MARMARA ÜNİVERSİTESİ YAYINEVİ

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**Prof. Dr. Mehmet AKALIN**

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MARMARA ÜNİVERSİTESİ

# 15 OCTOBER 2014 WEDNESDAY (ORAL PRESENTATIONS)

# TURKISH TECHNICAL TEXTILES MARKET

Y. Ulcay

*Uludağ University, College of Engineering, Department of Textile Engineering, Görükle, Bursa, 16059 Turkey*
E-mail: ulcay@uludag.edu.tr

## Abstract

Industrial Textiles are: textile materials and products intended for end uses other than clothing, household furnishing, and floor covering, where the fabric or fibrous component is selected principally for its performance and properties as opposed to decorative characteristics.

Technical Textiles are textile materials and products manufactured primarily for their technical performance and functional properties such as mechanical, electrical, thermal, durability, etc., rather than their decorative characteristics. Technical textiles try to compensate specific requirements such as lightness, resistance, reinforcement, filtration, fire-retardancy, conductivity, insulation, flexibility, absorption and so on.

All type of fiber materials including high performance fibers, regular textile fibers and recycled fiber can be used in the production of technical textiles depending on application area and expected performances. The most manufacturing techniques of spinning, weaving, braiding, knitting and non-woven and finishing processes such as dyeing, printing, coating, laminating are employed in technical textile production to meet requirements of the end use products. Therefore, definition of technical textiles depends on the end use of the product rather than the raw material.

The technical textiles are commonly categorized in 12 subtitles which derived major markets. In general, the technical textiles are part of the flexible engineering materials in which the fiber reinforced composites are part of.

Smart Textiles (also named as intelligent textiles, electronic textiles or e-textiles etc) are textile materials which sense conditions in their environment and respond to those conditions mainly chemical and/or electronic approaches. Many smart textiles already feature in advanced types of clothing, principally for protection and safety and for added fashion or convenience.

One of the main reasons for the fast development of smart textiles is the importance to the military industry. However, they are becoming increasingly prominent as biomedical materials. The most important smart materials at present are: phase change materials, shape memory materials, chromic materials and conductive materials.

Term of Functional Textiles: Technical textiles and some application of the conventional textiles with adding value by physical and chemical modifications gives a new concept of Functional Textiles

Production and types of technical textiles are growing in Turkey, but it is still far away from its potential. Infra-structure is present in Turkey for technical textiles production in terms of both technology and labor quality.

New investments for mobiltech and nonwoven productions are growing nowadays. However, there is a lack of technology in the production of high performance fibers and related polymer chemistry field. At the moment, production of types of technical textiles is limited, but the consumption is very wide.

Technical textiles are a niche market in Turkey and getting more respect. Chemical companies and machinery manufacturers must recognize the potential. Related sectors and government should focus to the technical textiles field. Technical textile business gives opportunity to more profit than commodity textiles.

# SMART FUNCTIONAL MATERIALS FOR ENERGY HARVESTING: FROM LABORATORY TO COMMERCIALISATION

E. Siores[1,2], N. Soin[1], T. H. Shah[1], S. C. Anand[1]

[1]*IMRI, University of Bolton, Deane Road, Bolton, BL3 5AB, United Kingdom.*
[2]*Fibrlec Ltd., I-Zone, University of Bolton, Deane Road, Bolton, BL3 5AB, United Kingdom.*
E-mail: e.siores@bolton.ac.uk

## Abstract

The piezoelectric effect in Poly(vinylidene fluoride), PVDF, was discovered over 40 years ago and since then, significant work has been carried out aiming at the production of high β-phase fibers and their integration into fabric structures for energy harvesting. However, little work has been done in the area of production of "true piezoelectric fabric structures" based on flexible polymeric materials such as PVDF. In this work, we demonstrate "3D spacer" technology based all-fiber piezoelectric fabrics as power generators and energy harvesters (Figure 1(a)). The knitted single-structure piezoelectric generator consists of high β-phase (~80%) piezoelectric PVDF monofilaments as the spacer yarn interconnected between silver (Ag) coated polyamide 66 multifilament yarn layers acting as the top and bottom electrodes. The novel and unique textile structure provides an output power density in the range of 1.10 - 5.10 μWcm-2 at applied impact pressures in the range of 0.02 - 0.10 MPa, providing significantly higher power outputs and efficiencies over the existing 2D woven and nonwoven piezoelectric structures (Figure 1(b)). This all fiber piezoelectric fabric possesses the advantage of efficient charge collection due to intimate contact of electrodes and uniform distribution of pressure on the fabric surface, leading to enhanced performance. Moreover, the "feel" of the all-fiber piezoelectric generator is not very different from any other conventional textile material and is soft and flexible providing potential maximum level of comfort to the wearer. Bearing all these merits in mind, we believe our method of producing large quantities of high quality piezoelectric yarn and piezoelectric fabric provides an effective option for the development of high performance energy-harvesting textile structures for electronic devices that could be charged from ambient environment or by human movement. Furthermore, via the creation of hybrid photovoltaic films and fibers, energy can be captured from solar radiation and used where the mechanical impetus is absent. The high energy efficiency, mechanical durability and comfort of the soft, flexible and all-fiber based power generator is highly attractive for a variety of potential applications such as wearable electronic systems and energy harvesters charged from ambient environment or by human movement.



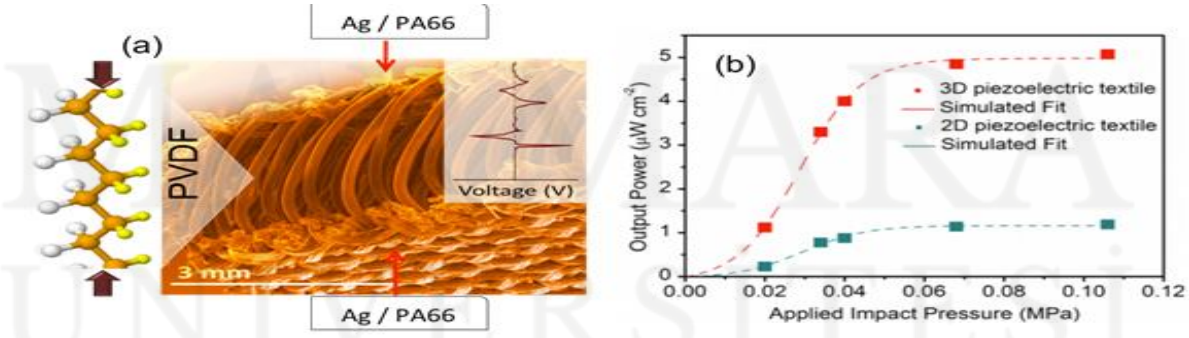


**Figure 1:** Figure illustrating (a) the structure of 3D spacer piezoelectric fabric, (b) measured power output of the 2D and 3D piezoelectric fabrics as a function of the impact pressure.

# ADVANCED TEXTILES AND WEARABLES

T. Dias

*Advanced Textiles Research Group*, *School of Art and Design, Nottingham Trent University, UK*
E-mail: tilak.dias@ntu.ac.uk

## Abstract

Today the demand for wearable devices is growing. To continue to meet this demand engineers, designers and commercial pioneers are conceptualizing new applications. Textiles have a major role to play in this strategically important area and offer many advantages over traditional materials such as support for technologically advanced products, flexibility, softness, and high-strength-to-weight ratios. The highly developed mass production techniques that characterize the textile sector facilitate the path for the development of new products and their cost effective manufacture for many applications. These concepts are of particular benefit for certain groups who have specific requirements for wearable systems including the emergency services, military, elite athletes, patients and fashion innovators. Realizing these concepts will expand an exciting new manufacturing sector knitting together advanced textiles and electronics manufacturing.

Most wearable technologies manifested themselves in laboratories or as clothes that were specially made and bore little resemblance to garments which users would regard as normal. In the first generation of wearable technologies, electronic devices were simply attached to garments or included in pockets. In the second generation, electronic functionality was achieved by incorporating conducting yarns into the textile structure. However, our research has demonstrated their major drawbacks caused by inherent hysteresis of textile structures which limits their application only to relative measurements. Therefore, we have taken a major step forward and develop a third generation of electronic textiles where integrated circuits are fully incorporated into yarns prior to fabric or garment production.

The aim of the presentation is to report the development of a new platform technology whereby semiconductor micro devices are directly embedded within the fibers. Once produced, these electronically functional yarns will be incorporated into fabrics using conventional textile machinery or used as sewing thread in garment manufacture. The resultant smart yarn technology will have a profound effect on the production and use of electronic textiles in wearable applications by providing robust functionality that is resistant to wear, washing, drying and can be produced at lower costs than the electronic textiles available today where functionality is often added at the fabric and/or garment manufacturing stage.

Our current focus involves the packaging of miniature semiconductor sensors, actuators, micro controllers and their interconnect within polymer micro pods that will provide a flexible hermetic seal for mechanical, thermal and electrical protection whilst free fibers between pods will ensure that, where required, the textile characteristics of the resultant fabrics are retained. Prototypes of electronically functional yarns with fully integrated systems for light therapies and the measurement of 1) temperature and humidity 2) pressure, and 3) position and orientation are being developed.

MARMARA ÜNİVERSİTESİ YAYINEVİ

# INNOVATIVE SURFACE TREATMENTS OF TEXTILE YARNS AND FABRICS

K. Eufinger, M. Vanneste

*Centexbel Gent, Technologiepark 7, 9052 Zwijnaarde, Belgium*
E-mail: Karin.Eufinger@centexbel.be

## Abstract

The surface treatment of textile yarns and fabrics is undergoing a slow conversion from using traditional, energy and water consuming coating and finishing processes, to modern and innovative methods 'borrowed' from other industrial sectors and adapted to the novel application areas of technical textiles. This evolution comes together with the realization that surface treatment of textile yarns and fabrics can not only be used to give the textile its final finishing touch, but also to modify the textile surface for further coating or impregnation, e.g. for composite applications. Some examples for reduced water and energy consuming coating and finishing processes are radiation drying (IR) and curing (UV and UV-LED), plasma treatment, hotmelt coating and dyeing with ionic liquids. At Centexbel we have been researching these methods not only due to their potential for reducing the environmental impact, but also for developing innovative products with novel properties. In this presentation we will be discussing the highlights of selected projects at Centexbel demonstrating the potential of these innovative surface treatment techniques.



MARMARA ÜNİVERSİTESİ

MARMARA ÜNİVERSİTESİ YAYINEVİ

# CARBON NANOTUBE YARNS FOR ARTIFICIAL MUSCLES AND FLEXIBLE PHOTOVOLTAICS

F. Göktepe

*Department of Textile Engineering, Çorlu Engineering Faculty, Namık Kemal University, Tekirdağ, Turkey*
E-mail: goktepef@gmail.com

## Abstract

Carbon nanotubes have found quite diverse applications from composites to filtering applications, antifouling coatings to rechargeable batteries. Worldwide production capacity of CNTs has exceeded several thousand tonnes per year due to the commercial interest owing to such a wide application fields and its superior properties. Although CNTs have such a significant potential, they are mainly produced in bulk powder form while the production of spinnable CNT is very limited. This work demonstrates yarn spinning from spinnable CNT forests which is the hierarchical fiber composites created by growing aligned CNT fibers in nanoscale and presents superior tensile and torsional actuation performance obtained by these highly special yarns which can be used as artificial muscles in humanoid robots, robotic reptiles or insects etc. The work also presents engineered CNT yarns which was designed and produced specifically as flexible photovoltaics showing that power conversion efficiency values can exceed well over 3% offering high potential for powering wearable electronics and lightweight solar cells.



MARMARA ÜNİVERSİTESİ

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# MODELLING OF COMPRESSION PROPERTIES OF NONWOVEN MATERIALS AND RELATED SYSTEMS

A. Rawal, V. Kumar

*Department of Textile Technology, Indian Institute of Technology Delhi, Hauz Khas, New Delhi-110016, India*
E-mail: amitrawal77@hotmail.com; arawal@textile.iitd.ac.in

## Abstract

Nonwoven materials are subjected to compression loading during their end-use performance in various technical and industrial applications. In this research work, a compression model of thermally bonded nonwoven materials has been proposed by defining two distinct regions displaying the bending of free fiber segments between the fiber-to-fiber contacts followed by the transverse compression of fiber contacts through classical Hertzian contact mechanics approach. The mechanistic models developed in this study, have clearly elucidated the main fiber and structural parameters that control the compression behavior of fused fibrous networks. A comparison has also been made between the theoretical and experimental pressure-strain curves of randomly and preferentially aligned fused fibrous networks. In general, a good agreement has been obtained between theoretical and experimental results of pressure-strain curves of thermally bonded nonwovens. The usefulness of the compression model of nonwovens is not only limited to fibrous networks but it has been successfully applied to highly porous network of carbon nanotubes.



MARMARA ÜNİVERSİTESİ

# PRODUCTION OF ANTIBACTERIAL TEXTILES WITH A REDUCED LEACHING OF BIOCIDAL AGENTS

C. Vineis[1], C. Tonetti[1], A. Varesano[1], G. Mazzuchetti[1], S. Ortelli[2], A.L. Costa[2], M. Periolatto[3], F. Ferrero[3]

*[1]CNR-ISMAC, Institute for Macromolecular Studies, Biella, Italy.*
*[2]CNR-ISTEC, Institute of Science and Technology for Ceramics, Faenza (RA), Italy.*
*[3]Politecnico di Torino, Department of Applied Science and Technology, Turin, Italy.*
E-mail: C.Vineis@bi.ismac.cnr.it

## Abstract

Antibacterial textiles have obtained increasing interest from both academic research and industry because of their potential to provide better quality life and safety benefits to people. Textile products are prone to host micro-organisms whose proliferation is responsible for diseases, unpleasant odors, color degradation and deterioration of fabrics. Antimicrobial finishes are used in many textile products, such as sportswear, outdoor apparels, undergarments, shoes, furnishings, upholstery, hospital linens, wound care wraps, towels and wipes. Other applications are envisaged for antibacterial filter applications (e.g., biotechnology processes, water purification, clean rooms, operating theatres, domestic appliances).

In this work, four different approaches for the production of antibacterial cotton fabrics are described. The first approach deals with the deposition of titanium dioxide nanoparticles from colloidal water solutions (nanosol) by pad-dry-cure procedure. The second approach deals with in-situ polymerization on cotton fibers of a positively charged conjugated polymer (namely, polypyrrole). The third consists in the modification of cotton fabrics with citric acid bind to fiber surface. The last method involves the deposition of chitosan followed by UV-curing on fabrics.

All the proposed approaches have the aim to reduce or avoid the leaching of biocidal agents to the environment. The treated fabrics showed excellent (>97%) antibacterial properties against both Gram-negative and Gram-positive bacteria following standard test methods (AATCC 100, ASTM E 2149-01).



**Acknowledgements:**
This work is partially supported through the PROBIOPOL project funded by Progetto Bandiera - La Fabbrica del Futuro, call FdF-SP2-T4.1.

# ELABORATION AND CHARACTERIZATION OF NEW MICROCAPSULES FOR COSMETO-TEXTILES

N. Azizi[1], Y. Chevalier[2], M. Majdoub[1]

[1]*Laboratoire des Interfaces et Matériaux Avancés (LIMA), Faculté des Sciences, Bd. de l'Environnement 5019 Monastir, Tunisia.*
[2]Laboratoire d'Automatique et de Génie des Procédés (LAGEP), Université Claude Bernard Lyon 1, UMR CNRS 5007, 69622 Villeurbanne Cedex, France.
E-mail: azizinedra@yahoo.fr

## Abstract

Encapsulation is a suitable way to control fragrance release and to make perfumed textiles more durable. New polyurethane microcapsules based on renewable materials and containing perfume were designed for cosmeto-textile application. The polymer wall was synthesized by interfacial polycondensation technique. The chemical structure of the microcapsules was confirmed by IR and 1H NMR spectroscopies. Spherical shape and particle size distributions of microcapsules were revealed by means of optical microscopy, scanning electron microscopy (SEM) observations and small-angle light scattering measurements. The encapsulation efficiency of perfume, accounts for 40%. The microcapsules were deposited onto textile substrate by an impregnation process using a binding agent. The durability and the perfume release behavior of the impregnated textile were evaluated through SEM observations and UV-visible spectroscopy.

MARMARA ÜNİVERSİTESİ YAYINEVİ

# IMPACT OF HOT-STRETCHING TREATMENT ON PHYSICAL AND MECHANICAL PROPERTIES OF BRAIDED POLYAMIDE SUTURE

F. Debbabi[1], S. B. Abdessalem[1,2]

[1]*Monastir University, Textile Engineering Laboratory, Tunisia*
[2]*Monastir University, National Engineering School of Monastir, Tunisia*
E-mail: debbabi_faten@yahoo.fr

## Abstract

Encapsulation is a suitable way to control fragrance release and to make perfumed textiles more durable. New polyurethane microcapsules based on renewable materials and containing perfume were designed for cosmeto-textile application. The polymer wall was synthesized by interfacial polycondensation technique. The chemical structure of the microcapsules was confirmed by IR and 1H NMR spectroscopies. Spherical shape and particle size distributions of microcapsules were revealed by means of optical microscopy, scanning electron microscopy (SEM) observations and small-angle light scattering measurements. The encapsulation efficiency of perfume, accounts for 40%. The microcapsules were deposited onto textile substrate by an impregnation process using a binding agent. The durability and the perfume release behavior of the impregnated textile were evaluated through SEM observations and UV-visible spectroscopy.

Today, suture is the most used implant in human body, but they are not yet perfect. The first used polymeric suture is polyamide suture which is a non-absorbable suture, commonly used in dermatologic surgery. There is a lack in literature describing precisely suture manufacturing process. The braided polyamide sutures have to undergo several manufacturing steps including hot-stretching. This treatment was reported to have positive impact on suture mechanicals properties. The aim objective of this work was to analyze physical structural changes of polyamide fibers after hot-stretching step and to highlight mechanical properties changes related to this treatment. Obtained results showed that hot-stretching of polyamide suture; allow obtain uniform and compact suture. However, during this treatment, there is not only change in structural properties but also modification of mechanical and macromolecular properties. In this study, we have submitted hot-stretching sutures under different conditions to straight pull test and analyzed by differential scanning calorimetry. Changes in mechanical properties due to hot-stretching have been correlated to macromolecular properties such as crystallinity, crystal size and macromolecular chains orientation. Hot-stretching suture at a temperature higher than 200 °C and medium value of drawing ratio, involves the best suture properties. Below 180°C, polyamide braided suture undergoes thermal shrinkage during hot-stretching, leading to breaking extension increase. The percentage of crystallinity of fabricated suture was ameliorated by hot-stretching suture and reaches 33 % with creation of numerous crystals with smaller size.



MARMARA ÜNİVERSİTESİ

# CONTROLLED RELEASE OF FLUORESCENT DYE AND VITAMIN LOADED PET NANOFIBERS

S. Duzyer[1], A. Hockenberger[1], S. Sinha-Ray[2], A.L. Yarin[2]

[1]*Uludag University, Department of Textile Engineering, Bursa, 16059,TURKEY.*
[2]*University of Illinois at Chicago, Department of Mechanical and Industrial Engineering, Chicago, USA.*
E-mail: sebnemduzyer@uludag.edu.tr

## Abstract

In drug delivery, one of the problems that pharmaceutical scientists are faced is the development of systems with controlled and targeted release properties. During the treatment, an optimum concentration (C) should be maintained in the body to obtain the highest therapeutic value. Electrospinning is a promising technique to produce drug-loaded nanofibers with controlled release properties. In this study, two model drugs were embedded PET solutions and nanofibers were produced by electrospinning. Also, poly(ethylene glycol), PEG and poly(ethylene oxide), PEO were added to the spinning solutions as porogens in order to facilitate the release properties of the nanofibers. The surface characteristics of the nanofiber mats were evaluated by SEM studies and contact angle measurements. With the addition of vitamin, the contact angle values were decreased dramatically. The release kinetics of the nanofibers was studied and the released amount of drug is tracked by fluorescence intensity. The encapsulation of PEG as a porogen in the PET-based nanofibers led to a significant boost in release properties. The encapsulation of an additional porogen PEO in the PET/PEG nanofiber mats resulted in a lower level of the release saturation. The presence of PEO in addition to PEG reduced the ultimate riboflavin release level. It was shown that the dye release process from nanofiber mats with porogens or self-porogens is associated with the desorption-limited mechanism and the release process consists of two stages. At the first stage, the dye/vitamin is released from the pre-existing pores, at the second one-from the pores/micro-cracks formed due to leaching or dissolution of the fiber body or micro-crack formation.

MARMARA ÜNİVERSİTESİ YAYINEVİ

# EFFECTS ON FIBER FORMATION IN MELT SPINNING DUE TO 1-D NANO-PARTICLE MODIFICATION IN THERMOPLASTIC POLYMERS

R. Stolz[1], T. Vad[1], S. Dabringhaus[1], G. Seide[1], T. Gries[1], T. Weirich[2], J. Wulfhorst[3]

[1]*Institut für Textiltechnik (ITA), RWTH Aachen University, Aachen, Germany.*
[2]*Central Facility for Electron Microscopy (GFE), RWTH-Aachen University, Aachen, Germany.*
[3]*Freudenberg & Co. KG, Weinheim, Germany*
E-mail: rene.stolz@ita.rwt-aachen.de

## Abstract

Incorporating nanoparticles into thermoplastic polymers enables the adjustment of specific properties in fibers. Nanoparticle modified fibers are able to meet special requirements in terms of mechanical, electrical, or optical properties. Carbon nanotubes (CNT), due to their special geometry and material properties have decent effects on the fiber formation in polymer fibers. CNTs combine properties such as a high aspect ratio, rigidity, and electrical conductivity. Incorporating these particles into polymer fibers by melt mixing will thus enhance the mechanical, electrical, and thermal properties of polymer fibers.

The effects on fiber formation are additionally depending on the quality of the nano-compound, the processing parameters and the orientation of the particles. A homogeneous distribution with a low amount of particle agglomeration is a necessity for a good melt extrusion. The orientation of the polymer chains and the particles as well as the formation of semi crystalline structures is mainly controlled by the take-up velocity. These effects are further enhanced by solid state drawing, which leads to an increase in fiber tenacity and, correspondingly, a loss of flexibility.

The dependency of the CNT-orientation effects on variations in the melt draw ratio and the solid state drawing is studied by Wide-Angle X-Ray scattering and electron tomography. Furthermore, the effect of CNTs as crystallization inhibitor in low drawn melts can be shown. On the other hand the crystallinity in high drawn melts is increased: The orientation of the CNTs is increased by drawing, which leads to an increase in the crystallinity. Hence, the CNTs act like a nucleation agent, which does not disturb the formation of the periodic structure of the semi-crystalline polymer regions.

The studies in the project works answers question about the crystallinity of fibers concerning draw ratio and concentration of nanoparticles. Further answers are found to the orientation of crystals in polymeric fibers as a result of the drawing. Based on these results scientific findings about the flow behavior of polymeric melts below the spinneret is gained.

Further studies concerning the influence of the orientation behavior of 2-D nanoparticles (such as, e.g., organo-clays or graphene) on the formation of the semi-crystalline polymer structure and the resulting fiber properties are in progress.



MARMARA ÜNİVERSİTESİ

# SIDE EMITTING POLYMERIC OPTICAL FIBRES FOR SAFETY TEXTILES

J. Militký, D. Křemenáková, R. Mishra, H. Jamshaid

*Textile Faculty, Dept. of Material Engineering, Studentská 2, Liberec 461 17 Czech Republic*
E-mail: jiri.militky@tul.cz

## Abstract

Standard polymer optical fiber (POF) is a dielectric waveguide transferring light or infrared radiation across its axis by the mechanism of total internal reflection on the interface of two materials with different refractive indices [1]. The main requirement for classical POF is to prevent side emission causing loss of transferred light. In the side emitting plastic optical fibers (SEPOF) the light leaks out from their surface. Side emission occurs if the light incidence angle is smaller than critical angle. This effect can be obtained by the increasing of cladding refractive index, decreasing of core refractive index or by the change of incident light angle. It is also possible to use multiple micro-bending of core or cladding; additives causing reflection or fluorescence into core/cladding or to create geometric asymmetry in the core/cladding system. There are various commercial types of patented SEPOF including methods of their preparation [2, 3]. The SEPOF can be used for creation of optically active textile structures providing opportunities to highlight people and objects without the need for external light exposure. Due to the transmission loss, the intensity of radiation emitted in any direction decays exponentially along the straight fiber axis with increasing distance from the light source [4, 5]. An optical fiber integrated in weaving patterns can be described by a sequence of locally bended and straight sections. For this case the transmission loss is based on the distance between threads, thickness of threads and weaves. Local bends should be suppressed in the cases of using SEPOF for achieving active visibility at higher distances from light source. It is therefore necessary to use special embedding of SEPOF into textile structures e.g. in the form of tubes wrapped by textile yarns.

The main aim of this contribution is description of SEPOF optical and mechanical properties and their efficient embedding into fibrous structures for creation of safety textile structures with active visibility in shadows. For preparation of textile structures containing SEPOF the braiding technology is used. The SEPOF end connected with light energy source is prepared by cutting with heated wire and then by polishing with diamond powder. Illumination system with light emitting diode (LED) is used as light source (illumination intensity of source is 43.9 Wm-2). The special device for measurement of light intensity on surface and cross section at various distances from light source is described. The dependence of surface and cross section light intensity on the distance from light source is expressed by the exponential type model with attenuation factor as the rate parameter. Second parameter defines quality of illuminating system; it is light intensity at the input to the fiber. The influence of the optical fiber type and diameter on the attenuation factor of light intensity at the surface and cross section is quantified. Light intensity of textile structures is compared with light intensity of fibers. The results of SEPOF flex fatigue and damage resistance tests are described. Some practical examples of belts containing SEPOF are presented. Their practical applications areas are discussed.

**Acknowledgement:** This work was supported by research project FR-TI1/242 “High visibility protective textiles” of Czech Ministry of Industry.

MARMARA ÜNİVERSİTESİ YAYINEVİ

# DEVELOPMENT OF WATER AND OIL REPELLENT COTTON FABRIC BY SOL-GEL COATING

N. Onar[1], G. Mete[1], A. Akşit[2], B. Kutlu[2], E. Çelik[3]

[1]*Pamukkale University, Faculty of Engineering, Textile Engineering Department, DENIZLI-TURKEY*
[2]*Dokuz Eylul University, Faculty of Engineering, Textile Engineering Department, IZMIR-TURKEY*
[3]*Dokuz Eylul University, Faculty of Engineering, Materials and Metallurgy Engineering Department, IZMIR-TURKEY*
E-mail: nonar@pau.edu.tr

## Abstract

In this study, water and oil repellency properties of fabrics treated with silane based nanosols were developed by sol-gel technique. As to this aim, silane based nanosols added tridecafluoro octyltriethoxysilane, hexadecyltrimethoxysilane, vinyltrimethoxy silane, phenyltriethoxysilane, zirconium (IV) acetylacetonate, titanium (IV) isopropoxide, 3-aminopropyl trimethoxysilane, glycidyloxypropyl triethoxysilane as precursors and containing solvents and chelating agents were impregnated on cotton fabrics at low temperature in air using sol-gel technique. The pH values of nanosols were measured by pH meter. The structural and microstructural natures of the coatings were characterized by using Fourier transform infrared spectroscopy (FTIR), X-ray diffractometry (XRD) and scanning electron microscopy (SEM). In addition, water and oil repellency properties, contact angle, their wash fastness and add-on values of the coated fabric samples were determined. In conclusion, it was found that the cotton fabrics with the best water and oil repellency properties could be produced using nanosols containing HDMS as precursor and Ruco Guard AFB with lower concentration at conventional process as commercial water-oil repellent agent at acidic conditions. Moreover the natural textile performance properties of the fabric samples did not significantly change after treatment with the nanosols.



MARMARA ÜNİVERSİTESİ

# DEVELOPMENT AND COMPARISON OF DIFFERENT SOUND ABSORBENT WOVEN FABRICS

A. Zulifqar[1], M. A. Nazeer[2], M. Abbas[1], Q. Nawaz[1], M. A. Raza[1]

[1]*Faculty of Engineering and Technology, Department of Textile Engineering, National Textile University, Faisalabad, Pakistan*

[2]*Faculty of Engineering, Department of Bio-Medical Sciences & Engineering, KOC University, Istanbul, Turkey*

E-mail: mnazeer13@ku.edu.tr

## Abstract

Noise has become serious environment pollution in the daily life of labors and is an increasing public health problem according to the World. Noise can have the adverse health effects like hearing loss, sleep disturbances, tiredness, cardiovascular and psycho physiologic problems, performance reduction, annoyance responses, and adverse social behavior. The proper surroundings for working become a legitimate right of the workers. The sound absorption properties are important not only for noise reduction, but also for controlling reverberation time for speech intelligibility in rooms and for promoting fuller sound in concert halls. Industrial Textiles are focusing on textile materials that can be utilized in application for sound absorption, thus new textiles were to be examined in relation to this performance.

In this study the comparison of noise absorbent coefficient of different noise absorbent woven fabrics and factors which affect most the sound absorbency was made. Multilayer woven fabrics with different materials, weaves, construction and combination of developed fabrics were developed. Three homogeneous structures of nylon with plain, twill and satin weaves, two of glass with twill and satin weaves, while three hybrid structures of nylon and polyester with twill, satin and plan weaves were developed. All the individual and stitched multilayer samples were tested using Impudence tube method according to the ISO 10534-2 and ASTM E1050. The test results were compiled and compared. Noise absorption coefficients were studies for five different frequencies 125 Hz, 250 Hz, 500 Hz. 1000 Hz, 1500 Hz, for each constructed panels. It is observed for all panels that NAC's value increase with the increase in frequency. AS frequency increases from 125 Hz to 1500 Hz the NAC.s value also increases respectively.

It was observed that density is one of the most important factors affecting the sound absorption of a fabric. If the density of fabric increases the Noise reduction coefficient value of panels also increases.

# LEAN NONWOVEN PRODUCTION FOR MEDICAL APPLICATIONS

C. Bach[1], T. Gries[1], S. Jockenhoevel[1,2]

*[1]Institut für Textiltechnik der RWTH Aachen Universit, Aachen, Otto-Blumenthal-Str. 1, 52074, GERMANY.*
*[2]Department of Applied Medical Engineering - Helmholtz Institute for Biomedical Engineering, RWTH Aachen University, Aachen, Pauwelstraße 20, 52074, GERMANY.*
E-mail: christoph.bach@ita.rwth-aachen.de

## Abstract

Nonwovens offer some unique properties like high porosity, fine and interconnective pores, good drapability, and lots of options in raw materials. This is why nonwovens are used in a multitude of applications in the area of wound dressings or surgical drapes. Furthermore nonwovens are used as a scaffold material for commercial and scientific purposes. A critical aspect in the production of medical nonwovens is the contamination due to the production of dust, the risk of crosscontamination due to residues of material in some areas of the machines and the high effort for cleaning the machinery. Especially the carding process shows these deficits. Due to this a lean nonwoven production process was developed, which leaves out the fiber opening.

Therefore it was the aim of the study to evaluate the effect of prominent process parameters onto the “lean” nonwovens mechanics and to compare these to conventionally manufactured nonwovens mechanics.

The trials were conducted with two different materials. The first material was a non texturized 111F10 Polypropylene fiber, which was used as a substitute for a silk fiber. The second fiber was a texturized 167F30 Polyester fiber. The lean nonwoven process showed good results. We were able to process both fibers in a large process spectrum. The difference in mechanical strength between the lean and the conventional process was between 10% and 20%.

# A NOVEL TECHNIQUE TO SYNTHESISE LOW RESISTIVITY FLEXIBLE CONDUCTIVE TEXTILES

R. A. Soltani, C. Hunt, O. Thomas, N. Biddle

*National Physical Laboratory, Teddington, TW11 0LW, UK.*
E-mail: roya.ashayer-soltani@npl.co.uk

## Abstract

An additive method that attaches silver nanoparticles directly to fabric fibers is reported. This metallization is then thickened by electroplating to produce a highly durable and flexible conductive fabric. Direct metallization of the fibers is the key to the stability and durability of the fabric allowing it to retain its original flexibility with minimal weight increase. This technique has been shown to work on different types of fabrics including knitted, woven and nonwoven. The results showed that the conductivity of the fabric to some extent is dependent on the type of fibers and its surface properties of the textile used. Nonwoven textile showed the lowest resistivity of 6x10-3 Ω/□, whereas Lycra had a resistivity of 2 Ω/□.

Our washing trials using commercial laundry detergent have shown that the fabrics are still conductive after 50 washes. The nanometal release was also investigated according to ISO standard and showed a value far below the acceptable value.

There is an increasing demand for wearable electronics from industries such as sport and fitness, consumer electronics, medical and healthcare applications. However, true wearable technology should be integrated within the clothing with maximum comfort and minimum visibility. The conductive textile solution we present here could make this possible.

# INVESTIGATION OF THE EFFECTS OF OXYGEN AND NITROGEN PLASMA TREATMENT ON THE FLAX FABRICS

S.Canbolat[1], D.Kut[2], P.Tiryaki[2], F.Demir[2]

[1]*Istanbul Commerce University, Faculty of Engineering and Design, Department of Fashion and Textile, Istanbul, Turkey.*
[2]*Uludag University, Faculty of Engineering, Department of Textile Engineering, Bursa, Turkey.*
E-mail: scanbolat@ticaret.edu.tr

## Abstract

In this study, flax fabrics were applied with oxygen and nitrogen plasma treatment for different execution time. After the plasma treatment, the effects of gas type and execution time on flax fabrics were investigated in terms of shear strength, hydrophility, color differences, dimensional change and surface properties. According to the results, nitrogen plasma treatment caused to increase the shear strength of flax fabrics more than oxygen plasma treatment. Furthermore, the oxygen and nitrogen plasma treatment caused to increase of hydrophility of flax fabrics and the hydrophility of samples increased with the increment in execution time of plasma treatment. The color differences results indicated that there were not significant differences in color change of flax samples. Besides, scanning electron microscope images demonstrated that the nitrogen plasma treatment provided the optimal surface modification. According to the results, plasma treatment can be improved the physical and chemical properties of flax fibers.

MARMARA ÜNİVERSİTESİ YAYINEVİ

# X-RAY ATTENUATION PROPERTIES OF METAL POWDER-SILICONE RUBBER COATED FABRICS

N. Aral, F.B. Nergis, C. Candan

*Istanbul Technical University, Faculty of Textile Design and Technology Faculty, Department of Textile Engineering, Gumussuyu Campus, Istanbul, Turkey*
E-mail: nebahataral@yahoo.com

## Abstract

Personal shielding products, such as lead aprons, are important equipment of the physicians and patients from harmful effects of X-ray radiation during medical operations. However, the toxicity of lead is a major concern and its disposal is associated with some environmental hazards. Additionally lead aprons, composed of layered thin lead sheets, have common cracking problems in practice due to bending and incorrect hanging after use [5]. Recent studies of non-lead (Pb) protective materials have focused on developing processes that incorporate metal powders into polymer sheets with sufficient metal content for effective shielding, and obtaining enough durability to avoid tearing and cracking [6-8].

