

Uranium(IV)

Reaction	Baes and Mesmer, 1976	Thoenen et al., 2014	Brown and Ekberg, 2016	Grenthe et al., 2020
$\text{U}^{4+} + \text{H}_2\text{O} \rightleftharpoons \text{UOH}^{3+} + \text{H}^+$	-0.65 ± 0.04	-0.54 ± 0.06	-0.58 ± 0.08	-0.54 ± 0.06
$\text{U}^{4+} + 2 \text{H}_2\text{O} \rightleftharpoons \text{U}(\text{OH})_2^{2+} + 2 \text{H}^+$	(-2.6)	-1.1 ± 1.0	-1.4 ± 0.2	-1.9 ± 0.2
$\text{U}^{4+} + 3 \text{H}_2\text{O} \rightleftharpoons \text{U}(\text{OH})_3^+ + 3 \text{H}^+$	(-5.8)	-4.7 ± 1.0	-5.1 ± 0.3	-5.2 ± 0.4
$\text{U}^{4+} + 4 \text{H}_2\text{O} \rightleftharpoons \text{U}(\text{OH})_4 + 4 \text{H}^+$	(-10.3)	-10.0 ± 1.4	-10.4 ± 0.5	-10.0 ± 1.4
$\text{U}^{4+} + 5 \text{H}_2\text{O} \rightleftharpoons \text{U}(\text{OH})_5^- + 5 \text{H}^+$	-16.0			
$\text{UO}_2(\text{am, hyd}) + 4 \text{H}^+ \rightleftharpoons \text{U}^{4+} + 2 \text{H}_2\text{O}$		1.5 ± 1.0		

$\text{UO}_2(\text{am,hyd}) + 2 \text{H}_2\text{O} \rightleftharpoons \text{U}^{4+} + 4 \text{OH}^-$			-54.500 ± 1.000	
$\text{UO}_2(\text{c}) + 4 \text{H}^+ \rightleftharpoons \text{U}^{4+} + 2 \text{H}_2\text{O}$	-1.8			
$\text{UO}_2(\text{c}) + 2 \text{H}_2\text{O} \rightleftharpoons \text{U}^{4+} + 4 \text{OH}^-$				-60.860 ± 1.000

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

P.L. Brown and C. Ekberg, Hydrolysis of Metal Ions. Wiley, 2016, pp. 336–349.

I. Grenthe, X. Gaona, A.V. Plyasunov, L. Rao, W.H. Runde, B. Grambow, R.J.M. Konings, A.L. Smith and E.E. Moore, Second Update on the Chemical Thermodynamics of Uranium, Neptunium, Plutonium, Americium and Technetium, OECD Pub., 2020.

T. Thoenen, W. Hummel, U. Berner and E. Curti, The PSI/Nagra Chemical Thermodynamic Database 12/07, Villigen: Paul Scherrer Institut PSI, 2014.

Uranium(VI)

Reaction	Baes and Mesmer, 1976	Grenthe et al., 1992	NIST46	Brown and Ekberg, 2016	Grenthe et al., 2020
$\text{UO}_2^{2+} + \text{H}_2\text{O} = \text{UO}_2(\text{OH})^+ + \text{H}^+$	-5.8	-5.2 ± 0.3	-5.9 ± 0.1	-5.13 ± 0.04	$-5.2_5 \pm 0.2_4$
$\text{UO}_2^{2+} + 2 \text{H}_2\text{O} = \text{UO}_2(\text{OH})_2 + 2 \text{H}^+$		≤ -10.3		$-12.1_5 \pm 0.2_0$	-12.15 ± 0.07
$\text{UO}_2^{2+} + 3 \text{H}_2\text{O} = \text{UO}_2(\text{OH})_3^- + 2 \text{H}^+$		-19.2 ± 0.4		$-20.2_5 \pm 0.4_2$	$-20.2_5 \pm 0.4_2$
$\text{UO}_2^{2+} + 4 \text{H}_2\text{O} = \text{UO}_2(\text{OH})_4^{2-} + 2 \text{H}^+$		-33 ± 2		$-32.4_0 \pm 0.6_8$	$-32.4_0 \pm 0.6_8$
$2 \text{UO}_2^{2+} + 2 \text{H}_2\text{O} = (\text{UO}_2)_2(\text{OH})_2^{2+} + 2 \text{H}^+$	-5.62	-5.62 ± 0.04	-5.58 ± 0.04	-5.68 ± 0.05	-5.62 ± 0.08
$3 \text{UO}_2^{2+} + 5 \text{H}_2\text{O} = (\text{UO}_2)_3(\text{OH})_5^+ + 5 \text{H}^+$	-15.63	$-15.5_5 \pm 0.1_2$	-15.6	$-15.7_5 \pm 0.1_2$	$-15.5_5 \pm 0.1_2$

$3 \text{UO}_2^{2+} + 4 \text{H}_2\text{O} = (\text{UO}_2)_3(\text{OH})_4^{2+} + 4 \text{H}^+$	(-11.75)	-11.9 ± 0.3		-11.78 ± 0.05	-11.9 ± 0.3
$3 \text{UO}_2^{2+} + 7 \text{H}_2\text{O} = (\text{UO}_2)_3(\text{OH})_7^- + 7 \text{H}^+$		-31 ± 2.0		-32.2 ± 0.8	-32.2 ± 0.8
$4 \text{UO}_2^{2+} + 7 \text{H}_2\text{O} = (\text{UO}_2)_4(\text{OH})_7^+ + 7 \text{H}^+$		-21.9 ± 1.0		-22.1 ± 0.2	-21.9 ± 1.0
$2 \text{UO}_2^{2+} + \text{H}_2\text{O} = (\text{UO}_2)_2(\text{OH})^{3+} + \text{H}^+$		-2.7 ± 1.0			-2.7 ± 1.0
$\text{UO}_2(\text{OH})_2(\text{s}) + 2\text{H}^+ = \text{UO}_2^{2+} + 2 \text{H}_2\text{O}$	5.6		6.0	4.81 ± 0.20	

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

P.L. Brown and C. Ekberg, Hydrolysis of Metal Ions. Wiley, 2016, pp. 350–379.

I. Grenthe, J. Fuger, R.J.M. Konings, R.J. Lemire, A.B. Muller, C. Nguyen-Trung and H. Wanner, Chemical Thermodynamics of Uranium, Chemical Vol 1, OECD Publishing, Paris, 1992.

I. Grenthe, X. Gaona, A.V. Plyasunov, L. Rao, W.H. Runde, B. Grambow, R.J.M. Konings, A.L. Smith and E.E. Moore, Second Update on the Chemical Thermodynamics of Uranium, Neptunium, Plutonium, Americium and Technetium, OECD Publishing, Paris, 2020.

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