B.3 Tables of ion interaction coefficients

Table B-6, Table B-7, Table B-8 and Table B-9 contain the selected specific ion interaction coefficients used in this review, according to the specific ion interaction treatment described. Table B-6 contains cation interaction coefficients with Cl^-, ClO_4^- and NO_3^-, Table B-7 anion interaction coefficients with Li^+, Na^+ (or NH_4^+) and K^+, and Table B-8 neutral species – electroneutral combination of ions. The coefficients have the units of $kg \cdot mol^{-1}$ and are valid for 298.15 K and 1 bar. The species are ordered by charge and appear, within each charge class, in the standard order of arrangement, *cf.* Section 2.1.8.

It should be noted that ion interaction coefficients tabulated in Table B-6, Table B-7 and Table B-8 may also involve ion pairing effects, as described in Section B.1.3.1. In direct comparisons of ion interaction coefficients, or when estimates are made by analogy, this aspect must be taken into account.

Table B-6: Ion interaction coefficients $\varepsilon(j,k)$ (kg·mol^{-1}) for cations j with k = Cl^-, ClO_4^- and NO_3^- at 298.15 K. The uncertainties represent the 95 % confidence level. The ion interaction coefficients marked with † can be described more accurately with an ionic strength dependent function, listed in Table B-7. The coefficients $\varepsilon(M^{n+}, Cl^-)$ and $\varepsilon(M^{n+}, NO_3^-)$ reported by Ciavatta [1980CIA] were evaluated without taking chloride and nitrate complexation into account, as discussed in Section B.1.3.1.

j	k	$\varepsilon(j,k)$	Comments
H^+	Cl^-	0.12 ± 0.01	
	ClO_4^-	0.14 ± 0.02	Reported by Ciavatta [1980CIA].
	NO_3^-	0.07 ± 0.01	
NH_4^+	Cl^-	-0.01 ± 0.01	Reported by Ciavatta [1980CIA].
	ClO_4^-	$-0.08 \pm 0.04^\dagger$	
	NO_3^-	$-0.06 \pm 0.03^\dagger$	
H_2gly^+	Cl^-	-0.06 ± 0.02	Reported by Ciavatta [1988CIA].
	ClO_4^-	—	
	NO_3^-	—	
H_5edta^+	Cl^-	-0.23 ± 0.15	
	ClO_4^-	-0.23 ± 0.15	See Section VIII.3.7 of [2005HUM/AND].
	NO_3^-	-0.23 ± 0.15	
$SnOH^+$	Cl^-	—	
	ClO_4^-	-0.07 ± 0.13	See Section VII.1.1 of [2012GAM/GAJ].
	NO_3^-	—	
SnF^+	Cl^-	—	
	ClO_4^-	0.14 ± 0.10	See Section VIII.3.1.1 of [2012GAM/GAJ].
	NO_3^-	—	
$SnCl^+$	Cl^-	—	
	ClO_4^-	0.08 ± 0.07	See Section VIII.3.2.1 of [2012GAM/GAJ].
	NO_3^-	—	
$SnBr^+$	Cl^-	—	
	ClO_4^-	0.15 ± 0.07	See Section VIII.3.3.1 of [2012GAM/GAJ].
	NO_3^-	—	
$SnNO_3^+$	Cl^-	—	
	ClO_4^-	0.17 ± 0.09	See Section X.1.1 of [2012GAM/GAJ].
	NO_3^-	—	
$SnSCN^+$	Cl^-	—	
	ClO_4^-	0.17 ± 0.29	See Section XI.1.1 of [2012GAM/GAJ].
	NO_3^-	—	
Tl^+	Cl^-	—	
	ClO_4^-	$-0.21 \pm 0.06^\dagger$	
	NO_3^-	—	

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Table B-6 (continued)

j	k	$\varepsilon(j,k)$	Comments
$ZnHCO_3^+$	Cl^-	0.2	Taken from Ferri *et al.* [1985FER/GRE].
	ClO_4^-	—	
	NO_3^-	—	
$CdCl^+$	Cl^-	—	
	ClO_4^-	0.25 ± 0.02	Reported by Ciavatta [1980CIA].
	NO_3^-	—	
CdI^+	Cl^-	—	
	ClO_4^-	0.27 ± 0.02	Reported by Ciavatta [1980CIA].
	NO_3^-	—	
$CdSCN^+$	Cl^-	—	
	ClO_4^-	0.31 ± 0.02	Reported by Ciavatta [1980CIA].
	NO_3^-	—	
$HgCl^+$	Cl^-	—	
	ClO_4^-	0.19 ± 0.02	Reported by Ciavatta [1988CIA].
	NO_3^-	—	
Cu^+	Cl^-	—	
	ClO_4^-	0.11 ± 0.01	Reported by Ciavatta [1980CIA].
	NO_3^-	—	
Ag^+	Cl^-	—	
	ClO_4^-	0.00 ± 0.01	Reported by Ciavatta [1980CIA].
	NO_3^-	$-0.12 \pm 0.05^\dagger$	
$NiOH^+$	Cl^-	-0.01 ± 0.07	Evaluated in [2005GAM/BUG] (Section V.3.1.1) for the reaction $Ni^{2+} + H_2O \rightleftharpoons NiOH^+ + H^+$ from $\Delta\varepsilon$ in chloride media / perchlorate media.
	ClO_4^-	0.14 ± 0.07	
	NO_3^-	—	
NiF^+	Cl^-	—	
	ClO_4^-	0.34 ± 0.08	Derived from $\Delta\varepsilon = \varepsilon(NiF^+,ClO_4^-) - \varepsilon(Ni^{2+},ClO_4^-) - \varepsilon(Na^+,F^-) = -(0.049 \pm 0.060)$ kg·mol^{-1} (see Section V.4.2.3 of [2005GAM/BUG]).
	NO_3^-	—	
$NiCl^+$	Cl^-	—	
	ClO_4^-	0.47 ± 0.06	See details in Section V.4.2.4 of [2005GAM/BUG].
	NO_3^-	—	
$NiNO_3^+$	Cl^-	—	
	ClO_4^-	0.44 ± 0.14	See details in Section V.6.1.2 of [2005GAM/BUG], specially sub-section V.6.1.2.1 for an alternative treatment of this system.
	NO_3^-	—	

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Table B-6 (continued)

j	k	$\varepsilon(j,k)$	Comments
$Ni(H_2cit)^+$	Cl^-	—	
	ClO_4^-	0.12 ± 0.50	See Section VII.7 in [2005HUM/AND].
	NO_3^-	—	
$NiBr^+$	Cl^-	—	
	ClO_4^-	0.59 ± 0.10	See details in [2005GAM/BUG], *cf.* Section V.4.2.5, specially sub-section V.4.2.5.1 for an alternative treatment of this system.
	NO_3^-	—	
$NiHS^+$	Cl^-	—	
	ClO_4^-	-0.85 ± 0.39	See details in [2005GAM/BUG], Section V.5.1.1.2.
	NO_3^-	—	
$NiSCN^+$	Cl^-	—	
	ClO_4^-	0.31 ± 0.04	Derived from $\Delta\varepsilon = \varepsilon(NiSCN^+,ClO_4^-) - \varepsilon(Na^+,SCN^-) - \varepsilon(Ni^{2+},ClO_4^-) = -(0.109 \pm 0.025)$ kg·mol^{-1} (see [2005GAM/BUG], Section V.7.1.3.1).
	NO_3^-	—	
$Fe(OH)_2^+$	Cl^-	—	
	ClO_4^-	0.37 ± 0.18	Determined in Section VII.1.3.2 of TDB-Iron Part 1.
	NO_3^-	—	
FeF^+	Cl^-		
	ClO_4^-	0.34 ± 0.07	Determined in Section VIII.2.1.3 of TDB-Iron Part 1.
	NO_3^-		
$FeCl_2^+$	Cl^-	—	
	ClO_4^-	0.52 ± 0.05	Determined in Section VIII.2.3.2.2.1 of TDB-Iron Part 1.
	NO_3^-	—	
$FeSO_3^+$	Cl^-	—	
	ClO_4^-	0.4	Determined in Section IX.2.2.3 of TDB-Iron Part 2.
	NO_3^-	—	
$FeSO_4^+$	Cl^-	—	
	ClO_4^-	0.4 ± 0.1	Determined in Section IX.1.2.1.4.1 of TDB-Iron Part 1.
	NO_3^-	—	
$Zr_4(OH)_{15}^+$	Cl^-	—	
	ClO_4^-	0.09 ± 0.92	Determined in [2005BRO/CUR] from the overall fit of the hydrolysis data as described in Appendix D.
	NO_3^-	-0.02 ± 1.46	
ZrF_3^+	Cl^-	—	
	ClO_4^-	0.20 ± 0.06	Determined from SIT plot in [2005BRO/CUR].
	NO_3^-	—	

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Table B-6 (continued)

j	k	$\varepsilon(j,k)$	Comments
YCO_3^+	Cl^-	—	
	ClO_4^-	0.17 ± 0.04	Taken from Spahiu [1983SPA].
	NO_3^-	—	
$Am(OH)_2^+$	Cl^-	-0.27 ± 0.20	Evaluated in [2003GUI/FAN] (*cf.* Section 12.3.1.1) from $\Delta\varepsilon$ (in NaCl solution) for the reactions $An^{3+} + nH_2O(l) \rightleftharpoons An(OH)_n^{(3-n)} + nH^+$ (An = Am, Cm).
	ClO_4^-	0.17 ± 0.04	Estimated in [1995SIL/BID].
	NO_3^-	—	
AmF_2^+	Cl^-	—	
	ClO_4^-	0.17 ± 0.04	Estimated in [1995SIL/BID].
	NO_3^-	—	
$AmSO_4^+$	Cl^-	—	
	ClO_4^-	0.22 ± 0.08	Evaluated in [1995SIL/BID].
	NO_3^-	—	
$AmCO_3^+$	Cl^-	0.01 ± 0.05	Evaluated in [2003GUI/FAN] (Section 12.6.1.1.1) from $\Delta\varepsilon$ (in NaCl solution) for the reactions $An^{3+} + nCO_3^{2-} \rightleftharpoons An(CO_3)_n^{(3-2n)}$ (based on $\varepsilon(Am^{3+}, Cl^-) = (0.23 \pm 0.02)$ kg·mol^{-1} and $\varepsilon(Na^+, CO_3^{2-}) = -(0.08 \pm 0.03)$ kg·mol^{-1}.
	ClO_4^-	0.17 ± 0.04	Estimated in [1995SIL/BID].
	NO_3^-	—	
$Am(ox)^+$	Cl^-	—	
	ClO_4^-	0.08 ± 0.10	See Section VI.13 of [2005HUM/AND].
	NO_3^-	—	
PuO_2^+	Cl^-	—	
	ClO_4^-	0.24 ± 0.05	Derived from $\Delta\varepsilon = \varepsilon(PuO_2^{2+}, ClO_4^-) - \varepsilon(PuO_2^+, ClO_4^-) = (0.22 \pm 0.03)$ kg·mol^{-1} [1995CAP/VIT]. In [1992GRE/FUG], $\varepsilon(PuO_2^+, ClO_4^-) = (0.17 \pm 0.05)$ kg·mol^{-1} was tabulated based on [1989ROB], [1989RIG/ROB] and [1990RIG]. Capdevila and Vitorge's data [1992CAP], [1994CAP/VIT] and [1995CAP/VIT] were unavailable at that time.
	NO_3^-	—	
PuO_2F^+	Cl^-	—	
	ClO_4^-	0.29 ± 0.11	Estimated in [2001LEM/FUG] by analogy with $\Delta\varepsilon$ of the corresponding Np(IV) reaction.
	NO_3^-	—	
PuO_2Cl^+	Cl^-	—	
	ClO_4^-	0.50 ± 0.09	From $\Delta\varepsilon$ evaluated by Giffaut [1994GIF].
	NO_3^-	—	

