

Copper - Cu

Chemical properties of copper - Health effects of copper - Environmental effects of copper

Atomic number	29
Atomic mass	63.546 g.mol ⁻¹
Electronegativity according to Pauling	1.9
Density	8.9 g.cm ⁻³ at 20°C
Melting point	1083 °C
Boiling point	2595 °C
Vanderwaals radius	0.128 nm
Ionic radius	0.096 nm (+1) ; 0.069 nm (+3)
Isotopes	6
Electronic shell	[Ar] 3d ¹⁰ 4s ¹
Energy of first ionisation	743.5 kJ.mol ⁻¹
Energy of second ionisation	1946 kJ.mol ⁻¹
Standard potential	+ 0.522 V (Cu ⁺ / Cu) ; + 0.345 V (Cu ²⁺ / Cu)
Discovered by	The ancients



Copper

Copper is a reddish metal with a face-centered cubic crystalline structure. It reflects red and orange light and absorbs other frequencies in the visible spectrum, due to its band structure, so it has a nice reddish color. It is malleable, ductile, and an extremely good conductor of both heat and electricity. It is softer than zinc and can be polished to a bright finish. It is found in group Ib of the periodic table, together with silver and gold. Copper has low chemical reactivity. In moist air it slowly forms a greenish surface film called patina; this coating protects the metal from further attack.

Applications

Most copper is used for electrical equipment (60%); construction, such as roofing and plumbing (20%); industrial machinery, such as heat exchangers (15%) and alloys (5%). The main long established copper alloys are bronze, brass (a copper-zinc alloy), copper-tin-zinc, which was strong enough to make guns and cannons, and was known as gun metal, copper and nickel, known as cupronickel, which was the preferred metal for low-denomination coins.

Copper is ideal for electrical wiring because it is easily worked, can be drawn into fine wire and has a high electrical conductivity.

Copper in the environment

Copper is a very common substance that occurs naturally in the environment and spreads through the environment through natural phenomena. Humans widely use copper. For instance it is applied in the industries and in agriculture. The production of copper has lifted over the last decades. Due to this, copper quantities in the environment have increased.

The world's copper production is still rising. This basically means that more and more copper ends up in the environment. Rivers are depositing sludge on their banks that is contaminated with copper, due to the disposal of copper-containing wastewater. Copper enters the air, mainly through release during the combustion of fossil fuels. Copper in air will remain there for an eminent period of time, before it settles when it starts to rain. It will then end up mainly in soils. As a result soils may also contain large quantities of copper after copper from the air has settled.

Copper can be released into the environment by both natural sources and human activities. Examples of natural sources are wind-blown dust, decaying vegetation, forest fires and sea spray. A few examples of human activities that contribute to copper release have already been named. Other examples are mining, metal production, wood production and phosphate fertilizer production.

Because copper is released both naturally and through human activity it is very widespread in the environment. Copper is often found near mines, industrial settings, landfills and waste disposals.

Most copper compounds will settle and be bound to either water sediment or soil particles. Soluble copper compounds form the largest threat to human health. Usually water-soluble copper compounds occur in the environment after release through application in agriculture.

World production of copper amounts to 12 million tons a year and exploitable reserves are around 300 million tons, which are expected to last for only another 25 years. About 2 million tons a year are reclaimed by recycling. Today copper is mined as major deposits in Chile, Indonesia, USA, Australia and Canada, which together account for around 80% of the world's copper. The main ore is a yellow copper-iron sulfide called chalcopyrite (CuFeS₂).

Health effects of copper

Routes of exposition

Copper can be found in many kinds of food, in drinking water and in air. Because of that we absorb eminent quantities of copper each day by eating, drinking and breathing. The absorption of copper is necessary, because copper is a trace element that is essential for human health. Although humans can handle proportionally large concentrations of copper, too