COMPONENTS:	EVALUATOR:
(1) Carbon; C; [7440-44-0] (2) Mercury; Hg; [7439-97-6]	C. Guminski; Z. Galus Department of Chemistry University of Warsaw Warsaw, Poland July, 1985

CRITICAL EVALUATION:

There is general agreement that carbon is insoluble in mercury. However, when mercury was boiled in a carbon crucible, traces of graphite were precipitated upon cooling (1); this suggested that carbon may have a very low solubility provided that there was no mechanical fragmentation of carbon from the crucible during the experiment. On the other hand, no corrosion of carbon was observed when mercury was circulated over carbon at 719 K for 30 days (2). Because of its high melting point, the solubility of carbon in Hg should be extremely low.

Solid HgC_2 may be prepared by reaction of C_2H_2 with certain Hg compounds, but the carbide is not formed by direct contact of the elements (3).

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2. Nejedlik, J.F.; Vargo, E.J. *Electrochem. Technol.* 1965, *3*, 250.
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COMPONENTS:	EVALUATOR:
(1) Silicon; Si; [7440-21-3] (2) Mercury; Hg; [7439-97-6]	C. Guminski; Z. Galus Department of Chemistry University of Warsaw Warsaw, Poland July, 1985

CRITICAL EVALUATION:

Silicon is not attacked by mercury at room and elevated temperatures (1). Strachan and Harris (2) stated that the solubility of silicon is lower than 7×10^{-3} at % at room temperature. Calculations of solubility according to equations given by Kozin give extremely low values: 7.4×10^{-46} (3) and 2.0×10^{-25} at % (4) at 298 K. However, assuming that the corrosiveness of Si is proportional to its solubility in Hg, one may surmise, after the work of Nejedlik and Vargo (5), that the solubility of Si in Hg at 719 K should be of similar order of magnitude as the solubility of vanadium in Hg at the same temperature, i.e., 10^{-5} at %.

Further experimental work is needed in this system.

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COMPONENTS:	EVALUATOR:
(1) Germanium; Ge; [7440-56-4] (2) Mercury; Hg; [7439-97-6]	C. Guminski; Z. Galus Department of Chemistry University of Warsaw Warsaw, Poland July, 1985

CRITICAL EVALUATION:

Germanium has a low solubility in mercury. Edwards (1), without giving details of his electrical resistivity measurements of germanium amalgams, reported that the solubility at 573 K is at least 0.074 at %. Strachan and Harris (2) stated that the solubility should be lower than 3×10^{-3} at % at room temperature. Stepanova and Zakharov (3,4) showed that germanium may be electrolytically introduced into mercury with the formation of supersaturated amalgams; from oxidation currents of the amalgams the solubility of germanium at 298 K was estimated by these authors to be 2.7×10^{-4} at %. This value is too high, and is rejected, as compared to more precise measurements discussed below; the error in this solubility value is connected with the graphical procedure for the solubility determination. Moreover, Karpinski and Kublik (5) showed that under experimental conditions similar to those of (3,4) some of the germanium crystals may be oxidized, thus resulting in significantly overstated values for the solubility.

Karpinski and Kublik (5) reported on an exhaustive electroanalytical study of the formation and dissolution of germanium amalgams. These authors determined the solubility at 298.2 K to be 3.0×10^{-7} at %. Gladyshev and Tember (6), by employing radioactive ^{71}Ge, found that the solubility at 293 K is 1×10^{-5} at %. In an earlier reference (7) attributed to the latter authors, the solubility at 298 K was reported to be lower than 3×10^{-6} at %; details of the experimental procedure for this radioactive isotope work were not presented. Gladyshev and coworkers reported additional polarographic measurements of germanium amalgams, as follows: 1.4×10^{-5} (8) and 1.5×10^{-5} at % (9) at 293 K, and 1×10^{-5} at % (10) at 298 K. These values may be overstated because of too short drop-times of the mercury electrode during the polarographic measurements.

Kozin's estimated solubilities of 1.3×10^{-18} (11) and 1.1×10^{-12} at % (12) at 298 K are clearly too low.

Sarieva et al (13) performed polarographic studies at 293 to 353 K and these authors reported only the upper limits of the germanium solubility in this temperature range; the solubility limits at 293 and 353 K were 4.3×10^{-5} and 9.2×10^{-4}, respectively.

The saturated germanium amalgam is in equilibrium with solid germanium (5).

The tentative solubility of germanium in mercury at 298 K is 3×10^{-7} at % (5).

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12. Kozin, L.F. *Fiziko-Khimicheskie Osnovy Amalgamnoi Metallurgii*, Nauka, Alma-Ata, 1964.
13. Sarieva, L.S.; Kovaleva, S.V.; Gladyshev, V.P. *Zh. Fiz. Khim.* 1984, *58*, 502.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Germanium; Ge; [7440-56-4] (2) Mercury; Hg; [7439-97-6]	Gladyshev, V.P.; Tember, G.A. *Izv. Akad. Nauk Kaz. SSR., Ser Khim.* 1972, No. 2, 14-21.
VARIABLES: One temperature: 293 K	**PREPARED BY:** C. Guminski; Z. Galus

EXPERIMENTAL VALUES:

Solubility of germanium in mercury at 293 K was reported to be 0.005 ± 0.002 mg/10 cm^3 Hg. The corresponding mass % and atomic % solubilities calculated by the compilers are 3×10^{-6} mass % and 1×10^{-5} at %.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Amalgams were obtained by electroreduction, on a Hg cathode, of Ge(IV) in 0.5 mol dm^{-3} H_2SO_4; the Ge also contained radioactive ^{71}Ge, and oxygen was eliminated from the solution by a stream of hydrogen. The amalgam was then transferred into another cell for solubility measurements. Based on radioactivity measurements, a set of kinetic curves of aging of the amalgam was recorded. It was assumed that Ge crystals from the amalgam should cover the Hg surface while the bulk of the amalgam was a saturated solution. Independently of initial Ge content, the final level of radioactivity of the homogeneous phase was always the same after 16 h; this suggests that the level measured corresponds to the saturated amalgam of germanium.

SOURCE AND PURITY OF MATERIALS:

Mercury was purified by electrolysis then distilled from quartz apparatus.

GeO_2 was of "semiconductor" purity.

Water was distilled in a quartz apparatus.

H_2SO_4 was purified by electrolysis.

ESTIMATED ERROR:

Soly: precision ± 40%.

Temp: nothing specified.

REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Germanium; Ge; [7440-56-4] (2) Mercury; Hg; [7439-97-6]	Karpinski, Z.J.; Kublik, Z. *J. Electroanal. Chem. Interfacial Electrochem.* 1977, *81*, 53-66.
VARIABLES: One temperature: 25°C	**PREPARED BY:** C. Guminski; Z. Galus

EXPERIMENTAL VALUES:

Solubility of germanium in mercury at 25.0°C was reported to be $(2.0 \pm 0.5) \times 10^{-7}$ mol dm^{-3}. The corresponding atomic % solubility calculated by the compilers is 3.1×10^{-7} at %.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Germanium amalgams were obtained electrolytically on the hanging mercury-drop electrode from solutions of Ge(IV) of concn. 10^{-6}-10^{-5} mol dm^{-3} in a phosphate buffer at pH = 7.8. Chronoamperometric measurements: initially, reduction at -1.75 V vs. saturated Hg_2SO_4 electrode followed by pause of 15-60 seconds, then oxidation at -0.75 V. Measurements made at different Ge(IV) concentrations and the oxidation current, i_3, at -0.75 V was plotted against the time, t_2, of applied potential, -1.25 V, at which no Ge(IV) reduction current flowed. For $t_2 < 10$ min, i_3 systematically decreased with increase in t_2; for $t_2 > 10$ min i_3 was independent of t_2, indicating saturation equilibrium. Solubility was calculated from the determined diffusion coefficient of Ge in Hg and the time during oxidation.

