

## Hafnium ${}_{72}\text{Hf}^{178.49}$

Discovered in 1923 by D. Coster and G.C. von Hevesey at Copenhagen, Denmark.

[Latin: Hafnia = Copenhagen]

French: hafnium

German: hafnium

Italian: afnio

Spanish: hafnio



Atomic number	72
Density in g/cm <sup>3</sup>	13.31
Atomic radius in pm	158
Atomic weight	178.49
Melting point in °C	2227
Boiling point in °C	5400

**Description:** Hafnium is a lustrous, silvery, ductile metal that resists corrosion due to an oxide film on its surface. However, powdered hafnium will burn in air. The metal is unaffected by acids (except HF) and alkalis. It is used in control rods for nuclear reactors, and in high temperature alloys and ceramics.

### HAFNIUM SINGLE CRYSTAL PROPERTIES

<b>State:</b>	Single crystal
<b>Crystal structure:</b>	hexagonal
<b>Production method:</b>	Floating zone
<b>Standard size:</b>	diameter 7–8mm thickness 1mm
<b>Orientation:</b>	(0001)
<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>	<0.03 μm
<b>Purity:</b>	99.99%
<b>Crystal structure:</b>	(cell dimensions/pm), space group a-Hf h.c.p. (a=319.46, c=505.10), P63/mmc b-Hf cubic (a=362) T(a → a)=2033 K
<b>X-ray diffractions mass absorption coefficients:</b>	CuKα 159 (μ/ρ) / cm <sup>2</sup> g <sup>-1</sup> MoKα 91.7 (μ/ρ) / cm <sup>2</sup> g <sup>-1</sup>
<b>Neutron scattering length:</b>	0.777 b/10 <sup>-12</sup> cm
<b>Thermal neutron capture cross-section:</b>	104 σ <sub>a</sub> / barns
<b>Density:</b>	13.1 kg/m <sup>-3</sup> [293 K]; 2390 [liquid at m.p.]
<b>Melting point:</b>	2229.85 °C / 2503 °K
<b>Boiling point:</b>	5196.85 °C / 5470 °K
<b>Molar volume:</b>	13.41 cm <sup>3</sup>
<b>Thermal conductivity:</b>	23.0 [300 K] Wm <sup>-1</sup> K <sup>-1</sup>
<b>Coefficient of linear thermal expansion:</b>	5.9 x 10 <sup>-6</sup> K <sup>-1</sup>
<b>Electrical resistivity:</b>	35.1 x 10 <sup>-8</sup> [293 K] Ωm

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<b>Mass magnetic susceptibility:</b>	+5.3 x 10 <sup>-9</sup> (s) kg <sup>-1</sup> m <sup>3</sup>
<b>Young's modulus:</b>	141 GPa
<b>Rigidity modulus:</b>	56 GPa
<b>Bulk modulus:</b>	109 GPa
<b>Poisson's ratio:</b>	0.26
<b>Radi:</b>	Hf3+ 84; atomic 156; covalent 144
<b>Electronegativity:</b>	1.3 (Pauling); 1.23 (Allred); 3.8 eV (absolute)
<b>Effective nuclear charge:</b>	3.15 (Slater); 9.16 (Clementi); 13.27 (Froese-Fischer)
<b>Number of Isotopes (incl. nuclear isomers):</b>	33
<b>Isotope mass range:</b>	158 -> 184