The aim of the work is to develop a coating material which can be directly applied on textile materials using relevant conventional textile technologies. The base fabrics were coated with silicone rubber that contains tungsten, tin and copper powders. X-ray attenuation ratios of samples were measured at 80kV, 100kV, and 150kV tube voltages in accordance with medical protection standards. Besides, the coated surfaces of the samples were examined by SEM and EDS techniques to investigate powder dispersion and homogeneity.

The single layer of the coated fabrics, which were at around 0.50 mm thickness, attenuated 50-60% of radiation. In order to enhance the attenuation ratios, the total thickness of the samples were increased by composing layered structures in a sandwich form. Samples from two to five layers were also tested at 100kV level. The results showed that the tungsten, tin and copper additives in silicone rubber coating at 70% total metal weight ratios reached 88-95% radiation shielding levels at three to five layered forms which were sufficient for protection standards with equivalent lead thickness (0.25-0.50 mmPb).

As a conclusion the use of alternative metals like tungsten, tin and copper in fabric coating can be suggested as a potential method in the design of non-lead protective clothing against X-ray shielding in medical applications.



MARMARA ÜNİVERSİTESİ

MARMARA ÜNİVERSİTESİ YAYINEVİ

# DEVELOPMENT OF A DESIGN TOOL FOR POLYMER SPIN PACKETS

C. Sasse[1], C. Leithäuser[2], D. Hietel[2], G. Seide[1], T. Gries[1]

[1]*Institut für Textiltechnik (ITA) der RWTH Aachen University, Otto-Blumenthal-Straße 1, 52074 Aachen, Germany*
[2]*Fraunhofer Institute for Industrial Mathematics ITWM, Fraunhofer-Platz 1, 67663 Kaiserslautern, Germany*
E-mail: christian.sasse@ita.rwth-aachen.de

## Abstract

The application of new polymer materials often fails already with the spinning process. Spin packets have to be designed for new materials which lead to highly expensive development circles. A quick and beneficial implementation of new fiber materials is often avoided thereby. The quality of the spinning process and the yarn is influenced by the residence time of the melt in the spin packet. The design process is often based on expert experience and empirically.

The aim of this project is the reduction of the development duration from the polymer to new products. New materials can reach into the market faster and the variety of products will be increased.

This is realized by the development of a construction guideline based on numerical fluid simulations and spinning experiment. Within the simulations, typical single components of spin packets are examined and optimized by a combined approach of simulation and experiment. Every component is characterized by its influence on the melt properties. Any information is connected to an overall spin pack quality criteria.

By the use of the influence information for the single components and the overall spin pack criteria, a development guideline for polymer spin packs is created. The guideline will predict the quality of the spin process and therefore the yarn. A reduction of the development duration by 30 % and a reduction of faulty designs by 50 % are aspired.



MARMARA ÜNİVERSİTESİ

# DEVELOPMENT OF SPECIAL FILAMENT YARNS ON A NEWLY DESIGNED LABORATORY TYPE YARN DRAWING MACHINE

S. Ö. Hacioğullari, O. Babaarslan

*Çukurova University, Faculty of Engineering and Architecture, Department of Textile Engineering, Balcalı Campus, 01330 Sarıçam/Adana, Turkey*

E-mail: selcenozkan@gmail.com

## Abstract

Thanks to the Research&Development (R&D) and Production&Development (P&D) studies that have been conducted on synthetic filament yarns especially in recent years, these yarns have gained many functional properties. Hence, synthetic filament yarn production plays an essential role within the textile industry. However, in the establishments where continuous filament yarn production is made, the production line covers a fairly large scale, this industrial type machines possess a large number of process parameters and the production continues non-stop all day long. Because of these reasons, during the production activities it is pretty demanding to R&D and P&D studies. In the view of this disadvantageous case, this study was carried out, and with this study it was aimed to do continuous and systematic researches towards filament yarns. Thus, this study has two stages. The first one is the study of design, improving and manufacturing of lab-type filament yarn production machinery based on melt spinning principle (Figure 1) and the second one is the study of original product development done in the manufactured machinery. One of the most preferred methods for production these original products is adding micro and nano scale additives to polymer raw material in the chip form during production and in this study, production of flame retardant and UV filament *yarns have been carried out on this machine. As a result, many scientific studies about production of filament yarns especially for application of technical textiles can be realized with this lab-type machine.*

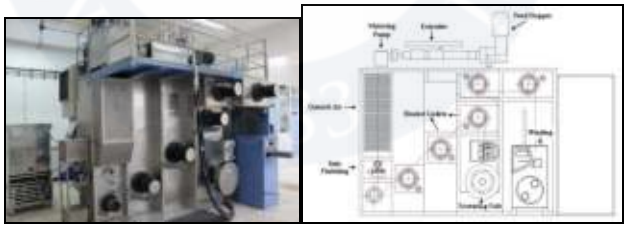


**Figure 1.** Laboratory type filament yarn machine views used for production

**Acknowledgements**

This paper was derived from studies as part of SAN-TEZ (00428.STZ.2009-2) project that have been supported by Republic of Turkey- Ministry of Science, Industry and Technology. Authors thank to this institution for their financial support.

# ITRU UAK-1 +1 FIBRE LENGTH AND NEPS SIZE DISTRIBUTION MEASUREMENT FROM FIBRE BEARD

F. Kalli

*Itru Group Ltd, Istanbul, Topkapı Center No:207,34020, Turkey.*
E-mail: info@itru.net

## Abstract

Itru Group has developed a Itru UAK-1+ Cotton Fiber/Fabric Information system to measure Length and Neps Size distribution from fiber beard. The importance of this system Length and Neps Size distribution takes at the same time. Along with the Length and Neps Size distribution . Coefficient of Fiber Straightness Variation ,Surface damages fibers percentage also measured. These new parameters could be used to check the hooked fibers in processing stages in ginning , spinning and genetics research on cotton fibers.

The field of application of this system also include card flat waste, comber noil and blow room waste and all processing stages from bale to ring frame delivery.
Cotton Fiber Neps size distribution in relation to Dyed Fabric appearance has been analyzed. It has been found that 5% Neps Size Distribution is closely related to Dyed Fabric Neps appearance.

Neps Index measured at the comber delivery which is related to deviation from Fiber Surface structure is closely correlated with the yarn neps per 1 km.

# DEVELOPMENT OF AN INLINE QUALITY MEASUREMENT SYSTEM FOR TUFTING PROCESS

M. Cetin, C. Niedringhaus, T. Gries

*Institut für Textiltechnik (ITA) of the RWTH Aachen University, Germany.*
E-mail: Mesut.Cetin@ita.rwth-aachen.de

## Introduction

Missing carbon fiber reinforced plastic production facilities which are fully automated are hindering to the manufacture of large-scale CFRP-components. A two-stage procedure consisting of a preforming process and a resin transfer moulding process is recommended for the manufacturing of composites in large scales. Starting point of the preform process are usually flat textiles structures such as woven or multiaxial. After a precut process they further processed in a sequence of handling, forming, joining and edging to complex, near-net-shape textile preform. Afterwards the preform is consolidated via a resin transfer moulding process. Because the preforming process is only partly automatable, high costs arise.

Nowadays the handling and transportation of the preforms impose a significant challenge. Therefore it has to be ensured that the preforms maintain their near-net-shape, their fiber orientation and their compactness throughout all transportation and handling process. To accomplish these criteria a newly developed approach by the Institut für Textiltechnik (ITA) of the RWTH Aachen University is being pursued, in which the preforms are fixated on expanded polystyrene foams (EPS-foams). The fixation on the foam is realized by the tufting technology. The amount of seams depends from the preform weight and the transportation loads. Process-related seam defects can lead to an unsafe fixation on the EPS-foam. Seam defects can be caused by thread tension which is too high, or an inhomogeneous EPS-foam. Seam defects are leading to fiber disorientation and can damage the preform caused by transportation loads. Therefore the recognition of seam defects during the tufting process is of paramount importance. None of the currently on the market available tufting systems provides a quality management solution which is capable of detecting seam defects in real time. To be able to use the tufting technology for fixation of textile preforms on EPS-foams it is essential to know as much as possible about the seam defects.



The aim is, therefore, to develop an inline quality measurement system which is able to detect seam defects while simultaneously measuring the thread tension in the thread feeding system. This enables to determine the influence of thread tension on the appearance of seam defects. Furthermore the amount of seam defects per seam length can be determined to quantify the remaining load bearing capacity of the seam for the transportation process.

## Methodology

The detection of seam defects during the tufting process is realized by an optical evaluation of the stitching pattern. During the process images of the tufting seam are generated and analyzed for seam defects by a tailor made algorithm (Fig. 1).

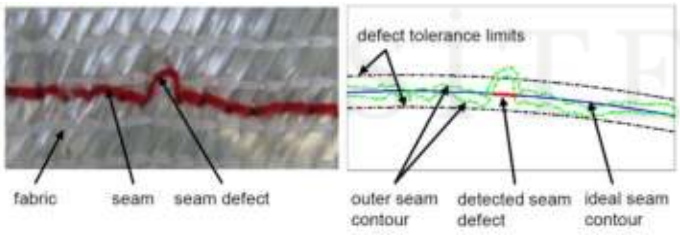



**Fig. 1:** Depiction of automatic and visual seam defect detection: image of seam (left); detection of seam defect (right)

The identification of the intended seam geometry within the seam defect detection software is not done by a regression analysis of the detected seam progression. This approach makes the developed system flexible for varying seam geometries. The sensitivity of the seam defect detection, which defines the minimal deviation that triggers defect detection, can be adjusted parametrically to the particular application. In addition the optical imaging can be adjusted to changes in the lighting conditions. The thread tension is being continuously measured by a sensor in the thread feeding system.

The developed quality management solution is capable of recognizing tufting seams and identifying seam defects. Furthermore the thread tension can be measured. Through the use of this developed system the following assessments can be executed:

- Quantification of seam defects per seam length,
- Identification of correlation between a seam defect and thread tension
- Determination of process capability
- Determination of the seam´s remaining load bearing capacity

An exemplary report is shown in Figure 2. The results of thread tension measuring and optical seam defect detection are displayed automatically in a single diagram. The diagram shows the thread tension over time and in addition marks the points in time in which it detected seam defects.

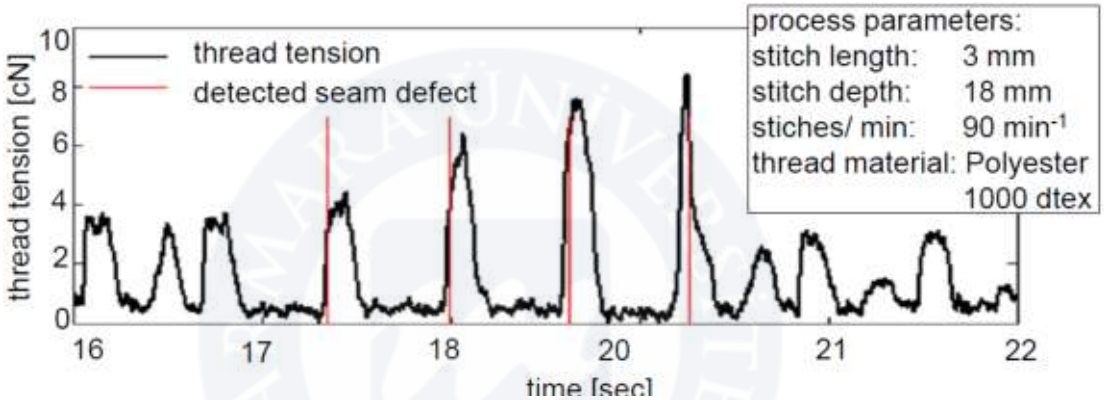



**Fig. 2:** Thread tension over time with points in time of seam defect detection

## Conclusion

The developed inline quality measurement system is capable of detecting seam defects during the tufting process. The ability to measure in real time provides capabilities of correlating thread tension to seam defects. Optimal process parameters can be derived from these results. By means of those results the thread tension in the thread feeding system can be varied for particular cases of application to optimize the seam intrusion. Consequently the developed system yields a huge contribution to ensure a high seam quality in the tufting process.

# DATA BASE FOR THE NEW AUTOMATIC PATTERN DESIGN METHOD

O.V.Surikova, G.I.Surikova, V.E. Kuzmichev

*Clothing Design Department, Ivanovo Textile Institute, Ivanovo State Polytechnic University, PhD of Technology,153000, Russia.*
E-mail: kshi@ivgpu.com

## Introduction

The mass sewing production is economically profitable only at releasing the batches of clothes models for consumers of different sizes and growths. However, modern techniques of pattern design don't provide necessary accuracy level of pattern transformation for the derivative sizes and growths. The model fulfilled and carefully verified in a basic size and growth, can unrecognizably change in the other sizes and growths. The aim of this work is to develop the computer technology information base of women clothing automatic design for the different figures assuring high quality and visual likeness of product appearance.

## Means and methods of research

For solving the arranged problem the following researches were done:

- the researches of anthropometrical figure features of different sizes and growths using the computer technology of three-dimensional body-scanner ( Human Solution, Germany)
- the researches of changing regularities of parameters for clothes design of different sizes and growths;
- the researches of volume and silhouette parameters of a dress in the different sizes figures.

## Results

The received data changing regularity base of pattern parameters which will provide the set volume and silhouette of dress for different size figures. The received results made the information base for computer technology development of women clothing automatic design according to women standard figures size scale. The technology of clothing automatic design has been used in CAD " Grazia" ( Ukraine). It provides the harmony and anthropometrical conformity of figure- design-clothes system of different sizes and growths, excluding the necessity of pattern correction and reduces design works input in all productions.



The usage of developed technology will allow:

- to improve design projects quality for non- standard figures;
- to reduce labor input in design work due to automation of construction design process for women standard figures size scale;
- to reduce labor input in design work due to excluding the necessity of pattern correction for non- standard figures;
- to reduce material consumption in design work due to cutting of garment sample amount in material;
- to reduce material prime cost of new models due to cutting of designer labor input and reducing of material consumption of goods.

# SIMULATION MODEL FOR STABILIZATION OF CARBON FIBER

M. Akdere, F. Pohlkemper, G. Seide, T. Gries

*Institut für Textiltechnik (ITA) of the RWTH Aachen University, Germany.*
E-mail: Musa.Akdere@ita.rwth-aachen.de

## Introduction

Carbon fibers possess excellent mechanical properties as well as low density. Because of that they are very suitable for the use in lightweight constructions. Until now, carbon fibers are not well established in market sectors like automotive industry or renewable energy industry. Limiting factors for the development of the market are the complicated and expensive manufacturing and the associated high price for carbon fibers. The production of carbon fibers is divided into two individual steps. The polyacrylonitrile (PAN) fibers are first stabilized and afterwards carbonized. Especially the stabilization process requires a long processing time and is thus very energy and cost-intensive. To get the best performance every precursor material needs a particular temperature profile. Currently these temperature profiles have to be determined with the trial-and-error method by laborious test runs. These tests can be reduced significantly by the usage of a simulation model which can predict the resulting stabilization of a carbon fiber.

## Methodology

The stabilization of carbon fibers is divided in three main reactions: the dehydrogenization, the oxidation and the cyclization. Based on the consideration of M.G. Dunham and these reactions can be described by differential equations. In addition the differential equation for the current temperature of the fiber bundle and the free oxygen concentration depending on the main reaction products are considered. The resulting differential equation systems are solved with the finite difference method. Most of the required parameters are taken from literature values. Only a few parameters like the reaction enthalpy, the Arrhenius pre-exponential factor and the activation energy of Stabilization have to be derived from experiments. To get these parameters Differential Scanning caloriometry (DSC) tests are done. With DSC the emitted and absorbed heat for a material can be analyzed. Using the method of “Fitzer and Müller” the missing parameters are determined from the experiments.



## Results

Currently the stabilization of a fiber bundle have been simulated only locally on a specific cross section in a constant temperature profile. The received results have been compared with previous results and show a good accordance. The next steps will be to include variable temperature profiles into the fiber model and to couple the fiber model with heat-simulation of a complete stabilization oven.

# MODELLING AND ANALYSIS OF THREE DIMENSIONAL ORTHOGONAL WOVEN FABRICS WITH FINITE ELEMENT METHOD

M. Korkmaz, G. Durur

*The Department of Textile Engineering, Pamukkale University, Denizli, TURKEY*
E-mail: gdurur@pau.edu.tr

## Abstract

Three dimensional woven fabrics that have superior mechanic perform are used in many different fields like space and aviation, defense, automotive, medical etc. Three dimensional woven fabrics that a particular value in their thickness direction solves the delamination problem that is observed in two dimensional composite materials and is described as separation interlayers. 3D woven fabrics are analyzed with Finite Element method to estimate their specialities. Estimate of fabric specialities give some advantages to users and producers in decision stage. Also, three dimensional woven fabrics that are used in space and aviation industries are improved their safety thanks to model with Finite Element method.

In this work, three dimensional orthogonal woven fabrics are modeled and analyzed with Finite Element method. Results of analysis are compared with experimental results that are taken from reference work in the thesis where determine maximum strength and displacement values. Similar results have been getting from the experimental method and Finite Element analysis. Since load that is applied to fabric in elastic limits, the load applied- maximum stress graphic should be linear. Load applied- maximum stress graphic that is more linear than reference work has been getting with this work.

# THE INFLUENCE OF WEAVE CONSTRUCTION ON 3D GARMENT SIMULATION

E. Buyukaslan[1], S. Jevšnik[2], F. Kalaoglu[2]

[1]*Istanbul Bilgi University, Fashion Design, Istanbul, Turkey.*
[2]*Istanbul Technical University, Textile Technology and Design Faculty, Istanbul, Turkey.*
E-mail: evrim.buyukaslan@bilgi.edu.tr

## Abstract

Virtual prototyping is often used for animations and graphics, however it also has great advantages for garment industry such as minimizing the time and customization of the garment for individual customers. 3 D body scanners offer better simulation results than a parametric body model. Thus in this study it is preferred to use a 3 D body scanner in order to create virtual models. It is well-known that mechanical properties of a garment have an influence on the simulation results. In this study 2 different woven fabrics with same composition and similar thickness are used, but the fabrics differed in weave construction. The aim of the study is to see how the weave construction influences the virtual garment simulation. Mechanical properties of the fabrics are measured by using FAST measuring system and a 3D scanner is used to create a virtual model. 2 D patterns of a three pieces flare skirt is created by a commercial 2 D pattern making program and created 2D patterns are used to create a real flare skirt made of two different woven fabrics. The created skirts are ideally identical in terms of measurements. On the other hand, generated 2D patterns are virtually stitched for creating 3D virtual garments on the virtual model. Finally real model is dressed with produced skirts and photographed while the model is standing in the same position. Real garments and their virtual look are compared to see how much the fabric construction influence the simulation results.

Currently there are many studies to improve the virtual garment images. To create more realistic garment simulations, it is essential to understand mechanical properties of fabrics. This study helps to understand fabric's simulation behavior depending on its weave construction.

# 16 OCTOBER 2014 THURSDAY (ORAL PRESENTATIONS)

# MATERIALS AND PRODUCTION TECHNOLOGIES FOR THE FUTURE TEXTILE INDUSTRY: INNOVATIVE, EFFECTIVE AND INTELLIGENT

T. Gries, B. Aslan

*Institut für Textiltechnik of RWTH Aachen University, Aachen, Germany.*
E-mail: thomas.gries@ita.rwth-aachen.de

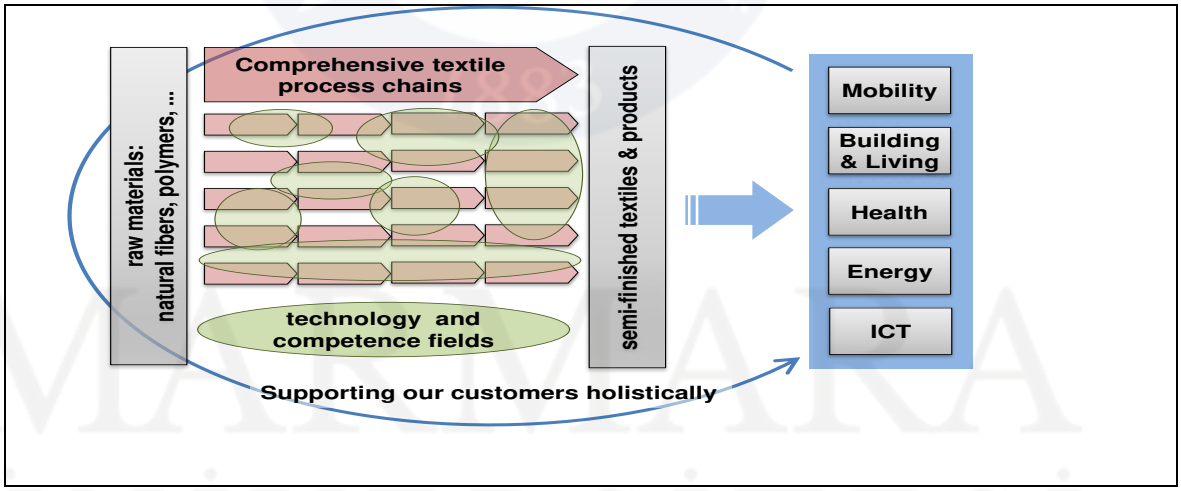
## Abstract

Developments in the medical and healthcare devices have improved both the quality of life and have increased the average human lifespan by several years, especially in the developed world. Delivery of drugs is

Fibres are materials with adjustable properties like strength and stiffness, flexibility and elasticity, surface and porosity, and offer a wide range of possibilities for today's and future applications. The integration of those properties in different textile structures results in turn in further desirable property spectrums ranging from:

- Soft and /or completely elastic to rigid, and/or firm.
- Bendable, foldable, drapable to rigid and geometrically stable.
- Highly absorbent to close.

Thus advanced fibrous structures can be engineered for different applications in the field of Mobility, Building and Living, Health, Energy and Information and Communication Technologies (ICT). To transfer these properties from raw material to fiber, to textile, to component, and further on to the market it is mandatory to adapt and/or to develop the production technologies along the comprehensive textile process chains according the necessities of the future textile industry. Thereby it is decisive for the success to integrate the right technologies and competencies as depicted in the figure.




Hence the ITA provides:

- One stop shop for research and allied services,
- interdisciplinary resources,
- innovations for the Industry and Society,
- global network for tomorrows products, and
- education for textile innovation.

Within the above described context, the present talk deals with the latest effective and intelligent innovations of ITA and its partners which contributes to materials and production technologies to match the future needs of the textile industry.

# TEXTILE TECHNOLOGY TRANSFER TO TURKEY- RESEARCH to MARKET

U. Merklein

*3T Textile Technology Transfer GmbH, Aachen, Germany*
E-mail: Uwe.Merklein@3T-gmbh.de

## Challenge

The most important challenge for the industry is the mind change from fast success to a more sustainable strategy with future orientated innovation..

What is the future role of Technology Transfer Companies and University for the Industry up to the end consumer?

## Our way of Technology Transfer

Technology transfer is the result of strong research activities at universities and the demands of most successful enterprises or future-orientated SME's. Usually it is a process which occurs over several decades and changes the focus of businesses to a mid or long term strategy instead of quick, short term profit opportunities.

Our way shall support the companies for a faster implementation of their market and future orientated strategy.




## Our PARTNERS for SUCCESS

| | |
|---|---|
| AACHEN UNIVERSITY | for Interdisciplinary Research |
| ITA Aachen | for INNOVATION in TEXTILE for the Application fields |
| External Partners | for CHANGE MANAGEMENT and special demands of the market |

## Global Activities

Beside the efforts in pushing the research and development activities, it is necessary to consider the global market and scientific trends. To achieve this goal the questions which should be asked are:

Can business push technology instead of just waiting for the pulling market?

Creating innovate business opportunities instead of just being a follower and focus on the future without neglecting the present?

A special system of country managers is aware about Market, scientific and Global trends, collecting data and looking after customers and interested companies.

Marketability and an maximum on customer relation is realized by teams of native speakers and offices in the regions




## Pushing Technology

Center of activities is the INNOVATION process mainly for the following application fields : AUTOMOTIVE, LIFE SCIENCE, BUILDING+LIVING, ENERGY



## Conclusion

The results of this work show that a concept has been successfully developed for the market entry. After a lead time of more than four years, it is now in the hands of the industry to use the technology transfer to cover the mega market trends like textile reinforced concrete, alternative energy, light-weight design and usage of high performance fibers or fictionalization of textiles for technical applications.

# SMART TEXTILES FOR DRUG DELIVERY APPLICATIONS

T. Shah

*IMRI University of Bolton, UK*
E-mail: ths1@bolton.ac.uk

## Abstract

Developments in the medical and healthcare devices have improved both the quality of life and have increased the average human lifespan by several years, especially in the developed world. Delivery of drugs is a vital and important facet within the medical field. Drugs are commonly used in the forms of tablets, ointments, injections and in many situations these modes of drug delivery may not be suitable and other methods need to be employed. Conventional oral and intravenous routes of drug administration that are most popular require repeated drug doses to maintain therapeutic drug concentration in the blood. On many occasions systemic drug administration suffers from poor drug bioavailability due to its incomplete absorption and/or degradation. In such situations drug administration can be effectively addressed by employing controlled or sustained drug release strategies. These include; formulations based on emulsions, enteric coatings, matrix based diffusion, erosion and dissociation, and by using pro-drug formulations. Enteric coatings protect the drug from the action of the highly acidic (pH<3) environment in the stomach by coating the drugs with pH responsive materials which dissolve in the pH range of intestinal environment thus resulting in release of the drug. Furthermore, textile based drug delivery may be applicable in some of the circumstances when the standard drug delivery methods are not suitable or viable. Transdermal delivery can avoid the passage of the drug through stomach and liver, thus enhancing the efficacy of the drug and reducing the dosages to be administered. Therefore, Transdermal and in-vivo drug delivery methods are good alternatives in many situations, especially in circumstances where sustained and prolonged drug treatments are required. Many transdermal patches are already commercially available. Most of these patches consist of multi-layer systems, in which in addition to an ointment (or other drug-containing substance), a regulatory system (e.g. a membrane) is used. Textiles materials have been developed for drug delivery applications in order to replace or compliment the conventional methods of drug delivery. Smart textiles provide the opportunity of being coated with specific drug carriers and deliver the drug in response to the desired stimulus, such as a change in temperature or pH, concentration of specific ions in the blood stream. Responsive nanogels are classified according to their ability to respond to the changes in various environments. The responsive nature of these materials makes them attractive as coating materials for the development of a wide range of smart textiles that are able to respond to environmental changes and thus releasing drugs in the presence of the appropriate stimuli. The drug releasing smart textiles can be prepared by immobilizing stimuli responsive nanogels onto the surface of a range of fabrics using a variety of coating techniques. The coated textiles then could be used as smart materials for many biomedical applications such as wound dressings. This paper will present the recent developments in smart textiles for drug delivery applications and look at the future challenges in this field.

# ALTERNATIVE THERMAL AND SOUND INSULATION MATERIALS FOR THE BUILDING INDUSTRIES

A. Patnaik[1,2], M. Mvubu[1], A. F. Botha[1], R. D. Anandjiwala[1,2]

[1]*CSIR Materials Science and Manufacturing, Polymers and Composites Competence Area, Nonwovens and Composites Group, P.O. Box 1124, Port Elizabeth 6000, South Africa*
[2]*Department of Textile Science, Faculty of Science, Nelson Mandela Metropolitan University, Port Elizabeth 6031, South Africa*
E-mail: apatnaik@csir.co.za

## Abstract

Building and construction industries are rapidly expanding due to large number of ongoing infrastructure projects in response to increasing demand for residential houses and commercial properties. Thermal insulation of a building plays an important role in energy savings by heat gains and losses through the building envelope. If a building is properly insulated, then the energy requirement in heating the building during winter and cooling during summer will be less which will directly contribute to the electricity cost. With the ever increasing electricity price, now building insulation becomes more important than ever before and a good thermal insulation product will contribute to the energy savings. Noise pollution is a major health concern as it has negative effects on physiological aspects such as hearing loss, headache, nausea and psychological aspects like fear and stress. Noise also significantly decreases productivity in various environments. Noise pollution must be controlled in hospitals, homes, shopping malls etc. in order to improve the quality of life. Therefore, a demand for better noise/sound absorbing (acoustic) materials is increasing in order to minimize its negative effect.

The widely used thermal insulation material in the construction industry is glass fiber based which is derived from the silica sources and other materials used are derived from the petroleum based resources. Glass fiber based materials known to have their carcinogenic effects. With new regulation and demand for greener material, development of materials which can perform both thermal and sound insulation will provide a sustainable alternative.

This paper reports the development of alternative thermal and sound insulation materials for applications in building industries, which can perform both functions simultaneously at a fractional cost. These materials were developed by utilizing various combinations of fiber blends during needle-punching process in nonwoven manufacturing. The nonwovens were intended for the roof ceiling insulation application. Six layered nonwovens were developed by combining recycled polyester (RPET), waste wool, flax and hemp fibers in 70/30 and 60/40 proportions. One sample was prepared with a 50/50 combination of RPET and cashmere waste fibers. All samples were tested for thermal insulation, acoustic, compressive resistance and moisture absorption properties. Some of the selected samples were also tested for fire properties. Nonwoven mats having 40% waste wool and 50% cashmere waste along with 60% and 50% RPET fibers provided the best insulation, acoustic, compressive resistance, moisture absorption and fire properties. The percentage of waste wool and cashmere fibers in the mat composition played a major role in achieving the desired insulation property. Besides the structure of the nonwoven fabrics, fiber type is another factor in deciding the thermal insulation property amongst various fibers. The RPET/waste wool and RPET/flax fibers mats can absorb more than 60% of the incident noise in the frequency range of 50-5700 Hz. All the developed materials had adequate moisture resistance at high humidity condition and also fire resistance up to 400°C without the use of any fire retardant additive or coating. The development of such product from renewable and recyclable raw material will contribute to the cost benefit as well as in “Green Building” initiative through reduction in carbon foot print.

# PACKAGING OF TEXTILE SEMI-FINISHED PRODUCTS: CHALLENGES AND SOLUTIONS

B. Aslan[1], M. Wischnowski[1], T. Gries[1], L. Hes[2]

[1]*Institut für Textiltechnik of RWTH Aachen University, Aachen, Germany.*
[2]*Institute for Nanomaterials, Advanced Technologies and Innovation, TU Liberec*
E-mail: bayram.aslan@ita.rwth-aachen.de

## Abstract

The packaging of textile semi-finished products has got a significant impact on product quality as well as production costs. There are various process steps in the textile industry, where the processing speed varies from 20 m/min up to 1200 m/min. Therefore the process steps cannot be rigidly linked to one another. The intermediate products from individual processes need to laid in material carriers for storage and transportations purposes as well as for the resubmission to the follow up process. The way of laying technology and the sort of material carrier depends on the properties of the semi-finished product and the manufacturing process. Within this Context and also in general the use of modern textile machinery is designed to increase the production, to improve the quality and to decrease the production costs. The main focus of technological modifications lies on constantly increasing production speed. This requires that transport, setup and down time have increasing share of the production costs.

In the present work the packaging of textile semi-finished products within the textile manufacturing chain are investigated from a holistic point of view based on Quality Function Deployment methodology as depicted in the figure. In consultation with textile and textile machinery manufacturer's, requirements of two packaging processes, which affect the production costs significantly, are identified. For both packaging problems, innovative solutions are developed to match the requirements as much as necessary. Thereby it has been taken in account that a maximum industrial implementation is guaranteed at the least possible effort for textile manufacturers.



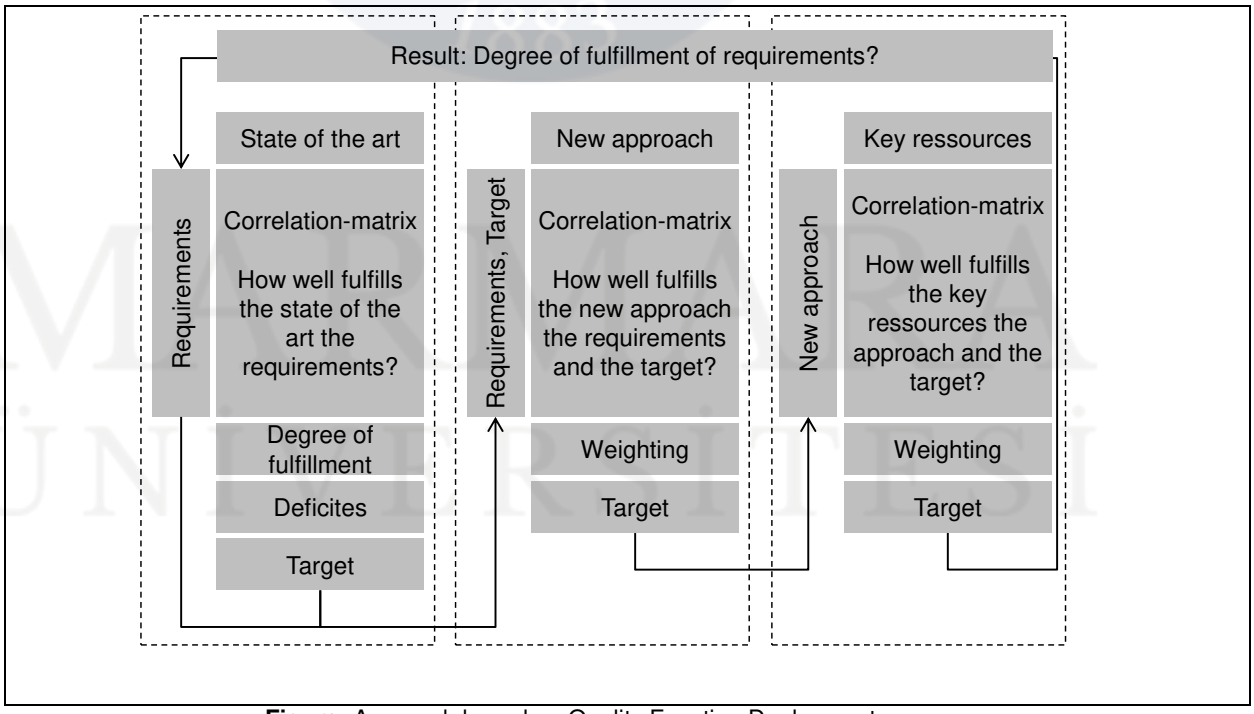



**Figure:** Approach based on Quality Function Deployment

MARMARA ÜNİVERSİTESİ YAYINEVİ

# MODELLING OF BRAIDED STRUCTURES FOR BIOMEDICAL APPLICATIONS: A TEXTILE PERSPECTIVE

A. Rawal, H. Saraswat, A. Sibal

*Department of Textile Technology, Indian Institute of Technology Delhi, Hauz Khas, New Delhi*
E-mail: arawal@textile.iitd.ac.in , amitrawal77@hotmail.com

## Abstract

Textile materials conventionally used for clothing and decorative fabrics, have now emerged as a potential candidate for biomedical applications. Braiding is one of the fascinating textile techniques that can precisely control the geometrical and mechanical behavior of engineered biomaterial. In general, braiding is normally used for producing narrow rope-like materials by interlacing diagonally three or more strands of filaments or yarns. These braided structures have been successfully used as sutures, scaffolds, artificial muscles, stents, dental applications and many other biomedical applications. However, these materials have not been fully explored and tuned due to lack of fundamental understanding in their geometrical and mechanical characteristics.

