]
n-butane	25 to 46	1	0.66	[54]

TABLE 14.1. *Continued.*

Solvent	Temperature (°C)	Volume fraction, ϕ_2	χ	References
	100	1	0.65	[44]
1-butanol	100	1	2.45	[44]
2-butanone	100	1	1.55	[44]
butyl acetate	100	1	1.06	[44]
carbon tetrachloride	100	1	0.48	[44]
	23.5	0.76 to 0.87	0.54	[130]
chlorobenzene	100	1	0.70	[44]
1-chlorobutane	100	1	0.68	[44]
chloroform	100	1	0.78	[44]
	23.5	0.82 to 0.91	0.67	[130]
chloromethane	100	1	0.91	[44]
1-chloropentane	100	1	0.59	[44]
cycloheptane	100	1	0.29	[44]
cyclohexane	8	0.2	0.437	[47]
	25	0 to 1	0.43	[46,51,55]
	25 to 65	1	0.55 to 0.40	[48–51]
	30	0 to 0.2	0.44	[47,53]
	100	1	0.39	[44]
	23.5	0.75 to 0.86	0.38	[130]
cyclohexene	100	1	0.40	[44]
cyclooctane	100	1	0.24	[44]
cyclopentane	100	1	0.41	[44]
	23.5	0.79 to 0.86	0.32 to 0.27	[130]
n-decane	100	1	0.48	[44]
1,1-dichloroethane	100	1	0.87	[44]
1,2-dichloroethane	100	1	1.13	[44]
dichloromethane	100	1	1.00	[44]
2,2-dimethylbutane	23.5	0.71 to 0.85	0.49 to 0.46	[130]
2,2-dimethylpropane	25 to 46	1	0.82 to 0.87	[54]
	35	0.8	0.82	[54]
1,4-dioxane	100	1	1.26	[44]
ethanol	100	1	3.3	[44]
ethyl acetate	100	1	1.35	[44]
ethyl benzene	100	1	0.59	[44]
n-heptane	25 to 65	1	0.57 to 0.47	[48,49]
	100	1	0.53	[44]
	23.5	0.80 to 0.87	0.51	[130]
n-hexane	25 to 65	1	0.65 to 0.50	[48,49]
	100	1	0.56	[44]
methyl acetate	100	1	1.55	[44]
2-methylbutane	25 to 35	0.8	0.65	[54]
	35 to 46	1	0.65 to 0.68	[54]
2-methylpropane	25 to 46	1	0.78 to 0.70	[54]
n-nonane	25	1	0.49	[49]
	100	1	0.49	[44]
n-octane	25	0.2 to 0.4	0.44 to 0.48	[56]
	25 to 65	1	0.52 to 0.43	[48,49]
	100	1	0.50	[44]
n-pentane	25	0 to 1	0.48 to 0.75	[48,49,51,54,57,58]
	35	0.4 to 1	0.62	[54,57]
	40	0 to 0.4	0.49 to 0.57	[57]
	40 to 65	1	0.61 to 0.57	[48,51,54]
	55	0.6 to 0.8	0.63	[57]
	100	1	0.60	[44]
1-pentanol	100	1	2.20	[44]
propane	35	1	0.61	[54]
	100	1	0.79	[44]

