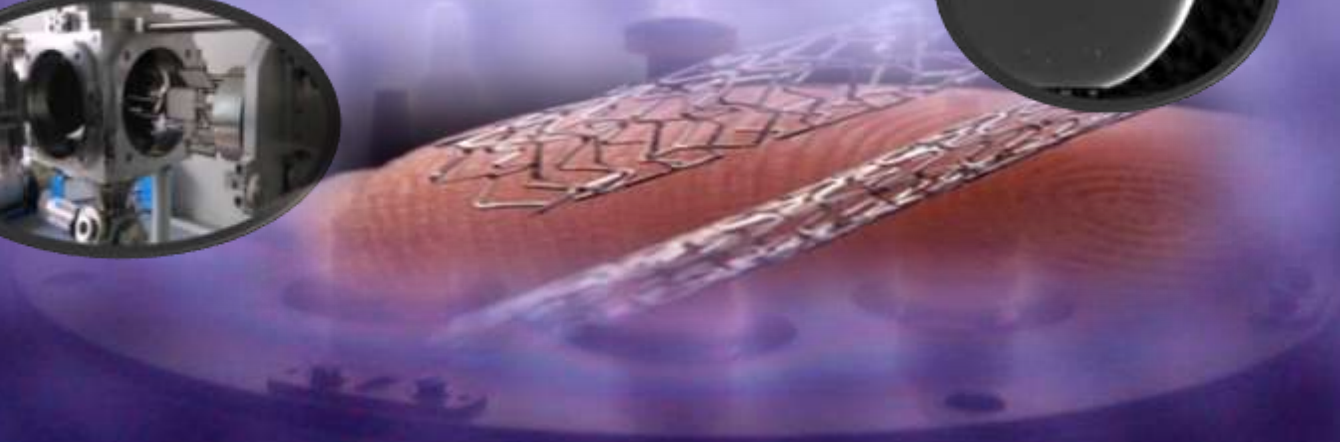
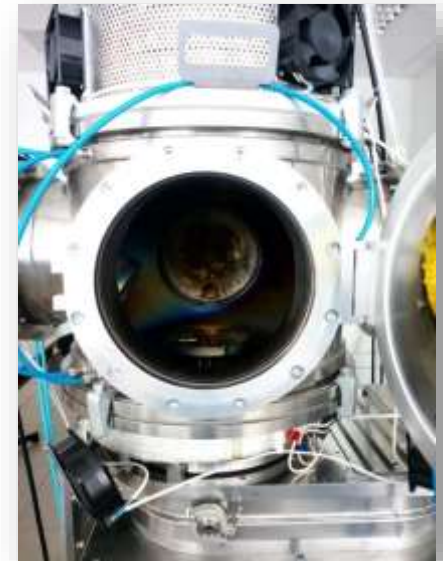
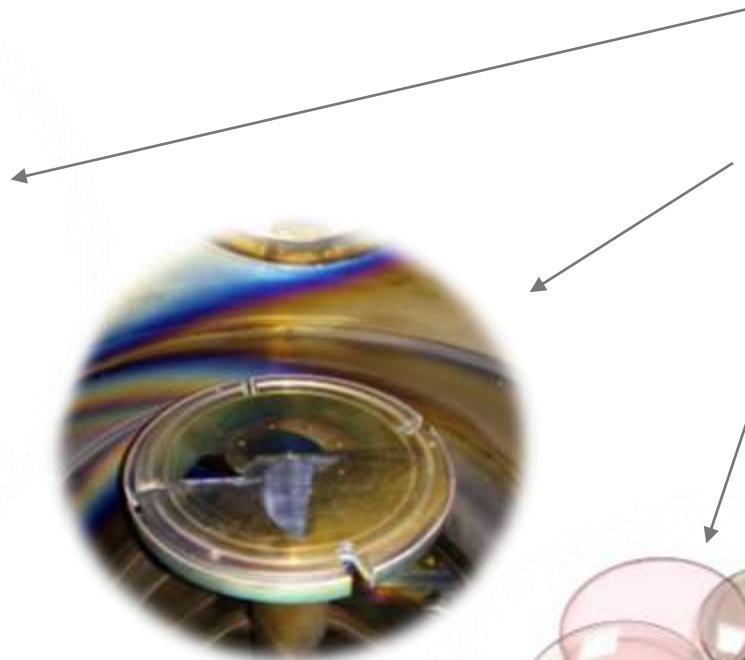


