Biomaterials

MIM.5.P072
AFM study of a calcium hydroxyapatite morphology

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Keywords: hydroxyapatite, atomic force microscopy, morphology

During the last 20 years bioactive materials based on calcium hydroxyapatite with chemical composition and structure similar to that of mineral constituent of bone tissue are widely used in surgery. However, the problems of synthesis of nanodispersed calcium apatite with highly developed surface, which are the most similar to the morphology of particles of mineral component of bone, are still relevant.

In this paper, the morphology of nanopowder apatite was investigated by scanning probe microscope JSPM-4500/4610 (JEOL, Japan) using the atomic force microscopy method.

The image parameters were as follows: the image size 90.0 x 90.0 nm, image height - 12.2 nm, the exposure time at single point – 83.33 microseconds. The cantilever with diamond whiskers NSG10-DLC was used as a probe. The high-dispersion powders of HAP were obtained by sol-gel method. The particle size were proved to be of about 40 nm (Fig.1), and the specific surface area of ~ 500 m^2/g.

We observed the characteristic shape and “texturing” of apatite particles. The sizes of apatite particle were very close to those in natural bone. However, the particles in natural bone have needle shape, and the “horseshoe” shape was due to the drying in the synthesis process.

The ends of the particles were not fixed, which was caused by the surface tension. For example, by drying the particles in acetic acid remained needle-shaped. Because in recent cancer treatment, for example bone cancer treatment, gold nanoparticles were used the study of interaction between the particles of calcium apatite nanopowder and gold nanoparticles becomes of great relevance. In particular, it was found that due to deposition (physical adsorption) gold nanoparticles are formed of ~ 3 nm size on apatite surface, and it can be practically used for delivery the drugs to diseased bone.

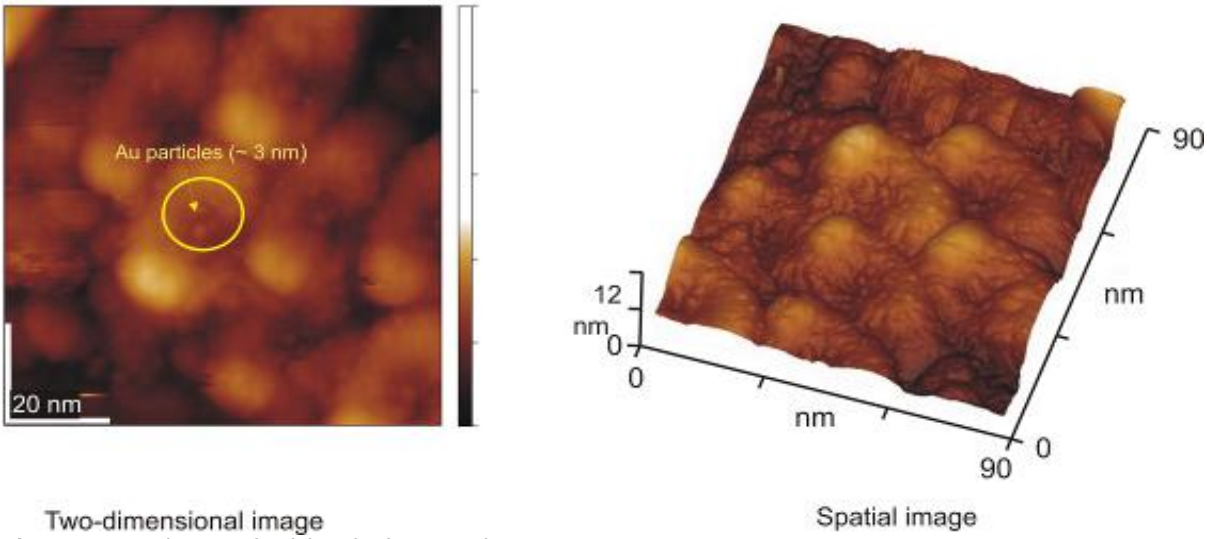

Figure 1. AFM image of calcium hydroxyapatite.