TABLE 14.1. *Continued.*

Solvent	Temperature (°C)	Volume fraction, ϕ_2	χ	References
propyl acetate	100	1	1.19	[44]
tetrahydrofuran	100	1	0.68	[44]
toluene	100	1	0.60	[44]
1,1,1-trichloroethane	100	1	0.56	[44]
trichloroethylene	100	1	0.54	[44]
2,2,4-trimethylpentane	23.5	0.67 to 0.87	0.50 to 0.45	[130]
n-undecane	100	1	0.48	[44]
Poly(*cis*-isoprene)				
acetone	0	1	2.1	[59]
	25	0.8 to 1	1.27 to 1.8	[59]
benzene	10	0.6 to 0.8	0.42	[60]
	25	0 to 1	0.40 to 0.43	[60–62]
	25 to 55	1	0.46 to 0.43	[63]
	40	0.8	0.41	[60]
	23.5	0.69 to 0.86	0.33 to 0.28	[106]
2-butanone	25	0.6 to 1	0.86 to 1.43	[59]
	45	0.6 to 1	0.83 to 1.2	[59]
carbon tetrachloride	23.5	0.69 to 0.84	0.14 to 0.02	[106]
chloroform	23.5	0.66 to 0.85	0.19 to −0.01	[106]
cyclohexane	20	0 to 0.20	0.31	[113]
	23.5	0.64 to 0.84	0.29 to 0.21	[106]
dichloromethane	23.5	0.69 to 0.89	0.54 to 0.41	[106]
ethyl acetate	25	0.4 to 1	0.69 to 1.24	[59,64]
	50	0.4 to 1	0.68 to 1.0	[59,64]
ethylbenzene	25 to 55	1	0.34 to 0.30	[63]
n-heptane	25 to 55	1	0.50	[63]
	23.5	0.68 to 0.84	0.37 to 0.29	[106]
n-hexane	25 to 55	1	0.54 to 0.50	[63]
2-methylheptane	25 to 55	1	0.50 to 0.47	[63]
2-methylhexane	25 to 55	1	0.51	[63]
2-methylpentane	25 to 55	1	0.56 to 0.52	[63]
n-octane	25 to 55	1	0.49 to 0.46	[63]
n-pentane	25 to 55	1	0.61 to 0.53	[63]
toluene	25 to 55	1	0.36 to 0.32	[63]
2,2,4-trimethylpentane	25 to 55	1	0.49 to 0.46	[63]
p-xylene	25 to 55	1	0.27	[63]
Poly(*N*-isopropylacrylamide)				
ethanol	10 to 60	0.09	0.46 to 0.47	[111]
water	3	0.07	0.49	[111]
	30	0.14	0.55	[111]
	60	0.74	1.08	[111]
Poly(*DL*-lactide)				
acetone	120	1	0.56	[18]
benzene	120	1	0.52	[18]
2-butanone	120	1	0.53	[18]
carbon tetrachloride	120	1	0.89	[18]
chloroform	120	1	0.32	[18]
dichloromethane	120	1	0.99	[18]
ethyl acetate	120	1	0.46	[18]
n-heptane	120	1	2.0	[18]
n-hexane	120	1	2.0	[18]
n-pentane	120	1	1.6	[18]
Poly(methacrylamide)				
water	23 to 56	0	0.500 to 0.499	[105]

