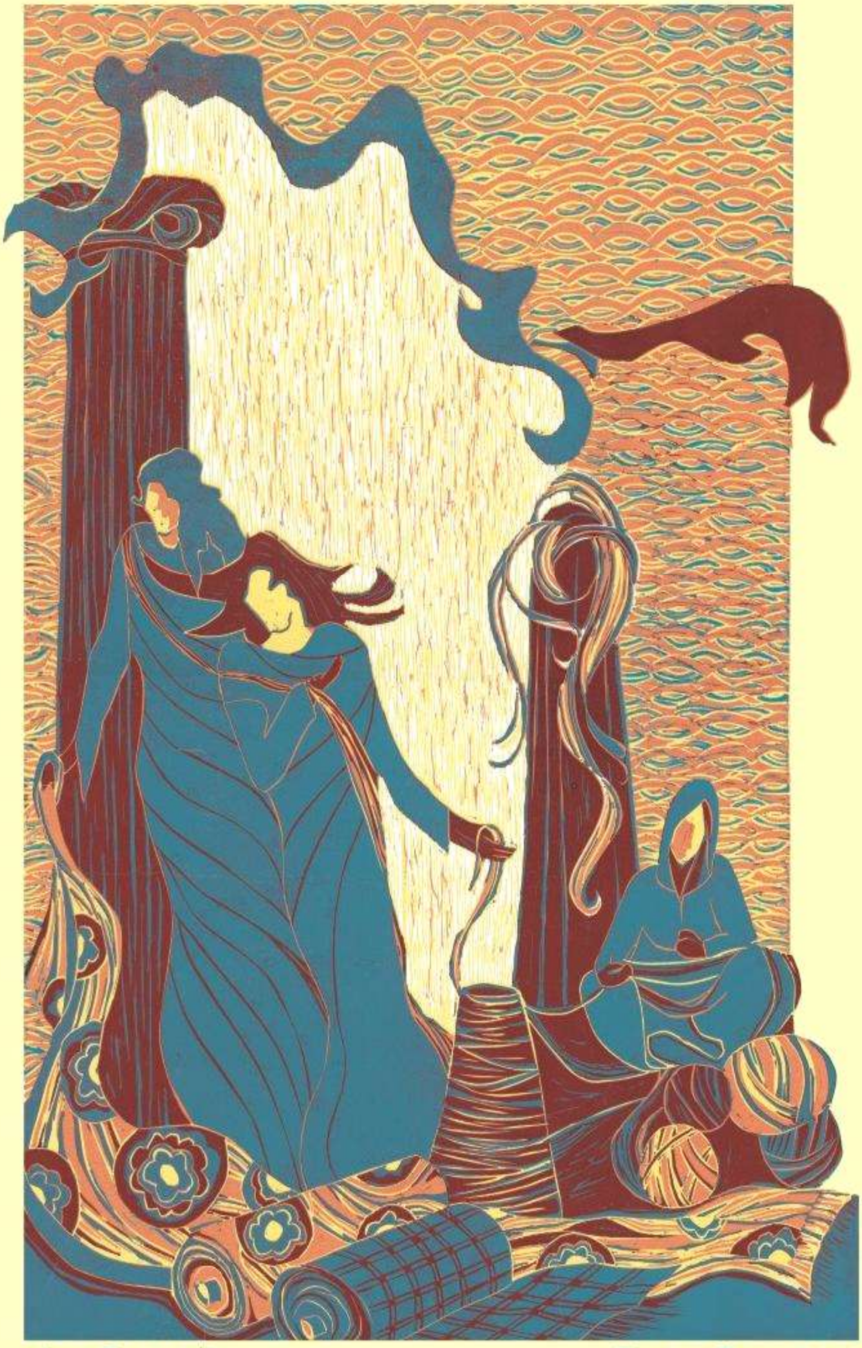
XII th INTERNATIONAL İZMİR TEXTILE & APPAREL SYMPOSIUM

IITAS 2010



28-30 October 2010

EGE UNIVERSITY
DEPARTMENT OF TEXTILE ENGINEERING

XIIth INTERNATIONAL İZMİR TEXTILE & APPAREL SYMPOSIUM

IITAS 2010

28-30 OCTOBER 2010
İZMİR - TURKEY

BOOK OF ABSTRACTS

Organizers

- **Ege University, Department of Textile Engineering**
- **Ege University Textile and Apparel Research - Application Center**

XIIth INTERNATIONAL İZMİR TEXTILE & APPAREL SYMPOSIUM

BOOK OF ABSTRACTS

EDITORS

Assoc. Prof. Dr. E. Perrin AKÇAKOCA KUMBASAR	Ege University
Assist. Prof. Dr. Zümrüt BAHADIR ÜNAL	Ege University
Dr. Cihat Okan ARIKAN	Ege University
Dr. Nida OĞLAKCIOĞLU	Ege University
Tuba BEDEZ ÜTE (MSc)	Ege University
Gözde ERTEKİN (MSc)	Ege University
Mustafa ERTEKİN (Textile Eng.)	Ege University

ISBN 978-975-483-872-5

Meta Basım Matbaacılık Hizmetleri
87 Sok. No. 4/A Bornova
Tel: (0232) 343 64 54 E-mail: metabasim@gmail.com
İzmir, Ekim - 2010

Content

SPONSORS

UNIONS & ASSOCIATIONS (In alphabetical order)

Ege İhracatçı Birlikleri

Ege Üniversitesi Bilim-Teknoloji Uygulama ve Araştırma Merkezi

İstanbul Tekstil ve Konfeksiyon İhracatçı Birlikleri

The Association of Swiss Textile Machinery Manufacturers

Türkiye Bilimsel ve Teknolojik Araştırma Kurumu (TÜBİTAK)

Türkiye Tekstil Sanayii İşverenleri Sendikası

COMPANIES (In alphabetical order)

Akın Tekstil A.Ş.

Asteks Kauçuk ve Plastik San. ve Tic. A.Ş.

Aygenteks Dış Ticaret ve Tekstil Sanayi Ltd. Şti.

Barine Home

BASF - The Chemical Company

Bekaert Carding Solutions

Benninger AG

Bozzetto Kimya A.Ş.

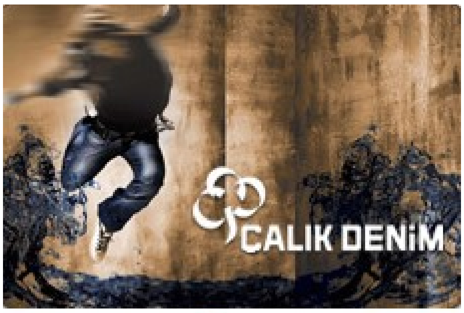
Bursa Tekstil&Konfeksiyon AR-GE Merkezi (BUTEKOM)

Clariant Türkiye A.Ş.

Climber B.C.

Coats

Cotton Incorporated



Çalık Denim

Dilo Systems GmbH

DyStar Textilfarben GmbH

Ekoten Tekstil A.Ş.

Gemsan A.Ş.

Haksever Düğme ve Kemer San. Dış Tic. Ltd. Şti.

IRO AB

Kedi Tekstil Matbaacılık Promosyon San.ve Tic.Ltd.Şti.

Lindauer DORNIER GmbH

Mayteks Örme Sanayi ve Ticaret A.Ş.

Mesdan S.p.A.

Miren Tekstil İthalat ve Mümessillik San. Tic. Ltd. Şti.

Oerlikon Textile Components

Orta Anadolu Ticaret ve San. İşletmesi T.A.Ş.

Özgün Boya Sanayi ve Ticaret Ltd. Şti.

Öztek Tekstil Terbiye Tesisleri San. ve Tic. A.Ş.

Picanol NV

Pulcra Kimya San.ve Tic. A.Ş.

Rieter Textile Systems

Sanko Holding

Savio Macchine Tessili S.p.A.

Spindelfabrik Suessen GmbH

Stäubli Sanayi Makine ve Aksesuarları Tic. Ltd. Şti.

Steinemann Technology AG

Trützschler Spinning

Uster Technologies

Ülkem Kimya ve Tekstil Dış Tic. Ltd. Şti.

Yünsa Yünlü San. ve Tic. A.Ş.

ADVISORY BOARD

Baran ARIN	Turkish Textile Dyeing and Finishing Industrialists' Association, Chairman of the Executive Board
Mustafa BALKUV	Turkish Knitwear Industrialists Association, Chairman of the Executive Board
Melike ANIL BİNGÖL	Chamber of Textile Engineers, Chairman
Jak ESKİNAZİ	Aegean Apparel Exporters Union, Former Chairman of the Executive Board
İsmail GÜLLE	İstanbul Textile & Raw Materials Exporters' Association, Chairman of the Executive Board
Prof. Dr. Hüseyin KADOĞLU	Head of Textile Eng. Department, Ege University
Prof. Dr. Emel ÖNDER KARAOĞLU	Dean of Textile Technology and Design Faculty, İstanbul Technical University
Teyfik KISACIK	Mediterranean Turkish-German Businessmen' Association, Chairman
Emre KIZILGÜNEŞLER	Aegean Apparel Exporters Union, Chairman of the Executive Board
Abdülkadir KONUKOĞLU	TOBB Textile Industry Assembly, Chairman
Fikri KURT	Association of Knitting Industrialists, Chairman of the Executive Board
Prof. Dr. Beno KURYEL	Dean of Engineering Faculty, Ege University
Prof. Dr. Binnaz MERİÇ	Head of Textile Eng. Department, Uludağ University
Halit NARİN	Turkish Textile Employers' Association, Chairman of the Executive Board
Cem NEGRİN	Turkish Clothing Manufacturer's Association, Chairman of the Executive Board
Sadık OĞUZ	Turkish Textile Foundation, Vice President of the Executive Board
Umut ORAN	TOBB Apparel and Ready Wear Industrial Assembly, Chairman
Nedim ÖRÜN	Association of Aegean Apparel Industrialists, Chairman of the Executive Board
Müzeyyen SARAÇOĞLU	Alumni Association of Textile Engineers from Ege University, Chairman
Prof. Dr. Necdet SEVENTEKİN	Ege University Textile & Apparel Research-Application Center, Director
Hikmet TANRIVERDİ	İstanbul Ready Wear and Clothing Exporters' Association, Chairman of the Executive Board
SABRİ ÜNLÜTÜRK	Aegean Textile & Raw Materials Exporters' Association, Chairman of the Executive Board

SCIENTIFIC COMMITTEE

Màrio de ARAÚJO	University of Minho, Portugal
Mirela BLAGA	Technical University of Gheorghe Asachi, Romania
Chokri CHERIF	Technische Universität Dresden, Germany
Krste DIMITROVSKI	University of Ljubljana, Slovenia
Kerim DURAN	Ege University, Turkey
Ana Marija GRANCARIĆ	University of Zagreb, Croatia
Paul KIEKENS	Universiteit Gent, Belgium
Vladan KONCAR	ENSAIT, France
Alenka MAJCEN LE MARECHAL	University of Maribor, Slovenia
Jiŕi MILITKÝ	University of Liberec, Czech Republic
Bülent ÖZİPEK	İstanbul Technical University, Turkey
Sigitas STANYS	Kaunas University of Technology, Lithuania
Işık TARAKÇIOĞLU	Textile Research Association, Turkey
Savvas G. VASSILIADIS	TEI Piraeus, Greece

ORGANIZING COMMITTEE

Assoc. Prof. Dr. E. Perrin AKÇAKOCA KUMBASAR	Ege University
Assist. Prof. Dr. Zümrüt BAHADIR ÜNAL	Ege University
Dr. Cihat Okan ARIKAN	Ege University
Dr. Nida OĞLAKCIOĞLU	Ege University
Tuba BEDEZ ÜTE (MSc)	Ege University
Gözde ERTEKİN (MSc)	Ege University
Mustafa ERTEKİN (Textile Eng.)	Ege University

Support Service

İpek BOSTANCIOĞLU

14:00	**REGISTRATION**
17:00 – 19:00	**WELCOME COCKTAIL**
	OPENING CEREMONY
	OPENING SPEECHES
	PRESENTING GRATITUDE PLAQUES
19:00	Presentation of gratitude plaques to **Mr. Ertekin ASHABOĞLU, Mr. Mahmut ÇALIK** and **Mr. Kemal SÖZKESEN** on behalf of the deceased **Mr. O. Nuri SÖZKESEN** for their valuable contributions in building and developing Turkish Textile & Apparel Industry; and to **RIETER TEXTILE SYSTEMS** and **TRÜTZSCHLER GmbH** companies which granted textile machines to Ege University Textile Engineering Department.
20:00	The speech of **Mr. Halit NARİN,** Chairman of Turkish Textile Employers' Association and the **COCKTAIL PROLONGER** to be sponsored by The Turkish Textile Employers' Association.

Thursday, October 28

09:30 – 10:00 Where Will Textile Industry Produce in the Future? Part IX
Işık Tarakçıoğlu
Textile Research Association (TADER), Turkey

10:00 – 10:30 The Global Textile Industry – Challenges and Opportunities in the Aftermath of the Global Financial and Economic Crisis 2008
Christian Schindler
International Textile Manufacturers Federation (ITMF), Switzerland

10:30 – 11:00 **Coffee Break**

11:00 – 11:30 International Trends and the Position of Turkey in Textile-Apparel Commerce
Ziya Altunyaldız
Undersecretariat of The Prime Ministry for Foreign Trade, Turkey

11:30 – 12:00 EU Negotiations to Liberalise Trade – Implications for Textile and Clothing Sector and for Turkey
Fernando Perreau De Pinninck
European Commission Industrial Tariff and Non-Tariff Negotiations, Belgium

12:00 – 14:00 **Lunch**

14:00 – 14:30 **Hikmet Tanrıverdi**
İstanbul Apparel Exporters' Association (IHKIB), Turkey

14:30 – 15:00 Turkish Textile and Apparel Sector in the Aftermath of the Crisis
Haluk Özelçi
İstanbul Textile and Apparel Exporters' Association, Belgium

15:00 – 15:30 **Coffee Break**

15:30 – 16:00 Research and Development Supports of Ministry of Industry and Trade
Ziya Karabulut
Ministry of Industry and Trade Directorate General for Industrial Research and Development, Turkey

16:00 – 16:30 Trends in the Global Fashion Industry and Enhancement of Turkish Brands
Nur Baytok[1], Tahir Kollu[2],
[1] Werner International, USA
[2] Kolin Ltd. Turkey

16:30 – 17:00 The Future Vision of the Sector
Umut Oran
International Apparel Federation, Turkey

20:00 **Dinner (Öztek Tekstil Terbiye Tesisleri San. ve Tic. A.Ş.)**

09:30 – 10:00 Characterization of Polyester Monofilaments and Fabrics Shrinkage

Jiří Militký[1], **Dana Křemenáková**[2], **Martina Košátková-Hušková**[2]

[1] *Technical University of Liberec, Department of Textile Materials, Czech Republic*

[2] *Technical University of Liberec, Department of Textile Technology, Czech Republic* 38

10:00 – 10:30 Air Jet Spinning–Yarns & Fabrics Compared to Established Spinning Systems

Harald Schwippl

Rieter Machine Works Ltd., Switzerland.. 40

10:30 – 11:00 **Coffee Break**

11:00 – 11:30 Optimized Production Methods with Automatic Weaving Preparation and Shedding Systems for Modern Frame Weaving

Ozan Çöteli[1], **Reinhard Furrer**[2]

[1]*Stäubli Sanayi Makine ve Aksesuarları Tic. Ltd. Şti. Istanbul / Turkey*

[2] *Stäubli Sargans AG, Sargans, Switzerland*.. 41

11:30 – 12:00 Evaluation of Effectiveness of Foreign Parts Separation Systems

Hermann Selker

Trützschler Spinning Company, Germany 42

12:00 – 12:30 Progressive Technologies from the Lindauer Dornier GmbH

Yaman Turgal[1], **Siegfried Sachs**[2]

[1]*DORNIER Makina Turkey Ltd. Sti., Istanbul, Turkey*

[2]*Lindauer DORNIER GmbH, Lindau, Germany*.. 43

12:30 – 14:00 **Lunch**

14:00 – 14:30 Innovative Can Mechanism with Improved Sliver Laying Kinematic for the Reduction of Logistic Costs

Bayram Aslan, **Thomas Gries**

RWTH Aachen University, Faculty of Mechanical Engineering, Institut für Textiltechnik, Aachen, Germany.. 45

14:30 – 15:00 IRO Weft Feeders

Carl Gunnar Jönsson

IRO AB, Sweden... 47

15:00 – 15:30 **Poster Session**

15:30 –16:00 **Coffee Break**

16:00 – 16:30 Options in Modern Technology to Address and Overcome Current Limitations in Yarn Clearing

Deniz Bütüner, Thomas Nasiou
Uster Technologies AG, Uster, Switzerland 48

16:30 – 17:00 The Value of Card Wire Design in Carding for Spinning and in Nonwovens

Lieven Vangheluwe
Technical Quality and R&D-Manager, Bekaert Carding, Belgium 50

17:00 – 17:30 Mechanical and Viscoelastic Properties of Nylon 66 Cord Yarns

Andrej Demšar, Vili Bukošek
University of Ljubljana, Faculty of Natural Sciences and Engineering, Department of Textiles, Ljubljana, Slovenia 51

20:00 **Dinner (The Association of Swiss Textile Machinery Manufacturers)**

16:00 – 16:30 Surface Modification of Polyester Fabric with Lipase – The Influence to Interface Phenomena

Ana Marija Grancarić[1], **Anita Tarbuk**[1], **Dragan Đorđević**[2]
[1]*University of Zagreb, Faculty of Textile Technology, Zagreb, Croatia*
[2]*University of Niš, Faculty of Technology Leskovac, Leskovac, Serbia*

16:30 – 17:00 Innovations from Research at Cotton Incorporated

William Rearick
Cotton Incorporated, USA

17:00 – 17:30 Application of Microencapsulated Thermochromic Pigments on Jeanswear by Exhaustion and Other Methods

J. Neves, J. H. O. Nascimento, A. Carvalho, M. Neves
University of Minho, School of Engineering, Guimarães, Portugal

20:00 **Dinner (The Association of Swiss Textile Machinery Manufacturers)**

09:30 – 10:00 Radical Innovation in Textile Product Design and Fabrication
Mário de Araújo
University of Minho, School of Engineering, Portugal 63

10:00 – 10:30 Textile Electronics
Vladan Koncar
ENSAIT, France 65

10:30 – 11:00 **Coffee Break**

11:00 – 11:30 The Future of Textile Productions in the Developed Countries
Amotz Weinberg
Shenkar College, Israel 67

11:30 – 12:00 Innovative Textile Based Structures for Novel Composite Materials
C. Kowtsch, G. Hoffmann, O. Diestel, Ch. Cherif
Institute of Textile Machinery and High Performance Material Technology, TU Dresden, Germany 68

12:00 – 12:30 Moisture Absorbtivity of Functional Underwear
Lubos Hes
Technical University of Liberec, Czech Republic 69

12:30 – 14:00 **Lunch**

14:00 – 14:30 Prologue – New Period of Fashion with New Definitions
Ümit Ünal
Turkey

14:30 – 15:00 Possibilities of Acquiring Anthropometrical Data and Its Limitations
Ausma Vilumsone, Inga Dabolina
Institute of Textile Materials Technology and Design, Riga Technical University, Latvia 71

15:00 – 15:30 **Poster Session**

15:30 –16:00 **Coffee Break**

20:00 **Dinner (The Association of Swiss Textile Machinery Manufacturers)**

09:30 – 10:00 Ecological Modern Stain Management
Wolfgang Knaup, Jochen Schmidt
Clariant International Ltd, Switzerland 87

10:00 – 10:30 Novel Synthetic Fibers by Multicomponent Melt-Spinning
Rudolf Hufenus
Empa, Swiss Federal Laboratories for Materials Testing and Research, Switzerland 88

10:30 – 11:00 **Coffee Break**

11:00 – 11:30 FRONT Project: A New Perspective for Flame Retarded Textiles by Nanotechnology
P. Kiekens[1], J. Alongi[2] and FRONT Consortium
[1]*Ghent University, Department of Textiles, Belgium*
[2]*Politecnico di Torino, Dipartimento di Scienza dei Materiali e Ingegneria Chimica, Italy* 90

11:30 – 12:00 Innovations in Textile Finishing
Michael W. Schmitt
BASF SE, Germany 91

12:00 – 12:30 Multifunctional Knitting Design for Sports T-Shirts Thermal Comfort
M. Neves, N.L.Filho, J. Neves
University of Minho, School of Engineering, Portugal 92

12:30 – 14:00 **Lunch**

14:00 – 14:30 Biodegradation of Antimicrobial Treated Cellulose Textile Substrates
D. Jausovec[1], D. Angelescu[2], B. Lindman[3], B. Voncina[1]
[1]*University of Maribor, Faculty of Mechanical Engineering, Textile Department, Slovenia*
[2]*Romanian Academy, Institute of Physical Chemistry "I. G. Murgulescu", Romania*
[3]*Department of Physical Chemistry 1, Centre for Chemistry and Chemical Engineering, Lund University, Sweden* 94

14:30 – 15:00 Thermal Comfort Properties of Knitted Fabrics Made of Elastane and Bioactive Yarns
Elena Onofrei[2], Ana Maria Rocha[1,2], André Catarino[1,2]
University of Minho, [1]Department of Textile Engineering, [2]Centre for Textile Science and Technology, Portugal 95

15:00 – 15:30 Biopreparation – From Analytical Point of View
E.Csiszár[1], E. Fekete[2], B. Koczka[3]
[1] *Department of Physical Chemistry and Materials Science, Budapest University of Technology and Economics, Hungary*
[2] *Institute of Materials and Environmental Chemistry, Chemical Research Center, Hungary*
[3] *Department of General and Analytical Chemistry, Budapest University of Technology and Economics, Hungary* 97

15:30 – 16:00 Coffee Break

16:00 – 16:30 Closing

20:00 Dinner

TRENDS IN THE GLOBAL FASHION INDUSTRY AND ENHANCEMENT OF TURKISH BRANDS

Nur Baytok[1], Tahir Kollu[2]
[1] *Werner International, INC,USA*
[2]*Kolin Ltd., Turkey*
drtahirkollu@ttnet.com

Globalization will keep on making our industry grow, but uncertainty will also grow and business rules will become less evident. Especially, with the recent global economic recession, the customers are looking for new products and creative value solutions, shorter lead times, fast reaction from suppliers, better quality, better communication, better services and lower prices. In short, the customers are looking for innovation, perceived value and speed.

Barriers are fading, competitiveness is evolving and the world is shrinking. So, it is up to the companies where they want to position themselves in the global textile industry. In order to find the most suitable positioning strategy, the companies need to question and assess their strategic awareness, and their capabilities and skills.

CHARACTERIZATION OF POLYESTER MONOFILAMENTS AND FABRICS SHRINKAGE

Jiří Militký[1], **Dana Křemenáková**[2], **Martina Košátková-Hušková**[2]
[1] *Technical University of Liberec, Department of Textile Materials, Hálkova 6, 46117Liberec, Czech Republic*
[2] *Technical University of Liberec, Department of Textile Technology, Hálkova 6, 46117Liberec, Czech Republic*
jiri.militky@tul.cz

The ion exchange membranes are often reinforced with woven fabric or a net of polymers. The properties of these supporting nets have major influence on the mechanical strength, dimensional stability, and durability of membrane. The plain woven fabrics from synthetic monofilaments (usually polyesters or polyamides) are often used for creation of nets. By proper drawing and heat setting the monofilaments structure and macroscopic shrinkage can be changed in wide range. Their breaking strength can vary in broad bounds depending upon manufacturing conditions as well. Because the monofilaments are produced for wide range of applications their stabilization is not high and the quick marked shrinkage appears (see. Fig. 1). The same is valid for reinforced fabric without thermal setting – fixation.