In this paper, the geometrical and mechanical models of braided structures have been presented and analyzed for potential biomedical applications. Accordingly, the geometrical models of strand trajectory on the surface of cylindrical and conical shaped mandrels with diamond, regular and triaxial braid patterns have been developed. Subsequently, the strands on other complex shaped braided structures were simulated and braid angles have been predicted and compared with the experimental results. Furthermore, the model for tensile properties of braided sutures has been proposed by elucidating the most important geometrical and material parameters. The model has accounted for the kinematical changes occurring in the braid and constituent strand geometries under defined level of strain. Similarly, the tensile behavior of tubular braids consisting of an elastic core has been proposed based on defined braid geometry, core properties and tensile properties of helically undulated strands of filaments. The model can be used for developing cylindrical ligament prosthesis consisting of high strength fibers wound over a soft elastic core. A simple analytical model for predicting the tensile behavior of multi-layered braided scaffolds has also been proposed based on the previously developed model on 'braid-elastic core' system. In general, a good agreement has been obtained between the theoretical and experimental stress-strain curves. The work in-progress can be easily combined together with the biological perspective to engineer the exquisite biomaterial for desired application.



MARMARA ÜNİVERSİTESİ

# ELECTROSPINNING OF POLYACRYLONITRILE NANOFIBRES WITH ADDITIVES; STUDY OF CRYSTALLINITY AND MOLECULAR ORIENTATION

C. J. Greyling

*Technology Station in Clothing and Textiles, Cape Peninsula University of Technology, Bellville, South Africa.*
E-mail: CocosSolutions@gmail.com

## Abstract

Polyacrylonitrile, (PAN), polymers are of interest due to their many unique characteristics in comparison to most other fiber forming polymers. The focus of this study was the effect of electrospinning variables and additives on their unusual thermal properties and internal molecular morphology with the objective of improving the performance of this fiber in industrial application, or at least contributing to the understanding of how the fiber processing variables affect the thermal performance.

The process of electrospinning was used to process samples of PAN fibers with additives in order to determine their effect on the molecular orientation and crystallinity of the resultant nano- and micron-sized fibers[1]. The effect of additives in the forms of low molecular weight oligomers, blends of conductive polymers and nanoparticles and conductive salts (mainly copper and lithium based) on the molecular structure and thermal properties is reported. In addition the effect of certain electrospinning processing variables such as the PAN polymer grade, the type of solvent, the temperature, the spinning voltage and the spinning distance were evaluated in terms of their effect on the resultant fiber molecular structure.

The crystallinity and molecular orientation are quantified using various analytical techniques including: Fourier-Transform Infra-Red Spectroscopy (FTIR); Differential Scanning Colorimetry; (DSC) Thermal Gravimetric Analysis, TGA, Scanning and Transmission Electron Microscopy; Wide-Angle X-ray Diffractometry, XRD, Small-angle Neutron Scattering; SANS, Solid-state $^{13}C$ Nuclear Magnetic Resonance Spectroscopy; NMR, and Electron-spin Resonance Spectroscopy, ESR.

The researcher has ascertained in this study that the orientation of electrospun PAN is comparable to that in commercial wet-spun fibers when the electrospinning field strength is greater than 0,75 kV per cm. The process of electrospinning leads to chemical degradation of the PAN polymer only previously noted by other fiber scientists after heating PAN fibers to more than 280 °C. This is due to the high mechanical stress on the high surface area electospun fibers spun into an oxygen rich air atmosphere.

The addition of certain salts, particularly lithium chloride and copper nitrate, to the PAN electrospinning dope by the researchers produced fibers with improved thermal stability in comparison to the control PAN samples with no additives. In addition these salts lower the endotherm for the production of carbonized fibers from PAN fibers and will therefore make more structured, stronger, high tenacity carbon fibers. The XRD revealed that through the addition of certain salts to disrupt the dipole interactions in PAN that fibers with a 2D hexagonal crystal structure can be electrospun and have a structure similar to wet spun PAN. It is shown that fibers in a non-aligned electrospun mat have a 3D crystal structure and lower molecular orientation that wet spun fibers. Some industrial applications of electrospinning using PAN fibers are developed and reported.

MARMARA ÜNİVERSİTESİ YAYINEVİ

# KERATIN NANOFIBRE MEMBRANES WITH INORGANIC NANOPARTICLES FOR FILTRATION

C. Tonetti[1], A. Varesano[1], C. Vineis[1], G. Mazzuchetti[1], S. Ortelli[2], M. Blosi[2], A.L. Costa[2]

[1]*CNR-ISMAC, Institute for the Macromolecular Studies, Biella, Italy.*
[2]*CNR-ISTEC, Institute of Science and Technology for Ceramics, Faenza (RA), Italy.*
E-mail: a.varesano@bi.ismac.cnr.it

## Abstract

Keratin is the most abundant non-food protein in nature, being the major component of wool, feather, hair, horns and nails. Keratin extracted from wool can be solubilised and processed in polar solvent, and used to produce nanofibres by electrospinning. Keratin nanofibres are able to efficiently remove toxic substances such as formaldehyde, metal ions and dye. The integration of inorganic nanoparticles like TiO2 and Ag into electrospun nanofibres improves membrane functionalities such as biocidal action and photocatalytic properties.

In this work, electrospinnable keratin water solutions doped with inorganic nanoparticles were prepared by mixing keratin solutions with Ag and TiO2 nanosol. The keratin-based solutions with ceramic nanosol were successfully electrospun into nanofibrous membranes by means of the addition of poly(ethylene oxide). The as-spun keratin/PEO nanofibres showed a highly interconnected fibrous structure of beaded nanofibers. After thermal treatment and water soaking a mass loss of 9.93±0.70% was measured and nanofibre porous structure was maintained.

Antibacterial and photocatalytic properties were tested. Antibacterial tests against Escherichia coli were carried out (AATCC 100 Test Method). Both composite nanofibres showed excellent bacteria reductions (95% for Ag and 97% for TiO2). Photocatalytic degradation of Rhodamine B dye (RhB) was 53% for TiO2-loaded nanofibres in 2 h under 9 W/m2 UV light.

**Acknowledgements:**
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MARMARA ÜNİVERSİTESİ

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# SMART WEARABLE SYSTEMS TO AVOID FALLING ASLEEP WHILE DRIVING

C. R. Borràs

*Head of Smart Objects & Functional Textiles, CETEMMSA, Spain*
E-mail: crovira@cetemmsa.com

## Abstract

The market of health and wellbeing experienced an exceptional boost in the last decade and is expected to grow exponentially in the short and medium term future. This sector demands innovative technologies and is actually pulling the sector of smart textiles and wearable electronics. The later are among the main technologies on which CETEMMSA is strategically focused. Textile-based systems capable of monitoring vital signs, capturing body movements, heating specific areas or acquiring and processing signals on fabric surface are some of the applications under development at CETEMMSA.

In this occasion we present a novel rich application allowing real-time monitoring of untethered wearable systems to avoid falling asleep while driving, measuring respiration frequency and cardiac signal. The system allows drivers for the first time to monitor in real-time the exhaustion through an app. A sinusoidal coil created by conductive thread in a chest strap allows measuring the respiratory frequency and electrodes with silver metallic conductor wire that connect to snaps serve to measure the cardiac signal all in the same textile band. The data obtained by the respiratory band is sent wirelessly through Bluetooth protocol to a Smartphone, who processes the signal and determines the status of driver drowsiness. Early versions of the devices have enabled a preliminary validation of these to test its functionalities and demonstrate the feasibility of drowsiness detection through use, as well as the possibility of obtaining valuable data on the habits of life of its users in a way noninvasively.



MARMARA ÜNİVERSİTESİ

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# FUTURE AND PROSPECT OF TEXTILE AND RMG SECTOR OF BANGLADESH

H. Kabir[1], S. M. F. Iqbal[2]

[1]*National Institute of Textile Engineering and Research, Savar, Dhaka, Bangladesh*
[2]*Bangladesh University of Textiles, Dhaka, Bangladesh*
E-mail: humaunka@gmail.com

## Abstract

Textiles from Bangladesh have historically been ranked among the best in the world. Now-a-days, Textile and Ready-Made Garments (RMG) industry plays an eminent role in the export of Bangladesh. Starting its journey in the 80's of last century, Bangladesh is now the second largest exporter of ready-made garments in the world. Thanks to the country's millennium-old heritage of textiles i.e. from super soft and fine 'Moslin' to UNESCO listed heritage 'Jamdani', hardworking manpower, competitive production cost, visionary entrepreneurs and investment-friendly public policy. However, the trade race is never over. Owing to excellent strengths, opportunities and heritages, the most important Bangladeshi industry must overcome existing weaknesses as well as successfully encounter new threats from competitors and quickly-changing challenges of global sourcing scenario. Furthermore, the industry should take new initiatives in both product and market diversification. In this article, a novel approach is made to present an in-depth SWOT analysis of Bangladeshi Textile and RMG industry as well as long-term and short-term strategic policies are recommended.



MARMARA ÜNİVERSİTESİ

# SHAPE MEMORY TEXTILES: DESIGNING ORIGAMI LIGHT FILTERS

I. Cabral, A.P. Souto

*University of Minho, Guimarães, Campus de Azurém, 4800-058, Portugal.*
E-mail: diascabral@gmail.com

## Abstract

Performing at the same time as a sensor and actuator, thermo-responsive shape memory alloys are able to assume a temporary shape and return to their programmed shape, by sensing a certain activation temperature. This capacity has been of great interest for application in diverse areas. Yet, the possibility of enhanced performance, functions and aesthetics made shape memory alloys gain attention in the textile field.

Shape memory alloys memorize their programmed shape at a substantially higher temperature than those tolerated by textile fibers. Due to this condition, they need to be trained before their integration in the textile substrate. This has led research projects to develop diverse approaches to design and develop shape memory textiles.

This paper reports an ongoing research focused on study possibilities for the integration of Nitinol in textile structures, whose dynamic behavior achieves geometrically defined shapes. The creation of textile dynamic morphologies encompassed Nitinol training thus studying the angle accuracy attained as well as Nitinol integration in woven substrates.

The design process has been developed based on origami techniques, combining foldability properties and dynamic geometries. The aim is to explore the interaction between the textile layers variation with the light that passes through them, without acting upon the light source.

The results achieved have been implemented in the design of an origami shape memory textile with dynamic light filter behavior.

MARMARA ÜNİVERSİTESİ YAYINEVİ

# REINFORCEMENT OF CO-BONDED PATCH REPAIRS FOR STRUCTURAL COMPOSITES

P. Abel[1], M. Linke[2], T. Gries[1]

[1]*Institut fuer Textiltechnik (ITA) of RWTH Aachen University, Germany.*
[2]*Hamburg University of Applied Sciences, Department Fahrzeugtechnik und Flugzeugbau, Germany.*
E-mail: philipp.abel@ita.rwth-aachen.de

## Abstract

Fiber fair and reliable repair of high performance composite structures is still an unsolved issue. The two main for challenges bonded repairs are that they do not reach the full mechanical strength of the undamaged material and that there is no reliable possibility to check the adhesive bond through non destructive testing.

Environmental conditions during the repair process (climate, surface contamination) play a vital role for the success of the repair. While under laboratory conditions bonded repairs can already reach up to 90 % of the original strength of the component (e. g. in tensile test), those results are generally not achieved in field conditions. However, many composite repairs need to be carried out on site, i. e. under unfavorable environmental conditions. Tests have shown that additional reinforcement by high performance multifilament yarns which are stitched through the bonding area can improve the mechanical properties of the repair.

Within the research project “StructRepair+”, the effect of additional form-fit-reinforcement to co-bonded patch repairs is investigated. High performance multifilament yarn is used for sewing the dry textile repair patch to the composite part. The repair patch is then impregnated with matrix resin together with the sewing yarn in a resin infusion process. The additional reinforcement offers an additional load path, which is less dependent on the environmental conditions. The stitching can also be used to modify the stiffness distribution in the bonding area and thus the distribution of stress in the joint. The presentation includes newest results of mechanical testing and an approach to structural simulation of reinforced co-bonded repairs with different reinforcement designs.



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# NOVEL APPROACH TO CONTROLLED SURFACE MODIFICATION IN TEXTILE VIA MAGNETIC CROSS-LINKED ENZYME AGGREGATES (CLEA)

A. Perzon[1], C. Dicko[1], Ö. Çobanoğlu[2], O. Yükselen[2], J. Eryilmaz[2], E. Dey[1]

[1]*Division of Pure and Applied Biochemistry, Chemical Center, Lund University, Sweden*
[2]*SANKO Tekstil İşletmeleri A.Ş., Bursa, Turkey*.
E-mail: jeryilmaz@isko.com.tr

**Abstract:**

The current interest in implementing methodologies that bio-mimic nature can be tuned towards a development of more sophisticated and safer processes in textile industry. One of the examples considered in this paper follows the CLEA (Cross-Linked Enzyme Aggregates) approach, where immobilized enzymes of multi-functional subunits are transformed into cellulosome-like complexes via covalently cross-linking enzymes to form aggregates. Our approach is to implement this cellulosome-like design by architecting CLEA magnetic nanoparticles -consisting of cellulase and other enzymes- to effectively and controllably penetrate denim to remove indigo dye without damaging the fabric. The efficiency is due to exponentially increased surface concentration of biocatalyst and the choice of aggregate size controls the penetration depth and hence preventing the fabric disruption. In addition, due to the presence of magnetic nanoparticles, the continuous recovery and reusability makes this design more economic and ecologic compared to the conventional chemical processes. The careful fabrication and functionalization of such design as well as its application with preliminary results will be presented in this contribution.



MARMARA ÜNİVERSİTESİ

# COCO-ECO TEXTILES-GOLDEN FIBER FROM GOD'S OWN COUNTRY

F. Varghese[1], C.J. Thampi[2]

[1]*Managing Director: Kerala State Industrial Enterprises Ltd.,Government of Kerala, Trivandum,Kerala,India.*
[2]*President : T.M. Natural Resource Research and Development Centre, Trivandum,Kerala,India..*
E-mail: febivarghese@rediffmail.com

## Introduction

COIR fiber is a natural bio-degradable fiber extracted from the fruit of the Coconut Palm tree. Husk of the coconut fruit (mesocarp tissue) contains 20% to 30% fiber of varying length from 150 to 200 mm. The major constituents of Coir fiber are Lignin and Cellulose . Fiber contains 45% lignin, which makes it the hardest among the natural fibers. Coir fiber which is rich in lignin content can be utilized for extraction of lignin, an industrially very important product. It is biodegradable, eco-friendly, and due to its peculiar characteristics, Coir is the hardest and the only natural fiber resistant to salt water which makes it suitable for marine applications also

## Experiment

Physical Properties of Jute & Coconut Fibres are shown below:

| Properties | Coconut Fiber | Jute Fiber |
|---|---|---|
| Gravimetric Fineness (Tex) | 25-50 | 2-5 |
| Tenacity (gms / Tex) | 15-25 | 35-50 |
| Extension % at break | 8-20 | 1-2 |
| Modulus of Torsional Rigidity x $10^{10}$ dynes. $Cm^2$ | 0.2-1.5 | 0.25-1.30 |
| Flexural Rigidity (in dynes. $Cm^{2)}$ | 150-250 | 3.5-6 |
| Transverse swelling in water % | 5-15 | 20-22 |
| M. R % at 65% R. H | 10.5 | 12.5 |
| M.R% at 100% RH | 20 | 36 |



## Results and Discussion

The industrial applications of lignin include preparation of lignin sulphonic acid, which is used as raw material in ion exchange resins, as a grinding acid in cement concrete production, in insecticide and fungicide formulations and also as an important ingredient of oil well drilling muds. Similarly, the varieties of coir fiber having higher percentage of alpha cellulose can be utilized as a potential raw material for production of value-added products like cellulose powder, microcrystalline cellulose, cellulose acetate, as a filler in paints and varnishes, cellulose nitrate, carboxy methyl cellulose, etc.

The use of coconut fiber as an alternative raw material to wood for various products is found to be quite sustainable. The high lignin content of coir makes it suitable for producing composite products of high quality. The process consists of converting the coir fiber into a felt and then into a board in combination with preservative treated rubber wood veneers, bonded together with a boiling water resistant/ proof synthetic resin adhesive. Having a density of 750 Kg/m3 and a Tensile and Compressive Strength of 24 and 51 N/Sq.mm, respectively.

Various mechanical properties of different samples and grades of Coir Fiber are shown below:

| Sample | Grade | Breaking Load (kgf) | Breaking | Tex | Tenacity (gm/tex) |
|---|---|---|---|---|---|
| WCT | Coarse | 1.22 | 29.4 | 112 | 10.9 |
| | Medium | 0.62 | 28.1 | 43 | 14.2 |
| | Fine | 0.36 | 27.0 | 25 | 14.3 |
| COD | Coarse | 1.64 | 31.3 | 186 | 8.8 |
| | Medium | 0.91 | 30.2 | 71 | 12.8 |
| | Fine | 0.45 | 29.2 | 30 | 14.8 |
| GB | Coarse | 1.69 | 31.8 | 145 | 11.6 |
| | Medium | 0.79 | 31.0 | 57 | 13.8 |
| | Fine | 0.41 | 25.5 | 27 | 15.3 |
| ECT | Coarse | 1.339 | 31.2 | 110.6 | 12.1 |
| | Medium | 0.68 | 26.4 | 68.8 | 12.8 |
| | Fine | 0.35 | 27.1 | 24 | 14.8 |
| KUD | Coarse | 1.23 | 27.7 | 93 | 13.2 |
| | Medium | 0.75 | 26.1 | 58.6 | 12.8 |
| | Fine | 0.31 | 17.7 | 23 | 13.3 |
| MAL | Coarse | 1.03 | 27.7 | 83.8 | 12.3 |
| | Medium | 0.83 | 30.4 | 58.4 | 14.2 |
| | Fine | 0.31 | 18.3 | 24.6 | 12.8 |



Coir composite has both vertical and horizontal load bearing strengths and also the best compression / strength ratios among phenol- bonded composites.

## Conclusion

Coir Fiber is biodegradable ,eco-friendly and has got excellent chemical and physical properties which makes it suitable for multifarious applications .COIR, once considered as a waste has now become the smart natural fiber, due to its distinctive chemical characteristics with tangible industrial applications.

MARMARA ÜNİVERSİTESİ YAYINEVİ

# FROM RECYCLED FIBERS TO TECHNICAL AND HYGIENIC TEXTILES

A. Harlin[1], H. Sixta[2], M. Määttänen[2], K. Valta[2], P. Heikkilä[1], M. Vähä-Nissi[1]

[1]*VTT Technical Research Centre of Finland, PL 1000, Finland*
[2]*Aalto University, Espoo, Finland*
E-mail:

## Abstract

The demand for dissolving pulps has increased during the recent years. In particular, dissolving pulps are much sought for as raw-material for special fibers, and since the demand has surpassed the supply, the price of suitable dissolving pulp stocks has soared. At the same time, the supply of competing raw-materials, such as cotton, has been limited or their ecological sustainability has been challenged. In the market there has been raised a need for cheaper and more sustainable raw materials for textile fibers.

In this paper we present processes for the preparation of dissolving pulps from recycled fibers like deinked fine paper and fluting clips (cardboard) as well from used cotton cloths. Due to the origin of pulp fiber composition, both raw materials contained lignin, hemicelluloses, extractives, and inorganic impurities – unwanted components in dissolving pulp. In order to meet the quality parameters of commercial dissolving pulps recycled fibers were conducted through purification process of several stages. Differently used cotton cloths were subjected to adjustment of molar mass.

The prepared dissolving pulps were tested using carbamate method and wet spinning. As another method has been applied novel ionic liquid dissolving and extrusion spinning. The materials were further converted to nonwovens by means of novel foam forming process.

Nonwovens are versatile material group suitable for various medical applications including e.g. wound care, tissue engineering, wipes and absorbing materials, operating room textiles, and protective clothing. Properties of nonwoven materials can be adjusted not only by varying materials and production methods, but also functionalization with various surface treatment and coating technologies. Printing methods, for example, can be used in functionalization of selected areas of nonwoven material. The foam coating technology enables application of thin functional coatings. Atomic layer deposition (ALD) and sol-gel techniques can be used to adjust surface properties with inorganic coatings also in nanoscale. In this presentation we will review some examples of nonwovens functionalization's with above mentioned technologies.

This paper review the possibilities to combine the novel technologies described above for technical and hygienic textiles



MARMARA ÜNİVERSİTESİ

# INVESTIGATION OF THE SOME PERFORMANCE PROPERTIES OF KNITTED FABRICS PRODUCED BY SOYBEAN AND ORGANIC COTTON YARN

M. Topalbekiroğlu, C. Gunesoglu, Z. Ünal

*Gaziantep University, Textile Engineering Department, Gaziantep, 27340, Turkey.*
E-mail: tbekir@gantep.edu.tr

## Abstract

With increasing of life standards comfort properties of clothing get important. Thus, new fiber types have been developed for comfort demands. In this study soybean and organic cotton yarns were assessed in terms of clothing comfort parameters like air permeability, wicking ability, water vapor permeability and thermal sensation measurements. According to test results and statistical analysis it was observed that the variation in fiber type (soybean or organic cotton) was not significantly important selecting criteria on air permeability. Air permeability can be adjusted strongly by the changes at fabric thickness. But the variation in fiber type (soybean or organic cotton) was important selecting criteria on thermal conductivity and thermal resistance and water vapor permeability. The variation in yarn count (soybean or organic cotton) was important selecting criteria on thermal absorbsivity. We concluded that the variation in fabric weight, yarn count and fiber density (soybean or organic cotton) were important selecting criteria on wicking.

# INVESTIGATION OF DYEABILITY BEHAVIOR OF BANANA FIBERS WITH NATURAL DYE EXTRACT FROM TURMERIC PLANTS

H. Dayioglu[1], N. Merdan[1], S. Canbolat[1], E. D. Kocak[2]

[1]*Istanbul Commerce University, Faculty of Engineering and Design, Textile Engineering, Istanbul, Turkey.*
[2]*Marmara University, Technology Faculty, Textile Engineering, Istanbul, Turkey.*
E-mail: hdayioglu@ticaret.edu.tr

## Abstract

In this study, the fibers produced from the banana plants provided from Antalya region were treated with a variety of mordants, and then the fibers were dyed with the natural dye extracted from turmeric plants (Curcuma longa) via ultrasonic and conventional method. Finally, the dyeing and fastness properties of samples were investigated. The recent studies have demonstrated that the synthetic dyes can be non-biodegradable, allergenic, cytotoxic and, partially, carcinogenic. Recently demand for eco-friendly, non-carcinogenic and non-toxic products has been gradually increased. Compared to the synthetic dyes, the natural dyes are advantageous in that they are biodegradable and non-toxic, not causing health problems, and they are produced under temperate conditions. These properties of natural dyes lately result in increasing their usage. Today utilization of many plant extracts as natural dyes has been investigated such as turmeric (Curcuma longa).

# EFFICIENCY OF NANO QACS ANTIBACTERIAL TREATED GARMENTS

E. Raafat, B.G. Gabr

*Apparel Design & Technology Dept., Faculty of Applied Arts, Helwan University, Cairo, Egypt*
E-mail: bahiragabr@yahoo.com

## Abstract

The term "nano" in Greek language means dwarf, materials of nano-scale keep their strength, hardness or flexibility but weight becomes nil. Now a day, nano particles are embedded into textiles giving stain retardant, wash&wear, Ultra Violet protection and antibacterial properties. The market of antibacterial treated garments is growing rapidly. Medical clothing items and hosiery (including under-wear and socks) are seen as the largest sectors for antibacterial treatments worldwide. The growth of bacteria on textiles possesses a range of unwanted negative effects; initially irritation and up to reach eczema, these are concerning the wearer, particularly if grown bacteria are into socks or underwear; also garments can generate unpleasant odor, stains and discoloration in the fabric, as well as reduction in fabric strength and subsequently contamination. In the medical field, incorporating bacteria within nursing gowns can be fatal.

Aim of this paper, is to assess the efficiency of nano-quaternary ammonium compounds (QACs) treated garments; including woven nursing gowns, knitted under-wears and socks.

Methodology was undertaken using a number of nine different clothing materials; both woven and knitted garments, with fiber content of 100% cotton, PES/cotton and 100%PES. All of which were treated using nano-QACs antibacterial substance. Both treated and untreated garments were examined using a number of test methods; first, the agar diffusion plate, determining antibacterial behavior using BS EN ISO 20645:2004, this was done before and after 10 washing cycles, intended for Staphylococcus aureus bacteria, Escherichia coli bacteria, Aspergillus flavus fungus and candida albicans fungus. Second, thermo-physiological comfort properties were examined, including wettability BS 5445 for sensible perspiration "sweat", while heat-loss using the temperature gradient was tested as an important aspect for under-wears and socks items performance. Third, Spray test using BS EN 2490 (ISO 4920) evaluating stain retardant effect on nursing gowns.

In conclusion, antibacterial efficiency of all treated clothing items increased, when compared to resultant data of untreated ones; inhabitation zone diameter (mm/1cm sample) was zero for all untreated clothing items, while treated samples ranged in-between 12 to 22mm/1cm for Staphylococcus aureus bacteria, this was the same even after ten washing-cycles. Comfort properties were almost the same, before and after nano treatment; the main difference was into the 100%PES under-wear, where nano treatment decreased heatloss by 4°C, keeping a sort of uncomfortable feeling to wearer. Spray test results, were exactly the same for all woven nursing gowns, before and after the nano-antibacterial treatment was applied.

# SURFACE FUNCTIONAL TREATMENT OF SURGICAL SUTURES WITH ANTIMICROBIAL AGENT

W. Enab, M. Mekawy, A. A. Moneim

*Egypt Japan University of Science and Technology, New Borg El- Arab City, Postal Code 21934, Alexandria, Egypt.*
E-mail: walaa.yehia@ejust.edu.eg

## Abstract

Nowadays, surgical sutures are developed for tissue engineering and wound healing applications, beside the traditional role in wound closure. Surgical sutures are one of the main factors that cause wound infection. Polyester (PET) is one of the synthetic materials that used in non-absorbable multifilament braided sutures, a braided suture can harbor bacteria in the interstices between its fibers. In this work, polyester suture is coated with nanosilver particles for imparting antimicrobial and bactericidal properties to the sutures. In situ coating of polyester surface is carried out by reduction of silver nitrate into nanosilver by ethylene glycol which is produced by Alkali hydrolysis of polyester. Experimental results showed that good and homogenous intact of silver nano particles on the surface of PET suture. Several tests have been performed for studying the effect of this chemical treatment on the physical, tensile, handling and antibacterial properties on coated sutures, and its scientific explanation. Sutures with bioactive coatings as fabricated here, in conjunction with 3-D textile technology, may provide attractive materials for producing 3-D scaffolds with controlled synthesis for tissue engineering applications.

# NEW BIOBASED MICROPARTICLES: ELABORATION, CHARACTERIZATION AND APPLICATION ON POLYAMIDE SUBSTRATE

M. B. Abdelkader[1], N. Azizi[1], Y. Chevalier[2], M. Majdoub[1]

[1]*Laboratoire des Interfaces et Matériaux Avancés (LIMA), Faculté des Sciences, Bd. de l'Environnement 5019 Monastir, Tunisia*

[2]*Laboratoire d'Automatique et de Génie des Procédés (LAGEP), Université Claude Bernard Lyon1, UMR CNRS 5007, 43bd du 11 Novembre 1918, 69622 Villeurbanne Cedex, France.*

E-mail: benabdelkadermaroua@gmail.com

## Abstract

The last 25 years mark a period of accelerated technological expansion and the establishment of multitude innovative products in all areas. With this growing trend, textile materials have also recently found applications in various fields especially the cosmetics one. A novel sector of smart textiles is introduced and several commercial cosmetotextile products are currently available in the market. On contact with human body, these products are designed to transfer an active material for cosmetic purposes. Thereby, microencapsulation technology seems as an alternative technique to provide satisfactory performance and to increase durability of encapsulated material. As a current trend, researchers tend to go further more by producing cosmetic loaded-microparticles from renewable resources such as dianhydrohexitol, leading to green and bio-sourced materials. Interestingly, Isosorbide (DAS) attract increasing attention, because they tend to be very inexpensive and available in large quantities. In that frame, Azizi et al., (2014) synthesized isosorbide-based polyurethane microcapsules for cosmetotextile applications. Thus, these kinds of polymeric membrane are of great interest for microparticles preparation.

Having been inspired by the above concept, we studied the development of polyurethane biobased microparticles aimed for cosmetotextile applications. A novel kind of microparticles containing 2-ethoxynaphtalen (neroline) was successfully synthesized into polyurethane shell through the interfacial polycondensation of 1,4:3,6-dianhydro-D-sorbitol (DAS) with hexamethylen diisocyanate (HDI). The success of polymerization reaction leading to the formation of the polyurethane shell was checked by ATR-FTIR. Optical microscopy was used to study the microparticles mechanism shell formation, their morphology and shape. Their surface morphology was studied by Scanning Electron Microscopy (SEM). Then, spraying was tested as application methods. Adhesion of synthesized microparticles to textiles material was evaluated through microscopic observations.

MARMARA ÜNİVERSİTESİ YAYINEVİ

# EFFECT OF FRAGRANCE FINISH ON MECHANICAL AND COMFORT PROPERTIES OF DIGITALLY PRINTED FABRIC

T. Aamir[1], M. A. Nazeer[2], A. Hussain[3], N. Bhatti[3], Z. Javed[4], R. Masood[4]

[1] *National Textile University, Department of Textile & Apparel Design, Pakistan*
[2] *Faculty of Engineering, KOC University, Istanbul, Turkey*
[3] *G.C University, Department of Home Economics, Faisalabad, Pakistan*
[4] *National Textile University, Faculty of Engineering & Technology, Faisalabad, Pakistan*
E-mail: mnazeer13@ku.edu.tr

## Abstract

With the growing demands of fragrance finished fabrics especially in ladies wear, we have printed 100% cotton fabrics for both corresponding and non-corresponding prints. Digital printing technique has been used for these studies. We have already reported the positive and cost effective impact of corresponding printing along with the fragrance finishing on customer's perception. Along with the aesthetic properties of a fabric, some other properties of fabrics should be accounted for wearing purposes. So in this study, the effects of fragrance finishing on mechanical and comfort properties of fabric have been evaluated. Along with the mechanical properties, the effects of fragrance finish for moisture management, water and air permeability through the fabric has been investigated and reported.



MARMARA ÜNİVERSİTESİ

MARMARA ÜNİVERSİTESİ YAYINEVİ

# THE MECHANICAL AND EMSE PROPERTIES OF TUFTED CARPETS PRODUCED BY PET / FE2O3 COMPOSITE YARN

C.Gunesoglu[1], M.Topalbekiroğlu[1], D.Yarbasan[1], O.Dal[1], O.Celen[2], M.Sezen[2], A.Kabalcıoğlu[3]

*[1]Gaziantep University, Textile Engineering Department, Gaziantep, 27340, Turkey.*
*[2]Korteks Yarn, BTSO, Sari Cad. No:3, Bursa, Turkey.*
*[3]Kabalcioglu LTD., 4.Org. San. Bol., No:14, Gaziantep,27120, Turkey.*
E-mail: gunesoglu@gantep.edu.tr

**Abstract**

Tufting carpet or tuft structure is formed by the tuft yarns which are pre-textured yarns placed on the ground. Tufting carpet yarns creates curls similar to sewing machine needle movement on the floor with gun tuft. It's easier to produce tuft system in R&D activities than other machine carpet systems due to having the opportunity to carry out with one bobbin. This study evaluates EMSE (Electromagnetic Shielding Performance) property of tufted carpet when produced by magnetic nano particles imbedded PET yarns along with some mechanical properties like tensile strength, resilience after dynamic and static loading abrading and abrading. The composite yarns were also assessed by XRD and SEM analysis.



MARMARA ÜNİVERSİTESİ

MARMARA ÜNİVERSİTESİ YAYINEVİ

# CONTINUOUS QUALITY CONTROL AND ASSURANCE IN MASS PRODUCTION OF MULTIAXIAL NON-CRIMP FABRICS

P. Abel[1], P. Kreuer, B. Abbas[2], T. Fuertjes[3], T. Gries[1]

[1]*Institut fuer Textiltechnik (ITA) of RWTH Aachen University, Germany.*
[2]*Institut für Unternehmenskybernetik e.V. (IfU), Germany.*
[3]*Werkzeugmaschinenlabor (WZL) der RWTH Aachen University, Germany.*
E-mail: philipp.abel@ita.rwth-aachen.de

## Abstract

High volume production of composites part, e.g. in the wind energy sector or in automotive demand highly standardized and quality assured semi finished products. For multiaxial non crimp fabrics (NCF) which are widely used as fiber reinforcement in these two sectors, a continuous quality control system, however, is still lacking.

A new approach is presented, in which existing systems for error detection are used to build up a closed loop control for quality optimization in the production process of NCF. The fiber material is screened for fiber disorientation and gaps and deviations in aerial weight at different positions alongside the production line using state of the art equipment for error detection. Additionally, the machine-parameters are monitored and the yarn tension of both reinforcement fibers and stitching yarn are measured continuously. A self learning control is developed that automatically adjusts the settings of the production machine so that a minimum of errors in the textile is achieved. In Addition, the quantitative description generated in the process, is used to develop an error map for each batch of material produced. This error map allows for production waste to be minimized, as the produced material can be automatically sorted into different quality grades, meeting the demands of different customers.

The presentation includes recent results of the research project “Auto-NCF” in which the three Aachen based institutes ITA, IfU and WZL collaborate in the implementation of the described concept of automated quality control for the NCF production process.



MARMARA ÜNİVERSİTESİ

# HOW TO INTEGRATE RECENT DEVELOPMENT IN TECHNOLOGY WITH DIGITAL PROTOTYPE TEXTILE AND APPAREL APPLICATIONS

E. Papachristou, N.Bilalis

*Technical University of Crete, Department of Production Engineering and Management, Chania GREECE*
E-mail: evridik_p@yahoo.com

## Abstract

The textile and clothing industry is moving away from its traditional roots in an attempt to revive the fortunes of this mature industry, through the adoption of novel technologies. Digital Prototypes are used as an essential tool in the modern design process. The integration can speed up the design process and affect competition between companies. Typical applications are digital textile and fashion design, pattern generation to custom-design clothing, fitting evaluation, style editing, and virtual try-on. However, new product developments in textiles and clothing have widened our views of the world and must also be covered. The ever-growing spectrum of smart textiles and wearable technologies has the potential to take the textile industry in a completely new & sustainable direction, far beyond its traditional roots. The integration of smart functionality into clothing and other textile products into the digital prototype is essential in order to alter our relationship with them and the way we use them.

# ANTIMICROBIAL APPLICATIONS IN THREE-DIMENSIONAL KNIT SPACER FABRIC FOR FOOTWEAR

A.M. Sariisik [1], Ö Kus[1], G.C. Türkoğlu[1], B. kutlu[1], S. Sakin[2], H.A. Karavana[3]

[1]*Dokuz Eylül University, Department of Textile Engineering, İzmir-Turkey*
[2]*Sun Holding Research&Development Center, İzmir-Turkey*
[3]*Ege University, Department of Leather Engineering, İzmir-Turkey*
E-mail: gizem.turkoglu@deu.edu.tr

**Abstract**

Usage of Three-Dimensional (3-D) textile materials that composed of integrating two separate layers of the textile surface with a resilient yarn is an open field to develop, recently. In accordance with this study, benefiting 3-D textile structures in the footwear is identified as the main target. It is also aimed to provide new usage areas to these 3-D fabrics, widely used in automotive and mattress industries, via the characteristics of air permeability, heat and moisture transfer ability. Through its skin-friendly and breathable structure, it is planned to benefit in medical practices for especially diabetic patients. During this study, two different antimicrobial and antifungal products are transferred by impregnation processes to the 3-D textile material was produced by Sun Holding R&D Center. After determining the features of the fabric, performance characteristics such as thickness measurements, strength and compressibility are investigated. The alteration in chemical structure after impregnation is examined via FT-IR analysis. The antimicrobial and antifungal activity of the fabric is tested, as well.