TABLE 14.1. *Continued.*

Solvent	Temperature (°C)	Volume fraction, ϕ_2	χ	References
Poly(methacrylic acid)				
0.02 N HCl	20 to 58	0	0.498 to 0.500	[105]
Poly(methyl acrylate)				
acetone	100	1	0.40	[19]
benzene	90 to 110	1	0.51 to 0.37	[19,65]
n-butane	100	1	1.86	[19]
1-butanol	100	1	0.79	[19]
2-butanone	100	1	0.40	[19]
butyl acetate	100	1	0.58	[19]
butylbenzene	90 to 110	1	1.14 to 1.05	[65]
tert-butylbenzene	90 to 110	1	1.03 to 0.95	[65]
butylcyclohexane	90 to 110	1	2.3 to 2.1	[65]
carbon tetrachloride	100	1	0.68	[19]
chlorobenzene	100	1	0.31	[19]
1-chlorobutane	100	1	0.74	[19]
chloroform	100	1	−0.10	[19]
chloromethane	100	1	0.34	[19]
1-chloropentane	100	1	0.84	[19]
cycloheptane	100	1	1.56	[19]
cyclohexane	90 to 110	1	1.7 to 1.5	[19,65]
cyclohexene	100	1	1.31	[19]
cyclooctane	100	1	1.61	[19]
cyclopentane	100	1	1.47	[19]
cis-decahydronaphthalene	90 to 110	1	2.1 to 1.8	[65]
trans-decahydronaphthalene	90 to 110	1	2.1 to 1.9	[65]
n-decane	88 to 100	1	2.7 to 2.4	[19,65]
1,1-dichloroethane	100	1	0.20	[19]
1,2-dichloroethane	100	1	0.02	[19]
dichloroethane	100	1	−0.09	[19]
1,4-dioxane	100	1	0.20	[19]
n-dodecane	90 to 110	1	3.0 to 2.7	[65]
ethanol	100	1	1.01	[19]
ethyl acetate	100	1	0.43	[19]
ethylbenzene	90 to 110	1	0.83 to 0.67	[19,65]
n-heptane	100	1	2.10	[19]
n-hexane	100	1	2.08	[19]
methyl acetate	100	1	0.38	[19]
naphthalene	100 to 110	1	0.48	[65]
n-nonane	100	1	2.4	[19]
n-octane	90 to 100	1	2.4 to 2.2	[19,65]
n-pentane	100	1	1.92	[19]
1-pentanol	100	1	0.76	[19]
propane	100	1	2.5	[19]
1-propanol	100	1	0.82	[19]
propyl acetate	100	1	0.49	[19]
n-tetradecane	90 to 110	1	3.4 to 3.1	[65]
tetrahydrofuran	100	1	0.34	[19]
1,2,3,4-tetrahydronaphthalene	90 to 110	1	1.04 to 0.95	[65]
3,3,4,4-tetramethylhexane	90 to 110	1	2.2 to 1.9	[65]
toluene	90 to 110	1	0.67 to 0.62	[65]
	100	1	0.53	[19]
1,1,1-trichloroethane	100	1	0.43	[19]
trichloroethylene	100	1	0.45	[19]
3,4,5-trimethylheptane	90 to 110	1	2.4 to 2.2	[65]
2,2,5-trimethylhexane	90 to 110	1	2.5 to 2.2	[65]

TABLE 14.1. *Continued.*

Solvent	Temperature (°C)	Volume fraction, ϕ_2	χ	References
2,2,4-trimethylpentane	90 to 110	1	2.4 to 2.1	[65]
n-undecane	100	1	2.7	[19]
Poly(methyl methacrylate)				
acetone	25 to 27	0	0.48	[66,67]
benzene	16 to 27	0	0.47 to 0.44	[16,67]
butyl acetate	2 to 60	0	0.496 to 0.487	[68]
1-chlorobutane	14 to 48	0	0.515 to 0.495	[68]
chloroform	27	0	0.44	[67]
1,4-dioxane	27	0	0.42	[67]
4-heptanone	16 to 62	0	0.515 to 0.490	[68]
isoamyl acetate	20 to 60	0	0.524 to 0.499	[68]
3-pentanone	27	0	0.49	[67]
tetrahydrofuran	25 to 27	0	0.494 to 0.46	[67,69]
toluene	27	0	0.45	[67]
m-xylene	27	0	0.50	[67]
Poly(α-methylstyrene)				
toluene	25	0.3 to 0.7	0.48 to 0.65	[70]
Polypropylene				
acetone	100	1	1.72	[44]
benezene	25	0	0.498	[71]
	100	1	0.51	[44]
butane	100	1	0.37	[44]
1-butanol	100	1	2.23	[44]
2-butanone	100	1	1.36	[44]
butyl acetate	100	1	0.84	[44]
carbon tetrachloride	100	1	0.29	[44]
chlorobenzene	100	1	0.54	[44]
1-chlorobutane	100	1	0.48	[44]
chloroform	100	1	0.61	[44]
chloromethane	100	1	0.76	[44]
1-chloropentane	100	1	0.39	[44]
cycloheptane	100	1	0.10	[44]
cyclohexane	25	0	0.42	[71]
	100	1	0.17	[44]
cyclohexene	100	1	0.22	[44]
cyclooctane	100	1	0.06	[44]
cyclopentane	100	1	0.21	[44]
1,1-dichloroethane	100	1	0.70	[44]
1,2-dichloroethane	100	1	0.97	[44]
dichloromethane	100	1	0.86	[44]
1,4-dioxane	100	1	1.15	[44]
ethanol	100	1	3.0	[44]
ethyl acetate	100	1	1.14	[44]
ethylbenzene	100	1	0.40	[44]
n-decane	100	1	0.18	[44]
n-heptane	100	1	0.24	[44]
n-hexane	80	1	0.18	[72]
	100	1	0.28	[44]
methyl acetate	100	1	1.37	[44]
n-nonane	100	1	0.20	[44]
n-octane	100	1	0.22	[44]
n-pentane	100	1	0.35	[44]
1-pentanol	100	1	1.99	[44]
propane	100	1	0.46	[44]
propyl acetate	100	1	0.96	[44]
tetrahydrofuran	100	1	0.55	[44]

