COMPONENTS:

(1) Erbium chloride; $ErCl_3$; [10138-41-7]

(2) Methanol; CH_4O; [67-56-1]

ORIGINAL MEASUREMENTS:

Merbach, A.; Pitteloud, M.N.; Jaccard, P. *Helv. Chim. Acta* 1972, 55, 44-52.

Pitteloud, M.N. *These*. Faculte des Sciences de l'Universite de Lausanne. 1971.

VARIABLES:

T/K = 298.2

PREPARED BY:

T. Mioduski and M. Salomon

EXPERIMENTAL VALUES:

	mean solubilities/mol kg^{-1}	
t/°C	a	b
25	4.53	4.63

[a] Initial salt is the adduct $ErCl_3.4CH_3OH$. Equilibrated solid phase analyzed and found to be $ErCl_3.4CH_3OH$.

[b] Solutions equilibrated with anhydrous $ErCl_3$. Equilibrated solid phases not analyzed, but assumed by the compilers to be $ErCl_3.4CH_3OH$.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Isothermal method as in (1,2). Mixtures were equilibrated for at least 4 days. Prolonged operations were performed in a dry box. Erbium determined by titration with $(NH_4)_3H(EDTA)$ using a small amount of urotropine buffer and Xylenol Orange indicator. Chloride was determined by potentiometric titration with $AgNO_3$ solution. Composition of the adduct $ErCl_3.4CH_3OH$ confirmed by ^1H NMR and X-ray diffraction.

The reported solubilities are mean values of 2-4 determinations.

SOURCE AND PURITY OF MATERIALS:

Er_2O_3 of at least 99.9% purity dissolved in HCl to produce the hexahydrate. The salt was dehydrated as described in (3). The adduct $ErCl_3.4CH_3OH$ prepared by dissolving the hydrate in a small excess of o-methylformate followed by distillation and crystallization from methanol.

Methanol was purified and dried by the Vogel method.

ESTIMATED ERROR:

Soly: precision ± 0.5% as in (1) (compilers).

Temp: precision probably at least ± 0.05 K as in (1) (compilers).

COMMENTS AND/OR ADDITIONAL DATA:

Reference (3) was incorrectly cited in the source paper as: *J. Inorg. Nucl. Chem.* 1958, 7, 224 (this is the reference to a paper by J.H. Freeman and M.L. Smith which described the preparation of anhydrous salts by treatment with thionyl chloride). Reference (3) was corrected by the compilers.

REFERENCES:

1. Brunisholz, F.; Quinche, J.P.; Kalo, A.M. *Helv. Chim. Acta* 1964, *47*, 14.
2. Flatt, R. *Chimia* 1952, *6*, 62.
3. Taylor, M.D.; Carter, C.P. *J. Inorg. Nucl. Chem.* 1962, *24*, 387 (see COMMENTS at left).

COMPONENTS:	EVALUATOR:
(1) Erbium chloride; $ErCl_3$; [10138-41-7] (2) Ethanol; C_2H_6O; [64-17-5]	Tomasz Mioduski Institute of Nuclear Research Warsaw, Poland and Mark Salomon USA ET & DL Ft. Monmouth, NJ, USA

CRITICAL EVALUATION:

The solubility of erbium chloride in ethanol at 298.2 K has been reported in two publications (1,2), and the results are summarized in the following table.

initial solid	equilibrated solid	solubility/mol kg^{-1}	(ref)
$ErCl_3$	$ErCl_3 \cdot C_2H_5OH$	3.35	(1)
$ErCl_3$	not analyzed	3.48	(2)
$ErCl_3 \cdot 4C_2H_5OH$	$ErCl_3 \cdot 4.1C_2H_5OH$	3.41	(2)

The publication by Kirmse (1) does not contain experimental details or sources and purities of materials, but they probably were similar to those reported by Merbach et al. (2). For a full description of Kirmse's experimental methods, precision and sources of materials, see the INTRODUCTION to this volume. Kirmse prepared the anhydrous salt by the method of Taylor and Carter (3), and Merbach et al. propably used the method of Freeman and Smith (4). The experimental methods used by Merbach et al. were described in detail: high purity Er_2O_3 (>99.9 %) was used, the stoichiometry of the salts verified by both cation and anion chemical analysis and by X-ray diffraction, the absence of the oxychloride and the purity of the solvent were confirmed. Given these details the compilers have estimated an experimental precision of ±0.5 % for the final results of Merbach et al. While it is difficult to determine the precision of Kirmse's data, the accuracy of these data are probably 2-3 % at best.

