



Sveučilište u Zagrebu / University of Zagreb  
**Tekstilno-tehnološki fakultet**  
 Faculty of Textile Technology



**Textile Science Research Centre (TSRC) /**



**23<sup>rd</sup> September 2015.**

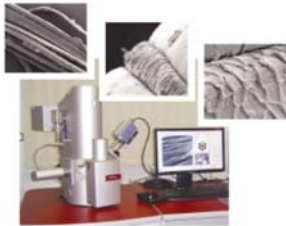
Textile Science Research Centre - **TSRC** / Technical Museum  
 University of Zagreb, Faculty of Textile Technology



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**Advanced materials and advanced technologies**

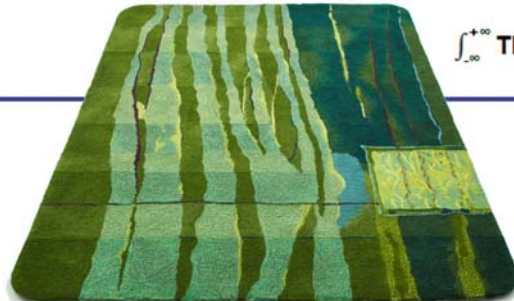


8.30 - 12.30 LECTURES

Technical Museum  
 Savska st. 18, Zagreb



$\int_{-\infty}^{+\infty} \text{TEXTILES} \rightarrow \text{waste} \xrightarrow{+3R} \text{M21C} \cong \$$



**Event:** Textile Science Research Centre Day 2015

**Place:** Technical Museum, small hall, Savska street 18, Zagreb

**Date:** September 23<sup>rd</sup> 2015

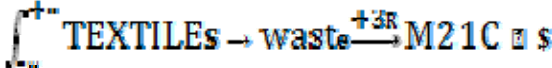
**Schedule:** according to agenda

**Organizing institution:** University of Zagreb Faculty of Textile Technology, Textile Science Research Centre (TSRC)

**TSRC head:** Tanja Pušić

Textile Science Research Centre (TSRC) was established in 2008 at the University of Zagreb Faculty of Textile Technology. On the occasion of TSRC Open day it presents textile research and artistic potentials with the aim to popularize textile science. The theme **Advanced materials and advanced technologies** will be presented in the form of lectures during the morning hours.

## AGENDA

<b>8.30-9.00</b>	<b>Registration</b>
<b>9.00-12.45</b>	<b>Lectures</b>
9.00-9.15	Research Strategy of University of Zagreb Faculty of Textile Technology and its Textile Science Research Centre
9.15-9.35	Synthesis and Targeted Application of Metallic Nanoparticles (UIP HRZZ project STARS)
9.35-9.55	Research on deformation of textile materials subjected to biaxial, shear, spherical and cyclic stresses
9.55-10.15	
10.15-10.35	Use of Microscale Combustion Calorimeter for development and characterization of textile materials
<b>10.35-11.10</b>	<b>Coffee break</b>
11.10-11.30	Nonthermal Plasma – Advanced Technology for the Modification of Textile Material Properties
11.30-11.50	Problems and advantages of Ink Jet technology in commercial textile printing
11.50-12.10	A paintings as a carpet
<b>12.10</b>	<b>Discussion</b>

## More about lectures.....

### Research Strategy of

- **University of Zagreb Faculty of Textile Science**

**Sandra Bischof**

TTF is a leading scientific institution within the field of textile technology and has a long 50 years tradition. During that period numerous R&D projects have been conducted and resulted with innovations in the area of new materials and improvements of technological processes. Taking into the consideration the number of patents - TTF is one of the leading faculties of the University of Zagreb. It is equipped with modern instruments of latest generation which are on the disposal to the academy and industry.

