



## Product Information

### Properties of Niobium and Nb Alloy Products



#### ASTM B392, B393, B394: Mechanical Properties, Annealed Condition

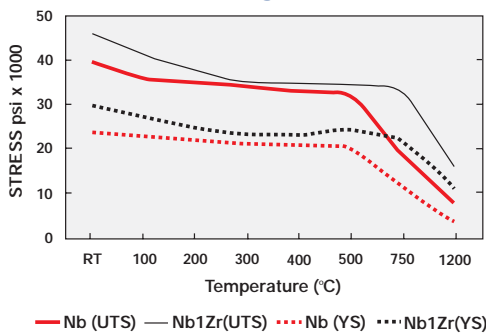
ASTM B392, B393, B394: Mechanical Properties, Annealed Condition <sup>A,B</sup> (90% Minimum Recrystallized)

	Ultimate Tensile Strength min., psi (MPa)	Yield Strength (0.2% offset) min., psi (MPa)	Elongation in 1 in. (25 mm) Gauge Length, min %
Type 1 and 2	18,000 (125)	10,500 (73)	25 <sup>A</sup> 20 <sup>B</sup>
Type 3 and 4	28,000 (195)	18,000 (125)	20 <sup>A</sup> 15 <sup>B</sup>

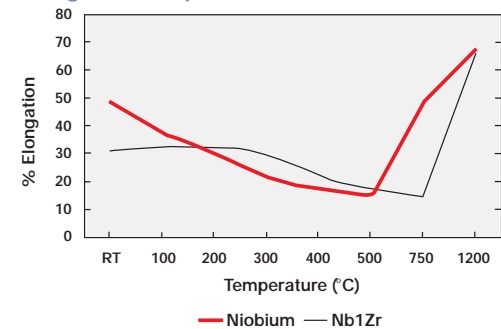
<sup>A</sup> Rod, bar 0.125 in. (3.18 mm) to 2.5 in. (63.5 mm) dia. Sheet, strip, plate 0.010 in (0.25 mm) or greater

<sup>B</sup> Wire 0.020 in. (0.508 mm) to 0.124 in. (3.14 mm). Sheet, strip less than 0.010 in. (0.254 mm)

Ultimate Tensile Strength of Niobium



Elongation Properties of Niobium



#### Typical Modulus of Elasticity Properties of Niobium and Nb1Zr

Typical Modulus of Elasticity Properties of Niobium and Nb1Zr

Temperature	Niobium (psi x 10 <sup>6</sup> ) (MPa x 10 <sup>3</sup> )	Nb1Zr (psi x 10 <sup>6</sup> ) (MPa x 10 <sup>3</sup> )
Room Temperature	14.3 (98.6)	14.7 (101.3)
800°C (1470°F)	12.0 (82.7)	
1200°C (2190°F)	11.0 (75.8)	
1790°C (3270°F)	7.5 (51.7)	

(continued on b...

## Thermal Properties of Nb and Nb1Zr

	Niobium	Nb1Zr
<b>Melting Point</b>	2468°C (4474°F)	2410°C (4370°F)
<b>Boiling Point</b>	5127°C (9261°F)	-
<b>Specific Heat at 0°C, cal/g/°C</b>	0.064	-
<b>Average linear coefficient of expansion, cm/cm/°C x 10-6 (in/in/°F x 10-6)</b>		
18° to 300°C (64° to 572°F)	7.31 (4.06)	
18° to 400°C (64° to 752°F)	7.39 (4.12)	
18° to 500°C (64° to 932°F)	7.47 (4.15)	
18° to 600°C (64° to 1112°F)	7.56 (4.20)	
18° to 700°C (64° to 1292°F)	7.64 (4.25)	
18° to 800°C (64° to 1472°F)	7.72 (4.29)	
18° to 900°C (64° to 1652°F)	7.80 (4.34)	
18° to 1000°C (64° to 1831°F)	7.88 (4.38)	
<b>Thermal Conductivity, W/m°K, (Btu ft./hr.ft2 °F)</b>		
0°C (31°F)	52.3 (30.2)	43.9
100°C (212°F)	54.4 (31.4)	
200°C (392°F)	56.6 (32.7)	
300°C (572°F)	58.6 (33.9)	52.0
400°C (752°F)	60.7 (35.1)	
500°C (932°F)	63.2 (36.5)	
600°C (1112°F)	65.3 (37.7)	
1027°C (1880°F)	61.4 (35.5)	
<b>Recrystallization Temperature Range</b>	900° to 1200°C (1650° to 2200°F)	900° to 1250°
<b>Heat of Fusion, J/Kg (Btu/lb)</b>	290,000 (124.2)	

## Electrical and Magnetic Properties of Nb and Nb1Zr

	Niobium	Nb1Zr
<b>Electrical Conductivity, % IACS</b>	13.2	
<b>Electrical resistivity, microhm-cm</b>		
at 25°C (77°F)	12.5 (31.75)	12.6 (32.0)at 1027°C (1881°F)
at 54.8 (139.2)	52.6 (133.6)	
at 2027°C (3681°F)	88.3 (224.3)	79.1 (200.8)
<b>Temperature coefficient of electrical resistivity per °C (per °F) at 0° to 600°C (32° to 1112°F)</b>	.00395 (0.0022)	
<b>Electron work function (eV)</b>	4.01	
<b>Ionization potential (eV)</b>	6.67	
<b>Positive ion emission (eV)</b>	5.5	
<b>Electrochemical equivalence (m/coulomb)</b>	0.1926	
<b>Electron emission, A value [amp cm-2(°K)-2]</b>	37.57	
<b>Total emissivity</b>		
at 1880°C (3516°F)	0.19	
at 2000°C (3632°F)	0.24	
<b>Total Radiation</b>		
at 1880°C (3516°F)	22	
at 1980°C (3596°F)	30	
<b>Magnetic susceptibility at 25°C, cgs</b>	2.28 x 10-6	
<b>Critical temperature (°K)</b>	9.5	

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