The influence of the foaming agent on the mechanical properties of the PM hydroxyapatite-based biocomposites processed by two-step 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 TiH_2 (100-150 μm; 15-20 % mass.) as reinforcement's precursor as well as blowing agent. To increase the porosity by the space holder technique, $CaCO_3$ powder is added (5-10 % mass.). The homogenization step is performed in Pulverisette 6 ball mill (n = 200 rpm, time = 30 min.) followed by the cold compaction at 150 MPa. The green compacts are submitted to the two-steps sintering (TSS) route. Both foaming reactions developed in a manner specific to this composite system: the hydride dehydrogenation lead to TiO_2 (rutile) synthesis respectively the CaO was not synthesized along the $CaCO_3$ decomposition, and $Ca_3(PO4)_2$ was formed . The compression tests of the researched biocomposites proved widened spectrum of mechanical behavior, from fragile to ductile, depending on the foaming agents content and decomposition reactions along the TSS technology.