- **Textile Science Research Centre**

**Tanja Pušić**

Textile Science Research Centre (TSRC) is operating in accordance with the research strategies of the University of Zagreb and the Faculty of Textile Technology. Through the activities of experts and researchers, TSRC is involved in European initiatives in the field of

textiles and clothing, connected with a numerous institutions at home and abroad, participate in the creation of policy documents and initiatives. Within TSRC Day 2015 will be presented a scientific and artistic achievements within the theme of *Advanced materials and advanced technologies*.

### **Synthesis and Targeted Application of Metallic Nanoparticles (UIP HRZZ project STARS)**

***Iva Rezić***

This on-going project aims to establish international interdisciplinary research group that will synthesize new metal nanoparticles by environmentally friendly enzymatic reactions and apply them on different polymer materials. Metal nanoparticles have novel electronic, optical, magnetic, medical, catalytic and mechanical properties owing to their high surface to volume ratio and the quantum size effect, which depend greatly on their size, structure and shape. Therefore a conservative estimation of the world market predicts the global consumption of metal oxide nanoparticles to rise from 270 tons in 2012 to 1700 tons by 2020. Different enzymes will be isolated and used to synthesize metallic nanoparticles. Furthermore, the kinetics and mechanism of reactions, characterization of the products by using different instrumental methods (such as GEMMA, PDMA and MALDI-TOF-MS/MS) will be performed. Implementation of this project will establish new interdisciplinary research group targeting problems in the fields of nanotechnology, material science and bio/analytical chemistry, as well as enhance the independent research leadership of the principal investigator by installing the scientific infrastructure necessary for research on the synthesis and targeted application of metal nanoparticles. By deposition of targeted nanoparticles on polymers, new materials for food packaging and geotextiles are foreseen.

### **Research on deformation of textile materials subjected to biaxial, shear, spherical and cyclic stresses**

***Stana Kovačević, Snježana Brnada, Ivana Schwarz***

The direction and amount of textile material deformation subjected to static or dynamic stresses in various directions is closely related to material coefficient of anisotropy. Anisotropic properties of textile material can not be completely defined by standard test methods and devices. Technical textile fabrics durability in certain application areas is the most important requirement placed upon such material, and it depends on a number of structural and process parameters as well as the conditions of material usage. In the application and exposure to the usage conditions of such materials, there is fatigue i.e. deformations appearance caused by constant influence of biaxial strain. It is therefore of utmost importance to define the change of rheological and durability properties of materials, and their resistance to biaxial, shear, spherical and cyclic stresses, which is an indicator of the durability of materials. These findings will provide the improved designing and production and also better functionalization of materials in different application area. The study of material behavior during stress (biaxial, shear, spherical and cycling) and usage (aging process) will be performed through cooperation with other research institutions and industry. The research of textile materials mainly produced in Croatia will contribute to the progress of textile science, the Croatian economy, transfer of knowledge and experience to young scientists, improvement of technical and other textile fabrics production. Innovative component of a research is development of new devices for characterization of deformations as well.

## $\int_{-\infty}^{+\infty}$ TEXTILES $\rightarrow$ waste $\xrightarrow{+3R}$ M21C $\cong$ \$

***Edita Vujasinović, Marijana Pavunc Samaržija***

Beginning of 21<sup>st</sup> century can be characterized with significant development in the field of materials, which is extremely evident in the field of textile fibers and fabrics. Today, the textile fibers and fabrics are used, except for the production of garments, for a wide variety of other products such as all kind of vehicles, sports and protective clothes, sports equipment, or structural materials through the fiber-reinforced composites (geo-textiles, reinforced concrete, medical textiles, etc.). It is estimated that the production of these textile products in the 2014 was approx. 30 million tons with 160 billion USD market share. Probably, such growing trend (4% per year) will continue to be in the future too, resulting in significant increase of textile waste and necessity for its proper recycling as well as in attempts for providing sufficient quantity of raw materials for their production i.e. for the production of textile fibers. Although approx. 90.8 million tons of textile fibers are produced in 2014 it is expected that demand for them will continuously grow in the future.