SOURCE AND PURITY OF MATERIALS:

Supporting electrolytes were prepared with analytical reagents (Ciech) and triply-distilled water, then purified with charcoal and electrolyzed at -1.7 V.

GeO_2 was 99.999% pure from Fluka. Hg purified with acidified $Hg_2(NO_3)_2$ solution then distilled under reduced pressure.

ESTIMATED ERROR:

Soly: precision ± 25%.

Temp: precision ± 0.2 K.

REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Germanium; Ge; [7440-56-4] (2) Mercury; Hg; [7439-97-6]	1. Gladyshev, V.P.; Syroeshkina, L.S.; Sarieva, L.S. *Izv. Vyssh. Ucheb. Zaved., Khim. Khim. Tekhnol.* 1980, *23*, 936-9. 2. Same authors. *Zh. Anal. Khim.* 1979, *34*, 296-9. 3. Gladyshev, V.P.; Kovaleva, S.V.; Sarieva, L.S. *Zh. Anal. Khim.* 1982, *37*, 1762-6.
VARIABLES: Temperature: 293-298 K	PREPARED BY: C. Guminski; Z. Galus

EXPERIMENTAL VALUES:

Solubility of germanium in mercury:

T/K	Soly/mass %	Soly/at %[a]	Reference
293	$(5.0 \pm 0.5) \times 10^{-6}$	$(1.4 \pm 0.1) \times 10^{-5}$	[1]
293	5.5×10^{-6}	1.5×10^{-5}	[2]
298	3×10^{-6}	1×10^{-5}	[3]

[a] by compilers

It appears that these results may be too high because the mercury drop-times during the polarographic measurements may have been too short to reach equilibrium in the amalgam (compilers).

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Ge(II) was reduced on the dropping-Hg electrode by polarography; Ge(II) concentrations were 1×10^{-5} - 1×10^{-2} mol dm^{-3}. The electrolyte was 1-10 mol dm^{-3} HCl + 0.5 mol dm^{-3} $Na_2H_2PO_2$. Argon was passed for 15 min. through the solutions to remove oxygen. The electrode process proceeded with 100% current efficiency. Stationary concentrations of germanium amalgams at various Ge(II) concentrations in the solutions were calculated coulometrically; the inflection point in the plot of peak current vs. logarithm of Ge(II) concentration indicated the saturation concentration.

SOURCE AND PURITY OF MATERIALS:

GeO_2 and HCl were of high purity. NaH_2PO_4, chemically pure, was recrystallized.

Hg was specified as "R-O" grade.

ESTIMATED ERROR:

Soly: precision ± 10% in (1); nothing specified in (2) and (3).

Temp: nothing specified.

REFERENCES:

COMPONENTS:	EVALUATOR:
(1) Tin; Sn; [7440-31-5] (2) Mercury; Hg; [7439-97-6]	C. Guminski; Z. Galus Department of Chemistry University of Warsaw Warsaw, Poland July, 1985

CRITICAL EVALUATION:

Tammann (1) reported the first study on the phase relationship in the Sn-Hg system. This author found that the melting point, m.p., of Hg is elevated by the addition of small amounts of Sn; the elevation of the m.p. was 2.4 K at 0.474 at % Sn. Tammann reported that the m.p. of Hg was 244 K, as compared to the true m.p. of 234.13 K; it is the opinion of the evaluators that Tammann inadvertently misstated the m.p., and that his experimental value was 234 K.

Heycock and Neville (2) studied this system in the tin-rich region and found the continuous decrease in the m.p. with addition of up to 9.29 at % Hg; the m.p. was 486.21 K at 9.29 at % Hg.

The first extensive phase diagram studies of the Sn-Hg system were reported by Pushin (3) and by Van Heteren (4). Both authors used thermal analysis to determine the crystallization temperatures over the complete composition range, and there was excellent agreement in the liquidus temperatures. The liquidus curve in Hansen's phase diagram (5) is based mainly on these data. More recent determinations of the liquidus by thermal analysis (6-11) and by EMF measurements of concentration cells (9,12,13) confirm the validity of the liquidus curve obtained by Pushin and by Van Heteren. However, Hansen's phase diagram has been revised by Hultgren et al. (14) because of the more recent determinations (11) of the compositions in the solid phases in the Sn-rich region.

The solubility of tin also has been determined at selected temperatures by chemical analyses of the equilibrium liquid phase. Gouy (15) reported the first determination of the solubility of tin near room temperature. Van Heteren (4) and Haring and White (16) obtained a solubility of 1.21 and 1.263 at %, respectively, at 298 K, while Joyner (17) found a solubility of 1.24 at % Sn at 298.6 K. Bennett and Lewis (18) found the solubility at 303 and 313 K to be 1.43 and 1.76 at %, respectively. Filippova and coworkers (19,20) determined the solubility of 1.29 at % at 298 K by calorimetry.

The solubility of gray and white tin in mercury was determined by Van Lent (21); in the temperature range of 239.6 to 273.2 K it was found that the solubility difference between these two forms of tin may be as high as 10%. The author suggests that some of the discrepancies in the previously reported solubilities in this low temperature range may be attributed to the difference in solubility between the two forms of tin.

Strachan and Harris (22) determined the solubility of 0.256 at % at room temperature. Campbell and Carter (23) reported that the solubility of tin increased from 0.28 to 3.65 at % in the temperature range of 303 to 343 K, while Shalaevskaya and coworkers (24) found that the solubility increased from 2.59 to 3.86 at % in the range of 295 to 333 K. Kozin (25) estimated a solubility of 17.02 at % at 298 K. The values from (24,25) are rejected because the solubilities are either too high or too low.

The Sn-Hg phase diagram is shown in Fig. 1 (14).

(continued next page)

COMPONENTS:	EVALUATOR:
(1) Tin; Sn; [7440-31-5] (2) Mercury; Hg; [7439-97-6]	C. Guminski; Z. Galus Department of Chemistry University of Warsaw Warsaw, Poland July, 1985

CRITICAL EVALUATION: (continued)

Recommended (r) and tentative values of the solubility of tin in mercury:

T/K	Soly/at %	Reference
238	0.23 (gray Sn)[a]	[21]
238	0.26 (white Sn)[a]	[21]
253	0.35 (gray Sn)	[21]
253	0.38 (white Sn) (r)[b]	[4,9,21]
263	0.47 (gray Sn)	[21]
263	0.49 (white Sn) (r)	[9,21]
266	0.54 (white Sn)	[21]
273	0.66 (r)	[9,13,21]
293	1.05 (r)[b]	[4,9,12,13,17]
298.2	1.26 (r)	[9,12,13,16,17,19,20]
323	2.4 (r)[b]	[9,12,13,18]
373	30 (r)	[3,4,7-10]
473	84 (r)	[3,4,7,8,10]

[a] Extrapolated value from data of cited references.

[b] Interpolated value from data of cited references.

