



1 Decay Scheme

Ho-166 decays by beta minus emission to excited states of Er-166.

L'holmium 166 se désintègre uniquement par émission bêta moins vers les états excités d'erbium 166.

2 Nuclear Data

$$T_{1/2}({}^{166}\text{Ho}) : 26,795 \quad (29) \quad \text{h}$$

$$Q^{-}({}^{166}\text{Ho}) : 1854,5 \quad (9) \quad \text{keV}$$

2.1 β^{-} Transitions

	Energy keV	Probability $\times 100$	Nature	lg <i>ft</i>
$\beta_{0,8}^{-}$	24,1 (9)	0,0353 (11)		5
$\beta_{0,7}^{-}$	41,7 (9)	0,00010 (3)	1st forbidden	12,1
$\beta_{0,6}^{-}$	192,0 (9)	0,304 (7)	Allowed	6,9
$\beta_{0,5}^{-}$	326,2 (9)	0,00276 (22)	Unique 1st forbidden	9,5
$\beta_{0,4}^{-}$	394,5 (9)	0,955 (16)	1st forbidden	7,4
$\beta_{0,3}^{-}$	1068,6 (9)	0,0072 (21)	Unique 1st forbidden	11,6
$\beta_{0,1}^{-}$	1773,9 (9)	50,5 (15)	Unique 1st forbidden	9
$\beta_{0,0}^{-}$	1854,5 (9)	48,2 (15)	1st forbidden	8,1

2.2 Gamma Transitions and Internal Conversion Coefficients

	Energy keV	$P_{\gamma+ce}$ $\times 100$	Multipolarity	α_K	α_L (10^{-2})	α_M (10^{-2})	α_T
$\gamma_{1,0}(\text{Er})$	80,5725 (13)	51,7 (11)	E2	1,65 (5)	401 (8)	97,8 (20)	6,90 (14)
$\gamma_{2,1}(\text{Er})$	184,4107 (21)	0,0020 (9)	E2	0,205 (6)	9,84 (30)	2,36 (7)	0,333 (10)
$\gamma_{3,2}(\text{Er})$	520,80 (7)	0,00036 (2)	E2	0,01192 (36)	0,234 (7)	0,0535 (16)	0,0149 (5)
$\gamma_{4,3}(\text{Er})$	674,25 (7)	0,0200 (17)	E2	0,00653 (20)	0,1138 (34)	0,0257 (8)	0,00799 (24)

	Energy keV	$P_{\gamma+ce}$ $\times 100$	Multipolarity	α_K	α_L (10^{-2})	α_M (10^{-2})	α_T
$\gamma_{3,1}$ (Er)	705,21 (7)	0,0147 (12)	E2+M1	0,00591 (18)	0,1012 (30)	0,0228 (7)	0,00721 (22)
$\gamma_{3,0}$ (Er)	785,78 (7)	0,0121 (3)	E2	0,00467 (14)	0,0769 (23)	0,0173 (5)	0,00566 (17)
$\gamma_{5,2}$ (Er)	1263,25 (15)	0,0155 (9)	E2(+M3)	0,0018 (2)	0,03 (1)	0,0058 (2)	0,0021 (2)
$\gamma_{4,1}$ (Er)	1379,452 (10)	0,935 (35)	E2	0,00151 (5)	0,022 (1)	0,0048 (2)	0,00179 (5)
$\gamma_{5,1}$ (Er)	1447,66 (15)	0,00105 (10)	E2(+E0)	0,00138 (4)	0,0198 (6)	0,0044 (2)	0,00163 (5)
$\gamma_{4,0}$ (Er)	1460,025 (10)	0,0003	E0	0,3			
$\gamma_{5,0}$ (Er)	1528,23 (15)	0,00014 (5)	E2	0,00125 (4)	0,0178 (5)		0,00147 (4)
$\gamma_{6,1}$ (Er)	1581,860 (15)	0,186 (4)	E1+(M2)	0,0006 (1)			
$\gamma_{6,0}$ (Er)	1662,433 (15)	0,118 (5)	E1	0,000484 (15)			
$\gamma_{7,1}$ (Er)	1732,2 (5)	0,000046 (20)	M1(+E2)	0,0015 (2)			
$\gamma_{8,1}$ (Er)	1749,846 (24)	0,0272 (10)	E1(+M2)	0,0005 (2)			
$\gamma_{7,0}$ (Er)	1812,8 (5)	0,000056 (19)	E1(+M2)	0,0004 (2)			
$\gamma_{8,0}$ (Er)	1830,419 (24)	0,0081 (2)	E1	0,000413 (12)			

