

Cadmium

Cd

General Information

Discovery

Cadmium was discovered by F. Stromeyer in 1817 in Göttingen, Germany, from an impurity in zinc carbonate.

Appearance

Cadmium is a soft, bluish-white metal which is easily cut with a knife.

Source

The only mineral containing significant quantities of cadmium is greenockite, although some is present in sphalerite. Almost all commercially produced cadmium is obtained as a by-product of the treatment of zinc, copper and lead ores.

Uses

Cadmium is used extensively in electroplating, which accounts for about 60% of its use. It is also used in many types of solder, for standard e.m.f. cells, for nickel-cadmium batteries and in rods to control atomic fission. It is a component of some of the lowest melting alloys, alloys with low coefficients of friction, and alloys with great resistance to fatigue. Cadmium compounds are used in blue and green phosphors in colour television sets. Cadmium forms a number of compounds, the sulfide being used as an artist's pigment as it is bright yellow.

Biological Role

Cadmium is toxic, carcinogenic and teratogenic. In the past, failure to recognise the toxicity of this element caused workers to be exposed to danger in the form of solder fumes and cadmium plating baths.

General Information

Cadmium tarnishes in air, and is soluble in acids but not in alkalis.

Physical Information

Atomic Number	48
Relative Atomic Mass ($^{12}\text{C}=12.000$)	112.41
Melting Point/K	594
Boiling Point/K	1038
Density/kg m ⁻³	8650 (293K)
Ground State Electron Configuration	[Kr]4d ¹⁰ 5s ²
Electron Affinity (M-M ⁻)/kJ mol ⁻¹	+26

Key Isotopes

Nuclide	¹⁰⁶ Cd	¹⁰⁸ Cd	¹⁰⁹ Cd	¹¹⁰ Cd	¹¹¹ Cd	¹¹² Cd
Atomic mass	105.91	107.9		109.9	110.9	111.9
Natural abundance	1.25%	0.89%	0%	12.51%	12.81%	24.13%
Half-life	stable	stable	450 days	stable	stable	stable
Nuclide	¹¹³ Cd	¹¹⁴ Cd	¹¹⁵ Cd	¹¹⁶ Cd		
Atomic mass	112.9	113.9		115.9		
Natural abundance	12.22%	28.72%	0%	7.47%		
Half-life	stable	stable	stable	stable		

Ionisation Energies/kJ mol⁻¹

M - M ⁺	867.6
M ⁺ - M ²⁺	1631
M ²⁺ - M ³⁺	3616
M ³⁺ - M ⁴⁺	5300
M ⁴⁺ - M ⁵⁺	7000
M ⁵⁺ - M ⁶⁺	9100
M ⁶⁺ - M ⁷⁺	11100
M ⁷⁺ - M ⁸⁺	14100
M ⁸⁺ - M ⁹⁺	16400
M ⁹⁺ - M ¹⁰⁺	18800

Other Information

Enthalpy of Fusion/kJ mol ⁻¹	6.11
Enthalpy of Vaporisation/kJ mol ⁻¹	100
Oxidation States	
Main	Cd ⁺²
Others	Cd ⁺¹