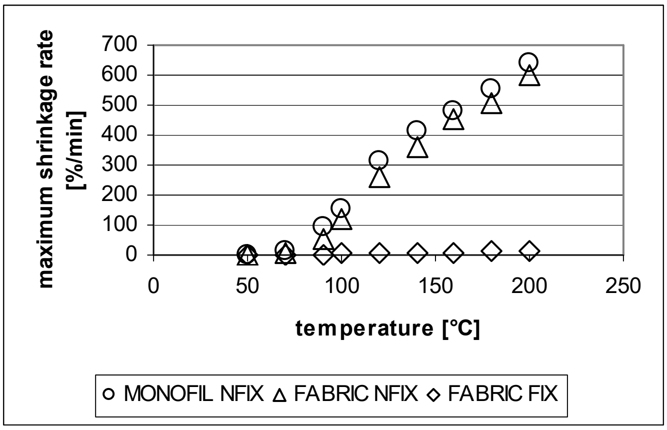


Figure 1. Shrinkage rate dependence on the shrinkage temperature for monofilament, fixed and non fixed fabric

It is therefore necessary to investigate thermally induced shrinkage of textile reinforcement. For this purpose the method based on the evaluation of maximum shrinkage rate was proposed [1]. PET monofilaments for technical applications with measured fineness 33.84 dtex were used for experiments. Shrinkage experiments were realized on the TST2 shrinkage tester (Lenzing) under standard conditions. The pre-stress 0.7 g was selected. Measurements were realized at temperatures 70, 90, 100, 120, 140, 160, 180 and 200°C. All measurements were investigated in the time interval till 1 min which was sufficient for effective (maximum - equilibrium) shrinkage S_e reaching. All measurements were repeated 20 times and mean values were used for curves creation and parameters estimation.

The typical shrinkage kinetic curve (dependence of shrinkage on the time) for temperature 100°C is shown in the Fig. 2a. The corresponding shrinkage rate curves obtained by the using of spline smoothing with optimized smoothing parameter [15] is shown in the Fig. 2b.

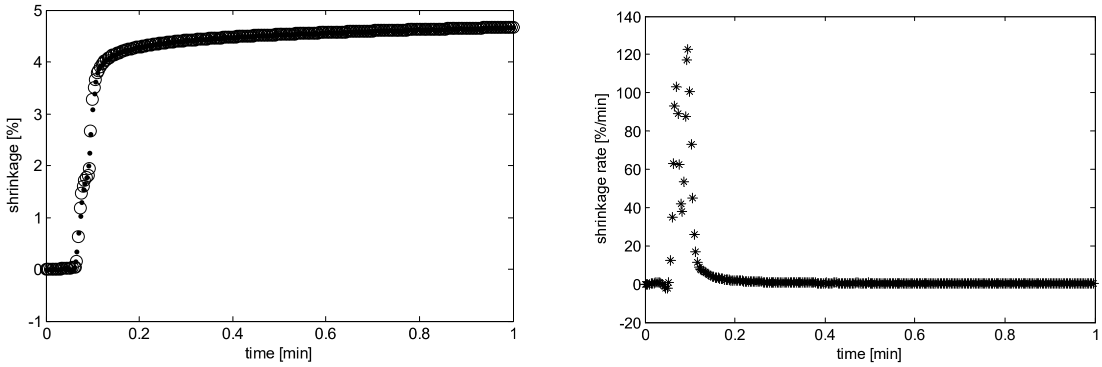


Figure 2. a) Time dependence of shrinkage at 100°C (empty circles are experimental points, dot are smoothed values), b) Time dependence of shrinkage rate at 100°C

The maximum shrinkage rate corresponding to the Fig. 2b was evaluated to be equal to the R_s = 122.46 % min^{-1}. By the same manner the values of R_s for all investigated temperatures were evaluated. The dependence of R_s on the temperature is shown in the Fig. 3.

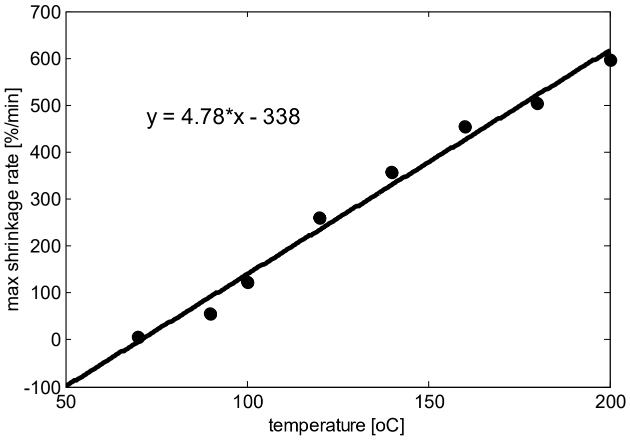


Figure 3. Temperature dependence of maximum shrinkage rate (dots) and straight line from LS regression

The approximation of this dependence by least squares (LS) straight line is very good (see Fig. 3 solid line). Corresponding shrinkage rate thermal sensitivity coefficient SRT for the range 70-200°C is then equal to the slope i.e. **SRT = 4.78 % min^{-1} °C^{-1}**. Generally, this huge value of SRT indicates no proper thermal stabilization of fibers and therefore necessity of subsequent thermal treatment.
This approach was used for characterization of reinforcing fabric “Ulester” from polyester monofilaments (see. Fig. 1).

Acknowledgement
This work was supported by research projects VCT I – LN 00B0090, VCTII No. 1M0553.

Key Words: Shrinkage rate, industrial polyester monofilaments, membrane reinforcements, monofilament fabrics

References
[1] Militký J. et. all.: *Thermal Sensitivity of Industrial Polyester Monofilaments Shrinkage Rate*, 15th Int. Conf. STRUTEX, Liberec December 2008

AIR JET SPINNING – YARNS & FABRICS COMPARED TO ESTABLISHED SPINNING SYSTEMS

Harald Schwippl
Rieter Machine Works Ltd., Switzerland
harald.schwippl@rieter.com

Introduction

Alongside the existing end spinning methods, such as ring spinning, compact spinning and rotor spinning technology, air-jet spinning was already gaining a market share in the US in the early 1980s. Modifications made in the late 1990s resulted in significant changes in yarn structure compared with the first generation of air-jet-spun yarns. This enabled twist to be imparted more effectively to the outer surface of the yarn, which consequently increased the yarn tenacity. This also made it possible for the first time to process shorter staple lengths, such as 100% cotton, in addition to manmade fibers and blends. This enabled the potential sphere of application for air-jet spinning to be widened significantly. The specific structure of these yarns often displays particular advantages in the textile end product, which considerably expands the range of end products and their product characteristics.

Rieter already started to acquire technological know-how for the development of air-jet spinning processes some years ago. A start was then made later to develop a suitable machine concept for air-jet spinning.

Experimental Setup

The following study was conducted in the context of a cooperative venture between Lenzing and Rieter. It seeks to establish the properties of yarns produced using the air-jet spinning process and compares them with those of yarns produced using established spinning methods. Characteristic differences in downstream processing of the yarns and in the textile fabric were measured in addition to yarn properties. Two different TENCEL® LF/cotton blends were used as the raw material.

OPTIMIZED PRODUCTION METHODS WITH AUTOMATIC WEAVING PREPARATION AND SHEDDING SYSTEMS FOR MODERN FRAME WEAVING

Ozan Çöteli[1], Reinhard Furrer[2]
[1]Stäubli Sanayi Makine ve Aksesuarları Tic. Ltd. Şti. Istanbul, Turkey
[2] Stäubli Sargans AG, Sargans, Switzerland
O.Coteli@staubli.com

In order to match the specific needs of the market a mill has to configure its weaving machines with the right shed motion. Powerful frame drive systems are available today to match the high speed requirements of modern weaving equipment. An overview will be given on state-of-the-art technology in frame weaving systems that reach not only high speed and performance but ensure as well high quality and reliability. A particular look is taken on a cam motion system providing some interesting technical features. This machine - particularly designed for water jet weavers - allows economical production of standard and technical fabrics.

Weaving preparation – the production stage between warp preparation and weaving – can be a deciding factor for modern weaving mills to remain competitive in a moving market. Quick changing demands and short delivery times require flexibility in production and the ability to adapt to the customers' needs. The capacity and throughput times in weaving preparation need to be designed to fulfil the requirements of the weaving shed in order not to become the bottleneck of the factory. – Some modern means and methods to optimize and rationalize the weaving preparation department are subject of the presentation.

Key Words: Shedding, dobbies, cam motions, automatic warp drawing-in, weaving preparation

EVALUATION OF EFFECTIVENESS OF FOREIGN PARTS SEPARATION SYSTEMS

Hermann Selker
Trützschler Spinning Company, Germany
hermann.selker@truetzschler.de

Foreign parts separation equipment for spinning has been on the market for about 10 years. During this period, a rapid development took place.

1. Concept

In 1999, the first equipment was used directly after bale opening. This was to prevent foreign parts from being broken up and consequently multiplied during processing in the cleaning line. However, this reasoning proved to be wrong in practice. In reality, the degree of opening at the beginning of the line was not sufficient enough to actually detect small parts. Generally, the large parts are really not a problem; they are separated during the regular cleaning process.

2. Separation

In the initial development stage, the fibre flow was briefly diverted and separated after detection of a foreign part. This resulted in a large loss of good fibres. Today, sophisticated nozzle systems are used for a highly selective separation. The application of sensors to measure the speeds of the foreign parts resulted in a reduction of the blow-out time of the nozzles. The economic efficiency is significantly improved by a more specific separation and shorter blow-out times.

3. Sensors

The first systems focused entirely on the colour. The tuft flow was scanned with a large number of colour sensors. This was followed by the use of black and white cameras, simple colour cameras, and ultrasound and UV sensors. The current highlights are high-quality 3-CCD colour cameras At the same time, the software for image analyzing became increasingly faster and safer. Today, even transparent and white foreign parts can be safely selected in cotton. Due to ever increasing camera resolutions it was also possible to reduce the minimally detectable part size. The comparison and evaluation of the various sensor systems is a major part of this paper.

4. Evaluation criteria

To allow objective comparison of various sensors and machines, an evaluation system was developed. The foreign parts are classified by type, size and by the threat they pose to further processing in spinning. The result is an evaluation matrix that can be used for the evaluation of any foreign part separator.

PROGRESSIVE TECHNOLOGIES FROM THE LINDAUER DORNIER GMBH

Yaman Turgal[1], Siegfried Sachs[2]
[1]*DORNIER Makina Turkey Ltd. Sti., Istanbul, Turkey*
[2]*Lindauer DORNIER GmbH, Lindau, Germany*
yaman.turgal@lindauerdornier.com

"Those who only tread into the footsteps of another leave no footprints behind"

Lindauer DORNIER GmbH has been producing weaving machines for over half a century. From the start of weaving technology development our central desire and unbroken enthusiasm have been aimed at refined technologies for the production of high quality woven fabrics. The special feature of the DORNIER rapier weaving machine is its **positively controlled weft insertion system**, which relates to the model of the human hand, and in its functional cycle, is comparable to the handing over of the baton by one runner to another in a relay race. This revolutionary technology has been in successful use since 1967 and is today still creating the maximum in textile structuring possibilities for the widest variety of weaves. Only with DORNIER there are up to **16 weft colours**, which can be processed pick and pick, and the new colour selector version which is self-monitoring and correcting. The rigid rapier rods are guided almost contact-free on an aerostatic bearing to enable the filling to be inserted at speeds up to 600 rpm. Yarn load is markedly reduced by **open shed weft insertion**, while, on top of that, the rapier's special motion cycle ensures competitive tension levels which also enable the safe processing of low tensile strength yarns. In 2009 with the new A1 and P1 weaving machine model, we at DORNIER initiated the absolutely new **Fast-Ethernet-Technology** electronic control system after 20 successful years with CAN-Bus electronics. Intuitive handling of weaving machine control is possible for the first time with the newly produced **DORNIER ErgoWeave®** operating concept using unambiguous symbols and little text. A sensitive touch screen can be directly activated by the operator. Input options are clearly arranged according to yarn run during weft insertion and warp end motion. With this controlling, processing and monitoring-level communication structure, the largest data quantities can be reliably transmitted in real time, which is of special importance for the air-jet weaving machine and for controlling the relevant valves. Put into practice with these new control electronics is a new belt-free drive concept, the new **CompactDrive** for the rapier weaving machine. With this new drive the centrifugal mass, the clutch-brake unit and speed control are integrated in the drive motor. The air-cooled motor is designed for high load weaving with a maximum number of heald frames and lifting hooks. Two further variants are available for the air-jet weaving machine: the **DirectDrive**, which contains no clutch-brake unit, and the **DORNIER SyncroDrive®,** by which the weaving machine and the shedding unit are driven via separate motors. With the last-mentioned version, a marked reduction in shaft and heddle system loading is achieved, which is reflected in the fabric quality and the longer working life of the mechanical components. An ideal back shed section is very important for a good fabric result, even more when low-tension warp materials come into use, which is quite usual with technical fabrics. Conventional backrest roller units, frequently with heavy deflecting rollers, have sometimes resulted in warp material capillary damage and consequently in poorer fabric quality.

DORNIER weaving machines have left clear footprints behind in the textile world of woven fabric production with their often revolutionary and decisive technologies, and will also do so in the 21st century.

Key Words: New DORNIER system family of weaving machines, efficient weaving technology, new control and drive concept

INNOVATIVE CAN MECHANISM WITH IMPROVED SLIVER LAYING KINEMATIC FOR THE REDUCTION OF LOGISTIC COSTS

Bayram Aslan, Thomas Gries

RWTH Aachen University, Faculty of Mechanical Engineering, Institut für Textiltechnik, Aachen, Germany

bayram.aslan@ita.rwth-aachen.de

Problem/Literature Review

In spinning mills, one of the best methods of transportation of fibrous material is by using spinning cans. However, spinning cans due to their structural and dimensional characteristics require more space (approx. 25 % base area of the spinning mill) for their storage which leads to enormous space costs. Additionally, the required transport and setup time is a significant part of the logistic and manufacturing costs. Apart from this the modern high speed machines are concentrated on increasing the rate of production during improving quality and decreasing manufacturing costs. Thus, logistic, setup and nonproductive time costs constitute a major part of manufacturing the costs [1]. There exist some transport system solutions for automating the can logistic in spinning mills [2; 3; 4; 5; 6; 7]. Such automation solutions are associated with high investment costs and do not find application in industrial practice. Therefore, the manual handling of the spinning can is dominant in spinning mills. This work presents an innovative can holder with improved sliver laying mechanism. The new laying mechanism increases the can capacity without affecting the sliver quality. This leads to the reduction of logistic costs in spinning mills.

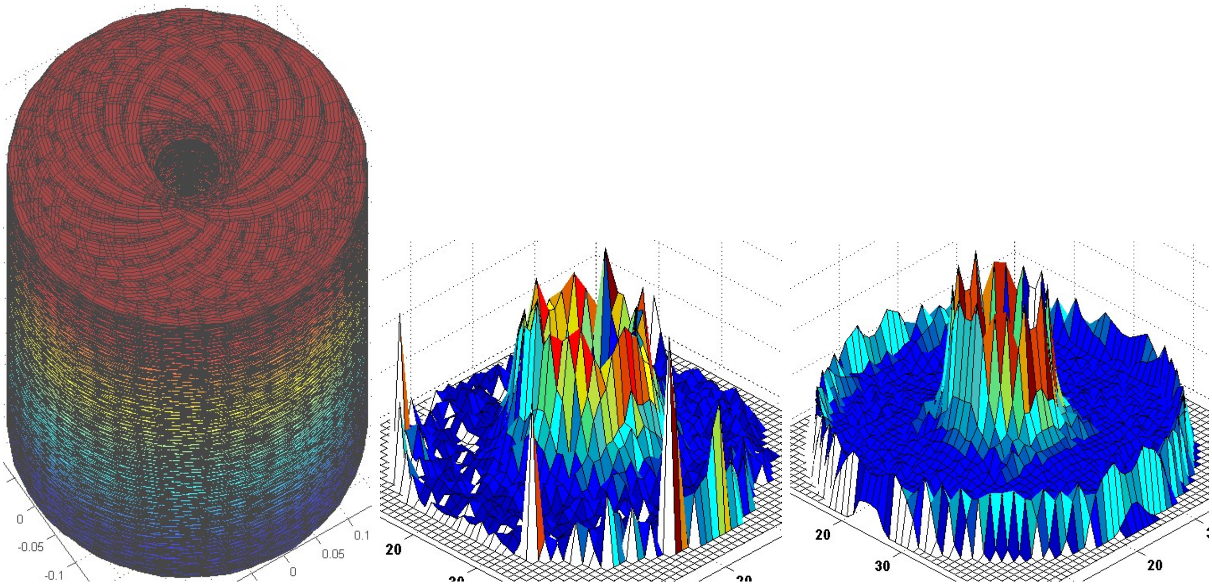
Analysis and Discussion

The work described in this paper is targeted at increasing the efficiency and utilization of spinning cans. This is expected to lead to increase of the capacities of cans, which would have a direct effect on the reduction of batch change times. This eventually would lead to availability of more space in spinning mills. Apart from the logistic advantage the work also deals with a new developed concept for laying slivers which would lead to the reduction of unnecessary forces and drafts acting on the sliver. This in turn would lead to enhanced quality of the yarn delivered at the end of the entire spinning process.

Experimental tests have been carried out and the forces acting on the sliver have been measured using pressure sensors from Tekscan, Boston USA, figure 1. A systematical approach for tests has been carried out, in order to determine the effect of the amount of sliver laid in a spinning can, especially the distribution of pressure exerted over the laying area; on the sliver quality in terms of coefficient of variation. Using the experimental results a process simulation of the sliver laying with integrated mathematical model of a sliver has been developed, figure 1. The new developed laying concepts are evaluated using the process simulation tool. The best laying concept has been detected which is leading to the targeted results. In cooperation with textile machinery manufacturing industry and power transmission industry, the kinematically modified new laying concept is going to be developed as a flexible can holder test bench. This modular test bench can be used for spinning cans as well as carding cans. The modified laying concept is being tested for and has also been briefly discussed in this paper.

Conclusion

The results of this work show that a concept has been successfully developed for increasing the packing density in spinning cans and also for reducing the logistic costs associated with spinning cans in spinning mills. This innovation also depicts the opportunity for reduction of investment costs for new spinning cans. Above all the results also portrays a solution for improved product quality by homogenization of the distribution of pressure in the spinning can.



3-D Simulation 3-D measured load of pressure 3-D simulated load of pressure

Figure 1. Conventional sliver laying kinematic

Key Words: Staple fibre spinning, sliver, carding, drawing

References

[1] Klinke, R., Bedeutung der Kannenformate im Arbeitsablauf der Baumwollspinnerei unter Besonderer Berücksichtigung der Strecken, Zeitschrift für die gesamte Textilindustrie 61 (1959), Nr. 9, S. 329-334

[2] Lamprecht, I, Das fahrerlose Kannentransportsystem „Canny One“, Textilpraxis International 49 (1994), H. 9, S. 566, 568, 570

[3] Wiggers, H.; Lamprecht, I., Praxiserfahrung mit einem FTS-System in einem Spinnereibetrieb, VDI-Berichte 1107 (1994), S. 149-168, Düsseldorf: VDI-Verlag, 1994

[4] Renner, M., Transportautomatisierung in der Spinnerei, Chemiefasern/Textilindustrie 40/92 (1990), H. 12, S. 1211-1213

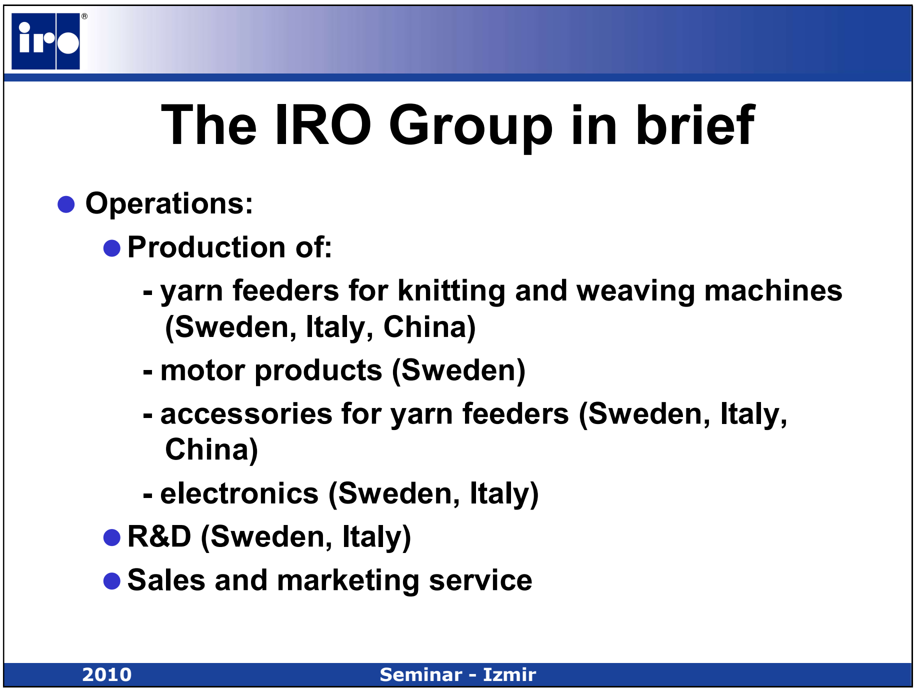
[5] Langen, M., Transportautomatisierung von der Karde bis zur Weberei, Chemiefasern/Textilindustrie 38/90 (1988), H. 12, S. 1146-1149.

[6] Lamprecht, I.; Schlichter, S., Transportautomatisierung in der Spinnereivorbereitung, Melliand Textilberichte 73 (1992), H. 8, S. 616.622

[7] N.N., Transport-Automation in der Spinnerei, in: Loy, W. (Hrsg.): Taschenbuch für die Textilindustrie 2002, S. 89-96, Berlin: Fachverlag Schiele & Schön GmbH, 2002.

IRO WEFT FEEDERS

Carl Gunnar Jönsson
IRO AB, Sweden
carlgunnar.jonsson@iro.se



OPTIONS IN MODERN TECHNOLOGY TO ADDRESS AND OVERCOME CURRENT LIMITATIONS IN YARN CLEARING

Deniz Bütüner, Thomas Nasiou
Uster Technologies AG, Uster, Switzerland
deniz.buetuener@uster.com

In this presentation USTER® will explain current limitations in yarn clearing and show options how with modern technology they can be addressed. Furthermore, USTER® will present ideas on how the textile industry can assure quality of yarn while at the same time optimizing the economical impact.

