Ceramics don't always have to be white

myplant

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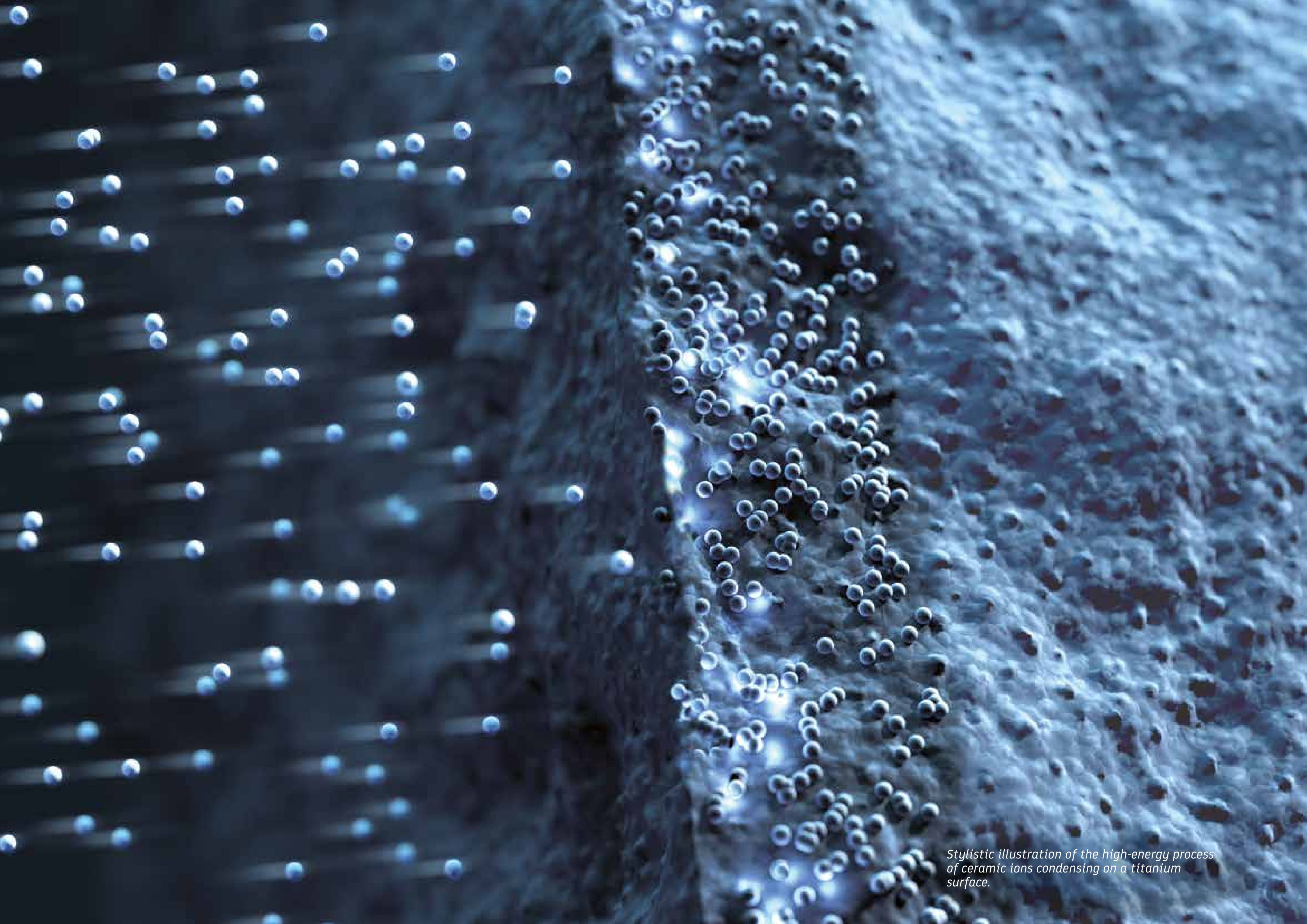


Stylistic illustration of the high-energy process of ceramic ions condensing on a titanium surface.

myplant bio

With **myplant bio**, myplant GmbH combines the **tissue-friendly properties of a ceramic implant** with the **technical advantages of a titanium implant**.

