The NiTi shape memory alloys (SME), with its chemical composition near to equal-atomic, reveal incredible interesting properties - one- and two-way shape memory and superelasticity effects and good corrosion resistance. These features contributed to the many applications these alloys in a wide range of biomedical fields - for the manufacturing of surgical devices and medical implants. However, the specific mechanical properties of NiTi alloys make it better than other metallic biomaterials suitable for the bone fixation [1].

However, the high content of nickel in the alloy and ability to release its ions in the bodily fluids environment, still raises concerns as toapplication of these materials as long-term implants [2]. Therefore, it is justified to ensure better corrosion resistance of NiTi SMA, which is achieved by modifying the surface of alloy by suitable, biocompatible, protective coatings. The surface of the NiTi alloys have been coveredby polymers, ceramics or composites [3]. The coatings also create additional barriers to protect the human body against Ni ions migrations and can also fulfill some additional functions. For example, calcium phosphate-based (CaP) layers, ie, hydroxyapatite (HAp), facilitate the connection of a bone with a metallic implant [4]. Implantation of the implant into the body may lead to the introduction of micro-organisms, which later result in the development of inflammation. Therefore, it is necessary that the implant exhibit antibacterial properties. Silica matrix enables incorporation of metal ions (e.g. silver) in low concentrations and their gradual release into the environment, which will provide a long-lasting antibacterial effect [5]. However, the greatest potential has composite materials, which combine multiple functions.

The structure, chemical composition and surface properties of the coatings covered implants are crucial important in osseointegration processes and may be controlled by the use of various techniques of surface engineering. However, most of them require the use of elevated temperatures, what in the case of NiTi alloys may lead to the decomposition of alloy and therefore results in reduction of the shape memory and superelasticity effects [1]. Also, too thick and /or rigid coatings can limit or completely block the shape memory effect. Therefore, it is important to develop a method of surface modification that enables to control the thickness of the coatings. The economic aspects related to the purchase and use of equipment should be also taken into account. For these reasons, a method of electrophoretic deposition (EPD) it appears to be very attractive. This method is an interesting alternative to many other methods of surface modification with thin coatings [6].

In the project, in order to improve the biocompatibility, the surface of the NiTi SME alloy will be covered by biocompatible multifunctional composite layers consisted of titanium oxides, hydroxyapatite and complex of nano silica-silver. In the first stage, in order to improve the corrosion resistance of NiTi, the surface will be covered with TiO_2 film by autoclaving. Then, the composite coatings consisting of HAp and $nSiO_2$ / Ag complex will be deposited on the passivated surface by electrophoresis (EPD). Such a combination will result in creation of coatings promoted of osseointegration and revealed antibacterial properties. The obtained multifunctional layers will be detailed characterized in basic research by characterization: structure (XRD, Raman spectroscopy), morphology and topography (SEM, AFM, profilometer). An influence of the applied methods on the course of the unique martensitic transformation closely related to shape memory effect will be characterized by DSC. It will be also very important to describe an ability of layers to deformation associated with the shape memory effect and its adhesion to metallic substrate. Thetendency to corrosion processes in a simulated body fluid (OCP, the potenctiodynamic characteristics) will be characterized. The studies will also determine the wettability of the coatings surface, which has a significant influence on the absorption of molecules promoted the adhesion of bacteria or fibroblasts to the implant surface. The bioactivity of coatings in an environment simulated body fluids will be also assesses. In order to determine the influences of created new composite coatings on human cells, the biological biocompatibility will be determined by use the fibroblast cells. The bacteriological tests confirming antibacterial properties of coatings will be also performed. The studies will give information on optimal conditions for producing homogeneous, biocompatible, multifunctional layers do not cause blocking unique shape memory effect. The layers with the best antibacterial properties and the same contributing to the proliferation of desired cells will be selected.

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