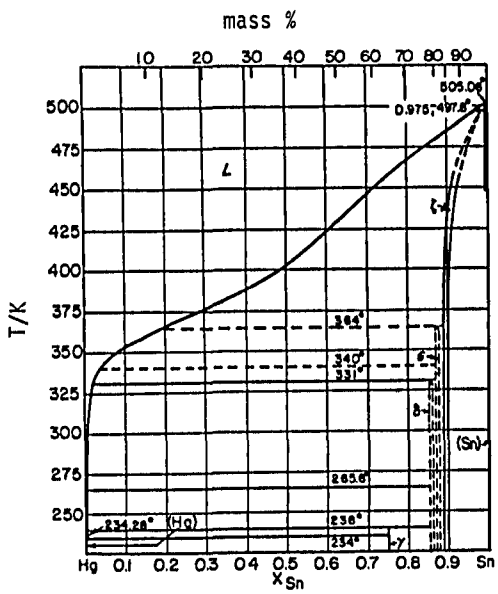

Fig. 1. Sn-Hg system (14)

(continued next page)

COMPONENTS:	EVALUATOR:
(1) Tin; Sn; [7440-31-5] (2) Mercury; Hg; [7439-97-6]	C. Guminski; Z. Galus Department of Chemistry University of Warsaw Warsaw, Poland July, 1985

CRITICAL EVALUATION:

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COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Tin; Sn; [7440-31-5] (2) Mercury; Hg; [7439-97-6]	Tammann, G. *Z. Phys. Chem.* 1889, *3*, 441-9.
VARIABLES: Temperature	**PREPARED BY:** C. Guminski; Z. Galus

EXPERIMENTAL VALUES:

Elevation of the melting point of Hg, ΔT/K, upon addition of tin:

ΔT/K	mass %	at %[a]
0.60	0.063	0.106
1.1	0.148	0.250
2.1	0.219	0.369
2.4	0.281	0.474

[a] by compilers.

Solubilities at Sn content higher than 0.25 at % are erroneous (compilers).

The melting point of Hg was reported to be 244 instead of 234 K, but it is the opinion of the compilers that the former value was a typographical error in the original publication.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The melting temperatures were determined. No further details were given.

SOURCE AND PURITY OF MATERIALS:

Nothing specified.

ESTIMATED ERROR:

Soly: nothing specified.

Temp: precision better than ± 0.1 K.

REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Tin; Sn; [7440-31-5] (2) Mercury; Hg; [7439-97-6]	Heycock, C.T.; Neville, F.H. *J. Chem. Soc.* 1890, *57*, 376-93.
VARIABLES: Temperature: 213-231°C	**PREPARED BY:** C. Guminski; Z. Galus

EXPERIMENTAL VALUES:

Crystallization temperatures of tin amalgams:

t/°C	at Hg/100 at Sn	at % Sn
231.4	0.0911	99.91
231.2	0.1809	99.82
230.89	0.3127	99.69
230.22	0.5889	99.41
229.05	1.078	98.93
227.53	1.7256	98.30
225.05	2.772	97.30
223.07	3.886	96.25
219.39	6.141	94.21
214.62	9.21	91.57
213.06	10.24	90.71

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The experiments were performed in heavy iron blocks, and the amalgams were protected from the atmosphere by a surface layer of paraffin. The melting temperatures were determined with calibrated mercury thermometers.

SOURCE AND PURITY OF MATERIALS:

Nothing specified.

ESTIMATED ERROR:

Soly: nothing specified.

Temp: precision probably ± 0.05 K (compilers).

REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Tin; Sn; [7440-31-5] (2) Mercury; Hg; [7439-97-6]	Pushin, N.A. *Zh. Russ. Fiz. Khim. Obshch., Ser. Khim.* 1902, *34*, 856-78. *Z. Anorg. Chem.* 1903, *36*, 201-54.
VARIABLES: Temperature: 25-229°C	**PREPARED BY:** C. Guminski; Z. Galus

EXPERIMENTAL VALUES:

Crystallization temperature of tin amalgams:

t/°C	at % Hg	t/°C	at % Hg	t/°C	at % Hg
229.4	0.7	170.5	30.9	101.5	69.2
227	1.7	166	33.2	98	71.5
224	3.0	159.2	36.2	97	73.3
221	4.8	152	40.0	93.5	74.6
218.2	6.3	140.5	45.7	88.7	80.0
215.5	7.8	132.5	50.0	81.5	87.4
211.7	10.0	122.7	54.6		
207.5	12.1	117.5	58.2		
199.7	16.2	114	60.1		
192.5	20.0	108	63.8		
185.2	23.5	105	66.7		
180	26.4	102	68.2		

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:	SOURCE AND PURITY OF MATERIALS:
The amalgams were obtained by mixing and heating the metals together. The experiments were carried out under paraffin or vaseline, and the cooling curves were recorded.	Nothing specified.
	ESTIMATED ERROR: Soly: nothing specified. Temp: precision ± 0.5 K.
	REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Tin; Sn; [7440-31-5] (2) Mercury; Hg; [7439-97-6]	Van Heteren, W.J. *Z. Anorg. Chem.* 1904, *42*, 129-73.
VARIABLES: Temperature: (-37)-212°C	**PREPARED BY:** C. Guminski; Z. Galus

EXPERIMENTAL VALUES:

Liquidus temperatures of the Sn-Hg system:

t/°C	at % Sn	t/°C	at % Sn
-37.7	0.05	99.0	28.96
-36.8	0.1	102.4	31.87
-35.6	0.2	103.4	32.46
-34.35	0.3	107.4	35.33
65.2	5.17	115.2	40.27
79.7	10.79	133.4	49.99
88.4	18.11	155.2	61.44
90.0	20.37	173.0	70.31
94.0	24.53	183.7	76.62
95.4	25.23	198.55	82.84
98.75	28.45	211.6	89.95

The following solubilities of Sn in Hg were also reported:

t/°C	Soly/at %
-18.8	0.36
0	0.59
15	0.97
25	1.21

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The amalgams were prepared from weighed amounts of the metals in CO_2 atmosphere. The liquid fraction of the amalgam was filtered into a separate glass tube and covered with paraffin or ricin oil. The amalgams were heated and cooling curves were recorded with the use of a recording thermometer at the higher temperatures, and with a toluol thermometer at the lower temperatures. In the solubility measurements, the amalgams were filtered through a chamois skin. The samples were weighed and analyzed; tin was probably determined gravimetrically as SnO_2 (compilers).

SOURCE AND PURITY OF MATERIALS:

Mercury was twice-distilled under vacuum.

Tin from Bankazinn contained traces of lead; it was melted, washed and dried before use.

ESTIMATED ERROR:

Soly: nothing specified.

Temp: precision better than ± 0.5 K (compilers).

REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Tin; Sn; [7440-31-5] (2) Mercury; Hg; [7439-97-6]	Joyner, R.A. *J. Chem. Soc.* 1911, 195-205.
VARIABLES: Temperature: 14-163°C	**PREPARED BY:** C. Guminski; Z. Galus

EXPERIMENTAL VALUES:

The solubility of tin in mercury:

t/°C	Soly/at % Sn
14.0	1.05
25.4	1.24
63.2	4.04
90.0	18.0
163.0	66.7

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Amalgam was prepared by combining Sn filings with Hg in sealed tubes containing H_2, then heating the tubes in a thermostat. Liquid phase was pipetted through glass-wool filter, and weighed sample was analyzed gravimetrically for Sn as the oxide.

SOURCE AND PURITY OF MATERIALS:

Commercial Sn was dissolved in HCl, and the crystallized $SnCl_2$ was treated with HNO_3 to be converted to metastannic acid. The latter was dried and reduced to Sn with coal gas or H_2. The finely divided Sn was then fused under KCN and cast into bars.

Mercury purity not specified.

ESTIMATED ERROR:

Soly: precision probably no better than ± 0.5% (compilers).

Temp: precision better than ± 0.1 K (compilers).

REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Tin; Sn; [7440-31-5] (2) Mercury; Hg; [7439-97-6]	Honda, K.; Ishigaka, T. *Sci. Rep. Tohoku Univ.* 1925, *14*, 219-32.
VARIABLES:	**PREPARED BY:**
Temperature: 508 K	C. Guminski; Z. Galus

EXPERIMENTAL VALUES:

Depression of freezing point of tin amalgam containing 1 at % of mercury was determined to be 3.04 K. The melting temperature of pure tin was assumed to be 505.0 K.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The usual method of thermal analysis was used. The alloys to be tested were melted in an alundum tube. The melts were protected from oxidation with a thick layer of asbestos wool which was covered with paraffin or vaseline. Temperatures were measured with a copper-constantan thermocouple.

SOURCE AND PURITY OF MATERIALS:

Metals probably were extra pure grade from Merck (compilers).

ESTIMATED ERROR:

Soly: nothing specified.

Temp: precision better than $\pm$ 0.05 K.

REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Tin; Sn; [7440-31-5] (2) Mercury; Hg; [7439-97-6]	Gayler, M.L.V. *J. Inst. Metals* 1937, *60*, 379-406.
VARIABLES: Temperature: 75-230°C	**PREPARED BY:** C. Guminski; A. Galus

EXPERIMENTAL VALUES:

Gayler presented a phase diagram based mainly on the unpublished data of Prytherch (1) and of Van Heteren (2), with three points from the author's own measurements. The mass % liquidus data points were read from the curve and converted to atomic % by the compilers.

t/°C	mass %	at %	t/°C	mass %	at %	t/°C	mass %	at %
75	5.2	8.5	124	35.4	48.1	222	94.0	96.4
85	10.0	15.8	174	60.0	71.7	228	96.5	97.9
90	13.0	20.2	181	70.0	79.8	229	97.6	98.6
94	17.2	26.0	199	75.8	84.1	230	99.0	99.4
107	25.3	36.4	210	83.2	89.3	93-104[a]	20	30
108	27.2	38.7	215	88.0	92.5	102-112[a]	30	42
						151-157[a]	50	63

[a] Data of Gayler.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The amalgams were prepared from the pure metals. The alloys were placed in silica tubes and sealed in an atmosphere of dry hydrogen. The cooling and heating curves were recorded with the use of thermocouples. Prytherch's method is not specified in detail, but he also applied thermal analysis.

SOURCE AND PURITY OF MATERIALS:

Chemically pure tin contained a trace of iron.

Mercury was chemically purified and redistilled.

ESTIMATED ERROR:

Nothing specified.

REFERENCES:

1. Prytherch, W.E.
Unpublished work cited by Gayler in this paper.

2. Van Heteren, W.J.
Z. Anorg. Chem. 1904, *42*, 129-73.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Tin; Sn; [7440-31-5] (2) Mercury; Hg; [7439-97-6]	Haring, M.M.; White, J.C. *Trans. Electrochem. Soc.* 1938, *73*, 211-21.
VARIABLES:	**PREPARED BY:**
One temperature: 25°C	C. Guminski; Z. Galus

EXPERIMENTAL VALUES:

The solubility of tin in mercury at 25°C was reported to be 1.263 at %.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Known quantities of tin and mercury were placed in a flask with a few milliliters of 0.06 mol dm^{-3} HCl; the latter solvent was used to remove the oxide film on the tin. The flask was heated in a beaker of boiling water with shaking. The hot amalgam was then rapidly passed through two capillaries into an air-free cell through a special funnel. The double filtration in the capillaries removed any solid amalgam and traces of oxide. A known quantity of amalgam was dissolved in conc. HNO_3, evaporated to dryness, heated to drive off the Hg, then ignited to constant weight to determine the Sn as the oxide.

SOURCE AND PURITY OF MATERIALS:

Mercury was sprayed through a column of 1.0 mol dm^{-3} HNO_3 and $Hg_2(NO_3)_2$, then dried, and twice distilled.

Tin was prepared by electrolysis of stannous chloride in hydrochloric acid.

ESTIMATED ERROR:

Soly: precision ± 0.2%.

Temp: precision ± 0.02 K.

REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Tin; Sn; [7440-31-5] (2) Mercury; Hg; [7439-97-6]	Bennett, J.A.R.; Lewis, J.B. *J. Chim. Phys.* 1958, *55*, 83-7. *Am. Inst. Chem. Eng. J.* 1958, *4*, 418-22.
VARIABLES: Temperature: 30-40°C	**PREPARED BY:** C. Guminski; Z. Galus

EXPERIMENTAL VALUES:

The solubility of tin in mercury at 30 and 40°C was reported to be 0.85 and 1.05 mass %.

The corresponding atomic % solubilities calculated by the compilers are 1.43 and 1.76 at %, respectively.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The Sn amalgams were prepared by dissolution of rotating Sn cylinders in Hg. The dissolution vessel was mounted inside a glove box filled with pure argon. The amalgam samples were analyzed by distilling out the Hg at 573 K in a nitrogen atmosphere. The sample and the residue were weighed for analysis.

SOURCE AND PURITY OF MATERIALS:

Metal purities were 99.99%.

ESTIMATED ERROR:

Soly: nothing specified.

Temp: precision $\pm$ 0.2 K.

REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Tin; Sn; [7440-31-5] (2) Mercury; Hg; [7439-97-6]	Van Lent, P.H. *Acta Met.* 1961, *9*, 125-28.
VARIABLES:	**PREPARED BY:**
Temperature: (-34)-0°C	C. Guminski; Z. Galus

EXPERIMENTAL VALUES:

Solubility of gray and white tin in mercury:

t/°C	Sn (gray) Soly/at %	Sn (white) Soly/at %
-33.6	0.243 ± 0.001	0.269 ± 0.002
-21.6	0.344	0.369 ± 0.002
-10.6	0.467 ± 0.004	0.492 ± 0.002
-6.55	0.566 ± 0.002	0.560 ± 0.001
0.00	0.659 ± 0.003	0.656

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Amalgams were prepared by adding Sn powder to Hg which was contained in a stoppered tube. The gray Sn amalgam was prepared at -40°C, then stored at -20°C for 12 hours. The white Sn amalgam was prepared and stored at room temperature. The equilibrations were made by suspending the amalgam tubes in a dewar tube which contained various salt-water eutectic mixtures. The tubes were vigorously agitated for 8 hours, then 40 g of the amalgam solution was removed, and the Sn was determined gravimetrically as SnO_2.

SOURCE AND PURITY OF MATERIALS:

Mercury was purified by air oxidation of impurities and vacuum distilled.

Tin purity not specified.

ESTIMATED ERROR:

Soly: precision better than ± 1%.

Temp: precision better than ± 0.1 K.

REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Tin; Sn; [7440-31-5] (2) Mercury; Hg; [7439-97-6]	Taylor, D.F.; Burns, C.L. *J. Res. Nat. Bur. Stand.* 1963, *67A*, 55-70.
VARIABLES:	**PREPARED BY:**
Temperature: 99-230°C	C. Guminski; Z. Galus

EXPERIMENTAL VALUES:

Liquidus temperatures of mercury-tin alloys:

t/°C	at % Sn	t/°C	at % Sn
231.9	100.0	204.0	87.11
230.1	98.81	203.2	85.72
222.9	96.97	199.5	84.29
219.3	95.74	197.5	82.04
218.4	93.83	191.6	79.85
216.0	92.53	176.1	71.72
214.4	91.22	157.5	62.83
212.8	89.86	139.0	52.98
208.3	88.53	118.9	42.01
208.4	88.50	99.0	29.70

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Weighed amounts of Sn and Hg were sealed in Pyrex tubes provided with reentrant thermocouple wells. Before sealing, the tubes were repeatedly evacuated and flushed with dry H_2 and finally sealed with a residual H_2 pressure of 2-5 torr. The alloys were homogenized by heating to 250°C and holding for at least 1 hour, then quenched in water at 20-25°C. Heating and cooling curves were recorded as soon as possible after annealing by measuring the temperature of the alloy, and the differential temperature of the alloy vs. pure Hg. A minimum of six heating-cooling runs were made on each composition.

