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
http://elmina.tmf.bg.ac.rs

Organized by:
Serbian Academy of Sciences and Arts and Faculty of Technology and Metallurgy, University of Belgrade

Endorsed by:
European Microscopy Society and Federation of European Materials Societies

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.

ORGANIZERS

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GENERAL INFORMATION

DATE AND VENUE: The conference will be held August 27-29, 2018 at the Rectorate of the University of Belgrade, Studentski Trg 1, 11000 Belgrade, Serbia with the beginning at 8:30 AM on August 27th, 2018, in the Solemn Hall.

REGISTRATION: At the registration desk, located and the ground floor hall of the conference venue. Registration desk working hours are: Sunday, August 26th, from 16:00 to 18:00, Monday, August 27th, from 08:00 to 18:30, Tuesday, August 28th, from 08:00 to 13:00, Wednesday, August 29th, from 08:00 to 11:00. Registered participants will receive a nametag and a conference bag.

INSTRUCTIONS FOR AUTHORS: The conference will feature plenary sessions and poster sessions as well as vendor presentations during lunch breaks. Presentations during plenary sessions will last 30 minutes each, including discussion. Standard and hands-free microphones will be on site. No A-V equipment will be provided for any poster presentations. Poster presenters must remain at their poster on their assigned day during the required poster session. Each poster will be allocated a 130 cm high and 95 cm wide (130X95) display area.

CONFERENCE AWARDS: Poster presentations will be reviewed according to the following criteria: (a) relevance to a specific symposium, (b) scientific content, quality and innovative proposals, (c) clarity of the text, and (d) compliance with the format. During the conference, the best three (3) posters, selected by a poster award committee, will receive awards.

From Titania to Titanates: Phase and Morphological Transition

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Regarding their extraordinary properties, such as biological and chemical stability, photocatalytic activity, cost-effectiveness, the titanium-based nanomaterials are the subject of an intense research. Although titania is well known as a photocatalyst, the titanates are promising candidates for the wide range of applications including ion exchange, high adsorption capacity toward organic molecules and radioactive toxic metal ions [2], in photovoltaics, H- and Li-storage, gas sensors, etc. The hydrothermal process became a very important way to obtain these materials in nanostructural form since the discovery of anatase-based alkaline hydrothermal treatment reported by Kasuga *et al.* [1].

In this work, nine products were obtained by modifying the experimental conditions (6, 12 and 18 h at 110, 135 and 160 °C) of hydrothermal treatment of starting nanoanatase in less alkaline medium (5 mol dm^{-3} NaOH solution) than usual. Specimens are labeled as T_{T-t}, where T is temperature of the treatment and t is duration of the treatment. The step-by-step optimization of this simple and costless procedure was necessary in order to obtain a pure titanate phase and to finally distinguish the titanates from titania in terms of structure and microstructure. The nanocrystalline samples were characterized by HRTEM/SAED, XRPD, EDS, TG, UV-VIS and BET techniques.

According to XRPD and HRTEM, the complete conversion of anatase to pure titanate phase was achieved after energetically the most intensive treatment, *i.e.* 18 h at 160 °C. Among other products, a certain amount of anatase remained, with its decreasing content as the temperature and time of hydrothermal treatment increases. This increment significantly improves the solubility of TiO_2 promoting the changes in morphology from the approximately spherical anatase nanoparticles into elongated titanate nanosheets (Fig. 1). Based on EDS and TG, the $Na_{0.4}H_{1.6}Ti_2O_5 \cdot H_2O$ formula could be assigned to T_{160_18}. The HRTEM/SAED revealed the shortening of interplanar distances along *a*axis because of the dehydratation due to the high vacuum of the TEM chamber and high energy of the electron beam irradiation confirming the layered structure of $Na_{0.4}H_{1.6}Ti_2O_5 \cdot H_2O$ (Fig. 2). Because of the poor characterization of titanate nanosheets found in literature, the optical and textural properties of products were also investigated. A blue shift toward lower wavelength is observed with the temperature increasing being the most pronounced for the T_{160_18} (Fig. 3). This is the consequence of full transformation of TiO_2 into $Na_{0.4}H_{1.6}Ti_2O_5 \cdot H_2O$. For the same reason, the values of specific surface areas decreased with the temperature increasing.