In this process, the titanium abutment and implant are encased in a strong, biocompatible ceramic layer.

The benefits of ceramic implant surfaces, with their exceptional tissue compatibility and biocompatibility, have been known about for many years and verified by numerous studies. Using a complex multi-phase high vacuum followed by a condensation process, an **abrasion-resistant ceramic layer** (**Cerid®**) is applied to the implant and a ceramic niobium layer (**Niob**) to the abutment section.

This bioengineering process, which has undergone advanced development specifically for myplant bio dental implants, involves high-energy charging of **atoms**, which then **penetrate** deep **into the surface** of the titanium and thereby form the **abrasion- and shear-resistant titanium/ceramic composite**.

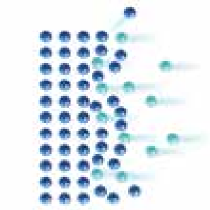
The shear-resistant ceramic dioxide layer produced is approximately 4-7 micrometers thick. One of the special features of the high-strength Cerid® and niobium ceramic layer is its high **biocompatibility**, with an index of 1.

It is well known that mucositis is frequently a prelude to peri-implantitis, resulting in implant loss. Both **Cerid®** and **Niob** exhibit the highest chemical stability of all materials used in medical applications. This all but rules out titanium corrosion involving destruction of the passivating protective titanium layer, as can occur in the acidic environment of inflammatory gingival changes.

Cerid®-/Niob surface technology

The **Cerid®/Niob surface technology** used in **myplant bio** produces a high-strength **titanium/ceramic composite**.

The use of a high-vacuum coating creates an **abrasion-resistant anti-corrosion layer** both on the implant and on the abutment section.



A special condensation process is used for high-energy charging of **atoms** that then **penetrate the surface** of the titanium and form a **strong bond**. This ceramic dioxide layer is approximately 4-7 micrometers thick. One of the special features of the high-strength Cerid® and niobium ceramic dioxide layer coatings is their high **biocompatibility**, with an index of 1.

Both **Cerid®** (titanium-zirconium) and **Niob** (titanium-niobium-nitride) exhibit the highest chemical stability of all materials used in medical applications and have built up an extensive track record over the years with positive clinical evidence.

Biological properties of Cerid® ceramic

Abrasion and corrosion protection thanks to Cerid® coating

Biocompatible zirconium dioxide surface

All proteins remain 100 % native. Bone trabeculae on the implant surface.

Courtesy of Prof. R. Thull, Germany

Good bone apposition thanks to micro-roughness

Cerid® coating on the enossal section

- High biological compatibility, as no titanium ions are released, nor are titanium particles abraded. This enables unhindered integration of hard and soft tissues.

- The biocompatibility index is 1. That means that the proteins on the surface retain 100 % of their biochemical properties.

- Very well suited to all patient groups owing to the bioceramic coating. Can also be used in patients with titanium hypersensitivity.

- The implant suffers no particle abrasion as a result of mastication.

- Corrosion-free – whereas the corrosion rate of titanium rises in acidic environments, the Cerid® surface remains stable.

- The high-strength, nano-scale micro-roughness of the Cerid® surface ensures good bone apposition.

Detail of SEM photo of Cerid® coating.

Biological properties of Niob ceramic

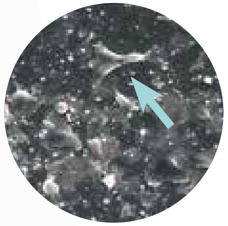
The positive findings concerning the **biocompatible Niob ceramic surface** are based on decades of experience in medical technology (such as with prosthetic knees and hips).

For the gingival area of the prosthodontic abutment sections in particular, the **gold-coloured niobium ceramic coating has proved resistant** to **corrosion** resulting from plaque build-up and helps the implant to **integrate without inflammation**.

