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Structural analysis of PM hydroxyapatite-based biocomposites elaborated by two-step sintering

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The aim of the research is to develop bone grafts from biocompatible materials by powder metallurgy technology (PM). This paper presents the results of experimental research regarding the elaboration of some biocomposites by two-step sintering (TSS). The initial powder mixture consists of hydroxyapatite powders (30...50μm and <200 nm; 75 %mass) as matrix, respectively TiH_2 (<150 μm; 15-25 %mass) and $CaCO_3$ (5-10 %mass) as flowing agents and reinforcement precursor. The homogenization is performed in a Fritsch-Pulverisette 6 planetary mill (n=200 rot/min for 30 minutes). The green compacts, unilaterally cold compacted at 150 MPa, are submitted to the sintering treatment in a Nabertherm chamber furnace, type L5/12. The sintering parameters are: the 1st step = the sintering temperature, T = 900°C for 1 min, followed by the 2nd step = 800°C for t = 450, respectively 600 minutes. The paper follows the foaming agents and the influence of the sintering parameters on the bone implants structure. The biocomposites macrostructure analyzed by optical microscopy (OM) outlines the closed/open porosity type depending on the foaming agents' participation percentage. The structural analysis studied through SEM and EDX outlines the presence of the foaming reaction products of which TiO_2/Ti has positive effects and CaO has negative effects on the bone graft functionality.

Keywords: biocomposites, hydroxyapatite, two-step sintering, structural characterization

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