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

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. Solution Treated 900-955ºC, Aged 540ºC. Alpha-Beta Alloy.

Applications: Blades, discs, rings, airframe, 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 379 379 Estimated from Rockwell C.

Hardness, Knoop 414 414 Estimated from Rockwell C.

Hardness, Rockwell C 41 41

Hardness, Vickers 396 396 Estimated from Rockwell C.

Tensile Strength, Ultimate 1170 MPa 170000 psi

Tensile Strength, Yield 1100 MPa 160000 psi

Elongation at Break 10 % 10 %

Modulus of Elasticity 114 GPa 16500 ksi Average of tension and compression

Compressive Yield Strength 1070 MPa 155000 psi

Notched Tensile Strength 1550 MPa 225000 psi Kt (stress concentration factor) = 6.7

Ultimate Bearing Strength 2140 MPa 310000 psi e/D = 2

Bearing Yield Strength 1790 MPa 260000 psi e/D = 2

Poisson's Ratio 0.33 0.33

Charpy Impact 23 J 17 ft-lb V-notch

Fatigue Strength 160 MPa 23200 psi at 1E+7 cycles. Kt (stress concentration factor) = 3.3

Fatigue Strength 700 MPa 102000 psi Unnotched 10,000,000 Cycles

Fracture Toughness 43 MPa-m½ 39.1 ksi-in½

Shear Modulus 44 GPa 6380 ksi

Shear Strength 760 MPa 110000 psi Ultimate shear strength

Electrical Properties

Electrical Resistivity 0.000178 ohm-cm 0.000178 ohm-cm

Magnetic Permeability 1.00005 1.00005 at 1.6 kA/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