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Total and Spontaneous Fission Half-lives of the Americium and Curium Nuclides

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Abstract

The total half-life and the half-life for spontaneous fission are evaluated for the various long-lived nuclides of interest. Recommended values are presented for ^{241}Am, ^{242m}Am, ^{243}Am, ^{242}Cm, ^{243}Cm, ^{244}Cm, ^{245}Cm, ^{246}Cm, ^{247}Cm, ^{248}Cm, and ^{250}Cm. The uncertainties are provided at the 95% confidence limit for each of the recommended values.

I. Introduction

The long-lived nuclides of the americium and curium elements are of interest for their use in certain safeguard applications.

The general procedure followed in this paper has been to review each of the experiments and list the published values in the enclosed tables. A first estimate of the recommended values is included. Efforts will continue to reevaluate the various experiments to better gauge the systematic errors involved and reassess the total error.

Tabulated Results

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

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

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

Author(Year)	$T_{1/2}$ (Years)
Hall(57)	458.1 (0.5)
Wallman(58)	457.7 (1.8)
Oetting(67)	432.7 (0.7)
Stone(68)	436.6 (3.0)
Brown(68)	433. (7.)
Jove(72)	426.3 (2.1)
Ramthun(75)	432.0 (0.2)
Polyukhov(74)	432.8 (3.1)

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

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

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

Author(Year)	$T_{1/2}$ (Years)	Decay Mode
Street(50)	10000. (no uncert.)	alpha
Hoff(55)	850. (no uncert.)	electron capt.
Barnes(67)	32000. (1600.)	alpha
Barnes(67)	980. (50.)	electron capt.
Barnes(67)	152. (7.)	total $T_{1/2}$
Zelenkov(80)	141. (2.)	total $T_{1/2}$

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

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

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

Author(Year)	$T_{1/2}$ (Years)
Street(50)	10000.
Diamond(53)	8100. (600.)
Wallman(58)	7951. (48.)
Barnes(67)	7289. (160.)
Beadle(60)	7224. (50.)
Brown(68)	7370. (40.)
Polyukhov(74)	7380. (34.)
Aggarwal(80)	7358. (42.)

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

Author(Year)	$T_{1/2}$ (10^{6}Years)
Hanna(52)	7.2 (0.2)
Armani(67)	6.09 (0.18)
Zhang(79)	7.46 (0.6)
Raghuraman(82)	7.15 (0.15)

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

Author(Year)	$T_{1/2}$ (Days)
Hanna(50)	162.5 (2.)
Glover(54)	162.46 (0.32)
Hutchinson(54)	163.0 (1.8)
Flynn(65)	164.4 (0.4)
Kerrigan(75)	163.2 (0.2)
Diamond(77)	162.76 (0.08)
Zhang(79)	163.02 (0.18)
Jadhav(80)	162.13 (2.25)
Usuda(81)	161.35 (0.30)
Aggarwal(82)	163.00 (0.11)
Wiltshine(84)	163.0 (0.2)

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

Author(Year)	$T_{1/2}$ (10^{7}Years)
Ghiorso(52)	1.4 (0.2)
Malkin(63)	1.46 (0.05)
Metta(65)	1.346 (0.006)
Barton(70)	1.250 (0.007)
Hastings(72)	1.343 (0.006)

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

Author(Year)	$T_{1/2}$ (Years)
Stevens(54)	19.2 (0.6)
Friedman(54)	18.4 (0.5)
Carnell(61)	17.59 (0.06)
Bentley(68)	18.099 (0.015)
Kerrigan(72)	18.12 (0.06)

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

Author(Year)	$T_{1/2}$ (Years)
Hulet(54)	20000 (no uncert.)
Friedman(54)	11500 (5000.)
Browne(55)	14300 (2900.)
Huizenga(57)	8000. (no uncert.)
Carnell(61)	9320. (280.)
Metta(69)	8265. (180.)
MacMurdo(71)	8532. (53.)
Polyukhov(76)	8445. (200.)

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

Author(Year)	$T_{1/2}$ (10^7Years)
Fields(56)	< 1.2
Fried(56)	2.0 (0.8)
Metta(69)	1.80 (0.01)
MacMurdo(71)	1.85 (0.02)

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

Author(Year)	$T_{1/2}$ (Years)
Friedman(54)	4000. (600.)
Browne(55)	2300. (460.)
Butler(56)	6620. (320.)
Carnell(61)	5480. (170.)
Metta(69)	4711. (32.)
MacMurdo(71)	4820. (20.)
McCracken(71)	4655. (40.)
Polyukhov(76)	4852. (76.)

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

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

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

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

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

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

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

Author(Year)	$T_{1/2}$ (10^4Years)
Huizenga(57)	2. (no uncert.)
Metta(67)	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		1.1 (0.1) x 10^{4}