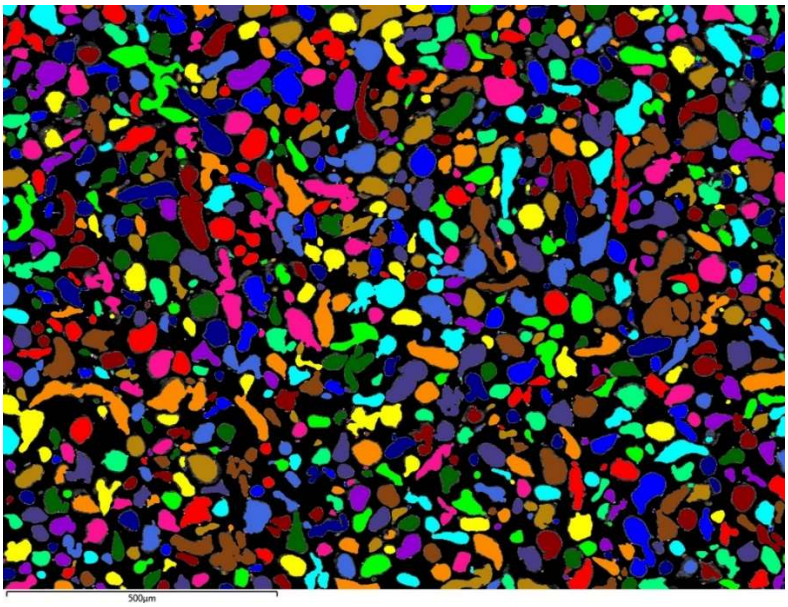
Book of Abstracts

TEXTILE SCIENCE RESEARCH CENTRE

OPEN DAY 2023

MICRO-NANO WORLD OF TEXTILES



Additive manufacturing particles using AztecAM
Available at: https://nano.oxinst.com/application-detail/additive-manufacturing/
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3. Primalab

DUNJA DRMAČ: European Chemical Industry Council (CEFIC), Brisel

TIGHTENING THE SEAMS OF EU CHEMICAL LEGISLATION - HOW TO PREPARE?

Abstract:

Chemicals are essential in everyday life: from cosmetics, home appliances, hygiene products to clothes to make them aesthetically nice and functional. The European Union has the most comprehensive chemical legislation in the world that governs how chemicals can be sold on the EU market or conditions to use them in certain applications. The current political agenda with The European Green Deal plans to make the rules on chemicals even more ambitious to raise the protection of people and the environment. Anyone that deals with chemicals in the EU in one way or another will be affected and needs to anticipate the changes to substitute, innovate, adapt its supply chain. Cefic, the European Chemical Industry Council, representing chemical companies and national federations is in forefront of this action. The presentation will outline the main changes and impacts and suggest how to best prepare.

Key words:

REACH, The European Green Deal, chemicals, supply chain

IVANA VINKOVIĆ VRČEK

Institute for Medical Research and Occupational Health,

Ksaverska cesta 2, 10000 Zagreb, Croatia

RISKS OF HUMAN EXPOSURE TO COMPLEX MIXTURES OF CHEMICALS AND NANOPLASTICS

Abstract:

Aggregate and combined exposure of humans to chemical mixtures is additionally challenged by the plastic value chain, which is central to modern living and constitutes a vital source for innovation-driven growth owing to their unique properties. As a multifunctional, resistant, easy-to-process and affordable material, plastics hold similar promise for the future, but their use has become tainted by plastic pollution, which is considered one of the most concerning environmental problems due to its abundance and persistence in the aquatic environment. Plastics in the environment undergo slow photo-, chemical, physical and biological degradation and fragmentation to micro- and nanoparticles. Indeed, the increasing environmental pollution with plastic nanoparticles (PNP) has amplified global concerns. Considering specific physico-chemical properties and reactivity of materials at the nanoscale, PNP can adsorb and accumulate toxic chemicals from the environment, acting as “Trojan horse” for hazardous substances and complicating the human health hazard risk assessment. Therefore, the effects, activity and toxicity of complex mixtures, i.e. combination of PNP and hazardous chemicals, should be considered to properly reveal the toxicity of our environmental pollution with plastics and different pollutants. As a show case, effects of combined exposure to different types of PNPs and pharmaceuticals on estrogen receptor activity will be presented.

