

High Performance Metal Solutions

Niobium C-103 Alloy for Space Exploration

H.C. Starck 

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Lift Off with H.C. Starck Solutions' C-103 Niobium Alloy

H.C. Starck Solutions' C-103 niobium alloy with niobium-hafnium-titanium is well-suited for rocket and jet propulsion applications utilized in spacecraft and launch vehicles. A key advantage of the niobium alloy is its high strength at temperatures up to 2700 °F (1482 °C), particularly in high performance rocket nozzle applications. H.C. Starck Solutions' C-103 niobium alloy also has excellent resistance to high frequency vibrations at cryogenic temperatures, as occur in many satellite applications, because of its low ductile-to-brittle transition temperature.

Applications

- > Orbital rocket chambers and nozzles
- > Reaction control nozzles for missiles
 - > Rockets
 - > Satellites
- > Jet engine afterburner liners
- > Burst disks for wind tunnels

Benefits

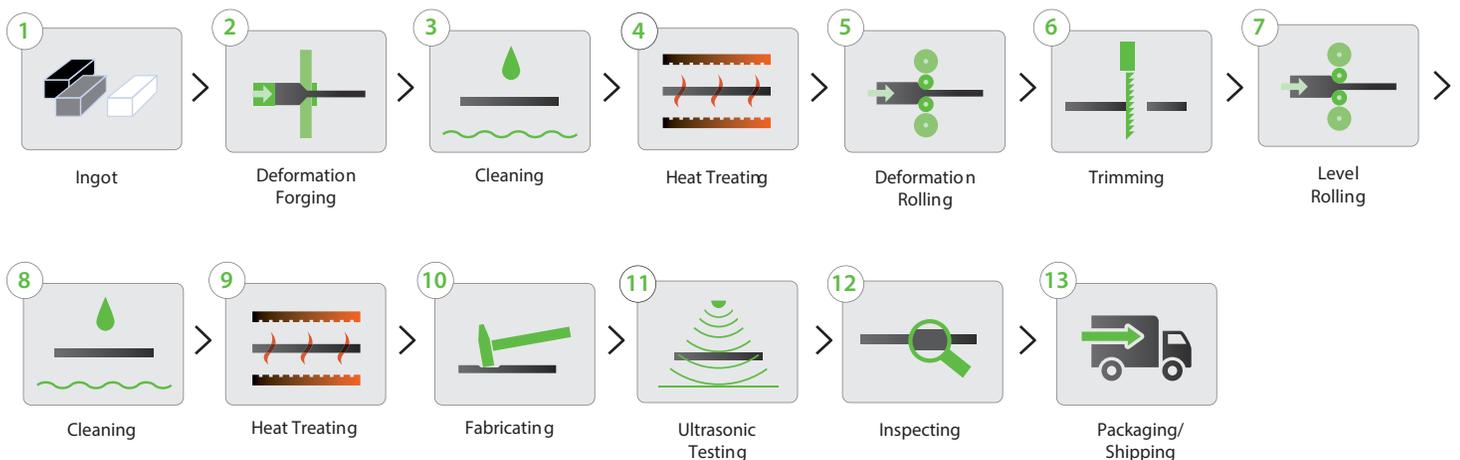
Capable of withstanding high stresses at elevated temperatures

- > Low ductile-to-brittle transition temperature for cryogenic applications
- > Formable after TIG welding
- > Excellent fabricability
- > Readily weldable

Niobium Process

- > In-house expertise in forging, rolling, machining, cutting and fabrication
- > Chemical, mechanical, and microstructure monitoring in-house
- > Expertise in thermal processing
- > Consistent grain size and texture properties

Niobium Process



H.C. Starck Solutions' C-103 Niobium Alloy Forms, Thickness and Tolerances

Available Forms and Fabrications

H.C. Starck Solutions collaborates with customers to fabricate and machine components for aerospace, including build-to-print and design of niobium C-103 alloy components.

H.C. Starck Solutions' C-103 niobium alloy meets ASTM B652, B654, B655, AMS7852 and AMS7857 specification.

H.C. Starck Solutions' C-103 niobium alloy powders are available for additive manufacturing applications in both flake and spherical morphologies.

Niobium C103 Material	Dimensions inches	Dimensions cm
Bar and Rod	1.5 in. – 6.5 in. diameter	3.81 cm – 16.51 cm
Sheet	0.024 in. – 0.1875 in. thick, up to 24 in. width	.06 cm – .48 cm, up to 61 cm width
Plate	0.1875 in. – 1 in. thick, common widths	.06 cm – 2.54 cm
Ingots	up to 9.5 in. diameter	up to 24.1 cm
Slabs	as requested	
Niobium C-103 Powder	additive manufacturing	
Fabricated Parts	per customer specifications	

Thickness of Material (in)	Tolerance on Thickness A Width under 6 in	plus or minus (in) Width 6- 24 in	Tolerance on Width B (slit) Width under 6 in	plus or minus (in) Width 6- 24 in	Tolerance on Sheared Length 12 in and under		Tolerance on Sheared Length over 12 in	
					Plus	Minus	Plus	Minus
0.005 - 0.010 excl	0.0005	0.001	0.012	---	1/16	0	3/32	0
0.010 - 0.015 excl	0.0007	0.001	0.015	0.015	1/16	0	3/32	0
0.015 - 0.020 excl	0.0008	0.0015	0.015	0.015	1/16	0	3/32	0
0.020 - 0.030 excl	0.0015	0.0025	0.020	0.025	1/16	0	3/32	0
0.030 - 0.060 excl	0.0025	0.0035	0.025	0.030	1/16	0	3/32	0
0.060 - 0.090 excl	0.004	0.005	0.025	0.035	1/16	0	3/32	0
0.090 - 0.125 excl	0.006	0.007	---	---	1/16	0	3/32	0
0.125 - 0.187 excl	0.010	0.010	---	---	1/16	0	3/32	0
0.187 - 0.250 excl	0.015	0.015	---	---	1/8	0	5/32	0
0.250 - 0.312 excl	0.020	0.020	---	---	1/8	0	5/32	0
0.312 - 0.375 excl	0.025	0.025	---	---	3/16	0	7/32	0

Thickness of Material (in)	Tolerance on Thickness A Width under 150 mm	plus or minus (in) Width 150-610 mm	Tolerance on Width B (slit) Width under 150 mm	plus or minus (in) Width 150-610 mm	Tolerance on Sheared Length 305 mm and under		Tolerance on Sheared Length over 305 mm	
					Plus	Minus	Plus	Minus
0.13 - 0.25 excl	0.013	0.025	0.30	---	1.6	0	2.4	0
0.25 - 0.40 excl	0.018	0.025	0.4	0.4	1.6	0	2.4	0
0.40 - 0.50 excl	0.020	0.04	0.4	0.4	1.6	0	2.4	0
0.50 - 0.80 excl	0.04	0.06	0.5	0.6	1.6	0	2.4	0
0.80 - 1.5 excl	0.06	0.09	0.6	0.8	1.6	0	2.4	0
1.5 - 2.3 excl	0.010	0.013	0.6	0.9	1.6	0	2.4	0
2.3 - 3.2 excl	0.015	0.018	---	---	1.6	0	2.4	0
3.2 - 4.8 excl	0.025	0.25	---	---	1.6	0	2.4	0
4.8 - 6.4 excl	0.04	0.4	---	---	3.2	0	4.0	0
6.4 - 8.0 excl	0.05	0.5	---	---	3.2	0	4.0	0
8.0 - 9.5 excl	0.06	0.6	---	---	4.8	0	5.6	0

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