Titanium Ti-6Al-4V (Grade 5), Annealed

Subcategory: Alpha/Beta Titanium Alloy; Metal; Nonferrous Metal; Titanium Alloy

Close Analogs: 4 other heat treatments of this alloy are listed in MatWeb.

Key Words: Ti-6-4; UNS R56400; ASTM Grade 5 titanium; UNS R56401 (ELI); Ti6Al4V, biomaterials, biomedical implants, biocompatibility

Component	Wt. %
Al	6
Fe	Max 0.25
O	Max 0.2
Ti	90
V	4

Material Notes:

Information provided by Allvac and the references. Annealing Temperature 700-785ºC. Alpha-Beta Alloy.

Applications: Blades, discs, rings, airframes, fasteners, components. Vessels, cases, hubs, forgings. Biomedical implants.

Biocompatibility: Excellent, especially when direct contact with tissue or bone is required. Ti-6Al-4V's poor shear strength makes it undesirable for bone screws or plates. It also has poor surface wear properties and tends to seize when in sliding contact with itself and other metals. Surface treatments such as nitriding and oxidizing can improve the surface wear properties.

Physical Properties	Metric	English	Comments
Density	4.43 g/cc	0.16 lb/in³	
Mechanical Properties			
Hardness, Brinell	334	334	Estimated from Rockwell C.
Hardness, Knoop	363	363	Estimated from Rockwell C.
Hardness, Rockwell C	36	36	
Hardness, Vickers	349	349	Estimated from Rockwell C.
Tensile Strength, Ultimate	950 MPa	138000 psi	
Tensile Strength, Yield	880 MPa	128000 psi	
Elongation at Break	14 %	14 %	
Reduction of Area	36 %	36 %	
Modulus of Elasticity	113.8 GPa	16500 ksi	
Compressive Yield Strength	970 MPa	141000 psi	
Notched Tensile Strength	1450 MPa	210000 psi	K_t (stress concentration factor) = 6.7
Ultimate Bearing Strength	1860 MPa	270000 psi	e/D = 2
Bearing Yield Strength	1480 MPa	215000 psi	e/D = 2
Poisson's Ratio	0.342	0.342	

Charpy Impact	17 J	12.5 ft-lb	V-notch
Fatigue Strength	240 MPa	34800 psi	at 1E+7 cycles. K_t (stress concentration factor) = 3.3
Fatigue Strength	510 MPa	74000 psi	Unnotched 10,000,000 Cycles
Fracture Toughness	75 MPa-m½	68.3 ksi-in½	
Shear Modulus	44 GPa	6380 ksi	
Shear Strength	550 MPa	79800 psi	Ultimate shear strength

Electrical Properties

Electrical Resistivity	0.000178 ohm-cm	0.000178 ohm-cm	
Magnetic Permeability	1.00005	1.00005	at 1.6kA/m
Magnetic Susceptibility	3.3e-006	3.3e-006	cgs/g

Thermal Properties

CTE, linear 20°C	8.6 µm/m-°C	4.78 µin/in-°F	20-100ºC
CTE, linear 250°C	9.2 µm/m-°C	5.11 µin/in-°F	Average over the range 20-315ºC
CTE, linear 500°C	9.7 µm/m-°C	5.39 µin/in-°F	Average over the range 20-650ºC
Specific Heat Capacity	0.5263 J/g-°C	0.126 BTU/lb-°F	
Thermal Conductivity	6.7 W/m-K	46.5 BTU-in/hr-ft²-°F	
Melting Point	1604 - 1660 °C	2920 - 3020 °F	
Solidus	1604 °C	2920 °F	
Liquidus	1660 °C	3020 °F	
Beta Transus	980 °C	1800 °F	

References for this datasheet.