

*International DATA Series***SELECTED DATA ON MIXTURES**

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The three papers of this issue contain original unpublished excess enthalpy measurements on 78 mixtures taken in the laboratory directed by Prof. Dr. J. Grigor.



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The three papers of this issue contain original unpublished excess enthalpy measurements on 78 mixtures taken in the laboratory directed by Prof. Dr. J. Ortega.

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Excess enthalpies of some alpha, omega-dichloroalkane (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

In order to understand the relationship between the structure of organic compounds and the thermodynamic properties of mixtures, systematic information on the behavior of substances with different structural characteristics is required.

As part of our plan to publish a complete series of thermodynamic data for selected classes of mixtures, we have previously reported excess enthalpies and excess volumes for several homologous series of substances, including esters + n-alkanes (1 to 13), + 1-chloroalkanes (1, 14 to 20), or + 1-alkanols (4, 21 to 26). The purpose of these measurements is to provide important data both for chemical engineering applications and for testing theoretical group-contribution models (1, 4, 10, 16, 17).

The literature includes several studies of the properties of 1-chloroalkane + alkane mixtures (see ref. 27). However, few data are available for mixtures of α,ω -dichloroalkanes + n-alkanes (28 to 34). The application of group-contribution methods revealed differences between compounds with one Cl-atom and two Cl-atoms ("proximity effect"). There is also evidence for enthalpic effects in mixtures containing long-chain molecules due to changes in the conformational equilibrium of the molecules (27).

In order to examine these effects in more detail, we investigated the excess enthalpies of 35 mixtures of α,ω -dichloroalkanes (1,2-dichloroethane through 1,6-dichlorohexane) + n-alkanes (pentane, heptane, nonane, undecane, tridecane, pentadecane, or heptadecane) using a Calvet type microcalorimeter at 298.15 K and atmospheric pressure. There appears to be no previous systematic excess enthalpy measurements on these mixtures.

*Author to whom correspondence should be addressed.

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SELECTED DATA ON MIXTURES

International DATA Series*

1a. EXCESS ENTHALPY

Published by Thermodynamics Research Center

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

Components: 1. 1,2-Dichloroethane, $C_2H_4Cl_2$
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); 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

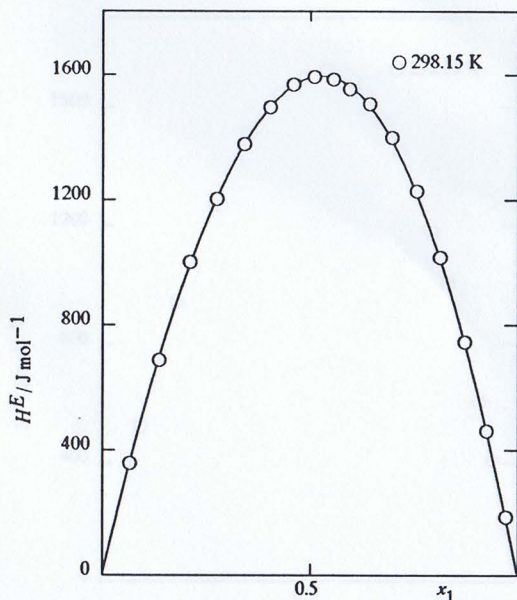
Ortega, J.; Plácido, J. (University of Las Palmas of Gran Canaria, Canary Islands, Spain); FIRST PUBLISHED RESULTS

DIRECT EXPERIMENTAL VALUES

Notes: P , atm.

$T/K = 298.15$

x_1	$H^E / J \text{ mol}^{-1}$						
0.0652	354.8						
0.1357	685.2						
0.2094	997.5						
0.2741	1200.6						
0.3409	1375.4						
0.4017	1492.5						
0.4595	1565.7						
0.5104	1589.9						
0.5562	1580.9						
0.5966	1551.1						
0.6447	1502.5						
0.6989	1395.9						
0.7588	1225.8						
0.8141	1013.1						
0.8733	743.7						
0.9251	458.7						
0.9710	184.8						



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	6350.1 (9.8)	722 (40)	-76 (47)	-310 (100)		5.9	9.9

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

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

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. 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; $\rho(298.15 \text{ K})/\text{kg m}^{-3} = 1245.74$; $n_D(298.15 \text{ K}) = 1.4422$.
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: $\delta T(\text{reproducibility})/K = 0.001$; $\delta T(\text{IPTS-68})/K = 0.02$; $\delta x_1 < 0.0005$; $\delta H^E / |H^E| = 0.02$ (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

Published by Thermodynamics Research Center

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

Components: 1. 1,2-Dichloroethane, $C_2H_4Cl_2$
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

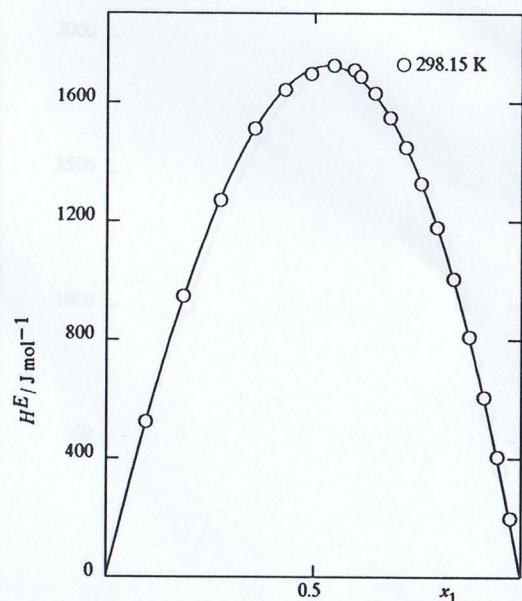
Ortega, J.; Plácido, J. (University of Las Palmas of Gran Canaria, Canary Islands, Spain); FIRST PUBLISHED RESULTS

DIRECT EXPERIMENTAL VALUES

Notes: P , atm.

$T/K = 298.15$

x_1	$H^E/J \text{ mol}^{-1}$						
0.0959	521.3						
0.1858	945.2						
0.2748	1270.4						
0.3560	1510.3						
0.4286	1641.3						
0.4918	1695.1						
0.5476	1723.5						
0.5965	1709.2						
0.6114	1686.7						
0.6467	1631.1						
0.6836	1547.8						
0.7218	1447.9						
0.7590	1326.2						
0.7981	1178.1						
0.8381	1004.2						
0.8758	808.0						
0.9112	603.7						
0.9435	403.9						
0.9739	197.3						



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	6861 (12)	923 (27)	-203 (60)			7.6	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 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) '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: $\delta T(\text{reproducibility})/K = 0.001$; $\delta T(\text{IPTS-68})/K = 0.02$; $\delta x_1 < 0.0005$; $\delta H^E/|H^E| = 0.02$ (over central range of concn.).

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

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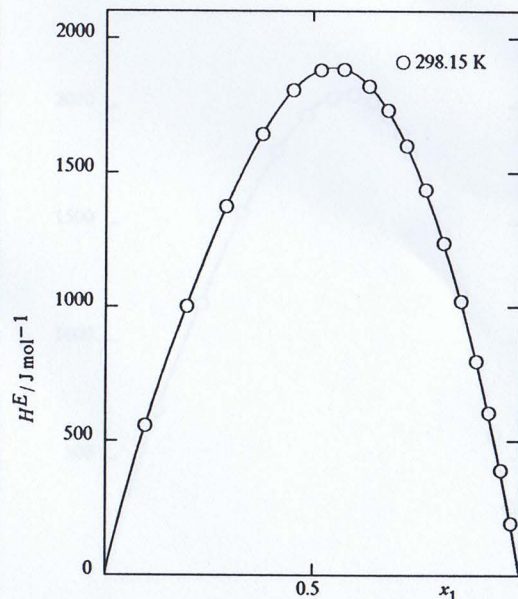
Ortega, J.; Plácido, J. (University of Las Palmas of Gran Canaria, Canary Islands, Spain); FIRST PUBLISHED RESULTS

DIRECT EXPERIMENTAL VALUES

Notes: P , atm.

$T/K = 298.15$

x_1	$H^E/J \text{ mol}^{-1}$						
0.0976	554.3						
0.1975	999.2						
0.2937	1371.8						
0.3788	1640.2						
0.4531	1805.0						
0.5191	1879.7						
0.5750	1881.3						
0.6353	1820.0						
0.6813	1731.4						
0.7261	1597.4						
0.7710	1434.5						
0.8145	1235.1						
0.8557	1018.8						
0.8930	795.6						
0.9234	603.4						
0.9524	387.9						
0.9777	192.2						



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	7462.5 (5.6)	1822 (19)	-1177 (58)	-795 (49)	1526 (98)	2.6	4.8

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.

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

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2. Undecane, $C_{11}H_{24}$
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

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SOURCE OF DATA

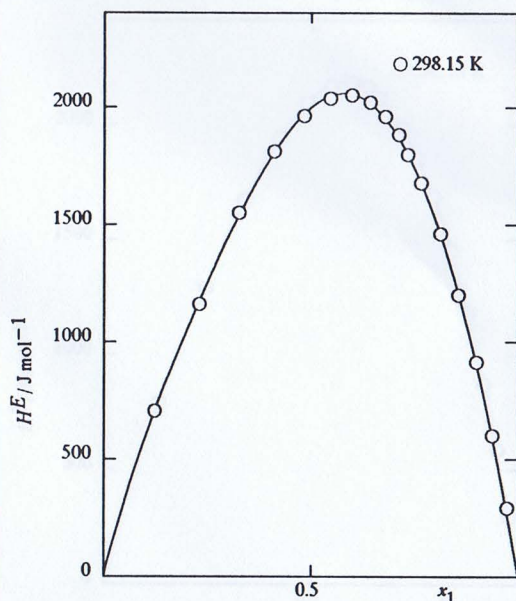
Ortega, J.; Plácido, J. (University of Las Palmas of Gran Canaria, Canary Islands, Spain); FIRST PUBLISHED RESULTS

DIRECT EXPERIMENTAL VALUES

Notes: P , atm.