Plasma technologies in medicine



MDL protective coating

The coating prevents the deposition of viruses (including COVID-19) and bacterial colonization of surfaces

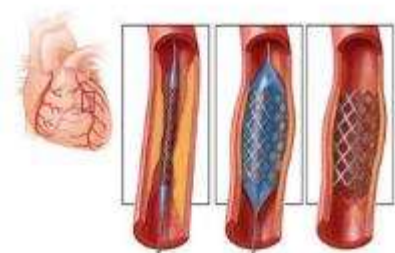


Implants with a high risk for the patient according to the FDA

- Prosthetic heart valves
- Intrauterine contraceptives
- Implants and endoprosthesis
- Coronary and peripheral stents
- Etc.

In spite of the improvement in the applied implants and the improvement of the technologies for their manufacture, the percentage of complications and unsatisfactory outcomes, arthroplasty, remains quite high.

There is a premature destruction of implants and as a result their breakdown, also there is an extraction of particles by implants which enter the blood and then spread to the organs and tissues of the body.



Issues with implant usage

The main factors which cause the unsuccessful outcome of operations during implant installation:

- bacterial contamination of the implant
- cellular and immune reactions to a foreign body
- bio-degradation of implants and, as a consequence, breakdown of the implants

Plasma technology for implants

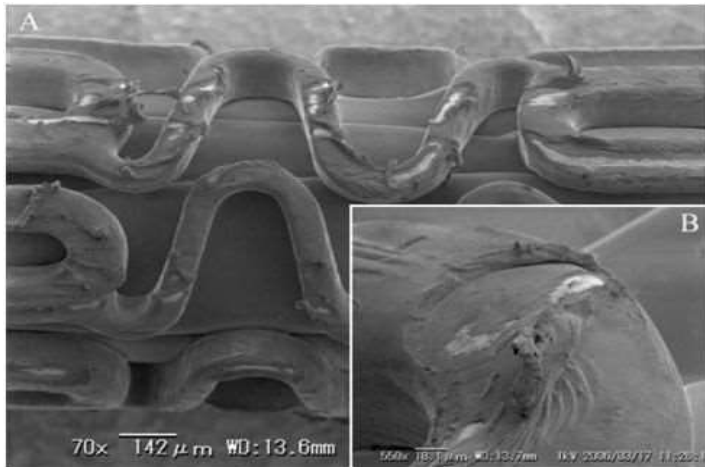
Our technology provides the properties necessary for successful functioning for each type of implant:

- **Biotolerism** (or biocompatibility, complete absence of influence on tissues and cells)
- **Bactericidal**
- **Thrombose resistance**
- **Adhesive strength**
- **Chemical and mechanical resistance**

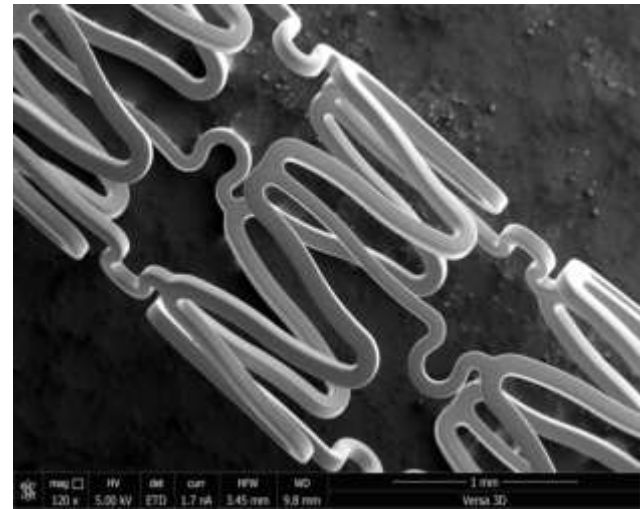
The technology allows to completely cover the surface of a product with complex morphology.

