

# Beryllium

Be

## ***General Information***

### **Discovery**

Discovered as the oxide by Vauquelin in beryl and in emeralds in 1798. The metal was isolated in 1828 by Wohler independently by the action of potassium on beryllium chloride.

### **Appearance**

Beryllium is a metal, steel grey in colour.

### **Source**

Beryllium is found in some 30 mineral species, the most important of which are bertrandite, beryl, chrysoberyl and phenacite. Aquamarine and emerald are precious forms of beryl.

Beryl and bertrandite are the most important commercial sources of the element and its compounds. The metal is usually prepared by reducing beryllium fluoride with magnesium metal.

### **Uses**

Beryllium is used as an alloying agent in producing beryllium copper, which is used for springs, electrical contacts, spot-welding electrodes and non-sparking tools. It has found application as a structural material for high-speed aircraft, missiles, spacecraft and communication satellites, and is also extensively used in the space shuttle. Because beryllium is relatively transparent to X-rays, ultra-thin beryllium foil is finding use in X-ray lithography for the reproduction of micro-miniature integrated circuits.

Beryllium is also used in nuclear reactors as a reflector or moderator. The oxide has a very high melting point and is also used in nuclear work as well as having ceramic applications.

### **Biological Role**

Beryllium and its salts are both toxic and carcinogenic.

### **General Information**

Beryllium is one of the lightest of all metals, and has one of the highest melting points. Its modulus of elasticity is about one third greater than that of steel. It resists attack by concentrated nitric acid, has excellent thermal conductivity and is nonmagnetic. It has a high permeability to X-rays, and when bombarded by alpha particles produces neutrons. At ordinary temperatures it resists oxidation in air.

## Physical Information

Atomic Number	4
Relative Atomic Mass ( $^{12}\text{C}=12.000$ )	9.012
Melting Point/K	1551
Boiling Point/K	3243 (under pressure)
Density/kg m <sup>-3</sup>	1847.7 (293K)
Ground State Electron Configuration	[He]2s <sup>2</sup>
Electron Affinity (M-M <sup>-</sup> )/kJ mol <sup>-1</sup>	-18

## Key Isotopes

Nuclide	<sup>7</sup> Be	<sup>9</sup> Be	<sup>10</sup> Be
Atomic mass	7.017	9.012	10.014
Natural abundance	0%	100%	0%
Half-life	53.37days	stable	2.5x10 <sup>6</sup> yrs

## Ionisation Energies/kJ mol<sup>-1</sup>

M - M <sup>+</sup>	899.4
M <sup>+</sup> - M <sup>2+</sup>	1757.1
M <sup>2+</sup> - M <sup>3+</sup>	14848
M <sup>3+</sup> - M <sup>4+</sup>	21006

## Other Information

Enthalpy of Fusion/kJ mol <sup>-1</sup>	9.80
Enthalpy of Vaporisation/kJ mol <sup>-1</sup>	308.8

### Oxidation States

Main	Be <sup>II</sup>
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### Covalent Bonds/kJ mol<sup>-1</sup>

Be - H	226
Be - O	523
Be - F	615
Be - Cl	293