$T/K = 298.15$

x_1	$H^E / J \text{ mol}^{-1}$						
0.1231	701.8						
0.2309	1157.6						
0.3276	1548.9						
0.4120	1809.8						
0.4840	1962.2						
0.5464	2035.1						
0.5998	2048.0						
0.6446	2018.2						
0.6807	1959.3						
0.7133	1881.0						
0.7347	1794.8						
0.7674	1675.9						
0.8131	1458.0						
0.8569	1195.9						
0.8988	909.9						
0.9384	599.2						
0.9725	291.5						



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	7977 (19)	2973 (67)	-310 (210)	-1200 (190)	1240 (370)	8.9	13

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

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Materials: 1. 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; $\rho(298.15 \text{ K})/\text{kg m}^{-3} = 1245.74$; $n(D, 298.15 \text{ K}) = 1.4422$.
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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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-Dichloroethane, $C_2H_4Cl_2$
2. Tridecane, $C_{13}H_{28}$
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

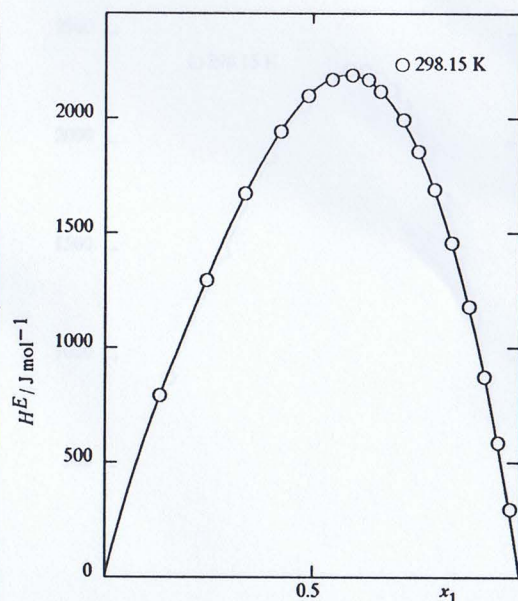
Ortega, J.; Plácido, J. (University of Las Palmas of Gran Canaria, Canary Islands, Spain); FIRST PUBLISHED RESULTS

DIRECT EXPERIMENTAL VALUES

Notes: P , atm.

$T/K = 298.15$

x_1	$H^E/J \text{ mol}^{-1}$						
0.1352	787.9						
0.2466	1290.3						
0.3395	1667.9						
0.4232	1938.0						
0.4907	2090.7						
0.5470	2162.4						
0.5945	2180.8						
0.6351	2160.8						
0.6641	2109.6						
0.7191	1988.1						
0.7550	1851.4						
0.7930	1685.5						
0.8349	1452.0						
0.8754	1174.2						
0.9132	868.6						
0.9463	582.4						
0.9763	292.8						



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	8440 (18)	3274 (65)	-190 (200)	-1010 (180)	1410 (360)	8.5	23

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. 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; $\rho(298.15 \text{ K})/\text{kg m}^{-3} = 1245.74$; $n(D, 298.15 \text{ K}) = 1.4422$.
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. 1,2-Dichloroethane, $C_2H_4Cl_2$
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 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

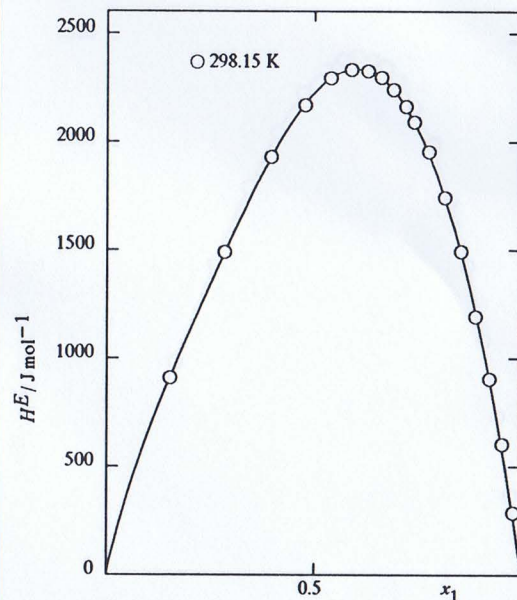
Ortega, J.; Plácido, J. (University of Las Palmas of Gran Canaria, Canary Islands, Spain); FIRST PUBLISHED RESULTS

DIRECT EXPERIMENTAL VALUES

Notes: P , atm.

$T/K = 298.15$

x_1	$H^E / J \text{ mol}^{-1}$						
0.1527	906.5						
0.2845	1488.3						
0.3967	1926.5						
0.4770	2167.2						
0.5394	2289.5						
0.5891	2328.9						
0.6278	2322.8						
0.6609	2293.1						
0.6902	2235.9						
0.7212	2160.3						
0.7414	2088.9						
0.7760	1952.0						
0.8153	1740.4						
0.8534	1490.3						
0.8891	1190.1						
0.9229	901.1						
0.9533	598.9						
0.9794	285.5						



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	8886 (19)	4180 (76)	190 (210)	-1440 (220)	1970 (410)	9.7	19

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. 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; $\rho(298.15 \text{ K})/\text{kg m}^{-3} = 1245.74$; $n(D, 298.15 \text{ K}) = 1.4422$.
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: $\delta T(\text{reproducibility})/K = 0.001$; $\delta T(\text{ITS-68})/K = 0.02$; $\delta x_1 < 0.0005$; $\delta H^E/|H^E| = 0.02$ (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-Dichloroethane, $C_2H_4Cl_2$
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); 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

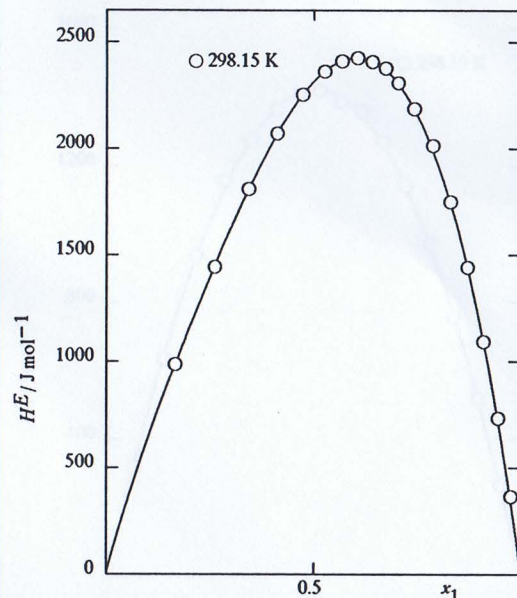
Ortega, J.; Plácido, J. (University of Las Palmas of Gran Canaria, Canary Islands, Spain); FIRST PUBLISHED RESULTS

DIRECT EXPERIMENTAL VALUES

Notes: P , atm.

$T/K = 298.15$

x_1	$H^E / J \text{ mol}^{-1}$						
0.1667	983.4						
0.2616	1442.2						
0.3441	1809.3						
0.4134	2071.6						
0.4746	2252.5						
0.5271	2362.3						
0.5690	2410.5						
0.6056	2425.6						
0.6402	2408.1						
0.6732	2377.8						
0.7042	2305.7						
0.7420	2185.2						
0.7862	2012.4						
0.8281	1750.4						
0.8694	1440.4						
0.9086	1090.8						
0.9443	730.9						
0.9747	361.7						



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	9245 (16)	4243 (63)	620 (190)	-600 (210)	1020 (390)	8.1	16

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. 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; $\rho(298.15 \text{ K})/\text{kg m}^{-3} = 1245.74$; $n(D, 298.15 \text{ K}) = 1.4422$.
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.; 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-Dichloropropane, $C_3H_6Cl_2$
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); 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

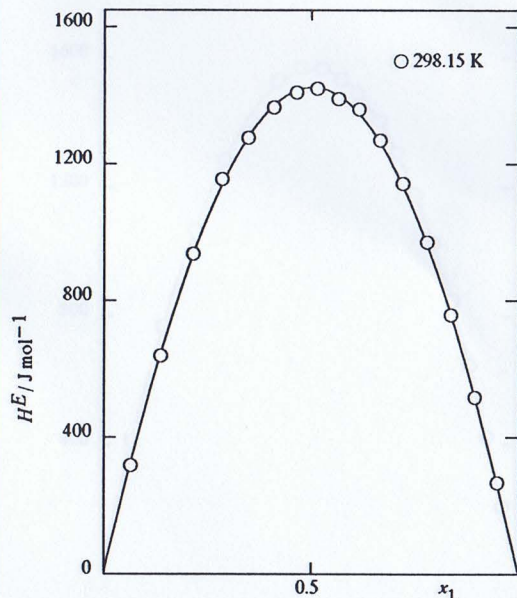
Ortega, J.; Plácido, J. (University of Las Palmas of Gran Canaria, Canary Islands, Spain); FIRST PUBLISHED RESULTS

DIRECT EXPERIMENTAL VALUES

Notes: P , atm.

$T/K = 298.15$

x_1	$H^E/J \text{ mol}^{-1}$						
0.0650	317.1						
0.1373	638.3						
0.2168	936.4						
0.2861	1155.2						
0.3487	1275.5						
0.4098	1363.6						
0.4648	1409.0						
0.5142	1418.7						
0.5649	1388.7						
0.6142	1359.8						
0.6661	1269.4						
0.7207	1142.9						
0.7789	970.7						
0.8358	756.0						
0.8951	514.8						
0.9480	265.2						



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	5692 (13)	90 (28)	-409 (64)			7.8	16

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.

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; $\rho(298.15 \text{ K})/\text{kg m}^{-3} = 1178.45$; $n(D, 298.15 \text{ K}) = 1.4455$.
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: $\delta T(\text{reproducibility})/K = 0.001$; $\delta T(\text{IPTS-68})/K = 0.02$; $\delta x_1 < 0.0005$; $\delta H^E/H^E = 0.02$ (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.
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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. 1,3-Dichloropropane, $C_3H_6Cl_2$
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

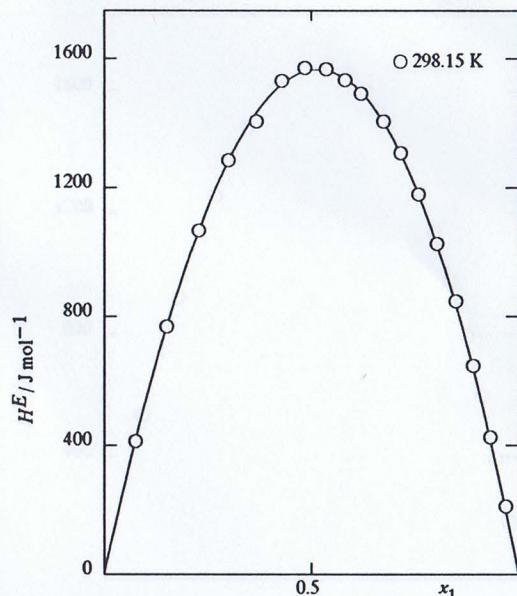
Ortega, J.; Plácido, J. (University of Las Palmas of Gran Canaria, Canary Islands, Spain); FIRST PUBLISHED RESULTS

DIRECT EXPERIMENTAL VALUES

Notes: P , atm.