3 Atomic Data

3.1 Er

ω_K	:	0,942	(4)
$\bar{\omega}_L$:	0,216	(9)
n_{KL}	:	0,838	(4)

3.1.1 X Radiations

	Energy keV	Relative probability	
X_K	$K\alpha_2$	48,2215	
	$K\alpha_1$	49,1282	
	$K\beta_3$	55,495	}
	$K\beta_1$	55,682	}
	$K\beta_5''$	56,04	}
			32,5
	$K\beta_2$	57,21	}
	$K\beta_4$	57,313	}
	$KO_{2,3}$	57,456	}
			8,45
X_L	$L\ell$	6,14	
	$L\alpha$	6,9 – 6,95	
	$L\eta$	7,05	
	$L\beta$	7,75 – 8,34	
	$L\gamma$	8,81 – 9,43	

3.1.2 Auger Electrons

	Energy keV	Relative probability
Auger K		
KLL	37,78 – 40,55	100
KLX	45,52 – 49,10	52,4
KXY	53,07 – 57,84	6,86
Auger L		
	3,9 – 7,6	

4 Electron Emissions

		Energy keV		Electrons per 100 disint.
e _{AL}	(Er)	3,9 - 7,6		28,0 (6)
e _{AK}	(Er)			0,63 (5)
	KLL	37,78 - 40,55	}	
	KLX	45,52 - 49,10	}	
	KXY	53,07 - 57,84	}	
ec _{1,0} T	(Er)	23,09 - 80,54		45,2 (15)
ec _{1,0} K	(Er)	23,090 (2)		10,81 (35)
ec _{1,0} L	(Er)	70,82 - 72,22		26,3 (8)
ec _{1,0} M	(Er)	78,37 - 79,16		6,41 (21)
ec _{1,0} N	(Er)	80,12 - 80,57		1,493 (49)
$\beta_{0,8}^-$	max:	24,1 (9)		0,0353 (11)
$\beta_{0,8}^-$	avg:	7,1 (10)		
$\beta_{0,7}^-$	max:	41,7 (9)		0,00010 (3)
$\beta_{0,7}^-$	avg:	13 (2)		
$\beta_{0,6}^-$	max:	192,0 (9)		0,304 (7)
$\beta_{0,6}^-$	avg:	52 (1)		
$\beta_{0,5}^-$	max:	326,2 (9)		0,00276 (22)
$\beta_{0,5}^-$	avg:	93 (3)		
$\beta_{0,4}^-$	max:	394,5 (9)		0,955 (16)
$\beta_{0,4}^-$	avg:	115 (3)		
$\beta_{0,3}^-$	max:	1068,6 (9)		0,0072 (21)
$\beta_{0,3}^-$	avg:	356 (9)		
$\beta_{0,1}^-$	max:	1773,9 (9)		50,5 (15)
$\beta_{0,1}^-$	avg:	651,1 (6)		
$\beta_{0,0}^-$	max:	1854,5 (9)		48,2 (15)
$\beta_{0,0}^-$	avg:	693,8 (6)		

5 Photon Emissions

5.1 X-Ray Emissions

		Energy keV	Photons per 100 disint.	
XL	(Er)	6,14 — 9,43	7,91 (18)	
XK α_2	(Er)	48,2215	2,91 (10)	} K α
XK α_1	(Er)	49,1282	5,16 (17)	
XK β_3	(Er)	55,495	}	K' β_1
XK β_1	(Er)	55,682		
XK β_5''	(Er)	56,04		
XK β_2	(Er)	57,21	}	K' β_2
XK β_4	(Er)	57,313		
XKO _{2,3}	(Er)	57,456		

