ORTJ0962

ELDATA: Int. Electron. J. Phys.-Chem. Data **1996**, *2*, 111-120

Excess enthalpies of 12 binary liquid mixtures of .alpha.,.omega.-dichloroalkanes (C2, C4, C6) + benzene, toluene, ethylbenzene, or butylbenzene at 298.15 K

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(Received in final form February 3, 1997)

Enthalpy-of-mixing H^E measurements are reported at 298.15 K for 12 binary liquid mixtures containing 1,2-dichloroethane, 1,4-dichlorobutane, or 1,6-dichlorohexane + benzene, + toluene, + ethylbenzene, or + butylbenzene at 298.15 K over the entire range of composition. The H^E curves represented as a function of the mole fraction of dichloroalkane are asymmetrical and may be positive, or negative, or S-shaped. The H^E values are always smaller at low concentrations of the dichloroalkane. They decrease from benzene to toluene and then increase with the number of C-atoms of the n-alkylbenzene. For a given n-alkylbenzene, H^E decreases with the number of C-atoms of the dichloroalkane. H^E is the result of an exothermic contribution, due to dipole-induced dipole (n-π) interactions between the polar Cl-groups and the π-electrons of the aromatic hydrocarbon, and an endothermic contribution mainly due to dipole-dipole interactions between the polar Cl-groups. The more negative H^E with toluene, compared to benzene, is due to the inductive effect of the methyl group in toluene. The endothermic contribution decreases with the number of C-atoms in the dichloroalkane, but increases with the number of C-atoms in the n-alkylbenzene.

1. INTRODUCTION

In continuation of our systematic experimental studies on the excess thermodynamic properties of α,ω-dichloroalkane + n-alkane mixtures [BLAA0930; ORTJ0930] we have determined the excess molar enthalpies, H^E, of 12 systems containing an α,ω-dichloroalkane (1,2-dichloroethane, 1,4-dichlorobutane, or 1,6-dichlorohexane) + an aromatic hydrocarbon (benzene, toluene, ethylbenzene, or butylbenzene) at 298.15 K. Many H^E data have been published in the literature for 1,2-dichloroethane + benzene, at temperatures from 288.15 to 318.15 K, and for 1,2-dichloroethane + toluene, at temperatures from 298.15 to 308.15 K [AMAK0580; BANI0830; BAUE1150; BROI0552; CHEG0520; KIRV2370; KORA3530; MAHB0771; NIGR0801; OTTJ2660; PATH0790; RUIL0550; SIEL0511; SUNS0760; TSCH0485]. We found only a few data sources for the other systems: 1,2-dichloroethane + n-alkylbenzenes (methyl through octyl) at (295 ± 1) K [TSCH0485], 1,3-dichloropropane and 1,4-dichlorobutane + benzene at 303.15 K [ROYF1800], and 1,3-dichloropropane, 1,4-dichlorobutane, 1,5-dichloropentane, or 1,6-dichlorohexane + benzene at 298.15 K [GROJ0734].

1-Chloroalkane + benzene mixtures have been carefully examined in terms of the DISQUAC group-contribution model [GARI0890]. Several similar studies on α,ω-dichloroalkane + n-alkane mixtures [HAHG0860; POLC0800; KEHH0880] revealed the occurrence of the Cl-Cl 'proximity effect' in α,ω-dichloroalkanes. The same effect appears in α,ω-dichloroalkane + CCl_4 mixtures [KEHH0881] and we expect to observe it in α,ω-dichloroalkane + aromatic hydrocarbons. A small H^E database of 1-chloroalkane or α,ω-dichloroalkane + aromatic hydrocarbons has been analyzed using the classical quasi-chemical lattice theory in terms of group surface interactions [GROJ0733; GROJ0734]. The H^E database revised and completed in the present investigation, along with data on vapor-liquid equilibria, and data for mixtures containing other α,ω-dihaloalkane and aromatic hydrocarbons, will be used to test the applicability of DISQUAC and other group-contribution models to α,ω-dichloroalkane + aromatic hydrocarbon mixtures.

2. EXPERIMENTAL SECTION

2.1. Apparatus and Procedure

The experimental data were taken at atmospheric pressure by means of a Calvet type microcalorimeter, model MS-80D (SETARAM, Lyon, France) with a stainless steel batch mixing cell (volume ca. 8 cm^3) and with negligible vapor phase. The temperature T (ITS-90) was maintained constant at (298.15 ± 0.02) K. The microcalorimeter was calibrated electrically after each measurement (see [ORTJ0881]). Check measurements on cyclohexane + hexane and benzene + heptadecane are in agreement to within 1 % (over central range of

concentration) with the data reported in [MCGM0690] and [DIAM0742]. The estimated uncertainties in the mole fraction composition x_i and H^E are, respectively, $\sigma(x_i)$ = 0.0005 and $\sigma(H^E)$ = 0.02 $|H^E|$ (over central range of concentration).

