

43-Tc-99

Tc-99 is a pure beta emitter. This nuclide is useful for thickness gauge of film and leather.
Tc-99m is used extensively in medical nuclear imaging.

- Atomic Mass: 98.9062546 +- 0.0000021 amu
- Excess Mass: -87323.307 +- 1.916 keV
- Binding Energy: 852743.069 +- 1.921 keV
- Beta Decay Energy: B- 293.651 + 1.417 keV

this must be an incidental gamma (γ)

"The 1995 update to the atomic mass evaluation" by G.Audi and A.H.Wapsta, Nuclear Physics A595 vol. 4 p.409-480, December 25, 1995.

- Spin: 9/2+
- Half life: 211100 Y *211,100 years*
- Mode of decay: Beta to Ru-99
 - Decay energy: 0.294 MeV

Meta state at 0.143 MeV

- Spin: 1/2-
- Half life: 6.01 H
- Mode of decay: IT
 - Decay energy: 0.143 MeV
- Mode of decay: Beta to Ru-99
 - Branch ratio: 0.0037 %
 - Decay energy: 0.437 MeV

- Possible parent nuclides:
Beta from Mo-99

R.R.Kinsey, et al., *The NUDAT/PCNUDAT Program for Nuclear Data*, paper submitted to the 9th International Symposium of Capture-Gamma-ray Spectroscopy and Related Topics, Budapest, Hungary, October 1996. Data extracted from NUDAT database (Dec.18, 1997).

Fission Yields

Fissile with Neutron Energy	Yields (sum = 2)	
	Direct	Accumulated
U-235 with 0.0253 eV	1.17335E-08	6.11047E-02
U-235 with 1.0 MeV	3.77921E-09	5.71393E-02
U-238 with 1.0 MeV	8.30069E-11	6.19569E-02
Pu-239 with 0.0253 eV	8.50639E-08	6.14029E-02
Pu-239 with 1.0 MeV	5.66225E-08	5.98386E-02

^{43}Tc - artificial element.

Isotopes from Tc^{85} through Tc^{115}

Fission Yields to Meta State

Fissile with Neutron Energy	Yields (sum = 2)	
	Direct	Accumulated
U-235 with 0.0253 eV	2.71323E-09	5.31610E-02
U-235 with 1.0 MeV	7.60750E-10	4.97112E-02
U-238 with 1.0 MeV	1.67092E-11	5.39025E-02
Pu-239 with 0.0253 eV	1.96699E-08	5.34205E-02
Pu-239 with 1.0 MeV	1.13980E-08	5.20595E-02

$^{43}\text{Tc}^{99}$ common fission product of Uranium in reactor.

CSWEG, ENDFB-VI Summary Documentation, Report BNL-NCS-17541 (ENDF-201) (1991)

Cross section graphs:

Tc99(N,G) * JEF-2.2

Most of cross section data are adopted from NGATLAS - Atlas of Neutron Capture Cross Sections (Courtesy of IAEA NDS)

Total Cross Section

- at 0.0253 eV = 23.06 b
- Maxwell avg. at 0.0253 eV = 20.91 b
- at 14 MeV = 4.537 b
- Fission spectrum avg. = 5.614 b
- g-factor = 1.0230

Elastic Scattering Cross Section

Tc-99 is a pure beta emitter. This nuclide is useful for thickness gauges of film and leather. Tc-99m is used extensively in medical nuclear imaging.

- Atomic Mass: 98.9062546 ± 0.0000001 amu
- Excise Mass: 97.9323303 ± 1.918 keV
- Binding Energy: 882743.089 ± 1.921 keV
- Beta Decay Energy: 8.253 691 ± 1.417 keV

(This must be an incidental gamma (γ))

The 1993 update to the atomic mass evaluation, by G.Audi and A.H.Wapstra, Nuclear Physics A325 vol. 4 p.469-480, December 22, 1993.

- Spin: 9/2+
- Half life: 2.11100 Y
- Mode of decay: Beta to Ru-99
- Decay energy: 0.294 MeV

- Meta state at 0.143 MeV
- Spin: 1/2-
- Half life: 6.01 H
- Mode of decay: IT
- Decay energy: 0.143 MeV
- Mode of decay: Beta to Ru-99
- Branch ratio: 0.0037 %
- Decay energy: 0.457 MeV

- Possible parent nuclides:
Beta from Mo-99

R.L.Kinney, et al. The NUBAT/NUBAPT Program for Nuclear Data, paper submitted to the 9th International Symposium of Capture-Gamma Spectroscopy and Related Topics, Budapest, Hungary, October 1998. Data extracted from NUBAT database (Dec. 18, 1997).