Merbach et al. (2) consider the difference in solubilities of the anhydrous chloride and the tetrasolvate to be due to the formation of small quantities of chloroalcoholates (dissolution of the anhydrous salt is highly exothermal). However Kirmse reports the solid phase to be the monosolvate when starting with the anhydrous salt. If in this case it is true that the "equilibrated" solid phase is the monosolvate, then we would have to conclude that either the monosolvate or the tetrasolvate is metastable. It would appear to the evaluators that the tetrasolvate is the stable solid phase which means that the solubility should be higher in the metastable monosolvate system. The data of Merbach et al. suggest this, but the data of Kirmse is contradictory. It is interesting to note that the average solubility for the "monosolvate" systems is 3.42 mol kg^{-1} which is essentially identical (within experimental error) to the value of 3.41 mol kg^{-1} reported by Merbach et al. for the tetrasolvate system.

In summary it appears that at 298.2 K the stable solid phase is the tetrasolvate, and that we can designate the *tentative* solubility in this system as 3.41 mol kg^{-1}. When solutions are equilibrated with anhydrous $ErCl_3$, it is not clear whether the resulting saturated solution contains a metastable monosolvate solid phase, or whether the solid phase is actually the stable tetrasolvate.

REFERENCES

1. Kirmse, E. M. *Tr. II Vses Konf. po Teor. Rastvorov* 1971, 200.
2. Merbach, A.; Pitteloud, M.N.; Jaccard, P. *Helv. Chim. Acta* 1972, 55, 44: Pitteloud, M.N. *These.* Faculté des Sciences de l'Université de Lausanne. 1971.
3. Taylor, M.D.; Carter, C.P. *J. Inorg. Nucl. Chem.* 1962, *24*, 387.
4. Freeman, J.H.; Smith, M.L. *J. Inorg. Nucl. Chem.* 1958, *7*, 224.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Erbium chloride; $ErCl_3$; [10138-41-7] (2) Alcohols	Kirmse, E.M. *Tr. II Vses. Konf. po Teor. Rastvorov* 1971, 200-6.

VARIABLES:	PREPARED BY:
T/K = 298	T. Mioduski and M. Salomon

EXPERIMENTAL VALUES:

solvent			mass %	mol kg^{-1}	nature of the solid phase
ethanol;	C_2H_6O;	[64-17-5]	47.8	3.347	$ErCl_3 \cdot C_2H_6O$
2-methoxyethanol;	$C_3H_8O_2$;	[109-86-4]	3.5	0.133	$ErCl_3 . nC_3H_8O_2$ (n = 2-3)
2-ethoxyethanol;	$C_4H_{10}O_2$;	[110-80-5]	7.6	0.301	$ErCl_3 . 2C_4H_{10}O_2$

[a] Molalities calculated by the compilers.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Experimental details not given, but were probably similar to previous works of the author which are compiled throughout this volume.

SOURCE AND PURITY OF MATERIALS:

Nothing specified, but based on previous work by the authors, the anhydrous salt was probably prepared by the method of Taylor and Carter (1).

ESTIMATED ERROR:

Nothing specified.

REFERENCES:

1. Taylor, M.D.; Carter, C.P. *J. Inorg. Nucl. Chem.* 1962, *24*, 387.

COMPONENTS:

(1) Erbium chloride; $ErCl_3$;
[10138-41-7]

(2) Ethanol; C_2H_6O; [64-17-5]

ORIGINAL MEASUREMENTS:

Merbach, A.; Pitteloud, M.N.; Jaccard, P.
Helv. Chim. Acta 1972, 55, 44-52.

Pitteloud, M.N.
These. Faculte des Sciences de l'universite de Lausanne. 1971.

VARIABLES:

T/K = 298.2

PREPARED BY:

T. Mioduski and M. Salomon

EXPERIMENTAL VALUES:

	mean solubilities/mol kg^{-1}	
t/°C	a	b
25	3.41	3.48

[a] Initial salt is the adduct $ErCl_3.4C_2H_5OH$. Equilibrated solid phase analyzed and found to be $ErCl_3.4.1C_2H_5OH$.

[b] Solutions equilibrated with anhydrous $ErCl_3$. Equilibrated solid phases not analyzed, but assumed by the compilers to be $ErCl_3.4C_2H_5OH$.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Isothermal method as in (1,2). Mixtures were equilibrated for at least 4 days. Prolonged operations were performed in a dry box. Erbium determined by titration with $(NH_4)_3H(EDTA)$ using a small amount of urotropine buffer and Xylenol Orange indicator. Chloride was determined by potentiometric titration with $AgNO_3$ solution. Composition of the adduct $ErCl_3.4C_2H_50$ confirmed by ^1H NMR and X-ray diffraction

The reported solubilities are mean values of 2-4 determinations.

COMMENTS AND/OR ADDITIONAL DATA:

Reference (3) was incorrectly cited in the source paper as: *J. Inorg. Nucl. Chem.* 1958, *7*, 224 (this is the reference to a paper by J.H. Freeman and M.L. Smith which describes the preparation of anhydrous salts by treatment with thionyl chloride). Reference (3) was corrected by the compilers.

