



# Silicon

## Description

Silicon is a metalloid element, atomic number  $Z = 14$  and located in Group IV A of the periodic table of elements as a part of the carbonoid family. It occurs in amorphous and crystalline forms: the first one is a brownish powder, more active than the crystalline variant which is known in a blue-gray octahedra and metallic lustre. By its abundance, silicon exceeds by far any other element, except oxygen. It constitutes 27.72% of the solid crust of the Earth, while oxygen is 46.6% and aluminium, the next element in abundance after silicon, has a presence of just 8.13%. Silicon is found in many forms of dioxides and countless variations of natural silicates. It also forms several series of hydrides, various halides, etc.

The basic process to produce silicon is to heat silica and coke in a submerged electric arc furnace at high temperatures. These are required to produce a reaction where oxygen is removed, leaving silicon as an end product. This is known as a reduction process. In this process, metal carbides are usually formed first at lower temperatures, when silicon is formed, it displaces the carbon. Afterwards, refining processes are used to improve the Si purity.

## Properties

Physical Properties		Electronic Properties	
Name	Silicon	Valence	2, 4
Atomic Number	14	Electro negativity	1.9
Symbol	Si	Covalent Radius	1.11
Atomic Weight	28.0816	Ionic Radius	0.41
Density (g/ml)	2.33	Atomic Radius	1.32
Boiling Point °C	2900	Atomic Structure	[Ne]3s <sup>2</sup> 3p <sup>2</sup>
Melting Point °C	1410	Ionization Potential (eV)	8.15

Silicon is a metalloid with a strong metallic lustre and is extremely breakable. It is usually tetravalent in its compounds, but sometimes it is divalent, and it is significantly electropositive in its chemical behaviour.

In its purest form, silicon is an intrinsic semiconductor though its semiconducting capacity, which is highly increased by doping it with small amounts of certain substances. Silicon is similar to metals in its chemical behaviour. It is almost as electropositive as tin, more so than germanium or lead. According to this quasi-metallic character, it forms tetra positive ions and various covalent compounds.

Silicon is stable under normal conditions, but it may react with hydrofluoric and nitric acids producing toxic gases (SiF<sub>4</sub>, NO<sub>x</sub>). Impurities in silicon may react with diluted acids emitting flammable and toxic gases (i.e. hydrogen or silane).

Silicon in stone form is neither combustible nor flammable.

Silicon is not classified by the EU as a hazardous substance, nor as a hazardous good for transportation in bulk form, while as an amorphous powder, it is classified as 4.1 Class, UN Number 1346.

## Uses

- Silicon, when in not very high purity, is used in metallurgy as a reducing agent and as an alloying element in steel, brass, aluminium, and bronze. When small amounts of silicon are added to aluminium, it becomes easier to cast and also improves its strength, hardness and some other properties.
- In its oxide or silicate form, silicon is used to make bricks, glass, ceramics and soaps.
- Silicon metal is also the base material for the manufacturing of silicones.
- When Silicon is purified and doped with elements such as boron, phosphorus and arsenic, it can be used as a semiconductor in various applications.

### COMETAL, S.A.

- C/José Lázaro Galdiano 4
- 28036 Madrid (Spain)
- Tel: +34 91 4585980
- Fax: +34 91 4585987

- cometal@cometalsa.com
- www.cometalsa.com
- VAT Nr ESA28117026

