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Int. DATA Ser., Sel. Data Mixtures, Ser. A 1993, 21(1), 48-84

Excess enthalpies of some alpha, omega-dibromoalkane (C2-C6) + normal alkane (C5-C17) mixtures

Ortega, J.* and Placido, J.

Universidad de Las Palmas de Gran Canaria, Escuela Superior de Ingenieros Industriales, Cátedra de Termodinámica y Fisicoquímica, Las Palmas de Gran Canaria, Islas Canarias, Spain

INTRODUCTION

As a continuation of our systematic measurements of the thermodynamic properties of mixtures as described previously (1), the present paper reports excess enthalpies for 35 mixtures of α,ω -dibromoalkanes (1,2-dibromoethane through 1,6-dibromohexane) + n-alkanes (pentane, heptane, nonane, undecane, tridecane, pentadecane, or heptadecane) measured at 298.15 K and atmospheric pressure with a Calvet type microcalorimeter.

The literature includes several studies of the properties of 1-bromoalkane + alkane mixtures (see refs. 2 and 3). However, few measurements have been made on mixtures of α,ω -dibromoalkanes + alkanes (see ref. 4). Excess molar Gibbs energies, G^E , have been calculated from vapor-liquid equilibrium data (5) for 1,2-dibromoethane + cyclohexane, in agreement with values derived from the solid-liquid phase diagram (6), and for 1,3-dibromopropane + nonane (7). The G^E data for 1,2-dibromoethane + n-alkanes were estimated from light scattering measurements (8). Excess molar enthalpies have been reported for 1,2-dibromoethane through 1,6-dibromohexane + hexane, or + cyclohexane (4, 9 to 13) and for 1,2-dibromoethane + n-alkanes (hexane, octane, decane, dodecane, or hexadecane) (14).

The main purpose of our measurements is to derive interaction parameters for various group-contribution models. Moreover, we will investigate in detail the "proximity effect" between the Br-atoms (4), the enthalpic effects in mixtures with long-chain molecules (2), and the influence of the conformational equilibria in α,ω -dibromoalkanes on the properties of mixtures (6, 11, 15).

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SELECTED DATA ON MIXTURES

International DATA Series*

1a. EXCESS ENTHALPY

The Texas A&M University System, College Station, TX 77843-3111

Published by Thermodynamics Research Center

Components: 1. 1,2-Dibromoethane, C₂H₄Br₂
2. Pentane, C₅H₁₂

State: Binary system, single-phase liquid; pure components, both liquid

Variables: H^E, molar excess enthalpy
x₂, mole fraction of component 1

Parameters: T, temperature

Constants: P, pressure

Method: Direct calorimetric measurement of the enthalpy of mixing at constant T and P and variable x₁; ref. 1

Author(s): Ortega, J. (Universidad de Las Palmas de Gran Canaria, Escuela Superior de Ingenieros Industriales, Cátedra de Termodinámica y Físicoquímica, Las Palmas de Gran Canaria, Islas Canarias, Spain); Plácido, J.

Edited by: Kehiaian, H. V. (Institut de Topologie et de Dynamique des Systèmes, Université Paris VII, CNRS, 1, Rue Guy de la Brosse, 75005 Paris, France)

SOURCE OF DATA

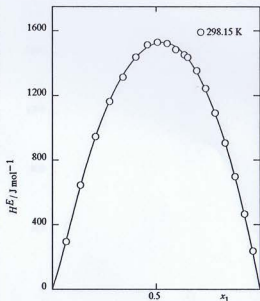
Ortega, J.; Plácido, J. (University of Las Palmas of Gran Canaria, Canary Islands, Spain); FIRST PUBLISHED RESULTS

DIRECT EXPERIMENTAL VALUES

Notes: P, atm.

T/K = 298.15

x ₁	H ^E /J mol ⁻¹						
0.0665	293.8						
0.1361	643.3						
0.2085	944.2						
0.2756	1162.6						
0.3413	1314.3						
0.4024	1437.9						
0.4577	1513.7						
0.5072	1529.1						
0.5525	1522.1						
0.5947	1484.4						
0.6359	1450.9						
0.6535	1436.4						
0.6961	1354.2						
0.7391	1243.2						
0.7835	1092.0						
0.8321	905.0						
0.8789	696.1						
0.9253	463.5						
0.9647	235.7						



Points, direct experimental H^E values; curves, H^E_{calc} calculated from the smoothing equation.

SMOOTHING EQUATION

$$H_{\text{calc}}^E = x_1 x_2 \sum_{i=1}^n a_i (x_1 - x_2)^{i-1}$$

Coeffs. a_i in the smoothing eq., std. deviation σ_a and max. deviation δ_{m detd.} by least-squares anal.

T/K	a ₁	a ₂	a ₃	a ₄	a ₅	a ₆	σ _d
	J mol ⁻¹						
298.15	6092 (17)	725 (88)	310 (190)	-840 (530)	-990 (330)	1760 (680)	9.2

δ_{m detd.} mol⁻¹ = 18

The std. deviations σ_a of the coeffs. a_i are given in parentheses

$$\delta_m = \max |H_{\text{calc}}^E - H^E|; \sigma_d = [\sum (H_{\text{calc}}^E - H^E)^2 / (N - n)]^{1/2}$$

N, no. of direct exptl. values; n, no. of coeffs. a_i

All direct exptl. values equally weighted

AUXILIARY INFORMATION

Apparatus: Calvet type microcalorimeter, model MS-80D (SETARAM, France) with stainless steel batch mixing cell (vol. ca. 8 cm³) and with negligible vapor phase, described in ref. 2. Microcalorimeter calibrated by Joule effect after each measurement. Energies measured by integrating the thermograms.

Procedure: Calibration, filling, and operation described in ref. 2. Cell filled with known masses of pure components. Check measurements on cyclohexane + hexane in agreement to within 1% (over central range of concn.) with the data reported in ref. 3.

Materials: 1. Aldrich Chem. Co., Inc. (Milwaukee, WI, USA) material, of stated purity 99 mole %, dried over mol. sieve Type 3A (from Fluka) and used without further purification; ρ(298.15 K)/kg m⁻³ = 2168.26; n(D, 298.15 K) = 1.5356.
2. Fluka AG (Buchs, St. Gallen, Switzerland) 'puris' grade material of stated GLC purity > 99.5 mole %, dried over mol. sieve Type 3A (from Fluka) and used without further purification; ρ(298.15 K)/kg m⁻³ = 621.31; n(D, 298.15 K) = 1.3547.
Materials were degassed ultrasonically before use.

Errors: δT(reproducibility)/K = 0.001; δT(IPTS-68)/K = 0.02; δx₁ < 0.0005; δH^E/|H^E| = 0.02 (over central range of concn.).

REFERENCES

1. *Int. DATA Ser., Ser. A, Guideline 1a*, 1973.
2. Ortega, J.; Gonzalez, E.; Matos, J. S.; Legido, J. L. *J. Chem. Thermodyn.* 1992, 24, 15.
3. McGlashan, M. L.; Stoeckli, H. F. *J. Chem. Thermodyn.* 1969, 1, 589.

SELECTED DATA ON MIXTURES
International DATA Series*

1a. EXCESS ENTHALPY

The Texas A&M University System, College Station, TX 77843-3111

Published by Thermodynamics Research Center

Components: 1. 1,2-Dibromoethane, $C_2H_4Br_2$
2. Heptane, C_7H_{16}
State: Binary system, single-phase liquid; pure components, both liquid
Variables: H^E , molar excess enthalpy
 x_2 , mole fraction of component 1
Parameters: T , temperature
Constants: P , pressure
Method: Direct calorimetric measurement of the enthalpy of mixing at constant T and P and variable x_1 ; ref. 1

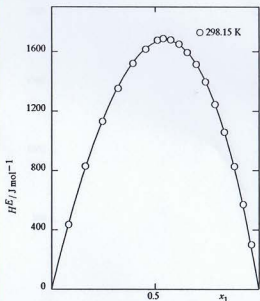
Author(s): Ortega, J. (Universidad de Las Palmas de Gran Canaria, Escuela Superior de Ingenieros Industriales, Cátedra de Termodinámica y Fisicoquímica, Las Palmas de Gran Canaria, Islas Canarias, Spain); Plácido, J.
Edited by: Kehiaian, H. V. (Institut de Topologie et de Dynamique des Systèmes, Université Paris VII, CNRS, 1, Rue Guy de la Brosse, 75005 Paris, France)

SOURCE OF DATA

Ortega, J.; Plácido, J. (University of Las Palmas de Gran Canaria, Canary Islands, Spain); FIRST PUBLISHED RESULTS

DIRECT EXPERIMENTAL VALUES

Notes: P , atm.								
$T/K = 298.15$								
x_1	$H^E/J \text{ mol}^{-1}$							
0.0821	433.8							
0.1641	827.6							
0.2465	1130.6							
0.3225	1353.0							
0.3933	1519.8							
0.4546	1616.4							
0.5110	1675.0							
0.5389	1687.1							
0.5748	1679.1							
0.6139	1648.6							
0.6551	1592.8							
0.6971	1511.7							
0.7419	1394.6							
0.7879	1242.9							
0.8336	1057.1							
0.8801	825.6							
0.9234	569.8							
0.9633	299.8							



Points, direct experimental H^E values; curves, H^E_{calc} calculated from the smoothing equation.

SMOOTHING EQUATION

$$H^E_{\text{calc}} = x_1 x_2 \sum_{i=1}^n a_i (x_1 - x_2)^{i-1}$$

Coeffs. a_i in the smoothing eq. std. deviation σ_d and max. deviation δ_m detd. by least-squares anal.

T/K	a_1	a_2	a_3	a_4	a_5	σ_d	δ_m
	$J \text{ mol}^{-1}$						
298.15	6644 (13)	1256 (29)	333 (64)			8.2	14

The std. deviations σ_i of the coeffs. a_i are given in parentheses

$$\delta_m = \max |H^E_{\text{calc}} - H^E|; \sigma_d = [\sum (H^E_{\text{calc}} - H^E)^2 / (N - n)]^{1/2}$$

N , no. of direct exptl. values; n , no. of coeffs. a_i

All direct exptl. values equally weighted

AUXILIARY INFORMATION

Apparatus: Calvet type microcalorimeter, model MS-80D (SETARAM, France) with stainless steel batch mixing cell (vol. ca. 8 cm^3) and with negligible vapor phase, described in ref. 2. Microcalorimeter calibrated by Joule effect after each measurement. Energies measured by integrating the thermograms.

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2. Fluka AG (Buchs, St. Gallen, Switzerland) 'puris' grade material of stated GLC purity > 99.5 mole %, dried over mol. sieve Type 3A (from Fluka) and used without further purification; $\rho(298.15 \text{ K})/\text{kg m}^{-3} = 679.46$; $n(D, 298.15 \text{ K}) = 1.3851$.
Materials were degassed ultrasonically before use.

Errors: δT (reproducibility)/K = 0.001; δT (IPTS-68)/K = 0.02; $\delta x_1 < 0.0005$; $\delta H^E / |H^E| = 0.02$ (over central range of concn.).

REFERENCES

1. *Int. DATA Ser., Ser. A, Guideline 1a*, 1973.
2. Ortega, J.; Gonzalez, E.; Matos, J. S.; Legido, J. L. *J. Chem. Thermodyn.* 1992, 24, 15.
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51

Int. DATA Ser., Vol. Data Mixtures, Ser. A 1993, 21(1), 51

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The Texas A&M University System, College Station, TX 77843-3111

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State: Binary system, single-phase liquid; pure components, both liquid
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Parameters: T , temperature
Constants: P , pressure
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Edited by: Kehiaian, H. V. (Institut de Topologie et de Dynamique des Systèmes, Université Paris VII, CNRS, 1, Rue Guy de la Brosse, 75005 Paris, France)

SOURCE OF DATA

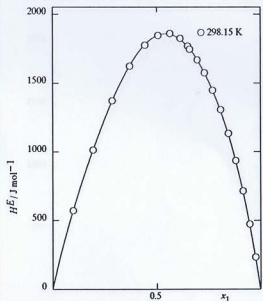
Ortega, J.; Plácido, J. (University of Las Palmas de Gran Canaria, Canary Islands, Spain); FIRST PUBLISHED RESULTS

DIRECT EXPERIMENTAL VALUES

Notes: P , atm.

$T/K = 298.15$

x_1	$H^E / J \text{ mol}^{-1}$				
0.0990	569.9				
0.1947	1009.6				
0.2865	1369.0				
0.3693	1620.0				
0.4434	1773.9				
0.5072	1842.8				
0.5639	1856.6				
0.6124	1821.6				
0.6500	1766.1				
0.6594	1741.6				
0.6959	1666.3				
0.7322	1570.6				
0.7700	1445.7				
0.8079	1302.6				
0.8453	1130.4				
0.8815	933.3				
0.9160	712.5				
0.9480	471.4				
0.9765	230.6				



Points, direct experimental H^E values; curves, H^E_{calc} calculated from the smoothing equation.

SMOOTHING EQUATION

$$H^E_{\text{calc}} = x_1 x_2 \sum_{i=1}^n a_i (x_1 - x_2)^{i-1}$$

Coeffs. a_i in the smoothing eq. std. deviation σ_a and max. deviation δ_m detd. by least-squares anal.

T/K	a_1	a_2	a_3	a_4	a_5	σ_a	δ_m
	$J \text{ mol}^{-1}$						
298.15	7360.2 (6.9)	1390 (23)	-556 (74)	474 (62)	1790 (130)	3.4	5.9

The std. deviations σa_i of the coeffs. a_i are given in parentheses

$$\delta_m = \max |H^E_{\text{calc}} - H^E|; \sigma_a = \{ \sum (H^E_{\text{calc}} - H^E)^2 / (N - n) \}^{1/2}$$

N , no. of direct exptl. values; n , no. of coeffs. a_i

All direct exptl. values equally weighted

AUXILIARY INFORMATION

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 2. Fluka AG (Buchs, St. Gallen, Switzerland) 'purum' grade material of stated GLC purity > 99 mole %, dried over mol. sieve Type 3A (from Fluka) and used without further purification; $\rho(298.15 \text{ K})/\text{kg m}^{-3} = 713.85$; $n(D, 298.15 \text{ K}) = 1.4033$.
 Materials were degassed ultrasonically before use.

Errors: δT (reproducibility)/K = 0.001; δT (IPTS-68)/K = 0.02; $\delta x_i < 0.0005$; $\delta H^E / |H^E| = 0.02$ (over central range of concn.).

REFERENCES

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SELECTED DATA ON MIXTURES
International Data Series*

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The Texas A&M University System, College Station, TX 77843-3111

Published by Thermodynamics Research Center

Components: 1. 1,2-Dibromoethane, $C_2H_4Br_2$
2. Undecane, $C_{11}H_{24}$
State: Binary system, single-phase liquid; pure components, both liquid
Variables: H^E , molar excess enthalpy
Parameters: x_2 , mole fraction of component 1
Parameters: T , temperature
Constants: P , pressure
Method: Direct calorimetric measurement of the enthalpy of mixing at constant T and P and variable x_2 ; ref. 1

Author(s): Ortega, J. (Universidad de Las Palmas de Gran Canaria, Escuela Superior de Ingenieros Industriales, Cátedra de Termodinámica y Fisicoquímica, Las Palmas de Gran Canaria, Islas Canarias, Spain); Plácido, J.
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SOURCE OF DATA

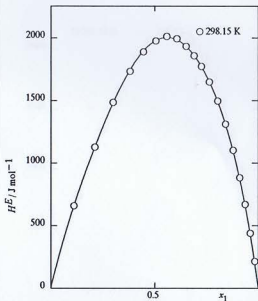
Ortega, J.; Plácido, J. (University of Las Palmas of Gran Canaria, Canary Islands, Spain); FIRST PUBLISHED RESULTS

DIRECT EXPERIMENTAL VALUES

Notes: P , atm.

$T/K = 298.15$

x_1	$H^E/J \text{ mol}^{-1}$				
0.1137	656.7				
0.2130	1125.4				
0.3006	1484.3				
0.3802	1731.2				
0.4456	1884.1				
0.5047	1972.0				
0.5577	2007.7				
0.6047	1991.2				
0.6502	1928.4				
0.6885	1852.6				
0.7238	1767.5				
0.7624	1646.0				
0.8030	1493.0				
0.8415	1308.7				
0.8778	1097.8				
0.9096	879.3				
0.9362	666.5				
0.9608	438.1				
0.9819	212.2				



Points, direct experimental H^E values; curves, H^E_{calc} calculated from the smoothing equation.

SMOOTHING EQUATION

$$H^E_{\text{calc}} = x_1 x_2 \sum_{i=1}^n a_i (x_1 - x_2)^{i-1}$$

Coeffs. a_i in the smoothing eq., std. deviation σ_d and max. deviation δ_m detd. by least-squares anal.

T/K	a_1	a_2	a_3	a_4	a_5	σ_d	δ_m
	$J \text{ mol}^{-1}$						
298.15	7878 (10)	2001 (37)	-380 (110)	770 (100)	2240 (200)	5.2	9.1

The std. deviations σ_i of the coeffs. a_i are given in parentheses

$$\delta_m = \max |H^E_{\text{calc}} - H^E|; \sigma_d = [\sum (H^E_{\text{calc}} - H^E)^2 / (N - n)]^{1/2}$$

N , no. of direct exptl. values; n , no. of coeffs. a_i

All direct exptl. values equally weighted

AUXILIARY INFORMATION

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2. Fluka AG (Buchs, St. Gallen, Switzerland) 'purum' grade material of stated GLC purity > 97 mole %, dried over mol. sieve Type 3A (from Fluka) and used without further purification; $\rho(298.15 \text{ K})/\text{kg m}^{-3} = 736.80$; $n(D, 298.15 \text{ K}) = 1.4154$.
Materials were degassed ultrasonically before use.

Errors: $\delta T(\text{reproducibility})/K = 0.001$; $\delta T(\text{IPTS-68})/K = 0.02$; $\delta x_1 < 0.0005$; $\delta H^E/|H^E| = 0.02$ (over central range of concn.).

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1a. EXCESS ENTHALPY

The Texas A&M University System, College Station, TX 77843-3111

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2. Tridecane, $C_{13}H_{28}$
State: Binary system, single-phase liquid; pure components, both liquid
Variables: H^E , molar excess enthalpy
 x_2 , mole fraction of component i
Parameters: T , temperature
Constants: P , pressure
Method: Direct calorimetric measurement of the enthalpy of mixing at constant T and P and variable x_1 ; ref. 1

Author(s): Ortega, J. (Universidad de Las Palmas de Gran Canaria, Escuela Superior de Ingenieros Industriales, Cátedra de Termodinámica y Fisicoquímica, Las Palmas de Gran Canaria, Islas Canarias, Spain); Plácido, J.
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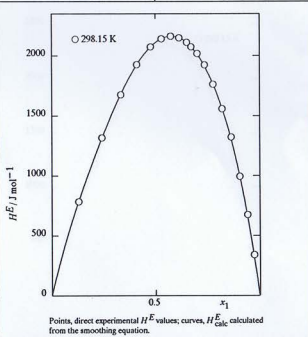
SOURCE OF DATA
Ortega, J.; Plácido, J. (University of Las Palmas de Gran Canaria, Canary Islands, Spain); FIRST PUBLISHED RESULTS

DIRECT EXPERIMENTAL VALUES

Notes: P , atm.

$T/K = 298.15$

x_1	$H^E/J \text{ mol}^{-1}$					
0.1297	780.5					
0.2418	1313.9					
0.3348	1675.6					
0.4122	1923.5					
0.4773	2071.6					
0.5301	2140.8					
0.5750	2161.6					
0.6148	2149.4					
0.6512	2111.9					
0.6737	2072.4					
0.7028	2016.3					
0.7382	1922.3					
0.7782	1760.0					
0.8209	1555.7					
0.8639	1320.3					
0.9050	991.4					
0.9421	672.2					
0.9738	338.3					



SMOOTHING EQUATION

$$H^E_{\text{calc}} = x_1 x_2 \sum_{i=1}^n a_i (x_1 - x_2)^{i-1}$$

Coeffs. a_i in the smoothing eq., std. deviation σ_d and max deviation δ_m detd. by least-squares anal.

