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THE INFLUENCE OF THE FOAMING AGENT ON THE MECHANICAL PROPERTIES OF THE PM HYDROXYAPATITE-BASED BIOCOMPOSITES PROCESSED BY TWO-STEPS SINTERING ROUTE

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Abstract: As bone tissue engineering applications, the studied biocomposites are processed by the powder metallurgy (PM) route. The powder mixture is made of hydroxyapatite submicronic powders (< 200 nm) respectively micronic (30-50 μm) as matrix and TiH2 (100-150 μm; 15-25% wt) as reinforcement's precursor as well as blowing agent. To increase the porosity by the space holder technique, CaCO3 powder is added (5-10% wt.) [1]. The homogenization step is performed in Pulverisette 6 ball mill (n = 200 rpm, time = 30 min.) followed by the cold compaction at 120-170 MPa. The green compacts are submitted to the two-steps sintering (TSS) route developed on the Nabertherm conventional furnace: 1st step at 900^0C for few minutes and the 2nd step at 800^0 for 450 minutes respectively 600 minutes. The efficiency of this sintering route is accompanied by the improvement of the mechanical properties of the processed biocomposites [2-4]. The hydrogen and CO2 releasing as foaming reagents along the 2nd step dwell time determine specific Ti, TiO2 and CaO content in the biocomposites' structure. The microhardness is tested by the Vickers micro-indentation testing (HV) using a Vilson-Volpert 401MVA micro-hardness tester. Using the initial gradient of the unloading curves, the Instrumented Hardness (HIT) and Instrumented Elastic Modulus (EIT) will be estimated using the Oliver and Pharr model.

Selective references:

1. S. F. F. Mariotto et al. - *Porous stainless steel for biomedical applications***,** Mat. Res. 2011; 14(2), p. 146-154
2. M. Mour et. al. - *Advances in porous biomaterials for dental and orthopaedic applications*, Materials 2010, 3(5), p: 2947 - 2974
3. Y. I. Fang, D. K. Agrawal, D. M. Roy, R. Roy - *Microwave sintering of hydroxyapatite ceramics*, J. Mat. Res., 9, p. 180 – 187
4. N. Iqbal et al. – *Microwave synthesis, characterization, bioactivity and in vitro biocompatibility of zeolite-hydroxyapatite (Zeo-HA) composite for bone tissue engineering applications*. Ceramics International, 40, December 2014, p. 16091-16097

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