

COMPONENTS:

(1) Cerium; Ce; [7440-45-1]

(2) Mercury; Hg; [7439-97-6]

EVALUATOR:

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CRITICAL EVALUATION:

There have been a number of reports on the solubility of cerium in mercury near room temperature; nearly all of the determinations were made by electrochemical methods, such as polarography, stripping voltammetry, and chronoamperometry. The 293 K solubilities reported by Shvedov et al., 8.1×10^{-2} at %, (1) and by Sagadieva, 2.3×10^{-2} at %, (19) are too high and are rejected. The report that the amalgam containing 5 at % Ce in liquid Hg at room temperature (24) is clearly in error. Also, Kozin's calculated solubilities of 4.5×10^{-2} (5,11) and 0.42 at % (12) at 298 K are too high. On the other hand the 298 K solubilities reported by several workers are in general agreement: 1.00×10^{-2} at % (2), 9.3×10^{-3} at % (3), 8.7×10^{-3} at % (4,21), 9.0×10^{-3} at % (8-10), 1.0×10^{-2} at % (18), and 8.3×10^{-3} at % (27).

There have been a number of reports on the determination of the solubility of cerium in mercury at various temperatures. Sagadieva et al. (13,22) observed that the solubility increased from 9×10^{-3} to 1.8×10^{-2} at % at 298 to 343 K. The latter group of workers (14) also reported solubilities ranging from 1.3×10^{-2} to 3.6×10^{-2} at % at the same temperatures, but these values are rejected by consensus of the original authors. Bowersox and Leary (23) determined the solubility of cerium at 293, 423 and 523 K by chemical analysis of the equilibrated amalgams. The results of the latter authors are in rough agreement with those of (13), (14) and (22); the temperature dependence of the solubility in (23) is steeper than in (13) and (22), and the solubility at 293 K appears to be slightly high.

Usenova et al. investigated the solubility of cerium in lead and cadmium (15) and other lanthanide amalgams (16).

The liquid amalgam is in equilibrium with various Ce-Hg solid phases (6,20); this is also suggested by the partial phase diagram (17). The compounds CeHg_5 (7) and $\text{CeHg}_{6.5}$ (25) have been reported, but their temperature stability limits have not been specified. The compound CeHg_4 has been shown to be actually $\text{Ce}_5\text{Hg}_{21}$ (26), similar to other isostructural LnHg_4 compounds.

Recommended (r) and tentative values of the solubility of Ce in Hg.

<u>T/K</u>	<u>Soly/at %</u>	<u>Reference</u>
298	9×10^{-3} (r) ^a	[2-4, 8-10, 13,14,18,21-23,27]
323	2×10^{-2} ^b	[13,14,23]
423	0.2	[23]
523	0.8	[23]

^amean value from data of cited references.

^binterpolated value from data of cited references.

References

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2. Usenova, K.A.; Osipova, G.V.; Krebaeva, Sh.D.; Enikeev, R.Sh. *Radiokhimiya* 1974, 16, 99.

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(Continued next page)

<p>COMPONENTS:</p> <p>(1) Cerium; Ce; [7440-45-1]</p> <p>(2) Mercury; Hg; [7439-97-6]</p>	<p>EVALUATOR:</p> <p>C. Guminski; Z. Galus Department of Chemistry University of Warsaw Warsaw, Poland July, 1985</p>
<p>CRITICAL EVALUATION: (Continued)</p> <ol style="list-style-type: none"> 10. Sagadieva, K.Zh.; Zebreva, A.I. <i>Izv. Akad. Nauk. Kaz. SSR, Ser. Khim.</i> <u>1977</u>, No. 5, 28. 11. Kozin, L.F. <i>Vestn. Akad. Nauk. Kaz. SSR</i> <u>1972</u>, No. 3, 34. 12. Kozin, L.F. <i>Tr. Inst. Khim. Nauk Akad. Nauk Kaz. SSR</i> <u>1962</u>, 9, 101. 13. Sagadieva, K.Zh.; Zebreva, A.I.; Dzholdasova, R.M.; Mukhamedieva, Sh.M. <i>Sbor. Rab. Khim., Alma-Ata</i>, <u>1973</u>, No. 3, 341. 14. Sagadieva, K.Zh.; Zebreva, A.I.; Dzholdasova, R.M.; Mamutova, Z.A. <i>Prikl. Teoret. Khim., Alma-Ata</i> <u>1973</u>, 152. 15. Usenova, K.A.; Aygaraeva, M.M.; Osipova, G.V.; Enikeev, R.Sh. <i>Radiokhimiya</i> <u>1973</u>, 15, 826. 16. Usenova, K.A.; Krebaeva, Sh.D.; Osipova, G.V.; Enikeev, R.Sh. <i>Radiokhimiya</i> <u>1974</u>, 16, 104. 17. Kirchmayr, H.R.; Lugscheider, W. <i>Z. Metallk.</i> <u>1966</u>, 57, 725. 18. Usenova, K.A.; Osipova, G.V. <i>Sbor. Rabot Khim., Alma-Ata</i>, <u>1973</u>, No. 3, 364. 19. Sagadieva, K.Zh. cited by M.T. Kozlovskii, A.I. Zebreva, V.P. Gladyshev, <i>Amalgamy i ikh Primienienie</i>, Nauka, Alma-Ata, <u>1971</u>, p. 19. 20. Merlo, F.; Fornasini, M.L. <i>J. Less-Common Metals</i> <u>1979</u>, 64, 221. 21. Sagadieva, K.Zh.; Badavamova, G.L. <i>VII Vsesoyuznoe Soveshchanie po Polarografii</i>, Nauka, Moskva, <u>1978</u>, p. 122. 22. Sagadieva, K.Zh.; Dzholdasova, R.M.; Zebreva, A.I. <i>Uspekhi Polarografii s Nakopleniem</i>, Tomsk, <u>1973</u>, p. 104. 23. Bowersox, D.F.; Leary, J.A. <i>U.S. At. Ener. Comm. Rep., LAMS-2518</i> <u>1961</u>. 24. Muthman, W.; Beck, H. <i>Ann. Chem.</i> <u>1904</u>, 331, 46. 25. Iandelli, A.; Palenzona, A. <i>Handbook on the Physics and Chemistry of Rare Earths</i>, K. A. Gschneider, L. Eyring, Eds., North-Holland, Amsterdam <u>1978</u>, Ch. I. 26. Berndt, A.F. <i>J. Less-Common Metals</i> <u>1967</u>, 13, 366. 27. Sagadieva, K.Zh.; Badavamova, G.L.; Zebreva, A.I. <i>Izv. Vyssh. Ucheb. Zaved., Khim. Khim. Tekhnol.</i> <u>1984</u>, 27, 329. 	

COMPONENTS:	ORIGINAL MEASUREMENTS:	
(1) Cerium; Ce; [7440-45-1] (2) Mercury; Hg; [7439-97-6]	Bowersox, D.F.; Leary, J.A. <i>U.S. At. Ener. Comm. Rep., LAMS-2518, 1961.</i>	
VARIABLES:	PREPARED BY:	
Temperature: 20-250°C	C. Guminski; Z. Galus	
EXPERIMENTAL VALUES:		
The solubilities of Ce in Hg.		
$t/^{\circ}\text{C}$	$\text{g Ce/dm}^3 \text{ Hg}$	$\text{Soly/at } \%^a$
20	1.31	1.38×10^{-2}
150	19.8	0.214
250	74.5	0.817
^a by compilers.		
AUXILIARY INFORMATION		
METHOD/APPARATUS/PROCEDURE:	SOURCE AND PURITY OF MATERIALS:	
Hg was outgassed in a reaction vessel at 523 K then cooled to room temperature. The vessel was filled with He and a weighed quantity of Ce coupons was added. The evacuation and refilling of the vessel with He were repeated several times. The mixture of the metals was equilibrated for 24 h at 623 K. Then temperature of the vessel was adjusted to a selected level and samples of the amalgam were drawn through a coarse Pyrex frit at intervals of 5 to 90 h. Each sample was cooled, weighed and analyzed for Ce content. The procedure gives good results when filtration is carried out 20 h after adjustment of equilibration temperature.	Triply distilled Hg was used. Cerium purity not specified.	
	ESTIMATED ERROR:	
	Soly: precision better than $\pm 2\%$. Temp: nothing specified.	
	REFERENCES:	

COMPONENTS:	ORIGINAL MEASUREMENTS:	
(1) Cerium; Ce; [7440-45-1] (2) Mercury; Hg; [7439-97-6]	Sagadieva, K.Zh.; Zebreva, A.I.; Dzholdasova, R.M.; Mukhamedieva, Sh.M. <i>Sbor. Rabot Khim.</i> , Alma-Ata, <u>1973</u> , No. 3, 341-6.	
VARIABLES:	PREPARED BY:	
Temperature: 25-70°C	C. Guminski; Z. Galus	
EXPERIMENTAL VALUES:		
Solubility of cerium at 25-70°C.		
$t/^{\circ}\text{C}$	$\text{Soly/mol dm}^{-3} \times 10^3$	$\text{Soly/at \%} \times 10^{3^a}$
25	6	9
40	8	12
55	10	15
70	12	18
^a by compilers.		
The same results are also reported in (1).		
AUXILIARY INFORMATION		
METHOD/APPARATUS/PROCEDURE:	SOURCE AND PURITY OF MATERIALS:	
The amalgams were obtained by reduction of Ce(III) with sodium amalgam. Cerium amalgams were oxidized potentiostatically at -0.1 V vs. SCE, and current-time dependencies were recorded. Current was initially constant, then it decreased exponentially with time. The concentration of the saturated amalgam was calculated from the charge corresponding to the oxidation in the region of exponential dependence of the current.	Nothing specified.	
	ESTIMATED ERROR:	
	Soly: precision \pm 10% (compilers).	
	Temp: nothing specified.	
	REFERENCES:	
	1. Sagadieva, K.Zh.; Dzholdasova, R.M.; Zebreva, A.I. <i>Uspekhi Polarografii s Nakopleniem</i> , Tomsk, <u>1973</u> , pp. 104-5.	

