FIRST INTERNATIONAL CONFERENCE ON ELECTRON MICROSCOPY OF NANOSTRUCTURES

ELMINA 2018

ПРВА МЕЂУНАРОДНА КОНФЕРЕНЦИЈА О ЕЛЕКТРОНСКОЈ МИКРОСКОПИЈИ НАНОСТРУКТУРА

August 27-29, 2018, Belgrade, Serbia
27–29. август 2018. Београд, Србија

FIRST INTERNATIONAL CONFERENCE

ELMINA 2018

PROGRAM

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BOOK OF ABSTRACTS

Rectorate of the University of Belgrade, Belgrade, Serbia
August 27-29, 2018
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Organized by:
Serbian Academy of Sciences and Arts and Faculty of Technology and Metallurgy, University of Belgrade

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FIRST INTERNATIONAL CONFERENCE
ELMINA 2018
Program and Book of Abstracts

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At the beginning we wish you all welcome to Belgrade and ELMINA2018 International Conference organized by the Serbian Academy of Sciences and Arts and the Faculty of Technology and Metallurgy, University of Belgrade. We are delighted to have such a distinguished lineup of plenary speakers who have agreed to accept an invitation from the Serbian Academy of Sciences and Arts to come to the first in a series of electron microscopy conferences: Electron Microscopy of Nanostructures, ELMINA2018. We will consider making it an annual event in Belgrade, due to this year's overwhelming response of invited speakers and young researchers. The scope of ELMINA2018 will be focused on electron microscopy, which provides structural, chemical and electronic information at atomic scale, applied to nanoscience and nanotechnology (physics, chemistry, materials science, earth and life sciences), as well as advances in experimental and theoretical approaches, essential for interpretation of experimental data and research guidance. It will highlight recent progress in instrumentation, imaging and data analysis, large data set handling, as well as time and environment dependent processes. The scientific program contains the following topics:

- Instrumentation and New Methods
- Diffraction and Crystallography
- HRTEM and Electron Holography
- Analytical Microscopy (EDS and EELS)
- Nanoscience and Nanotechnology
- Life Sciences

To put this Conference in proper prospective, we would like to remind you that everything related to nanoscience and nanotechnology started 30 to 40 years ago as a long term objective, and even then it was obvious that transmission electron microscopy (TEM) must play an important role, as it was the only method capable of analyzing objects at the nanometer scale. The reason was very simple - at that time, an electron microscope was the only instrument capable of detecting the location of atoms, making it today possible to control synthesis of objects at the nanoscale with atomic precision. Electron microscopy is also one of the most important drivers of development and innovation in the fields of nanoscience and nanotechnology relevant for many areas of research such as biology, medicine, physics, chemistry, etc. We are very proud that a large number of contributions came from young researchers and students which was one of the most important objectives of ELMINA2018, and which indicates the importance of electron microscopy in various research fields. We are happy to present this book, comprising of the Conference program and abstracts, which will be presented at ELMINA2018 International Conference. We wish you all a wonderful and enjoyable stay in Belgrade.

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Comprehensive Characterization of Multiferroic $BiFeO_3$ Powder Fabricated by the Hydrothermal Procedure

Maria Čebela[1], Radmila Hercigonja[2], Milena Rosić[1], Dejan Zagorac[1], Jelena Luković[1], Jelena Zagorac[1], Dragana Jordanov[1] and Branko Matović[1]

[1] *Institute for Nuclear Sciences, Centre of Excellence-CextremeLab Vinca, University of Belgrade, Belgrade, Serbia*
[2] *University of Belgrade, Faculty of Physical Chemistry, Serbia*

