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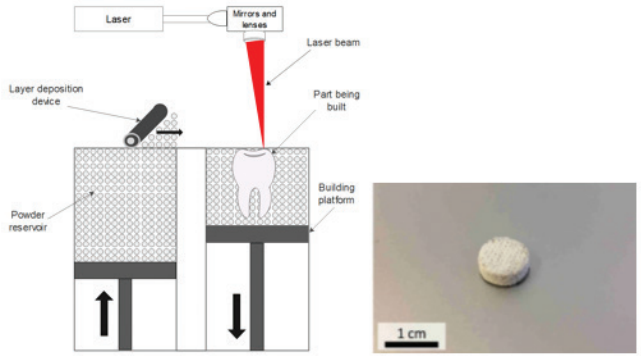
TAILORING CALCIUM PHOSPHATE POWDER PROPERTIES FOR 3D-LASER PRINTING

Adapter les propriétés de la poudre de phosphate de calcium pour l'impression laser 3D

Due to their strong similarities with the natural mineral component, calcium phosphates ceramics (stoichiometric hydroxyapatite, B-TCP, substituted calcium phosphates, and biphasic compounds) are privileged biomaterials as orthopedic implants or dental restorations in medical or aesthetics applications. In combination with additive manufacturing technologies, bioceramics parts can be designed with complex shapes to be harder and stiffer than steel with better thermal and chemical resistance than metals or polymers, and at the same time to be biocompatible and/or bioactive improving the osseointegration/osseoincorporation of the implant.

Selective Laser Melting/Sintering are promising additive manufacturing techniques allowing the production of functional complex net-shaped and fully dense parts. However, specific tailored ceramic powder for these 3D-laser printing techniques need to be produced. The challenge here is to produce nano-structured agglomerates in order to increase the surface and thus the reactivity required for effective sintering while keeping suitable flowability and dispersing properties for handling facilities, which is preferably achieved by spherical agglomerated particles of a few tens of microns. Within this context, the objectives of the phD work will be to understand the relationships between the powder properties and the synthesis process parameters. The tailored nano-structured agglomerates could be produced through a multistep process based on precipitation, wet grinding, calcination and spray-drying steps, arranged in this order or differently. The effect of the operational parameters on the chemical and physical properties of the powder will be characterized as well as their sinterability (by additive technologies and conventional sintering).



Selective laser sintering/melting process (left) and first test made of stoichiometric hydroxyapatite powder (right)
(Figures adapted from L. Ferrage thesis 2017)