2.2. Materials

$C_2H_4Cl_2$, 1,2-Dichloroethane (Ethylene dichloride). Fluka AG (Buchs, Switzerland) 'puriss' grade material of stated GLC purity > 99.5 %, was degassed ultrasonically, dried over molecular sieves Type 3A (reference 69828, from Fluka), and used without further purification. n(D, 298.15 K) = 1.4422 (1.4421 [RIDJ0860]); ρ(298.15 K)/kg m^{-3} = 1245.38 (1246.37 [RIDJ0860]).

$C_4H_8Cl_2$, 1,4-Dichlorobutane. Aldrich Chem. Co., Inc. (Milwaukee, WI, USA) material of stated purity > 99 %, was degassed ultrasonically, dried over molecular sieves Type 3A (reference 69828, from Fluka), and used without further purification. n(D,298.15 K) = 1.4522 (1.4522 [TRC00640]; ρ(298.15 K)/kg m^{-3} = 1133.06 (1135.3 [TRC00640]).

C_6H_6, Benzene. Aldrich Chem. Co., Inc. (Milwaukee, WI, USA) material of stated purity > 99.8 %, was degassed ultrasonically, dried over molecular sieves Type 3A (reference 69828, from Fluka), and used without further purification. n(D,298.15 K) = 1.4980 (1.49792 [RIDJ0860]); ρ(298.15 K)/kg m^{-3} = 873.51 (873.60 [RIDJ0860]).

$C_6H_{12}Cl_2$, 1,6-Dichlorohexane. Aldrich Chem. Co., Inc. (Milwaukee, WI, USA) material of stated purity > 99 %, was degassed ultrasonically, dried over molecular sieves Type 3A (reference 69828, from Fluka), and used without further purification. n(D,298.15 K) = 1.4545; ρ(298.15 K)/kg m^{-3} = 1067.59.

C_7H_8, Toluene. Aldrich Chem. Co., Inc. (Milwaukee, WI, USA) material of stated purity > 99.8 %, was degassed ultrasonically, dried over molecular sieves Type 3A (reference 69828, from Fluka), and used without further purification. n(D,298.15 K) = 1.4940 (1.49413 [RIDJ0860]); ρ(298.15 K)/kg m^{-3} = 862.15 (862.19 [RIDJ0860]).

C_8H_{10}, Ethylbenzene. Aldrich Chem. Co., Inc. (Milwaukee, WI, USA) material of stated purity > 99.8 %, was degassed ultrasonically, dried over molecular sieves Type 3A (reference 69828, from Fluka), and used without further purification. n(D,298.15 K) = 1.4928 (1.49320 [RIDJ0860]); ρ(298.15 K)/kg m^{-3} = 862.60 (862.53 [RIDJ0860]).

$C_{10}H_{14}$, Butylbenzene. Aldrich Chem. Co., Inc. (Milwaukee, WI, USA) material of stated purity > 99 %, was degassed ultrasonically, dried over molecular sieves Type 3A (reference 69828, from Fluka), and used without further purification. n(D,298.15 K) = 1.4875 (1.48742 [RIDJ0860]); ρ(298.15 K)/kg m^{-3} = 856.17 (856.07 [RIDJ0860]).

3. RESULTS

The direct experimental H^E values are tabulated and graphed in the Appendix and saved on disk as Standard ELDATA Files **ORTJ0962.001** through **ORTJ0962.012**.

The data were fitted to Eq. (1):

$$H^E_{calc}/\text{J mol}^{-1} = x_1x_2\Sigma A_i[x_1/(x_1 + kx_2)]^{i-1} \quad (1)$$

all points weighted equally. With an adjusted coefficient k and n = 4 coefficients A_i, the standard deviations $\sigma(H^E)$, defined by Eq.(2):

$$\sigma(H^E) = [\Sigma(H^E_{calc} - H^E)^2/(N-n)]^{1/2} \quad (2)$$

where N is the number of experimental values, are less than 8 J mol^{-1}.

4. DISCUSSION AND CONCLUSIONS

The H^E values at 298.15 K reported in the literature for 1,2-dichloroethane + benzene are in good agreement with our measurements. However, considerable discrepancies exist between our measurements and the data obtained by other authors in the case of 1,2-dichloroethane + toluene and other α,ω-dichloroalkane + n-alkylbenzene mixtures. The largest difference, 300 J mol^{-1} at equimolar composition and 298.15 K, was found in the case of 1,6-dichlorohexane + benzene [GROJ0734].

Our H^E results change regularly with the molecular structure of the components. When represented as a function of the mole fraction of the dichloroalkane, the H^E curves are asymmetrical and may be positive, or negative, or S-shaped. The H^E values are always smaller at low concentrations of the dichloroalkane. They decrease from benzene to toluene and then increase with the number of C-atoms of the n-alkylbenzene. For a given n-alkylbenzene, H^E decreases with the number of C-atoms of the dichloroalkane [ORTJ0963].

H^E is the result of an exothermic contribution, due to dipole-induced dipole (n-π) interactions between the polar Cl-groups and the π-electrons of the aromatic hydrocarbon, and an endothermic contribution mainly due to dipole-dipole interactions between the polar Cl-groups. The more negative H^E with toluene, compared to benzene, is due to the inductive effect of the methyl group in toluene. The endothermic contribution decreases with the number of C-atoms in the dichloroalkane, but increases with the number of C-atoms in the n-alkylbenzene.

