

Erbium (Er) - Student Datasheet

Element 68 · Lanthanide · source-reviewed learning reference

Erbium is element 68, a lanthanide whose Er^{3+} optical transitions connect the periodic table to fiber-optic amplifiers, lasers, pink glass and specialized photonic materials.

Quick reference

Atomic number	68
Relative atomic mass	167.259
Electron configuration	[Xe] $4f^{12} 6s^2$
Period / group / block	6 / Lanthanide / f
State context	Soft silvery lanthanide metal
Density	9.07 g/cm ³
Melting / transition	1802 K
Boiling / gas reference	3141 K
Oxidation states	+3
Electronegativity	1.24

Structure & orbitals

Ordinary erbium metal is HCP. Pink Er_2O_3 and Er-doped glasses or fibers are separate compound/host materials and are not represented by this metal lattice.

The displayed $4f_{xyz}$ orbital is one representative real f cubic harmonic. It is not a picture of the whole 4f subshell or the electronic bands in the bulk material.

Phase behavior

At approximately standard pressure, erbium is treated as a solid below 1802 K, liquid between melting and approximately 3141 K, and gas above the boiling reference. The ordinary crystal label applies to the stated material reference; unmodeled solid allotropy is not fabricated.

Five things to remember

- Atomic number 68 means every erbium nucleus has 68 protons.
- Neutral Erbium has the ground-state configuration [Xe] $4f^{12} 6s^2$.
- The representative teaching isotope is ^{166}Er .
- The famous telecom role belongs to Er^{3+} ions doped into glass fibers, not to metallic erbium wires.
- The ordinary material reference is Hexagonal close-packed (HCP).

Erbium: Real World & Signature Science

Element-specific science, uses and history

Big idea

The famous telecom role belongs to Er^{3+} ions doped into glass fibers, not to metallic erbium wires. Er metal, Er_2O_3 and Er-doped silica are different materials with different structures and functions.

Why this element is scientifically distinctive

Explore Er across the teaching nucleus, isolated-atom orbitals, evidence-aware material structure and temperature/evidence views, then connect those models to uses, isotopes, search-led questions and source-backed context.

Fiber amplifiers	Er^{3+} -doped silica fibers can amplify light near the low-loss telecom window around 1.55 μm .
Lasers	Er-doped crystals and glasses support several useful laser transitions.
Colored glass	Er compounds can give glass and ceramics a characteristic pink color.
Alloys	Small erbium additions can modify selected alloy properties and workability.
Compound boundary	Er-doped fiber is a silica host containing Er ions; its behavior is not the same as elemental HCP erbium metal.

From source material to Erbium applications: high-level material path

1. Erbium is obtained from mineral or metallurgical feedstocks in which it is chemically associated with other elements rather than mined as abundant native metal.
2. Industrial separation and refining produce element-specific compounds or metal feedstock; this guide does not provide operational extraction recipes.
3. The refined material is converted into the particular alloy, compound, doped host or component required by the application.
4. Recycling and recovery depend on the host product, concentration and economics; application materials must not be confused with pure element.

History checkpoints

1843	Carl Gustaf Mosander separated an erbium-containing oxide while studying yttria-derived rare-earth fractions.
19th century	Historical naming of erbia/terbia shifted as rare-earth separations were corrected.
20th century	High-purity Er compounds enabled optical spectroscopy and laser development.
Modern telecom era	Erbium-doped fiber amplifiers became central to long-distance optical communications.

Use contexts

- ['Fiber-optic amplifiers', ' Er^{3+} in silica can amplify optical signals around telecommunications wavelengths.']
- ['Lasers', 'Er-doped crystals and glasses are used in specialized laser systems.']
- ['Glass & ceramics', 'Er compounds provide pink coloration and optical absorption features.']
- ['Metallurgy', 'Er additions are used in selected alloy and materials research contexts.']

Erbium: Isotopes, Questions & Evidence

Evidence status and learner self-check

Isotope context

¹⁶⁶ Er	Most abundant natural isotope	Reference teaching isotope for this page.
Natural erbium	Multiple-isotope element	Several naturally occurring isotopes contribute to the atomic weight.
Radioisotopes	Artificial isotopes	Used mainly in research and isotope-specific applications.

Common questions

What is erbium?

Erbium is chemical element 68, symbol Er, a soft silvery lanthanide metal.

What is erbium used for?

Major uses include erbium-doped fiber amplifiers, lasers and colored/optical glasses.

Where is erbium found?

It occurs mixed with other rare earths in minerals such as monazite and bastnäsite and is separated during rare-earth processing.

Who discovered erbium?

Carl Gustaf Mosander identified erbium in 1843 during rare-earth separation work.

Is erbium a metal?

Yes. It is a lanthanide metal.

Why is erbium used in fiber optics?

Er³⁺ ions have optical transitions near 1.55 μm, a key low-loss telecommunications window in silica fiber.

Evidence & safety

Atomic identity and reference values are source-reviewed. Material viewers are teaching representations, not crystallographic refinements. Search demand shapes headings and FAQs but never overrides measured/evaluated evidence or element-versus-compound distinctions.

This page is educational. Chemical, occupational, radiological or medical safety decisions require the specific material/isotope, its current safety data and qualified guidance.

Core sources

Royal Society of Chemistry - Erbium - <https://periodic-table.rsc.org/element/68/erbium>

NIST - Atomic Weights and Isotopic Compositions - https://physics.nist.gov/cgi-bin/Compositions/stand_alone.pl

IUPAC - Periodic Table of Elements - <https://iupac.org/what-we-do/periodic-table-of-elements/>