COMPONENTS: (1) Cerium; Ce; [7440-45-1] (2) Mercury; Hg; [7439-97-6]	ORIGINAL MEASUREMENTS: 1. Usenova, K.A.; Osipova, G.V.; Krebaeva, Sh.D.; Enikeev, R.Sh. <i>Radiokhimiya</i> 1974, 16, 99-103. 2. Dzholdasova, R.M.; Sagadieva, K.Zh.; Zebreva, A.I. <i>Izv. Akad. Nauk. Kaz. SSR, Ser. Khim.</i> 1976, No. 3, 63-6.
VARIABLES: One temperature: 25°C	PREPARED BY: C. Guminski; Z. Galus
EXPERIMENTAL VALUES: <p>The solubility of cerium in mercury at 25°C was found to be $(6.8 \pm 0.7) \times 10^{-3}$ and $(6.0 \pm 1.0) \times 10^{-3}$ mol dm⁻³ in (1) and (2), respectively.</p> <p>The respective atomic % solubility calculated by the compilers are 1.00×10^{-2} and 9.0×10^{-3} at %.</p> <p>Refs. (3)-(5) reported identical solubility as in (2), while (6) reported a slightly higher value of 7×10^{-3} mol dm⁻³ (read from a curve by the compilers).</p>	
AUXILIARY INFORMATION	
METHOD/APPARATUS/PROCEDURE: The amalgams were prepared by reduction of Ce(III) with Na amalgam; the Ce content in the amalgams was determined by analysis of solution before and after reduction. Constantly stirred acetate-buffered solutions were oxidized potentiostatically: at -0.5 V vs. SCE at pH 3 in (1) and at -0.1 V vs. SCE in (2). Kinetic decomposition curves were recorded in (1) and the inflection on the plot of half-decomposition time vs. Ce concentration corresponded to the saturation point; concentration change was traced with Ce ¹⁴⁴ radioisotope. In (2) the solubility was determined from the exponential part of the current-time curve which corresponds to the charge consumed for the oxidation of the homogeneous amalgam. All measurements were made in hydrogen atmosphere.	SOURCE AND PURITY OF MATERIALS: Nothing specified. ESTIMATED ERROR: Soly: precision approximately $\pm 10\%$ in (1) and $\pm 15\%$ in (2). Temp: precision ± 0.5 K.
REFERENCES: 3. Sagadieva, K.Zh.; Zebreva, A.I. <i>Izv. Akad. Nauk Kaz. SSR, Ser. Khim.</i> 1977, No. 5, 28. 4. Zebreva, A.I.; Sagadieva, K.Zh.; Dzholdasova, R.M. <i>Issl. v Obl. Khim. Redkozeml. Elementov</i> 1975, 77. 5. Sagadieva, K.Zh.; Zebreva, A.I.; Dzholdasova, R.M.; Mukhamedieva, Sh.M. <i>Sbor. Rabot Khim.</i> , Alma-Ata, 1973, No. 3, 341. 6. Dzholdasova, R.M.; Sagadieva, K.Zh.; Zebreva, A.I. <i>Prikl. Teoret. Khim.</i> , Alma-Ata, 1974, 206.	

COMPONENTS: (1) Cerium; Ce; [7440-45-1] (2) Mercury; Hg; [7439-97-6]	ORIGINAL MEASUREMENTS: 1. Bulina, V.A.; Zebreva, A.I.; Enikeev, R.Sh. <i>Izv. Vyssh. Ucheb. Zaved., Khim. Khim. Tekhnol.</i> 1977, 20, 959-61. 2. Sagadieva, K.Zh.; Zebreva, A.I.; Badavamova, G.L. <i>Elektrokhimia</i> 1979, 15, 210-3.
VARIABLES: One temperature: 25°C	PREPARED BY: C. Guminski; Z. Galus
EXPERIMENTAL VALUES: The solubility of cerium in mercury at 25°C was found to be $(6.3 \pm 0.5) \times 10^{-3}$ and 5.9×10^{-3} mol dm ⁻³ , respectively, in (1) and (2). The respective atomic % solubility calculated by the compilers are 9.3×10^{-3} and 8.7×10^{-3} at %. The result of (2) was previously reported in (3).	
AUXILIARY INFORMATION	
METHOD/APPARATUS/PROCEDURE: Amalgams in (2) were prepared by reduction of Ce(III) with Na amalgam. Amalgams of various concentrations were oxidized potentiostatically at limiting-current potential of -0.1 V vs. SCE, and current recorded as function of time. Measurements were made in static buffered solution of 0.2 mol dm ⁻³ NaOAc + 0.04 mol dm ⁻³ HCl at pH 5. Limiting current, i_d , was obtained from semilog plot of current vs. time; i_d increased linearly with Ce concentration, and was nearly constant above saturation. Solubility determined from intercept of i_d vs. concentration plot. Heterogeneous amalgam in (1) also oxidized potentiostatically, and transition from oxidation of heterogeneous to homogeneous amalgam was indicated by inflection in current-time curve. Solubility determined from charge used for oxidation of homogeneous amalgam.	SOURCE AND PURITY OF MATERIALS: Nothing specified. ESTIMATED ERROR: Soly: precision 10-20% (compilers). Temp: precision probably ± 0.5 K (compilers). REFERENCES: 3. Sagadieva, K.Zh.; Badavamova, G.L. <i>VII Vsesoyuznoe Soveshchanie po Polarografii</i> , Nauka, Moskva, 1978, p. 122.

COMPONENTS: (1) Cerium; Ce; [7440-45-1] (2) Mercury; Hg; [7439-97-6]	ORIGINAL MEASUREMENTS: Sagadieva, K.Zh.; Badavamova, G.L.; Zebreva, A.I. <i>Izv. Vyssh. Ucheb. Zaved., Khim. Khim. Tekhnol.</i> <u>1984</u> , 27, 329-33.
VARIABLES: One temperature: 25°C	PREPARED BY: C. Guminski; Z. Galus
EXPERIMENTAL VALUES: Solubility of Ce in Hg at 25°C was reported to be $5.6 \times 10^{-3} \text{ mol dm}^{-3}$. The atomic % solubility calculated by the compilers is 8.3×10^{-3} at %.	
AUXILIARY INFORMATION	
METHOD/APPARATUS/PROCEDURE: The amalgam was prepared by electro-reduction of Ce(III) in citrate buffer (pH 5-6) on the hanging-mercury-drop electrode with Pt base. The electrolysis was carried out in potentiostatic conditions at potentials changing between -1.7 and -2.5 V vs. SCE in atmosphere of an inert gas. The Ce amalgam was then oxidized by stripping voltammetry. The total amount of Ce in Hg was found by integration of area under the voltammetric peak. A break on the plot relating the anodic peak current against Ce concentration corresponds to the saturation of the amalgam.	SOURCE AND PURITY OF MATERIALS: Purity of Hg drop electrode was tested by stripping analysis without the depolarizer in the solution. Cerium purity not specified.
	ESTIMATED ERROR: Soly: precision no better than $\pm 10\%$ (compilers). Temp: nothing specified.
	REFERENCES:

COMPONENTS:	EVALUATOR:
(1) Praseodymium; Pr; [7440-10-0] (2) Mercury, Hg; [7439-97-6]	C. Guminski; Z. Galus Department of Chemistry University of Warsaw Warsaw, Poland July, 1985

CRITICAL EVALUATION:

The most reliable solubility of praseodymium in mercury at 298 K has been determined by electroanalytical measurements by Zebreva and coworkers: 8.3×10^{-3} (6), 1.15×10^{-2} (7,10,16), 1.12×10^{-2} (8,14), and 1.41×10^{-2} at % (8,14). At 343 K, Zebreva et al. reported solubilities of 2.35×10^{-2} (8,14), 2.36×10^{-2} (10) and 2.41×10^{-2} at % (8,14). Other experimental determinations at 298 K are rejected because the solubilities were too high (3.1×10^{-2} at % (3,13) and 5.6×10^{-2} at % (4)), or too low (5.9×10^{-3} at % (5)). Kozin's calculated solubilities of 0.13 (1) and 0.15 (2) at % at 298 K are clearly too high.

The evaluators' plot of the logarithm of solubility vs. reciprocal temperature for the Pr-Hg system shows a significantly lower slope as compared to the same type of plots for the other lanthanide-Hg systems. The lower slope also suggests a lower enthalpy of solution for the Pr-Hg system as compared to the other Ln-Hg systems.

Griffin and Gschneider (9) determined the liquidus in the Pr-rich region, while Kirchmayr and Lugscheider (12) presented a schematic phase diagram at 760 mm Hg vapor pressure. The compound, $\text{PrHg}_{6.5}$, has been established (17), but its decomposition temperature is not known. Existence of other compounds also has been reported (9,11,12,15,17).

Tentative values of the solubility of Pr in Hg:

<u>T/K</u>	<u>Soly/at %</u>	<u>Reference</u>
298	1.1×10^{-2}	[7,8,10,16]
323	1.7×10^{-2}	[8,10]
973	84	[9]
1073	91	[9]
1173	97.5	[9]

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- Sagadieva, K.Zh.; Badavamova, G.L. *VII Vsesoyuznoe Soveshchaniye po Polarografii*, Nauka, Moskva, 1978, p. 122.
- Iandelli, A.; Palenzona, A. *Handbook on Physics and Chemistry of Rare Earths*, Gschneider, K.A., Eyring, L., Eds., North-Holland, Amsterdam 1978, Ch. I.

COMPONENTS: (1) Praseodymium; Pr; [7440-10-0] (2) Mercury; Hg; [7439-97-6]	ORIGINAL MEASUREMENTS: Griffin, R.B.; Gschneider, K.A. <i>Met. Trans.</i> <u>1971</u> , 2, 2517-24.																																		
VARIABLES: Temperature: 650-932°C	PREPARED BY: C. Guminski; Z. Galus																																		
EXPERIMENTAL VALUES: Data were presented as a phase diagram in the Pr-rich region. The solubility of Hg in Pr was taken from the liquidus data points by compilers. <table> <tr> <th><u>t/°C</u></th><th><u>Soly/at %</u></th></tr> <tr><td>932</td><td>0.15</td></tr> <tr><td>930</td><td>0.3</td></tr> <tr><td>926</td><td>0.6</td></tr> <tr><td>920</td><td>1.1</td></tr> <tr><td>916</td><td>1.3</td></tr> <tr><td>907</td><td>2.0</td></tr> <tr><td>900</td><td>2.6</td></tr> <tr><td>890</td><td>3.3</td></tr> <tr><td>866</td><td>5.1</td></tr> <tr><td>839</td><td>6.8</td></tr> <tr><td>807</td><td>9.1</td></tr> <tr><td>792</td><td>10.2</td></tr> <tr><td>770</td><td>12.4</td></tr> <tr><td>713</td><td>15.2</td></tr> <tr><td>675</td><td>17.3</td></tr> <tr><td>650</td><td>18.9</td></tr> </table>		<u>t/°C</u>	<u>Soly/at %</u>	932	0.15	930	0.3	926	0.6	920	1.1	916	1.3	907	2.0	900	2.6	890	3.3	866	5.1	839	6.8	807	9.1	792	10.2	770	12.4	713	15.2	675	17.3	650	18.9
<u>t/°C</u>	<u>Soly/at %</u>																																		
932	0.15																																		
930	0.3																																		
926	0.6																																		
920	1.1																																		
916	1.3																																		
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713	15.2																																		
675	17.3																																		
650	18.9																																		
AUXILIARY INFORMATION																																			
METHOD/APPARATUS/PROCEDURE: The alloys were prepared by adding weighed amounts of mercury to a tantalum crucible containing praseodymium or previously prepared amalgam with lower content of mercury. The crucibles were sealed by arc-welding in a helium atmosphere. The samples were then melted at 200 to 250°C above the liquidus temperature for 1 hour. Differential thermal analysis cooling curves were recorded with the use of a calibrated Chromel-Alumel thermocouple.	SOURCE AND PURITY OF MATERIALS: Praseodymium was 99.6% pure, with 0.02% calcium and 0.3% other lanthanides. Mercury was triply distilled.																																		
	ESTIMATED ERROR: Soly: nothing specified. Temp: precision \pm 2 K.																																		
	REFERENCES: 																																		

COMPONENTS:		ORIGINAL MEASUREMENTS:			
(1) Praseodymium; Pr; [7440-10-0] (2) Mercury; Hg; [7439-97-6]		1. Bulina, V.A.; Guminichenko, L.V.; Zebreva, A.I.; Enikeev, R.Sh. <i>Radiokhimiya</i> <u>1977</u> , <u>19</u> , 89-93. 2. Sagadieva, K.Zh.; Zebreva, A.I.; Badavamova, G.L. <i>Elektrokhimiya</i> <u>1979</u> , <u>15</u> , 210-13.			
VARIABLES:		PREPARED BY:			
One temperature: 25°C		C. Guminski; Z. Galus			
EXPERIMENTAL VALUES:					
The solubility of praseodymium in mercury at 25°C was reported as follows:					
$\frac{\text{Soly/mol dm}^{-3} \times 10^3}{5.6 \pm 1.0}$		$\frac{\text{Soly/at \%} \times 10^{3^a}}{8.3}$		<u>Reference</u>	
7.8		11.5		(1)	
				(2)	
<div><div></div><div>^aby compilers.</div></div>					
Result of (2) was also reported in (3) and (4).					