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Property Code: [HMSD1000] HEAT OF MIXING AND SOLUTION **ORTJ0962.001**
State: Two-component system, single-phase liquid or two-phase liquid-liquid (LL)
Pure component 1, liquid
Pure component 2, liquid
Parameters: [P1] T/K, Temperature
Variables: [X1] x_1/-, Mole fraction of component 1
[Y1] H^E/J mol^{-1}, Molar excess enthalpy
Method: Direct low-pressure calorimetric measurement of H^E at variable x_1 and constant T

Components: **1. $C_2H_4Cl_2$, 1,2-Dichloroethane**
2. C_6H_6 , Benzene

[P1] = .298150E+03

[X1]	[Y1]
.609000E–01	.193200E+01
.128800E+00	.676200E+01
.199100E+00	.133630E+02
.267700E+00	.194810E+02
.332400E+00	.243110E+02
.392500E+00	.350980E+02
.448300E+00	.491050E+02
.498400E+00	.616630E+02
.541500E+00	.726110E+02
.581500E+00	.805000E+02
.611800E+00	.890330E+02
.664800E+00	.977270E+02
.721400E+00	.994980E+02
.781500E+00	.940240E+02
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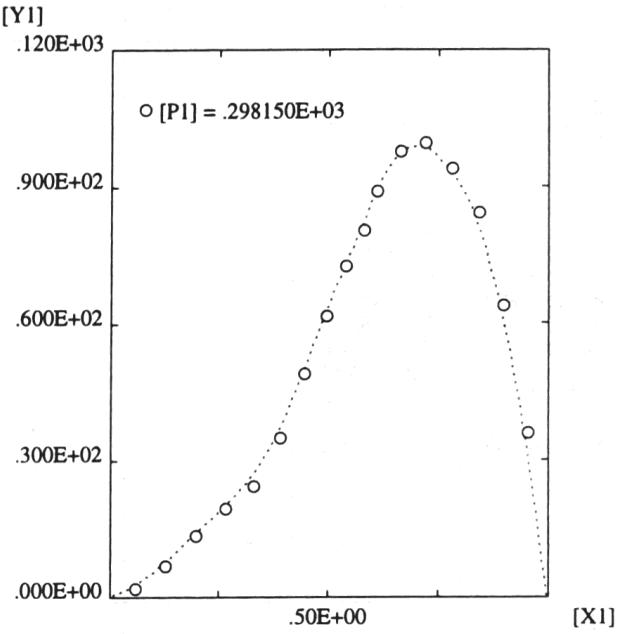

Property Code: [HMSD1000] HEAT OF MIXING AND SOLUTION **ORTJ0962.002**
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Pure component 1, liquid
Pure component 2, liquid
Parameters: [P1] T/K, Temperature
Variables: [X1] x_1/-, Mole fraction of component 1
[Y1] H^E/J mol^{-1}, Molar excess enthalpy
Method: Direct low-pressure calorimetric measurement of H^E at variable x_1 and constant T

Components: **1. $C_2H_4Cl_2$, 1,2-Dichloroethane**
2. C_7H_8 , Toluene

[P1] = .298150E+03

[X1]	[Y1]
.698000E–01	–.394000E+02
.146900E+00	–.692000E+02
.223000E+00	–.949000E+02
.297300E+00	–.113200E+03
.366400E+00	–.122900E+03
.428400E+00	–.123200E+03
.526000E+00	–.102100E+03
.567700E+00	–.848000E+02
.611700E+00	–.664000E+02
.659300E+00	–.481000E+02
.706000E+00	–.315000E+02
.755400E+00	–.166000E+02
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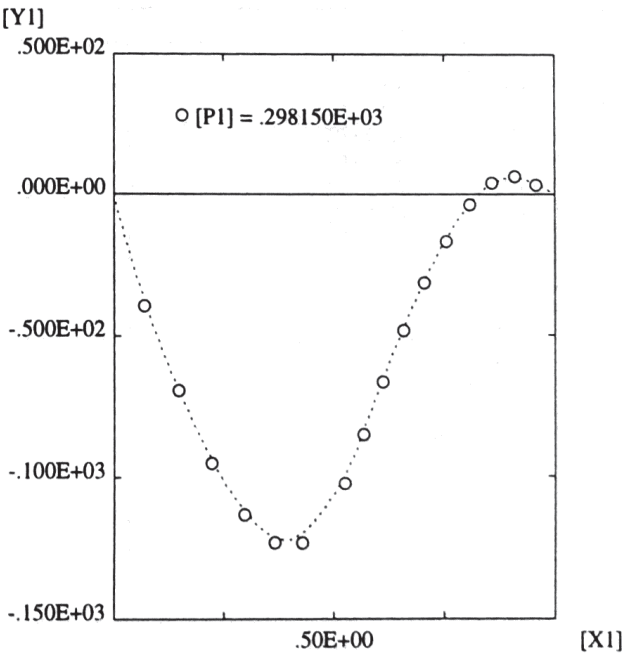