$T/K = 298.15$

x_1	$H^E/J\text{ mol}^{-1}$								
0.0754	411.4								
0.1517	768.6								
0.2280	1067.2								
0.3001	1285.6								
0.3680	1406.2								
0.4300	1531.9								
0.4861	1571.7								
0.5365	1566.7								
0.5810	1534.3								
0.6198	1491.3								
0.6742	1405.1								
0.7159	1307.4								
0.7597	1180.1								
0.8037	1025.8								
0.8478	845.8								
0.8895	645.3								
0.9309	423.2								
0.9681	208.8								



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	6258 (10)	401 (27)				7.9	25

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; $\rho(298.15\text{ K})/\text{kg m}^{-3} = 1178.45$; $n(D, 298.15\text{ K}) = 1.4455$.
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: $\delta T(\text{reproducibility})/K = 0.001$; $\delta T(\text{IPTS-68})/K = 0.02$; $\delta x_1 < 0.0005$; $\delta H^E/|H^E| = 0.02$ (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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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-Dichloropropane, $C_3H_6Cl_2$
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 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)

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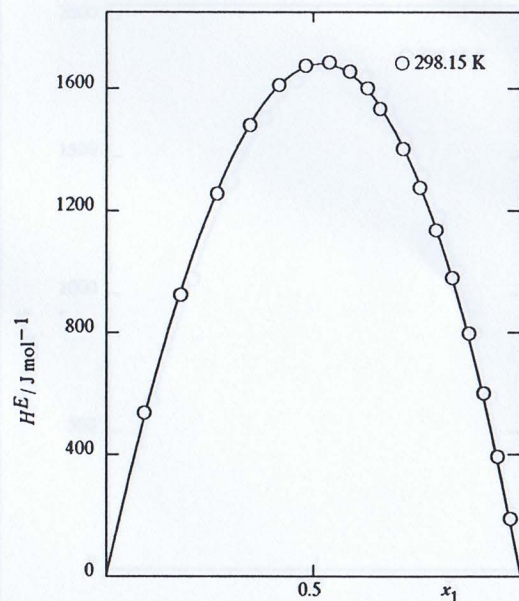
Ortega, J.; Plácido, J. (University of Las Palmas of Gran Canaria, Canary Islands, Spain); FIRST PUBLISHED RESULTS

DIRECT EXPERIMENTAL VALUES

Notes: P , atm.

$T/K = 298.15$

x_1	$H^E / J \text{ mol}^{-1}$						
0.0908	535.5						
0.1796	922.4						
0.2667	1255.9						
0.3467	1478.7						
0.4182	1609.7						
0.4828	1673.6						
0.5398	1684.2						
0.5891	1655.6						
0.6312	1600.6						
0.6627	1532.5						
0.7182	1401.8						
0.7576	1274.6						
0.7963	1135.4						
0.8350	976.5						
0.8739	796.1						
0.9098	598.4						
0.9437	390.1						
0.9744	187.4						



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	6708 (12)	568 (31)				8.9	20

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; $\rho(298.15 \text{ K})/\text{kg m}^{-3} = 1178.45$; $n_D(298.15 \text{ K}) = 1.4455$.
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: $\delta T(\text{reproducibility})/K = 0.001$; $\delta T(\text{IPTS-68})/K = 0.02$; $\delta x_1 < 0.0005$; $\delta H^E / |H^E| = 0.02$ (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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Int. DATA Ser., Ser. A 1993, 21(1), 12

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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-Dichloropropane, $C_3H_6Cl_2$
2. Undecane, $C_{11}H_{24}$
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

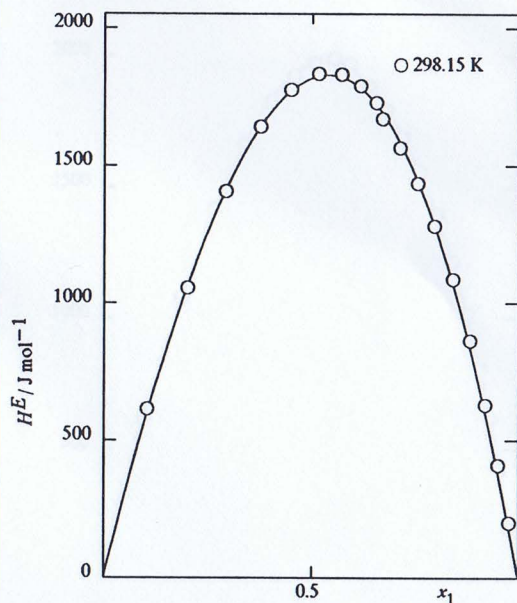
Ortega, J.; Plácido, J. (University of Las Palmas of Gran Canaria, Canary Islands, Spain); FIRST PUBLISHED RESULTS

DIRECT EXPERIMENTAL VALUES

Notes: P , atm.

$T/K = 298.15$

x_1	$H^E / \text{J mol}^{-1}$						
0.1055	612						
0.2026	1053						
0.2940	1404						
0.3784	1640						
0.4507	1773						
0.5156	1831						
0.5717	1830						
0.6176	1788						
0.6556	1726						
0.6720	1668						
0.7151	1563						
0.7570	1432						
0.7970	1278						
0.8417	1083						
0.8834	860						
0.9206	627						
0.9509	408						
0.9773	200						



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 mol^{-1}							
298.15	7261 (19)	1177 (51)				14	23

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; $\rho(298.15 \text{ K})/\text{kg m}^{-3} = 1178.45$; $n_D(298.15 \text{ K}) = 1.4455$.
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: $\delta T(\text{reproducibility})/K = 0.001$; $\delta T(\text{IPITS-68})/K = 0.02$; $\delta x_1 < 0.0005$; $\delta H^E/|H^E| = 0.02$ (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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Int. DATA Ser., Sel. Data Mixtures, Ser. A 1993, 21(1), 13

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-Dichloropropane, $C_3H_6Cl_2$
2. Tridecane, $C_{13}H_{28}$
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

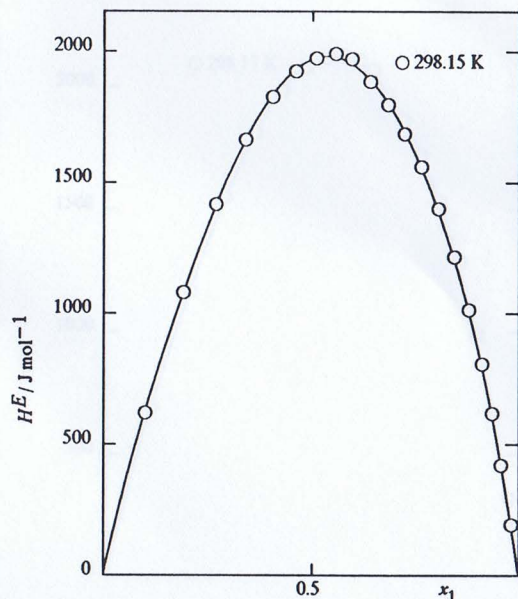
Ortega, J.; Plácido, J. (University of Las Palmas of Gran Canaria, Canary Islands, Spain); FIRST PUBLISHED RESULTS

DIRECT EXPERIMENTAL VALUES

Notes: P , atm.

$T/K = 298.15$

x_1	$H^E/J\text{ mol}^{-1}$						
0.1000	617.3						
0.1916	1077.5						
0.2699	1414.9						
0.3415	1660.6						
0.4049	1823.5						
0.4605	1921.1						
0.5103	1971.0						
0.5565	1987.0						
0.5952	1968.1						
0.6389	1881.2						
0.6824	1792.6						
0.7218	1683.2						
0.7638	1556.1						
0.8047	1397.6						
0.8438	1212.6						
0.8794	1010.8						
0.9109	802.6						
0.9354	614.3						
0.9581	418.5						
0.9825	191.1						



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	7866 (16)	1266 (58)	-720 (180)	800 (150)	2220 (310)	8.6	19

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; $\rho(298.15\text{ K})/\text{kg m}^{-3} = 1178.45$; $n(D, 298.15\text{ K}) = 1.4455$.
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: $\delta T(\text{reproducibility})/K = 0.001$; $\delta T(\text{ITS-68})/K = 0.02$; $\delta x_1 < 0.0005$; $\delta H^E/|H^E| = 0.02$ (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-Dichloropropane, $C_3H_6Cl_2$
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 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

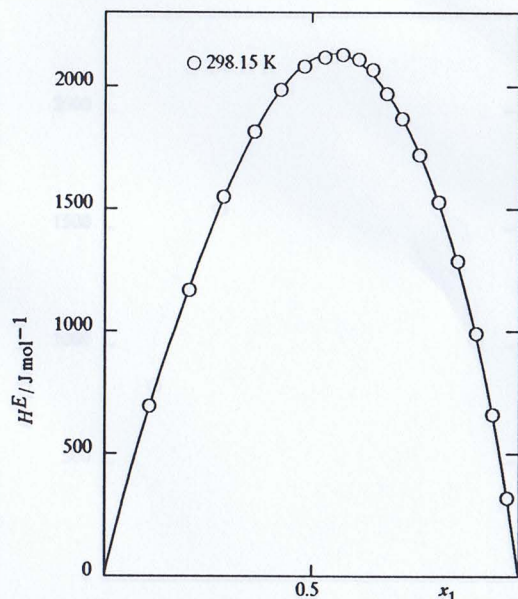
Ortega, J.; Plácido, J. (University of Las Palmas de Gran Canaria, Canary Islands, Spain); FIRST PUBLISHED RESULTS

DIRECT EXPERIMENTAL VALUES

Notes: P , atm.

$T/K = 298.15$

x_1	$H^E / J \text{ mol}^{-1}$						
0.1106	691.5						
0.2047	1166.2						
0.2891	1546.5						
0.3621	1812.1						
0.4255	1984.4						
0.4823	2078.9						
0.5315	2117.2						
0.5742	2125.4						
0.6129	2107.9						
0.6463	2066.5						
0.6809	1967.7						
0.7172	1865.3						
0.7585	1719.0						
0.8052	1524.6						
0.8512	1283.0						
0.8958	988.7						
0.9366	656.0						
0.9722	317.6						



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	8425 (17)	1940 (59)	-780 (190)	450 (160)	2200 (340)	8.7	20

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.

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; $\rho(298.15 \text{ K})/\text{kg m}^{-3} = 1178.45$; $n(D, 298.15 \text{ K}) = 1.4455$.
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: $\delta T(\text{reproducibility})/K = 0.001$; $\delta T(\text{ITS-68})/K = 0.02$; $\delta x_1 < 0.0005$; $\delta H^E / |H^E| = 0.02$ (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.