5.2 Gamma Emissions

	Energy keV	Photons per 100 disint.
$\gamma_{1,0}$ (Er)	80,5725 (13)	6,55 (8)
$\gamma_{2,1}$ (Er)	184,4107 (11)	0,0015 (7)
$\gamma_{3,2}$ (Er)	520,80 (7)	0,00035 (2)
$\gamma_{4,3}$ (Er)	674,24 (7)	0,0198 (17)
$\gamma_{3,1}$ (Er)	705,21 (7)	0,0146 (12)
$\gamma_{3,0}$ (Er)	785,78 (7)	0,0120 (3)
$\gamma_{5,2}$ (Er)	1263,24 (15)	0,0155 (9)
$\gamma_{4,1}$ (Er)	1379,446 (10)	0,933 (35)
$\gamma_{5,1}$ (Er)	1447,66 (15)	0,00105 (10)
$\gamma_{4,0}$ (Er)	1460,018 (10)	0,0002
$\gamma_{5,0}$ (Er)	1528,23 (15)	0,00014 (5)
$\gamma_{6,1}$ (Er)	1581,852 (15)	0,186 (4)
$\gamma_{6,0}$ (Er)	1662,424 (15)	0,118 (5)
$\gamma_{7,1}$ (Er)	1732,2 (5)	0,000046 (20)
$\gamma_{8,1}$ (Er)	1749,837 (14)	0,0272 (10)
$\gamma_{7,0}$ (Er)	1812,8 (5)	0,000056 (19)
$\gamma_{8,0}$ (Er)	1830,408 (24)	0,0081 (2)

6 Main Production Modes

Ho – 165 (E = thermal)(n, γ)Ho – 166

Ho – 165(d,p)Ho – 166

Ho – 165(d,pg)Ho – 166

Er – 167(t)Ho – 166

Dy – 166 decay, $T_{1/2} = 81,6$ h

7 References

- M.G.INGHRAM, R.J.HAYDEN. Phys. Rev. 71 (1947) 130
(Half-life)
- P.J.GRANT, J.M.HILL. Nature 163 (1949) 524
(Half-life)
- M.ANTONEVA, A.A.BASHILOV, B.S.DZHELEPOV. Izv. Acad. Nauk. SSSR 14 (1950) 299
(Half-life)
- A.SUNYAR. Phys. Rev. 93 (1954) 1345
(Beta transitions)
- R.L.GRAHAM, J.L.WOLFSON, M.A.CLARK. Phys. Rev. 98 (1955) 1173a
(Beta emission probabilities)
- J.M.CORK, M.K.BRICE, R.G.HELMER, R.M.WOODS JR. Phys. Rev. 110 (1958) 526
(Half-life, Beta plus transitions)
- J.E CLINE, E.C.YATES, E.H.TURK. Nucl. Phys. 30 (1962) 154
(Beta transitions)
- D.C.HOFFMAN. J. Inorg. Nucl. Chem. 25 (1963) 1196
(Half-life)
- M.K.RAMASWAMY, S.M.BRAHMAVAR. Curr. Sci. India 32 (1963) 451
(Conv. Elec. emission probabilities)
- L.FUNKE, K.HOHMUT, H.JUNGCLAUSEN, K.KANN, G.MUELLER, H.SODAN, L.WERNER. Kernenergie 6 (1963) 152
(Beta emission energies)
- W.GELLETLY, J.S.GEIGER, R.L.GRAHAM. Bull. Amer. Phys. Soc. 11 (1966) 352
(K X-ray emission probabilities, K X-ray energies)
- H.A.NEUMANN. Z. Naturforsch. 21a (1966) 1328
(Gamma-ray emission probabilities)
- P.ERMAN, G.T.EMERY, M.L.PERLMAN. Phys. Rev. 147 (1966) 858
(K X-ray emission probabilities, K X-ray energies)
- W.H.BRANTLEY, A.R.POLDERMAN, W.H.G.LEWIN. Bull. Amer. Phys. Soc. 11 (1966) 824
(Conv. Elec. emission probabilities)
- H.DANIEL, G.TH.KASCHL. Nucl. Phys. 76 (1966) 97-117
(Half-life, Beta emission probabilities, Conv. Elec. emission probabilities)
- J.ZYLICZ, M.H.JORGENSEN, O.B.NIELSEN, O.SKILBREID. Nucl. Phys. 81 (1966) 88
(Conv. Elec. emission probabilities)
- S.E.KARLSSON, I.ANDERSSON, O.NILSSON, G.MALMSTEN, C.NORDLING, K.SIEGBAHN. Nucl. Phys. 89 (1966) 513
(K X-ray emission probabilities, K X-ray energies)
- J.A.BEARDEN. Rev. Mod. Phys. 39 (1967) 78
(K X-ray energies)
- C.GUNTHER, L.D.PARSIGNAULT. Phys. Rev. 153 (1967) 1297
(Gamma-ray emission probabilities)
- S.B.BURSON. Phys. Rev. 158 (1967) 1161
(Gamma-ray emission probabilities)
- W.GELLETLY, J.S.GEIGER, R.L.GRAHAM. Phys. Rev. 157 (1967) 1043
(L X-ray ratio)
- M.ARNOUX, A.GIZON. Compt. Rend. Acad. Sci. Paris 264 (1967) 1518
(L/M ratio)
- S.HOEGBERG, J.E.BERGMARK, G.MALMSTEN, O.NILSSON. Nucl. Phys. A120 (1968) 569
(K X-ray emission probabilities, K X-ray energies)
- M.BOGDANOVIC, M.MLADJENOVIC, R.STEPIC. Nucl. Phys. A106 (1968) 209
(Conv. Elec. emission probabilities)
- O.NILSSON, I.THOREN, G.MALMSTEN, S.HOEGBERG. Nucl. Phys. A120 (1968) 561
(K/L ratio)

