SYNTHESIS OF HYDROXYAPATITE NANOPARTICLES

*C. Santos[1,2], M. M. Almeida[1] and M. E. V. Costa[1]**

1-Department of Ceramic and Glass Engineering, CICECO, University of Aveiro, 3810-193 Aveiro, Portugal

2- Institute for Biological Interfaces; Forschungszentrum Karlsruhe GmbH, 76344 Eggenstein-Leopoldshafen Karlsruhe, Germany

elisabete@cv.ua.pt

Hydroxyapatite $Ca_{10}(PO_4)_6(OH)_2$ (Hap), due to its similarity to the mineralized matrix of natural bone, is a calcium phosphate specially significant in biomedical applications, such as artificial bone graft, reinforcing filler for composites, drug delivery systems, etc. Hap properties are strongly dependent on its stoichiometry, cristalinity and particle size. Natural bone is itself a nanocomposite, consisting of Hap nanosized needles with an average length of 50 nm, 25 nm in with and only 2-5 nm thick, dispersed in a collagen matrix [1]. Such morphology, together with a convenient spatial orientation of the Hap nanocrystals inside the organic matrix, has a major contribution to the properties of bones, particularly their mechanical properties.

In order to simulate the natural bone structure, synthesis of nanosized Hap has received much attention in recent years. Several techniques, including solid state reaction route, wet chemical synthesis, sol-gel based procedures, emulsion and micro emulsions methods and hydrothermal synthesis have been used [2]. Depending on the technique, it is possible to synthesize materials with various morphologies, composition, and cristalinity degree, which will essentiality condition their mechanical properties, bioactivity and dissolution behaviour in biological environment.

In this research, it is explored and discussed the influence of the precipitation method (wet chemical synthesis and hydrothermal synthesis) in the preparation of nanosized Hap particles in presence of citric acid, with the aim to develop the fundamental knowledge to purse alternative ways to prepare novel nanosized Hap particles with different characteristics that can be used in diverse applications.

The obtained results show the feasibility to prepare Hap nanoparticles with distinct properties by wet chemical synthesis, or by hydrothermal synthesis. Transmission electron microscopy (TEM) results revealed that Hap nanoparticles obtained by wet chemical synthesis (figure 1a) are poorly crystalline and present a needle-like shape with a length of 100 nm, whereas Hap nanoparticles obtained by hydrothermal synthesis (figure 1b) are crystalline, uniform and rod-like shaped with an average length of 55 nm, 26 nm in with.

References:

[1]- Maria Vallet-Regi et al., Calcium phosphates as substitution of bone tissues. *Progress in solid state chemistry*, 32: 1-31, 2004.

[2]- Heilen Arce et al; Effect of pH and temperature on the formation of hydroxyapatite at low temperatures by decomposition of a Ca-EDTA complex. *Polyhedron;* 23 (2004), 1897-1901.

Figures:

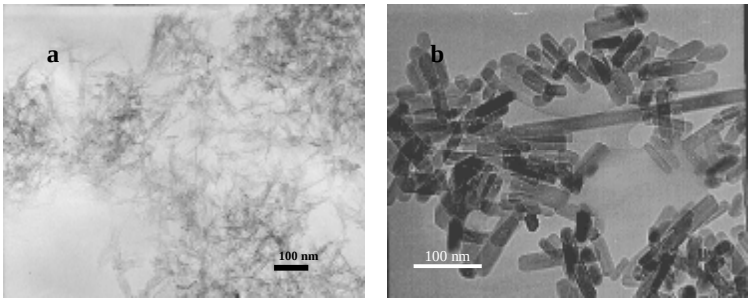

Figure 1- TEM images of nanosized Hap particles prepared by (a) wet precipitation method; (b) hydrothermal synthesis technique.