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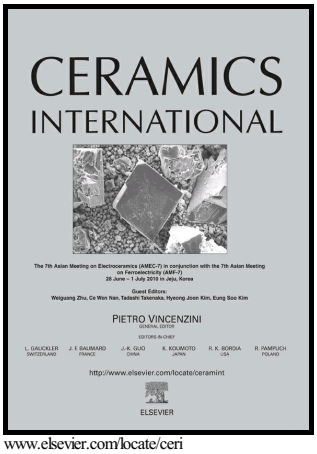

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Influence of feedstock concentration on tetragonality and particle size of hydrothermally synthesized barium titanate powders

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Abstract

Barium titanate ($BaTiO_3$) powders were synthesized through hydrothermal process with $Ba(OH)_2{\cdot}8H_2O$ and TiO_2. By increasing the feedstock concentration (FC) from 0.25 to 1.50 M, $BaTiO_3$ powders maintain a stable average particle size (~180 nm and ~6.4441 m^2/g) with an increasing tetragonality (*c/a*: 1.0065 ~ 1.0075). Johnson-Mehl-Avrami and standard reaction rate equations were adopted to analyze the kinetic process of $BaTiO_3$ formation. The reaction is governed by first-order and phase-boundary-controlled mechanism for 0.25 M and 1.50 M, respectively. Lower extent of reaction is believed to lead to the better tetragonality for $BaTiO_3$ powders fabricated with higher FC. On the other hand, the relative stable particle size is correlated with the unvaried nucleation frequency and grain growth rate with various FC. This work can provide a guideline to manipulate the properties of $BaTiO_3$ powders used in electronic industry.

Keywords: Barium titanate; Hydrothermal synthesis; Tetragonality enhancement; Stable particle size; Kinetics analysis

1. Introduction

$BaTiO_3$ is the most widely investigated perovskite material due to its piezoelectric and ferroelectric properties. Various synthesis methods have been developed for $BaTiO_3$ fabrication [1-6]. Hydrothermal