

Equilibrium constants for hydrolysis and associated equilibria in critical compilations

Tin(II)

Equilibrium reactions	lgK at infinite dilution and $T = 298 \text{ K}$						
	Baes and Mesmer, 1976	Feitknecht, 1963	Hummel et al., 2002	NIST46	Cigala et al., 2012	Gamsjäger et al, 2012	Brown and Ekberg, 2016
$\text{Sn}^{2+} + \text{H}_2\text{O} \rightleftharpoons \text{SnOH}^+ + \text{H}^+$	-3.40		-3.8 ± 0.2	-3.4	-3.52 ± 0.05	-3.53 ± 0.40	-3.53 ± 0.40
$\text{Sn}^{2+} + 2 \text{H}_2\text{O} \rightleftharpoons \text{Sn}(\text{OH})_2 + 2 \text{H}^+$	-7.06		-7.7 ± 0.2	-7.1	-6.26 ± 0.06	-7.68 ± 0.40	-7.68 ± 0.40
$\text{Sn}^{2+} + 3 \text{H}_2\text{O} \rightleftharpoons \text{Sn}(\text{OH})_3^- + 3 \text{H}^+$	-16.61		-17.5 ± 0.2	-16.6	-16.97 ± 0.17	-17.00 ± 0.60	-17.56 ± 0.40
$2 \text{Sn}^{2+} + 2 \text{H}_2\text{O} \rightleftharpoons \text{Sn}_2(\text{OH})_2^{2+} + 2 \text{H}^+$	-4.77			-4.8	-4.79 ± 0.05		
$3 \text{Sn}^{2+} + 4 \text{H}_2\text{O} \rightleftharpoons \text{Sn}_3(\text{OH})_4^{2+} + 4 \text{H}^+$	-6.88		-5.6 ± 1.6	-6.88	-5.88 ± 0.05	-5.60 ± 0.47	-5.60 ± 0.47
$\text{Sn}(\text{OH})_2(\text{s}) \rightleftharpoons \text{Sn}^{2+} + 2 \text{OH}^-$				-25.8	-26.28 ± 0.08		

$\text{SnO(s)} + 2 \text{H}^+ \rightleftharpoons \text{Sn}^{2+} + \text{H}_2\text{O}$	1.76		2.5 ± 0.5				1.60 ± 0.15
$\text{SnO(s)} + \text{H}_2\text{O} \rightleftharpoons \text{Sn}^{2+} + 2 \text{OH}^-$		-26.2					
$\text{SnO(s)} + \text{H}_2\text{O} \rightleftharpoons \text{Sn(OH)}_2$		-5.3					
$\text{SnO(s)} + 2 \text{H}_2\text{O} \rightleftharpoons \text{Sn(OH)}_3^- + \text{H}^+$		-0.9					

C.F. Baes and R.E. Mesmer, The Hydrolysis of Cations. Wiley, New York, 1976, p. 357.

P.L. Brown and C. Ekberg, Hydrolysis of Metal Ions. Wiley, 2016, pp. 836–842.

R.M. Cigala, F. Crea, C. De Stefano, G. Lando, D. Milea and S. Sammartano, The inorganic speciation of tin(II) in aqueous solution. Geochim. Cosmochim. Acta, 87, 1–20 (2012).

W. Feitknecht and P. Schindler, Solubility constants of metal oxides, metal hydroxides and metal hydroxide salts in aqueous solution. Pure and Applied Chemistry, 6, 126–199 (1963).

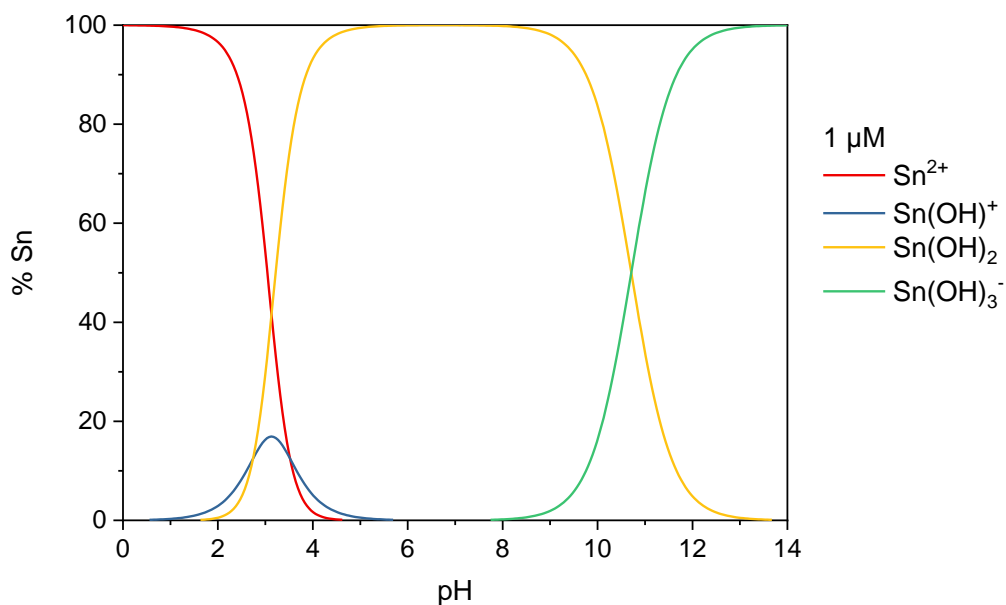
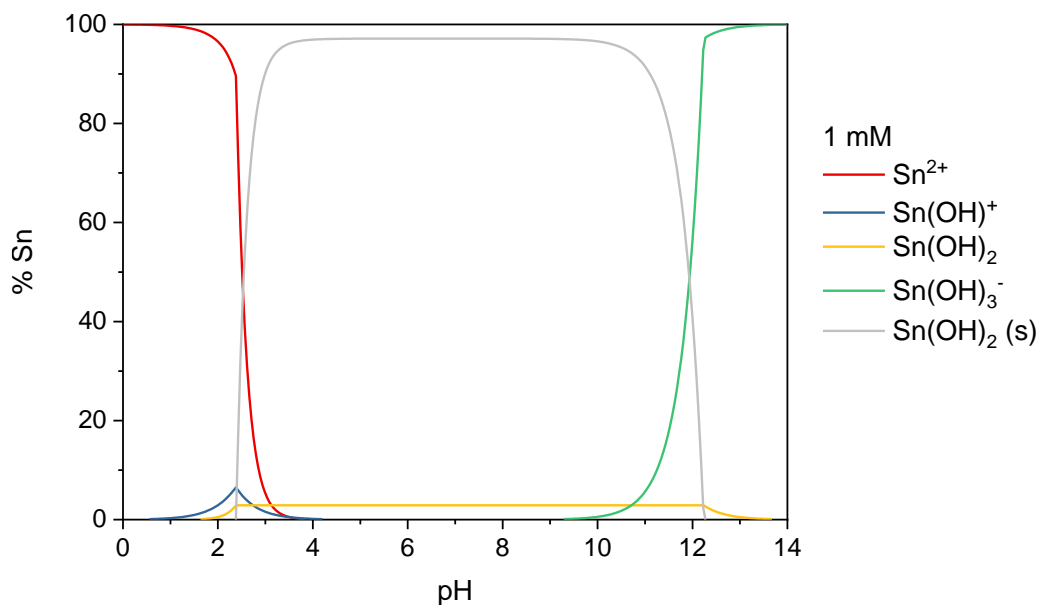
H. Gamsjäger, T. Gajda, J. Sangster, S. K. Saxena and W. Voigt, Chemical Thermodynamics of Tin. Chemical Thermodynamics Volume 12. OECD, Paris, 2012.