The stable chemical constitution and hardness of the **surface ensure that the surface remains unchanged** even after many years of exposure. Over the years, that means a **much lower tendency towards inflammation** and consequently that the risk of **cervical bone loss** and **implant loss is minimised**.

Titanium with a niobium ceramic coating forming a biochemically and mechanically stable barrier in the transgingival region

Courtesy of Dr D. Repenning, Germany



A bond between the ceramic coating and gingival epithelial cells can be observed within just a few hours

Courtesy of Hitoshi Oguchi, Japan

Niobium coating on the abutment

- The smooth Niob ceramic surface features anti-plaque properties.
- Exceptional biocompatible characteristics mean that the gingival epithelial cells adhere firmly to the niobium-ceramic material.
- The surface remains unchanged even after many years of exposure.
- Biochemical and mechanical stability acting as a barrier in the transgingival region makes for an outstanding periodontal situation.
- Preventing titanium ions from being released into the tissue reduces the risk of inflammatory responses to titanium.
- As with other similarly coloured abutment coatings, the golden hue of the niobium coating, particularly in cases involving thin soft-tissue cuffs, exhibits a better colour index than conventional abutments and thus ensures natural and aesthetically pleasing appearance.

Mechanical properties

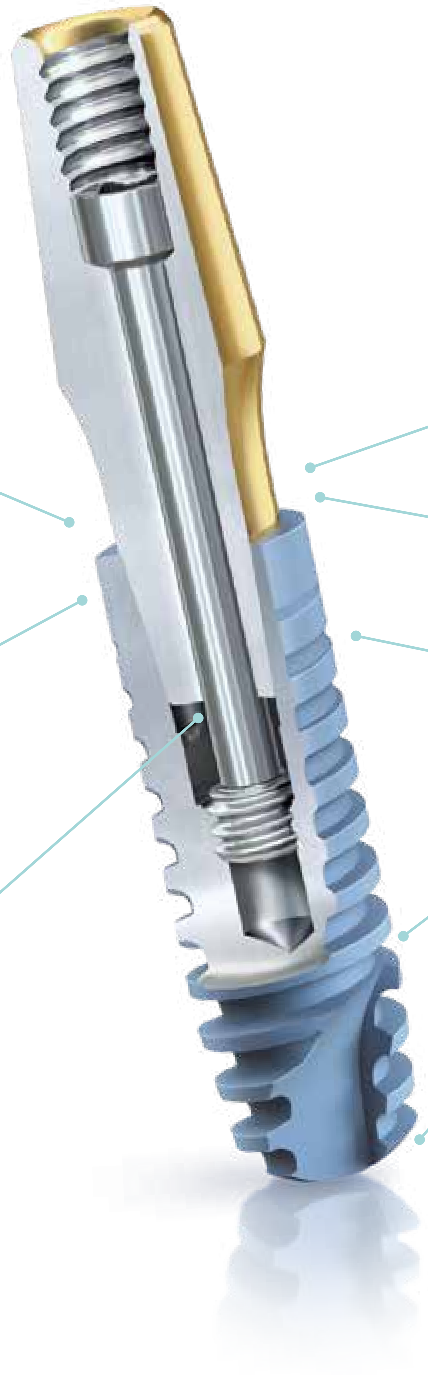
With the **myplant bio** implant system, a concept that has been documented over decades has been further advanced, optimised and adapted to the criteria of modern, future-orientated implant therapy.

The concept of a two-phase ceramic-coated implant with a **self-locking and rotation-resistant tapered internal connection** provides an almost **bacteria-proof and micro-movement-free** seal. This implant-abutment connection results in exceptional mechanical load capacity with high fatigue strength.

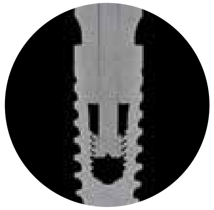
The **deep platform-switching** offers a larger surface for bone apposition on the implant shoulder, allowing a stable and healthy soft-tissue cuff to form. Consequently, with the myplant bio implant system, only **minimally invasive** exposure is required in the area around the central screw.