Properties of plasma technology

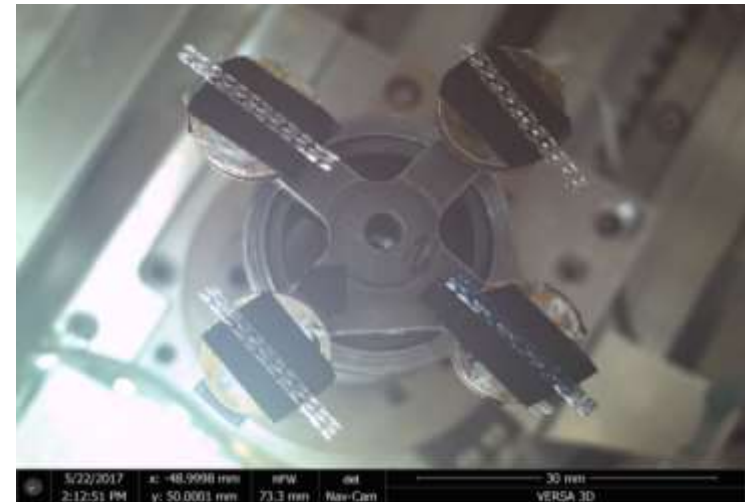
Destruction of the polymer coating of the implant



Our perpetual coating of the implant

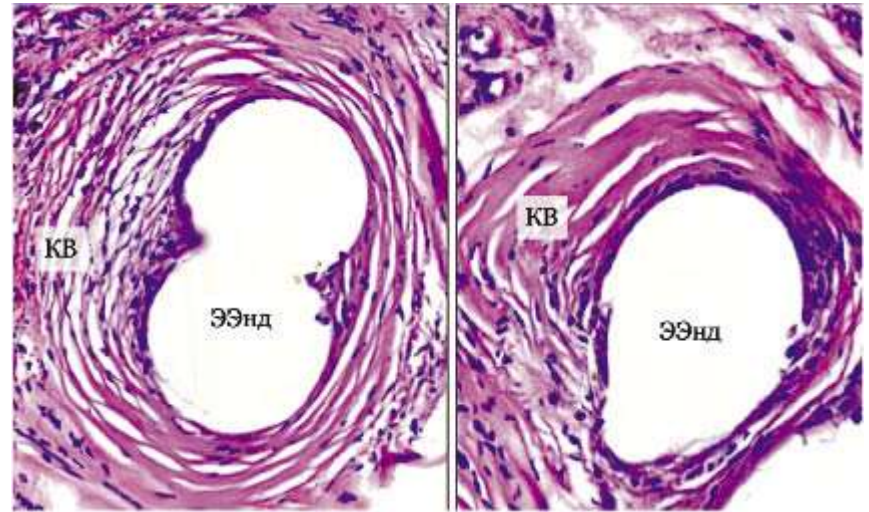
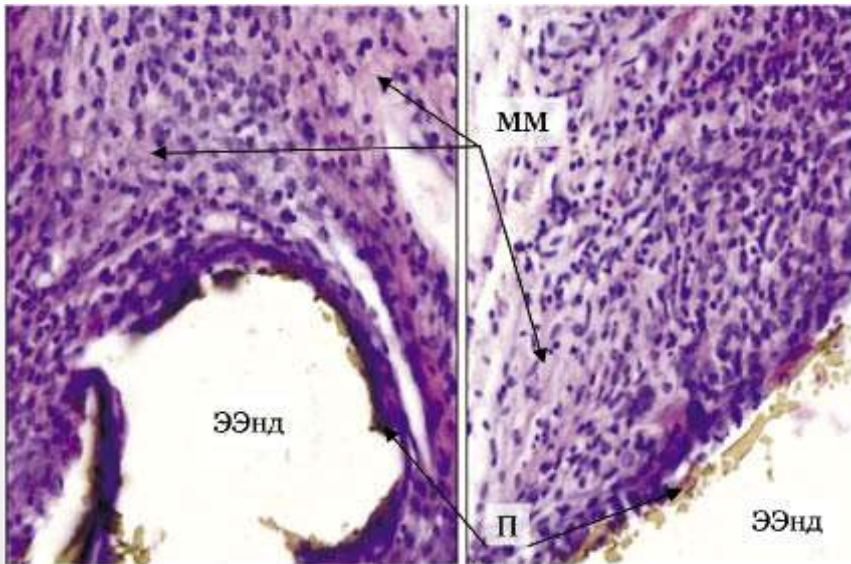


