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Formation of discrete β -Ca₃(PO₄)₂-Y₂O₃ phase mixtures influenced through elevated heat treatments

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Abstract

The possibility to attain a discrete β -tricalcium phosphate (β -Ca₃(PO₄)₂)/yttria (Y₂O₃) composites starting from the solution based precursors were deliberated. The sequential steps of calcination temperature and the associated phase changes to yield a pure form of β -Ca₃(PO₄)₂/Y₂O₃ were elaborated through a wide range of analytical techniques. Alteration in the precursor concentrations yielded β -Ca₃(PO₄)₂/Y₂O₃ composite with a wide range of individual compositional ratios. The advanced crystallization of Y₂O₃ is evident whereas the delayed formation of β -Ca₃(PO₄)₂ is mainly contributed by the sluggish phase transition of calcium deficient apatite. The formation of pure β -Ca₃(PO₄)₂/Y₂O₃ composite is attained only at 1500 °C, where Y³⁺ prefers accommodation at the Ca²⁺(1), Ca²⁺(2) and Ca²⁺(3) sites of β -Ca₃(PO₄)₂ structure. The selective mechanical properties determined from the indentation technique implied a detrimental role of Y₂O₃ in the resultant mechanical data of β -Ca₃(PO₄)₂/Y₂O₃ composites.

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