

Gadolinium

Gd

General Information

Discovery

Gadolinium was discovered by J.-C. Galissard de Marignac in 1880 in Geneva, Switzerland. Lecoq de Boisbaudran isolated the element in 1886.

Appearance

Gadolinium is a silvery-white metal with a lustrous sheen.

Source

In common with other lanthanides, gadolinium is found principally in the minerals monazite and bastnaesite, from which it can be commercially prepared by ion exchange and solvent extraction. It is also prepared by reduction of the anhydrous fluoride with calcium metal.

Uses

Gadolinium has useful properties in alloys. As little as 1% gadolinium has been found to improve the workability and resistance of iron and chromium alloys to high temperatures and oxidation. Its compounds are useful in magnetic resonance imaging (MRI), particularly in diagnosing cancerous tumours.

Biological Role

Gadolinium has no known biological role, and has low toxicity.

General Information

Gadolinium reacts slowly with oxygen and water, and reacts with acids. It is relatively stable in dry air but tarnishes in moist air.

Physical Information

Atomic Number	64
Relative Atomic Mass ($^{12}\text{C}=12.000$)	157.25
Melting Point/K	1586
Boiling Point/K	3539
Density/kg m ⁻³	7900 (298K)
Ground State Electron Configuration	[Xe]4f ⁷ 5d ¹ 6s ²
Electron Affinity (M-M ⁻)/kJ mol ⁻¹	-50

Key Isotopes

Nuclide	¹⁵² Gd	¹⁵³ Gd	¹⁵⁴ Gd	¹⁵⁵ Gd	¹⁵⁶ Gd	¹⁵⁷ Gd
Atomic mass	151.9		153.9	154.9	155.9	156.9
Natural abundance	0.2%	0%	2.1%	14.8%	20.6%	15.6%
Half-life	1.1x10 ¹⁴ yrs	242 days	stable	stable	stable	stable
Nuclide	¹⁵⁸ Gd	¹⁶⁰ Gd				
Atomic mass	157.9	159.9				
Natural abundance	24.8%	21.9%				
Half-life	stable	stable				

Ionisation Energies/kJ mol⁻¹

M - M ⁺	592.5
M ⁺ - M ²⁺	1167
M ²⁺ - M ³⁺	1990
M ³⁺ - M ⁴⁺	4250
M ⁴⁺ - M ⁵⁺	
M ⁵⁺ - M ⁶⁺	
M ⁶⁺ - M ⁷⁺	
M ⁷⁺ - M ⁸⁺	
M ⁸⁺ - M ⁹⁺	
M ⁹⁺ - M ¹⁰⁺	

Other Information

Enthalpy of Fusion/kJ mol ⁻¹	15.5
Enthalpy of Vaporisation/kJ mol ⁻¹	301
Oxidation States	
Gd ⁺² , Gd ⁺³	