The main difference of coated stents is not the violation and blocking inherent in coronary stents with a polymer base and a drug coating, but the integration into the processes of the body



Immune reactions to the coating

Giant cells of foreign bodies in contact with the implant with coating were absent.



The structure of the connective tissue capsule around the experimental sample: concentric small-cell layers of collagen fibers (CF) with a smooth transition to the surrounding connective tissue, the absence of inflammatory changes and giant cell reaction to the implant.

Properties of plasma technology

Bio-factor

Contact inertness of the surface - there are no free covalent bonds in the coating, which determines **the absence of chemical and physical impact** on the tissues, and also **does not cause unwanted cellular reactions** to the foreign body. Studies of coatings show the absence of morphological changes in cells and destructive tissue reactions.

Mechanical properties

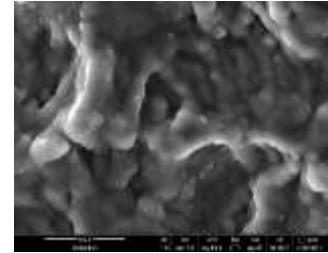
High mechanical strength, chemical inertness of the coating, density similar to diamond, ultra-low sliding friction coefficient and ideal adhesion to metal surfaces allows to increase the durability of structures without changing their functional capabilities.

Electrophysical properties

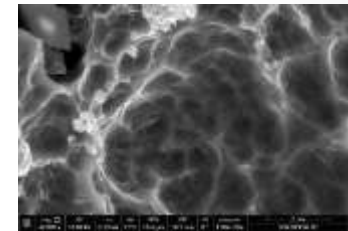
Nanosize inclusions-islands of layered structures of a coating of one type, with a smaller width of the band gap, are located in the matrix of the other layer type with a larger band gap, because of the difference in the width of the gaps, charge carriers are localized within the island, resulting in a quasiatomic (which is a set of separate levels) energy spectrum, which **prevents platelet aggregation**.

Problem: the release of metal ions

Surface without coating provokes the release of metal ions



with carbon coating of Sp3 phase



without coating

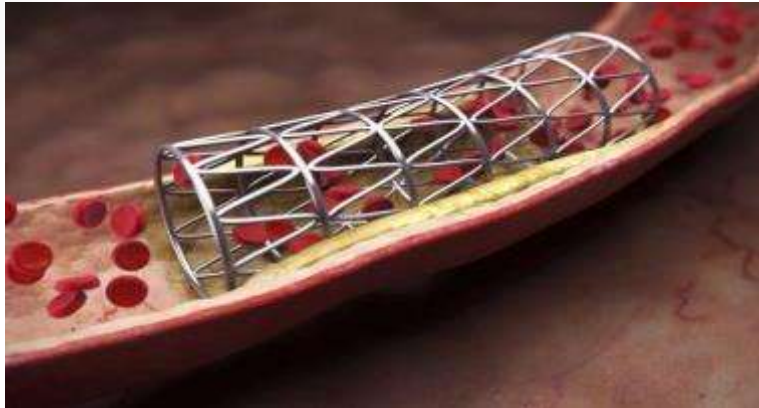
Implant sample	Molecular mass parameters of supernatants after incubation of dental implants		
Implants	D, nm	ACR, kcps	PD, %
without coating	221	5.3	0.005
with carbon coating of Sp3 phase	0	0	0