T/K	a_1	a_2	a_3	a_4	a_5	σ_d	δ_m
	$J \text{ mol}^{-1}$						
298.15	8425 (14)	2775 (53)	150 (160)	200 (150)	1870 (300)	7.2	13

The std. deviations σ_i of the coeffs. a_i are given in parentheses
 $\delta_m = \max |H^E_{\text{calc}} - H^E|$; $\sigma_d = [\sum (H^E_{\text{calc}} - H^E)^2 / (N - n)]^{1/2}$
 N , no. of direct exptl. values; n , no. of coeffs. a_i
 All direct exptl. values equally weighted

AUXILIARY INFORMATION

Apparatus: Calvet type microcalorimeter, model MS-80D (SETARAM, France) with stainless steel batch mixing cell (vol. ca. 8 cm^3) and with negligible vapor phase, described in ref. 2. Microcalorimeter calibrated by Joule effect after each measurement. Energies measured by integrating the thermograms.

Procedure: Calibration, filling, and operation described in ref. 2. Cell filled with known masses of pure components. Check measurements on cyclohexane + hexane in agreement to within 1% (over central range of concn.) with the data reported in ref. 3.

Materials: 1. Aldrich Chem. Co., Inc. (Milwaukee, WI, USA) material, of stated purity 99 mole %, dried over mol. sieve Type 3A (from Fluka) and used without further purification; $\rho(298.15 \text{ K})/\text{kg m}^{-3} = 2168.26$; $n(D, 298.15 \text{ K}) = 1.5356$.
2. Fluka AG (Buchs, St. Gallen, Switzerland) 'puriss' grade material of stated GLC purity > 99.5 mole %, dried over mol. sieve Type 3A (from Fluka) and used without further purification; $\rho(298.15 \text{ K})/\text{kg m}^{-3} = 752.79$; $n(D, 298.15 \text{ K}) = 1.4238$.
Materials were degassed ultrasonically before use.

Errors: δT (reproducibility)/K = 0.001; δT (IPTS-68)/K = 0.02; $\delta x_1 < 0.0005$; $\delta H^E / |H^E| = 0.02$ (over central range of concn.).

REFERENCES

1. *Int. DATA Ser., Ser. A, Guideline 1a*, 1973.
2. Ortega, J.; Gonzalez, E.; Matos, J. S.; Legido, J. L. *J. Chem. Thermodyn.* 1992, 24, 15.
3. McGlashan, M. L.; Stoeckli, H. F. *J. Chem. Thermodyn.* 1969, 1, 589.

SELECTED DATA ON MIXTURES
International Data Series*

1a. EXCESS ENTHALPY

The Texas A&M University System, College Station, TX 77843-3111

Published by Thermodynamics Research Center

Components: 1. 1,2-Dibromoethane, $C_2H_4Br_2$
2. Pentadecane, $C_{15}H_{32}$
State: Binary system, single-phase liquid; pure components, both liquid
Variables: H^E , molar excess enthalpy
 x_i , mole fraction of component i
Parameters: T , temperature
Constants: P , pressure
Method: Direct calorimetric measurement of the enthalpy of mixing at constant T and P and variable x_i ; ref. 1

Author(s): Ortega, J. (Universidad de Las Palmas de Gran Canaria, Escuela Superior de Ingenieros Industriales, Cátedra de Termodinámica y Físicoquímica, Las Palmas de Gran Canaria, Islas Canarias, Spain); Plácido, J.
Edited by: Kehiaian, H. V. (Institut de Topologie et de Dynamique des Systèmes, Université Paris VII, CNRS, 1, Rue Guy de la Brosse, 75005 Paris, France)

SOURCE OF DATA

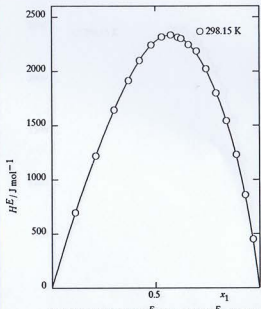
Ortega, J.; Plácido, J. (University of Las Palmas de Gran Canaria, Canary Islands, Spain); FIRST PUBLISHED RESULTS

DIRECT EXPERIMENTAL VALUES

Notes: P , atm.

$T/K = 298.15$

x_1	$H^E/J \text{ mol}^{-1}$					
0.1128	691.1					
0.2123	1216.6					
0.3006	1642.1					
0.3693	1913.5					
0.4241	2095.6					
0.4807	2239.3					
0.5311	2315.1					
0.5748	2330.6					
0.6089	2309.9					
0.6246	2299.1					
0.6586	2243.9					
0.6975	2183.8					
0.7431	2018.7					
0.7923	1797.8					
0.8408	1541.7					
0.8877	1229.0					
0.9311	855.0					
0.9686	448.8					



Points, direct experimental H^E values; curves, H^E_{calc} calculated from the smoothing equation.

SMOOTHING EQUATION

$$H^E_{\text{calc}} = x_1 x_2 \sum_{i=1}^n a_i (x_1 - x_2)^{i-1}$$

Coeffs. a_i in the smoothing eq., std. deviation σ_a and max. deviation δ_m detd. by least-squares anal.

T/K	a_1	a_2	a_3	a_4	a_5	a_6	σ_d
	$J \text{ mol}^{-1}$						
298.15	9084 (17)	3185 (82)	-840 (210)	-930 (550)	2840 (390)	2450 (750)	8.5

$$\delta_m/J \text{ mol}^{-1} = 22$$

The std. deviations σa_i of the coeffs. a_i are given in parentheses

$$\delta_m = \max |H^E_{\text{calc}} - H^E|; \sigma_d = [\sum (H^E_{\text{calc}} - H^E)^2 / (N - n)]^{1/2}$$

N , no. of direct exptl. values; n , no. of coeffs. a_i

All direct exptl. values equally weighted

AUXILIARY INFORMATION

Apparatus: Calvet type microcalorimeter, model MS-80D (SETARAM, France) with stainless steel batch mixing cell (vol. ca. 8 cm^3) and with negligible vapor phase, described in ref. 2. Microcalorimeter calibrated by Joule effect after each measurement. Energies measured by integrating the thermograms.

Procedure: Calibration, filling, and operation described in ref. 2. Cell filled with known masses of pure components. Check measurements on cyclohexane + hexane in agreement to within 1% (over central range of concn.) with the data reported in ref. 3.

Materials: 1. Aldrich Chem. Co., Inc. (Milwaukee, WI, USA) material, of stated purity 99 mole %, dried over mol. sieve Type 3A (from Fluka) and used without further purification; $\rho(298.15 \text{ K})/\text{kg m}^{-3} = 2168.26$; $n(D, 298.15 \text{ K}) = 1.5356$.
2. Fluka AG (Buchs, St. Gallen, Switzerland) 'purum' grade material of stated GLC purity > 98 mole %, dried over mol. sieve Type 3A (from Fluka) and used without further purification; $\rho(298.15 \text{ K})/\text{kg m}^{-3} = 764.80$; $n(D, 298.15 \text{ K}) = 1.4298$.
Materials were degassed ultrasonically before use.

Errors: δT (reproducibility)/K = 0.001; δT (TPS-68)/K = 0.02; $\delta x_1 < 0.0005$; $\delta H^E/H^E = 0.02$ (over central range of concn.).

REFERENCES

1. *Int. DATA Ser., Ser. A, Guideline 1a*, 1973.
2. Ortega, J.; Gonzalez, E.; Matos, J. S.; Legido, J. L. *J. Chem. Thermodyn.* 1992, 24, 15.
3. McGlashan, M. L.; Stoeckli, H. F. *J. Chem. Thermodyn.* 1969, 1, 589.

SELECTED DATA ON MIXTURES
International DATA Series*

1a. EXCESS ENTHALPY

The Texas A&M University System, College Station, TX 77843-3111

Published by Thermodynamics Research Center

Components: 1. 1,2-Dibromoethane, $C_2H_4Br_2$
2. Heptadecane, $C_{17}H_{36}$
State: Binary system, single-phase liquid; pure components, both liquid
Variables: H^E , molar excess enthalpy
 x_2 , mole fraction of component 1
Parameters: T , temperature
Constants: P , pressure
Method: Direct calorimetric measurement of the enthalpy of mixing at constant T and P and variable x_1 ; ref. 1

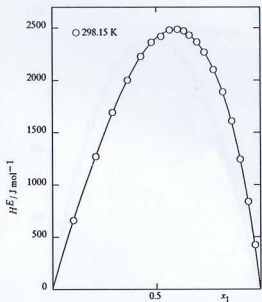
Author(s): Ortega, J. (Universidad de Las Palmas de Gran Canaria, Escuela Superior de Ingenieros Industriales, Cátedra de Termodinámica y Fisicoquímica, Las Palmas de Gran Canaria, Islas Canarias, Spain); Klaciaun, J.
Edited by: Klaciaun, H. V. (Institut de Topologie et de Dynamique des Systèmes, Université Paris VII, CNRS, 1, Rue Guy de la Brosse, 75005 Paris, France)

SOURCE OF DATA

Ortega, J.; Plácido, J. (University of Las Palmas de Gran Canaria, Canary Islands, Spain); FIRST PUBLISHED RESULTS

DIRECT EXPERIMENTAL VALUES

Notes: P , atm.							
$T/K = 298.15$							
x_1	$H^E/J \text{ mol}^{-1}$						
0.0995	656.8						
0.2087	1269.3						
0.2904	1693.1						
0.3627	2001.4						
0.4269	2227.4						
0.4782	2364.0						
0.5231	2419.0						
0.5658	2481.7						
0.6032	2486.7						
0.6344	2470.5						
0.6610	2429.9						
0.6970	2365.7						
0.7324	2268.9						
0.7768	2102.1						
0.8207	1886.8						
0.8639	1609.0						
0.9043	1243.4						
0.9418	835.0						
0.9739	422.6						



Points, direct experimental H^E values; curves, H^E_{calc} calculated from the smoothing equation.

SMOOTHING EQUATION

$$H^E_{\text{calc}} = x_1 x_2 \sum_{i=1}^n a_i (x_1 - x_2)^{i-1}$$

Coeffs. a_i in the smoothing eq., std. deviation σ_a and max. deviation δ_m detd. by least-squares anal.

T/K	a_1	a_2	a_3	a_4	a_5	σ_d	δ_m
	J mol ⁻¹						
298.15	9603 (15)	3510 (52)	560 (170)	1390 (140)	2110 (290)	7.9	17

The std. deviations σa_i of the coeffs. a_i are given in parentheses

$$\delta_m = \max |H^E_{\text{calc}} - H^E|; \sigma_d = [\sum (H^E_{\text{calc}} - H^E)^2 / (N - n)]^{1/2}$$

N , no. of direct exptl. values; n , no. of coeffs. a_i

All direct exptl. values equally weighted

AUXILIARY INFORMATION

Apparatus: Calvet type microcalorimeter, model MS-80D (SETARAM, France) with stainless steel batch mixing cell (vol. ca. 8 cm³) and with negligible vapor phase, described in ref. 2. Microcalorimeter calibrated by Joule effect after each measurement. Energies measured by integrating the thermograms.

Procedure: Calibration, filling, and operation described in ref. 2. Cell filled with known masses of pure components. Check measurements on cyclohexane + hexane in agreement to within 1% (over central range of concn.) with the data reported in ref. 3.

Material: 1. Aldrich Chem. Co., Inc. (Milwaukee, WI, USA) material, of stated purity 99 mole %, dried over mol. sieve Type 3A (from Fluka) and used without further purification; $\rho(298.15 \text{ K})/\text{kg m}^{-3} = 2168.26$; $n(D, 298.15 \text{ K}) = 1.5356$.
2. Fluka AG (Buchs, St. Gallen, Switzerland) 'purum' grade material of stated GLC purity > 99 mole %, dried over mol. sieve Type 3A (from Fluka) and used without further purification; $\rho(298.15 \text{ K})/\text{kg m}^{-3} = 774.33$; $n(D, 298.15 \text{ K}) = 1.4347$.
Materials were degassed ultrasonically before use.

Errors: δT (reproducibility)/K = 0.001; δT (IPTS-68)/K = 0.02; $\delta x_1 < 0.0005$; $\delta H^E / |H^E| = 0.02$ (over central range of concn.).

REFERENCES

1. *Int. DATA Ser., Ser. A, Guideline 1a*, 1973.
2. Ortega, J.; Gonzalez, E.; Matos, J. S.; Legido, J. L. *J. Chem. Thermodyn.* 1992, 24, 15.
3. McGlashan, M. L.; Stoeckli, H. F. *J. Chem. Thermodyn.* 1969, 1, 589.

SELECTED DATA ON MIXTURES
International DATA Series*

1a. EXCESS ENTHALPY

The Texas A&M University System, College Station, TX 77843-3111

Published by Thermodynamics Research Center

Components: 1. 1,3-Dibromopropane, C₃H₆Br₂
2. Pentane, C₅H₁₂
State: Binary system, single-phase liquid; pure components, both liquid
Variables: H^E, molar excess enthalpy
x_i, mole fraction of component i
Parameters: T, temperature
Constants: P, pressure
Method: Direct calorimetric measurement of the enthalpy of mixing at constant T and P and variable x_i; ref. 1

Author(s): Ortega, J. (Universidad de Las Palmas de Gran Canaria, Escuela Superior de Ingenieros Industriales, Cátedra de Termodinámica y Fisicoquímica, Las Palmas de Gran Canaria, Islas Canarias, Spain);
Kebiaia, H. V. (Institut de Topologie et de Dynamique des Systèmes, Université Paris VII, CNRS, 1, Rue Guy de la Brosse, 75005 Paris, France)

SOURCE OF DATA

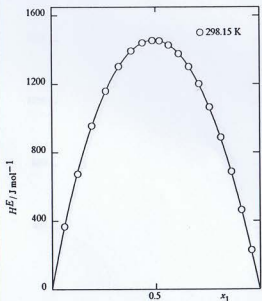
Ortega, J.; Plácido, J. (University of Las Palmas de Gran Canaria, Canary Islands, Spain); FIRST PUBLISHED RESULTS

DIRECT EXPERIMENTAL VALUES

Notes: P, atm.

T/K = 298.15

x ₁	H ^E /J mol ⁻¹						
0.0604	365.3						
0.1249	674.4						
0.1925	955.6						
0.2605	1159.1						
0.3243	1302.2						
0.3842	1393.9						
0.4382	1439.5						
0.4850	1453.9						
0.5190	1451.0						
0.5625	1427.4						
0.6099	1375.7						
0.6592	1301.3						
0.7091	1200.4						
0.7594	1063.9						
0.8129	886.5						
0.8641	686.7						
0.9117	461.8						
0.9585	227.5						



Points, direct experimental H^E values; curves, H^E calculated from the smoothing equation.

SMOOTHING EQUATION

$$H_{\text{calc}}^E = x_1 x_2 \sum_{i=1}^n a_i (x_1 - x_2)^{i-1}$$

Coeffs. a_i in the smoothing eq. std. deviation σ_a and max. deviation δ_m detd. by least-squares anal.

T/K	a ₁	a ₂	a ₃	a ₄	a ₅	σ _d	δ _m
	J mol ⁻¹						
298.15	5821.3 (6.5)	-171 (27)	377 (32)	-200 (69)		4.1	8.4

The std. deviations σ_{a_i} of the coeffs. a_i are given in parentheses

$$\delta_m = \max |H_{\text{calc}}^E - H^E|; \sigma_d = [\sum (H_{\text{calc}}^E - H^E)^2 / (N - n)]^{1/2}$$

N, no. of direct exptl. values; n, no. of coeffs. a_i

All direct exptl. values equally weighted

AUXILIARY INFORMATION

Apparatus: Calvet type microcalorimeter, model MS-80D (SETARAM, France) with stainless steel batch mixing cell (vol. ca. 8 cm³) and with negligible vapor phase, described in ref. 2. Microcalorimeter calibrated by Joule effect after each measurement. Energies measured by integrating the thermograms.

Procedure: Calibration, filling, and operation described in ref. 2. Cell filled with known masses of pure components. Check measurements on cyclohexane + hexane in agreement to within 1% (over central range of concn.) with the data reported in ref. 3.

Materials: 1. Aldrich Chem. Co., Inc. (Milwaukee, WI, USA) material, of stated purity 99 mole %, dried over mol. sieve Type 3A (from Fluka) and used without further purification; ρ(298.15 K)/kg m⁻³ = 1970.14; n(D, 298.15 K) = 1.5204.
2. Fluka AG (Buchs, St. Gallen, Switzerland) 'puriss' grade material of stated GLC purity > 99.5 mole %, dried over mol. sieve Type 3A (from Fluka) and used without further purification; ρ(298.15 K)/kg m⁻³ = 621.31; n(D, 298.15 K) = 1.3547.
Materials were degassed ultrasonically before use.

Errors: δT(reproducibility)/K = 0.001; δT(IPTS-68)/K = 0.02; δx₁ < 0.0005; δH^E/|H^E| = 0.02 (over central range of concn.).

REFERENCES

1. *Int. DATA Ser., Ser. A, Guideline 1a*, 1973.
2. Ortega, J.; Gonzalez, E.; Matos, J. S.; Legido, J. L. *J. Chem. Thermodyn.* 1992, 24, 15.
3. McGlashan, M. L.; Stoekli, H. F. *J. Chem. Thermodyn.* 1969, 1, 589.

Published: January 31, 1993

*Ser. A. Thermodynamic Properties of Non-reacting Binary Systems of Organic Substances

SELECTED DATA ON MIXTURES

International DATA Series*

1a. EXCESS ENTHALPY

The Texas A&M University System, College Station, TX 77843-3111

Published by Thermodynamics Research Center

Components: 1. 1,3-Dibromopropane, C₃H₆Br₂
 2. Nonane, C₉H₂₀
 State: Binary system, single-phase liquid; pure components, both liquid
 Variables: H^E, molar excess enthalpy
 Parameters: x_i, mole fraction of component i
 T, temperature
 Constants: P, pressure
 Method: Direct calorimetric measurement of the enthalpy of mixing at constant T and P and variable x_i; ref. 1

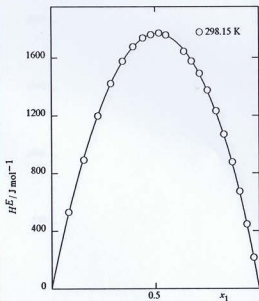
Author(s): Ortega, J. (Universidad de Las Palmas de Gran Canaria, Escuela Superior de Ingenieros Industriales, Cátedra de Termodinámica y Fisicoquímica, Las Palmas de Gran Canaria, Islas Canarias, Spain); Plácido, J.
 Edited by: Kehiaian, H. V. (Institut de Topologie et de Dynamique des Systèmes, Université Paris VII, CNRS, 1, Rue Guy de la Brosse, 75005 Paris, France)

SOURCE OF DATA

Ortega, J.; Plácido, J. (University of Las Palmas de Gran Canaria, Canary Islands, Spain); FIRST PUBLISHED RESULTS

DIRECT EXPERIMENTAL VALUES

Notes: P, atm.							
T/K = 298.15							
x ₁	H ^E /J mol ⁻¹						
0.0810	527.2						
0.1555	890.4						
0.2243	1195.3						
0.2874	1418.9						
0.3442	1573.9						
0.3953	1672.9						
0.4420	1732.6						
0.4810	1757.0						
0.5189	1766.0						
0.5534	1753.7						
0.6391	1639.6						
0.6765	1573.7						
0.7141	1487.8						
0.7535	1372.5						
0.7940	1228.8						
0.8323	1065.6						
0.8709	873.0						
0.9062	671.4						
0.9409	444.2						
0.9732	214.4						



Points, direct experimental H^E values; curves, H^E_{calc} calculated from the smoothing equation.

SMOOTHING EQUATION

$$H_{\text{calc}}^E = x_1 x_2 \sum_{i=1}^n a_i (x_1 - x_2)^{i-1}$$

Coeffs. a_i in the smoothing eq., std. deviation σ_d and max. deviation δ_m detd. by least-squares anal.

T/K	a ₁	a ₂	a ₃	a ₄	a ₅	σ _d	δ _m
	J mol ⁻¹						
298.15	7051 (14)	330 (49)	170 (150)	480 (130)	560 (260)	7.6	14

The std. deviations σ_i of the coeffs. a_i are given in parentheses

$$\delta_m = \max |H_{\text{calc}}^E - H^E|; \sigma_d = [2 \sum (H_{\text{calc}}^E - H^E)^2 / (N - n)]^{1/2}$$

N, no. of direct exptl. values; n, no. of coeffs. a_i

All direct exptl. values equally weighted

AUXILIARY INFORMATION

Apparatus: Calvet type microcalorimeter, model MS-80D (SETARAM, France) with stainless steel batch mixing cell (vol. ca. 8 cm³) and with negligible vapor phase, described in ref. 2. Microcalorimeter calibrated by Joule effect after each measurement. Energies measured by integrating the thermograms.

