MATERION

DATA SHEET

Niobium C-103 Alloy Bar and Rod Products

Our C-103 alloy bar and rod products are composed of niobium, hafnium and titanium, giving them high temperature and load-bearing characteristics while still being relatively easy to work with when compared to other materials. Niobium has the lowest density of the refractory metals and exhibits excellent thermal conductivity, high room-temperature ductility and low ductile-to-brittle transition temperature (giving it resistance to high-frequency vibrations at cryogenic temperatures). C-103 provides a high-performance alloy solution for rocket nozzle applications in aerospace, spacecraft, missiles and launch vehicles. It is also an excellent choice for afterburner liners and seals.

Chemical Composition

Mass fraction in % (cg/g); ppm (µg/g).

Element	Composition (wt%)
Hafnium	9 - 11
Titanium	0.7 - 1.3
Tantalum - maximum	0.5
Tungsten - maximum	0.5
Zirconium - maximum	0.7
Carbon - maximum	150 ppm
Hydrogen - maximum	10 ppm
Nitrogen - maximum	150 ppm
Oxygen - maximum	225 ppm
Total Other Elements - maximum	3000 ppm
Niobium	Balance

Typical Physical Properties

Density	Melting Point	Coefficient of Expansion 200-2200˚F (93-1204˚C)	Specific Heat (at 100˚C)	Thermal Conductivity (870 - 1300˚C)	Modulus of Elasticity	Emissivity
0.32 lb./in^3 (8.850 gm/cm^3)	4262˚F (2350˚C)	3.8 – 4.5 10^{-6} ˚in/in/F^{-1} (6.8 – 8.1 10^{-6} m/m˚C)	0.082 BTU/lb.˚F (343 J/kg ˚C)	22 – 26 BTU/hr-ft ˚F (38 – 45 W/m˚C)	13x10^6 psi (90 GPa) at 20˚C 9.3x10^6 psi (64 GPa) at 1200˚C	0.28 (816˚C) 0.23 (1093˚C)

Typical Mechanical Properties

Tensile properties can be supplied upon request when a purchase order is placed.

Temperature	Yield Strength 0.2% Offset ksi (MPa)	Tensile Strength ksi (MPa)	Elongation % inches (mm)
70˚F (25˚C)	38 (262)	54 (372)	20 (508)
2000˚F (1093˚C)	16 (110)	21 (145)	20 (508)

Forms Available

Niobium C-103 rod is available in diameters of 1.5” to 6.5” (38.1 to 165.1 mm). Bar and rod will be supplied in fully recrystallized condition unless otherwise requested.

Metallurgical Characteristics

C-103 is a single-phase niobium alloy with all elements in solid solution.

- Stress relieve: as requested
- Re-crystallize at 2300˚F (1093˚C)

Dimensional Variations for Bar and Rod

Diameter	Tolerance +/-
1.0” to 1.5” (25.4 - 38.1 mm) excl.	0.015” (0.381 mm)
1.5” to 2.0” (38.1 – 50.8 mm) excl.	0.020 (0.508 mm)
2.0 to 4.0 (50.8 – 101.6 mm) excl.	0.030 (0.762 mm)
4.0 to 6.5 (101.6 – 165.1 mm) excl.	0.040 (1.016 mm)

Disclaimer:

Only the buyer can determine the appropriateness of any processing practice, end-product or application. Materion does not make any warranty regarding its recommendations, the suitability of Materion's product, or its processing suggestions for buyer's end product, application or equipment.

The properties presented on this data sheet are for reference purposes only, intended only to initiate the material selection process. They do not constitute, nor are they intended to constitute, a material specification. Material will be produced to one of the applicable industry standards, if any, listed in the Industry Standards and Specification section.

Actual properties may vary by thickness and/or part number. Please contact your local sales engineer for detailed properties to be used in simulation.

Any properties marked as preliminary are subject to change at any time as the manufacturing process is further refined.

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