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P4. Influence of α -Tricalcium Phosphate Crystallinity on Cement Formation

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INTRODUCTION: Calcium phosphates have been used in orthopaedic surgery for several decades. Due to their similarity to the natural bone, calcium phosphate cements (CPC) are able to successfully adapt to the body as well as integrate into the bone structure, filling bone defects. Different level of reactant crystallinity made by synthesis and heat treatment have not yet been investigated for the influence on the rate of cementation. Our goal is to produce porous calcium deficient hydroxyapatite from the hydrolysis of tricalcium phosphate [1] using source materials with a different crystallinity. Alfa tricalcium phosphates (α -TCP) when mixed with water undergoes the following hydrolysis reaction: $3\alpha\text{-Ca}_3(\text{PO}_4)_2 + \text{H}_2\text{O} \rightarrow \text{Ca}_9(\text{HPO}_4)(\text{PO}_4)_5\text{OH}$.

MATERIALS AND METHODS: Powder was prepared by precipitation of calcium nitrate and dibasic ammonia hydrogen phosphate solutions in alkaline medium, filtration, washing and drying at 120 °C. To obtain α -TCP at different levels of crystallinity, synthesized powder was heated at elevated temperatures (625-900 °C) for 10 min. Cementation reactions were carried out by mixing α -TCP powders with water and placement in a humid environment at 38 °C for different time periods (1-24 h). XRD and FTIR methods were used to characterize the starting powder and determine the cementation reaction. Further analysis was completed by Rietveld analysis of XRD data and deconvolution of FTIR spectra.

RESULTS AND DISCUSSION: XRD results showed that crystallinity of α -TCP increased with temperature, as confirmed by Rietveld refinement. Cementation results showed the formation of CDHA at shorter times for smaller crystal size containing powder - cementation was faster for powders heated at lower temperatures.

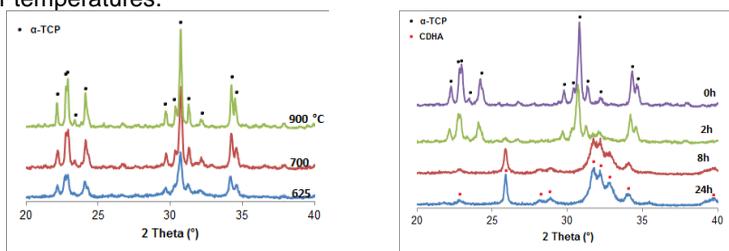


Fig. 1. XRD diagrams of α -TCP powders showing crystallinity increase by increasing the temperature (left); cementation reactions of α -TCP powder heated at 700 °C (right)

Keywords: calcium phosphate cements, cementing reaction, crystallinity.

References:

1. R. G. Carrodeguas et al., *Acta Biomaterialia* 7 3536–3546 (2011).