

Selenium

Se

General Information

Discovery

Selenium was discovered by J.J.Berzelius in 1817 in Stockholm, Sweden.

Appearance

Selenium exists as several allotropic forms. The most stable variety, crystalline hexagonal selenium, is a metallic grey colour. Crystalline monoclinic selenium is deep red. Amorphous selenium is either red (in powder form) or black (in vitreous form).

Source

Most of the world's selenium is obtained from the anode muds from electrolytic copper refineries. These muds are either roasted with soda or sulphuric acid, or smelted with soda to release the selenium. Selenium is found in a few rare minerals.

Uses

Selenium is both photovoltaic action (converts light to electricity) and photoconductive action (electrical resistance decreases with increased illumination). Selenium is therefore useful in photocells and solar cells. It can also convert a.c. electricity to d.c. electricity, so is extensively used in rectifiers. It is used by the glass industry, and to make stainless steel. It is also used in photocopiers.

Biological Role

Selenium is an essential trace element but is toxic in excess. It is carcinogenic and teratogenic. Hydrogen selenide and other selenium compounds are extremely toxic.

General Information

Selenium burns in air, is unaffected by water and reacts with concentrated nitric acid and alkalis.

Physical Information

Atomic Number	34
Relative Atomic Mass ($^{12}\text{C}=12.000$)	78.96
Melting Point/K	490
Boiling Point/K	958.1
Density/kg m ⁻³	4790 (293K)
Ground State Electron Configuration	[Ar]3d ¹⁰ 4s ² 4p ⁴
Electron Affinity (M-M ⁻)/kJ mol ⁻¹	-195

Key Isotopes

Nuclide	⁷⁴ Se	⁷⁵ Se	⁷⁶ Se	⁷⁷ Se	⁷⁸ Se	⁸⁰ Se
Atomic mass	73.923	74.923	75.919	76.920	77.917	79.917
Natural abundance	0.9%	0%	9%	7.6%	23.5%	49.6%
Half-life	stable	120.4 days	stable	stable	stable	stable
Nuclide	⁸² Se					
Atomic mass	81.917					
Natural abundance	9.4%					
Half-life	stable					

Ionisation Energies/kJ mol⁻¹

M - M ⁺	940.9
M ⁺ - M ²⁺	2044
M ²⁺ - M ³⁺	2974
M ³⁺ - M ⁴⁺	4144
M ⁴⁺ - M ⁵⁺	6590
M ⁵⁺ - M ⁶⁺	7883
M ⁶⁺ - M ⁷⁺	14990
M ⁷⁺ - M ⁸⁺	19500
M ⁸⁺ - M ⁹⁺	23300
M ⁹⁺ - M ¹⁰⁺	27200

Other Information

Enthalpy of Fusion/kJ mol ⁻¹	5.1
Enthalpy of Vaporisation/kJ mol ⁻¹	90
Oxidation States	
Main	Se ⁺⁴ , Se ⁺⁶
Others	Se ⁻² , Se ⁺¹ , Se ⁺²
Covalent Bonds/kJ mol⁻¹	
Se - H	305
Se - C	245
Se - O	343
Se - F	285
Se - Cl	245
Se - Se	330