KEYNOTE LECTURES

SYNTHESIS–STRUCTURE–PROPRETIES CORRELATION OF HYDROXYAPATITE BASED BIOCOMPOSITES

O. Shikimaka[1,*], M. Bivol[1], D. Grabco[1], D. Topal[1], C. Pyrtsac[2], A. Prisacaru[1,2], V. Cobzac[3], V. Nacu[3], B. A. Sava[4], M. Dumitru[4], C. Tardei[5], B. G. Sbarcea[5]
[1]*Institute of Applied Physics, Moldova State University, Chişinău, Republic of Moldova*;
[2]*Technical University of Moldova, Chişinău, Republic of Moldova;*
[3]*"Nicolae Testemitanu" State University of Medicine and Pharmacy, Chişinău, Republic of Moldova;*
[4]*National Institute for Laser, Plasma and Radiation Physics, Bucharest, Romania;*
[5]*National Institute for R&D in Electrical Engineering, Bucharest, Romania*
[*]E-mail: olga.shikimaka@ifa.usm.md

Bioceramics based on hydroxyapatite (HA) and bioglass (BG) are of increasing interest due to their potential using in the treatment, regeneration or replacement of bone tissue. In this work, biocomposites based on hydroxyapatite obtained by two different routes - chemical precipitation (HAP) and sol-gel (HAG) - were investigated. The bioglass of an original boro-silico-phosphate composition was introduced into bioceramics in two different proportions of 5 and 10%. In addition, different temperatures covering the range of 1100-1250°C were used for the biocomposites sintering. A comparative analysis of the influence of each of these conditions on the structure, porosity, mechanical behavior (hardness, plasticity, fragility) and biological properties (bioactivity, cell viability) of the composites was performed.

The results showed that HAG-based composites had higher porosity in comparison with HAP ones (Fig 1. a, b). Higher glass content and higher sintering temperature (T_s) promoted the decomposition of the hydroxyapatite into tricalcium phosphate. This in turn influences the mechanical and biological properties [1]. HAP-based composites demonstrated higher hardness and at the same time higher fragility as opposed to HAG-based ones. The optimal T_s was found to be 1200°C and the optimal glass content 5% for better mechanical properties. Concerning the bioactivity, HAG-based composites were more active during the first days of SBF (simulated body fluid) testing due to higher porosity and solubility showing earlier formation of carbonated hydroxyapatite (CHA) layer on its surface (Fig. c). But after longer period of 10-15 days there were no differences between HAP and HAG based composites, both of them showing a dense layer of CHA important for osteoconduction and osteointegration of the implant material. The MTT test of biocompatibility demonstrated 94-99% of cell viability for HAP-based composites and some lower values for HAG ones due to higher dissolution rate inducing an increased ion concentration in the surrounding biological environment.

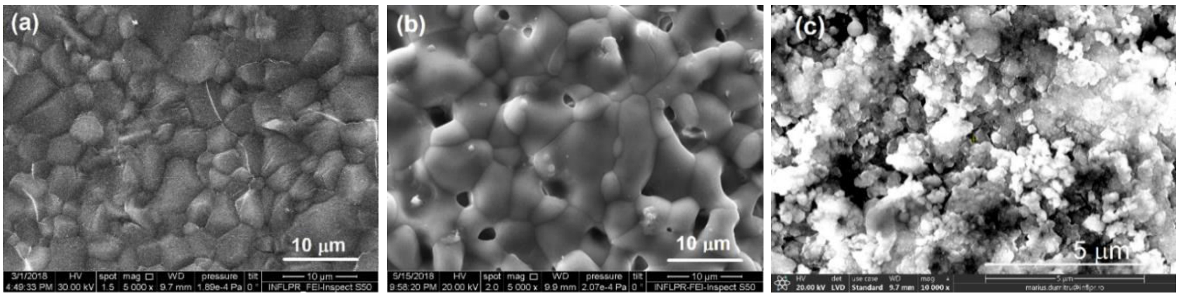

Figure 1. SEM images of HAP (a) and HAG (b) based composites with 5% of BG sintered at 1250°C. HAG-5%BG-1200°C after 3 days of soaking in SBF (c).

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