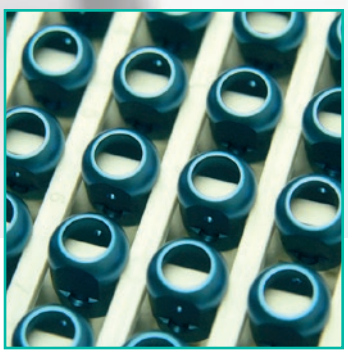
DOT Coatings

Improving Mechanical Properties by Titanium Anodizing



DOT
medical implant solutions

Type II anodizing (DOTIZE®)

Principles

The anodizing process was originally developed in the USA for aerospace applications. Anodizing has proven itself as a successful procedure that is capable of improving the mechanical characteristics of titanium and titanium-alloy-based components for implant replacement as well as devices for osteosynthesis.

When adapted to the requirements of the orthopaedic industry, anodizing prevents cold welding of devices for osteosynthesis, (i.e. between bone nail and screw), improves fatigue strength and enhances resistance to abrasion as well as corrosion. Furthermore, the amount of protein adsorption during the immediate post operative interaction process between the blood and the implant surface is decreased by anodizing. Adherence of osteoblasts is thus inhibited and subsequent bone growth onto the implant supressed. Complications related to removing bone nails, screws or plates after the successful fracture healing process can be reduced by this effect.

Technology

The DOTIZE® anodizing procedure that was developed by DOT, replaces the thin natural oxide film on the implant surface with a thick oxide coating. This is achieved through a spark discharge produced on the surface of the implant whilst it is immersed in an electrolytic bath containing a strong alkaline solution. The implant surface is melted by the discharge and the oxide layer becomes an integral part of the base material. The DOTIZE® procedure is suited to practically all titanium alloys used in medical applications. The implant dimensions are not altered by the surface treatment. Micro-pores and cracks in the base material are obliberated by the procedure. The DOTIZE® procedure conforms to the AMS 2488 (Aerospace Material Specification) standard.

Advantages

- Reduction in bone on-growth behavior
- Improved fatigue strength of the implants
- Reduction of the risk of cold welding
- Higher pre-loading of threaded connections is possible

Test criteria DOTIZE®	Result
Coating thickness	Max. 1-2 µm
Ongrowth behavior	Up to 19% reduced colonization of the implants with bone cells caused by reduced protein absorption
Wear resistance	Increased resistance to wear compared to untreated titanium alloys
Biocompatibility	Good biocompatibility
Corrosion resistance	The corrosion resistance is up to 44 % higher than with untreated titanium
Fatigue strength	Increase of up to 15 % in the fatigue strength compared with untreated base material

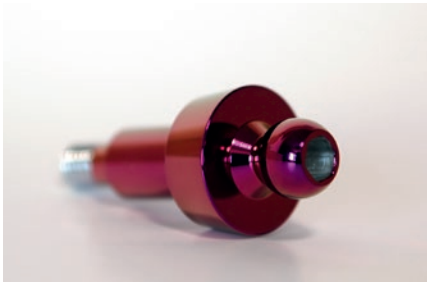
Type III anodizing (Coloring)

Principles

Color anodizing titanium alloys is used as a standard surface treatment for osteosynthesis components as well as for dental and orthopedic implants. Type III anodizing (coloring) merely changes the implant properties from a cosmetic point of view. The components are colored according to their size to facilitate identification before and during surgery.

Technology

When required, pickling in an acid bath is performed in order to achieve a uniform implant surface for anodizing. The product is subsequently anodized in dilute acid. The resulting titanium oxide layer acts as an optical interference filter. All the colors of the rainbow can be produced by varying the thickness of the coating. The standard colors available are red, blue, yellow and green. However, we are able to produce many other color variations at the request of the customer. The thickness of layer ranges from 20-200 nm depending on the color selected.



Advantages

- Improves identification of implants
- Cosmetically appealing

Test criteria coloring	Result
Colors	According to the color scheme
Coating thickness	20–200 nm (depending on color)
Roughness Ra	≤ 0.05 µm (on polished surface)

Summary

Titanium and titanium alloys are often used as the material of choice for manufacturing devices for osteosynthesis or joint replacement implants.
Anodizing is often chosen as a standard procedure for treating these surfaces. Whereas in principle, the biological and biomechanical characteristics of implants are modified by using Type II anodizing, it is only the cosmetic characteristics of the implant that are changed by using Type III anodizing (color anodizing). DOT GmbH offers you both anodizing procedures to suit your requirements. Since 1998, DOT GmbH has anodized millions of devices for osteosynthesis and components for implant joint replacement with the DOTIZE® system and coloring process.
Type II and III titanium anodizing in applications for medical technology have been approved both in the European Union and in the USA.

Literature

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We look forward to talking with you!

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DOT – coating specialist for orthopedic and dental implants

DOT is one of Europe's leading providers of medical coating solutions for orthopedic and dental implants and instruments and also their cleanroom packaging.

Our comprehensive supply chain concept makes us an ideal medical technology partner. Our activities help restore the health of patients worldwide and thus make a major contribution to the improvement of their quality of life.

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