Tin-rich Alloys

Constant temperature diffusion followed by serial sectioning and analyses were carried out to identify the various phases and their compositions in high Sn alloys (max. t/°C = 110). Hg analysis was by modification of that of Crawford and Larson (1): known weight of sample was heated in vacuum at 500°C and Hg determined by the weight loss. X-ray diffraction studies on these alloys also reported.

SOURCE AND PURITY OF MATERIALS:

Refined Hg from N.B.S. contained <1.1 mg/kg metallic impurity.

Baker and Adamson reagent grade tin sticks and tin from Consolidated Mining and Smelting Company of Canada Limited were used.

Analyses of tin specimens were given.

ESTIMATED ERROR:

Soly: nothing specified.

Temp: precision ± 0.5 K.

REFERENCES:

1. Crawford, W.H.; Larson, J.H.
J. Dental Research 1955, *34*, 313.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Tin; Sn; [7440-31-5] (2) Mercury; Hg; [7439-97-6]	Petot-Ervas, G.; Caillet, M.; Desrè, P. *C.R. Acad. Sci., Ser. 2* 1967, *264*, 490-3.
VARIABLES: Temperature: (-35)-192°C	**PREPARED BY:** C. Guminski; Z. Galus

EXPERIMENTAL VALUES:

Solubility of tin in mercury at various temperatures; data in first four columns by EMF measurements, and last two columns by thermal analysis:

t/°C	Soly/at %	t/°C	Soly/at %	t/°C	Soly/at %
54	2.5	-35.4	0.16	79	9
61	3.0	-28.4	0.29	147	57
67.5	4.0	-17.9	0.41	192	80
70	5.0	-8.4	0.52		
78	8.0	1.1	0.65		
85	15	16.5[a]	0.97±0.02		
92	20	26[a]	1.27±0.02		
103	30	30[a]	1.40±0.03		
108.5	35	40[a]	1.88±0.02		
113.5	40	50[a]	2.59±0.04		
123	45	60[a]	3.34±0.02		
129	50	72[a]	5.6±0.5		
142.5	55				

[a] Previously published in refs. (1) and (2).

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Measurements of the EMF of the cell,

$$Sn|Sn(II)|Sn(Hg),$$

were performed in an argon atmosphere. At temperatures below 200°C the electrolytes were $SnCl_2$-NH_4Cl and $SnCl_2$-LiCl in water or glycerine. At temperatures above 200°C EMF measurements were made by using the molten electrolyte, $SnCl_2$-$ZnCl_2$-KCl-LiCl. Solubility corresponds to breakpoint of EMF vs. log (concentration). Method of thermal analysis is not described in detail.

SOURCE AND PURITY OF MATERIALS:

Not specified.

ESTIMATED ERROR:

Soly: precision better than ± 2%.

Temp: precision ± 0.1 K for EMF measurements.

REFERENCES:

1. Bonnier, E.; Desrè, P.; Petot-Ervas, G. *C.R. Acad. Sci., Ser. 2* 1962, *255*, 2432-4.

2. Petot-Ervas, G.; Desrè, P.; Bonnier, E. *Bull. Soc. Chim. Fr.* 1967, 1261-4.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Tin; Sn; [7440-31-5] (2) Mercury; Hg; [7439-97-6]	Yan-Sho-Syan, G.V.; Semibratova, N.M.; Nosek, M.V. *Tr. Inst. Khim. Nauk Akad. Nauk Kaz. SSR* 1969, *24*, 120-7.
VARIABLES:	PREPARED BY:
Temperature: 70-215°C	C. Guminski; Z. Galus

EXPERIMENTAL VALUES:

Liquidus temperatures of tin-mercury alloys:

t/°C	Soly/at %
70	10.0
84	20.0
102	30.0
115	40.0
130	50.0
150	60.0
173	70.0
182	75.0
193	80.0
201	85.0
215	90.0

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Thermal analysis was used in the determination of liquidus temperatures. The procedure was probably the same as described in (1).

SOURCE AND PURITY OF MATERIALS:

Mercury was chemically purified and then twice-distilled under vacuum.

Tin purity was 99.9998%.

ESTIMATED ERROR:

Soly: nothing specified.

Temp: precision ± 1 K.

REFERENCES:

1. Yan-Sho-Syan, G.V.; Nosek, M.V.; Semibratova, N.M.; Shalamov, A.E.
Tr. Inst. Khim. Nauk Akad. Nauk Kaz. SSR 1967, *15*, 139-49.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Tin; Sn; [7440-31-5] (2) Mercury; Hg; [7439-97-6]	Predel, B.; Rothacker, D. *Acta Met.* 1969, *17*, 783-91.
VARIABLES:	**PREPARED BY:**
Temperature: 209-230°C	C. Guminski; Z. Galus

EXPERIMENTAL VALUES:

The authors present a revised phase diagram for the composition range of 87.5-100 at % Sn. The solubilities were read from the liquidus line by the compilers:

t/°C	Soly/at %	t/°C	Soly/at %
230.3	99.3	219.7	94.5
228.4	98.8	218.6	93.7
226.6	98.1	217.6	93.4
224.7	97.5	215.4	91.9
221.8	96.4	213.6	91.5
221.6	96.0	212.1	90.6
221.2	95.5	211.4	90.1
220.9	95.1	210.0	89.1
222.8	97.0	209.5	88.5

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The amalgams were prepared from weighed amounts of the metals, then differential thermal analysis curves were recorded to determine the liquidus points.

SOURCE AND PURITY OF MATERIALS:

Tin was 99.999% pure.

Mercury was 99.9995% pure.

ESTIMATED ERROR:

Nothing specified.

REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Tin; Sn; [7440-31-5] (2) Mercury; Hg; [7439-97-6]	Filippova, L.M.; Zebreva, A.I.; Zhumakanov, V.Z. *Ukr. Khim. Zh.* 1981, *47*, 473-6. *Izv. Vyssh. Ucheb. Zaved., Khim. Khim. Tekhnol.* 1982, *25*, 827-9.
VARIABLES:	PREPARED BY:
One temperature: 298 K	C. Guminski; Z. Galus

EXPERIMENTAL VALUES:

The solubility of tin in mercury at 298 K was reported to be 0.87 ± 0.06 mol dm^{-3}. The corresponding atomic % solubility calculated by the compilers is 1.29 at %.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The heterogeneous amalgam was prepared by mixing weighed amounts of the metals. Heat effect, Q, was measured directly during thermometric titration when subsequent portions of mercury were added to the amalgam. The inflection point on the plot of Q vs. amalgam concentration of tin corresponded to the solubility of tin in mercury. Experiments were performed in argon atmosphere.

SOURCE AND PURITY OF MATERIALS:

Source and purity of Sn and Hg not specified.

Argon was of "A" class purity.

ESTIMATED ERROR:

Soly: precision ± 7%.

Temp: not specified.

REFERENCES:

COMPONENTS:	EVALUATOR:
(1) Lead; Pb; [7439-92-1] (2) Mercury; Hg; [7439-97-6]	C. Guminski; Z. Galus Department of Chemistry University of Warsaw Warsaw, Poland July, 1985

CRITICAL EVALUATION:

Tammann (1) was the first to report on the solubility of lead in mercury by determining the freezing point upon addition of small quantities of lead to mercury. At a lead concentration of 0.347 at % he found that the melting point of mercury was elevated by 1.30 K.