Fission Yields

Fission with Neutron Energy		Yields (sum = 2)	
		Direct	Accumulated
U-235 with 0.0253 eV	1.17395E-08	6.11047E-02	
U-235 with 1.0 MeV	8.77821E-09	2.71393E-02	
U-238 with 1.0 MeV	8.30089E-11	6.19589E-02	
Pu-239 with 0.0253 eV	8.50839E-08	6.14029E-02	
Pu-239 with 1.0 MeV	8.68258E-08	6.68886E-02	

Fission Yields to Meta State

Fission with Neutron Energy		Yields (sum = 2)	
		Direct	Accumulated
U-235 with 0.0253 eV	2.71393E-08	2.31810E-02	
U-235 with 1.0 MeV	7.60750E-10	4.97112E-02	
U-238 with 1.0 MeV	1.87092E-11	6.38029E-02	
Pu-239 with 0.0253 eV	1.98996E-08	2.34509E-02	
Pu-239 with 1.0 MeV	1.13980E-08	8.20292E-02	

CSWEE, ENDF-B-W Summary Convention, Project ENDF-201 (1991)

Cross section (barns)

3 CONSORTIUM, WASHINGTON
MARINE ENVIRONMENTAL

2

POLLUTION CONTROL HEARINGS BOARD
STATE OF WASHINGTON

- 40.0253 eV = 53.98 b
- Max. at 0.0253 eV = 539.1 b
- at 14 MeV = 4.537 b
- Fission spectrum avg. = 2.614 b

Personnel Data/Fax/Copies
Hearings/Reporting Cross section

Fax Log Report

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- at 0.0253 eV = 3.422 b
- Maxwell avg. at 0.0253 eV = 3.419 b
- at 14 MeV = 3.060 b
- Fission spectrum avg. = 4.196 b
- g-factor = 1.1276

Total Inelastic Cross Section

- at 14 MeV = 214.8 mb
- Fission spectrum avg. = 1.324 b

(n,2n) Cross Section

- at 14 MeV = 1.233 b
- Fission spectrum avg. = 1.336 mb

(n,3n) Cross Section

- Fission spectrum avg. = 0.7922 micro barn

(n,na) Cross Section

- at 14 MeV = 550.7 micro barn
- Fission spectrum avg. = 0.1318 micro barn

(n,np) Cross Section

- at 14 MeV = 6.887 mb
- Fission spectrum avg. = 1.792 micro barn

(n,nd) Cross Section

- at 14 MeV = 2.496920e-18 b
- Fission spectrum avg. = 0.001605 micro barn

(n,nt) Cross Section

- Fission spectrum avg. = 1.559880e-10 b

Radiative Capture Cross Section

- at 0.0253 eV = 19.64 b
- Maxwell avg. at 0.0253 eV = 17.49 b
- Resonance integral = 311.6 b
- at 14 MeV = 1.007 mb
- Fission spectrum avg. = 87.10 mb
- g-factor = 1.0047

(n,p) Cross Section

- at 14 MeV = 13.41 mb
- Fission spectrum avg. = 58.07 micro barn

(n,d) Cross Section

- at 14 MeV = 1.050 mb
- Fission spectrum avg. = 0.2284 micro barn

(n,t) Cross Section

- at 14 MeV = 94.79 micro barn
- Fission spectrum avg. = 0.03123 micro barn

(n,He3) Cross Section

- at 14 MeV = 1.078180e-13 b
- Fission spectrum avg. = 5.943110e-12 b

(n,alpha) Cross Section

- at 14 MeV = 6.605 mb
- Fission spectrum avg. = 24.12 micro barn

XS averaged from JENDL3.2, Courtesy of T.Nakagawa at JAERI



Element Tc

43 Technetium - artificial element.

isotopes from Tc⁸⁵ through Tc¹¹⁵

93 Tc⁹⁹ common fission product of Uranium in reactor.

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(n,He3) Cross Section
• at 14 MeV = 84.78 micro barn
• Fission spectrum avg = 0.00133 micro barn

(n,p) Cross Section
• at 14 MeV = 1.020 mb
• Fission spectrum avg = 0.2584 micro barn

(n,b) Cross Section
• at 14 MeV = 13.41 mb
• Fission spectrum avg = 88.07 micro barn

(n,p) Cross Section
• at 0.0253 eV = 19.84 b
• Maxwell avg at 0.0253 eV = 17.48 b
• Resonance integral = 311.8 b
• at 14 MeV = 1.007 mb
• Fission spectrum avg = 87.10 mb
• g-factor = 1.0047

(n,nf) Cross Section
• at 14 MeV = 2.46920E-18 b
• Fission spectrum avg = 0.001802 micro barn

(n,nd) Cross Section
• at 14 MeV = 8.887 mb
• Fission spectrum avg = 1.795 micro barn

(n,np) Cross Section
• at 14 MeV = 520.7 micro barn
• Fission spectrum avg = 0.1318 micro barn

(n,na) Cross Section
• at 14 MeV = 520.7 micro barn
• Fission spectrum avg = 0.1318 micro barn

(n,3n) Cross Section
• at 14 MeV = 1.333 b
• Fission spectrum avg = 1.338 mb

(n,2n) Cross Section
• at 14 MeV = 214.8 mb
• Fission spectrum avg = 1.324 b

Total Inelastic Cross Section
• at 0.0253 eV = 3.422 b
• Maxwell avg at 0.0253 eV = 3.419 b
• at 14 MeV = 3.080 b
• Fission spectrum avg = 4.186 b
• g-factor = 1.1278