



CORROSION MATERIALS

Worldwide Corrosion Resistant Alloy Specialists

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ISO 9001:2015 Certified
ISO Registered Since 1993

Description

Titanium Grades 1, 2, 3 and 4 are commercially pure (99% minimum titanium). Each grade has slight variations in chemical composition that affect mechanical properties and design capability. The corrosion resistance is similar across all four grades. Titanium is light weight, exceptionally corrosion resistant and often exceeds the corrosion resistance of stainless steels in most environments. Of the four commercially pure (C.P.) titanium grades, Grade 2 is the alloy of choice for most industrial applications that require good ductility and corrosion resistance.

Industries & Applications

Titanium Grade 2 has a lower density making it very desirable where weight can be a concern. Medical and aerospace are two key industries for titanium alloys. The strength and corrosion resistance properties of titanium Grade 2 also make it well suited to applications in the marine, chemical processing and desalination industries. Typical applications for Grade 2 titanium include oil & gas components, reaction and pressure vessels, tubing or piping systems, heat exchangers, liners, flue-gas desulphurization systems and many other industrial components. Continuous service temperatures can reach up to 800°F with occasional, intermittent service at 1000°F.

Resistance to Corrosion

Titanium's C.P. grades corrosion resistance comes from a strongly adherent, stable, protective oxide film, which forms in the presence of oxygen. This film makes the commercially pure titanium grades resistant to most oxidizing, neutral and inhibited reducing, as well as mildly reducing environments. Grade 2 offers excellent resistance to seawater and marine atmospheric corrosion. Corrosion resistance is similar between the four C.P. grades, but mechanical properties vary along with varying oxygen and iron contents. Grade 2 titanium is resistant to attack from moist chlorides and metallic chlorides, chlorite and hypochlorite solutions, nitric and chromic acids, organic acids as well as many gaseous industrial applications.

Fabrication and Heat Treatment

Titanium Grade 2 has good ductility, which allows for cold formability. To prevent cold forming concerns, the minimum bend radius for material under 0.070" thick should be 2T, while 2.5T should be used for material over 0.070". The material can also be easily machined, hot worked and welded. Hot working should be performed between 400°F and 600°F. Stress relieving should be performed by heating to a temperature between 900°F and 1100°F followed by either forced air or slow cooling. Annealing temperatures range from 1200°F to 1400°F for 6 minutes to 2 hours followed by an air cool.

Welding of Grade 2 titanium can be performed using various methods such as MIG and TIG. Inert gas shielding is crucial to prevent oxygen pickup and embrittlement of the weld area. A mixture of argon and helium is typically preferred but should be tested prior to accepting a welding procedure. Preheat or post heat treatments are not required.

The information contained in this technical data sheet is intended to be used as a guide and may be revised at any time without prior notice. The information is believed to be reliable and accurate, however Corrosion Materials does not make any warranty or assume any legal liability with respect to the accuracy, completeness or usefulness of the information.

TECHNICAL DATA SHEET

TITANIUM Commercially Pure

Grade 1 - UNS R50250 / Grade 2 - UNS R50400 /
Grade 3 - UNS R50550 / Grade 4 - UNS R50700

Chemical Composition (%)¹ - Grade 2

(Ti) Titanium	Remainder
(Fe) Iron	0.30 max
(O) Oxygen	0.25 max
(C) Carbon	0.08 max
(N) Nitrogen	0.03 max
(H) Hydrogen ^{2,3}	0.015 max

¹Per applicable ASTM specifications. ²Lower hydrogen values may be obtained by negotiating with the manufacturer. ³Final product analysis.

Physical Properties for Grade 2 Titanium

Melting Point, approximate	3020°F
Density @ Room Temperature	0.163 lb/in. ³
Beta Transus	1675°F +/-25°F
Modulus of Elasticity (Tension)	14.9 X 10 ³ ksi
Modulus of Elasticity (Torsion)	6.5 X 10 ³ ksi
Specific Heat (RT)	0.124 Btu/lb•°F
Electrical Resistivity (RT)	56 Ω•cir mil/ft
Coefficient of Thermal Expansion	
68°F to 212°F	4.8 x 10 ⁻⁶ in./in. •°F
68°F to 572°F	5.3 x 10 ⁻⁶ in./in. •°F
68°F to 932°F	5.4 x 10 ⁻⁶ in./in. •°F
Thermal Conductivity @ 68°F	9.5 Btu•in./ft ² •h•°F

