



High Performance Metal Solutions

High Performance Tantalum for Semiconductors

H.C.Starck 

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The H.C. Starck Solutions Advantage

H.C. Starck Solutions' tantalum has the highest purity levels with very stable thermal, electrical and mechanical properties for a broad range of semiconductor applications and device operating temperatures. A major advantage of tantalum is its compatibility with silicon and silicon dioxide for chip processing. Tantalum targets are used to deposit thin film coatings via physical vapor deposition (PVD) sputtering.

Application in Integrated Circuits

- > Diffusion barrier for copper metallization
 - > Immiscible with copper, bonds well with silicon and silicon oxide and has a low thermal expansion coefficient
- > Resistors and on chip capacitors
 - > Tantalum oxide has high dielectric constant with low temperature variation for capacitors
 - > Tantalum nitride has a near zero temperature coefficient of resistance for thin film resistors

Benefits

- > Purity of the sputter target material is maintained in the deposited film
- > The process is much easier to control than chemical vapor deposition (CVD)
- > Prevent interaction of copper seed layer and silicon in diffusion barrier
- > Stable resistivity with temperature on chip resistor (oxynitrides)
- > Stable capacitance with temperature on chip capacitor (tantalum oxide has a high dielectric constant)

End Products

- | | |
|-------------------------------------|----------------------------|
| > Copper interconnect metallization | > Magnetic recording media |
| > Printer components | > Flat panel displays |
| > Optical and industrial glass | > Thin film resistors |

Forms Available

- | | |
|-------------------|----------------------------|
| > Tantalum blanks | > Finished tantalum plates |
| > Tantalum strips | > Near-net shapes |

H.C. Starck Solutions' high purity tantalum is electron beam (EB) melted under high vacuum and with controlled melt rates. Grain size and crystallographic texture are controlled through the use of special thermo-mechanical processes and are customized for specific applications.

Tantalum is very ductile and can be fabricated into plates that are either diffusion bonded for planar sputter systems or formed into shapes such as the hollow cathode sputter target or radiofrequency coils (RF) coils.

Tantalum Purity Levels

Tantalum purity is measured by GDMS (Glow Discharge Mass Spectrometry) and gasses are measured by Leco analyzers.

Elements	3N5 Purity	4N Purity	4N5 Purity
	99.95% Ta	99.99% Ta	99.995% Ta
	Max. ppm	Max. ppm	Max. ppm
Al	5	1	0.5
Ca	5	1	0.5
Cl	3	1	1
Co	1	0.5	0.5
Cr	5	1	0.5
Cu	5	1	0.5
Fe	5	1	0.5
K	1	0.4	0.1
Li	1	0.5	0.05
Mg	5	1	0.5
Mn	5	1	0.5
Mo	40	10	10
Na	1	0.4	0.4
Nb	300	100	50
Ni	5	1	0.5
Pb	1	1	1
Si	5	1	0.5
Sn	5	1	0.5
Ti	5	1	0.5
V	5	1	0.5
W	150	80	50
Zn	5	1	0.5
Zr	5	1	0.5

Elements	3N5 Purity	4N Purity	4N5 Purity
	99.95% Ta	99.99% Ta	99.995% Ta
	Max. ppm	Max. ppm	Max. ppm
Max Total Detectable Metallics	500	100	50

Interstitials			
C	40	30	20
O	80	80	80
H	10	5	5
N	40	30	20
S	1	1	1

Typical Tantalum Target Microstructure



Typical fully recrystallized, equiaxed microstructure with grain size less than 80 microns.

Tantalum Dimensional Tolerances

Nominal Thickness**	Thickness Tolerance		Length, Width, and Diameter Tolerances			Flatness Tolerances*
	Round to Round	Square to Round	Sheared Edge	Water Jet Edge	Machined Edge	Level Rolled
	„R2R“	„S2R“	(Rectangular Plates Only)			
0.1250"	+ .050" / -0	+ .020" / -0	+0.1875" / -0	+0.030" / -0	+0.020" / -0	0.015"
-0.2999"						per foot
0.3000"	+ .050" / -0	+ .025" / -0	+0.25" / -0	+0.040" / -0	+0.030" / -0	0.020"
-0.4739"						per foot
0.4740"	+ .050" / -0	+ .030" / -0	NA	+0.060" / -0	+0.030" / -0	0.025"
-0.650"						per foot

H.C. Starck Solutions' tantalum is supplied to semiconductor level quality standards including ship to control and is certified as conflict-free material by the EICC as a "Conflict-Free Smelter" of tantalum for H.C. Starck Solutions' sustainable procurement process.

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