Having in mind that due to urbanization and population growth, cultivable land and pastures (the origin of natural fibers) are diminishing as well as reserves of oil, natural gas and wood pulp (raw material for production of synthetic fibers) while at the same time textile wastes enlarges, it becomes clear that textiles recycling (recovery) is the only possible solution i.e. the best and most desirable way of textiles waste handling, ensuring at the same time large quantity of raw material for the production of new textiles. Although, textile recovery is known from the ancient time, today the best and the most desirable way of textile waste recycling, in reality, appropriate disposal and/or proper recovery/reuse is more complex and sometimes impossible, especially for modern, multifunctional or structural textiles based on high performance fibers and/or smart materials. In order to be able to reduce textile waste, save energy, preserve environment and ensure enough raw material in the future, it is necessary to incorporate multifunctionality and the principles of eco-design or so-called green design (design textiles for recycling or sustainable textile design) into design of new textiles.

### **Use of Microscale Combustion Calorimeter for development and characterization of textile materials**

***Sandra Flinčec Grgac***

Microscale combustion calorimetry (MCC) was designed to measure heat release properties using a controlled heating program to pyrolyze a polymeric sample. MCC as a quantitative analytical method is used for measuring of heat release capacity (HRC), heat release rate (HRR) at different temperatures, peak heat release rate (PHRR), temperature at PHRR (TPHRR), total heat release (THR), and percent char yield for different flameretardant textiles including treated cotton. Therefore, since its invention, MCC has been successfully applied to evaluate heat release properties of various polymers including flame-retardant materials.

### **Nonthermal Plasma – Advanced Technology for the Modification of Textile Material Properties**

***Sanja Ercegović Ražić, Slobodan Milošević***

Researches related to the application of nonthermal plasma are particularly topical in the development of environmental processes of the pretreatment and finishing of textile materials in order to obtain a product with necessary functional properties were actual in the last 20 years. In recent years the interest of researchers have focused on the processes development of plasma as a medium for the direct deposition of particles, process of polymerization and creating centers for grafting modifiers on the textile surface. The subject under discussion is to targeting different properties of textile materials treated with plasma, owing to various physical - chemical processes that occur in the interaction of plasma and textile surface. In

this paper will be presented the results obtained by the cooperation between the two institutions, related to the application of nonthermal plasmas as advanced technology for the modification of textile surfaces and achieving of new functional properties

## **Problems and advantages of Ink Jet technology in commercial textile printing**

***Martinia Ira Glogar, Đurđica Parac-Osterman***

In the last 3 decades there has been increased intensity in Ink Jet technology development. Due to its proved efficiency, digital printing techniques are increasingly applied in textile industry. The advantages of these techniques are quick response on high market demands, the range of colour gamut, possibility of creating the unique designs, as well as optimal response for energy and water savings. This technology of non – contact ink droplet deposit on textile fabric surface, is based on multi-coloured print in CMYK system. But, due to a complex interaction of specific textile surface structure characteristics, demands on composition and rheological properties of printing inks as well as technology of printing ink droplet formation, there are still numerous problems to be solved. On University of Zagreb Faculty of Textile Technology, Department for Textile Chemistry and Ecology, the researches with aim of optimizing the method of textile pretreatment and postprocessing will be performed, as key phases in printing inks preparations based on soluble textile dyestuff (for example Ink Jet printing inks based on reactive textile dyestuff).

## **A painting as a carpet**

***Koraljka Kovač Dugandžić, Marija Gradečak***

Collaboration between artists and designers with technical staff of industrial sector will be outlined as an important element of the development and implementation of products with high added value. The course of successful cooperation between artist doc. art. Koraljka Kovac Dugandžić with designers and technologists of textile factory plant Regeneracija from Zabok will be presented. The result of this collaboration is manufacture of high quality woolen carpets with abstract motifs of artists paintings. Project *Self-portraits* is part of a broader strategy of a new development phase of Regeneracija, based on the preserved industrial heritage of high-quality handmade carpets. Within this topic employees and students of the Faculty of Textile Technology, both from the engineering and artistic areas, can make significant contribution.