

Palladium

Pd

General Information

Discovery

Palladium was discovered by W.H. Wollaston in 1803 in London.

Appearance

Palladium is a steel-white metal which is lustrous, malleable and ductile. It does not tarnish in air.

Source

It is found associated with platinum and other metals in deposits in the former USSR, North and South America and Australia. It is also found associated with nickel-copper deposits in South Africa and USA. It is extracted commercially from these latter ores.

Uses

Finely divided palladium is a good catalyst and is used for hydrogenation and dehydrogenation reactions. White gold is an alloy of gold decolourised by the addition of palladium. It is also used with gold, silver and other metals as a "stiffener" in dental inlays and bridgework. Hydrogen easily diffuses through heated palladium and this provides a way of purifying the gas.

Biological Role

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

General Information

Palladium resists corrosion, but reacts with oxidising acids and fused alkalis. At room temperature the metal has the unusual property of absorbing up to 900 times its own volume of hydrogen.

Physical Information

Atomic Number	46
Relative Atomic Mass ($^{12}\text{C}=12.000$)	106.42
Melting Point/K	1825
Boiling Point/K	3413
Density/kg m ⁻³	12020 (293K)
Ground State Electron Configuration	[Kr]4d ¹⁰
Electron Affinity (M-M ⁻)/kJ mol ⁻¹	-98.4

Key Isotopes

Nuclide	¹⁰² Pd	¹⁰³ Pd	¹⁰⁴ Pd	¹⁰⁵ Pd	¹⁰⁶ Pd	¹⁰⁸ Pd
Atomic mass	101.901		103.90	104.90	105.90	107.90
Natural abundance	1.02%	0%	11.14%	22.33%	27.33%	26.46%
Half-life	stable	17 days	stable	stable	stable	stable
Nuclide	¹⁰⁹ Pd	¹¹⁰ Pd				
Atomic mass						
Natural abundance	0%	11.72%				
Half-life	13.47 h	stable				

Ionisation Energies/kJ mol⁻¹

M - M ⁺	805
M ⁺ - M ²⁺	1875
M ²⁺ - M ³⁺	3177
M ³⁺ - M ⁴⁺	4700
M ⁴⁺ - M ⁵⁺	6300
M ⁵⁺ - M ⁶⁺	8700
M ⁶⁺ - M ⁷⁺	10700
M ⁷⁺ - M ⁸⁺	12700
M ⁸⁺ - M ⁹⁺	15000
M ⁹⁺ - M ¹⁰⁺	17200

Other Information

Enthalpy of Fusion/kJ mol ⁻¹	17.2
Enthalpy of Vaporisation/kJ mol ⁻¹	361.5
Oxidation States	
Main	Pd ⁺²
Others	Pd ⁰ , Pd ⁺⁴