With the USTER® *QUANTUM 2,* the help of the CCU 2006 as the standard central unit and the powerful USTER® *QUANTUM EXPERT SYSTEM*, we are able to illustrate this better yarn clearing performance on a continuous base in a way that the spinning mill can **adjust the clearing limits in real time to meet the required level of quality by saving unnecessary cuts.**

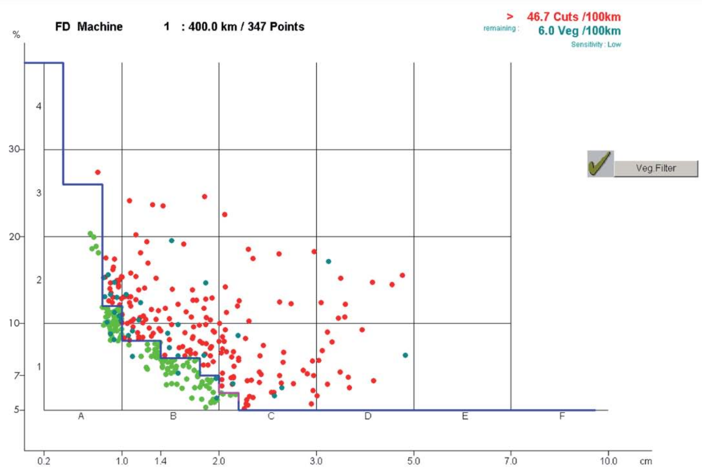
We will also show advanced handling of contamination and mass faults.

The adjustment of the clearing limits is not improving only the quality level of the yarn but in all cases is also reducing the manufacturing costs by removing no more faults than the disturbing ones.

Over the years it has been proven time and time again that **USTER® yarn clearing is much more effective than any other alternative in the market.** This difference in performance was assessed using traditional methods such as USTER® *CLASSIMAT* tests and fabric comparisons.

The Example

This spinning mill produces Nec 40 combed knitting yarn. **They have high requirements from their clients in regards to clearing contamination.** But at the same time this mill was looking for ways to improve their cost in a competitive environment.



FD events and cuts distribution with separation of vegetables

In this example the spinning mill set the contamination clearing curve based on the desired quality in this respect as agreed with the end user of the yarn. But, **with the implementation of USTER® *QUANTUM 2* clearers vegetable filter it was possible to save 6 cuts/100 km** by using it at a very conservative way (level: LOW) and by this do not affect the final quality at all.

In this specific mill example, every additional clearer cut costs 0.00927 US$

The Result

The proposal shown in this example leads to a number of improvements:

- **Savings up to 91’000 US$ per year. Still further optimization is possible but the approach was conservative.**
- 7% less compressed air consumption.
- The spinning mill could reduce in this example the winding speed by 30 m/min and still achieve the same production rate only by reducing the cuts by 6/100 km (less efficiency loss due to less cuts/ splices). By this, the mill was able to deal more efficient with the yarn Hairiness increase due to winding. Further speed reduction is possible by using the vegetable filter in a sharper operation level (e.g. MEDIUM).

The Conclusion

With USTER® *QUANTUM* you have the unique possibility to visualize and see all yarn events and with modern tools distinguish between disturbing and non disturbing faults. With this choice you can find an optimal balance between productivity and quality as displayed in our example.

THE VALUE OF CARD WIRE DESIGN IN CARDING FOR SPINNING AND IN NONWOVENS

Lieven Vangheluwe
Technical Quality and R&D-Manager, Bekaert Carding, Belgium
Lieven.Vangheluwe@bekaert.com

Although carding is considered a mature technology in spinning (short staple and long staple) and nonwovens, there is still progress in quality and performance. The success of the carding operation depends on a number of factors, of which the selection and quality of the card wires is of tremendous importance.

The paper presents a number of new insights in the effect of card wire in carding. Results with the novel SiroLock® card wire (brought to the market by Bekaert Carding Solutions) show that breakthroughs in carding are possible thanks to further developments in card wires.

MECHANICAL AND VISCOELASTIC PROPERTIES OF NYLON 66 CORD YARNS

Andrej Demšar, **Vili Bukošek**
University of Ljubljana, Faculty of Natural Sciences and Engineering,
Department of Textiles, Ljubljana, Slovenia
andrej.demsar@ntf.uni-lj.si

Introduction and purpose

Today the consumption of different composite materials and among them especially rubber composites constantly increases. Rubber composites are produced and used at certain conditions (temperature, pressure, time) which could affect physical and mechanical properties (such as modulus, elongation, tensile strength) of textile part of the composite. Rubber composites are produced and used at certain conditions (temperature, pressure, time) which could affect physical and mechanical properties (such as modulus, elongation, tensile strength) of textile part of the composite. In many applications exposure to heat occurs in at least one stage of the manufacturing process. It is desirable to minimise these changes so that the optimum performance can be realised from the textile reinforcements. This is achieved by treating the yarns at elevated temperatures under tension (heat setting). By selection of conditions of heat setting, the general physical properties of cord can be adjusted to required level. During heat setting process the supermolecular structure of cord yarn is stabilised and changes of properties on subsequent exposure of yarn to heat are reduced or minimised.

The purpose of the following work is to determine mechanical, physical, viscoelastic and morphological properties of nylon 66 cord yarns and their dependence on the production process and application conditions (temperature and time) of the rubber composite.

Experimental

Commercial nylon 66 cord yarns were analysed before and after annealing at different annealing conditions. The annealing conditions (temperature, time and state) were selected so that the production and application temperatures of textile rubber composites were simulated. Yarn tensile properties have been determined using Instron tensile tester. From the tensile tests data the stress strain curves were generated and the breaking force, breaking extension, breaking stress, elasticity modulus, yield stress and yield strain were determined. Viscoelastic properties were analyzed with the use of dynamic mechanical analysis (DMA). The DMA tests were carried out on TA equipment, DMA Q800 (USA), with a controlled gas cooling accessory (GCA). The samples were heated from −10 °C to 260 °C at a constant rate 3 °C/min. During heating, the test specimen was deformed (oscillated) at a constant amplitude of 10 μm at a single frequency of 1 Hz. The mechanical properties were measured. The strain deformation values were sufficiently small (< 0,10 %) to assure that the mechanical response of the specimens were within the linear viscoelastic range. The elastic modulus E' (storage modulus - measure of the energy stored elastically, component in phase), the loss modulus E" (loss modulus - measure of the energy lost as heat, a component that is 90° out of phase), the loss factor (defined as $\tan \delta = E''/E'$) and T_g were measured and compared.

Results

On the basis of the tensile tests results it can be concluded that the breaking stress is not affected by the treatment conditions. The breaking strain increases at samples treated at free sate and decreases at samples treated at clamped and preloaded state. Modulus of elasticity decreases and yield point moves to higher strains at all treated samples. The tensile properties of samples treated at free state decrease in whole deformation range compared to raw samples. The stresses at samples treated in clamped or preloaded state increase compared to raw samples above the initial deformation (> 5 %).

The DMA analysis showed that initial moduli of temperature-treated nylon cord yarns in the clamped state decrease after temperature treatment. Temperature treatment decreases the number of entanglements among molecules in the amorphous region and thus decreases amorphous orientation. On the other hand, additional crystallisation occurs during temperature treatment in the amorphous regions of cord yarn, which increases the order of the amorphous regions, thereby decreasing the segmental mobility of molecules. Thus, it can be concluded that dynamic mechanical analysis enables the detection of subtle differences in the materials (on the molecular level) and aids in determining the optimal process conditions for given materials and, similarly, optimal materials for given applications.

Key Words: Nylon, cord yarns, dynamic mechanical analysis, viscoelastic properties, mechanical properties

References

1. Bukošek, V., Prevoršek, D. C., Model of nylon 6 fibers microstucture : microfibrillar model or "Swiss-cheese" model?. *Int. j. polym. mater.*, 2000, vol. 47, no. 4, page 569-592.
2. Murthy, N. S., et al., Drawing and annealing of nylon-6 fibres: studies of crystal growth, orientation of amorphous and crystalline domains and their influence on properties. *Polymer*, 1995, Vol. 36, no. 20, page 3863 – 3873.
3. Peterlin, A., Morphology and Properties of Crystalline polymers with Fiber Structure, *J. Textile Research Journal.*, 1972, vol. 42, no. 1, page 20-30.
4. Peterlin, A., J. *Journal of Applied Physics*., 1977, vol. 48, no. 10, page 4099-4107.
5. Prevoršek, D. C. et al., Viscoelastic properties of N6 and N66 tire cords: morphological analysis. *Ruber chem. Tech.,* 1987, vol. 60, page. 659.
6. Wootton, D.B., *The application of textiles in rubber*. Shawbury, Shrewsbury, Shropshire [Great Britain] : Rapra Technology, 2001.
7. Lewin M., Pearce E.M., *Handbook of Fiber Science and Technology; Volume IV.: Fiber Chemistry*, Marcel Dekker, Inc., New York and Basel, 1985.
8. Prevoršek D.C., Oswald H.J., *Melt Spinning of PET and Nylon Fibers. In the book Solid State Behaviour of linear Polyesters and Polyamides*, Prentice Hall, New Jersey, 1990, 131 – 208.
9. Bukošek, V., *Ph.D. thesis*; Ljubljana, 1997 (in Slovenian).
10. Gupta, V.B., *In Textile Fibers: developments and innovations, Volume 2,* Kothari, V.K., Ed.; IAFL Publications: New Delhi, 2000, p 11-118.
11. Elyashevich, G.K.; Baranov, V.G.; Frenkel, S.Y., *J Macromol Sci – Physics,* B13 (2), 1977, 255-289.

TEXTILE DESIGN AND FASHION

Sabrina Beretta
BOZZETTO S.p.A, Italy
sabrina.beretta@bozzetto.it

1. Bozzetto

- R&D

"The formula of our success: deep chemical knowledge and strong application know-how"
"State-of-the-art application labs to support our business development"

2. Resins

- Plastic and Resin

The Americans address "*reactants*" to the glyoxalic derivatives, where in Europe is preferred the use of "*resins*".

- Glyoxalic

The chemical formula and chemical structure of gloxalic resins.
Benefits, advantages and disadvantages of resin application on textile.

- Acrylic

The chemical formula and chemical structure of gloxalic resins.
Benefits, advantages and disadvantages of resin application on textile.

- Polyurethane

The chemical formula and chemical structure of gloxalic resins.
Benefits, advantages and disadvantages of resin application on textile.

3. Trends of resin applications in fashion

Fashion show movie and resin examples in new trends.

4. Collection show in Bozzetto Group stand

SUSTAINABILITY

Wolfang Hoehn
Pulcra Chemicals, Germany
whoehn@pulcrachem.de

Breviol E-RA - New kind of universal reducing agent defining ecologically and economically best state of art.

Subject is an innovative reducing agent which means considerably environmental and economic progress in textile, paper and leather industry compared with common reducing agents used so far.

This multiple break through in state of art of industrial use of reductors provides on the one hand for a new, unique and simply to be installed effluent decoloration and heavy metal reduction facility with maximum effect and minimum costs both for equipment, energy and chemicals used. Sludge to be disposed at high costs isnt occuring at all resp. can be reduced to a minimum if combination with existing or intended flocculation plants is aimed at.

On the other hand the sulphur (sulphite and sulphate) input for effluent caused by conventional reductive processes occuring during textile processing chain may be reduced at least by the half. The COD, nitrogene, phosphor and heavy metal contribution of the product to waste is zero.

Finally the liquid state of the reducing agent concerned means no adverse effect on respiratory system of workers nor danger of inflammation by humidity during transport, storage and application.

REACTIVE DYE TECHNOLOGY TO MEET MARKET AND ECOLOGICAL REQUIREMENTS

M. Dorer, P. S. Collishaw, J. R. Easton
DyStar Colors, Germany
dorer.markus@dystar.com

Increasing environmental pressure and enforcement of pollution control legislation in Europe, India and more recently in Southern China has resulted in factory closures. Stricter controls on effluent volume and pollution load are being introduced and monitored. This presentation illustrates the benefits from the higher strength and build-up of DyStar Remazol® Ultra RGB reactive dye technology which has been particularly designed for the problematic deep shades.

At the same time the leading brands and retailers are demanding faster speed to market, high fastness and compliance to restricted substance lists. The Levafix® CA range from DyStar has been designed to meet these requirements especially in critical pale - medium shades.

These innovations represent the *Best Available Technology* for exhaust dyeing of cotton by reducing the impact on the effluent load whilst supporting higher productivity requirement for short lead times demanded from the textile supply chain.

TENCEL® - NEW CELLULOSE FIBERS FOR CARPETS

Cenk Durakçay[1], **Johann Männer**[2]
[1] *Lenzing AG, Business Unit Textile Fibers,Global Textile Marketing, Lenzing, Austria*
[2] *Lenzing AG, Business Unit Textile Fibers, Fiber Science & Development, Lenzing, Austria*
c.durakcay@lenzing.com

Textile coverings are still the most common material for floorings. In living areas carpets used are mainly either cut or loop pile. Historically, natural fibers like wool, cotton, or jute were dominant in this field. Following industrialization at the beginning of the last century viscose fibers were also introduced. The development of synthetic fibers in the 60's caused a decrease of natural fibers and viscose. Polyamide and polypropylene, then, become the most popular materials in carpets. With commercialization of the Lyocell process in the 90's a new generation of cellulose fibers was developed. Lyocell fibers branded as TENCEL® have higher tenacity, modulus and bending strength compared to viscose.

For tufted carpets fibers are typically high-dtex long staple and are processed into semi worsted or woollen yarns. TENCEL® fibers based on high decitex lyocell have now been developed. For carpet manufacturing coarse long staple TENCEL® fibers are suited up to a titer of 15dtex and cut length up to 150mm. Woolen and semi worsted yarn spinning is possible also in blend with wool and synthetic fibers.

First tufted carpet prototypes in cut and loop pile can be used in domestic living areas with a high comfort factor. TENCEL® in particular exhibits excellent moisture management properties due to its internal nanofibril structure. This brings positive effects for the room climate as well as beneficial hygiene and low static properties. TENCEL® fibers are inherently antiallergic, antistatic and moth proof.

The cellulose fiber TENCEL® derives from the natural raw material wood, is produced by a sustainable process and to 100% biodegradable, thus offering a new range of ecologically friendly carpets.

References

- Kunz, M., Diplomarbeit: Marktstudie Lenzing Lyocell – eine neue Faser für den Teppichmarkt, 2003
- Feilmair, W., Eichinger, D., Firgo, H., Männer, J., Krüger, P., Funktionalität von Lenzing Lyocell in Heimtextilien, TITK, 2002
- ÖNORM S1408 Recovery: This test defines the recovery of the pile after a certain force and time and simulates the effect of a chair leg.
- Abu Rous, M., Ingolic, E., Schuster, K. C., Cellulose 13 (2006), 441

STRATEGIES FOR WATER RECYCLING IMPLEMENTATION IN SLOVENE TEXTILE COMPANIES

A. Majcen Le Marechal, S. Vajnhandl, T. Jerič, D. Mattioli, S. Grilli

University of Maribor, Faculty of Mechanical Engineering, Smetanova street 17, SI-2000 Maribor, Slovenia
Enea, Dipartimento Ambiente, Cambiamenti Globali e Sviluppo Sostenibile, Via Martiri di Monte Sole 4, 40129 Bologna, Italy
alenka.majcen@uni-mb.si

This paper presents proposed solutions for water reuse implementation in two Slovene textile finishing companies. Research was performed within FP7 EU project AquaFit4Use.

As a first step a very complete database was obtained with the characterization of all relevant textile production processes. On the one hand, data concerning water use, chemicals and energy were collected for all relevant production processes like, yarn scouring, bleaching, dyeing and fabric desizing, bleaching, mercerizing, dyeing, printing and washing. On the other hand, all relevant batch discharges from each process were analyzed by measuring relevant parameters. Afterwards textile effluents were classified in high and low concentrated, in view of their separate treatments and further reuse possibilities. The distinction between low and high concentrated effluents was based on effluents potential treatability by membrane and AOP technologies and their reusability in textile processes. For evaluating the potential for reduction in water use, water and pollutants balances (based on wastewater chemical/physical characterization) were calculated.

In both studied textile companies most machinery are used to carry out different processes and their discharges are very diverse in pollution level. Investigated companies are also very different in annual volume and pollution level of major waste streams. For this reason the separation of waste streams based on machinery would allow to segregate significant pollutant loads in a very small volume. In the other textile company no reuse network based on machinery separation is useful. As an alternative an effective way of effluents segregation based on effluents monitoring is proposed. The advantage of such design is a thorough segregation of process effluents. That makes a reuse treatment possible at viable technical and economical conditions, with very good characteristics of treated effluents.

According to the conclusions drawn from the analysis of the existing water and wastewater network and from the effluents characterization, simplified reuse network scenarios were designed. Scenarios are based on machinery separation and on effluents separation and continuous monitoring of the effluents characteristics. In these scenarios wastewater treatment technologies proposed are different combinations of UF, NF, AOP, MBR and evapoconcentration.

Additionally samples of treated textile waste waters with above mentioned technologies were used for laboratory dyeing of cotton according to company dyeing procedures, so called "reusability" experiments. Dyed material was evaluated by colour matching and compare to the quality of the dyed material obtained with their normal process water. All results were acceptable; some of them were even very good.

Acknowledgement

This proposal is prepared by the thematic working group of the Water Supply and Sanitation Technology Platform (WSSTP) one of the EU Technology Platforms. The integrated research project AquaFit4Use (EU-FP7-ENV-211534) is being funded by the European Commission covering six Sub-Projects.

FLUOROCARBON / GEMSOL FLC

Seher Şenada
Gemsan A.Ş., Turkey
seher_senada@gemsan.com

Gemsan has maintained its leadership within the industry by self development efforts throughout the years. The special chemicals, which give the textile products their unique properties, have been developed at Gemsan's laboratories. Gemsan's textile auxiliaries which are used from home textiles to upholstry, as well as denim industry, knitted products, narrow weaving, safety products such as safety belts, all help to make our lives easier and safer.

Gemsol FLC, the special chemical named as florocarbon, takes consumers' glads with effects on all kinds of fabrics.

Gemsol FLC is weak cationic chemical with colour of milk. This chemical imparts excellent durable water, dirt and oil repellency to the weaving or knitting cotton, synthetics, viscon and their blends. It solubles in water easily. Gemsol Flc can be applied to white and coloured fabrics. It resists to washing and dry cleaning.

SURFACE MODIFICATION OF POLYESTER FABRIC WITH LIPASE – THE INFLUENCE TO INTERFACE PHENOMENA

Ana Marija Grancarić[1], Anita Tarbuk[1], Dragan Đorđević[2]
[1]*University of Zagreb, Faculty of Textile Technology, Zagreb, Croatia*
[2]*University of Niš, Faculty of Technology Leskovac, Leskovac, Serbia*
amgranca@ttf.hr

The most important phase in textile finishing processes is adsorption of chemical substances and compounds on textile materials surface and wettability as well. Interface phenomena happen between liquid and solid phase, like water solution and textile material, resulting in change of textile material surface free energy. Electrokinetic phenomena, as zeta potential and specific amount of surface charge, characterize electric charge of textile material, while contact angle characterize its wettability. The conventional processes of polyester modification, hydrolysis and aminolysis, improve properties of finished material but pollute the waste water as well. For that reason, nowadays the alternative procedures are investigated, such are treatments using ultrasound or different enzymes - lipase, catalase, etc. Therefore, the interface phenomena of polyester fabric after pre-treatment with enzymes - commercial lipase Company BioCatalysts origin from *Candida cylindracea*, and laboratory obtained lipase from *Penicilium roqueforti* was researched. This paper deals with the electrokinetic phenomena – zeta potential, isoelectric point (IEP), a point of zero charge (PZC), and specific amount of surface charge; as well as contact angle, water and dyestuff adsorption of such modified polyester fabrics.

Key Words: Polyester fabric, lipase, interface phenomena, electrokinetic phenomena, adsorption

INNOVATIONS FROM RESEARCH AT COTTON INCORPORATED

William A. Rearick
Cotton Incorporated, USA
BRearick@cottoninc.com

The mission of Cotton Incorporated is to increase the demand for and profitability of cotton. Textile research is therefore market oriented, and applications research rather than basic research is preferred. Work with chemical and equipment companies to develop new molecules or unique processes are done, but the strictly internal work involves developing new formulations, process conditions, and process sequences.

Innovations typically involve product development and marketing teams at the beginning of the process. The most common research decision criteria include impact on profit, demand, and sustainability. Cotton Incorporated is continuously seeking R&D cooperation with for-profit companies throughout the global product supply chain, as well as research organizations and universities.

Several developments that enhance the performance of cotton fabrics or add value to cotton fabrics are summarized.

APPLICATION OF MICROENCAPSULATED THERMOCHROMIC PIGMENTS ON JEANSWEAR BY EXHAUSTION AND OTHER METHODS

J. Neves, J. H. O. Nascimento, A. Carvalho, M. Neves
University of Minho, School of Engineering, Guimarães, Portugal
jgneves@det.uminho.pt

Today, textile finishing processes are the highest added value in Jeanswear product, in clothes or in the publicity associated to it. The multiplicity of its use and the inter-disciplinarily present in the Denim substrate allows its use for all the consumers' profile. Jeanswear products are able to transmit, communicate and publicize the information to these consumers. From the transforming and ephemeral nature of Man, this work joins fashion, technology and design in a project with smart and controlled solutions for the clothing industry.
To this objective we use organic thermochromic pigments on Denim substrates, but first we had to solve the problem of its application given the high price of these pigments and the weak performance of the conventional pad processes.
The chemical modification of the surface properties of the substrate allowed us to dye the Jeanswear with colors similar to denim, with a relatively small percentage of pigment. This also allowed to obtain special effects in the fabrics and compare with the effects obtained by spraying and pad processes.
In a second step the surface treatment by plasma (RF, Alcatel) improved the adhesion needs for the application of products with antibacterial and self-cleaning properties.
The results obtained with the study of the degradation of colour, using a QUV device (accelerated weathering tester), enabled by the time of action of UV exposure, different finishes and effects of laundry stains, used in many Jeanswear products
This work has allowed an extrapolation to other substrates, in particular fabrics made of bamboo, soybean and PLA.