D - the average particle diameter

ACR - the average count rate, kilo counts per second,

PD - polydispersity of the sample, %

Problem: calcification



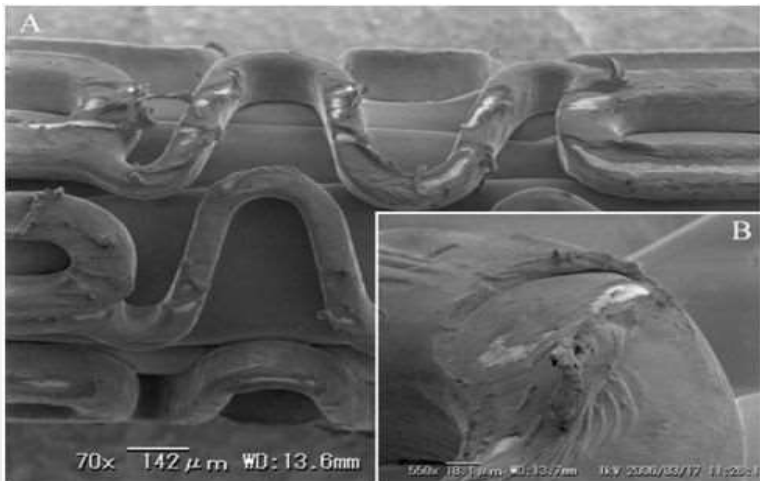
Medtronic Stent

Calcification happens when calcium builds up in blood vessels (including aortas)

Disadvantages

A) Damage to the integrity of the stent coating after a standard opening of a Noncompliant Catheter.

C) Platelet death caused by cytostatic agents, which leads to a decrease in blood clotting and disturbance of mechanisms of restoration of damaged vessels.



In vivo calcification in subcutaneous implantation to rats

Product	Ca mg / g dry tissue content				
Stents	1	2	3	4	5
Sample without covering	57,63 ± 2,43	31,87 ± 2,01	52,49 ± 2,07	55,91 ± 1,89	48,45 ± 1,46
Sample with covering	0,29 ± 0,13	0,34 ± 0,14	0,41 ± 0,09	0,41 ± 0,11	0,39 ± 0,09

Problem: bacterial colonization

Covering on the prosthesis of the vessel



Vessel Implant by Gore & Associates Co



Adhesion and survival of gram-positive (GP) and Gram-negative (GN) test cultures on implant surfaces with a nano-carbon coating and without coating

GP test / GN test	S. aureus / E. coli		S. epidermidis / Kl. pneumoniae		C. albicans / Ps. aeruginosa	
	ad.	surv.	ad.	surv.	ad.	surv.
Coated implant	0/0	0/0	0/0	0/0	2,04/0	2/0
Implant without coating	3,26/3,1	4/5	2,79/5	5/6	3,3/4	4/6

Financial performance

UK

Patients already attend annual examinations **due to the existing problems associated with the use of implants**. They get tested for the presence of metal molecules in the blood and implant particles in the surrounding living tissues.

USA

The amount of legal claims against the three leading American implant manufacturers reached \$ 6 billion.

Evaluate predicts the growth of expenses of implant manufacturers for research and development from the current \$ 25.3 billion to \$ 34 billion by 2022

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