COMPONENTS:				ORIGINAL MEASUREMENTS:			
(1) Praseodymium; Pr; [7440-10-0]				1. Sagadieva, K.Zh.; Zebreva, A.I.; Oteeva, G.Z. <i>Izv. Akad. Nauk Kaz. SSR, Ser. Khim.</i> 1977, No. 6, 22-4.			
(2) Mercury; Hg; [7439-97-6]				2. Sagadieva, K.Zh.; Zebreva, A.I.; Badavamova, G.L. <i>Izv. Akad. Nauk Kaz. SSR, Ser. Khim.</i> 1978, No. 3, 74-6.			
VARIABLES:				PREPARED BY:			
Temperature: 25-70°C				C. Guminski; Z. Galus			
EXPERIMENTAL VALUES:							
Solubility of praseodymium in mercury was determined by chronoamperometry and coulometry.							
t/°C	By Chronoamperometry			By Coulometry ^b			
	Soly			Soly			
	mol dm ⁻³	at % ^a	Ref.	mol dm ⁻³	at % ^a		
25	0.0095	0.0141	(1)	0.0076	0.0112		
	0.0078	0.0115	(2)				
40	0.0125	0.0125	(1)	0.0098	0.0145		
	0.0097	0.0144	(2)				
55	0.0145	0.0215	(1)	0.0115	0.0170		
	0.0112	0.0166	(2)				
70	0.0163	0.0241	(1)	0.0159	0.0235		
	0.0160	0.0236	(2)				
^a by compilers.							
^b ref. (1).							
Results of ref. (1) also reported in (3); authors in (1) state that coulometric results are more accurate.							
AUXILIARY INFORMATION							
METHOD/APPARATUS/PROCEDURE:				SOURCE AND PURITY OF MATERIALS:			
Amalgams were prepared by reduction of Pr(III) with Na-amalgam. Chronoamperometric curves were recorded in (1); magnitude of limiting current, <i>i</i> _d , is proportional to Pr concentration, <i>N</i> _{Pr} , in homogeneous amalgam. Inflection point on <i>i</i> _d vs. <i>N</i> _{Pr} curve corresponds to solubility of Pr. After all crystals in amalgam are dissolved by chronoamperometric oxidation, the solubility is calculated by integrating the charge corresponding to exponentially decreasing current (coulometry). In (2), <i>N</i> _{Pr} varied from 1.8-75.0 x 10 ⁻³ mol dm ⁻³ . Amalgams allowed to stand 6 hr before chronoamperometric oxidation at -0.1 V vs. SCE; solubility obtained as in (1).				Nothing specified.			
				ESTIMATED ERROR:			
				Soly: precision no better than ± 10% (compilers).			
				Temp: nothing specified.			
				REFERENCES:			
				3. Sagadieva, K.Zh.; Zebreva, A.I. <i>Dep. VINITI</i> , 1355-77, 1977; abstracted in <i>Izv. Vyssh. Ucheb. Zaved., Khim. Khim. Tekhnol.</i> 1978, 21, 157.			

COMPONENTS:	EVALUATOR:
(1) Neodymium; Nd; [7440-00-8]	C. Guminski; Z. Galus
(2) Mercury; Hg; [7439-97-6]	Department of Chemistry
	University of Warsaw
	Warsaw, Poland
	July, 1985

CRITICAL EVALUATION:

Kozin calculated neodymium solubilities in mercury at 298 K of 0.044 (1) and 0.058 (2,8) at %. Experimental determinations show that the latter values are too high. Bulina et al. reported a solubility of 8.1×10^{-3} at % (4) and 4.6×10^{-3} at % (7) at 298 K, while Usenova et al. (5,10) reported 1.6×10^{-2} at %. Sagadieva et al. (14), from electroanalytical methods, reported that the neodymium solubility increased from 4.9×10^{-3} to 1.1×10^{-2} at % at 298 to 343 K; the results at 298 and 313 K are in good agreement with those reported by (3), (4) and (7), but the solubilities at higher temperatures were too low as compared to other measurements. Shvedov et al. (6) reported a solubility of 0.055 at % at 293 K, but this value is rejected because it is too high. Messing and Dean (3) determined the solubilities at 368 to 573 K and they reported that the solubility increased from 0.0496 to 0.680 at % over this temperature range.

The saturated neodymium amalgams are in equilibrium with Nd-Hg intermetallic compounds (9,11,12); a schematic phase diagram has been presented by Kirchmayr and Lugscheider (11). $\text{NdHg}_{6.5}$ solid phase was also determined, but no temperature range of its stability was reported (13).

The tentative values of neodymium solubility in mercury.

<u>T/K</u>	<u>Soly/at %</u>	<u>Reference</u>
298	6×10^{-3} ^a	[4,7,14]
323	1.2×10^{-2} ^b	[3]
373	4×10^{-2}	[3]
473	0.2	[3]
573	0.6	[3]

^a mean value from data of cited references.

^b extrapolated from data of (3).

References

1. Kozin, L.F. *Tr. Inst. Khim. Nauk Akad. Nauk Kaz. SSR* 1962, 9, 101.
2. Kozin, L.F. *Fiziko-Khimicheskie Osnovy Amalgamoi Metalurgii*, Nauka, Alma-Ata, 1964.
3. Messing, A.F.; Dean, O.C. *U.S. At. Ener. Comm. Rep.*, ORNL-2871, 1960.
4. Bulina, V.A.; Guminichenko, L.V.; Zebreva, A.I.; Enikeev, R.Sh. *Radiokhimiya*, 1977, 19, 89.
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6. Shvedov, V.P.; Frolov, A.Z.; Nikishin, G.D. *Radiokhimiya* 1971, 13, 252.
7. Bulina, V.A.; Zebreva, A.I.; Enikeev, R.Sh. *Izv. Vyssh. Ucheb. Zaved., Khim. Khim. Tekhnol.* 1977, 20, 959.
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10. Usenova, K.A.; Osipova, G.V. *Sborn. Rab. Khim. Kaz. Univer.*, Alma-Ata, 1973, No. 3, 364.
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12. Merlo, F.; Fornasini, M.L. *J. Less-Common Metals* 1979, 64, 221.
13. Iandelli, A.; Palenzona, A. *Handbook on the Physics and Chemistry of Rare Earths*, K. A. Gschneider, L. Eyring, Eds., North-Holland, 1978, Amsterdam, Ch. I.
14. Sagadieva, K.Zh.; Badavamova, G.L.; Zebreva, A.I. *Izv. Akad. Nauk Kaz. SSR, Ser. Khim.*, 1983, No. 6, 29.

COMPONENTS: (1) Neodymium; Nd; [7440-00-8] (2) Mercury; Hg; [7439-97-6]	ORIGINAL MEASUREMENTS: Messing, A.F.; Dean, O.C. <i>U.S. At. Ener. Comm. Rep., ORNL-2871, 1960.</i>																																	
VARIABLES: Temperature: 313-523 K	PREPARED BY: C. Guminski; Z. Galus																																	
EXPERIMENTAL VALUES: The solubility of neodymium in mercury at various temperatures. <table border="1" data-bbox="370 500 987 909"> <thead> <tr> <th><u>T/K</u></th> <th><u>Soly/mass %</u></th> <th><u>Soly/at %</u></th> </tr> </thead> <tbody> <tr> <td>313</td> <td>0.00898^a</td> <td>0.0125</td> </tr> <tr> <td>368-373</td> <td>0.0357</td> <td>0.0496</td> </tr> <tr> <td>378-383</td> <td>0.0296</td> <td>0.0411</td> </tr> <tr> <td>433-438</td> <td>0.0746</td> <td>0.104</td> </tr> <tr> <td>473-477</td> <td>0.188</td> <td>0.261</td> </tr> <tr> <td>483-488</td> <td>0.193</td> <td>0.268</td> </tr> <tr> <td>518-523</td> <td>0.196</td> <td>0.272</td> </tr> <tr> <td>521-523</td> <td>0.262</td> <td>0.364</td> </tr> <tr> <td>568-573</td> <td>0.418</td> <td>0.680</td> </tr> <tr> <td>629</td> <td>0.633^a</td> <td>0.877</td> </tr> </tbody> </table> <p>^acalculated from least squares equation by the authors.</p>		<u>T/K</u>	<u>Soly/mass %</u>	<u>Soly/at %</u>	313	0.00898 ^a	0.0125	368-373	0.0357	0.0496	378-383	0.0296	0.0411	433-438	0.0746	0.104	473-477	0.188	0.261	483-488	0.193	0.268	518-523	0.196	0.272	521-523	0.262	0.364	568-573	0.418	0.680	629	0.633 ^a	0.877
<u>T/K</u>	<u>Soly/mass %</u>	<u>Soly/at %</u>																																
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AUXILIARY INFORMATION																																		
METHOD/APPARATUS/PROCEDURE: Mercury and neodymium, after drying and outgassing in the stainless steel dissolver, were kept for several days at the desired temperature. A similar equilibration period was allowed after each temperature change. After equilibration, a sample of liquid amalgam was forced through the filter, and the collected sample was dissolved in nitric acid and submitted for analysis for neodymium and mercury.	SOURCE AND PURITY OF MATERIALS: Not given. ESTIMATED ERROR: Soly: standard deviation of least squares fit 0.1063. Temp: precision \pm 5 K. REFERENCES:																																	

COMPONENTS: (1) Neodymium; Nd; [7440-00-8] (2) Mercury; Hg; [7439-97-6]	ORIGINAL MEASUREMENTS: Usenova, K.A.; Osipova, G.V.; Krebaeva, Sh.D.; Enikeev, R.Sh. <i>Radiokhimiya</i> 1974, 16, 99-103.
VARIABLES: One temperature: 25°C	PREPARED BY: C. Guminski; Z. Galus
EXPERIMENTAL VALUES: The solubility of neodymium in mercury at 25°C was found to be $(1.1 \pm 0.2) \times 10^{-2}$ mol dm ⁻³ . The atomic % solubility calculated by the compilers is 1.6×10^{-2} at %. The same result is also reported in (1).	
AUXILIARY INFORMATION	
METHOD/APPARATUS/PROCEDURE: The amalgam was prepared by reduction of Nd(III) with sodium amalgam. The amalgam was then oxidized potentiostatically, at -0.5 V vs. SCE, in a stirred system containing the amalgam and an acetate buffer of pH = 3. Based on analysis of the kinetic decomposition curves, the oxidation of homogeneous and heterogeneous amalgams could be distinguished. An inflection on the plot of half-decomposition time versus concentration of Nd corresponds to the saturation point. Changes of concentration were determined with the use of Nd ¹⁴⁷ radioisotope. The experiments were performed in H ₂ atmosphere.	SOURCE AND PURITY OF MATERIALS: Not specified.
	ESTIMATED ERROR: Soly: precision approximately $\pm 20\%$. Temp: precision ± 0.5 K. REFERENCES: 1. Usenova, K.A.; Osipova, G.V. <i>Sborn. Rab. Khim. Alma-Ata</i> , 1973, No. 3, 364.

