

Winter 3-11-2016

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## Recommended Citation

Matteo Frasnelli, "Flash sintering of TCP bioceramics: Effect of particle size and influence on  $\beta \rightarrow \alpha$  transition" in "Electric Field Assisted Sintering and Related Phenomena Far From Equilibrium", Rishi Raj (University of Colorado at Boulder, USA) Thomas Tsakalakos (Rutgers University, USA) Eds, ECI Symposium Series, (2016). [http://dc.engconfintl.org/efa\\_sintering/64](http://dc.engconfintl.org/efa_sintering/64)

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# Flash sintering of TCP bioceramics: effect of particle size and influence on $\beta \rightarrow \alpha$ transition

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KEYWORDS: TCP nanopowders, flash sintering,  $\beta \rightarrow \alpha$  phase transition

In this work, sintering behavior of tricalcium phosphate ceramics under the effect of an external electrical field (in Flash sintering configuration) was analyzed to obtain dense bio-resorbable components. The aim was to understand whether the application of the external E-field, which allows to reduce drastically sintering time and temperature, limits also the undesired  $\beta \rightarrow \alpha$ -TCP phase transition.

TCP powders were synthesized by solid state reaction and by wet synthesis through precipitation from aqueous solutions, this allowing to obtain amorphous calcium phosphate nanoparticles, which were crystallized into nano  $\beta$ -TCP by thermal treatment. Then, cold-pressed green pellets were prepared and their sintering behavior was studied by dilatometry under different E-field at constant rate heating. The presence of  $\alpha$ -TCP and the microstructure were investigated by XRD and SEM techniques.

It is shown that a Flash phenomenon takes place for both TCP powders morphology below 1000°C it being more evident at higher E-fields and when smaller particles were used. Moreover, although  $\beta \rightarrow \alpha$  transition occurs at ~1150°C for pure TCP, the detection of both polymorphs indicates a local higher temperature, which could be correlated to Joule effect induced by the current flow along the material.