Property Code: [HMSD1000] HEAT OF MIXING AND SOLUTION **ORTJ0962.003**
State: Two-component system, single-phase liquid or two-phase liquid-liquid (LL)
Pure component 1, liquid
Pure component 2, liquid
Parameters: [P1] T/K, Temperature
Variables: [X1] x_1/-, Mole fraction of component 1
[Y1] H^E/J mol^{-1}, Molar excess enthalpy
Method: Direct low-pressure calorimetric measurement of H^E at variable x_1 and constant T

Components: **1. $C_2H_4Cl_2$, 1,2-Dichloroethane**
2. C_8H_{10} , Ethylbenzene

[P1] = .298150E+03

[X1]	[Y1]
.844000E–01	–.117000E+02
.170700E+00	–.143000E+02
.256400E+00	–.184000E+02
.337600E+00	–.103000E+02
.412100E+00	.490000E+01
.474700E+00	.205000E+02
.532700E+00	.347000E+02
.583000E+00	.461000E+02
.603200E+00	.538000E+02
.642300E+00	.633000E+02
.687200E+00	.721000E+02
.734200E+00	.764000E+02
.783200E+00	.767000E+02
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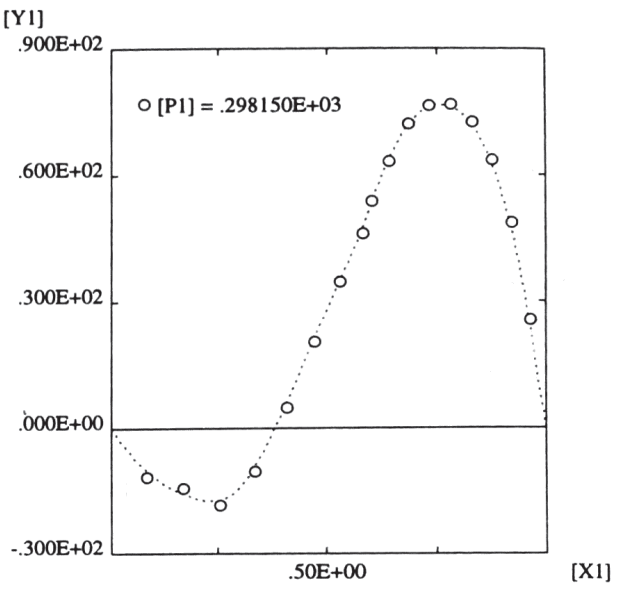
.964100E+00	.256000E+02



Property Code: [HMSD1000] HEAT OF MIXING AND SOLUTION **ORTJ0962.004**
State: Two-component system, single-phase liquid or two-phase liquid-liquid (LL)
Pure component 1, liquid
Pure component 2, liquid
Parameters: [P1] T/K, Temperature
Variables: [X1] x_1/-, Mole fraction of component 1
[Y1] H^E/J mol^{-1}, Molar excess enthalpy
Method: Direct low-pressure calorimetric measurement of H^E at variable x_1 and constant T

Components: **1. $C_2H_4Cl_2$, 1,2-Dichloroethane**
2. $C_{10}H_{14}$, Butylbenzene

[P1] = .298150E+03

[X1]	[Y1]
.101900E+00	.537000E+02
.205400E+00	.107500E+03
.303300E+00	.169200E+03
.390000E+00	.222400E+03
.466800E+00	.262600E+03
.533600E+00	.291000E+03
.589900E+00	.305200E+03
.637700E+00	.308900E+03
.693000E+00	.295300E+03
.733900E+00	.285400E+03
.775800E+00	.267800E+03
.817700E+00	.238400E+03
.859900E+00	.193700E+03
.900600E+00	.148500E+03
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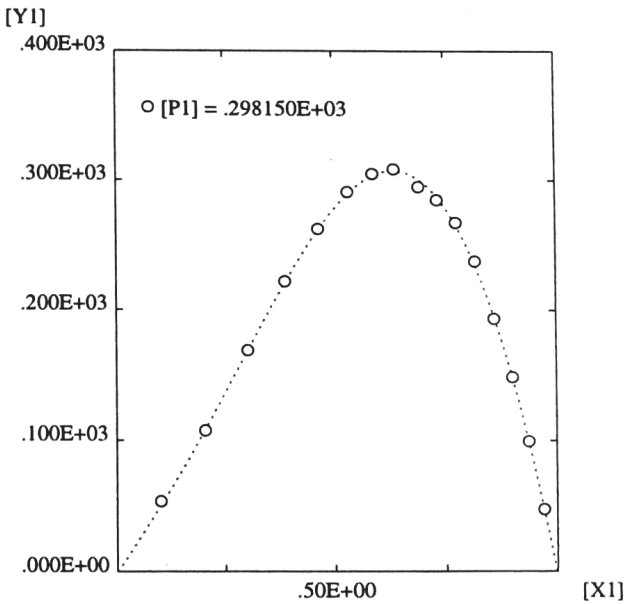
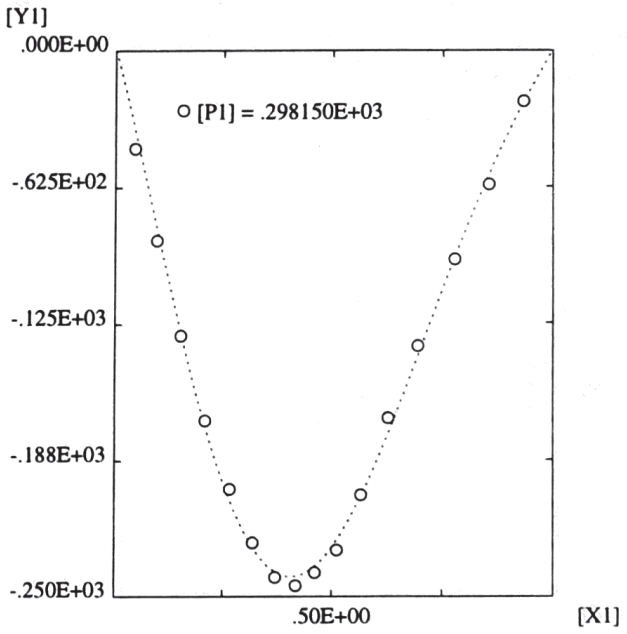


