

# Selenium - Se

## Chemical properties of selenium - Health effects of selenium - Environmental effects of selenium

Atomic number	34
Atomic mass	78.96 g.mol <sup>-1</sup>
Electronegativity according to Pauling	2.4
Density	4.79 g.cm <sup>-3</sup> at 20°C
Melting point	217 °C
Boiling point	688 °C
Vanderwaals radius	0.14 nm
Ionic radius	0.198 nm (-2) ; 0.042 nm (+6)
Isotopes	9
Electronic shell	[Ar] 3d <sup>10</sup> 4s <sup>2</sup> 4p <sup>4</sup>
Energy of first ionisation	940,7 kJ.mol <sup>-1</sup>
Energy of second ionisation	2045 kJ.mol <sup>-1</sup>
Energy of third ionisation	2973.7 kJ.mol <sup>-1</sup>
Standard potential	- 0.77 V
Discovered by	Jons Berzelius 1817



## Selenium

Selenium is a non metallic chemical element, member of the group XVI of the periodic table. In chemical activity and physical properties it resembles sulfur and tellurium. Selenium appears in a number of allotropic forms: the most popular are a red amorphous powder, a red crystalline material, and a gray crystalline metallike form called *metallic* selenium. This last form conducts electricity better in the light than in the dark and is used in photocells. Selenium burns in air and is unaffected by water, but dissolves in concentrated nitric acid and alkalis.

### Applications

Selenium has good photovoltaic and photoconductive properties, and it is used extensively in electronics, such as photocells, light meters and solar cells. The second largest use of selenium is in the glass industry: selenium is used to remove colour from glass, to give a red colour to glasses and enamels. The third main use, taking about 15% is sodium selenite for animal feeds and food supplements. Selenium can also find applications in photocopying, in the toning of photographs. Its artistic use is to intensify and extend the tonal range of black and white photographic images. Other uses of selenium are in metal alloys such as the lead plates used in storage batteries and in rectifiers to convert AC current in DC current. Selenium is used to improve the abrasion resistance in vulcanized rubbers. Some selenium compounds are added to anti-dandruff shampoos.

### Selenium in the environment

Selenium is among the rarer elements on the surface of this planet, and is rarer than silver. Selenium is present in the atmosphere as methyl derivatives. Uncombined selenium is occasionally found and there are around 40 known selenium-containing minerals, some of which can have as much as 30% selenium - but all are rare and generally they occur together with sulfides of metals such as copper, zinc and lead. The main producing countries are Canada, USA, Bolivia and Russia. Global industrial production of selenium is around 1500 tonnes a year and about 150 tonnes of selenium are recycled from industrial waste and reclaimed from old photocopiers.

Selenium occurs naturally in the environment. It is released through both natural processes and human activities. Well fertilized agricultural soil generally has about 400 mg/ton since the element is naturally present in phosphate fertilizers and is often added as a trace nutrient. In its natural form as an element selenium cannot be created or destroyed, but selenium does have the ability to change form.

Selenium levels in soils and waters increase, because selenium settles from air and selenium from waste also tends to end up in the soils of disposal sites. When selenium in soils does not react with oxygen it remains fairly immobile. Selenium that is immobile and will not dissolve in water is less of a risk for organisms. The oxygen levels in the soil and the acidity of the soil will increase mobile forms of selenium. Higher oxygen levels and increased acidity of soils is usually caused by human activities, such as industrial and agricultural processes.

When selenium is more mobile, the chances of exposure to its compounds will be greatly enhanced. Soil temperatures, moisture, concentrations of water-soluble selenium, the season of the year, organic matter content and microbial activity determine how fast selenium will move through soil. In other words, these factors determine its mobility.

Agriculture cannot only increase the selenium content in soil; it can also increase selenium concentrations in surface water, as selenium is brought along in irrigation drainage water.

## Health effects of selenium

Humans may be exposed to selenium in several different ways. Selenium exposure takes place either through food or water, or when we come in contact with soil or air that contains high concentrations of selenium. This is not very surprising, because selenium occurs naturally in the environment extensively and it is very widespread.

The exposure to selenium mainly takes place through food, because selenium is naturally present in grains, cereals and meat. Humans need to absorb certain amounts of selenium