

Aluminium

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General Information

Discovery

Aluminium was first prepared in an impure form by Hans Christian Oersted in Copenhagen in 1825, and isolated as an element in 1827 by Wöhler.

Appearance

Aluminium is a hard and strong, silvery-white metal. An oxide film prevents it from reacting with air and water.

Source

Aluminium is not found free in nature, but is the most abundant metal in the Earth's crust (8.1%) in the form of minerals such as bauxite and cryolite. Most commercially produced aluminium is obtained by the Bayer process of refining bauxite. In this process the bauxite is refined to pure aluminium oxide, which is mixed with cryolite and then electrolytically reduced to pure aluminium.

Uses

Aluminium is used in an enormous variety of products, due to its particular properties. It has low density, is non-toxic, has a high thermal conductivity, has excellent corrosion resistance, and can be easily cast, machined and formed. It is also non-magnetic and non-sparking. It is the second most malleable metal and the sixth most ductile. It is therefore extensively used for kitchen utensils, outside building decoration, and in any area where a strong, light, easily constructed material is needed.

The electrical conductivity of aluminium is about 60% that of copper per unit area of cross-section, but it is nevertheless used in electrical transmission lines because of its low density. Alloys of aluminium with copper, manganese, magnesium and silicon are of vital importance in the construction of aeroplanes and rockets.

Aluminium, when evaporated in a vacuum, forms a highly reflective coating for both light and heat which does not deteriorate as does a silver coating. These aluminium coatings are used for telescope mirrors, in decorative paper, packages and toys, and have many other uses.

Biological Role

Aluminium has no known biological role. It can be accumulated in the body from daily intake, and at one time was suggested as a potential causative factor in Alzheimer's disease (senile dementia).

General Information

The ancient Greeks and Romans used alum (potassium aluminium sulfate) in medicine as an astringent, and in dyeing as a mordant. Sir Humphry Davy proposed the name aluminum for the element, which was undiscovered at the time, and later agreed to change it to aluminium.

Aluminium oxide, alumina, occurs naturally as corundum and emery, and is used in glass-making and refractories. The precious stones ruby and sapphire contain aluminium with very small amounts of specific impurities.

Physical Information

Atomic Number	13
Relative Atomic Mass ($^{12}\text{C}=12.000$)	26.982
Melting Point/K	933
Boiling Point/K	2740
Density/kg m ⁻³	2698 (293K)
Ground State Electron Configuration	[Ne]3s ² 3p ¹
Electron Affinity (M-M ⁻)/kJ mol ⁻¹	-44

Key Isotopes

Nuclide	²⁶ Al	²⁷ Al
Atomic mass	25.986	26.982
Natural abundance	0%	100%
Half-life	7.4x10 ⁵ yrs	stable

Ionisation Energies/kJ mol⁻¹

M - M ⁺	577.4
M ⁺ - M ²⁺	1816.6
M ²⁺ - M ³⁺	2744.6
M ³⁺ - M ⁴⁺	11575
M ⁴⁺ - M ⁵⁺	14839
M ⁵⁺ - M ⁶⁺	18376
M ⁶⁺ - M ⁷⁺	23293
M ⁷⁺ - M ⁸⁺	27457
M ⁸⁺ - M ⁹⁺	31857
M ⁹⁺ - M ¹⁰⁺	38459

Other Information

Enthalpy of Fusion/kJ mol ⁻¹	10.67
Enthalpy of Vaporisation/kJ mol ⁻¹	290.8
Oxidation States	
Main	Al ⁺³
Others	Al ⁰ , Al ⁺¹
Covalent Bonds/kJ mol⁻¹	
Al - H	285
Al - C	225
Al - O	585
Al - F	665
Al - Cl	498
Al - Al	200