

<p>COMPONENTS:</p> <p>(1) Vanadium; V; [7440-62-2]  (2) Mercury; Hg; [7439-97-6]</p>	<p>EVALUATOR:</p> <p>C. Guminski; Z. Galus  Department of Chemistry  University of Warsaw  Warsaw, Poland</p> <p>July, 1985</p>
<p>CRITICAL EVALUATION:</p> <p>Tammann and Hinnüber (1) reported that the solubility of vanadium in mercury is very low at 291 K, and Irvin and Russell (2) could only demonstrate that the solubility was lower than their experimentally detectable limit of <math>2 \times 10^{-4}</math> at % at 293 K. Kozin (3) predicted a solubility of <math>4.8 \times 10^{-6}</math> at % at 298 K. Strachan and Harris (4) reported an erroneously high solubility of 0.161 at % at room temperature. No reliable experimental data are available for the solubility of vanadium in mercury near room temperature.</p> <p>At high temperatures, Weeks (5) found that the solubility of vanadium increased from <math>2.4 \times 10^{-5}</math> to <math>5.2 \times 10^{-4}</math> at % as the temperature increased from 778 to 955 K. As compared to (5), Parkman reported lower solubilities of <math>3.2 \times 10^{-5}</math> to <math>1.2 \times 10^{-4}</math> at % between 811 and 911 K (6). In subsequent reports by Parkman and Whaley (7,8), even lower values of <math>1.6 \times 10^{-5}</math> to <math>6 \times 10^{-5}</math> at % were presented for the same temperature range as in (6); the same experimental method was used in (7,8), and the authors did not give any explanation for the lower results in the later measurements. Weeks (5) reported greater confidence in the higher solubilities because of reaction between the silica capsules and the vanadium amalgams.</p> <p>Extrapolation of the high temperature data of refs. (5) to (8) to 298 K yields a solubility of the order of <math>10^{-10}</math> at %. However, it should be noted that the solubilities of (5) and (7) differed by nearly an order of magnitude at 900 K.</p> <p>Because no intermetallic compounds were found in this system, the saturated amalgam should be in equilibrium with solid vanadium (9).</p> <p>The solubility of vanadium-based alloys in mercury also have been reported (6,8).</p> <p>The tentative solubility of vanadium in mercury at 773 K is <math>2 \times 10^{-5}</math> at % (5,6).</p> <p><u>References</u></p> <ol style="list-style-type: none"> <li>1. Tammann, G.; Hinnüber, J. <i>Z. Anorg. Chem.</i> <b>1927</b>, <i>160</i>, 249.</li> <li>2. Irvin, N.M.; Russell, A.S. <i>J. Chem. Soc.</i> <b>1932</b>, 891.</li> <li>3. Kozin, L.F. <i>Fiziko-Khimicheskie Osnovy Amalgamoi Metallurgii</i>, Nauka, Alma-Ata, <b>1964</b>.</li> <li>4. Strachan, J.F.; Harris, N.L. <i>J. Inst. Metals</i> <b>1956-57</b>, <i>85</i>, 17.</li> <li>5. Weeks, J.R. <i>Corrosion</i> <b>1967</b>, <i>23</i>, 98.</li> <li>6. Parkman, M.F. <i>U.S. At. Ener. Comm. Rep.</i>, TID-7626, <b>1962</b>, Pt. I, p. 35.</li> <li>7. Parkman, M.F.; Whaley, D.K. <i>Aerojet-General Nucleonics, Rep. AN-957</i>, <b>1963</b>; cited by (5).</li> <li>8. Parkman, M.F. <i>Ext. Abst., Electrothermics and Metallurgy Div.</i>, Vol. 2, No. 2, The Electrochemical Soc. <b>1964</b>, pp. 16-21.</li> <li>9. Jangg, G. <i>Metall</i> <b>1978</b>, <i>32</i>, 798.</li> </ol>	

