Bacterial colonization of surfaces of dental implants poses a serious challenge for contemporary medicine. Such a process, starting from adhesion of individual microbes, leads to formation of well-adherent and dense biofilm in its final stage. In order to avoid its formation, antibiotic therapy is typically applied, however, in many cases it turns out unsuccessful. Therefore, new solutions of this problem are constantly sought i.e. covering both pre- and post-implantation efforts. One of the most effective ways to prevent the formation of the biofilm is surface modification of dental implant material during its production process through fabrication of antibacterial coatings. Recently, a number of methods allowing for deposition of such coatings was proposed of which micro-arc oxidation (MAO) technique deserves a special attention. The results of studies presented in peer-reviewed literature covering both biological tests and microstructure observations confirmed that the coatings fabricated with MAO method with antibacterial additives allow for significant limiting of activity of microbes beside characteristic porous nature of such material. However, currently applied metallic antibacterial additions may cause serious side effects. Therefore, an effort is made to develop new, neutral material for such application. Nanometric ceramic particles turned out to be significantly safer for human organism, despite their lower antibacterial effect as compared with metallic ones. It has to be noted that there is a lack of comprehensive approach to the microstructure and key mechanical properties i.e. adhesion, hardness and residual stresses and correlation with MAO process parameters allowing for a full control of the incorporation of ceramic antibacterial additives.

Therefore, the main goal of the proposed project is optimization of parameters of MAO deposition process aimed at fabrication of the coatings with ceramic antibacterial additions like ZrO_2, ZnO and CeO_2 on the surface of commercially pure titanium. Application of new type of material intended to be used in the future as dental implant, i.e. titanium grade 4 subjected to hydrostatic extrusion, is considered as an additional aspect of these studies. The influence of a strong anisotropy of the substrate material on microstructure and mechanical properties of produced coating will be investigated. Summarizing, correlation of coatings deposition parameters with MAO process with advanced microstructure and mechanical studies should allow for a full control of the incorporation of ceramic antibacterial additions.