As shown in this work, the structure, morphology and texture of samples strongly depend of the conditions of hydrothermal treatment. The production of single phase titanate and its detailed microscopic characterization finally allowed the clarification of long-standing confusion between titania and titanates.

References:

[1] T Kasuga *et al*, Langmuir **14** (1998), p. 3160.
[2] Y Zhang *et al*, RSC Advances **5** (2015), p. 79479.
[3] The authors acknowledge funding from the Ministry of Education, Science and Technological Development of the Republic of Serbia, Grant Numbers III45007 and III45019. The support of the bilateral cooperation with Slovenia is also gratefully acknowledged (Project No. 451-03-3095/2014-09/32).

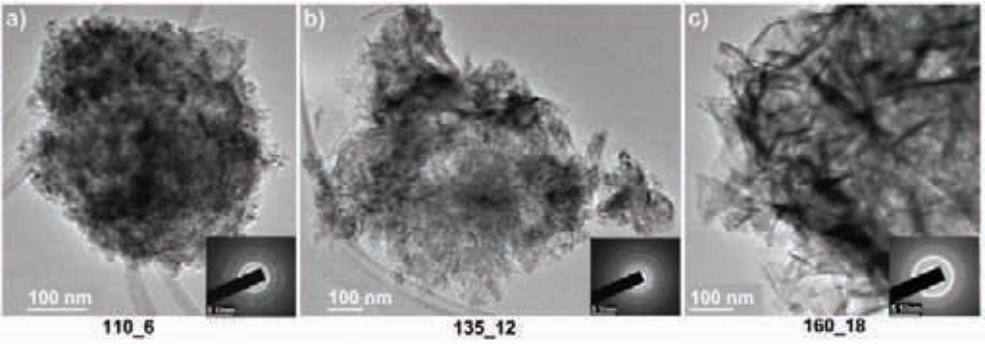

Figure 1. TEM and SAED of selected T_{T_t} samples: a) T_{110_6}, b) T_{135_12} and c) T_{160_18}.

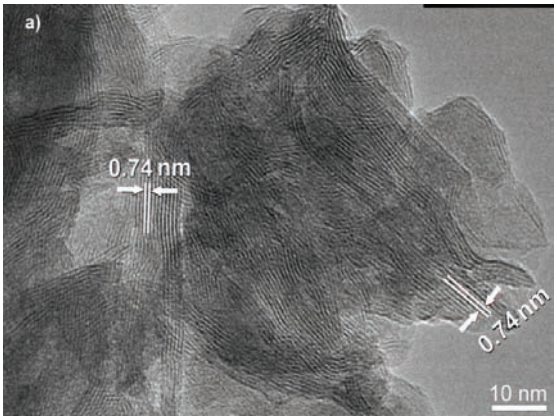

Figure 2. HRTEM image of the T_{160_18} titanate nanosheets showing its layered nature, curving of thin layers and reduction of interlayer spacing of (200) lattice planes from 0.90 to 0.74 nm.

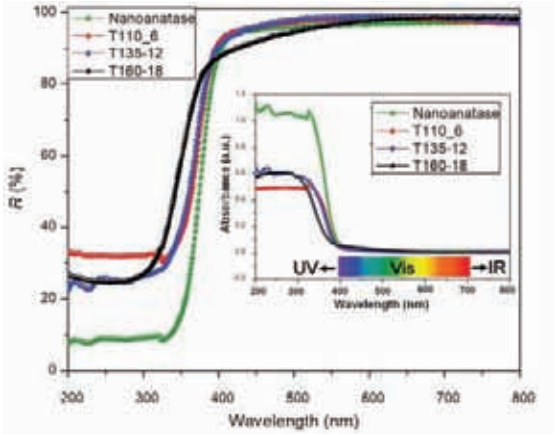

Figure 3. UV-Vis diffuse reflectance and absorption spectra of selected samples.