



Selenium

Description

Selenium is a chemical element in the periodic table with atomic number 34. It can be found in several allotropic forms. Amorphous selenium exists in two forms; the glassy, black coloured form is obtained by quenching liquid selenium, whilst the colloidal, red coloured form is obtained in reduction reactions. Gray crystalline selenium with a hexagonal structure is the most common form.

The abundance of this in the Earth's crust is widely distributed and is estimated at being approximately $7 \times 10^{-5}\%$ in weight, being available in the form of selenides of heavy elements, and to a lesser extent as a free element in association with elemental sulphur. Selenium minerals are not found in sufficient quantity to be useful as a commercial source of the element, hence selenium bearing copper sulphide ores represent its main source.

Commercial production is made by heating sludge from copper refineries with sodium carbonate or sulphuric acid. First, a binder of sodium carbonate and water is added to the sludge to form a hard paste, which is then extruded or cut into pellets to be dried. The dry paste is roasted afterwards at 530-650°C and then dipped in water to obtain dissolved hexavalent selenium as sodium selenate (Na_2SeO_4).

Properties

Physical Properties		Electronic Properties	
Name	Selenium	Valence	2, -2, 4, 6
Atomic Number	34	Electro negativity	2.55
Symbol	Se	Covalent Radius	1.16
Atomic Weight	78.96	Ionic Radius	1.98
Density (g/ml)	4.79	Atomic Radius	1.40
Boiling Point °C	685	Atomic Structure	$[\text{Ar}]3d^{10}4s^24p^2$
Melting Point °C	217	Ionization Potential (eV)	9.76

Selenium burns in the air with a blue flame to produce selenium dioxide, SeO_2 . This element also reacts directly with various metals and non-metals, including hydrogen and the halogens. Non-oxidizing acids do not react with selenium, but nitric acids, concentrated sulphuric acid and strong alkali hydroxides dissolve it. Selenium is toxic and is insoluble in water and alcohol, slightly soluble in carbon disulfide and soluble in either. Selenium has a photoelectric effect, converting light into electricity, and its electrical conductivity increases when it is exposed to light. At temperatures below its melting point, it is a semiconductor material.

Selenium metal is classified by the EU as a hazardous substance. The CLP Regulation classifies it as:

- Acute Tox.3 (*), H331
- Acute Tox.3 (*), H301
- STOT RE 2 (*), H373 (**)
- Aquatic Chronic 4, H413

(*) = Minimum classification; (**) = Route of exposure not specified because necessary information is not available.

Selenium is not classified as a hazardous good for transportation.

Uses

- Selenium is used in metallurgy as a steel alloying agent, mainly in austenitic stainless steel, improving its machinability.
- Other uses are in the manufacturing of photovoltaic cells, in photocopying for reproducing and copying documents, in the glass industry to decolourise glass and to make ruby coloured glasses and enamels, as photographic toners, etc.

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