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FLASH SINTERING OF TRICALCIUM PHOSPHATE (TCP) BIOCERAMICS

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ABSTRACT

Tricalcium phosphate (β-TCP) bioceramic was consolidated by flash sintering in the present work.
TCP powders were synthesized by solid-state route, starting from calcium carbonate and ammonium phosphate, and shaped into cylindrical pellets of different height by uniaxial pressing. Sintering was performed within an on purpose modified dilatometer working under constant heating rate and monitoring shrinkage and electrical parameters (current and field), simultaneously.
The obtained TCP bodies exhibit well densified microstructure, maintaining the β-TCP composition.
A power balance model, based on a thermal runaway mechanism and considering the contribution of the contact resistance on the voltage actually applied on TCP material, is shown to successfully predict the flash phenomenon.
The achieved results, although preliminary, show the possibility to employ flash sintering to obtained dense β-TCP products at lower furnace temperature and in shorter time with respect to the conventional process, avoiding the undesirable expansion related to the β to α transition.

Keywords: flash sintering; β –TCP; thermal runaway; bioceramics

1. INTRODUCTION

In the past decades, calcium phosphate ceramics have gradually assumed a primary role in tissue engineering, due to their chemical affinity with the mineralized portion of bone and dental enamel [1]. They are often defined as bioactive ceramics, because of their capability to be solubilized by the biological fluids, thus promoting the osteoblast activity (osteogenesis) and leading the formation of new integrated tissue (osteoconductivity) [2]. Within this wide family of compounds, the most interesting are hydroxyapatite $Ca_{10}(PO_4)_6(OH)_2$ (HA), tricalcium phosphate $Ca_3(PO_4)_2$ (TCP) and their