Pushin (2) and Jänecke (3) determined the crystallization temperatures of lead amalgams over nearly the complete composition range with good agreement. The major portion of the liquidus for the phase diagram (4) of this system, Fig. 1, is based upon the data of these authors. Yan-Sho-Syan and coworkers (5) performed exhaustive thermographic experiments and their liquidus line in the composition range of 0-65 at % Pb differs significantly from that of the previous (2-4) and some subsequent results.

A number of workers have reported solubility determinations over narrow composition ranges, especially for those near room temperature. Thompson (6) employed a filtration method to obtain a solubility in the temperature range of 293-342 K, and the interpolation of his data yields a solubility of 1.63 at % at 298 K. This solubility is in good agreement with the carefully determined value of 1.65 at % which was obtained by Haring et al. (7) from EMF measurements. Filippova et al. (8,9), from thermometric titration, also determined a solubility of 1.65 at % at 298 K. These three determinations at 298 K are considered to be the most accurate at this temperature. The solubility of 1.42 at % determined by EMF measurements (10) is considered too low by the evaluators.

Gouy (11) reported a lead solubility of 1.3 at % at 288-291 K, while Jangg and Kirchmayr (12) determined a solubility of 1.35 at % at 288 K. The latter value is in good agreement with the extrapolated data of (6). Moshkevich and Ravdel (13) determined the solubility of lead in the Hg-rich region, at 237-323 K, by observing the decrease in weight of a lead disc which was rotated in a known quantity of mercury. These authors' results were in good agreement with the acceptable solubilities reported by other workers (6-9,12).

There have been other reports of the solubility in the Hg-rich region, but these solubilities are rejected because they are either too low (1.05 at % at room temperature (14), 0.99 at % at 293 K (15), 1.16 at % at 291 K (16), and a set of points on the liquidus line shifted down to 303 K in the 64-95 at % range (17)), or too high (1.9 at % in the temperature range of 273-302 K (18) and higher than 1.00 at % at 273 K (19)). Kozin's estimate (20) of the 298 K solubility of lead in mercury, 26.9 at %, is clearly too high.

Heycock and Neville (21) determined the solubility in the Pb-rich region by observing the freezing point depression of lead by addition of up to 6.08 at % of mercury. Ishigaki and Honda (22) similarly determined the freezing point depression of lead upon addition of 1.0 and 2.0 at % Hg. The results of the measurements by both groups of authors agreed with the data of Pushin (2), and Jänecke (3).

As shown in Fig. 1 (4), the saturated amalgams are in equilibrium with either Pb or Pb_2Hg. However, the phase diagram is not yet completely clear.

(continued next page)

COMPONENTS:	EVALUATOR:
(1) Lead; Pb; [7439-92-1] (2) Mercury; Hg; [7439-97-6]	C. Guminski; Z. Galus Department of Chemistry University of Warsaw Warsaw, Poland July, 1985

CRITICAL EVALUATION: (continued)

Recommended (r) and tentative values of the solubility of lead:

T/K	Soly/at %	Reference
237	0.44	[13]
258	0.73	[13]
273	0.96	[13]
293.2	1.47 (r)[b]	[6,13]
298.2	1.63 (r)[a]	[7-9,13]
323	2.7 (r)[a]	[6,13]
373	13[a]	[2,3,5]
473	63[a]	[2,5]
573	93 (r)[b]	[2,3,5,21]

[a] mean value from cited references.

[b] Interpolated value from data of cited references.

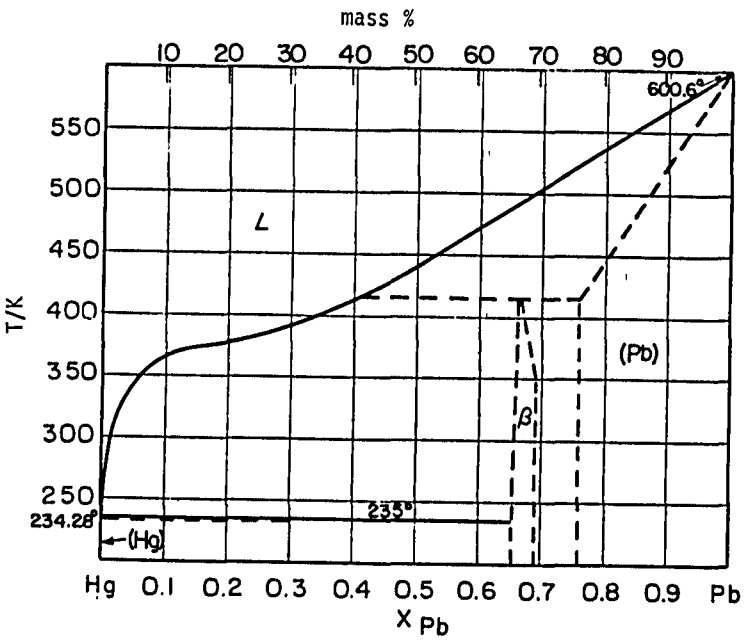

Fig. 1. The Pb-Hg system (4)

(continued next page)

COMPONENTS:	EVALUATOR:
(1) Lead; Pb; [7439-92-1] (2) Mercury; Hg; [7439-97-6]	C. Guminski; Z. Galus Department of Chemistry University of Warsaw Warsaw, Poland July, 1985

CRITICAL EVALUATION: (continued)

References

1. Tammann, G. *Z. Phys. Chem.* 1889, *3*, 441.
2. Pushin, N. *Zh. Russ. Fiz. Khim. Obshch., Ser. Khim.* 1902, *34*, 856; *Z. Anorg. Chem.* 1903, *36*, 201.
3. Jänecke, E. *Z. Phys. Chem.* 1907, *60*, 400.
4. Hultgren, R.; Desai, P.D.; Hawkins, D.T.; Gleiser, M.; Kelley, K.K. *Selected Values of the Thermodynamic Properties of Binary Alloys*, Am. Soc. Metals, Metals Park, OH 1973, p. 971.
5. Yan-Sho-Syan, G.V.; Nosek, M.V.; Semibratova, N.M.; Shalamov, A.E. *Tr. Inst. Khim. Nauk Akad. Nauk Kaz. SSR* 1967, *15*, 139.
6. Thompson, H.E. *J. Phys. Chem.* 1935, *39*, 655.
7. Haring, M.M.; Hatfield, M.R.; Zapponi, P.P. *Trans. Electrochem. Soc.* 1939, *75*, 473.
8. Filippova, L.M.; Gayfullin, A.Sh.; Zebreva. A.I. *Prikl. Teor. Khim.*, Alma-Ata 1974, No. 5, 76.
9. Filippova, L.M.; Zebreva, A.I.; Korobkina, N.P. *Ukr. Khim. Zh.* 1978, *44*, 791.
10. Hoyt, C.S.; Stegman, G. *J. Phys. Chem.* 1934, *38*, 753.
11. Gouy, M. *J. Phys.* 1895, *4*, 320.
12. Jangg, G.; Kirchmayr, H. *Z. Chem.* 1963, *3*, 47.
13. Moshkevich, A.S.; Ravdel, A.A. *Zh. Prikl. Khim.* 1970, *43*, 71.
14. Strachan, J.F.; Harris, N.L. *J. Inst. Metals* 1956-57, *85*, 17.
15. Nigmatullina, A.A.; Zebreva, A.I. *Izv. Akad. Nauk Kaz. SSR, Ser. Khim.* 1965, *15*, No. 2, 20.
16. Spencer, J.F. *Z. Elektrochem.* 1905, *11*, 683.
17. Fay, H.; North, E. *Am. Chem. J.* 1901, *25*, 216.
18. Babinski, J.J.; cited by G. Timofeyev, *Z. Phys. Chem.* 1912, *78*, 304.
19. Richards, T.W.; Garrod-Thomas, R.N. *Z. Phys. Chem.* 1910, *72*, 165.
20. Kozin, L.F. *Fiziko-Khimicheskie Osnovy Amalgamnoi Metallurgii*, Nauka, Alma-Ata, 1964.
21. Heycock, C.T.; Neville, F.H. *J. Chem. Soc.* 1892, *61*, 888.
22. Honda, K.; Ishigaki, T. *Sci. Rep. Tohoku Univer.* 1925, *14*, 219.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Lead; Pb; [7439-92-1] (2) Mercury; Hg; [7439-97-6]	Tammann, G. *Z. Phys. Chem.* 1889, *3*, 441-9.
VARIABLES: Temperature	**PREPARED BY:** C. Guminski; Z. Galus

EXPERIMENTAL VALUES:

Elevation of the melting point of mercury, ΔT/K, upon addition of small amounts of lead:

ΔT/K	g Pb/100 g Hg	at % Pb[a]
-0.02	0.015	0.015
+0.027	0.070	0.068
+0.37	0.172	0.166
+0.89	0.247	0.239
+1.24	0.333	0.322
+1.30	0.359	0.347

[a] by compilers.

