Innovative surface treatments for bone engaging implants

Bone On-Growth Surfaces

DOT Surfaces

medical implant solutions
Implant surface micron topography is a critical factor in achieving bone on-growth.

The success of many devices is dependent upon the "integration" or "fusion" of the implant into the natural bone structure. This integration may be accomplished through bone on-growth, bone in-growth, or a combination of both mechanisms.

**Bone on-growth:** the development of bone in direct apposition/contact with the surface (e.g. generally ≤ 100 micron scale).

**Bone in-growth:** the development of bone around, but not necessarily in direct contact with an implant macro feature (e.g. thread or porous surface/scaffold).

**Background**

In the 1970s, implant researchers first determined that roughening titanium implant improved their success rates.

Over the next few decades, many "roughening" technologies were developed and evaluated through research and practice. In the specific case of bone engaging screws, processes that create micron scale topographies were found to be extremely effective, and as such continue to dominate the market today.

Bone on-growth surfaces are commonly utilized in dental, spine and orthopedics.

**User needs met**

- Biocompatible, maintaining original substrate properties.
- Impacts the mechanisms involved with the extent and rate of bone formation.
- Increases the interface bond strength between the implant and bone.
- Reduces the risk of screw loosening.
**Characteristics**

The characteristics of the bone on-growth surfaces are dependent upon the technology utilized.

**RBM – Resorbable Blast Media Micro-blasting**

RBM is a subtractive surface technique, where the surface is modified by precision micro-blasting using a calcium phosphate based media. After blasting, the parts are processed through nitric acid to resorb residual media left on the surface. The typical RBM process imparts a micron scale topographically complex surface, with primary features in the 10-50 micron range. The resulting surface roughness has a $Sa$ of 1.5 +/- 0.5 microns.

**RBM – Resorbable Blast Media Micro-blasting and Acid Etching**

After RBM processing, the implants are subsequently acid etched to superimpose fine micron pits over the RBM surface. This secondary process results in a dual scale topography. The RBM + Etched surface is topographically complex in two scales including 10-50 micron primary features with 1-10 micron secondary pitting. The resulting surface roughness has a $Sa$ 1.5 +/- 0.5 microns.

**Corundum Blast Media Micro-Blasting and Acid Etching**

In this process, corundum (aluminum oxide) is utilized in the place of RBM. The additional hardness of the corundum media permits the generation of a slightly deeper surface texture, with more angular facets. After corundum blasting the implants may be further acid etched to impart fine micron pitting over the blasted surface to create a dual surface topography. The Corundum + Etched surface is topographically complex in two scales including 10-100 micron primary features with 1-10 micron secondary pitting. The resulting surface roughness as measured has a $Sa$ of 1.75 +/- 0.75 microns.

**Customized Surface**

**Customized Surface Processing:**

DOT commonly teams with its customers to analyze and duplicate their current surface technologies. DOT will partner with your R&D team to develop customized surface designs for your specific device application.
DOT America utilizes automated, precision micro-blasting with resorbable calcium phosphate based or aluminum oxide medias to impart micron scale topographies on implant surfaces. As required, DOT may additionally acid etch titanium surfaces to develop a more definitive dual scale topography of micron (10-100 µm) and fine micron (1-10 µm) characteristics.

Since 1995, DOT has been processing implants with micron scale technologies for enhanced bone healing. Implants with DOT bone on-growth technologies have been cleared or approved in technology applications in the US, Europe, and Asia.

Bibliography


