ELMINA 2022

SECOND INTERNATIONAL CONFERENCE ON ELECTRON MICROSCOPY OF NANOSTRUCTURES

ДРУГА МЕЂУНАРОДНА КОНФЕРЕНЦИЈА О ЕЛЕКТРОНСКОЈ МИКРОСКОПИЈИ НАНОСТРУКТУРА

August 22nd–26th, 2022, Belgrade, Serbia
22–26. август 2022. Београд, Србија

SECOND INTERNATIONAL CONFERENCE

ELMINA 2022

Serbian Academy of Sciences and Arts, Belgrade, Serbia
August 22nd-26th, 2022
http://elmina.tmf.bg.ac.rs

Program and Book of Abstracts

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and
Faculty of Technology and Metallurgy, University of Belgrade

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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.

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ORGANIZERS

SERBIAN ACADEMY OF SCIENCES AND ARTS
Knez Mihailova 35, 11000 Belgrade, Serbia
Phone: +381 11 2027200
https://www.sanu.ac.rs/en/

FACULTY OF TECHNOLOGY AND METALLURGY, UNIVERSITY OF BELGRADE
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https://www.tmf.bg.ac.rs/en/

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GENERAL INFORMATION

DATE AND VENUE: The conference will be held August 22nd-26th, 2022 at the Serbian Academy of Sciences and Arts, Knez Mihailova 35, 11000 Belgrade, Serbia with the beginning at 8:30 AM on August 22nd 2022, in the main lecture hall.

REGISTRATION: At the registration desk, located in front of the main lecture hall of the conference venue. Registration desk working hours are: Monday, August 22nd, from 8:00 to 14:00, Tuesday, August 23rd, from 8:15 to 14:00, Wednesday, August 24th, from 8:15 to 14:00 and Thursday August 24th, from 8:15 to 12:00. Registered participants will receive a nametag and a conference bag.

INSTRUCTIONS FOR AUTHORS: The conference will feature plenary sessions, oral sessions and poster sessions as well as vendor presentations during lunch breaks. Presentations during plenary sessions will last 30 minutes each, including discussion while oral presentations will be 15 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 1180 mm high and 841 mm wide (A0 format) display area.

CONFERENCE AWARDS: Oral and 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) oral and three (3) poster presentations, selected by an award committee, will receive awards.

The effect of poly(dimethylsiloxane) segment content on the morphology of polyurethane composite materials

Marija V. Pergal[1], Igor Kodranov[2], Dana Vasiljević-Radović[1], Milos Steinhart[3], Gordana Gojgić-Cijović[1], Dragan Manojlović[2], and Milena Špírková [3]

1 Institute of Chemistry, Technology and Metallurgy, University of Belgrade, Department of Microelectronic Technologies, Belgrade, Serbia

2 Faculty of Chemistry, University of Belgrade, Belgrade, Serbia

3 Institute of Macromolecular Chemistry AS CR, v.v.i. (IMC), Prague, Czech Republic

Polyurethane (PU) is an extraordinarily versatile polymeric material and has been widely used in industrial and biomedical applications [1,2]. To meet the demands of any particular application, the properties of PU can be modified in two possible ways: changing PU microstructures or adding nanofillers within polymer matrix. Polyurethane/clay nanocomposites have been intensively investigated in the last decades as promising nano-engineered materials with achieved a significantly improved performances (thermal, mechanical, barrier and anticorrosion) compared to pristine ones [3]. The clays or layered silicate are good candidates for the preparation of PU nanostructured materials due to their availability, low cost, high ion exchange capacity, high aspect ratio and well-developed intercalation chemistry. Depending on preparation methods, dispersion, and degree of the delamination of clay particles within a polymer matrix, hybrids are obtained with structures ranging from intercalated to exfoliated [3]. The difference in the micro-phase morphology of these two types of polymer/clay nanocomposites is a reason for the differences in their physical properties. Many literatures report that *in situ* polymerization gives PU nanocomposites with the improved properties [3].

Therefore in this study, *in situ* polymerization procedure in solvent mixture was used for the preparation of thermosetting PU nanocomposites (PUNCs) with different content of soft segment (from 30 to 60 wt%), and with the addition of organomodified montmorillonite clay (Cloisite 30B®) as the nanofiller, in an amount of 0.5 wt.%. The PUNCs were based on poly(dimethylsiloxane) macrodiol (PDMS) that represents soft segment and 4,4′-diphenylmethane diisocyanate (MDI) and hyperbranched polyester (BH-30) which were selected as the hard segment. The PUNCs are marked so that the last two numbers in title indicate wt.% of soft segment in materials. Namely, the main objective of this study is to analyze the effect of the soft segment content on the morphology of the prepared PU nanocomposite films using atomic force microscopy (AFM), scanning electron microscopy (SEM), and small- and near wide-angle X-Ray scattering (SWAXS) analyses. SEM images of the fractured surfaces were obtained on JEOL JSM-6610LV. AFM analysis was carried out by atomic force microscope (Dimension Icon, Bruker, USA). SWAXS measurements of the PUNCs were performed using SAXS instrument (originally Molecular Metrology, USA, recently considerably upgraded by SAXSLAB, now Xenocs).

