^{100}Pd ε decay (3.63 d) 1992Si11,1965Ev05,1977KaXX

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	Balraj Singh and Jun Chen	NDS 172, 1 (2021)	31-Jan-2021

Parent: ^{100}Pd: E=0.0; J$^{\pi}$=0^{+}; $T_{1/2}$=3.63 d *9*; Q(ε)=378 *25*; %ε decay=100.0

^{100}Pd-$T_{1/2}$: From the Adopted Levels of ^{100}Pd.

^{100}Pd-Q(ε): From 2017Wa10.

1992Si11: ^{100}Pd source was produced via the ^{103}Rh(p,4n) reaction by irradiation of metallic foil of >99% pure rhodium with a 45 MeV proton beam provided by the 88-inch cyclotron at the Lawrence Berkeley Laboratory. Measured Eγ, Iγ, γγ-coin with γ-x intrinsic Ge detectors at LBNL and University of Toronto. Deduced levels, J, π, decay branching ratios, log *ft*. Comparisons with theoretical calculations.

1965Ev05: ^{100}Pd source was produced via ^{103}Rh(p,4n) with 42 MeV protons from the Nevis Synchrocyclotron. γ rays were detected with a Ge(Li) detector and conversion electrons were detected with a six-gap beta-ray spectrometer. Measured Eγ, Iγ, γ(t), γγ(θ), E(ce), I(ce), ce-γ-coin. Deduced levels, isomer $T_{1/2}$, conversion coefficients, γ-ray multipolarities. Proposed configurations for low-lying states.

Others:

γ, ce: 1977KaXX, 1964Ro20, 1964An07, 1970An30, 1974Si18, 1964Ko04, 1953Ma64. 1977KaXX mention ce measurements with a high resolution magnetic spectrometer (0.1% in momentum), but no detailed results about subshell ratios and conversion coefficients are available.

γγ(θ): 1971Re06, 1965Ma34.

γγ(θ,H,t): 1971Re06, 1965Ma34, 1966Ma54. Others (dealing mainly with hyperfine studies and electric quadrupole interaction studies): 1993Kr26, 1993Kh11, 1993Kh10, 1990Kl05, 1990De32, 1987Bh06, 1987Kl04, 1987Li19, 1986Va19, 1986Ho17, 1985Me17, 1983Tr17, 1982Ar21, 1979Vi12, 1975Kr15, 1975Kr13, 1973Ha61, 1971KiZL, 1970Ko14, 1970Re10, 1966Ma64, 1966Ma54.

γγ(t): 1979En03, 1971Re06, 1965Ma34.

$T_{1/2}$ of ^{100}Pd: 1968Pa24. Others: 1972Ch13, 1964An07, 1964Ro20, 1948Li03.

1995Sc50: cross section for production of ^{100}Pd in ^{50}Cr(^{58}Ni,X) reaction.

Calculated β^{+}/ε ratio: 1988Su16.

Total decay energy deposit of 372 keV *34* calculated by RADLIST code is in agreement with expected value of 378 keV *25*, indicating the completeness of the decay scheme.

^{100}Rh Levels

E(level)†	J$^{\pi}$‡	$T_{1/2}$‡	Comments
0.0	1^{-}		Proposed configuration=$\pi(g^4_{9/2},p_{1/2})_{1/2-} \otimes \nu(d_{5/2},s_{1/2})_{1/2^+ \text{ or } 3/2^+}$ (1965Ev05).
32.68 *2*	(2)$^{-}$	27.6 ns *6*	$T_{1/2}$: γγ(t) (1979En03). Proposed configuration=$\pi(g^4_{9/2},p_{1/2})_{1/2-} \otimes \nu(d_{5/2},s_{1/2})_{3/2^+ \text{ or } 5/2^+}$ (1965Ev05).
74.78 *2*	(2)$^{+}$	214.3 ns *20*	g=+2.151 *4* (1966Ma54,1965Ma34) $T_{1/2}$: values from this dataset: 213.6 ns *20* (1979En03), 214.5 ns *20* (1971Re06), 235 ns *3* (1965Ma34), 180 ns *20* (1965Ev05). J$^{\pi}$: (84γ)(75γ)(θ) rules out J=0 and favors J=2 over J=1. g factor: from γγ(θ,H,t). Other: 2.152 *15* (1971Re06). Q=0.076 *20* (1979Vi12), an estimated value from a comparison of quadrupole interaction frequencies in ^{100}Rh and ^{99}Ru, using Q=0.23 *5* for a 99-keV level in ^{99}Ru. Proposed configuration=$\pi(g^5_{9/2})_{9/2+} \otimes \nu(d_{5/2},s_{1/2})_{5/2+}$ and/or $\pi(g^5_{9/2})_{7/2+} \otimes \nu(d_{5/2},s_{1/2})_{3/2+}$ (1965Ev05).
86.28 *8*	(1,2)		
136.38 *6*	(1)		
139.92 *5*	(0,1)		
151.86 *5*	(1)$^{+}$		
154.00 *10*	(0,1)		
158.80 *2*	1^{+}	<0.35 ns	$T_{1/2}$: other: <0.5 ns from γγ(t) (1979En03). Proposed configuration=$\pi(g^5_{9/2})_{7/2+} \otimes \nu(d_{5/2},s_{1/2})_{5/2+}$ (1965Ev05).