SOURCE AND PURITY OF MATERIALS:

Er_2O_3 of at least 99.9% purity dissolved in HCl to produce the hexahydrate. The salt was dehydrated as in (3). The adduct $ErCl_3.4C_2H_60$ prepared by dissolving the hydrate in a small excess of o-ethylformate followed by distillation and crystallization from ethanol.

Ethanol (Fluka) was used as received. Purity and absence of water was confirmed by NMR method.

ESTIMATED ERROR:

Soly: precision ± 0.5% as in (1) (compilers).

Temp: precision probably at least ± 0.05K as in (1) (compilers).

REFERENCES:

1. Brunisholz, F.; Quinche, J.P.; Kalo, A.M. *Helv. Chim. Acta* 1964, *47*, 14.
2. Flatt, R. *Chimia* 1952, *6*, 62.
3. Taylor, M.D.; Carter, C.P. *J. Inorg. Nucl Chem.* 1962, *24*, 387 (see COMMENTS at left).

COMPONENTS:

(1) Erbium chloride; $ErCl_3$; [10138-41-7]

(2) Ethanol; C_2H_6O; [64-17-5]

(3) Water; H_2O; [7732-18-5]

ORIGINAL MEASUREMENTS:

Sakharova, Yu.G; Ezhova, T.A.

Zh. Neorg. Khim. 1976, *21*, 551-4; *Russ. J. Inorg. Chem.* (*Engl. Transl.*) 1976, *21*, 296-8.

VARIABLES:

Temperature

PREPARED BY:

T. Mioduski and M. Salomon

EXPERIMENTAL VALUES:

solubility of $ErCl_3.6H_2O$ in 96.8 % $C_2H_5OH^a$

	sample 1	sample 2	sample 3	sample 4	mean solubilities	
t/°C	g/100 g^b	g/100 g	g/100 g	g/100 g	g/100 g	mol kg^{-1c}
20	37.86	37.57	38.19	37.99	37.90	1.599
30	37.38	37.68	37.61	37.47	37.53	1.574
40	37.67	37.50	37.37	37.50	37.51	1.573
50	38.58	38.84	38.62	38.78	38.70	1.654
60	40.29	40.49	40.02	40.30	40.27	1.766

[a] It is not clearly stated whether the mixture is 96.8 mass % or 96.8 volume % ethanol.

[b] Solubilities reported as grams of hexahydrate in 100 g of solvent.

[c] Molalities calculated by the compilers.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Isothermal method used. Equilibrium was reached after 3-4 h. Identical results obtained by approaching equilibrium from above and below. Two of the data points in the table obtained after 3 hours of equilibration, and the remaining two data points obtained after 4 h of equilibration.

The metal content in each aliquot taken for analysis was determined by complexometric titration with Trilon B.

Analyses of the solids withdrawn at 20°C, 40°C and 60°C showed the solid phase to be the hexahydrate: i.e. ethanol was not found in any of the solid phases.

SOURCE AND PURITY OF MATERIALS:

$ErCl_3.6H_2O$ prepd by dissolving c.p. grade oxide in dil (1:3) HCl followed by evapn and crystn. The crystals were dried in a desiccator over $CaCl_2$, P_2O_5 and NaOH. The crystals analyzed for the metal by titrn with Trilon B, and for Cl by the Volhard method. The hexahydrate melted at 163.8 - 165.0°C. 96.8% ethanol prepd by prolonged boiling of c.p. grade 93.5% ethanol with anhydr $CuSO_4$ followed by distn. Ethanol concn detd refractometrically and pycnometrically.

ESTIMATED ERROR:

Soly: results apparently precise to within ± 0.9 % (compilers).

Temp: nothing specified.

REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Erbium chloride; $ErCl_3$; [10138-41-7] (2) 2-Propanol; C_3H_8O; [67-63-0]	Merbach, A.; Pitteloud, M.N.; Jaccard, P. *Helv. Chim. Acta* 1972, 55, 44-52. Pitteloud, M.N. *These.* Faculte des Sciences de l'Universite de Lausanne. 1971.
VARIABLES:	**PREPARED BY:**
T/K = 298.2	T. Mioduski and M. Salomon

EXPERIMENTAL VALUES:

	mean solubilities/mol kg^{-1}	
t/°C	a	b
25	0.84	0.83

[a] Initial salt is the adduct $ErCl_3.3C_3H_7OH$. Equilibrated solid phase analyzed and found to be $ErCl_3.3.7C_3H_8O$.

