

Thulium

Tm

General Information

Discovery

Thulium was discovered by P.T. Cleve in 1879 in Uppsala, Sweden.

Appearance

Thulium is a silvery metal with a bright lustre.

Source

Thulium is found principally in the mineral monazite, from which it is extracted by ion exchange and solvent extraction. It can also be isolated by reduction of the anhydrous fluoride with calcium metal, or reduction of the oxide with lanthanum metal.

Uses

When irradiated in a nuclear reactor, thulium produces an isotope that emits X-rays. A "button" of this isotope is used to make a lightweight, portable X-ray machine for medical use. The "hot" thulium is replaced every few months. Otherwise this element is little used.

Biological Role

Thulium has no known biological role, and is non-toxic.

General Information

Thulium tarnishes in air and reacts with water. It is soft, malleable and ductile, and can be cut with a knife.

Physical Information

Atomic Number	69
Relative Atomic Mass ($^{12}\text{C}=12.000$)	168.93
Melting Point/K	1818
Boiling Point/K	2220
Density/ kg m^{-3}	9321 (293K)
Ground State Electron Configuration	$[\text{Xe}]4f^{13}6s^2$
Electron Affinity (M-M $^-$)/ kJ mol^{-1}	-50

Key Isotopes

Nuclide	^{169}Tm	^{170}Tm
Atomic mass	168.9	
Natural abundance	100%	0%
Half-life	stable	134 days

Ionisation Energies/ kJ mol^{-1}

M - M $^+$	596.7
M $^+$ - M $^{2+}$	1163
M $^{2+}$ - M $^{3+}$	2285
M $^{3+}$ - M $^{4+}$	4119
M $^{4+}$ - M $^{5+}$	
M $^{5+}$ - M $^{6+}$	
M $^{6+}$ - M $^{7+}$	
M $^{7+}$ - M $^{8+}$	
M $^{8+}$ - M $^{9+}$	
M $^{9+}$ - M $^{10+}$	

Other Information

Enthalpy of Fusion/ kJ mol^{-1} 18.4

Enthalpy of Vaporisation/ kJ mol^{-1} 247

Oxidation States

Main Tm $^{+3}$

Others Tm $^{+2}$