$NdFeO_3$ nanocrystals under glycine nitrate combustion formation

Ekaterina Tugova, Sergey Yastrebov, Oleg Karpov, Roger Smith

PII: S0022-0248(17)30180-X
DOI: http://dx.doi.org/10.1016/j.jcrysgro.2017.03.022
Reference: CRYS 24097

To appear in: *Journal of Crystal Growth*

Received Date: 1 February 2017
Accepted Date: 14 March 2017

Please cite this article as: E. Tugova, S. Yastrebov, O. Karpov, R. Smith, $NdFeO_3$ nanocrystals under glycine nitrate combustion formation, *Journal of Crystal Growth* (2017), doi: http://dx.doi.org/10.1016/j.jcrysgro.2017.03.022

$NdFeO_3$ nanocrystals under glycine nitrate combustion formation

Ekaterina Tugova [a], Sergey Yastrebov [a], Oleg Karpov [a], Roger Smith [b]

[a] *A.F. Ioffe Physicotechnical Institute, St.Petersburg, Russia*

[b] *School of Science, Loughborough University, Loughborough, LE11 3TU, United Kingdom*

Abstract

Nanocrystalline perovskite $NdFeO_3$ with the orthorhombic structure was prepared by a glycine nitrate combustion method under different technological conditions. The starting materials $Fe(NO_3)_3 \cdot 9H_2O$, $Nd(NO_3)_3 \cdot 6H_2O$ in stoichiometric amounts and H_2NCH_2COOH were used. These quantities were varied by changing the ratio of glycine moles to metal nitrate moles (G/N) in the range between 0.25 to 0.75. The prepared $NdFeO_3$ nanocrystals were characterized by X-ray diffraction (XRD) and electron microscopy. Decomposition of the XRD diffraction profile using Voigt contours was exploited for analysis of the pattern in the area where the most prominent diffraction peak was situated. We demonstrate that Voigt functions reduce to Lorentzians for G/N=0.75 and 0.55. A volume-weighted diameter distribution function was derived using the width of the Lorentzians. The log-normal shape of the distribution is discussed in terms of the model, assuming exponential growth of cluster size in the time available for the $NdFeO_3$ nanograin to grow.

Keywords: A1.Crystal structure; A1. Nanostructures; A1. Nucleation; A1. X-ray diffraction; B1. Oxides; B1. Perovskites

1 Introduction

The rare-earth orthoferrites, having perovskite structure of general formula $RFeO_3$ (where R is a rare-earth ion) [1,2] have attracted much interest due to their novel magnetic [3,4] and magneto-optic [4] properties and are still the subject of much research aimed at a better understanding of the properties of the magnetic subsystems and how interactions between them depend on external parameters, such as temperature, field, pressure, etc. [3,4]. Among them,