Property Code: [HMSD1000] HEAT OF MIXING AND SOLUTION **ORTJ0962.005**
State: Two-component system, single-phase liquid or two-phase liquid-liquid (LL)
Pure component 1, liquid
Pure component 2, liquid
Parameters: [P1] T/K, Temperature
Variables: [X1] x_1/-, Mole fraction of component 1
[Y1] H^E/J mol^{-1}, Molar excess enthalpy
Method: Direct low-pressure calorimetric measurement of H^E at variable x_1 and constant T

Components: **1. $C_4H_8Cl_2$, 1,4-Dichlorobutane**
2. C_6H_6 , Benzene

[P1] = .298150E+03

[X1]	[Y1]
.456000E–01	–.444000E+02
.976000E–01	–.867000E+02
.154400E+00	–.130300E+03
.210900E+00	–.168900E+03
.267200E+00	–.200400E+03
.320800E+00	–.225200E+03
.372500E+00	–.241200E+03
.419000E+00	–.244900E+03
.463000E+00	–.238800E+03
.512600E+00	–.228600E+03
.568700E+00	–.203400E+03
.629200E+00	–.168000E+03
.695700E+00	–.135100E+03
.778500E+00	–.959000E+02
.855900E+00	–.613000E+02
.933400E+00	–.234000E+02

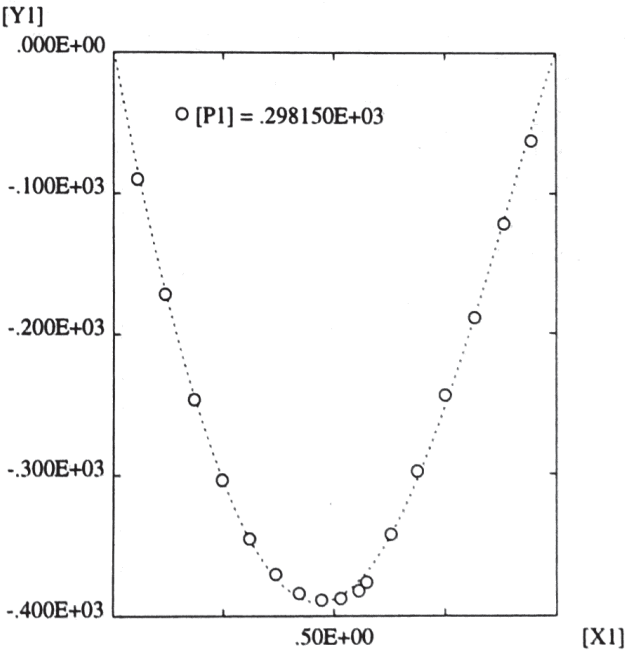


Property Code: [HMSD1000] HEAT OF MIXING AND SOLUTION **ORTJ0962.006**
State: Two-component system, single-phase liquid or two-phase liquid-liquid (LL)
Pure component 1, liquid
Pure component 2, liquid
Parameters: [P1] T/K, Temperature
Variables: [X1] x_1/-, Mole fraction of component 1
[Y1] H^E/J mol^{-1}, Molar excess enthalpy
Method: Direct low-pressure calorimetric measurement of H^E at variable x_1 and constant T

Components: **1. $C_4H_8Cl_2$, 1,4-Dichlorobutane**
2. C_7H_8 , Toluene

[P1] = .298150E+03

[X1]	[Y1]
.557000E–01	–.899000E+02
.118000E+00	–.171100E+03
.184100E+00	–.246400E+03
.247700E+00	–.303400E+03
.310600E+00	–.344600E+03
.369000E+00	–.370300E+03
.422500E+00	–.383600E+03
.471900E+00	–.388500E+03
.517100E+00	–.387300E+03
.556900E+00	–.381700E+03
.574900E+00	–.375700E+03
.628800E+00	–.341700E+03
.687500E+00	–.297900E+03
.750800E+00	–.243700E+03
.816400E+00	–.188400E+03
.881600E+00	–.121300E+03
.944200E+00	–.624000E+02



