Zirconium

Zirconium is used in services too severe for stainless steels, nickel alloys, and titanium or where a significant improvement in service life can be achieved by choosing zirconium instead of less expensive metals or plastics. When zirconium is chosen for an application, the high cost and expected serviceability require the chemical composition, mechanical properties, and overall casting quality be precisely controlled.

Typical Applications of Zirconium

In nuclear reactors for fuel rod cladding
For the production of Zirconium-Uranium alloys
For reactor core structures because of its unique combination of properties
According to the Minerals Education Coalition, Zirconium is also used in steel alloys, colored glazes/enamels, bricks, ceramics, abrasives, flash bulbs, lamp filaments, artificial gems, and some deodorants
Zirconium-based alloys can also be found in tubes, lamp sockets, and heat exchangers
Other applications where zirconium can be used are, e.g., catalysts, furnace bricks, lab crucibles, surgical instruments, television glass, for removing residual gases from vacuum tubes, and as a hardening agent in alloys such as steel.
Zirconium carbonate is also used to treat poison ivy

Significant Characteristics and Applications

Good deformability and ductility
Good high-temperature strength
Resistant to corrosion caused by fast-circulating coolants
No formation of strong radioactive isotopes
Resistant to mechanical damage caused by neutron bombardments

Composition Zirconium grade 702 and 705

Element	702C %	705C %
Carbon	0.1 max.	0.1 max.
Hafnium	4.5 max.	4.5 max.
Hydrogen	0.005 max.	0.005 max.
Iron	0.3 max.	0.3 max.
Nitrogen	0.03 max.	0.03 max.
Oxygen	0.25 max.	0.3 max.
Phosphorous	0.01 max.	0.01 max.
Niobium	–	2.0 - 3.0
Other elements (total)	0.40 max.	0.40 max.
Zirconium	Balance	Balance

Mechanical and Physical Properties of Zirconium grade 702 and 705

	702C	705C
Yield Strength, psi (MPa)	40,000 (276)	50,000 (345)
Tensile Strength, psi (MPa)	55,000 (379)	70,000 (483)
Elongation, percent in 1 inch	12	12
Brinell Hardness, 3000 kg max.	210	235
Modulus of Elasticity, psi x 10^6	14.4 x 10^6	14.0 x 10^6
Coefficient of thermal expansion per °C (25°C)	5.89 x 10^{-6}	6.3 x 10^{-6}
Thermal conductivity Btu-ft/hr-ft^2-°F	13	10
Density, lb/in^3/(g/cc)	0.235 (6.51)	0.240 (6.64)
Melting point, °F (°C)	3365 (1852)	3344 (1840)