



Tungsten

Description

Wolfram, also called tungsten, is a chemical element of atomic number $Z = 74$ which is located in the group VI B of the periodic table of elements. It is a rare metal in the earth's crust, the 57th in abundance. It is found as oxides and salts in certain minerals. The word Wolfram comes from the German words 'wolf' and 'rahm', translates as 'Wolf drool' in reference to the superstitions of the medieval Saxon miners who believed that the devil appeared in wolf form and lived deep in the cassiterite mines, corroding the mineral with its drool. The word Tungsten comes from the Swedish words 'tung' translated as heavy and 'sten', stone.

It is never found as free metal in nature, but as its salts combined with other elements, mainly as scheelite (CaWO_4) and wolframite ($(\text{Fe, Mn})\text{WO}_4$), which are the most important minerals. There are other minor minerals such as the cuproscheelite (CuWO_4) ferberite (FeWO_4), the hübnerite (MnWO_4) and stöizite (PbWO_4). These minerals are extracted and used to produce about 35,000 tons per year tungsten concentrates. China produces more than 75% of this total and most of the remaining production comes from: Austria, Bolivia, Portugal and Russia.

To obtain Tungsten from its ores they are melted with soda ash to obtain sodium tungstate, Na_2WO_4 . Soluble sodium tungstate is then extracted with hot water and treated with hydrochloric acid to obtain tungstic acid, H_2WO_4 . This compound, once washed and dried, forms the Tungsten oxide WO_3 , which is reduced with hydrogen or carbon in an electric furnace. The obtained fine powder is reheated in moulds in hydrogen atmosphere, and pressed into bars which are wound and hammed at high temperature to make them compact and ductile. It is also possible to obtain Tungsten by reduction with hydrogen of WF_6 .

Properties

Physical Properties		Electronic Properties	
Name	Tungsten	Valence	2, 3, 4, 5, 6
Atomic Number	74	Electro negativity	2.36
Symbol	W	Covalent Radius	1.46
Atomic Weight	183.85	Ionic Radius	0.64
Density (g/ml)	19.3	Atomic Radius	1.39
Boiling Point °C	5555	Atomic Structure	$[\text{Xe}]4f^{14}5d^46s^2$
Melting Point °C	3422	Ionization Potential (eV)	7.86

It is steel-gray coloured, very hard and dense metal; it has the highest melting point of all metals and the highest boiling point of all known elements. From a chemical point of view, tungsten is relatively inert. It is not easily attacked by the common acids, alkalis, or aqua regia. It reacts with a mixture of nitric and hydrofluoric acids. Oxidizing fused salts such as sodium nitrite easily attack it. Chlorine, bromine, iodine, carbon dioxide, carbon monoxide and gaseous sulphur only react with tungsten at high temperatures. Carbon, boron, silicon and nitrogen also form various compounds with it at elevated temperatures; it does not react with hydrogen.

Tungsten is neither classified as a hazardous substance by the EU legislation nor as a dangerous good for its transportation

Uses

- Manufacturing of special steels.
- Manufacturing of tungsten carbide for machining tools.
- TIG welding electrodes.
- Filament bulbs and electric heaters.
- Luminaries manufacturing.

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