<b>COMPONENTS:</b> (1) Vanadium; V; [7440-62-2] (2) Mercury; Hg; [7439-97-6]	<b>ORIGINAL MEASUREMENTS:</b> 1. Parkman, M.F. <i>Extended Abst., Electrothermics and Metallurgy Div., Vol. 2, No. 2, The Electrochemical Soc. 1964, pp. 16-21.</i> 2. Same author <i>U.S. At. Ener. Comm. Rep., TID-7626 1962, Pt. I, pp. 35-41.</i>												
<b>VARIABLES:</b> Temperature: 811-911 K	<b>PREPARED BY:</b> C. Guminski; Z. Galus												
<b>EXPERIMENTAL VALUES:</b> <p>The mass % solubility of vanadium in mercury was reported graphically as a semi-logarithmic plot against the reciprocal temperature. The solubility data points were read off the curve and the conversion made to atomic % by the compilers.</p> <table border="1" data-bbox="384 572 932 725"> <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>811</td> <td><math>4 \times 10^{-6}</math></td> <td><math>1.6 \times 10^{-5}</math></td> </tr> <tr> <td>873</td> <td><math>1.1 \times 10^{-5}</math></td> <td><math>4 \times 10^{-5}</math></td> </tr> <tr> <td>911</td> <td><math>1.5 \times 10^{-5}</math></td> <td><math>6 \times 10^{-5}</math></td> </tr> </tbody> </table> <p>The original data also were reported in ref. (3).          Numerical solubility values reported in (2) were <math>8 \times 10^{-6}</math> and <math>3 \times 10^{-5}</math> mass % at 811 and 911 K, respectively. The corresponding atomic % solubilities calculated by the compilers are <math>3.2 \times 10^{-5}</math> and <math>1.2 \times 10^{-4}</math> at %, respectively.</p>		<u>T/K</u>	<u>Soly/mass %</u>	<u>Soly/at %</u>	811	$4 \times 10^{-6}$	$1.6 \times 10^{-5}$	873	$1.1 \times 10^{-5}$	$4 \times 10^{-5}$	911	$1.5 \times 10^{-5}$	$6 \times 10^{-5}$
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<b>AUXILIARY INFORMATION</b>													
<b>METHOD/APPARATUS/PROCEDURE:</b> <p>Specimen of vanadium was placed in contact with Hg in a glass capsule. The capsule was sealed under a vacuum after at least 16 hours of outgassing of the mercury. The capsules were heated to the desired temperature and equilibrated for 16 hours. A sample of the solution was collected and cooled. Mercury was separated from the sample by molecular distillation and the residue was taken into acid solution, dried, and analyzed by emission spectroscopy.</p> <p>It appears that the same method was used in all three reports.</p>	<b>SOURCE AND PURITY OF MATERIALS:</b> Vanadium was chemically pure. Triple-distilled Hg free of detectable impurities was used. <b>ESTIMATED ERROR:</b> Soly: precision $\pm$ 10% in (2). Temp: precision $\pm$ 3 K in (1). <b>REFERENCES:</b> 3. Parkman, M.F.; Whaley, D.K. <i>Aerojet-General Nucleonics, Rep. AN-957 1963.</i>												