Key Words: Jeanswear, thermochomic pigments, special effects

References

1. NEVES J., NEVES M.-The Weathering Effect in the Application of Environmental Interactive Materials on Tensile Fabric Coatings, in, "Natural and Artificial Ageing of Polymers". Editor Thomas Reichert, Fraunhofer ICT, Germany. ISBN 978-3-9810472-8-8. CEEES Publication No 11, 2009

2. FILIPA L., JORGE N., CAMPOS A., HRDINA R.- Weathering of Microencapsulated Thermochromic Pigments. Research Journal of textile and Apparel. The Hong Kong Polytechnic University. Vol.13 No 1, 2009, pp 78-89

3. NASCIMENTO J.H.O., TEIXEIRA V., NEVES J., CARNEIRO J. – Properties of UV-Blocking PET Fabric with TiO_2 Nanocoating by DC-pulsed Sputtering- 3rd International Conference on Surfaces, Coatings and Nanostructures Materials, Barcelona, Spain, 21-24 October, 2008

RADICAL INNOVATION IN TEXTILE PRODUCT DESIGN AND FABRICATION

Mário de Araújo
University of Minho, School of Engineering, 4800-058 Guimarães, Portugal
mario.araujo@det.uminho.pt

The past few decades have been marked by profound changes that take place at an ever increasing pace. Many of these changes may be considered truly radical where others are simply evolutionary. Change is occurring in all areas. Some are taking place in the scientific & technological domain while others in the economic, social and political spheres. Nevertheless all these changes seem to be inter-related, as they are elements of a system which is in rapid transformation.
The vision of Design in the framework of the Marketing strategy is of the utmost importance for the development of new products with assured market success, in a time in which supply far exceeds demand and so the main difficulties lie in selling and not so much in production, of which there is overcapacity.
The key areas to be considered in the development of fiber based products (fashion wear, sports & leisure wear, protective clothing and other technical textile applications) are visual communication, tactile communication and functionalization.
A customer buys a product to satisfy needs. According to Abraham Maslow, human needs may be classified in 5 types.
Markets are composed by consumers and these may differ in a variety of ways. They may differ in terms of desires, purchasing power, geographic location, attitudes and buying habits, forming groups with homogeneous characteristics.
Innovation may be described as the successful introduction of something new and useful, i.e. the introduction of new methods, techniques, practices and new or modified products and services. It is a process that adds value or brings a new solution to a problem. A more effective solution to a problem creates *competitive advantage* to the company.
Companies must be alert to what is happening in the *emerging sciences and technologies* to ascertain which solution they should choose in order to solve the problem of the client with a greater effectiveness.
The emerging sciences and technologies such as the ones that are shaping the *intelligence revolution, the biotechnology revolution and the quantum revolution* are the fundamental areas that we must watch in order to find better solutions both for old and new problems. It is there, at the *frontier of science* that we must be in order to be able to develop and fabricate the next generation of products that will lead to a *sustainable development* that is truly *knowledge based*.
With all these sources of inspiration and knowledge in mind for the development of the future generations of fiber based products, there is no doubt that, as these will be ever more sophisticated and complex, product design will have to be accomplished *by multidisciplinary design teams* and excellence in *design management*.

Key Words: Radical change, fiber based products, total product design, design & marketing, competitiveness & innovation, emerging science & technology, ICT, biotechnology, nanotechnology

References

M. D. de Araújo, Innovation in the Textile/ Apparel Chain, *Kyoto Textile Seminar: The Background of Producing Creativity*, Organised by S. Kawabata, The University of Kyoto, Japan, August, 1998 (invited paper);

M. D. de Araújo, et al, Design & Marketing Innovation, Journal of the Textile Institute, Manchester, UK, Vol. 89, Part 3, Special Issue, 1998, P1-19 (invited paper);

M. D. de Araújo and M. Graça Guedes, Technological Change: The Impact of Globalization and Regionalization on Market and Organizational Structure and Emerging Technologies, Part I, II and III, Management of Technological Change (Proceedings), Technical University of Iasi, Romania, 22-24 October, 1999, P19-36 ;

A.Curtis, The Century of the Self*, BBC4 series,* 2002;

M. D. de Araújo, INNOVATION IN TEXTILES , FORUM OF INNOVATION IN TEXTILES (Coordinator: Mário de Araújo), 5th AUTEX Conference, University of Maribor, Portoroz, Slovenia, 27-29 June, 2005;;

A. Vendl and S. Nicholls, NatureTech*, MR-FILM production for ORF series,* 2006;

M. Kaku, Visions of The Future*, BBC4 series,* 2007;

M. D. de Araújo, Innovation in the Textile Industry, 1st Symposium of Technological Innovation, SENAI/CETIQT, Rio de Janeiro, Brazil, 1st Oct. 2008 (invited paper, during the inauguration of the Center for Innovation of the Textile Industry);

Strategic Business Insights: http://www.strategicbusinessinsights.com/vals/;

A. Maslow: http://en.wikipedia.org/wiki/Abraham_Maslow

TEXTILE ELECTRONICS

Xuyuan Tao, Vladan Koncar
GEMTEX,ENSAIT, 2 allée Louise et Victor Champier, 59056 Roubaix, France
vladan.koncar@ensait.fr

The textile structures with integrated electronics may be realized using two different approaches.The first one uses traditional textiles with integrated miniaturized electronic components. The advantage of this approach is that electronic components are already available on the market, on the other side their integration is not easy and interfaces between electronic parts having metallic contacts and flexible conductive fibres or fabrics (organic in many cases) are not yet sufficiently reliable and efficient. The second approach consists in developing textile organic electronic parts, fully compatible with "traditional" textile structures. In this case there are no problems related to compatibility and reliability is not any more a problem. Therefore, fully textile organic electronic circuits may be realized.

Interest in textile transistors has been growing rapidly in recent decade. According to articles published until now, fibre transistors can be divided into two families: wire thin film transistors (WTFTs) and wire electrochemical transistors (WECTs). The advantage of WTFTs is the short response time (<1 µs), meanwhile the magnitude of the voltage required to control the gate is as high as several tens of volts. On the other hand, the required control voltage for WECTs is only 2~3 V. However, the large switch time, more than several tens of seconds, scales down WECTs technology to quasi-static applications. The difference between proprieties of WTFTs and WECTs result from different insulating materials between the gate and semiconductor layers. For conventional organic field-effect transistors, the insulating material is obtained from inorganic oxide (i.e.SiO_2) or polymer dielectrics (~10 nF/cm^2). Meanwhile for electrochemical transistors, the insulating layer is realized by the liquid or gel electrolyte (>10 $\mu F/cm^2$). The excellent high capacitance of electrolytes results from the formation of electric double layers (EDLs) at interfaces, which can be exploited to induce a very large charge carrier density (>10^{14} cm^2) in the channel of an OFET at low applied voltages.

In terms of the geometry pattern of wire transistors, WTFTs integrate the dielectric layer, the semiconductor layer and three electrodes (gate, source and drain) in one wire filament. As a result, the possibility and processability of integration of such transistors into textile fabric is easy to realize by simple physical contacts between different yarns. However, in order to guarantee the width-length ratio of the channel as large as possible, the deposited layer should cover the filament all around. Therefore, the filament should be continually rotated during the evaporation process. Furthermore, in order to assure the electrical performance, the thickness of different layers should be carefully controlled. Sometimes, the mask of deposition is also necessary. Hence, this complicated multiple layers deposition makes WTFTs unsuitable for the large-scale production.

In this paper the fibre form transistor that has become one of the most interesting topics in the field of smart textiles is presented. The use of PEDOT:PSS to realize a parallel wire electrochemical textile transistor has been reported. A novel geometry pattern makes the transistor easier to insert into textile fabric making the large-scale production possible. The length of transistor can be up to several centimeters. An inverter circuit and an amplifier were fabricated by using one transistor as well in order to demonstrate the feasibility of fully textile electronic circuits. The particularity of our novel geometry pattern of WECTs is that two parallel filaments are twisted together like a thread. One of them is used for the gate electrode and the other is used for drain and source electrodes. The PEDOT:PSS is used as thin-film electrodes in the WECT. The ON and OFF states of transistor are realized by the redox reaction of the PEDOT film.

THE FUTURE OF TEXTILE PRODUCTIONS IN THE DEVELOPED COUNTRIES

Amotz Weinberg
Shenkar College, Israel
e@shenkar.ac.il

The future of conventional textile production in developed countries, taking into account costs of labor, transportation, and the impact of automation.

Fields of advanced textiles, suitable for developed countries. References will be made to textile materials for: composites, medical, construction and 'smart clothing'.

The impact of ecology on textile production.

The role of academia in the textile industry

INNOVATIVE TEXTILE BASED STRUCTURES FOR NOVEL COMPOSITE MATERIALS

C. Kowtsch, G. Hoffmann, O. Diestel, Ch. Cherif
Institute of Textile Machinery and High Performance Material Technology, TU Dresden, Germany
cornelia.kowtsch@tu-dresden.de

Two research areas in the field of light weight construction engineering are currently being pursued. For one, light metal alloys such as aluminium or magnesium are being tested, while textile reinforced composites such as carbon and glass fibre based textile reinforcements are also being intensively developed. Both material fields offer special characteristics, however no one material currently meets all the needs for high performance light weight applications. Advanced textile reinforcements for metal composites (TRM) combine the superior properties of the reinforcement material with the advantages of metal matrices. Although TRMs possess a huge potential for major adaptation and introduction in the commercial market and novel applications, their exploitation remains hindered by the wide range of principle composition and the difficulties involved in processing them. The European Centre for Emerging Materials and Processes Dresden (ECEMP) is focusing on a systematic development of TRMs which meet handling prerequisites as well as stress and strain requirements using cost efficient and sustainable manufacturing processes. In accordance with these ambitious tasks, the interdisciplinary network brings together multi-disciplinary research teams throughout the value added chain beginning in the molecule stages to semi-finished fabrics and continuing to the completion of complex structures.

By applying textile reinforcements in sandwich constructions by integration between sheet metals or embedding textile based reinforcements in metal matrix a maximum compatibility for subsequent processing (e.g. mechanical processing, shaping, joining) of such composites to complex components as well as a local reinforcement of highly stressed machine parts or similar can be achieved. To create such composites with textile based reinforcements which meet the requirements of lightweight constructions novel three-dimensional wired woven structures are developed. Hence the wire has to be shaped. By means of specially developed joining technologies the woven structures are stiffened subsequently. These structures are suitable both for sandwich construction and as reinforcement in TRM.

In this way, ECEMP value added chains will enable rapid transfer and integration of new multifunctional textile based reinforcements for metal composites into the design and operation of manufacturing process, allowing European enterprises to adapt faster to the new needs in the supply chain.

The research project is done within the framework of the “European Centre for Emerging Materials and Processes Dresden” (ECEMP) in cooperation with the Institute of Lightweight Structures and Polymer Technology and the Institute of Materials Science of TU Dresden. The project B2 CelTexComp (13922/2379) of “European Centre for Emerging Materials and Processes Dresden“ is financed by Sächsische AufbauBank (Saxon Development Bank) with funds from European Union and Free State of Saxony within the European Fund for Regional Development (EFRE). The Institute of Textile Machinery and High Performance Material Technology of TU Dresden and the cooperating institutes would like to express their thanks to the above-mentioned institutions for funding the project.

Key Words: Spacer fabric, structural development, wire weave, 3D- weave, technical textiles

MOISTURE ABSORBTIVITY OF FUNCTIONAL UNDERWEAR

Lubos Hes
Technical University of Liberec, Czech Republic
lubos.hes@gmail.com

Abstract
Modern testing of thermophysiological comfort of underwear involves not only their water vapour permeability and thermal resistance in dry state, but also testing of these stationary properties in wet state. Besides stationary properties, also transient properties, like warm-cool feeling [1] or thermal absorbtivity [2] are important.
In the paper, the concept of special version of this parameter, called moisture absorbtivity, is explained and used for evaluation of transient moisture transfer between simulated wet human skin and selected dry functional underwear fabrics.

Introduction
The main protective property of underwear, besides thermal insulation and sufficient permeability for water vapour in gazeous state, is effective absorbtion of sweat and its fast in-plane distribution in large area. Celulosic fabrics exhibit very good moisture absorbtion, but its spreading into large area is, due to very high adhesion forces, limited. For underwear made of common circular PES fibres is typical low or medium moisture absorbtion, and bad in-plane moisture distribution. The best underwear, like this made of COOLMAX fibres, exhibit medium moisture transfer between the skin and the fabric, and efficient distribution of the moisture in quite large area of the fabric. From these examples follows, that successful design of functional underwear requires the use of special testing method, which simulates transient moisture transfer between wet human skin and the studied underwear fabrics and enables to determine the resulting warm-cool feeling between the skin and fabric as the objective parameter. This method was published by L. Hes in 1999 [3].

Principle of the testing method
Measurement of moisture absorptivity of textile fabric is performed on the commercial instrument ALAMBETA and consists in evaluation of level of heat flow q(t) which passes through upper surface of moistened sample which simulates wet (sweated) human skin and which is in contact with surface of the measured sample. After mutual contact of both textile fabrics under defined pressure (200 Pa) the moisture is due to surface sorption taken away from the skin simulating fabric and conducted outside the surface of heat power sensing disc. Textile fabrics with higher sorption and higher capillary conduction of moisture (with higher wetting and wicking capacities) then make the skin simulating fabric more dry and indicate drier (warmer) warm-cool feeling and vice versa. As a textile fabric which is in contact with a model of wet human skin (skin simulator) serves thin knitted fabric COOLMAX-FC 205 (square mass 170g.m-2) moistened by 0,5 ml of solution of detergent with water 1:50. As the objective parameter of warm-cool feeling felt by the testing instrument is the so-called thermal absorbtivity introduced in textile testing in 1987 [4].

Materials with higher thermal absorbtivity (higher b) offer cooler feeling. The heat flow q [W/ m^2] passing from the hand or the human skin (simulated by the measuring head of the instrument) at temperature t2 into the fabric at initial temperature t1 is given by the next equation, valid for short time [2] τ of contact:

$$q = b \frac{t_2 - t_1}{\sqrt{\pi \cdot \tau}}$$

Thermal absorptivity b [$Wm^{-2}s^{1/2}K^{-1}$] here is the objective parameter which characterizes warm-cool feeling of fabrics and represents the amount of heat (heat flow) which passes at the difference of temperature of 1 K through the surface unit in one unit of time as consequence of heat accumulation in one unit of volume.

Results evaluation

Moisture absorbtivity of 11 different underwear fabrics in dry and wet state is displayed in the Fig. 1. Two fabrics on the right hand side (tkanina, kosile – Czech words) are woven fabrics with high cotton content which causes low in-plane spreading of the moisture. Thus, the central part of the sample contains relatively big amount of water, which increases the cool feeling and brings thermal discomfort.

Contrary to that, the samples on the left hand side contain polypropylene fibres with surface channels and star section (patented by the Czech company MOIRA)) or polyester fibres COOLMAX with similar fibre section, with enables the effective in-plane moisture conduction. Here, the wet thermal absorbtivity (moisture absorbtivity) values are lower then 500 $Ws^{1/2}/m^2/K$, which indicates warmer, dry feeling. Practical wearing tests support these results and the MOIRA underwear is widely used in Czech Republic, as well as the COOLMAX underwear in Europe.

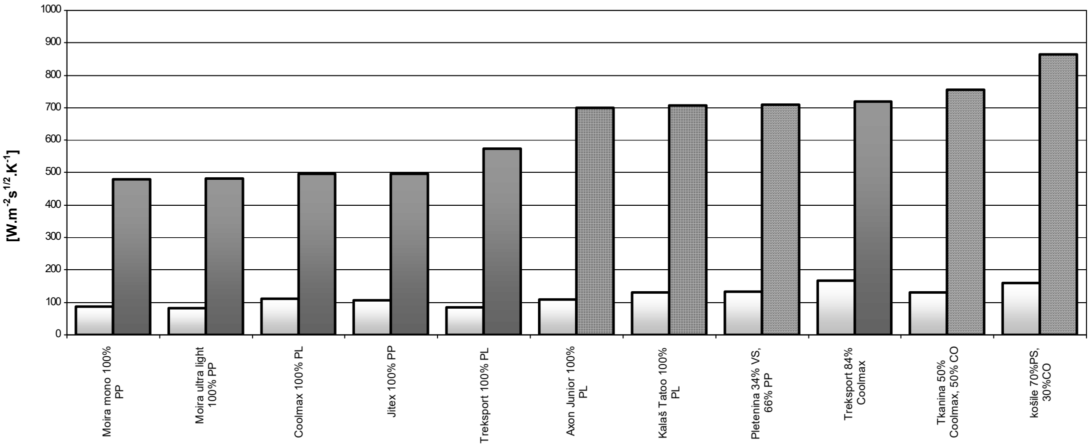


Figure 1. Moisture absorbtivity of various underwear fabrics in dry and wet state (higher values)

Acknowledgements

This research was partly supported the Specific Research Grant, offered by the Czech Ministry of Education (MSMT) and supported financially by TUBITAK – BIDEB.

References

1. Yoneda M., Kawabata S. :Analysis of Transient Heat Conduction in Textiles and Its Applications, Part II, *Journal of Textile Machinery Society of Japan* 31, 73-81 (1983)
2. Hes L.: Thermal properties of Nonwovens, in: Proc. INDEX 87 Congress, Genf 1987
3. Hes L.: Moisture absorbtivity of textile fabrics, in: Internat. Conf. ON Engineered Fabrics, UMIST, Manchester 1999.
4. Hes L., Doležal I.: New Method and Equipment for Measuring Thermal Properties of Textiles, J. Text. Mach. Soc. Japan 42, T124-128, 1989

POSSIBILITIES OF ACQUIRING ANTHROPOMETRICAL DATA AND ITS LIMITATIONS

Ausma Vilumsone, Inga Dabolina
Institute of Textile Materials Technology and Design,
Riga Technical University, 14/24-319, Azenes str., Riga, LV 1048, Latvia
ausma.vilumsone@rtu.lv

The paper studies, systemizes and analyzes methods, systems and possibilities of anthropometrical data acquisition. It reviews and analyzes the possibilities of combining different methods and gives a comparison of the methods. Different data acquisition devices are analyzed and their suitability for the acquisition of a human body surface description and measures. The limitations of 3D scanning of a human body are studied and analyzed, the analytical review is provided, possible solutions identified.

Two researches connected with the limitations of 3D scanning have been described.

The scanning systems for human body measure acquisition use different data acquisition ways: dynamic range (lights and darks), laser beams, a.o. The experiment determines the laser beam reflective abilities of different textile materials and the curve characterising the reflectivity has been compared to the Lamberts' law diffuse reflectivity curve.

An analysis of the oscillations of the human body in rest state has been performed and the significance of these oscillations for 3D anthropometrical measurements has been studies.

Key Words: Anthropometrics, human body measurement, scanning

LATEST TECHNIQUE AND TECHNOLOGY FOR THE PRODUCTION OF NEEDLE FELTED NONWOVENS AND THEIR APPLICATIONS

Sinan Karadal
DILO GROUP, Germany
karadal@temafa.de

Complete nonwoven lines from DiloGroup

DiloGroup with DiloSystems, DiloTemafa, DiloSpinnbau and DiloMachines is the leading supplier of complete nonwoven lines. Experience from more than 100 years of manufacturing textile machinery is a sound basis for reliable technical solutions and customer satisfaction. Since the formation of DiloGroup in 1996, DiloGroup has supplied more than 200 complete production lines and systems for the production of a large range of nonwovens. Dilo is the preferred engineering partner for the nonwovens industry.

On the occasion of XIIth International Izmir Textile & Apparel Symposium (IITAS), DiloGroup will inform visitors about installations for the production of needled nonwovens. Special emphasis will be laid on technical applications for the sectors automotive, geotextiles, filters and insulation. Further information will be provided for other sectors like artificial leather, industrial and household wipes, mattress and bedding and home furnishings. Furthermore, general and specific information will be given on preparation and webforming equipment for applications in the medical, hygiene and cosmetic field.

DiloGroup carding lines for highspeed and large working widths are particularly successful for the waterentangling and thermobonding technologies.

Dilo is not just a supplier of machines, components and service, but delivers solutions custom-designed. On top Dilo provides professional training and service during installation, start-up and the maintenance cycle of the equipment. Dilo is ready to supply customers with “The Line Made in Germany”.

INVESTIGATION OF THE VARIETY OF THE HUMAN TEXTILE SENSATION OF THE TEXTILE FABRICS AS PREPARATION FOR THE BUILDING OF FUZZY EXPERT SYSTEM

Priscilla Reiners, Yordan Kyosev, Dominik Münks
Hochschule Niederrhein, Department of Textile and Clothing Technology, Mönchengladbach, Germany
Priscilla.reiners@hs-niederrhein.de

The knowledge about the tactile sensation of different people is very important for the producers, especially, if they would like to develop better products, which content the customer's requirements to textile fabrics. The people just describe their feeling by touching fabrics. The first task of this work is to analyze the differences and varieties in the tactile sensation. After that, it is planned, to mathematize the verbal statements about tactile sensation using fuzzy logic in order to build an expert system in this area.

At the first stage of this study, 200 students tested two different fabrics and rated them on a scale from 1 for "not recognizable" to 6 for "high intense recognizable" for 24 different attributes. The panel was carried out behind a special test box, where the person couldn`t rate the fabrics visual; only by touching. Every evaluator had 20 minutes left to test [1].

Figure 1. Test box

For testing the reproducibility there were given some attributes, which were nearly same, e.g. smooth and soft. They were both chosen to see, if the proband feel both time the same. The histogram shows how similar the tester felt this two attributes. This cognition is important to prepare the results into mathematical data. For testing, if this connection is always given, there were made more tests with different fabrics but this similar attributes. The results are always like in figure 2 are presented.

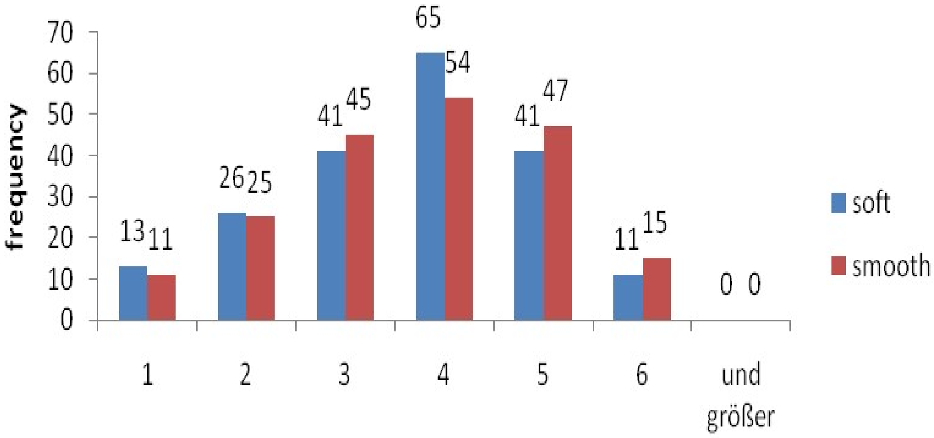


Figure 2. Results about the attributes “soft” and “smooth” of the same fabrics

The intention for doing this study is to combine the objective textile testing with tactile sensation and get an association between these two different assessment methods. The fuzzy logic allows work with linguistic variables which are very similar to the human speach and allows operation with non crisp, “fuzzy” terms like “more soft”, “almost soft” etc. Because of this, it is very suitable for the mathematical description of the experimental results and hopefully an succesfull tranlsation tools between the fabric parameters, estimated by the KAWABATA device and these evaluated by the subjective evaluation by humans [2, 3, 4, 5].

Key Words: Tactile sensation, fuzzy logic, fuzzy expert system, attributes

References

1. Raheel, Mastura, Jiang Liu**,** An Empirical Model for Fabric Hand: Part II: Subjective Assessment, *Textile Research Journal, Feb 1991; vol. 61: pp. 79-82.*
2. Park, Shin-Woong, Hwang, Young-Gu, Measuring and Fuzzy Predicting Total Handle from Selected Mechanical Properties of Double Weft-Knitted Fabrics, *Textile Res. Journal, Jan 1999; vol. 69: pp. 19-24.*
3. Peeva, K., Kyosev,Y., (2004): Fuzzy Relational Calculus - Theory, Software and Applications (with CD-ROM), World Scientific Publishing Company, ISBN 981-256-076-9, pp.300.
4. Kyosev,Y. (2003): Application of intuitionistic fuzzy logic in expert system for textile engineering, Notes on Intuitionistic fuzzy sets, vol. 9, Nr. 4, 2003, ISSN 1310-4926, pp. 135-139.
5. Kyosev,Y, Peeva, K., et.al. Max-product Fuzzy Relational Equations as Inference Engine for Prediction of Textile Yarn Properties, in Computational Intelligence, Theory And Applications: International Conference 9th Fuzzy Days In Dortmund, Germany, Sept. 18-20, 2006 Proceedings.