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

Published by Thermodynamics Research Center

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

Components: 1. 1,3-Dichloropropane, $C_3H_6Cl_2$
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); 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

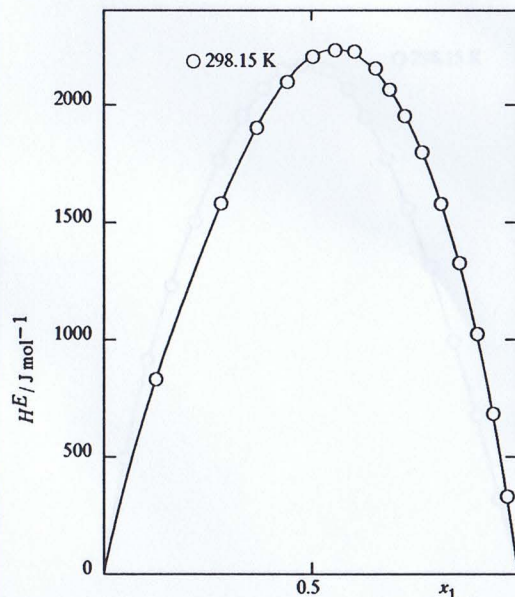
Ortega, J.; Plácido, J. (University of Las Palmas of Gran Canaria, Canary Islands, Spain); FIRST PUBLISHED RESULTS

DIRECT EXPERIMENTAL VALUES

Notes: P , atm.

$T/K = 298.15$

x_1	$H^E / J \text{ mol}^{-1}$						
0.1273	828.6						
0.2819	1578.8						
0.3678	1900.2						
0.4421	2095.8						
0.5046	2202.4						
0.5579	2230.1						
0.6037	2223.0						
0.6553	2152.8						
0.6892	2061.9						
0.7259	1949.1						
0.7670	1796.9						
0.8132	1575.5						
0.8581	1324.4						
0.9009	1020.9						
0.9395	679.4						
0.9729	328.1						



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	8800 (14)	2274 (53)	-590 (170)	170 (140)	2500 (290)	6.9	12

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; $\rho(298.15 \text{ K})/\text{kg m}^{-3} = 1178.45$; $n(D, 298.15 \text{ K}) = 1.4455$.
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: $\delta T(\text{reproducibility})/K = 0.001$; $\delta T(\text{ITS-68})/K = 0.02$; $\delta x_1 < 0.0005$; $\delta H^E/|H^E| = 0.02$ (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

Published by Thermodynamics Research Center

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

Components: 1. 1,4-Dichlorobutane, $C_4H_8Cl_2$
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); 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

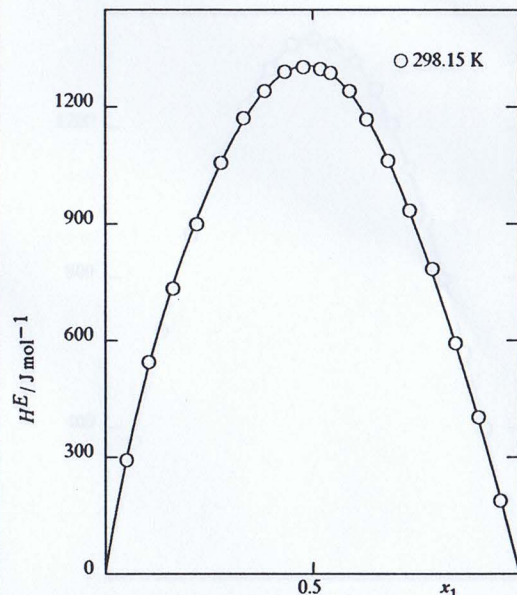
Ortega, J.; Plácido, J. (University of Las Palmas of Gran Canaria, Canary Islands, Spain); FIRST PUBLISHED RESULTS

DIRECT EXPERIMENTAL VALUES

Notes: P , atm.

$T/K = 298.15$

x_1	$H^E / \text{J mol}^{-1}$						
0.0504	291.3						
0.1056	543.3						
0.1634	732.4						
0.2205	899.0						
0.2787	1055.5						
0.3334	1172.4						
0.3838	1241.4						
0.4326	1290.2						
0.4772	1302.2						
0.5187	1297.7						
0.5442	1288.4						
0.5897	1241.0						
0.6322	1167.6						
0.6836	1060.5						
0.7366	933.8						
0.7900	782.2						
0.8461	591.2						
0.9002	401.4						
0.9536	187.5						



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 mol^{-1}						
298.15	5221 (12)	-318 (42)	-1220 (130)	-700 (110)	1540 (230)	6.6	10

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; $\rho(298.15 \text{ K})/\text{kg m}^{-3} = 1133.06$; $n_D(298.15 \text{ K}) = 1.4524$.
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: $\delta T(\text{reproducibility})/K = 0.001$; $\delta T(\text{ITS-68})/K = 0.02$; $\delta x_1 < 0.0005$; $\delta H^E/H^E = 0.02$ (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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Int. DATA Ser., Ser. A, Guideline 1a, 1973.

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

Published by Thermodynamics Research Center

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

Components: 1. 1,4-Dichlorobutane, $C_4H_8Cl_2$
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

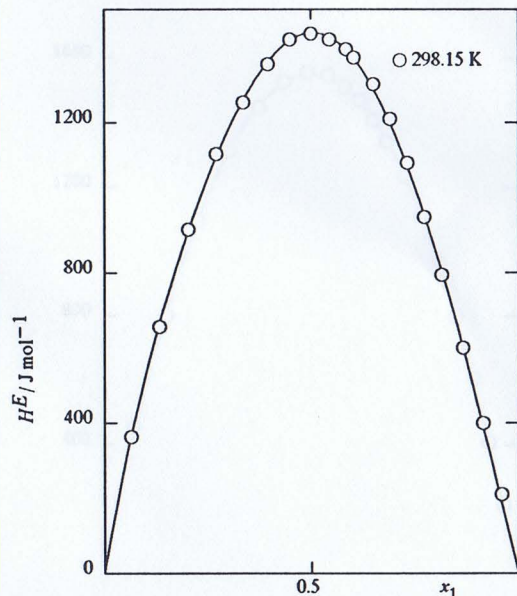
Ortega, J.; Plácido, J. (University of Las Palmas of Gran Canaria, Canary Islands, Spain); FIRST PUBLISHED RESULTS

DIRECT EXPERIMENTAL VALUES

Notes: P , atm.

$T/K = 298.15$

x_1	$H^E / J \text{ mol}^{-1}$						
0.0652	362.3						
0.1342	655.4						
0.2041	915.1						
0.2718	1115.3						
0.3364	1253.4						
0.3956	1354.2						
0.4506	1419.0						
0.5003	1433.7						
0.5449	1419.8						
0.5850	1393.2						
0.6035	1371.0						
0.6515	1301.3						
0.6915	1208.1						
0.7325	1092.2						
0.7738	946.5						
0.8150	792.0						
0.8656	599.3						
0.9146	397.0						
0.9587	209.2						



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	5748 (15)	153 (53)	-1010 (170)	-940 (140)	840 (290)	8.3	15

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; $\rho(298.15 \text{ K})/\text{kg m}^{-3} = 1133.06$; $n(D, 298.15 \text{ K}) = 1.4524$.
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: $\delta T(\text{reproducibility})/K = 0.001$; $\delta T(\text{IPTS-68})/K = 0.02$; $\delta x_1 < 0.0005$; $\delta H^E / |H^E| = 0.02$ (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

Published by Thermodynamics Research Center

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

Components: 1. 1,4-Dichlorobutane, $C_4H_8Cl_2$
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 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

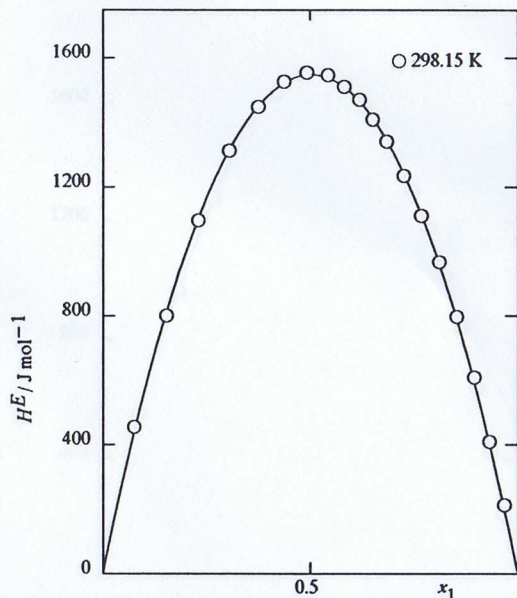
Ortega, J.; Plácido, J. (University of Las Palmas of Gran Canaria, Canary Islands, Spain); FIRST PUBLISHED RESULTS

DIRECT EXPERIMENTAL VALUES

Notes: P , atm.

$T/K = 298.15$

x_1	$H^E / J \text{ mol}^{-1}$						
0.0761	454.1						
0.1548	800.4						
0.2319	1097.0						
0.3073	1313.1						
0.3755	1450.0						
0.4380	1526.9						
0.4934	1554.9						
0.5431	1547.7						
0.5828	1511.1						
0.6186	1470.7						
0.6519	1410.3						
0.6855	1341.5						
0.7264	1234.5						
0.7689	1111.9						
0.8112	966.0						
0.8535	796.1						
0.8943	607.6						
0.9321	407.6						
0.9669	211.7						



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	6195 (12)	90 (26)	142 (57)			7.4	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.

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; $\rho(298.15 \text{ K})/\text{kg m}^{-3} = 1133.06$; $n_D(298.15 \text{ K}) = 1.4524$.
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: $\delta T(\text{reproducibility})/K = 0.001$; $\delta T(\text{IPTS-68})/K = 0.02$; $\delta x_1 < 0.0005$; $\delta H^E / |H^E| = 0.02$ (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

Published by Thermodynamics Research Center

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

Components: 1. 1,4-Dichlorobutane, $C_4H_8Cl_2$
2. Undecane, $C_{11}H_{24}$
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

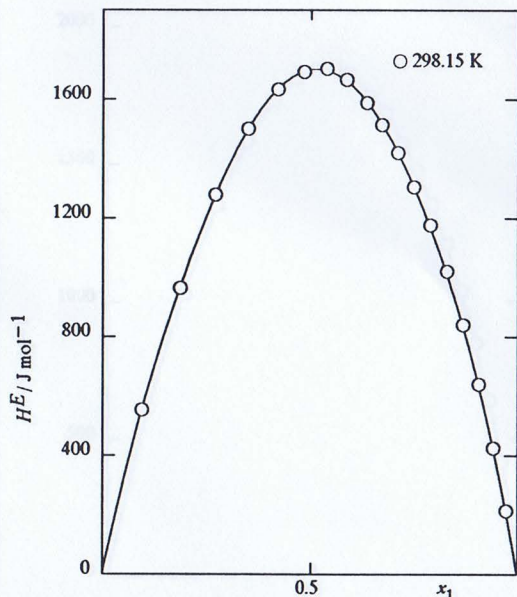
Ortega, J.; Plácido, J. (University of Las Palmas of Gran Canaria, Canary Islands, Spain); FIRST PUBLISHED RESULTS

DIRECT EXPERIMENTAL VALUES

Notes: P , atm.