The surface topographies and heterogeneity of relief of the prepared PUNCs were investigated by AFM (Fig 1). The nanocomposite with 60 wt% of soft segments (PUNC-60) has smoot surface and homogeneous phase relief, while topographies of other samples display oval like formations (or spherical harder ‘nanoparticles’). Bigger and more spherical formations were observed in PUNC-40 than in nanocomposite PUNC-30. All materials were characterized by lighter (harder) and darker (softer) areas originating mainly from the micro-phase separation of the soft and hard PU segments.

SEM micrographs of fractured surfaces of the PUNCs (Fig. 2) show the presence of brighter parts („points“) in the investigated samples, which originate from the addition of clay nanoparticles. It was observed oval formations composed of hard domains in PUNCs, but they were slightly bigger in PUNC with higher soft segment content than in nanocomposite PUNC-30, which is in agreement with AFM.

Based on SWAXS results, the strong and significant Cloisite 30B peak at 3.48 nm^{-1} was not visible in any of the prepared materials, apparently due to its negligible concentration or the presence of organoclay exfoliated structure in the PUNC matrix [4].

References:

[1] J. Zhang et al, Prog. Org. Coat. **75** (2012), 579-583.
[2] M. Špírková et al, Polymers. 12 (2020), 1-18.
[3] M.V. Pergal et al, Ind. Eng. Chem. Res. 56 (2017), 4970-4983.
[4] This work was financially supported by the Ministry of Education, Science and Technological Development of the Republic of Serbia (Grant No: 451-03-68/2022-14/200026) and by the Czech Science Foundation (Grant Agency of the Czech Republic, Project No. No: 18-03932S).

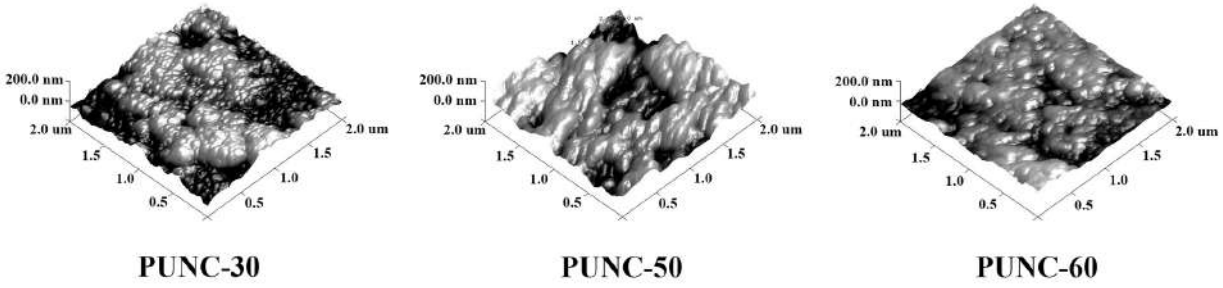

Figure 1. 3D AFM images of selected PUNC films.

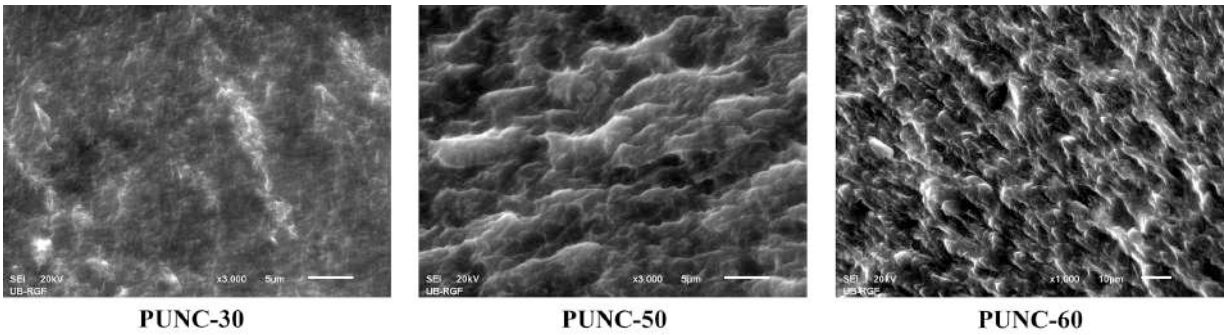

Figure 2. SEM micrographs of selected PUNC films.