TABLE 14.1. *Continued.*

Solvent	Temperature (°C)	Volume fraction, ϕ_2	χ	References
toluene	100	1	0.43	[44]
1,1,1-trichloroethane	100	1	0.37	[44]
trichloroethylene	100	1	0.39	[44]
n-undecane	100	1	0.17	[44]
Polystyrene				
acetic acid	162 to 229	1	3.0 to 2.1	[73]
acetone	25	0.6 to 1	0.81 to 1.1	[74]
	40	1	1.08	[75]
	50	0.6 to 0.8	0.80 to 0.92	[74]
	162 to 229	1	1.30 to 0.56	[73]
acetonitrile	162 to 229	1	2.02 to 0.93	[73]
aniline	162 to 229	1	1.11 to 0.68	[73]
benzaldehyde	162 to 229	1	1.22 to 0.80	[73]
benzene	15	0.3 to 0.8	0.40 to 0.26	[76]
	25 to 30	0	0.455 to 0.43	[77,78]
	30	0.3 to 0.8	0.40 to 0.26	[76]
	40	1	0.26	[75]
	45	0.3 to 0.8	0.40 to 0.26	[76]
	60	0.3 to 0.8	0.40 to 0.26	[76]
	120 to 200	1	0.32 to 0.39	[41,51]
	160 to 180	1	0.29 to 0.24	[65]
	162 to 229	1	0.66 to 0.13	[73]
	23.5	0.61 to 0.79	0.28 to 0.17	[129]
benzyl alcohol	162 to 229	1	1.42 to 0.65	[73]
1-butanol	162 to 229	1	1.47 to 0.82	[73]
2-butanone	10 to 50	0.2	0.547 to 0.542	[79]
	25	0.4 to 0.8	0.63 to 0.77	[80]
	27 to 52	0	0.490 to 0.474	[78,81–84]
	40	1	0.84	[75]
	70	0.6 to 0.8	0.63 to 0.72	[80]
	162 to 229	1	1.16 to 0.36	[73]
butyl acetate	30	0	0.466	[20]
	162 to 229	1	1.01 to 0.45	[73]
tert-butyl acetate	22 to 64	0	0.501 to 0.494	[132]
	64 to 111	0	0.494 to 0.501	[132]
	30 to 90	0.12 to 0.32	0.60 to 0.59	[133]
	143 to 183	1	0.39 to 0.1	[133]
butylbenzene	183 to 203	1	0.38 to 0.34	[65]
butylcyclohexane	160 to 180	1	0.77 to 0.71	[65]
carbon tetrachloride	40	1	0.29	[75]
	162 to 229	1	0.90 to 0.26	[73]
	23.5	0.71 to 0.81	0.22 to 0.24	[129]
chlorobenzene	30	0	0.454	[20]
	162 to 229	1	0.68 to 0.28	[73]
	137.6	1	0.30	[107]
chloroform	25	0.2 to 0.8	0.52 to 0.17	[74]
	40	1	0.13	[75]
	50	0.2 to 0.8	0.45 to 0.14	[74]
	162 to 229	1	0.43 to −0.01	[73]
	23.5	0.62 to 0.81	0.05 to −0.15	[129]
cumene	25	0	0.444	[77]
cyclohexane	15	0.5	0.77	[85]
	24	0 to 0.2	0.508 to 0.58	[86]
	30	0.3	0.62	[85]
	34	0 to 0.8	0.500 to 0.93	[86]
	35	0 to 0.3	0.50 to 0.57	[87]