<b>COMPONENTS:</b> (1) Vanadium; V; [7440-62-2] (2) Mercury; Hg; [7439-97-6]	<b>ORIGINAL MEASUREMENTS:</b> Weeks, J.R. <i>Corrosion</i> <u>1967</u> , 23, 98-106.															
<b>VARIABLES:</b> Temperature: 505-682°C	<b>PREPARED BY:</b> C. Guminski; Z. Galus															
<b>EXPERIMENTAL VALUES:</b> <p>The mass % solubility was presented graphically as a function of temperature. The data points were read off the curve and the conversion to atomic % made by the compilers.</p> <table border="1" data-bbox="493 541 1049 725"> <thead> <tr> <th><math>t/^\circ\text{C}</math></th> <th>Soly/mass %</th> <th>Soly/at %</th> </tr> </thead> <tbody> <tr> <td>682</td> <td><math>1.3 \times 10^{-4}</math></td> <td><math>5.2 \times 10^{-4}</math></td> </tr> <tr> <td>620</td> <td><math>1.0 \times 10^{-4}</math></td> <td><math>4.0 \times 10^{-4}</math></td> </tr> <tr> <td>555</td> <td><math>5.0 \times 10^{-5}</math></td> <td><math>2.0 \times 10^{-4}</math></td> </tr> <tr> <td>505</td> <td><math>6.0 \times 10^{-6}</math></td> <td><math>2.4 \times 10^{-5}</math></td> </tr> </tbody> </table> <p>Four other data points were presented, but these were one order of magnitude lower than those reported above.</p> <p>The authors state that the higher values of the solubilities are most dependable. There was a reaction between the vanadium amalgam and the silica capsules, and the capsule walls were coated with a deposit which could not be removed by heating in vacuum.</p>		$t/^\circ\text{C}$	Soly/mass %	Soly/at %	682	$1.3 \times 10^{-4}$	$5.2 \times 10^{-4}$	620	$1.0 \times 10^{-4}$	$4.0 \times 10^{-4}$	555	$5.0 \times 10^{-5}$	$2.0 \times 10^{-4}$	505	$6.0 \times 10^{-6}$	$2.4 \times 10^{-5}$
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<b>AUXILIARY INFORMATION</b>																
<b>METHOD/APPARATUS/PROCEDURE:</b> Mercury and vanadium were placed in Vycor capsule which was sealed under vacuum and put in the stainless steel capsule. The amalgam mixtures were equilibrated for 72 hours at the desired temperature. A centrifuge was used at the end of the equilibration period to force a sample of the liquid alloy through the filter. The Hg was distilled from the sample of the homogeneous amalgam, and the residue was dissolved in HNO <sub>3</sub> -HF or aqua regia and analyzed spectrographically.	<b>SOURCE AND PURITY OF MATERIALS:</b> Mercury was triple-distilled reagent grade. Vanadium purity not specified.															
<b>ESTIMATED ERROR:</b> Soly: nothing specified. Temp: precision $\pm 2$ K.																
<b>REFERENCES:</b>																

<b>COMPONENTS:</b>  (1) Niobium; Nb; [7440-03-1] (2) Mercury; Hg; [7439-97-6]	<b>EVALUATOR:</b>  C. Guminski; Z. Galus Department of Chemistry University of Warsaw Warsaw, Poland July, 1985
<b>CRITICAL EVALUATION:</b>  Limited measurements show that the solubility of niobium in mercury is very low. Strachan and Harris (1) could not detect any niobium in mercury at the detection limit of $2 \times 10^{-3}$ at % at room temperature. Weeks (2) studied the solubility at temperatures up to 1023 K and concluded that the solubility is lower than the detection limit of $6 \times 10^{-6}$ at %. However, Weeks and Fink (3) earlier reported a solubility of $8 \times 10^{-6}$ at % at 923 K. Bowersox and Leary (4) showed that the solubility is lower than $1.6 \times 10^{-5}$ at % at 623 K. Fleitman and coworkers (5,6) reported that Nb is not affected by Hg at 866 and 976 K; similar observation was noticed by Nejedlik and Vargo (7) at 719 K. Kozin predicted very low solubilities; e.g., $1.6 \times 10^{-18}$ (8) and $1.3 \times 10^{-12}$ at % (9) at 298 K. The solubilities of Nb-Zr alloys in Hg also were investigated (2,5) and were found to be below the detection limits.  <u>References</u>  1. Strachan, J.F.; Harris, N.L. <i>J. Inst. Metals</i> <u>1956-57</u> , 85, 17. 2. Weeks, J.R. <i>Corrosion</i> <u>1967</u> , 23, 98. 3. Weeks, J.R.; Fink, S. <i>U.S. At. Ener. Comm. Rep.</i> , BNL-900, <u>1964</u> , p. 136. 4. Bowersox, D.F.; Leary, J.A. <i>U.S. At. Ener. Comm. Rep.</i> , LAMS-2518, <u>1961</u> . 5. Fleitman, A.H.; Romano, A.J.; Klamut, C.J. <i>Trans. Am. Nucl. Soc.</i> <u>1965</u> , 8, 15. 6. Fleitman, A.H.; Brandon, J. <i>U.S. At. Ener. Comm. Rep.</i> , BNL-799, <u>1963</u> , p. 75. 7. Nejedlik, J.F.; Vargo, E.J. <i>Electrochem. Technol.</i> <u>1965</u> , 3, 250. 8. Kozin, L.F. <i>Tr. Inst. Khim. Nauk Akad. Nauk Kaz. SSR</i> <u>1962</u> , 9, 101. 9. Kozin, L.F. <i>Fiziko-Khimicheskie Osnovy Amalgamoi Metallurgii</i> , Nauka, Alma-Ata, <u>1964</u> .	

<b>COMPONENTS:</b>  (1) Niobium; Nb; [7440-03-1] (2) Mercury; Hg; [7439-97-6]	<b>ORIGINAL MEASUREMENTS:</b>  Bowersox, D.F.; Leary, J.A. <i>U.S. At. Ener. Comm. Rep., LAMS-2518,</i> <u>1961.</u>
<b>VARIABLES:</b>  One temperature: 350°C	<b>PREPARED BY:</b>  C. Guminski; Z. Galus
<b>EXPERIMENTAL VALUES:</b>  The solubility of Nb in Hg at 350°C is lower than 0.001 g of Nb in 1 dm <sup>3</sup> of Hg. The corresponding atomic percent detection limit calculated by the compilers is $2 \times 10^{-5}$ at %.	
<b>AUXILIARY INFORMATION</b>	
<b>METHOD/APPARATUS/PROCEDURE:</b>  The solubility was determined by immersing a weighed coupon of niobium into definite amount of boiling mercury and periodically reweighing the coupon. The weight loss corresponds to the part of the niobium which dissolved.	<b>SOURCE AND PURITY OF MATERIALS:</b>  Triple-distilled Hg was used.  Niobium purity not specified.  <b>ESTIMATED ERROR:</b>  Soly: detection limit was 1 mg of Nb. Temp: nothing specified.  <b>REFERENCES:</b>

<b>COMPONENTS:</b>  (1) Niobium; Nb; [7440-03-1] (2) Mercury; Hg; [7439-97-6]	<b>ORIGINAL MEASUREMENTS:</b>  Weeks, J.R. <i>Corrosion</i> <u>1967</u> , 23, 98-106.
<b>VARIABLES:</b>  Temperature: 500-750°C	<b>PREPARED BY:</b>  C. Guminski; Z. Galus
<b>EXPERIMENTAL VALUES:</b>  The solubility of niobium in mercury was presented graphically as a function of temperature. All of the solubility data between 500 and 750°C fall close to the detection limit of $3 \times 10^{-6}$ mass %. The compilers calculated the atomic percent detection limit as $6 \times 10^{-6}$ at %.	
<b>AUXILIARY INFORMATION</b>	
<b>METHOD/APPARATUS/PROCEDURE:</b>  Mercury and niobium were placed in a quartz capsule which was sealed under vacuum and put in a stainless steel capsule. The mixture was equilibrated for 72 hours at the desired temperature. The centrifuge was used at the end of the equilibration period to force a sample of the liquid alloy through the filter. The mercury was distilled from the homogeneous amalgam and the residue was dissolved in HF-HNO <sub>3</sub> or aqua regia, and analyzed spectrographically.	<b>SOURCE AND PURITY OF MATERIALS:</b>  Mercury was triple-distilled, reagent grade.  Niobium purity not specified.  <b>ESTIMATED ERROR:</b>  Soly: nothing specified. Temp: precision $\pm$ 2 K.  <b>REFERENCES:</b>