- E.FALKSTROEM, S.NILSSON, S.BOREVING. Arkiv Pysik 39 (1968) 1
(Conv. Elec. emission energies)
- M.BOGDANOVIC, M.MLADJENOVIC, R.STEPIC. Z. Physik 216 (1968) 267
(K/L ratio)
- G.C.NELSON, E.N.HATCH. Nucl. Phys. A127 (1969) 560
(Conv. Elec. emission energies)
- O.NILSSON, I.THOREIN, G.MALMSTEN, S.HOGBERG. Nucl. Phys. A139 (1969) 712
(ICC)
- C.W.REICH, J.E.CLIN. Phys. Rev. A159 (1970) 181-201
(Gamma ray energies, Gamma-ray emission probabilities)
- J.L.CAMPBELL, H.J.SMITH, I.K.MAC KENZIE. Nucl. Instrum. Methods 92 (1971) 237
(Conv. Elec. emission energies)
- O.DRAGON, B.MARTIN, D.MERKERT, M.VINDUSKA. Nucl. Phys. A183 (1972) 390
(K X-ray emission probabilities, K X-ray energies)
- J.L.CAMPBELL, R.J.GOBLE, J.J.SMITH, J.H.AMILTON, J.C.MANTHURUTHIL. Radioactivity in Nuc. Spec. (1972) 1387
(Conv. Elec. emission energies)
- E.P.GREGORIEV, A.V.ZOLOTAVIN, S.V.KAMYNOV. Bull. Acad. Sci. USSR, Fyz. Ser. 38 (1974) 30
(Beta emission probabilities)
- E.P.GREGORIEV, A.V.ZOLOTAVIN, S.V.KAMYNOV. Izv. Akad. Nauk. SSSR, Ser. Fiz. 38 (1974) 2499
(Beta emission probabilities)
- K.VENKATARAMANIAN, V.LAKSHMINARAYANA, K.VENKATAREDDY. Curr. Science (India) 45 (1976) 473
(Beta emission probabilities, Gamma-ray emission probabilities)
- F.P.LARKINS. At. Data. Nucl. Data Tables 20 (1977) 313
(Auger electron energies)
- M.ALLAB, F.AZGUI, G.ARDISSON. Radiochem. Radioanal. Letters 30 (1977) 253
(Gamma-ray emission probabilities, Gamma ray energies)
- V.M.KARTASHOV, A.G.TROIZKAYA, G.A.SHEVILEV. Probl. Yad. Fiz. Kosm. Luchei 7 (1977) 3
(Conv. Elec. emission probabilities)
- F.RÖSEL, W.M.FRIES, K.ADLER, H.C.PAULI. At. Data. Nucl. Data Tables 21 (1978) 92
(Conv. Elec. emission probabilities)
- SRINIVASA RAO, S.LAKSHMINARAYANA, V.SESHAGIRI RAO, D.L.SASTRY. Current Science 48 (1979) 811
(angular corr.)
- V.V.BULGAKOV, V.I.GAVRILYUK, A.A.KLYUCHNIKOV, A.P.LASKO, P.N.MUZALEV, N.V.STRELCHUK, A.I.FEOKISTOV, Y.E.FRANTSEV. Summaries of the 30th Conf. Nucl. Spectr. and Struct. Samarkand (1981) 293
