

## Titanium ${}_{22}\text{Ti}^{47.90}$

Titanium was discovered in 1791 by Rev. W. Gregor at Creed, Cornwall, England, and independently in 1795 by M.H. Klaproth at Berlin, Germany.

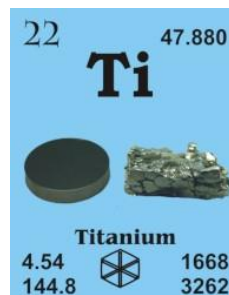
[Names after the Titans, the sons of the Earth goddess of Greek mythology]

French: titane

German: titan

Italian: titanio

Spanish: titanio



Atomic number	22
Density in g/cm <sup>3</sup>	4.54
Atomic radius in pm	176
Atomic weight	47.887
Melting point in °C	1668
Boiling point in °C	3287

**Description:** Titanium is a hard, lustrous, silvery metal which resists corrosion due to an oxide layer on its surface. However, the powdered metal will burn if ignited. Titanium is unaffected by many acids (except HF, H<sub>3</sub>PO<sub>4</sub> and concentrated H<sub>2</sub>SO<sub>4</sub>), and alkalis. White titanium dioxide is used in paints because of its covering power. The metal itself is used in chemical plants, lightweight alloys, hip replacement joints, etc.

### TITANIUM SINGLE CRYSTAL PROPERTIES

<b>State:</b>	single crystal grains with ~mm size
<b>Crystal structure:</b>	hexagonal
<b>Production method:</b>	Floating zone
<b>Standard size:</b>	diameter 8-10mm thickness 1-2mm
<b>Orientation:</b>	(10-10), (1-100) and (11-20)
<b>Orientation accuracy:</b>	<2°, <1°, <0.4° or <0.1°
<b>Polishing:</b>	as cut, one or two sides polished
<b>Roughness of surface:</b>	<0.03µm
<b>Purity:</b>	99.97%
	C 3
	H < 1
	O 9
	N < 5
	Cu 1.60
	Fe 1.80
	Ni < 1
	Pb 0.30
	Si 0.30
	Ga, Hf and Ta are below the detection limit
<b>Density:</b>	4.51 g/cm <sup>3</sup>

#### Typical analysis (ppm):



<b>Melting point:</b>	1659.85 °C / 1933 °K
<b>Boiling point:</b>	3286.85 °C / 3560 °K
<b>Molar volume:</b>	10.55 cm <sup>3</sup>
<b>Thermal conductivity:</b>	21.9 [300 K] Wm <sup>-1</sup> K <sup>-1</sup>
<b>Coefficient of linear thermal expansion:</b>	8.35 x 10 <sup>-6</sup> K <sup>-1</sup>
<b>Electrical resistivity:</b>	42.0x 10 <sup>-8</sup> [293 K] Wm
<b>Mass magnetic susceptibility:</b>	+4.01 x 10 <sup>-8</sup> (s) kg <sup>-1</sup> m <sup>3</sup>
<b>Young's modulus:</b>	120.2 GPa
<b>Rigidity modulus:</b>	45.6 GPa
<b>Bulk modulus:</b>	108.4 GPa
<b>Poisson's ratio:</b>	0.361
<b>Radii:</b>	Ti <sup>4+</sup> 69; Ti <sup>2+</sup> 80; atomic 145; covalent 132
<b>Electronegativity:</b>	1.54 (Pauling); 1.32 (Allred); 3.45 eV (absolute)
<b>Effective nuclear charge:</b>	3.15 (Slater); 4.82 (Clementi); 6.37 (Froese-Fischer)
<b>Number of Isotopes (incl. nuclear isomers):</b>	13
<b>Isotope mass range:</b>	41 -> 53
<b>Crystal structure, (cell dimensions / pm), space group</b>	hexagonal
<b>X-ray diffraction: mass absorption coefficients:</b>	CuK $\alpha$ 208 ( $\mu/r$ ) / cm <sup>2</sup> g <sup>-1</sup> MoK $\alpha$ 24.2 ( $\mu/r$ ) / cm <sup>2</sup> g <sup>-1</sup>
<b>Neutron scattering length:</b>	-0.3438 b/10 <sup>-12</sup> cm
<b>Thermal neutron capture cross-section:</b>	6.09 sa / barns