3D FABRICS MANUFACTURED ON ELECTRONIC FLAT KNITTING MACHINES

Mihai Penciuc, Mirela Blaga, Cezar Doru Radu
Gheorghe Asachi Technical University, Faculty of Textiles, Leather and Industrial Management, Iasi, Romania
mirela_blaga@yahoo.com

The modern developed weft electronic flat knitting machines are capable of manufacturing engineered forms of knitted fabrics, because of their technical features: electronic needle selection, knitting and transfer techniques, shaping abilities, number of needle beds, quick set-up of the machines and CAD systems for pattern design.

Developments in 3D knitted fabrics have been performed by researchers, with purpose of obtaining products with controlled characteristics, for different end uses. Araujo et.al (2004) presented a suite of 3D performs for composite materials produced by weft knitting on flat machines, 3D shaped fabrics made of glass fibres, sandwich structures with engineered cross-sections. Fabrics with shaped outer fabrics, with layers of variable shape or with connecting layers of different lengths have been designed, in order to prove the potential of this technology. Abounaim et al (2009) designed 3D fabrics for composites with increased mechanical properties by integrating reinforcement inlay yarns in knitted fabrics. Different geometric shapes of spacer fabrics were produced by flat knitting using Glass-Polypropelene hybrid yarns for lightweight applications. Ciobanu et. al (2008) has studied the dynamic behaviour of different variants of 3D geometries. It has been demonstrated that fabrics with 3D structure or 3D surface effects could be an alternative for the improvement of the air flow.

Marmarali et.al (2005) analysed the dimensional and physical properties of spacer fabrics with different loop lengths and yarn combinations of cotton and polyester, produced on electronic flat knitting machines. It has been found that the structural and finishing parameters are affecting fabric's comfort properties, such as air permeability. Blaga and Penciuc (2008) developed an innovative design of 3D pockets knitted along with the body panel, in order to improve the quality and the fabric appearance.

Fabrics with tri-dimensional effects or multilayer fabrics can be produced by employing various techniques, such as: partial knitting or wedge technique, needle bed racking combined with different structures, net jacquard backing, flexible stitch, sandwich structures.

The paper aims to bring further developments of tri-dimensional fabrics, by combining two of the mentioned techniques, in order to create original shapes. Multilayer knitted fabric design principle has been applied and sandwich structures were created with two outer layers and two connecting layers. Additionally, on one outer layer, 3D surface effect has been obtained using wedge technique, by altering the number of needles from course to course within the same fabric. In theory, any combination of these techniques can be created, but in practice one must meet the technical requirements of each technique and to overcome the production limitations, especially concerning the take-down adjustments. The paper indicates all knitting sequences, technical features of production on the machines, and their potential for technical applications.

The fabrics were manufactured on the electronic CMS 530 E 6.2 Stoll knitting machine and were finished by coating with acrylic resins Viaco 8054 in order to maintain their spatial geometric form.

From literature survey and from the proposed knitted structures, one can conclude that weft electronic flat knitting machines offer a great potential to be exploited for new technical applications.

Key Words: Sandwich fabrics, independent layers, connecting layers, wedge technique, weft electronic flat knitting machines

References

[1] ABOUNAIM, M., et al., *3D spacer fabric as sandwich structure by flat knitting for composite using hybrid yarn*, In Autex 2009 World Textile Conference, book of proceedings, Edited by KADOGLU H., Izmir, 2009, pp. 675-681.
[2] ARAUJO, M. et al, *Modelling and simulation of the mechanical behaviour of Weft Knitted fabrics for Technical Applications*, Autex Research Journal, Vol. 4, No. 2, 2004
[3] BLAGA M. and PENCIUC M., *3D Applications produced on Knitted Fabrics,* 44 Congress IFKT "Knitting round the clock", Knitting Technology, Saint-Petersburg, 23-27 September 2008.
[4] BRUER, S., et al., *Three-Dimensionally Knit Spacer Fabrics: a Review of Production Techniques and Applications*, Journal of Textile and Apparel, Technology and Management, vol. 4, Issue 4, 2005
[5] CIOBANU L., et al, *3D Surface Controlled Structures for Fluid Flow Improvement*, In The first world Conference on 3D Fabrics and Their Applications, 10-11 April, 2008, Manchester, UK.
[6] LAM, J. K.C and ZHOU, J. Y., *Principle on 3D Knitted Fabrics, A Knitter's Perspective*, 1st World Conference on 3D Fabrics and their Applications, 10 – 11 April, 2008, Manchester, UK
[7] LEHNER M., *Technical Textiles on CMS Flat Knitting Machines* – Stoll GmbH.
[8] MARMARALI, A. et.al, '*Dimensional and Physical Properties of 3-D Fabrics Produced on the Flat Knitting Machines'*, Indian Journal of Fibre & Textile Research, Vol: 30, Number: 4, 371-376, 2005
[9] PENCIUC, M. et. al., Manufacturing of 3d Complex Knitted Shapes, In Proceedings of IFKT Congress, Ljubljana, Slovenia, 2010.

100 YEARS IN TEXTILE MACHINES
CONTINUOUS DEVELOPMENTS ON WINDING AND OPEN END TECHNOLOGY
NEW AND REVOLUTIONARY SYSTEM ON TWISTING: TWIST AND TWIST...

Vittorio Colussi, Gabriele Tonin
Savio Macchine Tessili S.p.A., Italy
g.tonin@saviospa.it

The partnership with the customers and markets represents the unique added value for the development of the technology on Savio machinery.
IITAS 2010 symposium represents an important moment and comments and suggestions will elp to have further implementation on Savio products.
Savio Area Managers will introduce our company and our group history. Founded in 1911 by Marcello Savio entrepreneur born in Pordenone, SAVIO started its activity as a small handcraft enterprise specialized in making components for the local textile machinery market; today the company has a leadership position in yarn finishing machines sector. In October 1998, it has been acquired by Radici group and in 2001 has become part of ITEMA Group (Italian textile Machinery). ISO9001-2008 certificated, Savio today operates in worldwide markets in manufacturing and sales of textile machinery. During recent years additional manufacturing plants have been set up in China and India, while Savio keeps its operative and strategic headquarter in Pordenone, in a 171.000 square meters plant, of which 69.000 of covered area with 480 employees.
Savio will also show the whole products range in the winding, twisting and O.E. spinning sectors.
For the winding sector, it will be described the POLAR family of automatic winders; since its first presence in 2005 in Singapore, POLAR has received wide consent from our customers for the innovative winding solutions, in order to optimize downstream processes efficiency. POLAR family includes the M/L version (with manual bobbins feeding and manual or automatic package doffing), E version (with automatic bobbins feeding and automatic package doffing) and I Direct Link System version (directly linked with the ring spinning frame and with automatic bobbins loading and automatic package doffing).
As far as the twisting sector is concerned, our range of two-for-one twisters has gained important market shares, imposing itself as a valid alternative for those customers looking for reliable twisting machines, with high productivity performances, qualitative and technological qualities. The new generation of twisters, SIRIUS, debuting as world premiere at ITMA ASIA 2010, will be fully described, as well as the new Twist & Twist technology, patented by Savio.
T&T is based on a different approach, which means a higher spindle productivity with same power consumption The result is that Twist & Twist produces 32% more than standard 2x1 twisting process with same power consumption or 25% less spindles are required to get same production output.
The new generation rotor spinning frame FlexiRotorS 3000 / Duo-Spinner is fully controlled by the PC with a speed of 150.000 loop/min., represents the most modern proposal in the .E. spinning. In fact, also this sector, are always more and more required smaller yarn tocks, with prompt and certain delivery times.

TEXPARTS® CONVERSION PLUS

Cemil Esen
Oerlikon Textile Components, Oerlikon Accotex Texparts GmbH, Turkey Office
cemil.esen@oerlikon.com

Oerlikon Textile Components have been used all over the world, for many reasons, by the machinery producers and by the end users. The end users prefer Oerlikon Textile Components to get optimum benefit from the components and use them to obtain best yarn values to make value added products. From the point of conversion, we focus on following customers;

1. The customer has old machinery, consisting of old European machines
2. The customer has new machinery made up of low-priced Asian machines

The continuously changing market situations, but also non-efficient machinery, result in a non-competitive situation of a spinning mill. Changing markets force spinning mills to reposition themselves, for example from low-price suppliers to quality suppliers or from local suppliers to international suppliers.
The fact is that the customer feels the need for investment. Of course, an investment in new European machinery with Oerlikon Textile Components will be the best solution. The kind of investment, however, depends on the different initial situation of the spinning mill:

1. The customer does not have the funds to invest in new machines.
2. The market situation is not safe enough for the customer and he does not want to invest a high amount of money.

The downward spiral for the spinning mill will inexorably continue. To be inefficient and not competitive on the market means less sales or “dying in instalments”.

Texparts® Conversion Plus is a future-oriented concept enabling the spinning mill not to dispense with productivity and high-quality output because of low funds.

Quality Module

1. Texparts® Drafting Unit including Accotex® Cots and Aprons
2. Texparts® Bottom Roller
3. Texparts® Bobbin Hanger
4. Texparts® Yarn Guide Elements
5. Texparts® Rings and Travellers

There are different types of faults that influence yarn quality. The following factors are examined, for example:

- Number of imperfections
- Periodical interferences
- Medium- and long-wave interferences
- Hairiness
- Quality variations between the packages

All these interferences directly influence the quality of the final product, i.e. the textile fabrics. The number of imperfections is strongly influenced by the drafting system, the ring and traveller system, the condition of the yarn guide elements and the cot and apron quality. Periodical interferences always develop with rotating components and untrue running. Top rollers, bottom rollers and their bearings are the main causes.

Long- and medium-wave faults are often synonymous with drafting errors; this means that the faults usually origin in the drafting zone. The cause may also be the supply of the roving, for example due to a Bobbin Hanger which does not function properly. If the Bobbin Hanger feeds the roving unevenly, faulty drafts result from this, which become visible later in the spectrogram – often as long-wave interferences.

Yarn hairiness is influenced by components directly contacting the yarn – namely ring, travellers and yarn guide elements.

The variations between the bobbins, which means between the single spinning units, often are not considered during standard quality assurance in the spinning mill. But it is precisely the variation between the spinning units which may cause streakiness in the later textile fabrics. Here, the key to success is the constant and reliable stability of the components. One component must be identical to the other, from the first spindle to the last spindle in an installation. Also the equal setting of components as, for example, the weighting arms, reduces the quality variations between the spindles.

Productivity Module

1. Texparts® Complete Spindle
2. Texparts® Rings and Travellers

Key factors to increase productivity are on the one hand the increase of spindle speed in order to obtain a higher output, but also the use of an ideal spindle for the optimization of the auto-doffing process of a spinning machine is part of it. This means quicker doffing times and thus lesser productivity loss during bobbin or lot changes.

Production costs are reduced when the energy consumption during spinning is optimized.

A long service life of the spindle unit optimizes a spinning mill's spare parts consumption per spindle and year, but also production losses through frequent maintenance work due to part replacements come at the expense of yarn production costs.

The fixed costs comprise machine investment costs, while the variable costs comprise: spare parts, energy, and maintenance costs. Depending on the yarn count the yarn production costs could be reduced by 15 to 17 %. Briefly, the Conversion Kits by Oerlikon Textile Components are tailored to your requirements.

LAST IMPROVEMENTS AT WEFT INSERTION ON AIRJET MACHINES

Gürcan İmdat
Picanol NV, Belgium
Gurcan.IMDAT@globaltextilepartner.com

In recent decades, the Picanol Group has evolved from a traditional weaving machine builder to a worldwide supplier of total solutions for the textile industry as well as for other industries.

The group develops, manufactures and sells through Weaving Machines (Picanol) high-tech weaving machines, based on air (airjet) or rapier (rapier) technology. It supplies weaving machines to weaving mills worldwide, and also offers its customer such products and services as training, upgrade kits, parts and service contracts. For more than seventy years, Picanol has played a pioneering role in the industry. Today, it is a world player in the weaving machine industry.Picanol also markets accessories via GTP Global Textile Partner. Next to this, the division Industries covers all activities not related to weaving machines like the foundry activities (Proferro) and the group's mechanic finishing activities. It is the ambition to offer the customer engineered casting solutions for middle to large series in a value-driven partnership in the long term. Through PsiControl Mechatronics and Melotte the company applies to the design, the development, the manufacturing and support of technological components, services and mechatronical system solutions for original equipment manufacturers in various industries.

Next to the head office in Ypres (Belgium), the Picanol Group has production facilities in Asia, Europe and the United States, linked to its own worldwide service and sales network. The Picanol Group employs 1,904 employees worldwide and has been listed on Euronext Brussels since 1966

Compressed air accounts for a significant share of fabric cost on airjet machines.PICANOL is working on to decrease those costs and focusing on helping the customer who has taken the advantage of working with airjet machines.In that respect we want to bring the last updated info about cost saving on airjet insertion parameters.

AIR MASTER:

AirMaster is a software module which allows air consumption measurement as well as leakage and clogging detection. AirMaster processes the information from an electronic air consumption meter. This meter is available in either an integrated version or a stand-alone tool version.

Besides real-time air consumption measurement, AirMaster can also carry out a testing procedure during which all insertion elements are checked.

AUTOSPEED:

With the new Autospeed feature, the insertion capacity of the main nozzles remains at its highest possible performance. While Autospeed keeps the arrival time of the filling yarns at a set value, by adjusting the air quantity going to the main nozzle, Autospeed continuously adapts the machine speed based on the air-friendliness of the filling yarn.

JET FUNNEL:

Jet Funnel brings weft yarn close enough to ideal insertion position → use of conical reed entrance no longer required in case of a 4C machine = cost saving for the customer Positive impact on running of machine ito stop level and sensitivity for fabric defects.

RELAY NOZZLE:

The E-type Relay Nozzle is the combination of all the air insertion knowledge accumulated over the last 40 years by both Picanol and Te Strake.

The E-type RN brings the highest performance to an Air Jet weaving loom while allowing to weave the most delicate fabric without creating any marks, a situation that is rare but still occurred with the D-type.A new type of coating is used, called ChromeNitrite (CrN). It is smoother, shinier and offers a similar resistance toDLC.However, unlike DLC that tends to peel off the tube, CrN will not because it is applied in layers.

ARVD&ARVDPLUS:

The ARVD feature automatically adapts the closing time of the relay nozzle valves to the behavior and air friendliness of the filling yarnThe ARVD software uses the winding information from the prewinders to calculate the optimal blowing timing of each valve. The valve will close earlier in case of a fast filling and later in case of a slow filling.

The customer can change the settings via the loom display. The ARVD status per channel can be switched between Off, Low, Medium and High, indicating the possible amount of reduction for the relay nozzle timings.

STRUCTURAL PATTERNING OF WOVEN FABRICS AND THEIR MECHANICAL PROPERTIES

Krste Dimitrovski, **Živa Zupin**
University of Ljubljana, Faculty of Natural Sciences and Engineering, Department of Textiles, Ljubljana, Slovenia
krste.dimitrovski @ ntf.uni-lj.si

1. Introduction

Pattering of woven fabrics can be by colour, by structure, or both by colour and structure at the same time. Structural pattering is the only one that allows discreet patterns with the use of one coloured warp and weft threads. For structural pattering a different structure/weave is used in the particular parts of designs. Used weave cannot differ dramatically since it causes problems in weaving processes as well as in quality of fabrics in terms of visual expression and properties. That why the most common structural pattering uses the warp and weft effect of one same or similar weaves. It makes plain weave not very suitable for structural pattering and opposite twill and satin weaves appropriate for this. The question is for getting patterns with only small visual difference what kind of weaves to chose in terms of getting proper mechanical properties of fabrics. We made a research on several especially prepared samples in twill and satin weaves assessing their mechanical properties.

2. Materials and Methods

For the research purposes were engineered and produced 12 samples in seven different weaves. Samples formed three comparable groups. The first one were the samples made in industrial conditions from sized yarns 17 x 2 tex as a warp and the same non sized yarns in weft. The set density of fabrics were 46 ends/cm and 26 picks/cm respectively. They differed in used weaves (four twills and 3 satins). The second group had only two samples that had identical structures of two previously mentioned only the fineness and density of weft been different (25 x 2 tex and 18 pics/cm). The third group consists from the same satin weave as in first group only the warp density was 40 ends/cm and the production took place in a much slower laboratory condition.
The physical and mechanical characteristics of samples were measured according to standards.

3. Results

Some of results showing the differences among used weave in structural pattering are shown in the Fig.1

4. Conclusions

As can be seen from the results the tensile properties of samples significantly differ regarding used weave and the producing conditions. Generally twills used as a weave allow higher breaking strength than satins. In our constructions the breaking elongations in warp directions of twill samples were two to two and half times higher than in weft directions which were not a case with satins samples where the breaking elongations in both directions almost did not differ.

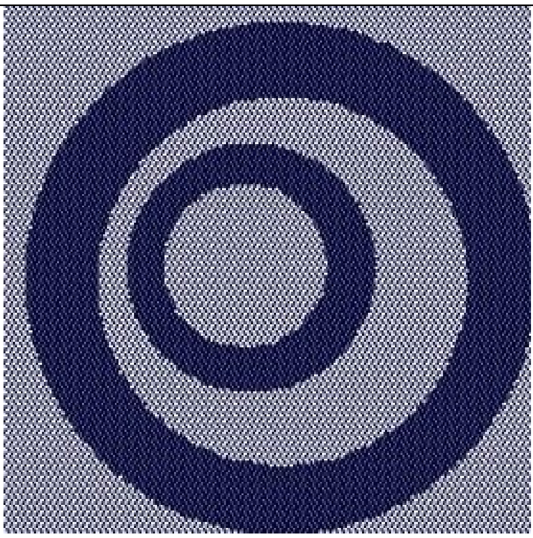
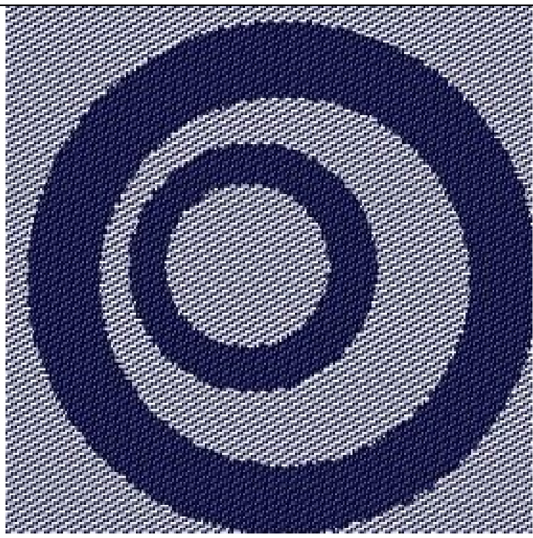
	
Weaves: warp and weft broken twils Industrial fabrics – mechanical properties Ff1 =2166,67 N; Ff2 =1111,71 N Ef1 = 22,85 % ; Ef2 = 8,08 %	Weaves: warp and weft soley Industrial fabrics – mechanical properties Ff1 = 2016,93 cN: Ff2 = 1049,85 N Ef1 = 11,95 % ; Ef2 = 12,1 % Laboratory made fabrics – mechanical properties Ff1 = 1724,4 cN; Ff2 = 1107,91 cN Ef1 = 13,55 % ; Ef2 = 14,86 %

Figure 1. Different mechanical properties of structured jacquard pattern with similar visual effect where Ff1 and Ff2 are tensile strength and Ef1 and Ef2 tensile elongation of fabrics in warp (1) and weft (2) direction

Key Words: Textile design, twill, satin, breaking force, breaking elongation

5. References

1. Dimitrovski, Krste. Colour designing multicolour fabrics. V Textile and colour. Uredila Slava Jeler. Firenze : Tassinari, 2004. - (Fondazione Giorgio Ronchi).Str. 39-57.
2. Gabrijelčič, Helena, Dimitrovski, Krste. Numerički i grafički prikaz i usporedba dvobojnih tkanina s različitim modelima boja / Numerical and graphical presentation and analysis of two-color woven fabrics with different color. Tekstil, 2007, let. 56, št. 4, str. 209-220.
3. Bizjak, Matejka, Dimitrovski, Krste. The role of technological parameters atwoven fabrics construction. International journal of polymeric materials, , 2000, let. 47, št. 4, str. 603-612.
4. Adanur, Sabit. Handbook of weaving.Lancaster : Technomic, cop. 2001
5. Zupin, Živa, Dimitrovski, Krste. Vpliv vezave in gostote na mehanske lastnosti Tkanin Zbornik prispevkov [Elektronski vir] / simpozij o novostih v tekstilstvu in 3. simpozij o novostih v grafiki Ljubljana, 21. junij 2007. - Ljubljana: Naravoslovnotehniška fakulteta,Oddelek za tekstilstvo, 2007. Str. 141-145.

PROFESSIONAL SAMPLE MAKING

Robert R. Zollikofer
Polytex AG, Schoenenwer, Switzerland
robert.zollikofer@polytex.ch

Professional sample making:

➔ **Top quality samples, produced with state of the art efficiency, are 1st class selling tools**

Introduction:

- Polytex develops sample making machines since 60 years. The machines are built in Switzerland. Since many years innumerous Turkish companies already produce their samples on Polytex equipment.
- Polytex offers the complete range of textile sample making machines (1 stop shopping): gross cut, precision cut, production of all types of samples (waterfall, waterfall cards, shade cards, hangers, yarn tabs…), assembly and mounting.
- Polytex offers solution which can be matched to the individual, specific requirements of each company according to:
  - Sample type
  - sample size,
  - number of samples to be produced
- Polytex sample making solutions aim to produce samples:
  - ✓ with continuously high quality
  - ✓ with best possible modern appeal
  - ✓ by using dramatically less fine fabrics for the production of samples
  - ✓ with an extremely reduced production time

Samples – why and what for:

Samples target the market. With samples the textile producers show and promote their products in the market. Samples must be appealing, of good quality, display well the textile offer from the supplier, and the quality and functionality of the fabrics. Samples are your business card. ??Are your samples as good as your products??

Efficient making of professional samples

With Polytex machines good quality samples can be produced professionally and with great efficiency. Some examples:

- **Waterfall card production:** 5'400 WFcards à 10 colours à 3cm with: 1 pers/1 day à 8hrs/Polytex FC + ZH
- **Yarn sample production with Polytex FL:** adjustable in speed, tension, pitch/revolution, size of sample, up to 130 samples/hour/1person
- **Books**: 87minutes for 92 books à 35x45cm, 10 shades, with KF, ZL, BO and 2 persons

Benefits:

Direct benefits: efficiency, productivity, quality

Indirect benefits: production logistics, flexibility, sample availability “just in time”

How:
Multiple pattern production
Capacity to do clean precision cutting
Polytex technologies
Printing, assembly, mounting

Outlook:
The future is here!

