INFLUENCE OF ORGANIC ADDITIONS IN NACRE LAYER DEPOSITION ON TITANIUM FOILS FOR IMPLANTATION

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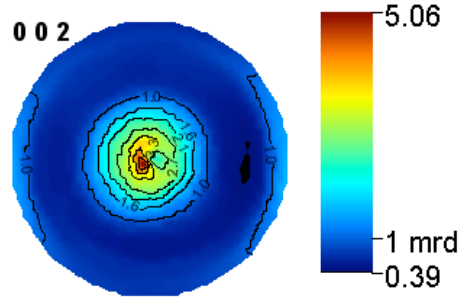
Calcium carbonate crystallizes in three different forms in natural habitat, calcite, aragonite and vaterite. Calcite is used for a long time in bone prostheses but this crystalline form gives rise to some drawbacks, like prostheses dislocations after 15 to 20 years. This is putatively due to the absence of ostéoinduction of this allotropic form. Vaterite is too much unstable to be used as human bone implants. On the other hand it has been proved that natural aragonite formed in nacreous layer of pearl oysters (like *Pinctada maxima*) is very biocompatible and ostéoinductive. In molluscs, the natural nacre layers are strongly textured and composed of 2 % to 5% in mass of organic phases.

This work focuses on the synthesis of nacre-like layers on titanium foils using an electrochemical way. In order to obtain calcium carbonate deposition, synthetic sea water is used as electrolyte. The aragonite form has been obtained by optimisation of deposition parameters like potential, temperature, concentrations of organic phases (chitosan and extracted phases of natural nacre powder).



To obtain similar properties as natural nacres, one of the important layer parameter is the texture.The growth of aragonite must be controlled to obtain aragonite c-axes mainly perpendicular to the foil surface, as already obtained on purely inorganic deposits (see pole figure). The aragonite microstructure resembles pseudo-hexagonal platelets (SEM image) as the ones found in natural mollusc nacre layers. In order to characterise texture, structure and microstructures of the layers, we use 4-circle x-ray diffractometry in the "combined analysis" methodology. Several experimental conditions were spanned and systematic characterisation used which helped stabilising textures with {001} pole figures. Different crystallite shapes and sizes were obtained, which can be explained by a shift of the electrochemical equilibrium. Using organic addition, the regular cauliflowers aragonite crystal shapes are obtained, but these are composed of pseudo-hexagonal crystal cross-section. In such cases the textures of the deposits culminate at about 2 to 3 m.r.d. and mimic some class of gastropods nacre layers, like *Tectus niloticus*.