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INNOVATIVE STRATEGY FOR SHAPING NEW BIOMIMETIC MATERIALS FOR THERAPEUTIC PURPOSES

Stratégie innovante pour la mise en forme de nouveaux matériaux biomimétiques à visée thérapeutique

Due to many different reasons such as tumor resection or important bone fracture, a bone substitute can be needed. In this field many different strategies has been developed with calcium phosphate such as ciment, or porous scaffold. However, porous phosphocalcic ceramic surface properties (reactivity, roughness, nanoporosity) still need to be improved for a better bone regeneration. Moreover, infection, which is one of the major risks associated with surgery, and common phenomenon of resistance to antibiotics are problematic and deserve to be taken into account at the initial stage of material design.

In this work we propose to use supercritical CO_2 to create a new generation of highly reactive biomaterials with properties similar to cortical bone mineral (architecturally, chemically). In addition, the developed process allows in the same time a functionalisation of this filling material to orient its biological activity or even induce therapeutic activity thanks to different ionic species well known by the body such as Zn, Cu, Ag, Sr... Each of them bringing different properties to the material: anti-inflammatory, antibacterial or stimulating for bone regeneration.

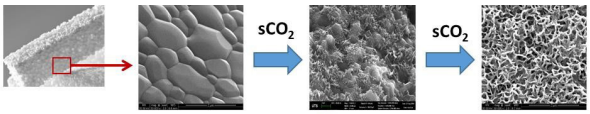

Figure 1: SEM images of HA/TCP bioceramic modified by supercritical CO_2 process

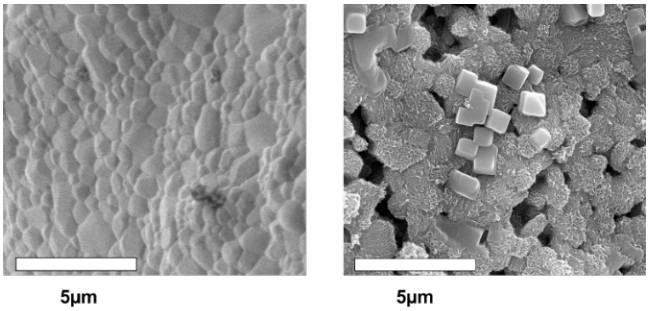

Figure 2: SEM images of HA/TCP bioceramic unmodified and modified with ionic species

The first aim of this work has been to determine without foreign ionic species, the nature of the newly formed calcium phosphate at the surface of the scaffold thanks to different characterization methods (RAMAN, FTIR, DRX, BET, Mercury porosimeter SEM) and optimize the process parameters (pressure, temperature, degassing speed…) in order to obtain a uniform coating.

The second part has been to integrate the doping ions into the structure one by one at different concentration. Different analyses has been carried out like RAMAN, FTIR, DRX, SEM, EDX but also release test, antibacterial test, cells viability test.