[b] Solutions equilibrated with anhydrous $ErCl_3$. Equilibrated solid phases not analyzed, but assumed by the compilers to be $ErCl_3.3C_3H_7OH$.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Isothermal method as in (1,2). Mixtures were equilibrated for at least 4 days. Prolonged operations were performed in a dry box. Erbium determined by titration with $(NH_4)_3H(EDTA)$ using a small amount of urotropine buffer and Xylenol Orange indicator. Chloride was determined by potentiometric titration with $AgNO_3$ solution. Composition of the adduct $ErCl_3.3C_3H_8O$ confirmed by ^1H NMR and X-ray diffraction.

The reported solubilities are mean values of 2-4 determinations.

COMMENTS AND/OR ADDITIONAL DATA:

Reference (3) was incorrectly cited in the source paper as: *J. Inorg. Nucl. Chem.* 1958, 7, 224 (this is the reference to a paper by J.H. Freeman and M.L. Smith which describes the preparation of anhydrous salts by treatment with thionyl chloride). Reference (3) was corrected by the compilers.

SOURCE AND PURITY OF MATERIALS:

Er_2O_3 of at least 99.9% purity dissolved in HCl to produce the hexahydrate. The salt was dehydrated as in (3). The adduct $ErCl_3.3C_3H_8O$ prepared by dissolving the hydrate in a small excess of o-methylformate followed by distillation and trans-solvation of the methanol complex with 2-propanol.

Iso-propanol (fluka) was used as received. Purity and absence of water was confirmed by NMR.

ESTIMATED ERROR:

Soly: precision ± 0.5% as in (1) (compilers).

Temp: precision probably at least ± 0.05K as in (1) (compilers).

REFERENCES:

1. Brunisholz, F.; Quinche, J.P.; Kalo, A.M. *Helv. Chim. Acta* 1964, *47* 14.
2. Flatt, R. *Chimia* 1952, *6*, 62.
3. Taylor, M.D.; Carter, C.P. *J. Inorg. Nucl. Chem.* 1962, *24*, 387 (see COMMENTS at left.

COMPONENTS:

(1) Erbium chloride; $ErCl_3$; [10138-41-7]

(2) 1,2-Diethoxyethane; $C_6H_{14}O_2$; [629-14-1]

ORIGINAL MEASUREMENTS:

Kirmse, E.M.; Zwietasch, K.J.

Z. Chem. 1967, *7*, 281.

VARIABLES:

T/K = 298

PREPARED BY:

T. Mioduski

EXPERIMENTAL VALUES:

The solubility of $ErCl_3$ in 1,2-diethoxyethane at 25°C was reported to be

0.67 mass %

The corresponding molality calculated by the compiler is

$0.0247 \text{ mol kg}^{-1}$

The composition of the solid phase was given in terms of the Er:Cl:ether ratio as

1:2.93:1.86

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Isothermal method used. The anhydrous mixtures were equilibrated at 25°C for several days with frequent shaking.

The solid phase was dried in a vacuum desiccator over P_2O_5.

Er was determined by complexometric titration using Xylenol Orange indicator. Chloride was determined by the Volhard titration method.

SOURCE AND PURITY OF MATERIALS:

Sources and purities of materials not given. The anhydrous chloride was obtained by the method of Taylor and Carter (1).

The solvent was prepared by the Williamson synthesis: i.e. by reaction of C_2H_5I with the monoethylether of ethylene glycol.

ESTIMATED ERROR:

No estimates possible.

REFERENCES:

1. Taylor, M.D.; Carter, C.P.
J. Inorg. Nucl. Chem. 1962, *24*, 387.

COMPONENTS:	EVALUATOR:
(1) Erbium chloride; $ErCl_3$; [10138-41-7] (2) 1,1'-Oxybis-propane (di-n-propyl ether); $C_6H_{14}O$; [111-43-3]	Tomasz Mioduski Institute of Nuclear Research Warsaw, Poland

CRITICAL EVALUATION:

The solubility of erbium chloride in di-n-propyl ether at 298.2 K has been reported in three publications by Kirmse et al. (1-3). In (1) the solubility was given as 0.1 mass % (0.004 mol kg^{-1}), and in (2,3) the solubility was given as 0.2 mass % (0.007 mol kg^{-1}). Reference (1) specifies the solid phase as $ErCl_3 \cdot 0.47C_6H_{14}O$.

Since we believe all the solubility data in (1) to contain a large systematic error, these results must be rejected. This also means that the composition of the equilibrated solid phase cannot be assumed to be correct.

The solubility of 0.007 mol kg^{-1} at 298.2 K reported in (2,3) is designated as a *tentative* solubility, and the precision of this value is probably 10 % at best.

REFERENCES

1. Kirmse, E.M.; Zwietasch, K.J.; Tirschmann, J. *Wiss. Hefte, Paed. Inst. Koethen,* 1968, *1*, 128.

2. Kirmse, E.M.; Zwietasch, K.J.; Tirschmann, J.; Oelsner, L.; Niedergesaess, U. *Z. Chem.* 1968, *8*, 472.
3. Kirmse, E.M. *Tr. II Vses. Konf. po Teor. Rastvorov* 1971, 200.

