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. Named after Finnish chemist Johan Gadolin, Gadolinium is one of the very few elements honored with a scientist's name!
2. It's a 'rare earth' element, part of the Lanthanide series, but don't let the name fool you – it's actually moderately abundant in the Earth's crust, just tricky to extract!
3. Gadolinium is a superstar in medicine! It's primarily used as a contrast agent in Magnetic Resonance Imaging (MRI) scans, helping doctors visualize soft tissues, tumors, and blood vessels with incredible clarity.
4. Talk about a neutron sponge! Gadolinium has the highest known thermal neutron capture cross-section of any element, making it exceptionally good at absorbing neutrons.
5. Because of its neutron-gobbling superpower, Gadolinium is used in control rods for nuclear reactors to help regulate the nuclear fission process and keep energy production safe and steady.
6. Below 20°C (that's about 68°F), pure Gadolinium is ferromagnetic – meaning it acts like a strong magnet! Above that temperature, it becomes paramagnetic.
7. This element exhibits the magnetocaloric effect! It changes temperature when exposed to a magnetic field, making it a hot (or cool!) candidate for super-efficient, eco-friendly refrigeration technology.
8. Beyond MRI and nuclear power, Gadolinium also pops up in X-ray detectors, helping to make medical imaging even sharper and more precise.
9. While its compounds are vital for MRI, direct elemental Gadolinium is not something you want to mess with, and even contrast agents require careful use in patients with kidney issues.
10. It helps make DVDs and Blu-ray discs work! Certain Gadolinium compounds are used in magneto-optical recording, allowing lasers to read and write data.
11. Scientists are exploring Gadolinium for cutting-edge data storage, potentially leading to much denser and faster memory technologies in our future devices.

👁 APPEARANCE
A shiny, silvery-white metal that looks sleek and sophisticated.

🦸 SUPERHERO PERSONA
"The Invisible Seeker, Gadolinium helps doctors peek inside your body with powerful magnetic scans, and can even stop rogue neutrons in their tracks!"

🔗 EVERYDAY CONNECTION
That super-detailed image your doctor gets of your brain or knee? Gadolinium is often the secret ingredient making it crystal clear!

🎬 POP CULTURE
Like a super-spy gadget from a James Bond movie, revealing hidden truths and protecting from invisible threats.

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.