COMPONENTS: (1) Neodymium; Nd; [7440-00-8] (2) Mercury; Hg; [7439-97-6]	ORIGINAL MEASUREMENTS: 1. Bulina, V.A.; Zebreva, A.I.; Enikeev, R.Sh. <i>Izv. Vyssh. Ucheb. Zaved., Khim. Khim. Tekhnol.</i> <u>1977</u> , <u>20</u> , 959-61. 2. Bulina, V.A.; Guminichenko, L.V.; Zebreva, A.I.; Enikeev, R.Sh. <i>Radiokhimiya</i> <u>1977</u> , <u>19</u> , 89-93.
VARIABLES: One temperature: 25°C	PREPARED BY: C. Guminski; Z. Galus
EXPERIMENTAL VALUES: The solubility of neodymium in mercury at 25°C was found to be $(3.1 \pm 0.5) \times 10^{-3}$ and $(5.5 \pm 0.8) \times 10^{-3} \text{ mol dm}^{-3}$, respectively, in (1) and (2). The corresponding atomic % solubility calculated by the compilers were 4.6×10^{-3} and 8.1×10^{-3} at %.	
AUXILIARY INFORMATION	
METHOD/APPARATUS/PROCEDURE: The method of preparation of amalgam in (1) was not specified. In (2) the amalgam was prepared by reduction of Nd(III) with Na-amalgam from chloride-acetate buffered solution of pH = 4; the Nd content in the amalgam was determined from the Nd(III) in the solution before and after reduction. The amalgam in (1) was oxidized potentiostatically at -0.3 V vs. SCE, and the solubility was obtained from the i-t curve and the charge for oxidation of the saturated amalgam. The solubility in (2) was obtained by a similar method.	SOURCE AND PURITY OF MATERIALS: Nothing specified. ESTIMATED ERROR: Soly: precision approximately $\pm 20\%$. Temp: nothing specified. REFERENCES:

COMPONENTS:		ORIGINAL MEASUREMENTS:			
(1) Neodymium; Nd; [7440-00-8] (2) Mercury; Hg; [7439-97-6]		Sagadieva, K.Zh.; Badavamova, G.L.; Zebreva, A.I. Izv. Akad. Nauk Kaz. SSR, Ser. Khim. 1983, No. 6, 29-32.			
VARIABLES:		PREPARED BY:			
Temperature		C. Guminski; Z. Galus			
EXPERIMENTAL VALUES:					
The solubilities of Nd in Hg at various temperatures were determined by coulometry and chronoamperometry.					
<u>t/°C</u>	<u>25</u>	<u>40</u>	<u>55^b</u>	<u>70^b</u>	
Soly/10 ³ mol dm ⁻³	3.3	5.4	6.5	6.9	
Soly/10 ³ at % ^a	4.9	8.0	9.6	10	by coulometry
Soly/10 ³ mol dm ⁻³	3.4	5.6	6.0	7.5	
Soly/10 ³ at % ^a	5.0	8.3	8.9	11	by chronoamperometry
^a by compilers.					
^b results at 55 and 70°C are understated.					
AUXILIARY INFORMATION					
METHOD/APPARATUS/PROCEDURE:			SOURCE AND PURITY OF MATERIALS:		
The amalgams were prepared by reduction of Nd(III) by sodium amalgam in chloride-acetate solution at pH = 4. The amount of Nd introduced into Hg was determined from analysis of the Nd(III) solution before and after reduction. Chronoamperometric oxidation of the amalgam was then carried out at 0.1 V vs. SCE. The saturation point was estimated from a bend on the current vs. Nd concentration curve (chronoamperometry), as well as by the integration of the diffusion current as a function of time (coulometry).			Nothing specified.		
			ESTIMATED ERROR:		
			Soly: nothing specified; precision ± 10% (compilers).		
			Temp: nothing specified.		
			REFERENCES:		

COMPONENTS:

(1) Samarium; Sm; [7440-19-9]
(2) Mercury; Hg; [7439-97-6]

EVALUATOR:

C. Guminski; Z. Galus
Department of Chemistry
University of Warsaw
Warsaw, Poland
July, 1985

CRITICAL EVALUATION:

The first experimental determination of the solubility of samarium in mercury was reported by Messing and Dean (3); these authors found that the solubility increased from 0.0501 to 0.652 at % at 358 to 578 K, and the extrapolated solubility at 298 K, from their fitted solubility equation, was 1.2×10^{-2} at %. Because the solubility determinations by these authors for other lanthanide metals in mercury are generally acceptable, the evaluators tentatively accept the data for the Sm-Hg system reported in (3). Kozin reported predicted solubilities of 3.2×10^{-2} (1) and 4.5×10^{-2} at % (2) at 298 K. The solubility determination of Zebreva and coworkers (6-8, 11), 4.6×10^{-2} at % at 298 K, is in rough agreement with the calculated results of Kozin and with the extrapolated value of Messing and Dean. Other determinations of the solubility near room temperature are: 0.15 at % at 298 K by potentiometry (4,12); 0.164 at % at 293 K by amalgam polarography (5); 0.13 at % at 293 K by anodic oxidation of a thin film of the amalgam (15); and 0.124 at % at 293 K by an unspecified method (9); all of these latter values are too high and are rejected. Dzholdasova (16) reported solubilities of 0.045, 0.060 and 0.094 at % at 286, 298 and 313 K, respectively; however, experimental details were not described.

As shown by the schematic phase diagram for the Ln-Hg system (13,14,17), the saturated amalgam is in equilibrium with intermetallic solid phases. Also, $\text{SmHg}_{6.5}$ was established (17) but no decomposition temperature is known.

The tentative values of Sm solubility in Hg:

<u>T/K</u>	<u>Soly/at %</u>	<u>Reference</u>
298	$2 \times 10^{-2}{}^a$	(3)
323	$3 \times 10^{-2}{}^a$	(3)
373	6×10^{-2}	(3)
473	0.2	(3)
473	0.6	(3)

^aextrapolated values from data of (3).

References

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2. Kozin, L.F. *Fiziko-Khimicheskie Osnovy Amalgamnoi Metallurgii*, Nauka, Alma-Ata, 1964.
3. Messing, A.F.; Dean, O.C. *U.S. At. Ener. Comm. Rep.*, ORNL-2871, 1960.
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12. Usenova, K.A.; Krebaeva, Sh.D. *Sbor. Rab. Khim.*, Alma-Ata, 1973, No. 3, 369.

(Continued next page)

COMPONENTS: (1) Samarium; Sm; [7440-19-9] (2) Mercury; Hg; [7439-97-6]	EVALUATOR: C. Guminski; Z. Galus Department of Chemistry University of Warsaw Warsaw, Poland July, 1985
CRITICAL EVALUATION: (continued) 13. Kirchmayr, H.R.; Lugscheider, W. <i>Z. Metallk.</i> <u>1960</u> , 57, 725. 14. Merlo, F.; Fornasini, M.L. <i>J. Less-Common Metals</i> <u>1979</u> , 64, 221. 15. Perov, E.I.; Akimov, V.P.; Serebrennikov, V.V. <i>Tr. Tomsk. Univ.</i> <u>1971</u> , 204, 90. 16. Dzholdasova, R.M. <i>Dissertation</i> , Alma-Ata, <u>1979</u> ; as cited by Korshunov, V.I. <i>Itogi Nauki i Tekhniki, Elektrokhimiya</i> <u>1981</u> , 17, 85. 17. Iandelli, A.; Palenzona, A. <i>Handbook on the Physics and Chemistry of Rare Earths</i> , K. A. Gschneider, L. Eyring, Eds., North-Holland, <u>1978</u> , Amsterdam, Ch. I.	

COMPONENTS:	ORIGINAL MEASUREMENTS:	
(1) Samarium; Sm; [7440-19-9] (2) Mercury; Hg; [7439-97-6]	Messing, A.F.; Dean, O.C. U.S. At. Ener. Comm. Rep. ORNL-2871, <u>1960.</u>	
VARIABLES:	PREPARED BY:	
Temperature: 313-578 K	C. Guminski; Z. Galus	
EXPERIMENTAL VALUES:		
The solubility of samarium in mercury was determined at various temperatures.		
<u>T/K</u>	<u>Soly/mass %</u>	<u>Soly/at %</u>
313	^a 0.0131	0.0175
358-363	0.0376	0.0501
373-383	0.0627	0.0834
418-423	0.0834	0.111
433-438	0.142	0.189
443-448	0.104	0.139
468-478	0.168	0.224
498-503	0.213	0.284
523-528	0.202	0.269
573-578	0.467	0.621
573-578	0.490	0.652
629	^a 0.618	0.822
^a Calculated from least squares-fitted equation by the authors.		
AUXILIARY INFORMATION		
METHOD/APPARATUS/PROCEDURE:	SOURCE AND PURITY OF MATERIALS:	
Mercury and the test metal, after drying and outgassing in the stainless steel dissolver, were kept for several days at the desired temperature. A similar equilibration period was allowed after each temperature change. After equilibration, a sample of liquid amalgam was forced through the filter. The filtrate was collected, dissolved in nitric acid, and submitted for analysis for samarium and mercury.	Nothing specified.	
	ESTIMATED ERROR:	
	Soly: least squares fit standard deviation 0.07606.	
	Temp: precision \pm 5 K.	
	REFERENCES:	

COMPONENTS: (1) Samarium; Sm; [7440-19-9] (2) Mercury; Hg; [7439-97-6]	ORIGINAL MEASUREMENTS: Sagadieva, K.Zh.; Zebreva, A.I. <i>Izv. Akad. Nauk Kaz. SSR, Ser. Khim.</i> <u>1977</u> , No. 5, 28-32.
VARIABLES: One temperature: 25°C	PREPARED BY: C. Guminski; Z. Galus
EXPERIMENTAL VALUES: The solubility of samarium in mercury at 25°C was found to be $(3.1 \pm 0.4) \times 10^{-2}$ mol dm ⁻³ . The atomic % solubility calculated by the compilers is 4.6×10^{-2} at %. The same result is given also in (1-3).	
AUXILIARY INFORMATION	
METHOD/APPARATUS/PROCEDURE: The amalgams were presumably prepared by reduction of Sm(II) with sodium amalgam. Amalgams of various concentrations were oxidized potentiostatically at the limiting current potential of -0.1 V vs. SCE, and the current was recorded as a function of time. The measurements were made in a static, buffered solution of 0.2 mol-dm ⁻³ NaOAc + 0.04 mol-dm ⁻³ HCl at pH = 5. The limiting current, i_d , was obtained from a semilog plot of current vs. time; i_d increased linearly with concentration of Sm, and was nearly constant above saturation. The solubility was determined from the intercept of the i_d vs. concentration plot.	SOURCE AND PURITY OF MATERIALS: Nothing specified. ESTIMATED ERROR: Soly: nothing specified; precision approximately $\pm 10\%$ (compilers). Temp: precision ± 0.5 K. REFERENCES: 1. Zebreva, A.I.; Sagadieva, K.Zh.; Dzholdasova, K.M. <i>Issl. Obl. Khim. Redkozeml. Elementov</i> <u>1975</u> , 77. 2. Sagadieva, K.Zh.; Zebreva, A.I.; Dzholdasova, R.M.; Mertke, I. <i>Dep. VINITI</i> 2573-75, <u>1975</u> . 3. Sagadieva, K.Zh.; Zebreva, A.I.; Badavamova, G.L. <i>Elektrokhimia</i> <u>1979</u> , 15, 210.

