

Copper Tungsten

RWMA Resistance welding Tungsten Copper Electrode, CuW or WCu is a mixture of copper and tungsten. As copper and tungsten are not mutually soluble, The material is composed of distinct particles of one metal dispersed in a matrix of the other one. The microstructure is therefore rather a metal matrix composite instead of a true alloy.



The material combines the properties of both of the Metals, resulting in a material that is Heat-Resistant, Ablation-resistant, Highly Thermally and electrically conductive and easy to machine.

Parts are made from the CuW composite by pressing the tungsten particles into the desired shape, sintering the compacted part, then infiltrating with molten copper. Sheets, rods, and bars of the composite mixture are available as well.

Commonly used copper tungsten mixtures contain 10–50 wt.% of copper and the remaining portion being mostly tungsten. The typical properties are dependent on its composition. The mixture with less wt.% of copper has higher density, higher hardness, and higher resistivity. The typical density of CuW90, with 10% of copper, is 16.75 g/cm³ and 11.85 g/cm³ for CuW50 . CuW90 has higher hardness and resistivity of 260 HB kgf/mm² and 6.5 μΩ.cm than CuW50.

Typical Properties Of Commonly Used Copper Tungsten Composition

Composition	Density	Hardness	Resistivity	IACS	Bending Strength
wt. %	g/cm ³ ≥	HB Kgf/mm ² ≥	μΩ.cm≤	%≥	Mpa≥
W50/Cu50	11.85	115	3.2	54	–
W55/Cu45	12.30	125	3.5	49	–
W60/Cu40	12.75	140	3.7	47	–
W65/Cu35	13.30	155	3.9	44	–
W70/Cu30	13.80	175	4.1	42	790
W75/Cu25	14.50	195	4.5	38	885
W80/Cu20	15.15	220	5.0	34	980
W85/Cu15	15.90	240	5.7	30	1080
W90/Cu10	16.75	260	6.5	27	1160

Application

- Heat sinks as passive cooling elements of electronic devices
- Electrodes for resistance welding
- Electrodes in electric spark erosion cutting machines

- Arcing contacts and vacuum contacts in high and medium voltage breakers or vacuum interruptions

Properties

TUNGSTEN WT. %	55	68	70	75	78	80	85	90
Tungsten wt. % 55 68 70 75 78 80 85 90 UTS (MPa)	434	517	586	620	648	662	517	483
Thermal Conductivity (W/(cm K))	2.4	2.1	2.01	1.89	1.84	1.82	1.75	1.47
Electro Resistance at 20°C	3.16	3.33	3.41	3.51	3.71	3.9	4.71	6.11

Electrical And Thermal Properties

The Electrical and Thermal Properties of the composites vary with different proportions. An increase in copper increases thermal conductivity, which plays a huge part when being used in circuit breakers. Electrical resistivity increases with an increase in the percentage of tungsten present in the composite, ranging from 3.16 at 55% tungsten to 6.1 when the composite contains 90% tungsten. An increase in tungsten leads to an increase in ultimate tensile strength up until the alloy reaches 80% tungsten and 20% copper with an ultimate tensile strength of 663 MPa. After this mixture of copper and tungsten, the ultimate tensile strength then begins to decrease fairly rapidly.