Technical Data Sheet

ATI Nb1Zr™ Alloy (Type 3 & 4)

Niobium Alloy

(UNS R04261)

INTRODUCTION

It was discovered that the addition of 1% zirconium to niobium greatly improved the creep strength over the soft pure metal. Thus ATI Nb1Zr™ Alloy became the replacement for pure niobium in applications requiring the chemical resistance of niobium and a material with high melting temperature. In addition to greatly increasing the strength of pure niobium at higher temperatures, ATI Nb1Zr™ Alloy also has low thermal nuclear capture cross-section properties. This alloy has been closely associated with the nuclear industry, which requires specified elevated temperature strength in the range of 1800º F to 2200º F. Because of the increasing need for better strengths, as technology has advanced, ATI Nb1Zr™ Alloy has been replaced in some applications by alloys such as ATI C103™ Alloy, which has greater strength and thus improved reliability, but still retains all the desirable characteristics of ATI Nb1Zr™ Alloy. ATI Nb1Zr™ Alloy has the advantage of being less expensive than the higher strength alloys, and can be used in applications where a high temperature material is needed with low loads such as a loadfree thermal shield. Due to the excellent fabricability and ductility, this material is readily available in all desired mill product forms.

PHYSICAL PROPERTIES

TABLE 7 - PHYSICAL PROPERTIES of ATI Nb1Zr™ Alloy		
Density	0.31 lbs./cu. in. or 8.57 gms./cu. cm.	
Melting Point	4365 ± 15ºF or 2410 ± 10ºC	
Thermal Conductivity	24.2 BTu/(hr.) (ft.)2 (ºF/ft.) (25ºC)	
Specific Heat	0.065 BTu/ºF/lb. (70ºF)	
Emissivity	Total Hemispherical Emittance	
	TemperatureºC	**WC-1 Zr**
	500	0.103
	600	0.110
	700	0.117
	800	0.130
	900	0.142
	1000	0.154
	1100	0.167
	1200	0.179

MECHANICAL PROPERTIES

TABLE 8 - MECHANICAL PROPERTIES of ATI Nb1Zr™ Alloy	
Bend Ductility	ATI Nb1Zr™ Alloy recrystallized sheet will pass a -320ºF, 90º, 2T bend in both parent metal and weldment.

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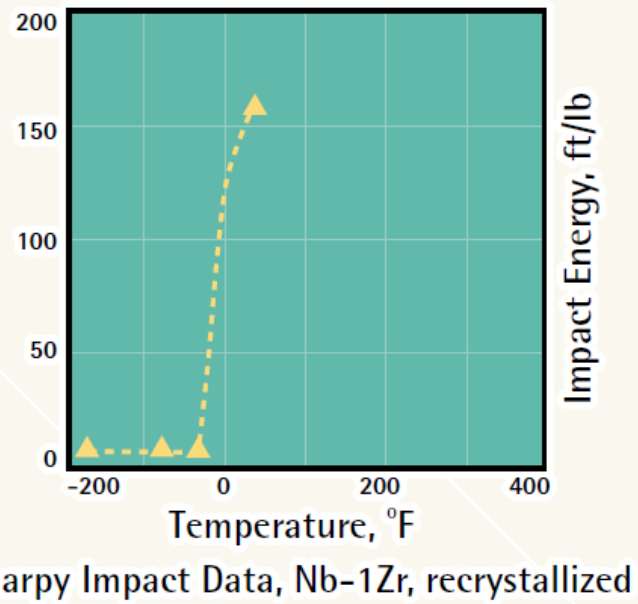
Modulus of Elasticity

10 x 106 psi (estimated) at room temperature.



Charpy Impact Data, Nb-1Zr, recrystallized

METALLURGICAL PROPERTIES

TABLE 9 - METALLURGICAL PROPERTIES of ATI Nb1Zr™ Alloy	
Grain Size	
1. Sheet and strip	ASTM avg. 6
2. Plate	ASTM avg. 5
3. Rod <21/2" diameter	ASTM avg. 4
4. Billet > 21/2" diameter	ASTM avg. 3

METALLOGRAPHY

It is typical of niobium alloys to display “stringers" in heavily worked material. These stringers result from interstitial impurities which occur predominately in the grain boundaries during casting. In subsequent fabrication, these impurities are stretched along the work direction and eventually form very fine intermetallic compounds which show up after recrystallization annealing as peppery areas.

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