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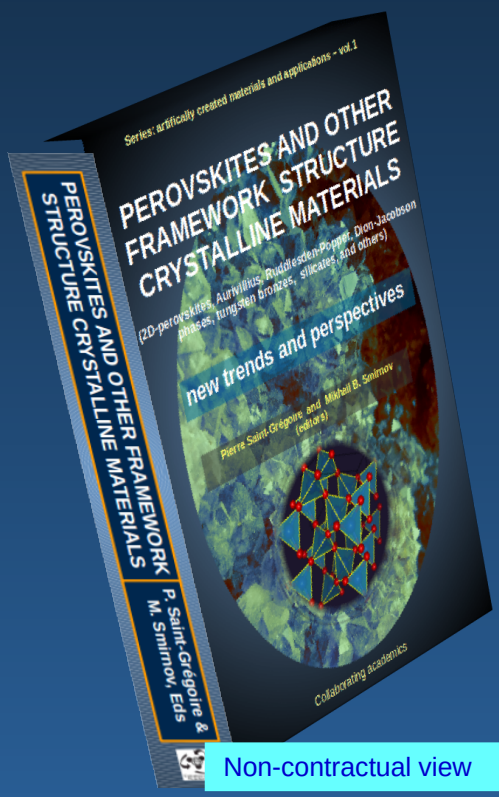

Non-contractual view

A. Fundamental aspects and general properties

B. Elaborated materials and applied properties

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Chap.20 : A review of the synthesis of single-crystal 1D perovskite nanostructures by the hydrothermal method

O.Kovalenko (1,2), A. Ragulya (1,2)

(1) Department of Physics, Chemistry and Technology of Nanotextured Ceramics and Nanocomposite Materials, Frantsevich Institute for Problems of Materials Science NASU, Ukraine

(2) LLC NanoTechCenter, Ukraine

Corresponding author : olgiuskovalenko@gmail.com

Abstract : Recently, anisotropic, particularly, one-dimensional (1D) ferroelectric perovskite nanostructures have been of high interest due to a number of unique properties. Despite the existing works about the synthesis of such 1D nanostructures, there remain issues of fine-tuning the particle morphology due to the complex mechanism of particle formation. Therefore, in this paper, an attempt was made to describe the influence of the crystallization mechanism as well as hydrothermal synthesis parameters (such as reagent nature, pH, concentration, surfactant, heat treatment mode) on the peculiarities of the anisotropic growth and the formation of the 1D perovskite nanostructures.

Keywords : PEROVSKITE, NANOSTRUCTURE, ANISOTROPY, CRYSTALLIZATION

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I. Introduction

The perovskite-type compound with the general formula of ABO_3 (Fig.1) is the most studied ferroelectric oxides due to the unique dielectric and ferroelectric properties[1,2]. Compositions based on the $BaTiO_3$, $SrTiO_3$, $PbTiO_3$ and $PbZrO_3$ form solid solutions with each other and with a large number of other oxides and provide an enormous variety of ferroelectric properties[3]. Particularly, $BaTiO_3$ and $Pb(Zr,Ti)O_3$ are widely used for its high dielectric and piezoelectric coefficients, respectively[4,5]. It makes this material widely used in non-volatile digital memories, thin-film capacitors, electronic transducers, actuators, high-k dielectrics* as well as pyroelectric sensors, electrooptic modulators, optical memories and nonlinear optics[6].

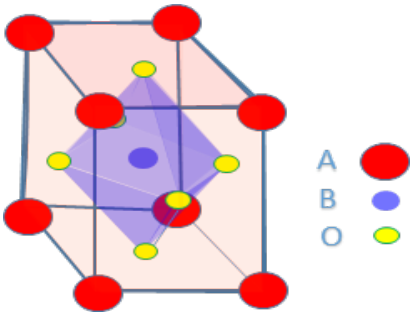

Figure 1: Perovskite structure. i) A-site (dodecahedral coordination) with (Ba,Ca,Na, K, Sr, Pb) cations; ii) B-site (octahedral coordination) with (Ti,Zr, Nb,Ta) cations; iii) BO_6 oxygen octahedral

Recently, increasing attention is paid to the one-dimensional (1D) ferroelectric nanostructures including nanowires, nanorods, and nanotubes due to the excellent performance in nanoelectronic, photoelectronic, and data storage devices[7,8,9,1011,12,13]. Recently, the 1D perovskite nanostructures have attracted attention in such application as nano-sensors and catalysts for the integration in the current electronic devices[10,14,15], biological materials (mimicking of the ion channels, drug delivery systems, stem cells investigation), photodetectors, solar cells, building blocks for laser applications, etc[8,16,17].

*material with a high dielectric constant (k) as compared to silicon dioxide