COMPONENTS:

(1) Erbium chloride; $ErCl_3$; [10138-41-7]

(2) 1-Ethoxybutane (ethyl n-butyl ether); $C_6H_{14}O$; [628-81-9]

EVALUATOR:

Tomasz Mioduski

Institute of Nuclear Research
Warsaw, Poland

CRITICAL EVALUATION:

The solubility of erbium chloride in 1-ethoxybutane at 298.2 K has been reported in three publications by Kirmse et al. (1-3). In (1) the solubility was given as 0.3 mass % (0.011 mol kg^{-1}), and in (2,3) the solubility was given as 0.5 mass % (0.018 mol kg^{-1}). Reference (1) specifies the solid phase as $ErCl_3 \cdot 0.49C_6H_{14}O$.

Since we believe all the solubility data in (1) to contain a large systematic error, these results must be rejected. This also means that the composition of the equilibrated solid phase cannot be assumed to be correct.

The solubility of 0.018 mol kg^{-1} at 298.2 K reported in (2,3) is designated as a *tentative* solubility, and the precision of this value is probably 10 % at best.

REFERENCES

1. Kirmse, E.M.; Zwietasch, K.J.; Tirschmann, J. *Wiss. Hefte, Paed. Inst. Koethen,* 1968, *1*, 128.
2. Kirmse, E.M.; Zwietasch, K.J.; Tirschmann, J.; Oelsner, L.; Niedergesaess, U. *Z. Chem.* 1968, *8*, 472.
3. Kirmse, E.M. *Tr. II Vses. Konf. po Teor. Rastvorov* 1971, 200.

COMPONENTS:	EVALUATOR:
(1) Erbium chloride; $ErCl_3$; [10138-41-7] (2) 1-Methoxypentane (methyl n-amyl ether); $C_6H_{14}O$; [628-80-8]	Tomasz Mioduski Institute of Nuclear Research Warsaw, Poland

CRITICAL EVALUATION:

The solubility of erbium chloride in 1-methoxypentane at 298.2 K has been reported in three publications by Kirmse et al. (1-3). In (1) the solubility was given as 30.8 mass % (1.63 mol kg^{-1}), and in (2,3) the solubility was given as 33.5 mass % (1.84 mol kg^{-1}). Reference (1) reports the solid phase to be $ErCl_3 \cdot 0.49C_6H_{14}O$.

Since descriptions of experimental techniques and purities of materials were not given, it is not possible to determine the source of the differences in solubility values. However we can probably conclude that the data in (1) should be rejected.

The solubility data reported in (1) are in all cases significantly different than those subsequently reported by Kirmse (e.g. see the critical evaluations for $ErCl_3$ in 1-ethoxybutane and in di-n-propyl ether, and for YCl_3 in 1-methoxypentane). It is interesting to also note that the solubility data reported in (3) are generally in agreement with those data reported by Merbach et al. (4) (e.g. see the critical evaluation for the $ErCl_3$ - C_2H_5OH system where the difference between Kirmse's result and Merbach's result is around 2 %). On this basis the data in (1) are rejected which also means that the composition of the equilibrated solid phase cannot be assumed to be correct.

The solubility result of 1.84 mol kg^{-1} at 298.2 K reported in (2,3) is designated as a *tentative* value, and the precision of this value is probably around 2 %.

REFERENCES

1. Kirmse, E.M.; Zwietasch, K.J.; Tirschmann, J. *Wiss. Hefte, Paed. Inst. Koethen,* 1968, *1*, 128.

2. Kirmse, E.M.; Zwietasch, K.J.; Tirschmann, J.; Oelsner, L.; Niedergesaess, U. *Z. Chem.* 1968, *8*, 472.

3. Kirmse, E.M. *Tr. II Vses. Konf. po Teor. Rastvorov* 1971, 200.

4. Merbach, A.; Pitteloud, M.N.; Jaccard, P. *Helv. Chim. Acta* 1972, 55, 44.

COMPONENTS:

(1) Erbium chloride; $ErCl_3$; [10138-41-7]

(2) Ethers

ORIGINAL MEASUREMENTS:

Kirmse, E.M.; Zwietasch, K.J.; Tirschmann, J.

Wiss. Hefte, Paed. Inst. Koethen 1968, *1*, 128-30.

VARIABLES:

T/K = 298

PREPARED BY:

T. Mioduski and M. Salomon

EXPERIMENTAL VALUES:

solvent			solubility[a]	
			mass %	mol kg^{-1}
di-n-propyl ether;	$C_6H_{14}O$;	[111-43-3]	0.1[b]	0.004
1-ethoxybutane;	$C_6H_{14}O$;	[628-81-9]	0.3[c]	0.011
1-methoxypentane;	$C_6H_{14}O$;	[628-80-8]	30.8[d]	1.627

[a] Molalities calculated by the compilers.