Subcrestal placement allows the bone to grow over the implant shoulder, which enables biological support for the peri-implant soft tissue on the vertical and thus a **much more aesthetically pleasing appearance**.

The **progressive thread design** of the myplant bio implant increases apically, and the implant body is conical with an arched curvature of the thread flanks, resulting in a **biomechanically favourable load distribution** into the bone. The apically enlarging thread area allows for good **anchoring in various qualities of bone** and produces a load distribution that preserves the bone structure during mastication. Vertical and lateral forces that occur are transmitted primarily to the more elastic cancellous bone, taking the burden off the cortical bone. As a structure lending biological support to the peri-implant soft tissue, **preserving the marginal bone level** is an essential factor in achieving a long-lasting **aesthetically pleasing outcome**.

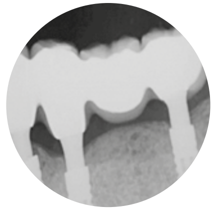


Deep **platform-switching** provides an increased area for bone deposition on the implant shoulder



A **self-locking and rotation-resistant tapered internal connection** provides an almost bacteria-proof seal

Surfaces manufactured to a high degree of precision create a strong, positive connection, similar to a one-piece implant system. The myplant bio implant system is thus **largely free of micro-movements** between the implant and abutment.



Courtesy of Prof. H.G. Nentwig, Germany.

Can be inserted deep subcrestally if bone supply is adequate

Uniform geometry of the internal **conical connection** for all components

Progressive thread design for improved primary stability and biomechanically favourable load distribution

Apical bevel for simplified insertion of the implant

Rounded implant tip for gentle sinus floor elevation

Selected publication references

Titanium contamination in tissue

Verifiable titanium contamination when the implant is inserted and consistently when under load.

1 *Schliephake H, Reiss G, Urban R, Neukam FW, Guckel S. Metal release from titanium fixtures during placement in the mandible: an experimental study. Int J Oral Maxillofac Implants 1993;8:502-511*

2 *Mombelli A, Hashim D, Cionca N. What is the impact of titanium particles and biocorrosion on implant survival and complications? A critical review. Clin Oral Implants Res 2018;29 Suppl 18:37-53.*

3 *Suárez-López Del Amo F, Garaicoa-Pazmiño C, Fretwurst T, Castilho RM, Squarize CH. Dental implants-associated release of titanium particles: A systematic review. Clin Oral Implants Res 2018;29:1085-1100.*

Titanium ions in tissue – mechanical/abrasion

Studies into changes in the surfaces of dental implants following insertion in human jawbones

4 *Grünberg C. Untersuchung von Oberflächenveränderungen dentaler Implantate nach Insertion in humanen Kieferknochen. Eine In vitro-Studie. Technical University of Munich. Munich, 2013.*

Study into the the abrasion process on implants leading to abrasion by titanium particles in the implant as a whole and the soft tissue.

5 *Romanos GE, Fischer GA, Delgado-Ruiz R. Titanium Wear of Dental Implants from Placement, under Loading and Maintenance Protocols. Int J Mol Sci 2021;22.*

Titanium contamination in tissue due to corrosion at pH 7.4

6 *Thull R, Trautner K, Karle E. Modell zur immunologischen Prüfung von Biomaterialien. Biomed Technik 1992;37:162-169.*

7 *Soler MD, Hsu SM, Fares C, Ren F, Jenkins RJ, Gonzaga L, et al. Titanium Corrosion in Peri-Implantitis. Materials (Basel) 2020;13.*

Titanium ions and inflammation-associated responses

Titanium ions increase the rate of inflammation-associated processes (usually involving evidence of tissue mediators)

8 *Degidi M, Artese L, Scarano A, Perrotti V, Gehrke P, Piatelli A. Inflammatory infiltrate, microvessel density, nitric oxide synthase expression, vascular endothelial growth factor expression, and proliferative activity in peri-implant soft tissues around titanium and zirconium oxide healing caps. J Periodontol 2006; 77:73-80.*