# 16 OCTOBER 2014 THURSDAY (POSTER PRESENTATIONS)

MARMARA ÜNİVERSİTESİ YAYINEVİ

# DESIGN AND ANALYSIS OF PROTEIN FIBER YARN FOR MEDICAL TEXTILES

A. Ragaišienė, J. Rusinavičiūtė

*Kaunas University of Technology, Kaunas, Studentų str. 56, Lt-51424, Lithuania.*
E-mail: audrone.ragaisiene@ktu.lt

## Abstract

Wool is one of the natural fibers, which has scales on the fiber surface, besides it is biodegradable and close to the human fiber. Thermal properties of dog hair were known long time ago in cold climate countries. People wear outerwear, gloves and scarf made from dog hair and believe that dog hairs has not only thermal, but medical properties too. In recent years, become more and more attractive yarn with both these protein fibers – sheep wool and dog hair. There are possibilities to adapt such blended yarn to organic, safe for human medicine. Yarns with dog's hair are characterized not only perfect thermomechanical characteristics, but they have good healing properties, particularly for the treatment of rheumatism and joint diseases. The aim of this research is to design the yarn from protein fibers blends and to research their mechanical indices. Object of this study - woolen yarns which were designed and produced mixing the wool of German blackhead sheep (85%) and the dog hair (15%) of different dog breeds: Yorkshire, Spaniel, Poodle and Bouvier des Flandres.

It was estimated that the condenser spinning system tends to be used to process blends of wools which vary in length and fiber diameter. So, in this study sheep's wool and dog's hair fiber were opened with periodic operation opener „TP-90 SI", then batching was made (emulsion „Serbana UN" with water in ratio 1:10), second opening and blending. After a few hours relaxation blends were carded (three-card woolen set with condenser „Befama", Poland). Then ring spinning was made and winding process.

It was found, that woolen yarns with 15% Poodle dog's hair have maximal values of breaking tenacity and elongation at break, accordingly, 3.81 cN/tex and 17.8%. Woolen yarns with 15% Bouvier des Flandres dog's hair were the weakest (2.79 cN/tex). The minimum elongation at break (15.5%) was estimated for woolen yarns with 15% Yorkshire dog's hair.



MARMARA ÜNİVERSİTESİ

MARMARA ÜNİVERSİTESİ YAYINEVİ

# PECULIARITIES OF FORMATION THE SILVER SELENIDE LAYER ON THE SILICONE COATED POLYAMIDE CLOTH

D. Milasiene, R. Ivanauskas

*Kaunas University of Technology, Kaunas, K. Donelaičio St. 73, LT-44029, Lithuania*
E-mail: daiva.milasiene@ktu.lt

## Abstract

Nowadays problems of creating new materials that would be able to reduce or eliminate the negative EMF radiation are being solved intensively. There are many discussions about microwave ovens, computers, transmitters of different purposes of means of communication and others electromagnetic fields (EMF) sources influence on people, especially children, health. Now there is no doubt that higher or lower influence exists on both microscopic and full organism level. The newest researches are made and published in order to modify people apparel and daily fabrics more effectively. One of the ways is the chemical modification of surface of different textile materials for clothing with the binary chalcogenide thin layers. These layers have a number of applications in various fields, including coatings, solar cells, photoconductors, IR detectors, semiconducting films, and etc. The interest in silver selenide has greatly enhanced during the recent years because it was found that upon tuning of stoichiometry between two elements, silver selenide can show magneto resistance (MR) behavior. The presentation concerns the formation of silver selenide thin layers in the surface of polyamide cloth by sorption-diffusion method in two stages. The sorption–diffusion method for the preparation thin layers of metal chalcogenides in the surface of polymer is simple and promising. Using this method the layers of CuxS, CuxSe and AgxSe on polyamide PA 6 films substrates in two stages were formed [1]. Same method was used to form silver selenide layer on polyamide fabric in current research [2]. In the first stage, polymer samples were seleniumized in solution of potassium selenotrithionate ($K_2SeS_2O_6$). In the second stage, seleniumized silicone coated polyamide cloth samples were treated with solution of silver salt. The results of X−ray diffraction and chemical analysis confirmed the formation of silver selenide particle layers in the surface of polyamide fibers and in the porous of silicon coating.



MARMARA ÜNİVERSİTESİ

MARMARA ÜNİVERSİTESİ YAYINEVİ

# DESIGN AND MANUFACTURE OF HEATED TEXTILES

E. Mbise[1], R. Morris[2], T. Dias[1], W. Hurley[1]

[1]*School of Art & Design, Nottingham Trent University, Burton Street, Nottingham NG1 4BU, UK*
[2]*School Science and Technology, Nottingham Trent University, Clifton campus, Nottingham,* UK
E-mail: ekael.mbise2011@my.ntu.ac.uk

## Abstract

Textile heating systems is one of the major growing sectors in textiles. This is due to the development of conductive yarns and emerge of computerized knitting systems. These together made possible for introduction of heating systems which are directly made from textiles. Main advantages of this improvement is the generation of heated materials with built-in flexibility provided by textile structures.

This poster will be describing different types of textile heating systems, their applications and important criterion required in design and production of polymer based heated textiles.



MARMARA ÜNİVERSİTESİ

# MECHANICAL PROPERTIES OF CENTRIFUGALLY SPUN NANOFIBERS

H. Yalcin[1], Y. Akgul[1,2], R. Simsek[1], A. Hassanin[1,3], A. Kilic[1], A. Demir[1]

*[1]TEMAG Labs, Istanbul Technical University, Istanbul, Gumussuyu, 34437, Turkey.*
*[2]Karabuk University, Karabuk, 78050, Turkey.*
*[3]Alexandria University, Textile Engineering Department, Alexandria, Egypt.*
E-mail: harun_yalcin@hotmail.com

## Abstract

Nanofibers possess unique properties such as high surface area to volume ratio and small pore sizes since these fibers are used in, filters, sensors, electronics, biomedical materials and textiles applications. Probably electrospinning is the most common method to produce nanofibers. However, this method has some big challenges such as low production rate and high voltage necessity for industrial applications. In this study, nanofibers were fabricated by “centrifugal spinning” an alternative technique to overcome these difficulties. Also, the yield of production is not related to solution conductivity. Despite the above mentioned advantages, there is elaborated works in the literature about centrifugal spinning, while nearly 2000 papers are published per year on electrospinning. PVA solution with 10% wt. concentration was prepared by dissolving in water. Centrifugal spinning device was designed and built by TEMAG Lab group, has been used. Rotating disc speed was 6000 rpm and solution flow rate was 10 – 15 ml/h. Distance between rotating disc and web collector was 20-30 cm. Mechanical, physical and morphological properties of produced web have been carried out.

# CHARACTERIZATION OF MONO- AND MULTIFILAMENT YARNS BASED ON POLYMER BLEND SYSTEMS FOR THE TEXTILE AND COMPOSITE MARKET

T. Schlüter[1], J. Struebig[1], G. Seide[1], Y. Gloy[1], T. Gries[1], L. V. Schueren[2], T. Krooß[3]

[1]*Institut fuer Textiltechnik of RWTH Aachen University (ITA), Otto-Blumenthal-Strasse 1, 52074 Aachen, Germany.*
[2]*Centexbel, Technologiepark 7, 9052 Gent, Belgium.*
[3]*Institut für Verbundwerkstoff GmbH, Erwin-Schrödinger-Straße 58, D-67663 Kaiserslautern, Germany.*
E-mail: tobias.schlueter@ita.rwth-aachen.de

## Abstract

The project Blends 4 Innovation, funded by the Arbeitsgemeinschaft industrieller Forschungsvereinigungen (AiF) and the IWT Flanders, aims at creating novel high-value materials based on polymer blends for the textile and composite market. The use of polymer blends allows for the production of tailored materials since properties of two polymers can be combined leading to the desired characteristics. These mainly include mechanical properties, thermal stability, dyeability, impact resistance and permeability. This could greatly contribute to cost-effective and efficient processing of textiles, composites and films. The cost of a virgin material can be drastically reduced by blending the material with a low-cost polymer while retaining the mechanical properties of the virgin polymer. Furthermore, end of life (EOL) materials consisting of different polymers may become easily recyclable since contamination with other polymers may now give an active contribution to the improvement of the material properties or create an extra functionality. Summing up the successful usage of blends enables opportunities for companies along the entire production chain like raw material manufactures, textile extrusion companies as well as manufactures of composites.

The use of polymer blends will be diversified to a large range of polymer combinations (PET/PP, PP/PA and PET/PA) and composition ratios. At first the processability of different polymer blends including compatibiliser is studied in detail. Therefore lab scale extrusion trials varying the composition ratio, the compatibiliser and the processing parameters are carried out. Once appropriate polymer blend systems are found, mono and multifilament yarns with improved properties are produced on standard single screw melt spinning lines. The resulting blend morphology will be evaluated, in which mainly a fibrillar morphology will be obtained due to the stretching. In addition, the production of polymer films with an improved permeability is intended. Finally fiber reinforced composites are manufactured using yarns and textile fabrics made of the chosen polymer blend systems. The lower melting polymer will act as matrix phase while the second polymer (e.g. present as fibrils) will act as reinforcement. For the reinforcement effect of the final hot pressed product, it is important that the difference of the melting point of the reinforcing polymer in the blend is higher than 30 K.

# TRENDS IN AMBIENT ASSISTANT WORKING - CURRENT AND FUTURE UTILIZATION RATES OF INTELLIGENT ASSISTANCE SYSTEMS IN WORK CLOTHES FOR PRODUCTION AND LOGISTICS

J. Lemm, K. Lee, G. Seide, T. Gries

*Institut fuer Textiltechnik of RWTH Aachen University (ITA), Otto-Blumenthal-Strasse 1, 52074 Aachen, Germany.*
E-mail: jacqueline.lemm@ita.rwth-aachen.de

## Abstract

In the BMBF-funded research project "Empirical study of current and future efficiencies of mobile computer systems for the support of older workers in production and logistics (short: EUNA)," the research field of "Ambient Assisted Working" (AAW) is addressed. - We believe in the approach that social and technical innovation should go hand in hand: Industry 4.0 technologies require trained employees.

Within the framework of the "human-technology interaction for the demographic change", the following research-leading hypothesis is subjected to the research project: Decreased performance skills and visual acuity of older workers will be (and have to be) compensated increasingly by companies by the use of a targeted technological support.

The research project EUNA as a scientific pre-project, with the character of a study, is focused on the creation of empirical evidence for the contribution and the present and future significance of the AAW for social and economic participation of older workers in the labor market. “Es werden sowohl die Technologieanwender aus Produktion und Logistik als auch die Technologieanbieter aus dem Bereich innovativer und intelligenter Bekleidungs-komponenten in die Untersuchung ein-bezogen.” The technology users in production and logistics as well as the technology providers in the field of innovative and intelligent clothing components will be included in the study. Appropriate data collection methods for the identification of scopes and technologies or applications provide exploratory workshops or interviews with selected experts. Ensuring the empirical or statistical relevance is achieved by a survey of a selected target group by means of standardized interviews (online or questionnaire methods).

In particular, it is investigated which working processes are suitable for the support of older workers by means of environment integrated computer technology components in the area of production and logistics related work environments. Moreover, it is investigated what the requirements are, which technological support the market offers for it, how they should be developed and which penetration of the technologies currently exists or can be expected in the future.

With the results of the surveys in EUNA, ideas for the development or further development of user-friendly designs and prototypes in the area of AAW can be realized. Together with industry partners from the German textile and clothing industry and on the other hand from the user’s point, the results can be directly transferred into practical production projects.

# ANTIBACTERIAL PROPERTIES OF TIN-FINISHED TEXTILES

B. Y. Büyükakıncı[1], H. Güçlü[2]

[1]*Istanbul Aydın University Engineering Faculty, Department of Textile Engineering, Istanbul, Turkey.*
[2]*Marmara University Vocational School of Health Related Professions, Istanbul, Turkey.*
E-mail: yesimbuyukakinci@aydin.edu.tr

## Abstract

Antibacterial treatments are important for textiles, especially those used for medical and hygienic purposes. Therefore, various antibacterial compounds have been used for all types of textiles to reduce and prevent infections. Generally, silver- and quaternary ammonium salts are used for obtaining antibacterial properties in textile. The aim of this research is to offer antibacterial properties of wool fabrics by using tin ions and reducing costs by creating an alternative to silver ion usage. Tin is one of the hundreds of chemicals which kill microorganisms. As a result of researches, tin compounds which are used in the food sector and in plating and dentistry for ages could be an alternative to silver and be used as an antibacterial finishing material in the textile sector. In the current study 100% raw wool fabric samples were treated by tin ions that are prepared in different concentrations (5-25g/L) to obtain antibacterial properties. Three different kinds of bacteria, Staphylococcus Aureus (SA) as gram positive bacteria, Escherichia Coli (EC) as gram negative bacteria, and Bacillus Subtilis (BS) as gram positive spore forming bacteria were studied. The anti-bacterial activities of the washed and unwashed samples were evaluated according to the AATCC100-2004 Test Methods and the results were interpreted. In this study, very good antibacterial activity for tin-treated wool fabrics (unwashed and washed) were achieved. The antibacterial effect of SnCl2 solution is somewhat better against SA and BS than EC bacteria. The effect did not disappear after five times of washing.

MARMARA ÜNİVERSİTESİ YAYINEVİ

# INVESTIGATION OF STRUCTURAL AND MECHANICAL PROPERTIES OF HIGH PERFORMANCE YARNS PRODUCED BY SPINNABLE CARBON NANOTUBES

V. Yalı, F. Göktepe

*Namık Kemal University, Çorlu Faculty of Engineering, Tekirdağ, Turkey.*
E-mail: vyali@nku.edu.tr

## Abstract

As well-known, after controlling the location of atoms by using nanotechnology; the scientists realized that they can change the functionality of a material as they want and this led many further researches and studies on nanotechnology. In parallel to these developments, it is now possible to have high performance textile products with high functionality by the help of nanotextiles studies. Due to having a range of useful properties, such as high strength and modulus, high electrical and thermal conductivities and low density, carbon nanotubes (CNTs) are of great technological interest. In following its outstanding properties, there are some recent works on spinnable CNTs, i.e. production of CNTs in fiber form at nano-scale. Fabrication of CNT yarn spun from vertically aligned CNTs forest has been reported but the mechanism of spinning is not clear. There are a significant number of studies on production of CNTs mainly in powder form in the literature, but only a few of them are about yarn production from CNT forests. That's why there is a need of researches on spinning yarns from CNT forests and detailed investigation of mechanical properties of these yarns explaining the fiber-yarn inter-relations. Therefore, the structural, mechanical and electrical properties of twisted yarns spun from CNT forests by using different twist levels have been investigated in this study. Furthermore, the obtained yarn properties have been analyzed in detail mainly comparing with conventional yarns.



MARMARA ÜNİVERSİTESİ

# EFFECTS ON FIBER PROPERTIES OF MELTSPUN PA6 FIBERS DUE TO MODIFICATION WITH 2-D NANOPARTICLES

R. Stolz[1], T. Vad[1], W. Steinmann[1], G. Seide[1], T. Gries[1], K. Klopp[2], K. Bender[3]

[1]*Institut für Textiltechnik (ITA), RWTH Aachen University, Aachen, Germany.*
[2]*Heimbach GmbH & Co. KG. Düren, Germany.*
[3]*EMS-CHEMIE AG, Domat/Ems, Switzerland.*
E-mail: rene.stolz@ita.rwt-aachen.de

## Abstract

Within the framework of this research project, nylon 6 fiber composites are developed with the aim of improving the product's life cycle and energy efficiency of nonwovens made of it. The fiber composite contains nylon 6 and 2-D nanoparticles, such as, e.g., organoclays or graphenes. The improvement of the fiber properties is – presumably – the key to a higher productivity and reduction of energy costs. The project results are in general transferable to other nonwovens. As an example the developed fiber composite material can be further processed into felts for water removal in paper machines and is expected to significantly increase the life-time of the felt as well as to reduce the energy consumption of the paper machine during operation.

To achieve these goals, the spinnability and reproducibility in the production process of highly viscous polymers and abrasion resistant materials has to be improved by addition of 2-D nanoparticles to the polymer. For this reason, organo-clays and graphene platelets are used as additives in different concentration from 0.1 wt% up to 5 wt%.

Due to their structure and geometrical shape, the nanoparticles may influence the processing and the tribological behavior of the fiber. In order to gain insight into the relationship between processing conditions, material composition, polymer – and nanoparticle structure, and resulting material properties, Small- and Wide-Angle X-ray scattering experiments as well as transmission electron microscopy investigations and mechanical tests will be carried out on materials with different viscosities and different additives. Mono- and bi-component fibers will be used for the investigation of the effects.

After processing the polymer composite material into fibers, it is necessary to prove that the fibers can be converted into suitable nonwovens. Analysis of the fibers and the nonwovens along the value chain is done in order to verify the aims of the project.

In the state of fiber manufacturing, the fiber (-structure) formation as well as the textile and mechanical properties are investigated. For the processing of the nonwoven, the analysis of mechanical properties, in particular the abrasion resistance is crucial.

MARMARA ÜNİVERSİTESİ YAYINEVİ

# A STUDY ON THE EFFECT OF VITAMINS ON PH PROPETIES OF WOUND DRESSINGS UNDER CONTROLLED TEMPERATURE

M. Uzun[1], C. Bach[1], T. Gries[1], S. Jockenhoevel[1,2]

[1]*Institut für Textiltechnik (ITA), RWTH Aachen University, Aachen, Gemany*
[2]*Department of Applied Medical Engineering, Helmholtz Institute for Biomedical Engineering, RWTH Aachen University, Aachen, Germany*
E-mail: m.uzun@marmara.edu.tr

## Abstract

Wound healing is a complex process which is influenced by both intrinsic and extrinsic factors and it is becoming more complex with the latest treatment methods and investigations of wound nature. The term “wound healing” covers all types of wounds, burns, and ulcerations. There is a considerable global variation in the treatment of acute and chronic wounds, therefore establishing a standardized, best way to manage wounds may not be possible. Complete wound healing, which includes restoration of function, is hardly ever achieved in those disfigured by wounds, especially when one includes the appearance of the skin or absence of an appendage.

Potential Hydrogen (pH) is the degree of concentration of hydrogen ions in a substance or solution. The pH is an important parameter for the human body due to its effect on the speed of biochemical reactions. The pH of intact skin ranges from about 4.8 to 6.0, while the interstitial fluid exhibits a near neutral pH. The lower pH of venous blood is 7.35 and arterial blood is 7.45. It is also demonstrated that the pH value of the wound is time dependent and it changes from acidic to alkaline. The objective of this study is to determine the effect of wound dressings on the pH stability of the fluids. The commercially available wound dressings were treated with the different agents at three different concretions (1%, 3% and 5%). The effect of the dressings on the pH value of two different solutions, solution A and distilled water, was investigated over a period of 7 days. Two different methods for contacting fluid with the dressings were used to simulate wounds with different levels of exudate; i) immersing the dressing in 35ml fluid; and ii) adding 5ml drop-wise onto the dressing’s absorbent pad, on a daily basis. The test environment was kept at body temperature which is 37±0.5oC.



MARMARA ÜNİVERSİTESİ

MARMARA ÜNİVERSİTESİ YAYINEVİ

# A COMPARATIVE STUDY ON CONVENTIONAL AND HOLLOW VISCOSE FIBRES BASED NONWOVEN FABRICS

M. Uzun[1], C. Bach[1], T. Gries[1], S. Jockenhoevel[1,2]

[1]*Institut für Textiltechnik (ITA), RWTH Aachen University, Aachen, Gemany*
[2]*Department of Applied Medical Engineering, Helmholtz Institute for Biomedical Engineering, RWTH Aachen University, Aachen, Germany*
E-mail: m.uzun@marmara.edu.tr

## Abstract

The main aim of the developing hollow fiber structures is to provide better thermal insulation property to the final product. The idea is to use hollow channels as the air entrapper which will enhance the insulating properties of the structures. The hollow structure provides higher bulk and covering factor, improved bending resistance and crimp rigidity, and reduced pilling. The light weight is also improves the general comfort behavior of the textile structures. It has been suggested that the thermal comfort properties of textile structures enhance by hollow fiber structures due to the decreased thermal conductivity and improved thermal insulation. The presence of air in the hollow channels can enhance overall properties of textile structures. Hollow structures allow air inclusion including a very good air and heat retention in addition to its low weight. Hollow fibers have been engineered and produced especially for the sport clothing which helps during the cooling process of the human-body and removes the moisture from the skin surface. Use of hollow fibers in place of cylindrical fibers affects the physical properties of the product. A reduced heat transfer is of special interest under the changed physical properties for fiber-filled products such as pillows, mattresses, sleeping bags, etc. The hollow fibers have a huge potential for the application of advanced and functionalized medical textiles. There are some commercial applications of hollow fibers in medical textiles such as artificial kidney (dialyzer), artificial liver and mechanical lung (blood oxygenator).

In this paper, conventional and hollow viscose fibers have been used to produce wound dressings by making use of nonwoven lane. The main aim of the study is to investigate the effect of hollow structures on the overall physical, absorbency and thermophysiological properties of nonwoven viscose fabrics.



MARMARA ÜNİVERSİTESİ

# POLYTHERIMIDE FIBERS AND POLYETHERIMIDE/CARBON COMPOSITES AS INNOVATIVESOLUTIONS FOR TRANSPORTATION AND SAFETY APPLICATIONS IN THE FRAMEWORK OF THE COURSE PROGRAM

I. Noll, N. Vestweber, G. Seide, T. Gries

*Institut für Textiltechnik (ITA), RWTH Aachen University, Aachen, Gemany*
E-mail: inga.noll@rwth-aachen.de

## Abstract

In the last few years high performance materials have become of great importance due to the production and the associated challenges of innovative applications. Not only in the transportation industry but also in the field of safety gear, materials with extraordinary properties for lightweight purposes, for high mechanical loads and for fire resistance are in demand. Within the framework of a student incentive program called “COURSE Program”, the possibilities of launching a composite material consisting of carbon and polyetherimide in the market shall be evaluated and respective application fields determined. The COURSE program is supported by Kuraray Co., Ltd. - a Japanese manufacturer of chemicals, fibers and other high performance materials. At large, the COURSE program has been called to life in order to enable students to gain a comprehensive insight into scientific work on top of the experiences gathered in the framework of a bachelor thesis and the work as a student assistant. The students are advised by research assistants from the Institute for Textiles of the RWTH Aachen University. Polyetherimide (PEI) itself is an amorphous thermoplast, which provides high heat resistance and flame retardancy. Furthermore, polyetherimide fibers ensure good dyeability in a wide range of shades when using conventional polyester dyeing processes. In comparison to polyamide, which is frequently used in technical applications, polyetherimide provides a higher maximum continuous service temperature at 170 °C. The high temperature polymer polyetheretherketone on the other hand embodies inferior properties than polyetherimide in terms of density. When combining polyetherimide with carbon fibers as a hybrid paper, the composite material may provide technical benefits for high temperature and high mechanical load applications after being heatpressed. Therefore, the PEI/CF composite could be an innovative solution for various applications due to its unique properties.

# MORPHOLOGICAL ANALYSIS OF POLYCAPROLACTONE NANOFIBERS CONTAINING NANOHYDROXYAPATITE PARTICLES

R. Erdem[1], M. Akarsu[2], E. Burunkaya[2], Ö. Erdem[3], M. Akalın[4]

[1]*Textile Technology, Serik Vocational School of Higher Education, Akdeniz University, Antalya, Turkey.*
[2]*Chemistry, Faculty of Science, Akdeniz University, Antalya, Turkey.*
[3]*Chemistry, Institute of Natural and Applied Science, Cukuorova University, Adana, Turkey.*
[4]*Textile Engineering, Technology Faculty, Marmara University, Istanbul, Turkey.*
E-mail: ramazanerdem@akdeniz.edu.tr

## Abstract

Electrospinning is an useful technique which has recently attracted many researchers for producing ultrafine and continuous sub-micron fibers and/or nanofibers. While electrospinning of purely polymer material systems have gained significant interest by scientific world, recent studies also proved that incorporating inorganic nanoparticles into nanofibers to form nanofibrous composites have made electrospinning very attractive in fulfilling some specific functional applications, in particular, for bone tissue engineering. Polymer/ceramic composite scaffolds are potential materials to mimic the natural bone moderately. Natural bone is consists of inorganic compound such as hydroxyapatite (HAp) with nanometer scale and organic compounds such as collagen. It is claimed that nano-hydroxyapatite particles in bone tissue increases the mechanical strength of the bone, and triggers the osteconductivity, protein adsorption and osteoblast adhesion. The purpose of this study is to realize a successful electrospinning process from the blended solution including Polycaprolactone and nano-hydroxyapatite particles, and to explore the morphological and mechanical properties of the final nanofibrous structures that may be used in the field of bone tissue engineering.

## Methodology

Nano-hydroxyapatite particles (nHAp) have been synthesized by sol gel process. Polycaprolactone (PCL) was purchased from Sigma Aldrich. Dimethylformamide (DMF)/ Tetrahydrofurane (THF) solvents were acquired from Merck. PCL (9%wt.) was dissolved in (DMF)/(THF) blended (70/30%) solvent at 60°C for 6 hours. After the polymer completely dissolved, 0,05 gram NaCl was added to the PCL solution in order to increase the conductivity, and stirred around 1 hour. Then, 0,2 gram nHAp was added into the PCL solution and stirred about 2 hours. Electrospinning was carried out in the laboratory spinning unit (NS24, NanoFMG). Each solution was placed in a 3 ml syringe and sent to the drum collector (covered with aluminum foil) through a 20 gauge nozzle. The power supply (AC) was set up for a positive voltage of 28kV. The flow rate of the solution was also determined by setting up the syringe pump at 1,5 ml/hour. The rotational speed of the drum collector was 35 rpm/min and its distance was set to 20 cm away from the nozzle. At the time of the experiments, relative humidity and temperature values ranged from 52% RH and 26°C. Electrospun fibers and nHAp were characterized by Scanning Electron Microscopy (SEM, JSM-5910 LV from JEOL), equipped with an Oxford Instruments INCA Energy Dispersive Spectrometer (EDS) at 5 kV.



## Results

It is very well known that the morphology of the nanofibers is significantly influenced by the electrospinning parameters such as; applied voltage, polymer solution feeding rate and the distance between feeding unit and the collector. Therefore, in order to explore precisely the effect of nHAp amount in the solution to the morphology of resulting electrospun nanofiber, all electrospinning parameters were remained the same. In general, beadless and uniform nanofibers were obtained through the electrospinning process. SEM analysis presented that agglomeration was happened among the nano-hydroxyapatite particles (Figure 1–A). On the other hand, this agglomeration problem did not affect the uniformity of the nanofibers (Figure1-B). Agglomeration of particles may hamper the electrospinning, if they are added into the solution more than a certain amount.

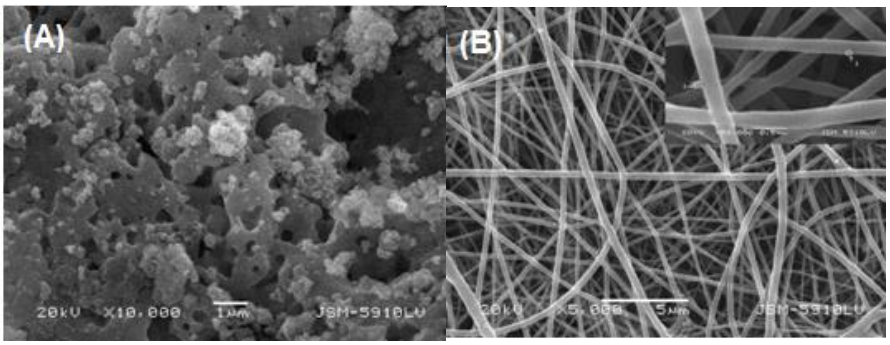



**Figure 1.** SEM images of nano particles and nanofibers. (A) Nano-hydroxyapatites, (B) Nano-hydroxyapatite added PCL nanofibers.

Structural details (elemental composition) of the electrospun nanofibers can be seen in Figures 2. C and O are the main elements found in the structure of PCL. Au and Pd elements were also detected in EDS spectrum; this was due to the sputter coated nanofibrous composites surfaces before the SEM analysis. Peaks for Ca and P were also recorded. This was attributed to the addition of HAp (Ca10(PO4)6(OH)2) in the blend.

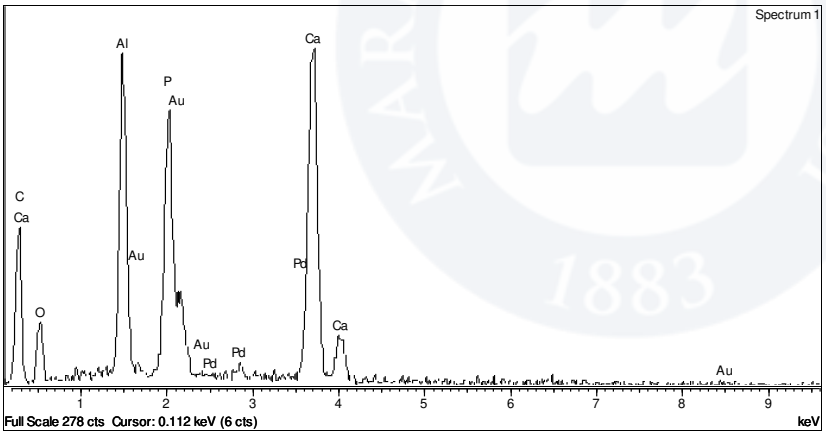



**Figure 2.** EDS analysis of nHAp added PCL nanofibers.

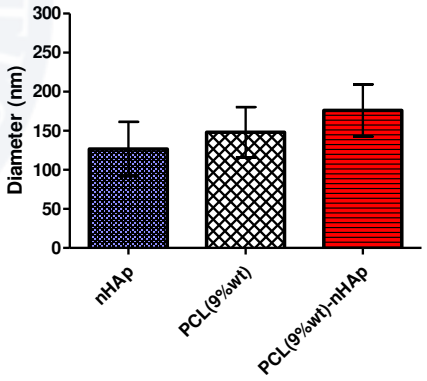



**Figure 3.** Size of nano-hydroxyapatite particles and diameter of the nanofibers.

Figure 3 shows the size of the particles and the diameter of the nanofibers. Size of the nHAp was calculated as 120±50 nm, respectively. Diameter of the pure PCL nanofibers was determined as 148±56 nm. Finally, the diameter of the nHAp added PCL blend nanofibers was measured as 176±58.

## Conclusion

Nano-hydroxyapatite added Polycaprolactone nanofibers were obtained successfully by electrospinning technique. EDS analysis proved that nHAp were integrated well to PCL fibers. Agglomeration of haydroxyapatite particles did not influence the nanofibers uniformity.

# MORPHOLOGICAL ANALYSIS OF ROSEMARY AND ORIGANI OIL ADDED POLYCAPROLACTONE BASED ELECTROSPUN NANOFIBERS

R. Erdem[1], Y. Özyiğit[2], E. U. Sözmen[3]

[1]*Textile Technology, Serik Vocational School of Higher Education, Akdeniz University, Antalya, TURKEY*
[2]*Agriculture, Korkuteli Vocational School of Higher Education, Akdeniz University, Antalya, TURKEY*
[3]*Field Crops, Faculty of Agriculture, Akdeniz University, Antalya, TURKEY*
E-mail: ramazanerdem@akdeniz.edu.tr

## Abstract

Sweet marjoram (Origanum majorana L.-Origani Oil) is a hardy perennial and herbaceous plant which mainly grows wild in natural areas of Egypt and eastern Mediterranean countries. Origanum majorana has substantial characteristic such as strong antioxidant activity, as a result of its high content of phenolic acids and flavonoids. It is widely used as a folk remedy against asthma, indigestion, headache and rheumatism. Rosemary (*Rosmarinus officinalis* L.) (Lamiaceae), also known as rosemary, is an aromatic evergreen shrub widely distributed throughout the Mediterranean region [3]. Rosemary is known as a medicinal plant, and has been cultivated for a long time in ancient Egypt, China and India (Rashed, 2014). It shows antibacterial, antioxidant and antiphlogistic behaviors. It is well known that the activity of rosemary extracts in food industry and medicine due to the presence of some important antioxidant oil and phenolic complexes. In the last decade, electrospinning process has gained remarkable popularity in scientific and commercial fields because it provides efficient and simple method for fabricating nanofibrous structures from a wide variety of natural and synthetic polymers [5]. Nanofibrous scaffolds exhibit outstanding characteristics, such as considerably large surface area-to-volume ratio, high degree of porosity with a very small pore size and their 3D structure are similar to extracellular matrix [6]. Thus, electrospun nanofibers are claimed as candidate materials for many biomedical applications, such as wound dressing, drug delivery and scaffolds for tissue engineering. The aim of this study is to analyze the morphological characteristics of Rosemary and Origani oil added Polycaprolactone nanofibers.



## Methodology

Samples of Rosemary (Rosmarinusofficinalis) and Marjoram (Origanummajorana) were collected at last week of June 2014 in Akdeniz University Campus. Harvest was done by hand-pruningshearsat fully flowering period for two species. Fresh herbs were dried on ground in the shade at room temperature for one week. Dried samples (100 g) of material from each species were subjected to hydrodistillation for 3 hours using a Clevenger-type apparatus to produce the essential oils.The essential oils were stored in black glass bottles at 4 °C until analysis. PCL (9%wt.) was dissolved in Dimethylformamide (DMF)/ Tetrahydrofurane (THF) blended (70/30%) solvent at 60°C for 6 hours. After the polymer completely dissolved, 0,025 gram NaCl was added to the solution (only blend solution) in order to increase the conductivity, and stirred around 1 hour. Then, 0,25g Rosemary oil and 0,25g Origami oil was added individually to prepare two different PCL solutions. Blend solutions were mixed by laboratory type magnetic stirrer (Stuart, SB 162) for two hours at room temperature. Electrospinning was performed in the laboratory spinning unit (NS24, NanoFMG). Each solution was placed in a 3 ml syringe and sent to the drum collector (covered with aluminum foil) through a 20 gauge nozzle. The power supply (AC) was set up for a positive voltage of 28kV. The flow rate of the solution was also determined by setting up the syringe pump at 1,25 ml/hour. The rotational speed of the drum collector was 35 rpm/min and its distance was set to 20 cm away from the nozzle. At the time of the experiments, relative humidity and temperature values ranged from 50% RH and 27°C.

## Results

Figure 1 shows the SEM images of nanofibers. According to images, PCL nanofibers have some beads and the distribution of the nanofibers is not uniform enough. This is due to the PCL solution does not include NaCl, which normally increases the conductivity solution and enables electrospinning process to produce uniform and bead free nanofibers.