Mechanical Properties¹ | Annealed

Product Form	Tensile Minimum	Yield 0.2% offset	Elongation Minimum	Other Req. ²
Bar	Gr. 1 35 ksi	20 ksi Min.	24%	30% Min. ROA
	Gr. 2 50 ksi	40 ksi Min.	20%	30% Min. ROA
	Gr. 3 65 ksi	55 ksi Min.	18%	30% Min. ROA
	Gr. 4 80 ksi	70 ksi Min.	15%	35% Min. ROA
Sheet/Plate	Gr. 1 35 ksi	20 to 45 ksi	24%	Bend Test: 3T - under 0.070", 4T - 0.070" to 0.187"
	Gr. 2 50 ksi	40 to 80 ksi	20%	Bend Test: 4T - under 0.070", 5T - 0.070" to 0.187"
	Gr. 3 65 ksi	55 to 95 ksi	18%	
	Gr. 4 80 ksi	70 to 65 ksi	15%	Bend Test: 5T - under 0.070", 6T - 0.070" to 0.187"
Welded & Seamless Pipe	Gr. 1 35 ksi	20 to 45 ksi	24%	-
	Gr. 2 50 ksi	40 to 80 ksi	20%	-
	Gr. 3 65 ksi	55 to 95 ksi	18%	-
Welded & Seamless Tube	Gr. 1 35 ksi	20 to 45 ksi	24%	-
	Gr. 2 50 ksi	40 to 80 ksi	20%	-
	Gr. 3 65 ksi	55 to 95 ksi	18%	-

¹Minimums per ASTM specifications.

²ROA = Reduction of Area.

Aqueous Corrosion Data

Media	Common Name	Temperature	Corrosion Rate (mpy)
5% to 99.7% C ₂ H ₄ O ₂	Acetic Acid	255°F	nil
10% AlCl ₃	Aluminum Chloride	220°F	1.1
25% AlCl ₃	Aluminum Chloride	68°F	0.04
10% H ₃ BO ₃	Boric Acid	Boiling	nil
Cl ₂	Chlorine Gas (dry)	140°F	very high
Cl ₂ with >1.5% H ₂ O	Chlorine Gas (wet)	392°F	nil
50% CuSO ₄	Copper Sulfate	Boiling	nil
1% to 30% FeCl ₃	Ferric Chloride	212°F	nil
90% CH ₂ O ₂	Formic Acid (aerated)	212°F	0.05
90% CH ₂ O ₂	Formic Acid	212°F	118
1% HCl	(non-aerated)	100°F	1.2
5% HCl	Hydrochloric Acid	200°F	260
20% HCl	Hydrochloric Acid	95°F	165
50% MgCl ₂	Hydrochloric Acid	392°F	0.2
40% HNO ₃	Magnesium Chloride	212°F	2.30
70% HNO ₃	Nitric Acid	158°F	1.56
10% H ₂ C ₂ O ₄	Nitric Acid	95°F	0.58
5% H ₃ PO ₃	Oxalic Acid	151°F	0.2
30% H ₃ PO ₃	Phosphoric Acid	140°F	39
85% H ₃ PO ₃	Phosphoric Acid	70°F	7
5% H ₂ SO ₄	Phosphoric Acid	70°F	9
25% H ₂ SO ₄	Sulfuric Acid	77°F	28.3
75% H ₂ SO ₄	Sulfuric Acid	95°F	41
98% H ₂ SO ₄	Sulfuric Acid	392°F	1.5
Sea Water @ High Pressure 690°F	Sulfuric Acid	nil	

Applicable Specifications*

Form	ASTM	ASME	Military Standard	AMS
Bar	B348	SB348	MIL-T-9047	4902
Sheet & Plate	B265	SB265	MIL-T-9046 CP-3	4902

*EN 10204 Type 3.1 applies to all product forms.

Please contact Corrosion Materials for a complete list of items available from our extensive inventory, as well as our value-added processing services.

We supply a complete range of items in many alloys, including C-276, 22, B-2, B-3®, 200/201, 400, 405, K-500, 625, 600, 800H/HT®, 20, F255, 6B, Titanium Gr. 2 and Titanium Gr. 5.

Our machine shop, welding shop and processing departments are equipped with state-of-the-art manufacturing equipment allowing Corrosion Materials the ability to provide the service you desire along with the economic and technical advantages you need and deserve.

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Baker
2262 Groom Rd.
Baker, Louisiana 70714
800.535.8032 toll free
225.775.3675 phone
225.774.0514 fax

Houston
12305 Cutten Rd.
Houston, Texas 77066
800.455.2276 toll free
713.939.0364 phone
713.939.1126 fax

Bolingbrook
400 Quadrangle Drive, Ste C
Bolingbrook, Illinois 60440
800.706.7471 toll free
630.226.1043 phone
630.226.1044 fax

Auburn
9 Saint Mark Street
Auburn, MA 01501
844.442.0818 toll free
774.321.6212 phone
774.321.6206 fax

Shanghai
333 Jiujiang Road
Shanghai, China 200001
86-21-6045 2221 phone
86-21-6045 2225 fax

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