Ti-5.5Al-3.5Sn-3Zr-1Nb-0.25Mo-0.3Si

TIMETAL® 829

WELDABLE,HIGH STRENGTH, HIGH TEMPERATURE, CREEP RESISTANT ALLOY

TIMETAL 829 is a weldable, high strength, high temperature (1004°F / 540°C) creep resistant alloy specifically developed for gas turbine engine components.

TIMETAL 829 is a near alpha alloy but includes both alpha and beta stabilizer alloying elements.

TIMETAL 829 can be worked in the beta phase field, but to avoid the formation of an unacceptably large beta grain size, a process route involving alternate beta and alpha + beta working is recommended. One way to achieve this is to heat into the beta field but allow the temperature to drop into the alpha + beta field during forging.

TABLE 1

CHEMICAL COMPOSITION

ELEMENT	WEIGHT %	
	Minimum	*Maximum*
Aluminum	5.20	5.70
Tin	3.00	4.00
Zirconium	2.50	3.50
Niobium	0.70	1.30
Molybdenum	0.20	0.35
Silicon	0.20	0.50
Carbon	—	0.08
Oxygen	0.09	0.15
Nitrogen	—	0.03
Hydrogen	—	0.006
Residual Elements, each	—	0.05
Residual Elements, total	—	0.20
Titanium	Remainder	

TABLE 2

PHYSICAL PROPERTIES

PROPERTY	VALUE	
	English	*SI*
Density	0.164 lb in^{-3}	4.54 g cm^{-3}
Beta Transus	1859°F	1015°C
Thermal Conductivity*	4.00 Btu hr^{-1} ft^{-1} $°F^{-1}$	6.90 W m^{-1} K^{-1}
Magnetic Permeability	Nonmagnetic	
Mean Coefficient of Thermal Expansion		
68-392°F (20-200°C)	5.24 x 10^{-6} in in^{-1} $°F^{-1}$	9.45 x 10^{-6} m m^{-1} $°C^{-1}$
68-752°F (20-400°C)	5.43 x 10^{-6} in in^{-1} $°F^{-1}$	9.77 x 10^{-6} m m^{-1} $°C^{-1}$
68-1112°F (20-600°C)	5.54 x 10^{-6} in in^{-1} $°F^{-1}$	9.98 x 10^{-6} m m^{-1} $°C^{-1}$
Elastic Modulus*	~17 Msi	~120 GPa

* Typical values at room temperature of about 68-78°F (20-25°C).

TABLE 3

HEAT TREATMENT

Solution Heat Treatment	+	*Aging Heat Treatment*
1922°F (1050°C) / 30 mins / Air Cool or Oil Quench*		1157°F (625°C) 2 hours / Air Cool

* Oil quenching is recommended for heat treatment of sections above 30mm (1.18 in) in order to promote the formation of a fine basket weave or Widmanstätten alpha | microstructure. Air cooling is adequate for smaller sections.

TABLE 4

MINIMUM MECHANICAL PROPERTIES

Test Temperature	*UTS ksi (MPa)*	*0.2% YS ksi (MPa)*	*Elongation 5D %*	*Reduction in Area %*	*Notched Tensile Strength K_t=3*	*Fracture Toughness K_{1c} ksi$\sqrt{in}$ (MPa$\sqrt{m}$)*
68°F (20°C)	135 (930)	119 (820)	9	15	1.6 x actual tensile strength	71 (78)
1004°F (540°C)	83 (570)	64 (440)	9	25	–	65 (59)

TIMET®

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TABLE 5

TYPICAL ELEVATED TEMPERATURE TENSILE PROPERTIES

TIMETAL 829 DISC FORGINGS

Test Temperature °F (°C)	*0.2% YS ksi (MPa)*	*UTS ksi (MPa)*	*Elongation on 5D %*	*Reduction in Area %*
212 (100)	106 (730)	126 (870)	10	21
392 (200)	94 (645)	113 (780)	10	22.5
572 (300)	85 (585)	104 (715)	10	24.5
752 (400)	79 (545)	99 (675)	10.5	27.5
932 (500)	75 (515)	94 (650)	12	31.5
1004 (540)	73 (500)	92 (635)	13	34
1112 (600)	67 (465)	88 (610)	14.5	38.5
1202 (650)	62 (425)	83 (575)	16	43

TABLE 6

CREEP PROPERTIES

CREEP TEST (TYPICAL)

Test Temperature	*Time hours*	*Stress ksi (MPa)*	*Total Plastic Strain %*
1004°F (540°C)	100	44 (300)	0.048

POST-CREEP TENSILE TEST* (MINIMUM)

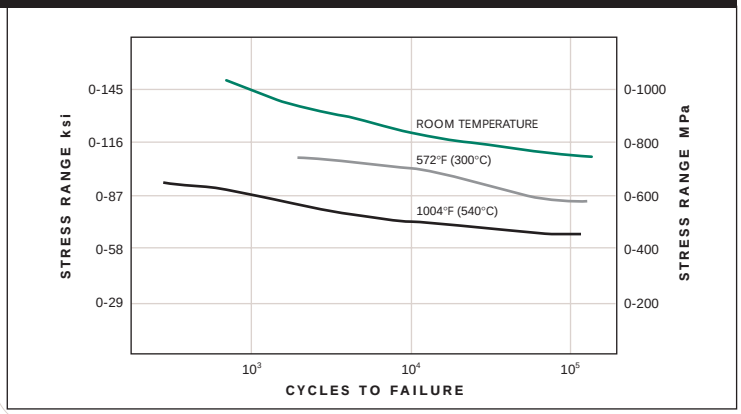
0.2% YS ksi (MPa)	*UTS ksi (MPa)*	*Elongation 5D %*	*Reduction in Area %*
119 (820)	135 (930)	7	12

* The creep test piece is subjected to a room temperature tensile test without any surface conditioning or removal.

FIGURE 1

FATIGUE PROPERTIES

TIMETAL 829 FORGINGS



The data and other information contained herein are derived from a variety of sources which TIMET believes are reliable. Because it is not possible to anticipate specific uses and operating conditions, TIMET urges you to consult with our technical service personnel on your particular applications.

For more information, please contact the TIMET Sales Office/Service Center nearest you, TIMET's Technical Laboratories or TIMET's Website @ www.timet.com

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