

COMPONENTS: (1) Zinc hydroxide; $Zn(OH)_2$; [20427-58-1] (2) Ammonium nitrate; NH_4NO_3 ; [6484-52-2] (3) Ammonium sulfate; $(NH_4)_2SO_4$; [35089-90-8] (4) Ammonium chloride; NH_4Cl ; [12125-02-9] (5) Water; H_2O ; [7732-18-5]	ORIGINAL MEASUREMENTS: Herz, W. Z. <i>Anorg. Chem.</i> 1900, 23, 222-7.																																				
VARIABLES: Solvent composition	PREPARED BY: T. P. Dirkse																																				
EXPERIMENTAL VALUES: Composition of equilibrium solution of $Zn(OH)_2$ dissolved in aqueous solutions of ammonium salts. <table border="1" data-bbox="309 613 1111 1017"> <thead> <tr> <th data-bbox="309 613 529 679">mol Zn(II) dm⁻³^a</th> <th data-bbox="613 613 795 679">mol NH_4^+ dm⁻³^a</th> <th data-bbox="915 613 1111 679">Ammonium salt used</th> </tr> </thead> <tbody> <tr> <td>0.0038</td> <td>0.58</td> <td>NH_4Cl</td> </tr> <tr> <td>0.0025</td> <td>0.45</td> <td>"</td> </tr> <tr> <td>0.0015</td> <td>0.30</td> <td>"</td> </tr> <tr> <td>0.006</td> <td>0.85</td> <td>NH_4NO_3</td> </tr> <tr> <td>0.0038</td> <td>0.64</td> <td>"</td> </tr> <tr> <td>0.003</td> <td>0.56</td> <td>"</td> </tr> <tr> <td>0.002</td> <td>0.43</td> <td>"</td> </tr> <tr> <td>0.001</td> <td>0.22</td> <td>"</td> </tr> <tr> <td>0.012</td> <td>1.47</td> <td>$(NH_4)_2SO_4$</td> </tr> <tr> <td>0.0045</td> <td>0.74</td> <td>"</td> </tr> <tr> <td>0.002</td> <td>0.37</td> <td>"</td> </tr> </tbody> </table> <p data-bbox="263 1044 1173 1120">^aThe author used the equation $Zn(OH)_2 + 2 NH_4^+ = Zn^{2+} + 2 NH_4OH$ to calculate these results from the analysis for free NH_3 in the solutions. He made no allowance for the possible formation of zinc-ammonia complex ions.</p>		mol Zn(II) dm ⁻³ ^a	mol NH_4^+ dm ⁻³ ^a	Ammonium salt used	0.0038	0.58	NH_4Cl	0.0025	0.45	"	0.0015	0.30	"	0.006	0.85	NH_4NO_3	0.0038	0.64	"	0.003	0.56	"	0.002	0.43	"	0.001	0.22	"	0.012	1.47	$(NH_4)_2SO_4$	0.0045	0.74	"	0.002	0.37	"
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METHOD/APPARATUS/PROCEDURE: Solid $Zn(OH)_2$ was added to an aqueous solution of an ammonium salt. The mixture was placed in a stoppered flask and allowed to stand with frequent shaking. After equilibrium was reached a sample of saturated solution was analyzed for free NH_3 . The method of analysis is not described. No temperature is specified but the work presumably was carried out at room temperature.	SOURCE AND PURITY OF MATERIALS: Pure, dry $Zn(OH)_2$ was used. There is no information about the quality or purity of any of the other materials that were used. ESTIMATED ERROR: No details are given. REFERENCES:																																				

COMPONENTS: (1) Zinc hydroxide; Zn(OH)_2 ; [20427-58-1] (2) Sodium hydroxide; NaOH ; [1310-73-2] (3) Potassium hydroxide; KOH ; [1310-58-3] (4) Water; H_2O ; [7732-18-5]	ORIGINAL MEASUREMENTS: Moir, J. <i>Proc. Chem. Soc.</i> <u>1905</u> , 21, 310-1.																																							
VARIABLES: Alkali concentration.	PREPARED BY: T. P. Dirkse																																							
EXPERIMENTAL VALUES: Solubility of Zn(OH)_2 in aqueous NaOH . <table border="1" data-bbox="137 507 960 766"> <thead> <tr> <th>mol NaOH dm^{-3}</th> <th>mol $\text{Zn(OH)}_2 \text{ dm}^{-3^a}$</th> <th>mol $\text{Zn(OH)}_2 \text{ dm}^{-3^b}$</th> </tr> </thead> <tbody> <tr><td>7.5</td><td>1.692</td><td>1.89</td></tr> <tr><td>2.5</td><td>0.48</td><td>0.452</td></tr> <tr><td>1.3</td><td>0.17</td><td>0.171</td></tr> <tr><td>0.5</td><td>0.040</td><td>0.0364</td></tr> <tr><td>0.1</td><td>0.0035</td><td>0.00265</td></tr> <tr><td>0.05</td><td>0.0010</td><td>0.00097</td></tr> <tr><td>0.01</td><td>0.0002</td><td>0.000135</td></tr> </tbody> </table> <p>^aThese results were obtained experimentally.</p> <p>^bThese results were calculated from the equation $y = 0.004x \left[\frac{79x + 6}{x + 2} \right]$</p> Solubility of Zn(OH)_2 in aqueous KOH <table border="1" data-bbox="137 870 960 1067"> <thead> <tr> <th>mol KOH dm^{-3}</th> <th>mol $\text{Zn(OH)}_2 \text{ dm}^{-3^a}$</th> <th>mol $\text{Zn(OH)}_2 \text{ dm}^{-3^b}$</th> </tr> </thead> <tbody> <tr><td>5.5</td><td>1.36</td><td>1.291</td></tr> <tr><td>2.0</td><td>0.32</td><td>0.328</td></tr> <tr><td>1.5</td><td>0.21</td><td>0.2033</td></tr> <tr><td>1</td><td>0.110</td><td>0.1132</td></tr> </tbody> </table> <p>^aThese results were obtained experimentally.</p> <p>^bThese results were calculated from the equation $y = 0.004x \left[\frac{79x + 6}{x + 2} \right]$ where $x = \text{mol KOH dm}^{-3}$ and $y = \text{mol Zn(OH)}_2 \text{ dm}^{-3}$</p>		mol NaOH dm^{-3}	mol $\text{Zn(OH)}_2 \text{ dm}^{-3^a}$	mol $\text{Zn(OH)}_2 \text{ dm}^{-3^b}$	7.5	1.692	1.89	2.5	0.48	0.452	1.3	0.17	0.171	0.5	0.040	0.0364	0.1	0.0035	0.00265	0.05	0.0010	0.00097	0.01	0.0002	0.000135	mol KOH dm^{-3}	mol $\text{Zn(OH)}_2 \text{ dm}^{-3^a}$	mol $\text{Zn(OH)}_2 \text{ dm}^{-3^b}$	5.5	1.36	1.291	2.0	0.32	0.328	1.5	0.21	0.2033	1	0.110	0.1132
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METHOD/APPARATUS/PROCEDURE: No details are given but, presumably, equilibrium was reached by two methods; (a) excess Zn(OH)_2 was added to the alkali solution; and (b) water was added to a saturated solution of Zn(OH)_2 in the aqueous alkali. The experiments apparently were carried out at room temperature, but this is not specified. No analytical procedures are described.	SOURCE AND PURITY OF MATERIALS: No details are given. ESTIMATED ERROR: No details are given. REFERENCES:																																							

COMPONENTS: (1) Zinc hydroxide; $\text{Zn}(\text{OH})_2$; [20427-58-1] (2) Sodium hydroxide; NaOH ; [1310-73-2] (3) Hydrochloric acid; HCl [7647-01-0] (4) Water; H_2O ; [7732-18-5]		ORIGINAL MEASUREMENTS: Reichle, R. A.; McCurdy, K. G.; Hepler, L.G. <i>Can. J. Chem.</i> <u>1975</u> , <i>53</i> , 3841-5.			
VARIABLES: pH of solvent and temperature.		PREPARED BY: T. P. Dirkse			
EXPERIMENTAL VALUES:					
Solubility of $\text{Zn}(\text{OH})_2$ in solutions of varying pH.					
pH	$10^5 C_{\text{Zn}}/\text{mol kg}^{-1}$	pH	$10^5 C_{\text{Zn}}/\text{mol kg}^{-1}$	pH	$10^5 C_{\text{Zn}}/\text{mol kg}^{-1}$
temp., 12.5°C					
13.80	327	11.51	0.50	8.99	0.46
13.71	216	11.50	0.31	8.55	1.33
13.51	91.8	11.10	0.24	7.96	13.2
13.34	45.1	9.83	0.23	7.70	48.3
13.18	25.2	9.49	0.23	7.32	265
12.85	6.12	9.27	0.31	7.22	415
12.21	1.68	9.14	0.38	7.06	844
temp., 25.0°C					
13.19	178	10.14	0.31	8.41	1.30
12.97	67.3	9.43	0.38	7.90	4.74
12.77	28.3	9.18	0.54	7.63	17.2
12.52	11.2	8.97	0.61	7.44	32.1
12.29	5.74	8.91	0.92	7.31	49.7
11.05	0.54	8.72	0.84	7.00	204
10.84	0.46	8.67	1.22		
temp., 50.0°C					
12.50	261	10.75	1.38	8.27	1.45
12.24	88.7	10.25	0.92	8.04	1.84
11.99	33.7	10.02	0.84	7.82	2.43
11.76	14.8	9.55	0.76	7.54	4.97
11.55	8.03	9.08	0.87	7.26	10.7
11.25	2.92	8.77	0.99	7.05	19.6
10.99	2.14	8.52	1.15	6.75	53.4
AUXILIARY INFORMATION					
METHOD/APPARATUS/PROCEDURE: Equilibrium was approached isothermally by shaking the mixtures gently for about two weeks in a constant temperature bath. $\text{HCl}(\text{aq})$ or $\text{NaOH}(\text{aq})$ was added to adjust the pH of the solvent. The concentration of zinc was determined by atomic absorption spectroscopy. The pH was measured with a glass electrode.			SOURCE AND PURITY OF MATERIALS: The crystalline $\epsilon\text{-Zn}(\text{OH})_2$ was prepared as described by others (1). No information is given about the source of the other materials.		
			ESTIMATED ERROR: Uncertainties in the experimentally determined solubilities are about 5%.		
			REFERENCES: 1. Dietrich, H. G.; Johnston, J. <i>J. Am. Chem. Soc.</i> <u>1927</u> , <i>49</i> , 1419.		

COMPONENTS:

- (1) Zinc hydroxide; Zn(OH)_2 ; [20427-58-1]
 (2) Sodium hydroxide; NaOH ; [1310-73-2]
 (3) Hydrochloric acid; HCl [7647-01-0]
 (4) Water; H_2O ; [7732-18-5]

ORIGINAL MEASUREMENTS:

Reichle, R. A.; McCurdy, K. G.; Helper, L. G.
Can. J. Chem. 1975, 53, 3841-5.

EXPERIMENTAL VALUES, contd.

Solubility of Zn(OH)_2 in solutions of varying pH,

pH	$10^5 C_{\text{Zn}} / \text{mol kg}^{-1}$	pH	$10^5 C_{\text{Zn}} / \text{mol kg}^{-1}$	pH	$10^5 C_{\text{Zn}} / \text{mol kg}^{-1}$
temp., 75.0°C					
12.22	1029	10.54	3.06	8.55	1.84
11.95	319	10.22	2.14	8.38	2.06
11.68	104	10.01	2.06	8.08	2.06
11.35	29.1	9.71	1.84	7.89	1.99
11.14	12.6	9.54	1.76	7.65	2.37
10.85	5.27	8.93	1.68	7.18	7.22
				6.94	13.1

COMPONENTS: (1) Zinc oxide; ZnO; [1314-13-2] (2) Carbon dioxide; CO ₂ ; [124-38-9] (3) Sodium chloride; NaCl; [7647-14-5] (4) Water; H ₂ O; [7732-18-5]	ORIGINAL MEASUREMENTS: Shlyapnikov, D. S.; Shtern, E. K. <i>Dokl. Akad. Nauk SSSR</i> <u>1975</u> , 225, 428-31.												
VARIABLES: NaCl concentration and pressure of CO ₂ .	PREPARED BY: T. Michalowski												
EXPERIMENTAL VALUES: <p style="text-align: center;">Solubility of ZnO at 20°C under a CO₂ pressure of 50 atm.</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th></th> <th style="text-align: center;"><u>in water</u></th> <th style="text-align: center;"><u>in 4 mol NaCl dm⁻³</u></th> </tr> </thead> <tbody> <tr> <td>g ZnO dm⁻³</td> <td style="text-align: center;">3.8712</td> <td style="text-align: center;">3.2529</td> </tr> <tr> <td>mol ZnO dm⁻³^a</td> <td style="text-align: center;">0.0475</td> <td style="text-align: center;">0.040</td> </tr> <tr> <td>pH of solution</td> <td style="text-align: center;">5.98</td> <td style="text-align: center;">5.50</td> </tr> </tbody> </table> <p>^a Calculated by compiler.</p> <p>An accompanying graph shows that the solubility of ZnO at 200°C and P_{CO₂} = 100 atm increases from about 0.3 g dm⁻³ in pure water to about 0.9 g dm⁻³ in 2 mol NaCl dm⁻³. The solubility is attributed to the transformation of ZnO to Zn(HCO₃)₂.</p>			<u>in water</u>	<u>in 4 mol NaCl dm⁻³</u>	g ZnO dm ⁻³	3.8712	3.2529	mol ZnO dm ⁻³ ^a	0.0475	0.040	pH of solution	5.98	5.50
	<u>in water</u>	<u>in 4 mol NaCl dm⁻³</u>											
g ZnO dm ⁻³	3.8712	3.2529											
mol ZnO dm ⁻³ ^a	0.0475	0.040											
pH of solution	5.98	5.50											
AUXILIARY INFORMATION													
METHOD/APPARATUS/PROCEDURE: Solution and solid ZnO were shaken in an autoclave at the prescribed temperature for 24 hours. CO ₂ was introduced as a solid. Metal analysis was done compleximetrically and spectrophotometrically. No further details are given.	SOURCE AND PURITY OF MATERIALS: No details are given.												
ESTIMATED ERROR: This cannot be determined from the information given in the article.													
REFERENCES:													