COMPONENTS:	EVALUATOR:
(1) Europium; Eu; [7440-53-1] (2) Mercury; Hg; [7439-97-6]	C. Guminski; Z. Galus Department of Chemistry University of Warsaw Warsaw, Poland July, 1985
<p>CRITICAL EVALUATION:</p> <p>Kozin estimated from his semiempirical treatment that the solubility of europium in mercury at 298 K is 0.12 (1) and 0.14 at % (2,10). Some recent experimental determinations of the solubility appear to confirm Kozin's estimates. Sagadieva and coworkers reported solubility at 298 K of 0.098 (3,7,8,17) and 0.112 at % (7,17). At 293 K, Shvedov et al. (4) reported a solubility of 0.142 at %, while Perov and coworkers (14) reported a solubility of 0.152 at %, and Gerasimov et al. (9) reported a solubility of 0.165 at % without describing the method of determination. There have been other reports (5,6,11,15) of the solubility near room temperature, but these are rejected because they are nearly an order of magnitude too high because of supersaturation of the amalgams in these studies.</p> <p>The saturated amalgam is in equilibrium with various compounds (6,12,13,16): EuHg_{10}, EuHg_5, $\text{EuHg}_{3.6}$, EuHg_3, EuHg_2, EuHg, and Eu_3Hg_2. No systematic thermal analysis of the Eu-Hg system has been made.</p> <p>The tentative solubility of europium in mercury at 298 K is 0.1 at % (3,7,17).</p> <p>References</p> <ol style="list-style-type: none"> 1. Kozin, L.F. <i>Tr. Inst. Khim. Nauk Akad. Nauk Kaz. SSR</i> 1962, 9, 101. 2. Kozin, L.F. <i>Fiziko-Khimicheskie Osnovy Amalgamnoi Metallurgii</i>, Nauka, Alma-Ata, 1964. 3. Sagadieva, K.Zh.; Zebreva, A.I.; Badavamova, G.L. <i>Elektrokhimiya</i> 1979, 15, 210. 4. Shvedov, V.P.; Frolov, A.Z.; Nikishin, G.D. <i>Radiokhimiya</i> 1971, 13, 252. 5. Usenova, K.A.; Krebaeva, Sh.D.; Osipova, G.V.; Enikeev, R.Sh. <i>Radiokhimiya</i> 1974, 16, 104. 6. McCoy, H.N. <i>J. Am. Chem. Soc.</i> 1941, 63, 1622. 7. Sagadieva, K.Zh.; Zebreva, A.I.; Khanapina, K. <i>Izv. Vyssh. Ucheb. Zaved., Khim. Khim. Tekhnol.</i> 1977, 20, 1263. 8. Sagadieva, K.Zh.; Zebreva, A.I. <i>Izv. Akad. Nauk Kaz. SSR, Ser. Khim.</i> 1977, No. 5, 28. 9. Gerasimov, Ya.I.; Krestovnikov, A.N.; Kuznetsov, F.A.; Lavrentev, V.I.; Lomov, A.L. <i>Khimicheskaya Termodinamika v Tsvetnoi Metallurgii, Vol. 7</i>, Metallurgia, Moskva, 1975; as cited from Kozin, L.F.; Nigmatova, R.Sh.; Dergacheva, M.B. <i>Termodinamika Binarnykh Amalgamnykh Sistem</i>, Nauka, Alma-Ata, 1977, p. 192. 10. Kozin, L.F. <i>Vestn. Akad. Nauk Kaz. SSR</i> 1972, No. 3, 34. 11. Usenova, K.A.; Krebaeva, Sh.D. <i>Sbor. Rabot Khim.</i>, Alma-Ata, 1973, No. 3, 369. 12. Iandelli, A.; Palenzona, A. <i>Atti Acad. Naz. Lincei, Cl. Sci. Fis. Mat. Nat., Rend.</i> 1964, 37, 165. 13. Merlo, F.; Fornasini, M.L. <i>J. Less-Common Metals</i> 1979, 64, 221. 14. Perov, E.I.; Akimov, V.P.; Serebrennikov, V.V. <i>Tr. Tomsk. Univ.</i> 1971, 204, 90. 15. Udris, E.Ya.; Korshunov, V.N. <i>Elektrokhimiya</i> 1982, 18, 636. 16. Iandelli, A.; Palenzona, A. <i>Handbook on the Physics and Chemistry of Rare Earths</i>, Gschneider, K.A.; Eyring, L., Eds., North-Holland, 1978, Amsterdam, Ch. I. 17. Sagadieva, K.Zh.; Zebreva, A.I.; Khanapina, K. <i>Dep. VINITI</i>, 2234-76, 1976. 	

COMPONENTS: (1) Europium; Eu; [7440-53-1] (2) Mercury; Hg; [7439-97-6]	ORIGINAL MEASUREMENTS: Shvedov, V.P.; Frolov, A.Z.; Nikishin, G.D. <i>Radiokhimiya</i> 1971, 13, 252-5.
VARIABLES: One temperature: 20°C	PREPARED BY: C. Guminski; Z. Galus
EXPERIMENTAL VALUES: The solubility of europium in mercury at 20°C was found to be 0.142 at %.	
AUXILIARY INFORMATION	
METHOD/APPARATUS/PROCEDURE: The amalgams were prepared by reduction of Eu(III) with sodium amalgam, and then oxidized under polarographic conditions. The wave height increased with the amalgam concentration up to the saturation point; further increase of amalgam concentration caused a decrease of the wave height. The maximum on the wave height-amalgam concentration dependency indicated the concentration of the saturated amalgam. Solutions were deoxygenated by bubbling H ₂ or by adding Na ₂ SO ₃ before the experiment. Concentrations of Eu in the amalgam were determined radiochemically or by complexometric titration with Trilon B. Back titration method was used with Zn(CH ₃ COO) ₂ in ammonia buffer. All work with amalgams was carried out under a layer of dehydrated ethanol or acetone.	SOURCE AND PURITY OF MATERIALS: Nothing specified. ESTIMATED ERROR: Soly: precision \pm 10% (compilers). Temp: not specified. REFERENCES:

COMPONENTS: (1) Europium; Eu; [7440-53-1] (2) Mercury; Hg; [7439-97-6]	ORIGINAL MEASUREMENTS: Perov, E.I.; Akimov, V.P.; Serebrennikov, V.V. <i>Tr. Tomsk. Univ.</i> <u>1971</u> , <i>204</i> , 90-3.
VARIABLES: One temperature: 20°C	PREPARED BY: C. Guminski; Z. Galus
EXPERIMENTAL VALUES: The solubility of europium in mercury at 20°C was reported to be 0.114 mass %. The atomic % solubility calculated by the compilers is 0.152 at %. It is not certain if the liquid amalgam and the solid phase reached equilibrium.	
AUXILIARY INFORMATION	
METHOD/Apparatus/Procedure: Thin film mercury electrode on Ag base was polarized in citrate-alkaline solution containing Eu(III). The electrolysis was performed under a hydrogen atmosphere, then the electrode was washed in water and dipped in 0.1 mol dm ⁻³ HCl solution. The Eu content in the latter solution was analyzed by photocalorimetry. The solubility of Eu in Hg was then calculated from amount of Eu(III) in the solution and volume of Hg electrode.	SOURCE AND PURITY OF MATERIALS: Nothing specified.
	ESTIMATED ERROR: Soly: nothing specified; no better than ± 10% (compilers). Temp: nothing specified.
	REFERENCES:

COMPONENTS: (1) Europium; Eu; [7440-53-1] (2) Mercury; Hg; [7439-97-6]	ORIGINAL MEASUREMENTS: Sagadieva, K.Zh.; Zebreva, A.I.; Khanapina, K. <i>Izv. Vyssh. Ucheb. Zaved., Khim. Khim. Tekhnol.</i> <u>1977</u> , <u>20</u> , 1263-6.
VARIABLES: One temperature: 25°C	PREPARED BY: C. Guminski; Z. Galus
EXPERIMENTAL VALUES: Solubility of europium in mercury at 25°C was reported to be: $(7.5 \pm 0.5) \times 10^{-2} \text{ mol dm}^{-3}$, or 0.112 at %, from chronoamperometry; $(6.6 \pm 0.7) \times 10^{-2} \text{ mol dm}^{-3}$, or 0.098 at %, from coulometry.	
AUXILIARY INFORMATION	
METHOD/APPARATUS/PROCEDURE: The Eu amalgams were presumably prepared by reduction of Eu(III) with sodium amalgam. Amalgams of various concentrations were then oxidized under potentiostatic conditions at -1.0 V vs. SCE. When the metal content in the amalgam exceeded its solubility in mercury, the anodic limiting current, i_s , was independent of the amalgam concentration, N. On the basis of a plot of i_s vs. N, the solubility was estimated from the breakpoint of the curve by chronoamperometry. For the current-time dependence for the oxidation of the heterogeneous amalgam, there was an exponential component attributed to the oxidation of the homogeneous amalgam. The content of Eu in the saturated amalgam by coulometry was obtained by integration of the i_s vs. t curve for the oxidation.	SOURCE AND PURITY OF MATERIALS: Nothing specified. ESTIMATED ERROR: Soly: precision approximately $\pm 10\%$. Temp: precision ± 0.5 K. REFERENCES:

COMPONENTS: (1) Europium; Eu; [7440-53-1] (2) Mercury; Hg; [7439-97-6]	ORIGINAL MEASUREMENTS: Sagadieva, K.Zh.; Zebreva, A.I.; Badavamova, G.L. <i>Elektrokhimia</i> <u>1979</u> , 15, 210-3.
VARIABLES: One temperature: 25°C	PREPARED BY: C. Guminski; Z. Galus
EXPERIMENTAL VALUES: The solubility of europium in mercury at 25°C was found to be $6.6 \times 10^{-2} \text{ mol dm}^{-3}$ (9.8×10^{-2} at % by compilers). The same result is reported also in (1,2).	
AUXILIARY INFORMATION	
METHOD/APPARATUS/PROCEDURE: The amalgams were presumably prepared by reduction of Eu(III) with sodium amalgam. Amalgams of various concentrations were oxidized potentiostatically at the limiting current potential of -0.1 V vs. SCE, and the current was recorded as a function of time. The measurements were made in a static, buffered solution of 0.2 mol dm^{-3} NaOAc + 0.04 mol dm^{-3} HCl at pH = 5. The limiting current, i_d , was obtained from a semilog plot of current vs. time; i_d increased linearly with concentration of Eu and was nearly constant above saturation. The solubility was determined from the intercept of the i_d vs. concentration plot.	SOURCE AND PURITY OF MATERIALS: Nothing specified. ESTIMATED ERROR: Soly: nothing specified; precision probably about $\pm 10\%$ (compilers). Temp: not specified. REFERENCES: 1. Sagadieva, K.Zh.; Zebreva, A.I.; Khanapina, K. <i>Izv. Vyssh. Ucheb. Zaved., Khim. Khim. Tekhnol.</i> <u>1977</u> , 20, 1263. 2. Sagadieva, K.Zh.; Zebreva, A.I. <i>Izv. Akad. Nauk Kaz. SSR, Ser. Khim.</i> <u>1977</u> , No. 5, 28.