Continued on next page (footnotes at end of table)

^{100}Pd ε decay (3.63 d) 1992Si11,1965Ev05,1977KaXX (continued)

^{100}Rh Levels (continued)

† From least-squares fit to Eγ data.
‡ From the Adopted Levels.

ε radiations

E(decay)	E(level)	Iε†‡	Log *ft*	Comments
(2.2×10^2 *3*)	158.80	92 *8*	4.4 *1*	εK=0.844 *4*; εL=0.125 *3*; εM+=0.0305 *8*
(2.2×10^2 *3*)	154.00	0.037 *11*	7.8 *2*	εK=0.845 *4*; εL=0.125 *3*; εM+=0.0303 *8*
(2.3×10^2 *3*)	151.86	0.66 *6*	6.6 *1*	εK=0.845 *4*; εL=0.124 *3*; εM+=0.0303 *8*
(2.4×10^2 *3*)	139.92	0.20 *3*	7.1 *1*	εK=0.847 *3*; εL=0.1234 *24*; εM+=0.0300 *7*
(2.4×10^2 *3*)	136.38	0.27 *15*	7.0 *3*	εK=0.847 *3*; εL=0.1232 *23*; εM+=0.0299 *7*
(2.9×10^2# *3*)	86.28	<0.07	>7.8	εK=0.8510 *19*; εL=0.1199 *15*; εM+=0.0290 *4*
(3.5×10^2# *3*)	32.68	<4	>5.8^{1u}	εK=0.823 *6*; εL=0.142 *5*; εM+=0.0353 *13* Iε: 1 *3* from intensity balance.
(378# *25*)	0.0	<8	>6.0	εK=0.8554 *11*; εL=0.1166 *8*; εM+=0.02807 *23*

† From I(γ+ce) intensity balance at each level.
‡ Absolute intensity per 100 decays.
# Existence of this branch is questionable.

γ(^{100}Rh)

Iγ normalization: Σ(I(γ+ce) of γs to g.s.)=96 *4*, assuming Ice(g.s.)<8% corresponding to log *ft*>5.9 for a first-forbidden transition. If Ice(g.s.)=0, then Iγ normalization=0.55 *3*. Both these values are consistent with 0.61 *7* (1970An30) from Iγ(absolute)(84γ) measured relative to that of 540γ from ^{100}Rh ε decay

A 55.82γ placed from a level at 214.6 by 1965Ev05 is not confirmed in later studies and therefore this γ together with the 214.6 level is not considered in the decay scheme.

The experimental conversion coefficients from 1970An30 are relative to the 84γ treated as M1 with α(K)=0.492.

E_γ †	I_γ †#	E_i(level)	J^π_i	E_f	J^π_f	Mult.‡	δ‡	α@	$I_{(\gamma+ce)}$#	Comments
(15.5)	<0.12	151.86	(1)$^+$	136.38	(1)				0.5 *1*	γ required by $\gamma\gamma$ data in (p,nγ). I_γ: expected to be highly converted; α=4.22 if E1. $I_{(\gamma+ce)}$: estimated (evaluators) from branching ratio in (p,nγ) (1983Bi04).
32.66 *2*	4.9 *3*	32.68	(2)$^-$	0.0	1$^-$	M1+E2	0.15 *3*	10.1 *7*		α(K)=7.98 *22*; α(L)=1.8 *4*; α(M)=0.34 *7* α(N)=0.053 *11*; α(O)=0.00147 *3* E_γ: others: 32.72 *6* (1965Ev05), 32.4 *2* (1964An07). I_γ: 8.6 *2* (1977KaXX). Mult.,δ: from L1/L2/L3=100/57 *10*/48 *10* and α(L)exp=3.4 *17* (1970An30). Other: K/(L+M)=7.0 *10* (1964Ro20).
42.08 *2*	13.5 *8*	74.78	(2)$^+$	32.68	(2)$^-$	[E1]		1.695		α(K)=1.463 *21*; α(L)=0.191 *3*; α(M)=0.0350 *5* α(N)=0.00556 *8*; α(O)=0.000207 *3* E_γ: others: 42.10 *5* (1965Ev05), 41.9 *5* (1964An07). I_γ: other: 17 *3* (1977KaXX); 1965Ev05 report I(γ+ce)=51.
53.52 *15*	0.08 *2*	86.28	(1,2)	32.68	(2)$^-$	[D]		1.5 *6*		α(K)=1.3 *6*; α(L)=0.16 *7*; α(M)=0.029 *12* α(N)=0.0048 *20*; α(O)=0.00022 *12* E_γ: other: 1964An07 report a γ of 51.7 *5*.
61.60 *5*	0.51 *10*	136.38	(1)	74.78	(2)$^+$	[D]		1.0 *4*		
72.52 *10*	0.15 *4*	158.80	1$^+$	86.28	(1,2)	[D]		0.61 *25*		α(K)=0.53 *22*; α(L)=0.07 *3*; α(M)=0.012 *5* α(N)=0.0020 *9*; α(O)=9.E−5 *5* Iγ=0.38 *8* (1977KaXX).
74.78 *2*	92 *5*	74.78	(2)$^+$	0.0	1$^-$	E1		0.336		α(K)=0.293 *5*; α(L)=0.0357 *5*; α(M)=0.00657 *10* α(N)=0.001061 *15*; α(O)=4.48$\times10^{-5}$ *7* E_γ: others: 74.77 *8* (1965Ev05), 74.4 *4* (1964An07). I_γ: others: 69.8 (1965Ev05), 81.1 *17* (1977KaXX). Mult.: from α(K)exp=0.25 *14* (1970An30). Others: α(K)exp=0.42 (1965Ev05), K/(L)=8.4 *8* (1964An07), K/(L+M)=7.2 *5* (1964Ro20).
84.00 *2*	100 *6*	158.80	1$^+$	74.78	(2)$^+$	M1		0.561		α(K)=0.488 *7*; α(L)=0.0598 *9*; α(M)=0.01114 *16* α(N)=0.00184 *3*; α(O)=9.15$\times10^{-5}$ *13* E_γ: others: 84.00 *9* (1965Ev05), 83.8 *4* (1964An07). Mult.: α(K)exp=0.54 (1965Ev05), 0.69 *23* (1970An30). Others: K/L=9.0 *9* (1964An07), K/(L+M)=7.1 *5* (1964Ro20).

