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A novel crystallization technique of hydroxyapatite utilizing contact reaction of minute droplet with atmospheric plasmas: Effects of the liquid source composition on the produced crystal properties

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Abstract

To develop the technique for the control of the crystal composition and properties such as size distribution and morphology utilizing the contact reaction field around the minute droplets in atmospheric pressure plasma, fine spherical particles of hydroxyapatite ($(Ca_{10}(PO_4)_6(OH)_2)$; HAp) were synthesized by a new plasma crystallization method. In this work, to elucidate the effects of the production region and crystal properties of hydroxyapatite for the liquid source composition, Ca^{2+} concentration and the Ca/P molar ratio in minute droplets were varied. The following results were obtained: 1) fine spherical HAp particles can be produced by the introduction of minute droplets with the initial Ca^{2+} concentration of 0.5 mol/*l* and the Ca/P molar ratio of 1.67. 2) the composition of the produced particles depends on both the material salt concentration and Ca/P ratio in the HAp source solution. 3) when the initial Ca^{2+} concentration is set in the range higher than 1.0 mol/*l* at the constant Ca/P molar ratio of 1.67, fine spherical particles of β-TCP and HAp mixture are crystallized. 4) For the Ca/P molar ratio below 1.67, α-TCP and HAp co-precipitated. 5) The dependence of $(C_{Ca})_0$ on the average size of the produced HAp particles is large