COMPONENTS:

- (1) Gadolinium; Gd; [7440-54-2]
 (2) Mercury; Hg; [7439-97-6]

EVALUATOR:

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 Department of Chemistry
 University of Warsaw
 Warsaw, Poland

July, 1985

CRITICAL EVALUATION:

Kozin initially calculated (1) a solubility of 3.4×10^{-5} at % at 298 K for gadolinium in mercury, but he subsequently corrected (2) his estimate to 1.96×10^{-4} at %. The experimental determinations of the gadolinium solubility are appreciably higher than the estimates of Kozin. Bulina and coworkers employed electrochemical oxidation and reported solubilities of 9.8×10^{-3} (4) and 5.3×10^{-3} at % (5) at 298 K. Messing and Dean (3) equilibrated the saturated amalgams at 363 to 618 K then analyzed the filtered liquid phase; they found that the solubility of gadolinium increased monotonically from 0.0377 to 0.967 at % in this temperature range. The extrapolated solubility at 298 K, from the least-squares fitted equation of (3), is 8.2×10^{-3} at %. The latter solubility is in good agreement with those reported by (4) and (5). Sayun and Vokhrysheva (6) observed that the gadolinium amalgam of concentration 2.1×10^{-2} at % was a homogeneous liquid at temperatures higher than 293 K. The latter authors subsequently reported solubilities of 0.042 to 0.061 at % in the temperature range of 293 to 353 K, respectively (9,10), but all of their data are rejected because they are clearly too high.

Schematic, partial phase diagrams for the Gd-Hg system have been presented by (7,8).

The tentative values of gadolinium solubility in mercury:

<u>T/K</u>	<u>Sol/at %</u>	<u>Reference</u>
298	7×10^{-3} ^a	[4,5]
323	1.5×10^{-2} ^b	[3]
373	5×10^{-2}	[3]
473	0.24	[3]
573	0.65 ^b	[3]

^a mean value from data of cited references.

^b interpolated data of (3).

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1. Kozin, L.F. *Tr. Inst. Khim. Nauk Akad. Nauk Kaz. SSR* **1962**, *9*, 101.
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3. Messing, A.F.; Dean, O.C. *U.S. At. Ener. Comm. Rep.*, ORNL-2871, **1960**.
4. Bulina, V.A.; Zebreva, A.I.; Enikeev, R.Sh. *Izv. Vyssh. Ucheb. Zaved., Khim. Khim. Tekhnol.* **1977**, *20*, 959.
5. Bulina, V.A.; Guminichenko, L.V.; Zebreva, A.I. *Radiokhimiya* **1977**, *19*, 89.
6. Sayun, M.G.; Vokhrysheva, L.E. *Elektrokhimiya* **1975**, *11*, 1679.
7. Kirchmayr, H.R.; Lugscheider, W. *Z. Metallk.* **1966**, *57*, 725.
8. Merlo, F.; Fornasini, M.L. *J. Less-Common Metals* **1979**, *64*, 221.
9. Vokhrysheva, L.E.; Sayun, M.G. *Izv. Akad. Nauk Kaz. SSR, Ser. Khim.* **1976**, No. 5, 64.
10. Vokhrysheva, L.E.; Sayun, M.G. *Dep. VINITI*, 146-77, **1977**; *Novosti Polarografii*, Zinatne, Riga, **1975**, p. 52.

COMPONENTS:	ORIGINAL MEASUREMENTS:	
(1) Gadolinium; Gd; [7440-54-2] (2) Mercury; Hg; [7439-97-6]	Messing, A.F.; Dean. O.C. U.S. At. Ener. Comm. Rep., ORNL-2871, 1960.	
VARIABLES:	PREPARED BY:	
Temperature: 313-629 K	C. Guminski; Z. Galus	
EXPERIMENTAL VALUES:		
The solubility of gadolinium in mercury was determined at various temperatures.		
<div><div>T/K</div><div>313</div><div>363-368</div><div>403-408</div><div>418-423</div><div>478-483</div><div>483-493</div><div>553-558</div><div>553-563</div><div>608-618</div><div>629</div></div>	<div><div>Soly/mass %</div><div>^a8.95 x 10⁻³</div><div>0.0296</div><div>0.0635</div><div>0.0948</div><div>0.212</div><div>0.215</div><div>0.443</div><div>0.419</div><div>0.760</div><div>^a0.785</div></div>	<div><div>Soly/at %</div><div>0.0114</div><div>0.0377</div><div>0.0810</div><div>0.121</div><div>0.270</div><div>0.274</div><div>0.664</div><div>0.533</div><div>0.967</div><div>1.000</div></div>
<div>^aCalculated from least squares equation by the authors.</div>		
AUXILIARY INFORMATION		
METHOD/APPARATUS/PROCEDURE:	SOURCE AND PURITY OF MATERIALS:	
Mercury and gadolinium, after drying and outgassing in the stainless steel dissolver, were kept for several days at the desired temperature. A similar equilibration period was allowed after each temperature change. After equilibration, a sample of liquid amalgam was forced through the filter. The filtrate was collected, dissolved in nitric acid, and submitted for analysis for gadolinium and mercury.	Nothing specified.	
	ESTIMATED ERROR:	
	Soly: standard deviation of least squares fit = 0.03539.	
	Temp: precision \pm 5 K.	
	REFERENCES:	

COMPONENTS: (1) Gadolinium; Gd; [7440-54-2] (2) Mercury; Hg; [7439-97-6]	ORIGINAL MEASUREMENTS: 1. Bulina, V.A.; Guminichenko, L.V.; Zebreva, A.I.; Enikeev, R.Sh. <i>Radiokhimiya</i> 1977, 19, 89-93. 2. Bulina, V.A.; Zebreva, A.I.; Enikeev, R.Sh. <i>Izv. Vyssh. Ucheb. Zaved., Khim. Khim. Tekhnol.</i> 1977, 20, 959-61.
VARIABLES: One temperature: 25°C	PREPARED BY: C. Guminski; Z. Galus
EXPERIMENTAL VALUES: The solubility of gadolinium in mercury at 25°C was found to be $(6.6 \pm 1.2) \times 10^{-3}$ and $(3.6 \pm 0.4) \times 10^{-3}$ mol dm ⁻³ in (1) and (2), respectively. The atomic % solubility calculated by the compilers are 9.8×10^{-3} and 5.3×10^{-3} at %, respectively.	
AUXILIARY INFORMATION	
METHOD/APPARATUS/PROCEDURE: The heterogeneous amalgam in (1) was prepared by reduction of Gd(III) with Na amalgam from buffered solution of pH = 4. The amalgam was potentiostatically oxidized at 0.1 V vs. SCE. The solubility was determined from the charge, from the i-t curve, used to oxidize the homogeneous amalgam; the curve attained a plateau at saturation. In (2) the heterogeneous amalgam with small admixture of Na was kept 2-3 days under purified benzene. The liquid phase was carefully decanted and oxidized chronoamperometrically at 0.1 V vs. SCE. The solubility was calculated from the charge consumed for the oxidation of the homogeneous amalgam.	SOURCE AND PURITY OF MATERIALS: Nothing specified.
	ESTIMATED ERROR: Soly: precision approximately $\pm 20\%$. Temp: precision ± 0.5 K.
	REFERENCES:

<p>COMPONENTS:</p> <p>(1) Terbium; Tb; [7440-27-9] (2) Mercury; Hg; [7439-97-6]</p>	<p>EVALUATOR:</p> <p>C. Guminski; Z. Galus Department of Chemistry University of Warsaw Warsaw, Poland July, 1985</p>
<p>CRITICAL EVALUATION:</p> <p>Kozin first predicted a terbium solubility of 7.4×10^{-6} at % at 298 K (1), and subsequently corrected his estimate to 5.2×10^{-5} at %. These estimated solubilities are at least two orders of magnitude lower than the best experimental determinations. Bulina et al. (3) and Sagadieva et al. (6) reported 298 K solubilities of 1.5×10^{-3} and 1.1×10^{-3} at %, respectively. The latter values agree within the experimental errors; also, these solubilities are nearer to the solubilities of the neighboring lanthanides at the same temperature, as compared to the rejected solubility of less than 10^{-4} at % at 293 K (4). Kirchmayr and Lugscheider (5) stated that the solubility of terbium should be similar to those of Nd, Sm and Gd.</p> <p>The saturated amalgam is in equilibrium with Tb-Hg solid phases, as shown by the schematic phase diagram reported by (5).</p> <p>The tentative solubility of terbium at 298 K, taking the mean value from (3) and (6), is 1.3×10^{-3} at %.</p> <p><u>References</u></p> <ol style="list-style-type: none"> 1. Kozin, L.F. <i>Tr. Inst. Khim. Nauk Akad. Nauk Kaz. SSR</i> <u>1962</u>, 9, 101. 2. Kozin, L.F. <i>Fiziko-Khimicheskie Osnovy Amalgamnoi Metallurgii</i>, Nauka, Alma-Ata, 1964. 3. Bulina, V.A.; Zebreva, A.I.; Enikeev, R.Sh. <i>Izv. Vyssh. Ucheb. Zaved., Khim. Khim. Tekhnol.</i> <u>1977</u>, 20, 959. 4. Shvedov, V.P.; Frolov, A.Z.; Nikishin, G.D. <i>Radiokhimiya</i> <u>1971</u>, 13, 252. 5. Kirchmayr, H.R.; Lugscheider, W. <i>Z. Metallk.</i> <u>1968</u>, 59, 296. 6. Sagadieva, K.Zh.; Badavamova, G.L.; Zebreva, A.I. <i>Izv. Vyssh. Ucheb. Zaved., Khim. Khim. Tekhnol.</i> <u>1984</u>, 27, 329. 	

COMPONENTS: (1) Terbium; Tb; [7440-27-9] (2) Mercury; Hg; [7439-97-6]	ORIGINAL MEASUREMENTS: Sagadieva, K.Zh.; Badavamova, G.L.; Zebreva, A.I. <i>Izv. Vyssh. Ucheb. Zaved., Khim. Khim. Tekhnol.</i> <u>1984</u> , 27, 329-33.
VARIABLES: One temperature: 25°C	PREPARED BY: C. Guminski; Z. Galus
EXPERIMENTAL VALUES: The solubility of terbium in mercury at 25°C was reported to be 7.3×10^{-4} mol dm ⁻³ . The atomic % solubility calculated by the compilers is 1.1×10^{-3} at %.	
AUXILIARY INFORMATION	
METHOD/APPARATUS/PROCEDURE: The amalgam was prepared by electro-reduction of Tb(III) in citrate buffer (pH 5-6) on the hanging mercury drop electrode with Pt base. The electrolysis was carried out under potentiostatic conditions at potentials ranging between -1.7 and -2.5 V vs. SCE in an inert gas atmosphere. The amalgam was then oxidized by stripping voltammetry. The total amount of Tb in Hg was found by integration of the area under the voltammetric peak. The breakpoint on the plot relating the anodic peak current against Tb concentration corresponds to the saturation of the amalgam.	SOURCE AND PURITY OF MATERIALS: Purity of Hg-drop electrode was tested by the stripping analysis without the depolarizer; impurities were below 10^{-6} at % (compilers). ESTIMATED ERROR: Soly: nothing specified; precision no better than $\pm 10\%$ (compilers). Temp: nothing specified. REFERENCES:

