Gadolinium (Gd)

Element 64 — Complete Summary

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64
Gd
Gadolinium
157.25

Key Properties

Atomic Mass	157.25
Category	Lanthanides
State at 20°C	solid
Melting Point	1313°C
Boiling Point	3273°C
Density	7.9
Electron Config	[Xe] 4f75d16s2
Electronegativity	1.2
Year Discovered	1880
Discovered By	Jean Charles Galissard de Marignac

✨ Did You Know?

1. It has the highest ability to capture thermal neutrons of any known element, making it highly effective for use in shielding and control rods in nuclear reactors.
2. Gadolinium compounds are widely used as a contrast agent for MRI scans. When injected into the bloodstream, they enhance the visibility of tumors and tissues.
3. It is named after the Finnish chemist and geologist Johan Gadolin, who discovered the first rare earth element, yttrium.
4. It is one of the few elements that is ferromagnetic at or near room temperature (its Curie point is 20 °C or 68 °F).
5. Gadolinium can be used in alloys that form some of the most powerful magnets.

APPEARANCE
Gadolinium is a silvery-white, malleable, and ductile metal.

SUPERHERO PERSONA
"The Contrast, a hero with magnetic abilities who helps doctors see diseases more clearly in MRI scans."

EVERYDAY CONNECTION
Gadolinium is found in the contrast agent injected for an MRI scan.

POP CULTURE
Gadolinium has the highest neutron-capture ability of any element, making it useful for nuclear shielding.

Overview of Gadolinium

Gadolinium is a silvery-white, soft, and ductile lanthanide metal with atomic number 64. It tarnishes quickly in air and reacts with both water and oxygen. While not widely used in its pure metallic form, gadolinium compounds are vital in medical imaging, advanced alloys, and nuclear technology. The element is named after Finnish chemist Johan Gadolin, who studied rare earth minerals in the late 18th century.

Uses of Gadolinium

Gadolinium's unique magnetic and nuclear properties make it indispensable in modern science and medicine:

Medical imaging (MRI): Gadolinium-based contrast agents enhance the clarity of magnetic resonance imaging (MRI) scans, helping doctors detect tumors and abnormalities in organs and tissues.

Alloys and materials: Adding even 1% gadolinium improves the workability and corrosion resistance of iron and chromium alloys. It is also used in the manufacture of strong magnets, electronic components, and data storage devices.

Nuclear technology: Gadolinium has one of the highest neutron absorption cross-sections of any element, making it a key component of control rods in nuclear reactors.

Natural Occurrence and Production of Gadolinium

Gadolinium is never found in its pure state in nature. It occurs in minerals such as monazite and bastnaesite, often alongside other rare earth elements.

Extraction: Gadolinium is separated from other lanthanides through ion exchange and solvent extraction techniques.

Production: The pure metal can be obtained by reducing anhydrous gadolinium fluoride (GdF_3) with calcium metal.

History of Gadolinium

1880 – Discovery: French chemist Charles Galissard de Marignac in Geneva discovered gadolinium while studying rare earth mixtures, separating it from what was then called "didymium."

1886 – Naming and isolation: French chemist Paul-Émile Lecoq de Boisbaudran further purified the element and named it gadolinium after Johan Gadolin and the mineral gadolinite.

Biological Role of Gadolinium

Gadolinium has no known biological role. While generally considered to have low toxicity, some gadolinium-based compounds can pose risks if retained in the body, which has led to careful regulation of their medical use.