<p>COMPONENTS:</p> <p>(1) Tantalum; Ta; [7440-25-7]  (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>The solubility of tantalum in mercury is very low. Kozin predicted solubilities of <math>4.3 \times 10^{-26}</math> (1) and <math>1.7 \times 10^{-16}</math> at % (2) at 298 K. The solubility of 0.011 at % reported by Strachan and Harris (3) is much too high and is rejected. Bowersox and Leary (4) found that the solubility is lower than their detection limit of <math>8 \times 10^{-6}</math> at % at 623 K. At 873 to 973 K, Weeks (5,6) showed that the solubility of tantalum is less than <math>2 \times 10^{-7}</math> at %. While investigating the Pr-Hg system, Griffin and Gschneider (7) observed no dissolution of tantalum in mercury at 873 to 1403 K. Similar observations of the inertness of tantalum towards mercury were reported earlier by Bolton (8). Fleitman and coworkers (9), Nejedlik and Vargo (10) and Kirchmayr (11) also could not detect any dissolution of Ta in Hg at 630-1300 K.</p> <p><u>References</u></p> <ol style="list-style-type: none"> <li>1. Kozin, L.F. <i>Tr. Inst. Khim. Nauk Akad. Nauk Kaz. SSR</i> 1962, 9, 101.</li> <li>2. Kozin, L.F. <i>Fiziko-Khimicheskie Osnovy Amalgamnoi Metallurgii</i>, Nauka, Alma-Ata, 1964.</li> <li>3. Strachan, J.F.; Harris, N.L. <i>J. Inst. Metals</i> 1956-57, 85, 17.</li> <li>4. Bowersox, D.F.; Leary, J.A. <i>U.S. At. Ener. Comm. Rep.</i>, LAMS-2518, 1961.</li> <li>5. Weeks, J.R. <i>Corrosion</i> 1967, 23, 98.</li> <li>6. Weeks, J.R.; Fink, S. <i>U.S. At. Ener. Comm. Rep.</i>, BNL-900, 1964, p. 136.</li> <li>7. Griffin, R.B.; Gschneider, K.A. <i>Met. Trans.</i> 1971, 2, 2517.</li> <li>8. Bolton, W. <i>Z. Elektrochem.</i> 1905, 11, 51.</li> <li>9. Fleitman, A.H.; Romano, A.J.; Klamut, C.J. <i>Trans. Am. Nucl. Soc.</i> 1965, 8, 15.</li> <li>10. Nejedlik, J.F.; Vargo, E.J. <i>Electrochem. Technol.</i> 1965, 3, 250.</li> <li>11. Kirchmayr, H.R. <i>Z. Metallk.</i> 1965, 56, 767.</li> </ol>	

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<b>EXPERIMENTAL VALUES:</b>  The solubility of Ta in Hg at 350°C was reported to be lower than 0.001 g of Ta in 1 dm <sup>3</sup> of Hg. The corresponding atomic % solubility limit calculated by the compilers is $8 \times 10^{-6}$ at %.	
<b>AUXILIARY INFORMATION</b>	
<b>METHOD/APPARATUS/PROCEDURE:</b>  The solubility was determined by immersing a weighed coupon of tantalum into a definite amount of boiling Hg and periodically measuring the coupon weight. The weight loss corresponds to the part of the Ta which dissolved.	<b>SOURCE AND PURITY OF MATERIALS:</b>  Triple distilled Hg was used.  Tantalum purity not specified.  <b>ESTIMATED ERROR:</b>  Soly: detection limit was 1 mg. Temp: nothing specified.  <b>REFERENCES:</b>

<b>COMPONENTS:</b>  (1) Tantalum; Ta; [7440-25-7] (2) Mercury; Hg; [7439-97-6]	<b>ORIGINAL MEASUREMENTS:</b>  Weeks, J.R. <i>Corrosion</i> <u>1967</u> , 23, 98-106.
<b>VARIABLES:</b>  Temperature: 600-700°C	<b>PREPARED BY:</b>  C. Guminski; Z. Galus
<b>EXPERIMENTAL VALUES:</b>  The solubility of tantalum in mercury in the temperature range of 600-700°C was found to be below the detection limit of $2 \times 10^{-7}$ mass %. The same result was reported in (1).	
<b>AUXILIARY INFORMATION</b>	
<b>METHOD/APPARATUS/PROCEDURE:</b>  Mercury and irradiated tantalum were placed in a quartz capsule which was sealed under vacuum and put in a stainless steel capsule. Hg and the solute metal were equilibrated for 72 hours at the desired temperature. The centrifuge was used at the end of the equilibration period to force a sample of the liquid alloy through the filter. The filtrate was analyzed for radioactivity of tantalum.	<b>SOURCE AND PURITY OF MATERIALS:</b>  Triple-distilled, reagent grade mercury was used.  Tantalum specimens were irradiated in the Brookhaven Graphite Research Reactor.  <b>ESTIMATED ERROR:</b>  Soly: nothing specified. Temp: precision $\pm$ 2 K.  <b>REFERENCES:</b>  1. Weeks, J.R.; Fink, S. <i>U.S. At. Ener. Comm. Rep.</i> , BNL-900, <u>1964</u> , p. 136.