$T/K = 298.15$

x_1	$H^E/J \text{ mol}^{-1}$						
0.0937	550.6						
0.1849	962.5						
0.2705	1278.2						
0.3485	1498.9						
0.4209	1632.9						
0.4838	1692.4						
0.5393	1701.6						
0.5876	1665.2						
0.6355	1588.0						
0.6729	1512.7						
0.7111	1419.7						
0.7502	1305.3						
0.7899	1176.1						
0.8296	1019.8						
0.8690	838.4						
0.9065	638.1						
0.9417	423.4						
0.9731	212.6						



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	6794.3 (9.0)	437 (31)	-714 (96)	354 (81)	1578 (170)	4.4	6.4

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; $\rho(298.15 \text{ K})/\text{kg m}^{-3} = 1133.06$; $n(D, 298.15 \text{ K}) = 1.4524$.
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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Int. DATA Ser., Sel. Data Mixtures, Ser. A 1993, 21(1), 20

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

Published by Thermodynamics Research Center

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

Components: 1. 1,4-Dichlorobutane, $C_4H_8Cl_2$
2. Tridecane, $C_{13}H_{28}$
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

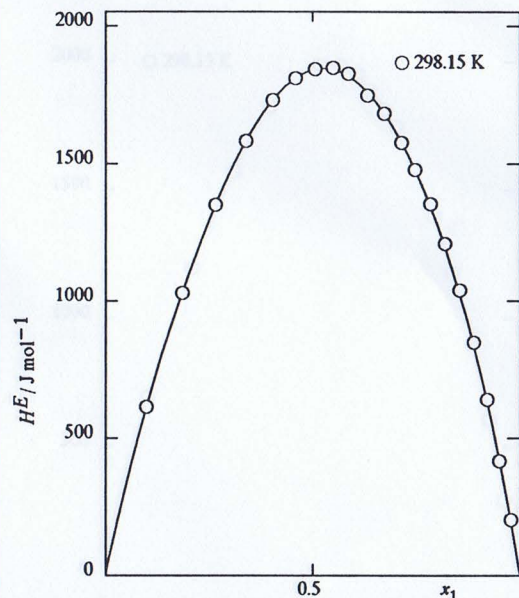
Ortega, J.; Plácido, J. (University of Las Palmas of Gran Canaria, Canary Islands, Spain); FIRST PUBLISHED RESULTS

DIRECT EXPERIMENTAL VALUES

Notes: P , atm.

$T/K = 298.15$

x_1	$H^E / J \text{ mol}^{-1}$						
0.0988	610.5						
0.1861	1027.8						
0.2656	1347.5						
0.3398	1582.4						
0.4037	1727.6						
0.4593	1807.5						
0.5075	1841.6						
0.5507	1845.7						
0.5868	1823.9						
0.6335	1745.2						
0.6725	1678.5						
0.7143	1575.4						
0.7470	1475.1						
0.7831	1352.0						
0.8189	1205.1						
0.8539	1036.7						
0.8880	845.2						
0.9204	636.4						
0.9506	415.1						
0.9772	201.9						



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	7351 (11)	844 (39)	-290 (120)	390 (100)	1280 (210)	5.8	12

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.

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; $\rho(298.15 \text{ K})/\text{kg m}^{-3} = 1133.06$; $n(D, 298.15 \text{ K}) = 1.4524$.
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: $\delta T(\text{reproducibility})/K = 0.001$; $\delta T(\text{ITS-68})/K = 0.02$; $\delta x_1 < 0.0005$; $\delta H^E/|H^E| = 0.02$ (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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SELECTED DATA ON MIXTURES
International DATA Series*

1a. EXCESS ENTHALPY

Published by Thermodynamics Research Center

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

Components: 1. 1,4-Dichlorobutane, $C_4H_8Cl_2$
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 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

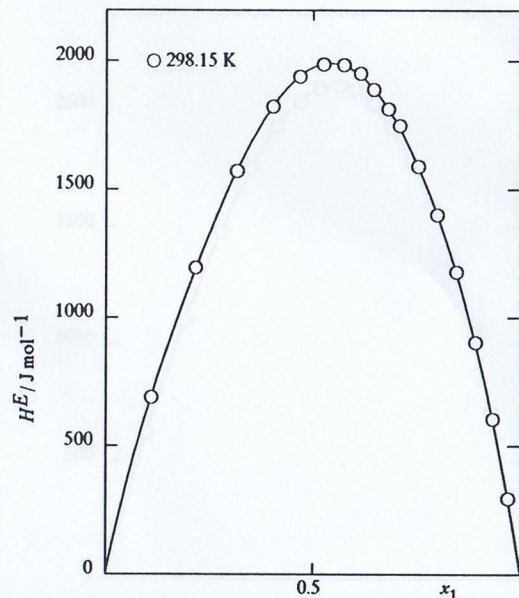
Ortega, J.; Plácido, J. (University of Las Palmas of Gran Canaria, Canary Islands, Spain); FIRST PUBLISHED RESULTS

DIRECT EXPERIMENTAL VALUES

Notes: P , atm.

$T/K = 298.15$

x_1	$H^E / J \text{ mol}^{-1}$						
0.1113	689.9						
0.2183	1195.3						
0.3171	1573.1						
0.4034	1823.7						
0.4686	1939.7						
0.5261	1988.3						
0.5739	1985.5						
0.6152	1952.7						
0.6476	1890.2						
0.6825	1815.3						
0.7094	1748.6						
0.7540	1590.8						
0.7986	1402.3						
0.8459	1177.3						
0.8915	904.1						
0.9336	602.6						
0.9705	293.8						



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	7904.8 (8.4)	1542 (30)	-887 (94)	-89 (82)	2150 (170)	4.1	7.3

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.

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; $\rho(298.15 \text{ K})/kg \text{ m}^{-3} = 1133.06$; $n_D(298.15 \text{ K}) = 1.4524$.
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; $\rho(298.15 \text{ K})/kg \text{ m}^{-3} = 764.80$; $n_D(298.15 \text{ K}) = 1.4298$.
Materials were degassed ultrasonically before use.

Errors: $\delta T(\text{reproducibility})/K = 0.001$; $\delta T(\text{ITS-68})/K = 0.02$; $\delta x_1 < 0.0005$; $\delta H^E/H^E = 0.02$ (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-Dichlorobutane, $C_4H_8Cl_2$
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); 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

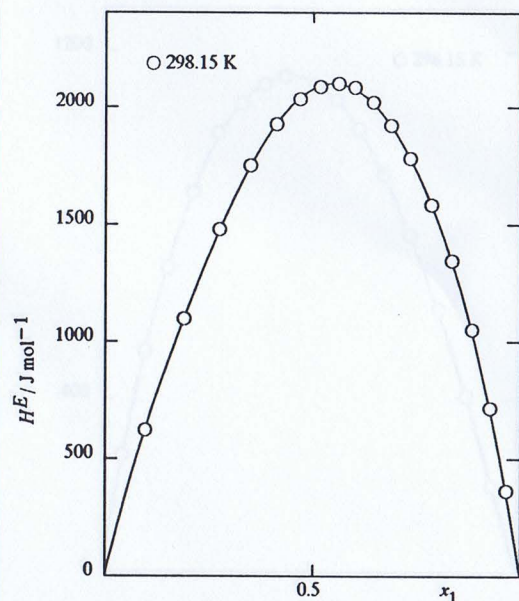
Ortega, J.; Plácido, J. (University of Las Palmas of Gran Canaria, Canary Islands, Spain); FIRST PUBLISHED RESULTS

DIRECT EXPERIMENTAL VALUES

Notes: P , atm.

$T/K = 298.15$

x_1	$H^E / J \text{ mol}^{-1}$						
0.0971	619.6						
0.1904	1094.6						
0.2749	1476.6						
0.3488	1749.9						
0.4121	1924.2						
0.4685	2030.9						
0.5184	2084.5						
0.5626	2097.9						
0.6011	2081.6						
0.6458	2018.1						
0.6880	1920.1						
0.7344	1780.4						
0.7853	1583.0						
0.8351	1342.7						
0.8831	1048.9						
0.9280	712.2						
0.9676	360.5						



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	8299.1 (9.1)	1841 (33)	-690 (100)	330 (88)	2070 (180)	4.8	7.7

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.

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; $\rho(298.15 \text{ K})/\text{kg m}^{-3} = 1133.06$; $n(D, 298.15 \text{ K}) = 1.4524$.
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.; 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-Dichloropentane, $C_5H_{10}Cl_2$
 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); 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

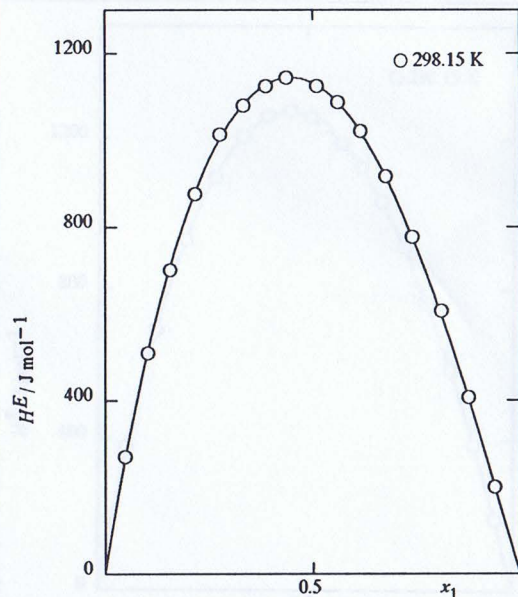
Ortega, J.; Plácido, J. (University of Las Palmas of Gran Canaria, Canary Islands, Spain); FIRST PUBLISHED RESULTS

DIRECT EXPERIMENTAL VALUES

Notes: P , atm.