COMPONENTS: (1) Terbium; Tb; [7440-27-9] (2) Mercury; Hg; [7439-97-6]	ORIGINAL MEASUREMENTS: Bulina, V.A.; Zebreva, A.I.; Enikeev, R.Sh. <i>Izv. Vyssh. Ucheb. Zaved., Khim. Khim. Tekhnol.</i> <u>1977</u> , <u>20</u> , 959-61.
VARIABLES: One temperature: 25°C	PREPARED BY: C. Guminski; Z. Galus
EXPERIMENTAL VALUES: The solubility of terbium in mercury at 25°C was found to be $(1.0 \pm 0.2) \times 10^{-3}$ g-atom dm ⁻³ . The atomic % solubility calculated by the compilers is 1.5×10^{-3} at %.	
AUXILIARY INFORMATION	
METHOD/APPARATUS/PROCEDURE: The heterogeneous amalgam of terbium, with small admixtures of sodium, was kept for 2-3 days under purified benzene, then the liquid phase was carefully separated by decantation. The amalgam was oxidized chronoamperometrically at +0.1 V vs. SCE. The solubility was calculated from the charge consumed for the oxidation of the saturated amalgam.	SOURCE AND PURITY OF MATERIALS: Nothing specified.
	ESTIMATED ERROR: Soly: precision \pm 20%. Temp: nothing specified.
	REFERENCES:

COMPONENTS: (1) Dysprosium; Dy; [7429-91-6] (2) Mercury; Hg; [7439-97-6]	EVALUATOR: C. Guminski; Z. Galus Department of Chemistry University of Warsaw Warsaw, Poland July, 1985
CRITICAL EVALUATION: <p>Bulina et al. determined dysprosium solubilities of 1.9×10^{-2} (4,5) and 1.2×10^{-3} at % (3) at 298 K. In the opinion of the evaluators the second result appears to be more reliable than the first because of its similarity to the solubility of the neighboring rare earths. Kozin's predicted solubilities of 1.0×10^{-6} (1) and 1.6×10^{-5} at % (2) at 298 K are too low.</p> <p>The schematic phase diagram for the Dy-Hg system shows that the liquid is in equilibrium with Dy-Hg intermetallic phases (6,7).</p> <p>The tentative solubility of dysprosium at 298 K is 1.2×10^{-3} at % (3).</p> <p><u>References</u></p> <ol style="list-style-type: none">1. Kozin, L.F. <i>Tr. Inst. Khim. Nauk Akad. Nauk Kaz. SSR</i> <u>1962</u>, 9, 101.2. Kozin, L.F. <i>Fiziko-Khimicheskie Osnovy Amalgamoi Metallurgii</i>, Nauka, Alma-Ata, <u>1964</u>.3. Bulina, V.A.; Zebreva, A.I.; Enikeev, R.Sh. <i>Izv. Vyssh. Ucheb. Zaved., Khim. Khim. Tekhnol.</i> <u>1977</u>, 20, 959.4. Bulina, V.A.; Usenova, K.A.; Zebreva, A.I.; Enikeev, R.Sh. <i>Issl. Obl. Khim. Redkozeml. Elementov</i> <u>1975</u>, 78.5. Bulina, V.A.; Zebreva, A.I.; Enikeev, R.Sh. <i>Khim. Khim. Tekhnol.</i>, Alma-Ata, <u>1974</u>, No. 16, 189.6. Kirchmayr, H. R.; Lugscheider, W. <i>Z. Metallk.</i> <u>1966</u>, 57, 725.7. Merlo, F.; Fornasini, M.L. <i>J. Less-Common Metals</i> <u>1979</u>, 64, 221.	

COMPONENTS: (1) Dysprosium; Dy; [7429-91-6] (2) Mercury; Hg; [7439-97-6]	ORIGINAL MEASUREMENTS: 1. Bulina, V.A.; Zebreva, A.I.; Enikeev, R.Sh. <i>Khim. Khim. Tekhnol.</i> , Alma-Ata <u>1974</u> , No. 16, 189-91. 2. Same authors <i>Izv. Vyssh. Ucheb. Zaved., Khim. Khim. Tekhnol.</i> 1977, 20, 959-61.
VARIABLES: One temperature: 25°C	PREPARED BY: C. Guminski; Z. Galus
EXPERIMENTAL VALUES: The solubility of dysprosium in mercury at 25°C was reported to be $(1.3 \pm 0.5) \times 10^{-2}$ mol dm ⁻³ and $(0.8 \pm 0.2) \times 10^{-3}$ g-atom dm ⁻³ . The respective atomic % solubility calculated by the compilers are 1.9×10^{-2} and 1.2×10^{-3} at %.	
AUXILIARY INFORMATION	
METHOD/APPARATUS/PROCEDURE: Dy amalgams in (1) were obtained by reduction of Dy(III) with Li amalgam in acetate buffer, and the Dy contents were determined by decomposition of the amalgam with acetic acid, followed by complexometric titration with trilon. In (2) the heterogeneous amalgam, with small admixture of Na, was kept for 2-3 days under purified benzene; the liquid phase was carefully separated by decantation. The amalgams were oxidized chronoamperometrically: -0.1 V vs. silver chloride electrode in (1); +0.1 V vs. SCE in (2). The solubility in (1) was calculated from the charge corresponding to the exponential part of the i-t curve; the solubility in (2) was calculated from the charge consumed for the oxidation of the saturated amalgam.	SOURCE AND PURITY OF MATERIALS: Nothing specified. ESTIMATED ERROR: Soly: precision approximately $\pm 40\%$ in (1) and $\pm 25\%$ in (2) (compilers). Temp: nothing specified. REFERENCES:

COMPONENTS: (1) Holmium; Ho; [7440-60-0] (2) Mercury; Hg; [7439-97-6]	EVALUATOR: C. Guminski; Z. Galus Department of Chemistry University of Warsaw Warsaw, Poland July, 1985
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CRITICAL EVALUATION:

There has been only one experimental determination of the solubility of holmium in mercury (3); at 298 K the solubility was reported to be 9×10^{-4} at %. Kozin's calculated values (1,2) were at least an order of magnitude lower than that found by (3).

The schematic phase diagram for this system, which shows that the liquid is in equilibrium with various intermetallic phases, has been presented by (4). However, Bulina and coworkers (5) reported that the saturated amalgam at 298 K is in equilibrium with HoHg rather than with HoHg_3 as suggested by (4).

The tentative value of the solubility of Ho in Hg at 298 K is 9×10^{-4} at % (3).

References

1. Kozin, L.F. *Tr. Inst. Khim. Nauk Akad. Nauk Kaz. SSR*, 1962, 9, 101.
2. Kozin, L.F. *Fiziko-Khimicheskie Osnovy Amalgamnoi Metallurgii*, Nauka, Alma-Ata, 1964.
3. Bulina, V.A.; Zebreva, A.I.; Enikeev, R.Sh. *Izv. Vyssh. Ucheb. Zaved., Khim. Khim. Tekhnol.* 1977, 20, 959.
4. Kirchmayr, H.R.; Lugscheider, W. *Z. Metallk.* 1966, 57, 725.
5. Bulina, V.A.; Zebreva, A.I.; Enikeev, R.Sh. *Izv. Vyssh. Ucheb. Zaved., Khim. Khim. Tekhnol.* 1977, 20, 522.

COMPONENTS: (1) Holmium; Ho; [7440-60-0] (2) Mercury; Hg; [7439-97-6]	ORIGINAL MEASUREMENTS: Bulina, V.A.; Zebreva, A.I.; Enikeev, R.Sh. <i>Izv. Vyssh. Ucheb. Zaved., Khim. Khim. Tekhnol.</i> 1977, 20, 959-61.
VARIABLES: One temperature: 25°C	PREPARED BY: C. Guminski; Z. Galus
EXPERIMENTAL VALUES: The solubility of holmium in mercury at 25°C was reported to be $(0.6 \pm 0.2) \times 10^{-3}$ g-atom dm ⁻³ . The atomic % solubility calculated by the compilers is $\frac{9}{9} \times 10^{-4}$ at %.	
AUXILIARY INFORMATION	
METHOD/APPARATUS/PROCEDURE: The heterogeneous amalgam of Ho, with small admixture of sodium, was kept for 2-3 days under purified benzene, then the liquid phase was carefully separated by decantation. The amalgam was oxidized chronoamperometrically at +0.1 V vs. SCE. The solubility was calculated from the charge consumed for the oxidation of the saturated amalgam.	SOURCE AND PURITY OF MATERIALS: Nothing specified.
	ESTIMATED ERROR: Soly: precision \pm 35%. Temp: nothing specified.
	REFERENCES:

COMPONENTS:

- (1) Erbium; Er; [7440-52-0]
- (2) Mercury; Hg; [7439-97-6]

EVALUATOR:

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July, 1985

CRITICAL EVALUATION:

There has been only one experimental determination of the solubility of erbium in mercury; the solubility at 298 K was reported to be 6×10^{-4} at % (3). Kozin's calculated solubilities (1,2) were more than an order of magnitude lower than that found by (3).

The schematic phase diagram for this system, which shows that the liquid is in equilibrium with intermetallic phases, has been presented by (5). Flad and Matthes (4) found the compound, Er_3Hg ; therefore, the report by Bulina et al. (6), that the saturated amalgam at 298 K is in equilibrium with ErHg , is questionable.

The tentative solubility of Er in Hg at 298 K is 6×10^{-4} at % (3).

References

1. Kozin, L.F. *Tr. Inst. Khim. Nauk Akad. Nauk Kaz. SSR* **1962**, *9*, 101.
2. Kozin, L.F. *Fiziko-Khimicheskie Osnovy Amalgamnoi Metallurgii*, Nauka, Alma-Ata, **1964**.
3. Bulina, V.A.; Zebreva, A.I.; Enikeev, R.Sh. *Izv. Vyssh. Ucheb. Zaved., Khim. Khim. Tekhnol.* **1977**, *20*, 959.
4. Flad, D.; Matthes, F. *Z. Chem.* **1964**, *4*, 466.
5. Kirchmayr, H.R.; Lugscheider, W. *Z. Metallk.* **1966**, *57*, 725.
6. Bulina, V.A.; Zebreva, A.I.; Enikeev, R.Sh. *Izv. Vyssh. Ucheb. Zaved., Khim. Khim. Tekhnol.* **1977**, *20*, 522.

COMPONENTS: (1) Erbium; Er; [7440-52-0] (2) Mercury; Hg [7439-97-6]	ORIGINAL MEASUREMENTS: Bulina, V.A.; Zebreva, A.I.; Enikeev, R.Sh. <i>Izv. Vyssh. Ucheb. Zaved., Khim. Khim. Tekhnol.</i> <u>1977</u> , 20, 959-61.
VARIABLES: One temperature: 25°C	PREPARED BY: C. Guminski; Z. Galus
EXPERIMENTAL VALUES: The solubility of erbium in mercury at 25°C was reported to be $(0.4 \pm 0.1) \times 10^{-3}$ g-atom dm ⁻³ . The atomic % solubility calculated by the compilers is 6×10^{-4} at %.	
AUXILIARY INFORMATION	
METHOD/APPARATUS/PROCEDURE: The heterogeneous amalgam of erbium, with small admixture of sodium, was kept for 2-3 days under purified benzene, then the liquid phase was carefully separated by decantation. The amalgam was oxidized chronoamperometrically at +0.1 V vs. SCE. The solubility was calculated from the charge consumed for the oxidation of the saturated amalgam.	SOURCE AND PURITY OF MATERIALS: Nothing specified.
	ESTIMATED ERROR: Soly: precision approximately $\pm 25\%$. Temp: nothing specified.
	REFERENCES:

COMPONENTS: (1) Thulium; Tm; [7440-30-4] (2) Mercury; Hg; 7439-97-6	EVALUATOR: C. Guminski; Z. Galus Department of Chemistry University of Warsaw Warsaw, Poland July, 1985
CRITICAL EVALUATION: Bulina et al. (1) reported the only experimental determination of the solubility of thulium in mercury; these authors reported a 298 K solubility of 4×10^{-4} at %. Kozin's (2,3) calculated solubilities were lower than the experimental value by at least two orders of magnitude. <u>References</u> 1. Bulina, V.A.; Zebreva, A.I.; Enikeev, R.Sh. <i>Izv. Vyssh. Ucheb. Zaved., Khim. Khim. Tekhnol.</i> 1977, 20, 959. 2. Kozin, L.F. <i>Tr. Inst. Khim. Nauk Akad. Nauk Kaz. SSR</i> 1962, 9, 101. 3. Kozin, L.F. <i>Fiziko-Khimicheskie Osnovy Amalgamnoi Metallurgii</i> , Nauka, Alma-Ata, 1964.	

