Manganese - Mn

Chemical properties of manganese - Health effects of manganese - Environmental effects of manganese

Atomic number	25
Atomic mass	54.9380 g.mol $^{-1}$
Electronegativity according to Pauling	1.5
Density	7.43 g.cm^{-3} at 20°C
Melting point	1247 °C
Boiling point	2061 °C
Vanderwaals radius	0.126 nm
Ionic radius	0.08 nm (+2) ; 0.046 nm (+7)
Isotopes	7
Electronic shell	[Ar] 3d^5 4s^2
Energy of first ionisation	716 kJ.mol $^{-1}$
Energy of second ionisation	1489 kJ.mol $^{-1}$
Standard potential	- 1.05 V (Mn^{2+}/ Mn)
Discovered	Johann Gahn in 1774

Manganese

Manganese is a pinkinsh-gray, chemically active element. It is a hard metal and is very brittle. It is hard to melt, but easily oxidized. Manganese is reactive when pure, and as a powder it will burn in oxygen, it reacts with water (it rusts like iron) and dissolves in dilute acids.

Applications

Manganese is essential to iron and steel production. At present steel making accounts 85% to 90% of the total demand, most of the total demand. Manganese is a key component of low-cost stainless steel formulations and certain widely used alumimum alloys. Manganese dioxide is also used as a catalyst. Manganese is used to decolorize glass and make violet coloured glass. Potassium permanganate is a potent oxidizer and used as a disinfectant. Other compound that find application are Manganese oxide (MnO) and manganese carbonate ($MnCO_3$): the first goes into fertilizers and ceramics, the second is the starting material for making other manganese compounds.

Manganese in the environment

Manganese is one of the most abundant metals in soils, where it occurs as oxides and hydroxides, and it cycles through its various oxidation states. Manganese occurs principally as pyrolusite (MnO_2), and to a lesser extent as rhodochrosite ($MnCO_3$). More than 25 million tonnes are mined every year, representing 5 million tons of the metal, and reserves are estimated to exeed 3 billion tonnes of the metal. The main mining areas for manganese ores are South Africa, Russia, Ukraine, Georgia, Gabon and Australia.
Manganese is an essential element for all species. Some organisms, such as diatoms, molluscs and sponges, accumulate manganese. Fish can have up to 5 ppm and mammals up to 3 ppm in their tissue, although normally they have around 1 ppm.

Health effects of manganese

Manganese is a very common compound that can be found everywhere on earth. Manganese is one out of three toxic essential trace elements, which means that it is not only necessary for humans to survive, but it is also toxic when too high concentrations are present in a human body. When people do not live up to the recommended daily allowances their health will decrease. But when the uptake is too high health problems will also occur.

The uptake of manganese by humans mainly takes place through food, such as spinach, tea and herbs. The foodstuffs that contain the highest concentrations are grains and rice, soya beans, eggs, nuts, olive oil, green beans and oysters. After absorption in the human body manganese will be transported through the blood to the liver, the kidneys, the pancreas and the endocrine glands.

Manganese effects occur mainly in the respiratory tract and in the brains. Symptoms of manganese poisoning are hallucinations, forgetfulness and nerve damage. Manganese can also cause Parkinson, lung embolism and bronchitis. When men are exposed to manganese for a longer period of time they may become impotent.
A syndrome that is caused by manganese has symptoms such as schizophrenia, dullness, weak muscles, headaches and insomnia.

Because manganese is an essential element for human health shortages of manganese can also cause health effects. These are the following effects:

- Fatness
- Glucose intolerance
- Blood clotting
- Skin problems
- Lowered cholesterol levels