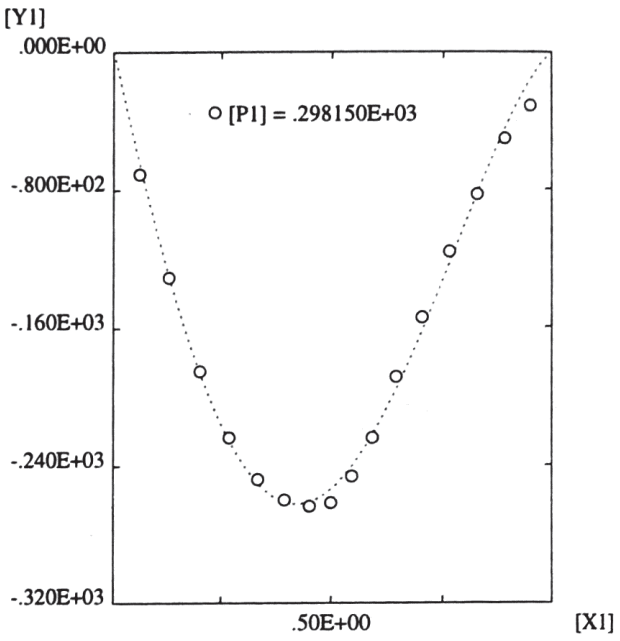
ORTJ0962.007

Property Code: [HMSD1000] HEAT OF MIXING AND SOLUTION
State: Two-component system, single-phase liquid or two-phase liquid-liquid (LL)
Pure component 1, liquid
Pure component 2, liquid
Parameters: [P1] T/K, Temperature
Variables: [X1] x_1/-, Mole fraction of component 1
[Y1] H^E/J mol^{-1}, Molar excess enthalpy
Method: Direct low-pressure calorimetric measurement of H^E at variable x_1 and constant T

Components: **1. $C_4H_8Cl_2$, 1,4-Dichlorobutane**
2. C_8H_{10} , Ethylbenzene

[P1] = .298150E+03

[X1]	[Y1]
.617000E–01	–.705000E+02
.130800E+00	–.130700E+03
.201700E+00	–.185200E+03
.269300E+00	–.223300E+03
.335500E+00	–.247700E+03
.396200E+00	–.259700E+03
.452400E+00	–.263500E+03
.501100E+00	–.261500E+03
.547700E+00	–.246300E+03
.592800E+00	–.223900E+03
.646800E+00	–.188700E+03
.703200E+00	–.154400E+03
.764300E+00	–.116100E+03
.826800E+00	–.831000E+02
.891100E+00	–.501000E+02
.950100E+00	–.310000E+02



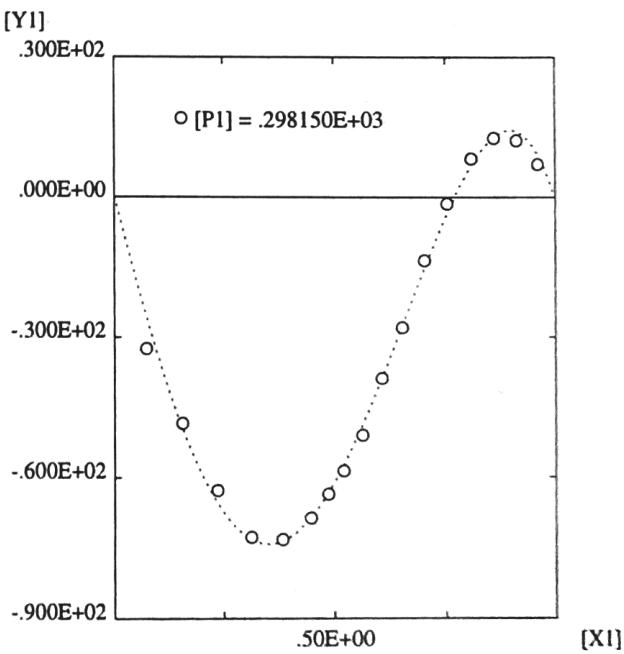
ORTJ0962.008

Property Code: [HMSD1000] HEAT OF MIXING AND SOLUTION
State: Two-component system, single-phase liquid or two-phase liquid-liquid (LL)
Pure component 1, liquid
Pure component 2, liquid
Parameters: [P1] T/K, Temperature
Variables: [X1] x_1/-, Mole fraction of component 1
[Y1] H^E/J mol^{-1}, Molar excess enthalpy
Method: Direct low-pressure calorimetric measurement of H^E at variable x_1 and constant T

Components: **1. $C_4H_8Cl_2$, 1,4-Dichlorobutane**
2. $C_{10}H_{14}$, Butylbenzene

