

DESCRIPTION FOR THE GENERAL PUBLIC

In recent years there has been a significant increase in demand for joint endoprostheses. Materials used in manufacturing of joint implants, such as the hip or knee joint, should meet many requirements, e.g. reliability, wear resistance or corrosion resistance in body fluids environment. Unfortunately, despite many years of experience and numerous accomplishments, it has not yet been possible to develop a perfect material that would fulfill all expectations. Each group of the biomaterials – polymers, ceramics or metal alloys – is characterized by many desirable qualities, but also has its limitations. For this reason, ways to improve the performance of metallic biomaterials are still sought.

In some applications, metal alloys are particularly difficult to replace, especially in biomechanical endoprostheses or surgical instruments. Because patient safety and health are paramount, modern methods are being sought to ensure the highest possible durability and reliability by achieving the best operating characteristics of biomaterials used in bone surgery. Researchers' experiences indicate that improvement in biofunctional properties of metallic materials can be achieved by applying anti-wear coatings. Selection of the suitable coating can not only increase the corrosion resistance of the material in the environment of biological fluids, but also help to reduce friction in artificial joints, what translates to reduction in wear of implant.

The aim of the research project is to analyze the influence of surface modification on performance of metallic biomaterials.

The project is anticipated to evaluate the influence of the mechanical properties of substrate and coating and the processes that occur in the contact zone on wear and friction of surface modified metallic biomaterials. It is also planned to assess the validity of the application of selected coatings on metallic implant materials used in joint replacements manufacturing. The project also assumes an analysis of the effect of surface modification of metallic biomaterials on their corrosion resistance.

The studies planned within the scope of the work include numerous material analyzes using modern research techniques. Material characteristics include e.g. determining of surface topography of the samples with the use of contact profilometry and optical-laser microscopy, obtaining information on chemical composition of coatings tested by energy-dispersive X-ray spectroscopy techniques (EDS), and determining their phase composition using X-ray diffractometry. It is also planned to investigate the selected mechanical properties of the analyzed substrates and coatings by using nanoindentation techniques and to conduct adhesion measurements using the scratch method. Functional properties of the coatings will also be analyzed by the means of corrosion tests (potentiodynamic method) and wear tests.