

Metallic implants are widely used in medicine. They possess excellent mechanical properties, however, they might corrode, what makes healing process difficult and might lead to re-implantation. Another problem is occurrence of bacterial infection at the implantation side. Bacterial infection and inflammation are among the main causes of complications after the application of titanium orthopedic implant. They are difficult to heal, cause complications, increase cost of healthcare and can also lead to increase of relapse.

Therefore biodegradable drug eluting layers which prevents from metallic corrosion and provides antibacterial activity would be advantageous. The development of such coatings, however, requires conducting of several fundamental research including: optimization of preparation methods of titanium implants, synthesis and selection of polymer as well as selection of polymer layer application method. (Fig. 1).

The main scientific goal of the project from the viewpoint of basic research is to determine the impact of: 1) surface modifications method of the metallic biomaterials (providing different properties) which serves as a core of the implant as well as 2) methods of bioresorbable polymer layer application (and different parameters) on: primarily layer adhesion, and also drug release kinetics and physicochemical properties of the implants.

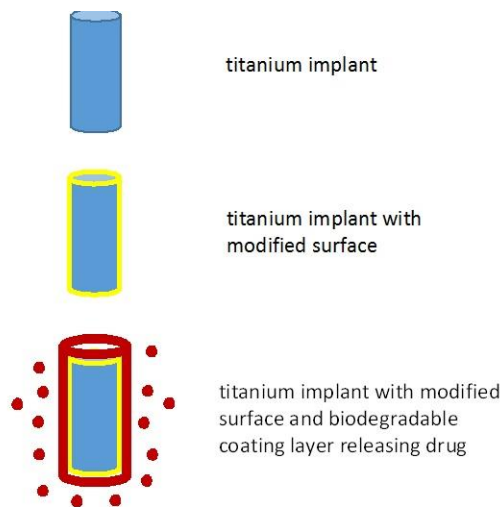


Fig. 1. Main stages of modification process of titanium implants.

Conditions of surface pretreatment of titanium alloys, prior to the process of the polymer coating, will be developed with the use of Ti6Al4V and Ti6Al6Nb alloys by mechanical methods (grinding, vibration machining, sandblasting) and anodic oxidation. For the manufactured samples study of corrosion resistance and ions release to the physiological solution after long-term exposure will be determined by the method of atomic emission with inductively coupled plasma ICP-AES spectroscopy. A series of aliphatic copolyesters will be prepared as a covering layer for metallic implant (polymerization in bulk, with the use of non-toxic initiator). Polymer coating will be obtained by various techniques: spin coating, dip coating. The influence of surface modification methods of the metallic biomaterials as well as kind of polymer and technique of its application on the metallic core will be analyzed in order to select the best variants for preparing polymer-metal implant. Polymer layer degradation and drug release kinetics will be characterized. Finally, the selected implants with biodegradable drug eluting coating will be subjected to biocompatibility and antibacterial activity analysis.

Developed strategies to obtain optimal implants with ciprofloxacin eluting biodegradable coatings will prevent corrosion of metal implants by forming tight barrier, and on the other hand, locally releasing drug will prevent the development of infections. Therefore, the detailed basic research on the influence of metal implants on biodegradable coating will be a progress toward development of biodegradable and biofunctional implants for various medical applications.