TUNGSTEN COPPER – DATASHEET

SUMMARY PROPERTIES

Name	Copper	Impurity	Tungsten	Density (g/cm³)	Hardness HB	Resistance (μΩcm)	Conductivity IACS/ %	TRS / Mpa
CuW (50)	50 + 2.0	0.5	Balance	11.85	115	3.2	54	-
CuW (55)	45 + 2.0	0.5	Balance	12.30	125	3.5	49	-
CuW (60)	40 + 2.0	0.5	Balance	12.75	140	3.7	47	-
CuW (65)	35 + 2.0	0.5	Balance	13.30	155	3.9	44	-
CuW (70)	30 + 2.0	0.5	Balance	13.80	175	4.1	42	790
CuW (75)	25 + 2.0	0.5	Balance	14.50	195	4.5	38	885
CuW (80)	20 + 2.0	0.5	Balance	15.15	220	5	34	980
CuW (85)	15 + 2.0	0.5	Balance	15.90	240	5.7	30	1080
CuW (90)	10 + 2.0	0.5	Balance	16.75	260	6.5	27	1160

MACHINING COPPER TUNGSTEN

Machining tungsten-copper alloys will be similar to machining gray cast iron. It is abrasive and produces discontinuous chips.The material becomes easier to machine as the copper content is increased, and conversely the higher the tungsten content, the more careful the machining must be. The hardness varies dependent on the Tungsten Copper mix but ranges from HB 115 to HB 260.

Carbide tools are recommended for milling, turning and drilling.

Machining and Finishing
Coolant is optional and carbide inserts are recommended in most cases. Coolants should be non-alkaline and water soluble with high lubricity. Due to the material characteristics, particularly the low thermal expansion, very close tolerances and fine finishes can be achieved.

Turning and Boring
Carbide inserted cutters are suggested. Positive rake for turning, no rake to positive rake for boring.

Roughing – Cutting depth of 0.030 inch to 0.125 inch and 0.008 inch to 0.015 inch feed, at 200 to 300 SFM.

Finishing – 0.010 inch to 0.015 inch cutting depth and 0.004 inch to 0.010 inch feed at 250 to 400 SFM.

Tapping
It is recommended to use high-speed steel or carbide, two flute plug spiral point taps, with positive rake. Chlorinated oil, sulfonated oil, or tapping fluid can be used. Use the coarsest threads possible. For large holes, a single point tool is recommended. For tough jobs which don't cut easily, a slightly oversized hole may be required. If this is not feasible due to decreasing the thread engagement area, then heating the work to 400˚F may help.

Drilling
Carbide tooling and drill are recommended to increase tool life. Surface treated high speed steel twist drill bits also perform satisfactorily. Increased clearance angles and automatic feeds will help to avoid binding and seizing. Coolant or lubricant is highly recommended. In the case of small holes, pay special attention to clearance and chip removal to avoid seizing or bit breakage.

Grinding
Use silicon carbide wheels with medium hardness. Diamond wheels should not be used due to rapid loading.

Milling
Premium grade carbide cutters are are highly recommended.

Roughing – feeds of 0.007 inch to 0.015 inch per tooth at speeds of 200 to 400 SFM
Finishing – feeds of 0.003 inch to 0.010 inch per tooth at speeds of 300 to 700 SFM

High level final surface finishes can be achieved by using light feed rates, high spindle speeds, large nose radius inserts, and positive rake inserts.

Sawing or Cutting
During sawing, use a bi-metal blade with blade pitch relative to the thickness of the material. As an alternative, use a segmented edge carbide blade with low speed. Coarse blades can be run at low speeds, and finer blades run at higher speeds. Coolant may be used, but is not essential. Copper tungsten can also be cut using high-speed abrasive cutoff wheels.

EDM
Both sinker and wire EDM techniques work well with tungsten copper, although rates are slow. Some grain removal and hydrogen embrittlement can occur on the finished surfaces.

Thermal Cutting
Laser cutting, plasma cutting, or oxy fuel cutting should not be used to cut tungsten copper because of the high levels of oxidation that result, plus the possibility of thermal cracking.

Stress Relieving
This is possible on machined parts. We recommend heating to 600˚F in air for two hours and cooling in air or in a protective atmosphere at 900˚F for 30 minutes.

Surface finishes
Conversion coatings such as black oxide, chromate, phosphate, anodizing are unsuitable for tungsten alloys. Plated coatings such as cadmium, nickel, or hard chrome can sometimes be used. Organic coatings such as epoxy or acrylic may also be suitable in some cases. Baking of these coatings at appropriate temperatures is recommended to achieve full cure.

Joining and Welding
Mechanical joining is the best option for joining tungsten alloy material using standard fasteners such as bolts and pins. Tungsten Alloys can also be threaded to mate to itself and function as a method of fastening.

Diffusion Bonding is an ideal way of joining tungsten alloy material to itself, but it has to be done by the material manufacturer. In the case of finished parts, there may some distortion during the process.

Brazing is a secure method to join high density tungsten material to itself and to other materials. Joint strength will be close to that of the parent material. One disadvantage is that it should be done in a controlled atmosphere to prevent oxidation. Brazing can also alter the chemistry of the material immediately surrounding the joint. Low temperature solders are unsuitable as they will not effectively wet tungsten alloys.

Silver Soldering is a popular method for joining high density tungsten alloy either to itself or to steel. Typically 0.002 inch clearance between the parts to be joined is required. For larger parts, more clearance is required. Parts should always be as clean as possible (sandblasting can be used if necessary). Both parts must be fluxed and carefully heated until the solder flows. A slow uniform cooling is recommended as uneven cooling can set up stress in the joint and the material.

Shrink Fitting is another good method of joining high density tungsten materials to steel. The tungsten alloy is chilled in dry ice or nitrogen as the steel is heated. During assembly, a slow cool is necessary while the parts are held by a locating pin or fixture.

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