COMPONENTS: (1) Thulium; Tm; [7440-30-4] (2) Mercury; Hg; [7439-97-6]	ORIGINAL MEASUREMENTS: Bulina, V.A.; Zebreva, A.I.; Enikeev, R.Sh. <i>Izv. Vyssh. Ucheb. Zaved., Khim. Khim. Tekhnol.</i> <u>1977</u> , 20, 959-61.
VARIABLES: One temperature: 25°C	PREPARED BY: C. Guminski; Z. Galus
EXPERIMENTAL VALUES: The solubility of thulium in mercury at 25°C was found to be $(0.3 \pm 0.1) \times 10^{-3}$ g-atom dm ⁻³ . The atomic % solubility calculated by the compilers is 4×10^{-4} at %.	
AUXILIARY INFORMATION	
METHOD/APPARATUS/PROCEDURE: The heterogeneous amalgam of thulium, with small admixture of sodium, was kept for 2-3 days under purified benzene, then the liquid phase was carefully separated by decantation. The amalgam was oxidized at +0.1 V vs. SCE under chronoamperometric conditions. The solubility was calculated from the charge consumed for the oxidation of the saturated amalgam.	SOURCE AND PURITY OF MATERIALS: Nothing specified.
	ESTIMATED ERROR: Soly: precision \pm 35%. Temp: not specified.
	REFERENCES:

COMPONENTS: (1) Ytterbium; Yb; [7440-64-4] (2) Mercury; Hg; [7439-97-6]	EVALUATOR: C. Guminski; Z. Galus Department of Chemistry University of Warsaw Warsaw, Poland July, 1985
CRITICAL EVALUATION: <p>Experimental determination of the solubility of ytterbium in mercury has been reported to be 0.128 at % at 293 K by Shvedov et al. (3), and 1.32 at % at 298 K by Usenova et al. (4,5). Kozin reported calculated solubilities of 0.40 (1) and 0.42 at % (2) at 298 K. In the opinion of the evaluators, the result of Shvedov et al. appears to be the most accurate; their solubility is more consistent by comparison with the solubilities of other lanthanides in mercury. The solubility of Usenova et al. appears to be too high. Kirchmayr and Lugscheider (6), by analogy to that of Nd, Sm and Gd, estimated that the solubility of Yb is of the order of 10^{-2} at % at 298 K.</p> <p>The saturated ytterbium amalgams are in equilibrium with Yb-Hg intermetallic phases (6,7); a schematic phase diagram has been reported by (6).</p> <p>Tentative value of the solubility of Yb in Hg at 298 K is 0.13 at % (3).</p> <p><u>References</u></p> <ol style="list-style-type: none">1. Kozin, L.F. <i>Tr. Inst. Khim. Nauk Akad. Nauk Kaz. SSR</i> <u>1962</u>, 9, 101.2. Kozin, L.F. <i>Fiziko Khimicheskie Osnovy Amalgamoi Metallurgii</i>, Nauka, Alma-Ata, <u>1964</u>.3. Shvedov, V.P.; Frolkov, A.Z.; Nikishin, G.D. <i>Radiokhimiya</i> <u>1971</u>, 13, 252.4. Usenova, K.A.; Krebaeva, Sh.D. <i>Sbor. Rabot. Khim. Alma-Ata</i>, <u>1973</u>, No. 3, 369.5. Usenova, K.A.; Krebaeva, Sh.D.; Osipova, G.V.; Enikeev, R.Sh. <i>Radiokhimiya</i>, <u>1974</u>, 16, 104.6. Kirchmayr, H.R.; Lugscheider, W. <i>Z. Metallk.</i> <u>1968</u>, 59, 296.7. Merlo, F.; Fornasini, M.L. <i>J. Less-Common Metals</i> <u>1979</u>, 64, 221.	

COMPONENTS: (1) Ytterbium; Yb; [7440-64-4] (2) Mercury; Hg; [7439-97-6]	ORIGINAL MEASUREMENTS: Svedov, V.P.; Frolov, A.Z.; Nikishin, G.D. <i>Radiokhimiya</i> 1971, 13, 252-5; <i>Soviet Radiochemistry</i> 1971, 13, 251-3.
VARIABLES: One temperature: 20°C	PREPARED BY: C. Guminski; Z. Galus; M. Salomon
EXPERIMENTAL VALUES: The solubility of ytterbium in mercury at 20°C was found to be 1.28×10^{-1} at %.	
AUXILIARY INFORMATION	
METHOD/APPARATUS/PROCEDURE: Soly determined polarographically by measuring the anodic limiting current, i_d , of amalgams of varying composition. For unsaturated amalgams, i_d increases linearly with increasing Yb concentration; for saturated amalgams, i_d decreases linearly with increasing Yb concentration apparently due to the formation of solid phases and increase in amalgam viscosity (1). The soly of Yb is obtained from the intercept of the two linear plots of i_d vs. concentration. Experimental details: supporting electrolyte was 0.1 mol dm ⁻³ LiCl or KCl; solutions deoxygenated by bubbling H ₂ or by adding Na ₂ SO ₃ to solution before the experiment; the capillary constant, (m ^{2/3} t ^{1/6}), was "practically" independent of Yb concentration. Presumably all polarograms were run in alcohol or acetone solutions. Experimental error said not to exceed 10% (compiler assumes this to mean accuracy).	SOURCE AND PURITY OF MATERIALS: Yb amalgams prepared by reducing Yb(III) acetate with Na amalgam (details not given). All work with amalgams done under a layer of dehydrated alcohol or acetone (source and purity of solvents not specified). Concentration of amalgam determined radiochemically or complexometrically by back-titration of excess Trilon B with Zn acetate in ammonia buffer (indicator eriochrome black). ESTIMATED ERROR: Soly: accuracy ± 10%. Temp: not specified. REFERENCES: 1. Zebreva, A.I.; Kozlovskii, M.T. <i>Coll. Czech Chem. Commun.</i> 1960, 25, 3188.

COMPONENTS: (1) Ytterbium; Yb; [7440-64-4] (2) Mercury; Hg; [7439-97-6]	ORIGINAL MEASUREMENTS: Usenova, K.A.; Krebaeva, Sh.D.; Osipova, G.V.; Enikeev, R.Sh. <i>Radiokhimiya</i> <u>1974</u> , 16, 104-6.
VARIABLES: One temperature: 25°C	PREPARED BY: C. Guminski; Z. Galus
EXPERIMENTAL VALUES: The solubility of ytterbium in mercury at 25°C was found to be $0.88 \pm 0.07 \text{ mol dm}^{-3}$. The atomic % solubility calculated by the compilers is 1.3 at %.	
AUXILIARY INFORMATION	
METHOD/APPARATUS/PROCEDURE: The amalgam was prepared by reduction of Yb(III) with sodium amalgam. The solubility of Yb in Hg was determined from the variation of the potential of the amalgam cell as a function of contact time of the cell with aqueous solutions of pH = 3. It was observed that the potential of homogeneous amalgams changed rapidly toward positive values, whereas the potential of heterogeneous amalgams remained nearly constant upon contact with the aqueous solution. The solubility of Yb was determined by measuring the potential of amalgams of various Yb content and observing the point of constant potential at saturation.	SOURCE AND PURITY OF MATERIALS: Nothing specified.
	ESTIMATED ERROR: Soly: precision approximately $\pm 10\%$. Temp: not specified.
	REFERENCES:

COMPONENTS: (1) Lutetium; Lu; [7439-94-3] (2) Mercury; Hg; [7439-97-6]	EVALUATOR: C. Guminski; Z. Galus Department of Chemistry University of Warsaw Warsaw, Poland July, 1985
CRITICAL EVALUATION: <p>There has been only one experimental determination of the solubility of lutetium in mercury; at 298 K Bulina et al. (1) reported a solubility of 3×10^{-4} at %. Kozin's (2,3) calculated solubilities were more than three orders of magnitude lower than that of the experimental value.</p> <p>Although the Lu-Hg phase diagram is not known, the compounds LuHg₃ and LuHg have been reported (4); the liquid amalgam probably is in equilibrium with these compounds in the appropriate temperature range.</p> <p>Tentative value of the solubility of Lu in Hg at 298 K is 3×10^{-4} at % (1).</p> <p><u>References</u></p> <ol style="list-style-type: none">1. Bulina, V.A.; Zebreva, A.I.; Enikeev, R.Sh. <i>Izv. Vyssh. Ucheb. Zaved., Khim. Khim. Tekhnol.</i> <u>1977</u>, <i>20</i>, 959.2. Kozin, L.F. <i>Tr. Inst. Khim. Nauk Akad. Nauk Kaz. SSR</i> <u>1962</u>, <i>9</i>, 101.3. Kozin, L.F. <i>Fiziko-Khimicheskie Osnovy Amalgamnoi Metallurgii</i>, Nauka, Alma-Ata, <u>1964</u>.4. Iandelli, A.; Palenzona, A. <i>Handbook on the Physics and Chemistry of Rare Earths</i>, Gschneider, K. A.; Eyring, L., Eds., North-Holland, <u>1978</u>, Amsterdam, Ch. I.	

COMPONENTS: (1) Lutetium; Lu; [7439-94-3] (2) Mercury; Hg; [7439-97-6]	ORIGINAL MEASUREMENTS: Bulina, V.A.; Zebreva, A.I.; Enikeev, R.Sh. <i>Izv. Vyssh. Ucheb. Zaved., Khim. Khim. Tekhnol.</i> <u>1977</u> , 20, 959-61.
VARIABLES: One temperature: 25°C	PREPARED BY: C. Guminski; Z. Galus
EXPERIMENTAL VALUES: The solubility of lutetium in mercury at 25°C was reported to be $(0.2 \pm 0.1) \times 10^{-3}$ g-atom dm ⁻³ . The atomic % solubility calculated by the compilers is 3×10^{-4} at %.	
AUXILIARY INFORMATION	
METHOD/APPARATUS/PROCEDURE: The heterogeneous amalgam of lutetium, with small admixture of sodium, was kept for 2-3 days under purified benzene, then the liquid phase was separated carefully by decantation. The amalgam was oxidized chronoamperometrically at +0.1 V vs. SCE. The solubility was calculated from the charge consumed for the oxidation of the saturated amalgam.	SOURCE AND PURITY OF MATERIALS: Nothing specified.
	ESTIMATED ERROR: Soly: precision approximately $\pm 50\%$. Temp: nothing specified.
	REFERENCES: