H.C.Starck

High Performance Metal Solutions

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GRAIN STABILIZED NIOBIUM (GSNb)

GSNb is a patent pending single-phase micro-alloy that has a grain size of approximately 2 ASTM numbers finer than standard commercial grade niobium.

Applications: Grain Stabilized Niobium (GSNb) is primarily used for is superior fine grain size while retaining the properties of commercial grade niobium. This allows for reduced “orange peel” during drawing and forming operations. As a result, it is particularly well suited for deep draw applications, and other applications where a fine grain size is required. It is used extensively in the industrial diamond market. GSNb’s corrosion resistant is equal to commercial grade niobium and finds use in the chemical process industry. GSNb can also be used in sputtering targets for fiber optic applications or architectural glass. In nuclear reactors it has low thermal neutron cross-section and superior corrosion resistance. It is an excellent getter and finds use in high temperature vacuum furnaces, and is resistant to attack by the molten alkali metals found in sodium vapor lamps.

Forms Available Foil: 0.001” to 0.015” thick by widths up to 12” wide. Sheet: 0.015” to 0.1875” thick by widths up to 36” wide. Plate 0.1875” to 1” thick in common widths. Many variations of thicknesses and widths are available to meet the needs of the application.

Physical Properties of Niobium

Atomic Number	41	
Atomic Weight	92.91	
Density	8.47	gm/cc (0.31 lbs/in^2)
Melting Point	2468	°C
Coefficient of Expansion (20° – 100°)	7.1 X	10^{-6}/ °C
Specific Heat (27° C)	0.065	cal/gm/°C
Thermal Conductivity	0.125	cal/sec-cm-°C
Electrical Resistivity (0° - 100° C)	14.5	microhm-cm
Crystal Structure	bcc	

Mechanical Properties of GSNb (annealed):

GSNb meets the mechanical properties requirements of ASTM B393 Type 2 Commercial Grade Niobium (UNS R04210)

Tensile Strength	18,000	psi (125 MPa) minimum
Yield Strength	10,500	psi (73 MPa) minimum
Elongation	20	% minimum (equal to or greater than 0.010" thick)
	15	% minimum (less than 0.010" thick)

Additional information not included in ASTM B363

Hardness (Typical)	HV 60-100
Grain Size (ASTM)	6 or finer (45 ums) for thicknesses < 0.010”

Olsen Cup Testing is available on request for thinner gauges. GSNb has similar values to Commercial Grade niobium. Typical Olsen Cup depth values for 0.005 to 0.010” thick GSNb are 0.240”(6.1) min.

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Corrosion Resistance The corrosion resistance of GSNb is identical to that of commercial grade niobium and can be used in all applications where commercial grade niobium is used. Like tantalum, GSNb is resistant to most acids with the exception of hydrofluoric, however it is not as resistant as tantalum to strong acids at high temperature. It should not be used with strong bases (alkalis).

Chemistry The chemical properties of GSNb are as follow

Element	ppm (max)	Element	ppm (max)
C	100	Si	100
O	250	W	500
N	100	Ni	50
H	15	Mo	200
Zr	200	Hf	200
Ta	3000	Ti	300
Fe	100	Nb	balance

Other trace elements are less than 50 ppm each.

The elements CONH are tested at the ingot stage and may be higher in finished material.

Fabrication

Machinability While challenging, GSNb can be machined using high rake angle tools, slow feeds and speeds, and water-soluble oils

Weldability GSNb can be resistance welded to itself and other metals such as tantalum, nickel, platinum, titanium and niobium. . It can be welded using GTAW (TIG) using proper shielding and cleanliness techniques. It can also be Electron Beam (EB) welded

Heat Treatment GSNb will recrystallize at temperatures above about 1650F (900°C) (Heat treat in vacuum only)

Typical Applications Sheet/Strip/Foil for forming applications such as crucibles, cups, and formed parts.
Any application that can use commercial grade niobium but requires improved forming and surface finish.

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