Procedure: Calibration, filling, and operation described in ref. 2. Cell filled with known masses of pure components. Check measurements on cyclohexane + hexane in agreement to within 1% (over central range of concn.) with the data reported in ref. 3.

Materials: 1. Aldrich Chem. Co., Inc. (Milwaukee, WI, USA) material, of stated purity 99 mole %, dried over mol. sieve Type 3A (from Fluka) and used without further purification; ρ(298.15 K)/kg m⁻³ = 1970.14; n(D, 298.15 K) = 1.5204.
 2. Fluka AG (Buchs, St. Gallen, Switzerland) 'purum' grade material of stated GLC purity > 99 mole %, dried over mol. sieve Type 3A (from Fluka) and used without further purification; ρ(298.15 K)/kg m⁻³ = 713.85; n(D, 298.15 K) = 1.4033.
 Materials were degassed ultrasonically before use.

Errors: δT(reproducibility)/K = 0.001; δT(IPTS-68)/K = 0.02; δx₁ < 0.0005; δH^E/|H^E| = 0.02 (over central range of concn.).

REFERENCES

1. *Int. DATA Ser., Ser. A, Guideline 1a*, 1973.
2. Ortega, J.; Gozalez, E.; Matos, J. S.; Legido, J. L. *J. Chem. Thermodyn.* 1992, 24, 15.
3. McGlashan, M. L.; Stoeckli, H. F. *J. Chem. Thermodyn.* 1969, 1, 589.

SELECTED DATA ON MIXTURES
International Data Series*

1a. EXCESS ENTHALPY

The Texas A&M University System, College Station, TX 77843-3111

Published by Thermodynamics Research Center

Components: 1. 1,3-Dibromopropane, $C_3H_6Br_2$
2. Undecane, $C_{11}H_{24}$
State: Binary system, single-phase liquid; pure components, both liquid
Variables: H^E , molar excess enthalpy
 x_2 , mole fraction of component 1
Parameters: T , temperature
Constants: P , pressure
Method: Direct calorimetric measurement of the enthalpy of mixing at constant T and P and variable x_1 ; ref. 1

Author(s): Ortega, J. (Universidad de Las Palmas de Gran Canaria, Escuela Superior de Ingenieros Industriales, Cátedra de Termodinámica y Fisicoquímica, Las Palmas de Gran Canaria, Islas Canarias, Spain); Plácido, J.
Edited by: Kehiaian, H. V. (Institut de Topologie et de Dynamique des Systèmes, Université Paris VII, CNRS, 1, Rue Guy de la Brosse, 75005 Paris, France)

SOURCE OF DATA

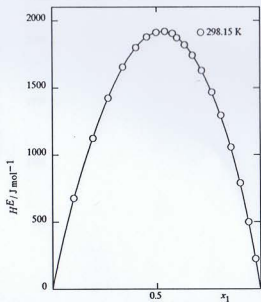
Ortega, J.; Plácido, J. (University of Las Palmas of Gran Canaria, Canary Islands, Spain); FIRST PUBLISHED RESULTS

DIRECT EXPERIMENTAL VALUES

Notes: P , atm.

$T/K = 298.15$

x_1	H^E $J\ mol^{-1}$						
0.1023	674.0						
0.1945	1120.5						
0.2687	1422.4						
0.3398	1652.5						
0.4018	1798.0						
0.4551	1877.2						
0.4996	1908.9						
0.5409	1917.2						
0.5777	1902.2						
0.5991	1870.1						
0.6359	1815.6						
0.6748	1739.6						
0.7196	1626.6						
0.7682	1465.0						
0.8115	1292.6						
0.8589	1056.2						
0.9036	786.3						
0.9436	497.4						
0.9768	224.0						



Points, direct experimental H^E values; curves, H^E_{calc} calculated from the smoothing equation.

SMOOTHING EQUATION

$$H^E_{calc} = x_1 x_2 \sum_{i=1}^n a_i (x_1 - x_2)^{i-1}$$

Coeffs. a_i in the smoothing eq., std. deviation σ_d and max. deviation δ_m detd. by least-squares anal.

T/K	a_1	a_2	a_3	a_4	a_5	σ_d	δ_m
	$J\ mol^{-1}$						
298.15	7643.0 (8.2)	833 (31)	-219 (96)	381 (84)	1590 (170)	4.6	6.7

The std. deviations σ_d of the coeffs. a_i are given in parentheses

$$\delta_m = \max |H^E_{calc} - H^E|; \sigma_d = [\sum (H^E_{calc} - H^E)^2 / (N - n)]^{1/2}$$

N , no. of direct exptl. values; n , no. of coeffs. a_i

All direct exptl. values equally weighted

AUXILIARY INFORMATION

Apparatus: Calvet type microcalorimeter, model MS-80D (SETARAM, France) with stainless steel batch mixing cell (vol. ca. 8 cm^3) and with negligible vapor phase, described in ref. 2. Microcalorimeter calibrated by Joule effect after each measurement. Energies measured by integrating the thermograms.

Procedure: Calibration, filling, and operation described in ref. 2. Cell filled with known masses of pure components. Check measurements on cyclohexane + hexane in agreement to within 1% (over central range of concn.) with the data reported in ref. 3.

Materials: 1. Aldrich Chem. Co., Inc. (Milwaukee, WI, USA) material, of stated purity 99 mole %, dried over mol. sieve Type 3A (from Fluka) and used without further purification; $\rho(298.15\ K)/kg\ m^{-3} = 1970.14$; $n(D, 298.15\ K) = 1.5204$.
2. Fluka AG (Buchs, St. Gallen, Switzerland) 'purum' grade material of stated GLC purity > 97 mole %, dried over mol. sieve Type 3A (from Fluka) and used without further purification; $\rho(298.15\ K)/kg\ m^{-3} = 736.80$; $n(D, 298.15\ K) = 1.4154$.
Materials were degassed ultrasonically before use.

Errors: δT (reproducibility)/K = 0.001; δT (IPTS-68)/K = 0.02; $\delta x_1 < 0.0005$; $\delta H^E / |H^E| = 0.02$ (over central range of concn.).

REFERENCES

1. Int. DATA Ser., Ser. A, Guideline 1a, 1973.
2. Ortega, J.; Gonzalez, E.; Matos, J. S.; Legido, J. L. *J. Chem. Thermodyn.* 1992, 24, 15.
3. McGlashan, M. L.; Stoeckli, H. F. *J. Chem. Thermodyn.* 1969, 1, 589.

SELECTED DATA ON MIXTURES
International Data Series*

1a. EXCESS ENTHALPY

The Texas A&M University System, College Station, TX 77843-3111

Published by Thermodynamics Research Center

Components: 1. 1,3-Dibromopropane, $C_3H_6Br_2$
2. Tridecane, $C_{13}H_{28}$
State: Binary system, single-phase liquid; pure components, both liquid
Variables: H^E , molar excess enthalpy
 x_2 , mole fraction of component 1
Parameters: T , temperature
Constants: P , pressure
Method: Direct calorimetric measurement of the enthalpy of mixing at constant T and P and variable x_1 ; ref. 1

Author(s): Ortega, J. (Universidad de Las Palmas de Gran Canaria, Escuela Superior de Ingenieros Industriales, Cátedra de Termodinámica y Fisicoquímica, Las Palmas de Gran Canaria, Islas Canarias, Spain); Plácido, J.
Edited by: Kehiaian, H. V. (Institut de Topologie et de Dynamique des Systèmes, Université Paris VII, CNRS, 1, Rue Guy de la Brosse, 75005 Paris, France)

SOURCE OF DATA

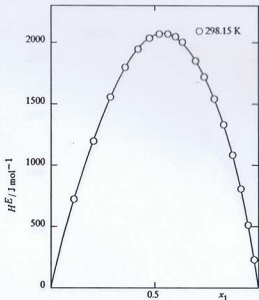
Ortega, J.; Plácido, J. (University of Las Palmas of Gran Canaria, Canary Islands, Spain); FIRST PUBLISHED RESULTS

DIRECT EXPERIMENTAL VALUES

Notes: P , atm.

$T/K = 298.15$

x_1	$H^E/J \text{ mol}^{-1}$						
0.1118	720.5						
0.2065	1195.1						
0.2882	1553.9						
0.3598	1797.5						
0.4200	1944.6						
0.4748	2032.9						
0.5220	2067.9						
0.5640	2069.4						
0.6014	2046.7						
0.6340	2002.9						
0.6977	1848.9						
0.7397	1717.6						
0.7867	1538.9						
0.8322	1328.6						
0.8753	1082.0						
0.9149	805.4						
0.9502	509.3						
0.9793	228.6						



Points, direct experimental H^E values; curves, H^E_{calc} calculated from the smoothing equation.

SMOOTHING EQUATION

$$H^E_{\text{calc}} = x_1 x_2 \sum_{i=1}^n a_i (x_1 - x_2)^{i-1}$$

Coeffs. a_i in the smoothing eq., std. deviation σ_d and max deviation δ_m detd. by least-squares anal.

T/K	a_1	a_2	a_3	a_4	a_5	σ_d	δ_m
	$J \text{ mol}^{-1}$						
298.15	8241.1 (9.2)	1416 (34)	-640 (110)	605 (94)	2140 (190)	4.9	8.0

The std. deviations σ_{a_i} of the coeffs. a_i are given in parentheses

$$\delta_m = \max |H^E_{\text{calc}} - H^E|; \sigma_d = [\sum (H^E_{\text{calc}} - H^E)^2 / (N - n)]^{1/2}$$

N , no. of direct expl. values; n , no. of coeffs. a_i

All direct expl. values equally weighted

AUXILIARY INFORMATION

Apparatus: Calvet type microcalorimeter, model MS-80D (SETARAM, France) with stainless steel batch mixing cell (vol. ca. 8 cm^3) and with negligible vapor phase, described in ref. 2. Microcalorimeter calibrated by Joule effect after each measurement. Energies measured by integrating the thermograms.

Procedure: Calibration, filling, and operation described in ref. 2. Cell filled with known masses of pure components. Check measurements on cyclohexane + hexane in agreement to within 1% (over central range of concn.) with the data reported in ref. 3.

Materials: 1. Aldrich Chem. Co., Inc. (Milwaukee, WI, USA) material, of stated purity 99 mole %, dried over mol. sieve Type 3A (from Fluka) and used without further purification; $\rho(298.15 \text{ K})/\text{kg m}^{-3} = 1970.14$; $n(D, 298.15 \text{ K}) = 1.5204$.
2. Fluka AG (Buchs, St. Gallen, Switzerland) 'puriss' grade material of stated GLC purity $> 99.5 \text{ mole } \%$, dried over mol. sieve Type 3A (from Fluka) and used without further purification; $\rho(298.15 \text{ K})/\text{kg m}^{-3} = 752.79$; $n(D, 298.15 \text{ K}) = 1.4238$.
Materials were degassed ultrasonically before use.

Errors: $\delta T(\text{reproducibility})/K = 0.001$; $\delta T(\text{IPTS-68})/K = 0.02$; $\delta x_1 < 0.0005$; $\delta H^E/|H^E| = 0.02$ (over central range of concn.).

REFERENCES

1. *Int. DATA Ser., Ser. A, Guideline 1a*, 1973.
2. Ortega, J.; Gonzalez, E.; Matos, J. S.; Legido, J. L. *J. Chem. Thermodyn.* 1992, 24, 15.
3. McGlashan, M. L.; Stoeckli, H. F. *J. Chem. Thermodyn.* 1969, 1, 589.

61

Int. DATA Ser., Sub. Data Mixtures Ser. A 1993, 21(10), 61

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Published: January 31, 1993

SELECTED DATA ON MIXTURES
International Data Series*

1a. EXCESS ENTHALPY

The Texas A&M University System, College Station, TX 77843-3111

Published by Thermodynamics Research Center

Components: 1. 1,3-Dibromopropane, C₃H₆Br₂

2. Pentadecane, C₁₅H₃₂

State: Binary system, single-phase liquid; pure components, both liquid

Variables: H^E, molar excess enthalpy

x₁, mole fraction of component 1

Parameters: T, temperature

Constants: P, pressure

Method: Direct calorimetric measurement of the enthalpy of mixing at constant T and P and variable x₁; ref. 1

Author(s): Ortega, J. (Universidad de Las Palmas de Gran Canaria, Escuela Superior de Ingenieros Industriales, Cátedra de Termodinámica y Físicoquímica, Las Palmas de Gran Canaria, Islas Canarias, Spain); Plácido, J.

Edited by: Kehiaian, H. V. (Institut de Topologie et de Dynamique des Systèmes, Université Paris VII, CNRS, 1, Rue Guy de la Brosse, 75005 Paris, France)

SOURCE OF DATA

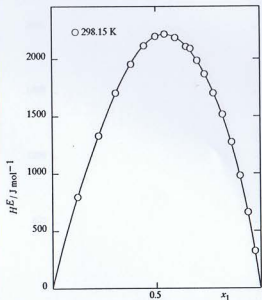
Ortega, J.; Plácido, J. (University of Las Palmas of Gran Canaria, Canary Islands, Spain); FIRST PUBLISHED RESULTS

DIRECT EXPERIMENTAL VALUES

Notes: P, atm.

T/K = 298.15

x ₁	H ^E /J mol ⁻¹							
0.1220	793.9							
0.2245	1327.1							
0.3065	1699.6							
0.3811	1949.0							
0.4440	2107.5							
0.4995	2189.1							
0.5445	2209.9							
0.5948	2178.4							
0.6471	2098.5							
0.6677	2083.6							
0.7002	1979.5							
0.7364	1859.7							
0.7777	1697.1							
0.8202	1511.0							
0.8633	1268.6							
0.9041	978.2							
0.9407	656.7							
0.9738	322.4							



Points, direct experimental H^E values; curves, H^E_{calc} calculated from the smoothing equation.

SMOOTHING EQUATION

$$H_{\text{calc}}^E = x_1 x_2 \sum_{i=1}^n a_i (x_1 - x_2)^{i-1}$$

Coeffs. a_i in the smoothing eq., std. deviation σ_d and max deviation δ_m detd. by least-squares anal.

T/K	a ₁	a ₂	a ₃	a ₄	a ₅	σ _d	δ _m
	J mol ⁻¹						
298.15	8749 (16)	1713 (57)	-810 (180)	1010 (160)	2630 (330)	8.1	19

The std. deviations σ_d of the coeffs. a_i are given in parentheses

$$\delta_m = \max |H_{\text{calc}}^E - H^E|; \sigma_d = [\sum (H_{\text{calc}}^E - H^E)^2 / (N - n)]^{1/2}$$

N, no. of direct exptl. values; n, no. of coeffs. a_i

All direct exptl. values equally weighted

AUXILIARY INFORMATION

Apparatus: Calvet type microcalorimeter, model MS-80D (SETARAM, France) with stainless steel batch mixing cell (vol. ca. 8 cm³) and with negligible vapor phase, described in ref. 2. Microcalorimeter calibrated by Joule effect after each measurement. Energies measured by integrating the thermograms.

Procedures: Calibration, filling, and operation described in ref. 2. Cell filled with known masses of pure components. Check measurements on cyclohexane + hexane in agreement to within 1% (over central range of concn.) with the data reported in ref. 3.

Materials: 1. Aldrich Chem. Co., Inc. (Milwaukee, WI, USA) material, of stated purity 99 mole %, dried over mol. sieve Type 3A (from Fluka) and used without further purification; ρ(298.15 K)/kg m⁻³ = 1970.14; n(D, 298.15 K) = 1.5204.
2. Fluka AG (Buchs, St. Gallen, Switzerland) 'purum' grade material of stated GLC purity > 98 mole %, dried over mol. sieve Type 3A (from Fluka) and used without further purification; ρ(298.15 K)/kg m⁻³ = 764.80; n(D, 298.15 K) = 1.4298.
Materials were degassed ultrasonically before use.

Errors: δT(reproducibility)/K = 0.001; δT(IPTS-68)/K = 0.02; δx₁ < 0.0005; δH^E/H^E = 0.02 (over central range of concn.).

REFERENCES

1. *Int. DATA Ser., Ser. A, Guideline 1a*, 1973.
2. Ortega, J.; Gonzalez, E.; Matos, J. S.; Lejido, J. L. *J. Chem. Thermodyn.* 1992, 24, 15.
3. McGlashan, M. L.; Stockki, H. F. *J. Chem. Thermodyn.* 1969, 1, 589.

Published: January 31, 1993

Published by Thermodynamics Research Center

Components: 1. 1,3-Dibromopropane, $C_3H_6Br_2$
2. Heptadecane, $C_{17}H_{36}$

State: Binary system, single-phase liquid; pure components, both liquid

Variables: H^E , molar excess enthalpy
 x_1 , mole fraction of component 1

Parameter: T , temperature

Constants: P , pressure

Method: Direct calorimetric measurement of the enthalpy of mixing at constant T and P and variable x_1 ; ref. 1

Author(s): Ortega, J. (Universidad de Las Palmas de Gran Canaria, Escuela Superior de Ingenieros Industriales, Cátedra de Termodinámica y Fisicoquímica, Las Palmas de Gran Canaria, Islas Canarias, Spain); Plácido, J.

Edited by: Kehiaian, H. V. (Institut de Topologie et de Dynamique des Systèmes, Université Paris VII, CNRS, 1, Rue Guy de la Brosse, 75005 Paris, France)

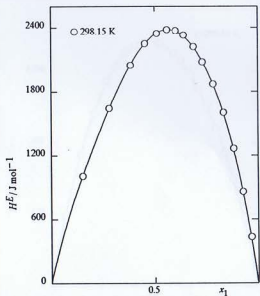
SOURCE OF DATA

Ortega, J.; Plácido, J. (University of Las Palmas de Gran Canaria, Canary Islands, Spain); FIRST PUBLISHED RESULTS

DIRECT EXPERIMENTAL VALUES

Notes: P , atm. $T/K = 298.15$

x_1	$H^E / J \text{ mol}^{-1}$				
0.1530	1004.9				
0.2801	1646.3				
0.3844	2048.5				
0.4536	2251.9				
0.5109	2348.2				
0.5611	2382.3				
0.6052	2372.7				
0.6437	2330.9				
0.6911	2221.3				
0.7353	2077.7				
0.7848	1869.7				
0.8345	1603.5				
0.8833	1262.6				
0.9285	859.4				
0.9681	430.1				



Points, direct experimental H^E values; curves, H^E_{calc} calculated from the smoothing equation.

SMOOTHING EQUATION

$$H^E_{\text{calc}} = x_1 x_2 \sum_{i=1}^n a_i (x_1 - x_2)^{i-1}$$

Coeffs. a_i in the smoothing eq., std. deviation σ_d and max. deviation δ_m detcd. by least-squares anal.

T/K	a_1	a_2	a_3	a_4	a_5	σ_d	δ_m
	$J \text{ mol}^{-1}$						
298.15	9346 (11)	2771 (44)	-470 (130)	180 (130)	2750 (260)	5.3	8.1

The std. deviations σ_i of the coeffs. a_i are given in parentheses

$$\delta_m = \max |H^E_{\text{calc}} - H^E|; \sigma_d = [\sum (H^E_{\text{calc}} - H^E)^2 / (N - n)]^{1/2}$$

N , no. of direct exptl. values; n , no. of coeffs. a_i

All direct exptl. values equally weighted

AUXILIARY INFORMATION

Apparatus: Calvet type microcalorimeter, model MS-80D (SETARAM, France) with stainless steel batch mixing cell (vol. ca. 8 cm^3) and with negligible vapor phase, described in ref. 2. Microcalorimeter calibrated by Joule effect after each measurement. Energies measured by integrating the thermograms.

Procedure: Calibration, filling, and operation described in ref. 2. Cell filled with known masses of pure components. Check measurements on cyclohexane + hexane in agreement to within 1% (over central range of concn.) with the data reported in ref. 3.