COMPONENTS: (1) Zinc oxide; ZnO; [1314-13-2] (2) Ammonia; NH ₃ ; [7664-41-7] (3) Ammonium sulfate; (NH ₄) ₂ SO ₄ ; [35089-90-9] (4) Water; H ₂ O; [7732-18-5]	ORIGINAL MEASUREMENTS: Guy, S.; Broadbent, C. P.; Jackson, D. J. D.; Lawson, G. J. <i>Hydrometallurgy</i> 1982,8, 251-60.																
VARIABLES: Concentration of NH ₃ and (NH ₄) ₂ SO ₄ at 298 K.	PREPARED BY: T. P. Dirkse																
EXPERIMENTAL VALUES: Solubility of ZnO in NH ₃ -(NH ₄) ₂ SO ₄ solutions at 25°C. <table border="1" data-bbox="183 551 1037 706"> <thead> <tr> <th>mol NH₃ dm⁻³</th> <th>mol (NH₄)₂SO₄ dm⁻³</th> <th>g Zn dm⁻³</th> <th>mol ZnO dm⁻³ ^a</th> </tr> </thead> <tbody> <tr> <td>2</td> <td>2</td> <td>47</td> <td>0.72</td> </tr> <tr> <td>3</td> <td>3</td> <td>81</td> <td>1.24</td> </tr> <tr> <td>4</td> <td>3</td> <td>168.3</td> <td>2.57</td> </tr> </tbody> </table> <p>^a calculated by compiler.</p> <p>The article contains a graph of the solubility of ZnO in a variety of NH₃-(NH₄)₂SO₄ solutions. However, the graphs show no data points but only smoothly drawn isosolubility curves. The solubility of ZnO increases as the concentration of NH₃ increases. It also increases with increasing (NH₄)₂SO₄ concentration. The authors assume that the following reaction is responsible for the solubility of ZnO in these solutions.</p> $2 \text{NH}_3 + \text{ZnO} + (\text{NH}_4)_2\text{SO}_4 = \text{Zn}(\text{NH}_3)_4\text{SO}_4 + \text{H}_2\text{O}$		mol NH ₃ dm ⁻³	mol (NH ₄) ₂ SO ₄ dm ⁻³	g Zn dm ⁻³	mol ZnO dm ⁻³ ^a	2	2	47	0.72	3	3	81	1.24	4	3	168.3	2.57
mol NH ₃ dm ⁻³	mol (NH ₄) ₂ SO ₄ dm ⁻³	g Zn dm ⁻³	mol ZnO dm ⁻³ ^a														
2	2	47	0.72														
3	3	81	1.24														
4	3	168.3	2.57														
AUXILIARY INFORMATION																	
METHOD/APPARATUS/PROCEDURE: Solvent and ZnO were placed in screw-capped polyethylene bottles and agitated in a thermostat for 16-18 hours. After filtration the zinc content of the filtrate was determined by atomic absorption spectrophotometry.	SOURCE AND PURITY OF MATERIALS: Analytical reagent grade materials were used. ESTIMATED ERROR: The temperature was controlled to ± 0.5 K but no information is given about the control or reproducibility of any other procedures or measurements. REFERENCES:																