Beryllium (Be)

Element 4 — Complete Summary

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4
Be
Beryllium
9.012

Key Properties

Atomic Mass	9.012
Category	Alkaline Earth Metals
State at 20°C	solid
Melting Point	1287°C
Boiling Point	2468°C
Density	1.85
Electron Config	[He] 2s2
Electronegativity	1.57
Year Discovered	1798
Discovered By	Louis-Nicolas Vauquelin

✨ Did You Know?

1. It is a key component of emeralds and aquamarines, which are forms of the mineral beryl.
2. The metal is transparent to X-rays, making it useful for creating \
3. Despite its strength, inhaling beryllium dust can cause a chronic, life-threatening lung disease called berylliosis.
4. The James Webb Space Telescope's mirrors are made of beryllium plated with gold because it is both strong and lightweight, and holds its shape at cryogenic temperatures.
5. It was once known as 'glucinium' from the Greek word for 'sweet' because of the taste of its salts (which are actually very toxic).

APPEARANCE
A hard, lightweight, steel-gray metal.

SUPERHERO PERSONA
"The Emerald Shield an incredibly strong yet lightweight hero, transparent to energy rays."

EVERYDAY CONNECTION
The precious gemstone, emerald.

POP CULTURE
Used to create the strong, lightweight hulls of spaceships in 'The Expanse'.

Overview of Beryllium

Beryllium is a silvery-white, lightweight metal that combines low density with exceptional strength when alloyed. It is transparent to X-rays and has a very high melting point, properties that make it useful in aerospace, nuclear, and medical applications. Despite these advantages, beryllium and its compounds are highly toxic, requiring strict safety precautions.

Uses of Beryllium

Beryllium's value comes from its unique physical and chemical properties, especially in alloy form:

Alloys: Beryllium-copper and beryllium-nickel alloys combine strength, durability, and excellent conductivity. They are widely used in springs, electrical contacts, and non-sparking tools.

Aerospace: Lightweight yet strong, beryllium is used in high-speed aircraft, missiles, and spacecraft where weight reduction is critical.

X-ray technology: Thin beryllium foils are transparent to X-rays, making them useful as windows in X-ray tubes and detectors, as well as in lithography.

Nuclear reactors: Beryllium serves as a neutron reflector and moderator. Beryllium oxide, with its high melting point, is also used in ceramics for nuclear applications.

Natural Occurrence and Production of Beryllium

Beryllium occurs naturally in about 30 minerals. The most important sources are beryl (beryllium aluminum silicate) and bertrandite. Gemstones such as emerald and aquamarine are forms of beryl.

Industrial production of pure beryllium typically involves reducing beryllium fluoride (BeF_2) with magnesium metal.

History of Beryllium

1798 – Discovery: French mineralogist René-Just Haüy suspected a new element in the minerals beryl and emerald. Chemist Nicholas Louis Vauquelin confirmed the discovery and originally named it glaucinium, after the sweet taste of its salts. The name was later changed to beryllium.

1828 – Isolation: Both Friedrich Wöhler in Germany and Antoine Bussy in France independently isolated metallic beryllium by reacting beryllium chloride with potassium.

Biological Role of Beryllium

Beryllium has no known biological function in humans or animals. It is toxic and carcinogenic: inhaling beryllium dust or fumes can cause berylliosis, a severe and incurable lung disease. Strict industrial controls are necessary to protect workers handling beryllium.