Materials: 1. Aldrich Chem. Co., Inc. (Milwaukee, WI, USA) material, of stated purity 99 mole %, dried over mol. sieve Type 3A (from Fluka) and used without further purification; $\rho(298.15 \text{ K})/\text{kg m}^{-3} = 1970.14$; $n(D, 298.15 \text{ K}) = 1.5204$.
2. Fluka AG (Buchs, St. Gallen, Switzerland) 'purum' grade material of stated GLC purity > 99 mole %, dried over mol. sieve Type 3A (from Fluka) and used without further purification; $\rho(298.15 \text{ K})/\text{kg m}^{-3} = 774.33$; $n(D, 298.15 \text{ K}) = 1.4347$.
Materials were degassed ultrasonically before use.

Errors: $\delta T(\text{reproducibility})/K = 0.001$; $\delta T(\text{IPTS-68})/K = 0.02$; $\delta x_1 < 0.0005$; $\delta H^E / H^E = 0.02$ (over central range of concn.).

REFERENCES

1. *Int. DATA Ser., Ser. A, Guideline 1a*, 1973.
2. Ortega, J.; Gonzalez, E.; Matos, J. S.; Legido, J. L. *J. Chem. Thermodyn.* 1992, 24, 15.
3. McGlashan, M. L.; Stockli, H. F. *J. Chem. Thermodyn.* 1969, 1, 589.

SELECTED DATA ON MIXTURES
International DATA Series*

1a. EXCESS ENTHALPY

The Texas A&M University System, College Station, TX 77843-3111

Published by Thermodynamics Research Center

Components: 1. 1,4-Dibromobutane, $C_4H_8Br_2$

2. Pentane, C_5H_{12}

State: Binary system, single-phase liquid; pure components, both liquid

Variables: H^E , molar excess enthalpy

x_2 , mole fraction of component 1

Parameters: T , temperature

Constants: P , pressure

Method: Direct calorimetric measurement of the enthalpy of mixing at constant T and P and variable x_1 ; ref. 1

Author(s): Ortega, J. (Universidad de Las Palmas de Gran Canaria, Escuela Superior de Ingenieros Industriales, Cátedra de Termodinámica y Fisicoquímica, Las Palmas de Gran Canaria, Islas Canarias, Spain); Plácido, J.

Edited by: Kehiaian, H. V. (Institut de Topologie et de Dynamique des Systèmes, Université Paris VII, CNRS, 1, Rue Guy de la Brosse, 75005 Paris, France)

SOURCE OF DATA

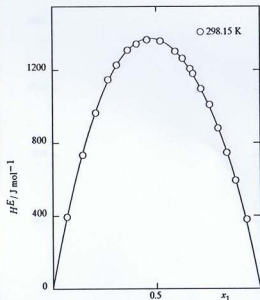
Ortega, J.; Plácido, J. (University of Las Palmas de Gran Canaria, Canary Islands, Spain); FIRST PUBLISHED RESULTS

DIRECT EXPERIMENTAL VALUES

Notes: P , atm.

$T/K = 298.15$

x_1	$H^E/J \text{ mol}^{-1}$						
0.0681	393.1						
0.1451	733.8						
0.2081	966.9						
0.2681	1148.6						
0.3104	1228.5						
0.3621	1310.9						
0.4054	1345.2						
0.4567	1367.2						
0.5207	1360.2						
0.5921	1304.4						
0.6273	1263.7						
0.6632	1208.1						
0.6777	1181.7						
0.7164	1097.3						
0.7570	1010.4						
0.7972	880.8						
0.8394	746.9						
0.8806	594.3						
0.9352	378.7						



Points, direct experimental H^E values; curves, H^E_{calc} calculated from the smoothing equation.

SMOOTHING EQUATION

$$H^E_{\text{calc}} = x_1 x_2 \sum_{i=1}^n a_i (x_1 - x_2)^{i-1}$$

Coeffs. a_i in the smoothing eq., std. deviation σ_a and max. deviation δ_m detd. by least-squares anal.

T/K	a_1	a_2	a_3	a_4	a_5	σ_d	δ_m
	$J \text{ mol}^{-1}$						
298.15	5475 (14)	-541 (49)	663 (67)	600 (140)		8.4	21

The std. deviations σa_i of the coeffs. a_i are given in parentheses

$$\delta_m = \max |H^E_{\text{calc}} - H^E|; \sigma_d = [2x(H^E_{\text{calc}} - H^E)^2/(N-n)]^{1/2}$$

N , no. of direct exptl. values; n , no. of coeffs. a_i

All direct exptl. values equally weighted

AUXILIARY INFORMATION

Apparatus: Calvet type microcalorimeter, model MS-80D (SETARAM, France) with stainless steel batch mixing cell (vol. ca. 8 cm^3) and with negligible vapor phase, described in ref. 2. Microcalorimeter calibrated by Joule effect after each measurement. Energies measured by integrating the thermograms.

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Materials: 1. Aldrich Chem. Co., Inc. (Milwaukee, WI USA) material, of stated purity > 99 mole %, dried over mol. sieve Type 3A (from Fluka) and used without further purification; $\rho(298.15 \text{ K}) \text{ kg m}^{-3} = 1819.90$; $n(D, 298.15 \text{ K}) = 1.5167$.
2. Fluka AG (Buchs, St. Gallen, Switzerland) 'puris' grade material of stated GLC purity > 99.5 mole %, dried over mol. sieve Type 3A (from Fluka) and used without further purification; $\rho(298.15 \text{ K}) \text{ kg m}^{-3} = 621.31$; $n(D, 298.15 \text{ K}) = 1.3547$.
Materials were degassed ultrasonically before use.

Errors: δT (reproducibility)/K = 0.001; δT (IPTS-68)/K = 0.02; $\delta x_1 < 0.0005$; $\delta H^E/|H^E| = 0.02$ (over central range of concn.).

REFERENCES

1. Int. DATA Ser., Ser. A, Guideline 1a, 1973.
2. Ortega, J.; Gonzalez, E.; Matos, J. S.; Legido, J. L. *J. Chem. Thermodyn.* 1992, 24, 15.
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0171-5508/93/0301-0432-20

64

Int. DATA Ser., Ser. A, Guideline 1a, 1973

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SELECTED DATA ON MIXTURES
International Data Series*

1a. EXCESS ENTHALPY

The Texas A&M University System, College Station, TX 77843-3111

Published by Thermodynamics Research Center

Components: 1. 1,4-Dibromobutane, $C_4H_8Br_2$
2. Heptane, C_7H_{16}
State: Binary system, single-phase liquid; pure components, both liquid
Variables: H^E , molar excess enthalpy
 x_i , mole fraction of component i
Parameters: T , temperature
Constants: P , pressure
Method: Direct calorimetric measurement of the enthalpy of mixing at constant T and P and variable x_i ; ref. 1

Author(s): Ortega, J. (Universidad de Las Palmas de Gran Canaria, Escuela Superior de Ingenieros Industriales, Cátedra de Termodinámica y Físicoquímica, Las Palmas de Gran Canaria, Islas Canarias, Spain); Plácido, J.
Edited by: Kehiaian, H. V. (Institut de Topologie et de Dynamique des Systèmes, Université Paris VII, CNRS, 1, Rue Guy de la Brosse, 75005 Paris, France)

SOURCE OF DATA

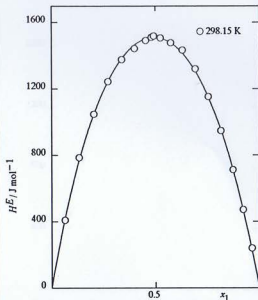
Ortega, J.; Plácido, J. (University of Las Palmas of Gran Canaria, Canary Islands, Spain); FIRST PUBLISHED RESULTS

DIRECT EXPERIMENTAL VALUES

Notes: P , atm.

$T/K = 298.15$

x_1	$H^E_j / \text{J mol}^{-1}$						
0.0650	408.6						
0.1344	784.4						
0.2049	1047.7						
0.2736	1244.5						
0.3396	1376.9						
0.4002	1442.7						
0.4551	1490.9						
0.4820	1512.0						
0.4929	1518.8						
0.5259	1507.7						
0.5744	1479.4						
0.6296	1433.9						
0.6909	1319.8						
0.7542	1154.1						
0.8152	946.5						
0.8725	711.3						
0.9217	469.9						
0.9635	238.0						



Points, direct experimental H^E values; curves, H^E_{calc} calculated from the smoothing equation.

SMOOTHING EQUATION

$$H^E_{\text{calc}} = x_1 x_2 \sum_{i=1}^n a_i (x_1 - x_2)^{i-1}$$

Coeffs. a_i in the smoothing eq., std. deviation σ_a and max. deviation δ_m detd. by least-squares anal.

T/K	a_1	a_2	a_3	a_4	a_5	σ_d	δ_m
	J mol^{-1}						
298.15	6041 (12)	51 (57)	911 (63)	-430 (140)		8.3	15

The std. deviations σ_i of the coeffs. a_i are given in parentheses

$$\delta_m = \max |H^E_{\text{calc}} - H^E|; \sigma_d = [\sum (H^E_{\text{calc}} - H^E)^2 / (N - n)]^{1/2}$$

N , no. of direct exptl. values; n , no. of coeffs. a_i

All direct exptl. values equally weighted

AUXILIARY INFORMATION

Apparatus: Calvet type microcalorimeter, model MS-80D (SETARAM, France) with stainless steel batch mixing cell (vol. ca. 8 cm^3) and with negligible vapor phase, described in ref. 2. Microcalorimeter calibrated by Joule effect after each measurement. Energies measured by integrating the thermograms.

Procedure: Calibration, filling, and operation described in ref. 2. Cell filled with known masses of pure components. Check measurements on cyclohexane + hexane in agreement to within 1% (over central range of concn.) with the data reported in ref. 3.

Materials: 1. Aldrich Chem. Co., Inc. (Milwaukee, WI, USA) material, of stated purity > 99 mole %, dried over mol. sieve Type 3A (from Fluka) and used without further purification; $\rho(298.15 \text{ K})/\text{kg m}^{-3} = 1819.90$; $n_D(298.15 \text{ K}) = 1.5167$.
2. Fluka AG (Buchs, St. Gallen, Switzerland) 'puriss' grade material of stated GLC purity > 99.5 mole %, dried over mol. sieve Type 3A (from Fluka) and used without further purification; $\rho(298.15 \text{ K})/\text{kg m}^{-3} = 679.46$; $n_D(298.15 \text{ K}) = 1.3851$.
Materials were degassed ultrasonically before use.

Errors: $\delta T(\text{reproducibility})/K = 0.001$; $\delta T(\text{TPTS-68})/K = 0.02$; $\delta x_1 < 0.0005$; $\delta H^E_j / |H^E_j| = 0.02$ (over central range of concn.).

REFERENCES

1. Int. DATA Ser., Ser. A, Guideline 1a, 1973.
2. Ortega, J.; Gonzalez, E.; Matos, J. S.; Legido, J. L. *J. Chem. Thermodyn.* 1992, 24, 15.
3. McGlashan, M. L.; Stoeckli, H. F. *J. Chem. Thermodyn.* 1969, 1, 589.

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*Ser. A. Thermodynamic Properties of Non-reacting Binary Systems of Organic Substances

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65

Int. DATA Ser., Vol. Data Mixtures, Ser. A 1993, 21(1), 65

Published by Thermodynamics Research Center

Components: 1. 1,4-Dibromobutane, $C_4H_8Br_2$ 2. Nonane, C_9H_{20}

State: Binary system, single-phase liquid; pure components, both liquid

Variables: H^E , molar excess enthalpy x_2 , mole fraction of component 1Parameters: T , temperatureConstants: P , pressureMethod: Direct calorimetric measurement of the enthalpy of mixing at constant T and P and variable x_1 ; ref. 1

Author(s): Ortega, J. (Universidad de Las Palmas de Gran Canaria, Escuela Superior de Ingenieros Industriales, Cátedra de Termodinámica y Fisicoquímica, Las Palmas de Gran Canaria, Islas Canarias, Spain); Plácido, J.

Edited by: Kehiaian, H. V. (Institut de Topologie et de Dynamique des Systèmes, Université Paris VII, CNRS, 1, Rue Guy de la Brosse, 75005 Paris, France)

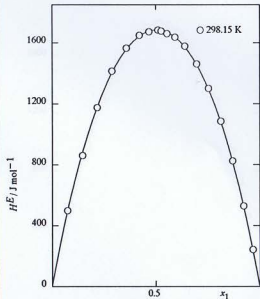
SOURCE OF DATA

Ortega, J.; Plácido, J. (University of Las Palmas of Gran Canaria, Canary Islands, Spain); FIRST PUBLISHED RESULTS

DIRECT EXPERIMENTAL VALUES

Notes: P , atm. $T/K = 298.15$

x_1	$H^E/J \text{ mol}^{-1}$						
0.0734	497.1						
0.1474	858.5						
0.2175	1175.3						
0.2899	1413.4						
0.3592	1565.4						
0.4220	1649.4						
0.4679	1671.6						
0.5122	1681.7						
0.5268	1676.2						
0.5540	1660.2						
0.5926	1635.5						
0.6402	1576.3						
0.6974	1459.9						
0.7547	1299.5						
0.8131	1083.6						
0.8694	823.3						
0.9228	527.4						
0.9676	241.5						

Points, direct experimental H^E values; curves, H^E_{calc} calculated from the smoothing equation.

SMOOTHING EQUATION

$$H^E_{\text{calc}} = x_1 x_2 \sum_{i=1}^n a_i (x_1 - x_2)^{i-1}$$

Coeffs. a_i in the smoothing eq., std. deviation σ_d and max. deviation δ_m detd. by least-squares anal.

T/K	a_1	a_2	a_3	a_4	a_5	σ_d	δ_m
	$J \text{ mol}^{-1}$						
298.15	6735 (13)	138 (31)	768 (67)			8.6	24

The std. deviations σ_i of the coeffs. a_i are given in parentheses

$$\delta_m = \max |H^E_{\text{calc}} - H^E|; \sigma_d = [\sum (H^E_{\text{calc}} - H^E)^2 / (N - n)]^{1/2}$$

 N , no. of direct expt. values; n , no. of coeffs. a_i

All direct expt. values equally weighted

AUXILIARY INFORMATION

Apparatus: Calvet type microcalorimeter, model MS-80D (SETARAM, France) with stainless steel batch mixing cell (vol. ca. 8 cm³) and with negligible vapor phase, described in ref. 2. Microcalorimeter calibrated by Joule effect after each measurement. Energies measured by integrating the thermograms.

Procedures: Calibration, filling, and operation described in ref. 2. Cell filled with known masses of pure components. Check measurements on cyclohexane + hexane in agreement to within 1% (over central range of concn.) with the data reported in ref. 3.

Materials: 1. Aldrich Chem. Co., Inc. (Milwaukee, WI, USA) material, of stated purity > 99 mole %, dried over mol. sieve Type 3A (from Fluka) and used without further purification; $\rho(298.15 \text{ K})/\text{kg m}^{-3} = 1819.90$; $n(D, 298.15 \text{ K}) = 1.5167$.

2. Fluka AG (Buchs, St. Gallen, Switzerland) 'purum' grade material of stated GLC purity > 99 mole %, dried over mol. sieve Type 3A (from Fluka) and used without further purification; $\rho(298.15 \text{ K})/\text{kg m}^{-3} = 713.85$; $n(D, 298.15 \text{ K}) = 1.4033$.

Materials were degassed ultrasonically before use.

Errors: δT (reproducibility)/K = 0.001; δT (IPTS-68)/K = 0.02; $\delta x_1 < 0.0005$; $\delta H^E/|H^E| = 0.02$ (over central range of concn.).

REFERENCES

1. *Int. DATA Ser., Ser. A, Guideline 1a, 1973.*
2. Ortega, J.; Gonzalez, E.; Matos, J. S.; Legido, J. L. *J. Chem. Thermodyn.* 1992, 24, 15.
3. McGlashan, M. L.; Stockli, H. F. *J. Chem. Thermodyn.* 1969, 1, 589.

SELECTED DATA ON MIXTURES
International Data Series*

1a. EXCESS ENTHALPY

The Texas A&M University System, College Station, TX 77843-3111

Published by Thermodynamics Research Center

Components: 1. 1,4-Dibromobutane, $C_4H_8Br_2$
2. Undecane, $C_{11}H_{24}$
State: Binary system, single-phase liquid; pure components, both liquid
Variables: H^E , molar excess enthalpy
 x_1 , mole fraction of component 1
Parameters: T , temperature
Constants: P , pressure
Method: Direct calorimetric measurement of the enthalpy of mixing at constant T and P and variable x_1 ; ref. 1

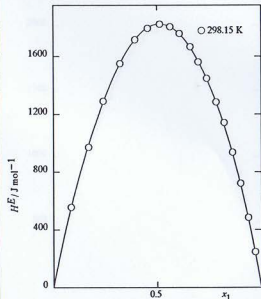
Author(s): Ortega, J. (Universidad de Las Palmas de Gran Canaria, Escuela Superior de Ingenieros Industriales, Cátedra de Termodinámica y Fisicoquímica, Las Palmas de Gran Canaria, Islas Canarias, Spain); Plácido, J.
Edited by: Kehiaian, H. V. (Institut de Physique et de Dynamique des Systèmes, Université Paris VII, CNRS, 1, Rue Guy de la Brosse, 75005 Paris, France)

SOURCE OF DATA

Ortega, J.; Plácido, J. (University of Las Palmas de Gran Canaria, Canary Islands, Spain); FIRST PUBLISHED RESULTS

DIRECT EXPERIMENTAL VALUES

Notes: P , atm.							
$T/K = 298.15$							
x_1	$H^E/J \text{ mol}^{-1}$						
0.0842	552.8						
0.1694	967.4						
0.2410	1286.5						
0.3217	1545.5						
0.3947	1711.6						
0.4560	1790.0						
0.5141	1818.9						
0.5646	1800.8						
0.6092	1754.0						
0.6609	1661.8						
0.6992	1558.0						
0.7386	1443.9						
0.7832	1280.8						
0.8220	1136.5						
0.8622	931.0						
0.9002	717.1						
0.9370	482.2						
0.9703	244.7						



Points, direct experimental H^E values; curves, H^E_{calc} calculated from the smoothing equation.

SMOOTHING EQUATION

$$H^E_{\text{calc}} = x_1 x_2 \sum_{i=1}^n a_i (x_1 - x_2)^{i-1}$$

Coeffs. a_i in the smoothing eq., std. deviation σ_d and max. deviation δ_m det. by least-squares anal.

T/K	a_1	a_2	a_3	a_4	a_5	σ_d	δ_m
	$J \text{ mol}^{-1}$						
298.15	7271 (20)	446 (47)	-350 (140)	250 (120)	1170 (250)	6.8	13

The std. deviations σ_i of the coeffs. a_i are given in parentheses

$$\delta_m = \max |H^E_{\text{calc}} - H^E|; \sigma_d = [\sum (H^E_{\text{calc}} - H^E)^2 / (N - n)]^{1/2}$$

N , no. of direct exptl. values; n , no. of coeffs. a_i

All direct exptl. values equally weighted

AUXILIARY INFORMATION

Apparatus: Calvet type microcalorimeter, model MS-80D (SETARAM, France) with stainless steel batch mixing cell (vol. ca. 8 cm³) and with negligible vapor phase, described in ref. 2. Microcalorimeter calibrated by Joule effect after each measurement. Energies measured by integrating the thermograms.

Procedure: Calibration, filling, and operation described in ref. 2. Cell filled with known masses of pure components. Check measurements on cyclohexane + hexane in agreement to within 1% (over central range of concn.) with the data reported in ref. 3.

Materials: 1. Aldrich Chem. Co., Inc. (Milwaukee, WI, USA) material, of stated purity > 99 mole %, dried over mol. sieve Type 3A (from Fluka) and used without further purification; $\rho(298.15 \text{ K})/\text{kg m}^{-3} = 1819.90$; $n_D(298.15 \text{ K}) = 1.5167$.
2. Fluka AG (Buchs, St. Gallen, Switzerland) 'purum' grade material of stated GLC purity > 97 mole %, dried over mol. sieve Type 3A (from Fluka) and used without further purification; $\rho(298.15 \text{ K})/\text{kg m}^{-3} = 736.80$; $n_D(298.15 \text{ K}) = 1.4154$.
Materials were degassed ultrasonically before use.

Errors: $\delta T(\text{reproducibility})/K = 0.001$; $\delta T(\text{IPTS-68})/K = 0.02$; $\delta x_1 < 0.0005$; $\delta H^E/|H^E| = 0.02$ (over central range of concn.).

