



ADDITIVE MANUFACTURING PRODUCTS

Nb – Hf – Ti Alloy C103 (UNS R04295)

Elmet Technologies produces additively manufactured C-103 niobium alloy using laser powder bed fusion (L-PBF). C103 niobium-hafnium titanium alloy 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. Elmet Technologies' 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.

CHEMICAL CHARACTERISTICS¹

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

Chemical composition of finished parts can be supplied on request when Purchase Order is placed.

The chemical composition of the starting powder shall conform to the following limits:

Nb	88 min	%
Hf	9.0 – 11.0	%
Ti	0.7 – 1.3	%
Ta	0.5 max.	%
W	0.5 max.	%
Zr	0.7 max.	%
C	150	ppm wt
O	500	ppm wt

CONDITION

Parts will be supplied in the as-printed condition unless otherwise requested

MECHANICAL PROPERTIES¹

Tensile properties can be supplied on request when Purchase Order is placed

¹ Information on testing methods on request.

TYPICAL PROPERTIES

Test Condition	Print Orientation	Tensile Strength MPa (ksi)	Yield Strength 0.2% offset MPa (ksi)	Elongation %
22°C (72°F)	Horizontal	515 (75)	425 (61)	25
22°C (72°F)	Vertical	525 (76)	430 (62)	25
1093°C (2000°F)	Horizontal	195 (28)	185 (27)	22
1093°C (2000°F)	Vertical	215 (31)	205 (30)	22

PHYSICAL PROPERTIES

Density 8.8 g/cm³

Relative Density 99+%

Surface Roughness <10 µm

Hazards identification in Advertising (Directive 67/548/EEC Article 26 and Directive 1999/45/EC Article 13) none.

IDENTIFICATION

The material will be identified with appropriate specification number, ingot or lot number, and nominal size. Shipping containers will be marked with the name of the customer and the purchase order number.

REJECTION

Elmet Technologies must receive written notification of rejected material with the reason for rejection. The right is reserved to inspect rejected material at customer plant for claim validation. The material may be returned only after proper authorization.

APPLICABLE STANDARDS

ASTM WK77186 New Specification for Additive Manufacturing — Finished Part Properties — Specification for Niobium-Hafnium Alloy UNS R04295 via Laser Beam Powder Bed Fusion for Spaceflight Applications

ASTM E8/E8M Test Method for Tension Testing of Metallic Materials

ASTM E21 Standard Test Methods for Elevated Temperature Tension Tests of Metallic Materials

ASTM B311 Test Method for Density Determination for Powder Metallurgy (P/M) Materials Containing Less Than Two Percent Porosity.



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