BRODER METALS GROUP Titanium grade 2 & 5

Broder Metals Group stocks **titanium** grade 2 and grade 5 round bar from 12.7 mm to 101.6 mm.

Properties of Titanium
Chemically, titanium is distinguished by its high reactivity, which is only surpassed by metals such as magnesium, calcium and sodium. That titanium can be employed under circumstances where most other structural material would be subject to severe corrosion is due to the properties of its oxide, TiO – it is highly resistant and forms a self-healing coating which is normally only about 0.01mm thick.
If the coating is damaged and the environment contains oxygen in some form, the titanium and oxygen react and rebuilds the oxide. In deoxidised or reduction environments, the oxide protection is weakened and the metal becomes exposed to corrosion. Thus where resistance to corrosion is required, the resistance can often be improved through the introduction of an oxidation agent into the application environment.

Commercially Pure Alloys
There are five grades of what is known as commercially pure or unalloyed titanium – ASTM Grades 1 through 4, and 7. Each grade has a different amount of impurity content, with Grade 1 being the most pure. Tensile strengths vary from 172 MPa for Grade 1 to 483 Mpa for Grade 4.

Alpha Alloys
Titanium alpha alloys are alloys that typically contain aluminium and tin, though they can also contain molybdenum, zirconium, nitrogen, vanadium, columbium, tantalum, and silicon. Alpha alloys do not generally respond to heat treatment, but they are weldable and are commonly used for cryogenic applications, aeroplane parts, and chemical processing equipment.

Alpha-Beta Alloys
Alpha-beta alloys can be strengthened by heat treatment and ageing, and therefore can undergo manufacturing while the material is still ductile, then undergo heat treatment to strengthen the material, which is a major advantage. The alloys are used in aircraft and aircraft turbine parts, chemical processing equipment, marine hardware, and prosthetic devices.

Beta Alloys
The smallest group of titanium alloys, beta alloys have good hardenability, good cold formability when they are solution-treated, and high strength when they are aged. Beta alloys are slightly denser than other titanium alloys, having densities ranging from 4840 to 5060 kg m-3. They are the least creep resistant alloys, they are weldable, and can have yield strengths up to 1345 MPa. They are used for heavier duty purposes on aircraft.

Applications

Because of its strength and light weight, titanium is used in metallic alloys and as a substitute for aluminium. Alloyed with aluminium and vanadium, titanium is used in aircraft and is also widely used in missiles and space capsules; the Mercury, Gemini, and Apollo capsules were made largely of titanium.

The relative inertness of titanium makes it available as a replacement for bone and cartilage in surgery and as a pipe and tank lining in the processing of foods. It is used in heat exchangers in desalination plants because of its ability to withstand salt-water corrosion. In metallurgy, titanium alloys are employed as deoxidizers and denitrogenizers to remove oxygen and nitrogen from molten metals.

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Aerospace

The aircraft industry is the single largest market for titanium products primarily due to their exceptional strength to weight ratio. The largest single use of titanium is in aero fire walls, outer skin, landing-gear components, hydraulic tubing, engine supports, compressor blades, discs, and housings of jet engines. Titanium alloys compete with aluminium, nickel and ferrous alloys in both commercial and military airframes.

Jewellery

Rings and spectacles are manufactured from titanium because of its inherent strength, resistance to dents and bending and it can be highly polished to provide a scratch free product.

Paint

Titanium paint is an excellent reflector of infrared radiation and is used extensively in solar observatories to reduce heat levels to improve viewing quality.

Cathodic Protection

A titanium anode coated with platinum provides cathodic protection from corrosion by seawater.

Medical

Replacement joints including hip ball joint.

Chemical and Mechanical Properties

Quality		Gr 1	Gr 2	Gr 4	Gr 5	Gr 7	Gr 9	Gr 11	Gr 12
Analysis %	Fe max	0.20	0.30	0.50	0.40	0.30	0.25	0.20	0.30
	O max	0.18	0.25	0.40	0.20	0.25	0.15	0.18	0.25
	N max	0.03	0.03	0.05	0.05	0.03	0.02	0.03	0.03
	C max	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
	H max	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015
	Pd					0.12-0.25		0.12-0.25	
	Al				5.5-6.7		2.5-305		
	V				3.5-4.5		2.0-3.0		
	Mo								0.4-0.4
Yield strength N/mm2	Rp 0.2	170-310	275-450	483-655	828-	275-450	483-	170-310	345-
Tensile Strength N/mm2	Rm min	240	345	550	895	345	620	240	483
Hardness	Vickers	140	170	310	330	170	250	140	170
Elonga-tion	5 x d	24	20	15	10	20	15-17	24	18

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From a strength perspective, the maximum temperature for the usage of unalloyed titanium grades is approximately 350°C. For components not subject to stress oxidation, a limit of approximately 500°C can be set.

Comparative Values

	Density	Melting Point	Thermal Expansion	Thermal conductivity	Electrical Resistance	Elasticity Modulus
Material	**Kg/m3**	**°C**	**Coefficient (x 10-6)**	**W/(m.K)**	**Ohm x n (x 10-8)**	**MPa (x 10-3)**
Titanium	4505	1688	8.4	17	55	106.4
Iron	7900	1530	12	63	9.7	206.0
Aluminium	2700	660	23	205	2.7	69.2
Nickel	8900	1453	15	92	9.5	206.0
Copper	8900	1083	17	385	1.7	107.9
Stainless Steel 18-8	7900	1410	17	16	72	200
Brass	8400	970	18.5	100	7.5	107.9
Monel	8800	1325	14	26	48	179.5

Titanium is just one of a range of materials stocked by Broder Metals Group Ltd – please see our website for the full range stocked: www.broder-metals-group.com

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