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Total and Spontaneous Fission Half-lives for Americium and Curium Nuclides.*

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I. Introduction

The long-lived nuclides of the americium and curium elements are of interest for their use in certain safeguard applications and for nuclear reactor burnup studies in waste management. Recommended values are presented for $^{241,242m,243}Am$, and for $^{242,243,244,245,246,247,248,250}Cm$. These values result from a consistent evaluation of all these half-lives. These preliminary estimates were presented earlier. The uncertainties are provided at the 95% confidence limit for each of the recommended values. It will be noted that many of the recommended errors considerably exceed errors quoted by individual authors in their publication, by up to an order of magnitude, e.g. the total half-life of $^{242,246,248}Cm$ and the spontaneous fission half-life of ^{244}Cm.

These preliminary estimates for the half-lives were given previously[1]. Efforts continue to reevaluate the various experiments to better gauge the systematic errors involved and reassess the total error.

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II. References

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Tabulated Results

Table I Spontaneous Fission Half-life of ^{241}Am

Author (Year)	Ref.	$T_{1/2}$ (10^{14} Years)
Segre (52)	1	> 0.14
Milkheev (60)	2	> 2.
Druin (61)	3	2.3 (0.8)
Galliker (70)	4	0.90 (0.04)
Gold (70)	5	1.147 (0.024)

Table II Total Half-life of ^{241}Am

Author (Year)	Ref.	$T_{1/2}$ (Years)
Hall (57)	6	458.1 (0.5)
Wallman (58)	7	457.7 (1.8)
Oetting (67)	8	432.7 (0.7)
Stone (68)	9	436.6 (3.0)
Brown (68)	10	433. (7.)
Jove (72)	11	426.3 (2.1)
Ramthun (75)	12	432.0 (0.2)
Polyukhov (74)	13	432.3 (3.1)

Table III Spontaneous Fission Half-life of ^{242m}Am

Author (Year)	Ref.	$T_{1/2}$ (10^{11} Years)
Caldwell (67)	14	9.5 (3.5)

Table IV Partial Half-lives of ^{242m}Am

Author (Year)	Ref.	$T_{1/2}$ (Years)	Decay Mode
Street (50)	15	10000. (no uncert.)	alpha
Hoff (55)	16	850. (no uncert.)	electron capt.
Barnes (67)	17	33000. (1600.)	alpha
Barnes (67)	17	980. (50.)	electron capt.
Barnes (67)	17	152. (7.)	total $T_{1/2}$
Zelenkov (80)	18	141. (2.)	total $T_{1/2}$

Table V Spontaneous Fission Half-life of ^{243}Am

Author (Year)	Ref.	$T_{1/2}$ (10^{14} Years)
Aleksandrov (66)	19	> 0.33 (0.03)
Gromov (66)	20	2. (0.5)

Table VI Total Half-life of ^{243}Am

Author (Year)	Ref.	$T_{1/2}$ (Years)
Street (50)	15	10000. (no uncert.)
Diamond (53)	21	8100. (600.)
Wallman (58)	7	7951. (48.)
Barnes (67)	17	7259. (160.)
Peadle (60)	22	7224. (50.)
Brown (68)	10	7370. (40.)
Polynkhov (74)	23	7380. (34.)
Aggarwal (80)	24	7358. (42.)

Table VII Spontaneous Fission Half-life of ^{242}Cm

Author (Year)	Ref.	$T_{1/2}$ (10^6 Years)
Hanna (51)	25	7.2 (0.2)
Amani (67)	26	6.09 (0.18)
Zhang (79)	27	7.46 (0.6)
Raghuraman (82)	28	7.15 (0.15)
Umezawa (82)	29	6.89 (0.17)

Table IX Spontaneous Fission Half-life of ^{244}Cm

Author (Year)	Ref.	$T_{1/2}$ (10^7 Years)
Ghiorso (52)	40	1.4 (0.2)
Mulkin (63)	41	1.46 (0.05)
Metta (65)	42	1.346 (0.006)
Amani (67)	26	1.33 (0.05)
Barton (70)	43	1.350 (0.007)
Hastings (72)	44	1.343 (0.006)