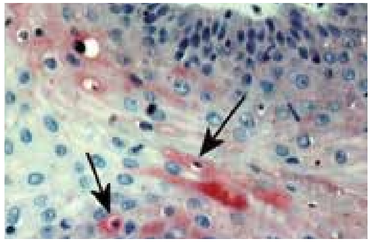
9 *Valles G, Gonzales-Melendi P, Gonzalez-Carrasco JL, Saldana L, Sanchez-Sabate E, Munuera L, Vilaboa N. Differential inflammatory macrophage response to rutile and titanium particles. Biomaterials 2006; 27:5199-5211.*

Ceramic (coating) with much more favourable findings with regard to inflammation-associated processes

10 *Zinelis S, Thomas A, Syres K, Silikas N, Eliades G. Surface characterization of zirconia dental implants. Dent Mater 2010;26:295-305.*

11 *Bylski D, Wedemeyer C, Xu J, Sterner T, Loer F, von Knoch M. Alumina ceramic particles, in comparison with titanium particles, hardly affect the expression of RANK-, TNF-alpha-, and OPG-mRNA in the THP-1 human monocytic cell line. J Biomed Mater Res A 2009;89:707-716.*

Tissue response to titanium and ceramics – in vivo study



Courtesy of Prof. H.J. Nickenig, Germany

Study into the effects of various implant materials (new niobium oxide ceramic layer – ([Ti,Nb]ON) versus the metallic layers of tantalum and titanium alloy) on cytokine expression.

Reduced inflammatory response (vs titanium)

12 Nickenig HJ, Schlegl KA, Wichmann M, Eitner S: Expression of interleukin 6 and tumor necrosis factor alpha in soft tissue over ceramic and metal implant materials before uncovering: a clinical pilot study. Int J Oral Maxillofac Implants 27(3): 671-676; 2012

Ceramic coating and biocompatibility

In vitro test system for gingival epithelial cell growth: 'HGE-15 cell-line' as a morphological equivalent to human gingival epithelial cells

"The surface of biocer was mostly covered with gingival epithelial cells. Cells shows flat and polygonal shape."
Nach Hitochi Oguchi, Japan

13 Oguchi H, Karube Y, Matsumoto K, Morito M. Response of Human Gingival Epithelial Cells (HGE-15) to Bioactive Glass RKKP. Prosthodont Res Pract 2008;7:5-11.

Exceptional chemical/biological resistance to pathogens

Heavily indented 'black corrosion' on the unprotected titanium in the acidic anaerobic environment

Anaerobic bacteria create a heavily acidic environment in the mucosal pockets and encourage 'black corrosion' on titanium

14 Sridhar S, Wilson TG, Jr., Palmer KL, Valderrama P, Mathew MT, Prasad S, et al. In Vitro Investigation of the Effect of Oral Bacteria in the Surface Oxidation of Dental Implants. Clin Implant Dent Relat Res 2015;17 Suppl 2:e562-575.

Biocompatibility

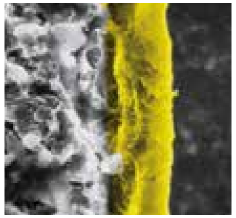
Courtesy of Prof. Thull, Germany

Proteins adsorbed on the surface remain 100 % native

$$BI = \frac{\text{Proportion of native proteins}}{\text{Total adsorbed proteins}}$$

15 Thull R, Trautner K, Karle EJ. Modell zur immunologischen Prüfung von Biomaterialien. Biomed Techn 1992;37:162-169.

Minimal inflammation with titanium-niobium ceramic



Courtesy of Dr D. Repenning, Germany

Studies into inflammatory processes when titanium-niobium ceramic is used

16 Betz T, Reuther JF, Bill J. Klinische Nachuntersuchung enossaler BoneLock®-Implantate unter besonderer Berücksichtigung der periimplantären Gewebe. Eine Studie über 5 Jahre. Dtsch Z Mund Kiefer Gesichts Chir 1995;19:35-40.

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