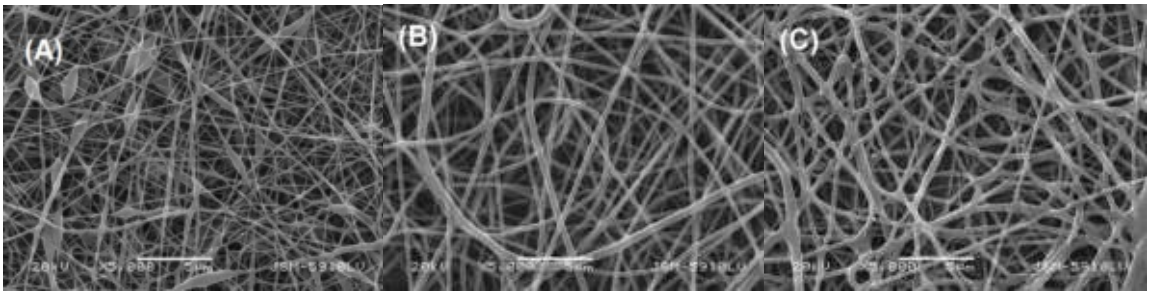
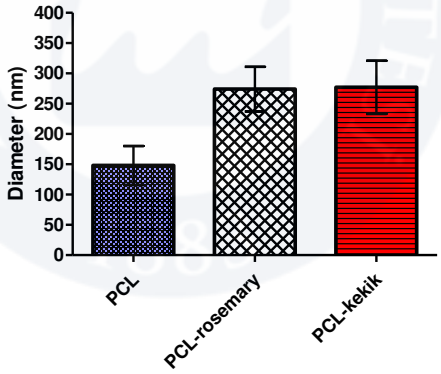



**Figure 1.** SEM images of the nanofibers: (A) PCL nanofibers, (B) Rosemary added PCL nanofibers, (C) Origami oil added PCL nanofibers.

There is no bead or deficiency observed for Rosemary and Origami oil added PCL nanofibers, because, NaCl was added to the spinning solution before the process. On the other hand, thickness of the extracted oil added PCL nanofibers increased compared to pure PCL nanofibers. This may be related to the increase in the viscosity of the solution containing extracted oil. Figure 2 illustrates the changes in the diameter of the nanofibers. According to the figure, diameter of the pure PCL nanofibers was found approximately 142nm, diameter of the Rosemary oil added nanofibers was calculated as 274nm, respectively, and the diameter of the Origami oil added nanofibers was measured as around 276 nm.






## Conclusion

Rosemary and Origani oil added Polycaprolactone nanofibers were fabricated successfully by electrospinning. SEM analysis proved that the nanofibers were uniform and bead free. The diameter of the nanofibers increased when the extracted oils added into the PCL based spinning solution. This was explained with the increase in solution viscosity. It can be claimed that Rosemary and Origani oil added PCL nanofibers are potential materials that may be used in biomedical and cosmetic fields.

# THE DEVELOPMENT OF EASY CLEANABLE UPHOLSTERY FABRICS

A. Mutlu

*Kadifeteks Mensucat San. A.S., Istanbul, Turkey*
E-mail:

## Abstract

People as much as possible make every effort to raise their comforts in their social life. The materials for achieving this objective, sometimes it might be a digital device or sometimes it might be a relax, soft , peacefully armchair or a sofa. While we have a food (or other kind of things), we can easily spill drinks or foods on the sofa during the watching TV. therefore the stains can be appeared easily on the sofa.

those stains ;
Simple materials that can be found in every houses.
Without any special services
without spending much money
If that stain can be easily and quickly cleaned, that armchair of fabric has special effect, therefore that specialty name is “easy clean”.
why “easy clean” ?

It is necessary to clean the fabric which is polluted with the daily materials in both upholstery fabrics industry and the other textile industries by using the simple method. According to the latest research data, attending to the business life of the women is increased with improving the educational level of the women who is living in the cities. Thus, participating to the business life of the women with graduation from the university and other similar high level school is % 71,1. When we do not limit the result obtained from that research data with the social life, it is seen to find the solution the clean activities that require the time. Nowadays for that reason the easy clean fabrics are important and it is competitive for the view of the producers.

As a conclusion of the research it is observed the increase and improves in the production of the easy clean fabric in the apparel fabric textile sector. It is detected to the absence of the product of the easy clean fabric with the commercial success in the upholstery fabric produced by chenille and the other special yarns which is % 80 of the Kadifeteks product list. Therefore a serious search and development project study was done. After determining the types of the fabric which were used for the production as the easy clean fabric, it was selected to the relevant chemical materials and the production process of the easy clean. and then it was determined to the right materials used for the pollution like e tea coffee and ink. Because of the absence of the accredited test method, the laboratory study was done by improving the test method on its own structure. The trial production was started by the successful methods. The serial production was done by eliminating the problems. The production development process was completed by evaluating the feedback of the customers after sales.

# NANOCOMPOSITE NANOFIBERS OF POLYACRYLONITRILE (PAN) AND SILVER NANOPARTICLES (AgNPS) ELECTROSPUN FROM DIMETHYLSULFOXIDE

N. Demirsoy[1], N. Ucar[2], A. Onen[1], N. Kizildag[2]

[1]*Istanbul Technical University, Department of Chemistry, Istanbul, Turkey.*
[2]*Istanbul Technical University, Department of Textile Engineering, Istanbul, Turkey.*
E-mail: kizildagn@itu.edu.tr

## Abstract

Polymer composites containing metal nanoparticles have attracted great attention because of their unique optical, electrical, and catalytic properties. The properties of these nanocomposites strongly depend on the amount, size and dispersion quality of the metal nanoparticles. The mechanical mixing of metal nanoparticles into the polymer solution is an easy method with the disadvantage of agglomeration of the particles. Recently in situ synthesis of metal nanoparticles has attracted more attention. Silver nanoparticles can be synthesized in polymers using many different methods such as photo reduction, heat treatment, chemical reduction using aqueous solution of sodium borohydride and hydrazinium hydroxide.

In literature, there are many studies about the synthesis of silver nanoparticles in polyacrylonitrile in many of which N,N-dimethylformamide (DMF) is used as the solvent due to its ability to reduce Ag ions to the metallic silver even at room temperature without the use of any external reducing agent. In this study, DMSO was used as the solvent and composite nanofibers of PAN with 1 and 3w% AgNO3 content were electrospun. Then silver nanoparticles were in situ synthesized by chemical reduction. The effect of silver nitrate amount on the morphology, conductivity and mechanical properties of PAN/AgNPs composite nanofibers were investigated. Beadless and uniform composite nanofibers, the diameters of which were in the 499-515 nm range, were successfully electrospun. The breaking stress and breaking elongation of PAN/Ag composite nanofibers were higher than the neat PAN nanofibers. The conductivity was improved to around 10-8S/cm with the incorporation silver nanoparticles.

**Acknowledgement**
We would like to thank to TUBITAK for supporting this study with Project (112M877).

MARMARA ÜNİVERSİTESİ YAYINEVİ

# COMPOSITE NANOFIBERS OF POLYACRYLONITRILE (PAN) AND AMINO-FUNCTIONALIZED CARBON NANOTUBES ELECTROSPUN FROM DIMETHYLSULFOXIDE

O. Eren[1], N. Ucar[2], A. Onen[3], N. Kizildag[2]

[1]*Istanbul Technical University, Polymer Science and Technology, Istanbul, Turkey.*
[2]*Istanbul Technical University, Department of Textile Engineering, Istanbul, Turkey.*
[3]*Istanbul Technical University, Department of Chemistry, Istanbul, Turkey.*
E-mail: kizildagn@itu.edu.tr

## Abstract

Carbon nanotubes (CNTs) are of great interest in nanotechnology because of their superior structural, mechanical, chemical, thermal, and electrical properties. In order to effectively transfer their superior properties to nanocomposites, homogeneous dispersion of nanotubes in the polymer and strong interfacial bonding between the nanotubes and polymers should be achieved. Functionalization of CNTs is an effective way for strong interfacial bonding and homogeneous dispersion. There are several approaches for functionalization of CNTs such as defect functionalization, covalent functionalization, and noncovalent functionalization.

When a literature survey is conducted, it was seen that there are many studies related with the investigation of reinforcing effect of CNTs in PAN/CNT composite nanofibers which were performed using DMF as the solvent [4-6]. In this study, DMSO was used as the solvent and PAN nanofibers reinforced with amino-functionalized multiwalled carbon nanotubes (f-MWCNTs) were successfully electrospun from DMSO. The concentration of f-MWCNTs were changed as 1w% and 3w% with respect to the weight of PAN. The effect of f-MWCNT concentration on morphology, conductivity and mechanical properties of composite nanofibers were examined. Uniform nanofibers were obtained. The diameters of the nanofibers were in the range of 515-536 nm. The addition of the f-MWCNTs resulted in an increase in nanofiber diameter. 3w% f-MWCNT loaded PAN/CNT nanofiber showed the best mechanical properties. Conductivity increased with the incorporation of amino-functionalized multiwalled carbon nanotubes.



**Acknowledgement**
We would like to thank to TUBITAK for supporting this study with Project (112M877).

MARMARA ÜNİVERSİTESİ

# DEVELOPMENT OF FLAME RETARDANT UPHOLSTERY FABRICS

M. Torsun, A. Mutlu

*Kadifeteks Mensucat San. A.S., Istanbul, Turkey*
E-mail:

## Abstract

The fire accidents in houses take second place by %30 rate in all fire accidents. However, the death rate in a fire accident which happens in a house is horrible, it takes the first place by % 80 rate. The second rate is % 10 belongs to fire accident in other buildings (a factory, a fuel station, etc.). According to a research in Holland in 2008, the factors which rush up the fire rate in houses were asked to firemen and the most response was “upholstered furniture”.

In the light of these statistical data, it is clearly seen that most of fire accidents occur from the flaming up of textiles. The common reasons of death in fire are breathing the smoke, burning of the respiratory tract and carbon dioxide (CO) poisoning and they have between % 50 and %80 rate. For these reasons, preventing the fire accidents in houses is very important. The best way of this is using FR (Flame Retardant) technology on upholstery fabrics.

Our goal is producing upholstery fabrics which passed the tests prepared suitable of flame retardant standards accepted worldwide and commonly used, also producing more comfortable, functional upholstery fabrics which have low carbon and smoke emission rate.

In this Project, , we apply these tests over the fabrics chosen to be made FR: NF P 92 – 503/504/505/507, French Flame Retardant Testing Standards (M1), English BS 5852, EU EN 1021, German DIN 4102, Spanish UNE EN 13773, Italian UNI 9175, American CALIFORNIA TB117. Also, low carbon and smoke emission of the fabric will be tested. In addition, the other tests of comfort properties (anti-stress, anti-microbial, etc.) will be applied. After applying all mentioned tests, the best environmentally sensitive production will be provided.

# SIMULATION MODEL OF PRODUCTION COST FOR A SELECTED DYING-FINISHING TEXTILE MILLS

E. Batuk, E.C. Sabır

*University of Cukurova, Department of Textile Engineering, 01330, Adana, Turkey.*
E-mail: emelc@cu.edu.tr

## Abstract

Production planning is the most important function in managing production in a textile plant. The production planning in Dyeing-Finishing plant has a special importance. In yarn and textile weave, the capacity increase in production can be easily provided by contract manufacturing (outsource) but same is not possible in dyeing-finishing. With respect to achieving some properties for the fabric such as width, weight in gram, color, touching, etc. every firm wants to carry out finishing of their own fabrics in their plants. In this study, based on medium and short term planned. It was proved that textile firms are more suitable for variable demands and the cost and time was calculated by simulation method according to different fabric types under variable demand. It is thought that the results obtained from analyses will provide help the firm for deciding production management.

# MECHANICAL AND THERMAL PROPERTIES OF WOOL WASTE FABRIC REINFORCED COMPOSITES

S.M. Yukseloglu[1], M. Caliskan[2]

[1]*Marmara University, Faculty of Technology, Textile Engineering Department, Istanbul, Turkey.*
[2]*Isiksoy Tekstil, DOSAB, No 20, Osmangazi, Bursa, Turkey.*
E-mail: myukseloglu@marmara.edu.tr

## Abstract

Today, the technology in composite materials is rapidly developing and almost every day new products are presented to the market. In general, felt and woven fabrics are used as a reinforcement material in textile composite structures. In these structures glass and carbon fibers are widely used ones. However for almost a decade, researchers have also shown some interest on natural fiber reinforced composites. Some other researchers have already publicized an attention on the reinforced natural fiber composites; for example bamboo fibers can be used to improve the mechanical properties of the composites. Alternatively, in this study, it has been aimed to use wool waste fabric to be able to produce a lightweight composite material. For this purpose, the composite samples were produced by using wool fabrics in warp direction together with their waste blends as a reinforced material. The production of these textile composites were achieved by using hand lay-up method. Various composite constructions were formed by using 100% wool waste fabric with polyester resin in different percentage of reinforcement. The produced reinforced wool composite structures were then tested for both their mechanical properties, i.e. Izod impact and tensile strength tests, and for their thermal properties. The fracture surfaces of the samples were also inspected on the scanning electron microscope. According to the results, it has been evaluated that wool fabrics and their waste may be use as a reinforced material for the application of textile composites in construction industry. The produced wool waste fabric reinforced composite structures have presented acceptable mechanical properties and thermal conductivity with presenting a lightweight structure. Therefore, we believe that wool waste materials can as well be used for future recycled textile materials for the reinforced composites.

MARMARA ÜNİVERSİTESİ YAYINEVİ

# PHOSPHORESCENT COMPOSITE NANOFIBERS: EFFECT OF POLYMER TYPE

R. Simsek[1], M. Calisir[2], M. Erol[2,3], A. Kilic[2]

[1]*Marmara University, Faculty of Technology, Department of Textile Engineering, Istanbul, 34722, Turkey.*
[2]*Istanbul Technical University, TEMAG Labs, Istanbul, Gumussuyu, 34437, Turkey.*
[3]*Nevsehir Haci Bektas Veli University, Metallurgical and Materials Engineering, Nevsehir, 50300, Turkey.*
E-mail: ramazan.simsek@marmara.edu.tr

## Abstract

Copper doped ZnS inorganic phosphors emitting green light, which are used in a lot of applications [1] such as in traffic signs, emergency signs, watches, clocks, paintings and textile printing have been known since 20th century. In literature, although there have been a lot studies about such phosphors, only a few reports of ZnS:M2+/polymer composite phosphorescence nanofibers have been published [2-4]. This study is aiming at investigating the effect of different polymer types on the phosphorescence and mechanical characteristics of the ZnS:Cu2+/polymer composite nanofibers. SEM, XRD, UV-Visible and DMA are carried out to characterize the nanofibers.



MARMARA ÜNİVERSİTESİ

# INFLUENCE OF REED ON FILTER FABRIC STRUCTURE

Ž. Rukuižienė

*Kaunas University of Technology, Kaunas, Studentu str.56, Lithuania.*
E-mail: audrone.ragaisiene@ktu.lt

## Abstract

Woven fabric, as a porous material, enables the transmission of substances, such as liquids, gases and particles, and therefore is interesting for different applications, especially for technical. The fabric structure is a very complex multi-level structure, the element (thread) as well as a design that consists of a filament.

It is well known, that during weaving process reed blades move between warp and change structure of fabric (especially with rather high density structure) – warp spacing in these places are higher. Weaving motions cause warp move back and forth through reed, heddle eyes and drop wires which stretch and looser warp yarn within weaving cycles. These technological effects influence a particular regularity of warp projections inequality in fabric width; while the projections of wefts remain steady in whole width of fabric. This structure inequality has a significant influence on some properties of filter fabric, such as air permeability. Fabric thickness is important since it affects permeability characteristics of fabric, also. The manufacture of the different structure fabric takes a lot of time and requires a considerable amount of money, which severely limits the development of research. In order to ensure appropriate filtration properties of fabrics for filters, the investigation of the technological parameters, such as the influence of the reed on the fabric structure were done.

MARMARA ÜNİVERSİTESİ YAYINEVİ

# THE EFFECT OF THE ULTRASONIC ENERGY ON DYEING A POLYAMIDE MATERIAL WITH REACTIVE DYES, INCLUDING A DIFFERENT CHROMOPHORE AND A REACTIVE GROUP

S. Canbolat[1], N.Merdan[1], M. Kilinc[1], F. Akin[2]

[1]*Istanbul Commerce University, Faculty of Engineering and Design, Department of Fashion and Textile, Istanbul, Turkey.*
[2]*Abbant Izzet Baysal University, Vocational High School, Bolu, Turkey.*
E-mail: scanbolat96@gmail.com

## Abstract

In this study, reactive dyes, which have different chromophore and reactive groups, were used. These dyes were in order; C.I. Reactive Blue 4 (Basilen Blue MR – BASF – chromophore group of anthraquinone, a reactive dye in the structure of dichlorotriazinel, C.I. Reactive Blue 15 (Cibacron Turquoise GF – CGY – chromophore group of phtalocyanine, a reactive dye in the structure of monochlorotriazinel, C.I. Reactive Blue 52 (Drimarene Blue X3LR - S – chromophore group of disazo - formazon metal complex, a reactive dye in the structure of trichloroprimidin) and C.I. Reactive Blue 69 (Lanasol Blue 3G – CGy – chromophore group of, α- boromoacrylamide of reactive group). These chosen dyes with polyamide material classic and ultrasonic method with dyed and these dyings' % gravity, receding colorant in washing, % fixation values were compared in the aspect of the methods. Furthermore washing, light, friction and sweat fastness values and ΔE*, ΔL*, Δa* and Δb* values taken from the colorimetric measurements were investigated.



MARMARA ÜNİVERSİTESİ

# EFFECT OF SWCNT ON PAN BASED CARBON NANOFIBER

O. Ağma[1], E. Pampal[1,2], A.Hassanin[1,3], R. Şimşek[1], A.Kılıç[1], A.Demir[1]

*[1]Temag Labs, Faculty of Textile Technology and Design, Istanbul Technical University,Istanbul,34437,Turkey.*
*[2]Textile Engineering Department, Bartin University, Bartin 74100, Turkey.*
*[3]Textile Engineering Department, Alexandria University, Egypt.*
E-mail: onuragma@gmail.com

## Abstract

In order to investigate the effect of functionalized single wall carbon nanotube (SWCNT) on polyacrylonitrile (PAN) based carbon nanofibers, SWCNTs containing PAN nanofiber mats were produced by electrospinning. SWCNTs have a high mechanical properties, good thermal stabilities and unique electrical features. PAN has been used commonly to fabricate nanofibers and easily to be carbonized. Different amount of SWCNT nanoparticles were added during the preparation of PAN (precursor) solution. After electrospinning, PAN nanofiber samples were stabilized and carbonized. Composite PAN/SWCNT carbon nanofibers morphological, physical, mechanical, electrical and thermal properties was characterized.

MARMARA ÜNİVERSİTESİ YAYINEVİ

# SOLUTION BLOWN NANOFIBERS FOR PHOTOCATALYTIC WATER FILTRATION APPLICATIONS

Y Polat, A. Kücüksari, E. Pampal, E. Canbay, S. Yilmaz, A. Kılıc, A. Demir

*TEMAG Labs, Istanbul Technical University, Istanbul, Gumussuyu, 34437, Turkey.*
E-mail: ysfpolat1@gmail.com

## Abstract

Solution blowing is an innovative method for the fabrication of nanofibrous membranes. Instead of electrostatic forces in widely known electrospinning procedure, compressed air jet is used to convey the polymer solution to the collector and produce polymeric nanofibers. In this study, solution blown nanofibrous membranes were functionalized using photocatalytic particles (namely TiO2) to decompose organics in contaminated water. A custom made solution blowing apparatus was designed to realize the system. TPU solution with 10% wt. concentration was prepared by dissolving in DMF. Air pressure was kept 1- 1.5 bar, whereas solution flow rate was 20 – 25 ml/h and nozzle-collector distance: 35 cm. Nanofibers were collected on a mesh type collector to form a membrane structure. Scanning electron microscope (SEM) is used for the morphological analysis of membrane. TiO2 nanoparticles were dispersed in methanol and then they were coated on membrane surface by electrospraying process to make the membrane effective under UV light. Finally, TiO2 coated membranes are subjected to UV light and degradation of methylene blue was measured with UV vis spectrometry and results were discussed.



MARMARA ÜNİVERSİTESİ

# SMART CONDUCTIVE TEXTILES

R. Ashayer-Soltani, C. Hunt, M. Wickham, O. Thomas

*National Physical Laboratory, Teddington, TW11 0LW, UK*
E-mail: Roya.ashayer-soltani@npl.co.uk

## Abstract

Smart textiles and wearable technology have the potential to change the way we manage our health, respond to emergency, communicate and entertain ourselves. There is an increasing demand for smart fabrics and interactive textiles. The US market alone for smart fabrics is predicted to reach $1.8 billion by 2015 according to a new report by Global Industry Analysts, Inc.

Applications
Wearable sensors and antennas: assisted living, military, data capture and feedback
Health and emergency: Physiological monitoring and triage
Leisure and fashion
Sports: Performance monitoring
Medical applications: Antibacterial (surgical masks, wound dressing)

NPL Smart Textile A unique technique has been developed at NPL (patent applied for) to coat individual fibers to a thickness of 20 nm with silver. The resulting fabric is flexible and stretchable textile. The conductive silver layer fully encapsulates fibers, has good adhesion, excellent conductivity with good adhesion and in addition has antibacterial properties due to the presence of silver.

Advantages
•Additive textile
•Stretchable
•Low resistivity (ρ = 0.188Ω/sq)
•Flexible
•Antimicrobial
•Straight forward integration with sensors
•Interconnecting pads
•Complex circuits
•Alternative nanometal finishes

MARMARA ÜNİVERSİTESİ YAYINEVİ

# OBTAINING FIBERS FROM STINGING NETTLE

E. H. Peker[1], V. Özyazgan[2]

[1]*Tekstil Araştırmaları Derneği, Istanbul, Turkey*
[2]*Istanbul Aydın University Engineering Faculty, Department of Textile Engineering, Istanbul, Turkey*
E-mail: ekrempeker@gmail.com

## Abstract

The soils on which cotton was planted became poisoned because of the usage of excess pesticides in the recent century. The same danger is valid for new agricultural areas where cotton agriculture is being carried out. The demand for cotton increases each day but each climate is not suitable to plant cotton. What is more, cotton plant requires excess amounts of water.

Stinging nettle which has been used during history is a vigorous growing plant and is wider than cotton according to its climate. Also it does not need pesticide and excess water like cotton does. Using stinging nettle will reduce the excess stress on cotton agriculture.

It is thought that the developments towards the use of new generation herbal fibers in textile industry would significantly meet the tendencies and demands of customers for comfortable, natural and environment-friendly products. The stinging nettle fibers are among the fibers having the qualifications which can satisfy these tendencies.

The stinging nettle fibers are natural, bio-degradable, and they have renewable resource. Low amount of energy is required in their production. For this reason, the stinging nettle fibers are environment-friendly and have ecological advantage. Moreover, by using the stinging nettle fibers, the amount of the water used in fiber production for textile industry can be decreased. With these positive features, the stinging nettle fibers have started to be used in textile sector again, and they have become the subject of research.

Similarly with ketene and cannabis, the stinging nettle contains 17% high-quality fiber. This high rate of fiber, low density, and good strength values are advantages for its use in textile.

As the environment is not harmed while processing the stinging nettle, it is thought that it may bring a breath of fresh air to textile industry, and it can be a high-quality alternative for customers tending to natural product.



MARMARA ÜNİVERSİTESİ

# BIOMEDICAL TEXTILES THROUGH MULTIFUNCTIOALIZATION OF COTTON FABRICS USING INNOVATIVE METHOXYPOLYETHYLENE GLYCOL-N-CHITOSAN GRAFT COPOLYMER

A.M. A. Mohsen[1,2], L. Vojtova[1], J. Jancar [1,3]

[1]*Central European Institute of Technology (CEITEC), Brno University of Technology, Brno, Czech Republic*
[2]*National Research Centre-Textile Research Division- El-Buhoth St., 12311 Cairo, Egypt*
[3]*Institute of Materials Chemistry, Brno University of Technology, Czech Republic.*
E-mail: abdo_mohsennrc@yaho.com

## Abstract

Multifunctioalization of cotton fabrics was developed by a novel finishing formulation. The method is based on chitosan–N-polyethylene glycol graft copolymer along with citric acid and sodium hypophosphite (SHP) as catalysts. Treatment of the cotton fabric resulted in the chemical attachment of the copolymer to the cotton fabric via bridging – based esterfication where the latter involves reaction of one molecule of the polycarboxylic acid (citric acid) with both the amino group of the copolymer and the hydroxyl groups of cotton. Inclusion of the copolymer in the crosslinked structure of cotton as well as by hydrogen bonding and van der Waals forces are additionally possible. The pad dry-cure method was used for the cotton fabrics treatment with aqueous solution of prepared copolymer along with citric acid and SHP. The so treated fabrics were monitored for copolymer content (expressed as N%), crease recovery, tensile strength, elongation at break, air permeability, water permeability, roughness, bursting strength and antibacterial activity. Fabric performances based on the outputs of these measurements advocate these multifunctionalized fabrics for use as medical textile.

**Acknowledgments**
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# BIOLOGICAL ACTIVITY OF CHITOSAN EXTRACTED FROM CRAWFISH SHELL

R. M. Abdel-Rahmana, R. Hrdinaa

*Institute of Organic Chemistry and Technology, Faculty of Chemical Technology, University of Pardubice, Studentská 573, Pardubice CZ-532 10, Czech Republic.*
E-mail: rmmar2008@yahoo.com

## Abstract

The present study was undertaken to define the optimal conditions for the extraction of ultra-pure chitin and chitosan from crawfish shell wastes. Chitin was extracted by deproteinization and demineralization steps. The optimal conditions as follows: the deproteinization was carried out by the use of 5 % NaOH at 90 0C for 20 h and protein content was measured, the demineralization was completely achieved with 10 % hydrochloric acid at ambient temperature for 2h. Chitosan was obtained by deacetylation step of chitin by 50% NaOH at 900C for 2 h. The obtained chitin and chitosan were characterized by elemental analysis, FT-IR, UV-Vis spectra, SEM, ICP-OES.

Cell viability tests indicated that chitin and chitosan hadn't cytotoxic against mouse fibroblast cell line 3T3 and HaCaT cells. Chitosan showed high antibacterial activity against Staphylococcus aureus and Escherichia Coli and also showed highly healing properties against female rats. Pure chitin and chitosan can be used in the different biomedical applications especially in wound healing and dressing purposes.

# MULTI-FUNCTIONAL TEXTILE COATINGS BASED ON POLYMERIC MATERIALS

S. Kazanc, G. Kaplan, A. Hamitbeyli, Ö. Akdemir

*Sanko Tekstil İşletmeleri A.Ş. İSKO Şubesi, AR-GE Merkezi, İnegöl, Bursa, Turkey.*
E-mail: oakdemir@isko.com.tr

## Abstract

Waterborne-polyurethane dispersions, consisting of polyol and polyisocyanates building blocks are conventional finish materials for various applications in textile industry, particularly in denim industry. This study aims to prepare a multifunctional polyol block, which is compatible with commercially available polyisocyanates, for polyurethane formation. Therefore, well-defined polymers having both hydroxyl and tertiary amine functions prepared via controlled radical polymerization technique namely atom transfer radical polymerization (ATRP). Hydroxyl functions are considered as cross-linking domains with polyisocyanates to form polyurethane and tertiary amine moieties are considered as quaternarization domains with different length of alkyl-bromides. 1H-NMR and Dynamic light scattering (DLS) techniques are used for structural characterization and thermal stability evaluation of synthesized polymers respectively. Those synthesized materials are primarily used for surface modification of cellulosic fabrics to achieve wash-fast antimicrobial coatings. Pad-batch technique is used for an application of different concentration of polymers onto fabrics. Dyeing studies with indigo dyestuff is conducted with both polymer treated and non-treated fabrics. Dyeing studies showed dye-uptake capabilities of polymer coated samples are found to be higher than non-treated fabrics. Datacolor spectrophotometer is used to evaluate color measurements. In addition to aforementioned features, synthesized polymers also exhibited a lower critical solution temperature (LCST) close to room temperature, which makes them potential candidates to be used as adaptive coating materials.

MARMARA ÜNİVERSİTESİ YAYINEVİ

# THE EFFECT OF ULTRASONIC TREATMENT ON DYEING PROPERTIES OF LUFFA CYLINDRICA FIBERS

B. Y. Şahinbaşkan

*Marmara University, Faculty of Technical Education, Department of Textile Studies, Goztepe, Istanbul, Turkey*
E-mail: burcuyilmaz@marmara.edu.tr

## Abstract

In this research work, conventional and ultrasonic treatments on exhaust dyeing of natural Luffa cylindrical (LC) fibers with reactive dyes were studied. Accordingly, the samples were alkali scoured, bleached with H2O2 and dyed with C.I. Reactive Red 241 and C.I. Reactive Blue 19 at 60 °C, 60 min with or without ultrasonic energy. The colouristic properties, penetration behavior and color fastnesses were investigated and compared with each other. Using ultrasonic energy for dyeing LC fibers enhances the exhaustion of dye, good colouristic properties and color fastnesses in dyeings are achieved. The ultrasonic power seems promising since it enhances color yields and reduces process time.



MARMARA ÜNİVERSİTESİ

# 17 OCTOBER 2014
# FRIDAY
# (ORAL PRESENTATIONS)

# A SUSTAINABLE APPROACH TO COLLECT POST-CONSUMER TEXTILE WASTE IN DEVELOPING COUNTRIES

E. Buyukaslan[1], S. Jevšnik[2], F. Kalaoglu[2]

[1]*Istanbul Bilgi University, Fashion Design, Beyoglu, Istanbul, Turkey.*
[2]*Istanbul Technical University, Textile Technology and Design Faculty, Beyoglu, Istanbul, Turkey.*
E-mail: evrim.buyukaslan@bilgi.edu.tr

## Abstract

Every year million tons of textile waste is being sent to landfills. It is estimated that in Turkey approximately half of the disposed textile waste is consisted of post-consumer textile waste. Although the amount of post-consumer textile waste is as high as pre-consumer textile waste, recovering opportunities for post-consumer textile waste is substantially disregarded. The purpose of this study is to make the preliminary work to investigate potential of post-consumer textile waste and recycling/reusing possibilities in Turkey by monitoring UK and US examples. This study may contribute to developing countries as many of them are lacking of an attempt to collect, recycle or reuse post-consumer textile waste.

# AN ECO-DESIGN APPROACH FOR THE FUNCTIONAL TEXTILE

A. H. Taieb[1, 2], S. Msahli[1], F. Sakly[1]

[1]*LGtex Ksar Hellal,Tunisia*
[2]*Design department of ISAM Sfax, Tunisia*
E-mail: amineht@yahoo.fr

## Abstract

Ecodesign is an approach to design of a product with special consideration for the environmental impacts of the product during its whole lifecycle. This paper describes barriers and success factor to implement eco-design in functional textile design. The designing phase is critical for the integration of environment issue. Methods and tools for designers are examined especially for wearable technology.

Ecodesign is an early stage of a design. Through an intelligent utilization of the available resources, Ecodesign aims at a product and process design that ensures maximum benefit for all actors involved as well as consumer satisfaction, while causing only minimum environmental impacts.

Fulfillment of customer requirements is also often seen as a driver for the development of ecodesign. We will also see the role of designer to responds to some ecological constrains in functional textile design. Different ecodesign aspects during the functional textile product life cycle are studied on this paper. Challenges and opportunities of ecodesign as well as Future trends are presented also in this work.

# GEOMETRY OF HANDMADE CARPET

F. Abidi, T. Hrizi, S. Msahli, F. Sakli

*Textile Engineering Laboratory of Ksar Hellal, University of Monastir, Tunisia*
E-mail: fatma_hanin@yahoo.fr

## Abstract

The handmade carpet is a carpet with knotted, cut regularly and woven in cloth face on a vertical loom. The term carpet means one type of thick fabric equipped with extra yarn on its surface, which is termed the pile. knots are formed over 2 warps. Weft yarns are horizontally inserted between warps as plain weave after each row of knots to support them.

The carpet has a complex structure in which their geometry is not been studied. It is composed of independent nodes. The Tunisian knot is a Turkish knot which is also known as symmetrical or Ghordes knot. This type of knot especially used in Armenia, Iran and Turkey. In this type, there are some little gaps which make it fluffier. A new system is developed for measuring parameters of construction of handmade carpets and for describing this new structure. The main contribution of the present paper is an extension of Peirce's geometry of plain weave to handmade carpet. The geometry of the handmade carpet is given by rigorous formulae in terms of the diameter of node, warp and weft threads. The study of geometry handmade carpet allows a prediction of the mass, texture, warp and weft account and the height of the node. The simulation results are reported herein with experimental verification.

# EFFECT OF DIFFERENT TYPES OF WASHES ON THE FABRIC STRENGTH OF DENIM

Z. A. Noonari

*Pak-Korea Garment Technology Institute Karachi Ministry of Textile Industry Government of Pakistan*
E-mail: za_sincere@yahoo.com

## Abstract

People since the last century have been interested in denim fabric. A lot of features in denim fabric have been developed due to its increasing demand. Denim washing process is the most important process in the manufacturing of denim. It is due to the washes of the denim that the appealing look is of a garment is achieved.

For this purpose denim trousers were chosen as apparel and after washing, changes on characteristics of denim trousers have been observed. It is concluded that after enzyme wash the denim fabric changed from harsh to softer. Due to abrasion damage ends/inch and picks/inch of denim fabric has been decreased and as a result surface density of fabric increased. Again tensile strength of fabric and seam strength of trousers has been decreased due to enzyme washing.

The different types of washes considered in the experimental work are

Stone wash

Enzyme wash

Rinse wash

Bleach wash

The washes mentioned were applied at the given conditions of the recipes. These washes were applied for one time on the samples. Since the purpose of the project work is to find the comparison among the mentioned denim washes on the strength properties of the denim fabric.

The fabric samples acquired of the mentioned quality were subjected to the washes named. Different wash effects were achieved. Once the samples were ready, they were subjected to tensile and tear strength tests. These tests are the most widely used tests for the strength of fabrics. For both of the tests, two kinds of samples were considered. One type of the washed fabric samples was of warp. And the other type of the samples was of weft. Five samples from each washed fabric sample were considered for tensile and teat strength tests separately. A mean value for every five samples was taken and considered for the comparison. The lowest strength damage in the weft direction of the fabric, as observed in tensile strength test, is that of Enzyme wash.

