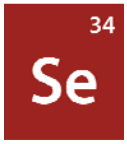
Stable isotopes of selenium available from ISOFLEX

Isotope	Z(p)	N(n)	Atomic Mass	Natural Abundance	Enrichment Level	Chemical Form
Se-74	34	40	73.922474	0.89%	>99.90%	Elemental
Se-76	34	42	75.919214	9.36%	>99.50%	Elemental
Se-77	34	43	76.919912	7.63%	≥99.20%	Elemental
Se-78	34	44	77.917309	23.78%	≥99.30%	Elemental
Se-80	34	46	79.916522	49.61%	99.90%	Elemental
Se-82	34	48	81.916700	8.73%	99.90%	Elemental



Selenium was discovered in 1817 by Jöns Jakob Berzelius. Its name originates with the Greek word *selene*, meaning "moon." It exists in several allotropic forms:

Amorphous forms exhibit two colors, occurring as either a red powder with density 4.26 g/cm^3 and hexagonal crystal structure, or a black vitreous solid with density 4.28 g/cm^3. The red form converts to the black form on standing, and it melts at 60-80 ºC. It is insoluble in water but reacts with water at 50 ºC when freshly precipitated. It is soluble in sulfuric acid, benzene and carbon disulfide.

Crystalline selenium exhibits two monoclinic forms: an alpha form, constituting dark red transparent crystals with a density of 4.50 g/cm^3, converts to a metastable beta form of hexagonal crystal structure when heated to about 170 ºC. They are both insoluble in water, soluble in sulfuric and nitric acids, and very slightly soluble in carbon disulfide. Also, both crystalline forms convert into gray metallic modification on heating.

The *gray metallic form* of selenium is its most stable modification. It constitutes lustrous-gray-to-black hexagonal crystals with a density of 4.18 g/cm^3 at 20 ºC and a melting point of 217 ºC. It is soluble in sulfuric acid and chloroform, very slightly soluble in carbon disulfide, and insoluble in alcohol.

Electrically, selenium acts as a rectifier, and it has marked photoconductive and photovoltaic action (it converts radiant to electrical energy). Selenium forms binary alloys with silver, copper, zinc, lead and other elements. The chemical properties of selenium fall between those of sulfur and tellurium; thus, it reacts with oxygen similarly to sulfur, forming two oxides. The metal combines with halogens, forming their halides. It is not attacked by hydrochloric acid, nor does it react with dilute nitric and sulfuric acids.

Selenium has many industrial uses, particularly electronic and solid-state applications, which are attributed to its unique properties: it converts light directly to electricity; its electrical resistance decreases with increased illumination; and it is able to convert alternating current to direct current. It is used in photoelectric cells, in solar cells, and as a rectifier in radio and television sets. Although a toxic metal at moderate concentrations, selenium is also an essential nutritional element at trace concentrations. Some of its compounds, such as hydrogen selenide, are very toxic. Exposure to the metal fumes can cause severe irritation of eyes, nose and throat. The United States Environmental Protection Agency lists the metal as one of the priority pollutant metals in the environment.

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Properties of Selenium

Name	Selenium
Symbol	Se
Atomic number	34
Atomic weight	78.96
Standard state	Solid at 298 °K
CAS Registry ID	7782-49-2
Group in periodic table	16
Group name	Chalcogen
Period in periodic table	4
Block in periodic table	p-block
Color	Gray, metallic luster
Classification	Nonmetallic
Melting point	217 °C
Boiling point	684.9 °C
Vaporization point	684.8 °C
Thermal conductivity	0.519 W/(m·K) at 298.2 °K
Electrical resistivity	106 μΩ·cm at 0 °C
Electronegativity	2.4
Specific heat	0.32 kJ/kg K
Heat of vaporization	26 $kJ \cdot mol^{-1}$ at 684.9 °C
Heat of fusion	5.4 $kJ \cdot mol^{-1}$
Density of liquid	3.99 g/cm^3 at 217 °C
Density of solid	4.82 g/cm^3
Electron configuration	$[Ar]3d^{10}4s^24p^4$
Atomic radius	1.19 Å
Ionic radius	Se^{4+}: 0.50 Å (coordination number 6); Se^{6+}: 0.42 Å (coordination number 6)
Oxidation states	-2, +4, +6

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