[b] Solid phase is $ErCl_3.0.47C_6H_{14}O$.

[c] Solid phase is $ErCl_3.0.37C_6H_{14}O$.

[d] Solid phase is $ErCl_3.0.49C_6H_{14}O$.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Mixtures were agitated isothermally at 25°C until equilibrium was reached. Er was determined by complexometric titration using Xylenol Orange indicator.

No other information available.

SOURCE AND PURITY OF MATERIALS:

Sources and purities of materials not specified. The anhydrous rare earth chloride was prepared by the method of Taylor and Carter (1).

ESTIMATED ERROR:

Nothing specified.

REFERENCES:

1. Taylor, M.D.; Carter, C.P.
J. Inorg. Nucl. Chem. 1962, *24*, 387.

COMPONENTS:

(1) Erbium chloride; $ErCl_3$; [10138-41-7]

(2) Ethers

ORIGINAL MEASUREMENTS:

Kirmse, E.M.; Zwietasch, K.J.; Tirschmann, J.; Oelsner, L.; Niedergesaess, U.
Z. Chem. 1968, *8*, 472-3.

Kirmse, E.M.
Tr. II Vses. Konf. po Teor. Rastvorov. 1971, 200-6.

VARIABLES:

Room Temperature: T/K around 298

PREPARED BY:

T. Mioduski and M. Salomon

EXPERIMENTAL VALUES:

solvent			$ErCl_3$ solubility[a,b] mass %	mol kg^{-1}
1-ethoxy-2-methoxyethane;	$C_5H_{12}O_2$;	[5137-45-1]	0.9	0.033
di-n-propyl ether;	$C_6H_{14}O_2$;	[111-43-3]	0.2	0.007
1-ethoxybutane;	$C_6H_{14}O$;	[628-81-9]	0.5	0.018
1-methoxypentane;	$C_6H_{14}O$;	[628-80-8]	33.5	1.841
1,4-dioxane;	$C_4H_8O_2$;	[123-91-1]	0.7	0.026

[a] Molalities calculated by the compilers.

[b] Nature of solid phases not specified.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The solute-solvent mixtures were isothermally agitated at 25°C or at room temperature. Authors state that the difference found for the solubility was within experimental error limits.

Er determined by complexometric titration.

No other details given.

SOURCE AND PURITY OF MATERIALS:

The anhydrous salt was prepared by the method of Taylor and Carter (1).

No other information given.

ESTIMATED ERROR:

Nothing specified.

REFERENCES:

1. Taylor, M.D.; Carter, C.P.
J. Inorg. Nucl. Chem. 1962, *24*, 387.

COMPONENTS:

(1) Erbium chloride; $ErCl_3$; [10138-41-7]

(2) Tetrahydrofuran; C_4H_8O; [109-99-9]

ORIGINAL MEASUREMENTS:

Rossmanith, K.; Auer-Welsbach, C.

Monatsh. Chem. 1965, *96*, 602-5.

VARIABLES:

Room Temperature: T/K about 293

PREPARED BY:

T. Mioduski

EXPERIMENTAL VALUES:

The solubility of $ErCl_3$ in tetrahydrofuran at 20°C (room temperature) was reported to be

0.786 g per 100 ml of solution

(0.0287 mol dm^{-3}, compiler).

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Isothermal method employed. The solution was equilibrated in an extractor with agitation for 60-80 hours at room temperature.
Erbium was determined by the oxalate method, and by titration with EDTA using Xylenol Orange indicator. The solvent was determined by difference.

Anhydrous materials were handled in a dry box through which was passed a stream of nitrogen free of carbon dioxide.

The solid phase is $ErCl_3.3.47C_4H_8O$.

SOURCE AND PURITY OF MATERIALS:

Sources and purities of initial materials not specified. $ErCl_3$ was prepared by conversion of the oxide by high temperature reaction with an excess of NH_4Cl followed by heating the product in a stream of dry nitrogen, and then in vacuum to remove unreacted NH_4Cl.

Tetrahydrofuran was distilled from $LiAlH_4$.

ESTIMATED ERROR:

Nothing specified.

REFERENCES:

COMPONENTS:

(1) Erbium chloride; $ErCl_3$; [10138-41-7]

(2) Tributylphosphate; $C_{12}H_{27}O_4P$; [126-73-8]

ORIGINAL MEASUREMENTS:

Korovin, S.S.; Galaktionova, O.V.; Lebedeva, E.N.; Voronskaya, G.N.

Zh. Neorg. Khim. 1975, *20*, 908-14; *Russ. J. Inorg. Chem. (Engl. Transl.)* 1975, *20*, 508-11.