[P1] = .298150E+03

[X1]	[Y1]
.748000E–01	–.323000E+02
.156300E+00	–.482000E+02
.236800E+00	–.626000E+02
.313000E+00	–.726000E+02
.383200E+00	–.729000E+02
.447200E+00	–.684000E+02
.486900E+00	–.634000E+02
.521500E+00	–.584000E+02
.562600E+00	–.508000E+02
.607500E+00	–.386000E+02
.652600E+00	–.278000E+02
.702700E+00	–.135000E+02
.754200E+00	–.120000E+01
.808200E+00	.840000E+01
.860900E+00	.126000E+02
.911600E+00	.122000E+02
.959800E+00	.720000E+01

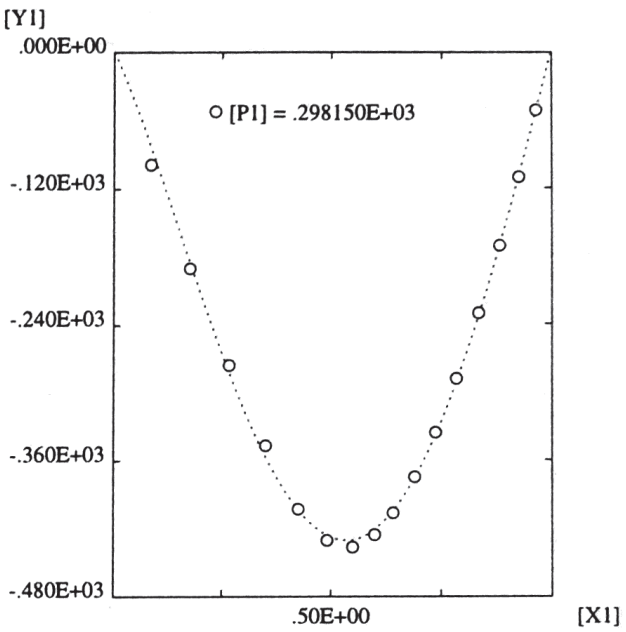


Property Code: [HMSD1000] HEAT OF MIXING AND SOLUTION **ORTJ0962.009**
State: Two-component system, single-phase liquid or two-phase liquid-liquid (LL)
Pure component 1, liquid
Pure component 2, liquid
Parameters: [P1] T/K, Temperature
Variables: [X1] x_1/-, Mole fraction of component 1
[Y1] H^E/J mol^{-1}, Molar excess enthalpy
Method: Direct low-pressure calorimetric measurement of H^E at variable x_1 and constant T

Components: **1. C_6H_6 , Benzene**
2. $C_6H_{12}Cl_2$, 1,6-Dichlorohexane

[P1] = .298150E+03

[X1]	[Y1]
.860000E–01	–.988000E+02
.177000E+00	–.190000E+03
.268600E+00	–.275300E+03
.351600E+00	–.346600E+03
.427000E+00	–.402900E+03
.493400E+00	–.430300E+03
.551200E+00	–.436500E+03
.600200E+00	–.425700E+03
.643300E+00	–.406700E+03
.691300E+00	–.374700E+03
.739000E+00	–.335000E+03
.785400E+00	–.287700E+03
.835100E+00	–.229800E+03
.882600E+00	–.170800E+03
.926100E+00	–.109800E+03
.965200E+00	–.515000E+02

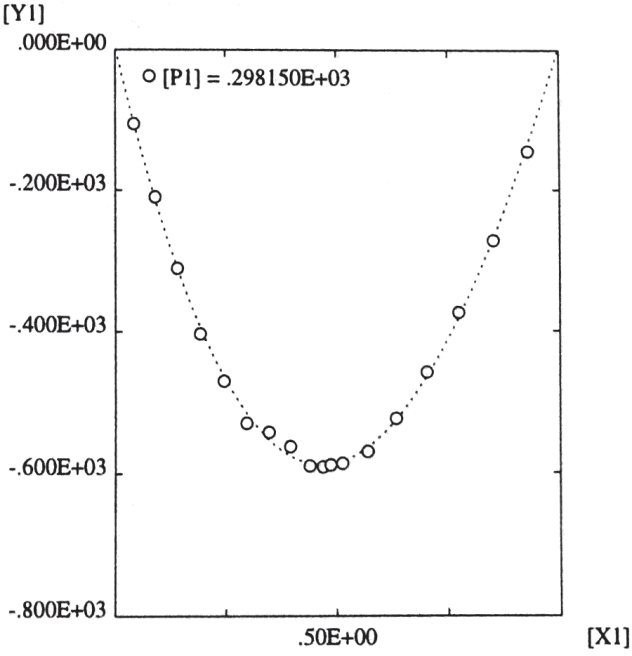


Property Code: [HMSD1000] HEAT OF MIXING AND SOLUTION **ORTJ0962.010**
State: Two-component system, single-phase liquid or two-phase liquid-liquid (LL)
Pure component 1, liquid
Pure component 2, liquid
Parameters: [P1] T/K, Temperature
Variables: [X1] x_1/-, Mole fraction of component 1
[Y1] H^E/J mol^{-1}, Molar excess enthalpy
Method: Direct low-pressure calorimetric measurement of H^E at variable x_1 and constant T