REFERENCES

1. *Int. DATA Ser., Ser. A, Guideline 1a*, 1973.
2. Ortega, J.; Gonzalez, E.; Matos, J. S.; Legido, J. L. *J. Chem. Thermodyn.* 1992, 24, 15.
3. McGlashan, M. L.; Stoeckli, H. F. *J. Chem. Thermodyn.* 1969, 1, 589.

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67

Int. DATA Ser., Sel. Data Mixtures, Ser. A 1993, 21(1), 67

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SELECTED DATA ON MIXTURES
International Data Series*

1a. EXCESS ENTHALPY

The Texas A&M University System, College Station, TX 77843-3111

Published by Thermodynamics Research Center

Components: 1. 1,4-Dibromobutane, $C_4H_8Br_2$
2. Tridecane, $C_{13}H_{28}$
State: Binary system, single-phase liquid; pure components, both liquid
Variables: H^E , molar excess enthalpy
 x_1 , mole fraction of component 1
Parameters: T , temperature
Constants: P , pressure
Method: Direct calorimetric measurement of the enthalpy of mixing at constant T and P and variable x_1 ; ref. 1

Author(s): Ortega, J. (Universidad de Las Palmas de Gran Canaria, Escuela Superior de Ingenieros Industriales, Cátedra de Termodinámica y Fisicoquímica, Las Palmas de Gran Canaria, Islas Canarias, Spain); Plácido, J.
Edited by: Kehiaian, H. V. (Institut de Topologie et de Dynamique des Systèmes, Université Paris VII, CNRS, 1, Rue Guy de la Brosse, 75005 Paris, France)

SOURCE OF DATA

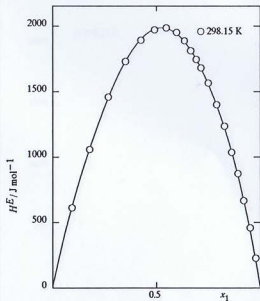
Ortega, J.; Plácido, J. (University of Las Palmas of Gran Canaria, Canary Islands, Spain); FIRST PUBLISHED RESULTS

DIRECT EXPERIMENTAL VALUES

Notes: P , atm.

$T/K = 298.15$

x_1	$H^E/J \text{ mol}^{-1}$						
0.0919	610.2						
0.1778	1056.1						
0.2684	1457.2						
0.3521	1726.0						
0.4255	1889.9						
0.4908	1968.7						
0.5480	1981.6						
0.5972	1948.4						
0.6364	1885.4						
0.6665	1809.2						
0.6932	1741.0						
0.7157	1677.6						
0.7512	1563.2						
0.7908	1396.8						
0.8286	1232.0						
0.8625	1034.1						
0.8928	869.7						
0.9207	664.0						
0.9508	456.4						
0.9772	224.7						



Points, direct experimental H^E values; curves, H^E_{calc} calculated from the smoothing equation.

SMOOTHING EQUATION

$$H^E_{\text{calc}} = x_1 x_2 \sum_{i=1}^n a_i (x_1 - x_2)^{i-1}$$

Coeffs. a_i in the smoothing eq., std. deviation σ_d and max. deviation δ_m detd. by least-squares anal.

T/K	a_1	a_2	a_3	a_4	a_5	σ_d	δ_m
	$J \text{ mol}^{-1}$						
298.15	7909 (15)	925 (49)	-740 (160)	280 (130)	1840 (270)	7.3	11

The std. deviations σ_i of the coeffs. a_i are given in parentheses

$$\delta_m = \max |H^E_{\text{calc}} - H^E|; \sigma_d = [\sum (H^E_{\text{calc}} - H^E)^2 / (N - n)]^{1/2}$$

N , no. of direct exptl. values; n , no. of coeffs. a_i

All direct exptl. values equally weighted

AUXILIARY INFORMATION

Apparatus: Calvet type microcalorimeter, model MS-80D (SETARAM, France) with stainless steel batch mixing cell (vol. ca. 8 cm^3) and with negligible vapor phase, described in ref. 2. Microcalorimeter calibrated by Joule effect after each measurement. Energies measured by integrating the thermograms.

Procedure: Calibration, filling, and operation described in ref. 2. Cell filled with known masses of pure components. Check measurements on cyclohexane + hexane in agreement to within 1% (over central range of concn.) with the data reported in ref. 3.

Materials: 1. Aldrich Chem. Co., Inc. (Milwaukee, WI, USA) material, of stated purity > 99 mole %, dried over mol. sieve Type 3A (from Fluka) and used without further purification; $\rho(298.15 \text{ K})/\text{kg m}^{-3} = 1819.90$; $n(D, 298.15 \text{ K}) = 1.5167$.
2. Fluka AG (Buchs, St. Gallen, Switzerland) 'puriss' grade material of stated GLC purity > 99.5 mole %, dried over mol. sieve Type 3A (from Fluka) and used without further purification; $\rho(298.15 \text{ K})/\text{kg m}^{-3} = 752.79$; $n(D, 298.15 \text{ K}) = 1.4238$.
Materials were degassed ultrasonically before use.

Errors: $\delta T(\text{reproducibility})/K = 0.001$; $\delta T(\text{IPTS-68})/K = 0.02$; $\delta x_1 < 0.0005$; $\delta H^E/|H^E| = 0.02$ (over central range of concn.).

REFERENCES

1. *Int. DATA Ser., Ser. A, Guideline 1a*, 1973.
2. Ortega, J.; Gonzalez, E.; Matos, J. S.; Legido, J. L. *J. Chem. Thermodyn.* 1992, 24, 15.
3. McGlashan, M. L.; Stoeckli, H. F. *J. Chem. Thermodyn.* 1969, 1, 589.

SELECTED DATA ON MIXTURES
International DATA Series*

1a. EXCESS ENTHALPY

The Texas A&M University System, College Station, TX 77843-3111

Published by Thermodynamics Research Center

Components: 1. 1,4-Dibromobutane, $C_4H_8Br_2$
2. Pentadecane, $C_{15}H_{32}$
State: Binary system, single-phase liquid; pure components, both liquid
Variables: H^E , molar excess enthalpy
 x_2 , mole fraction of component 1
Parameters: T , temperature
Constants: P , pressure
Method: Direct calorimetric measurement of the enthalpy of mixing at constant T and P and variable x_1 ; ref. 1

Author(s): Ortega, J. (Universidad de Las Palmas de Gran Canaria, Escuela Superior de Ingenieros Industriales, Cátedra de Termodinámica y Fisicoquímica, Las Palmas de Gran Canaria, Islas Canarias, Spain); Plácido, J.
Edited by: Kehiaian, H. V. (Institut de Topologie et de Dynamique des Systèmes, Université Paris VII, CNRS, 1, Rue Guy de la Brosse, 75005 Paris, France)

SOURCE OF DATA

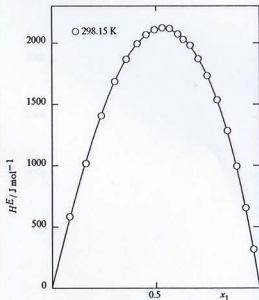
Ortega, J.; Plácido, J. (University of Las Palmas de Gran Canaria, Canary Islands, Spain); FIRST PUBLISHED RESULTS

DIRECT EXPERIMENTAL VALUES

Notes: P , atm.

$T/K = 298.15$

x_1	$H^E/J \text{ mol}^{-1}$					
0.840	581.1					
1.638	1015.4					
2.381	1405.2					
3.035	1683.2					
3.596	1866.5					
4.110	1991.0					
4.546	2064.5					
4.947	2106.4					
5.319	2121.0					
5.666	2115.3					
6.071	2070.3					
6.331	2026.3					
6.668	1978.4					
7.057	1868.0					
7.478	1732.1					
7.963	1532.7					
8.451	1281.2					
8.899	990.6					
9.326	651.3					
9.700	314.5					



Points, direct experimental H^E values; curves, H^E_{calc} calculated from the smoothing equation.

SMOOTHING EQUATION

$$H^E_{\text{calc}} = x_1 x_2 \sum_{i=1}^n a_i (x_1 - x_2)^{i-1}$$

Coeffs. a_i in the smoothing eq., std. deviation σ_d and max. deviation δ_m detd. by least-squares anal.

T/K	a_1	a_2	a_3	a_4	a_5	σ_d	δ_m
	$J \text{ mol}^{-1}$						
298.15	8438 (14)	1188 (51)	-30 (170)	870 (140)	890 (290)	8.2	18

The std. deviations σ_d of the coeffs. a_i are given in parentheses

$$\delta_m = \max |H^E_{\text{calc}} - H^E|; \sigma_d = [\sum (H^E_{\text{calc}} - H^E)^2 / (N - n)]^{1/2}$$

N , no. of direct exptl. values; n , no. of coeffs. a_i
All direct exptl. values equally weighted

AUXILIARY INFORMATION

Apparatus: Calvet type microcalorimeter, model MS-80D (SETARAM, France) with stainless steel batch mixing cell (vol. ca. 8 cm^3) and with negligible vapor phase, described in ref. 2. Microcalorimeter calibrated by Joule effect after each measurement. Energies measured by integrating the thermograms.

Procedure: Calibration, filling, and operation described in ref. 2. Cell filled with known masses of pure components. Check measurements on cyclohexane + hexane in agreement to within 1% (over central range of concn.) with the data reported in ref. 3.

Materials: 1. Aldrich Chem. Co., Inc. (Milwaukee, WI, USA) material, of stated purity > 99 mole %, dried over mol. sieve Type 3A (from Fluka) and used without further purification; $\rho(298.15 \text{ K})/\text{kg m}^{-3} = 1819.90$; $n(D, 298.15 \text{ K}) = 1.5167$.
2. Fluka AG (Buchs, St. Gallen, Switzerland) 'purum' grade material of stated OLC purity > 98 mole %, dried over mol. sieve Type 3A (from Fluka) and used without further purification; $\rho(298.15 \text{ K})/\text{kg m}^{-3} = 764.80$; $n(D, 298.15 \text{ K}) = 1.4298$.
Materials were degassed ultrasonically before use.

Errors: δT (reproducibility)/K = 0.001; δT (IPTS-68)/K = 0.02; $\delta x_1 < 0.0005$; $\delta H^E / |H^E| = 0.02$ (over central range of concn.).

REFERENCES

1. Int. DATA Ser., Ser. A, Guideline 1a, 1973.
2. Ortega, J.; Gonzalez, E.; Matos, J. S.; Legido, J. L. *J. Chem. Thermodyn.* 1992, 24, 15.
3. McGlashan, M. L.; Stoekli, H. F. *J. Chem. Thermodyn.* 1969, 1, 589.

Components: 1. 1,4-Dibromobutane, $C_4H_8Br_2$
2. Heptadecane, $C_{17}H_{36}$

State: Binary system, single-phase liquid; pure components, both liquid

Variables: H^E , molar excess enthalpy

x_i , mole fraction of component i

Parameters: T , temperature

Constants: P , pressure

Method: Direct calorimetric measurement of the enthalpy of mixing at constant T and P and variable x_i ; ref. 1

Author(s): Ortega, J. (Universidad de Las Palmas de Gran Canaria, Escuela Superior de Ingenieros Industriales, Cátedra de Termodinámica y Fisicoquímica, Las Palmas de Gran Canaria, Islas Canarias, Spain); Plácidio, J.

Edited by: Kehiaian, H. V. (Institut de Topologie et de Dynamique des Systèmes, Université Paris VII, CNRS, 1, Rue Guy de la Brosse, 75005 Paris, France)

SOURCE OF DATA

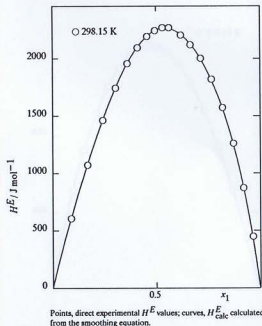
Ortega, J.; Plácidio, J. (University of Las Palmas de Gran Canaria, Canary Islands, Spain); FIRST PUBLISHED RESULTS

DIRECT EXPERIMENTAL VALUES

Notes: P , atm.

$T/K = 298.15$

x_1	$H^E/J \text{ mol}^{-1}$								
0.0892	601.1								
0.1694	1069.2								
0.2431	1459.1								
0.3048	1738.8								
0.3624	1949.6								
0.4108	2088.7								
0.4571	2186.2								
0.4961	2236.5								
0.5326	2262.3								
0.5643	2261.4								
0.6212	2198.1								
0.6668	2114.8								
0.7155	1994.9								
0.7684	1815.0								
0.8210	1568.0								
0.8725	1255.7								
0.9212	868.9								
0.9649	445.6								



SMOOTHING EQUATION

$$H^E_{\text{calc}} = x_1 x_2 \sum_{i=1}^n a_i (x_1 - x_2)^{i-1}$$

Coeffs. a_i in the smoothing eq., std. deviation σ_d and max. deviation δ_m detd. by least-squares anal.

T/K	a_1	a_2	a_3	a_4	a_5	σ_d	δ_m
	$J \text{ mol}^{-1}$						
298.15	8958.1 (9.6)	1671 (35)	-400 (110)	1597 (96)	2090 (200)	5.4	8.6

The std. deviations σ_d of the coeffs. a_i are given in parentheses

$$\delta_m = \max |H^E_{\text{calc}} - H^E|; \sigma_d = [\sum (H^E_{\text{calc}} - H^E)^2 / (N - n)]^{1/2}$$

N , no. of direct exptl. values; n , no. of coeffs. a_i

All direct exptl. values equally weighted

AUXILIARY INFORMATION

Apparatus: Calvet type microcalorimeter, model MS-80D (SETARAM, France) with stainless steel batch mixing cell (vol. ca. 8 cm³) and with negligible vapor phase, described in ref. 2. Microcalorimeter calibrated by Joule effect after each measurement. Energies measured by integrating the thermograms.

Procedure: Calibration, filling, and operation described in ref. 2. Cell filled with known masses of pure components. Check measurements on cyclohexane + hexane in agreement to within 1% (over central range of concn.) with the data reported in ref. 3.

Materials: 1. Aldrich Chem. Co., Inc. (Milwaukee, WI, USA) material, of stated purity > 99 mole %, dried over mol. sieve Type 3A (from Fluka) and used without further purification; $\rho(298.15 \text{ K})/\text{kg m}^{-3} = 1819.90$; $n(D, 298.15 \text{ K}) = 1.5167$.
2. Fluka AG (Buchs, St. Gallen, Switzerland) 'purum' grade material of stated GLC purity > 99 mole %, dried over mol. sieve Type 3A (from Fluka) and used without further purification; $\rho(298.15 \text{ K})/\text{kg m}^{-3} = 774.33$; $n(D, 298.15 \text{ K}) = 1.4347$.
Materials were degassed ultrasonically before use.

Errors: δT (reproducibility)/K = 0.001; δT (IPTS-68)/K = 0.02; $\delta x_i < 0.0005$; $\delta H^E/H^E = 0.02$ (over central range of concn.).

REFERENCES

1. *Int. DATA Ser., Ser. A, Guideline 1a*, 1973.
2. Ortega, J.; Gonzalez, E.; Matos, J. S.; Legido, J. L. *J. Chem. Thermodyn.* 1992, 24, 15.
3. McGlashan, M. L.; Stoeckli, H. F. *J. Chem. Thermodyn.* 1969, 1, 589.

SELECTED DATA ON MIXTURES
International Data Series*

1a. EXCESS ENTHALPY

The Texas A&M University System, College Station, TX 77843-3111

Published by Thermodynamics Research Center

Components: 1. 1,5-Dibromopentane, $C_5H_{10}Br_2$
2. Pentane, C_5H_{12}
State: Binary system, single-phase liquid; pure components, both liquid
Variables: H^E , molar excess enthalpy
 x_i , mole fraction of component i
Parameters: T , temperature
Constants: P , pressure
Method: Direct calorimetric measurement of the enthalpy of mixing at constant T and P and variable x_i ; ref. 1

Author(s): Ortega, J. (Universidad de Las Palmas de Gran Canaria, Escuela Superior de Ingenieros Industriales, Cátedra de Termodinámica y Fisicoquímica, Las Palmas de Gran Canaria, Islas Canarias, Spain); Plácidio, J.
Edited by: Kehiaian, H. V. (Institut de Topologie et de Dynamique des Systèmes, Université Paris VII, CNRS, 1, Rue Guy de la Brosse, 75005 Paris, France)

SOURCE OF DATA

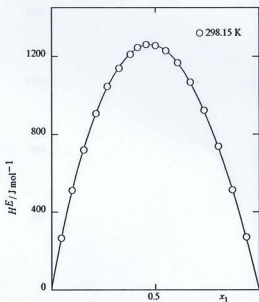
Ortega, J.; Plácidio, J. (University of Las Palmas of Gran Canaria, Canary Islands, Spain); FIRST PUBLISHED RESULTS

DIRECT EXPERIMENTAL VALUES

Notes: P , atm.

$T/K = 298.15$

x_1	$H^E/J \text{ mol}^{-1}$						
0.0469	265.6						
0.0992	511.1						
0.1558	717.9						
0.2139	905.3						
0.2707	1046.2						
0.3261	1138.2						
0.3786	1210.4						
0.4149	1245.2						
0.4554	1258.7						
0.5008	1254.7						
0.5515	1227.1						
0.6083	1165.8						
0.6696	1066.3						
0.7356	922.5						
0.8033	736.0						
0.8703	511.6						
0.9374	269.9						



Points, direct experimental H^E values; curves, H^E_{calc} calculated from the smoothing equation.

SMOOTHING EQUATION

$$H^E_{\text{calc}} = x_1 x_2 \sum_{i=1}^n a_i (x_1 - x_2)^{i-1}$$

Coeffs. a_i in the smoothing eq., std. deviation σ_{δ} and max. deviation δ_m detd. by least-squares anal.

T/K	a_1	a_2	a_3	a_4	a_5	σ_{δ}	δ_m
	$J \text{ mol}^{-1}$						
298.15	5024.8 (7.4)	-529 (26)	-198 (83)	-272 (67)	550 (140)	3.9	6.4

The std. deviations σ_{a_i} of the coeffs. a_i are given in parentheses

$$\delta_m = \max |H^E_{\text{calc}} - H^E|; \sigma_{\delta} = [\sum (H^E_{\text{calc}} - H^E)^2 / (N - n)]^{1/2}$$

N , no. of direct exptl. values; n , no. of coeffs. a_i

All direct exptl. values equally weighted

AUXILIARY INFORMATION

Apparatus: Calvet type microcalorimeter, model MS-80D (SETARAM, France) with stainless steel batch mixing cell (vol. ca. 8 cm^3) and with negligible vapor phase, described in ref. 2. Microcalorimeter calibrated by Joule effect after each measurement. Energies measured by integrating the thermograms.

Procedure: Calibration, filling, and operation described in ref. 2. Cell filled with known masses of pure components. Check measurements on cyclohexane + hexane in agreement to within 1% (over central range of concn.) with the data reported in ref. 3.

Materials: 1. Aldrich Chem. Co., Inc. (Milwaukee, WI, USA) material, of stated purity > 97 mole %, dried over mol. sieve Type 3A (from Fluka) and used without further purification; $\rho(298.15 \text{ K})/\text{kg m}^{-3} = 1692.49$; $n(D, 298.15 \text{ K}) = 1.5102$
2. Fluka AG (Buchs, St. Gallen, Switzerland) 'puriss' grade material of stated GLC purity > 99.5 mole %, dried over mol. sieve Type 3A (from Fluka) and used without further purification; $\rho(298.15 \text{ K})/\text{kg m}^{-3} = 621.31$; $n(D, 298.15 \text{ K}) = 1.3547$.
Materials were degassed ultrasonically before use.

Errors: δT (reproducibility)/K = 0.001; δT (IPTS-68)/K = 0.02; $\delta x_1 < 0.0005$; $\delta H^E / |H^E| = 0.02$ (over central range of concn.).

REFERENCES

1. *Int. DATA Ser., Ser. A, Guideline 1a*, 1973.
2. Ortega, J.; Gonzalez, E.; Matos, J. S.; Legido, J. L. *J. Chem. Thermodyn.* 1992, 24, 15.
3. McGlashan, M. L.; Stoeckli, H. F. *J. Chem. Thermodyn.* 1969, 1, 589.