Polytex VB	– fully automatic shade card production – possibility to do totally free card designs
Polytex MW	– up to 400 Yarn sample cards / hour
Polytex KR	– ovelocking fully automatic
	– 1 operator overlocking 1‘000 swatches / hour
Polytex KE	– as little as 2 seconds production time per sample, fully automatic
	– already 10 machines in 5 countries

LOGISTICS COMPLEXITY ON FULLY INTEGRATED PRODUCTION OF SOCKS AND TIGHTS IN PERSPECTIVE BY ENTERPRISE - SOFTWARE

Erwin Doerner
DOKU GmbH Textile Software, Zweigstrasse 9a, 82266 Inning am Ammersee, Germany
e.doerner@dokugmbh.com

Socks and tights are under control of fashion and fast moving trends. This means in matters of sourcing socks and tights always shorter manufacturing time slot by higher style-diversity and drooping lot-size with high quality-claim. On the other hand the production of socks needs a high in-house production depth.

Our software-house is engaged since more than 20 years on developing and distributing enterprise-software to plan and control textil-production. Based on my experience I want to deliver inside of the logistic complexity on fully integrated production of socks and tights in perspective by enterprise-software.

The lecture will show

- the changing of quantity-units during the production-process starting from customer-order until shipment.
- the concept of “style”, “set”, “bag”, “box” and “assortment”
- the term of “customer-order”, “production-order”, “manufacturing-order”, “tracking-order”, “boarding-order” and “shipment-order”
- planning and sourcing of raw-material
  - needs
  - date of availability
- raw-planning of capacity
  - each manufacturing-stage by continuous process
  - reservation of capacity
  - calculation date of process-start
  - efficiency
- fine-planning and production-control
  - manufacture-order
  - material-reservation
  - rout-card-ticket; mobile-registration-system
  - progress-control
- tracking-order
  - synchronization of manufacturing-order in order of set
- boarding-order
  - pack in order of box
- shipment-order
  - pack in order of assortment

ECOLOGICAL MODERN STAIN MANAGEMENT

Wolfgang Knaup, Jochen Schmidt
Clariant International Ltd, Rothausstr 61, CH-4132 Muttenz, Switzerland
Wolfgang.Knaup@clariant.com
Jochen.Schmidt@clariant.com

Managing soils and stains on textiles with fluorocarbons is today state of the art technology. These so called repellent finishes do provide washfast water-, alcohol, oil- and soil repellent properties. They are considered to be actively visible. On the other side the so called passive protection is with their soil release performance not directly visible. These finishes do need an domestic washing after soiling in order to become visible.

The ecological pressure has increase because perfluorooctane sulfonic acid (PFOS) and perfluorooctanoic acid (PFOA) have been found globally in wildlife and humans, leading to a wide discussion on the origin and consequences of these chemicals. Since Clariant has a leading position in the repellent field with their Nuva products the paper talks about alternatives which do meet ecological and modern requirements.

NOVEL SYNTHETIC FIBERS BY MULTICOMPONENT MELT-SPINNING

Rudolf Hufenus
Empa, Swiss Federal Laboratories for Materials Testing and Research, St. Gallen, Switzerland
rudolf.hufenus@empa.ch

The current trends in polymer melt spinning are manifold. Recent research activities include enhancement of mechanical properties [1, 2], implementation of electric or magnetic functions [3, 4], introduction of biologically active species like drugs or silver composites [5, 6], as well as variation of fiber morphology by bicomponent spinning [7, 8]. Bicomponent fibers are considered to be one of the most inte-resting developments in the field of synthetic fibers [9].

Empa's laboratory for Advanced Fibers develops synthetic fibers with distinct functionalities in new combinations. Our custom-made pi-lot melt-spinning plant enables the prototype production of mono-, bi- and tri-component fibers with various cross-sections and material combinations with a throughput of up to several kg/h [10, 11]. The plant is, on one hand, a very flexible setup with features correspon-ding to an industrial plant; on the other hand it requires only a small throughput starting at 100 g/h, enabling us to work with very preci-ous materials. By selective laser melting, a special spin pack for three-component melt-spinning was designed and built, comprising an oil cooling and heating system to keep the melt flows at different temperatures down to the spinneret plate. Ongoing projects include biodegradable fibers from renewable sources, artificial turf fibers for future sports flooring and fibers with rheological core for flexure-rate responsive damping.

For temporary textile implants, fibers from biocompatible and biodegradable polymers are preferable [12]. Furthermore, polymers from renewable sources are future-oriented. The commercially available polyesters polylactide (PLA) and polyhydroxyalkanoate (PHA) com-bine these aspects. However, inflammatory response to degradation by-products limits the application of PLA as biomaterial, whereas the low crystallization rate of PHA renders melt-spinning difficult. Bicomponent fibers provided a way to overcome the respective limita-tions. PHA-PLA core-sheath fibers with a maximum tensile stress of up to 0.34 GPa and a Young's modulus of up to 7.1 GPa were pro-duced. X-ray diffraction measurements revealed that the PLA component alone is responsible for the tensile strength. In vitro biocompa-tibility studies with human dermal fibroblasts showed that cells adhere on the fibers, making them good candidates for medical thera-peutic approaches. Different degradation rates of PHA and PLA open the way to control the disintegration of bicomponent fibers by ad-justing their core-sheath ratio.

Artificial turf is a lower maintenance all-weather alternative to natural turf [13]. On one hand, polyamide (PA) carpets have excellent resi-lience but provoke abrasion injuries (friction burn). On the other hand, polyethylene (PE) monofilaments are skin-friendly but tend to permanent deformation. PA-PE bicomponent fibers render a robust, skin-friendly artificial turf. The goal of our respective work was to develop a bi-component monofilament with optimized cross-section and material combination to maximize resilience while minimizing risk of skin abrasion, in order to achieve artificial grass for sports flooring that resembles natural turf with respect to playability and ap-pearance. We succeeded in producing fibers for artificial turf that show a better resilience than up-to-date synthetic grass, without cut-back in skin-friendliness. However, the wear-resistance of the fibers does not yet meet the demands of a football pitch. By further modi-fying the cross-section of the bi-component fibers we expect to fulfill this requirement, too.

Instead of using hard shell components to dissipate the energy of the impact, state-of-the-art-concepts of impact protective garments rely on flexible materials [14]. We start to develop fibers that exhibit rate-dependent viscoelastic properties owing to the presence of a fluid core with distinctive rheological characteristics. The fluid shall be confined inside a suitably structured fiber core that induces fluid flow upon fiber bending, resulting in a rate-adaptive mechanical damping ef-fect. The challenges of this project involve the use of non-equilibrium multi-component po-lymer melt flow behavior during melt-spinning to generate the desired fiber core geometry, filled with a fluid of suitable rheological properties. A customized piston extruder has been developed to cope with the expected range of processing viscosities. Fibers with a rheological core are expected to open an entire field of adaptive product applications, notably as protectors against impact, or for rate-adaptive damping in fiber-reinforced high-performance composites.

Key Words: Synthetic fiber, melt-spinning, bicomponent, textile implants, artificial turf

References

1. Fornes TD, Baur JW, Sabba Y, and Thomas EL. Polymer 2006;47(5):1704-1714.
2. Sandler JKW, Pegel S, Cadek M, Gojny F, van Es M, Lohmar J, Blau WJ, Schulte K, Windle AH, and Shaffer MSP. Polymer 2004;45(6):2001-2015.
3. Kim B, Koncar V, Devaux E, Dufour C, and Viallier P. Synthetic Metals 2004;146(2):167-174.
4. Liang Y, Xia X, Luo Y, and Jia Z. Materials Letters 2007;61(14-15):3269-3272.
5. Yeo SY, Lee HJ, and Jeong SH. Journal of Materials Science 2003;38(10):2143-2147.
6. Dastjerdi R, Mojtahedi MRM, and Shoshtari AM. Fibers and Polymers 2008;9(6):727-734.
7. Shi XQ, Ito H, and Kikutani T. Polymer 2006;47(2):611-616.
8. Huang J, Baird DG, Loos AC, Rangarajan P, and Powell A. Composites Part A: Applied Science and Manufacturing 2001;32(8):1013-1020.
9. Kathiervelu SS. Synthetic Fibres 2002;31(3):11-16.
10. Houis S, Schmid M, and Lübben J. Journal of Applied Polymer Science 2007;106(3):1757-1767.
11. Kaufmann J, Lübben JF, and Schwitter E. Composites Part A: Applied Science and Manufacturing 2007;38:1975-1984.
12. Hearle JWS. Fibers, Structure. Ullmann's Fibers, Vol. 1 : Fiber classes, production and characterization, vol. 1. Weinheim: Wiley-VCH, 2008. pp. 39-79.
13. McLeod A. The management and maintenance of second generation sand-filled synthetic sports pitches. National Resources Department, vol. Doctor of Engineering. Cranfield: Cranfield University, 2008. pp. 351.
14. Walker K, Robson S, Ryan N, Mallen L, Sibbick R, Budden G, and Mepham A. Advanced Materials & Processes 2008;166(9):36-37.

FRONT PROJECT: A NEW PERSPECTIVE FOR FLAME RETARDED TEXTILES BY NANOTECHNOLOGY

P. Kiekens[1], J. Alongi[2] and FRONT Consortium
[1]*Ghent University, Department of Textiles, Technologiepark 907, B-9052 Zwijnaarde, Ghent, Belgium*
[2]*Politecnico di Torino, Dipartimento di Scienza dei Materiali e Ingegneria Chimica, Alessandria Branch, V. Teresa Michel 5, 15121, Alessandria, Italy*
paul.kiekens@ugent.be

FRONT is an innovative project with the main objective to produce textile fabrics resistant to fire with high performances and quality, required for the security of the human life. In order to simulate the industrial textile process, the finishing phase is mimicked. The idea is to develop a similar method based on the same physical and chemical principles at the bottom of any dyeing processes and of the current, and already consolidated, chemical finishing treatments. In order to introduce this type of approach, nanotechnology is applied. In particular, the introduction of nanoparticles into the textile is done by the immersion of the fabrics into an aqueous nanoparticle solution, followed by the final fixation of the nanoparticles through thermal treatment. The textile material put in contact with the dispersion of nanoparticles absorbs them and, because of the formation of various types of bindings according to both the fiber typology and the nanoparticles, prevents any following release. Cotton, polyester and a blend of them are used. The action mechanism is very similar to the dyes and chemical behavior: in the case of the cotton, by formation of a chemical bond among the cellulose and the nanoparticles; in the case of the polyester by adhesion of nanoparticles on the polymer surface, after fixation using either thermal or coating treatment.
General characterization will be done starting from the determination of the chemical and physical structure of nanoparticles, their morphology and thermo-stability in air and in inert atmosphere. In addition, the study of nanoparticle/fiber interactions will be followed according to their affinity and thermal stability and of flame retardancy properties of the above textile fabric prototypes prepared. In order to measure the flame retardant properties, a cone calorimeter will be used to quantify and clarify parameters as heat release rate, total heat release, residual mass that are useful information about the kinetic aspects of the combustion. Moreover, particular attention will be focused on smoke toxicity as well as smoke release and opacity which are very important parameters to take into account when developing new flame retardant materials.

The authors would like to thank the European Commission for the economical funding of the FRONT (Flame Retardant on Textiles) project 2008/2010 (7th Framework Program, contractual n° 222486).

INNOVATIONS IN TEXTILE FINISHING

Michael W. Schmitt
Head of Global Innovation, BASF SE, Ludwigshafen Germany
michael-werner.schmitt@basf.com

Putting Future into Textiles* - is a strong commitment of BASF to the textile industry. Textile processes and chemicals need to be constantly improved to meet highest standards in consumer safety, resource saving and climate protection for a better Future. As a reliable partner Future to us means that we continue to offer innovative solutions to support all stages in textile processing.

Major challenges in finishing are comfort enhancing solutions such as for surface protection, smoothness and superb handle with highest standards in consumer safety and resource saving. Recent examples of innovations in textile finishing are:

The Lurotex® Duo System consists of stain repellent and soil release products based on C6 chemistry; this technology reduces unwanted side products below the level of detection with standard analytical methods. The specially developed and highly efficient Perapret® Booster XLR does not release critical blocking chemicals and enhances the spotless effect.

Fixapret Resin 4U is a new environmentally improved easy care and non iron finishing system for highest smoothness and very low formaldehyde and no VOC. It is of high reactivity for lower curing temperatures and for flexible curing conditions. Fixapret 4U is a valid contribution to save energy, cost and to enhance productivity.

Key Words: Consumer safety, resource saving, climate protection

MULTIFUNCTIONAL KNITTING DESIGN FOR SPORTS T-SHIRTS THERMAL COMFORT

M. Neves, N.L.Filho, J. Neves
University of Minho, School of Engineering, Campus de Azurém, 4800-058 Guimarães, Portugal
mneves@det.uminho.pt

In this communication, a study on the design and development of functional knitted fabrics with comfort specifications is presented. The comfort perceived by the user, depends greatly on the ability of the t-shirt to maintain the body surface in an equilibrium state in terms of thermo-physiological comfort. This is related to the capacity of removing the moisture resulting from transpiration away from the body surface. Having these premises in mind, a study on the development of new knit using different raw materials was conducted.
Aiming to optimize liquid transfer, three knitted fabric structures were developed which enabled the development of 36 samples from the combination of bamboo, soybean and corn fibres with three types of polyester (thermolite, coolmax and drirelease). These samples were characterized and tested in laboratory in order to evaluate the properties related to sensorial and thermal physiological comfort.
The best performing structures were selected to be used in specific fields for four types of T-shirt developed through the patchwork technique, which were used in different environments and physical effort conditions considering specific sports practice. The prototypes performance was subjectively evaluated by 50 professional athletes from three teams: female volleyball, basketball and male football.
The experimental and subjective work proved that the double-faced structures significantly contributed to increasing thermal and physiological comfort.
In a parallel work and with the objective of modifying the surface properties of same fibres used before, we applied plasma treatment and Physical Vapor Deposition (PVD) techniques on the PLA knit to sputter the atoms onto the substrate. This technique consists in the removal of atoms or atoms clusters from a target material and their deposition (in the solid phase) as a thin film deposited on a sample (metallic, glass, polymeric).
In the present study, the PLA fibres were coated with a thin film based in TiO_2, presenting different properties as self-cleaning, antibactericide, and UV-blocking.
The system used in the nanocoating process was a magnetron sputtering RF Alcatel 650 with load-lock (pre-camera for samples introduction and also used for samples surface treatment for better thin films adhesion) and a system for pulsed DC magnetron sputtering. The gases used are argon as inert gas, and oxygen as reactive gas. In the first step of the work it was done the study of the surface treatment influence in PLA fibres by and the consequences in thin film adhesion. The samples were characterized by contact angle analyses (in a goniometer), SEM (Scanning electron microscopy), XPS (X-ray photoelectron spectroscopy and AFM (Atomic force microscope).

Key Words: Thermal comfort, multifunctional structures, physical vapor nanocoating deposition

References

1. Berger, X.; Sari, H., A new dynamic clothing model. Part 1: Heat and mass transfers. *Int. J. Therm. Sci*., 39, pp. 635-645, (2000).

2. Ghaddar, N., Ghali, K. & Jones, B., Integraded human-clothing system model for estimating the effect of walking on clothing insulation. *International Journal Thermal Sciences*, 42, pp. 605-619.(2003)

3. Hes, L., Dolezal, I. A New Portable Computer-Controlled Skin Model for Fast Determination of Vapour and Thermal Resistance of Fabrics. In Proceedings of ATC 7, edited by Anand, S., New Delhi (2003)

4. Kwon, A.; Kato, M.; Kawamura, H.; Yanai, Y.; Tokura, H., Physiological significance of hydrophilic and hydrophobic textile materials during intermittent exercise in humans under the influence of warm ambient temperature with and without wind. Eur. J. Appl. Physiol. 78, pp. 487-493, (1998).

5. Markus, Weder, Physiological Properties of Sportswear, Proceedings of International Textile Congress 2004, UPC, Spain, (2004)

BIODEGRADATION OF ANTIMICROBIAL TREATED CELLULOSE TEXTILE SUBSTRATES

D. Jausovec[1], D. Angelescu[2], B. Lindman[3], B. Voncina[1]

[1]University of Maribor, Faculty of Mechanical Engineering, Textile Department, Smetanova 17, 2000 Maribor, Slovenia
[2]Romanian Academy, Institute of Physical Chemistry "I. G. Murgulescu", Splaiul Independentei 202, 060021 Bucharest, Romania
[3]Department of Physical Chemistry 1, Centre for Chemistry and Chemical Engineering, Lund University, P.O. Box 124, S-221 00 Lund, Sweden
bojana.voncina@uni.mb-si

The influence of antimicrobial agent, 3-(trimethoxysilyl)-propyldimethyloctadecyl ammonium chloride (TMPAC), on the biodegradation of cellulose textile substrates was investigated.

In the first part of the work, changes in surface morphology of TMPAC treated cotton and untreated cotton after the soil exposure tests were investigated by Scanning Electron Microscopy (SEM). Changes in functional groups of treated cotton and untreated cotton after the test soil exposure were obtained using Fourier-Transform Infrared Spectroscopy FT-IR. It is observed that the application of TMPAC on cotton fabrics decreases their biodegradability. This was confirmed by lower changes in surface morphology and by the lower intensity of the bands at 1638 and 1544 cm^{-1} for the antimicrobial treated samples.

Secondly, the influence of the antimicrobial agent on the degradation of model cellulose film after addition of enzymes produced from Trichoderma viride and Aspergillus niger was investigated. Model cellulose film was prepared by dissolving cellulose grade pulp in NMMO/DMSO solution and spin coating onto the silica wafer. The surface morphology, roughness and thickness of the model cellulose film in dry state as well in hydrated state were investigated using Atomic Force Microscopy. The kinetics of model cellulose film swelling, antimicrobial agent adsorption and enzymatic degradation was studied using ellipsometry.

Results show fast initial adsorption of antimicrobial agent on the model film followed by slower adsorption over the following hours. Significant differences in film mass and film thickness were obtained when pure model cellulose film and model cellulose film pre-treated with TMPAC were exposed to two different concentrations of enzyme extracted from Trichoderma viride. On the basis of optical properties of the investigated cellulose layer it can be concluded that TMPAC significantly decreases the degradation rate when enzyme Trichoderma viride was used, whereas it did not affect the Aspergillus niger cellulase activity, which anyhow was much lower.

Key Words: Cellulose, biodegradation, textile substrates, cellulose model film

THERMAL COMFORT PROPERTIES OF KNITTED FABRICS MADE OF ELASTANE AND BIOACTIVE YARNS

Elena Onofrei[2], **Ana Maria Rocha**[1,2], **André Catarino**[1,2]
University of Minho, [1]Department of Textile Engineering, [2]Centre for Textile Science and Technology
Campus de Azurém, 4800 - 058 Guimarães, Portugal
eonofrei@det.uminho.pt

Consumers are showing an increasing interest in additional benefits from textiles including thermal comfort and bio-activity. In response to this growing demand, an increasing range of fibres and fabrics with anti-inflammatory and antimicrobial activity became available, targeting end uses ranging from sportswear and underwear to protective clothing for healthcare workers and emergency personnel [1]. Seacell® is a commonly used cellulose-based fiber with bio-active properties. Seaweed is added as the active substance to protect the skin and have anti-inflammatory properties. The structure of Seacell® facilitates the active exchange of substances between the fibre and the skin, thereby creating a sense of well-being. The "active" version with added silver promotes extra antimicrobial activity [2, 3, 4].
In active sportswear, stretch and recovery properties as well as thermal and moisture management properties are also of utmost importance to impart garment comfort. Knitted fabrics containing elastic yarns because of their higher stretch and recovery properties are considered preferred candidates for this application.
This paper presents a study made with the purpose of understanding the effect of stitch length and structure on the dimensional, thermal, air and water vapour permeability properties of knitted fabrics made of Seacell and elastane yarns, for active sportswear applications.

The experiment
Yarns composed of 20% SeaCell® pure/10% SeaCell® active/70% Combed Cotton, 12 tex and bare elastane 4.4 tex were used in the experiment. Single Jersey, Single Piqué and Double Piqué were selected for this study. The fabrics were produced on a 8-feed Single-Jersey Circular Knitting Machine MERZ – MBS, with loop lengths of 2.0, 2.5 and 3.0 mm respectively. All tests were carried out after the samples were conditioned in standard atmospheric conditions according to ISO 139:1973. Basic statistics were explored, together with ANOVA, in order to understand the influence of loop length and structure on the different properties measured. PASW Statistics 17 was used.

Discussion of Results
Fabric Thickness increases with loop length, and the variation was more evident for Single Jersey fabrics. The tuck-knit combination fabrics showed higher thickness than that of plain knit fabric, because of tuck stitch accumulation. Mass per unit area decreased when the loop length increased. The Double Piqué fabrics showed a higher mass per unit area and it reduced with Single Piqué and Single Jersey, respectively. So, the knit-tuck structure showed a higher mass per unit area than plain knit fabrics. These results are consistent with the studies of C.D. Kane [6].
The structure seems to have a significant influence on the knitted fabric's air permeability. Single Jersey fabrics showed highest air permeability and piqué fabrics showed lower air permeability. This evolution is determined by reduced thickness and mass of the Single Jersey fabrics compared with piqué fabrics. For the highest loop length Single and Double Piqué

tend to present similar results as Single Jersey with the smallest loop length. The air permeability on tuck-stitch structures seems to become different only for higher tightness factors. The index of water vapour transmission rate of the Single Jersey structure is slightly higher than of the other structures. This difference is most probably a consequence of the thinner structure of Single Jersey fabrics.
The thermal conductivity and thermal resistance of Single Jersey fabrics is influenced by the loop length. For the knit-tuck stitches combination only the thermal conductivity is significantly influenced by the loop length.
The structures with higher loop length registered the higher thermal conductivity. The fabric with the higher thickness presents the higher thermal resistance, so better thermal insulation properties. For the fabrics with knit-tuck stitches, the influence of loop length on thermal resistance is not statistically significant. A possible explanation is the small differences on fabrics' thickness with loop length. The porosity promoted by the tuck stitches can also explain this behaviour.
The structure has a significant influence on the thermal resistance. Fabrics with tuck-knit stitches showed higher thermal resistance than the fabrics with plain stitches.
Regarding thermal absorptivity as loop length increases this parameter slightly decreases for all the structures. Single jersey structure has a smoother surface compared with piqué structures and, as consequence the Single Jersey structure presents a higher thermal absorptivity.

Conclusions

To achieve the optimal clothing comfort, it is necessary to consider the end-use of the garment when selecting the fabric. Thermo-physiological comfort properties, such as air permeability and thermal properties can be changed by fabric construction.
The loop length significantly influences these properties especially air permeability and thermal conductivity.
The knit-tuck structures, due to their high thermal resistance values, could be preferred for insulation garments in order to protect from cold and for promoting a warmer feeling at first contact. Single jersey structures should be chosen for active sportswear or summer garments for improved water vapour and air permeability, and for higher thermal absorptivity.