Components: **1. $C_6H_{12}Cl_2$, 1,6-Dichlorohexane**
2. C_7H_8 , Toluene

[P1] = .298150E+03

[X1]	[Y1]
.432000E–01	–.105500E+03
.910000E–01	–.208500E+03
.140800E+00	–.310000E+03
.193400E+00	–.402700E+03
.246400E+00	–.469900E+03
.298100E+00	–.528400E+03
.348400E+00	–.541100E+03
.396200E+00	–.562000E+03
.440400E+00	–.588900E+03
.469400E+00	–.590100E+03
.487000E+00	–.587300E+03
.513300E+00	–.585600E+03
.570200E+00	–.568200E+03
.633800E+00	–.522400E+03
.702600E+00	–.457100E+03
.775000E+00	–.372700E+03
.851800E+00	–.270200E+03
.930100E+00	–.144200E+03

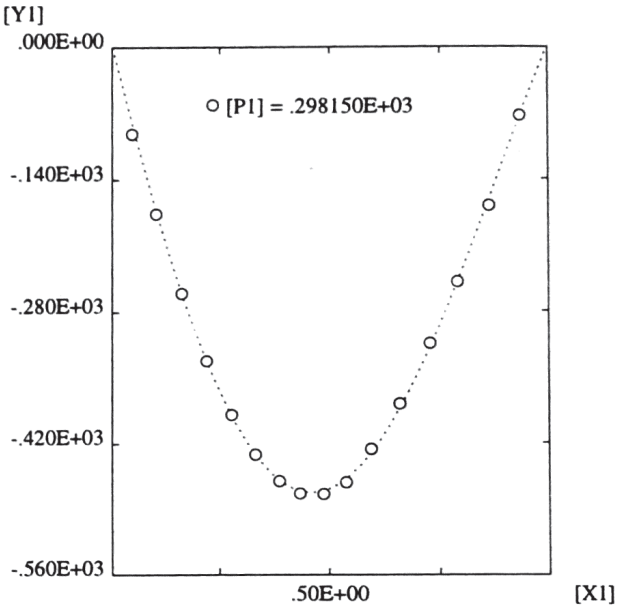


Property Code: [HMSD1000] HEAT OF MIXING AND SOLUTION **ORTJ0962.011**
State: Two-component system, single-phase liquid or two-phase liquid-liquid (LL)
Pure component 1, liquid
Pure component 2, liquid
Parameters: [P1] T/K, Temperature
Variables: [X1] x_1/-, Mole fraction of component 1
[Y1] H^E/J mol^{-1}, Molar excess enthalpy
Method: Direct low-pressure calorimetric measurement of H^E at variable x_1 and constant T

Components: **1. $C_6H_{12}Cl_2$, 1,6-Dichlorohexane**
2. C_8H_{10} , Ethylbenzene

[P1] = .298150E+03

[X1]	[Y1]
.484000E–01	–.916000E+02
.103900E+00	–.175800E+03
.163100E+00	–.260100E+03
.221000E+00	–.332200E+03
.278800E+00	–.389800E+03
.334000E+00	–.431800E+03
.387600E+00	–.459200E+03
.435800E+00	–.472800E+03
.487900E+00	–.473600E+03
.539500E+00	–.460600E+03
.596600E+00	–.426300E+03
.659500E+00	–.378600E+03
.728300E+00	–.314100E+03
.791200E+00	–.249000E+03
.863200E+00	–.168300E+03
.934500E+00	–.722000E+02



Property Code: [HMSD1000] HEAT OF MIXING AND SOLUTION **ORTJ0962.012**
State: Two-component system, single-phase liquid or two-phase liquid-liquid (LL)
Pure component 1, liquid
Pure component 2, liquid
Parameters: [P1] T/K, Temperature
Variables: [X1] x_1/-, Mole fraction of component 1
[Y1] H^E/J mol^{-1}, Molar excess enthalpy
Method: Direct low-pressure calorimetric measurement of H^E at variable x_1 and constant T

Components: **1. $C_6H_{12}Cl_2$, 1,6-Dichlorohexane**
2. $C_{10}H_{14}$, Butylbenzene

[P1] = .298150E+03

[X1]	[Y1]
.621000E–01	–.639000E+02
.128400E+00	–.119800E+03
.197100E+00	–.171900E+03
.262300E+00	–.212700E+03
.327900E+00	–.256100E+03
.387800E+00	–.274400E+03
.443600E+00	–.293900E+03
.493000E+00	–.302500E+03
.530000E+00	–.303800E+03
.580000E+00	–.295300E+03
.588300E+00	–.295100E+03
.642000E+00	–.272000E+03
.698900E+00	–.239900E+03
.760300E+00	–.201000E+03
.822700E+00	–.151200E+03
.885900E+00	–.104900E+03
.946500E+00	–.501000E+02