71

Int. DATA Ser., Ser. A, Guideline 1a, 1993, 24(1), 71

SELECTED DATA ON MIXTURES
International Data Series*

1a. EXCESS ENTHALPY

The Texas A&M University System, College Station, TX 77843-3111

Published by Thermodynamics Research Center

Components: 1. 1,5-Dibromopentane, C₅H₁₀Br₂
2. Heptane, C₇H₁₆
State: Binary system, single-phase liquid; pure components, both liquid
Variables: H^E, molar excess enthalpy
x₂, mole fraction of component 1
Parameters: T, temperature
Constants: P, pressure
Method: Direct calorimetric measurement of the enthalpy of mixing at constant T and P and variable x₂; ref. 1

Author(s): Ortega, J. (Universidad de Las Palmas de Gran Canaria, Escuela Superior de Ingenieros Industriales, Cátedra de Termodinámica y Fisicoquímica, Las Palmas de Gran Canaria, Islas Canarias, Spain); Plácido, J.
Edited by: Kehiaian, H. V. (Institut de Topologie et de Dynamique des Systèmes, Université Paris VII, CNRS, 1, Rue Guy de la Brosse, 75005 Paris, France)

SOURCE OF DATA

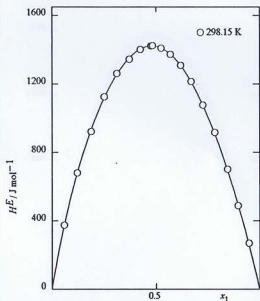
Ortega, J.; Plácido, J. (University of Las Palmas de Gran Canaria, Canary Islands, Spain); FIRST PUBLISHED RESULTS

DIRECT EXPERIMENTAL VALUES

Notes: P, atm.

T/K = 298.15

x ₁	H ^E /J mol ⁻¹						
0.0584	373.1						
0.1230	678.9						
0.1878	920.4						
0.2520	1125.7						
0.3120	1261.5						
0.3708	1345.4						
0.4252	1400.7						
0.4754	1422.1						
0.4833	1424.1						
0.5253	1407.9						
0.5694	1372.9						
0.6191	1308.1						
0.6702	1212.9						
0.7269	1077.2						
0.7836	915.2						
0.8447	700.6						
0.8958	487.3						
0.9486	267.7						



Points, direct experimental H^E values; curves, H^E_{calc} calculated from the smoothing equation.

SMOOTHING EQUATION

$$H_{\text{Calc}}^E = x_1 x_2 \sum_{i=1}^n a_i (x_1 - x_2)^{i-1}$$

Coeffs. a_i in the smoothing eq., std. deviation σ_d and max. deviation δ_m detd. by least-squares anal.

T/K	a ₁	a ₂	a ₃	a ₄	a ₅	σ _d	δ _m
	J mol ⁻¹						
298.15	5674.4 (9.6)	-452 (37)	-210 (110)	-369 (94)	830 (200)	5.5	9.6

The std. deviations σ_i of the coeffs. a_i are given in parentheses

$$\delta_m = \max |H_{\text{Calc}}^E - H^E|; \sigma_d = [2\sum (H_{\text{Calc}}^E - H^E)^2 / (N - n)]^{1/2}$$

N, no. of direct expl. values; n, no. of coeffs. a_i

All direct expl. values equally weighted

AUXILIARY INFORMATION

Apparatus: Calvet type microcalorimeter, model MS-80D (SETARAM, France) with stainless steel batch mixing cell (vol. ca. 8 cm³) and with negligible vapor phase, described in ref. 2. Microcalorimeter calibrated by Joule effect after each measurement. Energies measured by integrating the thermograms.

Procedure: Calibration, filling, and operation described in ref. 2. Cell filled with known masses of pure components. Check measurements on cyclohexane + hexane in agreement to within 1% (over central range of concn.) with the data reported in ref. 3.

Materials: 1. Aldrich Chem. Co., Inc. (Milwaukee, WI, USA) material, of stated purity > 97 mole %, dried over mol. sieve Type 3A (from Fluka) and used without further purification; ρ(298.15 K)/kg m⁻³ = 1692.49; n(D, 298.15 K) = 1.5102.
2. Fluka AG (Buchs, St. Gallen, Switzerland) 'puris' grade material of stated GLC purity > 99.5 mole %, dried over mol. sieve Type 3A (from Fluka) and used without further purification; ρ(298.15 K)/kg m⁻³ = 679.46; n(D, 298.15 K) = 1.3851.
Materials were degassed ultrasonically before use.

Errors: δT(reproducibility)/K = 0.001; δT(IPTS-68)/K = 0.02; δx₁ < 0.0005; δH^E/|H^E| = 0.02 (over central range of concn.).

REFERENCES

1. *Int. DATA Ser., Ser. A, Guideline 1a*, 1973.
2. Ortega, J.; Gonzalez, E.; Matos, J. S.; Legido, J. L. *J. Chem. Thermodyn.* 1992, 24, 15.
3. McGlashan, M. L.; Stoeckli, H. F. *J. Chem. Thermodyn.* 1969, 1, 589.

SELECTED DATA ON MIXTURES
International DATA Series*

1a. EXCESS ENTHALPY

The Texas A&M University System, College Station, TX 77843-3111

Published by Thermodynamics Research Center

Components: 1. 1,5-Dibromopentane, $C_5H_{10}Br_2$
2. Nonane, C_9H_{20}
State: Binary system, single-phase liquid; pure components, both liquid
Variables: H^E , molar excess enthalpy
 x_2 , mole fraction of component 1
Parameters: T , temperature
Constants: P , pressure
Method: Direct calorimetric measurement of the enthalpy of mixing at constant T and P and variable x_1 ; ref. 1

Author(s): Ortega, J. (Universidad de Las Palmas de Gran Canaria, Escuela Superior de Ingenieros Industriales, Cátedra de Termodinámica y Fisicoquímica, Las Palmas de Gran Canaria, Islas Canarias, Spain); Plácido, J.
Edited by: Kehiaian, H. V. (Institut de Topologie et de Dynamique des Systèmes, Université Paris VII, CNRS, 1, Rue Guy de la Brosse, 75005 Paris, France)

SOURCE OF DATA

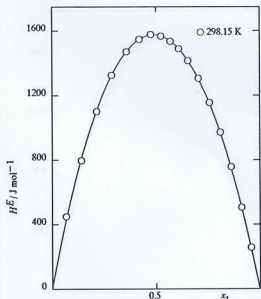
Ortega, J.; Plácido, J. (University of Las Palmas de Gran Canaria, Canary Islands, Spain); FIRST PUBLISHED RESULTS

DIRECT EXPERIMENTAL VALUES

Notes: P , atm.

$T/K = 298.15$

x_1	$H^E/J \text{ mol}^{-1}$						
0.0679	448.2						
0.1426	797.3						
0.2168	1101.9						
0.2892	1325.7						
0.3589	1472.4						
0.4208	1548.0						
0.4766	1578.3						
0.5261	1567.5						
0.5703	1536.4						
0.6102	1488.7						
0.6551	1416.3						
0.7039	1306.4						
0.7558	1156.3						
0.8083	970.7						
0.8601	755.6						
0.9114	504.9						
0.9583	255.9						



Points, direct experimental H^E values; curves, H^E_{calc} calculated from the smoothing equation.

SMOOTHING EQUATION

$$H^E_{\text{calc}} = x_1 x_2 \sum_{i=1}^n a_i (x_1 - x_2)^{i-1}$$

Coeffs. a_i in the smoothing eq. std. deviation σ_d and max. deviation δ_m detd. by least-squares anal.

T/K	a_1	a_2	a_3	a_4	a_5	σ_d	δ_m
	$J \text{ mol}^{-1}$						
298.15	6303 (12)	-229 (26)	285 (59)			7.4	23

The std. deviations σ_d of the coeffs. a_i are given in parentheses

$$\delta_m = \max |H^E_{\text{calc}} - H^E|; \sigma_d = [\sum (H^E_{\text{calc}} - H^E)^2 / (N - n)]^{1/2}$$

N , no. of direct exptl. values; n , no. of coeffs. a_i

All direct exptl. values equally weighted

AUXILIARY INFORMATION

Apparatus: Calvet type microcalorimeter, model MS-80D (SETARAM, France) with stainless steel batch mixing cell (vol. ca. 8 cm^3) and with negligible vapor phase, described in ref. 2. Microcalorimeter calibrated by Joule effect after each measurement. Energies measured by integrating the thermograms.

Procedure: Calibration, filling, and operation described in ref. 2. Cell filled with known masses of pure components. Check measurements on cyclohexane + hexane in agreement to within 1% (over central range of concn.) with the data reported in ref. 3.

Materials: 1. Aldrich Chem. Co., Inc. (Milwaukee, WI, USA) material, of stated purity > 97 mole %, dried over mol. sieve Type 3A (from Fluka) and used without further purification; $\rho(298.15 \text{ K})/\text{kg m}^{-3} = 1692.49$; $n(D, 298.15 \text{ K}) = 1.5102$.
2. Fluka AG (Buchs, St. Gallen, Switzerland) 'purum' grade material of stated GLC purity > 99 mole %, dried over mol. sieve Type 3A (from Fluka) and used without further purification; $\rho(298.15 \text{ K})/\text{kg m}^{-3} = 713.85$; $n(D, 298.15 \text{ K}) = 1.4033$.
Materials were degassed ultrasonically before use.

Errors: δT (reproducibility)/K = 0.001; δT (IPTS-68)/K = 0.02; $\delta x_1 < 0.0005$; $\delta H^E/|H^E| = 0.02$ (over central range of concn.).

REFERENCES

1. *Int. DATA Ser., Ser. A, Guideline 1a*, 1973.
2. Ortega, J.; Gonzalez, E.; Matos, J. S.; Legido, J. L. *J. Chem. Thermodyn.* 1992, 24, 15.
3. McGlashan, M. L.; Stoeckli, H. F. *J. Chem. Thermodyn.* 1969, 1, 589.

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Received: November 25, 1992

*Ser. A. Thermodynamic Properties of Non-reacting Binary Systems of Organic Substances

Published: January 31, 1993

SELECTED DATA ON MIXTURES
International Data Series*

1a. EXCESS ENTHALPY

The Texas A&M University System, College Station, TX 77843-3111

Published by Thermodynamics Research Center

Components: 1. 1,5-Dibromopentane, $C_5H_{10}Br_2$
2. Undecane, $C_{11}H_{24}$
State: Binary system, single-phase liquid; pure components, both liquid
Variables: H^E , molar excess enthalpy
 x_2 , mole fraction of component 1
Parameters: T , temperature
Constants: P , pressure
Method: Direct calorimetric measurement of the enthalpy of mixing at constant T and P and variable x_1 ; ref. 1

Author(s): Ortega, J. (Universidad de Las Palmas de Gran Canaria, Escuela Superior de Ingenieros Industriales, Cátedra de Termodinámica y Fisicoquímica, Las Palmas de Gran Canaria, Islas Canarias, Spain); Plácido, J.
Edited by: Kehiaian, H. V. (Institut de Topologie et de Dynamique des Systèmes, Université Paris VII, CNRS, 1, Rue Guy de la Brosse, 75005 Paris, France)

SOURCE OF DATA

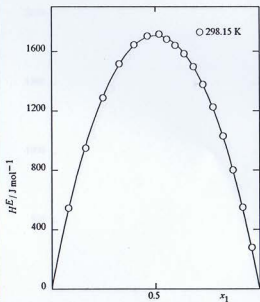
Ortega, J.; Plácido, J. (University of Las Palmas of Gran Canaria, Canary Islands, Spain); FIRST PUBLISHED RESULTS

DIRECT EXPERIMENTAL VALUES

Notes: P , atm.

$T/K = 298.15$

x_1	$H^E/J \text{ mol}^{-1}$						
0.0795	542.6						
0.1639	948.3						
0.2473	1286.3						
0.3255	1515.5						
0.3982	1644.3						
0.4624	1702.3						
0.5188	1715.4						
0.5560	1679.7						
0.5962	1638.9						
0.6385	1581.7						
0.6832	1494.6						
0.7295	1377.0						
0.7777	1222.6						
0.8260	1028.3						
0.8735	798.8						
0.9185	546.4						
0.9618	278.0						



Points, direct experimental H^E values; curves, H^E_{calc} calculated from the smoothing equation.

SMOOTHING EQUATION

$$H^E_{\text{calc}} = x_1 x_2 \sum_{i=1}^n a_i (x_1 - x_2)^{i-1}$$

Coeffs. a_i in the smoothing eq., std. deviation σ_d and max deviation δ_m detd. by least-squares anal.

T/K	a_1	a_2	a_3	a_4	a_5	σ_d	δ_m
	$J \text{ mol}^{-1}$						
298.15	6819 (16)	65 (35)	618 (76)			9.5	18

The std. deviations σ_i of the coeffs. a_i are given in parentheses

$$\delta_m = \max |H^E_{\text{calc}} - H^E|; \sigma_d = [\sum (H^E_{\text{calc}} - H^E)^2 / (N - n)]^{1/2}$$

N , no. of direct exptl. values; n , no. of coeffs. a_i

All direct exptl. values equally weighted

AUXILIARY INFORMATION

Apparatus: Calvet type microcalorimeter, model MS-80D (SETARAM, France) with stainless steel batch mixing cell (vol. ca. 8 cm^3) and with negligible vapor phase, described in ref. 2. Microcalorimeter calibrated by Joule effect after each measurement. Energies measured by integrating the thermograms.

Procedure: Calibration, filling, and operation described in ref. 2. Cell filled with known masses of pure components. Check measurements on cyclohexane + hexane in agreement to within 1% (over central range of concn.) with the data reported in ref. 3.

Materials: 1. Aldrich Chem. Co., Inc. (Milwaukee, WI, USA) material, of stated purity > 97 mole %, dried over mol. sieve Type 3A (from Fluka) and used without further purification; $\rho(298.15 \text{ K})/\text{kg m}^{-3} = 1692.49$; $n(D, 298.15 \text{ K}) = 1.5102$
2. Fluka AG (Buchs, St. Gallen, Switzerland) 'purum' grade material of stated GLC purity > 97 mole %, dried over mol. sieve Type 3A (from Fluka) and used without further purification; $\rho(298.15 \text{ K})/\text{kg m}^{-3} = 736.80$; $n(D, 298.15 \text{ K}) = 1.4154$.
Materials were degassed ultrasonically before use.

Errors: $\delta T(\text{reproducibility})/K = 0.001$; $\delta T(\text{IPTS-68})/K = 0.02$; $\delta x_1 < 0.0005$; $\delta H^E/|H^E| = 0.02$ (over central range of concn.).

REFERENCES

1. *Int. DATA Ser., Ser. A, Guideline 1a*, 1973.
2. Ortega, J.; Gonzalez, E.; Matos, J. S.; Legido, J. L. *J. Chem. Thermodyn.* 1992, 24, 15.
3. McGlashan, M. L.; Stoekli, H. F. *J. Chem. Thermodyn.* 1969, 1, 589.

Published: January 31, 1993

SELECTED DATA ON MIXTURES
International Data Series*

1a. EXCESS ENTHALPY

The Texas A&M University System, College Station, TX 77843-3111

Published by Thermodynamics Research Center

Components: 1. 1,5-Dibromopentane, $C_5H_{10}Br_2$
2. Tridecane, $C_{13}H_{28}$
State: Binary system, single-phase liquid; pure components, both liquid
Variables: H^E , molar excess enthalpy
 x_2 , mole fraction of component i
Parameters: T , temperature
Constants: P , pressure
Method: Direct calorimetric measurement of the enthalpy of mixing at constant T and P and variable x_1 ; ref. 1

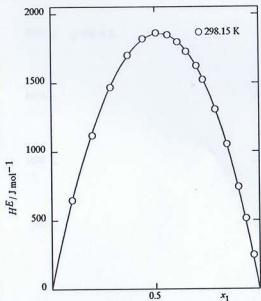
Author(s): Ortega, J. (Universidad de Las Palmas de Gran Canaria, Escuela Superior de Ingenieros Industriales, Cátedra de Termodinámica y Fisicoquímica, Las Palmas de Gran Canaria, Islas Canarias, Spain); Plácido, J.
Edited by: Kehiaian, H. V. (Institut de Topologie et de Dynamique des Systèmes, Université Paris VII, CNRS, 1, Rue Guy de la Brosse, 75005 Paris, France)

SOURCE OF DATA

Ortega, J.; Plácido, J. (University of Las Palmas of Gran Canaria, Canary Islands, Spain); FIRST PUBLISHED RESULTS

DIRECT EXPERIMENTAL VALUES

Notes: P , atm.							
$T/K = 298.15$							
x_1	$H^E/J \text{ mol}^{-1}$						
0.0979	644.5						
0.1955	1116.4						
0.2856	1467.2						
0.3684	1696.6						
0.4417	1817.8						
0.5071	1860.4						
0.5628	1844.7						
0.6105	1795.2						
0.6521	1725.1						
0.7008	1620.8						
0.7314	1521.4						
0.7903	1304.7						
0.8453	1050.4						
0.9010	739.5						
0.9355	510.6						
0.9711	245.5						



Points, direct experimental H^E values; curves, H^E_{calc} calculated from the smoothing equation.

SMOOTHING EQUATION

$$H^E_{\text{calc}} = x_1 x_2 \sum_{i=1}^n a_i (x_1 - x_2)^{i-1}$$

Coeffs. a_i in the smoothing eq. std. deviation σ_d and max. deviation δ_m detd. by least-squares anal.

T/K	a_1	a_2	a_3	a_4	a_5	σ_d	δ_m
	$J \text{ mol}^{-1}$						
298.15	7404 (15)	625 (33)	438 (73)			8.6	14

The std. deviations σ_d of the coeffs. a_i are given in parentheses

$$\delta_m = \max |H^E_{\text{calc}} - H^E|; \sigma_d = \{ \sum (H^E_{\text{calc}} - H^E)^2 / (N - n) \}^{1/2}$$

N , no. of direct exptl. values; n , no. of coeffs. a_i

All direct exptl. values equally weighted

AUXILIARY INFORMATION

Apparatus: Calvet type microcalorimeter, model MS-80D (SETARAM, France) with stainless steel batch mixing cell (vol. ca. 8 cm³) and with negligible vapor phase, described in ref. 2. Microcalorimeter calibrated by Joule effect after each measurement. Energies measured by integrating the thermograms.
Procedures: Calibration, filling, and operation described in ref. 2. Cell filled with known masses of pure components. Check measurements on cyclohexane + hexane in agreement to within 1% (over central range of concn.) with the data reported in ref. 3.
Materials: 1. Aldrich Chem. Co., Inc. (Milwaukee, WI, USA) material, of stated purity > 97 mole %, dried over mol. sieve Type 3A (from Fluka) and used without further purification; $\rho(298.15 \text{ K})/\text{kg m}^{-3} = 1692.49$; $n(D, 298.15 \text{ K}) = 1.5102$.
2. Fluka AG (Buchs, St. Gallen, Switzerland) 'puriss' grade material of stated GLC purity > 99.5 mole %, dried over mol. sieve Type 3A (from Fluka) and used without further purification; $\rho(298.15 \text{ K})/\text{kg m}^{-3} = 752.79$; $n(D, 298.15 \text{ K}) = 1.4238$.
Materials were degassed ultrasonically before use.
Errors: δT (reproducibility)/K = 0.001; δT (IPTS-68)/K = 0.02; $\delta x_1 < 0.0005$; $\delta H^E/H^E = 0.02$ (over central range of concn.).

REFERENCES

1. *Int. DATA Ser., Ser. A, Guideline 1a*, 1973.
2. Ortega, J.; Gonzalez, E.; Matos, J. S.; Legido, J. L. *J. Chem. Thermodyn.* 1992, 24, 15.
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Published: January 31, 1993

SELECTED DATA ON MIXTURES
International Data Series*

1a. EXCESS ENTHALPY

The Texas A&M University System, College Station, TX 77843-3111

Published by Thermodynamics Research Center

Components: 1. 1,5-Dibromopentane, $C_5H_{10}Br_2$
2. Pentadecane, $C_{15}H_{32}$

State: Binary system, single-phase liquid; pure components, both liquid

Variables: H^E , molar excess enthalpy

x_2 , mole fraction of component 1

Parameters: T , temperature

Constants: P , pressure

Method: Direct calorimetric measurement of the enthalpy of mixing at constant T and P and variable x_1 ; ref. 1

Author(s): Ortega, J. (Universidad de Las Palmas de Gran Canaria, Escuela Superior de Ingenieros Industriales, Cátedra de Termodinámica y Fisicoquímica, Las Palmas de Gran Canaria, Islas Canarias, Spain); Plácido, J.