Bismuth ferrite ($BiFeO_3$) has recently drawn attention due to its outstanding multi-functional properties, as well as for being a lead-free ceramic material. In the current study, BiFeO3 nanoparticles were synthesized by strictly controlled hydrothermal process. High geometric molded particles of a small size and with high degree of purity (99.74 %) were obtained. We used nitrates of bismuth and iron as well as 8M potassium hydroxide as a basis for synthesis. The results of the X-ray diffraction study of the obtained polycrystalline material show single-phase bismuth ferrite that crystallizes with a rhombohedral lattice. Using the Rietveld method it has been determined that the particles of the synthesized powder are in a nanometric range with a particle size of about 30 nm. It was found that all reflections of the obtained bismuth ferrite belong to the rhombohedral α-$BiFeO_3$ phase which crystallizes in the space group R3c (No. 161). In addition, electronic and magnetic properties of $BiFeO_3$ were investigated using combination of experimental and theoretical methods. HRTEM analysis confirmed existence of twin stacking faults, which are responsible for enhanced magnetic properties. EPR measurements suggested existence of electrons trapped by vacancies or defects. It has been proposed that $Fe^{3+}-O_V$ defect complex could be created at elevated temperatures followed by formation of trivalent Fe ions, which intensely provide local 3d moments. The magnetic behavior of the synthesized material was studied by means of SQUID device and using a vibrating sample magnetometer (VSM). The temperature dependence of the magnetization shows the antiferomagnetic-paramagnetic phase transition at the temperature of TN = 220K, while below this temperature weak ferromagnetic behavior has been detected. Theoretical studies were performed using a full potential linearized augmented plane-waves plus local orbital (FP(L)APW+lo)

method, based on the density functional theory (DFT). In addition, a structure prediction has been performed and 11 additional $BiFeO_3$ modifications have been proposed. In the next stage, an *ab initio* optimization of predicted structures has been performed and the structure of the γ-phase has been elucidated.

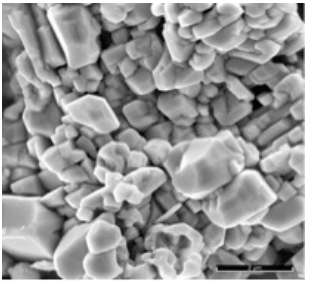

Figure 1. SEM image of BFO synthesized with 8 M KOH for 6 h at 200 °C (bar length is 2μm).

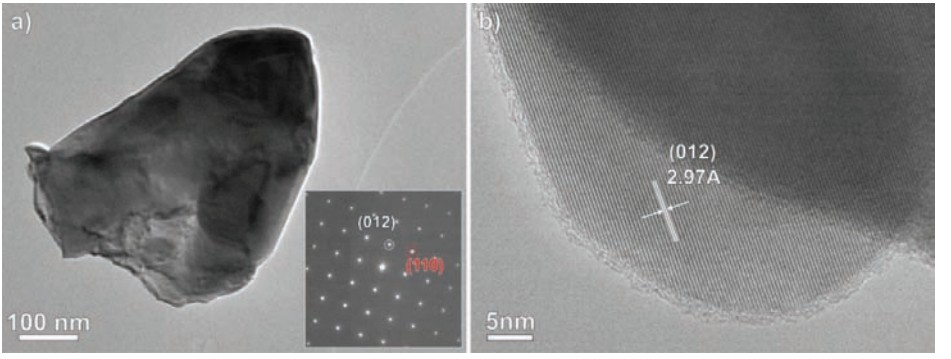

Figure 2. TEM image of a typical BFO particle (insert - SAED pattern over one grain) (a) and HRTEM image with characteristic d-spacing value (b).

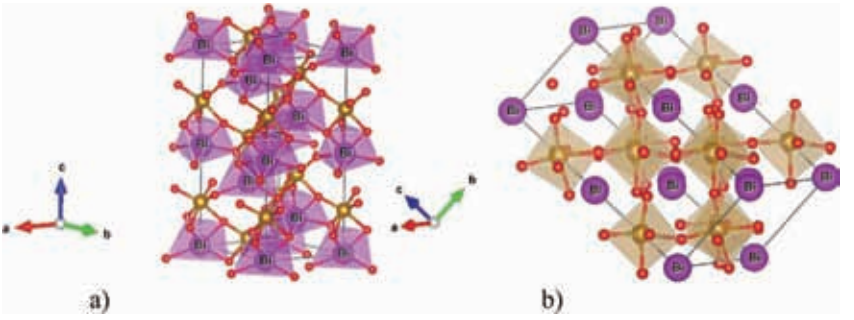

Figure 3. Visualization of the synthesized and calculated α-BiFeO3 structure: (a) sixfold coordination (CN=6) of the Bi atom by O atom; (b) sixfold coordination (CN=6) of the Fe atom by O atom.

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