Key words:

nanoplastics, risk assessment, complex mixtures, human exposure

Karlo LELAS

University of Zagreb Faculty of Textile Technology (TTF)

DAMPED HARMONIC OSCILLATIONS: A DIFFERENT POINT OF VIEW

Abstract:

Phenomena related to vibrations are investigated by both natural and technical sciences. We encounter vibrations on all spatial scales, e.g., from the vibrations of atoms in crystal lattices of solids to the vibrations of buildings due to earthquakes. Sometimes vibrations are desirable and sometimes not. In this lecture, we will briefly refer to the so-called viscous damping of unwanted vibrations and the related concept of critical damping. Often in the literature, critical damping is highlighted as the optimal way of dissipating vibration energy. We will show the shortcomings of this approach and offer a different way of determining the optimal damping of vibrations.

Key words:

vibrations, damped harmonic oscillator, critical damping, optimal damping

SANJA NJEGAČ[1] & EDITA VUJASINOVIĆ[2]:

[1] Croatian State Archives

[2]University of Zagreb Faculty of Textile Technology (TTF)

THE MISTERY OF ARCHIVAL PAPERS

Abstract:

While the archivist, the curious or the scientist carefully unrolls the centuries-old scroll, it is impossible not to wonder what secrets and mysteries it might hold.

As part of the Watermark Portal program of the Central Laboratory for Conservation and Restoration at the Croatian State Archives, in cooperation with the Department of Materials, Fibres and Textile Testing of the Faculty of Textile Technology, University of Zagreb, and with the financial support of the Ministry of Culture, research is being carried out on traditional handmade papers, their origin and species and the water signs present. The research was conducted on selected copies of preserved and restored archival material from the Croatian State Archives and the Bishop's Archives in Šibenik, created in the period from the 15th century until the 19th century.

Research insight into the properties of traditionally handmade papers contributes to a better understanding of written cultural heritage and the selection of the best conservation-restoration procedures in order to slow down their aging process, while modern recording techniques and new digital tools enable better insight into the structure and parts of objects that are not visible through visual analysis of the whole archival material. In addition, that is where the mysterious micro and nano world of fibres comes on the scene.

The works thus become media through which we discover essential information about the history of archival material, literacy, the mastery of its creators, as well as about the periods of the documents' life in all their stages - right up to binding and use. In a broader context, paper analyzes can contribute to the discovery of trade routes and paper distribution, cultural and political connections, and other circumstances related to the history of written heritage.

Key words:

archival documents, watermark, paper, fibre carrier, fibres

LUCIA SPASEVSKI

Oxford Instruments, UK

Oxford Instruments Nanoanalysis products and solutions for textile analysis

Abstract:

In this presentation, we will discuss Oxford Instruments' solutions for characterisation and process control of textile fibres treatment. Design and manufacture of advanced biocomposite materials with improved properties for a wide range of applications have increased the need for innovative high speed and resolution analysis techniques. Oxford Instruments offers a range of equipment for the control of treated textile fibres in terms of improvement of treatment process and final fibre properties.

The majority of the presentation will focus on high end EDS detector such as Ultim Max 100 and Ultim Extreme detector including a discussion on how high spatial resolution Energy Dispersive X-ray Spectroscopy (EDS) can map elemental distributions at a nanometre scale – which can aid in both NPs synthesis optimization and quality control of fibres. We will also introduce our novel Unity BEX imaging detector that combines Backscattered electron and X-ray imaging and therefore change the usual EDS workflow due to impressive throughput and automation options which are ideal for any Quality assurance/quality control (QA/QC) and treatment process optimization or whole sample analysis.