MARMARA ÜNİVERSİTESİ YAYINEVİ

# PIEZOELECTRIC CHARACTERISTICS OF MELT EXTRUDED AND POLED POLYPROPYLENE MONOFILAMENTS

D. V. Bayramol[1], N. Soin[2], T. Shah[2], E. Siores[2], R.L. Hadimani[3]

[1]*Department of Textile Engineering, Namik Kemal University, Corlu-Tekirdag, TR*
[2] *Institute for Materials Research and Innovation, University of Bolton, Bolton BL3 5AB, UK*
[3]*Department of Electrical and Computer Engineering, Iowa State University, Ames, IA 50011, USA*
E-mail: dermanvs@gmail.com

## Abstract

There has been an extensive work on energy harvesting using piezoelectric materials. Limitations of crystal and ceramic piezoelectric materials led to a significant increase in the search on polymers to produce light weight, flexible and highly versatile piezoelectric materials. In this paper, the piezoelectric effect in polypropylene filaments is demonstrated. Polypropylene has been subjected to an extension of (5:1), high temperature (and high voltage (15kV) on a modified laboratory scale melt extruder. Mechanical properties (linear density, tensile strength, %elongation etc.) and voltage response of produced piezoelectric filaments were investigated. Furthermore, the microstructure and crystalline structure of un-poled (UP) and poled (P) polypropylene (PP) filaments are analyzed using electron microscopy. The results show that crystalline structure of PP polymer undergoes a phase change during the production process; from non- polar phase to polar phase, so that obtained filaments generate voltage when subjected to an impact.



MARMARA ÜNİVERSİTESİ

# A PIEZO-RESISTIVE APPLICATION IN TEXTILE DESIGN

M.Z. Bilir[1], F. Duran[1, 2], B.H. Gürcüm[3]

[1]*University of Gazi, Ankara, Gölbaşı, Turkey.*
[2]*University of Gazi, Ankara, Beşevler, Turkey.*
[3]*University of Gazi, Ankara, Gölbaşı, Turkey.*
E-mail: mehmetbilir@msn.com

## Abstract

In recent years, smart applications in all fields of the life have been found because of developing science technology. In the textile area, smart textile applications such as wearable computers, heat/pH/chemical sensitive clothings, shape memory fabrics, color change materials and piezoresistive applications have became new steps of inventions. In recent years progresses has been made in the integration of these inventions into clothing. Developments in smart textile focus on sensor systems, so some sensor types have been using in textile clothing design, as well. One of this sensor applications is piezoresistive sensor. Piezoresistive textile application is one of these important developments in smart textile. Piezo is derived from the Greek word piezein, “to squeeze”. Piezoelectric effect was discovered by Pierre Curie and Jacques Curie in 1880. They found that if certain crystals were subjected to mechanical strain, they became electrically polarized and the degree of polarization was proportional to the applied strain. The Curies also discovered that these same materials deformed when they were exposed to an electric field. It was only in the 1950s that the piezoelectric effect started to be used for industrial sensing applications (Novetny M. & Ronkanen P., 2009). In today’s World, piezoelectric applications are in many areas, such as electric cigarette lighters, loud speakers, fire alarms, microbalances and textile applications (pressure sensors etc.).

In this study, we have used a piezo-resistive sensor to size weight on foot with a prototype textile design in shoes. A lot of industrial accidents occur because of overloading, so we are aimed at decreasing overloading accidents with this prototype design. This piezo-resistive textile design works with ardunio, piezo-sensor is so elastic so we can use this sensor with part of shoes. System saves overloadings on foots and send signal to user at the moment of overloading. This system is a prototype so it will be a beginning for future job-shoes design for this aim.

# PROJECTION OF SCIENCES ONTO TEXTILE AND FASHION: NANO-TECHNOLOGY AND CHARGEABLE FABRIC EXAMPLE

Ö. Çobanoğlu, J. Eryilmaz, M. F. Ataşalan, S. Kazanç

*SANKO Tekstil İşletmeleri A.Ş., Bursa, Turkey.*
E-mail: ocobanoglu@isko.com.tr

**Abstract:**

Physico-chemical properties of materials start to deviate from those when they are in bulk form, given the components forming them shrink to smaller sizes. Shrinkage in size, benefiting from higher surface area of materials, or in other words a larger ratio of surface-to-volume, leads to manifestation of some new features which otherwise either do not exist or are there but negligible in bulk. The dimensions at which these new features start to dominate over those in bulk, corresponding fabrication and characterization methods with a vast variety of application techniques are all together considered to form an emerging multi-disciplinary field of nano-science. Application areas of nano-science in technical textiles -at the time of this writing- are widening and keep a significant number of research groups busy world-wide.

When decorated with nano-structures, fibres forming the textile materials -in addition to their conventional qualities- start to exhibit new and innovative features which are not achievable through conventional techniques involved in textile manufacturing. These textile fabrics having new surface features allow producers to apply new production methods to achieve an unprecedented spectrum of material science applications in textile form. Such innovative materials find application areas in technical textiles such as energy harvesting and storage.

It is reported in the literature that fibers forming a textile fabric can be conformally coated with a single atom thick nano-sheets of carbon, called graphene, geometrically isolating the surface of the fibers from their surroundings. Upon graphene coating of fibers, molecules and/or other nano-structures, which normally cannot be bound to conventional textile materials, can then be attached or grown on each of the fibers. Graphene coating does not only function as a substrate for other additives but also makes the fabric electrically conductive. Fabric conductance, coupled with the awailability of growing pseudo-capacitive nano-crystals such as manganese-oxides, suggests that the fabric can function as an electrode material within a suitable electrolyte, forming a charge-able battery in textile form just as good as any other battery.

This proceeding provides readers with an overview of our multidisciplinary approach to technical textile research through reviewing recent preliminary results of an example project aiming at developing super-capacitor fabric structures. The fundamental idea of the project is based on, production of graphene nano-sheets and their application onto textile fabric, growing the oxides of manganese on graphene coating and utilization of the final fabric within a suitable electrolyte as electrode material. Graphene nano-sheet production and characterization methods, application to textile fabric and surface resistance measurements as well as construction of super-capacitor architecture and characterization of the final device capacitance via electro-chemistry are presented.

# PREPARATION OF CHITOSAN/POLYETHYLENE OXIDE BASED NANOFIBROUS WOUND DRESSING MATERIAL (WITH/WITHOUT NANOSILVER) BY ELECTROSPINNING TECHNIQUE

R. Erdem[1], L. Kabasakal[2], M. Akalın[3]

[1]*Textile Technology, Serik Vocational School of Higher Education, Akdeniz University, Antalya, TURKEY*
[2]*Pharmacology Department, Faculty of Pharmacy, Marmara University, Istanbul, TURKEY.*
[3]*Textile Engineering, Technology Faculty, Marmara University, Istanbul, TURKEY*
E-mail: ramazanerdem@akdeniz.edu.tr

## Abstract

Chitosan (CS) [poly-(b-1/4)-2-amino-2-deoxy-D-glucopyranose] is a polycationic biopolymer obtained by partial or full alkaline deacetylation of chitin, which is a sort of polysaccharide structure found in arthropods shells (for example, crabs, shrimps and insects) and cell wall of fungi. Many researchers have defined CS as a satisfactory and suitable material for biomedical applications because of its good biocompatibility, biodegradability, nontoxicity, cell adhesivity, antimicrobial activity, wound healing effect and ability to chelate with metals. Antimicrobial properties of the CS have been mentioned in many studies. Although showing a broad spectrum of antimicrobial activity, CS possesses different inhibition characteristics against different type of fungi, Gram-positive and Gram-negative bacteria. Silver (Ag) has been used as an antimicrobial agent for a long time. Recently Ag nanoparticles have attracted many researchers as a potent antimicrobial agent because of their large surface area which enable them to fight more efficiently against bacterium and microbes. Electrospinning is a term used to describe a class of fiber forming in submicron range by applying electrostatic forces. The process is comprised of several operational components: (i) charging of the fluid, (ii) formation of the cone-jet, (iii) thinning of the instable jet in an electric field and (iv) collection of the jet on a suitable collector. Since it has been found difficult to electrospin CS individually, CS has been mixed with other synthetic or natural polymers. PEO, a water-soluble and aerobically biodegradable thermoplastic polymer, is extensively studied in electrospinning processes for biomedical applications due to its simple usage individually or with other polymers, and its excellent biocompatibility and very low toxicity. In literature, PEO has been electrospun with a range of natural proteins because it is very difficult to electrospin natural proteins individually in terms of obtaining beadless uniform nanofibers.

The purpose of this study is to develop a nanofibrous scaffolds as a potential wound dressing material composed of CS/PEO based nanofibers with AgNPs. The impact of AgNPs on the electrospinning process has also been investigated. Another target of this study is to examine the antimicrobial properties of the various CS/PEO blended (30/70, 70/30, 50/50 (with and without nanosilver)) electrospun nanofibrous scaffolds against Gram-negative bacteria (Escherichia coli) and fungi (Candida albicans). The aim of this study is to explore the cytotoxic characteristics of the electrospun nanofibrous scaffolds and to investigate the healing performance of the scaffolds by the periodic observation of the wound closures on Spraque Dawley (SD) rats.

# INVESTIGATION OF THERMAL AND ELECTRICAL CONDUCTIVITY PROPERTIES OF CARBON BLACK COATED COTTON FABRICS

N. D. Gültekin[1], İ. Usta[2]

[1]*Marmara University, Department of Textile Education, Istanbul, Turkey.*
[2]*Marmara University, Department of Textile Engineering, Istanbul, Turkey.*
E-mail: ndemirel@marmara.edu.tr

## Abstract

The development of nanotechnology has stimulated research on applications of nanosized particles in textile processing. There are different types of applications to employ nanoparticles in textiles. One of the possible application is coating surfaces with the nanoparticles which can be dispersed well in coating solutions. Among the conductive fillers, carbon black has various advantages due to its low density, high surface area, good electrical conductivity, high chemical stability. Carbon black has a significant cost advantage over the highly conductive carbon materials like carbon nanotubes. Carbon black nanoparticles are hydrophobic in nature and tend to aggregate in solutions. Therefore, hydrophilicity and dispersibility of the nanoparticles, which are the key to the nanoparticle coating of fabrics, should be increased. In this study, carbon black nanoparticles were dispersed in distilled water. To improve dispersion stability of water based carbon black coating solutions, anionic wetting and dispersing agent was used. Plain weaved cotton fabrics are dipped into carbon black dispersion for 5 min. Because of the strong absorption, the cotton fabric is quickly coated by the carbon black dispersion. Then, the fabric with carbon black dispersion is subsequently dried in an oven at 120 °C for 10 min to remove water. The dipping-drying process was repeated for 5 times to increase the carbon black loading in cotton fabric. Different carbon black concentrations on coating process were examined. The effect of carbon black loading on thermal and electrical conductivity properties of fabrics were investigated.

MARMARA ÜNİVERSİTESİ YAYINEVİ

# PREPARATION OF NANOCOMPOSITE FIBRES BASED ON CELLULOSE AND GRAPHENE NANOPLATELETS USING IONIC LIQUIDS

S. Mahmoudian[1], M. Imran[2], M. R. Sazegar[3]

[1]*Department of Textile Engineering, Kashan Branch, Islamic Azad University, Kashan, Iran*
[2]*Department of Chemical Engineering, College of Engineering, King Saud University, Riyadh, Saudi Arabia*
[3]*Ibnu Sina Institute for Fundamental Science Studies, Faculty of Science, Universiti Teknologi Malaysia (UTM), Malaysia*
E-mail: shmahmoudian2@gmail.com

## Abstract

Nanocomposite fiber materials with nano-scale reinforcements are believed to have strong potential to widen fibers application. Graphene, a single layer of carbon atoms in a hexagonal lattice, has recently attracted great attention due to its unique mechanical, thermal and electrical properties. The high aspect ratio and unique surface features of graphene resulted in significant improvements of the nanocomposites properties. In this study, nanocomposite fibers made of cellulose and graphene nanoplatelets were wet spun from solution by using ionic liquid, 1-ethyl-3-methylimidazolium acetate (EMIMAc) as solvent. The effect of graphene loading on the thermal and electrical properties of the nanocomposite fibers was investigated. The nanocomposite fibers characterized by X-ray diffraction (XRD) and scanning electron microscopy (SEM) analysis. XRD analysis revealed a cellulose II crystalline structure for regenerated cellulose and the nanocomposite fibers. SEM images showed a homogenous morphology and round cross section for the nanocomposite fibers along with well dispersion of graphene nanoplatelets in regenerated cellulose matrix. The incorporation of graphene into cellulose matrix generated electrical conductivity. At 6 wt. % of graphene, the electrical conductivity was 2.9 × 10-4 S/cm. The nanocomposite fibers also showed considerable improvements in thermal stability and char yield compared to pure regenerated cellulose fibers. This work provides a facile and environmentally friendly method of preparing nanocomposite fibers based on cellulose and graphene nanoplatelets that can find several applications in cellulose-based carbon fibers, conductive fibers, apparel, etc.



MARMARA ÜNİVERSİTESİ

# EFFECTS OF SURFACTANT TYPE ON POLY (ACRYLONITRILE-CO-METHYLACRYLATE) LATEX SYNTHESIZES

F.Z. Engin Sagirli[1], C.Unsal[1], A.S.Sarac[2,3] , E.S.Kayali[4]

[1]*Department of Textile Engineering, Faculty of Textile Technology and Design, Istanbul Technical University, Turkey*
[2]*Department of Chemistry, Polymer Science and Engineering, Istanbul Technical University, Turkey*
[3]*Nanoscience & Nanoengineering, Istanbul Technical University, Turkey*
[4]*Department of Metallurgical and Materials Engineering, Faculty of Chemical and Metallurgical Engineering, Istanbul Technical University, Turkey*
E-mail: fzengin@itu.edu.tr

## Abstract

Emulsion polymerization refers to a unique process employed for some radical chain polymerizations. It involves the polymerization of monomers in the form of emulsions. Polymerization is propagated in micelles, which are stable structures of stabilizer that surround monomer, usually in a water continuous phase. So the particles are stopped from coagulating with each other. The physical state of the emulsion system makes it easy to control the process. There are several processes of the emulsion polymerization. Micro emulsion technique allows particles to transfer into spherical aggregates through the surfactant template. So firstly monomers dispersed in the aqueous surfactant solution by stirring vigorously which is important for micro emulsion polymerisation.

Surfactant was used in this process for creation of a micro-reactor vessel via micelle formation, where monomer is restricted in a localized environment originated from encapsulation by the surfactant. Also surfactant was used to improve the physical properties of polymers such as conductivity, stability, solubility in solvents and processability. So surfactant type affected copolymer's properties. SDS and SDBS have an important place among the surfactants because of their low price and commercial advantages.

Acrylonitrile (AN) copolymers have found great interest for the different high-performance products application purposes. Acrylic fibers consist of AN as a main monomer (minimum 85% as weight percentage) and typical comonomers such as methyl acrylate . AN copolymers were used as fibers, thin films and composites in conventional and technical textiles, polymer electrolytes and batteries.

In this study Poly (acrylonitrile-co-methylacrylate) [P(AN-co-MA)] latex were synthesized by in-situ emulsion polymerization in the presence of non-corrosive surfactants by using ammonium per sulphate in the aqueous medium. Two type of surfactants (SDBS and SDS ) used for investigation of surfactant effect on yield and polymerization process. After polymerisation, characterization of copolymers were performed by FTIR-ATR and Uv vis Spectrophotometric measurements. The results showed that best yield was obtained with SDBS.

MARMARA ÜNİVERSİTESİ YAYINEVİ

# STRIPPING OF REACTIVE DYES FROM WASTE COTTON FABRICS FOR REUSE THROUGH FIBRE REGENERATION PROCESS

P. Bigambo[1], C. Carr[1], M. Sumner[1], M. Rigout[2]

[1]*University of Leeds, Leeds, LS2 9JT, UK.*
[2]*University of Manchester, Manchester, M13 9PL, UK.*
E-mail: sdpb@leeds.ac.uk

## Abstract

In recent years, interests have been raised to recycle and reuse waste fabrics after they have reached their end of life. However, the presence of dye molecules attached onto the waste fabrics may impair not only the processability of the waste fabrics but also the properties of the final products. For instance, the presence of colors on the recycled material may affect the final color of the produced material as it may resist the future dye application on the material.

In this study, hydrolysis, reduction and oxidation were evaluated as potential reactions for delivering cheap and efficient color removal from dyed cotton fabrics. Sequential and combined reduction treatments with sodium dithionite and sodium hydroxide were examined as well as pre-formulated reducing agent obtained from BASF. Dye removal was also evaluated in acid and alkali hydrolysis with subsequent bleaching. Color removed were monitored visually and instrumentally where the color strength, K/S, and lightness, L* values of undyed fabric, untreated dyed fabric and stripped fabrics were compared. The efficiency of the dye removal was determined with a view to maximum color removed.

Three reactive dyes based on azo and anthraquinone chromophores (Reactive Black 5 (RB5), Reactive Red 228 (RR228) and Reactive Blue 19 (RBL19)) were investigated. Results indicated that post-bleaching of reactive dyed fabrics, stripped with acid and alkali solutions effectively removed most of the dye with the color strength, K/S and the lightness, L* values of the stripped dyed material approaching that of undyed fabric.



MARMARA ÜNİVERSİTESİ

# EFFECT OF THE SEQUESTERING AGENTS ON THE LIGHT FASTNESS OF THE REACTIVE DYES

W. H. Solangi[1], Z. A. Noonari[1], A. H. Memon[2], M. Q. Khan[3], A. A. Channa[4]

[1]*Pak-Korea Garment Technology Institute, Karachi Pakistan*
[2] *Enviroment Engg. & Management Institute MUET Jamshoro, Pakistan*
[3] *NTU-SFDAC Karachi Pakistan*
[4]*Pak-Korea Garment Technology Institute, Karachi Pakistan*
E-mail: wazeertextilian@hotmail.com

**Abstract**

One of the characteristic of sequestering agent is to reduce the hardness of water in order to make it fit for the use of in textile processing. Some of the sequestering agents have slightly adverse effect on the light fastness of reactive dyes; keeping in view this statement it is recommended that E.D.T.A and Sodium Hexa Meta phosphate may be widely used where there is non-availability of soft water which gives excellent results in pre-treatment and dyeing. Using the E.D.T.A and Sodium hexa Meta phosphate with different concentration with Reactive dyes (i.e. Cibacron), the effect on light fastness has been observed which is recorded through research work by plotting the graphs and making tables.

# INVESTIGATION OF POLYPYRROLE COATED COTTON FABRICS AS ELECTROMAGNETIC SHIELDING MATERIAL

Z. Yildiz[1], I. Usta[2], A. Gungor[3], H. A. Onen[4]

[1]*Istanbul Technical University, Institute of Sciences and Technology, Department of Polymer Science and Technology, Istanbul, TURKEY.*
[2]*Marmara University, Faculty of Technology, Department of Textile Engineering, Istanbul, TURKEY.*
[3]*Marmara University, Faculty of Arts and Sciences, Department of Chemistry, Istanbul, TURKEY.*
[4]*Istanbul Technical University, Faculty of Arts and Sciences, Department of Chemistry, Istanbul, TURKEY.*
E-mail: zehra.yildiz@marmara.edu.tr

## Abstract

Conductive polymers have superior properties such as low cost, ease of synthesis, flexibility and applicability in so many fields such as light-emitting diodes, electrochromic and electromagnetic shielding materials, anti-static coatings, sensors etc. Textile fabrics inherently behave as an insulator but can be rendered conductive by various methods such as conductive polymer deposition, conductive particle addition. Recently, conductive polymer coatings have been applied on various textile substrates such as polyester, cotton, wool fabrics etc. This study was aimed to obtain conductive cotton fabric surfaces by chemical oxidative polymerization of pyrrole monomer. For this purpose, iron (III) chloride was used as oxidant, and an aliphatic polyether with acidic groups was used as anionic surfactant respectively. Polypyrrole formation on cotton fabric surface was proved by Fourier transform infrared (FTIR) analysis. The obtained polypyrrole coated cotton fabric samples have been evaluated in terms of electromagnetic shielding effectiveness (EMSE) and electrical conductivity. Results showed that polypyrrole coated cotton fabrics have showed about 25 dB EMSE value in 0-3 GHz frequency range.

# INVESTIGATION OF THE EFFECT OF THE DYEING METHOD ON WOOL FABRICS DYED WITH NATURAL DYES EXTRACTED FROM VACCINIUM CORYMBOSUM L.

E. D. Kocak[1], M. Kilinc[2], S.Canbolat[2], H.Dayioglu[2], N.Merdan[2], F.Akin[3]

[1]*Marmara University, Faculty of Technology, Department of Textile Engineering, Istanbul/Turkey*
[2]*Istanbul Commercial University, Faculty of Design and Engineering, Department of Fashion and Textile, Istanbul/Turkey*
[3]*Abant Izzet Baysal University, Vocational High School*, Bolu, Turkey
E-mail: mkilinc@ticaret.edu.tr

## Abstract

In this investigation, wool fabrics were dyed with the natural dyes extracted from blueberry Vaccınıum Corymbosum L. via conventional, ultrasonic and microwave method. Before the dyeing process, some of the samples were applied oxygen plasma pre-treatment; the other sample was mordanted with aluminum potassium sulphate. The dyeing methods were evaluated in terms of color and fastness properties. The fastness results demonstrated that the mordanting caused to increase in the fastness properties. The results of measurements of color strength demonstrate that the samples with the best color strength were obtained in accordance with conventional and ultrasonic dyeing methods. Furthermore, plasma and microwave treatment applied wool has got better light fastness then the others. Microwave and plasma application increase the light fastness of wool fabric. Likewise, it has been demonstrated that the processes are not much effective on the staining fastness of the dyeing too. Pursuant to the washing fastness of the dyeing extracted from blueberry in terms of color change, the desired values of color changes could be achieved by using different mordents.

MARMARA ÜNİVERSİTESİ YAYINEVİ

# DETERMINATION OF ANTIMICROBIAL ACTIVITY OF THE DYED SILK FABRICS WITH SOME NATURAL DYES

R. Alkan[1], E. Torgan[2], C. Aydın[2], R. Karadag[2,3]

*[1]Kocaeli University, Kosekoy M.Y.O., Microbiology Laboratory, 41135 Kocaeli-Turkey.*
*[2]TCF-Armaggan, Cultural Heritage Preservation and Natural Dyes Laboratory, 34775 Umraniye-Istanbul-Turkey.*
*[3]Marmara University, Faculty of Fine Arts, Natural Dyes Laboratory, 34718 Kadıkoy-Istanbul-Turkey.*
E-mail: torganemine@gmail.com

## Abstract

In the past, indigo and yellow dye plants were used for green color dyeing. Indigo (Indigofera tinctoria L.), weld (Reseda luteola L.) and gall oak (Quercus infectoria Olivier) dye plants are selected for this study. Some of coloring compounds in the used plants are antibacterial and antimicrobial activity. In this study, silk fabric is dyed with natural indigo. Dyed silk fabric with natural indigo was cut in the 20x20 cm2 size. Excluding a fabric, all fabrics were mordanted in the same percentage with alum metal. Then, silk fabrics for green color dyeing are dyed separately with weld (Reseda luteola), gall oak (Quercus infectoria) and together weld (Reseda luteola) and gall oak (Quercus infectoria) in different percentage. Antibacterial and antimicrobial functionality of the twenty seven silk fabrics are established. Tests were conducted against the Staphylococcus aureus ATCC 6538. Antimicrobial testing was carried out by using the quantitative test method. The results of the counting test showed more reduction of survival Staphylococcus aureus in dark-colored fabric. Staphylococcus aureus were grown in nutrient broth medium for 24 hr at 37 ±1 0C. The fabric specimens (4.80±0.1 cm) were placed in container and sterilized for 15 min at 121 0C. An aliquot of 1000µl bacterial suspensions were added to the center of a 4.80±0.1 cm fabric and incubated for 24 hr at 37 ±1 0C. The fabric were resuspended in dilution medium. Ten fold serial dilutions were made to samples and each dilution was plated nutrient agar plates were incubated for 24 hr at 37 ±10C. Bacterial colonies were enumerated. The number of survival microorganism was determined by counting the colonies as colony-forming unit (CFU/ml) and reduction rate of bacteria was calculated. Coloring compounds and their percentage in the natural dyed silk fabrics are detected by HPLC-PDA (high pressure liquid chromatography with diode array detection). According to the analyses results, the best dyeing recipes for antibacterial and antimicrobial activity are determined.



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MARMARA ÜNİVERSİTESİ

# THE EFFECTS OF DOPANT AND SOLVENT ON MORPHOLOGY, CONDUCTIVITY AND MECHANICAL PROPERTIES OF POLYACRYLONITRILE (PAN) / POLYANILINE (PANI) COMPOSITE NANOFIBERS

N. Kizildag[1], N. Ucar[1], N. Demirsoy[2], E. Sezer[2], B. Ustamehmetoğlu[2], O. Eren[2], A. Onen[2], İ. Karacan[3], S. Guner[4]

[1]*Istanbul Technical University, Department of Textile Engineering, Istanbul, Turkey.*
[2]*Istanbul Technical University, Department of Chemistry, Istanbul, Turkey.*
[3]*Erciyes University, Department of Textile Engineering, Kayseri, Turkey.*
[4]*Istanbul Technical University, Department of Chemical Engineering, Turkey.*
E-mail: kizildagn@itu.edu.tr

## Abstract

Inherently conductive polymers (ICP) such as doped polyacetylene, polyaniline and polythiophene, which offer a special combination of properties (processability, electrical conductivity), have drawn great attention since 1970s. Among all conducting polymers, polyaniline (PANi) is the most intensively investigated due to its high environmental stability, low cost of raw material, ease of synthesis and good compatibility with other polymer supports and its wide application potential such as sensors, energy device etc. The conductive emeraldine salt (ES) form of polyaniline is obtained by adding protons into the insulating emeraldine base (EB) form through treatment with an acid (dopant). The type of the acid (dopant), and the solvent used, have important effects on the conductivity of the polyanilines since the interactions between the dopant, solvent and the polymer define the charge transport properties. Besides, the homogeneous distribution of doped polyaniline becomes important when it is used in polymer composites. When a literature survey is conducted, no studies related with the effects of different dopants, different solvents, different types of mixing processes (dispersion of PANi in the polymer matrix) on the morphology, conductivity and mechanical properties of PAN/PANi composite nanofibers were seen. Thus, in this study, the effects of different dopants such as camphorsulphonic acid (CSA), dodecylbenzene sulphonic acid sodium salt (DBSANa), different solvents such as N,N'-dimethylformamide (DMF), and dimethyl sulfoxide (DMSO) and different mixing processes such as magnetic mixing and mechanical mixing on the morphology, conductivity and mechanical properties of PAN/PANi composite nanofibers are investigated. It has been seen that composite nanofibers had the smallest fiber diameter, lowest conductivity and lowest mechanical properties when CSA(dopant) and DMF(solvet) are used. However, the composite nanofibers in which the polyaniline is doped with CSA in DMSO(solvent) had better conductivity and mechanical properties, besides having thicker diameters. When the mixing effects compared, mechanical mixing process resulted in higher mechanical properties of nanofibers compared to magnetic mixing process, while there was not much difference between fiber diameter and conductivity values.



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# GENERALIZED GEOMETRIC MODELING OF 3D ORTHOGONAL WOVEN PREFORMS: THE RECTANGULAR CROSS SECTION CASE

M. E. İnce[1], A. F. M. Seyam[2], M. H. Mohamed[2]

[1]*Gaziantep University, Textile Engineering Department, Gaziantep, P.K. 27310, Turkey.*
[2]*North Carolina State University, College of Textiles, Raleigh, 27695, US.*
E-mail: einceg@gantep.edu.tr

## Abstract

Due to the presence of through-the-thickness (z-) yarn, 3D woven composites outperform two-dimensional (2D) layered woven composites in terms of out-of-plane loads, impact, interlaminar shear, bending, and damage tolerance properties. Manufacturing efficiency and mechanical performance of 3D orthogonal woven fabric reinforced composite are affected by geometry and relative content of constituent yarns. Literature review revealed that geometric models for 3D orthogonal woven preforms are limited to jammed plain weave. The aim of this study is to develop a generalized model for non-jammed and jammed 3D orthogonal woven preforms for rectangular yarn case predicting fiber volume fraction (FVF) of structure constituents, preform thickness, preform areal density, and minimum thread spacing (x- and y-yarn spacing that achieve jammed construction) in terms of weave factor, number of layers, and constituents' variables (yarn arrangement, linear densities, packing factor, and fiber volumetric density). Numerical results are presented to demonstrate the influence of weave factor, z-yarn linear density, and number of y-yarn layers on preform thickness, areal density, constituents' FVF, and total FVF. The results indicate that the model is very effective tool that can be utilized to design preforms with predetermined analytical parameters that influence the final composites' performance characteristics.

# THE NEW PROTOTYPE THAT THERMAL CONDUCTIVITY MEASUREMENT WITH SENSORS

M. O. Gök[1], B. H. Gürcüm[2]

[1]*Gazi University, Faculty of Art and Design, Department of Textile Design, Gölbaşı Campus, Ankara, Turkey.*
[2]*Gazi University, Faculty of Art and Design, Department of Textile Design, Gölbaşı Campus, Ankara, Turkey.*
E-mail: tekstil1453@gmail.com

## Abstract

Recently, a wide of textile materials has been used as thermal insulators in many industrial applications. The thermal insulating properties of textile fabrics depend on especially their thermal conductivity characteristics. Thermal conductivity can be measured with various gadgets. Its principle is measurement of temperature changing. In this study, the temperature variation through the selected fabrics is measured with the maked prototype. Here, we used sensors for observing the thermal changing. The temperature was fixed at certain degree. With the increasing of temperature, the changing was viewed on the monitor. The results are converted to appropriate value with equality and compared with the real value (accredited results). The temperature variation through the selected fabrics is measured under different operating parameters such as densities and inlet temperature. Some factors can affect the results like humidity, temperature of the working environment, the type of conductive material, etc. As a result of this study, fabric thickness has a significant effect on the fabric temperature variations. Further research is being conducted in this direction.

# THERMAL AND MECHANICAL PROPERTIES OF WOVEN BASALT FABRIC REINFORCED HYBRID & NON-HYBRID COMPOSITES

H. Jamshaid, R. Mishra

*Technical University of Liberec, Faculty of Textile Engineering, Department of Material Engineering, Liberec, Czech Republic*
E-mail: hrntu@hotmail.com

## Abstract

In this study, experimental investigations are carried out to check the thermal and mechanical behavior of woven Basalt/PP and Basalt /Jute fiber hybrid woven and non hybrid woven fabric and their epoxy laminates. Three types of weaves are used for both hybrid and non hybrid structures. Tensile testing of all the woven fabrics is carried out. The thermal properties of the fabrics, i.e thermal resistance, diffusivity & thermal conductivity etc. are also studied vis-a-vis physiological behavior. In this paper ALAMBETA, PERMETEST and Air permeability tester are used, which provide reliable non-destructive measurement of thermal conductivity, thermal resistance, water vapor permeability and air permeability of fabric. Results are discussed in terms of fiber effect, woven geometry and the resin effect. Fabricated composite samples subjected to mechanical properties like tensile strength, Flexural strength and Impact strength test of all the samples are measured by using Universal testing machine and Impact testing machine. The thermo physiological properties are also studied.

# A NOVEL METHOD TO PRODUCE HYDROPHOBIC SURFACE: INORGANIC MATERIAL DOPED STABILIZED-PAN NANOFIBER

R. Simsek[1], M. Erol[2], M. Calisir[2], A. Kilic[2]

[1]*Marmara University, Faculty of Technology, Department of Textile Engineering, Istanbul, Kadıkoy, 34722, Turkey.*
[2]*TEMAG Labs, Istanbul Technical University, Istanbul, Beyoglu, 34437, Turkey.*
E-mail: ramazan.simsek@marmara.edu.tr

## Abstract

Hydrophobicity and hydrophilicity are important properties of a textile material. Wettability of textile material has so much attraction due to imparting unique properties and advantages for many applications. Well known studies on lotus and rice leaf provided a pathway for various application, such as “self-cleaning, snow sticking, erosion, anti-fogging and even current conduction”. In this regard, obtaining hydrophobic surface with a contact angle (CA) larger than 150° and a sliding angle (SA) less than 10° is the main propose by inhibiting water surface interaction. The authors of most of the recent studies have proposed that wettability has intimate relation with the chemical structure and architecture on surface that water molecules have interactions. Chemical structure plays an important role on the surface free energy. However, reducing surface free energy has influence on wettability to some extent. The surface topographic structure should contribute to inhibit the interaction between water and surface to be able to obtain super hydrophobic surface.

In this study, we proposed a novel and facile method that polyacrylonitrile (PAN) nanofiber mats was electrospun with doping of ZnO and CeO2 in varying amount. Additionally, stabilization of PAN nanofibers was performed via thermal treatment. Contact Angle measurements showed that as-spun PAN nanofiber shows super-hydrophilic character while stabilized PAN nanofiber surface has hydrophobic surface. Changing on Wettability character is attributed to modification of chemical structure and surface topology due to doping with inorganic materials and thermal treatment.

# EFFECT OF SURFACE TREATMENTS ON TENSILE AND CHARPY IMPACT STRENGTH PROPERTIES OF COTTON-VISCOSE WASTE FIBER REINFORCED POLYMER COMPOSITES

S.İ. Mıstık[1], M. Kayar[2]

[1]*Marmara University Faculty of Technology Department of Textile Engineering, Kadikoy, Istanbul, Turkey,*
[2]*Marmara University Faculty of Technical Education Department of Textile Studies, Kadikoy, Istanbul, Turkey*
E-mail: imistik@marmara.edu.tr

## Abstract

Assortment is very important and sensitive process for the ready-made garment production sector however tons of fabrics are wasted during the garment production every year. Generally waste fabrics are collected and sent to the waste fiber production companies to get waste fiber to be used for the insulation and decoration purposes.

In this study, ready-made garment waste cotton and viscose fibers were used. Waste fabrics were collected from garment production companies. And these fabrics were processed by Punteks and transformed into fiber form. Then surface treatment process was applied to ready-made garment waste cotton fiber by using NaOH, acetic and formic acid then mixed with ready-made garment waste viscose fibers. Finally polymer composites were produced from these treated cotton/viscose blend by using thermoset polyester resin as matrix. Waste fiber reinforced polyester composite structures were produced by using vacuum infusion method. Tensile strength and charpy impact strength properties of treated waste cotton/viscose fiber blend reinforced thermoset polyester composites were investigated. Higher tensile and charpy impact strength results were obtained from formic acid treated cotton - viscose waste fiber reinforced composites.

MARMARA ÜNİVERSİTESİ YAYINEVİ

# INVESTIGATION OF THE MECHANICAL AND ELECTRICAL PROPERTIES OF POLYESTER YARNS DOPED BARIUM TITANATE

Y. Ulcay1, R. Tural[1], S. Eren[2]

[1]*University of Uludag, Görükle, Bursa, 16059, Turkey.*
[2]*University of Uludag, Orhangazi, Bursa, 16810, Turkey.*
E-mail: rumeysa@uludag.edu.tr

## Abstract

In this study, fully drawn polyester yarns doped barium titanate were produced with core and sheat bicomponent fiber production technique. Bicomponent fibers can be defined as extruding two polymers from the same spinneret with both polymers contained within the same filament. Using bicomponent technique, we aimed to durability of electrical conductivity. Barium titanate is the first ferro electric ceramics. Due to its excellent dielectric, ferroelectric and piezoelectric properties, it is used different applications. Barium titanate is a member of a large family of compounds with the general formula ABO3 called perovskites. Barium titanate can be found in different forms. Cubic form of barium titanate was used in the study. Its particle size is 100 nanometers.

