(12-039) - Effect of the Mg2+ substitution on the sintering behavior and compressive strength of doped b-TCP ceramics

Alan Christie da Silva Dantas - Doutor
Dantas, A.C.S (1); Acchar, W. (2)
(1) UNIVASF; (2) UFRN

Beta -Tricalcium phosphate (b-TCP) ceramics are of interest for bone requirements implants due to resoption behavior. The mechanical properties of b-TCP, however, are not yet sufficient to allow load bearing application of implants. The aim of this work was to investigate the effect of Mg2+ substitution on the strength sintered TCP. The powders were synthesized using a mixture of Ca(OH)2 suspension and diluted H3PO4 with addition of MgO and calcined at 750 °C, 900 °C and 1050 °C. The cold isostatic pressing compacts were sintered at 1200 °C and 1300 °C, respectively. It was shown that a small Mg content (1.5 mol%) increased both compressive strength and fractional density of the TCP material sintered at 1200 °C from 132 ± 39 MPa at 92.1 % of fractional density to 193 ± 29 MPa at 94.5 % of theoretical density. Higher amounts of Mg inhibited the grain growth provoking a increase of the boundary mobility activation energy. SEM analysis of the fracture surfaces of the materials sintered at 1200 °C reveled a transgranular fracture mechanism for powders calcined at 750 °C. At higher calcination temperatures fracture mechanism changes to intergranular, due to exaggerated grain growth. Abnormal grain growth (AGG) was observed after sintering at 1300°C, as result of Calcium pyrophosphate (CPP - C2P2O7) liquid phase formation. Increase of Mg content promoted AGG, due to inhibition of grain growth during normal grain growth resulting in a increase of the residual elastic energy of the system.