The melting point of Hg was reported to be 244 instead of 234 K, but it is the opinion of the compilers that the former value was a typographical error in the original publication.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The melting temperatures of the amalgams were determined. No further details were given.

SOURCE AND PURITY OF MATERIALS:

Nothing specified.

ESTIMATED ERROR:

Soly: nothing specified.

Temp: precision $\pm$ 0.05 K.

REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Lead; Pb; [7439-92-1] (2) Mercury; Hg; [7439-97-6]	Heycock, T.C.; Neville, F.H. *J. Chem. Soc.* 1892, *61*, 888-914.
VARIABLES:	**PREPARED BY:**
Temperature: 304-323°C	C. Guminski; Z. Galus

EXPERIMENTAL VALUES:

Freezing points of lead amalgams:

t/°C	atom Hg/100 at Pb	at % Hg[a]
323.89	0.729	0.724
315.48	3.29	3.18
304.69	6.74	6.08

[a] by compilers.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Weighed quantities of the metals were placed in a hard glass tube then evacuated prior to sealing. The tube was heated to a red heat and well shaken. Temperatures of crystallization were measured with calibrated thermometers.

SOURCE AND PURITY OF MATERIALS:

Not specified.

ESTIMATED ERROR:

Soly: nothing specified.

Temp: precision probably better than ± 0.05 K (compilers).

REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Lead; Pb; [7439-92-1] (2) Mercury; Hg; [7439-97-6]	Pushin, N.A. *Zh. Russ. Fiz. Khim. Obshch., Ser. Khim.* 1902, *34*, 856-78. *Z. Anorg. Chem.* 1903, *36*, 201-54.
VARIABLES: Temperature: 23-318°C	**PREPARED BY:** C. Guminski; Z. Galus

EXPERIMENTAL VALUES:

Crystallization temperatures of lead amalgams:

t/°C	at % Hg	t/°C	at % Hg	t/°C	at % Hg
318.5	2.6	189.5	40.6	116.75	70.8
305.25	6.3	179	44.1	110.5	75.0
288	11.0	∿174	46.2	104.5	79.9
267.5	16.6	162.5	50.0	101	83.0
247	22.6	155.5	52.6	96.75	86.4
241	24.5	149.5	54.7	90.75	89.7
232	27.0	137	60.0	∿84	92.7
222.75	29.9	129.5	63.5	∿71	95.0
212	33.33	123.5	66.7	∿50	96.7
204	35.8	120.2	68.4	<23	98.2
191.5	39.8				

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The amalgams were obtained by mixing the metals, followed by heating. The cooling curves were recorded. The experiments were carried out under paraffin or vaseline.

SOURCE AND PURITY OF MATERIALS:

Nothing specified.

ESTIMATED ERROR:

Soly: nothing specified.

Temp: precision ± 0.5 K.

REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Lead; Pb; [7439-92-1] (2) Mercury; Hg; [7439-97-6]	Jänecke, E.J. *Z. Phys. Chem.* 1907, *60*, 399-412.
VARIABLES: Temperature: 106-307°C	**PREPARED BY:** C. Guminski; Z. Galus

EXPERIMENTAL VALUES:

Temperatures of crystallization:

t/°C	at % Hg
307	5
293	9
278	13
264	16.5
252	20
236	25
224	28.5
210	33.5
161	50
124	66.5
106	80

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The cooling of the amalgams was measured with mercury thermometers or thermo-elements, and microscopic observations were carried out in parallel.

SOURCE AND PURITY OF MATERIALS:

Not given.

ESTIMATED ERROR:

Soly: nothing specified.

Temp: precision ± 1 K (compilers).

REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Lead; Pb; [7439-92-1] (2) Mercury; Hg; [7439-97-6]	Honda, K.; Ishigaki, T. *Sci. Rep. Tohoku Univer.* 1925, *14*, 219-232.
VARIABLES:	**PREPARED BY:**
Temperature	C. Guminski; Z. Galus

EXPERIMENTAL VALUES:

Depression of freezing point of lead with 1.0 and 2.0 at % of mercury was reported to be 3.38 and 6.88 K, respectively. The melting point of lead was assumed to be 600.6 K.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The usual method of thermal analysis was used. The alloys to be tested were melted in an alundum tube. The melts were protected from oxidation with a thick layer of asbestos wool, over which paraffin or vaseline was poured. Temperatures were measured with a copper-constantan thermocouple.

SOURCE AND PURITY OF MATERIALS:

Nothing specified, but probably extra pure metals from Merck were used (compilers).

ESTIMATED ERROR:

Soly: nothing specified.

Temp: precision probably $\pm$ 0.05 K (compilers).

REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Lead; Pb; ¼7439-92-1] (2) Mercury; Hg; [7439-97-6]	Hoyt, C.S.; Stegman, G. *J. Phys. Chem.* 1934, *38*, 753-9.
VARIABLES:	**PREPARED BY:**
One temperature: 298 K	C. Guminski; Z. Galus

EXPERIMENTAL VALUES:

Solubility of lead in mercury at 298.16 K was reported to be 1.42 at %.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The amalgam was prepared by adding predetermined amounts of Pb to a known amount of Hg. The mixture was homogenized by warming and agitating in the separatory funnel in which the amalgam was prepared. EMF's of the cell

$Pb(Hg)_{sat} | PbSO_4 | ZnSO_4 | PbSO_4 | xPb(Hg)$

were measured. All operations were performed in hydrogen atmosphere.

SOURCE AND PURITY OF MATERIALS:

Mercury was purified with concentrated H_2SO_4 and then distilled 3 times under reduced pressure.

Lead was Kahlbaum's "for analysis."

ESTIMATED ERROR:

Soly: precision better than 1%.

Temp: precision ± 0.02 K.

REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Lead; Pb; [7439-92-1] (2) Mercury; Hg; [7439-97-6]	Thompson, H.E., Jr. *J. Phys. Chem.* 1935, *39*, 655-64
VARIABLES: Temperature: 19-69°C	**PREPARED BY:** C. Guminski; Z. Galus

EXPERIMENTAL VALUES:

The solubility of lead in mercury:

t/°C	Soly/at %
19.7	1.469
30.7	1.811
39.9	2.203
47.4	2.588
48.2	2.631
60.6	3.438
69.2	4.279

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Both metals were sealed in Pyrex glass tubes at a pressure of about 0.01 mm. Tubes were placed in the thermostat and shaken for several hours to saturate the mercury with lead. Then the homogeneous amalgam was filtered off and analyzed for the content of lead.