TABLE 14.1. *Continued.*

Solvent	Temperature (°C)	Volume fraction, ϕ_2	χ	References
	40	1	0.64	[75]
	44	0 to 0.8	0.494 to 0.93	[86]
	45	0 to 0.3	0.49 to 0.56	[87]
	49 to 60	0	0.495 to 0.486	[84]
	50	0.1	0.51	[85]
	65	0 to 0.3	0.47 to 0.54	[87]
	160 to 180	1	0.62 to 0.53	[65]
	162 to 229	1	1.11 to 0.46	[73]
	23.5	0.78 to 0.84	0.79 to 0.81	[129]
	30 to 50	0	0.52 to 0.39	[134]
	35	0.28 to 0.94	0.61 to 1.08	[139]
	65	0.23 to 0.92	0.52 to 0.69	[139]
cyclohexanone	27 to 57	0	0.436	[81]
cyclopentane	40	1	0.64	[75]
cis-decahydronapthalene	183 to 203	1	0.47 to 0.42	[65]
trans-decahydronaphthalene	183 to 203	1	0.52 to 0.46	[65]
n-decane	183 to 203	1	1.01 to 0.94	[65]
	120 to 160	1	1.36 to 1.03	[107]
1,2-dichloroethane	162 to 229	1	0.85 to 0.22	[73]
dichloromethane	40	1	0.34	[75]
	162 to 229	1	0.62 to −0.21	[73]
	23.5	0.64 to 0.82	0.17 to 0.05	[129]
1,4-dioxane	40	1	0.43	[75]
	162 to 229	1	0.95 to 0.42	[73]
n-dodecane	183 to 203	1	1.09 to 1.00	[65]
ethanol	162 to 229	1	1.80 to 0.43	[73]
ethyl acetate	27 to 49	0	0.490	[84]
	162 to 229	1	1.14 to 0.35	[73]
ethylbenzene	10 to 60	0.2	0.44	[88]
	25	0	0.450	[77]
	120 to 185	1	0.22 to 0.14	[72]
ethylene glycol	162 to 229	1	3.8 to 2.2	[73]
ethyl ether	162 to 229	1	0.78 to 0.71	[73]
fluorobenzene	40	1	0.37	[75]
formamide	162 to 229	1	4.1 to 3.2	[73]
n-heptane	40	1	0.95	[75]
	162 to 229	1	1.33 to 0.25	[73]
n-hexane	40	1	0.97	[75]
	162 to 229	1	1.35 to −0.03	[73]
n-hexadecane	183 to 203	1	1.22 to 1.14	[65]
isopropyl ether	40	1	0.78	[75]
	162 to 229	1	1.42 to 0.41	[73]
methanol	162 to 229	1	2.19 to 0.44	[73]
methylcyclohexane	72	0 to 0.4	0.49 to 0.67	[89]
2-methyl-1-propanol	162 to 229	1	1.71 to 0.81	[73]
naphthalene	183 to 203	1	0.12	[65]
nitrobenzene	162 to 229	1	1.18 to 0.72	[73]
n-octane	40	1	0.95	[75]
	162 to 229	1	2.19 to 0.80	[73]
1-octanol	162 to 229	1	1.41 to 0.55	[73]
n-pentane	162 to 229	1	1.12 to 0.83	[73]
1-pentanol	162 to 229	1	1.75 to 0.86	[73]
1-propanol	162 to 229	1	1.71 to 0.27	[73]
2-propanol	40	1	2.6	[75]
	162 to 229	1	1.74 to −0.15	[73]

TABLE 14.1. *Continued.*

Solvent	Temperature (°C)	Volume fraction, ϕ_2	χ	References
propyl acetate	25	0.4 to 0.8	0.66	[74]
	40	1	0.52	[75]
	70	0.4 to 0.8	0.60	[74]
pyridine	162 to 229	1	1.02 to 0.23	[73]
tetrachloroethylene	40	1	0.36	[75]
n-tetradecane	183 to 203	1	1.14 to 1.08	[65]
tetrahydrofuran	162 to 229	1	0.70 to −0.16	[73]
1,2,3,4-tetrahydronaphthalene	183 to 203	1	0.20	[65]
3,3,4,4-tetramethylhexane	160 to 180	1	0.90 to 0.76	[65]
toluene	22	0.2 to 0.6	0.40	[21]
	25	0.4 to 0.8	0.42 to 0.31	[80,87]
	25	0.2 to 0.8	0.37 to 0.16	[76]
	27 to 40	0	0.437 to 0.482	[20,53,69,78,81,82,84]
	40	1	0.19	[75]
	45	0 to 0.3	0.41 to 0.37	[87]
	60	0.8	0.32	[80]
	65	0 to 0.3	0.40 to 0.37	[87]
	68	0	0.452	[81,84]
	80	0.4 to 0.6	0.40 to 0.35	[80]
	162 to 229	1	0.67 to 0.04	[73]
	23.5	0.66 to 0.83	0.34 to 0.22	[129]
	25	0.03 to 0.34	0.43 to 0.40	[127]
	25	0.07 to 0.20	0.40 to 0.39	[131]
	40	0.06 to 0.18	0.42	[131]
	137.6	1	0.32	[107]
trichloroethylene	40	1	0.19	[75]
	162 to 229	1	0.69 to 0.12	[73]
2,2,4-trimethylpentane	162 to 229	1	1.72 to 0.35	[73]
water	162 to 229	1	4.4 to 3.1	[73]
o-xylene	162 to 229	1	0.72 to 0.26	[73]
Poly(tetramethylene oxide)				
acetone	100	1	0.73	[19]
benzene	100	1	0.04	[19]
n-butane	100	1	0.76	[19]
1-butanol	100	1	0.54	[19]
2-butanone	100	1	0.53	[19]
butyl acetate	100	1	0.30	[19]
carbon tetrachloride	100	1	0.10	[19]
chlorobenzene	100	1	−0.09	[19]
1-chlorobutane	100	1	0.22	[19]
chloroform	100	1	−0.38	[19]
chloromethane	100	1	0.19	[19]
1-chloropentane	100	1	0.18	[19]
cycloheptane	100	1	0.41	[19]
cyclohexane	100	1	1.23	[19]
cyclohexene	100	1	0.28	[19]
cyclooctane	100	1	0.40	[19]
cyclopentane	100	1	0.45	[19]
n-decane	100	1	0.80	[19]
1,1-dichloroethane	100	1	0.00	[19]
1,2-dichloroethane	100	1	0.05	[19]
dichloromethane	100	1	−0.12	[19]
1,4-dioxane	100	1	0.39	[19]
ethanol	100	1	1.08	[19]
ethyl acetate	100	1	0.45	[19]
ethylbenzene	100	1	0.07	[19]

TABLE 14.1. *Continued.*

Solvent	Temperature (°C)	Volume fraction, ϕ_2	χ	References
n-heptane	100	1	0.73	[19]
n-hexane	100	1	0.74	[19]
methyl acetate	100	1	0.58	[19]
n-nonane	100	1	0.78	[19]
n-octane	100	1	0.75	[19]
n-pentane	100	1	0.76	[19]
1-pentanol	100	1	0.37	[19]
propane	100	1	0.90	[19]
1-propanol	100	1	0.71	[19]
propyl acetate	100	1	0.36	[19]
tetrahydrofuran	100	1	0.13	[19]
1,1,1-trichloroethane	100	1	−0.02	[19]
trichloroethylene	100	1	−0.06	[19]
toluene	100	1	0.04	[19]
n-undecane	100	1	0.83	[19]
Poly(ε-valerolactone)				
acetone	120	1	0.64	[18]
benzene	120	1	0.34	[18]
2-butanone	120	1	0.43	[18]
carbon tetrachloride	120	1	0.61	[18]
chloroform	120	1	−0.02	[18]
dichloromethane	120	1	0.86	[18]
ethyl acetate	120	1	0.54	[18]
n-heptane	120	1	1.6	[18]
n-hexane	120	1	1.6	[18]
n-pentane	120	1	1.5	[18]
Poly(vinyl acetate)				
acetaldehyde	125 to 140	1	0.35 to 0.32	[90]
acetone	25 to 29	0	0.40	[91–93]
	30 to 40	0.8	0.34	[94]
	30 to 50	1	0.31 to 0.39	[94]
	100 to 140	1	0.32 to 0.21	[19,90]
acetonitrile	125 to 140	1	0.54 to 0.49	[90]
allyl chloride	40	1	0.27	[94]
benzene	5	0.2	0.46	[95]
	20	0	0.42	[16]
	30	0.4 to 0.8	0.45 to 0.29	[96]
	35 to 62	0	0.51 to 0.42	[97]
	30 to 50	1	0.30 to 0.26	[94]
	80 to 140	1	0.44 to 0.25	[19,90,98]
	125 to 145	1	0.37 to 0.32	[32,99,100]
n-butane	100	1	1.97	[19]
1-butanol	100 to 135	1	0.62 to 0.38	[19,99]
2-butanol	135	1	0.31	[99]
2-butanone	10 to 45	0	0.43	[91]
	100 to 140	1	0.34 to 0.20	[19,90]
butyl acetate	100	1	0.51	[19]
butylbenzene	125 to 145	1	0.95 to 0.88	[100]
butylcyclohexane	125 to 145	1	1.90 to 1.75	[100]
carbon tetrachloride	90 to 135	1	0.85 to 0.63	[19,32,98]
chlorobenzene	100 to 135	1	0.28 to 0.33	[19,32]
1-chlorobutane	100 to 135	1	0.73 to 0.66	[19,32]
chloroform	80 to 135	1	−0.17 to −0.09	[19,32,98]
chloromethane	100	1	0.25	[19]
1-chloropentane	100	1	0.82	[19]
1-chloropropane	40	1	0.75	[94]

TABLE 14.1. *Continued.*

Solvent	Temperature (°C)	Volume fraction, ϕ_2	χ	References
cycloheptane	100	1	1.63	[19]
cyclohexane	100 to 140	1	1.65 to 1.16	[19,32,90,98,100]
cyclohexene	100	1	1.18	[19]
cyclohexanol	135	1	0.44	[32,99]
cyclooctane	100	1	1.67	[19]
cyclopentane	100	1	1.53	[19]
cis-decahydronaphthalene	125 to 145	1	1.65 to 1.50	[100]
n-decane	100 to 145	1	2.5 to 2.01	[19,32,99,100]
1-decanol	135	1	0.81	[99]
1,1-dichloroethane	100	1	0.19	[19]
1,2-dichloroethane	100 to 140	1	−0.04 to 0.00	[19,90]
dichloromethane	100	1	−0.14	[19]
dimethylphthalate	25	0	0.400	[91]
1,4-dioxane	25	0	0.407	[91]
	100 to 140	1	0.17 to 0.03	[19,90]
n-dodecane	125 to 145	1	2.48 to 2.27	[99,100]
ethanol	50	0	0.47	[97]
	100	1	0.80	[19]
ethyl acetate	20	0	0.415	[16]
	100	1	0.36	[19]
ethylbenzene	100 to 135	1	0.66 to 0.58	[19,99]
n-heptane	100 to 120	1	2.14 to 1.63	[19,90,98]
1-heptanol	135	1	0.55	[99]
n-hexadecane	135	1	2.99	[99]
n-hexane	100 to 120	1	2.06 to 1.71	[19,98]
1-hexanol	135	1	0.49	[99]
isopropylamine	40	1	0.66	[94]
methanol	125 to 140	1	0.77 to 0.73	[90]
methyl acetate	100	1	0.30	[19]
2-methyl-2-propanol	135	1	0.30	[99]
nitroethane	125 to 140	1	0.14 to 0.19	[90]
n-nonane	100 to 145	1	2.38 to 1.88	[19,32,99,100]
n-octane	90 to 120	1	2.3 to 1.94	[19,98]
1-octanol	135	1	0.65	[99]
1-octene	135	1	1.55	[32]
n-pentane	100	1	2.06	[19]
1-pentanol	100 to 135	1	0.59 to 0.41	[19,99]
2-pentanone	135	1	0.38	[32]
propane	100	1	3.2	[19]
1-propanol	30 to 50	1	1.3 to 1.0	[94]
	100 to 135	1	0.64 to 0.38	[19,99]
2-propanol	125 to 140	1	0.44 to 0.35	[90,99]
propyl acetate	100	1	0.42	[19]
propylamine	40	1	0.61	[94]
n-tetradecane	135	1	2.70	[99]
tetrahydrofuran	100 to 140	1	0.30 to 0.14	[19,90]
1,2,3,4-tetrahydronaphthalene	125 to 145	1	0.83 to 0.77	[100]
3,3,4,4-tetramethylhexane	125 to 145	1	1.72 to 1.56	[100]
toluene	80 to 140	1	0.56 to 0.40	[19,90,98,99]
1,1,1,-trichloroethane	100	1	0.49	[19]
trichloroethylene	100	1	0.40	[19]
1,2,3-trichloropropane	15 to 50	0	0.38	[91]
2,2,4-trimethylpentane	100 to 120	1	2.17 to 1.86	[98]
n-undecane	100 to 145	1	2.7 to 2.14	[19,99,100]
vinyl acetate	30	0.4 to 0.8	0.41 to 0.22	[96]
water	40	1	2.5	[101]

TABLE 14.1. *Continued.*

Solvent	Temperature (°C)	Volume fraction, ϕ_2	χ	References
Poly(vinyl alcohol)				
water	30	0	0.494	[102]
Poly(vinyl chloride)				
acetaldehyde	125 to 140	1	0.76 to 0.69	[90]
acetone	120 to 140	1	0.77 to 0.53	[18,90]
acetonitrile	125 to 140	1	0.98 to 0.92	[90]
benzene	120	1	0.75	[18]
	125 to 140	1	0.41 to 0.37	[90]
2-butanone	0 to 50	0	0.402 to 0.413	[103]
	120 to 140	1	0.72 to 0.46	[18,90]
carbon tetrachloride	120	1	1.14	[18]
chloroform	120	1	0.91	[18]
cyclohexane	125 to 140	1	1.21 to 1.09	[90]
cyclohexanone	30 to 69	0	0.240 to 0.264	[103]
1,2-dichloroethane	125 to 140	1	0.55 to 0.49	[90]
dichloromethane	120	1	1.63	[18]
1,4-dioxane	14 to 77	0	0.518 to 0.454	[103]
	125 to 140	1	0.18 to 0.13	[90]
ethyl acetate	120	1	0.94	[18]
n-heptane	120	1	2.0	[18]
	125 to 140	1	1.64 to 1.54	[90]
n-hexane	120	1	2.1	[18]
methanol	125 to 140	1	1.42 to 1.24	[90]
nitroethane	125 to 140	1	0.69 to 0.61	[90]
n-pentane	120	1	1.7	[18]
2-propanol	125 to 140	1	1.10 to 0.97	[90]
tetrahydrofuran	125 to 140	1	0.43 to 0.34	[90]
toluene	125 to 140	1	0.45 to 0.41	[90]
Poly(vinyl methyl ether)				
acetone	40	1	0.75	[75]
benzene	40	1	0.15	[75]
2-butanone	40	1	0.50	[75]
carbon tetrachloride	40	1	0.06	[75]
chloroform	40	1	−0.92	[75]
cyclohexane	40	1	1.16	[75]
cyclopentane	40	1	1.14	[75]
dichloromethane	40	1	−0.39	[75]
1,4-dioxane	40	1	0.20	[75]
ethylbenzene	25	0.06 to 0.16	0.29 to 0.27	[131]
fluorobenzene	40	1	0.00	[75]
n-heptane	40	1	1.15	[75]
n-hexane	40	1	1.16	[75]
isopropyl ether	40	1	0.76	[75]
n-octane	40	1	1.16	[75]
2-propanol	40	1	0.90	[75]
propyl acetate	40	1	0.25	[75]
tetrachloroethylene	40	1	0.34	[75]
toluene	40	1	0.14	[75]
	25	0.06 to 0.15	0.28 to 0.26	[131]
trichloroethylene	40	1	−0.26	[75]
Poly(*N*-vinyl pyrrolidone)				
water	25	0.06	0.48	[109]

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