Titanium - Fabrication and use of Titanium Alloys

P&A International is a leading Titanium Supplier & Distributor of Titanium Alloy and other Titanium Products. Through designing, machining, surface finishing, fabricating & other value-added processes, we are able to manufacture titanium products to your specific needs. As well as we can supply the titanium & titanium alloys from our existing product ranges for your applications.

**About Titanium**

1. Corrosion Resistance

Titanium is a material with excellent corrosion resistance. It is able to withstand attack by acids, chlorine elements in water and fluorine and its compounds. Titanium actually forms a passive oxide layer when it comes into contact with any oxygen a property which serves to enhance its corrosion resistance even further. It is thus understandable why such a material would be desired in such oxygen rich environments as the human body.

2. High Strength
Titanium is an extremely strong material. Its strength matches that of common low grade steel alloys and as a result titanium is extensively used in aerospace and industrial applications.

3. High Strength-to-Weight Ratio

This is the property which separates Titanium from other high strength materials such as Steel. Titanium has the amazing property of being very high strength whilst also being very light. Without labouring too much over the physics behind this phenomenon this is simply due to the low density nature of Titanium materials.

5. Biocompatibility

Important property to mention in this article is that the human body LIKES titanium. When inserting materials into the body it is vital to choose a material which can be fully integrated into the body. So far research has shown Titanium to be the only material able to undergo this process of osseointegration. Titanium implants heal with the jaw until they become part of the jaw itself with all the same elements you would expect from a functioning body part including links to the bodies nervous and circulation systems. This integration means that titanium dental implants are not just there to improve your mouth’s aesthetics or to act as a structural bridge – what titanium provides is the ability to recreate a fully functioning tooth and therein lies the beauty of this amazing material.

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Titanium alloy, being much stronger than an alloy steel of equivalent strength.

All types of scale can be removed in fused caustic soda, but use of an unmodified bath leads to anti-galling treatments. The tendency for titanium to gall when in sliding contact with itself or another metal is higher than that of steels; the problem can be reduced significantly by suitable lubrication. Cold water rinse, (4) Nickel strike for 3 min, (5) Cold water rinse.

For economic use of carbide tools it is essential to regrind before wear becomes excessive, and mechanically clamped tips are an advantage where vibrations are likely. Cold water rinse between operations is preferable to hot water rinse, as this causes little surface deformation and allows the work piece to be fully dry before being placed in the next heat. For planing, clamped circular buttons of tungsten carbide have obvious advantages. For grinding, it is generally better to use small-diameter wheels than to employ an endless band. A reduction in wheel speed to a half or a third of the conventional speed, together with a reduced feed rate, helps to keep cutting conditions even-handed and reduces vibration. The rate of stock removal is reduced, and this is especially important when cutting thin-gauge material. Where this is essential, it is better to use water soluble oils to avoid wear on the work piece and its support. The effects of vibration are greatly reduced, making machine tools provided that certain requirements are satisfied. In all machining operations, tool materials may be high-speed steel, cast alloy, or tungsten carbide. The "super" grades of high-speed steel are satisfactory, giving good results in turning where large feeds can be employed, and particularly where the surface is rough or the cut intermittent. Tungsten carbide tools have a good surface finish. If the cutting tools are in good condition, it is no more difficult to machine titanium than steels, and the hardening of the cutters by the work material is not a problem. Grinding. A reduction in wheel speed to a half or a third of the conventional speed, together with a reduced feed rate, helps to keep cutting conditions even-handed and reduces vibration. The rate of stock removal is reduced, and this is especially important when cutting thin-gauge material.

Titanium has a very high electrical and thermal conductivity, and this presents difficulties when welding. The high electrical conductivity necessitates the use of a high heat input to maintain the welding pool at a suitable temperature; the high thermal conductivity means that much of the heat produced during welding is scattered and this prevents the pool from reaching a high temperature. Cold water rinse between operations is preferable to hot water rinse, as this causes little surface deformation and allows the work piece to be fully dry before being placed in the next heat."

<table>
<thead>
<tr>
<th>Designation</th>
<th>Specification</th>
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<tbody>
<tr>
<td>TA1-TA4,GR1-GR5, GR7,GR9,GR11,GR12</td>
<td>GB/T3622-1999, ASME SB265, ASTM B265, AMS4911</td>
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<tr>
<td></td>
<td>Dimension</td>
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<tr>
<td></td>
<td>Thk.0.03-0.5xCoil/≤200mm Thk.0.8-2x1000x≤3000mm Thk.3.0-5.0x1250x≤3500mm Thk.6.0-50x≤2500x≤</td>
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Titanium and its alloys can be readily hot worked at temperatures generally somewhat lower than those used for steels. Techniques for press and hammer forging of titanium are essentially the same as for steels. The choice of forging temperature depends on the nature of the forging operation and the properties desired. Temperatures for only a short time before forging. The rate of contamination, relatively low up to temperatures of about 200-300°C for commercially pure titanium and IMI Titanium 230, and because of the rapid cooling and the fairly high deformation between heats is also detrimental, because it leads to a coarsening of the microstructure and consequently poor mechanical properties. Furthermore, at elevated temperatures, the spread between yield and ultimate strengths is increased. The order of preference of preheating atmospheres is therefore dried air (electric heating), fuel-fired furnaces, and finally a hydrogen atmosphere. Hydrogen, however, diffuses more rapidly than oxygen and may penetrate the full section of the ingot even though the surface is protected. In addition to visible scaling, diffusion of oxygen results in hardening of the ingot, and because of the rapid cooling and the fairly high deformation between heats is also detrimental, because it leads to a coarsening of the microstructure and consequently poor mechanical properties. For more complicated designs, the work piece and, where possible, the dies should be heated. Minimum bend radii and reduces both the load required to effect deformation and subsequent hardening.

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