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Equilibrium constants for hydrolysis and associated equilibria in critical compilations

Aluminium

Equilibrium reactions	lg*K* at infinite dilution and *T* = 298 K		
	Baes and Mesmer, 1976	Brown and Ekberg, 2016	Hummel and Thoenen, 2023
$Al^{3+} + H_2O \rightleftharpoons AlOH^{2+} + H^+$	–4.97	−4.98 ± 0.02	−4.98 ± 0.02
$Al^{3+} + 2\ H_2O \rightleftharpoons Al(OH)_2^+ + 2\ H^+$	–9.3	−10.63 ± 0.09	−10.63 ± 0.09
$Al^{3+} + 3\ H_2O \rightleftharpoons Al(OH)_3 + 3\ H^+$	–15.0	−15.66 ± 0.23	−15.99 ± 0.23
$Al^{3+} + 4\ H_2O \rightleftharpoons Al(OH)_4^- + 4\ H^+$	–23.0	−22.91 ± 0.10	−22.91 ± 0.10
$2\ Al^{3+} + 2\ H_2O \rightleftharpoons Al_2(OH)_2^{4+} + 2\ H^+$	–7.7	−7.62 ± 0.11	−7.62 ± 0.11
$3\ Al^{3+} + 4\ H_2O \rightleftharpoons Al_3(OH)_4^{5+} + 4\ H^+$	–13.94	−14.06 ± 0.22	−13.90 ± 0.12
$13\ Al^{3+} + 28\ H_2O \rightleftharpoons Al_{13}O_4(OH)_{24}^{7+} + 32\ H^+$	–98.73	−100.03 ± 0.09	−100.03 ± 0.09
α-$Al(OH)_3(s) + 3\ H^+ \rightleftharpoons Al^{3+} + 3\ H_2O$	8.5	7.75 ± 0.08	7.75 ± 0.08
γ-$AlOOH(s) + 3\ H^+ \rightleftharpoons Al^{3+} + 2\ H_2O$		7.69 ± 0.15	9.4 ± 0.4

C.F. Baes and R.E. Mesmer, The Hydrolysis of Cations. Wiley, New York, 1976, p. 121.

P.L. Brown and C. Ekberg, Hydrolysis of Metal Ions. Wiley, 2016, pp. 757–797.

W. Hummel and T. Thoenen, Technical Report 21-03. The PSI Chemical Thermodynamic Database 2020. NAGRA, Wettingen, 2023, pp. 252-259.

Distribution diagrams

These diagrams have been computed at two Al(III) concentrations (1 mM = $1x10^{-3}$ mol L^{-1} and 1 μM = $1x10^{-6}$ 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).