W. Hummel, U. Berner, E. Curti, F.J. Pearson and T. Thoenen, Nagra / PSI Chemical Thermodynamic Data Base 01/01, July 2002.

NIST46, NIST Critically Selected Stability Constants of Metal Complexes: Version 8.0. Available at: www.nist.gov/srd/nist46

Distribution diagrams

These diagrams have been computed at two Sn(II) concentrations (1 mM = 1×10^{-3} mol L⁻¹ and 1 μ M = 1×10^{-6} mol L⁻¹) with the 'best' equilibrium constants above (in green). Calculations assume $T = 298$ K for the limiting case of zero ionic strength (*i.e.*, even neglecting plotted ions).



Equilibrium constants for hydrolysis and associated equilibria in critical compilations

Tin(IV)

Equilibrium reactions	lgK at infinite dilution and $T = 298\text{ K}$		
	Hummel et al., 2002	Gamsjäger et al, 2012	Brown and Ekberg, 2016
$\text{Sn}^{4+} + 4\text{H}_2\text{O} \rightleftharpoons \text{Sn}(\text{OH})_4 + 4\text{H}^+$			7.53 ± 0.12
$\text{Sn}^{4+} + 5\text{H}_2\text{O} \rightleftharpoons \text{Sn}(\text{OH})_5^- + 5\text{H}^+$			-1.07 ± 0.42
$\text{Sn}^{4+} + 6\text{H}_2\text{O} \rightleftharpoons \text{Sn}(\text{OH})_6^{2-} + 6\text{H}^+$			-11.14 ± 0.32
$\text{Sn}(\text{OH})_4 + \text{H}_2\text{O} \rightleftharpoons \text{Sn}(\text{OH})_5^- + \text{H}^+$	-8.0 ± 0.3	-8.60 ± 0.40	
$\text{Sn}(\text{OH})_4 + 2\text{H}_2\text{O} \rightleftharpoons \text{Sn}(\text{OH})_6^{2-} + 2\text{H}^+$	-18.4 ± 0.3	-18.67 ± 0.30	
$\text{SnO}_2(\text{cr}) + 2\text{H}_2\text{O} \rightleftharpoons \text{Sn}(\text{OH})_4$	-8.0 ± 0.2	-8.06 ± 0.11	
$\text{SnO}_2(\text{am}) + 2\text{H}_2\text{O} \rightleftharpoons \text{Sn}(\text{OH})_4$	-7.3 ± 0.3	-7.22 ± 0.08	
$\text{SnO}_2(\text{s}) + 4\text{H}^+ \rightleftharpoons \text{Sn}^{4+} + 2\text{H}_2\text{O}$			-15.59 ± 0.04

P.L. Brown and C. Ekberg, Hydrolysis of Metal Ions. Wiley, 2016, pp. 836–842.

W. Hummel, U. Berner, E. Curti, F.J. Pearson and T. Thoenen. Nagra / PSI Chemical Thermodynamic Data Base 01/01, July 2002.

H. Gamsjäger, T. Gajda, J. Sangster, S. K. Saxena and W. Voigt. Chemical Thermodynamics of Tin. Chemical Thermodynamics Volume 12. OECD, Paris, 2012.

Distribution diagrams

These diagrams have been computed at two Sn(IV) concentrations (1 mM = 1×10^{-3} mol L⁻¹ and 1 μ M = 1×10^{-6} mol L⁻¹) with the 'best' equilibrium constants above (in green). Calculations assume $T = 298$ K for the limiting case of zero ionic strength (*i.e.*, even neglecting plotted ions).

