

Tantalum

Tantalum is a grey metal with a melting point of approx. 3000 °C, Tantalum has the highest melting point of all elements after Tungsten and Rhenium. While pure Tantalum is ductile and highly malleable, even small amounts of Tungsten improve its mechanical strength dramatically. In the periodic system,

Tantalum (chemical symbol: Ta) is in the 5th group of elements with the atomic number 73. A thin, but very stable film of Tantalum pentoxide provides the passivation that makes tantalum's resistance to corrosion of comparable quality to that of noble metals. As a result of the passivation, Tantalum is resistant to most acids, and not even aqua regia will dissolve the metal. Tantalum is susceptible to corrosion only by hydrofluoric acid, acidic fluoride solutions and oleum (a mixture of sulphuric acid and sulphur trioxide). Due to the properties outlined above, Tantalum is an ideal substance for use in the construction of a broad spectrum of components used in the chemical and pharmaceutical industries. Furthermore, Tantalum is also used for the manufacture of medical instruments and implants, as it does not react with body tissue or bodily fluids. The electronics industry is another significant area of application.

ASTM Standard Specifications

ASTM B364 (and Ta-Ta-alloys – ingots, blocks)

ASTM B365 (and Ta-Ta-alloys – rods, wires)

ASTM B708 (Ta and Ta-alloys – sheet, strip)

ASTM B521 (Ta-Ta alloys and tubes, welded and seamless)

ASTM F560 (pure tantalum – Medical applications)

In the chemical and pharmaceutical industries today, however, the alloy with 2.5 % Tungsten is used most widely, as it allows tensile strength of up to 240 Mpa at 20 °C to be achieved. The material specification for this alloy is defined by the ASTM under the grade R05252.

Physical Properties

Symbol / Symbole			Ta
Ordnungszahl / Atomic number / Nombre atomique			73
Atommasse / Atomic mass / Masse atomique		g/mol	180.95
Schmelzpunkt / Melting point / Point de fusion		°C	2996
Siedepunkt / Boiling point / Point d'ébullition		°C	5458
Atomvolumen / Atomic volume / Volume atomique		m ³	1.80 · 10 ⁻²⁹
Dampfdruck Vapour pressure Pression de vapeur	bei / at / à 1800 °C (2073 K)	Pa	5 · 10 ⁻⁵
	bei / at / à 2500 °C (2773 K)		5 · 10 ⁻³
Dichte bei 20 °C / Density at 20 °C / Densité à 20 °C		g/cm ³	16.60
Kristallstruktur Lattice structure Structure cristalline			kubisch raumzentriert body-centred-cubic cubique corps centré
Gitterkonstante / Lattice constant / Paramètre de maille		m	330.3 · 10 ⁻¹²
Härte bei 20 °C Hardness at 20 °C Dureté à 20 °C	verformt/cold-worked/déformation	HV10	180 - 300
	rekristallisiert/recrystallized/recristallisé		80 - 100
E-Modul bei 20 °C / Young's modulus at 20 °C / Module de Young à 20 °C		GPa	186
Poisson'sche Zahl / Poisson's ratio / Ratio de Poisson			0.34
Linearer thermischer Ausdehnungskoeffizient bei 20 °C Linear coefficient of thermal expansion at 20 °C Coefficient linéaire d'expansion thermique à 20 °C		m/(m·K)	6.4 · 10 ⁻⁶
Wärmeleitfähigkeit bei 20 °C Thermal conductivity at 20 °C Conductivité thermique à 20 °C		W/(m·K)	54
Spezifische Wärme bei 20 °C Specific heat at 20 °C Chaleur spécifique à 20 °C		J/(g·K)	0.14
Elektrische Leitfähigkeit bei 20 °C Electrical conductivity at 20 °C Conductivité électrique à 20 °C		1/(Ω·m)	8 · 10 ⁻⁶
Spezifischer elektrischer Widerstand bei 20 °C Specific electrical resistance at 20 °C Résistance électrique spécifique à 20 °C		(Ω·mm ²)/m	0.13
Schallgeschwindigkeit bei 20 °C Acoustic velocity at 20 °C Vitesse du son à 20 °C	Longitudinalwelle / longitudinal wave / onde longitudinale	m/S	4100
	Transversalwelle / transverse wave / onde transversale		2900
Elektronenaustrittspotential Electron work function Potentiel d'émission électronique		eV	4.25
Einfangquerschnitt für thermische Neutronen Thermal neutron capture cross section Section efficace de capture de neutrons		m ²	2.13 · 10 ⁻²⁷
Rekristallisationstemperatur (Glühdauer 1 Stunde) Recrystallization temperature (1 hour at temp) Température de recristallisation (1 heure à température)		°C	900 - 1450
Supraleitfähigkeit (Übergangstemperatur) Superconductivity (transition temperature) Superconductivité (température de transition)		K	< 4.5