Edited by: Kehiaian, H. V. (Institut de Topologie et de Dynamique des Systèmes, Université Paris VII, CNRS, 1, Rue Guy de la Brosse, 75005 Paris, France)

SOURCE OF DATA

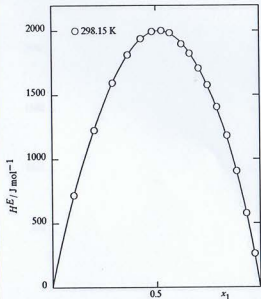
Ortega, J.; Plácido, J. (University of Las Palmas of Gran Canaria, Canary Islands, Spain); FIRST PUBLISHED RESULTS

DIRECT EXPERIMENTAL VALUES

Notes: P , atm.

$T/K = 298.15$

x_1	$H^E/J \text{ mol}^{-1}$				
0.1034	718.0				
0.2025	1227.0				
0.2936	1595.9				
0.3657	1815.0				
0.4286	1939.9				
0.4826	1995.6				
0.5278	2004.0				
0.5677	1987.1				
0.6244	1896.9				
0.6643	1824.6				
0.7064	1710.2				
0.7504	1577.5				
0.7953	1405.5				
0.8419	1183.8				
0.8887	905.8				
0.9349	575.3				
0.9731	260.4				



Points, direct experimental H^E values; curves, H^E_{calc} calculated from the smoothing equation.

SMOOTHING EQUATION

$$H^E_{\text{calc}} = x_1 x_2 \sum_{i=1}^n a_i (x_1 - x_2)^{i-1}$$

Coeffs. a_i in the smoothing eq., std. deviation σ_a and max. deviation δ_m detd. by least-squares anal.

T/K	a_1	a_2	a_3	a_4	a_5	σ_a	δ_m
	J mol ⁻¹						
298.15	7997 (15)	583 (54)	-250 (170)	630 (150)	1570 (300)	7.7	13

The std. deviations σ_{a_i} of the coeffs. a_i are given in parentheses

$$\delta_m = \max |H^E_{\text{calc}} - H^E|; \sigma_a = [\sum (H^E_{\text{calc}} - H^E)^2 / (N - n)]^{1/2}$$

N , no. of direct exptl. values; n , no. of coeffs. a_i

All direct exptl. values equally weighted

AUXILIARY INFORMATION

Apparatus: Calvet type microcalorimeter, model MS-80D (SETARAM, France) with stainless steel batch mixing cell (vol. ca. 8 cm^3) and with negligible vapor phase, described in ref. 2. Microcalorimeter calibrated by Joule effect after each measurement. Energies measured by integrating the thermograms.

Procedure: Calibration, filling, and operation described in ref. 2. Cell filled with known masses of pure components. Check measurements on cyclohexane + hexane in agreement to within 1% (over central range of conca.) with the data reported in ref. 3.

Materials: 1. Aldrich Chem. Co., Inc. (Milwaukee, WI, USA) material, of stated purity > 97 mole %, dried over mol. sieve Type 3A (from Fluka) and used without further purification; $\rho(298.15 \text{ K})/\text{kg m}^{-3} = 1692.49$; $n(D, 298.15 \text{ K}) = 1.5102$.
2. Fluka AG (Buchs, St. Gallen, Switzerland) 'pulum' grade material of stated GLC purity > 98 mole %, dried over mol. sieve Type 3A (from Fluka) and used without further purification; $\rho(298.15 \text{ K})/\text{kg m}^{-3} = 764.80$; $n(D, 298.15 \text{ K}) = 1.4298$.
Materials were degassed ultrasonically before use.

Errors: $\delta T(\text{reproducibility})/K = 0.001$; $\delta T(\text{IPTS-68})/K = 0.02$; $\delta x_1 < 0.0005$; $\delta H^E/|H^E| = 0.02$ (over central range of conca.).

REFERENCES

1. *Int. DATA Ser., Ser. A, Guideline 1a*, 1973.
2. Ortega, J.; Gonzalez, E.; Matos, J. S.; Legido, J. L. *J. Chem. Thermodyn.* 1992, 24, 15.
3. McGlashan, M. L.; Stoeckli, H. F. *J. Chem. Thermodyn.* 1969, 1, 589.

SELECTED DATA ON MIXTURES
International Data Series*

1a. EXCESS ENTHALPY

The Thermodynamic Property System, College Station, TX 77843-3111

Published by Thermodynamic Research Center

Components: 1. 1,2-Dichloroethane, $C_2H_4Cl_2$
2. Toluene, C_7H_8
State: Binary system, single phase liquid, pure components, both liquid
Variables: H^E , molar excess enthalpy
 x_1 , mole fraction of component 1
Parameters: T , temperature
Constants: P , pressure
Method: Direct calorimetric measurement of the enthalpy of mixing at constant T and P and variable x_1 ; ref. 1

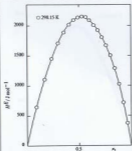
Author(s): Ortega, J. (Universidad de Las Palmas de Gran Canaria, Escuela Superior de Ingenieros Industriales, Cátedra de Termodinámica y Fisicoquímica, Las Palmas de Gran Canaria, Islas Canarias, Spain); Pláido, J.
Editor(s): Kohlas, H. V. (Institut de Topologie et de Dynamique des Systèmes, Université Paris VII, CNRS, 1, Rue Guy de la Brosse, 75005 Paris, France)

SOURCE OF DATA

Ortega, J.; Pláido, J. (University of Las Palmas de Gran Canaria, Canary Islands, Spain). FIRST PUBLISHED RESULTS

DIRECT EXPERIMENTAL VALUES

Notes: P , atm							
TZK = 298.15							
x_1	H^E J mol ⁻¹						
0.0911	649.7						
0.1698	1005.4						
0.2574	1447.6						
0.3081	1706.0						
0.3558	1887.5						
0.4062	2017.2						
0.4501	2093.3						
0.4915	2136.2						
0.5299	2151.1						
0.5655	2143.2						
0.5987	2099.7						
0.6402	2001.7						
0.6804	1921.5						
0.7192	1864.2						
0.7595	1871.3						
0.8011	1565.1						
0.8429	1298.7						
0.8846	1028.9						
0.9255	715.3						
0.9661	373.8						



Notes: direct experimental H^E values; curves, H^E_{calc} , obtained from the smoothing equation.

SMOOTHING EQUATION

$$H^E_{calc} = x_1^2 \sum_{i=1}^6 a_i (x_1 - x_2)^{i-1}$$

Coeffs. a_i in the smoothing eq., std. deviation σ_a and max. deviation δ_m and, by least squares method.

TZK	a_1	a_2	a_3	a_4	a_5	a_6	δ_m
	J mol ⁻¹						
298.15	8549 (17)	810 (90)	-400 (790)	1120 (160)	1600 (340)	9.5	17

The std. deviations σ_a of the coeffs. a_i are given in parentheses

$$\delta_m = \max |H^E_{calc} - H^E|; \sigma_a = [10^6 (H^E_{calc} - H^E)^2 / (N - 6)]^{1/2}$$

N , no. of direct expt. values; n , no. of coeffs. a_i

All direct expt. values equally weighted

AUXILIARY INFORMATION

Appearance: Capet type microcalorimeter, model MS-80 (SETARAM, France) with stainless steel batch mixing cell (vol. ca. 8 cm³) and with negligible vapor phase, described in ref. 2. Microcalorimeter calibrated by Joule effect after each measurement. Energies measured by integrating the thermogram.

Procedure: Calibration, filling, and operation described in ref. 2. Cell filled with known masses of pure components. Check measurements on cyclohexane + benzene in agreement to within 1% (over usual range of concn.) with the data reported in ref. 3.

Materials: 1. Aldrich Chem. Co., Inc. (Milwaukee, WI, USA) material, of stated purity > 99 mole %; dried over mol. sieve Type 3A (from Fluka) and used without further purification; $\rho(298.15 \text{ K}) = 1092.49$; $n_D(298.15 \text{ K}) = 1.5182$.
2. Fluka AG (Buchs, St. Gallen, Switzerland) "pure" grade material of stated D.L.C. purity > 99 mole %, dried over mol. sieve Type 3A (from Fluka) and used without further purification; $\rho(298.15 \text{ K}) = 774.33$; $n_D(298.15 \text{ K}) = 1.4947$.
Materials were degassed exothermically before use.

Errors: δT (reproducibility)/K = 0.001; δT (PTIS-68)/K = 0.02; $\delta n_D < 0.0005$; $\delta n_D^2 / (n_D^2) = 0.02$ (over usual range of concn.).

REFERENCES

1. Int. Data Ser., Ser. A, *Quarterly* 19, 1993.
2. Ortega, J.; Gonzalez, E.; Moran, J. S.; Lagido, I. L. *J. Chem. Thermodyn.* 1992, 24, 15.
3. McCleskey, M. L.; Szwedli, H. P. *J. Chem. Thermodyn.* 1969, 1, 589.

SELECTED DATA ON MIXTURES
International Data Series*

1a. EXCESS ENTHALPY

The Texas A&M University System, College Station, TX 77843-3111

Published by Thermodynamics Research Center

Components: 1. 1,6-Dibromohexane, $C_6H_{12}Br_2$
2. Pentane, C_5H_{12}
State: Binary system, single-phase liquid; pure components, both liquid
Variables: H^E , molar excess enthalpy
 x_2 , mole fraction of component i
Parameters: T , temperature
Constants: P , pressure
Method: Direct calorimetric measurement of the enthalpy of mixing at constant T and P and variable x_1 ; ref. 1

Author(s): Ortega, J. (Universidad de Las Palmas de Gran Canaria, Escuela Superior de Ingenieros Industriales, Cátedra de Termodinámica y Fisicoquímica, Las Palmas de Gran Canaria, Islas Canarias, Spain); Plácido, J.
Edited by: Kehiaian, H. V. (Institut de Topologie et de Dynamique des Systèmes, Université Paris VII, CNRS, 1, Rue Guy de la Brosse, 75005 Paris, France)

SOURCE OF DATA

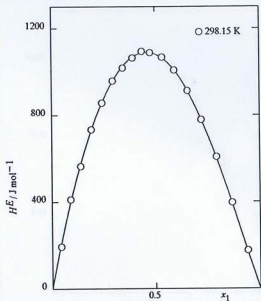
Ortega, J.; Plácido, J. (University of Las Palmas de Gran Canaria, Canary Islands, Spain); FIRST PUBLISHED RESULTS

DIRECT EXPERIMENTAL VALUES

Notes: P , atm.

$T/K = 298.15$

x_1	$H^E/J \text{ mol}^{-1}$						
0.0426	192.3						
0.0899	410.0						
0.1387	563.3						
0.1910	732.8						
0.2439	856.9						
0.2959	957.1						
0.3457	1016.9						
0.3928	1064.3						
0.4372	1092.6						
0.4781	1086.7						
0.5352	1066.3						
0.5921	1007.2						
0.6555	911.4						
0.7223	777.9						
0.7927	605.9						
0.8672	396.0						
0.9400	174.4						



Points, direct experimental H^E values; curves, H^E_{calc} calculated from the smoothing equation.

SMOOTHING EQUATION

$$H^E_{\text{calc}} = x_1 x_2 \sum_{i=1}^n a_i (x_1 - x_2)^{i-1}$$

Coeffs. a_i in the smoothing eq., std. deviation σ_{δ} and max. deviation δ_m detd. by least-squares anal.

T/K	a_1	a_2	a_3	a_4	a_5	σ_{δ}	δ_m
	$J \text{ mol}^{-1}$						
298.15	4326.9 (9.9)	-740 (40)	-406 (47)	-360 (100)		5.9	12

The std. deviations σ_{a_i} of the coeffs. a_i are given in parentheses

$$\delta_m = \max |H^E_{\text{calc}} - H^E|; \sigma_{\delta} = \sqrt{\sum (H^E_{\text{calc}} - H^E)^2 / (N - n)}^{1/2}$$

N , no. of direct exptl. values; n , no. of coeffs. a_i

All direct exptl. values equally weighted

AUXILIARY INFORMATION

Apparatus: Calvet type microcalorimeter, model MS-80D (SETARAM, France) with stainless steel batch mixing cell (vol. ca. 8 cm^3) and with negligible vapor phase, described in ref. 2. Microcalorimeter calibrated by Joule effect after each measurement. Energies measured by integrating the thermograms.

Procedures: Calibration, filling, and operation described in ref. 2. Cell filled with known masses of pure components. Check measurements on cyclohexane + hexane in agreement to within 1% (over central range of concn.) with the data reported in ref. 3.

Materials: 1. Aldrich Chem. Co., Inc. (Milwaukee, WI, USA) material, of stated purity > 97 mole %, dried over mol. sieve Type 3A (from Fluka) and used without further purification; $\rho(298.15 \text{ K})/\text{kg m}^{-3} = 1602.49$; $n(D, 298.15 \text{ K}) = 1.5054$.
2. Fluka AG (Buchs, St. Gallen, Switzerland) 'puriss' grade material of stated GLC purity > 99.5 mole %, dried over mol. sieve Type 3A (from Fluka) and used without further purification; $\rho(298.15 \text{ K})/\text{kg m}^{-3} = 621.31$; $n(D, 298.15 \text{ K}) = 1.3547$.
Materials were degassed ultrasonically before use.

Errors: δT (reproducibility)/K = 0.001; δT (IPTS-68)/K = 0.02; $\delta x_1 < 0.0005$; $\delta H^E/H^E = 0.02$ (over central range of concn.).

REFERENCES

1. *Int. DATA Ser., Ser. A, Guideline 1a*, 1973.
2. Ortega, J.; Gonzalez, E.; Matos, J. S.; Legido, J. L. *J. Chem. Thermodyn.* 1992, 24, 15.
3. McGlashan, M. L.; Stockli, H. F. *J. Chem. Thermodyn.* 1969, 1, 589.

Published: January 31, 1993

SELECTED DATA ON MIXTURES
International Data Series*

1a. EXCESS ENTHALPY

The Texas A&M University System, College Station, TX 77843-3111

Published by Thermodynamics Research Center

Components: 1. 1,6-Dibromohexane, $C_6H_{12}Br_2$
2. Heptane, C_7H_{16}
State: Binary system, single-phase liquid; pure components, both liquid
Variables: H^E , molar excess enthalpy
 x_i , mole fraction of component i
Parameters: T , temperature
Constants: P , pressure
Method: Direct calorimetric measurement of the enthalpy of mixing at constant T and P and variable x_i ; ref. 1

Author(s): Ortega, J. (Universidad de Las Palmas de Gran Canaria, Escuela Superior de Ingenieros Industriales, Cátedra de Termodinámica y Fisicoquímica, Las Palmas de Gran Canaria, Islas Canarias, Spain); Plácido, J.
Edited by: Kehiaian, H. V. (Institut de Topologie et de Dynamique des Systèmes, Université Paris VII, CNRS, 1, Rue Guy de la Brosse, 75005 Paris, France)

SOURCE OF DATA

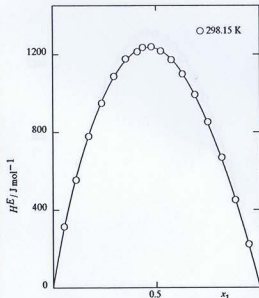
Ortega, J.; Plácido, J. (University of Las Palmas de Gran Canaria, Canary Islands, Spain); FIRST PUBLISHED RESULTS

DIRECT EXPERIMENTAL VALUES

Notes: P , atm.

$T/K = 298.15$

x_1	$H^E / J \text{ mol}^{-1}$								
0.0532	312.8								
0.1134	553.9								
0.1753	777.8								
0.2373	949.2								
0.2975	1086.0								
0.3545	1175.5								
0.4120	1212.7								
0.4378	1235.0								
0.4788	1237.0								
0.5244	1216.4								
0.5743	1171.0								
0.6287	1098.2								
0.6879	992.4								
0.7505	850.4								
0.8155	667.7								
0.8808	449.6								
0.9460	221.1								



Points, direct experimental H^E values; curves, H^E_{calc} calculated from the smoothing equation.

SMOOTHING EQUATION

$$H^E_{\text{calc}} = x_1 x_2 \sum_{i=1}^n a_i (x_1 - x_2)^{i-1}$$

Coeffs. a_i in the smoothing eq., std. deviation σ_a and max deviation δ_m detd. by least-squares anal.

T/K	a_1	a_2	a_3	a_4	a_5	σ_d	δ_m
	$J \text{ mol}^{-1}$						
298.15	4921 (14)	-680 (52)	-350 (160)	-230 (130)	730 (280)	7.7	17

The std. deviations σa_i of the coeffs. a_i are given in parentheses

$$\delta_m = \max |H^E_{\text{calc}} - H^E|; \sigma_d = [2(H^E_{\text{calc}} - H^E)^2 / (N - n)]^{1/2}$$

N , no. of direct exptl. values; n , no. of coeffs. a_i

All direct exptl. values equally weighted

AUXILIARY INFORMATION

Apparatus: Calvet type microcalorimeter, model MS-80D (SETARAM, France) with stainless steel batch mixing cell (vol. ca. 8 cm^3) and with negligible vapor phase, described in ref. 2. Microcalorimeter calibrated by Joule effect after each measurement. Energies measured by integrating the thermograms.

Procedures: Calibration, filling, and operation described in ref. 2. Cell filled with known masses of pure components. Check measurements on cyclohexane + hexane in agreement to within 1% (over central range of concn.) with the data reported in ref. 3.

Materials: 1. Aldrich Chem. Co., Inc. (Milwaukee, WI, USA) material, of stated purity > 97 mole %, dried over mol. sieve Type 3A (from Fluka) and used without further purification; $\rho(298.15 \text{ K})/\text{kg m}^{-3} = 1602.49$; $n(D, 298.15 \text{ K}) = 1.5054$.
2. Fluka AG (Buchs, St. Gallen, Switzerland) 'puris' grade material of stated GLC purity > 99.5 mole %, dried over mol. sieve Type 3A (from Fluka) and used without further purification; $\rho(298.15 \text{ K})/\text{kg m}^{-3} = 679.46$; $n(D, 298.15 \text{ K}) = 1.3851$.
Materials were degassed ultrasonically before use.

Errors: δT (reproducibility)/K = 0.001; δT (IPTS-68)/K = 0.02; $\delta x_i < 0.0005$; $\delta H^E / |H^E| = 0.02$ (over central range of concn.).

REFERENCES

1. *Int. DATA Ser., Ser. A, Guideline 1a*, 1973.
2. Ortega, J.; Gonzalez, E.; Matos, J. S.; Legido, J. L. *J. Chem. Thermodyn.* 1992, 24, 15.
3. McGlashan, M. L.; Stoeckli, H. F. *J. Chem. Thermodyn.* 1969, 1, 589.

SELECTED DATA ON MIXTURES
International Data Series*

1a. EXCESS ENTHALPY

The Texas A&M University System, College Station, TX 77843-3111

Published by Thermodynamics Research Center

Components: 1. 1,6-Dibromohexane, $C_6H_{12}Br_2$
2. Nonane, C_9H_{20}
State: Binary system, single-phase liquid; pure components, both liquid
Variables: H^E , molar excess enthalpy
 x_i , mole fraction of component i
Parameters: T , temperature
Constants: P , pressure
Method: Direct calorimetric measurement of the enthalpy of mixing at constant T and P and variable x_i ; ref. 1

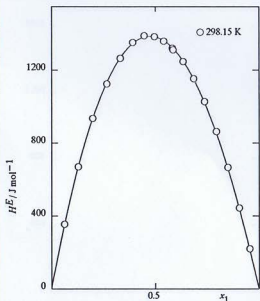
Author(s): Ortega, J. (Universidad de Las Palmas de Gran Canaria, Escuela Superior de Ingenieros Industriales, Cátedra de Termodinámica y Físicoquímica, Las Palmas de Gran Canaria, Islas Canarias, Spain); Plácido, J.
Edited by: Kehiaian, H. V. (Institut de Topologie et de Dynamique des Systèmes, Université Paris VII, CNRS, 1, Rue Guy de la Brosse, 75005 Paris, France)

SOURCE OF DATA

Ortega, J.; Plácido, J. (University of Las Palmas de Gran Canaria, Canary Islands, Spain); FIRST PUBLISHED RESULTS

DIRECT EXPERIMENTAL VALUES

Notes: P , atm.							
$T/K = 298.15$							
x_1	H^E_j J mol ⁻¹						
0.0622	355.1						
0.1296	670.6						
0.1989	935.2						
0.2665	1125.9						
0.3311	1265.9						
0.3912	1353.4						
0.4464	1391.2						
0.4963	1385.4						
0.5411	1360.4						
0.5817	1321.5						
0.5849	1313.2						
0.6325	1248.7						
0.6834	1154.9						
0.7365	1028.2						
0.7925	863.4						
0.8489	666.4						
0.9038	443.7						
0.9548	220.3						



Points, direct experimental H^E values; curves, H^E_{calc} calculated from the smoothing equation.

