



# Molybdenum

## Description

Molybdenum is a silvery metal which has the sixth highest melting point in the periodic table's elements. It is not found as a free metal naturally, but in several oxidation states of its minerals. Industrially, the molybdenum compounds are employed in high pressure and high temperature applications, such as pigments and hydro desulphurizing catalysts.

The main mineral source of molybdenum is molybdenite mineral ( $\text{MoS}_2$ ). It can also be found in other minerals such as Wulfenite ( $\text{PbMoO}_4$ ) and Powellite ( $\text{CaMoO}_4$ ). The world's largest producers of molybdenum raw material are the United States, China, Chile, Peru and Canada. About half of the world's production of Molybdenum is located in the United States. Molybdenum is obtained from ores and is also recovered as a by-product of tungsten and copper extraction, the latter being the primary mode of commercial exploitation. Molybdenum is present in mines in a range between 0.01 and 0.5%.

Molybdenite is heated to a temperature of  $700^\circ\text{C}$  and this sulphide is oxidized to molybdenum oxide (VI) by the action of air. The oxidized ore is then heated to  $1,100^\circ\text{C}$  to sublime the oxide, or may be treated with ammonia, which reacts with the molybdic oxide to form water soluble molybdates. From this solution, the oxide can be precipitated with hydrogen sulphide. To obtain pure molybdenum, the oxide is reduced by hydrogen. Ferro Molybdenum, the molybdenum bearing material used as a steel raw material, is usually obtained by aluminothermic reduction of Ferro Silicon with technical grade molybdic oxide.

## Properties

Physical Properties		Electronic Properties	
Name	Molybdenum	Valence	2, 3, 4, 5, 6
Atomic Number	42	Electro negativity	2.16
Symbol	Mo	Covalent Radius	1.45
Atomic Weight	95.94	Ionic Radius	0.62
Density (g/ml)	10.2	Atomic Radius	1.39
Boiling Point $^\circ\text{C}$	4639	Atomic Structure	$[\text{Kr}]4d^55s^1$
Melting Point $^\circ\text{C}$	2610	Ionization Potential (eV)	7.09

Molybdenum is a transition metal. The pure metal is silvery white and very hard. moreover, it has one of the highest melting points of all the elements. In small quantities, it is used in various steel alloys to harden or make them more resistant to corrosion.

Molybdenum only oxidizes rapidly at temperatures above  $600^\circ\text{C}$  (weak oxidation starts a  $300^\circ\text{C}$ ). Its coefficient of thermal expansion is one of the lowest among the commercially used metals.

Molybdenum is neither classified as a hazardous substance by the EU nor as a hazardous good for transportation.

## Uses

- As an alloying agent in cast iron, steel, and super alloys to enhance their hardenability, strength, toughness, and wear-and-corrosion resistance.
- As a refractory metal in hydro desulphurizing catalysts, pigments and lubricants manufacturing.

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