



# ADDITIVE MANUFACTURING OF CUSTOMIZED CERAMIC DENTAL IMPLANTS SUBSEQUENTLY JOINED WITH BIODEGRADABLE METAL CORES

## -NEWSLETTER 1-

WP1 was carried out simultaneously with WP2 and realized mainly by National Taipei University of Technology (NTUT) in consultation with Wrocław University of Science and Technology (WUST). The main objective was to develop a new process for printing ceramic preforms and designing gradient structures with various degrees of porosity.

As part of the task, new ceramic gradient structures were made. 99.9% Al<sub>2</sub>O<sub>3</sub> (AES-11C from Sumitomo) was chosen as the base. Not only the AES-11C were used to print samples (ideal to be in high solid loading), but also the following pore-making strategies were taken.

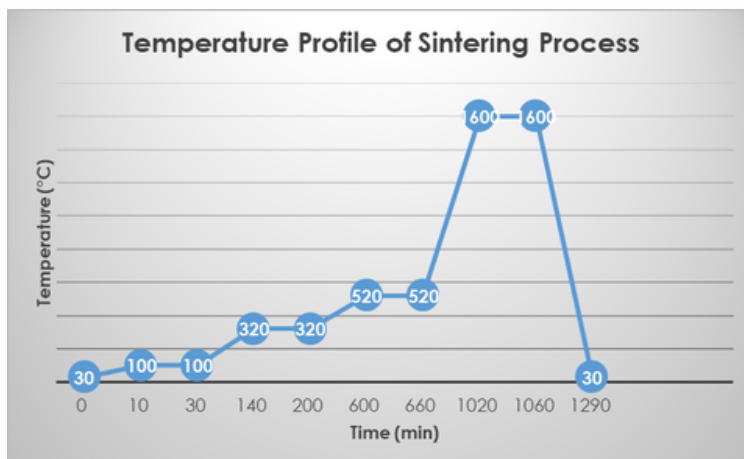
In the first approach (approach A), samples were made from a mixture of powders of different sizes to reduce shrinkage. AES-11C and HSA-02 powder are used in which the D<sub>50</sub> is 0.39 and 2 µm.

The next approach is by adding a pore-forming agent to which various additives were added: PMMA (10~20µm, approach B), and powdered walnut shells (40~80µm, approach C). In approaches A and B, the preforms were made with layers of a thickness of 20 µm each, while in approach C, the thickness of a single layer was 60 µm.

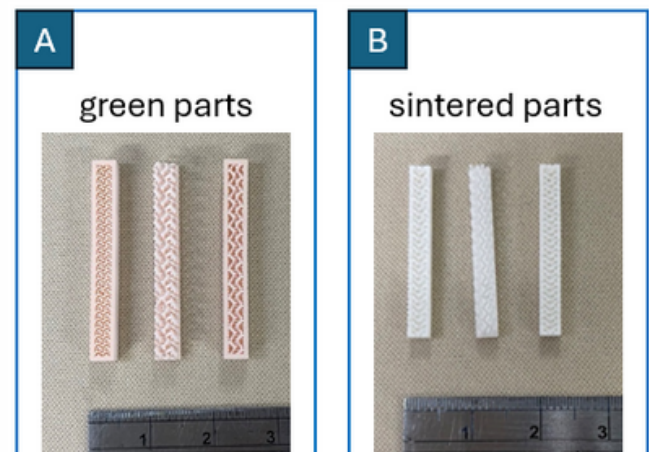
### Composition of ceramic powders used for 3D printing;

In brackets, the nomenclature of samples in WP2, WUST

	materials	
<b>approach A</b> (H1, H2, H3)	AES – 11C	HSA – 0.2
<b>approach B</b> (P1, P2)		PMMA
<b>approach C</b>		walnut shell
<b>approach D</b> (A1, A2, A3)		-



Temperature profile of the sintering process for  
AES-11C/HSA-0.2 sample



Printed results AES-11C/HSA-0.2 in 20µm  
layers; A - before and B - after sintering



Based on the fabrication tests, three compositions were selected (AES-11C, AES-11C/HSA-02 and AES-11C/PMMA) and used to produce samples: beams with different porosity and a tooth with structured meshed root. The prepared samples were delivered to WUST, where magnesium infiltration tests were performed.