

Equilibrium constants for hydrolysis and associated equilibria in critical compilations

Bismuth

Equilibrium reactions	lgK at infinite dilution and $T = 298 \text{ K}$				
	Baes and Mesmer, 1976	Lothenbach et al., 1999	NIST46	Kitamura et al., 2010	Brown and Ekberg, 2016
$\text{Bi}^{3+} + \text{H}_2\text{O} \rightleftharpoons \text{BiOH}^{2+} + \text{H}^+$	-1.09	-0.92	-1.1	-0.920	-0.92 ± 0.15
$\text{Bi}^{3+} + 2 \text{H}_2\text{O} \rightleftharpoons \text{Bi}(\text{OH})_2^+ + 2 \text{H}^+$	(-4)	-2.56	-4.5	-2.560 ± 1.000	-2.59 ± 0.26
$\text{Bi}^{3+} + 3 \text{H}_2\text{O} \rightleftharpoons \text{Bi}(\text{OH})_3 + 3 \text{H}^+$	-8.86	-5.31	-9.0	-8.940 ± 0.500	-8.78 ± 0.20
$\text{Bi}^{3+} + 4 \text{H}_2\text{O} \rightleftharpoons \text{Bi}(\text{OH})_4^- + 4 \text{H}^+$	-21.8	-18.71	-21.2	-21.660 ± 0.870	-22.06 ± 0.14
$3 \text{Bi}^{3+} + 4 \text{H}_2\text{O} \rightleftharpoons \text{Bi}_3(\text{OH})_4^{5+} + 4 \text{H}^+$		-0.80		-0.800	
$6 \text{Bi}^{3+} + 12 \text{H}_2\text{O} \rightleftharpoons \text{Bi}_6(\text{OH})_{12}^{6+} + 12 \text{H}^+$		1.34		1.340	0.98 ± 0.13

$9 \text{ Bi}^{3+} + 20 \text{ H}_2\text{O} = \text{Bi}_9(\text{OH})_{20}^{7+} + 20 \text{ H}^+$		-1.36		-1.360	
$9 \text{ Bi}^{3+} + 21 \text{ H}_2\text{O} = \text{Bi}_9(\text{OH})_{21}^{6+} + 21 \text{ H}^+$		-3.25		-3.250	
$9 \text{ Bi}^{3+} + 22 \text{ H}_2\text{O} = \text{Bi}_9(\text{OH})_{22}^{5+} + 22 \text{ H}^+$		-4.86		-4.860	
$\text{Bi}(\text{OH})_3(\text{am}) + 3 \text{ H}^+ = \text{Bi}^{3+} + 3 \text{ H}_2\text{O}$				31.501 ± 0.927	
$\alpha\text{-Bi}_2\text{O}_3(\text{cr}) + 6 \text{ H}^+ = 2 \text{ Bi}^{3+} + 3 \text{ H}_2\text{O}$		0.76			
$\text{BiO}_{1.5}(\text{s}, \alpha) + 3 \text{ H}^+ = \text{Bi}^{3+} + 1.5 \text{ H}_2\text{O}$	3.46			31.501 ± 0.927	2.88 ± 0.64

C.F. Baes and R.E. Mesmer, The Hydrolysis of Cations. Wiley, New York, 1976, p. 383.

P.L. Brown and C. Ekberg, Hydrolysis of Metal Ions. Wiley, 2016, pp. 874–884.

A. Kitamura, K. Fujiwara, R. Doi, Y. Yoshida, M. Mihara, M. Terashima and M. Yui, JAEA Thermodynamic Database for Performance Assessment of Geological Disposal of High-Level Radioactive and TRU-Wastes. Report JAEA-Data/Code 2009-024, Japan Atomic Energy Agency, 2010, 84 pp.

B. Lothenbach, M. Ochs, H. Wanner and M. Yui, Thermodynamic Data for the Speciation and Solubility of Pd, Pb, Sn, Sb, Nb and Bi in Aqueous Solution. Japan Nuclear Cycle Development Institute, 1999, pp. 12–22.

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Distribution diagrams

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