Table VIII Total Half-life of ^{242}Cm

Author (Year)	Ref.	$T_{1/2}$ (Days)
Hanna (50)	30	162.5 (2.)
Glover (54)	31	162.46 (0.32)
Hutchinson (54)	32	163.0 (1.3)
Flynn (65)	33	164.4 (0.4)
Kerrigan (75)	34	163.2 (0.2)
Diamond (77)	35	162.76 (0.08)
Zhang (79)	27	163.02 (0.18)
Jadhav (80)	36	162.13 (2.25)
Usuda (81)	37	161.25 (0.30)
Aggarwal (82)	38	163.00 (0.11)
Wiltshire (84)	39	163.0 (0.2)

Table X Total Half-life of ^{244}Cm

Author (Year)	Ref.	$T_{1/2}$ (Years)
Stevens (54)	45	19.2 (0.6)
Friedman (54)	46	18.4 (0.5)
Carnall (61)	47	17.59 (0.06)
Bentley (68)	48	18.099 (0.015)
Kerrigan (72)	49	18.12 (0.06)

Table XI Total Half-life of ^{245}Cm

Author (Year)	Ref.	$T_{1/2}$ (Years)
Hulet (54)	50	20000. (no uncert.)
Friedman (54)	46	11500. (5000.)
Browne (55)	51	14300. (2300.)
Huizenga (57)	52	8000. (no uncert.)
Carnall (61)	47	9320. (280.)
Metta (69)	53	8255. (180.)
MacMurdo (71)	54	8532. (53.)
Polyukhov (76)	55	8445. (200.)

Table XII Spontaneous Fission Half-life of ^{246}Cm

Author (Year)	Ref.	$T_{1/2}$ (10^7 Years)
Fields (56)	56	> 1.24
Fried (56)	57	2.0 (0.8)
Metta (69)	53	1.90 (0.01)
MacMurdo (71)	54	1.85 (0.02)

Table XIII Total Half-life of ^{246}Cm

Author (Year)	Ref.	$T_{1/2}$ (Years)
Friedman (54)	46	4000. (600.)
Browne (55)	51	2300. (460.)
Butler (56)	58	6620. (330.)
Carnall (61)	47	5480. (170.)
Metta (69)	53	4711. (22.)
MacMurdo (71)	54	4820. (20.)
McCracken (71)	59	4655. (40.)
Polyukhov (76)	60	4852. (76.)

Table XIV Total Half-life of ^{247}Cm

Author (Year)	Ref.	$T_{1/2}$ (10^7 Years)
Diamond (57)	61	> 4.
Fields (63)	62	1.64 (0.24)
Fields (71)	63	1.56 (0.05)

Table XV Spontaneous Fission Half-life of ^{248}Cm

Author (Year)	Ref.	$T_{1/2}$ (10^6 Years)
Butler (56)	58	4.6 (0.5)
Metta (69)	53	4.22 (0.12)
MacMurdo (71)	54	4.20 (0.05)
McCracken (71)	59	4.115 (0.034)

Table XVI Total Half-life of ^{248}Cm

Author (Year)	Ref.	$T_{1/2}$ (10^5 Years)
Schuman (68)	64	4.0 (0.3)
Metta (69)	53	3.84 (0.04)
MacMurdo (71)	54	3.94 (0.04)
McCracken (71)	59	3.703 (0.032)

Table XVII Spontaneous Fission Half-life of ^{250}Cm

Author (Year)	Ref.	$T_{1/2}$ (10^4 Years)
Huizenga (57)	52	2. (no uncert.)
Metta (67)	65	1.13 (0.05)

Table XVIII Recommended Half-lives and Uncertainties

Reference Nuclide	$T_{1/2}$ (total) Years	$T_{1/2}$ (spont.fiss.) Years
^{241}Am	432. (4.)	1.0 (0.1) x 10^{14}
^{242m}Am	141. (6.)	9.5 (3.5) x 10^{11}
^{243}Am	7370. (40.)	2. (0.5) x 10^{14}
^{242}Cm	163.0 (1.0) Days	7.2 (0.2) x 10^6
^{243}Cm	28.5 (0.2)	———
^{244}Cm	18.1 (0.1)	1.3 (0.1) x 10^7
^{245}Cm	8500. (200.)	———
^{246}Cm	4700. (150.)	1.8 (0.1) x 10^7
^{247}Cm	1.6 (0.1) x 10^7	———
^{248}Cm	3.8 (0.1) x 10^5	4.2 (0.1) x 10^6
^{250}Cm	7.4 x 10^3	1.1 (0.1) x 10^4