(L/M/N)
- T.SEKINE, H.BABA. J. Inorg. Nucl. Chem. 43 (1981) 1107
(Gamma-ray emission probabilities)
- M.SRINIVASA RAO, S.LAKSHMINARAYANA, D.G.S.NAGARAYANA, L.RAGHAVENDRA RAO, V.SESHAGIRI RAO, D.L.SASTRY. Indian J. of Pure and Applied Physics 22 (1984) 10
(Gamma ray energies)
- A.E.IGNATOCHKIN, E.N.SHURSHIKOV, YU.F.JABOROV. Nucl. Data Sheets 52 (1987) 365
(Spin and Parity, Half-life, excited levels, Gamma ray energies)
- B.CHAND, J.GOSWAMY, D.MEHTA, N.SINGH, P.N.TREHAN. Proc. Phys. Soc. (1988)
(X-ray emission probabilities)
- M.K.BALODIS, A.V.AFANASEV, P.T.PROKOFEV, YU.JA.TAMBERG. Izvestiya Akademii Nauk. SSSR, Seriya Fizicheskaya 52 (1988) 2117
(level scheme)
- A.ABZOUZI, M.S.ANTONY, V.B.NDOCKO NDONGUE. J. Radioanal. Nucl. Chem. 135 (1989) 1
(Half-life)
- B.CHAND, J. GOSWAMY, D. MEHTA, N.SINGH, P.N TREHAN. Nucl. Instrum. Methods Phys. Res. A284 (1989) 393
(Gamma-ray emission probabilities)
- J.M.CALHOUN, J.T.CESSNA, B.M.COURSEY, D.D.HOPPES, F.J.SCHIMA, M.P.UNTERWEGER. Radioactivity and Radiochemistry 2 (1991) 38-45
(Half-life, Gamma-ray emission probabilities)
- C.ARDISSON, V.BARCI, J.DALMASSO, A.HACHEM, G.ARDISSON. Il Nuovo Cimento 105A (1992) 215-232
(Gamma ray energies, Gamma-ray emission probabilities)
- M.P.UNTERWEGER, D.D.HOPPES, F.J.SCHIMA. Nucl. Instrum. Methods Phys. Res. A312 (1992) 349-352
(Half-life)

- J.M.DOMINGOS, G.D.SYMOW, A.C.DOUGLAS. Nucl. Phys. A180 (1992) 600
(mixing ratios)
- B.M.COURSEY, J.M.CALHOUN, J.CESSNA, D.B.GOLAS, F.J.SCHIMA, M.P.UNTERWEGER. Nucl. Instrum. Methods Phys. Res. A339 (1994) 26-30
(Gamma-ray emission probabilities)
- G.AUDI, A.H.WAPSTRA. Nucl. Phys. A595 (1995) 409
(Q)
- E.SCHÖNFELD, H.JANSSEN. Nucl. Instrum. Methods Phys. Res. A369 (1996) 527
(K fluorescence yield, L vacancies)
- R.B.FIRESTONE, V.S.SHIRLEY. Table of Isotopes, Wiley NewYork (1996)
(Production modes)
- R.G.HELMER, C. VAN DER LEUN. Nucl. Instrum. Methods Phys. Res. A450 (2000) 35
(Gamma ray energies)

