COMETAL

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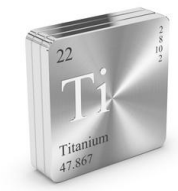

Titanium

Description

Titanium is a chemical element with atomic number 22. It is a silver gray transition metal. Compared with steel - a metal with which it competes in technical applications - it is much lighter, has higher corrosion resistance and mechanical strength, but is much more expensive, which limits its industrial use. It has excellent corrosion resistance and a high strength to weight ratio. It behaves chemically similar to zirconium and silicon.
It is a quite abundant metal in nature, considered the fourth most abundant structural metal on the Earth's surface and the ninth in the range of industrial metals. Titanium as metal is not found in nature. The minerals that have the highest concentration of this metal are Rutile (TiO_2) and Ilmenite ($FeO.TiO_2$), Anatase and Brookite are also both present in TiO_2.
Titanium production from Titanium ore concentrates is carried out through the Kroll process, obtaining titanium tetrachloride by chlorinating the concentrates in a fluidized bed reactor at 800°C in presence of carbon; once obtained, titanium tetrachloride is subsequently purified by fractional distillation and afterwards reduced with ground magnesium or sodium under inert atmosphere to form titanium sponge on the reactor walls. This product is then purified by leaching it with diluted hydrochloric acid and then compacted. The $MgCl_2$ formed is electrolytically recycled. By reducing the $TiCl_4$ using sodium instead of magnesium, the resulting sponge is granular, thereby facilitating the compacting procedure.

Properties

Physical Properties		Electronic Properties	
Name	Titanium	Valence	2, 3, 4
Atomic Number	22	Electro negativity	1.5
Symbol	Ti	Covalent Radius	1.36
Atomic Weight	47.9	Ionic Radius	0.68
Density (g/ml)	4.51	Atomic Radius	1.47
Boiling Point ºC	3287	Atomic Structure	$[Ar]3d^2 4s^2$
Melting Point ºC	1668	Ionization Potential (eV)	6.83

Titanium burns in the air when heated to yield the dioxide TiO_2 and when combined with halogens. It reduces water vapour to form carbon dioxide and hydrogen and similarly reacts with heated concentrated acids, although it forms trichloride with hydrochloric acid. The metal absorbs hydrogen to yield TiH_2 and forms the nitride TiN and the carbide TiC. TiS_2 sulphide, the lower oxides TiO Ti_2O_3, and sulphides TiS Ti_2S_3 are also known, along with salts of the three valence states.

Titanium is not classified as a hazardous substance by the EU. It is not classified as a hazardous good for transportationt in lumpy form, but it is considered so when presented as a powder or sponge:

- Ti powder, dry: UN Number 2546, Class 4.2.
- Ti wetted powder, with not less than 25% water: UN Number 1352, Class 4.1.
- Ti sponge (powder and granules), UN Number 2878, Class 4.1

Uses

- The aerospace industry is the largest user of titanium products thanks to its high strength-to-weight ratio and high temperature properties.
- Appliances in the chemical industry due to its high resistance to a large amount of acids for the manufacturing of pumps, valves, heat exchangers, etc.
- Applications in the metal refining industry in heat exchangers, coatings, jigs, etc.
- Medical appliances in prostheses, pacemakers and implants due to its biocompatibility, with the most notable recent use being the manufacturing of artificial hearts, whereby the first implant in a human body took place in 2001.

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