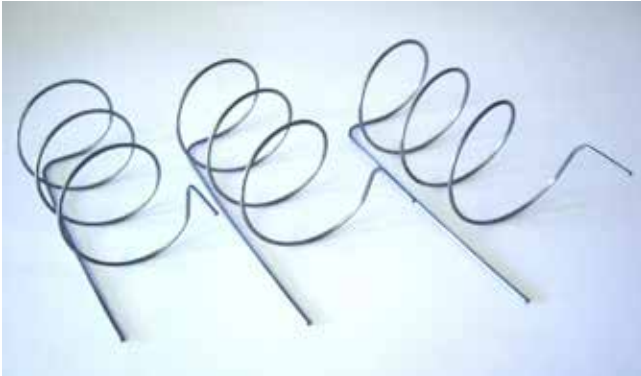


Data Sheet

Tungsten (W)



Significant Characteristics and Applications

- | Very high melting point and low vapor pressure
- | Very high density
- | Very high heat resistance
- | Good corrosion resistance in acids and liquid metals
- | Low thermal expansion
- | Very good shielding against X-ray and Gamma radiation
- | As from 500 °C rapid oxidization in atmosphere
- | Very brittle

Pure-Tungsten, W-alloys and W-composite materials are used for filaments in bulbs, filaments, X-ray tube anodes, electrical switching contacts, heating elements, shielding, electro-discharge electrodes (EDM), welding electrodes (TIG), friction-stir welding tools, thermocouples, tool holders, counterbalance weights and others.

Tungsten High Density Alloy (WSM)

WSM is a composite material with a very high percentage of Tungsten. Nickel-Iron is used as a composite metal, respectively for paramagnetic applications Nickel-Copper is used instead. Typical Applications of WSM: Shielding against X-ray and Gamma-radiation, balance and counterbalance weights (replacement of lead), ballistic projectiles, Aluminum and Magnesium pressure die-casting moulds, mould inserts and ejectors, extrusion pressing inserts, electrical contacts, electric resistance electrodes, tool holders, drilling rods and others. (For further details: WSM data sheet).

Tungsten-Copper (WCu)

WCu is a composite material made of Tungsten and various contents of Copper. This material type enables a combination of high wear and burn-off resistance with good electrical conductivity. Typical applications are: Electrical contacts, erodes electrodes, resistive welding electrodes. (Further details: WCu data sheet).

Range of Products

Strips, sheets, plates, wires, rods, tubes, sputtering targets, filaments, fabricated parts (screws, nuts and others), crucibles, high-temperature components, electrodes, contacts, fabricated components and assembling according to drawings.

Physical Properties

| | |
|----------------------------------|--|
| Element Symbol | W |
| Atomic Number | 74 |
| Atomic Mass | 183.85 |
| Valency | 2, 3, 4, 5 and 6 |
| Density (20 °C) | 19.3 g/cm ³ |
| Crystal Structure | body-centered cubic (bcc) |
| Melting Point | 3422 °C |
| Boiling Point | 5900 °C |
| Vapor Pressure | 1 · 10 ⁻⁸ hPa (~2100 °C) 1 · 10 ⁻⁵ hPa (~2600 °C) |
| Specific Electrical Resistivity | 0.055 · 10 ⁻⁶ Ω · m (20 °C) 0.326 · 10 ⁻⁶ Ω · m (1000 °C) 0.486 · 10 ⁻⁶ Ω · m (1500 °C) 0.671 · 10 ⁻⁶ Ω · m (2000 °C) |
| Coefficient of Thermal Expansion | 4.5 · 10 ⁻⁶ K ⁻¹ (20 °C) 4.6 · 10 ⁻⁶ K ⁻¹ (1000 °C) |
| Thermal Conductivity | 167 W/m · K ⁻¹ (20 °C) 111 W/m · K ⁻¹ (1000 °C) |

Mechanical Properties

| | |
|----------------------------------|---------------------|
| Hardness | 350 HV (min.) |
| E-Modulus | 407 GPa (20 °C) |
| G-Modulus | 166 GPa (20 °C) |
| Tensile Strength R _m | 900-4000 MPa (typ.) |
| Yield Strength R _{p0.2} | n/a |
| Elongation A | n/a |

Important Types and Alloys

W 99,95 % (powder metallurgical)
 WRe3, WRe5, WRe25, WRe26
 W-electrodes, doped:
 WT (ThO₂), WL (La₂O₃), WC (CeO₂), WZ (ZrO₂), WY (Y₂O₃),
 WMX (rare earth elements mixture)
 Tungsten Composite Materials:
 Tungsten High Density Alloy WSM (WNIfe, WNIcu)
 Tungsten-Copper WCu (typ. 10-50 % Cu)
 Tungsten-Silver WAg (typ. 15-70 % Ag)

ASTM Standard Specifications

ASTM B760 (Tungsten Plate, Sheet, and Foil)
 ASTM F288 (Tungsten Wire for Electron Devices and Lamps)
 ASTM F73 (Tungsten-Rhenium Alloy Wire for Electron Devices and Lamps)
 ASTM E696 (Tungsten-Rhenium Alloy Thermocouple Wire)
 ASTM F269 (Standard Test Method for Sag of Tungsten Wire)
 ASTM B702 (Copper-Tungsten Electrical Contact Material)
 ASTM B631 (Silver-Tungsten Electrical Contact Materials)
 ASTM B777 (Tungsten Base, High-Density Metal)
 DIN EN ISO 6848 (Arc Welding and Cutting – Non-consumable Tungsten Electrodes – Classification)