Key Words: Bio-active yarn, weft knitted structure, thermal properties

References

[1] Textiles in sport, Edited by R. Shishoo, First published 2005, Woodhead Publishing Limited and CRC Press LLC© 2005, Cambridge England.
[2] www.seacell.com, accessed at 19.02.2009.
[3] http://www.ftc.com.tw/prod_bodytek_seacell01e.htm, accessed at 20.02.2009.
[4] U.C. Hipler, P. Elsner - Biofunctional Textiles and the Skin, Current Problems in Dermatology, Vol. 33, Series Editor G. Burg Zürich, 2006.
[5] Fluhr J, Hipler UC, Elsner P - Silver-loaded cellulosic fibers with anti-fungal and anti-bacterial properties new bio-active fibers for intelligent textiles: SeaCell@Active. Proceedings of the Textile Institut 83rd World Conference (83rd TIWC) 23-27 Mai, Shanghai, China: 2, 2004: 633-637.
[6] C.D. Kane, U.J. Patil and P. Sudhakar - Studies on the Influence of Knit Structure and Stitch Length on Ring and Compact Yarn Single Jersey Fabric Properties, Textile Research Journal 2007; 77; 572 the online version of this article is available at http://trj.sagepub.com/cgi/content/abstract/77/8/572, accessed at 8.05.2009.

BIOPREPARATION – FROM ANALYTICAL POINT OF VIEW

E.Csiszár[1], **E. Fekete**[2], **B. Koczka**[3]

[1] *Department of Physical Chemistry and Materials Science, Budapest University of Technology and Economics, H-1521 Budapest, P.O. Box 9. Hungary*

[2] *Institute of Materials and Environmental Chemistry, Chemical Research Center, HAS, H-1025 Budapest, Pusztaszeri út 59-67. Hungary*

[3] *Department of General and Analytical Chemistry, Budapest University of Technology and Economics, H-1521 Budapest, P.O. Box 9. Hungary*

ecsiszar@mail.bme.hu

Bioscouring is the process, in which hydrolytic enzymes, such as pectinases, xylanases and cellulases are used for destroying and removing the undesired components from the outer layers of cellulosic fibres, producing hydrophilic fibre surface. For characterizing the changes in the surface structure of the fibres with alkaline and enzyme scouring processes, a couple of simple tests are widely applied. The most frequently used method is the dropping test, which determines fabric wettability by counting the elapsed seconds between the contact of a water drop with the fabric and the disappearance of the drop into the fabric. The time required for the water droplet to be absorbed by the fabric can be measured easily and the results of this method relate well to the practical goal of absorbance by the fabric. However, in some cases the test is not discriminative sufficiently and can not make significant differences for example between the effects of the different scouring processes or between the effects of different enzymes.

In this research linen and cotton fabrics were scoured with either conventional or enzymatic scouring methods. Efficiency of the different enzymes i.e. pectinases, laccases and cellulases, as well as their combinations in the removal of non-cellulosic matters was evaluated by different methods. Besides the water droplet test, changes in surface properties of the fibres were characterized more precisely by different methods to obtain quantitative information on hydrophobic and hydrophilic character of the fibre surface. Thin-layer wicking test, water imbibition test and inverse gas chromatography were applied.

FROM TRADITIONAL TEXTILES TO INNOVATIVE APPLICATIONS IN TECHNICAL TEXTILES SECTORS

Rainer Gebhardt, Romy Naumann
Saxon Textile Research Institute Chemnitz, Germany
rainer.gebhardt@stfi.de

Dramatic changes in numbers of employees as well as in companies throughout Europe require new strategies to transfer traditional textiles and technologies into innovative applications for instance in the field of technical textiles. Different examples for such innovative products and technologies and the diversification processes are shown.

The situation of the textile and clothing industries in Europe during the last decade was characterized by a decreasing number of textile and clothing companies accompanied by a rapid decline in the number of employees.

To consolidate the branch of textile and clothing industries in Europe the market has to be analyzed in detail. Strategies and solutions to overcome the crisis have to be found.

One possibility are diversification processes. Diversification in the textile industry means in a technological sense to use the existing potential of conventional technologies to open up new market fields for small and medium-sized enterprises and to find innovative applications in technical textile products. Suitable fields for such changing processes are home and household textiles as well as clothing textiles in a high level market segment. Which strategy for a certain country or region is applicable depends on the available resources in production and research [1].

Diversification from classical to innovative textiles has proven as a good way to consolidate the European textile and clothing industry. To find diversification strategies, innovative products and new markets the branch needs a high potential in research. Additionally, a certain structure of funding instruments is needed.

The diversification process is demonstrated by examples of Saxon textile industry and research results.

Key Words: Technical textiles, new applications, diversification process, innovation

References

[1] R. Gebhardt, M. Barteld, R. Naumann, P. Franitza, H. Erth, STFI „INTECHTEX – European Regional Strategy for Innovation in Technical Textiles“, Book of Proceedings „Innovation Pathways and Knowledge Economy”, Dresden, 29.05.2008, Page 86-89

[2] EURATEX Working group „Technical textiles“

[3] David Rigby Associates (2002) Technical Textiles and Industrial Nonwovens - World Market Forecast to 2010

[4] B. Gulich, W. Schilde, Trends in technical nonwovens Technische Textilien 2008 - Special: Deutschland, Seite 24 - 25 ; E24 - E25

THE CONDUCTIVE SPUN YARS AS ELECTRICAL COMPONENTS

S. Vassiliadis[1], K. Prekas[1], M. Rangoussi[1], K. Absalon[2], J. Maillard [2]
[1] *TEI Piraeus, Faculty of Engineering, Department of Electronics, Egaleo Athens, Greece*
[2] *ENSAIT, Roubaix, France*
svas@teipir.gr

The use of the electrically conductive spun yarns allows the establishment of multifunctional properties on the textile products. The characteristics of the textile product do not limit themselves any more within the common textile properties. The products with the multifunctional character beyond their basic textile performance, have additionally useful electrical, electromagnetic, thermal etc behaviour.

The textile fibers are very good electrical isolators due to the covalent bonds existing in the structure of the polymers. The lack of free electrons reduces practically to zero the conductivity of the fibres. There are several methods available to decrease the electrical resistance of the textile structures starting from the chemical modification of the fibres up to the use of the metallic fibres in blends with the normal isolating fibres.

The acquired conductivity is used for the benefit of heating applications [1]. The electrical current flowing through the conductive elements of the textile structure due the Joule effect results in the increase of the temperature. The use of conductive fibres for use in heating finds excellent application in the field of the protection from the extreme environmental and weather conditions.

The equivalent metallic character of the textile structure is important for applications related to the EMI protection. The Electromagnetic Interference can be dangerous for the persons who are exposed in the electromagnetic radiation of relative high field density. The shielding effect as as a protecting barrier [2], [3]. On the contrary the conductive yarns can support the creation of antennas incorporated in the textile fabrics. In the same sense the conductive yarns can be used as transmission lines for the transmission of high frequency signals [4],[5]. Textile materials were used also successfully for the construction of coaxial cables for high frequency applications.

Several attempts have been made in order to use organic electronics techniques in order to develop active electronic elements such as Bipolar Transistors of Field Effect Transistors on the textile materials [6]. The converge between the textile materials and the active electronic components allows the real engagement of the textile material towards the e-textile products.

In parallel the conductive yarns can be used as electrical lines for the transfer of electrical energy and the transfer of electrical signals. The electrical energy is necessary for the operation of the electrical and electronic circuits and the transfer of signals is important for the process procedures etc.

The structure of the conductive textile yarns is complex: helical alignment of the fibres, isolating fibres between the conductive ones etc. Also the relative position of the yarns in the structure of the fabric affects the electrical behavior of them. The present study investigates the detection of the electrical properties of the conductive yarns. In parallel it focuses on the establishment of correspondence between the structural characteristics and the respective properties of the related electrical components mainly resistors, coils and capacitors. The laboratory measurements confirm the above mentioned relationships.

Key Words: Conductive yarns, electrical components, electrical circuits

References

[1] Kayacan O. and Bulgun E., "Heating behaviors of metallic textile structures", IJCST, Vol. 21, (2/3), 2009, pp. 127-136.
[2] Cheng K.B., Lee M.L., Ramakrishna S. and Ueng T.H., "Electromagnetic Shielding Effectiveness of Stainless Steel/Polyester Woven Fabrics", Textile Research Journal, 71(1), 42-49 (2001).
[3] Kadoğlu, H., Duran, D., "Electromagnetic Shielding with Conductive Textiles", International Conference of Applied Research İn Textile, CIRAT-3, 2008, Sousse, Tunisia.
[4] Locher I. and Troester G., "Screen Printed Textile Trasmission Lines", Textile Research Journal, 77(11), 837-842, 2007.
[5] Chedid M., Belov I. and Leisner P., "Experimental Analysis and Modelling of Textile Transmission Line for Wearable Applications", IJCST, 19 (1), 2007 pp. 59-71.
[6]Tao X., Koncar V., Dufour C. and Vuillaume D., "A New Geometry Pattern for the Wire Organic Electrochemical Textile Transistor on a Nature Fibre", International Conference on Organic Electronics (ICOE 2010), 23-25 June, Paris, France.

SOFT COMPUTING TECHNIQUES IN KNITTING

Mirela Blaga[1], Dan Marius Dobrea[2]
[1] *Gheorghe Asachi Technical University, Faculty of Textiles, Leather and Industrial Management, Iasi, Romania*
[2] *Gheorghe Asachi Technical University, Faculty of Electronics and Telecommunications, Iasi, Romania*
mirela_blaga@yahoo.com

Soft computing techniques have been attractive for various application fields. According to the specialist's opinion, the role model for soft computing is human mind. The guiding principle of soft computing is: exploit the tolerance for imprecision, uncertainty, partial truth, robustness and low solution cost [1]. Over the years, the list with agreed techniques has been extended and nowadays the basic methods of soft computing are considered: artificial neural networks (ANN), genetic algorithms (GA), fuzzy logic (FL) as well as typical methodologies of decision making support, such as analytical hierarchy process (AHP) and quality function development (QFD) [2].
A wide consideration of the use of soft computing approach in fabric and clothing manufacturing has been given by different authors and a compendium of research work done so far in this field has been developed [3]. Other authors were focused on applying such techniques in solving specific problems for knitting process, knitted fabric properties and production quality [4], [5], [6], [7], [8], [9].
The paper aims with the analysis of the existing applications of the mentioned techniques in the knitting technology. A systemic vision approach is proposed about the knitting process, considering the factors which must be in perfect correlation: raw materials, fabric characteristics and finishing process. A key action of the fabric quality assurance is the good adjustment of the knitting parameters according to the raw material and fabric features, while constantly monitoring the knitting process. Considering this, the authors point out the main problems which require these methods and further potential research.

Key Words: Genetic algorithms, artificial neural network, fuzzy-logic, knitting process, knitted fabrics

References

1. Zadeh, L., A., 2005, *Toward a Generalized Theory of Uncertainty – An Outline*, Information Science 172 (1-2), pp.1-40.
2. Ito, T., 2007, *Dealing with uncertainty and Decision Support Applications*, International Journal of Soft Computing Applications, pp.5-16.
3. Majumdar, A., et.al., 2010, *Soft Computing Applications in Fabrics and Clothing: A Comprehensive Review*, Research Journal of Textile&Apparel, No. 1, Vol. 14.
4. Park S.W., et.al., 2000, *Applying Fuzzy Logic and Neural Networks to Total Hand Evaluation of Knitted Fabrics*, Textile Research Journal, 70(8), 675-681.
5. Ucar, N. and Ertugrul, S., 2002, *Predicting Circular Knitting Machine Parameters for Cotton Plain Fabrics Using Conventional and Neuro–Fuzzy Methods*, Textile Research Journal, 72(4), 361-366.
6. Shady, E.,et.al., 2006, *Detection and Classification of Defects in Knitted Fabric Structures*, Textile Research Journal, 76(4), 295- 300.
7. Ertugrul S. and Ucar N., 2000, *Predicting Bursting Strength of Cotton Plain Knitted Fabrics Using Intelligent Techniques*, Textile Research Journal, 70(10), 845-851.
8. Slah M., et.al., 2006, *A new approach for predicting the knit global quality by using the desirability function and neural networks*, Journal of Textile Institute, 97, 17-23.

DETERMINATION OF DYNAMIC CHARACTERISTICS OF SEWN SEAM AT IMPACT STRAIN

Ivana Dosedělová
Technical University of Liberec, Faculty of Textile, Department of Technology and Management of Apparel Production, Olomoucká 25, Prostějov, Czech Republic
ivana.dosedelova@tul.cz

This article deals with the sewn seams at the technical ready-made products. In some applications of technical ready-made products (parachutes, airbags, safety belts ...) there are the activities at which the impact forces rise and act on the fabric and its seams. It is needed to solve the questions about determination of dynamic properties of the seams for these applications of technical ready-made products so, that right constructional and technological parameters of the products could be chosen. It is possible to formulate the recommendation for projecting of the seams in practice on the basis of impact strength analysis.

1. Theoretical formulation of the problems

1.1 Mechanical impact

Mechanical impact is the phenomenon during which sudden change of movement of mass points of system sets (it means the change of size and direction of speed vector) in relatively short time by acting of considerable big external forces which arise in the place of touch of solids.

Impact strain has different effects than quasistatic strain. Strain increases so fast at impact strain that material is beyond to deform. Material resists higher strain at destruction, but it acquires lower elongation – material appears as fragile.

Impact strain has different mechanism of acting than quasistatic strain. Impact force induces the strain on one end of solid, which needs certain time to transfer to second end of the solid. Entire mass of the solid isn't partaken in impact immediately. Effect of the force appears as vibration, which spreads as waving in material and transfers induced strains in certain speed. Also deformation and energy spread in solid thanks to the strain waves.

Impact is the special case of transfer of force effects in solid substances. It is very complicated phenomenon. Difficulty of impact phenomenon is the cause of number of unsolved problems in this area. Theoretical solution of impact brings mathematical problems, experimental verifications are difficult realizable.

1.2 Impact strength

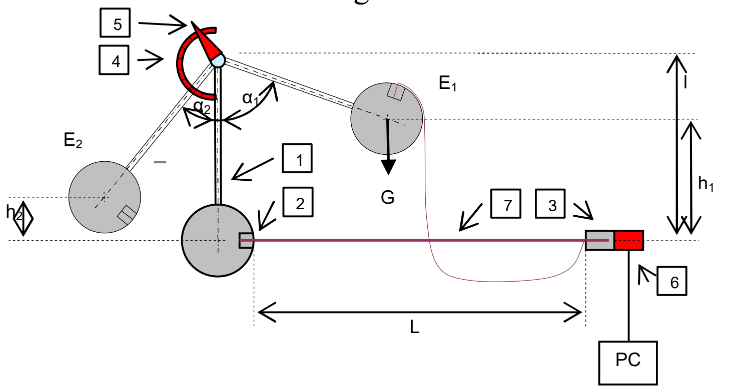
Impact strength of the seam is property, which presents resistance of the connected textile materials against external forces which act at impact. Strength of the seam can be in some cases lower than strength of the textile. Ultimate strength at impact is most often connected with the evaluation of maximal deformation work (energy), which is needed to consume to destruction of material.

Ultimate strength can be determined as maximal acting force which is needed to destruction of the seam at impact strain in conditions of available diagnostic test-apparatus. Furthermore impulse of force can be determined, if the variation of force is observed in dependence on time. Ultimate strength in impact and ultimate strength in quasistatic straining is different – dynamic coefficient at impact (impact factor) is evaluated.

2. Measuring of the impact strength of the seam on the textile sample

2.1 Apparatus for measuring of impact strength

Apparatus for measuring of mechanical characteristics in dynamic conditions was constructed on the principle of the Charpy´s hammer. It is constructed so that the material is broken when passes zero position. It enables to determine not only determination work, but also it enables to observe variation of acting force.



Description of apparatus:

(1) … swinging pendulum
(2) … turning gripping jaw
(3) … stationary gripping jaw
(4) … angular scale
(5) … pointer
(6) … gauging device (strain gauge)
(7) … plane of even fabric

Figure 1. The schema apparatus for measuring the impact strength of textile fabric and seams

2.2 Method of measuring of impact strength

Basis of the method is in the straining of the experimental samples of the areal textile with seam by impact force which acts perpendicular to the direction of seam. Experimental sample has specified dimensions and position of the seam. Maximal force and deformation work needed for destruction of the seam are evaluated.

2.3 Experimental results and evaluation of the measuring of dynamic characteristics at typed seams on laboratory sample

Values of maximal impact force and absorbed deformation work were determined by simulation of impact strain of different made seams. The measuring value absorbed deformation work at impact strain A_{defI} was compared with value absorbed deformation work at static strain A_{defS} and impact factor was evaluated. Results of average measured values will be in the full text.

3. Conclusion

The using properties of technical ready-made products are given not only by using textiles but also by technological ready-made procession. The knowledge of strength’s characteristic not only at quasi static strain but also at impact strain is necessary condition for successful projecting to the seams (especially the technical ready-made products seams).

Key Words: Strength, impact, technical ready-made product, force, strain

References

1. Dosedělová, I., *Strength of the sewn seam in dependence on the method of strain*, In Structure and Structural Mechanics of Textile Fabric, Technical University in Liberec, 2006, ISBN 80-7372-135-X
2. Dosedělová, I., *Theoretical and experimental method for determination of sewn seam strength*, In 6th TEXTILE SCIENCE 2007, Technical University in Liberec, 2007, ISBN 978-80-7372-207-4
3. Dosedělová, I., *Determination of sewn seam impact strength*, Acta Technica Corviniensis - Bulletin of Engineering (fascicule 4), ISSN: 1584-2665

CONTEXT – AWARE SYSTEMS AND BODY AREA SENSOR NETWORKS: A "MODEST" APPROACH

A. Papantoniou[1], **S. Vassiliadis**[1], **A. Sigalas**[1], **C. Aktipis - Trikoupis**[1], **C. Chatzopoulos**[2]

1 *Technological Education Institute (TEI) of Piraeus, Department of Electronics, Piraeus, Athens, Greece*
2 *Democritus University of Thrace, Department of Production & Management Engineering, Xanthi, Greece*
apap@teipir.gr

Nowadays sensors and tags seem to inhabit almost every object of our world. They are broadly used in many industrial domains including smart homes, distribution & retail industries, healthcare and asset management (Yang G.Z., 2006).
Body Area Sensor Network (BASN) commercial products are already introduced in the market, including wireless shoes, blood sugar monitors and pill cameras (WWRF, 2004). Such networks consist of a great number of devices, sensors and/or actuators, like the ones mentioned above, within, near or on a human body. These sensors can interact with other networks in close proximity, can reveal an "always on" or a "low energy cycle" status and finally, they can be context aware (Zimmerman T., 1999), (Hanson M. et al., 2009).
BASN devices capture large quantities of data continuously. According to (Paganelli E., 2007 and (Jurik S., 2008), back-end business applications have difficulties to extract and process information stemming from such quantities of data. This information is crucial for decisionmaking and subsequent actions from various monitoring & control centre services, like patient monitoring in healthcare. Signal processing is proposed as a means to extract this valuable information from captured data (Hanson M. et al., 2009) and intelligent data fusion techniques are found within the literature, that aggregate and process contextual data coming from various on and in-body sensors. Such applications are called Context-Aware Systems (Copetti A. et al, 2008), (Jafari et al., 2007).
In many cases like in (Paganelli E., 2007), (Copetti A. et al., 2008), such Context-Aware Systems follow the guidelines of Knowledge-Based Systems design and development therefore knowledge models (ontologies), inference engines and semantic reasoning are among the basic component modules of these systems.
The objective of this paper is to present, in a simple way, a guideline for developing a Context-Aware System that interacts with a BASN and supports intelligent data fusion and further decision-making. To this point of view, this paper can be considered as the first of a series of tutorial papers and includes system component architecture, brief descriptions of each component's functionality and simple exemplary scenarios.

Key Words: Context-aware systems, knowledge-based systems, sensors, body area networks

References

Copetti, A., Loques, O., Leite, J.C.B. (2008). Intelligent Context-Aware Monitoring in Home Care, *Proceedings of the 2nd International Conference: e-Medical systems*, October 29- 31, 2008, Tunisia

Hanson, M., Powell, H. C. Jr., Barth, A., Ringgenberg, K., Calhoun, B., Aylor, J., Lach, J. (2009). Body Area Sensor Networks: Challenges and Opportunities, *Computer*, vol. 42 (Jan. 2009), no. 1, pp. 58-65

Jafari, R., Bajcsy, R., Glaser, S., Gnade, B., Sgroi, M., Sastry, S., (2007), Platform design for health-care monitoring applications, in Workshop on High Confidence Medical Devices, Software, and Systems and Medical Device Plug-and-Play Interoperability, 2007, pp. 88–94.
Jurik, S., Weaver, A. (2008), Remote Medical Monitoring, *Computer* (Apr. 2008), pp. 96-99.
Paganelli, E., Giuli, D., (2007), An Ontology-Based Context Model for Home Health Monitoring and Alerting in Chronic Patient Care Networks, *Proceedings of the 21st International Conference on Advanced Information Networking and Applications Workshops* - Volume 02, IEEE Computer Society, 2007, USA
WWRF - Wireless World Research Forum, (2004), WWRF Briefings, Wireless Body Area and Sensor Networks Available from: http://www.wireless-world-research.org/ , 2004
Yang, G. Z. (2006), ed., *Body Sensor Networks*, Springer-Verlag, 2006.
Zimmerman, T.G., (1999), Wireless networked devices: A new paradigm for computing and communication, *IBM Systems Journal*, Vol. 38, No 4., 1999

DETECTION AND CLASSIFICATION USING IMAGE ANALYSIS TECHNIQUES

Mohamed Abou iiana
Textile Technology Center, Cairo University, Egypt
aboum27@hotmail.com

A new method for knitted fabric defect detection and classification using image analysis and neural networks is presented. Images of six different induced defects were obtained and used in the analysis. Statistical procedures and Fourier Transforms were utilized as two different approaches in the feature extraction effort and neural networks were used to detect and classify the defects. The results showed success in detection and classification of most defects especially when the Fourier transforms technique was utilized.

Acknowledgements
This research was supported financially by TUBITAK – BIDEB.

DEVELOPMENT OF POLYMER BASED CARBON NANOFIBER PRODUCTION TECHNOLOGY

H. Alper Ondur[1-3], **Ali Demir**[2], **Aras Mutlu**[3]

[1] *AKSA Akrilik Kimya Sanayi A. Ş., R&D Center, Yalova, Turkey*

[2] *Istanbul Technical University, Faculty of Textile Technologies and Design, Taksim, Istanbul, Turkey*

[3] *Istanbul Technical University, Institute of Science and Technology, Maslak, Istanbul, Turkey*

aondur@aksa.com

Due to their high strength, high modulus, superior fatigue, conductivity and corrosion resistance, carbon fibers are the main material for the rapidly developing composite materials as well as the technical textiles. Hence, carbon fibers have widespread applications in the fields of high value added composite materials for spacecrafts, high temperature gas and radioactive molecular filtration media and electrically conductive textiles.

Traditionally carbon fibers are based on PolyAcryloNitrile (PAN) polymer and are of varying diameters in the range of 5-10 µm. In order to produce carbon fibers with diameters in the range of 100–300 nm (nanometer), the electrospinning techniques have been recently used. By the techniques, fibers with sub-micron diameters can be used economically and efficiently. With the following stabilization and carbonization processes, PAN nanofibers are converted into carbon nanofibers with required micro-structure, electrical conductivity as well as mechanical properties.

In the recent years, so many researchers have been carried out in the field of carbon nanofiber production by electrospinning and potential applications. Nevertheless, there is still lack of knowledge with regard to the development of micro-structure of electrospun carbon nanofibers and their electrical and mechanical properties. In most of the recent research work, carbon nanofibers have been produced from randomly ordered PAN nanofibers and hence following thermal processes are carried out with little or no tension applied. In order to develop high mechanical properties, the nanofibers must be under high tension during thermal stabilization as well as carbonization. Otherwise, the resultant carbon nanofibers will have inferior mechanical properties.

