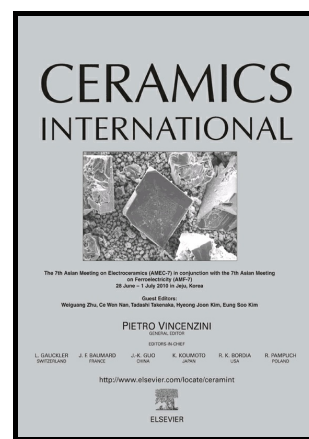


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**Combined precipitation and spray drying for the synthesis of hydroxyapatite nanopowders as soft spherical granules**

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**Abstract**

The aim of this study is to produce crystalline “hydroxyapatite” (HAp) nanopowders with very high “specific surface area” (SSA) as soft spherical granules in very small size. The HAp nanopowders were synthesized by sol-gel, biomimetic, gel combustion, precipitation and by “Combined Precipitation and Spray Drying” (CPSD). The properties of HAp nanopowders produced by these methods were investigated by XRD, FTIR, BET and SEM, and the results were compared. It was determined that synthesis process and drying conditions have very important influence on the properties of HAp nanopowders. The precipitate used as starting precursor for CPSD process was firstly synthesized by precipitation, and then it was ultrasonically dispersed in an ultrasonic bath assisted by mechanical stirring in order to prepare the “precipitate suspension like milk”, that will be referred to as “suspension” hereafter. Atomization of the suspension and direct drying of the sprays were carried out simultaneously using a spray dryer with a nozzle system at 180°C. The HAp nanopowders synthesized by CPSD method have a crystalline structure with an average crystallite size of 15.6 nm, and have an average particle size of 15.7 nm with very high SSA ( $121.34 \text{ m}^2.\text{g}^{-1}$ ) in soft spherical granule form. HAp nanopowders which were synthesized by four other methods and dried at 110°C have an average particle size larger than  $\geq 24.6 \text{ nm}$  in big, hard and shapeless agglomerate form with a SSA smaller than  $\leq 77.43 \text{ m}^2.\text{g}^{-1}$ . They attain a crystalline structure only after heat treatment at 600°C. The application of CPSD process to produce the crystalline HAp nanopowders as soft spherical granules with very high SSA at very low temperature constitutes the originality of this study.

**Keywords:** Hydroxyapatite Nanopowders, Atomization, Spray Drying, Soft Spherical Granules

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