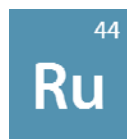


Stable isotopes of ruthenium available from ISOFLEX

Isotope	Z(p)	N(n)	Atomic Mass	Natural Abundance	Enrichment Level	Chemical Form
Ru-99	44	55	98.905939	12.7%	>96.00%	Metal
Ru-100	44	56	99.904219	12.6%	>97.00%	Metal
Ru-101	44	57	100.905581	17.0%	>98.00%	Metal
Ru-102	44	58	101.904349	31.6%	>98.00%	Metal
Ru-104	44	60	103.905429	18.7%	≥99.50	Metal



Ruthenium was discovered in 1844 by Karl Karlovich Klaus. It takes its name from the Latin name *Ruthenia*, meaning "Russia."

Ruthenium is a hard, silvery-white solid with a hexagonal close-packed crystal structure. It is insoluble in water, acids and *aqua regia*, and it is attacked by alkaline oxidants and by fused alkalis. When heated in air to 500-700 °C, ruthenium converts to its dioxide, a black crystalline solid of rutile structure. A trioxide of ruthenium is also known and is formed when the metal is heated above 1000 °C. Above 1100 °C the metal loses weight because the trioxide partially volatilizes.

Halogens react with ruthenium metal at elevated temperatures. The metal is attacked by chlorine water, bromine water or alcoholic solution of iodine at ambient temperatures. When finely divided metal is heated with carbon monoxide under 200 atm pressure, it converts to pentacarbonyl, a colorless liquid that decomposes to diruthenium nonacarbonyl, a yellow crystalline solid. Ruthenium reacts with cyclopentadiene in ether to form a sandwich complex, a yellow crystalline compound, *bis(cyclopentadiene) ruthenium(0)*, also known as *ruthenocene*.

Ruthenium alloyed to platinum, palladium, titanium or molybdenum has many applications. Because ruthenium is an effective hardening element for platinum and palladium, such alloys have high resistance to corrosion and oxidation and are used to make electrical contacts for resistance to severe wear. Ruthenium-palladium alloys are used in jewelry, decorations and dental work. The addition of 0.1% ruthenium markedly improves the corrosion resistance of titanium. Ruthenium alloys also make tips for fountain pen nibs, instrument pivots and electrical goods.

Properties of Ruthenium

Name	Ruthenium
Symbol	Ru
Atomic number	44
Atomic weight	101.07
Standard state	Solid at 298 °K
CAS Registry ID	7440-18-8
Group in periodic table	8
Group name	Precious metal or platinum group metal
Period in periodic table	5
Block in periodic table	d-block
Color	Silvery white metallic
Classification	Metallic
Melting point	2334 °C
Boiling point	3900 °C
Thermal conductivity	117.0 W/(m·K) at 298.2 °K
Electrical resistivity	7.1 $\mu\Omega\cdot\text{cm}$ at 0 °C
Electronegativity	2.2
Specific heat	0.24 kJ/kg K
Heat of vaporization	580 kJ·mol ⁻¹ at 3900 °C
Heat of fusion	25.7 kJ·mol ⁻¹
Density of liquid	10.65 g/cm ³ at 2334 °C
Density of solid	12.37 g/cm ³
Electron configuration	[Kr]4d ⁷ 5s ¹
Oxidation states	0, +1, +2, +3, +4, +5, +6, +7, +8
Most stable oxidation states	+2, +3, +4
Atomic radius	1.34 Å
Ionic radius	Ru ⁸⁺ : 0.36 Å (coordination number 8)