$T/K = 298.15$

x_1	$H^E / J \text{ mol}^{-1}$						
0.0479	268.6						
0.1035	507.8						
0.1578	700.8						
0.2176	875.1						
0.2772	1013.0						
0.3335	1080.4						
0.3869	1125.0						
0.4364	1143.9						
0.5107	1124.2						
0.5600	1087.9						
0.6163	1019.5						
0.6776	915.3						
0.7430	776.3						
0.8111	604.3						
0.8755	405.9						
0.9399	198.8						



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	4528.4 (9.1)	-941 (35)	113 (42)	-319 (91)		5.2	12

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; $\rho(298.15 \text{ K})/\text{kg m}^{-3} = 1095.27$; $n_D(298.15 \text{ K}) = 1.4545$.
 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: $\delta T(\text{reproducibility})/K = 0.001$; $\delta T(\text{ITS-68})/K = 0.02$; $\delta x_1 < 0.0005$; $\delta H^E / |H^E| = 0.02$ (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. 1,5-Dichloropentane, $C_5H_{10}Cl_2$
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)

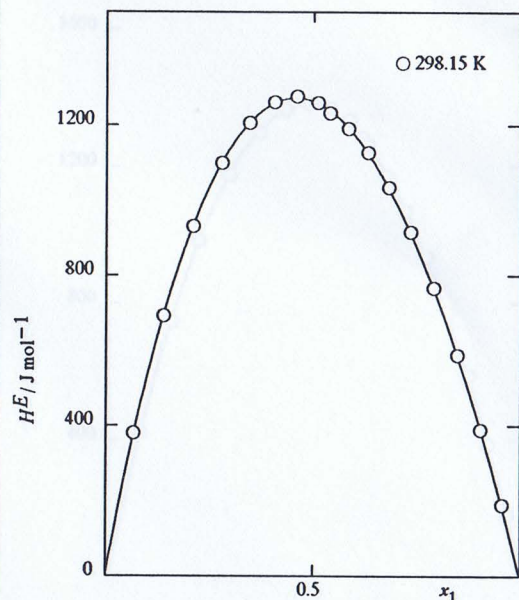
SOURCE OF DATA
Ortega, J.; Plácido, J. (University of Las Palmas of Gran Canaria, Canary Islands, Spain); FIRST PUBLISHED RESULTS

DIRECT EXPERIMENTAL VALUES

Notes: P , atm.

$T/K = 298.15$

x_1	$H^E / J \text{ mol}^{-1}$						
0.0678	379.2						
0.1401	690.7						
0.2115	930.4						
0.2807	1098.7						
0.3468	1204.1						
0.4067	1259.7						
0.4614	1275.2						
0.5109	1258.2						
0.5407	1230.0						
0.5849	1189.9						
0.6334	1124.9						
0.6841	1033.9						
0.7368	914.7						
0.7922	764.3						
0.8487	585.9						
0.9034	388.0						
0.9558	189.0						



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 mol ⁻¹							
298.15	5048.3 (5.8)	-826 (13)	196 (29)			3.6	7.3

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.

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; $\rho(298.15 \text{ K})/\text{kg m}^{-3} = 1095.27$; $n_D(298.15 \text{ K}) = 1.4545$.
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: $\delta T(\text{reproducibility})/K = 0.001$; $\delta T(\text{ITS-68})/K = 0.02$; $\delta x_1 < 0.0005$; $\delta H^E/H^E = 0.02$ (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.

25

Int. DATA Ser., Ser. A, Guideline 1a, 1973. 25

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-Dichloropentane, $C_5H_{10}Cl_2$
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 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

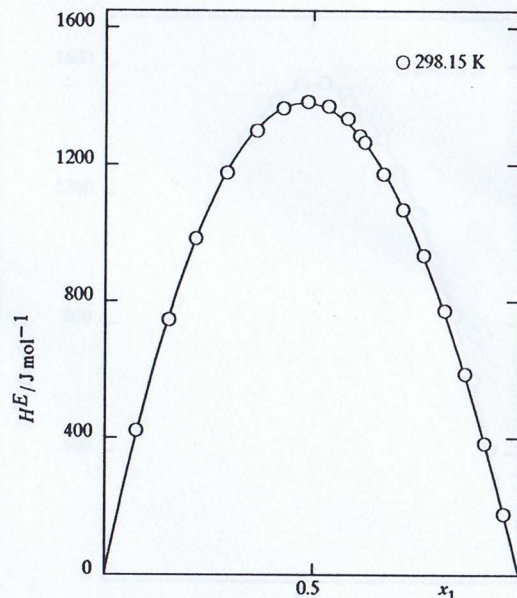
Ortega, J.; Plácido, J. (University of Las Palmas of Gran Canaria, Canary Islands, Spain); FIRST PUBLISHED RESULTS

DIRECT EXPERIMENTAL VALUES

Notes: P , atm.

$T/K = 298.15$

x_1	$H^E / J \text{ mol}^{-1}$						
0.0748	421.0						
0.1542	745.4						
0.2198	982.9						
0.2952	1175.6						
0.3652	1298.7						
0.4289	1363.7						
0.4862	1383.7						
0.5369	1370.0						
0.5819	1334.0						
0.6212	1282.5						
0.6236	1264.3						
0.6698	1172.0						
0.7177	1068.4						
0.7678	934.4						
0.8187	771.2						
0.8685	586.6						
0.9167	383.0						
0.9622	177.8						



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	5519 (13)	-446 (28)	-136 (64)			8.1	20

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; $\rho(298.15 \text{ K})/\text{kg m}^{-3} = 1095.27$; $n(D, 298.15 \text{ K}) = 1.4545$.
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: $\delta T(\text{reproducibility})/K = 0.001$; $\delta T(\text{ITS-68})/K = 0.02$; $\delta x_1 < 0.0005$; $\delta H^E/|H^E| = 0.02$ (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.

Received: November 25, 1992

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

Published: January 31, 1993

Components: 1. 1,5-Dichloropentane, $C_5H_{10}Cl_2$
2. Undecane, $C_{11}H_{24}$
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

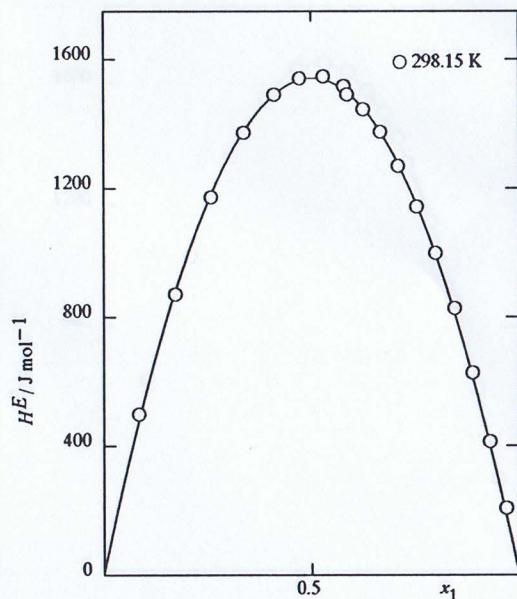
Ortega, J.; Plácido, J. (University of Las Palmas of Gran Canaria, Canary Islands, Spain); FIRST PUBLISHED RESULTS

DIRECT EXPERIMENTAL VALUES

Notes: P , atm.

$T/K = 298.15$

x_1	$H^E / J \text{ mol}^{-1}$						
0.0852	497.9						
0.1753	871.4						
0.2604	1173.6						
0.3392	1373.7						
0.4118	1491.7						
0.4738	1541.8						
0.5293	1547.3						
0.5785	1517.0						
0.5864	1490.9						
0.6254	1444.8						
0.6667	1375.8						
0.7098	1270.0						
0.7539	1143.9						
0.7996	999.6						
0.8449	825.9						
0.8890	625.3						
0.9299	411.8						
0.9677	206.7						



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_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	6168 (12)	99 (35)				9.7	24

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; $\rho(298.15 \text{ K})/\text{kg m}^{-3} = 1095.27$; $n(D, 298.15 \text{ K}) = 1.4545$.
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.

Components: 1. 1,5-Dichloropentane, $C_5H_{10}Cl_2$
2. Tridecane, $C_{13}H_{28}$
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

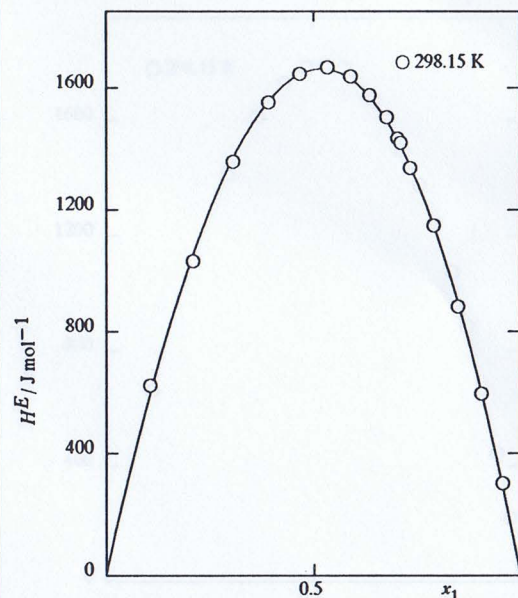
Ortega, J.; Plácido, J. (University of Las Palmas of Gran Canaria, Canary Islands, Spain); FIRST PUBLISHED RESULTS

DIRECT EXPERIMENTAL VALUES

Notes: P , atm.

$T/K = 298.15$

x_1	$H^E / J \text{ mol}^{-1}$						
0.1069	621						
0.2103	1030						
0.3063	1356						
0.3916	1551						
0.4667	1645						
0.5325	1666						
0.5884	1636						
0.6352	1575						
0.6756	1502						
0.7023	1433						
0.7102	1418						
0.7334	1336						
0.7893	1147						
0.8492	880						
0.9061	595						
0.9569	301						



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	6633 (17)	525 (44)				12	27

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; $\rho(298.15 \text{ K})/\text{kg m}^{-3} = 1095.27$; $n_D(298.15 \text{ K}) = 1.4545$.
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: $\delta T(\text{reproducibility})/K = 0.001$; $\delta T(\text{ITS-68})/K = 0.02$; $\delta x_1 < 0.0005$; $\delta H^E / |H^E| = 0.02$ (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.

Components: 1. 1,5-Dichloropentane, $C_5H_{10}Cl_2$
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 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

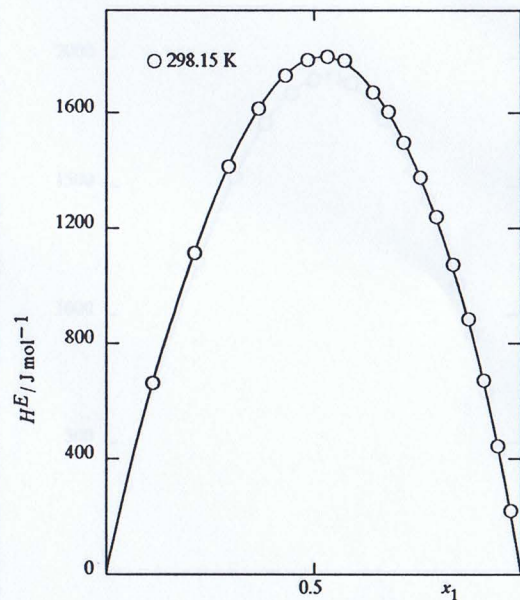
Ortega, J.; Plácido, J. (University of Las Palmas of Gran Canaria, Canary Islands, Spain); FIRST PUBLISHED RESULTS

DIRECT EXPERIMENTAL VALUES

Notes: P , atm.