Spinboy bicomponent machine was used in production. At core section, three different ratios of barium titanate masterbatch and at sheath section polyester polymer were used. When mechanical properties of bicomponent yarns were investigated, yarn strength has decreased by %97. Elongation did not change. But, when doped yarns were compared between each other yarn strength did not change. It was confirmed with statistical analyze. Yarn unevenness increased by 87% with the raising of dope ratio. It was confirmed with statistical analyze.

Conductivity depends on the number and movement of charges in a material. In electrical conductivity measurements, two probe and four probe techniques are used. In our study four probe techniques was used. Conductivity of the yarns increased by 83% and electrical resistance decreased by 85% with the raising of dope ratio. Bicomponent yarns showed semi-conductive property.



MARMARA ÜNİVERSİTESİ

MARMARA ÜNİVERSİTESİ YAYINEVİ

# INVESTIGATION OF THERMAL PROPERTIES OF POLYACRYLONITRILE (PAN) NANOFIBERS CONTAINING ZEOLITE NANOPARTICLES

N. D. Gültekin[1], N. Uçar[2]

[1]*Marmara University, Department of Textile Education, Istanbul, Turkey.*
[2]*İstanbul Technical University, Department of Textile Engineering, Istanbul, Turkey.*
E-mail: ndemirel@marmara.edu.tr

## Abstract

Among the various technologies available for the production of fibers, the electrospinning method has been widely used for the preparation of functional nanofibers. There are various fields of applications of PAN based fibers such as high performance textiles, solar cells, fuel cells, and filtration. Zeolites are a family of inorganic, crystalline materials. Zeolite has a three-dimensional structure and is made of aluminosilicates. Also, zeolite is cost effective and is not toxic for humans. Zeolites are important for applications such as catalysis, hydrogen storage, and heat pumps. In this study, polyacrylonitrile (PAN) nanofibers containing zeolite nanoparticles were produced with electrospinning method. PAN polymer solution concentration was fixed at 12 wt% and zeolite nanoparticle concentration was varied. Electrospinning solutions were prepared with zeolite nanoparticles concentrations of 0, 1, 3 and 10 % of the mass of the PAN polymer. The effect of zeolite nanoparticle concentration on thermal and morphological properties of nanofibers was studied by thermal camera analysis system, thermal conductivity device and SEM micrographs, respectively.



MARMARA ÜNİVERSİTESİ

# THE EFFECTS OF PHYSICAL PROPERTIES OF WOOLEN FABRICS ON THERMAL COMFORT

E. Akcagun[1], V. Dal[2], N. O. Ceviz[3], Z. Yildiz[4]

[1]*Mimar Sinan Fine Arts University / Vocational School / Istanbul / Turkey,*
[2]*Marmara University, Faculty of Technology, Department of Textile Engineering, Istanbul, TURKEY.*
[3]*Marmara University / Vocational School of Technical Sciences, Istanbul, TURKEY.*
[4]*Istanbul Technical University, Institute of Sciences and Technology, Department of Polymer Science and Technology, Istanbul, TURKEY.*
E-mail: engin.akcagun@msgsu.edu.tr

## Abstract

In literature a number of studies have been made dealing the effects of physical properties on thermal comfort. For instance, six types of knitted fabrics for sportswear in different compositions have been investigated in terms of water vapour permeability, moisture regain, air and thermal permeability. It was found that there is a correlation between water vapour permeability and porosity, fabric thickness. In another study, thermal properties of surgical clothing having various fabric compositions have been investigated. They found that material selection such as polyester, cotton, lamination added fabrics are an issue affecting thermal insulation and air permeability values respectively. This study was aimed to research thermal comfort properties of woolen fabrics based on their physical properties. For this purpose woolen fabrics that are commercially mostly used in men's wear were chosen. Then thermal comfort properties of these fabrics were measured. Three types of woolen fabrics with different weaving structures, warp/weft densities, and thicknesses were used for experiments the effects of physical properties on water vapour permeability and thermal resistance have been investigated. Results proved that water vapour permeability value increases with increasing weight and fabric thickness.

MARMARA ÜNİVERSİTESİ YAYINEVİ

# AN EXPLORATORY STUDY ON THE EFFECTS OF CONSUMER DEMOGRAPHICS ON PURCHASE INTENTION: SMART T-SHIRT PRODUCT FOR TURKISH MEN

M. Akalın[1], G. Turhan[2]

[1] *Marmara University, Technology Faculty, Istanbul, 34722, Turkey.*
[2] *Marmara University, Technical Faculty, Istanbul, 34722, Turkey*
E-mail: gturhan@marmara.edu.tr

## Abstract

This study attempts to gain knowledge about purchase intention in terms of demographic traits of Turkish men who are potential users for a smart t-shirt product. The demographics to be examined are respondents' age, marital status, operating state, monthly household income, and education level. Age is separated into three groups: (I) 14 - 17 years, (II) 18 - 25 years and, (III) 26 – 63 years. Marital status is expressed in two ways as either married or single. Operation state refers to whether or not to have a job. Monthly household income is composed of five categories as following: (I) £ 526 and below, (II) £ 527 – £ 877, (III) £ 878 – £ 1228, (IV) £ 1229 – £ 1579 and (V) £ 1580 and above. Education level is described by four levels: (I) Elementary school, (II) High school, (III) Bachelor's degree, and (IV) Master's or PhD degree. Data were collected from a total of 707 respondents who are resident in Istanbul. In IBM SPSS Statistics 20, Independent t-test and one way ANOVA were applied to explore the effects of demographics on purchase intention. The results from the tests indicated that men's purchase intention of smart t-shirt is not affected by their demographic traits. This finding that the variance of purchase intention for potential smart t-shirt users is not depending upon the change in the aforementioned demographics is significant for marketers and scholars. Apparently, differences in men's intention of buying this product are not due to having diverse demographics.



MARMARA ÜNİVERSİTESİ

# SUSTAINABLE TEXTILES AND LIFE-CYCLE PROCESSES IN INFANT CLOTHING

D. T. Cebeci

*Marmara University , Technical Sciences Vocational School of Higher Education, Göztepe Campus, 34722, Kadıköy , Istanbul, Turkey.*
E-mail: dilektum@marmara.edu.tr

## Abstract

This work mainly discusses the relation between sustainability and (sustainable) product design. It particularly emphasizes on the product life cycles making a comprehensive assessment of them in textile products. The processes associated with the product life cycles are discussed in detail. To illustrate these concepts as an application, infant clothing is closely examined. Life-cycle processes in the infant textile production are presented.

MARMARA ÜNİVERSİTESİ YAYINEVİ

# 'EMPATHEAR' - A WEARABLE TECHNOLOGY SCARF SIMULATING AUDITORY HALLUCINATIONS TO AFFECT EMPATHY IN SIBLINGS OF VOICE HEARERS

S. Mokhtar[1], E. R. Ramirez[2]

*1School of Design, Victoria University of Wellington, Wellington, New Zealand.*
*2School of Design, Victoria University of Wellington, Wellington, New Zealand.*
E-mail: mochaccane@gmail.com

## Abstract

This design case presents the process to develop Empathear, a system that simulates the experience of “hearing voices”. Hearing voices can be a symptom of mental illness such as schizophrenia. The voices can affect greatly the life of voice hearers. Empathear aims to show family members, primarily siblings, a part of the experience their loved ones live every day, with the goal of creating the conditions for empathy. Empathear consists of a wearable device that registers environmental noise and wirelessly plays voices that react to the environment through subtle earphones. The wearable device, manifested as a 'scarf', is an interactive physical garment expressing the importance of celebrating sibling bond. Wearable technology fashion is an up and coming way for technology to integrate itself into the wearer’s everyday living. It was this ideal of integration of electronics and fabrics that persuaded the development of Empathear towards wearable technology. This research poses that, using the opportunity to reveal beauty and creating pride around wearing such a garment, we can avoid extreme personal distress. An App was developed with the same capabilities as the scarf. Initial testing with families of people with schizophrenia and assessments by the Supporting Families in Mental Illness Organization New Zealand, who have brought the Empathear 'Scarf' and App, indicate that Empathear can be a helpful tool for creating a better understanding of hearing voices.



MARMARA ÜNİVERSİTESİ

# A STUDY ABOUT THERMAL AND MECHANICAL CHARACTERISTICS OF THE MEDICAL TEXTILE MATERIAL DESIGNED FOR PROVIDING PERISTALTIC MOTION

S. Guney[1], I. Üçgül[1], A. Koyun[2]

[1]*Süleyman Demirel University, Department of Textile Engineering, Isparta, Turkey.*
[2]*Süleyman Demirel University, Department of Computer Engineering, Isparta, Turkey.*
E-mail: sertacguney@sdu.edu.tr

## Abstract

A large number of materials are continuously being developed to meet the requirements for different engineering applications including biomedical area. However, development of a material in this field is a challenging issue especially for those devices that are implanted in the human body, because the material must fulfill an array of fundamental biological and mechanical requirements. Biomedical applications require careful attention as a result of ageing population worldwide, large number of injuries and the demand for higher quality of life. A wide range of materials including metals, alloys, ceramics, polymers and composites are currently used in this area, but unfortunately, some have shown tendencies to cause device failure after long term use in the body since they cannot fulfill some vital requirements. Developing or applying an optimal material, therefore, can cause the implant to last longer and to avoid the huge cost related to the inappropriate or unsuitable choice of materials. Shape memory alloys (SMA) have provided new insights into biomedical area for cardiovascular, orthopedic and dental applications, and for making advanced surgical instruments.

Until recently, Shape Memory Alloys (SMAs) were predominantly developed for applications in the biomedical and engineering industry, and only a limited number of applications in textiles are known. The biomedical success of these materials is due to their unusual properties, which makes them superior to conventional materials. Among many SMAs, NiTi alloy is considered to be the best because of its superb characteristics. This study aimed to design a medical textile material that could be used around internal organs to support in case of inability of peristaltic motion. NİTİ alloys were embedded in textile structure to simulate the peristaltic motion. Three types of knit prototypes were produced and controlled by electronic system. Their thermal and mechanical characteristics were assessed and compared.

MARMARA ÜNİVERSİTESİ YAYINEVİ

# GELLING FIBERS FROM ALGINATE

Y. Qin

*Jiaxing College, Material and Textile Engineering, China.*
E-mail: yiminqin1965@126.com

## Abstract

Traditionally wound dressings are often made of cellulosic fibers such as cotton and viscose rayon fibers in the form of woven or nonwoven gauzes. These dressings can be highly absorbent but since the fiber structure is chemically, physically and biomedically inert to the wound healing environment, the fibers remain integral during the course of the treatment. Upon healing of the wound, the dressing and fibers can be stuck with the dry escar, and dressing removal sometimes becomes painful and traumatic. In recent years, alginate fibers have been used to make high tech fibers for biomedical applications. When made into wound dressings, these natural polysaccharide based high tech products can provide an ideal environment for wound healing because of the high absorbency, good biocompatibility and gel forming characteristics of the fibers.2009).



MARMARA ÜNİVERSİTESİ

# DISPOSABLE MASK DESIGN FOR ODOR POLLUTION IN THE WORK ENVIRONMENT

A.M. Sariişik, G.E. Kartal

*Dokuz Eylül University, Faculty of Engineering Department of Textile Engineering, İzmir, Turkey.*
E-mail: gulsah.kartal@deu.edu.tr

## Abstract

Ambient scent is very important for work environment. Scent is so important is due to the vital function of our breathing. People working in a fragrant environment can work much more efficiently. In odor pollution environments, the work desire of employees leads to decrease markedly. Many companies do have a scent machine. But due to the intensity of the work, companies are not paying attention to this issue. Therefore, 30% of the machines are not being used effectively. Odor pollution masks have become preferable by those working in such areas. In this study, we determine the discomfort due to bad smell and we have designed a mask in order to reduce inefficiencies. For this purpose liposome microcapsules encapsulating agents have been produced and limonene material was capsulated. These capsules were transferred to nonwoven masks with the polyurethane binder and impregnation process. Finally, to assess the capsules, the particle size analysis, FTIR, SEM and TGA analyzes were performed. Results show that, limonene encapsulated liposome microcapsules are bounded by chemical bonds to the disposable nonwoven masks.

MARMARA ÜNİVERSİTESİ YAYINEVİ

# AUXETIC STRUCTURES FOR TECHNICAL TEXTILE APPLICATIONS

M. Uzun[1,3], D. V. Bayramol[2], M. Akdere[3]

[1]*Department of Textile Education, Marmara University, Goztepe, Istanbul 34722, Turkey*
[2]*Department of Textile Engineering, Namık Kemal University, Çorlu, Tekirdağ 59860, Turkey*
[3]*Institut für Textiltechnik (ITA) of the RWTH Aachen University, Germany*
E-mail: m.uzun@marmara.edu.tr

## Abstract

Auxetic materials present an extraordinary behavior due to having a negative Poisson's ratio. Materials having negative Poisson's ratios expand and get fatter when stretched while they get thinner when subjected to a compression. Properties of many engineering materials can be enhanced by negative Poisson's ratio therefore this unique devour can be desirable for many engineering applications. The aim of this study was to increase the awareness of auxetic related technical textile materials therefore material properties related to Poisson's ratio were introduced. Furthermore, the effect of auxetic fibers on reinforcement of a composite structure was investigated after auxetic filament production was referred. Conventional polypropylene (PP) stable fiber reinforced composites and auxetic PP stable fiber reinforced composites were fabricated by the hand layup method then several mechanical properties were investigated. Structural differences and changes on the composite structures were also examined by scanning electron microscopy (SEM). Effective porosity with strain and Impregnability can be used in medical textile applications. Auxetic materials can be impregnated due to their changeable pore sizes under a strain. This property can be used for medical textile applications. Prosthetic materials, surgical implants, suture/muscle/ligament anchors and a dilator to open up blood vessels during heart surgery are all possible applications.



MARMARA ÜNİVERSİTESİ

# 17 OCTOBER 2014
# FRIDAY
# (POSTER PRESENTATIONS)

# THE COMPARISON OF COMPACT (COM 4) YARNS WITH CONVANTIONAL RING YARNS

S. Canoğlu

*Marmara University, Faculty of Technology, Textile Engineering Department, Istanbul, 34722, Turkey*
E-mail: scanoglu@marmara.edu.tr

## Abstract

In the past, all of the new spinning technologies, such as OE-rotor spinning, DREF spinning, Air-jet spinning etc., have been aimed to increase the production per spindle and have been successful on this. However, as the production increases this does not mean that the yarn quality parameters get better. Also, until today, none of any new spinning methods has given a quality as ring spun yarn has. The clearest case is the capability of production of finest yarns by the ring spinning system. In contrary, structure of the ring-spun yarns is not ideal. The yarns consist of known fiber amount, do have very little or none contribution influence on tenacity and negative effect on the irregularity and hairiness of the yarns. Compact yarns were developed for the ring spinning frame to be able to alter most of these dissenting.

In this study, both conventional ring-spun yarns and compact (COM 4) yarns were produced from the same roving and later compared with their linear densities, twist, tenacity-elongation and hairiness. The results revealed that compact (COM 4) ring yarns have lower values in Uster H, yet have shown higher yarn twist, breaking strength and elongation.

MARMARA ÜNİVERSİTESİ YAYINEVİ

# THE EFFECT OF FUNCTIONALIZED MULTI-WALLED CARBON NANOTUBES (MWCNTS) ON PROPERTIES OF POLYESTER FABRIC DYED WITH MWCNTS

N. D. Gültekin, B. C. Gültekin

*Marmara University, Department of Textile Education, Istanbul, Turkey.*
E-mail: cgultekin@marmara.edu.tr

## Abstract

The development of nanotechnology has stimulated research on applications of nanosized particles in textile processing. Wearable electronics would allow the use of textiles as a communication platform with wide range of applications in sportswear, healthcare, military and work wear. It is important to improve the fabrics mechanical and chemical stability as well as their thermal resistance and electrical conductivity. Among the most promising nanomaterials for textile applications, carbon nanotubes has challenging properties, such as high thermal and chemical stability, high thermal conductivity, hardness and stability. The functionalization of CNTs allows tuning their properties. Carbon nanotubes can be dispersed in common solvents using chemical modification methods. Dyeing process provides a useful pathway for incorporating carbon nanotubes into textile materials. The process involves bringing textile and dyes into contact through a suitable medium. In this study, MWCNTs were functionalized with nitric acid. The prepared MWCNTs were incorporated in polyester fabrics by the conventional dyeing process commonly used to dye polyester fabrics, replacing dyes by MWCNTs dispersions. The dyeing process was carried out by the exhaustion method. The polyester fabric was immersed in the MWCNTs dispersion and maintained in motion for a certain period of time and temperature. The effect of MWCNT functionalization on morphological, thermal conductivity properties of fabrics were investigated. Colorfastness properties of dyed fabrics were also studied.



MARMARA ÜNİVERSİTESİ

# THERMAL STABILITY AND RESIDUAL EFFECTS ON CARBON/KEVLAR FABRIC COMPOSITES

S.O.Eruslu[1], A.O. Agırgan[2], E. Taskin[1]

[1]*Mechanical Engineering Namık Kemal University Corlu/Turkey*
[2]*Textile Engineering Namık Kemal University Corlu/Turkey*
E-mail: aoagirgan@nku.edu.tr

## Abstract

Thermal stability and residual effects on Carbon/Kevlar Fabric Epoxy composites are studied. Woven fabric and Noncrimp fabric laminated composites are produced by using vacuum Infusion. Material properties are determined experimentally. Thermal stability of specimens are studied at thermally isolated cabine for first three buckling mode up to glass transition temperature. Experimentally obtained mode shape results are compared with numerical results by using finite element (Fem) code Ansys. Thermal cycle tests are performed for ΔT=100 0C. Strength properties are redetermined for number of cycles for different orientation of laminated composites. Failure modes of composites are evaluated. It is found that residuals occurred by thermal cycle is effective at the strength of composites according to lay-up and number of layers.

# A FUZZY LOGIC APPLICATION ON STATISTICAL PROCESS CONTROL OF A SELECTED TEXTILE MILL

U. Dönmez[1], E.C. Sabır[2]

[1]*University of Kahramanmaraş Sütçü İmam, Kahramanmaraş, 46100, Turkey.*
[2]*University of Çukurova, 01330, Adana, Turkey.*
E-mail: emelc@cu.edu.tr

## Abstract

In this study, Control Charts in the process of Statistical Process Control were tried to interpret Fuzzy Logic technique in selected a textile mill. Selected textile mill, raw material and production costs are high, which is more than the number of a ring spinning process operations. In this study the number of quality yarn count Exchange was chosen as a parameter. Yarn count 22 different observations made for the exchange of data from each observation and a total of five other pieces of data were collected from 110. This is the number of data, were considered to be statistically adequate. In this study, primarily using this data as a statistical process capability analysis. Yarn count is sufficient change in business process (Cp (2.79)> (1.33)), and the process meets the specification values (Cpk (2.79)> (1.33)) were observed. The data obtained were interpreted with Fuzzy Logic technology. For this study, 8 for the membership functions of the input and 1 output data (for ring-spun yarn Ne 30) in the 8-by-step range of ± 3σ limits (± Check Out, ± A, ± B, ± C) is selected. Nelson's eight rules for the system based on the rule table is out of control and control of the process that determines the rule of 22 processed and interpreted with the method of fuzzy control system Mamdani. Centroid defuzzification method chosen stage conclusions. The data is loaded to the system, the system is available according to the situation, both individually and in Nelson's rules, but the most valuable sample of more than 8 groups, will test whether or not in control or out of control. If there is a negative situation, the system notified the data. System that works with the rule table make calculations using fuzzy inference system such as the standard deviation, the control limits. In this study, it is shown that control charts can be interpreted with fuzzy logic in yarn spinning in the textile industry.

# INVESTIGATION of COMFORT PROPERTIES of FISHERMAN CLOTHING USED in TURKEY with a SURVEY STUDY

A. Özbek, N. Erdoğan, Y. Doğdu

*University of Sinop, Gerze Vocational School, Gerze, Sinop, Turkey.*
E-mail: ahmetozbek77@gmail.com

## Abstract

In this study, comfort properties of work clothes used by fishermen working the bordering cities of the Blackest were investigated with a survey study. It was seen that the existing fisherman clothes consisting of polyester woven fabric coated with polyvinyl chloride has low air permeability and drapability. It can be said that low drapability results from polyvinyl chloride coating agent on polyester woven fabric. A survey study about fisherman clothes was carried out. 150 fisher cooperative society have participated in our survey study. One by one interviews with heads of 150 fisher cooperative societies have carried out. A questionnaire was used to clarify the fisherman's needs and wishes about fisherman clothes. Data collected from survey study have been analyzed and commented by statistical analysis program. It was understood that the fisherman clothes did not protected the people against to cold weather and the clothes sweated in hot weathers because of low air permeability. It was understood that the clothes had the undesirable properties such as limitation of movement, easy to dirty, bad odour, sweating and easy to abrasion and tearing. It was stated that the clothes are cleaned up and made dry easily. As a result, it was understood that comfort properties of the existing fisherman clothes were not sufficient. The results show that the clothing used by fisherman's does not satisfy all the users demands for safety, functionality and comfort. It is obvious that a new one prototype fisherman clothes for fisher industry in Turkey workers should be designed and produced.

# AN INVESTIGATION ABOUT THE EFFECTS OF SELECTED PARAMETERS ON THE SEAM PERFORMANCE FOR DENIM FABRICS

B. Z. Ünal, P. D. Baykal, E. Karazincir, E. Kalkanlı

*Çukurova University, Department of Textile Engineering, Adana, Turkey.*
E-mail: pduru@cu.edu.tr

## Abstract

In this study, it was aimed to determine the effects of different sewing threads and different washing types to the seam performance experimentally. In this context, three different high weight denim fabrics (one of them was produced without elastane and the others were produced with elastane) were selected as sample. Then, experiment samples were sewed with three different sewing threads (polyester/polyester core-spun, polyester/cotton core-spun and polyester filament) at the same linear density and three different washing processes (rinse, enzyme and stone with enzyme) were applied. After, fabric strength/elongation and seam strength/efficiency tests were performed according to the related standards. Finally, test results were analyzed statistically by using software package program.

# THE INFLUENCE OF NOZZLE PRESSURE AND YARN COUNT ON THE EVENNESS AND IMPERFECTION PROPERTIES OF VORTEX SPUN YARN PRODUCED BY MVS MACHINE

G. K. Günaydın, R. Erdem

*Textile Technology, Serik Vocational School of Higher Education, Akdeniz University, Antalya, Turkey.*
E-mail: ramazanerdem@akdeniz.edu.tr

## Abstract

In Murata vortex spinning, compressed air is transferred into the twisting chamber through the jet orifices, thereby; the high-speed whirled air current is created. This generates the negative pressure effect at the inlet of the nozzle block. The drafted fibers are drawn into the spiral fiber passage under the negative pressure; subsequently the preceding parts of those fibers are drawn into the vortex spun yarn trail along the guide needle. When the trailing ends of the drafted fibers are departed from the front roller nip point and have passed through the spiral fiber passage, the trailing portions of those fibers are inverted at the inlet of the hollow spindle and form the open-end trailing fibers because of the whirling force of the high-speed air stream. The high-speed whirled air current enables the open-end trailing fibers rotate around the core fibers, and finally the fiber bundles are twisted into the vortex spun yarn.

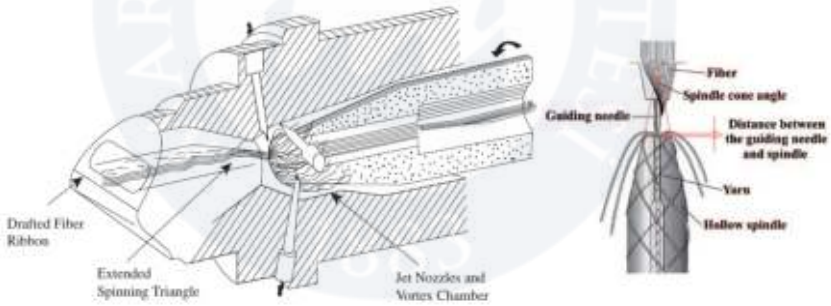


**Figure 1.** Shematic diagram of the nozzle block of vortex spinning machine.

Previous studies proved that the structure and performance of vortex spun yarns were influenced by the effects of nozzle angle, nozzle pressure, spindle diameter, yarn delivery speed, yarn linear density, fiber composition and the distance between the front roller and the spindle. Nozzle pressure was defined as one of the most effective parameters. Some authors strongly claimed that yarn evenness and imperfections are also significantly affected by the nozzle pressure. Yarn count is also another dominant factor on the structural properties of vortex spun yarn. The main purpose of this research is to examine the effects of two important parameters, nozzle pressure and yarn count, on the yarn structure properties of Vortex spun yarns.

## Methodology

Our experimental studies were performed on MVS 861, and the drafting ratios and delivery speed of slivers fed to the machine were 90/26, 130/40, 173/54, and 330m/min, respectively. Two process parameters, which were considered to influence the properties and structure of vortex yarns, were chosen for the investigation. These were: nozzle pressure and yarn count. Therefore, three different nozzle pressures (4,0 kgf/cm2, 4,5 kgf/cm2, 5,0 kgf/cm2) were determined for vortex spinning and three different yarn counts Ne 20, Ne 30 and Ne 40 were optimally produced. All the sample yarns were gained with the following spinning conditions; 70° nozzle discharge angle, 2p130d L7 -9,3 type needle holder, 1,2 mm spindle inner diameter on MVS-861 vortex spinner.

## Results

Optical images of nine different vortex yarn samples spun in various counts and nozzle pressures are shown in Figure 2. Tyagi et.al. used fiber tracing technique to analyze the structural properties of spun yarns and they classified the structure of vortex spun yarns into three main categories as core fibers, wrapper fibers and wild fibers. Core fibers were defined as straight or inclined fibers that constitute the most part of the yarn. Wrapper fibers are wrapped around the core fibers along

the yarn central axis. Wild fibers protrude from the yarn strand in various directions and sometimes they were observed in loop formation. Our visual analysis presented that all sample yarns had these three fiber types in different amounts.

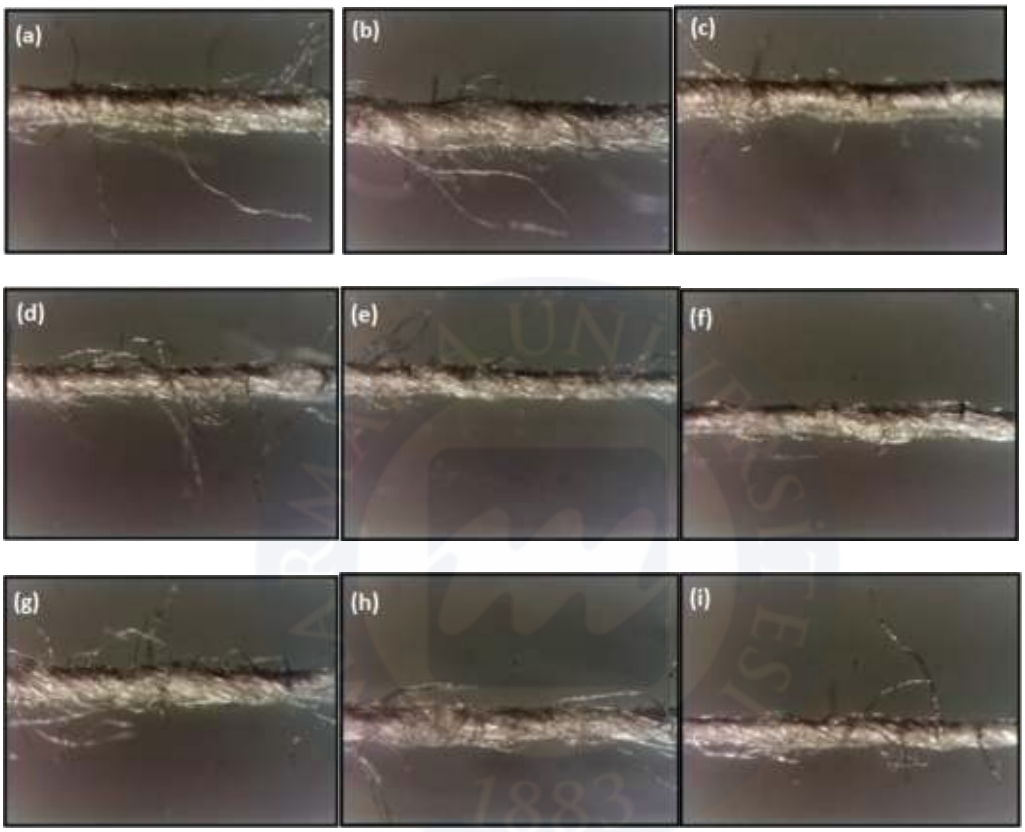




**Figure 2.** Yarn samples spun in different counts and nozzle pressures; (a) Ne20, 4 kgf/cm2; (b) Ne20, 4,5 kgf/cm2; (c) Ne20, 5 kgf/cm2; (d) Ne30, 4 kgf/cm2; (e) Ne30, 4,5 kgf/cm2; (f) Ne30, 5 kgf/cm2; (g) Ne40, 4 kgf/cm2; (h) Ne40, 4,5 kgf/cm2; (i) Ne40, 5 kgf/cm2.

As can be clearly seen from the images that as the yarns get finer, the amount of wrapper fibers increases. When more fibers in the fiber bundle fed into the vortex system, higher inter-fiber cohesion takes place which retards the separation of trailing ends of the fibers, and less wrapper and wild fibers form in coarse counts. On the other hand, in finer counts fewer fibers are located on the yarn strand means that fibers exposed more to the swirling force of air current. Consequently, greater amount of wrapper fibers form along the yarn axis. The influence of nozzle pressure can also be seen clearly from the images. Amount of wrapper fibers increases as the nozzle pressure gets greater. Because, increasing nozzle pressure generates an increase in the velocity of the air flow at the exit of the jet orifice as well as an increase in axial, radial and tangential velocities inside the nozzle block that enhance the number of open trail end fibers and therefore wrapper fibers.

## Conclusion

This study is conducted aiming to better understand vortex spun technology, to support steady implementation of the technology among the textile world, and experimenting the influence of the nozzle pressure and yarn count on the yarn properties for the cotton carded yarn production. Produced vortex spun yarn samples have three basic parts of a typical vortex yarn, core fibers, wrapper fibers and wild fibers. Experienced visual evaluation proved that amount of wrapper fibers increases with the increasing nozzle pressure. On the other hand, noticeable decline in the amount of wrapper fibers was observed in coarser yarns.

# THE EFFECTS OF ENZYMATIC AND ULTRASONIC ENERGY ON PILLING PROPERTIES OF COTTON FABRICS

N. Merdan, S. Canbolat, H. Dayioglu

*Istanbul Commerce University, Faculty of Engineering and Design, Department of Fashion and Textile, Istanbul, Turkey.*
E-mail: scanbolat@ticaret.edu.tr

## Abstract

Recently, the use of natural materials has gradually increased in home textile such as furniture, quilt cover set, bed and pillow in order for ecological properties of natural fibers. Although synthetic fibers have many advantages such as wrinkle recovery and high mechanic properties, natural fibers become prominent for people with allergies in bedding industry. The textile materials produced from cotton fibers have high air permeability. However, the cotton materials have pilling properties that are inconvenient for consumers. In this study, cotton fabrics produced as quilt cover set was applied enzymatic treatment. The enzymatic treatment was applied the cotton fabrics with dyeing process and without dyeing process. After enzymatic treatment, the samples were washed via conventional and ultrasonic method. In conclusion, the effects of enzymatic treatment, ultrasonic and conventional washing method on pilling properties of samples were investigated. The results demostrated that the enzymatic treatment and ultrasonic energy resulted in the increase in pilling properties of cotton fabrics.

# THE ULTRAVIOLET PROTECTION OF COTTON FABRICS IN THE INTERIORS

S. Canbolat[1], N. Merdan[1], H.Gezer[2], F. Akın[3]

[1]*Istanbul Commerce University, Faculty of Engineering and Design, Department of Fashion and Textile, Istanbul, Turkey.*
[2]*Marmara University, Faculty of Fine Arts, Industrial Product Design, Istanbul, Turkey*
[3]*Abbant Izzet Baysal University, Vocational High School, Bolu, Turkey*
E-mail: scanbolat@ticaret.edu.tr

## Abstract

Many of the glasses used in the facades have ultraviolet transmittance properties expect from the glasses having ultraviolet protection. The glasses which have ultraviolet protection are not economic. Therefore, the using of curtain having ultraviolet protection is more economical and practical than the using of glasses having ultraviolet protection. In this study, the ultraviolet protection of raw, bleaching, dyed without applied ultraviolet absorbers and dyed with applied ultraviolet absorbers was investigated. Some samples were applied with ultraviolet absorbers after the samples were dyed. Other samples were dyed without applied ultraviolet absorbers. After the dyeing process and applied of ultraviolet absorbers, the ultraviolet protection of samples was investigated. The results demonstrated that the increased of ultraviolet concentration caused to increase in the ultraviolet protection of samples.

# COMPARISON OF NATURAL AND SYNTHETIC ANTI MIGRANTS IN CONTINUOUS DYEING OF 100% POLYESTER

Z. Ali Noonari[1], W. H. Solangi[1], A. A. Channa[1], A. H. Memon[2]

[1]*Pak-Korea Garment Technology Institute, Karachi, Pakistan*
[2]*Enviroment Eng. & Management Institute MUET Jamshoro, Pakistan*
E-mail: za_sincere@yahoo.com

## Abstract

As we know polyester is a synthetic fiber and has more crystalline structure than natural fibers. In continuous dyeing of polyester by pad-Thermosol process, there are many advantages such as bulk production, low-cost, good efficiency etc. But during dyeing process there is a severe problem occurs that is dye migration .in order to control the dye migration different migration inhibitors are used in this project. Both natural and synthetic migration inhibitors are applied on the 100% polyester fabric in order to compare that which migration inhibitor hives better results on the pad-Thermosol process. After comparing the different properties of the both migration inhibitors the synthetic inhibitors found more efficient then the natural one. The following tests were conducted during project: Migration test, tensile strength, color strength, bending length, light fatness. Synthetic migration inhibitors gives better results for the tests which were conducted .but there is a problem that the synthetic migration inhibitors are not environmental friendly and they are costly then natural migration inhibitors.

# A STUDY ABOUT SEWABILITY PROPERTIES OF 100% COTTON WOVEN FABRIC WITH DIFFERENT CONSTRUCTION

G.Gülşen[1], F.D. Kadem[2]

[1]*Technical Sciences Vocational School, Adana, Sarıçam, 01350, Turkey*
[2]*University of Çukurova, Adana, Sarıçam, 01330, Turkey*
E-mail: ggulsen@cu.edu.tr

## Abstract

In this study; influence of selected physical properties of 100% cotton woven fabrics with different constructions on fabric sewability property were investigated. Sewability values of fabrics and needle penetration forces were tested by using L & M Sewability Tester. This device measures the penetration force exerted by a sewing needle on the fabric. When sewability values range between 0 and 10%, the fabric sewability will be considered good; between 10% and 20%, even though no great difficulties arise during sewing, the sewability will be considered fair. When sewability values exceed 20%, then sewability will be considered poor. Weft and warp yarns of fabrics have the same yarn count (Ne50). Fabrics have same density of warp (40 thread/cm), three different density of weft (26-30-34 thread/cm). Different weaving structures like twill (2/2), Panama (2/2) and the plain weave structures were used. Needle penetrations force increase due to structure plain, density of weft at (weft&warp) directions. When warp and weft densities are high, it has seen that the porosity of the fabric decreases, fabric becomes denser, more yarns are either broken or separated by the sewing needle, and so the needle penetration force increases. As a result of this study, it is proved that weaving structure and weft density of fabric are parameters effect sewability value of fabrics. The best sewability value obtained from the fabric which has panama weaving structure and the lowest weft density.