The analysis consisted in the vaporization of the mercury from the amalgam and weighing the residue as the amount of metal dissolved.

SOURCE AND PURITY OF MATERIALS:

High purity lead from the U.S. Bureau of Standards. Spectrographic analysis showed that only calcium was present in quantities more than a trace.

Mercury was purified with 6 mol dm^{-3} nitric acid and then triply distilled.

ESTIMATED ERROR:

Soly: precision better than 0.015%.

Temp: precision $\pm$ 0.1 K.

REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Lead; Pb; [7439-92-1] (2) Mercury; Hg; [7439-97-6]	Haring, M.M.; Hatfield, M.R.; Zapponi, P.T. *Trans. Electrochem. Soc.* 1939, *75*, 473-84.
VARIABLES:	**PREPARED BY:**
One temperature: 25°C	C. Guminski; Z. Galus

EXPERIMENTAL VALUES:

The solubility of lead in mercury at 25°C was reported to be 1.650 at %.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Amalgams were prepared electrolytically and the homogeneous amalgams were separated by filtration. The EMF of the amalgam cells enabled the determination of the activity of lead in the saturated amalgams of various concentrations. The standard potential of the lead electrode also was determined. The cell was of the type:

$$(Pt),H_2\,|\,(1\ atm)\,|\,HClO_4\ (xm)\,|\,HClO_4\ (xm) + Pb(ClO_4)_2\ (ym)\,|\,Pb(Hg)$$

where m is the concentration in mol kg^{-1}.

SOURCE AND PURITY OF MATERIALS:

All materials were of reagent grade.

Mercury was purified with dilute nitric acid and mercurous nitrate and then distilled.

ESTIMATED ERROR:

EMF's: precision ± 0.05 mV.

Temp: precision ± 0.02 K.

REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Lead; Pb; [7439-92-1] (2) Mercury; Hg; [7439-97-6]	Jangg, G.; Kirchmayr, H. *Z. Chem.* 1963, *3*, 47-56.
VARIABLES:	**PREPARED BY:**
One temperature: 15°C	C. Guminski; Z. Galus

EXPERIMENTAL VALUES:

The solubility of lead in mercury at 15°C was reported to be about 0.90 mol dm^{-3}. The corresponding atomic % solubility calculated by the compilers is 1.35 at %.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The amalgams were obtained by electrolysis. Potential of the lead amalgam was measured against the constant potential electrode in the cell,

$Pb(Hg)|Pb(CH_3COO)_2||KCl|Hg_2Cl_2$, Hg

The concentration of $Pb(CH_3COO)_2$ was 0.01, 0.1 or 1.0 mol dm^{-3} with addition of 5×10^{-3} mol dm^{-3} of CH_3COOH.

The concentration of the saturated amalgam was evaluated from the break in the curve relating potential to the logarithm of the amalgam concentration. The experiments were performed in an inert gas atmosphere.

SOURCE AND PURITY OF MATERIALS:

Nothing specified.

ESTIMATED ERROR:

Soly: precision ± 10% or better.

Temp: nothing specified.

REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Lead; Pb; [7439-92-1] (2) Mercury; Hg; [7439-97-6]	Moshkevich, A.S.; Rav'del, A.A. *Zh. Prikl. Khim.* 1970, *43*, 71-5.
VARIABLES: Temperature: (-36)-50°C	**PREPARED BY:** C. Guminski; Z. Galus

EXPERIMENTAL VALUES:

The solubility of lead in mercury:

t/°C	Soly/mass %	Soly/at %[a]
-36	0.45	0.44
-15	0.75	0.73
0	0.99	0.96
15	1.35	1.31
25	1.62	1.58
50	2.78	2.69

[a] by compilers.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

A lead disk was rotated in a known volume of mercury at a precisely controlled rate.

The concentration of dissolved lead in mercury was determined on the basis of a change of weight of the lead disk. To protect the amalgam against oxidation, it was covered by a layer of glycerine or acetone.

SOURCE AND PURITY OF MATERIALS:

Pure lead used was analyzed by spectral analysis.

Hg purity not specified.

ESTIMATED ERROR:

Soly: precision ± 1-2%.

Temp: precision ± 0.3 K.

REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Lead; Pb; [7439-92-1] (2) Mercury; Hg; [7439-97-6]	Filippova, L.M.; Zebreva, A.I.; Korobkina, N.P. *Ukr. Khim. Zh.* 1978, *44*, 791-3.
VARIABLES:	**PREPARED BY:**
Temperature: 25-40°C	C. Guminski; Z. Galus

EXPERIMENTAL VALUES:

Solubility of lead in mercury at 25 and 40°C was reported to be 1.1 and 1.4 mol dm^{-3}. The corresponding atomic % solubilities calculated by the compilers are 1.65 and 2.1 at %, respectively.

The same result at 25°C was also reported in (1).

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The heterogeneous lead amalgam was obtained by dissolution of lead in mercury. Heats of dilution (Q) of the amalgams of various compositions (heterogeneous and homogenous) were measured upon addition of mercury. A break in the curve of Q vs. N_{Pb} corresponds to the composition of the saturated amalgam. All operations were carried out in an argon atmosphere.

SOURCE AND PURITY OF MATERIALS:

Not given.

ESTIMATED ERROR:

Soly: precision no better than 1%.

Temp: nothing specified.

REFERENCES:

1. Filippova, L.M.; Gayfullin, A.Sh.; Zebreva, A.I.
Prikl. Teor. Khim., Alma-Ata 1974, No. 5, 76-82.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Lead; Pb; [7439-92-1] (2) Mercury; Hg; [7439-97-6]	Yan-Sho-Syan, G.V.; Nosek, M.V.; Semibratova, N.M.; Shalamov, A.E. *Tr. Inst. Khim. Nauk Akad. Nauk Kaz. SSR* 1967, *15*, 139-49.
VARIABLES:	PREPARED BY:
Temperature: 323-590 K	C. Guminski; Z. Galus

EXPERIMENTAL VALUES:

Liquidus temperatures of the Pb-Hg system determined on amalgams with different pretreatment:

	T/K			T/K	
at % Pb	Freshly Prepared and Quenched	Soaked at 623 K for 37 hrs and Quenched	at % Pb	Freshly Prepared and Quenched	Soaked at 623 K for 37 hrs and Quenched
2.5	323	-	50.0	451	445
5.0	365	-	52.5	454	-
7.5	373	370	55.0	458	457
10.0	377	371	57.5	461	-
12.5	388	371	60.0	468	471
15.0	391	378	62.5	474	475
17.5	394	378	65.0	482	-
20.0	394	384	67.5	488	-
22.5	396	-	70.0	494	-
25.0	399	388	72.5	501	-
27.5	404	-	75.0	509	-
30.0	411	398	77.5	519	-
32.5	413	-	82.5	532	-
35.0	-	410	85.0	541	-
37.5	420	-	87.5	553	546
40.0	423	418	90.0	565	551
42.5	433	-	92.5	570	-
45.0	438	429	95.0	583	-
47.5	444	-	97.5	590	-

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:	SOURCE AND PURITY OF MATERIALS:
The alloys were prepared by mixing weighed amounts of lead and mercury. The mixtures were placed in glass tubes and sealed for the different pretreatments of the amalgams. Thermographic analysis was performed to determine the liquidus temperatures. Comments The results for the freshly quenched amalgams are erroneous because of segregation of some fractions of the alloys (compilers). The authors did not specify the temperature from which the freshly prepared samples were quenched.	Mercury was purified chemically and electrochemically, then twice distilled under vacuum. Lead was 99.999% pure with regard to 17 metallic impurities.
	ESTIMATED ERROR: Soly: nothing specified. Temp: precision $\pm$ 3 K.
	REFERENCES: