

## Solubility phenomena involving $\text{CaSO}_4$ in hydrometallurgical processes concerning heavy metals\*

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Supplementary Information

**Table 1** Solubility of anhydrite in the system  $\text{CaSO}_4 + \text{H}_2\text{SO}_4 + \text{CuSO}_4 + \text{H}_2\text{O}$  at 348.1 K.

Composition ( $\text{mol kg}^{-1}$ )			Composition ( $\text{mol kg}^{-1}$ )		
$\text{H}_2\text{SO}_4$	$\text{CuSO}_4$	$\text{CaSO}_4$	$\text{H}_2\text{SO}_4$	$\text{CuSO}_4$	$\text{CaSO}_4$
0	0	0.00852	0.2	1.954	0.008 64
0	0.070 6	0.007 08	0.2	2.468	0.007 61
0	0.090 7	0.006 20	0.2	2.688	0.007 21
0	0.235	0.006 57	0.2	3.130	0.006 59
0	0.479	0.007 17	0.5	0	0.026
0	0.967	0.008 14	0.5	0.067	0.021 73
0	1.488	0.008 53	0.5	0.139	0.020 09
0	1.835	0.008 33	0.5	0.225	0.015 88
0	1.835	0.008 37	0.5	0.466	0.012 45
0	2.205	0.007 97	0.5	1.037	0.009 91
0	2.842	0.007 21	0.5	1.522	0.009 33
0	3.200	0.006 86	0.5	1.991	0.008 37
0.2	0	0.019 67	0.5	2.550	0.006 92
0.2	0.013	0.018 48	0.5	2.885	0.006 33
0.2	0.026	0.016 49	1.0	0	0.029 09
0.2	0.057	0.014 90	1.0	0.164	0.023 78
0.2	0.086	0.014 91	1.0	0.499	0.019 23
0.2	0.163	0.013 06	1.0	1.114	0.012 26
0.2	0.199	0.012 17	1.0	1.547	0.009 28
0.2	0.246	0.011 66	1.0	2.140	0.007 03
0.2	0.308	0.011 20	1.0	2.835	0.005 88
0.2	0.315	0.010 98	1.5	0	0.028 83
0.2	0.315	0.011 01	1.5	0.252	0.023 23
0.2	0.478	0.009 34	1.5	0.509	0.019 56
0.2	0.497	0.009 26	1.5	0.971	0.015 79
0.2	0.877	0.009 43	1.5	1.378	0.012 15
0.2	0.905	0.009 45	1.5	1.999	0.008 83
0.2	1.395	0.009 57	1.5	2.531	0.006 71
0.2	1.695	0.009 01	1.5	2.757	0.005 85

**Table 2** Solubility of anhydrite in the system  $\text{CaSO}_4 + \text{H}_2\text{SO}_4 + \text{CuSO}_4 + \text{H}_2\text{O}$  at 363.1 K.

Composition/( mol kg <sup>-1</sup> )			Composition/( mol kg <sup>-1</sup> )		
H <sub>2</sub> SO <sub>4</sub>	CuSO <sub>4</sub>	CaSO <sub>4</sub>	H <sub>2</sub> SO <sub>4</sub>	CuSO <sub>4</sub>	CaSO <sub>4</sub>
0	0	0.006 14	0.2	3.984	0.004 83
0	0.071	0.005 75	0.5	0	0.027 30
0	0.131	0.005 01	0.5	0.067	0.020 12
0	0.235	0.005 13	0.5	0.139	0.018 03
0	0.479	0.006 36	0.5	0.225	0.014 94
0	0.967	0.007 07	0.5	0.466	0.010 64
0	1.488	0.007 75	0.5	1.037	0.007 94
0	1.835	0.007 41	0.5	1.522	0.007 74
0	2.205	0.007 09	0.5	1.990	0.007 35
0	2.842	0.006 32	0.5	2.550	0.005 84
0	3.206	0.005 93	0.5	3.015	0.005 24
0	3.812	0.005 32	0.5	3.700	0.004 55
0	4.160	0.005 06	1.0	0	0.031 20
0.2	0	0.020 41	1.0	0.164	0.022 83
0.2	0.013	0.017 01	1.0	0.499	0.017 49
0.2	0.026	0.015 98	1.0	1.114	0.011 45
0.2	0.057	0.016 12	1.0	1.547	0.008 04
0.2	0.086	0.014 07	1.0	2.140	0.005 79
0.2	0.163	0.011 56	1.0	2.531	0.005 32
0.2	0.246	0.009 94	1.0	3.120	0.004 67
0.2	0.308	0.008 88	1.0	3.603	0.004 35
0.2	0.395	0.008 04	1.5	0	0.030 90
0.2	0.496	0.007 46	1.5	0.252	0.022 63
0.2	0.877	0.008 22	1.5	0.504	0.018 68
0.2	1.395	0.008 52	1.5	0.971	0.013 55
0.2	1.695	0.007 97	1.5	1.378	0.010 13
0.2	1.954	0.007 46	1.5	1.999	0.007 64
0.2	2.467	0.006 33	1.5	2.531	0.005 92
0.2	2.688	0.006 22	1.5	3.120	0.004 67
0.2	3.048	0.005 56	1.5	3.330	0.004 35

**Table 3** Solubility of anhydrite in the system  $\text{CaSO}_4 + \text{H}_2\text{SO}_4 + \text{ZnSO}_4 + \text{H}_2\text{O}$  at 348.1 K.