Key words: Ultim Max, EDS, Ultim Extreme, Unity BEX imaging, textile analysis, fibre analysis, NPs identification

ANJA LUDAŠ & SANJA ERCEGOVIĆ RAŽIĆ:

University of Zagreb Faculty of Textile Technology (TTF)

PLASMA IN A MICRO-NANO WORLD

Abstract:

Plasma is the fourth state of matter besides solid, liquid and gas. In plasma, atoms and molecules lose electrons and become positively charged ions and free electrons. The result is high-energy, neutral particles that behave like a gas but are electrically conductive. Plasma also occurs in nature and is observed in phenomena such as lightning, the sun, auroras...

Plasma in the micro-nano world has a significant impact on the textile industry, opening the door for innovation and the development of textiles with advanced properties. In the textile industry, plasma is used to treat the surface of textiles, usually analyzing the changes in properties at the nano level. Plasma treatment enables better utilization and durability of dyes, better print quality, and creates active centers for attracting other chemical compounds. An important application of plasma is to achieve/improve the hydrophobicity or hydrophilicity of the fiber surface. In addition, plasma is used in nanotechnology for the development of advanced textile materials. Micro/nanostructured plasmonic surfaces can be used for integration of sensors, microelectronics and functional coatings. This enables the production of textiles that monitor bodily functions, regulate temperature or provide additional protection against UV radiation. Nanoparticles and nanostructures synthesized by plasma can be incorporated into textiles to provide enhanced properties - antibacterial or targeted utility properties.

Examining the influence of the specific effect of the plasma exclusively in the surface layer of the substrate (up to 100 nm) requires the use of advanced instrumental methods to analyze the influence of the applied gas in the plasma state on the surface and material properties, including the analysis of topographic and micromorphological changes of the fiber surface by scanning electron microscopy and AFM microscopy, chemical changes by XPS spectroscopy, changes in hydrophilic/hydrophobic properties using, for example the contact angle, and applications of other instrumental analyzes.

Key words:

Plasma, micro-nano world, textile industry

IVA BRLEK:
University of Zagreb Faculty of Textile Technology (TTF)

WHY ENCAPSULATE DYES?

Abstract:

Microencapsulation is often used in the textile industry, but nanoencapsulation is also gaining interest due to its often more effective encapsulation, improved stability, and targeted release of encapsulated substances. Encapsulation can be defined as a technology for storing various active substances, e.g., pigments, dyes, essential oils, hardening agents, flame retardants, softeners, etc. Microcapsules consist of a core, i.e., an active substance, and a shell (membrane). The shell can be porous and thus release the active substance continuously, or it can be non-porous and release the core once or over a period under well-defined conditions. A particular active substance is encapsulated when we want to protect it from external influences i.e., to avoid chemical and physical reactions and to preserve the biological, functional, and physicochemical properties of the core. The effectiveness of the encapsulation method depends on the chemical composition of the active ingredient and the coating and their mutual inertness.

Encapsulation of dyes and pigments is not new, but its use is increasing every day. In this century, awareness of natural dyes is growing worldwide because of their therapeutic and medicinal properties and the high toxicity of synthetic dyes. Despite the dyeing properties and health benefits of natural pigments, problems arise such as the lack of stability and poor bioavailability of natural pigments. When using natural pigments as additives in some industries, the stability of the pigments during industrial processing must be considered and for this reason it is recommended to encapsulate such dyes. As natural pigments are usually very sensitive to environmental processes and conditions, encapsulation technology has proven to be a promising solution to achieve these goals. Thermochromic and photosensitive dyes are increasingly used in industry and textiles. They are often encapsulated so that their colour change properties can be optimally utilized under characteristic conditions and the desired effects can be achieved at the desired time.