SMOOTHING EQUATION

$$H^E_{calc} = x_1 x_2 \sum_{i=1}^n a_i (x_1 - x_2)^{i-1}$$

Coeffs. a_i in the smoothing eq., std. deviation σ_d and max deviation δ_m detd. by least-squares anal.

T/K	a_1	a_2	a_3	a_4	a_5	σ_d	δ_m
	J mol ⁻¹						
298.15	5536.8 (5.9)	-541 (17)				4.8	8.8

The std. deviations σ_i of the coeffs. a_i are given in parentheses

$$\delta_m = \max |H^E_{calc} - H^E|; \sigma_d = \{2[H^E_{calc} - H^E]^2 / (N - n)\}^{1/2}$$

N , no. of direct exptl. values; n , no. of coeffs. a_i

All direct exptl. values equally weighted

AUXILIARY INFORMATION

Apparatus: Calvet type microcalorimeter, model MS-80D (SETARAM, France) with stainless steel batch mixing cell (vol. ca. 8 cm³) and with negligible vapor phase, described in ref. 2. Microcalorimeter calibrated by Joule effect after each measurement. Energies measured by integrating the thermograms.

Procedure: Calibration, filling, and operation described in ref. 2. Cell filled with known masses of pure components. Check measurements on cyclohexane + hexane in agreement to within 1% (over central range of concn.) with the data reported in ref. 3.

Materials: 1. Aldrich Chem. Co., Inc. (Milwaukee, WI, USA) material, of stated purity > 97 mole %, dried over mol. sieve Type 3A (from Fluka) and used without further purification; $\rho(298.15 \text{ K})/\text{kg m}^{-3} = 1602.49$; $n(D, 298.15 \text{ K}) = 1.5054$.
2. Fluka AG (Buchs, St. Gallen, Switzerland) 'purum' grade material of stated GLC purity > 99 mole %, dried over mol. sieve Type 3A (from Fluka) and used without further purification; $\rho(298.15 \text{ K})/\text{kg m}^{-3} = 713.85$; $n(D, 298.15 \text{ K}) = 1.4033$.
Materials were degassed ultrasonically before use.

Errors: δT (reproducibility)/K = 0.001; δT (IPTS-68)/K = 0.02; $\delta x_i < 0.0005$; $\delta H^E/H^E = 0.02$ (over central range of concn.).

REFERENCES

1. *Int. DATA Ser., Ser. A, Guideline 1a*, 1973.
2. Ortega, J.; Gonzalez, E.; Matos, J. S.; Legido, J. L. *J. Chem. Thermodyn.* 1992, 24, 15.
3. McGlashan, M. L.; Stoekli, H. F. *J. Chem. Thermodyn.* 1969, 1, 589.

SELECTED DATA ON MIXTURES

International Data Series*

1a. EXCESS ENTHALPY

The Texas A&M University System, College Station, TX 77843-3111

Published by Thermodynamics Research Center

Components: 1. 1,6-Dibromohexane, C₆H₁₂Br₂
2. Undecane, C₁₁H₂₄
State: Binary system, single-phase liquid; pure components, both liquid
Variables: H^E, molar excess enthalpy
x₁, mole fraction of component 1
Parameters: T_i, temperature
Constants: P_i, pressure
Method: Direct calorimetric measurement of the enthalpy of mixing at constant T and P and variable x₁; ref. 1

Author(s): Ortega, J. (Universidad de Las Palmas de Gran Canaria, Escuela Superior de Ingenieros Industriales, Cátedra de Termodinámica y Fisicoquímica, Las Palmas de Gran Canaria, Islas Canarias, Spain); Plácido, J.
Edited by: Kehiaian, H. V. (Institut de Topologie et de Dynamique des Systèmes, Université Paris VII, CNRS, 1, Rue Guy de la Brosse, 75005 Paris, France)

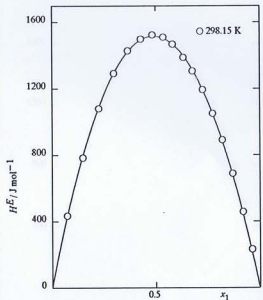
SOURCE OF DATA

Ortega, J.; Plácido, J. (University of Las Palmas de Gran Canaria, Canary Islands, Spain); FIRST PUBLISHED RESULTS

DIRECT EXPERIMENTAL VALUES

Notes: P, atm.

T/K = 298.15							
x ₁	H ^E /J mol ⁻¹						
0.0716	433.2						
0.1491	783.4						
0.2260	1081.9						
0.2992	1293.8						
0.3676	1428.6						
0.4297	1499.9						
0.4860	1523.9						
0.5372	1511.2						
0.5816	1468.8						
0.6327	1389.1						
0.6783	1307.4						
0.7262	1193.8						
0.7753	1050.9						
0.8207	890.3						
0.8702	688.8						
0.9185	457.2						
0.9618	230.8						



SMOOTHING EQUATION

$$H_{\text{calc}}^E = x_1 x_2 \sum_{i=1}^n a_i (x_1 - x_2)^{i-1}$$

Coeffs. a_i in the smoothing eq., std. deviation σ_a and max. deviation δ_m detd. by least-squares anal.

T/K	a ₁	a ₂	a ₃	a ₄	a ₅	σ _a	δ _m
	J mol ⁻¹						
298.15	6066 (13)	-172 (28)	187 (63)			7.9	13

The std. deviations σ_{a_i} of the coeffs. a_i are given in parentheses

$$\delta_m = \max |H_{\text{calc}}^E - H^E|; \sigma_a = [\Sigma (H_{\text{calc}}^E - H^E)^2 / (N - n)]^{1/2}$$

N, no. of direct exptl. values; n, no. of coeffs. a_i

All direct exptl. values equally weighted

AUXILIARY INFORMATION

Apparatus: Calvet type microcalorimeter, model MS-80D (SETARAM, France) with stainless steel batch mixing cell (vol. ca. 8 cm³) and with negligible vapor phase, described in ref. 2. Microcalorimeter calibrated by Joule effect after each measurement. Energies measured by integrating the thermograms.

Procedures: Calibration, filling, and operation described in ref. 2. Cell filled with known masses of pure components. Check measurements on cyclohexane + hexane in agreement to within 1% (over central range of concn.) with the data reported in ref. 3.

Materials: 1. Aldrich Chem. Co., Inc. (Milwaukee, WI, USA) material, of stated purity > 97 mole %, dried over mol. sieve Type 3A (from Fluka) and used without further purification; ρ(298.15 K)/kg m⁻³ = 1602.49; n(D, 298.15 K) = 1.5054.
2. Fluka AG (Buchs, St. Gallen, Switzerland) 'purum' grade material of stated GLC purity > 97 mole %, dried over mol. sieve Type 3A (from Fluka) and used without further purification; ρ(298.15 K)/kg m⁻³ = 736.80; n(D, 298.15 K) = 1.4154.
Materials were degassed ultrasonically before use.

Errors: δT(reproducibility)/K = 0.001; δT(IPTS-68)/K = 0.02; δx₁ < 0.0005; δH^E/|H^E| = 0.02 (over central range of concn.).

REFERENCES

1. *Int. DATA Ser., Ser. A, Guideline 1a*, 1973.
2. Ortega, J.; Gonzalez, E.; Matos, J. S.; Legido, J. L. *J. Chem. Thermodyn.* 1992, 24, 15.
3. McGlashan, M. L.; Stoeckli, H. F. *J. Chem. Thermodyn.* 1969, 1, 589.

SELECTED DATA ON MIXTURES
International DATA Series*

1a. EXCESS ENTHALPY

The Texas A&M University System, College Station, TX 77843-3111

Published by Thermodynamics Research Center

Components: 1. 1,6-Dibromohexane, $C_6H_{12}Br_2$
2. Tridecane, $C_{13}H_{28}$
State: Binary system, single-phase liquid; pure components, both liquid
Variables: H^E , molar excess enthalpy
 x_2 , mole fraction of component 1
Parameters: T , temperature
Constants: P , pressure
Method: Direct calorimetric measurement of the enthalpy of mixing at constant T and P and variable x_1 ; ref. 1

Author(s): Ortega, J. (Universidad de Las Palmas de Gran Canaria, Escuela Superior de Ingenieros Industriales, Cátedra de Termodinámica y Fisicoquímica, Las Palmas de Gran Canaria, Islas Canarias, Spain); Plácidio, J.
Edited by: Kehiaian, H. V. (Institut de Topologie et de Dynamique des Systèmes, Université Paris VII, CNRS, 1, Rue Guy de la Brosse, 75005 Paris, France)

SOURCE OF DATA

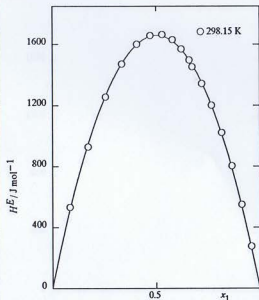
Ortega, J.; Plácidio, J. (University of Las Palmas de Gran Canaria, Canary Islands, Spain); FIRST PUBLISHED RESULTS

DIRECT EXPERIMENTAL VALUES

Notes: P , atm.

$T/K = 298.15$

x_1	$H^E / J \text{ mol}^{-1}$							
0.0851	531.4							
0.1727	925.9							
0.2578	1254.7							
0.3365	1472.1							
0.4092	1600.4							
0.4731	1656.6							
0.5297	1662.5							
0.5789	1628.8							
0.6227	1568.8							
0.6604	1495.8							
0.6750	1451.5							
0.7206	1341.8							
0.7674	1200.1							
0.8160	1020.4							
0.8647	801.1							
0.9126	546.8							
0.9592	275.2							



Points, direct experimental H^E values; curves, H^E_{calc} , calculated from the smoothing equation.

SMOOTHING EQUATION

$$H^E_{\text{calc}} = x_1 x_2 \sum_{i=1}^n a_i (x_1 - x_2)^{i-1}$$

Coeffs. a_i in the smoothing eq., std. deviation σ_d and max. deviation δ_m detd. by least-squares anal.

T/K	a_1	a_2	a_3	a_4	a_5	σ_d	δ_m
	$J \text{ mol}^{-1}$						
298.15	6629 (16)	139 (35)	112 (79)			9.5	18

The std. deviations σ_d of the coeffs. a_i are given in parentheses

$$\delta_m = \max |H^E_{\text{calc}} - H^E|; \sigma_d = [2\{H^E_{\text{calc}} - H^E\}^2 / (N - n)]^{1/2}$$

N , no. of direct expl. values; n , no. of coeffs. a_i

All direct expl. values equally weighted

AUXILIARY INFORMATION

Apparatus: Calvet type microcalorimeter, model MS-80D (SETARAM, France) with stainless steel batch mixing cell (vol. ca. 8 cm^3) and with negligible vapor phase, described in ref. 2. Microcalorimeter calibrated by Joule effect after each measurement. Energies measured by integrating the thermograms.

Procedures: Calibration, filling, and operation described in ref. 2. Cell filled with known masses of pure components. Check measurements on cyclohexane + hexane in agreement to within 1% (over central range of concn.) with the data reported in ref. 3.

Materials: 1. Aldrich Chem. Co., Inc. (Milwaukee, WI, USA) material, of stated purity > 97 mole %, dried over mol. sieve Type 3A (from Fluka) and used without further purification; $\rho(298.15 \text{ K})/\text{kg m}^{-3} = 1602.49$; $n(D, 298.15 \text{ K}) = 1.5054$.
2. Fluka AG (Buchs, St. Gallen, Switzerland) 'puriss' grade material of stated GLC purity > 99.5 mole %, dried over mol. sieve Type 3A (from Fluka) and used without further purification; $\rho(298.15 \text{ K})/\text{kg m}^{-3} = 752.79$; $n(D, 298.15 \text{ K}) = 1.4238$.
Materials were degassed ultrasonically before use.

Errors: δT (reproducibility)/K = 0.001; δT (IPTS-68)/K = 0.02; $\delta x_1 < 0.0005$; $\delta H^E / |H^E| = 0.02$ (over central range of concn.).

REFERENCES

1. *Int. DATA Ser., Ser. A, Guidefile 1a*, 1973.
2. Ortega, J.; Gonzalez, E.; Matos, J. S.; Legido, J. L. *J. Chem. Thermodyn.* 1992, 24, 15.
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SELECTED DATA ON MIXTURES
International DATA Series*

1a. EXCESS ENTHALPY

The Texas A&M University System, College Station, TX 77843-3111

Published by Thermodynamics Research Center

Components: 1. 1,6-Dibromohexane, $C_6H_{12}Br_2$
2. Pentadecane, $C_{15}H_{32}$
State: Binary system, single-phase liquid; pure components, both liquid
Variables: H^E , molar excess enthalpy
 x_2 , mole fraction of component 1
Parameters: T , temperature
Constants: P , pressure
Method: Direct calorimetric measurement of the enthalpy of mixing at constant T and P and variable x_1 ; ref. 1

Author(s): Ortega, J. (Universidad de Las Palmas de Gran Canaria, Escuela Superior de Ingenieros Industriales, Cátedra de Termodinámica y Fisicoquímica, Las Palmas de Gran Canaria, Islas Canarias, Spain); Plácidio, J.
Edited by: Kehiaian, H. V. (Institut de Topologie et de Dynamique des Systèmes, Université Paris VII, CNRS, 1, Rue Guy de la Brosse, 75005 Paris, France)

Ortega, J.; Plácidio, J. (University of Las Palmas de Gran Canaria, Canary Islands, Spain); FIRST PUBLISHED RESULTS

SOURCE OF DATA

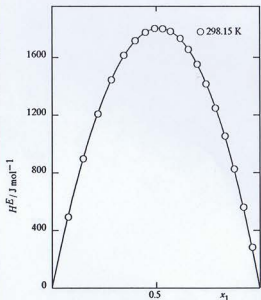
Ortega, J.; Plácidio, J. (University of Las Palmas de Gran Canaria, Canary Islands, Spain); FIRST PUBLISHED RESULTS

DIRECT EXPERIMENTAL VALUES

Notes: P , atm.

$T/K = 298.15$

x_1	$H^E/J \text{ mol}^{-1}$						
0.0762	490.9						
0.1502	894.4						
0.2200	1204.2						
0.2848	1441.2						
0.3448	1611.0						
0.3987	1711.4						
0.4482	1769.4						
0.4926	1794.6						
0.5322	1793.9						
0.5679	1775.2						
0.6158	1728.1						
0.6566	1651.1						
0.6987	1548.3						
0.7423	1411.8						
0.7870	1245.2						
0.8330	1050.3						
0.8782	821.7						
0.9228	556.2						
0.9643	279.7						



SMOOTHING EQUATION

$$H^E_{\text{calc}} = x_1 x_2 \sum_{i=1}^n a_i (x_1 - x_2)^{i-1}$$

Coeffs. a_i in the smoothing eq., std. deviation σ_{a_i} and max. deviation δ_m detd. by least-squares anal.

T/K	a_1	a_2	a_3	a_4	a_5	σ_d	δ_m
	$J \text{ mol}^{-1}$						
298.15	7186 (10)	377 (22)	236 (50)			6.6	13

The std. deviations σ_{a_i} of the coeffs. a_i are given in parentheses

$$\delta_m = \max |H^E_{\text{calc}} - H^E|; \sigma_d = [\sum (H^E_{\text{calc}} - H^E)^2 / (N - n)]^{1/2}$$

N , no. of direct exptl. values; n , no. of coeffs. a_i

All direct exptl. values equally weighted

AUXILIARY INFORMATION

Apparatus: Calvet type microcalorimeter, model MS-80D (SETARAM, France) with stainless steel batch mixing cell (vol. ca. 8 cm³) and with negligible vapor phase, described in ref. 2. Microcalorimeter calibrated by Joule effect after each measurement. Energies measured by integrating the thermograms.

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2. Fluka AG (Buchs, St. Gallen, Switzerland) 'purum' grade material of stated GLC purity > 98 mole %, dried over mol. sieve Type 3A (from Fluka) and used without further purification; $\rho(298.15 \text{ K})/\text{kg m}^{-3} = 764.80$; $n(D, 298.15 \text{ K}) = 1.4298$.
Materials were degassed ultrasonically before use.

Errors: δT (reproducibility)/K = 0.001; δT (TPS-68)/K = 0.02; $\delta x_1 < 0.0005$; $\delta H^E/H^E = 0.02$ (over central range of concn.).

REFERENCES

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SELECTED DATA ON MIXTURES
International DATA Series*

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The Texas A&M University System, College Station, TX 77843-3111

Published by Thermodynamics Research Center

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2. Heptadecane, $C_{17}H_{36}$
State: Binary system, single-phase liquid; pure components, both liquid
Variables: H^E , molar excess enthalpy
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Parameters: T , temperature
Constants: P , pressure
Method: Direct calorimetric measurement of the enthalpy of mixing at constant T and P and variable x_2 ; ref. 1

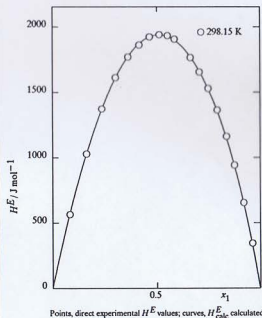
Author(s): Ortega, J. (Universidad de Las Palmas de Gran Canaria, Escuela Superior de Ingenieros Industriales, Cátedra de Termodinámica y Fisicoquímica, Las Palmas de Gran Canaria, Islas Canarias, Spain); Plácido, J.
Edited by: Kehlian, H. V. (Institut de Topologie et de Dynamique des Systèmes, Université Paris VII, CNRS, 1, Rue Guy de la Brosse, 75005 Paris, France)

SOURCE OF DATA

Ortega, J.; Plácido, J. (University of Las Palmas de Gran Canaria, Canary Islands, Spain); FIRST PUBLISHED RESULTS

DIRECT EXPERIMENTAL VALUES

Notes: P , atm.							
$T/K = 298.15$							
x_1	$H^E/J \text{ mol}^{-1}$						
0.0828	561.9						
0.1637	1025.2						
0.2379	1369.8						
0.3042	1607.7						
0.3636	1766.6						
0.4183	1858.1						
0.4672	1919.2						
0.5137	1936.7						
0.5527	1927.8						
0.5870	1901.8						
0.6641	1762.0						
0.7068	1650.8						
0.7495	1524.0						
0.7931	1361.2						
0.8373	1158.8						
0.8766	938.9						
0.9201	651.7						
0.9616	342.3						



SMOOTHING EQUATION

$$H^E_{\text{calc}} = x_1 x_2 \sum_{i=1}^n a_i (x_1 - x_2)^{i-1}$$

Coeffs. a_i in the smoothing eq., std. deviation σ_d and max. deviation δ_m detd. by least-squares anal.

T/K	a_1	a_2	a_3	a_4	a_5	σ_d	δ_m
	$J \text{ mol}^{-1}$						
298.15	7732 (10)	391 (37)	300 (110)	732 (99)	480 (200)	5.6	9.4

The std. deviations σ_{a_i} of the coeffs. a_i are given in parentheses

$$\delta_m = \max |H^E_{\text{calc}} - H^E|; \sigma_d = [2(H^E_{\text{calc}} - H^E)^2 / (N - n)]^{1/2}$$

N , no. of direct exptl. values; n , no. of coeffs. a_i

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2. Fluka AG (Buchs, St. Gallen, Switzerland) 'purum' grade material of stated GLC purity > 99 mole %, dried over mol. sieve Type 3A (from Fluka) and used without further purification; $\rho(298.15 \text{ K}) \text{ kg m}^{-3} = 774.33$; $n(D, 298.15 \text{ K}) = 1.4347$.
Materials were degassed ultrasonically before use.

Errors: δT (reproducibility)/K = 0.001; δT (IPTS-68)/K = 0.02; $\delta x_1 < 0.0005$; $\delta H^E / |H^E| = 0.02$ (over central range of concn.).

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34

Int. DATA Ser., Std. Data Materials, Ser. A 1993, 21(1), 84