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# TECHNOLOGY OFFER

## Coating of vascular stents to prevent thrombosis

*An innovative method for surface treatment of titanium vascular stent and other blood connecting devices has been developed. Method includes nanostructuring the surface of vascular stent by electrochemical anodization and subjecting the nanostructured surface to neutral oxygen atoms to eliminate surface induced thrombotic reactions. The developed method reduces adhesion and activation of platelets on medical devices. Producers of vascular stents and other blood connecting devices are sought for licence or technical cooperation agreement.*

**Technology field:** Cardiology, vascular stents, surface treatment, nanostructuring, plasma.

The major cause of mortality in the modern world is coronary artery disease. The majority of percutaneous coronary interventions involve stents, which are implemented in order to help enlarge the lumen wall, restore the blood flow through the affected vessel and thus decrease the risk of heart attack. In blood the clumping or aggregation of platelets in the blood leads to the formation of a thrombus which increases risk of heart attack.

The very promising properties of titanium and titanium alloys, specifically high biocompatibility, resistance to body fluids, great tensile strength, flexibility and high corrosion resistance, have ensured their successful and extensive use as biomaterials. Success of stents depends mainly on avoiding the aggregation of platelets in the blood vessels.

**The solution:**
**The problem is solved by nanostructuring of the surface and subjecting the nanostructured surface to plasma to eliminate surface induced thrombotic reactions.**

### *Advantages*

- **Method of surface structuring prevents adhesion and activation of platelets**
- **The surface is free of impurities**
- **Nanostructured surfaces have appropriate chemical structure and topography which reduces the risk of thrombosis on blood contacting devices**

The method of invention enables appropriate surface conditioning, which highly reduce adhesion and activation of platelets. In particular the method involves:
1.) nanostructuring the surface of titanium by electrochemical anodization



 

and
2.) subjecting the nanostructured surface to neutral oxygen atoms to eliminate surface induced thrombotic reactions.

The effect of surface structuring of the stent is schematically depicted in Figure 1. The platelets interact with the surface in different ways according to the surface of the tested samples.

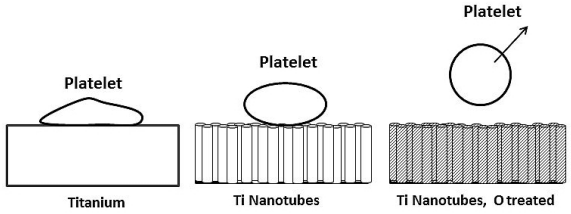


Figure 1: Schematic depiction of the surface effects on platelet interaction with surface.

The effects of the presented method were tested by incubation of samples with blood. Differences in adhesion of platelets were observed with SEM. As seen in Figure 2, titanium surface alone is highly attractive for attachment and activation of platelets, while practically no platelets were observed on the surfaces prepared by the presented method.
According to SEM analysis on samples done by the method of invention the platelet adhesion is prevented.

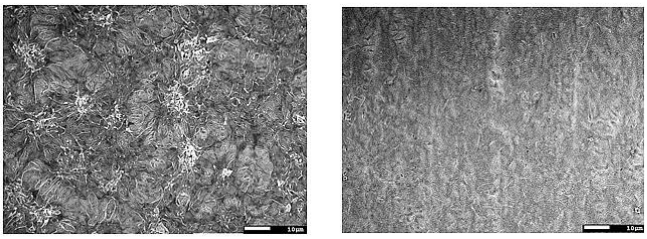

Figure 2. SEM image of adhesion of platelets on plain titanium (left) and nanostructured surface (right).

The technology has been developed in the Departement for Surface Engineering and Optoelectronics - F4 on Jožef Stefan Institute (JSI). The Jožef Stefan Institute is the leading Slovenian scientific research institute, covering a broad spectrum of basic and applied research. The staff of more than 960 specializes in natural sciences, life sciences and engineering. Based on European Research Ranking, Jožef Stefan Institute was ranked among the top ten research institutes in Europe in 2014.

## STAGE OF DEVELOPMENT

The technology has been demonstrated and tested in laboratory. Technology is ready to be licensed out.

## INTELLECTUAL PROPERTY

Patent application filed, WO2018029166A1.

## CONTACT DETAILS

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