

Chromium

Cr

General Information

Discovery

Chromium was discovered in 1780 by N.E. Vanquelin in Paris.

Appearance

Chromium is a blue-white, hard metal, capable of taking a high polish.

Source

Chromium is found principally in the ore chromite, which is found in many places including the former USSR, Turkey, Iran, Finland and the Philippines. Chromium metal is usually produced commercially by reduction of chromium(III) oxide by aluminium, or by electrolysis of chrome alum.

Uses

Chromium is used to harden steel, to manufacture stainless steel and to produce several alloys. It is also used in plating as it prevents corrosion and gives a high-lustre finish. It is also used as a catalyst.

Chromium compounds are valued as pigments for their vivid green, yellow, red and orange colours. The ruby takes its colour from chromium, and chromium added to glass imparts an emerald green colour.

Biological Role

Chromium is an essential trace element, but is carcinogenic in excess. Chromium compounds are toxic.

Physical Information

Atomic Number	24
Relative Atomic Mass ($^{12}\text{C}=12.000$)	51.996
Melting Point/K	2130
Boiling Point/K	2945
Density/kg m ⁻³	7190 (293K)
Ground State Electron Configuration	[Ar]3d ⁵ 4s ¹
Electron Affinity (M-M ⁻)/kJ mol ⁻¹	-94

Key Isotopes

Nuclide	⁵⁰ Cr	⁵¹ Cr	⁵² Cr	⁵³ Cr	⁵⁴ Cr
Atomic mass	49.946	50.945	51.941	52.941	53.939
Natural abundance	4.359%	0%	83.79%	9.50%	2.36%
Half-life	stable	27.8 days	stable	stable	stable

Ionisation Energies/kJ mol⁻¹

M - M ⁺	652.7
M ⁺ - M ²⁺	1592
M ²⁺ - M ³⁺	2987
M ³⁺ - M ⁴⁺	4740
M ⁴⁺ - M ⁵⁺	6690
M ⁵⁺ - M ⁶⁺	8738
M ⁶⁺ - M ⁷⁺	15550
M ⁷⁺ - M ⁸⁺	17830
M ⁸⁺ - M ⁹⁺	20220
M ⁹⁺ - M ¹⁰⁺	23580

Other Information

Enthalpy of Fusion/kJ mol ⁻¹	15.3
Enthalpy of Vaporisation/kJ mol ⁻¹	341.8

Oxidation States

Main	Cr ⁺³
Others	Cr ⁻² , Cr ⁻¹ , Cr ⁰ , Cr ⁺¹ , Cr ⁺² , Cr ⁺⁴ , Cr ⁺⁵ , Cr ⁺⁶