MARMARA ÜNİVERSİTESİ YAYINEVİ

# AN EXPERIMENTAL STUDY ABOUT IMPROVEMENT OF DENIM FABRIC'S THERMAL COMFORT

E.G. Saraç, F.D. Kadem

*University of Çukurova, Institute of Natural and Applied Sciences, Textile Engineering, Adana, Turkey*
E-mail: egsarac@gmail.com

## Abstract

Denim is one of the most fashionable, dynamic and innovative textile products. Brands are now looking for more technological, sustainable and comfort fabrics and jeans to maintain and improve their innovative line. The recent developments on material and biological science, nanotechnology and smart systems have opened a new way to smart textiles. Materials that can react to the environment have been considered; such as conductive materials, chromic materials and phase change materials (PCM). Phase change materials (PCM) provide thermal regulation and improve the thermal comfort which is an important performance feature. Phase change materials (PCM) take advantage of latent heat that can be stored or released from a material over a narrow temperature range. PCM possesses the ability to change their state with a certain temperature range. These materials absorb energy during the heating process as phase change takes place and release energy to the environment in the phase change range during a reverse cooling process. In this context, the influence of 'PCM finishing on denim jeans' on thermal regulation and other selected physical properties were investigated. Garments made from stretch and rigid denim fabrics were used in the study. Garments were treated with microcapsulated PCM in various concentrations given in bath and by dipping, followed by the curing process. DSC (Differential Scanning Calorimeter) tests were applied to denim fabrics. DSC is a standard method for thermal analysis in order to examine the heat storage and heat release capacity of the garment treated with PCM. DSC determines the amount of heat absorbed by a sample upon temperature change. Thermal properties of denim fabrics were analyzed by DSC (Differential scanning calorimetry) and morphology of microcapsules was characterized by SEM (Scanning electron microscopy) analyses.



MARMARA ÜNİVERSİTESİ

# PERFORMANCE COMPARISON Of FABRICS WEAVED USING AEGEAN AND EGYPTIAN COTTON YARNS

G. Çetin, Ö. Ay

*Trakya University, Edirne Vocational College of Technical Science, Department of Textile Edirne, Turkey*
E-mail: ozdemiray@trakya.edu.tr

## Abstract

This research has been based upon the effects of Aegean and Egyptian cotton fiber on performances of the fabric product. For this purpose, the quality characteristics have been determined at the first phase. At second phase 100% combed cotton has been produced and the quality of the fabric has been tested. At the third phase the fabrics have been weaved by using a main weave and the same fabric and tissue parameters. Finally density of yarns, fabric weight, tensile strength, tear strength tests have been applied to these fabrics. Upon the results obtained, statistical analysis has been done and results have been interpreted. When the results are analyzed, in terms of the characteristics determining the quality of fiber and yarn, distinctive differences in favor of Egyptian cotton have been observed about - the research subject- fiber and yarn. However it has been observed that the differences in question don't have the same ratio due to the discrepancy of the application differences during finishing process of fabric product's physical performance effect.

# INVESTIGATION OF THE EFFECT OF TURKEY RED OIL ON COLOUR, FASTNESS PROPERTIES AND HPLC-DAD ANALYSIS OF SILK FABRICS DYED WITH MADDER

L. M. Ozer[1], E. Torgan[2], C. Aydın[2], R. Karadağ[2,3]

[1]*Department of Textile Engineering, Faculty of Technology, Marmara University, Kadikoy, Istanbul, Turkey*
[2]*Turkish Cultural Foundation, Cultural Heritage Preservation and Natural Dyes Laboratory, Istanbul, Turkey*
[3] *Marmara University, Laboratory of Natural Dyes, Faculty of Fine Arts, Istanbul, Turkey*
E-mail: lmeyanci@gmail.com

## Abstract

The roots of madder (Rubia tinctorum L.) have been used for dyeing textile fibers such as wool, silk and cotton in many parts of the world since ancient times. The madder plant contains alizarin, pseudopurpurin, purpurin, rubiadin, munjistin and as many as 15 other anthraquinones as effective dyes. Madder is a dye found in the roots of various plants of Rubiacea family. Plants of this family grow in South America, Asia and Europe. . In this study, Rubia tinctorium L. extracted with Turkey red oil was applied to the silk fabrics mordanted with alum using various dyeing procedures. 40 pieces of silk fabrics were dyed with Rubia tinctorium L. extracting varying amount of Turkey red oil. The color of the each dyed material was investigated in terms of the CIELAB ( L*, a* and b*) and K/S values. The color fastness to light, washing, rubbing of the dyed samples were determined according to ISO standards. The color fastness to light and rubbing results showed very good levels. Unlike other studies, in the present investigation, Turkey red oil has been selected for the solvent extraction. It was observed that extracting with Turkey red oil gave very moderate fastness properties in dyeing. High performance liquid chromatography (HPLC) with a diode-array detection (DAD) was used to investigate of effects of dyestuff extracted with Turkey red oil in the silk fabrics, the sampling was performed from the dye extracts at 10 minutes. At the end of the analyses, the rates of main coloring compounds alizarin, purpurin, xanthopurpurin, munjistin and rubiadin were determined.

# COMPARISON OF CHILDREN'S CLOTHING PATTERNS ON DIFFERENT SYSTEMS

F. Citoglu[1], H. Temel[1,2]

[1]*Marmara University, Faculty of Technology, Textile Engineering Department, Istanbul, Turkey*
[2]*Marmara University, Institute of Pure and Applied Sciences, Göztepe Campus, Istanbul, Turkey*
E-mail: htemel72@hotmail.com

## Abstract

The success of products in the garment industry largely depends on a well-prepared pattern. Garment products should suit body size, body structure and fashions in order to meet the demands of consumers.

In this study it was aimed to compare basic children clothing patterns which were produced on different methods and how these clothings fit to bodies of children. The research discussed three different pattern systems: Muller, Metric, Contec. Basic clothing patterns were prepared and produced in size 104. How the body measurements are taken, measurements, the steps of the process, differences in drawings of body and arm patterns and drawing differences were compared. Clothings, which were produced for children who are size 104, were tested if they are suitable. The results showed that all three pattern systems are different in terms of body fitting, usability and outlook. The basic characteristic in preparing cloth pattern is its accordance with body. Thus, the accordance of the clothes prepared with the methods to body must be examined in another research topic. More reliable patterns can be prepared with a new method which combines the positive aspects of all the three methods.

# THE EFFECTS OF VARIOUS BLEACHING FORMULATIONS ON PHYSICAL PROPERTIES OF WOOLEN FABRICS

M. Akkaya[1], M. Akalin[2], Z. Yildiz[3]

[1]*Marmara University, Technical Education Faculty, Department of Textile Education, Istanbul, Turkey.*
[2]*Marmara University, Faculty of Technology, Department of Textile Engineering, Istanbul, Turkey.*
[3]*Istanbul Technical University, Institute of Sciences and Technology, Department of Polymer Science and Technology, Istanbul, Turkey.*
E-mail: mrl.akkaya@gmail.com

## Abstract

This study is a sub branch of a project investigating the Turkish traditional fabric structures. The mentioned fabrics in this study are called as “Şal-Şepik” in their region, Siirt. “Şal-Şepik” fabric is an important cultural heritage and its usage is based on ancient history. It can be considered as an important cultural product because of having special finishing processes and its raw material. Only madder is used in coloration process of “Şal-Şepik” fabric. In history, the raw material of “Şal-Şepik” fabric is mohair. But over time, the people in that region was started to use wool as raw material. The “Şal-Şepik” fabric was used in daily clothes because it keeps the wearer cool in summer, warm in winter, and it has a durable structure. But today the number of “Şal-Şepik” fabric weavers is in very limited number thus its production and usage tent to disappear.

In this study, three different mostly used bleaching formulations were applied on wool and mohair traditional fabrics. After bleaching process, fabric samples were evaluated in terms of abrasion resistance and thermal resistance respectively. Additionally, the fiber deformation stemming from the wet process was investigated by light microscopy.

MARMARA ÜNİVERSİTESİ YAYINEVİ

# EFFECT OF SURFACE TREATMENTS ON FLEXURAL STRENGTH PROPERTIES OF COTTON-POLYESTER WASTE FIBRE REINFORCED POLYMER COMPOSITES

M. Kayar[1], S. İ. Mıstık[2]

[1]*Marmara University Faculty of Technical Education Department of Textile Studies, Kadikoy, Istanbul, Turkey*
[2]*Marmara University Faculty of Technology Department of Textile Engineering, Kadikoy, Istanbul, Turkey*
E-mail: imistik@marmara.edu.tr

## Abstract

Assortment is very important and sensitive process for the ready-made garment production sector however tons of fabrics are wasted during the garment production every year. Generally waste fabrics are collected and sent to the waste fiber production companies to get waste fiber to be used for the insulation and decoration purposes.

In this study, ready-made garment waste cotton and polyester fibers were used. Waste fabrics were collected from garment production companies. And these fabrics were processed by Punteks and transformed into fiber form. Then surface treatment process was applied to ready-made garment waste cotton fiber by using NaOH and formic acid then mixed with ready-made garment waste polyester fibers. Finally polymer composites were produced from these treated cotton/polyester blend by using thermoset polyester resin as matrix. Waste fiber reinforced polyester composite structures were produced by using vacuum infusion method. Flexural strength properties of treated waste cotton/polyester fiber blend reinforced thermoset polyester composites were investigated. Higher flexural strength results were obtained from formic acid treated cotton - polyester waste fiber reinforced polymer composites.



MARMARA ÜNİVERSİTESİ

# IMPORTANCE OF BODY SIZES AND FIGURE TYPES ON CLOTHING FITTING

F. Citoğlu[1], H. Akkuş[2]

[1]*Marmara University, Faculty of Technology, Department of Textile Engineering Istanbul, Turkey.*
[2]*Bartın University, Institute of Pure and Applied Sciences, Department of Textile Education, Bartın, Turkey.*
E-mail: hakkus@bartın.edu.tr

## Abstract

As it is known, individuals who buy ready-made clothing are mostly disturbed by problems about “body adaptation”. Adjustments are required due to maladjustments occurring in the length and size of cloths. This results to a large extent in unnecessary extra costs and time loss in economic sense. Although there are various factors which enable clothes fit on body perfectly, the most important factor is to use body size in clothing correctly.

This study was held to determine the difficulties to find large sized outfits for women and specifications of the outfits that desire. Study was made on 170 large sized women who live in Istanbul and aged between 18 - 50 sized 44 and up. For the producer companies to be able to produce garments which allows comfort to especially thigh line by taking the typical Turkish women body type into consideration , the sizes and molds used in outfits should be standardized and studies should be made for Turkish large women sizes and outfit molds. As a result of study; it was determined that breast girth, waist and hip size of women who have unproportional body size being tight for clothes is one of the most important problems of them and solutions were offered accordingly.

# COMPARISON OF STRENGTH PROPERTIES OF POLYPROPYLENE-BASED SPUNBOND TEXTILE SURFACES WITH DIFFERENT VALUES OF MFI AND WEIGHT

İ. Tiyek[1], R. Gemci[1], M. Kılınçkıran[2], U. Dönmez[2], B. Yıldırım[2]

*[1]University of Kahramanmaraş Sütçü İmam, Faculty of Engineering and Architecture, Department of Textile Engineering, Kahramanmaraş, Turkey.*
*[2]University of Kahramanmaraş Sütçü İmam, Institute of Natural Sciences, Department of Material Science and Engineering, Kahramanmaraş, Turkey.*
E-mail: mkilinckiran@edu.tr

## Abstract

Polypropylene (PP) is a thermoplastic polymer and a material the most widely used after polyethylene in the polymer industry. Melting temperature of polypropylene is about 160 °C and it is usually processed at temperatures above 200 °C. In the production of Spunbond textile surfaces, PP polymer melted by heating in the extruder until to ensure suitable viscosity is extruded to cold air zone from spinnerets under certain pressure and formed webs by laying on the collector.

Melt flow index (MFI) is one of the most important factors in the processing stage of polymers. MFI values are directly related with the molecular weight of polymers and therefore it is mostly effective in determining the properties of the polymer processing and in establishing the properties of the material to be obtained.

In this paper, nonwoven textile surfaces with different weights were produced from polypropylene homopolymers with values of 25 and 35 MFI by spunbond method. The strength and elongation properties of this spunbond textile surfaces were tested and the influences of different values of MFI and weight to strength properties of spunbond textile surfaces were examined.

# INVESTIGATION OF MECHANICAL PROPERTIES OF $Al_2O_3$/PU COATED PES FABRIC

A. Koruyucu[1], A.Ö. Ağırgan[1], M. Ağırgan[2]

[1]*Departments of Textile Engineering, Namık Kemal University, Corlu, Turkey*
[2]*Textile Technology Dept. Kırklareli University Lüleburgaz Vocational school Luleburgaz, Turkey*
E-mail: adelituna@nku.edu.tr

## Abstract

Textile surface materials coated with chemical structures have been developed continuously for several last decades. The basic substrate of the surface material is mostly textile fabric coated on one or both sides with one or more polymer layers. This kind of products with the basic textile material has many improved properties and multiple advantages over the classic textile material. Polymer layer can be polyurethane. To improve its properties, appropriate additives are added: filling materials, binders etc. Coated polymers are applied to the textile material directly and indirectly. The chemical compositions of polymer coatings are constantly developed and new types of polymer additives are increasingly introduced. Abrasion resistance and strength are by far higher in polyurethane in comparison to other polymers. Polyurethane has the property of good adhesion which can be strengthened by addition of cross-linking agents. Mechanical properties of coated polyester fabrics, although there was some variation depending on the concentration of coating solution, were primarily affected by Al2O3 particles concentration in coating bath. In this study, the influences of the three different concentration of Al2O3 particles in PU coating solution and the amounts of thickness coating on mechanical properties of polyurethane coated polyester fabrics were investigated. Scoured polyester microfiber fabrics of weight 93,8 g m-2 were coated by knife over roller machine. The coated fabrics were dried at 120 ° C for 2 min and then cured at 150 ° C for 2 min. The thickness of the coated fabrics were 0,05 and 0,1 mm, respectively.ISO test methods 13937-1, 13934-2 and 12947-3; 12947-4 were employed for tear strength, breaking strength and Martindale abrasion fabric testing. All fabrics were tested in the warp direction and in the weft direction when sample quantity and geometry allowed. For mechanical testing three replications were conducted on each sample. It can be concluded from experimental results that breaking force and tearing force of coated fabrics exhibit different conclusions. The coating of polyurethane appears to improve the strength of the fabric. The application of Al2O3 /PU-coating appears to improve the abrasion resistance of the samples. An increase in the thickness of the coating also has appositive effect on the abrasion resistance of the coated fabrics.

MARMARA ÜNİVERSİTESİ YAYINEVİ

# MODELING AND CHARACTERIZATION OF ELASTIC BANDS IN THE THERAPEUTIC TREATMENT OF VENOUS LEG ULCERS

R. Halfaoui

Faculty of Engineering Sciences, Department of Engineering Process, Laboratory of Processing and Shaping of Fibrous Materials and Polymers, M'Hamed Bougarra University, Boumerdes, 35000, Algeria.
E-mail: halfaoui@umbb.dz

## Abstract

The legs varicose veins affects about 1% of the adult population, the majority of complications are due to venous disease. Medical compression bandages contribute significantly in the therapeutic treatment of venous ulcer. Experts in the medical field believe that the application of a bandage with a constant extension will allow users to obtain the gradient profile required pressure, although the circumference of the leg increases from ankle to mid-calf. Many published studies in this area show the effectiveness of various commercial bandages and very little work has been made in understanding the phenomenon showing how these tires exert pressure on the leg. The elastic textiles intended for the venous treatment diseases must be well defined, with some restrictions criteria required by the raw material characters. The elastic textile use involves a set of constraints applied in several directions and it is very useful to take into considerations the factors most affecting applications to simulate as closely as possible to reality. As many experts in the clinical field now confirm that the phenomenon of compression therapy is not yet mastered, this means that collaboration between specialists in this field of medical side and textile specialist area is virtually not, or if it is not seen the publication of their work. Knowledge of the rigid and elastic tissue behavior has become a necessity to address this phenomenon, for this reason, we have presented in this work the mechanical behavior of yarns and elastic bands and models used for the experiments and simulations of cuts. For all these reasons it is best to consider putting on the domestic market a bandage that is both rigid and elastic. From this assumption and after a lot of work on these materials, we offer a bandage on the basis of the mechanical model shown in the thesis, which describes both the elasticity and relaxation. Three articles were manufactured separately. Every article has its own mechanical properties and the most powerful purpose was chosen. The results obtained on the sample AT1 are very interesting for the users of this product that the tension decreases and when its use. This mechanical behavior is due to the structure warp yarns describing a viscoelastic model.

This phenomenon has a significant advantage in the use of this product for the therapeutic treatment of venous leg ulcers. The tension decrease is almost constant for about 8 hours, and then it stabilizes until the end of experiments. The mechanical behavior of textile AT2 is similar to the rigid textiles as inelastic gauze strips. The low yield is obtained by heat treatment of warp yarn textured polyamide and elasticity obtained instantly disappears after a very short time. Textiles AT3 exerts significant pressure when applying the leg and the previous results the decrease in operating tension drop of only 7% over time. For this reason, strict measures must be taken when using it in hospital. The use of this article must be constantly monitored to avoid possible complications of its use. Since the circumference of the lower limb of the human body is not perfect cylinder, and to simulate pressures applied on the surface, it is necessary to define all conditions for obtaining an average pressure of 38 mm Hg on entire leg surface. The elasticity, the flexural rigidity, the linear density in warp and weft, the diameters of the warp yarn and weft, the origins of raw materials and warp yarn and weft of the fabric by filling the raw materials are the factors that affect results. To reduce variations in pressure transferred through textiles used in this study, and in cuts simulations on the human leg, we used additional material as padding between the outer leg surface and the elastic fabric, it's a polyurethane film. All samples are made on a unilateral needle loom, which we have adapted a separate supply warp creel yarn. This technique allowed us to respond quickly to changes in the fabric structure, it has been fully realized in the mechanical workshops M'Hamed BOUGARA University of Boumerdes. As a first step, we defined the exact boundaries of production factors from which the samples produced have properties that meet the requirements of this application field. On an industrial scale (a National Project Research has been approved in this field), some data will be exchanged for economic and quality reasons; it is mainly to provide a quality product with smaller possible expenses. For this reason, it is first necessary to choose all the production technological parameters. These parameters were studied in previous work in the context of magister thesis. Then, the paper presents a theoretical and practical work to bring together all necessary elements for physical study of compression therapy, including how textiles exercise bandages and produce the required pressures are generated and how the intermediate forces on the leg by different bandages types. The influence of the bands thickness on the interface pressure was examined. There is described the models developed to estimate the pressure applied by the multilayer bandages and the longitudinal and transverse forces exerted by these bandages. In this work, we analyzed the behavior of actual internal pressure bandages studied previously. These pressures are measured

over a period of time for a given class of bandages with single layer, but can be applied with more layers. The basic idea of this work is to study the possibility of changing the structure and mechanical characteristics of the bands in order to improve the compression behavior during use. In this work, we have provided the pressure calculation regardless of the material thickness, which highlights the number of applied layers, but this implies that they are applied one on other a superimposed manner. It has been shown that if the material thickness is small, that is to say that relationship between thickness and application radius is less than 0.1, the thickness has little effect on applied pressure. We also developed a model that takes into account the applied material thickness (e/R> 1/10), but does not take into account the layers number. Finally, a second model was developed taking into account the layers number and the thickness of each layer when they are distinct, that is to say, when it belonged to different bands. To validate our results and theoretical calculations of the leg pressure with several layers of same elastic fabric, we have designed and carried out experiments on a soft roll that served as a prototype on which we postponed the actual dimensions of a leg sized. For all calculations and practical experiments we used three samples taken during previous work. The applied tensions to the textile and related extensions during each phase are carried out in the ascending and descending direction. All the graphs, it is clear that the tension is primary factor that influences directly with a large percentage of the pressure on the textile surface of interface pressures leg. Bandages using single layer, the textile pressure is directly transmitted to the leg surface. A significant deviation is observed at the ankle, lower calf and knee, by cons in the calf, the actual pressures are more or less uniform and at same time closer to calculated pressures. At the ankle and in the intermediate zones, the corresponding values of the actual pressure change curves plane with respect to the calculated values curve. The deviations are not very large so the proposed evaluation model pressures interface is experimentally verified; it can be used for the evaluation of applied pressures by bandage.

MARMARA ÜNİVERSİTESİ YAYINEVİ

# HAVING HEAT SAVING AND PREVENTING CORROSION ON MACHINES BY USING NANO TECHNOGICAL DYES

O. Peker

*Chemical Engineering, Turkey.*
E-mail: oya_peker@hotmail.com

## Abstract

"Cheap energy supplies and fighting with corrosion are the biggest issues of Industry. Within product costs, energy cost has the prime ratio. Because of that, various methods have been developed to have energy savings." "Corrosion is huge proplem for machines, boilers and steam distribution lines. Hundreds of billon dollars are spending to prevent corrosion and to extend machines lives. Our project is suggesting a new practice on this area.



MARMARA ÜNİVERSİTESİ

# E-TEXTILES FOR SPIRITUAL PURPOSES

S. Er

*Er GmbH Obermarkt 33, 6410 Telfs \ Tirol, Austria*
E-mail: ser@hotmail.de

## Abstract

Namaz Yolu, the greatest duty of Muslim (Namaz) teaches us and helps us with the built-in sensor in prayer. Namaz Yolu counts the Rekâts with silent. Namaz Yolu speaks the prayers aloud. Namaz Yolu will salute with light. Namaz yolu speaks the prayers slowly and clearly. Namaz Yolu speaks the prayers quickly and clearly Namaz Yolu speaks the prayers at normal speed. Namaz Yolu speaks the prayers and it counts also the Rekâts in. Namaz Yolu completed the Rekâts automatically. With Namaz Yolu you can speak your prayers slowly or rapidly, simultaneously counts Namaz Yolu in the Rekâts and finishes your prayer with its lights Namaz Yolu you can attach to your prayer rug. Namaz Yolu can help you in a journey, at home or every stage of your life, while picnicking or even when the children are playing with each other. During the sitting around with the family, Namaz Yolu teaches your children how to pray. Whether young or old, from 7 to 70 years, anyone who wants to learn to pray, who wants to improve his errors, which is confused unintentionally while praying, Namaz Yolu helps to improve themselves and to concentrate.

# MICROBIAL PROPERTIES OF TRADITIONAL AND ULTRASONIC WASHED BAMBOO AND ORGANIC COTTON FABRICS

M. Uzun[1,2], K. K. Govarthanam[1,3]

[1]*Institute for Material Research and Innovation, The University of Bolton, Bolton, BL3 5AB, UK*
[2]*Department of Textile Education, Marmara University, 34722, Goztepe, Istanbul, Turkey*
*3 Fothergill Engineered Fabrics, Littleborough, OL15 0LR, UK*
E-mail: m.uzun@marmara.edu.tr

## Abstract

In this experimental work, %100 bamboo and %100 organic cotton fabrics were investigated and compared to study the effect of different washing methods on the fibers, the fabric structure and the fabrics microbial behavior. The fabric structures were plain woven, the bamboo based fabric was 179.5 g/m2 and the organic cotton based fabric was 165.3 g/m2. Prior to washing Staphylococcus epidermidis (gram positive) and Escherichia coli (gram negative) bacteria were applied on the sample's surface. The samples were washed with traditional and ultrasonic techniques at 400C with 3 different time's settings, 10, 20 and 30 minutes, using AATCC standard detergent without optical brightener. The washed samples were rinsed in de-ionized water and dried at room temperature for 24 hours. The number of colonies present on the fabric after 24 hours were counted and compared to study the effect of different washing techniques. The physical characterization of fabrics was determined by using SEM.

It is found that the ultrasonic washed fabrics were affected less by the washing process compared to traditional washed fabrics. The bamboo fabrics that were washed using traditional technique at 30 minutes had some structural changes. Most of the samples did not have any significant physical changes after washing using both the techniques. For washing effectiveness of microbes, ultrasonic washing for 10 minutes removed the microbes better when compared to traditional washing for 10 minutes. But, as the washing time increased to over 20 minutes, the difference in wash performance between the two washing methods reduced and no difference was seen when the washing was done for 30 minutes.

MARMARA ÜNİVERSİTESİ YAYINEVİ

# INVESTIGATION OF ACRYLIC/CATIONIC DYE SYSTEM IN SIMULATED SEAWATER

M. A. Uddin[1], C M Carr[2], M. Rigout[1]

[1]*Textiles & Paper, School of Materials, University of Manchester, Manchester, M13 9PL, UK*
[2]*School of Design, University of Leeds, Leeds, LS2 9JT, UK*
E-mail: mdabbas.uddin@manchester.ac.uk

## Abstract

Freshwater consumption for traditional textile wet processing is very high. Alternative to freshwater has been carried out for decades. This study investigate the possibility of using seawater as dyeing medium for acrylic fiber as opposed to freshwater in commercially established dyeing process. Cationic dye has been traditionally used for dyeing of Acrylic fiber with very high fastness. Three cationic dyes, Basic Red 46, Basic Blue 41 and Basic Yellow 45 have been used in this study to dye acrylic fiber in depths of 0.05, 1.0 and 3.0% o.m.f. in three basic color of red, yellow and blue in simulated seawater (SSW) medium. The performances of the dyed fabric were compared to that of conventional dyeing in distilled water (DSW) system with color parameter, fastness to wash, dry rubbing and cross-staining. The color build-up was consistent throughout while there was a saturation level exist at higher depth although an increased dye sorption was observed in SSW due to increased physical interactions. The results indicate that SSW could be used dyeing medium for dyeing acrylic fibers for cationic dyes.



MARMARA ÜNİVERSİTESİ

# IN SITU FABRICATION AND IMPREGNATION OF SILVER NANOPARTICLES ON ENZYMATIC TREATED COTTON FABRIC

Z. A. Raza, F. Anwar, A. Rehman, M.T. Hussain, R.Masood

*Chemistry Research Laboratory, National Textile University, Faisalabad-37610, Pakistan*
E-mail: zarazapk@yahoo.com

## Abstract

In the present study, we investigate single bath fabrication and application of silver nanoparticles (SNPs) on enzymatic pretreated cotton fabric by using starch both as reducing and stabilizing agent without any resin or cross-linker under standard autoclave conditions of 15 psi, 121°C for 15 min. The characterization of SNPs was done using UV-visible spectroscopy, zeta analysis and TEM. The treated fabric was characterized by using SEM-EDX and AFM. The textile properties of the fabric including antibacterial activity, whiteness and wettability were measure by using the standard methods. The UV-visible absorption spectrum of both cotton fabrics and bath solution showed a typical absorption peak at ~ 420 nm corresponding to the surface Plasmon resonance of SNPs. The hydrodynamic diameter of SNPs was as smaller as 20 nm with respective zeta potential of -15.40 ± 4.69 mV. The SEM and AFM images revealed that the surface of the modified cotton fabric was rougher than that of untreated fabric, and SNPs were present on the surface of the treated fabric. Silver mapping and elemental analysis of the silver nanocoated cotton fabric using EDX confirmed the presence of SNPs in a homogeneous distribution. The SNPs impregnated cotton fabrics showed excellent broad spectrum antibacterial activity against various bacterial strains.

# ADSORPTION BEHAVIOR OF CONGO RED FROM AQUEOUS SOLUTIONS ON VISIL FIBERS AND ANTIMICROBIAL ACTIVITY ASSESSMENT OF CR DYED VISIL FABRIC TOWARDS E-COLI

A. F. Khan

*National Textile University, Pakistan*
E-mail: drfarhankhan@live.com

## Abstract

The adsorption behavior of Congo Red (CR) onto nonwoven Visil fabric and the antimicrobial activity of the CR dyed Visil fabric has been studied. Visil is well known for its flame retardant behavior which is a hybrid of viscose and silica (polysilicic acid). Effects of various parameters such as pH, treatment time, initial dye concentration on the amount of adsorption of the dye onto nonwoven Visil fabric were investigated. The antimicrobial activity assessment of the CR dyed Visil fabric samples towards E.coli was performed using the bacterial strain DPD2794. The results indicated that the adsorption behavior of CR on nonwoven Visil fabric remained almost the same as it has been previously investigated for some other adsorbents. Also the antimicrobial activity for the CR dyed Visil fabric samples found for bacterial strain DPD2794 predicting a rather less strong bond between CR and Visil non-woven fabric (hydrogen bonding) and the well-known toxic behavior of the benzidine based azo dyes.

MARMARA ÜNİVERSİTESİ YAYINEVİ

# MECHANICAL PROPERTIES OF SURFACE MODIFIED JUTE FIBRE/POLYPROPYLENE NONWOVEN COMPOSITES

M. M. A. Sayeed[1], A. Rawal[2], L. Onal[3], Y. Karaduman[4]

[1]*Textile Physics Division, Bangladesh Jute Research Institute, Manik Mia Avenue, Dhaka-1207, Bangladesh*
[2]*Department of Textile Technology, Indian Institute of Technology Delhi, Hauz Khas, New Delhi,India*
[3]*Department of Textile Engineering, Erciyes University, Kayseri, Turkey*
[4]*Department of Textile Technology, Akdagmadeni Vocational High School, Bozok University, Yozgat, Turkey*
E-mail: mmasayeed70@gmail.com

## Abstract

In this study, the jute/polypropylene nonwoven reinforced composites were prepared using film stacking method. The surface of jute fibers was modified using alkali treatment. These alkali treated jute fiber nonwoven composites were analyzed for their tensile and flexural properties. Increasing the amount of jute fibers in the nonwoven reinforced composites has improved their mechanical properties. The effect of stacking sequence of preferentially and non-preferentially oriented nonwovens within the composites was also analyzed. The flexural and tensile moduli of composites were found to be significantly enhanced when nonwovens consisting of preferentially and non-preferentially aligned jute fibers were stacked in an alternate manner.



MARMARA ÜNİVERSİTESİ

# PROTECTIVE CLOTHES FROM INSECTS

E. H. Peker

*Tekstil Araştırmaları Derneği, Istanbul, Turkey.*
E-mail: oya_peker@hotmail.com

## Abstract

Human beings have struggle against insects during history. I think, needn't to say, who is winner this fight. Because insects have very fast of proliferation. Curtains, mosquitonets, glasses and flywatters-which are used since in the beginning of 20th century- protect human being limitedly. These insects cause not only several diseases by bitting and sticking, but damage wooden materials and particularly wool clothes. Men have tried to protect themselves against insects using some plants and plant extracts. Some medicines which are invented 100 years ago ,for example D.D.T., provided some advantages, but it was scientifically proved that these chemicals are very harmful either person or environment. Nowadays most of these chemicals are banned. The main goal to protect persons who live countryside and bitten by ticks. It is known that some species of ticks cause very dangerous disease. Crimean Congo Hemorragic Fever is fatal disease. Secondary aim is to protect rice field workers against insects, flies, and anopheles. My Project depends on using special clothes treated with nano-technologic micro capsule chemicals. These chemicals take away all insects, flies and ticks by spreading special odour. Nano-chemicals are applicated on the clothes which are produced for agriculture workers all around of the world. These nano-chemicals are coated on the clothes by special sticky chemicals. These clothes are sent to the accredited laboratory and institute concerned for testing and conclusion.

MARMARA ÜNİVERSİTESİ YAYINEVİ

# EFFECT OF MICROWAVE ENERGY ON DISPERSE DYEABILITY OF POLYPROPYLENE FIBERS

E. D. Koçak[1], M. Akalın[1], N. Merdan[2], B. Y. Şahinbaşkan[3]

[1]*Marmara University, Faculty of Technology, Department of Textile Engineering, Goztepe, Istanbul, Turkey*
[2]*Istanbul Commerce University, Faculty of Engineering and Design, Department of Textile Engineering, Kucukyali, Istanbul, Turkey*
[3]*Marmara University, Faculty of Technical Education, Department of Textile Studies, Goztepe, Istanbul, Turkey*
E-mail: burcuyilmaz@marmara.edu.tr

## Abstract

Because of the savings in energy consumption and the shortened process time, the use of microwave energy in textile wet processes has become an important research topic in the eco-friendly studies. In this experimental work, 100 % isotactic polypropylene (iPP) which is widely used in technical textiles, 80/19/1 and 60/30/10 % iPP/ LLDPE (linear low-density polyethleylene polymer fibers) / EVA (elastomer of ethylene-vinyl acetate) ternary polymer blend fibers were dyed by conventional and microwave heating methods under atmospheric condition with C.I. Disperse Yellow 114, Red 60 and Blue79. The color yields of conventionally dyed samples were compared to those of the dyed samples using the microwave heating. Finally, the high proportion of EVA in triple fiber mixes can be improved the coloristic properties of ternary polymer blend fiber. The color fastness to light was quite good for dyed samples by microwave heating with C.I. Disperse Blue 79. The washing and rubbing fastness results were adequate for all dyed samples. The process time was reduced almost 90% by microwave heating.



MARMARA ÜNİVERSİTESİ

MARMARA ÜNİVERSİTESİ YAYINEVİ

# NITROGEN-DOPED TITANIUM DIOXIDE PHOTOCATALYSTS FOR VISIBLE RESPONSE APPLICABLE ON SELF-CLEANING PROPERTY OF TEXTILES

E. K. Zadeh, S. M. Zebarjad, K. Janghorban

*Department of Materials Science and Engineering, School of Engineering, Zand Blvd, Zip code: 71348, Shiraz, IR Iran.*
E-mail: eli.katuie@yahoo.com

## Abstract

Environmental pollution and shortage of energy resources caused to pay much more attention to materials which have self-cleaning properties. Hence, The usage of semiconductor oxides is more common. Since titanium dioxide (TiO2) is cheaper, non-toxic and more efficient, therefore it is under more attention. Adding different elements changes the structure and property of TiO2. For example nitrogen decreases the band gap energy, resulting less energy to produce free radicals. Sol-gel method is used for the synthesis and incorporation of nanoparticles over non-conductive textiles particularly at low temperatures. This is because at high temperature the performance of natural fibers decreases drastically. In the current research N-doped TiO2 nanoparticles were synthesized using Sol-Gel method, Then the synthesized N-TiO2 was heat treated to achieve a stable structure. Textiles were prepared and dried by Degreasing solution and gas blowing. Finally the stabilized N-TiO2 nanoparticles were dip-coated over textiles without usage of any binder. Self-cleaning characterization of textiles was considered by Drop Shape Analyzer 100, Wavelength of the absorbed energy of N-TiO2 was measured by UV-Vis Reflectance Spectroscopy and the stereographic pictures of textiles were taken using a stereographic microscopy. Results compared with bare TiO2, show that addition of nitrogen increases the wavelength of absorption and cause the photocatalystc property for self-cleaning property of textiles being applicable under radiation of visible light. In addition, due to low temperature process physical properties of textiles do not change and there is no need to be air flowed after dipping the textiles.



MARMARA ÜNİVERSİTESİ