ABSTRACT SUBMISSION

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Robocasting as a versatile tool for shaping composited and multi-materials with controlled geometries and distribution of the phases

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ABSTRACT

Robocasting, also called Direct Ink Writing (DIW) is an additive fabrication technique initially developed for ceramics. It relies on the extrusion of a paste (or ink) loaded with the material of interest through a thin needle, whose position is controlled in 3D. Appropriate paste compositions must be chosen to control the good printability of the inks, according to necessary properties : mainly shear thinning behavior, adequate viscosity, storage modulus and yield stress. This is reached through the optimization of several parameters (solid loading, particle size distribution, dispersant and gelling agents…). Moreover, post-treatments also have to be optimized : drying, debinding and sintering steps (when necessary) must all be controlled in order to avoid cracking, to preserve the shape and architecture and to reach the desired microstructure.

We will show here the versatility of robocasting. Optimization of the above-mentioned parameters allows the printing of many different materials, for many different applications. Indeed, robocasting technology enables the fabrication of complex geometries with or without the use of sacrificial supports. It makes possible the fabrication of highly porous scaffolds, but also of dense pieces. It enables gradients of architecture and composition thanks to the use of several syringes or a dynamic mixer : the composition of the ink car vary between mono-ceramic, multi-ceramics (zirconia + alumina with a precise contrôle of the location of phases), polymers and also metals (exemples of Ti and Mg will be shown). Porosity at different scales can also be achieved by combination with other fabrication techniques such as addition of sacrificial fugitives, or partial sintering.

As a result, robocasting is a good choice for the shaping of composites with controlled geometries and controlled spatial distribution of different phases. They can be used in many fields, from Ecology with the creation of composites for energy storage, to the Biomedical field with the fabrication of biomaterials for dental or orthopedics applications. These latter will be emphasized in our talk.

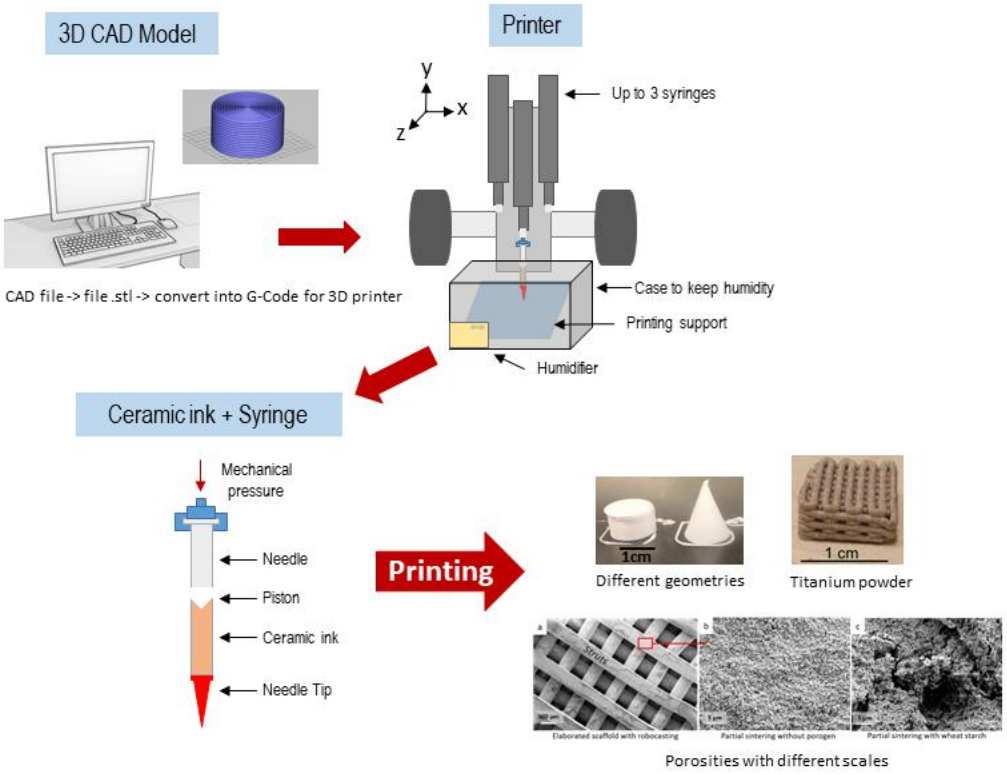

Figure 1 : Process of Robocasting