ELMINA 2022

SECOND INTERNATIONAL CONFERENCE ON ELECTRON MICROSCOPY OF NANOSTRUCTURES

ДРУГА МЕЂУНАРОДНА КОНФЕРЕНЦИЈА О ЕЛЕКТРОНСКОЈ МИКРОСКОПИЈИ НАНОСТРУКТУРА

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ELMINA 2022

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Book of Abstracts

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At the beginning we wish you all welcome to Belgrade and ELMINA2022 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 second electron microscopy conference: Electron Microscopy of Nanostructures, ELMINA2022. The scope of ELMINA2022 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 ELMINA2022, 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 ELMINA2022 International Conference. We wish you all a wonderful and enjoyable stay in Belgrade.

Detecting the Changes on Fibers' Surfaces after Different Chemical Treatments using Scanning Electron Microscopy

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In the last decade, jute fibers are within the scope of a wide variety of investigations thanks to their possibility for functionalization by using different chemical treatments. Among them, alkali and oxidative treatments represent the most direct, simplest, economical, and efficient methods for fibers' functionalization and therefore for improving their quality [1]. Namely, alkali treatments using sodium hydroxide lead to selective hemicellulose removal, increased the content of cellulose exposed on the fiber surface, and decreased the crystallinity index, while oxidation using sodium chlorite is used to selectively remove lignin that is accompanied by conversion of fiber carbonyl to carboxyl groups. After both chemical treatments, scanning electron microscopy (SEM) was employed to confirm the removal of the non-cellulosic components and to evaluate the changes in jute fiber surface morphology.

As can be seen from Figure 1a, the surface of multicellular raw jute fiber is uneven and rough and covered with fats, waxes, and pectin. It has to be noted that elementary fibers within the raw jute fiber cannot be seen since they are joined together into bundles by the hemicelluloses and lignin. By observing the SEM photographs of the fibers after hemicellulose or lignin removal, some changes in the fiber surface morphology can be spotted. More precisely, after the alkali treatments under different experimental conditions (sodium hydroxide concentration and/or treatment duration), the fibers' surfaces are relatively clean and smooth (Figures 1b and c) indicating the removal of the hemicelluloses and other non-cellulosic components located on the fibers' surfaces. As a consequence, new free spaces in the fiber structure were created, which is followed by pronounced elementary fibers' liberation, as is evident in Figures 1b and c [2]. In the case of the most severe alkali treatment (17% NaOH for 45 min, Figure 1d), the multi-cellular fiber structure is clearly visible as well as some of the elementary fibers stick out away from the fiber bundles [3]. The changes in the fiber surface morphology are also evident after the oxidative treatments using 0.7% sodium chlorite. Significant lignin removal and elementary liberation were observed after the oxidation for 90 min, Figure 1d.

The applied alkali and oxidative treatments are an appropriate starting point for obtaining multifunctional fibers. For example, to improve the jute fibers' dielectric properties, *in situ* synthesis of Cu-based nanoparticles (NPs) could be performed on the alkali and oxidatively modified fibers' surfaces [4]. Besides different characterization methods, SEM is usually used to confirm the presence of NPs on fibers' surfaces. A few smaller agglomerates of Cu-based NPs were observed across the surface of alkali treated fiber, while smaller irregularly shaped and larger agglomerates of Cu-based NPs (along with a low amount of fiber impurities) were distributed over the oxidatively treated fibers surface, Figure 2 [5].

References:

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[4] A Ivanovska *et al*, Industrial Crops and Products **180** (2022), p. 114792.
[5] The authors acknowledge funding from the Ministry of Education, Science and Technological Development of the Republic of Serbia (Contract No. 451-03-68/2022-14/200287 and 451-03-68/2022-14/200135).

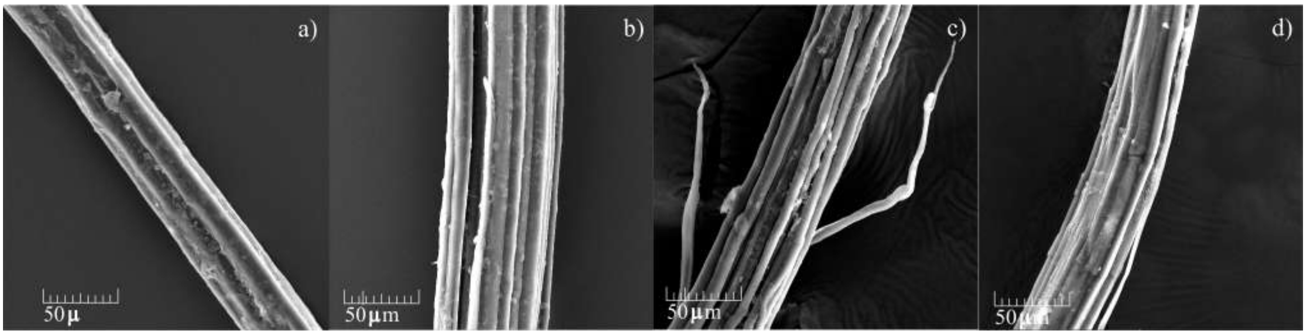

Figure 1. SEM photographs of: a) raw jute fiber, and fibers treated with: b) 5% NaOH for 10 min, c) 17.5% NaOH for 45 min, and e) 0.7% $NaClO_2$ for 90 min.

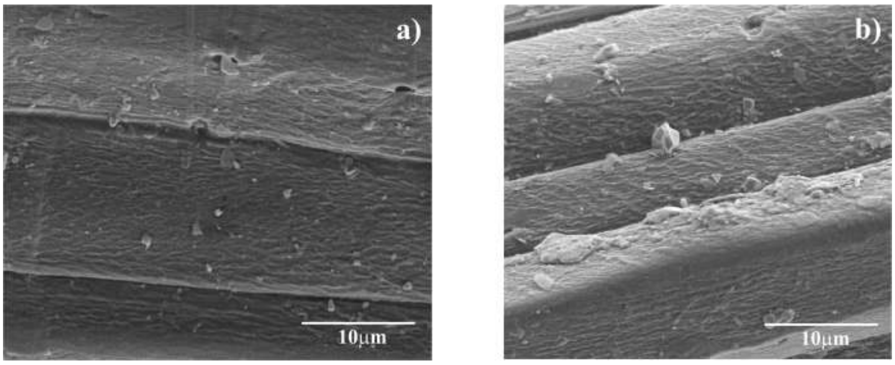

Figure 2. SEM photographs of fibers treated with: a) 17.5% NaOH for 30 min, and b) 0.7% $NaClO_2$ and coated with Cu-based NPs.

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