A NEW METHOD FOR THE SYNTHESIS OF COATINGS OF HA-GELATIN ON TITANIUM*

O.A. GOLOVANOVA

Department of Inorganic Chemistry Omsk F. M. Dostoevsky State University, Russian Federation

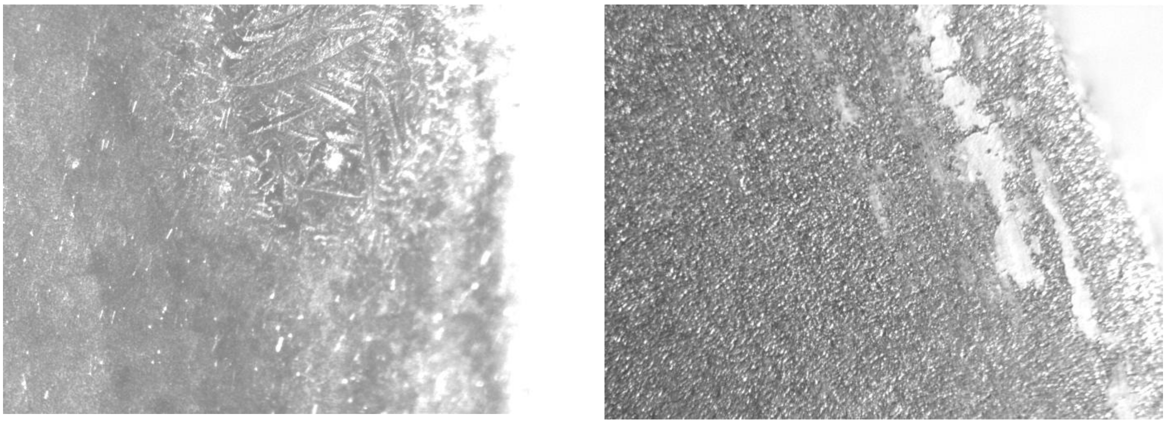
The disadvantage of all the above methods is insufficient adhesion of the coatings to the metal substrate. Strong chemical bonding between the coating and the substrate can be formed through fusion temperatures 1073–1273 K, which results in a hard diffusion layer.

An alternative method is formation of biomimetic coatings on metals and their alloys. In this case, the implant–bone bonding develops through the biomimetic formation of an active carbonate-hydroxyapatite (HA) layer on the material surface. This layer is formed as a result of the transition of calcium ions from the implant material into the fluid which composition is similar, as an example, to that of the simulated body fluid (SBF). Biomimetic apatite coatings may be formed on an inert material stable to dissolution, polymer as an example. This method has been successfully used for coating various polymeric materials, including the surface of fibers or fabrics. In this research, we aimed to produce a biomimetic gelatin-calcium-phosphate coating on the VT1-0 titanium alloy and to determine its composition and physicochemical properties.

Synthesis of the coatings on the plates for the HA system was performed in the presence of 1%, 2% and 3% gelatin. A hydroxyapatite suspension was prepared with the addition of gelatin, and then the titanium substrate samples were immerged in the suspension. The pH was 7.4, which corresponds to the physiological pH value. A VT1-0 grade titanium alloy was used for the study. This material has high tensile strength; it is highly biocompatible, non-toxic and corrosion resistant. Its characteristics are similar to the mechanical properties of the bone tissue. The surface of the samples was polished and etched; the etchant composition was HNO_3, NaF (1:1).

As can be seen from the figure, the HA crystals formed in the presence of gelatin are of large sizes. The XRD results showed that the samples synthesized in the simulated body fluid under varying concentration of gelatin are single-phase and represent hydroxyapatite.

During formation of the coatings based on the synthesized composites (Fig. 1), dendritic crystals are seen to start growing on the plate edge.



a. b.

Fig. 1. Surface morphology of the hydroxyapatite crystals grown on the VT1 titanium alloy surface in the presence of gelatin after 3 day soaking in the solution: etched surface (a), polished surface (b) (100x magnification).

The crystallization rate was found to depend on the technique used for treating the implant surface. More rapid growth of crystals was observed in the microsections of the polished samples, whereas on the etched samples, dendritic growth occurred in bulk defects caused by etching. Enhanced HA-gelatin deposition on the titanium substrate surface is found to occur on etched samples. It is revealed that exposure of titanium substrates to PIB with j=100 A/cm^2 makes possible further growth of HA crystals and regeneration of the metal implant surface.

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