VARIABLES:

T/K = 298

PREPARED BY:

T. Mioduski and M. Salomon

EXPERIMENTAL VALUES:

Composition of saturated solutions[a,b]

mass %	mol/kg sln[c]	g dm^{-3c}	mol dm^{-3c}	mol kg^{-1}	density/g cm^{-3}
41.3	1.43	530.0	1.94	2.57	1.36

[a] Solid phase is $ErCl_3$.

[b] Molality calculated by the compilers from the experimental solubility of 41.3 mass %.

[c] It is implied that these data also correspond to the saturated solution. However the molality calculated from these data is 2.35 mol kg^{-1}. The compilers conclude that these data probably do not correspond to saturated solutions.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Saturated solutions prepared isothermally with magnetic stirring. Equilibrium was attained after 25-30 d. The solution was centrifuged and an aliquot for analysis taken and added to methanol and precipitated with aq NH_3. The pptd $Er(OH)_3$ was washed repeatedly and heated to the oxide for gravimetric analysis. The solid phase was analyzed (no details given) for phosphorous and only the anhydrous $ErCl_3$ was found.

All operations were performed in a dry box through which a stream of argon was passed.

The major objective of this work was to establish the nature of complexation between TBP and $ErCl_3$ in solution.

SOURCE AND PURITY OF MATERIALS:

Anhydrous $ErCl_3$ prepared by chlorination of the oxide with CCl_4 vapor (1,2). Source and purity of materials not given. Er was analyzed gravimetrically, and Cl by Volhard's method.

Tributylphosphate (TBP) was purified "by the standard method." No additional details given.

ESTIMATED ERROR:

No estimate possible.

REFERENCES:

1. Korshunov, B.G.; Drobot, D.V.; Bukhtiyarov, V.V.; Shevtsova, Z.N. *Zh. Neorg. Khim.* 1964, *9*, 1427.
2. Novikov, G.I.; Tolmacheva, V.D. *Zh. Prikl. Khim.* 1965, *38*, 1160.

COMPONENTS:

(1) Erbium chloride; $ErCl_3$; [10138-41-7]

(2) Amines

ORIGINAL MEASUREMENTS:

Kirmse, E.M.

Tr. II Vses. Konf. po Teor. Rastvorov 1971, 200-6.

VARIABLES:

T/K = 298

PREPARED BY:

T. Mioduski and M. Salomon

EXPERIMENTAL VALUES:

			$ErCl_3$ solubility[a]	
solvent			mass %	mol kg^{-1}
diethylamine;	$(C_2H_5)_2NH$;	[109-89-7]	0.1	0.004
2-propanamine;	iso-C_3H_9N;	[75-31-0]	26.9	1.34_5
2-propen-1-amine;[b]	C_3H_7N;	[107-11-9]	29.9	1.559
1-butanamine;	n-$C_4H_{11}N$;	[109-73-9]	27.9	1.414
2-butanamine;	sec-$C_4H_{11}N$;	[13952-84-6]	18.6	0.835
di-2-butylamine;	(sec-$C_4H_9)_2N$;	[626-23-3]	1.0	0.037

[a] Molalities calculated by the compilers.

[b] The source paper specifies the solvent as $C_3H_5NH_2$. Upon request, the author kindly identified the solvent as allylamine.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Experimental details not given, but were probably similar to previous works of the author which are compiled throughout this volume.

Nature of the solid phases not specified.

SOURCE AND PURITY OF MATERIALS:

Nothing specified, but based on previous work by the author, the anhydrous salt was probably prepared by the method of Taylor and Carter (1).

ESTIMATED ERROR:

Nothing specified.

REFERENCES:

1. Taylor, M.D.; Carter, C.P.
J. Inorg. Nucl. Chem. 1962, *24*, 387.

COMPONENTS:

(1) Erbium chloride; $ErCl_3$; [10138-41-7]

(2) Hexamethylphosphorotriamide;
$C_6H_{18}N_3OP$; [680-31-9]

ORIGINAL MEASUREMENTS:

Mikheev, N.B.; Kamenskaya, A.N.;
Konovalova, N.A.; Zhilina, T.A.

Zh. Neorg. Khim. 1977, *22*, 1961-6; *Russ. J. Inrog. Chem. (Engl. Transl.)* 1977, *22*, 955-8.

VARIABLES:

Room temperature: T/K = 298 ± 3

PREPARED BY:

T. Mioduski and M. Salomon

EXPERIMENTAL VALUES:

Starting with the solvate $ErCl_3.3C((CH_3)_2N)_3PO$, the solubility at 25 ± 3°C[a] was given as

$$0.098 \text{ mol dm}^{-3}$$

[a] Table 3 in the English translation of the source paper states the temperature to be 23 ± 3°C. This is probably a typographical error as the text clearly states that all measurements were carried out at 25 ± 3°C.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Isothermal method. Salt and solvent were placed in a test-tube in a dry box, and the tube agitated at room temperature until equilibrium was reached. Aliquots were withdrawn periodically and analyzed for the metal content. Rare earth concentration was determined by complexometric titration, and by the radiometric method using the isotope Tm-170 ($t_{\frac{1}{2}}$ = 169 d). Authors state that results for both methods agreed. Although not clearly stated, it appears that equilibrium was reached in several weeks to several months.

