Ti-6Al-2Sn-4Zr-6Mo

TIMETAL® 6-2-4-6

HIGH-STRENGTH INTERMEDIATE TEMPERATURE ALLOY

TIMETAL 6-2-4-6 is an alpha-beta alloy capable of being heat treated to higher strengths in greater section sizes than *TIMETAL*® 6-4 alloy. The properties of this alloy are influenced by its thermo-mechanical history. Enhanced strength, ductility, and low-cycle fatigue properties are contained in alpha-beta forged material. Beta-forged material contains the best combination of good low-cycle fatigue and fatigue-crack growth resistance. *TIMETAL* 6-2-4-6 alloy is similar in forgeability and crack sensitivity to *TIMETAL* 6-4. This alloy is used in intermediate compressor stages of turbine engines for disks and blades, seals, and for airframe parts.

TABLE 1

CHEMICAL COMPOSITION

ELEMENT	WEIGHT %			
	Mil T-9047		*AMS 4981*	
	Min.	*Max.*	*Min.*	*Max.*
Aluminum	5.5	6.5	5.50	6.50
Tin	1.75	2.25	1.75	2.25
Zirconium	3.6	4.4	3.50	4.50
Molybdenum	5.5	6.5	5.50	6.50
Iron	—	0.15	—	0.15
Oxygen	—	0.15	—	0.15
Carbon	—	0.04	—	0.04
Nitrogen	—	0.04	—	0.04
Hydrogen	—	0.125	—	0.125
Residual Elements, each	—	0.1	—	0.10
Residual Elements, total	—	0.4	—	0.40

UNS R56260 – Ti-6Al-2Sn--4Zr-6Mo

TABLE 2

PHYSICAL PROPERTIES

Property	*T (°F)*	*T (°C)*	*Value*	*Value SI*
Density	72	22	0.168 lb in^{-3}	4.64 g cm^{-3}
Beta Transus	1715	935		
Melting (liquidus) Point	2900-3050	1595-1675		
Thermal Conductivity	68-78	20-25	4.40 Btu hr^{-1} ft^{-1} $°F^{-1}$	7.61 W m^{-1} K^{-1}
Specific Heat			0.120 Btu lb^{-1} $°F^{-1}$	502 J kg^{-1} K^{-1}
Electrical Resistivity	68-78	20-25	75-80.7 μΩ•in	190-205 μΩ•m
Magnetic Permeability			Nonmagnetic	
Mean Coefficient of Thermal Expansion	68-212	20-100	5.0 x 10^{-6} in in^{-1} °F	9.0 x 10^{-6} m m^{-1} $°C^{-1}$
Young's Modulus (Dependent on texture and heat treatment)	68 600 800	20 315 425	10-16.5 Msi 15.5 Msi 14.5 Msi	70-114 GPa 107 GPa 100 GPa

TABLE 3

MINIMUM TENSILE PROPERTIES

Material RD or Thk. (in)	*Condition*	*Specification*	*Temperature °F (°C)*	*UTS ksi (MPa)*	*0.2% YS ksi (MPa)*	*Elongation %*	*Reduction in Area %*
≤2.00	DA[c]	Mil T-9047G	68 (20)	160 (1103)	150 (1034)	10	25
2.00-4.00				150 (1034)	140 (965)	8 [6]	20 [15]
≤2.50	STA[d]	Mil T-9047G	68 (20)	170 (1172)	160 (1103)	10	20
>2.50-3.00				165 (1138)	155 (1068)	8 [6]	15 [12]
>3.00-4.00				160 (1103)	150 (1034)	8 [6]	15 [12]

[a] Unless otherwise noted, properties apply in any grain direction. [b] [ ] values apply to ST for ≥ 3.0 in. material. [c] Duplex Anneal Cycle at 870-900°C (1600-1650°F)/1h/AC + 540-593°C (1000-1100°F)/8h/AC [d] Solution Treated and Aged at 870-925°C (1600-1700°F)/2-90 min/WQ or AC + 480-675°C (1050-1250°F)/4-8hr

TABLE 4

TYPICAL VARIATIONS IN TENSILE PROPERTIES WITH HEAT TREAT CONDITION

% Primary α	*Condition*	*Temperature °F (°C)*	*UTS ksi (MPa)*	*0.2% YS ksi (MPa)*	*Elongation %*	*Reduction in Area %*
10-20	STA[a]	68 (20)	176 (1214)	162 (1118)	13	37
10-20	STOA[b]	68 (20)	160 (1100)	150 (1035)	6	12
40-50	STA[a]		180 (1242)	167 (1152)	14	42
40-50	STOA[b]		166 (1145)	155 (1070)	14	41
β forged	STA[c]		174 (1201)	152 (1049)	6.5	13

[a] Solution Treated and Aged at 885°C(1630°F)/1h/AC + 595°C(1100°F)/8h/AC [b] Solution Treated and Aged at 885°C(1630°F)/1h/AC + 705°C(1300°F)/1h/AC
[c] Solution Treated and Aged at 985°C(1810°F)/1h/AC + 595°C(1100°F)/1h/AC

TIMET®

1999 BROADWAY, DENVER, CO 80202 [303] 296-5600