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Table B-6 (continued)

j	k	$\varepsilon(j,k)$	Comments
NpO_2^+	Cl^-	0.09 ± 0.05	See Section 12.1 of [2001LEM/FUG].
	ClO_4^-	0.25 ± 0.05	Derived from $\Delta\varepsilon = \varepsilon(NpO_2^{2+}, ClO_4^-) - \varepsilon(NpO_2^+, ClO_4^-) = (0.21 \pm 0.03)$ kg·mol^{-1} [1987RIG/VIT], [1989RIG/ROB] and [1990RIG].
	NO_3^-	—	
NpO_2OH^+	Cl^-	—	
	ClO_4^-	-0.06 ± 0.40	Estimated in [2001LEM/FUG].
	NO_3^-	—	
$(NpO_2)_3(OH)_5^+$	Cl^-	—	
	ClO_4^-	0.45 ± 0.20	See Section 8.1.2 of [2001LEM/FUG].
	NO_3^-	—	
NpO_2F^+	Cl^-	—	
	ClO_4^-	0.29 ± 0.12	Estimated in [2001LEM/FUG] by analogy with $\Delta\varepsilon$ of the corresponding U(IV) reaction.
	NO_3^-	—	
NpO_2Cl^+	Cl^-	—	
	ClO_4^-	0.50 ± 0.14	Estimated in [2001LEM/FUG] by analogy with $\Delta\varepsilon$ of the corresponding Pu(VI) reaction.
	NO_3^-	—	
$NpO_2IO_3^+$	Cl^-	—	
	ClO_4^-	0.33 ± 0.04	Estimated in [2001LEM/FUG] by assuming $\varepsilon(NpO_2IO_3^+, ClO_4^-) \approx \varepsilon(UO_2IO_3^+, ClO_4^-)$.
	NO_3^-	—	
$Np(SCN)_3^+$	Cl^-	—	
	ClO_4^-	0.17 ± 0.04	Estimated in [2001LEM/FUG] by assuming $\varepsilon(Np(SCN)_3^+, ClO_4^-) \approx \varepsilon(AmF_2^+, ClO_4^-)$.
	NO_3^-	—	
$Ca[NpO_2(OH)_2]^+$	Cl^-	-0.07 ± 0.08	This review
	ClO_4^-	—	
	NO_3^-	—	
UO_2^+	Cl^-	—	
	ClO_4^-	0.26 ± 0.03	Evaluated in [1992GRE/FUG], using $\varepsilon(UO_2^{2+}, ClO_4^-) = (0.46 \pm 0.03)$ kg·mol^{-1}.
	NO_3^-	—	
UO_2OH^+	Cl^-	—	
	ClO_4^-	-0.06 ± 0.40	Evaluated in [1992GRE/FUG], using $\varepsilon(UO_2^{2+}, X) = (0.46 \pm 0.03)$ kg·mol^{-1}, where X = Cl^-, ClO_4^- and NO_3^-.
	NO_3^-	0.51 ± 1.4	

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Table B-6 (continued)

j	*k*	$\varepsilon(j,k)$	Comments
$(UO_2)_3(OH)_5^+$	Cl^-	0.81 ± 0.17	Evaluated in [1992GRE/FUG], using $\varepsilon(UO_2^{2+}, X)$ = (0.46 ± 0.03) kg·mol^{-1}, where X = Cl^-, ClO_4^- and NO_3^-.
	ClO_4^-	0.45 ± 0.15	
	NO_3^-	0.41 ± 0.22	
UF_3^+	Cl^-	0.1 ± 0.1	Estimated in [1992GRE/FUG].
	ClO_4^-	0.1 ± 0.1	
	NO_3^-	—	
UO_2F^+	Cl^-	0.04 ± 0.07	Taken from Riglet *et al.* [1989RIG/ROB], where the following assumptions were made: $\varepsilon(Np^{3+}, ClO_4^-) \approx \varepsilon(Pu^{3+}, ClO_4^-)$ = 0.49 kg·mol^{-1} as for other (M^{3+}, ClO_4^-) interactions, and $\varepsilon(NpO_2^{2+}, ClO_4^-) \approx \varepsilon(PuO_2^{2+}, ClO_4^-) \approx \varepsilon(UO_2^{2+}, ClO_4^-)$ = 0.46 kg·mol^{-1}.
	ClO_4^-	0.28 ± 0.04	See Section 9.4.2.2.1 of [2003GUI/FAN].
	NO_3^-	—	
UO_2Cl^+	Cl^-	—	
	ClO_4^-	0.33 ± 0.04	Evaluated in [1992GRE/FUG], using $\varepsilon(UO_2^{2+}, X)$ = (0.46 ± 0.03) kg·mol^{-1}, where X = Cl^-, ClO_4^- and NO_3^-.
	NO_3^-	—	
$UO_2ClO_3^+$	Cl^-	—	
	ClO_4^-	0.33 ± 0.04	Estimated in [1992GRE/FUG].
	NO_3^-	—	
UO_2Br^+	Cl^-	—	
	ClO_4^-	0.24 ± 0.04	Estimated in [1992GRE/FUG].
	NO_3^-	—	
$UO_2BrO_3^+$	Cl^-	—	
	ClO_4^-	0.33 ± 0.04	Estimated in [1992GRE/FUG].
	NO_3^-	—	
$UO_2IO_3^+$	Cl^-	—	
	ClO_4^-	0.33 ± 0.04	Estimated in [1992GRE/FUG].
	NO_3^-	—	
$UO_2N_3^+$	Cl^-	—	
	ClO_4^-	0.3 ± 0.1	Estimated in [1992GRE/FUG].
	NO_3^-	—	
$UO_2NO_3^+$	Cl^-	—	
	ClO_4^-	0.33 ± 0.04	Estimated in [1992GRE/FUG].
	NO_3^-	—	

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Table B-6 (continued)

j	k	$\varepsilon(j,k)$	Comments
UO_2SCN^+	Cl^-	—	
	ClO_4^-	0.22 ± 0.04	Estimated in [1992GRE/FUG].
	NO_3^-	—	
$Th(OH)_3^+$	Cl^-	0.06 ± 0.05	See Table VII-16 in Section VII.3.6.1 of [2008RAN/FUG].
	ClO_4^-	0.15 ± 0.10	
	NO_3^-	0.05 ± 0.15	
ThF_3^+	Cl^-	—	
	ClO_4^-	0.1 ± 0.1	See Table VIII-8 in Section VIII.1.2.1 of [2008RAN/FUG].
	NO_3^-	0.0 ± 0.2	
$Th(NO_3)_3^+$	Cl^-	—	
	ClO_4^-	0.25 ± 0.15	Evaluated in Section X.1.3.3 of [2008RAN/FUG], using $\varepsilon(Th^{4+},X) = (0.70 \pm 0.10)$ kg·mol^{-1} where X = ClO_4^- and NO_3^-.
	NO_3^-	0.25 ± 0.15	
H_6edta^{2+}	Cl^-	-0.20 ± 0.16	Evaluated in [2005HUM/AND] (Section VIII.3.7).
	ClO_4^-	-0.20 ± 0.16	
	NO_3^-	-0.20 ± 0.16	
Sn^{2+}	Cl^-	0.19 ± 0.04	See Section VI.2.1 of [2012GAM/GAJ].
	ClO_4^-	0.19 ± 0.04	See Section VI.2.1 of [2012GAM/GAJ].
	NO_3^-	—	
$Sn_3(OH)_4^{2+}$	Cl^-	—	
	ClO_4^-	-0.02 ± 0.16	See Section VII.1.1 of [2012GAM/GAJ].
	NO_3^-	—	
Pb^{2+}	Cl^-	—	
	ClO_4^-	0.15 ± 0.02	Reported by Ciavatta [1980CIA].
	NO_3^-	$-0.20 \pm 0.12^\dagger$	
$AlOH^{2+}$	Cl^-	0.09	Taken from Hedlund [1988HED].
	ClO_4^-	0.31	
	NO_3^-	—	
$Al_2CO_3(OH)_2^{2+}$	Cl^-	0.26	Taken from Hedlund [1988HED].
	ClO_4^-	—	
	NO_3^-	—	
Zn^{2+}	Cl^-	—	
	ClO_4^-	0.33 ± 0.03	Reported by Ciavatta [1980CIA].
	NO_3^-	0.16 ± 0.02	
$ZnCO_3^{2+}$	Cl^-	0.35 ± 0.05	Taken from Ferri *et al.* [1985FER/GRE].
	ClO_4^-	—	
	NO_3^-	—	

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Table B-6 (continued)

j	*k*	*ε*(*j*,*k*)	Comments
Cd^{2+}	Cl^-	—	
	ClO_4^-	—	
	NO_3^-	0.09 ± 0.02	Reported by Ciavatta [1980CIA].
Hg^{2+}	Cl^-	—	
	ClO_4^-	0.34 ± 0.03	Reported by Ciavatta [1980CIA].
	NO_3^-	−0.1 ± 0.1†	
Hg_2^{2+}	Cl^-	—	
	ClO_4^-	0.09 ± 0.02	Reported by Ciavatta [1980CIA].
	NO_3^-	−0.2 ± 0.1†	
Cu^{2+}	Cl^-	0.08 ± 0.01	Reported by Ciavatta [1980CIA].
	ClO_4^-	0.32 ± 0.02	
	NO_3^-	0.11 ± 0.01	
Ni^{2+}	Cl^-	0.17 ± 0.02	Reported by Ciavatta [1980CIA].
	ClO_4^-	0.370 ± 0.032	Derived from the ionic strength dependence of the osmotic and mean activity coefficient of $Ni(ClO_4)_2$ solution ([2005GAM/BUG], Section V.4.3).
	NO_3^-	0.182 ± 0.010	Derived from the ionic strength dependence of the osmotic and mean activity coefficient of $Ni(NO_3)_2$ solution ([2005GAM/BUG], Section V.6.1.2.1).
Co^{2+}	Cl^-	0.16 ± 0.02	Reported by Ciavatta [1980CIA].
	ClO_4^-	0.34 ± 0.03	
	NO_3^-	0.14 ± 0.01	
Fe^{2+}	Cl^-	0.17 ± 0.01	Determined in Section VI.4.3 of TDB-Iron Part 1.
	ClO_4^-	0.37 ± 0.04	Determined in Section VI.4.4 of TDB-Iron Part 1.
	NO_3^-	—	
$FeOH^{2+}$	Cl^-	—	
	ClO_4^-	0.46 ± 0.05	Section VII.1.3.1 of TDB-Iron Part 1
	NO_3^-	—	
$FeCl^{2+}$	Cl^-	0.64 ± 0.06	Determined in Section VIII.2.3.1.3 of TDB-Iron Part 1
	ClO_4^-	0.63 ± 0.05	Determined in Section VIII.2.3.2.2.1 of TDB-Iron Part 1
	NO_3^-	—	
$FeSCN^{2+}$	Cl^-	—	
	ClO_4^-	0.49 ± 0.05	Determined in Section X.1.2.1 of TDB-Iron Part 2 (replacement).
	NO_3^-	0.13 ± 0.04	Determined in Section X.1.2.1 of TDB-Iron Part 2 (estimate).
Mn^{2+}	Cl^-	0.13 ± 0.01	Reported by Ciavatta [1980CIA].
	ClO_4^-	—	
	NO_3^-	—	

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Table B-6 (continued)

j	k	$\varepsilon(j,k)$	Comments
$Tc_2O_2(OH)_2^{2+}$	Cl^-	-0.43 ± 0.11	This review
	ClO_4^-	—	
	NO_3^-	—	
$Zr(OH)_2^{2+}$	Cl^-	—	
	ClO_4^-	0.62 ± 0.39	Determined in [2005BRO/CUR] from the overall fit of the hydrolysis data as described in Appendix D.
	NO_3^-	—	
ZrF_2^{2+}	Cl^-	—	
	ClO_4^-	0.47 ± 0.08	Determined from SIT plot in [2005BRO/CUR].
	NO_3^-	—	
$ZrCl_2^{2+}$	Cl^-	—	
	ClO_4^-	0.84 ± 0.11	Determined from SIT plot in [2005BRO/CUR].
	NO_3^-	—	
$Zr(NO_3)_2^{2+}$	Cl^-	—	
	ClO_4^-	0.84 ± 0.11	Determined from SIT plot in [2005BRO/CUR].
	NO_3^-	—	
$YHCO_3^{2+}$	Cl^-	—	
	ClO_4^-	0.39 ± 0.04	Taken from Spahiu [1983SPA].
	NO_3^-	—	
$AmOH^{2+}$	Cl^-	-0.04 ± 0.07	Evaluated in [2003GUI/FAN] (*cf.* Section 12.3.1.1) from $\Delta\varepsilon$ (in NaCl solution) for the reactions $An^{3+} + n\,H_2O(l) \rightleftharpoons An(OH)_n^{(3-n)} + n\,H^+$.
	ClO_4^-	0.39 ± 0.04	Estimated in [1995SIL/BID].
	NO_3^-	—	
AmF^{2+}	Cl^-	—	
	ClO_4^-	0.39 ± 0.04	Estimated in [1995SIL/BID].
	NO_3^-	—	
$AmCl^{2+}$	Cl^-	—	
	ClO_4^-	0.39 ± 0.04	Estimated in [1995SIL/BID].
	NO_3^-	—	
AmN_3^{2+}	Cl^-	—	
	ClO_4^-	0.39 ± 0.04	Estimated in [1995SIL/BID].
	NO_3^-	—	
$AmNO_2^{2+}$	Cl^-	—	
	ClO_4^-	0.39 ± 0.04	Estimated in [1995SIL/BID].
	NO_3^-	—	
$AmNO_3^{2+}$	Cl^-	—	
	ClO_4^-	0.39 ± 0.04	Estimated in [1995SIL/BID].
	NO_3^-	—	

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Table B-6 (continued)

j	k	$\varepsilon(j,k)$	Comments
$AmH_2PO_4^{2+}$	Cl^-	—	
	ClO_4^-	0.39 ± 0.04	Estimated in [1995SIL/BID].
	NO_3^-	—	
$AmSCN^{2+}$	Cl^-	—	
	ClO_4^-	0.39 ± 0.04	Estimated in [1995SIL/BID].
	NO_3^-	—	
PuO_2^{2+}	Cl^-	—	
	ClO_4^-	0.46 ± 0.05	By analogy with $\varepsilon(UO_2^{2+},ClO_4^-)$ as derived from isopiestic measurements in [1992GRE/FUG].The uncertainty is increased because the value is estimated by analogy.
	NO_3^-	—	
PuF_2^{2+}	Cl^-		
	ClO_4^-	0.36 ± 0.17	Estimated in [2001LEM/FUG] by analogy with $\Delta\varepsilon$ of the corresponding U(IV) reaction.
	NO_3^-	—	
$PuCl^{2+}$	Cl^-	—	
	ClO_4^-	0.39 ± 0.16	Estimated in [2001LEM/FUG] by analogy with $\Delta\varepsilon$ of the corresponding Am(III) reaction.
	NO_3^-	—	
PuI^{2+}	Cl^-	—	
	ClO_4^-	0.39 ± 0.04	Estimated in [2001LEM/FUG] by assuming $\varepsilon(PuI^{2+},ClO_4^-) \approx \varepsilon(AmSCN^{2+},ClO_4^-)$ and $\varepsilon(NH_4^+,I^-) \approx \varepsilon(Na^+,SCN^-)$.
	NO_3^-	—	
$PuSCN^{2+}$	Cl^-	—	
	ClO_4^-	0.39 ± 0.04	Estimated in [2001LEM/FUG] by assuming $\varepsilon(PuSCN^{2+},ClO_4^-) \approx \varepsilon(AmSCN^{2+},ClO_4^-)$.
	NO_3^-	—	
NpO_2^{2+}	Cl^-	—	
	ClO_4^-	0.46 ± 0.05	By analogy with $\varepsilon(UO_2^{2+},ClO_4^-)$ as derived from isopiestic measurements noted in [1992GRE/FUG]. The uncertainty is increased because the value is estimated by analogy.
	NO_3^-	—	
$(NpO_2)_2(OH)_2^{2+}$	Cl^-	—	
	ClO_4^-	0.57 ± 0.10	See Section 8.1.2 in [2001LEM/FUG].
	NO_3^-	—	
NpF_2^{2+}	Cl^-	—	
	ClO_4^-	0.38 ± 0.17	Estimated in [2001LEM/FUG] by analogy with $\Delta\varepsilon$ of the corresponding U(IV) reaction.
	NO_3^-	—	

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Table B-6 (continued)

j	k	$\varepsilon(j,k)$	Comments
$NpSO_4^{2+}$	Cl^-	—	
	ClO_4^-	0.48 ± 0.11	Estimated on Section 10.1.2.1 of [2001LEM/FUG].
	NO_3^-	—	
$Np(SCN)_2^{2+}$	Cl^-	—	
	ClO_4^-	0.38 ± 0.20	Estimated in [2001LEM/FUG] by analogy with $\Delta\varepsilon$ of the corresponding U(IV) reaction.
	NO_3^-	—	
$Ca_3[NpO_2(OH)_5]^{2+}$	Cl^-	– 0.20 ± 0.11	This review
	ClO_4^-	—	
	NO_3^-	—	
UO_2^{2+}	Cl^-	0.21 ± 0.02	Reported by Ciavatta [1980CIA].
	ClO_4^-	0.46 ± 0.03	Reported by Ciavatta [1980CIA].
	NO_3^-	0.24 ± 0.03	Reported by Ciavatta [1980CIA]. These coefficients were not used in [1992GRE/FUG] because they were evaluated by Ciavatta [1980CIA] without taking chloride and nitrate complexation into account. Instead, Grenthe *et al.* used $\varepsilon(UO_2^{2+},X)$ = (0.46 ± 0.03) kg·mol^{-1}, for X = Cl^-, ClO_4^- and NO_3^-.
$(UO_2)_2(OH)_2^{2+}$	Cl^-	0.69 ± 0.07	Evaluated in [1992GRE/FUG], using $\varepsilon(UO_2^{2+},X)$ = (0.46 ± 0.03) kg·mol^{-1}, where X = Cl^-, ClO_4^- and NO_3^-.
	ClO_4^-	0.57 ± 0.07	
	NO_3^-	0.49 ± 0.09	
$(UO_2)_3(OH)_4^{2+}$	Cl^-	0.50 ± 0.18	Evaluated in [1992GRE/FUG], using $\varepsilon(UO_2^{2+},X)$ = (0.46 ± 0.03) kg·mol^{-1}, where X = Cl^-, ClO_4^- and NO_3^-.
	ClO_4^-	0.89 ± 0.23	
	NO_3^-	0.72 ± 1.0	
UF_2^{2+}	Cl^-	—	
	ClO_4^-	0.3 ± 0.1	Estimated in [1992GRE/FUG].
	NO_3^-	—	
USO_4^{2+}	Cl^-	—	
	ClO_4^-	0.3 ± 0.1	Estimated in [1992GRE/FUG].
	NO_3^-	—	
$U(NO_3)_2^{2+}$	Cl^-	—	
	ClO_4^-	0.49 ± 0.14	Evaluated in [1992GRE/FUG] using $\varepsilon(U^{4+},ClO_4^-)$ = (0.76 ± 0.06) kg·mol^{-1}.
	NO_3^-	—	
$Th(OH)_2^{2+}$	Cl^-	0.13 ± 0.05	Calculated in Section VII.3.6.1 of [2008RAN/FUG].
	ClO_4^-	0.33 ± 0.10	
	NO_3^-	0.10 ± 0.15	

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Table B-6 (continued)

j	k	$\varepsilon(j,k)$	Comments
ThF_2^{2+}	Cl^-	—	
	ClO_4^-	0.3 ± 0.1	See Table VIII-8 in Section VIII.1.2.1 of [2008RAN/FUG].
	NO_3^-	0.15 ± 0.20	
$ThSO_4^{2+}$	Cl^-	0.14 ± 0.15	See Section IX.1.3.2 of [2008RAN/FUG].
	ClO_4^-	0.3 ± 0.1	
	NO_3^-	—	
$Th(N_3)_2^{2+}$	Cl^-	—	
	ClO_4^-	0.40 ± 0.15	Estimated in Section X.1.2 of [2008RAN/FUG].
	NO_3^-	—	
$Th(NO_3)_2^{2+}$	Cl^-	—	
	ClO_4^-	0.43 ± 0.18	Estimated in Section X.1.3.3 of [2008RAN/FUG], using $\varepsilon(Th^{4+}, X) = (0.70 \pm 0.10)$ kg·mol^{-1} for X = ClO_4^- and NO_3^-.
	NO_3^-	0.43 ± 0.18	
$Th(H_2PO_4)_2^{2+}$	Cl^-	—	
	ClO_4^-	0.4 ± 0.1	Estimated in Section X.2.3.2 of [2008RAN/FUG].
	NO_3^-	—	
$Th(SCN)_2^{2+}$	Cl^-	—	
	ClO_4^-	0.38 ± 0.20	See Section XI.1.3.6.1 of [2008RAN/FUG].
	NO_3^-	—	
Be^{2+}	Cl^-	—	
	ClO_4^-	0.30 ± 0.04	Taken from [1986BRU], where it appears to have been based on the average of the values for $\varepsilon(Mg^{2+}, ClO_4^-)$ and $\varepsilon(Ca^{2+}, ClO_4^-)$ [1980CIA].
	NO_3^-	—	
Mg^{2+}	Cl^-	0.19 ± 0.02	
	ClO_4^-	0.33 ± 0.03	Reported by Ciavatta [1980CIA].
	NO_3^-	0.17 ± 0.01	
Ca^{2+}	Cl^-	0.14 ± 0.01	
	ClO_4^-	0.27 ± 0.03	Reported by Ciavatta [1980CIA].
	NO_3^-	0.02 ± 0.01	
Ba^{2+}	Cl^-	0.07 ± 0.01	
	ClO_4^-	0.15 ± 0.02	Reported by Ciavatta [1980CIA].
	NO_3^-	-0.28 ± 0.03	
Al^{3+}	Cl^-	0.33 ± 0.02	Reported by Ciavatta [1980CIA].
	ClO_4^-	—	
	NO_3^-	—	

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Table B-6 (continued)

j	k	$\varepsilon(j,k)$	Comments
Ni_2OH^{3+}	Cl^-	—	
	ClO_4^-	0.59 ± 0.15	By assuming $\varepsilon(Ni_2OH^{3+}, ClO_4^-) \approx \varepsilon(Be_2OH^{3+}, ClO_4^-)$, see Section V.3.1.1 in [2005GAM/BUG].
	NO_3^-	—	
Fe^{3+}	Cl^-	0.76 ± 0.03	Determined in Section VI.4.2.2 of TDB-Iron Part 1.
	ClO_4^-	0.73 ± 0.04	Determined in Sections VI.1.2.1.1.1 and VI.4.1 of TDB-Iron Part 1.
	NO_3^-	0.26 ± 0.08	Determined in Section IX.4.1.3 of TDB-Iron Part 2 (analogy).
Cr^{3+}	Cl^-	0.30 ± 0.03	Reported by Ciavatta [1980CIA].
	ClO_4^-	—	
	NO_3^-	0.27 ± 0.02	Reported by Ciavatta [1980CIA].
$ZrOH^{3+}$	Cl^-	—	
	ClO_4^-	0.57 ± 0.13	Determined in [2005BRO/CUR] from the overall fit of the hydrolysis data as described in Appendix D.
	NO_3^-	—	
$Zr_3(OH)_9^{3+}$	Cl^-	—	
	ClO_4^-	0.93 ± 0.35	Determined in [2005BRO/CUR] from the overall fit of the hydrolysis data as described in Appendix D.
	NO_3^-	—	
ZrF^{3+}	Cl^-	—	
	ClO_4^-	0.63 ± 0.10	Determined from SIT plot in [2005BRO/CUR].
	NO_3^-	—	
$ZrCl^{3+}$	Cl^-	—	
	ClO_4^-	0.87 ± 0.10	Determined from SIT plot in [2005BRO/CUR].
	NO_3^-	—	
$Zr(NO_3)^{3+}$	Cl^-	—	
	ClO_4^-	0.88 ± 0.11	Determined from SIT plot in [2005BRO/CUR].
	NO_3^-	—	
La^{3+}	Cl^-	0.22 ± 0.02	Reported by Ciavatta [1980CIA].
	ClO_4^-	0.47 ± 0.03	
	NO_3^-	—	
$La^{3+} \rightarrow Lu^{3+}$	Cl^-	—	
	ClO_4^-	$0.47 \rightarrow 0.52$	Taken from Spahiu [1983SPA].
	NO_3^-	—	

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Table B-6 (continued)

j	*k*	$\varepsilon(j,k)$	Comments
Am^{3+}	Cl^-	0.23 ± 0.02	The $\varepsilon(An^{3+},Cl^-)$ for An = Am and Cm is assumed to be equal to $\varepsilon(Nd^{3+},Cl^-)$ which is calculated from trace activity coefficients of Nd^{3+} ion in 0 – 4 m NaCl. These trace activity coefficients are based on the Pitzer ion interaction parameters evaluated in [1997KON/FAN] from osmotic coefficients in aqueous $NdCl_3$ – NaCl and $NdCl_3$ – $CaCl_2$.
	ClO_4^-	0.49 ± 0.03	Estimated in [1995SIL/BID].
	NO_3^-	—	
Pu^{3+}	Cl^-	—	
	ClO_4^-	0.49 ± 0.05	Estimated by analogy with $\varepsilon(Ho^{3+},ClO_4^-)$ [1983SPA] as in [1992GRE/FUG], [1995SIL/BID]. The uncertainty is increased because the value is estimated by analogy.
	NO_3^-	—	
$PuOH^{3+}$	Cl^-	—	
	ClO_4^-	0.50 ± 0.05	Estimated in [2001LEM/FUG].
	NO_3^-	—	
PuF^{3+}	Cl^-	—	
	ClO_4^-	0.56 ± 0.11	Estimated in [2001LEM/FUG].
	NO_3^-	—	
$PuCl^{3+}$	Cl^-	—	
	ClO_4^-	0.85 ± 0.09	Derived from the $\Delta\varepsilon$ evaluated in [2001LEM/FUG].
	NO_3^-	—	
$PuBr^{3+}$	Cl^-	—	
	ClO_4^-	0.58 ± 0.16	Estimated in [2001LEM/FUG] by analogy with $\Delta\varepsilon$ of the corresponding U(IV) reaction, and by assuming $\varepsilon(H^+,Br^-) \approx \varepsilon(Na^+,Br^-)$.
	NO_3^-	—	
Np^{3+}	Cl^-	—	
	ClO_4^-	0.49 ± 0.05	Estimated by analogy with $\varepsilon(Ho^{3+},ClO_4^-)$ [1983SPA] as in previous books in this series [1992GRE/FUG], [1995SIL/BID]. The uncertainty is increased because the value is estimated by analogy.
	NO_3^-	—	
$NpOH^{3+}$	Cl^-	—	
	ClO_4^-	0.50 ± 0.05	Estimated in [2001LEM/FUG].
	NO_3^-	—	
NpF^{3+}	Cl^-	—	
	ClO_4^-	0.58 ± 0.07	Evaluated in [2001LEM/FUG].
	NO_3^-	—	

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Table B-6 (continued)

j	k	$\varepsilon(j,k)$	Comments
$NpCl^{3+}$	Cl^-	—	
	ClO_4^-	0.81 ± 0.09	Derived from the $\Delta\varepsilon$ selected in [2001LEM/FUG].
	NO_3^-	—	
NpI^{3+}	Cl^-	—	
	ClO_4^-	0.77 ± 0.26	Estimated in [2001LEM/FUG] by analogy with $\Delta\varepsilon$ of the corresponding Np(IV) chloride reaction, and by assuming $\varepsilon(H^+,I^-) \approx \varepsilon(Na^+,I^-)$.
	NO_3^-	—	
$NpSCN^{3+}$	Cl^-	0.76 ± 0.12	Estimated in [2001LEM/FUG] by analogy with $\Delta\varepsilon$ of the corresponding U(IV) reaction.
	ClO_4^-	—	
	NO_3^-	—	
U^{3+}	Cl^-	—	
	ClO_4^-	0.49 ± 0.05	Evaluated in [2001LEM/FUG] by analogy with $\varepsilon(Am^{3+}, ClO_4^-)$.
	NO_3^-	—	
UOH^{3+}	Cl^-	—	
	ClO_4^-	0.48 ± 0.08	Evaluated in [1992GRE/FUG].
	NO_3^-	—	
UF^{3+}	Cl^-	—	
	ClO_4^-	0.48 ± 0.08	Estimated in [1992GRE/FUG].
	NO_3^-	—	
UCl^{3+}	Cl^-	—	
	ClO_4^-	0.50 ± 0.10	Estimated in [2003GUI/FAN].
	NO_3^-	—	
UBr^{3+}	Cl^-	—	
	ClO_4^-	0.52 ± 0.10	Estimated in [1992GRE/FUG] using $\varepsilon(U^{4+},X) = (0.76 \pm 0.06)$ kg·mol^{-1}, for X = Br^- and ClO_4^-.
	NO_3^-	—	
UI^{3+}	Cl^-	—	
	ClO_4^-	0.55 ± 0.10	Estimated in [1992GRE/FUG] using $\varepsilon(U^{4+},X) = (0.76 \pm 0.06)$ kg·mol^{-1}, for X = I^- and ClO_4^-.
	NO_3^-	—	
UNO_3^{3+}	Cl^-	—	
	ClO_4^-	0.62 ± 0.08	Evaluated in [1992GRE/FUG] using $\varepsilon(U^{4+},X) = (0.76 \pm 0.06)$ kg·mol^{-1} for X = NO_3^- and ClO_4^-.
	NO_3^-	—	
$ThOH^{3+}$	Cl^-	0.19 ± 0.05	
	ClO_4^-	0.48 ± 0.08	See Table VII-18 in Section VII.3.6.1 of [2008RAN/FUG].
	NO_3^-	0.20 ± 0.15	

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Table B-6 (continued)

j	k	$\varepsilon(j,k)$	Comments
ThF^{3+}	Cl^-	—	
	ClO_4^-	0.48 ± 0.08	Estimated in Section VIII.1.2.1 of [2008RAN/FUG] (Table VIII-8).
	NO_3^-	0.25 ± 0.20	
$ThCl^{3+}$	Cl^-	0.62 ± 0.11	Calculated in Section VIII.2.2.1.2 of [2008RAN/FUG] using $\varepsilon(Th^{4+},X) = (0.70 \pm 0.10)$ kg·mol^{-1}, for X = Cl^- and ClO_4^-
	ClO_4^-	0.62 ± 0.11	
	NO_3^-	—	
$ThClO_3^{3+}$	Cl^-	—	
	ClO_4^-	0.62 ± 0.11	Calculated in Section VIII.2.2.2 of [2008RAN/FUG] using $\varepsilon(Th^{4+},X) = (0.70 \pm 0.10)$ kg·mol^{-1}, for X = ClO_3^- and ClO_4^-
	NO_3^-	—	
$ThBr^{3+}$	Cl^-	—	
	ClO_4^-	0.62 ± 0.11	Calculated in Section VIII.3.2.1 of [2008RAN/FUG] using $\varepsilon(Th^{4+},X) = (0.70 \pm 0.10)$ kg·mol^{-1}, for X = Br^- and ClO_4^-
	NO_3^-	—	
$ThBrO_3^{3+}$	Cl^-	—	
	ClO_4^-	0.62 ± 0.08	Calculated in Section VIII.3.2.2 of [2008RAN/FUG] using $\varepsilon(Th^{4+},X) = (0.70 \pm 0.10)$ kg·mol^{-1}, for X = BrO_3^- and ClO_4^-
	NO_3^-	—	
ThN_3^{3+}	Cl^-	—	
	ClO_4^-	0.55 ± 0.15	See Section X.1.2 of [2008RAN/FUG].
	NO_3^-	—	
$ThNO_3^{3+}$	Cl^-	—	
	ClO_4^-	0.56 ± 0.14	Calculated in Section X.1.3.3 of [2008RAN/FUG] using $\varepsilon(Th^{4+},X) = (0.70 \pm 0.10)$ kg·mol^{-1}, X = ClO_4^- and NO_3^-.
	NO_3^-	0.56 ± 0.14	
$Th(H_2PO_4)^{3+}$	Cl^-	—	
	ClO_4^-	0.5 ± 0.1	Estimated in Section X.2.3.2 of [2008RAN/FUG].
	NO_3^-	—	
$Th(H_2PO_4)(H_3PO_4)^{3+}$	Cl^-	—	
	ClO_4^-	0.5 ± 0.1	Estimated in Section X.2.3.2 of [2008RAN/FUG].
	NO_3^-	—	
$ThSCN^{3+}$	Cl^-	—	
	ClO_4^-	0.50 ± 0.10	See Section XI.1.3.6.1 of [2008RAN/FUG].
	NO_3^-	—	

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Table B-6 (continued)

j	*k*	$\varepsilon(j,k)$	Comments
Be_2OH^{3+}	Cl^-	—	
	ClO_4^-	0.50 ± 0.05	Taken from [1986BRU], where the assumption was made that $\varepsilon(Be^{2+}, ClO_4^-) = 0.30$ kg·mol^{-1}, apparently based on the average of the values for $\varepsilon(Mg^{2+}, ClO_4^-)$ and $\varepsilon(Ca^{2+}, ClO_4^-)$ [1980CIA].
	NO_3^-	—	
$Be_3(OH)_3^{3+}$	Cl^-	—	
	ClO_4^-	0.51 ± 0.05	Taken from [1986BRU], where the assumption was made that $\varepsilon(Be^{2+}, ClO_4^-) = 0.30$ kg·mol^{-1}, apparently based on the average of the values for $\varepsilon(Mg^{2+}, ClO_4^-)$ and $\varepsilon(Ca^{2+}, ClO_4^-)$ [1980CIA].
	NO_3^-	—	
Sn^{4+}	Cl^-	—	
	ClO_4^-	0.7 ± 0.2	See Section VI.3.1 of [2012GAM/GAJ].
	NO_3^-	—	
$Al_3HCO_3(OH)_4^{4+}$	Cl^-	0.41	Taken from Hedlund [1988HED].
	ClO_4^-	—	
	NO_3^-	—	
$Ni_4(OH)_4^{4+}$	Cl^-	—	
	ClO_4^-	1.08 ± 0.08	Derived from $\Delta\varepsilon = 4\varepsilon(H^+, ClO_4^-) - \varepsilon(Ni_4OH_4^{4+}, ClO_4^-) - 4\varepsilon(Ni^{2+}, ClO_4^-)$ = (0.16 ± 0.05) kg·mol^{-1} (see [2005GAM/BUG], Section V.3.1.1.1).
	NO_3^-	—	
$Fe_2(OH)_2^{4+}$	Cl^-	—	
	ClO_4^-	1.04 ± 0.10	Determined in Section VII.1.3.3 of TDB-Iron Part 1.
	NO_3^-	—	
Zr^{4+}	Cl^-	0.33 ± 0.09	
	ClO_4^-	0.89 ± 0.10	Determined in [2005BRO/CUR]
	NO_3^-	0.33 ± 0.35	
$Y_2CO_3^{4+}$	Cl^-	—	
	ClO_4^-	0.80 ± 0.04	Taken from Spahiu [1983SPA].
	NO_3^-	—	
	NO_3^-	—	
Pu^{4+}	Cl^-	—	
	ClO_4^-	0.82 ± 0.07	Derived from $\Delta\varepsilon = \varepsilon(Pu^{4+}, ClO_4^-) - \varepsilon(Pu^{3+}, ClO_4^-) =$ (0.33 ± 0.035) kg·mol^{-1} [1995CAP/VIT]. Uncertainty estimated in [2001LEM/FUG]. In the [1992GRE/FUG], $\varepsilon(Pu^{3+}, ClO_4^-) = (1.03 \pm 0.05)$ kg·mol^{-1} was tabulated based on references [1989ROB], [1989RIG/ROB], [1990RIG].

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Table B-6 (continued)

j	k	$\varepsilon(j,k)$	Comments
			Capdevila and Vitorge's data [1992CAP], [1994CAP/VIT] and [1995CAP/VIT] were unavailable at the time.
	NO_3^-	—	
Np^{4+}	Cl^-	—	
	ClO_4^-	0.84 ± 0.06	Derived from $\Delta\varepsilon = \varepsilon(Np^{4+},ClO_4^-) - \varepsilon(Np^{3+},ClO_4^-) = (0.35 \pm 0.03)$ kg·mol^{-1} [1989ROB], [1989RIG/ROB], [1990RIG].
	NO_3^-	—	
U^{4+}	Cl^-	—	
	ClO_4^-	0.76 ± 0.06	Estimated in [1992GRE/FUG]. Using the measured value of $\Delta\varepsilon = \varepsilon(U^{4+},ClO_4^-) - \varepsilon(U^{3+},ClO_4^-) = (0.35 \pm 0.06)$ kg·mol^{-1} p.89 [1990RIG], where the uncertainty is recalculated in [2001LEM/FUG] from the data given in this thesis, and $\varepsilon(U^{3+},ClO_4^-) = (0.49 \pm 0.05)$ kg·mol^{-1}, a value for $\varepsilon(U^{4+},ClO_4^-)$ can be calculated in the same way as is done for $\varepsilon(Np^{4+},ClO_4^-)$ and $\varepsilon(Pu^{4+},ClO_4^-)$. This value, $\varepsilon(U^{4+},ClO_4^-) = (0.84 \pm 0.06)$ kg·mol^{-1} is consistent with that tabulated $\varepsilon(U^{4+},ClO_4^-) = (0.76 \pm 0.06)$ kg·mol^{-1}, since the uncertainties overlap. The authors of [2001LEM/FUG] do not believe that a change in the previously selected value for $\varepsilon(U^{4+},ClO_4^-)$ is justified at present.
	NO_3^-	—	
Th^{4+}	Cl^-	0.25 ± 0.03	Reported by Ciavatta [1980CIA].
	ClO_4^-	0.70 ± 0.10	Evaluated in Section VI.3.1 of [2008RAN/FUG].
	NO_3^-	0.31 ± 0.12	Evaluated in Section VI.3.1 of [2008RAN/FUG].
$Th_4(OH)_{12}^{4+}$	Cl^-	0.25 ± 0.20	
	ClO_4^-	0.56 ± 0.42	See Section VII.3.4.1.3 of [2008RAN/FUG].
	NO_3^-	0.42 ± 0.50	
$Th(H_3PO_4)^{4+}$	Cl^-	—	
	ClO_4^-	0.7 ± 0.1	Estimated in Section X.2.3.2 of [2008RAN/FUG].
	NO_3^-	—	
$Al_3(OH)_4^{5+}$	Cl^-	0.66	Taken from Hedlund [1988HED]
	ClO_4^-	1.30	Taken from Hedlund [1988HED]
	NO_3^-	—	
$Th_2(OH)_3^{5+}$	Cl^-	0.29 ± 0.09	
	ClO_4^-	0.91 ± 0.21	Calculated in Section VII.3.4.1.1 of [2008RAN/FUG].
	NO_3^-	0.69 ± 0.25	
$Th_2(OH)_2^{6+}$	Cl^-	0.40 ± 0.16	
	ClO_4^-	1.22 ± 0.24	Evaluated in Section VII.3.4.1.1 of [2008RAN/FUG].
	NO_3^-	0.69 ± 0.26	

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Table B-6 (continued)

j	k	$\varepsilon(j,k)$	Comments
$Zr_3(OH)_4^{8+}$	Cl^-	0.33 ± 0.28	Determined in [2005BRO/CUR] from the overall fit of the hydrolysis data as described in Appendix D.
	ClO_4^-	1.89 ± 0.31	
	NO_3^-	2.28 ± 0.35	
$Zr_4(OH)_8^{8+}$	Cl^-	—	
	ClO_4^-	3.61 ± 1.02	Determined in [2005BRO/CUR] from the overall fit of the hydrolysis data as described in Appendix D.
	NO_3^-	—	
$Th_4(OH)_8^{8+}$	Cl^-	0.70 ± 0.20	Evaluated in Section VII.3.4.1.3 of [2008RAN/FUG].
	ClO_4^-	1.69 ± 0.42	
	NO_3^-	1.59 ± 0.51	
$Th_6(OH)_{15}^{9+}$	Cl^-	0.72 ± 0.30	See details in Section VII.3.4.1.4 of [2008RAN/FUG].
	ClO_4^-	1.85 ± 0.74	
	NO_3^-	2.20 ± 0.77	
$Th_6(OH)_{14}^{10+}$	Cl^-	0.83 ± 0.30	Estimated in Section VII.3.4.1.4 of [2008RAN/FUG].
	ClO_4^-	2.2 ± 0.3	
	NO_3^-	2.9 ± 0.5	

Table B-7: Ion interaction coefficients, $\varepsilon(j,k)$ (kg·mol^{-1}), for anions j with k = Li^+, Na^+ and K^+ at 298.15 K. The uncertainties represent the 95 % confidence level. The ion interaction coefficients marked with † can be described more accurately with an ionic strength dependent function, listed in Table B-8.

j	k	$\varepsilon(j,k)$	Comments
OH^-	Li^+	-0.02 ± 0.03†	
	Na^+	0.04 ± 0.01	Reported by Ciavatta [1980CIA].
	K^+	0.09 ± 0.01	
F^-	Li^+	—	
	Na^+	0.02 ± 0.02	Evaluated in [1992GRE/FUG].
	K^+	0.03 ± 0.02	[1988CIA]
HF_2^-	Li^+	—	
	Na^+	-0.11 ± 0.06	Evaluated in [1992GRE/FUG].
	K^+	—	
Cl^-	Li^+	0.10 ± 0.01	
	Na^+	0.03 ± 0.01	Reported by Ciavatta [1980CIA].
	K^+	0.00 ± 0.01	
ClO_3^-	Li^+	—	
	Na^+	-0.01 ± 0.02	Reported by Ciavatta [1980CIA].
	K^+	—	
ClO_4^-	Li^+	0.15 ± 0.01	Reported by Ciavatta [1980CIA].
	Na^+	0.01 ± 0.01	
	K^+	—	
Br^-	Li^+	0.13 ± 0.02	
	Na^+	0.05 ± 0.01	Reported by Ciavatta [1980CIA].
	K^+	0.01 ± 0.02	
BrO_3^-	Li^+	—	
	Na^+	-0.06 ± 0.02	Reported by Ciavatta [1980CIA].
	K^+	—	
I^-	Li^+	0.16 ± 0.01	
	Na^+	0.08 ± 0.02	Reported by Ciavatta [1980CIA].
	K^+	0.02 ± 0.01	
IO_3^-	Li^+	—	
	Na^+	-0.06 ± 0.02	Estimated in [1992GRE/FUG].
	K^+	—	
HSO_4^-	Li^+	—	
	Na^+	-0.01 ± 0.02	Reported by Ciavatta [1980CIA].
	K^+	—	

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Table B-7 (continued)

j	*k*	$\varepsilon(j,k)$	Comments
N_3^-	Li^+	—	
	Na^+	0.015 ± 0.020	See Section X.1.2 of [2008RAN/FUG].
	K^+	—	
NO_2^-	Li^+	0.06 ± 0.04†	
	Na^+	0.00 ± 0.02	Reported by Ciavatta [1980CIA].
	K^+	-0.04 ± 0.02	Reported by Ciavatta [1988CIA].
NO_3^-	Li^+	0.08 ± 0.01	Reported by Ciavatta [1980CIA].
	Na^+	-0.04 ± 0.03†	
	K^+	-0.11 ± 0.04†	
$H_2PO_4^-$	Li^+	—	
	Na^+	-0.08 ± 0.04†	
	K^+	-0.14 ± 0.04†	
$H_2AsO_4^-$	Li^+	—	
	Na^+	-0.01 ± 0.01	Evaluated in Appendix A of this review in the entry for [2002RAP/SAN]
	K^+	—	
HCO_3^-	Li^+	—	
	Na^+	0.00 ± 0.02	These values differ from those reported in [1992GRE/FUG]. See the discussion in [1995GRE/PUI]. Values for CO_3^{2-} and HCO_3^- are based on [1980CIA].
	K^+	-0.06 ± 0.05	Calculated in [2001LEM/FUG] from Pitzer coefficients [1998RAI/FEL].
Hox^-	Li^+	-0.28 ± 0.09	Evaluated in Section VI.3.5 of [2005HUM/AND].
	Na^+	-0.07 ± 0.01	
	K^+	-0.01 ± 0.08	
H_2cit^-	Li^+	-0.11 ± 0.03	Evaluated in Section VII.3.6 of [2005HUM/AND].
	Na^+	-0.05 ± 0.01	
	K^+	-0.04 ± 0.01	
CN^-	Li^+	—	
	Na^+	0.07 ± 0.03	As reported in [1992BAN/BLI].
	K^+	—	
SCN^-	Li^+	—	Reported by Ciavatta [1980CIA].
	Na^+	0.05 ± 0.01	
	K^+	-0.01 ± 0.01	
$HCOO^-$	Li^+	—	
	Na^+	0.03 ± 0.01	Reported by Ciavatta [1980CIA].
	K^+	—	

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Table B-7 (continued)

j	k	$\varepsilon(j,k)$	Comments
CH_3COO^-	Li^+	0.05 ± 0.01	
	Na^+	0.08 ± 0.01	Reported by Ciavatta [1980CIA].
	K^+	0.09 ± 0.01	
H_3edta^-	Li^+	—	
	Na^+	– 0.33 ± 0.14	Evaluated in Section VIII.3.7 of [2005HUM/AND].
	K^+	– 0.14 ± 0.17	
$SiO(OH)_3^-$	Li^+	—	
	Na^+	– 0.08 ± 0.03	Evaluated in [1992GRE/FUG].
	K^+	—	
$Si_2O_2(OH)_5^-$	Li^+	—	
	Na^+	– 0.08 ± 0.04	Estimated in [1992GRE/FUG].
	K^+	—	
$Sn(OH)_3^-$	Li^+	—	
	Na^+	0.22 ± 0.03	See Section VII.1.1 of [2012GAM/GAJ].
	K^+	—	
$SnCl_3^-$	Li^+	—	
	Na^+	0.04 ± 0.07	See Section VIII.3.2.1 of [2012GAM/GAJ].
	K^+	—	
$SnBr_3^-$	Li^+	—	
	Na^+	0.16 ± 0.08	See Section VIII.3.3.1 of [2012GAM/GAJ].
	K^+	—	
$B(OH)_4^-$	Li^+	—	
	Na^+	– 0.07 ± 0.05†	
	K^+	—	
$Ni(SCN)_3^-$	Li^+	—	
	Na^+	0.66 ± 0.13	Evaluated in [2005GAM/BUG] (see Section V.7.1.3.1).
	K^+	—	
$Ni(cit)^-$	Li^+	—	
	Na^+	0.22 ± 0.50	Evaluated in Section VII.7 of [2005HUM/AND].
	K^+	—	
$Fe(SO_4)_2^-$	Li^+	—	
	Na^+	0.24 ± 0.14	Estimated in Section IX.1.2.1.4.3 of TDB-Iron Part 1.
	K^+	—	
$TcO(OH)_3^-$	Li^+	—	
	Na^+	– 0.08 ± 0.04	This review
	K^+	—	

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Table B-7 (continued)

j	*k*	$\varepsilon(j,k)$	Comments
ZrF_5^-	Li^+	—	
	Na^+	-0.14 ± 0.03	Determined from SIT plots in [2005BRO/CUR].
	K^+	—	
$Am(SO_4)_2^-$	Li^+	—	
	Na^+	-0.05 ± 0.05	Estimated in [1995SIL/BID].
	K^+	—	
$Am(CO_3)_2^-$	Li^+	—	
	Na^+	-0.14 ± 0.06	Evaluated Section 12.6.1.1.1 [2003GUI/FAN], from $\Delta\varepsilon_n$ in NaCl solution for the reactions $An^{3+} + n\,CO_3^{2-} \rightleftharpoons An(CO_3)_n^{(3-2n)}$ (An = Am, Cm) based on $\varepsilon(Am^{3+},Cl^-)$ = (0.23 ± 0.02) kg·mol^{-1} and $\varepsilon(Na^+,CO_3^{2-}) = -(0.08 \pm 0.03)$ kg·mol^{-1}.
	K^+	—	
$Am(ox)_2^-$	Li^+	—	
	Na^+	-0.21 ± 0.08	Evaluated in Section VI.13 of [2005HUM/AND].
	K^+	—	
$Am(edta)^-$	Li^+	—	
	Na^+	0.01 ± 0.16	Evaluated in Section VIII.13.2.1 of [2005HUM/AND].
	K^+	0.01 ± 0.16	Estimated in [2005HUM/AND] Section VIII.13.2.1 by assuming $\varepsilon(K^+,Am(edta)^-) \approx \varepsilon(Na^+,Am(edta)^-)$.
$PuO_2CO_3^-$	Li^+	—	
	Na^+	-0.18 ± 0.18	Estimated in [2001LEM/FUG] by analogy with $\varepsilon(Na^+,NpO_2CO_3^-)$.
	K^+	—	
$Pu(edta)^-$	Li^+	—	
	Na^+	—	
	K^+	0.01 ± 0.16	Estimated in [2005HUM/AND], Section VIII.12.2.1 by assuming $\varepsilon(K^+,Pu(edta)^-) \approx \varepsilon(Na^+,Am(edta)^-)$.
$NpO_2(OH)_2^-$	Li^+	—	
	Na^+	-0.01 ± 0.07	Estimated in [2001LEM/FUG] (Section 8.1.3).
	K^+	—	
$NpO_2(OH)_3^-$	Li^+	—	
	Na^+	-0.20 ± 0.02	This review
	K^+	—	
$NpO_2SO_4^-$	Li^+	—	
	Na^+	0.07 ± 0.13	This review
	K^+	—	

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Table B-7 (continued)

j	*k*	$\varepsilon(j,k)$	Comments
$NpO_2HPO_4^-$	Li^+	—	
	Na^+	-0.05 ± 0.11	This review
	K^+	—	
$NpO_2CO_3^-$	Li^+	—	
	Na^+	-0.18 ± 0.15	Calculated in [2001LEM/FUG] (Section 12.1.2.1.3).
	K^+	—	
$NpO_2(ox)^-$	Li^+	—	
	Na^+	-0.4 ± 0.1	Evaluated in Section VI.11.2.3 of [2005HUM/AND].
	K^+	—	
$NpO_2(H_2edta)^-$	Li^+	—	
	Na^+	-0.18 ± 0.16	Evaluated in Section VIII.11.2.3 of [2005HUM/AND].
	K^+	—	
$(NpO_2)_2CO_3(OH)_3^-$	Li^+	—	
	Na^+	0.00 ± 0.05	Estimated by analogy in [2001LEM/FUG] (Section 12.1.2.1.2).
	K^+	—	
$UO_2(OH)_3^-$	Li^+	—	
	Na^+	-0.24 ± 0.09	This review.
	K^+	—	
$UO_2F_3^-$	Li^+	—	
	Na^+	-0.14 ± 0.05	Evaluated in [2003GUI/FAN], Section 9.4.2.2.1.1.
	K^+	—	
$UO_2(N_3)_3^-$	Li^+	—	
	Na^+	0.0 ± 0.1	Estimated in [1992GRE/FUG].
	K^+	—	
$(UO_2)_2CO_3(OH)_3^-$	Li^+	—	
	Na^+	0.00 ± 0.05	Estimated in [1992GRE/FUG].
	K^+	—	
UO_2cit^-	Li^+	—	
	Na^+	-0.11 ± 0.09	Evaluated in [2005HUM/AND].
	K^+	—	
$Th(OH)_3(CO_3)^-$	Li^+	—	
	Na^+	-0.05 ± 0.20	See Section XI.1.3.2 of [2008RAN/FUG].
	K^+	—	
$Mg(cit)^-$	Li^+	—	
	Na^+	0.03 ± 0.03	Evaluated in [2005HUM/AND].
	K^+	—	

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Table B-7 (continued)

j	k	$\varepsilon(j,k)$	Comments
$UO_2(Hedta)^-$	Li^+	—	
	Na^+	-0.18 ± 0.16	Evaluated in Section VIII.10.2.4 of [2005HUM/AND].
	K^+	—	
$Mg(Hedta)^-$	Li^+	—	
	Na^+	0.11 ± 0.20	Estimated in Section VIII.5.1 of [2005HUM/AND]
	K^+	—	
SO_3^{2-}	Li^+	—	
	Na^+	-0.08 ± 0.05†	
	K^+	—	
SO_4^{2-}	Li^+	-0.03 ± 0.04†	
	Na^+	-0.12 ± 0.06†	
	K^+	-0.06 ± 0.02	Reported by Ciavatta [1988CIA].
$S_2O_3^{2-}$	Li^+	—	
	Na^+	-0.08 ± 0.05†	
	K^+	—	
HPO_4^{2-}	Li^+	—	
	Na^+	-0.15 ± 0.06†	
	K^+	-0.10 ± 0.06†	
CO_3^{2-}	Li^+	—	
	Na^+	-0.08 ± 0.03	These values differ from those reported in [1992GRE/FUG]. See the discussion in [1995GRE/PUI]. Values for CO_3^{2-} and HCO_3^- are based on [1980CIA].
	K^+	0.02 ± 0.01	Reported by Ciavatta [1980CIA].
ox^{2-}	Li^+	-0.51 ± 0.09	Evaluated in Section VI.3.5 of [2005HUM/AND].
	Na^+	-0.08 ± 0.01	
	K^+	0.07 ± 0.08	
$Hcit^{2-}$	Li^+	-0.17 ± 0.04	Evaluated in Section VII.3.6 of [2005HUM/AND].
	Na^+	-0.04 ± 0.02	
	K^+	-0.01 ± 0.02	
H_2edta^{2-}	Li^+	—	Evaluated in Section VII.3.7 of [2005HUM/AND].
	Na^+	-0.37 ± 0.14	
	K^+	-0.17 ± 0.18	
$SiO_2(OH)_2^{2-}$	Li^+	—	
	Na^+	-0.10 ± 0.07	Evaluated in [1992GRE/FUG].
	K^+	—	
$Si_2O_3(OH)_4^{2-}$	Li^+	—	
	Na^+	-0.15 ± 0.06	Estimated in [1992GRE/FUG].
	K^+	—	

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Table B-7 (continued)

j	*k*	$\varepsilon(j,k)$	Comments
$Ni(ox)_2^{2-}$	Li^+	—	
	Na^+	-0.26 ± 0.03	Evaluated in Section VI.7.2 of [2005HUM/AND].
	K^+	—	
$Ni(CN)_4^{2-}$	Li^+	—	
	Na^+	0.185 ± 0.081	Evaluated in [2005GAM/BUG] (see Section V.7.1.2.1.1).
	K^+	—	
$Fe(CO_3)_2^{2-}$	Li^+		
	Na^+	-0.05 ± 0.05	By analogy. See Appendix A entry for [1992BRU/WER].
	K^+		
CrO_4^{2-}	Li^+	—	
	Na^+	-0.06 ± 0.04†	
	K^+	-0.08 ± 0.04†	
$Zr(OH)_6^{2-}$	Li^+	—	
	Na^+	-0.10 ± 0.10	Determined in [2005BRO/CUR] by analogy to known interaction coefficients of doubly charged anionic species with alkali ions (source: [2001LEM/FUG]).
	K^+	—	
ZrF_6^{2-}	Li^+	—	
	Na^+	-0.15 ± 0.06	Determined from SIT plots in [2005BRO/CUR].
	K^+	—	
$NpO_2(OH)_4^{2-}$	Li^+	—	
	Na^+	-0.12 ± 0.04	This review
	K^+	—	
$NpO_2(HPO_4)_2^{2-}$	Li^+	—	
	Na^+	-0.1 ± 0.10	Estimated in [2001LEM/FUG].
	K^+	—	
$NpO_2(CO_3)_2^{2-}$	Li^+	—	
	Na^+	-0.02 ± 0.14	Estimated by analogy in [2001LEM/FUG] Section 12.1.2.1.2
	K^+	—	
NpO_2cit^{2-}	Li^+	—	
	Na^+	-0.06 ± 0.03	Evaluated in Section VII.11 of [2005HUM/AND].
	K^+	—	
$NpO_2(Hedta)^{2-}$	Li^+	—	
	Na^+	0.07 ± 0.16	Estimated in Section VIII.11.2.3 of [2005HUM/AND].
	K^+	—	

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Table B-7 (continued)

j	k	$\varepsilon(j,k)$	Comments
$UO_2(OH)_4^{2-}$	Li^+	—	
	Na^+	0.01 ± 0.04	This review
	K^+	—	
$UO_2F_4^{2-}$	Li^+	—	
	Na^+	-0.30 ± 0.06	Evaluated in [2003GUI/FAN], Section 9.4.2.2.1.1.
	K^+	—	
$UO_2(SO_4)_2^{2-}$	Li^+	—	
	Na^+	-0.12 ± 0.06	Estimated in [1992GRE/FUG].
	K^+	—	
$UO_2(N_3)_4^{2-}$	Li^+	—	
	Na^+	-0.1 ± 0.1	Estimated in [1992GRE/FUG].
	K^+	—	
$UO_2(ox)_2^{2-}$	Li^+	—	
	Na^+	-0.18 ± 0.07	Estimated in Section VI.1.2.4.1 of [2005HUM/AND].
	K^+	—	
UO_2edta^{2-}	Li^+	—	
	Na^+	-0.22 ± 0.18	Estimated in Section VIII.10.2.4 of [2005HUM/AND].
	K^+	—	
$UO_2(CO_3)_2^{2-}$	Li^+	—	
	Na^+	-0.02 ± 0.09	These values differ from those reported in [1992GRE/FUG]. See the discussion in [1995GRE/PUI]. Values for CO_3^{2-} and HCO_3^- are based on [1980CIA].
	K^+	—	
$(UO_2)_2(OH)_2(SO_4)_2^{2-}$	Li^+	—	
	Na^+	-0.14 ± 0.22	Evaluated in Section 9.5.1.1.2 of [2003GUI/FAN].
	K^+	—	
ThF_6^{2-}	Li^+	—	
	Na^+	-0.30 ± 0.06	See Table VIII-8 in Section VIII.1.2.1 of [2008RAN/FUG].
	K^+	—	
$Th(SO_4)_3^{2-}$	Li^+	-0.068 ± 0.003	In combination with $\varepsilon_2 = (0.093 \pm 0.007)$.
	Na^+	-0.091 ± 0.038	See Section IX.1.3.2 of [2008RAN/FUG].
	K^+	-0.091 ± 0.038	
$Th(OH)_2(CO_3)_2^{2-}$	Li^+	—	
	Na^+	-0.1 ± 0.2	See Section XI.1.3.2 of [2008RAN/FUG].
	K^+	—	
$Th(OH)_4(CO_3)^{2-}$	Li^+	—	
	Na^+	-0.1 ± 0.2	See Section XI.1.3.2 of [2008RAN/FUG].
	K^+	—	

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Table B-7 (continued)

j	k	$\varepsilon(j,k)$	Comments
$Mg(ox)_2^{2-}$	Li^+	—	
	Na^+	-0.15 ± 0.03	Estimated in Section VI.5.1 of [2005HUM/AND].
	K^+	-0.15 ± 0.10	Estimated in [2005HUM/AND], Section VI.5.1 by assuming $\varepsilon(K^+, Mg(ox)_2^{2-}) \approx \varepsilon(Na^+, Mg(ox)_2^{2-})$.
$Mg(edta)^{2-}$	Li^+	—	
	Na^+	-0.01 ± 0.15	Evaluated in Section VIII.5.2 of [2005HUM/AND].
	K^+	—	
$Ca(ox)_2^{2-}$	Li^+	—	
	Na^+	-0.15 ± 0.10	Estimated in [2005HUM/AND], Section VI.5.2 by assuming $\varepsilon(Na^+, Ca(ox)_2^{2-}) \approx \varepsilon(Na^+, Mg(ox)_2^{2-})$.
	K^+	-0.15 ± 0.10	Estimated in [2005HUM/AND], Section VI.5.2 by assuming $\varepsilon(K^+, Ca(ox)_2^{2-}) \approx \varepsilon(Na^+, Mg(ox)_2^{2-})$.
cit^{3-}	Li^+	-0.44 ± 0.15†	
	Na^+	-0.076 ± 0.030†	
	K^+	0.02 ± 0.02	Evaluated in Section VI.3.6 of [2005HUM/AND].
$Hedta^{3-}$	Li^+	—	
	Na^+	-0.10 ± 0.14	Evaluated in Section VIII.3.7 of [2005HUM/AND].
	K^+	0.31 ± 0.18	
PO_4^{3-}	Li^+	—	
	Na^+	-0.25 ± 0.03†	
	K^+	-0.09 ± 0.02	Reported by Ciavatta [1980CIA].
$Si_3O_6(OH)_3^{3-}$	Li^+	—	
	Na^+	-0.25 ± 0.03	Estimated in [1992GRE/FUG].
	K^+	—	
$Si_3O_5(OH)_5^{3-}$	Li^+	—	
	Na^+	-0.25 ± 0.03	Estimated in [1992GRE/FUG].
	K^+	—	
$Si_4O_7(OH)_5^{3-}$	Li^+	—	
	Na^+	-0.25 ± 0.03	Estimated in [1992GRE/FUG].
	K^+	—	
$Ni(CN)_5^{3-}$	Li^+	—	
	Na^+	0.25 ± 0.14	Evaluated in [2005GAM/BUG] (see Section V.7.1.2.1.1).
	K^+	—	
$Fe(CO_3)_3^{3-}$	Li^+	—	
	Na^+	-0.23 ± 0.07	By analogy. See Appendix A entry for [2005GRI].
	K^+	—	

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Table B-7 (continued)

j	*k*	$\varepsilon(j,k)$	Comments
$Am(CO_3)_3^{3-}$	Li^+	—	
	Na^+	-0.23 ± 0.07	Evaluated Section 12.6.1.1.1 [2003GUI/FAN], from $\Delta\varepsilon_n$ in NaCl solution for the reactions $An^{3+} + n\,CO_3^{2-} \rightleftharpoons An(CO_3)_n^{(3-2n)}$ (An = Am, Cm) based on $\varepsilon(Am^{3+},Cl^-)$ = (0.23 ± 0.02) kg·mol^{-1} and $\varepsilon(Na^+,CO_3^{2-}) = -(0.08 \pm 0.03)$ kg·mol^{-1}.
	K^+	—	
$Am(ox)_3^{3-}$	Li^+	—	
	Na^+	-0.23 ± 0.10	Estimated in [2005HUM/AND], Section VI.13.2.1 by assuming $\varepsilon(Na^+,Am(ox)_3^{3-}) \approx \varepsilon(Na^+,Am(CO_3)_3^{3-})$.
	K^+	—	
$Np(CO_3)_3^{3-}$	Li^+	—	
	Na^+	—	
	K^+	-0.15 ± 0.07	Estimated by analogy in [2001LEM/FUG] (Section 12.1.2.1.5).
$NpO_2(CO_3)_2^{3-}$	Li^+	—	
	Na^+	-0.33 ± 0.17	Calculated in [2001LEM/FUG] (Section 12.1.2.1.3).
	K^+	—	
$NpO_2(CO_3)_2OH^{3-}$	Li^+	—	
	Na^+	-0.40 ± 0.19	Estimated in [2001LEM/FUG] by analogy with $NpO_2(CO_3)_3^{4-}$.
	K^+	—	
$NpO_2(ox)_2^{3-}$	Li^+	—	
	Na^+	-0.3 ± 0.2	Evaluated in Section VI.11.2.3 of [2005HUM/AND].
	K^+	—	
NpO_2edta^{3-}	Li^+	—	
	Na^+	0.20 ± 0.16	Estimated in Section VIII.11.2.3 of [2005HUM/AND].
	K^+	—	
$edta^{4-}$	Li^+	—	
	Na^+	0.32 ± 0.14	Evaluated in Section VIII.3.7 of [2005HUM/AND].
	K^+	1.07 ± 0.19	
$P_2O_7^{4-}$	Li^+	—	
	Na^+	-0.26 ± 0.05	Reported by Ciavatta [1988CIA].
	K^+	-0.15 ± 0.05	Reported by Ciavatta [1988CIA].
$Fe(CN)_6^{4-}$	Li^+	—	
	Na^+	—	
	K^+	-0.17 ± 0.03	
$Tc_2OCl_{10}^{4-}$	Li^+	—	
	Na^+	0.89 ± 0.40	This review
	K^+	—	

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Table B-7 (continued)

j	k	$\varepsilon(j,k)$	Comments
$Zr(CO_3)_4^{4-}$	Li^+	—	
	Na^+	-0.09 ± 0.20	This value, referring to $\varepsilon(NH_4^+, Zr(CO_3)_4^{4-})$ has been estimated in [2005BRO/CUR] by analogy with the homovalent ion pair $(Na^+, U(CO_3)_4^{4-})$, see [1997GRE/PLY].
	K^+	—	
$NpO_2(CO_3)_3^{4-}$	Li^+	—	
	Na^+	-0.40 ± 0.19	Calculated in [2001LEM/FUG] (Section 12.1.2.1.2).
	K^+	-0.62 ± 0.42	$\varepsilon(NH_4^+, NpO_2(CO_3)_3^{4-}) = -(0.78 \pm 0.25)$ kg·mol^{-1} is calculated in [2001LEM/FUG] (Section 12.1.2.2.1).
$U(CO_3)_4^{4-}$	Li^+	—	
	Na^+	-0.09 ± 0.10	These values differ from those estimated in [1992GRE/FUG]. See the discussion in [1995GRE/PUI]. Values for CO_3^{2-} and HCO_3^- are based on [1980CIA].
	K^+	—	
$UO_2(CO_3)_3^{4-}$	Li^+	—	
	Na^+	-0.01 ± 0.11	These values differ from those reported in [1992GRE/FUG]. See the discussion in [1995GRE/PUI]. Values for CO_3^{2-} and HCO_3^- are based on [1980CIA].
	K^+	—	
$UO_2(ox)_3^{4-}$	Li^+	—	
	Na^+	-0.01 ± 0.11	Estimated in [2005HUM/AND], Section VI.10.2.4.1 by assuming $\varepsilon(Na^+, UO_2(ox)_3^{4-}) \approx \varepsilon(Na^+, UO_2(CO_3)_3^{4-})$.
	K^+	—	
$(UO_2)_3(OH)_4(SO_4)_3^{4-}$	Li^+	—	
	Na^+	0.6 ± 0.6	Estimated in Section 9.5.1.1.2 of [2003GUI/FAN].
	K^+	—	
$NpO_2(CO_3)_3^{5-}$	Li^+	—	
	Na^+	-0.53 ± 0.19	Calculated in [2001LEM/FUG] (Section 12.1.2.1.3).
	K^+	-0.22 ± 0.03	Evaluated in [2003GUI/FAN] (discussion of [1998ALM/NOV] in Appendix A) from $\Delta\varepsilon$ for the reactions $KNpO_2CO_3(s) + 2CO_3^{2-} \rightleftharpoons NpO_2(CO_3)_3^{5-} + K^+$ (in K_2CO_3–KCl solution) and $K_3NpO_2(CO_3)_2(s) + CO_3^{2-} \rightleftharpoons NpO_2(CO_3)_3^{5-} + 3K^+$ (in K_2CO_3 solution) (based on $\varepsilon(K^+, CO_3^{2-}) = (0.02 \pm 0.01)$ kg·mol^{-1}).
$UO_2(CO_3)_3^{5-}$	Li^+	—	
	Na^+	-0.62 ± 0.15	These values differ from those reported in [1992GRE/FUG]. See the discussion in [1995GRE/PUI]. Values for CO_3^{2-} and HCO_3^- are based on [1980CIA].
	K^+	—	

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Table B-7 (continued)

j	*k*	$\varepsilon(j,k)$	Comments
$Th(OH)(CO_3)_4^{5-}$	Li^+	—	
	Na^+	-0.22 ± 0.13	Evaluated in Section XI.1.3.2.1 of [2008RAN/FUG].
	K^+	—	
$Np(CO_3)_5^{6-}$	Li^+	—	
	Na^+	—	
	K^+	-0.73 ± 0.68	Calculated in [2001LEM/FUG] (Section 12.1.2.1.4).
$(NpO_2)_3(CO_3)_6^{6-}$	Li^+	—	
	Na^+	-0.46 ± 0.73	Calculated in [2001LEM/FUG] (Section 12.1.2.1.2).
	K^+	—	
$U(CO_3)_5^{6-}$	Li^+	—	
	Na^+	-0.30 ± 0.15	These values differ from those reported in [1992GRE/FUG]. See the discussion in [1995GRE/PUI]. Values for CO_3^{2-} and HCO_3^- are based on [1980CIA].
	K^+	-0.70 ± 0.31	Calculated in [2001LEM/FUG] from Pitzer coefficients [1998RAI/FEL].
$(UO_2)_3(CO_3)_6^{6-}$	Li^+	—	
	Na^+	0.37 ± 0.11	These values differ from those reported in [1992GRE/FUG]. See the discussion in [1995GRE/PUI]. Values for CO_3^{2-} and HCO_3^- are based on [1980CIA].
	K^+	—	
$(UO_2)_2NpO_2(CO_3)_6^{6-}$	Li^+	—	
	Na^+	0.09 ± 0.71	Estimated by analogy in [2001LEM/FUG] (Section 12.1.2.2.1).
	K^+	—	
$(UO_2)_5(OH)_8(SO_4)_4^{6-}$	Li^+	—	
	Na^+	1.10 ± 0.5	Estimated in Section 9.5.1.1.2 of [2003GUI/FAN].
	K^+	—	
$Th(CO_3)_5^{6-}$	Li^+	—	
	Na^+	-0.30 ± 0.15	Estimated in Section XI.1.3.2.1 of [2008RAN/FUG].
	K^+	—	
$(UO_2)_4(OH)_7(SO_4)_4^{7-}$	Li^+	—	
	Na^+	2.80 ± 0.7	Estimated in Section 9.5.1.1.2 of [2003GUI/FAN].
	K^+	—	

Table B-8: Ion interaction coefficients, $\varepsilon_1(j,k)$ and $\varepsilon_2(j,k)$, both in kg·mol^{-1}, for cations j with k = Cl^-, ClO_4^- and NO_3^- (first part), and for anions j with k = Li^+, Na^+ and K^+ (second part), according to the relationship $\varepsilon = \varepsilon_1 + \varepsilon_2 \log_{10} I_m$ at 298.15 K. The data are taken from Ciavatta [1980CIA], [1988CIA] unless indicated otherwise. The uncertainties represent the 95 % confidence level.

j k →	Cl^-		ClO_4^-		NO_3^-	
↓	ε_1	ε_2	ε_1	ε_2	ε_1	ε_2
NH_4^+			−0.088 ± 0.002	0.095 ± 0.012	−0.075 ± 0.001	0.057 ± 0.004
Tl^+			−0.18 ± 0.02	0.09 ± 0.02		
Ag^+					−0.1432 ± 0.0002	0.0971 ± 0.000
Pb^{2+}					−0.329 ± 0.007	0.288 ± 0.018
Hg^{2+}					−0.145 ± 0.001	0.194 ± 0.002
Hg_2^{2+}					−0.2300 ± 0.0004	0.194 ± 0.002
j k →	Li^+		Na^+		K^+	
↓	ε_1	ε_2	ε_1	ε_2	ε_1	ε_2
OH^-	−0.039 ± 0.002	0.072 ± 0.006				
NO_2^-	0.02 ± 0.01	0.11 ± 0.01				
NO_3^-			−0.049 ± 0.001	0.044 ± 0.002	−0.131 ± 0.002	0.082 ± 0.006
$H_2PO_4^-$			−0.109 ± 0.001	0.095 ± 0.003	−0.1473 ± 0.0008	0.121 ± 0.004
$B(OH)_4^-$			−0.092 ± 0.002	0.103 ± 0.005		
SO_3^{2-}			−0.125 ± 0.008	0.106 ± 0.009		
SO_4^{2-}	−0.068 ± 0.003	0.093 ± 0.007	−0.184 ± 0.002	0.139 ± 0.006		
$S_2O_3^{2-}$			−0.125 ± 0.008	0.106 ± 0.009		
HPO_4^{2-}			−0.19 ± 0.01	0.11 ± 0.03	−0.152 ± 0.007	0.123 ± 0.016
CrO_4^{2-}			−0.090 ± 0.005	0.07 ± 0.01	−0.123 ± 0.003	0.106 ± 0.007
cit^{3-}	−0.55 ± 0.11 [a]	0.3 ± 0.2[a]	−0.15 ± 0.03[a]	0.13 ± 0.03[a]		
PO_4^{3-}			−0.29 ± 0.02	0.10 ± 0.01		
TcO_4^-					−0.24 ± 0.05	0.33 ± 0.10

a: See Section VII.3.6 of [2005HUM/AND].

Table B-9: SIT interaction coefficients $\varepsilon(j,k)$ (kg·mol^{-1}) for neutral species, *j,* with *k,* electroneutral combination of ions at 298.15 K.

$j \quad k \rightarrow$ ↓	$Na^+ + ClO_4^-$	$Na^+ + Cl^-$	$K^+ + NO_3^-$
$H_2ox(aq)$	0.00 ± 0.01 [b]	0.00 ± 0.01 [b]	0.00 ± 0.01 [b]
$H_3cit(aq)$	0.00 ± 0.01 [b]	0.00 ± 0.01 [b]	0.00 ± 0.01 [b]
$H_4edta(aq)$	– 0.29 ± 0.14	– 0.29 ± 0.14	– 0.29 ± 0.14
$SnBr_2(aq)$	0.14 ± 0.07		
$SnSO_4(aq)$	0.19 ± 0.35		
$Sn(NO_3)_2(aq)$	0.130 ± 0.111		
Ni(ox)(aq)	– 0.07 ± 0.03	– 0.07 ± 0.03	
Ni(Hcit)(aq)	– 0.07 ± 0.5		
$Ni(SCN)_2(aq)$	0.38 ± 0.06 [a]		
Am(cit)(aq)		0.00 ± 0.05	
Np(edta)(aq)	– 0.19 ± 0.19 [g]		
$UO_2ox(aq)$	– 0.05 ± 0.06	– 0.05 ± 0.06	
Uedta(aq)	– 0.19 ± 0.19		
Mg(ox)(aq)		0.00 ± 0.03	0.0 ± 0.1 [c]
Mg(Hcit)(aq)	0.02 ± 0.05	0.02 ± 0.05	
Ca(ox)(aq)	0.0 ± 0.1 [d]	0.0 ± 0.1 [e]	0.0 ± 0.1 [f]

(a): See Section V.7.1.3.1 in [2005GAM/BUG].

(b): Basic assumption made in [2005HUM/AND]. See Sections VI.3.5 and VII.3.6 of that review for discussions.

(c): Estimated in Section VI.5.2 of [2005HUM/AND] by assuming ε(Mg(ox)(aq), KNO_3) ≈ ε(Mg(ox)(aq), NaCl).

(d): Estimated in Section VI.5.2 of [2005HUM/AND] by assuming ε(Ca(ox)(aq), $NaClO_4$) ≈ ε(Mg(ox)(aq), NaCl).

(e): Estimated in Section VI.5.1 of [2005HUM/AND] by assuming ε(Ca(ox)(aq), NaCl) ≈ ε(Mg(ox)(aq), NaCl).

(f): Estimated in Section VI.5.2 of [2005HUM/AND] by assuming ε(Ca(ox)(aq), KNO_3) ≈ ε(Mg(ox)(aq), NaCl).

(g): Estimated in Section VIII.11.2.2 of [2005HUM/AND] by assuming ε(Np(edta)(aq), $NaClO_4$) ≈ ε(Uedta(aq), $NaClO_4$).

Table B-10: Other ion interaction coefficients $\varepsilon(j,k)$ (kg·mol^{-1}) used in TDB-Iron Parts 1 and 2 for cations *j* and anions *k.*

j	*k*	ε(*j,k*)	Comments
H^+	HSO_4^-	0.14 ± 0.05	Determined in TDB-Iron Part 1, p. 476, footnote