

Thallium - Tl

Chemical properties of thallium - Health effects of thallium - Environmental effects of thallium

Atomic number	81
Atomic mass	204.383 g.mol ⁻¹
Electronegativity according to Pauling	1.8
Density	11.71 g.cm ⁻³ at 20°C
Melting point	304 °C
Boiling point	1473 °C
Vanderwaals radius	0.182 nm
Ionic radius	0.099 nm
Isotopes	11
Electronic shell	[Xe] 4f ¹⁴ 5d ¹⁰ 6s ² 6p ¹
Energy of first ionisation	589.1 kJ.mol ⁻¹
Energy of second ionisation	1970.5 kJ.mol ⁻¹
Energy of third ionisation	2877.4 kJ.mol ⁻¹
Discovered by	Sir William Crookes in 1861



Thallium

When freshly exposed to air, thallium exhibits a metallic lustre, but soon develops a blueish-grey tinge, resembling lead in appearance. A heavy oxide builds up on thallium if left in air, and in the presence of water the hydroxide is formed. The metal is very soft and malleable. It can be cut with a knife.

Applications

Thallium is used for making low-melting point special glass for highly reflective lenses. Thallium salts are used as reagents in chemical research. Thallium sulphate is still sold in developing countries where it is still permitted as a pesticide, although banned in Western countries. Since its electrical conductivity changes with exposure to infrared light, it is used in photocells. It is used for sink-float separation of minerals. Thallium amalgam is used in thermometers for low temperature, because it freezes at -58 °C (pure mercury freezes at -38 °C).

Thallium in the environment

Thallium is not a rare element; it is 10 times more abundant than silver. The element is widely dispersed, mainly in potassium minerals such as sylvite and pollucite. Thallium minerals are rare, but a few are known, such as crookesite and lorandite. World production of thallium compound is around 30 tonnes per year. There has been no assessment of how great the reserves are.

Thallium is partially water-soluble and consequentially it can spread with groundwater when soils contain large amounts of the component. Thallium can also spread by adsorption on sludge. There are indications that thallium is fairly mobile within soils.

Health effects of thallium

The element and its compounds are toxic and should be handled carefully.

Thallium occurs in the environment naturally in small amounts. It is not applied very widely by humans, merely as rat poison and as a substance in electro-technical and chemical industries. These applications can cause human exposure to thallium substances.

The human body absorbs thallium very effectively, especially through the skin, the breathing organs and the digestive tract.

Thallium poisoning is mainly caused by accidental uptake of rat poison, which contains large amounts of thallium sulphate. Consequently, stomachaches will appear and the nervous system will be damaged. In some cases the damage is so irreversible that death will soon follow. When a human survives thallium poisoning often consequences of disturbances of the nervous system, such as trembling, paralyses and behavioural changes will remain. With unborn children thallium poisoning can cause congenital disorders.

Due to accumulation of thallium in the bodies of humans, chronic effects consist, such as tiredness, headaches, depressions, lack of appetite, leg pains, hair loss and disturbances of the sight.

Further effects that can be related to thallium poisoning are nerve pains and joint pains. These are consequences of thallium uptake through food.

Effects of thallium on the Environment

There has been no significant contamination of the environment by thallium from industry, unlike that caused by its neighbors in the periodic table, mercury and lead.