Key words:

encapsulation, microcapsules, dyes, pigments

TSRC AWARD 2023

CATEGORY:

STUDENT

INES DOMINIĆ

PRETREATMENTS OF ENERGY CULTURE MISCANTHUS X GIGANTEUS FOR FIBERS EXTRACTION

Abstract:

Miscanthus x giganteus is a perennial energy plant that has recently been increasingly used in science, technology, and industry as a source of bioenergy. In this paper, one of the fiber extraction methods from 5 harvests was selected and optimized with the aim of high yield and fiber quality achievement, considering the ecology of the process. The most important fiber properties such as length, density and moisture were analyzed with respect to harvest time and extraction process. The results indicate that the extraction process in terms of fiber yield is satisfactory for the short fibers, which could be used in various industries, apart from textile. On the other hand, there are visible differences in fiber length, which are dependent on harvest time.

Moisture depends on external conditions in the case of natural fibers and that feature is important since it has direct impact on the use of fibers and can vary significantly. Change in moisture content has a direct impact on the properties of textiles, such as tensile strength, elasticity, fiber diameter and friction. A drop in the equilibrium relative humidity of a textile may cause weaker, thinner, less elastic, and therefore more brittle material. Fibers are extracted with the aim to be used as reinforcement in composites and additionally, the waste from the fibers production can be used for biofuel production. Such circular and green production is an excellent example of sustainable and zero waste practice.

Key words:

Miscanthus x giganteus, pretreatments, pulping, fiber extraction, biomass

. TSRC AWARD 2023

CATEGORY:

YOUNG RESEARCHER

PETRA MIHOVILOVIĆ

THE POSSIBILITY OF USING AN AZO DYE IN THE DETERMINATION OF CHITOSAN IN TEXTILE WASTEWATERS

Abstract:

Environmental pollution with microplastics is an ecological problem that is currently being discussed intensively on a global level. Textiles of synthetic origin are one of the main sources of microplastic particles released into the environment during the washing process of textiles. One of the possible solutions to reduce the amount of released particles is the functional processing of textile materials MP. Chitosan, a biodegradable polymer, has shown potential application in the modification of polyester fabrics. Wet fastness is an important parameter in evaluating the effectiveness of processing textile materials. As an additional step in the evaluation of wet fastness, it is necessary to determine and detect the amount of chitosan in the effluent. In this paper, two methods for the determination of chitosan in wastewaters based on the adsorption of the azo dye Remazol Red on chitosan are presented. The amount of chitosan was determined by UV/Vis spectrophotometry by monitoring the amount of the formed colloidal complex chitosan-Remazol Red, but also indirectly by monitoring the concentration of the unbound dye. The results showed that the use of the centrifugation procedure leads to an increase in the sensitivity of the method, which makes it possible to determine the amount of chitosan in the concentration range of 10-60 mg dm-3.

Key words:

wastewater, chitosan, adsorption, azo dyes, Remazol Red

Exhibitors:

1. **Oxford Instruments NanoAnalysis, UK**

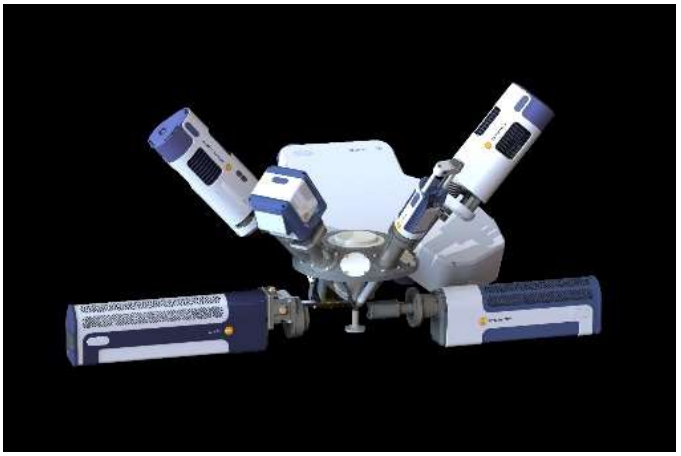

Figure 1: Oxford Instruments - New generation of BEX, EDS, EBSD and WDS detectors

2. **Mikrolux, d.o.o., HR**

Figure 2: TESCAN CLARA - Field-free analytical UHR SEM for materials characterization

3. Primalab d.o.o., HR

Figure 3: Identification of forensic materials using a portable Raman device

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