Solid phase samples washed three times with benzene or ether and dried on a steam bath in an argon atmosphere. The solid phase was analyzed and found to be $ErCl_3.3C_6H_{18}N_3OP$.

The solvate was analyzed for metal content by complexometric titration, for chloride by the Volhard method, and the solvent was obtained by difference. IR spectra confirmed the absence of water. Structural studies of the solvate were also carried out by X-ray analysis.

SOURCE AND PURITY OF MATERIALS:

$ErCl_3.3C_6H_{18}N_3OP$ prepared by dissolving the hydrate in the solvent and heating to 140-145°C for 5 m. The solvate was pptd by addition of abs ether, washed 7 times with ether, and dried over P_2O_5 in a stream of dry nitrogen. Yield was about 90%.

The solvent was purified as described in (1).

ESTIMATED ERROR:

Soly: precision ± 0.002 mol dm^{-3} at a 95% level of confidence (authors).

Temp: precision ± 3 K.

REFERENCES:

1. Fomicheva, M.G.; Kessler, Yu.M.; Zabusova, S.E.; Alpatova, N.M. *Elektrokhimiya* 1975, *11*, 163.

COMPONENTS:

(1) Erbium chloride; $ErCl_3$; [10138-41-7]

(2) Tetrachlorostannate; $SnCl_4$; [7646-78-8]

(3) Phosphorus oxychloride; $POCl_3$; [10025-87-3]

ORIGINAL MEASUREMENTS:

Lyubimov, E.I.; Batyaev, I.M.

Zh. Prikl. Khim. 1972, *45*, 1176-8.

VARIABLES:

$SnCl_4$ concentration

T/K = 293 and 333

PREPARED BY:

T. Mioduski

EXPERIMENTAL VALUES:

$SnCl_4$:$POCl_3$ ratio (by volume)	$SnCl_4$ concn mol dm^{-3}	solubility of Er_2O_3/mol Er dm^{-3}[a]		
		20°C[b]	20°C[c]	60°C[d]
0	0	0.002	----	0.0001
1:250	0.035	----	0.004	0.005
1:100	0.085	0.006	0.006	0.005
1:50	0.17	0.008 (0.007)	0.006	0.006
1:25	0.33	0.024	0.007	0.007
1:15	0.59	0.024	0.006	0.005
1:10	0.78	0.034	0.006	0.0055
1:5	1.4	----	----	0.011
1:1.5	3.0	----	----	0.011
1:1	4.6	----	----	0.011
4:1	6.8	----	0.010	0.001
pure $SnCl_4$	8.5	0.001	----	----

[a] This is also the solubility of $ErCl_3$ since the oxide is quantitatively converted to the chloride according to

$$Er_2O_3 + 6POCl_3 = 2ErCl_3 + 3P_2O_3Cl_4$$

Assuming $P_2O_3Cl_4$ to be soluble, the equilibrated solutions would then constitute a four component mixture.

[b] Preheated at 220°C for 2 hours. (120°C for the value in parenthesis).

[c] Preheated at 60°C (time not specified).

[d] No pretreatment.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Isothermal method used. $POCl_3$ + $SnCl_4$ solutions were prepared by volume in a dry box. The $SnCl_4$ content was verified by chemical analysis for Sn. This solution and Er_2O_3 were placed in sealed ampoules, heated to 120°C for 2 hours to increase the rate of solution, and then rotated in an air thermostat at 20°C for 2 hours. Without preheating, equilibrium was established after 200 hours. Preheating to 120°C lowered the equilibration time at 20°C to 2 hours.

Er was determined by colorimetric analysis, and in some cases by the oxalate method. The reported solubilities are mean values based on 3-5 parallel determinations.

The solubility of $ErCl_3$ in pure $POCl_3$ is small, but in the presence of $SnCl_4$ the solubility increases due to complexation:

$$2ErCl_3 + 3SnCl_4 = Er_2(SnCl_6)_3$$

SOURCE AND PURITY OF MATERIALS:

Er_2O_3 of "the first sort" was ignited at 950°C for 2 hours.

"Pure" grade $SnCl_4$ and $POCl_3$ were dehydrated with P_2O_5 and distilled under vacuum.

ESTIMATED ERROR:

Soly: authors state the "coefficient of variance" to be less than 7%.

Temp: precision presumably ± 0.2 K (compiler).

REFERENCES: