The Inorganic Chemist's Guide to Actinide Radiation Chemistry: A Review

Samantha J. Kruse[a,b]*, Sarah K. Scherrer[a], Gregory P. Horne[c], Jay A. LaVerne[b,d], Tori Z. Forbes[a]*

[a] *Department of Chemistry, University of Iowa, Iowa City, IA, USA, 52240*

[b] *Radiation Laboratory, University of Notre Dame, Notre Dame, IN, USA, 46556*

[c] *Center for Radiation Chemistry Research, Idaho National Laboratory, Idaho Falls, ID, USA, 83415*

[d] *Department of Physics and Astronomy, University of Notre Dame, Notre Dame, IN, USA, 46556*

Table of Contents

Aqueous Chemistry

Table S1. Table summarizing γ-irradiated actinides Th-Cf and their redox chemistry with the hydrated electron (e_{aq}^-).

Starting Oxidation State	Resulting Oxidation State	Conditions: Medium	Conc. (M)	pH	Ref.
Th(IV)	Th(III)	-	-	acidic	1
		$HClO_4$	0.01	acidic	2
$Th(IV)SO_4^{2+}$	Th(III)	-	-	acidic	1
U(IV)	U(III)	$HClO_4$	0.05-1.0	acidic	3, 4
		H_2SO_4	0.68	acidic	2
U(VI)	$U(IV)O_2$ nanoparticles	uranyl nitrate/10% isopropanol	0.01	1.2-4.0	5
	U(V)	-	-	5.3-6.8	6, 7
		artificial sea water	-	basic	8
		$HClO_4$	1.0	acidic	1
U(VI)carbonate complex	U(V)	CO_3^{2-}	0.01	basic	8
		CO_3^{2-}	0.05	basic	9
U(VI)IMDA complex	U(V)	IMDA	0.01-0.25	acidic	8
U(VI)NTA complex	U(V)	NTA	0.01-0.25	acidic	8
U(VI)oxalate complex	U(V)	$C_2O_4^{2-}$	0.1	acidic	8
Np(IV)	Np(III)	$HClO_4$	0.023-0.91	acidic	2
		H_2SO_4	0.042-0.68	acidic	2
Np(IV) carbonate complex	Np(III)	CO_3^{2-}	0.1-4.3	basic	10
		CO_3^{2-}	6.0	basic	2
Np(V)	$Np(IV)(OH)_4$	-	3.6-5.8	acidic	11
		-	5.3-6.1	acidic	6
Np(V) carbonate complex	Np(IV)	CO_3^{2-}	0.1-5.0	basic	2, 12
Np(V)	Np(IV)	OH^-	1.0-7.5	basic	13
Np(VI)	Np(V)	-	5.3-5.8	-	6
		-	2.5	-	14
Np(VI)	Np(V)	OH^-	0.5-12.5	basic	13, 15
	Np(VII)	sat. N_2O/NaOH	1.0	basic	16, 17
$Np(VI)O_2(OH)^+$	$Np(V)O_2OH$	-	-	-	14
Np(VI) carbonate complex	Np(V)	HCO_3^-/CO_3^{2-}	0.05	basic	9
		HCO_3^-/CO_3^{2-}	0.1-5.0	basic	10
		HCO_3^-/CO_3^{2-}	0.5 : 0.5	basic	10, 15
Np(VII)	Np(VI)	OH^-	0.1-12.5	basic	13
Pu(IV)	Pu(III)	H_2SO_4	0.018-0.078	1	2
Pu(IV) carbonate complex	Pu(III)	CO_3^{2-}	6.0	basic	18

	Pu(V)	CO_3^{2-}	-	basic	19
Pu(VI)	Pu(V)	-	-	5.6-6.1	6
		OH^-	2.0-7.5	basic	20
		CO_3^{2-}	0.05	basic	9
Pu(VI) carbonate complex	Pu(V)	CO_3^{2-}	0.1-1.0	basic	10
Pu(VII)	Pu(VI)	OH^-	1.0-7.5	14	20
Am(III)	Am(II)	$LiClO_4$	0.11	-	6, 21, 22
Am(IV)	Am(III)	HNO_3	1.0-9.0	acidic	23
Am(V)	Am(IV)	$LiClO_4$	0.11	-	21
Am(VI)	Am(V)	$LiClO_4$	0.11	-	21
Cm(III)	Cm(II)	sat. $N_2O/HClO_4/(CH_3)_3OH$	0.18-0.72 : 0.4-0.5	acidic	24
Bk(III)	Bk(II)	$(CH_3)_3OH$	0.0025	5	25
Cf(III)	Cf(II)	$HClO_4/(CH_3)_3OH$	dilute : 0.1	5.1-5.3	26
	Cf(II)	$HClO_4/(CH_3)_3OH$	0.001 : 0.5	acidic	27

Table S2. Table summarizing γ-irradiated actinides U-Cm and Cf and their redox chemistry with the H$^{\bullet}$ radical.

Starting Oxidation State	Resulting Oxidation State	Conditions			Ref.
		Medium	Conc. (M)	pH	
U(IV)	U(III)	H_2SO_4	0.5	acidic	2
U(V)	U(VI)	$HClO_4$	0.1	acidic	2, 28
		H_2SO_4	0.4	acidic	2, 28
U(VI)	U(V)	$HClO_4$	1.0	acidic	29
		H_2SO_4	0.5	acidic	2
	U(VI)/U(IV)	H_2SO_4	0.4	acidic	30
Np(III)	Np(IV)	$HClO_4$	1.0	acidic	1, 28
		H_2SO_4	1.0	acidic	1, 28
Np(IV)	Np(III)	$HClO_4$	0.9	acidic	1
Np(V)	Np(IV)	$HClO_4$	1.0	acidic	31
Np(VI)	Np(V)	$HClO_4$	1.0	acidic	1
		$HClO_4$	1.0	acidic	14
Pu(III)	Pu(IV)	$HClO_4$	3.0	acidic	1, 28
		$HClO_4/H_2SO_4$	0.2 : 1.8	acidic	1, 28
Pu(IV)	Pu(III)	$HClO_4$	3.0	acidic	1
		H_2SO_4	0.6-1.6	acidic	1
Pu(VI)	Pu(V)	$HClO_4$	1.0	acidic	1
Am(V)	Am(IV)	$HClO_4$	1.0	acidic	1
	Am(IV)/Am(VI)	HNO_3	1.0-9.0	acidic	23
Am(VI)	Am(V)	$HClO_4$	-	acidic	1
Cm(III)	Cm(II)	sat. $N_2O/HClO_4/(CH_3)_3OH$	0.07-1.0 : 0.010-0.020	acidic	32
Cf(III)	Cf(II)	$HClO_4$	1.0	acidic	27

Table S3. Table summarizing γ-irradiated actinides U-Cm and Cf and their redox chemistry with $^{\bullet}OH$.

Starting Oxidation State	Resulting Oxidation State	Conditions: Medium	Conc. (M)	pH	Ref.
U(IV)	U(III)	H_2SO_4	0.5	acidic	2
U(V)	U(VI)	$HClO_4$	0.1	acidic	2, 28
		H_2SO_4	0.4	acidic	2, 28
U(VI)	U(V)	$HClO_4$	1.0	acidic	29
		H_2SO_4	0.5	acidic	2
	U(VI)/U(IV)	H_2SO_4	0.4	acidic	30
Np(III)	Np(IV)	-	-	acidic	33
Np(IV)	Np(V)	$HClO_4$	1	acidic	34
Np(V)	Np(VI)	$HClO_4$	0.1-2.95	acidic	34
		$HClO_4$	1.0	acidic	35
		-	< 4.0	acidic	14
		-	3.64-4.75	acidic	35
		HNO_3	0.09-4.0	acidic	36
Pu(III)	Pu(IV)	$HClO_4$	3.0	acidic	1, 28
		$HClO_4/H_2SO_4$	0.2 : 1.8	acidic	1, 28
Pu(IV)	Pu(III)	$HClO_4$	3.0	acidic	1
		H_2SO_4	0.6-1.6	acidic	1
Pu(VI)	Pu(V)	$HClO_4$	1.0	acidic	1
Am(III)	Am(IV)	-	1.0-4.0	acidic	37
		$HClO_4$	1.0	acidic	37
		$LiClO_4$	0.11	acidic	18
Am(V)	Am(VI)	HNO_3	1.0-9.0	acidic	23
Cm(III)	Cm(IV)	sat. $N_2O/HClO_4/KSCN$	0.010 : 73-100 x 10^{-6}	acidic	32
Cf(III)	Cf(III)	sat. N_2O	-	5.1	26
	Cf(IV)/Cf(IV)$(SCN)^{2+}$ complex	sat. $N_2O/HClO_4/KSCN$	0.01 : 0.1	acidic	27

Table S4. Table summarizing γ-irradiated actinides Np and its redox chemistry with $O^{-\bullet}$ radical species.

Starting Oxidation State	Resulting Oxidation State	Conditions: Medium	Conc. (M)	pH	Ref.
Np(IV)	Np(V)	LiOH	1.03-2.0	basic	38
		NaOH	0.5-1.7	basic	38
Np(V)	Np(VI)	LiOH	1.0	basic	38
Np(VI)	Np(VI) peroxo/hydroxy-complexes	LiOH	0.033-0.24	basic	38

Table S5. Table summarizing γ-irradiated actinides Th-Np and Am and their redox chemistry with $HO_2^{\bullet}$.

Starting Oxidation State	Resulting Oxidation State	Conditions			Ref.
		Medium	Conc. (M)	pH	
Th(IV)	Th(IV) peroxo-complexes	H_2O_2	0.1	acidic	39
Th(IV)-HO_2	Th(IV) peroxo-complexes	H_2O_2	0.1	acidic	39
U(VI)	U(VI)peroxo-complexes	$H_2O_2/HClO_4$	0.1 : 0.1	acidic	40
U(VI)-HO_2	U(VI)peroxo-complexes	$H_2O_2/HClO_4$	0.1 : 0.1	acidic	40
Np(V)	Np(IV) or Np(V/VI) peroxo-complex	-	-	acidic	41
Am(IV)	Am(V)/Am(IV) peroxo-complexes	-	-	-	37
	Am(V)	HNO_3	1.0-9.0	acidic	23

Table S6. Table summarizing γ-irradiated actinides Np and its redox chemistry with $O_2^{-\bullet}$.

Starting Oxidation State	Resulting Oxidation State	Conditions			Ref.
		Medium	Conc. (M)	pH	
Np(VI)	Np(V) or Np(V/VI) peroxo-complex	-	-	acidic	42
		LiOH	0.1-1.0	basic	42

Table S7. Table summarizing γ-irradiated actinides Np and its redox chemistry with $O_3^{-\bullet}$.

Starting Oxidation State	Resulting Oxidation State	Conditions			Ref.
		Medium	Conc. (M)	pH	
Np(IV)	unknown	LiOH	0.2-2.0	basic	43
Np(V)	unknown	LiOH	0.2-2.0	basic	43

Table S8. Table summarizing γ-irradiated actinides U-Am and their redox chemistry with H_2O_2.

Starting Oxidation State	Resulting Oxidation State	Conditions			Ref.
		Medium	Conc. (M)	pH	
U(III)	U(IV)	$HClO_4$	0.5	acidic	33
U(IV)	U(V)	$HClO_4$	1.0	acidic	44
		H_2SO_4	0.98	acidic	44
		H_2SO_4	0.4	acidic	44
		HCl/NaCl	0.05 : 1.95	acidic	44
		HCl/NaCl	0.1 : 1.9	acidic	44
		HCl/NaCl	0.25 : 1.75	acidic	44
		HCl/NaCl	0.316 : 1.684	acidic	44
		HCl/NaCl	0.5 : 1.5	acidic	44
		HCl/NaCl	1.0 : 1.0	acidic	44
		HCl/NaCl	1.5 : 0.5	acidic	44
		HCl/NaCl	0.5 : 1.5	acidic	44
U(V)	U(VI)	-	-	acidic	44
U(VI)	U(VI) peroxo-complexes	-	-	acidic	6
Np(III)	Np(IV)	$HClO_4$	-	acidic	45
Np(IV)	Np(V)	HNO_3	-	acidic	46
Np(V)	Np(IV)	HNO_3	6.0-8.4	acidic	47
Np(VI)	Np(V)	-	-	-	42
		LiOH	0.1-13.7	basic	42
		$HClO_4$	-	acidic	45
		HNO_3	7.5	acidic	6
Np(VII)	Np(VI)	-	-	-	42
		LiOH	0.1-13.7	basic	42
Pu(III)	Pu(IV)	H_2SO_4	-	acidic	48
Pu(IV)	Pu(III)	$HClO_4$	1.0	acidic	49
		$HClO_4$	1.5	acidic	50
		$HClO_4/Na_2SO_4$	0.3 : 0.4	acidic	51
		HNO_3	0.98-1.96	acidic	52
Pu(VI)	Pu(V) or Pu(V)/(VI)peroxo-complexes	$HClO_4$	1.0	acidic	45
		HNO_3	1.0	acidic	45
		H_2SO_4	0.18	acidic	45
		$NaHCO_3$	0.05	basic	53
		$NaHC_3$	0.05	basic	53
Am(IV)	Am(III)	-	4.0	acidic	37
Am(V)	Am(IV)	$HClO_4$	0.1-0.2	acidic	45
Am(VI)	Am(V)	$HClO_4$	0.98	acidic	54
		HNO_3	1.0-9.0	acidic	23

Table S9. Table summarizing α-irradiated and multi-source irradiation of U systems and its redox chemistry under various conditions.

Starting Oxidation State	Resulting Oxidation State	Conditions: Medium	Conditions: Conc. (M)	Conditions: pH	Radiation Source	Ref.
U(IV)	U(IV)	$HClO_4$	0.2-11.5	acidic	α	55
		HNO_3	0.5-8.0	acidic	α	55
	U(VI)	deaerated H_2SO_4	0.4-1.5	acidic	α	41
		H_2SO_4/ sat. O_2	0.4	acidic	α	30
		H_2SO_4/ sat. N_2	0.4	acidic	α	30
$U(IV)O_2$	$[(U(VI)O_2)(\mu_2,\eta^2\text{-}O_2)(H_2O)_2]\cdot 2H_2O$	-	-	3.8	α	56-58
		deaeratd	-	-	α	59
		Ar/H_2 atm	-	-	α	59
	$[(U(VI)O_2)(\mu_2,\eta^2\text{-}O_2)(H_2O)_2]$	aerated	-	-	α	59, 60
		H_2O_2	conc.	-	α	61
	$U(VI)O_{2.33}$	-	-	-	α/β/γ/n	62-65
	$U(VI)_3O_7$	-	-	-	internal α > 250 μCi	62
commercial SNF $U(IV)O_2$	$[(UO_2)_8O_2(OH)_{12}]\cdot 10H_2O$	-	-	-	α/β/γ/n	66
	$[(U(VI)O_2)(\mu_2,\eta^2\text{-}O_2)(H_2O)_2]\cdot 2H_2O$	2 years of water exposure	-	-	α/β/γ/n	65
	$[(U(VI)O_2)(\mu_2,\eta^2\text{-}O_2)(H_2O)_2]$	2 years of water exposure	-	-	α/β/γ/n	65
$U(IV)(SO_4)_2$	U(IV)	deaerated H_2SO_4	0.1-18	0.1-1.95	α/β/γ/n	67
	U(VI)	aerated H_2SO_4	0.1-18	0.1-1.95	α/β/γ/n	67
U(IV)/U(VI)	U(VI)	H_2SO_4	-	-	α	41
U(VI)	U(VI)	H_2SO_4	-	acidic	α	41
$U(VI)O_2SO_4$	$U(VI)O_2SO_4$	$U(VI)O_2SO_4$ solution	conc.	0.1-3.26	α/β/γ/n	67
$U(VI)O_2F_2$	$U(VI)O_2F_2$	$U(VI)O_2F_2$ solution	conc.	1.35-4.25	α/β/γ/n	67
enriched $U(VI)O_2(NO_3)_2$	enriched $U(VI)O_2(NO_3)_2$	enriched $U(VI)O_2(NO_3)_2$ solution	conc.	0.60-2.05	α/β/γ/n	67

Table S10. Table summarizing γ-irradiated actinides U-Am and their redox chemistry with non-specified reactive species.

Starting Oxidation State	Resulting Oxidation State	Conditions			Ref.
		Medium	Conc. (M)	pH	
Th(IV)$(NO_3)_4$	Th(IV)	HNO_3	5.0	1.21-5.9	68
		$NaNO_3$	5.0	0.5-11	68
U(IV)	U(IV)	HNO_3	0.5-3.0	acidic	69
	U(VI)	H_3PO_4	14.8	acidic	70
U(VI)	U(IV)O_2 nanoparticles	deaerated uranyl nitrate/10% propanol	0.01	3.4	71
	U(VI)	aerated uranyl nitrate/10% propanol	0.01	3.4	71
Np(IV)	Np(IV)	HNO_3	0.4-1.0	acidic	72-74
	Np(V)	$HClO_4$	1.0	≥ 4	72-74
		XeO_3	-	≤ 1	72-74
		N_2O	-	≥ 4	72-74
	Np(V)/Np(VI)	NaOH	-	basic	75
Np(VI)	Np(IV)/Np(V)	NaOH	0.9-8.5	basic	74
	Np(IV) precipitate	NaOH/N_2O	1.0-3.0	basic	72-74
	Np(V)	NaOH	0.9-8.5	basic	74
	Np(VI)	NaOH	0.9-7.0	basic	72-74
		NaOH	-	basic	75
		NaOH/BrO_4^-	1.0-3.0 : 0.02	basic	72-74
		NaOH/BrO_4^-	0.2-3.8 : 0.02	basic	72-74
		NaOH/Na_2CO_3/N_2O	1.0 : 0.5	basic	72-74
		NaOH/Na_2CO_3/N_2O	0.1 : 0.5	basic	72-74
		N_2O/CO_3^{2-}	-	basic	72-74
		$HClO_4$	-	acidic	72-74
	Np(VII)	NaOH/$Na_2S_2O_8$	0.05-2.0 : 0.02	basic	72-74
Pu(III)	Pu(III)	deaerated $HClO_4$	0.2-0.5	acidic	41, 76
		HCl	0.8	acidic	72-74
		HCl	6.00	acidic	72-74
		H_2SO_4	0.4	acidic	41, 76
Pu(III)/Pu(IV)	Pu(III)/Pu(IV)	HCl	0.5-0.8	acidic	76
	Pu(III)	$HClO_4$	0.2-0.5	acidic	76
Pu(IV)	Pu(III)/Pu(VI)peroxo-complexes	$HClO_4$	0.2	acidic	76
Pu(IV)O_2	Pu(III)	ground water	-	acidic	77
Pu(IV)/Pu(VI)	Pu(IV)	HNO_3	4.0	acidic	78, 79
Pu(V)/Pu(VI)	Pu(IV)sulfate complexes	H_2SO_4	-	acidic	76
Pu(VI)	Pu(IV)/Pu(V)	alkaline	1.3-6.9	basic	72-74
	Pu(IV)/Pu(VI)	HCl	0.2	acidic	41

		alkaline	1.0-6.0	basic	75, 80
	Pu(IV)	HNO_3	0.3-4.0	acidic	81
	Pu(V)	HCl	0.2	acidic	72-74
Pu(VI)*/Pu(VI)	Pu(VII)	alkaline/N_2O	-	basic	16, 82
		$NaOH/K_2S_2O_8$	1.0	basic	83, 84
Pu(VII)	Pu(VI)	alkaline	0.87-3.5	basic	76
Am(III)	Am(V)	sat. $N_2O/HClO_4$	4.0	acidic	41
Am(VI)	Am(III)	H_3PO_4	3.0	acidic	41
	Am(VII)	NaOH with N_2O or $Na_2S_2O_8$	1.0-3.0	basic	41, 85
Cm(III)	Cm(II)	$HClO_4/(CH_3)_3OH$	0.1 : 0.1	5.3-6.0	24
Cm(IV)	Cm(III)	sat. $N_2O/HClO_4/(CH_3)_3OH$	0.1 : 0.1	5.3-6.0	24

Table S11. Table summarizing α-irradiated Pu systems and its redox chemistry under various conditions.

Starting Oxidation State	Resulting Oxidation State	Conditions			Ref.
		Medium	Conc. (M)	pH	
Pu(III)	Pu(III)	$HNO_3/HNO_2/NO_2$	-	acidic	86
	Pu(IV)	HNO_3	> 1.0	acidic	55, 87
		HNO_2	1.0-5.0	acidic	88
		H_2SO_4	-	acidic	89
	Pu(IV) peroxo-complexes/Pu(VI)	HNO_3	0.12	acidic	55, 87
Pu(IV)	Pu(III)	HNO_3	1.0-5.0	acidic	88
		$HNO_3/HNO_2/NO_2$	-	acidic	86
		HCl	-	acidic	76
		$HCl/HClO_4$	-	acidic	76
		$HClO_4$	1.0	acidic	90
	Pu(IV)	HNO_3	4.0-6.0	acidic	91
	Pu(VI)	HNO_3	6.0	acidic	92
	Pu(VI)/Pu(IV)	HNO_3	4.0-6.0	acidic	91
	Pu(IV) nitrate complexes	HNO_3	≥ 6.0	acidic	91
$Pu(IV)(OH)_4$	Pu(V)	NaOH	< 3.0	basic	93-95
	Pu(VI)	NaOH	> 3.0	basic	93-95
Pu(IV)/Pu(VI)	Pu(III)/Pu(IV)	$HClO_4$	1.0	acidic	41
Pu(V)	Pu(IV)colloids/Pu(VI)	$LiClO_4$	0.1	acidic	96
	Pu(VI)	$HNO_3/HNO_2/NO_2$	-	acidic	86
Pu(VI)	Pu(III)	HNO_3	-	acidic	97
		$HClO_4$	0.2	acidic	41
		HCl	0.5	acidic	89
	Pu(III)/(IV)	HNO_3	< 1.0	acidic	76, 98
	Pu(IV)	-	-	3.8	76, 98
		H_2SO_4	0.05-2.0	acidic	76, 99

		$HClO_4$	0.2	acidic	41
		HCl	0.5	acidic	89
	Pu(IV) colloids	$NaNO_3$	-	3.0	76
		$LiClO_4$	0.1	acidic	96
	Pu(V)	$HClO_4$	0.48-1.9	acidic	76
		$HClO_4$	0.2	acidic	41
		$HClO_4/NaClO_4$	0.516 : 0.5	1.01-7.32	100
		$HClO_4/NaClO_4$	0.101 : 0.9	1.01-7.32	100
		HNO_3	1.0-4.0	acidic	76, 98
		$HNO_3/HNO_2/NO_2$	-	acidic	86
		HCl	0.5	acidic	89
	Pu(VI)	HCl	0.062-0.5	acidic	101
Pu(VI)*/Pu(VI)	Pu(VI) dimers/Pu(V)	-	-	-	102

Table S12. Table summarizing α-irradiated Am systems and its redox chemistry under various conditions.

Starting Oxidation State	Resulting Oxidation State	Conditions			Ref.
		Medium	Conc. (M)	pH	
Am(III)	Am(IV)/Am(V)	$HNO_3/Na_2S_2O_8$	-	-	103
		HNO_3 or $NaNO_3$	0.5	-	104
Am(III)	Am(V)	NaCl	5.0	basic	41, 105
		K_2CO_3	3.0-5.5	basic	41
	Am(VI)	$(NH_4)_2S_2O_8/HNO_3$	0.2	acidic	106, 107
		$HClO_4$	0.2	acidic	106, 107
		H_2SO_4	0.2	acidic	106, 107
Am(IV)	Am(III)	H_3PO_4	10.0	acidic	41
		$HClO_4$	2.0-4.0	acidic	41
		HNO_3	0.4	acidic	41
		NH_4F	13	basic	41
Am(V)	Am(III)	$HClO_4$	0.1-2.0	acidic	41
		$HClO_4$	0.2	acidic	108
		$HClO_4$	1.0	acidic	106
		$HClO_4$	2.0	acidic	109
		$HClO_4/H_3PO_4$	0.1 : 0.01	acidic	41
		H_2SO_4	1.0	acidic	41
		H_2SO_4	1.0	acidic	109
		H_2SO_4	0.1	acidic	106
		HNO_3	0.5-9.0	acidic	41
		HCl	0.5	acidic	41
	Am(IV)	$HClO_4$	0.1	acidic	110
	Am(VI)	$HClO_4$ or $LiClO_4$	2.0	-	111
		$HNO_3/Na_2S_2O_8$	-	-	103
Am(VI)	Am(III)	H_3PO_4	3.0, 10.0-11.0	acidic	41

	$Am(IV)P_2W_{17}O_{61}$ complex	$K_{10}P_2W_{17}O_{61}$	0.003-0.008	-	41
	Am(V)	$HClO_4$	0-12.0	acidic	41, 112
		$HClO_4$	0.1-11.0	acidic	113
		$HClO_4/NaClO_4$	0.2-1.0 : 7.0	-	113
		H_2SO_4	0.1-10.0	acidic	41
		HNO_3	0.1-4.7	acidic	41
		$NaHCO_3$	-	basic	41
	$Na[Am(V)(CO_3)_3]$ precipitate	$NaHCO_3$	0.1	basic	114
		Na_2CO_3	0.1-2.0	basic	114
		K_2CO_3	-	basic	41
		$HClO_4$ or $LiClO_4$	1.0	-	54

Table S13. Table summarizing α-irradiated multi-element systems and their redox chemistry under various conditions.

Starting Oxidation State	Resulting Oxidation State	Conditions			Ref.
		Medium	Conc. (M)	pH	
Am(III)/Cm(III)	Am(V)/An(III) hydroxides/Cm(III) hydroxides	sat. $NaClO_4$	-	acidic	115
$Pu(IV)O_2$/ $Am(IV)(OH)_4$	Pu(VI)/Am(IV)	NaCl (Ar atm)/$HClO_4$	1.0-5.0	< 7.0	94
	Pu(VI)/Am(V)	NaCl (Ar atm)/$HClO_4$	5	> 7.0	94
		NaCl (ambient atm)/$HClO_4$	1.0-5.0	2.0-12.0	94
Pu(IV)/U(IV) (MOX47 fuel)	Pu(V)precipitate/U(VI)	-	0	-	116
	$Pu(V)/U(VI)O_4 \cdot 4H_2O$	H_2O_2	6.0×10^{-5}	acidic	116

Table S14. Table summarizing α-irradiated Cm systems and its redox chemistry under various conditions.

Starting Oxidation State	Resulting Oxidation State	Conditions			Ref.
		Medium	Conc. (M)	pH	
Cm(IV)	Cm(IV)	CsF	15.0	basic	41
	Cm(III) or $Cm(IV)P_2W_{17}O_{61}$ complex	$K_{10}P_2W_{17}O_{61}$	-	1.5-6.1	41, 117

Table S15. Table summarizing self-irradiated (β^-) Bk systems and its redox chemistry under various conditions.

Starting Oxidation State	Resulting Oxidation State	Conditions			Ref.
		Medium	Conc. (M)	pH	
Bk(III)	Bk(IV)	K_2CO_3	2.0	basic	41
Bk(IV)	Bk(III)	H_2SO_4	-	-	41, 118-120
		H_2SO_4	0.05-4.5	acidic	121
		H_2SO_4	1.0	acidic	122
		H_2SO_4/Na_2SO_4	0.1 : 1.0	acidic	121
		$HClO_4$	0.1-5.0	acidic	121
		$HClO_4$	1.0-5.0	acidic	118
		$HClO_4$	1.0	acidic	122
		$HClO_4$	1.0-8.0	acidic	123, 124
		$HClO_4/HNO_3$	-	1.0	124
		HNO_3	0.5-6.0	acidic	118
		HNO_3	-	acidic	125
		HNO_3	9.0	acidic	119
		K_2CO_3	2.0	basic	122
		$HNO_3/AgNO_3/(NH_4)_2S_2O_8$	4.0 : 0.01 : 0.1	acidic	120
	Bk(III)pyrophosphate	$Na_4P_2O_7/H_2SO_4$	0.12	1.5	121

Table S16. Table summarizing α-irradiated Cf systems and its redox chemistry under various conditions.

Starting Oxidation State	Resulting Oxidation State	Conditions			Ref.
		Medium	Conc. (M)	pH	
Cf(IV)	Cf(III)	$K_2P_2W_{17}O_{61}/K_2S_2O_8$	-	-	41
Cf(IV)$P_2W_{17}O_{61}$ complex	Cf(III)	$K_2P_2W_{17}O_{61}$	-	2.5-6.1	117

Table S17. Table summarizing γ-irradiated actinides Np-Cm and their redox chemistry with $NO_3^{\bullet}$.

Starting Oxidation State	Resulting Oxidation State	Conditions			Ref.
		Medium	Conc. (M)	pH	
Np(V)	Np(V)	HNO_3	0.09-4.0	acidic	126
		$HNO_3/LiNO_3$	1.0 : 3.0	acidic	127
		$HNO_3/LiNO_3$	1.0 : 6.0	acidic	127
	Np(VI)	HNO_3	1.0-5.0	acidic	127
		HNO_3	0.09-4.0	acidic	36, 128, 129
Np(VI)	Np(V)	HNO_3	0.09-4.0	acidic	126, 127
		HNO_3	4.0	acidic	36
		HNO_3	0.5-6.0	acidic	130
		HNO_3	0.001-2.0	acidic	72
		HNO_2	0.09-4.0	acidic	36, 128, 129
Pu(III)	Pu(IV)	HNO_3	2.0	acidic	131
		HNO_3	-	acidic	132
		deaerated HNO_3	-	acidic	132, 133
		HNO_2	-	acidic	132
		NO_2/N_2O_4 from HNO_3/NO_3^-	-	acidic	132
Pu(IV)	Pu(III)/Pu(VI)	HNO_3	0.3-1.0	acidic	134
	Pu(IV)OH_4	$NaOH/NO_3^-$	1.0-15.0	basic	135
Pu(VI)	Pu(III)/Pu(V)	HNO_2	-	acidic	97
	Pu(V)	HNO_3	0.001-0.5	acidic	76, 97
Pu(VI)*/Pu(VI)	Pu(VI)	HNO_3	> 8.0	acidic	81
Am(V)	Am(IV)	HNO_3	2.5	acidic	136
Am(VI)	Am(V)	HNO_3	1.0-9.0	acidic	23
Cm(III)	Cm(IV)	sat. N_2O/HNO_3	4.5-6.0	acidic	32
Cf(III)	Cf(III)	HNO_3	6.0	acidic	27

Table S18. Table summarizing α-irradiated Np systems and its redox chemistry under various conditions.

Starting Oxidation State	Resulting Oxidation State	Conditions			Ref.
		Medium	Conc. (M)	pH	
Np(IV)	Np(IV)/Np(V)/Np(VI)	HNO_3	> 1.0	acidic	137
	Np(V)	$HClO_4$	< 1.0	acidic	138
		HNO_3	0.11	acidic	137, 139
		HNO_3	0.33-0.62	acidic	137, 139
	Np(VI)	$HClO_4$	> 1.0	acidic	138
Np(VI)	Np(V)	$HClO_4$	0.48-1.70	acidic	140

Table S19. Table summarizing γ-irradiated actinides U-Am and their redox chemistry with $CO_3^{-\bullet}$ radical species.

Starting Oxidation State	Resulting Oxidation State	Conditions			Ref.
		Medium	Conc. (M)	pH	
U(IV)	U(IV)carbonate complexes	sat. $KHCO_3$	-	basic	18
		K_2CO_3	0.05	basic	9
Np(III)	Np(III) carbonate complexes	K_2CO_3	1.0-3.0	basic	2
Np(IV)	Np(IV) carbonate complexes	CO_3^{2-}	-	basic	141
Np(V)	Np(V) carbonate complexes	Na_2CO_3	0.5 : 1.0	basic	9
		Na_2CO_3/NaOH	0.5 : 0.2	basic	38
			0.5 : 0.6	basic	38
			0.5 : 1.0	basic	38
	Np(V)	CO_3^{2-}	-	basic	73
	Np(V)/Np(VI)	Na_2CO_3	-	basic	73
	Np(VI)	$NaHCO_3$	1.0	basic	72-74
		Na_2CO_3/$NaHCO_3$	0.25 : 0.75	basic	72-74
Np(VI)	Np(VI) carbonate complexes	Na_2CO_3/NaOH	0.5 : 1.0	basic	38
		sat. N_2O/CO_3^{2-}	-	basic	38
	Np(VII)	Na_2CO_3/NaOH	0.5 : 0.2	basic	142
			0.5 : 0.6	basic	152
			0.5 : 1.0	basic	152
Pu(III)	Pu(IV)	K_2CO_3	1.0-4.3	basic	2
Pu(IV)	Pu(V)	CO_3^{2-}	-	basic	141
Pu(V)	Pu(V)	Na_2CO_3	0.05	basic	9
Pu(VI)	Pu(VI)peroxo-carbonate complexes	Na_2CO_3	0.01-0.005	basic	143
Am(III)	Am(III) carbonate complexes	K_2CO_3	3.0-6.0	basic	2

Table S20. Table summarizing γ-irradiated actinides U-Am and Cf and its redox chemistry with $SO_4^{-\bullet}$.

Starting Oxidation State	Resulting Oxidation State	Conditions: Medium	Conditions: Conc. (M)	Conditions: pH	Ref.
U(IV)	U(V)	deaerated $H_2SO_4/HClO_4$	-	acidic	144
		H_2SO_4	2.0-5.0	acidic	145
U(V)	U(VI)	H_2SO_4	1.5	acidic	146
Np(III)	Np(IV)	H_2SO_4	3.0	acidic	147
Np(IV)	Np(V)	H_2SO_4	-	acidic	141
		H_2SO_4	0.01-0.4	acidic	72-74
Np(V)	Np(VI)	H_2SO_4	2.0	acidic	127
Pu(III)	Pu(IV)	H_2SO_4	5.0	acidic	131
Pu(IV)	Pu(V)	H_2SO_4	-	acidic	141
Am(III)	Am(IV)	$H_2SO_4/Na_2S_2O_8$	1.0 : 1.0	acidic	144
Cf(III)	Cf(IV)	$K_2S_2O_8/HClO_4$	0.1 : 0.003	-	148

Table S21. Table summarizing γ-irradiated actinides U-Am and Cf and their redox chemistry with the molecular halogen anions.

Starting Oxidation State	Resulting Oxidation State	Conditions: Medium	Conc. (M)	pH	Ref.
U(III)	U(IV)	Cl_2^- from $HClO_4$/HCl	0.5 : 0.1	acidic	33
		Br_2^- from $HClO_4$/NaBr	0.5 : 0.1	acidic	33, 136, 149
		I_2^- from $HClO_4$/KI	0.9 : 0.1	acidic	33
		aerated HCl	-	acidic	41
U(IV)	U(V)	deareated HCl	-	acidic	41
		HCl	0.8	acidic	150
U(V)	U(VI)	Cl_2^- from $HClO_4$/HCl/$UO_2(ClO_4)_2$	0.1 : 0.7 : 0.1	acidic	136
		Cl_2^- from NaCl	1.0	acidic	151
Np(III)	Np(IV)	Cl_2^- from HCl/$HClO_4$	0.1 : 0.9	acidic	152
		Br_2^- from HBr	1.0	acidic	152
		I_2 from NaI/$HClO_4$	0.1 : 0.9	acidic	152
Np(V)	Np(VI)	Cl_2^- from HCl	1.0-3.0	acidic	152
		Cl_2^- from HCl/LiCl	0.5 : 5.0	acidic	152
		Cl_2^- from HCl/LiCl	0.9 : 4.0	acidic	152
		Cl_2^- from HCl/$LiClO_4$	0.7 : 1.5	acidic	152
		Cl_2^- from HCl/$MgCl_2$	0.8 : 3.0	acidic	152
		Cl_2^- from HCl/$MgCl_3$	1.0	basic	151
		Cl_2^- from HCl/$MgCl_4$	1.0	basic	152
Pu(III)	Pu(IV)	Cl_2^- from HCl	1.0-5.0	acidic	153
		Cl_2^- from HCl/$HClO_4$	0.01 : 5.0	acidic	153
		Cl_2^- from HCl/H_2SO_4	0.01 : 2.5	acidic	153
		Cl_2^- from NaCl	1.0	basic	151
Am(III)	Am(IV)	Cl_2^- from NaCl	1.0	basic	151
Cf(III)	Cf(IV)	Cl_2^- from NaCl/$HClO_4$/$K_2S_2O_8$	1.0 : 0.003 : 0.1	-	148

Table S22. Table summarizing γ-irradiated actinides in multi-element systems and their redox chemistry with non-specified reactive species.

Starting Oxidation State	Resulting Oxidation State	Conditions			Ref.
		Medium	Conc. (M)	pH	
Gd-doped U(IV)O_2	UO_2/U(VI)	H_2O_2	-	acidic	154
Pu(VI)/U(VI)/Pd(II)	Pu(V)/U(V))/Pd(II)	HNO_3	4.0	acidic	78
Pu(VI)/Pd(II)	Pu(VI)/Pu(IV)/Pd(II)	HNO_3	4.0	acidic	78
Pu(IV)/Np(VI)	Pu(V)	HNO_3	0.5	acidic	155
Pu(VI)/Np(VI)	Pu(VI)/Np(V)	HNO_3	0.01-0.1	acidic	156
	Pu(V)/Np(V)	HNO_3	0.01-0.1	acidic	156
Pu(IV)/U(IV) (MOX47 fuel)	Pu(V)/U(VI)colloids	-	0	-	116

Solid-State Chemistry

Table S23. Summary of radiation studies on Pu solid-state materials.

Starting Complex	Resulting Complex/Species	Radiation Source (energy/dose)	Conditions		Ref.
			Atmosphere	Temperature (°C)	
δ-Pu	Frenkel defects	self-radiation	ambient	< 25	157
$PuAl_2$	Frenkel defects	self-radiation	ambient	< 25	157
$PuGa_3$	Frenkel defects	self-radiation	ambient	< 25	157
$PuCoGa_5$	Frenkel defects	self-radiation	ambient	< 25	157
	> 0.1 Å distortions + atom displacements	self-radiation	ambient	-255	158, 159
$PuCoIn_5$	Frenkel defects	self-radiation	ambient	< 25	157
$PuPt_2In_7$	Frenkel defects	self-radiation	ambient	< 25	157
Pu_2PtGa_8	Frenkel defects	self-radiation	ambient	< 25	157
Pu-doped $CaZrTi_2O_7$	Pu-O bond contraction	self-radiation	ambient	20-25	160
CaF_2 + 0.7 wt% Pu(III)	CaF_2 + Pu(III)/Pu(IV)	γ	ambient	0-25	161
	CaF_2 + Pu(III)/Pu(IV)	self-radiation	ambient	25	162
PuF_6	$PuF_4 + F_2$	γ (1 MGy)	ambient	60-70	163
	$PuF_4 + F_2$ / PuF_6	γ (1 MGy)	He	60-70	163
	$PuF_4 + F_2$ / $PuF_4 + KrF_2$	γ (1 MGy)	Kr	60-70	163

Table S24. Summary of radiation studies on Th solid-state materials.

Starting Complex	Resulting Complex/Species	Radiation Source (energy/dose)	Conditions		Ref.
			Atmosphere	Temperature (°C)	
ThO_2	ThO_2 + O vacancies	γ (0.5-2 MGy)	ambient	25	164-166
		H^+ (18 MeV)	ambient	50	167
		^{16}O (84 MeV)	ambient	50	167
		He^+ (100 keV)	ambient	25	168
		Ag^+ (100 MeV)	ambient	25	168
	ThO_{2-x} + ThO_{2+x} + Th_4O_9	H^+ (2 MeV)	ambient	600	169
	ThO_2 + dislocation loops	H^+ (2 MeV)	ambient	600	170
	anion + cation vacancies/interstitials	H^+ (2 MeV)	ambient	20-600	171
	ThO_2 + Pb impurities	e^- (3 MeV)	ambient	< 100	172
$Th_4(PO_4)_4P_2O_7$	phosphate-based radicals	γ (1 MGy)	ambient	20-22	173
		Kr (840 MeV)	-	25	174
	ThO_2 + $(ThO)_3(PO_4)_2$ + P_4O_{10}	He^+ (1.6 MeV)	ambient	20-23	173
		Pb^{2+} (200 keV)	ambient	20-24	173
		Au^{3+} (5 MeV)	ambient	20-25	173

Table S25. Summary of radiation studies on U solid-state materials.

Starting Complex	Resulting Complex/Species	Radiation Source (energy/dose)	Conditions: Atmosphere	Conditions: Temperature (°C)	Ref.
U(III)					
CaF_2 + doped with U	CaF_2 + U(IV)	γ	ambient	0-25	161
U(IV)					
UO_2	dislocation loops + lines	I (0.9 MeV)	ambient	25	175
		Fe (27 MeV)	ambient	25	175
		I (0.9 MeV) + Fe (27 MeV)	ambient	25	175
	UO_2 + U(V) + O vacancies	10^{13} Kr (740 MeV/cm^2)	ambient	26.85	176
	T_{2g} Raman blue-shift + UO_{2+x} + U_4O_9	He^{2+} (25 MeV)	ambient	25	177
$(U,Pu)O_2$	T_{2g} Raman blue-shift + UO_{2+x} + U_4O_9	Pu (*in-situ* α)	inert	25	178
$(U,Am)O_2$	U(IV)/(V) + Am(III)/(IV) in $(U,Am)O_2$	Am (*in-situ* α)	air or Ar/H_2	25	179, 180
$(U_{0.92}Ce_{0.08})O_2$	$(U_{0.92}Ce_{0.08})O_2$ + U(V) + O vacancies	10^{13} Kr (740 MeV/cm^2)	ambient	26.85	176
UN	UN + U(V) + O vacancies	$3x10^{13}$ Cd (1 GeV/cm^2)	ambient	26.85	176
U(V)					
CaO doped with U	Ca^{2+} vacancy + O^-	γ (4 kGy)	-	-196.15-266.85	181
U(VI)					
γ-UO_3	U(IV)	Xe (167 MeV)	ambient	25	166
		Au (950 MeV)	ambient	25	166
$(UO_2)(OH)_2$ + $(UO_2)_8O_2(OH)_{12}·10H_2O$	U(IV)	Xe (167 MeV)	ambient	25	166
		Au (950 MeV)	ambient	25	166
$K[UO_2(NO_3)_3]$	monodentate nitrate defects	γ (20 kGy)	vacuum	25	182
$Rb[UO_2(NO_3)_3]$	monodentate nitrate defects	γ (20 kGy)	vacuum	25	182
$Cs[UO_2(NO_3)_3]$	monodentate nitrate defects	γ (20 kGy)	vacuum	25	182
$Li_4[UO_2(O_2)_3]·10H_2O$	$Li_{24}[UO_2O_2(OH)]_{24}$	γ (3 MGy)	ambient	25	183
$Li_{24}[UO_2O_2(OH)]_{24}$	$Li_2[(UO_2)_3O_2(OH)_3]_2·7H_2O$	γ (4 MGy)	ambient	30	184
$Ca_2[UO_2(O_2)_3]·9H2O$	$Ca_2[UO_2(O_2)_{3-x}(OH)_{2x}]$	γ (3 MGy)	ambient	25	183
U_{60}	weakened UO_2^{2+} bond	γ (1 MGy)	ambient	25	185
	U_2O_7	He^{2+} (50 MGy)	ambient	25	185
$U_{60}Ox_{30}$	weakened UO_2^{2+} bond	γ (1 MGy)	ambient	25	185
	breakdown of cluster	He^{2+} (50 MGy)	ambient	25	185
$U_{24}Pp_{12}$	weakened UO_2^{2+} bond	γ (1 MGy)	ambient	25	185

	U(IV)/U(V)/U(VI)	He^{2+} (50 MGy)	ambient	25	185
$[UO_2O_2(H_2O)_2]\cdot 2H_2O$	weakened UO_2^{2+} bond	γ (1 MGy)	ambient	25	185
	$[UO_2O_2(H_2O)_2] + U_2O_7$	He^{2+} (50 MGy)	ambient	25	185
$Na_4[UO_2(O_2)_3]\cdot 9H_2O$	$Na_4[UO_2(CO_3)_3]$	γ (3 MGy)	ambient	25	186
		He^{2+} (225 MGy)	ambient	25	186
		γ (3 MGy)	hydrated Ar	25	186
		He^{2+} (225 MGy)	hydrated Ar	25	186
$[(UO_2)_8O_2(OH)_{12}]\cdot 10H_2O$	γ-$UO_3 + U_2O_7$	He^{2+} (100 MGy)	ambient	25	187
	$[UO_2O_2(H_2O)_2]\cdot 2H_2O$	He^{2+} (100 MGy)	ambient	> 25	187

Table S26. Summary of radiation studies on Am and Cm solid-state materials.

Starting Complex	Resulting Species or Defects	Conditions		Ref.
		Atmosphere	Temperature (°C)	
Am				
CaF_2 + doped with Am(III)	CaF_2 + Am(II)	ambient	0-25	161
CaF_2 + 0.1-0.2 wt% Am(III)	CaF_2 + Am(II) + e^-	ambient	25	188
$Am_2Zr_2O_7$ (*Fd*-3*m*)	*Fm*-3*m* symmetry + cation antisites + Frenkel pairs	N_2	25	189-191
	Am(III)/Am(IV)	ambient	25	192
$AmPO_4$	local P disorder	ambient	25	193
$Am_{0.93}Np_{0.07}PO_4$	local P disorder	ambient	25	193
$U_{1-x}Am_xO_{2\pm\delta}$ (x = 0.15 and 0.20)	increased interatomic distances	ambient	25	179, 194, 195
AmO_2	Am-O bond increase	ambient	25	196-200
$AmAlO_3$ (*R*-3*c*)	*Pm*-3*m* symmetry	ambient	25	201
Cm				
CaF_2 + doped with Cm(III)	CaF_2 + Cm(IV)	ambient	0-25	161
cubic-C Cm_2O_3	hexagonal-A Cm_2O_3 + CmO_2	He	25	202
rhombohedral $CmAlO_3$	cubic $CmAlO_3$	ambient	25-500	202

References

(1) Gogolev, A. V.; Shilov, V. P.; Fedoseev, A. M.; Pikaev, A. K. The study of reactivity of actinide ions towards hydrated electrons and hydrogen atoms in acid aqueous solutions by a pulse radiolysis method. *International Journal of Radiation Applications and Instrumentation. Part C. Radiation Physics and Chemistry* (1991) 37:3, 531-535. DOI: https://doi.org/10.1016/1359-0197(91)90031-V.

(2) Gogolev, A. V.; Shilov, V. P.; Fedoseev, A. M.; Pikaev, A. K. Stdy of reactions kinetics of hydrated electron with tetravalent actinoid ions in acidic media using pulsed radiolysis method. *Radiokhimiya* (1990) 32:4, 121-123.

(3) Pikaev, A. K.; Shilov, V. P.; Fedoseev, A. M. On mechanism of radiokysis of acicic aqueous solutions of tetravalent uranium ions. *Dokl. Akad. Nauk. SSSR* (1981) 260:6, 1407-1411.

(4) Pikaev, A. K.; Shilov, V. P.; Fedoseev, A. M. *Izv. Akad. Nauk. SSSR, Ser. Khim* (1980) 1947.

(5) Nenoff, T. M.; Jacobs, B. W.; Robinson, D. B.; Provencio, P. P.; Huang, J.; Ferreira, S.; Hanson, D. J. Synthesis and Low Temperature In Situ Sintering of Uranium Oxide Nanoparticles. *Chemistry of Materials* (2011) 23:23, 5185-5190. DOI: 10.1021/cm2020669.

(6) Sullivan, J. C.; Gordon, S.; Cohen, D.; Mulac, W.; Schmidt, K. H. Pulse radiolysis studies of uranium(VI), neptunium(VI), neptunium(V), and plutonium(VI) in aqueous perchlorate media. *The Journal of Physical Chemistry* (1976) 80:15, 1684-1686. DOI: 10.1021/j100556a006.

(7) Broszkiewicz, R. K.; Vojnovic, B.; Michael, B. D. Reduction of the U(VI) ion. A fast conductimetry study. *International Journal of Radiation Applications and Instrumentation. Part C. Radiation Physics and Chemistry* (1991) 37:3, 443-447. DOI: https://doi.org/10.1016/1359-0197(91)90016-U.

(8) Nash, K.; Mulac, W.; Noon, M.; Fried, S.; Sullivan, J. C. Pulse radiolysis studies of U(VI) complexes in aqueous media. *Journal of Inorganic and Nuclear Chemistry* (1981) 43:5, 897-899. DOI: https://doi.org/10.1016/0022-1902(81)80146-7.

(9) Mulac, W. A.; Gordon, S.; Schmidt, K. H.; Wester, D.; Sullivan, J. C. Reactions of uranium(V), neptunium(V), and plutonium(V) with the carbonate radical ion. *Inorg. Chem.* (1984) 23:12, 1639-1641. DOI: https://doi.org/10.1021/ic00180a003

(10) Pikaev, A. K.; Mefod'eva, M. P.; Krot, N. N.; Spitsyn, V. I. Constantes Absolues de Vitesse des Reactions de L'Electron Hydrate Avec les Ion Np et Pu Dans les Solutions Aqueuses de Carbonates *Izv. Akad. Nauk. SSSR, Ser. Khim* (1974) 2847-2848.

(11) Schmidt, K. H.; Gordon, S.; Thompson, R. C. A pulse radiolysis study of the reduction of neptunium (V) by the hydrated electron. *Journal of Inorganic and Nuclear Chemistry* (1980) 42:4, 611-615. DOI: https://doi.org/10.1016/0022-1902(80)80093-5.

(12) Pikaev, A. K.; Shilov, V. P. Investigation into reaction kinetics of O- radicals with neptunium (6) ions in aqueous solutions by pulse radiolysis method. *Izv. AN SSSR. Ser. Khim.* (1978) 2136-2139.

(13) Pikaev, A.; Ershov, B.; Makarov, I. Influence of the nature of a matrix on the reactivity of electrons in irradiated systems. *The Journal of Physical Chemistry* (1975) 79:26, 3025-3034.

(14) Schmidt, K.; Gordon, S.; Thompson, M.; Sullivan, J.; Mulac, W. The hydrolysis of neptunium (VI) and plutonium (VI) studied by the pulse radiolysis transient conductivity technique. *Radiation Physics and Chemistry (1977)* (1983) 21:3, 321-328. DOI: https://doi.org/10.1016/0146-5724(83)90160-7

(15) Pikaev, A. K.; Mefodjeva, M. P.; Zakharova, F. A.; Shilov, V. P.; Krot, N. N.; Gel'man, A. D.; Spitsyn, V. I. *J. Inorg. Nucl. Chem. Suppl.* (1978) *95*.

(16) Pikaev, A. K.; Shilov, V. P.; Krot, N. N.; Gel'man, A. D.; Spitsyn, V. I. Pulse Radiolysis Study of Reaction Rate of O- Radicals with Neptunium(VI) Ions in Aqueous Solutions. *Izv. Akad. Nauk. SSSR, Ser. Khim* (1969) 1199.

(17) Pikaev, A. K.; Shilov, V. P.; Krot, N. N.; Gel'man, A. D.; Spitsyn, V. I. *Sokl. Akad. Nauk. SSSR* (1970) 190, 387.

(18) Gogolev, A. V.; Shilov, V. P.; Fedoseev, A. M.; Pikaev, A. K. *Izv. Akad. Nauk. SSSR, Ser. Khim* (1990) 28.

(19) Gogolev, A. V.; Fedoseev, A. M.; Shilov, V. P.; Pikaev, A. K. Kinetics of the radiation chemical reactions of tervalent and quadrivalent actinides and lanthanides in carbonate solutions. *Bull. Acad. Sci. USSR Div. Chem. Sci.* (1990) 39, 21-25. DOI: https://doi.org/10.1007/BF00962995
(20) Pikaev, A. K.; Mefodjeva, M. P.; Krot, N. N.; Spitsyn, V. I. *Khim. Vys. Energ.* (1973) 7, 505.
(21) Gordon, S.; Mulac, W. A.; Schmidt, K. H.; Sjoblom, R. K.; Sullivan, J. C. Pulse-radiolysis studies of americium ions in aqueous perchlorate media. *Inorganic Chemistry* (1978) 17:2, 294-296. DOI: 10.1021/ic50180a021.
(22) Pikaev, A. K.; Shilov, V. P.; Spitsyn, V. I. Preparation and investiation of properties of bivalent americium ions in aqueous solutions using pulse radiolysis method. *Izv. Akad. Nauk. SSSR, Ser. Khim* (1976) 12, 2840.
(23) Horne, G. P.; Grimes, T. S.; Bauer, W. F.; Dares, C. J.; Pimblott, S. M.; Mezyk, S. P.; Mincher, B. J. Effect of Ionizing Radiation on the Redox Chemistry of Penta- and Hexavalent Americium. *Inorganic Chemistry* (2019) 58:13, 8551-8559. DOI: 10.1021/acs.inorgchem.9b00854.
(24) Sullivan, J. C.; Gordon, S.; Mulac, W. A.; Schmidt, K. H.; Cohen, D.; Sjoblom, R. Pulse radiolysis studies of americum(III) and curium(III) ions in perchlorate media. The preparation of Am II, Am IV, Cm II and Cm IV. *Inorganic and Nuclear Chemistry Letters* (1976) 12:8, 599-601. DOI: https://doi.org/10.1016/0020-1650(76)80076-1.
(25) Sullivan, J. C.; Schmidt, K. H.; Morss, L. R.; Pippin, C. G.; Williams, C. Pulse Radiolysis of Berkelium(III): Preparation and Identifications of Berkelium(III) in Aqueous Perchlorate Media. *Inorg Chem* (1988) 27:4, 597-598.
(26) Sullivan, J. C.; Morss, L. R.; Schmidt, K. H.; Mulac, W. A.; Gordon, S. Pulse radiolysis studies of californium(III) in aqueous perchlorate solution. Evidence for the preparation of californium(II). *Inorganic Chemistry* (1983) 22:16, 2338-2339. DOI: 10.1021/ic00158a023.
(27) Horne, G. P.; Rotermund, B. M.; Grimes, T. S.; Sperling, J. M.; Meeker, D. S.; Zalupski, P. R.; Beck, N.; Huffman, Z. K.; Martinez, D. G.; Beshay, A.; Peterman, D. R.; Layne, B. H.; Johnson, J.; Cook, A. R.; Albrecht-Schonzart, A. E.; Mezyk, S. P. Transient Radiation-Induced Berkelium(III) and Californium(III) Redox Chemistry in Aqueous Solution. *Inorganic Chemistry* (2022) 61:28, 10822-10832. DOI: 10.1021/acs.inorgchem.2c01106.
(28) Shilov, V. P.; Gogolev, A. V.; Fedoseev, A. M.; Pikaev, A. K. *Khim. Vys. Energ.* (1994) 28:2, 114.
(29) Shilov, V. P.; Pikaev, A. K.; Fedoseev, A. M. Investigation into kinetics of OH radical reaction with urnaium (4) ions in perchloric-acid solutions by the pulsed radiolysis method. *Khim. Vys. Energ.* (1982) 16:1, 89-90.
(30) Saini, R. D.; Bhattacharyya, P. K. Radiolytic oxidation of U(IV) sulphate in aqueous solution by alpha particles from cyclotron. *International Journal of Radiation Applications and Instrumentation. Part C. Radiation Physics and Chemistry* (1987) 29:5, 375-379. DOI: https://doi.org/10.1016/1359-0197(87)90009-9.
(31) Gogolev, A. V.; Shilov, V. P.; Fedoseev, A. M.; Pikaev, A. K. *Khim. Vys. Energ.* (1991) 25, 472.
(32) Horne, G. P.; Grimes, T. S.; Zalupski, P. R.; Meeker, D. S.; Albrecht-Schönzart, T. E.; Cook, A. R.; Mezyk, S. P. Curium(iii) radiation-induced reaction kinetics in aqueous media. *Dalton Transactions* (2021) 50:31, 10853-10859. DOI: 10.1039/D1DT01268A.
(33) Golub, D.; Cohen, H.; Meyerstein, D. Kinetics and mechanism of single electron oxidations of the tervalent uranium ion, U3+(aq), by free radicals in aqueous solutions. *Journal of the Chemical Society, Dalton Transactions* (1985) 4, 641-644. DOI: 10.1039/DT9850000641.
(34) Shilov, V. P.; Fedoseev, A. M.; Pikaev, A. K. Etude de la Reactivite des Ions de Neptunium vis-a-via de Radicaux OH dans les Solutions D'Acide Perchlorique, pa la Methode de la Radiolyse Pulsee. *Izv. Akad. Nauk. SSSR, Ser. Khim* (1982) 4, 940-942.
(35) Shilov, V. P.; Gogolev, A. V.; Fedoseev, A. M.; Pikaev, A. K. Invstigation of reactivity of neptunoyl-ions to inorganic free radicals by pulse radiolysis method. *Izv. Akad. Nauk. SSSR, Ser. Khim* (1986) 456-458.

(36) Mincher, B. J.; Precek, M.; Mezyk, S. P.; Martin, L. R.; Paulenova, A. The role of oxidizing radicals in neptunium speciation in γ-irradiated nitric acid. *Journal of Radioanalytical and Nuclear Chemistry* (2013) 296:1, 27-30. DOI: 10.1007/s10967-012-1937-1.
(37) Pikaev, A. K.; Shilov, V. P.; Spitsyn, V. I. Application of pulsed radiolysis method for investigation of americium (4) properties in aqueous solutions. *Dokl. Akad. Nauk. SSSR* (1977) 232:2, 387-390.
(38) Gogolev, A. V.; Shilov, V. P.; Pikaev, A. K. Radiolysis of neptunium (6) in carbonate solutions *Izv. Akad. Nauk. SSSR, Ser. Khim.* (1989) 1.
(39) Meisel, D.; Czapski, G.; Samuni, A. Hydroperoxy radical reactions. I. Electron paramagnetic resonance study of the complexation of hydroperoxyl radical with some metal ions. *Journal of the American Chemical Society* (1973) 95:13, 4148-4153. DOI: 10.1021/ja00794a007.
(40) Meisel, D.; Ilan, Y.; Czapski, G. Hydroperoxyl radical reactions. III. Pulse-radiolytic study of the reaction of the hydroperoxyl radical with some metal ions. *The Journal of Physical Chemistry* (1974) 78:23, 2330-2334. DOI: https://doi.org/10.1021/j150671a006
(41) Pikaev, A. K.; Šilov, V. P.; Spicyn, V. I. *Radioliz vodnych rastvorov lantanidov i aktinidov*; Nauka, (1983).
(42) Gogolev, A. V.; Shilov, V. P.; Pikaev, A. K. *Khim. Vys. Energ.* (1996) 30, 225.
(43) Gogolev, A. V.; Shilov, V. P.; Pikaev, A. K. Investigation of ozonide ion reaction with neptunium (6) ions in alkali aqueous solutions by the method of pulse radiolysis. *Radiokhimiya* (1989) 31:1, 124-128.
(44) Bhattacharyya, P. K.; Saini, R. D.; Ruikar, P. B. Reaction between U(IV) and H2O2 in hydrochloric acid medium. *Int. J. Chem. Kinet.* (1982) 14:11, 1219-1229. DOI: https://doi.org/10.1002/kin.550141106
(45) Koltunov, V. S. *Kinetics of Actinide Reactions*; Moscow: Atomizdat, (1974).
(46) Koltunov, V. S.; Kulikov, I. A.; Marchenko, V. I.; Milovanova, A. S. *Radiokhimiya* (1980) 22, 83.
(47) Tananaev, I. G.; Dzyubenko, V. I. On neptunium (5) interaction with hydrogen peroxide innitric acid solutions. *Radiokhimiya* (1988) 30:6, 842-845.
(48) Mazumdar, A. S. G.; Vaidyanathan, S. On the Oxidation of Plutonium (III) by Hydrogen Peroxide-Probable Formation of an Unstable Plutnium (III) Peroxy Complex *Radiochim. Acta* (1973) 19:4, 165-168. DOI: https://doi.org/10.1524/ract.1973.19.4.165
(49) Ekstrom, A.; McLaren, A. The kinetics and mechanism of the formation of the “brown” complex of plutonium(IV) and hydrogen peroxide. *Journal of Inorganic and Nuclear Chemistry* (1972) 34:3, 1009-1016. DOI: https://doi.org/10.1016/0022-1902(72)80078-2.
(50) Ghosh Mazumdar, A. S.; Srinivasan, B.; Natarajan, P. R. Radiation-induced oxidation of plutonium(III) in sulphuric acid solutions. *International Journal for Radiation Physics and Chemistry* (1973) 5:1, 51-58. DOI: https://doi.org/10.1016/0020-7055(73)90027-2.
(51) Newton, T.; Baker, F. The Reaction between Pu (III) and Oxygen in Aqueous SuIfate Solutions. *The Journal of Physical Chemistry* (1956) 60:10, 1417-1421.
(52) Koltunov, V. S.; Kulikov, I. A.; Kermanova, N. V.; Nikishova, L. K. Kinetics of Pusup (4) reduction by hydrogen peroxide in nitric acid. *Radiokhimiya* (1981) 23:3, 462-465.
(53) Nash, K.; Noon, M. E.; Fried, S.; Sullivan, J. C. The reaction between Pu(VI) and H2O2 in aqueous bicarbonate media. Formation of a Pu(VI) H2O2 complex (1). *Inorganic and Nuclear Chemistry Letters* (1980) 16:1, 33-35. DOI: https://doi.org/10.1016/0020-1650(80)80089-4.
(54) Woods, S. M.; Cain, A.; Sullivan, J. C. A kinetic study of the reduction of americium (VI) by hydrogen peroxide in aqueous perchlorate media. *J. Inorg. Nucl. Chem. Suppl.* (1974) 36, 2605.
(55) Andreichuk, N. N.; Frolov, A. A.; Vasil'ev, V. Y. Investigation of alpha-radiation effect on valence state of actinoids. *Radiokhimiya* (1987) 29:3, 412-417.
(56) Sattonnay, G.; Ardois, C.; Corbel, C.; Lucchini, J. F.; Barthe, M. F.; Garrido, F.; Gosset, D. Alpha-radiolysis effects on UO2 alteration in water. *Journal of Nuclear Materials* (2001) 288:1, 11-19. DOI: https://doi.org/10.1016/S0022-3115(00)00714-5.
(57) Corbel, C.; Sattonnay, G.; Lucchini, J.-F.; Ardois, C.; Barthe, M.-F.; Huet, F.; Dehaudt, P.; Hickel, B.; Jegou, C. Increase of the uranium release at an UO2/H2O interface under He2+ ion beam irradiation. *Nuclear Instruments and Methods in Physics Research Section B: Beam Interactions with Materials and Atoms* (2001) 179:2, 225-229. DOI: https://doi.org/10.1016/S0168-583X(01)00519-5.

(58) Canizarès, A.; Guimbretière, G.; Tobon, Y. A.; Raimboux, N.; Omnée, R.; Perdicakis, M.; Muzeau, B.; Leoni, E.; Alam, M. S.; Mendes, E.; et al. In situ Raman monitoring of materials under irradiation: study of uranium dioxide alteration by water radiolysis. *Journal of Raman Spectroscopy* (2012) 43:10, 1492-1497. DOI: https://doi.org/10.1002/jrs.4088.
(59) Traboulsi, A.; Vandenborre, J.; Blain, G.; Humbert, B.; Barbet, J.; Fattahi, M. Radiolytic Corrosion of Uranium Dioxide: Role of Molecular Species. *The Journal of Physical Chemistry C* (2014) 118:2, 1071-1080. DOI: 10.1021/jp409994y.
(60) Corbel, C.; Sattonnay, G.; Guilbert, S.; Garrido, F.; Barthe, M. F.; Jegou, C. Addition versus radiolytic production effects of hydrogen peroxide on aqueous corrosion of UO2. *Journal of Nuclear Materials* (2006) 348:1, 1-17. DOI: https://doi.org/10.1016/j.jnucmat.2005.05.009.
(61) Amme, M. Contrary effects of the water radiolysis product H2O2 upon th dissolution of nuclear fuel in natural ground water and deionized water. *Radiochimica Acta* (2002) 90:7, 399-406. DOI: doi:10.1524/ract.2002.90.7_2002.399
(62) Sunder, S.; Shoesmith, D. W. Chemistry of UO2 fuel dissolution in relation to the disposal of used nuclear fuel (1991).
(63) Shoesmith, D. W. *Electrochemistry-based model for the dissolution of UO2. AECL research No. AECL-10488*; MIC-94-05501/XAB; AEA Environment and Energy, Harwell (United Kingdom), Canada, (1991). DOI: https://doi.org/ GRA.
(64) Johnson, L. H. Radioactive Waste Forms of the Future. In North-Holland, Amsterdam; (1988).
(65) Ewing, R. C. Long-term storage of spent nuclear fuel. *Nature Materials* (2015) 14:3, 252-257. DOI: 10.1038/nmat4226.
(66) Hanson, B. D.; McNamara, B.; Buck, E. C.; Friese, J. I.; Jenson, E.; Krupka, K.; Arey, B. W. Corrosion of commercial spent nuclear fuel. 1. Formation of studtite and metastudtite. *Radiochimica Acta* (2005) 93:3, 159-168. DOI: doi:10.1524/ract.93.3.159.61613
(67) Boyle, J.; Ghormley, J.; Hochanadel, C.; Kieffer, W.; Sworski, T. The Radiation Chemistry of Aqueous Reactor Solutions. *Nuclear Science Engineering and Technology* (1953) 25.
(68) Boyle, J. W.; Mahlman, H. A. Radiation-Induced Decomposition of Thorium Nitrate Solutions. *Nuclear Science and Engineering* (1957) 2:4, 492-500. DOI: https://doi.org/10.13182/NSE57-A25414
(69) L. Salomon, E. L.-M. Mol, Belgium: European Company for Chemical Processing of Irradiated Fuel, (1966).
(70) Kochannyj, G. L. Effect of cobalt-60 gamma radiation on the determination of uranium(IV) in phosphoric acid solutions of uranium(iv) oxide. *Analytica Chimica Acta* (1965) 33, 76-83. DOI: https://doi.org/10.1016/S0003-2670(01)84856-X.
(71) Rath, M. C.; Naik, D. B.; Sarkar, S. K. Reversible growth of UO2 nanoparticles in aqueous solutions through 7MeV electron beam irradiation. *Journal of Nuclear Materials* (2013) 438:1, 26-31. DOI: https://doi.org/10.1016/j.jnucmat.2013.02.005.
(72) Pikaev, A. K.; Shilov, V. P.; Gogolev, A. V. Radiation chemistry of aqueous solutions of actinides. *Usp. Khim.* (1997) 66, 845-873.
(73) Shilov, V. P.; Gogolev, A. V.; Pikaev, A. K. Unusual radiolytic behavior of neptunium ions in aqueous bicarbonate solutions. *Doklady Akademii Nauk - Rossijskaya Akademiya Nauk* (2000) 375:3, 362-365.
(74) Pikaev, A. K.; Gogolev, A. V.; Shilov, V. P. Redox reactions of neptunium and plutonium in alkaline aqueous solutions upon gamma radiolysis. *Radiation Physics and Chemistry* (1999) 56:4, 483-491. DOI: https://doi.org/10.1016/S0969-806X(99)00334-5.
(75) Gogolev, A. V.; Shilov, V. P.; Pikaev, A. K. *Khim. Vys. Energ.* (1997) 31:2, 71-74.
(76) Pages, M. Radiolysis of aqueous solutions of plutonium. *J. Chim. Phys., Phys. Chim. Biol.* (1962) 59, 63.
(77) Vladimirova, M. V.; Fedoseev, D. A.; Dunaeva, M. A. Radiation-Chemical Behavior of Plutonium in the Heterogeneous System PuO2-Ground Water. *Radiochemistry* (2002) 44:5, 498-500. DOI: 10.1023/A:1021191710917.
(78) Tkhorzhnitskii, G. P.; Terekhov, G. A.; Egorov, G. F.; Medvedovskii, V. I.; Shevchenko, V. B.; Renard, E. V. Radiation-chemical behavior of the Pu (4) and Pu (6) macroconcentrations in aqueous nitrics

acid solutions in the presence of uranium macroamounts and stable isotopes of some fission products of actinides. *Radiokhimiya* (1975) 17:5, 724-728.
(79) Tkhorzhnitskii, G. P.; Egorov, G. F. *Radiokhimiya* (1985) 27, 194.
(80) Gogolev, A. V.; Shilov, V. P.; Pikaev, A. K. The formation of a neptunium (IV) peroxo complex upon gamma radiolysis of aqueous alkaline solutions of neptunium ions. *Mendeleev Communications* (1996) 6:4, 127-128. DOI: https://doi.org/10.1070/MC1996v006n04ABEH000611
(81) Vladimirova, M. V.; Sosnovskii, O. A. Radiation-chemical reduction of PuO22+ and NpO22+ ions in the case of their simultaneous presence in HNO3 soutions. *Radiokhimiya* (1980) 22, 662-670.
(82) Zakharova, F. A.; Pikaev, A. K.; Orlova, M. M.; Gel'man, A. D.; Spitsyn, V. I. *Dokl. Akad. Nauk. SSSI* (1971) 201, 636.
(83) Bhattacharyya, P. K.; Saini, R. D. Radiolytic formation of plutonium (VII) *Radiat. Eff. Lett.* (1981) 57:6, 165-169. DOI: https://doi.org/10.1080/01422448108226515
(84) Saini, R. D.; Bhattacharyya, P. K. Radiation chemistry of plutonium (VI). *Radiat. Physc. Chem.* (1984) 23:5, 509-513. DOI: https://doi.org/10.1016/0146-5724(84)90152-3
(85) Krot, N. N.; Shilov, V. P.; Nikolaevskii, V. B.; Pikaev, A. K.; D.Gel'man, A.; Spitsyn, V. I. Production of americium in septivalent state. *Dokl. Akad. Nauk. SSSR* (1974) 217, 589-592.
(86) Perrin, B.; Venault, L.; Broussard, E.; Vandenborre, J.; Blain, G.; Fattahi, M.; Nikitenko, S. Influence of plutonium oxidation state on the formation of molecular hydrogen, nitrous acid and nitrous oxide from alpha radiolysis of nitric acid solution. *Radiochimica Acta* (2022) 110:5, 301-310. DOI: doi:10.1515/ract-2021-1136
(87) Andreichuk, N. N.; Frolov, A. A.; Rotmanov, K. V.; Vasil'ev, V. Y. *J.* Plutnium (III) oxidation under alpha-irradiation in nitric acids. *Radioanal. Nucl. Chem. Artic.* (1990) 143:2, 427-432. DOI: https://doi.org/10.1007/bf02039611
(88) Liu, Z.; Fang, Z.; Wang, L.; He, H.; Lin, M.-Z. Alpha radiolysis of nitric acid aqueous solution irradiated by 238Pu source. *Nuclear Science and Techniques* (2017) 28:4, 54. DOI: 10.1007/s41365-017-0200-4.
(89) Connick, R.; Kasha, M.; McVey, W.; Sheline, G. *Spectrophotometric studies of plutonium in aqueous solution*; Technical Information Division, Oak Ridge Operations, (1946).
(90) Rabideau, S. W.; Bradley, M. J.; Cowan, H. D. *Alpha-particle Oxidation and Reduction in Aqueous Plutonium Solutions*; LAMS-2236; United States, (1958). DOI: 10.2172/4275417.
(91) Andreichuk, N. N.; Vasil'ev, V. Y.; Vysokoostrovskaya, N. B.; Kalashnikov, V. M.; Karasev, V. I.; Karelin, E. A.; Mishinev, V. B.; Nikolaev, V. M.; Osipov, S. V. Oxidation of plutnium (4) innitric acid solutions with high specifi alpha-radioactivity. *Radiokhimiya* (1976) 18:1, 89-92.
(92) Andreichuk, N. N.; Rotmanov, K. V.; Frolov, A. A.; Vasil'ev, V. Y. Reduction of Pu (6) in nitric acid solutions at alpha-irradiation. *Radiokhimiya* (1984) 26:1, 94-98.
(93) Büppelmann, K.; Kim, J. I.; Lierse, C. H. The Redox-Behaviour of Plutonium in Saline Solutions under Radiolysis Effects. *Radiochimica Acta* (1988) 44-45:1, 65-70. DOI: doi:10.1524/ract.1988.4445.1.65
(94) Büppelmann, K.; Magirius, S.; Lierse, C.; Kim, J. I. Radiolytic oxidation of americium(III) to americium(V) and plutonium(IV) to plutonium(VI) in saline solution. *Journal of the Less Common Metals* (1986) 122, 329-336. DOI: https://doi.org/10.1016/0022-5088(86)90427-3.
(95) Kim, J. I.; Lierse, C. H.; Buppelman, K.; Magirius, S. *Mater. Res. Soc. Symp. Proc.* (1986) 84, 603.
(96) Newton, T. W.; Hobart, D. E.; Palmer, P. D. The Formation of Pu(IV)-Colloid by the Alpha-reduction of Pu(V) or Pu(VI) in Aqueous Solutions. *Radiochimica Acta* (1986) 39:3, 139-148. DOI: doi:10.1524/ract.1986.39.3.139
(97) Vladimirova, M. V.; Kulikov, I. A.; Sosnovskii, O. A.; Ryabova, A. A. Reduction of PuO22+ in gamma radiolysis in aqueous HNO3. *Soviet Atomic Energy* (1981) 51, 475-478. DOI: https://doi.org/10.1007/BF01122566
(98) Vladimirova, M. V. Radiation-chemical reduction of Pu(6) in 0.3-6.0 M HNO3 *Radiokhimiya* (1980) 22:5, 686-691.
(99) Vladimirova, M.; Kulikov, I.; Ryabova, A.; Milovanova, A. Radiation chemistry of Pu and Np aqueous solutions. *Radiokhimiya* (1976) 18:1, 172-177.

(100) Seaborg, G. T.; Katz, J. J. *The Actinide Elements*: Vol. 14A of Division IV—the Plutnium Project Record (1955).
(101) Connick, R. The actinide elements. *National nuclear energy series, division IV* (1954) 14, 464.
(102) Shilov, V. P.; Gogolev, A. V.; Fedoseev, A. M. Mechanism of Pu(VI) and Pu(V) autoreduction in aqueous solutions. *Radiochemistry* (2011) 53:5, 466-473. DOI: 10.1134/S1066362211050043.
(103) Ermakov, V.; Rykov, A.; Timofeev, G.; Yakovlev, G. Investigations of the Kinetics of Redoc Reactions of the Actinide Elements. XX. Kinetics and Mechanism of the Interactions of Americium (III) and (V) with Peroxydisulfate ions in Nitric Acide Solution. *Sov. Radiochem.(Engl. Transl.)* (1971) 13:6, 851-857.
(104) Ohyoshi, A.; Jyo, A.; Shinohara, T. Kinetics of the Reaction of Americium (III) with Peroxydisulfate. *Bulletin of the Chemical Society of Japan* (1971) 44:11, 3047-3051. DOI: https://doi.org/10.1246/bcsj.44.3047
(105) Magirius, S.; Carnell, W. T.; Kim, J. I. Radiolytic oxidation of Am (III) to Am (V) in NaCL solutions. *Radiochim. Acta* (1985) 38, 29-32. DOI: https://doi.org/10.1524/ract.1985.38.1.29
(106) Asprey, L. B.; Stephanou, S. E. *The Auto-Reduction of Am(VI) and Am(V) in Dilute Acid*; Los Alamos Scientific Laboratory, USAEC Report, (1950).
(107) Asprey, L. B.; Stephanou, S. E.; Penneman, R. A. A New Valence State of Americium, Am(VI). *Journal of the American Chemical Society* (1950) 72:3, 1425-1426. DOI: 10.1021/ja01159a528.
(108) Hall, G.; Markin, T. The self-reduction of americium (V) and (VI) and the disproportionation of americium (V) in aqueous solution. *Journal of Inorganic and Nuclear Chemistry* (1957) 4:5-6, 296-303. DOI: https://doi.org/10.1016/0022-1902(57)80011-6
(109) Zaitsev, A. A.; Kosyakov, V. N.; Rykov, A. G.; Sobolev, Y. P.; Yakovlev, G. N. *At. Energ. (USSR)* (1959) 7:37.
(110) Zaitsev, A. A.; Kosyakov, V. N.; Rykov, A. G.; Sobolev, Y. P.; Yakovlev, G. N. *Sov. Radiochem.(Engl. Transl.)* (1960) 2, 348.
(111) Coleman, J. S. The kinetics of the disproportionation of americium (V). *Inorganic Chemistry* (1963) 2:1, 53-57.
(112) Anan'ev, A. V.; Shilov, V. P. Kinetics of americium (6) reduction in formate solutions. *Radiokhimiya* (1992) 34:4, 21-28.
(113) Kornilov, A. S.; Frolov, A. A.; Vasil'ev, V. Y. Investigation of alpha-irradiation effect on valent states of actinides. *Radiokhimiya* (1985) 27:1, 54-59.
(114) Coleman, J.; Keenan, T.; Jones, L.; Carnall, W.; Penneman, R. Preparation and properties of americium (VI) in aqueous carbonate solutions. *Inorganic Chemistry* (1963) 2:1, 58-61.
(115) Frolov, A. A.; Frolova, L. M.; Vasil'ev, V. Y. Behavior of americium and berkelium ionsin solutions under intensive alpha irradiation. *Radiokhimiya* (1987) 29:1, 79-87.
(116) Jégou, C.; Caraballo, R.; De Bonfils, J.; Broudic, V.; Peuget, S.; Vercouter, T.; Roudil, D. Oxidizing dissolution of spent MOX47 fuel subjected to water radiolysis: Solution chemistry and surface characterization by Raman spectroscopy. *Journal of Nuclear Materials* (2010) 399:1, 68-80. DOI: https://doi.org/10.1016/j.jnucmat.2010.01.004.
(117) Chistyakov, V. M.; Baranov, A. A.; Karbovnichii, P. N.; Erin, E. A.; Timofeev, G. A. Study of stability of tetravalent curium and californium in potassium tungstophospate solutions. *Radiokhimiya* (1990) 32:4, 36-40.
(118) Erin, E. A.; Vityutnev, V. M.; Kopytov, V. V.; Vasil'ev, V. Y. Investigation of berkelium (4) autoreduction in perchloric and nitric acid solutions. *Radiokhimiya* (1982) 24:2, 179-184.
(119) Chepovoi, V. I.; Lebedev, I. A.; Kulyako, Y. M.; Myasoedov, B. F. Oxidation of berkelium (3) in nitric-acid solution and stability of formed berkelium (4). *Radiokhimiya* (1980) 22:5, 658-661.
(120) Litvina, M. N.; Malikov, D. A.; Milyukova, M. S.; Myasoedov, B. F. Temperature effect on kinetics of americium (3) and berkelium (3) oxidation by mixture of ammonium persulfate and silver and their stability in tetravalent state. *Radiokhimiya* (1980) 22:5, 653-657.

(121) Gutmacher, R. G.; Bodé, D. D.; Lougheed, R. W.; Hulet, E. K. The stability of tetravalent berkelium in acid solution and the absorption spectra of Bk(IV) and Bk(III). *Journal of Inorganic and Nuclear Chemistry* (1973) 35:3, 979-994. DOI: https://doi.org/10.1016/0022-1902(73)80469-5.
(122) Baybarz, R. D.; Stokely, J. R.; Peterson, J. R. Absorption spectra of Bk(III) and Bk(IV) in several media. *Journal of Inorganic and Nuclear Chemistry* (1972) 34:2, 739-746. DOI: https://doi.org/10.1016/0022-1902(72)80456-1.
(123) Frolova, L. M.; Vityutnev, V. M.; Vasil'ev, V. Y. *Radiokhimiya* (1986) 28, 27.
(124) Frolov, A. A.; Kopytov, V. V.; Frolova, L. M.; Vasil'ev, V. Y. Investigation of alpha-emission effect on valence of actinides. *Radiokhimiya* (1988) 30:3, 557-561.
(125) Frolova, L. M.; Vityutnev, V. M.; Vasil'ev, V. Y. *Radiokhimiya* (1988) 25, 212.
(126) Mincher, B. J. *Irradiation effects on neptunium oxidation states*; Idaho National Lab.(INL), Idaho Falls, ID (United States), (2010).
(127) Gogolev, A. V.; Shilov, V. P.; Fedoseev, A. M.; Pikaev, A. K. Investigation of reactivity of neptunoyl-ions to inorganic free radicals by pulse radiolysis method.[Electrons] *Izv. Akad. Nauk. SSSR, Ser. Khim* (1986) 2, 456-458.
(128) Precek, M.; Paulenova, A.; Mincher, B. J. Reduction of Np(VI) in Irradiated Solutions of Nitric Acid. *Procedia Chemistry* (2012) 7, 51-58. DOI: https://doi.org/10.1016/j.proche.2012.10.010.
(129) Horne, G. P.; Grimes, T. S.; Mincher, B. J.; Mezyk, S. P. Reevaluation of Neptunium–Nitric Acid Radiation Chemistry by Multiscale Modeling. *The Journal of Physical Chemistry B* (2016) 120:49, 12643-12649. DOI: https://doi.org/10.1021/acs.jpcb.6b09683
(130) Mincher, B. J.; Precek, M.; Paulenova, A. The redox chemistry of neptunium in γ-irradiated aqueous nitric acid in the presence of an organic phase. *Journal of Radioanalytical and Nuclear Chemistry* (2016) 308:3, 1005-1009. DOI: 10.1007/s10967-015-4530-6.
(131) Gogolev, A. V.; Shilov, V. P.; Fedoseev, A. M.; Makarov, I. E.; Pikaev, A. K. Reactivity of neptunium and plutonium in relation to inorganic free radicals in aqueous solutions. *Radiokhimiya* (1988) 30:6, 761-766.
(132) Turel, Z. R.; Natarajan, P. R. *Lanthanide Actinide Res.* (1990).
(133) Nagar, M.; Natarajan, P. Studies on radiolytic oxidation of plutonium (III) in hydrochloric acid medium. *International Journal of Radiation Applications and Instrumentation. Part C. Radiation Physics and Chemistry* (1987) 30:3, 169-172. DOI: https://doi.org/10.1016/1359-0197(87)90074-9
(134) Vladimirova, M. V. Radiation-chemical reduction of Pu(6) in 0.3-6.0 M HNO3 *Radiokhimiya* (1980) 22:5, 686-691.
(135) Delegard, C. N. Solubility of PuO2 xH2O ni Alkaline Hanford High-Level Waste Solution. *Radiochim. Acta* (1987) 41:1, 11-21. DOI: https://doi.org/10.1524/ract.1987.41.1.11
(136) Gogolev, A. V.; Makarov, I. E.; Pikaev, A. K. In *Proceedings of the VIth Tihany Symposium on Radiation Chemistry*, Budapest: Akademia Kiado, (1987) Hedvig, E. P., Ed.; p 161.
(137) Frolova, L. M.; Frolov, A. A.; Vasil'ev, V. Y. Radiation-chemical behaviour of neptunium ions in nitric acid solutions in the presence of curium-244 *Radiokhimiya* (1984) 26:1, 108-114.
(138) Rotmanov, K. V.; Andreichuk, N. N.; Yasil'ev, V. Y. Investigation of alpha-radiation effect on valent states of actinoids 14. Valent transformations of neptunium under alpha-irradiation of perchloric solutions. *Radiokhimiya* (1995) 37:1, 38-43.
(139) Vasil'ev, V. Y.; Andreichuk, N. N.; Frolova, L. M.; Frolov, A. A.; Rotmanov, K. V. *Radiokhimiya* (1985) 27, 327.
(140) Zielen, A. J.; Sullivan, J. C.; Cohen, D. The photochemical reduction and the autoreduction of neptunium(VI). *Journal of Inorganic and Nuclear Chemistry* (1958) 7:4, 378-383. DOI: https://doi.org/10.1016/0022-1902(58)80246-8.
(141) Gordon, S.; Sullivan, J.; Ross, A. B. Rate Constants for Reactions of Radiation-Produced Transients in Aqueous Solutions of Actinides. *Journal of physical and chemical reference data* (1986) 15:4, 1357-1367. DOI: https://doi.org/10.1063/1.555768

(142) Pikaev, A. K.; Pirogova, G. N.; Kosareva, I. M.; Gogolev, A. V.; Shilov, V. P. Radiation-Chemical Aspects of Radioactive Waste Management. *High Energy Chemistry* (2003) 37:2, 60-72. DOI: 10.1023/A:1022876130099.
(143) Saini, R. D.; Bhattacharyya, P. K. Flash photolytic investigations on the reaction between Pu(VI) and CO-3 in alkaline medium. *International Journal of Radiation Applications and Instrumentation. Part C. Radiation Physics and Chemistry* (1986) 27:3, 189-193. DOI: https://doi.org/10.1016/1359-0197(86)90051-2.
(144) Pikaev, A. K.; Shilov, V. P.; Gogolev, A. V. Radiation chemistry of aqueous solutions of actinides. *Russian Chemical Reviews* (1997) 66:9, 763. DOI: 10.1070/RC1997v066n09ABEH000284.
(145) Gogolev, A. V.; Shilov, V. P.; Fedoseev, A. M.; Pikaev, A. K. The Use of Conjugated Scavengers to Determine the Rate Constants of Fast Reactions in Aqueous Solutions by Pulse Radiolysis. *Mendeleev Communications* (1993) 3:4, 155-156. DOI: https://doi.org/10.1070/MC1993v003n04ABEH000265
(146) Pikaev, A. K.; Gogolev, A. V.; Shilov, V. P.; Fedoseev, A. M. Reactivity of ions of actinides towards inorganic free radicals in irradiated aqueous solutions. *Isotopenpraxis* (1990) 26:10, 465-469.
(147) Hedvig, P.; Nyikos, L.; Dobó, J.; Schiller, R. *Proceedings of the Sixth Tihany Symposium on Radiation Chemistry: The 6th Tihany Symposium on Radiation Chemistry, Held at Balatonszéplak, Hungary, 21-26 September 1986, Organized by the Radiation Chemical Section of the Hungarian Chemical Society, in Co-operation with the International Atomic Energy Agency, Vienna*; Akadémiai Kiadó, (1987).
(148) Rotermund, B. M.; Mezyk, S. P.; Sperling, J. M.; Beck, N. B.; Wineinger, H.; Cook, A. R.; Albrecht-Schönzart, T. E.; Horne, G. P. Chemical Kinetics for the Oxidation of Californium(III) Ions with Select Radiation-Induced Inorganic Radicals (Cl2•– and SO4•–). *The Journal of Physical Chemistry A* (2024) 128:3, 590-598. DOI: 10.1021/acs.jpca.3c07404.
(149) Gogolev, A. V.; Fedoseev, A. M. In Tez. Dokl. I Moskovskoi Konferentsii po Radiokhimii, Moscow: Institute of Physical Chemistry of Academy at Sciences of the USSR; (1986).
(150) Bhattacharyya, P.; Saini, R. Radiolytic oxidation of U(IV) to U(VI) in H2SO4 and HCl media. *Radiat. Phys. Chem.;(United Kingdom)* (1979) 13:1.
(151) Lierse, C.; Sullivan, J. C.; Schmidt, K. H. Rates of oxidation of selected actinides by Cl2. *Inorganic Chemistry* (1987) 26, 1408-1410.
(152) Gogolev, A. V.; Shilov, V. P.; Fedoseev, A. M.; Makarov, I. E.; Pikaev, A. K. Pulse radiolysis study of reactivity of lathanide and actinide ions in the lowest oxidation state in respect to Cl2-, Br2-, and I2- ion-radicals in aqueous solutions. [Lanthanides: Sm, Eu, Yb; actinides: U, Np, Pu] *Izv. Akad. Nauk. SSSR, Ser. Khim* (1987) 6, 1248-1251.
(153) Gogolev, A. V.; Fedoseev, A. M.; Pikaev, A. K. Reactivity of inorganic free radicals with respect to plutonium (III) in aqueous solutions. *High Energy Chem. (Engl. Transl.); (United States)* (1988) 21:5, pp. 401-402 2009-2012-2017.
(154) Barreiro Fidalgo, A.; Jonsson, M. Radiation induced dissolution of (U, Gd)O2 pellets in aqueous solution – A comparison to standard UO2 pellets. *Journal of Nuclear Materials* (2019) 514, 216-223. DOI: https://doi.org/10.1016/j.jnucmat.2018.11.037.
(155) Vladimirova, M. V.; Kulikov, I. A.; Sosnovskii, O. A.; Nikishova, L. K. *Radiokhimiya* (1982) 24, 332.
(156) Vladimirova, M. V.; Ryabova, A. A.; Sosnovskii, O. A. *Radiokhimiya* (1980) 22, 679.
(157) Booth, C. H.; Jiang, Y.; Medling, S. A.; Wang, D. L.; Costello, A. L.; Schwartz, D. S.; Mitchell, J. N.; Tobash, P. H.; Bauer, E. D.; McCall, S. K.; et al. Self-irradiation damage to the local structure of plutonium and plutonium intermetallics. *Journal of Applied Physics* (2013) 113:9. DOI: 10.1063/1.4794016
(158) Booth, C.; Bauer, E. D.; Daniel, M.; Wilson, R.; Mitchell, J. N.; Morales, L. A.; Sarrao, J. L.; Allen, P. Quantifying structural damage from self-irradiation in a plutonium superconductor. *Physical Review B* (2007) 76:6, 064530. DOI: https://doi.org/10.1103/PhysRevB.76.064530
(159) Booth, C. H.; Daniel, M.; Wilson, R. E.; Bauer, E. D.; Mitchell, J. N.; Moreno, N. O.; Morales, L. A.; Sarrao, J. L.; Allen, P. G. Self-irradiation damage and 5f localization in PuCoGa5. *Journal of Alloys and Compounds* (2007) 444-445, 119-123. DOI: https://doi.org/10.1016/j.jallcom.2006.09.135.

(160) Greegor, R. B.; Lytle, F. W.; Chakoumakos, B. C.; Ewing, R. C.; Livak, R. J.; Clinard, F. W.; Crozier, E. D.; Alberding, N.; Seary, A. J.; Arnold, G. W.; et al. Application of various XAFS techniques to the investigation of structurally damaged materials. *Physica B: Condensed Matter* (1989) 158:1, 498-500. DOI: https://doi.org/10.1016/0921-4526(89)90363-3.
(161) Stacy, J. J.; Edelstein, N.; McLaughlin, R. D. Effects of Gamma Irradiation on Actinide Ions in Calcium Fluoride. *The Journal of Chemical Physics* (1972) 57:11, 4980-4988. DOI: 10.1063/1.1678168
(162) McLaughlin, R.; White, R.; Edelstein, N.; Conway, J. G. Optical Spectra of Pu in CaF2. *The Journal of Chemical Physics* (1968) 48:3, 967-969. DOI: 10.1063/1.1668850
(163) Steindler, M.; Steidl, D.; Fischer, J. The decomposition of plutonium hexafluoride by gamma radiation. *Journal of Inorganic and Nuclear Chemistry* (1964) 26:11, 1869-1878. DOI: https://doi.org/10.1016/0022-1902(64)80011-7
(164) Griffiths, T. R.; Dixon, J. Optical absorption spectroscopy of thorium dioxide. Analysis of oxidising and reducing anneals and gamma and UV radiation on both flux-grown and arc-fused single crystals. *Journal of the Chemical Society, Faraday Transactions* (1992) 88:8, 1149-1160, Article. DOI: 10.1039/FT9928801149
(165) Neeley, V. I.; Gruber, J. B.; Gray, W. J. F Centers in Thorium Oxide. *Physical Review* (1967) 158:3, 809-813. DOI: 10.1103/PhysRev.158.809.
(166) Tracy, C. L.; Lang, M.; Pray, J. M.; Zhang, F.; Popov, D.; Park, C.; Trautmann, C.; Bender, M.; Severin, D.; Skuratov, V. A.; et al. Redox response of actinide materials to highly ionizing radiation. *Nature Communications* (2015) 6:1, 6133. DOI: 10.1038/ncomms7133.
(167) Childs, B. G.; Harvey, P. J.; Hallett, J. B. Color Centers and Point Defects in Irradiated Thoria. *Journal of the American Ceramic Society* (1970) 53:8, 431-435. DOI: https://doi.org/10.1111/j.1151-2916.1970.tb12671.x.
(168) Jegadeesan, P.; Amirthapandian, S.; Kaur, G.; Kumar, D. S.; Das, A.; Avasthi, D. K.; Ananthasivan, K.; Panigrahi, B. K. Investigations on ion irradiation induced modifications in Th 5f occupancy in thoria. *Journal of Nuclear Materials* (2022) 570, 153961. DOI: https://doi.org/10.1016/j.jnucmat.2022.153961.
(169) Dennett, C. A.; Hua, Z.; Khanolkar, A.; Yao, T.; Morgan, P. K.; Prusnick, T. A.; Poudel, N.; French, A.; Gofryk, K.; He, L.; et al. The influence of lattice defects, recombination, and clustering on thermal transport in single crystal thorium dioxide. *APL Materials* (2020) 8:11. DOI: 10.1063/5.0025384
(170) Bawane, K.; Liu, X.; Yao, T.; Khafizov, M.; French, A.; Mann, J. M.; Shao, L.; Gan, J.; Hurley, D. H.; He, L. TEM characterization of dislocation loops in proton irradiated single crystal ThO2. *Journal of Nuclear Materials* (2021) 552, 152998. DOI: https://doi.org/10.1016/j.jnucmat.2021.152998.
(171) Dennett, C. A.; Deskins, W. R.; Khafizov, M.; Hua, Z.; Khanolkar, A.; Bawane, K.; Fu, L.; Mann, J. M.; Marianetti, C. A.; He, L.; et al. An integrated experimental and computational investigation of defect and microstructural effects on thermal transport in thorium dioxide. *Acta Materialia* (2021) 213, 116934. DOI: https://doi.org/10.1016/j.actamat.2021.116934.
(172) Griffiths, T. R.; Dixon, J. Electron irradiation of single crystal thorium dioxide and electron transfer reactions. *Inorganica Chimica Acta* (2000) 300-302, 305-313. DOI: https://doi.org/10.1016/S0020-1693(99)00597-6.
(173) Pichot, E.; Dacheux, N.; Emery, J.; Chaumont, J.; Brandel, V.; Genet, M. Preliminary study of irradiation effects on thorium phosphate-diphosphate. *Journal of Nuclear Materials* (2001) 289:3, 219-226. DOI: https://doi.org/10.1016/S0022-3115(01)00437-8.
(174) Tamain, C.; Garrido, F.; Thomé, L.; Dacheux, N.; Özgümüs, A.; Benyagoub, A. Amorphization of β-thorium phosphate diphosphate (β-TPD) irradiated with high energy krypton ions. *Journal of Nuclear Materials* (2006) 357:1, 206-212. DOI: https://doi.org/10.1016/j.jnucmat.2006.06.008.
(175) Bricout, M.; Onofri, C.; Debelle, A.; Pipon, Y.; Belin, R. C.; Garrido, F.; Leprêtre, F.; Gutierrez, G. Radiation damage in uranium dioxide: Coupled effect between electronic and nuclear energy losses. *Journal of Nuclear Materials* (2020) 531, 151967. DOI: https://doi.org/10.1016/j.jnucmat.2019.151967.
(176) Beauvy, M.; Dalmasso, C.; Iacconi, P. Irradiation effects of swift heavy ions in actinide oxides and actinide nitrides: Structure and optical properties. *Nuclear Instruments and Methods in Physics Research*

Section B: Beam Interactions with Materials and Atoms (2006) 250:1, 137-141. DOI: https://doi.org/10.1016/j.nimb.2006.04.096.
(177) Guimbretière, G.; Desgranges, L.; Canizarès, A.; Carlot, G.; Caraballo, R.; Jégou, C.; Duval, F.; Raimboux, N.; Ammar, M. R.; Simon, P. Determination of in-depth damaged profile by Raman line scan in a pre-cut He2+ irradiated UO2. *Applied Physics Letters* (2012) 100:25. DOI: 10.1063/1.4729588
(178) Kahraman, O.; Lebreton, F.; Martin, P.; Mermoux, M. Observable consequences of self-irradiation damage in a MIMAS-type MOX nuclear fuel as analyzed by x-ray diffraction, electron microprobe analysis, and Raman imaging. A possible methodological approach. *Journal of Applied Physics* (2022) 132:11. DOI: 10.1063/5.0103348
(179) Horlait, D.; Lebreton, F.; Roussel, P.; Delahaye, T. XRD Monitoring of α Self-Irradiation in Uranium–Americium Mixed Oxides. *Inorganic Chemistry* (2013) 52:24, 14196-14204. DOI: 10.1021/ic402124s.
(180) Prieur, D.; Lebreton, F.; Martin, P. M.; Caisso, M.; Butzbach, R.; Somers, J.; Delahaye, T. Comparative XRPD and XAS study of the impact of the synthesis process on the electronic and structural environments of uranium–americium mixed oxides. *Journal of Solid State Chemistry* (2015) 230, 8-13. DOI: https://doi.org/10.1016/j.jssc.2015.03.037.
(181) Natarajan, V.; Seshagiri, T. K.; Sastry, M. D. Radiation stabilization of U5+ in CaO matrix and its thermal stability: Electron paramagnetic resonance and thermally stimulated luminescence studies. *Pramana* (*1996*) 47:4, 325-330. DOI: 10.1007/BF02848532.
(182) Kruse, S. J.; Rajapaksha, H.; LaVerne, J. A.; Mason, S. E.; Forbes, T. Z. Radiation-Induced Defects in Uranyl Trinitrate Solids. *Chemistry – A European Journal* (2024) 30:35, e202400956. DOI: https://doi.org/10.1002/chem.202400956.
(183) Fairley, M.; Felton, D. E.; Sigmon, G. E.; Szymanowski, J. E. S.; Poole, N. A.; Nyman, M.; Burns, P. C.; LaVerne, J. A. Radiation-Induced Solid-State Transformations of Uranyl Peroxides. *Inorganic Chemistry* (2022) 61:2, 882-889. DOI: 10.1021/acs.inorgchem.1c02603.
(184) Felton, D. E.; Fairley, M.; Arteaga, A.; Nyman, M.; LaVerne, J. A.; Burns, P. C. Gamma-Ray-Induced Formation of Uranyl Peroxide Cage Clusters. *Inorganic Chemistry* (2022) 61:30, 11916-11922. DOI: 10.1021/acs.inorgchem.2c01657.
(185) Fairley, M.; Myers, N. M.; Szymanowski, J. E. S.; Sigmon, G. E.; Burns, P. C.; LaVerne, J. A. Stability of Solid Uranyl Peroxides under Irradiation. *Inorganic Chemistry* (2019) 58:20, 14112-14119. DOI: 10.1021/acs.inorgchem.9b02132.
(186) Fairley, M.; Sigmon, G. E.; LaVerne, J. A. Solid-State Transformation of Uranyl Peroxide Materials through High-Level Irradiation. *Inorganic Chemistry* (2023) 62:48, 19780-19785. DOI: 10.1021/acs.inorgchem.3c03373.
(187) Benjamin, S. E.; LaVerne, J. A.; Sigmon, G. E.; Burns, P. C. Investigation of Radiation Effects in the Uranyl Mineral Metaschoepite. *Inorganic Chemistry* (2023) 62:29, 11602-11610. DOI: 10.1021/acs.inorgchem.3c01337.
(188) Edelstein, N.; Easley, W.; McLaughlin, R. Formation and Characterization of Divalent Americium in CaF2 Crystals. *The Journal of Chemical Physics* (1966) 44:8, 3130-3131. DOI: 10.1063/1.1727193
(189) Belin, R. C.; Martin, P. M.; Valenza, P. J.; Scheinost, A. C. Experimental Insight into the Radiation Resistance of Zirconia-Based Americium Ceramics. *Inorganic Chemistry* (2009) 48:12, 5376-5381. DOI: 10.1021/ic900369b.
(190) Sickafus, K.; Minervini, L.; Grimes, R.; Valdez, J.; Ishimaru, M.; Li, F.; McClellan, K.; Hartmann, T. Radiation tolerance of complex oxides. *Science* (2000) 289:5480, 748-751. DOI: https://doi.org/10.1126/science.289.5480.748
(191) Martin, P. M.; Belin, R. C.; Valenza, P. J.; Scheinost, A. C. EXAFS study of the structural phase transition in the americium zirconate pyrochlore. *Journal of Nuclear Materials* (2009) 385:1, 126-130. DOI: https://doi.org/10.1016/j.jnucmat.2008.10.028.
(192) Sykora, R. E.; Raison, P. E.; Haire, R. G. Self-irradiation induced structural changes in the transplutonium pyrochlores An2Zr2O7 (An=Am, Cf). *Journal of Solid State Chemistry* (2005) 178:2, 578-583. DOI: https://doi.org/10.1016/j.jssc.2004.07.037.

(193) Popa, K.; Vigier, J.-F.; Martel, L.; Manara, D.; Colle, J.-Y.; Blanco, O. D.; Wiss, T.; Freis, D.; Konings, R. J. M. Synthesis, Characterization, and Stability of Americium Phosphate, AmPO4. *Inorganic Chemistry* (2020) 59:9, 6595-6602. DOI: 10.1021/acs.inorgchem.0c00697.
(194) Lebreton, F.; Martin, P. M.; Horlait, D.; Bès, R.; Scheinost, A. C.; Rossberg, A.; Delahaye, T.; Blanchart, P. New Insight into Self-Irradiation Effects on Local and Long-Range Structure of Uranium–Americium Mixed Oxides (through XAS and XRD). *Inorganic Chemistry* (2014) 53:18, 9531-9540. DOI: 10.1021/ic500681k.
(195) Prieur, D.; Martin, P. M.; Lebreton, F.; Delahaye, T.; Jankowiak, A.; Laval, J. P.; Scheinost, A. C.; Dehaudt, P.; Blanchart, P. Alpha self-irradiation effect on the local structure of the U0.85Am0.15O2±x solid solution. *Journal of Solid State Chemistry* (2012) 194, 206-211. DOI: https://doi.org/10.1016/j.jssc.2012.05.006.
(196) Prieur, D.; Vigier, J.-F.; Wiss, T.; Janssen, A.; Rothe, J.; Cambriani, A.; Somers, J. Structural investigation of self-irradiation damaged AmO2. *Journal of Solid State Chemistry* (2014) 212, 7-12. DOI: https://doi.org/10.1016/j.jssc.2013.12.016.
(197) Prieur, D.; Jankowiak, A.; Leorier, C.; Herlet, N.; Donnet, L.; Dehaudt, P.; Maillard, C.; Laval, J. P.; Blanchart, P. Fabrication and characterization of minor actinides bearing fuels obtained by conventional powder metallurgy process. *Powder Technology* (2011) 208:2, 553-557. DOI: https://doi.org/10.1016/j.powtec.2010.08.058.
(198) Hurtgen, C.; Fuger, J. Self-irradiation effects in americium oxides. *Inorganic and Nuclear Chemistry Letters* (1977) 13:3, 179-188. DOI: https://doi.org/10.1016/0020-1650(77)80091-3.
(199) Chikalla, T. D.; Eyring, L. Phase relationships in the americium-oxygen system. *Journal of Inorganic and Nuclear Chemistry* (1968) 30:1, 133-145. DOI: https://doi.org/10.1016/0022-1902(68)80072-7.
(200) Lebreton, F.; Belin, R. C.; Delahaye, T.; Blanchart, P. In-situ X-ray diffraction study of phase transformations in the Am–O system. *Journal of Solid State Chemistry* (2012) 196, 217-224. DOI: https://doi.org/10.1016/j.jssc.2012.06.027.
(201) Vigier, J.-F.; Popa, K.; Martel, L.; Manara, D.; Dieste Blanco, O.; Freis, D.; Konings, R. J. M. Plutonium and Americium Aluminate Perovskites. *Inorganic Chemistry* (2019) 58:14, 9118-9126. DOI: 10.1021/acs.inorgchem.9b00679.
(202) Mosley, W. Self-radiation damage in curium-244 oxide and aluminate. *Journal of the American Ceramic Society* (1971) 5:10, 475-479. DOI: https://doi.org/10.1111/j.1151-2916.1971.tb12182.x