

Silver

Ag

General Information

Discovery

Silver was known to ancient civilisations, and evidence indicates that man learned to separate silver from lead in 3000 B.C.

Appearance

Silver has a brilliant white metallic lustre, with a characteristic sheen.

Source

Silver occurs native in ores such as argentite and horn silver, but the principal sources are lead, lead-zinc, copper, gold and copper-nickel ores. Canada and the USA are the main silver producers in the Western hemisphere. The metal is either recovered from the ore, or during the electrolytic refining of copper.

Uses

Sterling silver contains 92.5% silver, the remainder being copper or some other metal, and is used for jewellery and silverware where appearance is important. About 30% of silver produced is used in the photographic industry, mostly as silver (I) nitrate. Silver is used in dental alloys, solder and brazing alloys, electrical contacts and batteries. Silver paints are used for making printed circuits. The metal is used to make mirrors, as it is the best reflector of visible light known, although it does tarnish with time.

Biological Role

Silver has no known biological role, although it is a suspected carcinogen. Silver compounds can be absorbed in the circulatory system and reduced silver deposited in various organs. This results in greyish pigmentation of the skin and mucous membranes, known as argyria. Silver has germicidal effects - it can kill lower organisms quite effectively.

General Information

Silver is stable to water and oxygen but is attacked by sulphur compounds in air to form a black sulphide layer. It dissolves in sulphuric and nitric acids. It is a little harder than gold and is extremely ductile and malleable. Pure silver has the highest electrical and thermal conductivity of all metals, and has the lowest contact resistance.

Physical Information

Atomic Number	47
Relative Atomic Mass (¹² C=12.000)	107.87
Melting Point/K	1235.08
Boiling Point/K	2485
Density/kg m ⁻³	10500 (293K)
Ground State Electron Configuration	[Kr]4d ¹⁰ 5s ¹
Electron Affinity (M-M ⁻)/kJ mol ⁻¹	125.7

Key Isotopes

Nuclide	¹⁰⁷ Ag	¹⁰⁹ Ag	¹¹¹ Ag
Atomic mass	106.911	108.90	
Natural abundance	51.83%	48.17%	0%
Half-life	stable	stable	7.5 days

Ionisation Energies/kJ mol⁻¹

M - M ⁺	731
M ⁺ - M ²⁺	2073
M ²⁺ - M ³⁺	3361
M ³⁺ - M ⁴⁺	5000
M ⁴⁺ - M ⁵⁺	6700
M ⁵⁺ - M ⁶⁺	8600
M ⁶⁺ - M ⁷⁺	11200
M ⁷⁺ - M ⁸⁺	13400
M ⁸⁺ - M ⁹⁺	15600
M ⁹⁺ - M ¹⁰⁺	18000

Other Information

Enthalpy of Fusion/kJ mol ⁻¹	11.3
Enthalpy of Vaporisation/kJ mol ⁻¹	257.7

Oxidation States

Main	Ag ^I
Others	Ag ⁰ , Ag ^{II} , Ag ^{III}

Covalent Bonds/kJ mol⁻¹

Not applicable