

General Information

Discovery

Tin was known to ancient civilisations. Alloyed with copper, it forms bronze—which gave its name to the Bronze Age.

Appearance

Tin is a silvery-white metal. It is soft, pliable and has a highly crystalline structure.

Source

Tin is found mainly in the ore cassiterite, which is found in Malaya, Bolivia, Indonesia, Thailand and Nigeria. It is obtained commercially by reducing the ore with coal in a reverberatory furnace.

Uses

Tin has many uses. It takes a high polish and is used to coat other metals to prevent corrosion, such as in tin cans which are made of tin-coated steel. Alloys of tin are important, such as soft solder, pewter, bronze and phosphor bronze. The most important tin salt used is tin(II) chloride which is used as a reducing agent and as a mordant. Tin salts sprayed onto glass are used to produce electrically conductive coatings. Most window glass is made by floating molten glass on molten tin to produce a flat surface. Recently, a tin-niobium alloy that is superconductive at very low temperatures has attracted interest.

Biological Role

Tin is non-toxic. Trialkyl and triaryl tin compounds are used as biocides and must be handled with care.

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Tin is unreactive to water and oxygen, as it is protected by an oxide film. It reacts with acids and bases. When heated in air, tin forms tin(IV) oxide which is feebly acidic.

When a tin bar is broken, a “tin cry” is heard due to the breaking of the tin crystals.

Tin has two allotropic forms. On warming, grey tin, with a cubic structure, changes into white tin, the ordinary form of the metal.

Physical Information

Atomic Number	50
Relative Atomic Mass ($^{12}\text{C}=12.000$)	118.71
Melting Point/K	505
Boiling Point/K	2543
Density/kg m ⁻³	7310 (293K)
Ground State Electron Configuration	[Kr]4d ¹⁰ 5s ² 5p ²
Electron Affinity (M-M ⁻)/kJ mol ⁻¹	-121

Key Isotopes

Nuclide	¹¹² Sn	¹¹³ Sn	¹¹⁴ Sn	¹¹⁵ Sn	¹¹⁶ Sn	¹¹⁷ Sn
Atomic mass	111.91		113.9	114.9	115.9	116.9
Natural abundance	1%	0%	0.7%	0.4%	14.7%	7.7%
Half-life	stable	115 days	stable	stable	stable	stable
Nuclide	¹¹⁸ Sn	¹¹⁹ Sn	¹²⁰ Sn	¹²¹ Sn	¹²² Sn	¹²⁴ Sn
Atomic mass	117.9	118.9	119.9		121.9	123.9
Natural abundance	24.3%	8.6%	32.4%	0%	4.6%	5.6%
Half-life	stable	stable	stable	27.5 h	stable	stable

Ionisation Energies/kJ mol⁻¹

M - M ⁺	708.6
M ⁺ - M ²⁺	1411.8
M ²⁺ - M ³⁺	2943
M ³⁺ - M ⁴⁺	3930.2
M ⁴⁺ - M ⁵⁺	6974
M ⁵⁺ - M ⁶⁺	9900
M ⁶⁺ - M ⁷⁺	12200
M ⁷⁺ - M ⁸⁺	14600
M ⁸⁺ - M ⁹⁺	17000
M ⁹⁺ - M ¹⁰⁺	20600

Other Information

Enthalpy of Fusion/kJ mol ⁻¹	7.2
Enthalpy of Vaporisation/kJ mol ⁻¹	296.2

Oxidation States

Sn⁺², Sn⁺⁴

Covalent Bonds/kJ mol⁻¹

Sn - H	314
Sn - C	225
Sn ⁺² - O	557
Sn ⁺⁴ - F	322
Sn ⁺⁴ - Cl	315
Sn - Sn	195