Composition/( mol kg <sup>-1</sup> )			Composition/( mol kg <sup>-1</sup> )		
H <sub>2</sub> SO <sub>4</sub>	ZnSO <sub>4</sub>	CaSO <sub>4</sub>	H <sub>2</sub> SO <sub>4</sub>	ZnSO <sub>4</sub>	CaSO <sub>4</sub>
0	0	0.008 54	0.2	1.636	0.009 72
0	0.000 26	0.008 34	0.2	2.222	0.009 41
0	0.000 42	0.008 1	0.2	2.600	0.008 69
0	0.023 3	0.006 69	0.2	3.065	0.006 55
0	0.045 2	0.006 32	0.2	4.030	0.003 88
0	0.068 7	0.006 58	0.5	0	0.026 00
0	0.114	0.007 02	0.5	0.039	0.024 80
0	0.162	0.007 56	0.5	0.089	0.021 86
0	0.231	0.008 08	0.5	0.180	0.020 02
0	0.468	0.009 03	0.5	0.327	0.017 10
0	0.723	0.010 15	0.5	0.568	0.015 43
0	0.775	0.010 29	0.5	1.165	0.011 38
0	1.019	0.010 64	0.5	1.729	0.010 32
0	1.509	0.010 53	0.5	2.327	0.009 45
0	2.105	0.010 21	0.5	2.981	0.007 74
0	2.406	0.009 27	0.5	3.929	0.007 14
0	2.456	0.008 96	1.0	0	0.029 09
0	2.502	0.009 07	1.0	0.140	0.025 33
0	2.654	0.008 61	1.0	0.289	0.022 32
0	2.688	0.008 55	1.0	0.570	0.018 17
0	2.782	0.007 89	1.0	1.186	0.013 09
0	3.248	0.006 46	1.0	1.688	0.009 93
0	3.354	0.006 23	1.0	2.263	0.007 80
0	3.437	0.006 09	1.0	2.809	0.006 37
0	3.450	0.006 21	1.0	3.570	0.004 88
0	3.599	0.005 75	1.0	4.247	0.004 03
0	4.201	0.004 5	1.5	0	0.028 83
0.2	0	0.019 67	1.5	0.152	0.025 98
0.2	0.011 7	0.018 20	1.5	0.295	0.023 68
0.2	0.023 2	0.017 55	1.5	0.668	0.019 59
0.2	0.034 7	0.016 14	1.5	1.292	0.013 45
0.2	0.046 2	0.016 66	1.5	1.769	0.010 90
0.2	0.069 0	0.014 50	1.5	2.240	0.008 69
0.2	0.146	0.012 95	1.5	2.864	0.006 51
0.2	0.298	0.010 77	1.5	3.506	0.004 90
0.2	0.571	0.009 75	1.5	3.535	0.004 97
0.2	1.156	0.010 05			

**Table 4** Solubility of anhydrite in the system  $\text{CaSO}_4 + \text{H}_2\text{SO}_4 + \text{ZnSO}_4 + \text{H}_2\text{O}$  at 363.1 K.

Composition/( mol kg <sup>-1</sup> )			Composition/( mol kg <sup>-1</sup> )		
H <sub>2</sub> SO <sub>4</sub>	ZnSO <sub>4</sub>	CaSO <sub>4</sub>	H <sub>2</sub> SO <sub>4</sub>	ZnSO <sub>4</sub>	CaSO <sub>4</sub>
0	0	0.006 15	0.2	2.263	0.008 62
0	0.037	0.005 43	0.2	2.638	0.008 02
0	0.074	0.005 14	0.2	3.244	0.007 09
0	0.118	0.005 35	0.2	4.114	0.005 94
0	0.167	0.005 68	0.5	0	0.027 30
0	0.244	0.006 08	0.5	0.014	0.024 64
0	0.435	0.006 68	0.5	0.019	0.023 72
0	0.468	0.006 68	0.5	0.039	0.023 73
0	0.752	0.007 57	0.5	0.052	0.022 71
0	1.106	0.008 22	0.5	0.075	0.023 14
0	1.139	0.008 13	0.5	0.298	0.016 18
0	1.503	0.008 20	0.5	0.608	0.012 51
0	2.134	0.008 82	0.5	1.232	0.009 81
0	2.251	0.008 44	0.5	1.689	0.008 94
0	2.415	0.008 36	0.5	2.341	0.008 05
0	2.517	0.008 34	0.5	3.698	0.007 42
0	2.538	0.008 28	0.5	4.253	0.005 87
0	2.831	0.007 75	1.0	0	0.031 20
0	2.885	0.007 73	1.0	0.288	0.022 71
0	3.303	0.006 95	1.0	0.567	0.016 94
0	3.318	0.006 97	1.0	1.181	0.011 04
0	3.426	0.006 67	1.0	1.657	0.009 55
0	3.832	0.005 78	1.0	2.319	0.007 62
0	3.878	0.005 65	1.0	2.903	0.006 40
0	3.921	0.005 27	1.0	3.543	0.005 81
0.2	0	0.020 41	1.0	3.583	0.005 33
0.2	0.012	0.017 70	1.0	3.638	0.005 05
0.2	0.023	0.016 83	1.5	0	0.030 90
0.2	0.035	0.016 12	1.5	0.153	0.027 54
0.2	0.046	0.015 64	1.5	0.304	0.024 65
0.2	0.069	0.014 22	1.5	0.634	0.019 74
0.2	0.142	0.011 67	1.5	0.666	0.019 14
0.2	0.297	0.009 28	1.5	1.711	0.010 76
0.2	0.369	0.008 95	1.5	2.247	0.008 59
0.2	0.373	0.008 95	1.5	2.693	0.006 59
0.2	0.571	0.008 91	1.5	3.224	0.005 78
0.2	1.123	0.008 57	1.5	3.538	0.005 49
0.2	1.684	0.008 71			

**Table 5** Solubility of anhydrite in the system  $\text{CaSO}_4 + \text{H}_2\text{SO}_4 + \text{MnSO}_4 + \text{H}_2\text{O}$  at 348.1 K.

Composition/( mol kg <sup>-1</sup> )			Composition/( mol kg <sup>-1</sup> )		
H <sub>2</sub> SO <sub>4</sub>	MnSO <sub>4</sub>	CaSO <sub>4</sub>	H <sub>2</sub> SO <sub>4</sub>	MnSO <sub>4</sub>	CaSO <sub>4</sub>
0	0	0.008 54	0.2	2.927	0.007 43
0	0.026	0.007 15	0.5	0	0.026 00
0	0.045	0.006 39	0.5	0.251	0.017 62
0	0.065	0.006 33	0.5	0.501	0.013 97
0	0.084	0.006 69	0.5	1.002	0.011 08
0	0.165	0.006 15	0.5	1.502	0.009 67
0	0.247	0.007 44	0.5	2.002	0.009 01
0	0.574	0.008 88	0.5	2.787	0.007 40
0	1.143	0.010 38	1.0	0	0.029 09
0	1.561	0.010 27	1.0	0.251	0.022 67
0	2.104	0.010 19	1.0	0.501	0.017 86
0	2.659	0.009 47	1.0	1.002	0.012 68
0	3.104	0.009 18	1.0	1.502	0.010 45
0	3.135	0.009 01	1.0	2.000	0.008 73
0.2	0	0.019 67	1.0	2.445	0.007 69
0.2	0.089	0.015 14	1.5	0	0.028 83
0.2	0.176	0.012 70	1.5	0.250	0.022 70
0.2	0.285	0.010 87	1.5	0.501	0.019 63
0.2	0.568	0.010 48	1.5	1.000	0.013 77
0.2	1.108	0.010 81	1.5	1.500	0.010 79
0.2	1.522	0.010 24	1.5	1.999	0.008 52
0.2	2.002	0.008 79	1.5	2.516	0.007 70
0.2	2.502	0.008 46	1.5	2.523	0.007 83

**Table 6** Solubility of anhydrite in the system  $\text{CaSO}_4 + \text{H}_2\text{SO}_4 + \text{MnSO}_4 + \text{H}_2\text{O}$  at 363.1 K.

Composition/( mol kg <sup>-1</sup> )			Composition/( mol kg <sup>-1</sup> )		
H <sub>2</sub> SO <sub>4</sub>	MnSO <sub>4</sub>	CaSO <sub>4</sub>	H <sub>2</sub> SO <sub>4</sub>	MnSO <sub>4</sub>	CaSO <sub>4</sub>
0	0	0.006 15	0.5	0.250	0.014 32
0	0.0256	0.004 22	0.5	0.501	0.010 41
0	0.043	0.003 94	0.5	1.001	0.008 36
0	0.067	0.003 81	0.5	1.502	0.008 66
0	0.084	0.003 56	0.5	2.002	0.008 19
0	0.170	0.004 59	0.5	2.503	0.007 35
0	0.277	0.005 49	1.0	0	0.031 20
0	0.570	0.006 80	1.0	0.251	0.022 07
0	1.101	0.008 37	1.0	0.501	0.016 90
0	1.567	0.008 57	1.0	1.002	0.011 65
0	2.130	0.009	1.0	1.502	0.009 24
0.2	0	0.020 41	1.0	2.002	0.007 99
0.2	0.150	0.009 87	1.0	2.203	0.007 61
0.2	0.300	0.008 18	1.5	0	0.030 9
0.2	0.500	0.007 71	1.5	0.251	0.027 28
0.2	1.001	0.007 77	1.5	0.501	0.019 07
0.2	1.507	0.007 93	1.5	1.002	0.013 13
0.2	2.002	0.007 72	1.5	1.502	0.009 86
0.2	2.703	0.008 19	1.5	2.002	0.008 36
0.5	0	0.027 30	1.5	2.203	0.007 99