$T/K = 298.15$

x_1	$H^E / J \text{ mol}^{-1}$						
0.1112	660.5						
0.2108	1110.5						
0.2939	1410.0						
0.3674	1609.5						
0.4315	1725.2						
0.4857	1777.5						
0.5328	1790.2						
0.5749	1776.7						
0.6443	1666.2						
0.6807	1599.4						
0.7184	1493.0						
0.7571	1372.5						
0.7962	1235.3						
0.8354	1069.6						
0.8732	879.8						
0.9099	667.7						
0.9438	440.4						
0.9742	218.1						



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 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	7141.7 (9.9)	667 (36)	-550 (110)	313 (97)	1470 (190)	5.0	9.5

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.

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; $\rho(298.15 \text{ K})/\text{kg m}^{-3} = 1095.27$; $n(D, 298.15 \text{ K}) = 1.4545$.
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: $\delta T(\text{reproducibility})/K = 0.001$; $\delta T(\text{ITS-68})/K = 0.02$; $\delta x_1 < 0.0005$; $\delta H^E / |H^E| = 0.02$ (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. 1,5-Dichloropentane, $C_5H_{10}Cl_2$
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); 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

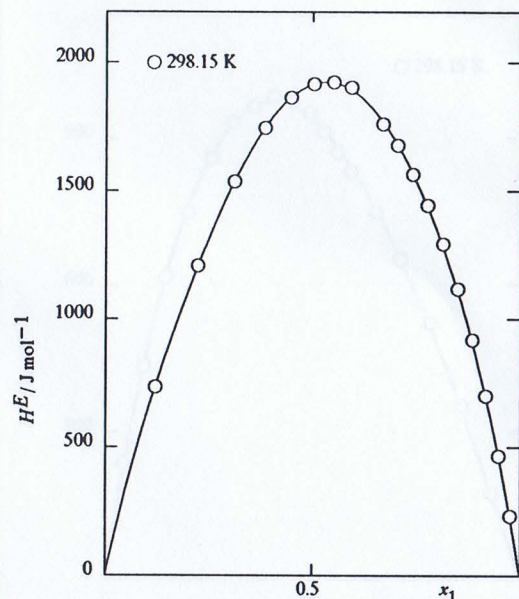
Ortega, J.; Plácido, J. (University of Las Palmas of Gran Canaria, Canary Islands, Spain); FIRST PUBLISHED RESULTS

DIRECT EXPERIMENTAL VALUES

Notes: P , atm.

$T/K = 298.15$

x_1	$H^E / \text{J mol}^{-1}$						
0.1202	734.3						
0.2228	1207.3						
0.3116	1537.5						
0.3857	1747.6						
0.4492	1864.5						
0.5044	1918.0						
0.5517	1926.4						
0.5930	1905.8						
0.6706	1761.9						
0.7057	1678.7						
0.7416	1565.8						
0.7783	1444.0						
0.8142	1293.4						
0.8503	1117.6						
0.8851	918.4						
0.9178	699.4						
0.9486	464.9						
0.9761	231.0						



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 mol^{-1}							
298.15	7665 (11)	1127 (42)	-620 (120)	350 (110)	1910 (220)	5.7	9.3

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; $\rho(298.15 \text{ K})/\text{kg m}^{-3} = 1095.27$; $n_D(298.15 \text{ K}) = 1.4545$.
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: $\delta T(\text{reproducibility})/K = 0.001$; $\delta T(\text{ITS-68})/K = 0.02$; $\delta x_1 < 0.0005$; $\delta H^E/|H^E| = 0.02$ (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

Published by Thermodynamics Research Center

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

Components: 1. 1,6-Dichlorohexane, $C_6H_{12}Cl_2$
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); 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

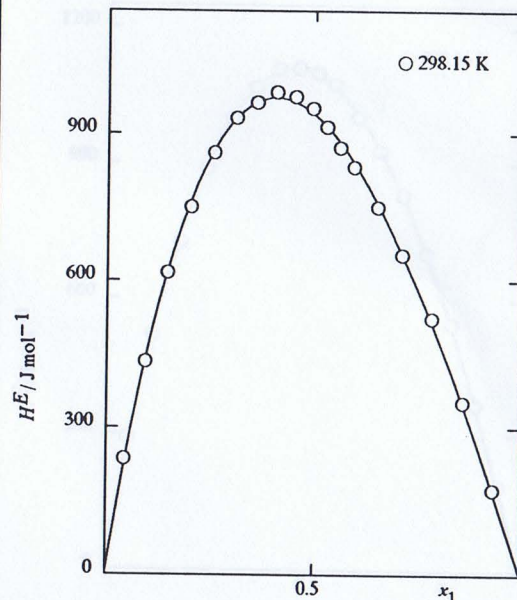
Ortega, J.; Plácido, J. (University of Las Palmas of Gran Canaria, Canary Islands, Spain); FIRST PUBLISHED RESULTS

DIRECT EXPERIMENTAL VALUES

Notes: P , atm.

$T/K = 298.15$

x_1	$H^E / J \text{ mol}^{-1}$								
0.0436	234.6								
0.0935	434.3								
0.1474	615.3								
0.2018	750.3								
0.2575	860.3								
0.3109	931.0								
0.3602	963.3								
0.4085	983.9								
0.4530	974.5								
0.4939	951.4								
0.5288	912.8								
0.5611	871.1								
0.5951	831.2								
0.6531	750.2								
0.7129	652.7								
0.7846	522.4								
0.8594	351.6								
0.9332	173.3								



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	3752 (12)	-1434 (29)	318 (63)			8.1	13

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 ~ 98 mole %, dried over mol. sieve Type 3A (from Fluka) and used without further purification; $\rho(298.15 \text{ K})/\text{kg m}^{-3} = 1067.59$; $n_D(298.15 \text{ K}) = 1.4555$.
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: $\delta T(\text{reproducibility})/K = 0.001$; $\delta T(\text{IPTS-68})/K = 0.02$; $\delta x_1 < 0.0005$; $\delta H^E / |H^E| = 0.02$ (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. 1,6-Dichlorohexane, $C_6H_{12}Cl_2$
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

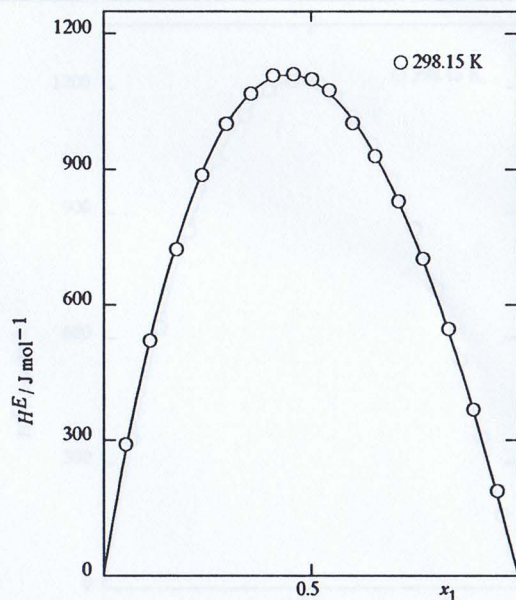
Ortega, J.; Plácido, J. (University of Las Palmas of Gran Canaria, Canary Islands, Spain); FIRST PUBLISHED RESULTS

DIRECT EXPERIMENTAL VALUES

Notes: P , atm.

$T/K = 298.15$

x_1	$H^E / J \text{ mol}^{-1}$						
0.0539	290.5						
0.1132	520.2						
0.1756	723.9						
0.2375	887.4						
0.2968	1000.8						
0.3545	1068.5						
0.4079	1108.4						
0.4574	1110.8						
0.5021	1100.3						
0.5432	1074.8						
0.5997	1002.1						
0.6528	929.0						
0.7098	828.7						
0.7686	701.3						
0.8293	546.1						
0.8904	367.4						
0.9480	186.9						



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	4389 (11)	-928 (23)	166 (53)			6.7	18

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 ~ 98 mole %, dried over mol. sieve Type 3A (from Fluka) and used without further purification; $\rho(298.15 \text{ K})/\text{kg m}^{-3} = 1067.59$; $n(D, 298.15 \text{ K}) = 1.4555$.
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: $\delta T(\text{reproducibility})/K = 0.001$; $\delta T(\text{IPITS-68})/K = 0.02$; $\delta x_1 < 0.0005$; $\delta H^E / |H^E| = 0.02$ (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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SELECTED DATA ON MIXTURES

International DATA Series*

1a. EXCESS ENTHALPY

Published by Thermodynamics Research Center

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

Components: 1. 1,6-Dichlorohexane, $C_6H_{12}Cl_2$
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 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)

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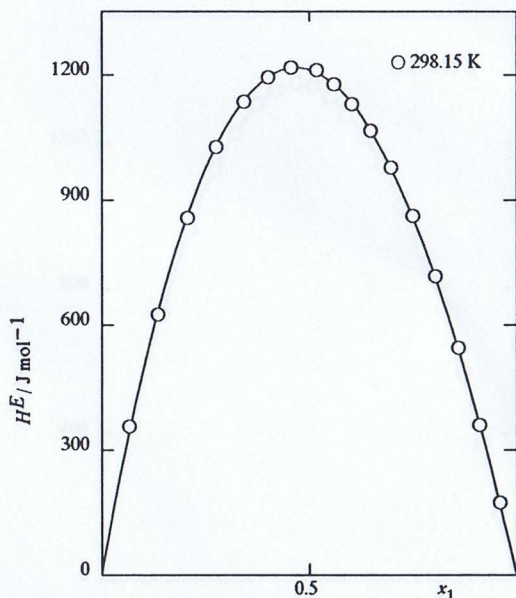
Ortega, J.; Plácido, J. (University of Las Palmas of Gran Canaria, Canary Islands, Spain); FIRST PUBLISHED RESULTS

DIRECT EXPERIMENTAL VALUES

Notes: P , atm.