γ(^{100}Rh) (continued)

E_γ †	I_γ †#	E_i(level)	J^π_i	E_f	J^π_f	Mult. ‡	α @	Comments
								(84γ)(75γ)(θ): A_2=0.173 *4* (1971Re06). Others: A_2=+0.18 *3* (1965Ev05); 1965Ma34.
86.37 *15*	0.05 *2*	86.28	(1,2)	0.0	1^-	[D]	0.37 *15*	α(K)=0.32 *13*; α(L)=0.039 *16*; α(M)=0.007 *3* α(N)=0.0012 *5*; α(O)=6.E−5 *3*
119.18 *8*	0.13 *5*	151.86	$(1)^+$	32.68	$(2)^-$	[E1]	0.0881	α(K)=0.0770 *11*; α(L)=0.00913 *13*; α(M)=0.001685 *24* α(N)=0.000275 *4*; α(O)=1.240×10^{-5} *18* Eγ=118.59, Iγ=0.34 *5* (1977KaXX).
126.15 *2*	15 *1*	158.80	1^+	32.68	$(2)^-$	E1	0.0748	α(K)=0.0654 *10*; α(L)=0.00774 *11*; α(M)=0.001428 *20* α(N)=0.000233 *4*; α(O)=1.059×10^{-5} *15* E_γ: others: 126.07 *19* (1965Ev05), 126.5 *5* (1964An07). I_γ: others: 18.0 *15* (1977KaXX), 33.4 (1965Ev05). Mult.: α(K)exp=0.064 *13* (1970An30).
139.92 *5*	0.35 *4*	139.92	(0,1)	0.0	1^-	[D]	0.10 *4*	α(K)=0.08 *4*; α(L)=0.010 *5*; α(M)=0.0019 *8* α(N)=0.00031 *14*; α(O)=1.5×10^{-5} *7* E_γ: other: 139.72 *30*, placed from a level at 215 by 1965Ev05. I_γ: others: 0.45 *7* (1977KaXX), 1.2 (1965Ev05).
151.88 *5*	0.61 *5*	151.86	$(1)^+$	0.0	1^-	E1	0.0439	α(K)=0.0384 *6*; α(L)=0.00452 *7*; α(M)=0.000834 *12* α(N)=0.0001364 *20*; α(O)=6.32×10^{-6} *9* E_γ: other: 151.55 *30* (1965Ev05). I_γ: others: 0.81 *4* (1977KaXX), 2.5 (1965Ev05). Mult.: from the Adopted Gammas.
154.00 *10*	0.061 *15*	154.00	(0,1)	0.0	1^-	[D,E2]	0.17 *12*	Iγ=0.16 *3* (1977KaXX).
158.87 *5*	3.2 *2*	158.80	1^+	0.0	1^-	[E1]	0.0386	α(K)=0.0338 *5*; α(L)=0.00397 *6*; α(M)=0.000732 *11* α(N)=0.0001199 *17*; α(O)=5.58×10^{-6} *8* E_γ: others: 158.77 *34* (1965Ev05), 158.1 *5* (1964An07). I_γ: other: 8.2 (1965Ev05).

† From 1992Si11.
‡ From ce data in this study, adopted in the Adopted Gammas.
# For absolute intensity per 100 decays, multiply by 0.52 *3*.
@ Total theoretical internal conversion coefficients, calculated using the BrIcc code (2008Ki07) with Frozen orbital approximation based on γ-ray energies, assigned multipolarities, and mixing ratios, unless otherwise specified.

$^{100}_{45}$Rh$_{55}$-4

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