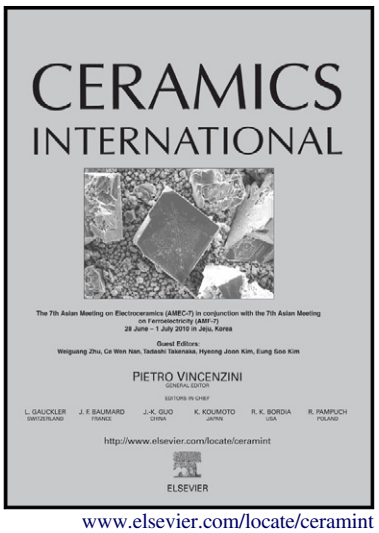

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PII: S0272-8842(14)00622-1
DOI: http://dx.doi.org/10.1016/j.ceramint.2014.04.071
Reference: CERI8439

To appear in: *Ceramics International*

Received date: 27 February 2014
Revised date: 14 April 2014
Accepted date: 15 April 2014

Cite this article as: Abbas Fahami, Bahman Nasiri-Tabrizi, Reza Ebrahimi-Kahrizsangi, Effects of composition and milling medium on mechanosynthesis of chlorapatite–alumina composite nanopowders, *Ceramics International,* http://dx.doi.org/10.1016/j.ceramint.2014.04.071

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Abstract

The effects of alumina content and milling medium on the formation of chlorapatite-based composite nanopowders were studied. The powder mixtures with various compositions were activated in a high-energy planetary ball mill for 5 h using two distinct milling media. The first medium (M_1) was composed of sealed tempered chrome steel vial and un-fused alumina balls. The second medium (M_2) consisted of sealed tempered chrome steel vial and balls. In the presence of different amounts of γ-Al_2O_3, no mechanochemical reaction occurred in M_1 medium. In contrast, in the second medium (M_2), chlorapatite–alumina composite nanopowders were obtained after 5 h of milling in the presence of 4 and 7 wt % alumina. In the presence of 4 wt% alumina, crystallite size and lattice strain of the product were about 30±2 nm and 0.62±0.031 %, respectively. With increasing the alumina content to 7 wt%, the lattice strain declined to 0.57±0.029 %, while the crystalline size increased to around 32±2 nm. From the electron microscopic images, the synthesized composite nanopowder had a cluster-like structure with an average particle size of about 97 nm.

Keywords

Chlorapatite-Alumina; Mechanochemical; Milling medium; Composition; Nanopowder.

1. Introduction

One of the most important fields of the biomedical research is the design of the novel materials with tunable performance and tailored properties [1]. Among the various forms of calcium phosphate ceramics, hydroxyapatite (HAp, $Ca_{10}(PO_4)_6(OH)_2$) is the most common ceramic for orthopedic applications, drug delivery, gene therapy, chromatography, and waste water remediation due to its structural and biological properties [2]. However, synthetic HAp has intrinsically high dissolution rate in a biological system, poor corrosion resistance in an acidic environment, and poor chemical

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