$T/K = 298.15$

x_1	$H^E / J \text{ mol}^{-1}$						
0.0660	355.2						
0.1362	624.3						
0.2066	855.6						
0.2764	1025.7						
0.3419	1133.4						
0.4013	1193.0						
0.4561	1216.0						
0.5177	1209.5						
0.5586	1175.1						
0.6026	1128.4						
0.6490	1065.1						
0.6984	976.0						
0.7500	859.7						
0.8043	714.1						
0.8587	543.5						
0.9107	357.2						
0.9589	172.1						



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 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	4841.8 (9.4)	-600 (20)	141 (45)			5.7	18

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.

Materials: 1. Aldrich Chem. Co., Inc. (Milwaukee, WI, USA) material, of stated purity ~ 98 mole %, dried over mol. sieve Type 3A (from Fluka) and used without further purification; $\rho(298.15 \text{ K})/\text{kg m}^{-3} = 1067.59$; $n(D, 298.15 \text{ K}) = 1.4555$.
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: $\delta T(\text{reproducibility})/K = 0.001$; $\delta T(\text{IPTS-68})/K = 0.02$; $\delta x_1 < 0.0005$; $\delta H^E / |H^E| = 0.02$ (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. 1,6-Dichlorohexane, $C_6H_{12}Cl_2$
2. Undecane, $C_{11}H_{24}$
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

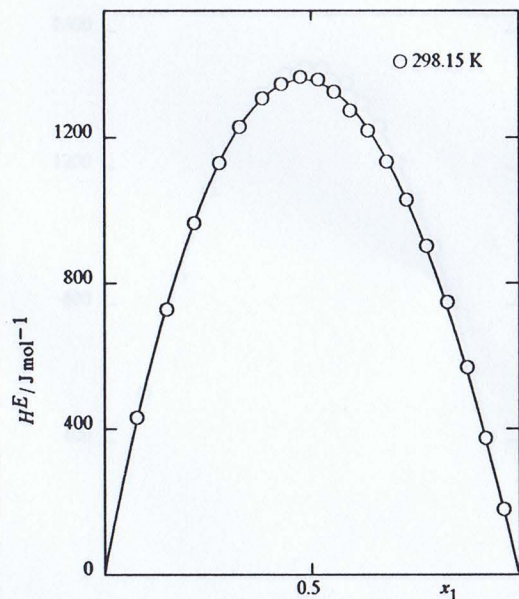
Ortega, J.; Plácido, J. (University of Las Palmas of Gran Canaria, Canary Islands, Spain); FIRST PUBLISHED RESULTS

DIRECT EXPERIMENTAL VALUES

Notes: P , atm.

$T/K = 298.15$

x_1	$H^E / J \text{ mol}^{-1}$						
0.0778	430.8						
0.1512	728.5						
0.2184	966.5						
0.2797	1131.6						
0.3289	1231.2						
0.3818	1308.0						
0.4290	1348.1						
0.4753	1366.5						
0.5174	1360.1						
0.5558	1327.0						
0.5947	1275.3						
0.6375	1220.2						
0.6822	1135.3						
0.7296	1030.7						
0.7779	901.8						
0.8263	747.2						
0.8739	569.5						
0.9199	373.4						
0.9626	179.0						



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 mol ⁻¹							
298.15	5430.3 (8.5)	-436 (24)				7.1	15

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.

Materials: 1. Aldrich Chem. Co., Inc. (Milwaukee, WI, USA) material, of stated purity ~ 98 mole %, dried over mol. sieve Type 3A (from Fluka) and used without further purification; $\rho(298.15 \text{ K})/\text{kg m}^{-3} = 1067.59$; $n_D(298.15 \text{ K}) = 1.4555$.
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: $\delta T(\text{reproducibility})/K = 0.001$; $\delta T(\text{ITS-68})/K = 0.02$; $\delta x_1 < 0.0005$; $\delta H^E/H^E = 0.02$ (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

Published by Thermodynamics Research Center

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

Components: 1. 1,6-Dichlorohexane, $C_6H_{12}Cl_2$
2. Tridecane, $C_{13}H_{28}$
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

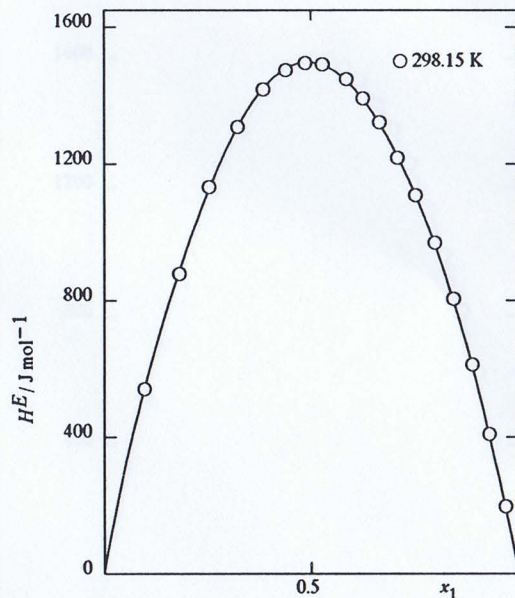
Ortega, J.; Plácido, J. (University of Las Palmas de Gran Canaria, Canary Islands, Spain); FIRST PUBLISHED RESULTS

DIRECT EXPERIMENTAL VALUES

Notes: P , atm.

$T/K = 298.15$

x_1	$H^E / J \text{ mol}^{-1}$						
0.0966	538.7						
0.1820	876.5						
0.2548	1132.0						
0.3234	1307.7						
0.3850	1417.4						
0.4386	1474.6						
0.4863	1496.2						
0.5288	1492.4						
0.5858	1448.0						
0.6248	1391.2						
0.6658	1321.8						
0.7085	1218.3						
0.7523	1108.2						
0.7978	967.5						
0.8424	803.1						
0.8869	611.9						
0.9281	408.2						
0.9673	195.4						



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	a_6	σ_d
	$J \text{ mol}^{-1}$						
298.15	5990.7 (7.9)	-178 (41)	-481 (90)	1140 (250)	1070 (160)	-1380 (330)	4.1

$$\delta_m / J \text{ mol}^{-1} = 6.9$$

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

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

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 ~ 98 mole %, dried over mol. sieve Type 3A (from Fluka) and used without further purification; $\rho(298.15 \text{ K})/\text{kg m}^{-3} = 1067.59$; $n(D, 298.15 \text{ K}) = 1.4555$.
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: $\delta T(\text{reproducibility})/K = 0.001$; $\delta T(\text{ITS-68})/K = 0.02$; $\delta x_1 < 0.0005$; $\delta H^E / H^E = 0.02$ (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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Int. DATA Ser., Sel. Data Mixtures, Ser. A 1993, 21(1), 35

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-Dichlorohexane, $C_6H_{12}Cl_2$
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 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)

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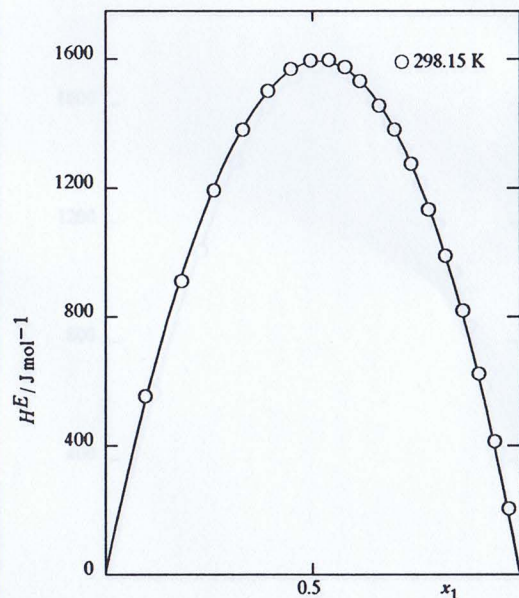
Ortega, J.; Plácido, J. (University of Las Palmas of Gran Canaria, Canary Islands, Spain); FIRST PUBLISHED RESULTS

DIRECT EXPERIMENTAL VALUES

Notes: P , atm.

$T/K = 298.15$

x_1	$H^E / J \text{ mol}^{-1}$						
0.0975	552.9						
0.1853	909.9						
0.2634	1193.2						
0.3328	1382.3						
0.3934	1501.5						
0.4478	1569.9						
0.4956	1596.2						
0.5403	1597.3						
0.5795	1574.9						
0.6142	1530.7						
0.6615	1456.2						
0.6981	1381.7						
0.7374	1276.0						
0.7786	1133.8						
0.8199	988.2						
0.8600	817.8						
0.8994	623.2						
0.9372	411.3						
0.9709	204.1						



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 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	6369 (14)	449 (31)	113 (68)			8.7	18

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.

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

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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-Dichlorohexane, $C_6H_{12}Cl_2$
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); 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

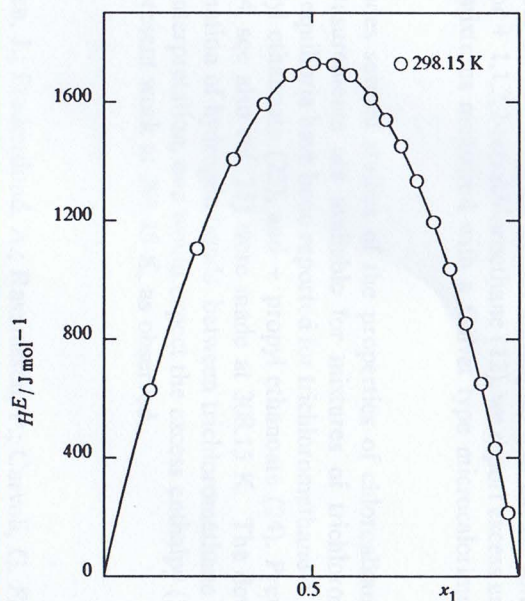
Ortega, J.; Plácido, J. (University of Las Palmas of Gran Canaria, Canary Islands, Spain); FIRST PUBLISHED RESULTS

DIRECT EXPERIMENTAL VALUES

Notes: P , atm.

$T/K = 298.15$

x_1	$H^E / J \text{ mol}^{-1}$						
0.1119	625.8						
0.2233	1104.7						
0.3111	1406.0						
0.3855	1591.7						
0.4486	1689.9						
0.5037	1728.2						
0.5508	1724.0						
0.5926	1690.2						
0.6424	1610.2						
0.6788	1540.3						
0.7165	1450.5						
0.7550	1331.6						
0.7944	1193.8						
0.8336	1035.4						
0.8720	852.5						
0.9089	647.5						
0.9430	429.0						
0.9737	212.4						



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_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	6898.7 (7.7)	633 (28)	-679 (85)	475 (76)	1370 (150)	3.9	7.9

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

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

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) '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.).

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