This work will be based on the previous research carried out with the support of SAN-TEZ and other scientific research supports. The previous research experience will enable the researchers to produce electrospun aligned PAN nanofibers. The parallel PAN nanofibers will then be stressed whilst thermal and chemical stabilization process. Following the stabilization at 280°C, the carbonization process will be carried out at elevated temperatures in the range of 1000-2200°C.

The microstructures, electrical and mechanical properties of such produced carbon nanofibers will be studied. The surface area for unit weight will be investigated for filtration applications.

Key Words: Carbon nanofiber, electrospinning, nanotechnology

DESIGN OF A FIBER STRUCTURE THAT CONVERTS SUNLIGHT TO ELECTRICAL ENERGY

Ali Demir[1], **Ayşe Çelik Bedeloğlu**[2], **Mutlu Sezen**[3], **Kübra Tütüncü**[4], **İsmail Borazan**[5]
[1] İstanbul Technical University, Textile Technologies and Design Faculty, Taksim, İstanbul, Turkey
[2] Dokuz Eylül University, Engineering Faculty, Buca, İzmir, Turkey
[3] Korteks A.Ş., Bursa, Turkey
[4] İstanbul Technical University, Institute of Science and Technology, Maslak, İstanbul, Turkey
[5] İstanbul Technical University, Textile Technologies and Design Faculty, Taksim, İstanbul, Turkey
ademir@itu.edu.tr

The aim of this project is to obtain a textile fibre which will produce electricity using photovoltaic effect. In the future, photovoltaic fibre produced, will be used to manufacture textile products (clothings, tents, etc.) which will produce electricity itself. In the project, by using various chemical materials and methods, photovoltaic effect will be developed on polyester filaments. These photovoltaic fibres, which are produced using easier techniques and materials compared to silicon based solar cells, are used to produce yarns and fabrics or photovoltaic fibres will be integrated into fabrics or clothes. Then, people who are working, living or being apart from the electrical grids, will be able to produce electricity needed using photovoltaic textile structures.

Preliminary studies on developing a fibre showing photovoltaic effect were done as a PhD research of Dr. Bedeloğlu. By this project, some of the required materials and equipment will be obtained to carry out further studies. The results (photovoltaic fibres and tapes) of the previous PhD research are both published in scientific journals indexed by Science Citation Index and presented at national and international conferences.

The specific purpose of this project is to develop and measure photovoltaic effect on textile structures by using different specific materials. The other purpose is to add a protective layer for use onto the structure without disturbing the photovoltaic effect.

Key Words: Photovoltaic fibre, photovoltaic textile, solar cell, nanocomposite material

DESIGN AND MANUFACTURING OF A PORTABLE DEVICE THAT PRODUCES NANOWEB CONSISTING OF NANOFIBERS

Ali Demir[1], Ertan Öznergiz[2], Salih Gülşen[2], Onur Erden[3], Zarife Doğan[1], Nur Baycular[4], Tuncay Gümüş[4], Gün Sazak Kozanoğlu[4], Y. Emre Kıyak[4]

[1] *Istanbul Technical University, Faculty of Textile Technologies and Design, Taksim, Istanbul, Turkey*
[2] *Istanbul Technical University, Faculty of Mechanical Engineering, Taksim, İstanbul, Turkey*
[3] *Istanbul Technical University, Institute of Social Science, Macka, Istanbul, Turkey*
[4] *Istanbul Technical University, Institute of Science and Technology, Maslak, Istanbul, Turkey*
ademir@itu.edu.tr

Electrospinning is known as being the most efficient and effective nanofiber production method. In this method, the polymer materials, which can either in solution or melt condition, is fed to a nozzle. With an applied high voltage polymer starts to transfer with continuously increasing speed from nozzle to collector after a certain voltage level, as the surface tension is eliminated. During this transfer, the solvent is quickly vaporized as the surface of the solution increases rapidly. Because of the increasing of speed, the fiber becomes incredibly fine. The fiber diameter is generally measured between 60 – 300 nm on collector.

Nanofibers obtained via electrospinning process can be produced from a wide range of polymers. These fibers have extremely high specific surface area due to their small diameters, and nanofiber mats can be highly porous with excellent pore interconnection. These unique characteristics plus the functionalities from the polymers themselves impart nanofibers with many desirable properties for advanced applications such as filtration, agrotextiles, and medical

The output of this process is drastically affected by process parameters such as solution viscosity, solution flow rate, potential difference between charging unit and collector, type of the collector and the distance between noozle and collector. In order to see the exact effect of these parameters, a stable and controllable electrospinning system is needed. So, the novel multifunctional electrospinning device described above is designed to keep most of these parameters under control.

In the last years, in which the earth was affected by global warming, as the air temperature temporarily rises, plants bloom their flowers by mistake; and latterly coming cold weathers harm the flowers. With this project, plants will be covered by a nanoweb that consists of nanofibers, which are produced by a portable electrospinning device. It's assumed that the nanoweb will protect the plant as it provides a microclimate effect and prevents the plants from harmful bugs and insects.

Wound dressing is a therapy to repair the skin damaged by ambustion and injury. Wound dressing material which defines the three-dimensional shape of the tissue to be engineered must support cell adhesion, migration, proliferation, and differentiation. Electrospinning is the technique of choice for the preparation of such materials. Investigations have revealed that the nanofibrous structure promotes cell adhesion, proliferation, and differentiation. Parameters relevant for these processes such as fiber diameters, surface topology, porosity, mechanical properties, and the fibrous architecture of the scaffold can be controlled by electrospinning in a broad range. A portable electrospinning device is built to be used especially for wound dressing applications.

Key Words: Nanofibers, nanoweb, electrospinning

NANOFIBER PRODUCTION WITH ELECTROSPINNING

Yüksel İkiz, Ayşegül Üstün
Pamukkale University, Engineering Faculty, Department of Textile, Denizli, Turkey
aysgltex_85@hotmail.com

Nanofibers have diameters between 50-500 nm, i.e. 0.05-0.5 micrometer. In other words, they have thicknesses around one thousandth of a hair. Electrospinning, which is one of nanofiber production methods, is the only stable method of serial production of filament polymer nanofibers.
Electrospinning is a simple, cost-effective, easy and rapid method of producing fibers in the scale of micro – nanometers. It is suitable for producing fibers from different polymers and is suitable for commercial fabrication. The essential characteristic which separates electrospinning from conventional techniques is the fact that the diameters of the fabricated fibers are sub-micron and the possibility of using all the polymers which are used by other methods in molten and solution forms. In this procedure, polymer is solved in a suitable solvent or melted with heat and placed in a syringe or a pipette.
This polymer solution is charged with electricity and an electrical attraction area is formed by induced high voltage which is in the magnitude of kV. The polymer solution on the edge of syringe, which was in the form of a droplet, takes the form of a kone (Tatlor cone) due to the electrical charges and the polymer solution is ejected when it overcomes the surface tension and the viscosity.
The fiber diameters diminish as the ejected polymer elongates and the solvent evaporates. The charging increases due to the decreased diameter and this leads to further splitting into smaller diameter. The important factors in electrospinning which determine the characteristics of the produced nanofibers are, the viscosity of the solution, surface tension, conductivity; the voltage, feeding amount, the distance between the edge of pipette and the collector; and atmospheric conditions. The average fiber diameters which are produced at six different concentrations of PVA polymers at a voltage of 20 kV and at a 10 cm distance between the pipette edge and the collector are shown in Figure 1. The fiber diameters increase with increasing concentration as shown in the figure.

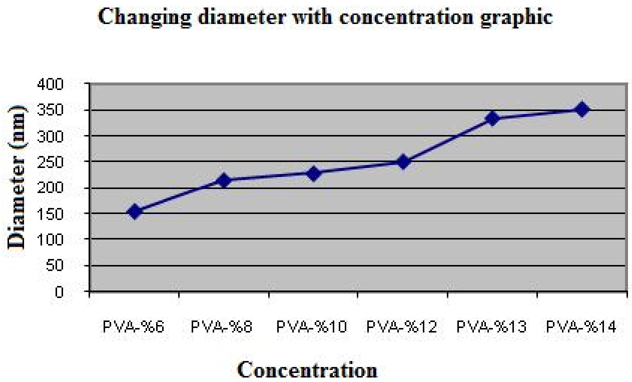


Figure 1. Average diameters of PVA nanofibers at different concentrations at 20 kV and a distance of 10 cm

According to the results, the greatest values of the whole measurements are provided when the concentration is maximum (15%), the voltage is maximum (35 kV) and the distance is minimum (10 cm), and these results are the maximum fiber diameter of 658 nm and the average diameter of 500 nm. The difference between the fiber diameters produced at concentration of 13% and 15 % are seen clearly. The fiber diameter provided at a distance of 20 cm is 530 nm when the concentration is 15% and it is 399 nm when the concentration is 13%. Generally the fiber diameter decreases with increasing distance. Average fiber diameters of PAN fibers are considerably higher than PVA fibers.

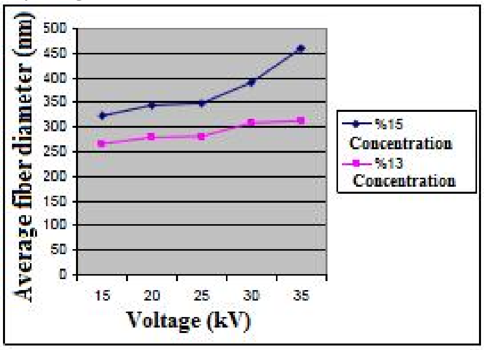


Figure 2. Average PAN fiber diameters produced at 20 cm distance at different concentrations and voltages

Key Words: Nanofiber, electrospinning, PAN, PVA

THE COMPARISON OF CRIMP PROPERTY VALUES OF NYLON 6 YARNS PRODUCED BY TWO DIFFERENT TYPES OF FALSE-TWIST TEXTURE MACHINES

Özdemir Ay, Tümay Atakan, Gürsoy Çetin
Trakya University, Edirne Vocational College of Technical Science, Edirne, Turkey
ozdemiray@trakya.edu.tr

In this study, some trials were conducted on Nylon filament yarns, which are mostly used in weft knitted fabrics. For this reason, Nylon 6 70/24/1 80 Nw Z twisted yarns were produced by two different false-twisting texture machines with two different heater lengths at a two different draw ratio. Draw value 1,25 and 1,30; length of heater 2 metres , temperature 180ºC and length of heater 0,5 metres and temperature 280ºC.

The production differences of Nylon 6 filament yarns, produced by two different false-twisting texture machines with two different heater lengths at a two different draw ratio were analyzed via the values of tensile strength, elasticity and crimp property, furthermore these differences were interpreted on the graphics.

Key Words: Nylon, poliamid, false twist texturing, crimp, draw texturing

References

1. Wulfhorst, B., Tekstil Üretim Yöntemleri, Honser 1983
2. Marjorie, Taylor A., Tekstil Teknolojisi, Forbes Publication, London 1972
3. Anmaç, E., Tekstilde Kullanılan Lifler, Dokuz Eylül Yay. İzmir 2004
4. Saçak, M., Lif ve Elyaf Kimyası, Gazi Kitabevi, Ankara 2002
5. Demir, A., Sentetik Flament İplik Üretim Ve Tekstüre Teknolojileri, İstanbul 2006
6. Wulfhorst, B., Meier, K., İnvestigations on a short High Temparatur Heater, Chemiefasern/Textilindustrie, Jan,Feb. 1993
7. Barnes, D.S., Morris, W.J., Rates of settingin false twist draw-texture.,Journal of the Textile Institute 71, no 6 1994
8. Karakaş, H.C., Dayıoğlu, H., Use of High Temparature heaters in false-twist texturing machines., Textile Institute 81 World Conferences, Melbourne, Australia 2001

THE EFFECT OF FLAT SETTINGS ON NEP FORMATION

Mustafa Ertekin, **Erhan Kırtay**
Ege University,Faculty of Engineering, Department of Textile Engineering, Bornova, Izmir, Turkey
mustafa.ertekin@ege.edu.tr

With the increasing demand on yarn quality and the ever increasing deterioration in quality of cotton due to the presence of high amount of trash and other contaminants, it is necessary to pay attention to the blow room and carding processes to provide the best quality product to the customer.

Carding is known to have a critical influence on yarn quality and performance in ring frame. The proverbs of the experts "The Card is the heart of the Spinning Mill" and "Well Carded is half spun" demonstrate the immense significance of carding for final results of the spinning operation. The tasks of the card are opening to individual fibers, eliminating of impurities, short fibers and dust, fiber blending, fiber orientation, sliver formation and disentangling of nep.

Neps are the fibres' buttons, which are difficult to eliminate during carding and preparing process. It was important to decrease the proportion of nep (fibrous and seed coat nep) inside cotton fibres.

Several studies have reported that 30% of neps changed with cotton origin, 30% resulting from maturity conditions and 40% correlating to manufacturing process.

The nep content influences the yarn's appearance, and thus the aesthetic properties of any fabric made of this yarn. The number of nep increases from machine to machine in the blow - room, the card reduces the remaining number to a small fraction. They are mostly opened out. Improvement in disentangling of nep is obtained by closer spacing between clothing; sharper clothing; optimal speed of taker-in; low doffer speeds, lower throughput and lower spacing between cylinder and flat. The most critical setting in a carding machine is between cylinder and flat tops [1].

In this study, three different flat settings are considered, in order to investigate the nep formation during carding. For this purpose, cotton samples which are taken from the feeding of the card and sliver of the same cotton, are measured by the AFIS device.

The statistical analysis according to the test results shows that:

- The nep count of the three cotton samples are considerably higher than the nep count of the sliver and the difference is significantly important.
- Nep removal (87%) ratio for the third setting (9-8-8-8-8-8) is the highest. There is a significant difference according to the other two settings.
- There is no significant difference between the nep removal ratio of the first setting (10-9-9-8-8-8) and the second setting (9-9-9-8-8-8).

Key Words: Yarn properties, nep formation, flat settings, card machine

A RESEARCH ON LINT GENERATION PROPERTIES OF DIFFERENT CARPET YARNS

Gamze Süpüren[1], Gonca Özçelik Kayseri[1], Nilgün Özdil[2]
[1]Ege University, Emel Akın Vocational Training School, Bornova-İzmir, 35100 Turkey
[2]Ege University, Textile Engineering Department, Bornova-İzmir, 35100 Turkey
gamze.supuren@ege.edu.tr

Carpet production has been an important area of Turkish Textile Industry for a long time. Traditional usage possibilities have been expanded with the innovations in the production technologies and techniques. This development is associated with the differentiation of the usage purposes and appearances of the carpets. One of the most important parameters, which affect the performance and physical properties of carpets, is the physical properties of the yarns, which are used in their production.

Lint and fuzz generation is one of the common problems during the usage of carpet yarns. In this study lint generation properties of different type of carpet yarns were investigated by using CTT (Constant Tension Transport) instrument.

Key Words: Carpet yarns, frictional properties, lint generation

A RESEARCH ON FLAX/COTTON BLENDED SIROSPUN YARNS

Tuba Bedez Üte, Pınar Çelik, Hüseyin Kadoğlu
Ege University, Engineering Faculty, Textile Engineering Department, Bornova, İzmir, Turkey
tuba.bedez@ege.edu.tr

Abstract

Flax fibres obtained from the stems of the plant Linum usitatissimum are used mainly to make linen. The plant has been used for fibre production since prehistoric times. It grows best at northern temperate latitudes, where moderately moist summers yield fine, strong but silky flax. Like cotton, flax fibre is a cellulose polymer, but its structure is more crystalline, making it stronger, crisper and stiffer to handle, and more easily wrinkled. Flax fibres range in length up to 90 cm, and average 12 to 16 microns in diameter [1]. Flax has been found to be a good candidate for growing in rotation with cotton in the Southeast, particularly along coastal areas [2]. The leading producers of flax fibre are France, Belgium and the Netherlands. Other significant producers are China, Belarus and the Russian Federation. The total area dedicated to flax cultivation for fibre is estimated at around 120 000 ha in Europe, and some 320 000 ha worldwide [1].

Flax stems that were crimped to disrupt the outer layers were soaked with various proportions of Viscozyme-EDTA solutions, retted, and then cleaned and cottonized with commercial processing equipment [3]. Retting, which is the separation of bast fiber from non-fiber tissues in the stems, is the major problem in processing flax [4]. Water-retting produces environmentally unacceptable fermentation waste whereas formerly the method chosen for getting high quality fiber [5, 6]. Presently, dew-retting is the accepted practice in European countries but has various disadvantages. Alternatively, in the 1980s, researches was undertaken to develop enzyme-retting as a method to replace dew-retting. Flaxzyme, a commercial enzyme mixture, which consists of pectinases, hemicellulases, and cellulases and reported that enzyme-retting produced fiber fineness, strength, color and waxiness comparable to the best water-retted fiber. Besides, enzyme-retting have a potential in supplying a short staple flax fiber suitable to blending with cotton in textile mills [7].

Cleaned fibers were obtained from both seed and fiber flax types, but with variations due to treatment. Retting formulations produced fibers having different properties. Fibers become finer but weaker with the increase of enzyme level [3].

Short fibres are produced during scutching or hackling. Scutching is the process for extracting the fibres from the flax stalks, separating the woody part and cleaning these fibres of other substances. This tow spinning consist of four steps; carding, preparing and combing, doubling and drafting, spinning [8].

Cotton-flax blended products are low-cost, environmentally friendly and more comfortable to wear even in summer. Flax is two to three times stronger than cotton, making it one of the strongest natural fibers known. The blend's fibers naturally absorb and transfer moisture away from the body. Adding flax to clothing fabrics helps keep skin cool partly because the flax improves moisture wicking, which means channeling moisture away from the skin's surface. Another important feature of moisture management is air permeability, which allows fabrics to dry quickly. If a fabric dries fast because it has high air permeability but it also has low

moisture- wicking capacity, the moisture won't absorb sufficiently to be pulled away from the skin [2].

Sirospun process enables a spin-twisted yarn production directly on the ring- spinning machine. Two rovings are led paralel through the drafting system and then separated by two special condensers and drafted separately. The number of turns per meter produced in the two yarn legs up to the nip point is about 20% lower than the twist of the yarn after the twisting point. In other words, the twist coefficient of the two yarn legs is only about half as high as in the final two-ply yarn [9].

In this research, spinning flax/cotton blended yarns by sirospun system was investigated. For this purpose, sirospun yarns were produced with three different blend ratio and twist coefficient and ring spun yarns were produced with the same blend ratios and twist coefficient. Sirospun yarns and ring spun yarns were produced in the same machine but distinctly double sectioned roving guides were used for sirospun yarns. The test results were statistically analyzed and evaluated. According to the results, it is seen that sirospun yarns have better properties than ring spun yarns, twist coefficient and blend ratio have significant effect on yarn properties.

Key Words: Flax fibres, flax yarns, flax/cotton blended yarns, short staple fibre spinning, sirospun

References

1. http://www.naturalfibres2009.org/en/fibres/flax.html
2. Rosalie Marion Bliss, Flax Fiber Offers Cotton Cool Comfort, *Agricultural Research,* November 2005, http://www.ars.usda.gov/is/ar/archive/nov05/fiber1105.htm
3. Akin, D., Foulk, J., Dodd, R., McAlister, D., Enzyme-retting of flax and characterization of processed fibers. *J. Biotechnol.* 2001,89 (2–3), 193–203.
4. Pallesen, B.E., The quality of combine-harvested fibre flax for industrials purposes depends on the degree of retting. *Ind. Crops Prod*. 1996, 5, 65–78.
5. Sharma, H.S.S., Van Sumere, C.F., Eds., The Biology and Processing of Flax. *M. Publications*. 1992a, Belfast, Northern Ireland.
6. Sharma, H.S.S., Van Sumere, C.F., Enzyme treatment of flax. *Genetic Eng. Biotechnol*. 1992b, 12, 19–23.
7. Akin, D.E., Dodd, R.B., Perkins, W., Henriksson, G.Eriksson, K.-E.L., Spray enzymatic retting: a new method for processing flax fibers. *Textile Res. J.,* 2000, 70, 486–494.
8. http://www.swicofil.com/lambacherflaxtowspinning.html
9. Brunk Norbert, Elitwist-A Compact Yarn For Superior Demands, *Express Textile India's* No.1 2003.

HIGH SPEED MELT SPUN PVDF MULTI-FILAMENT YARNS: ANALYSIS OF THE CRYSTALLINE STRUCTURE

S. Walter, T. Gries, G. Roth, W. Steinmann, G. Seide

[1] *Institut für Textiltechnik der RWTH Aachen University, Aachen, Germany*

[2] *Institut für Kristallographie der RWTH Aachen University, Aachen, Germany*

stephan.walter@ita.rwth-aachen.de

Polyvinylidene fluoride (PVDF, -(CH2-CF2)n-) is a semi-crystalline polymeric fiber material which has attracted considerable attention in recent years. Among the unique property profile of PVDF the chemical resistivity[1] as well as the piezo- and pyro-electric properties[2] are the main reasons for the on-going R&D activities. PVDF has a high UV stability and shows very low degradation over time. The chemical resistivity and the biocompatibility offer new applications in the field of medical textiles e.g. implants or scaffolds for tissue engineering[3] and technical textiles such as filters.

PVDF crystallizes into four different crystalline phases: α, β, γ and δ [4]. Melt Spun Fibers crystallize in the α, β, γ form[5,6]. The β-phase of PVDF exhibits piezo- and pyroelectrical effects. These effects are well investigated only for films. The potentials of active piezoelectric properties have yet to be discovered.

At the Institut für Textiltechnik, RWTH Aachen University (ITA) a DFG project has been conducted on melt spinning of PVDF multi-filament yarns. The project is titled "Determination of the basic principles for manufacturing of PVDF textile multi-filaments with defined properties". Target of the project is the description of the relationship of melt spinning, yarn formation, morphology and yarn parameters of textile PVDF multifilament yarn. The processes POY melt spinning, draw winding and false twist texturing are investigated in detail. The processability of PVDF multifilament in knitting and weaving is tested and influences of the processing on fiber characteristics examined. The obtained yarns are tested for textile parameters, DSC and WAXD measurements are conducted to describe the crystalline structure. Results are described and relationships between process and structure parameters are presented.

Experimental

The spinning was conducted on a conventional melt spinning plant. The draw winding of the LOY / POY spun yarns were carried out on a laboratory draw stand consisting of standards parts. The draw texturizing of the POY yarns was conducted on a texturizing machine AFK2 of the company Oerlikon Barmag, Remscheid, Germany.

The geometry of the crystal structures can be evaluated from the 2Theta-position of the WAXD reflections. The half-width of the intensity distribution in 2Theta allows predications about the crystal size in the considered direction. The half-width parameter in Phi-direction, which is now accessible with the new ITA analysis software, contains information about the crystallite alignment in the fiber direction. Figure 1-left shows the diffraction patterns of the Alpha-phase (a) and Beta-Phase (b) with indicated geometry of the fiber and possible evaluations.

Results and Discussion

The processability of PVDF via melt spinning is explored with the Type PVDF-C. The other types do not exhibit stable spinning behavior and partially do not allow extrusions beyond a few minutes due to pressure built-up in the spin packs. A process window for high speed melt spinning is explored shown in Figure 1-right.

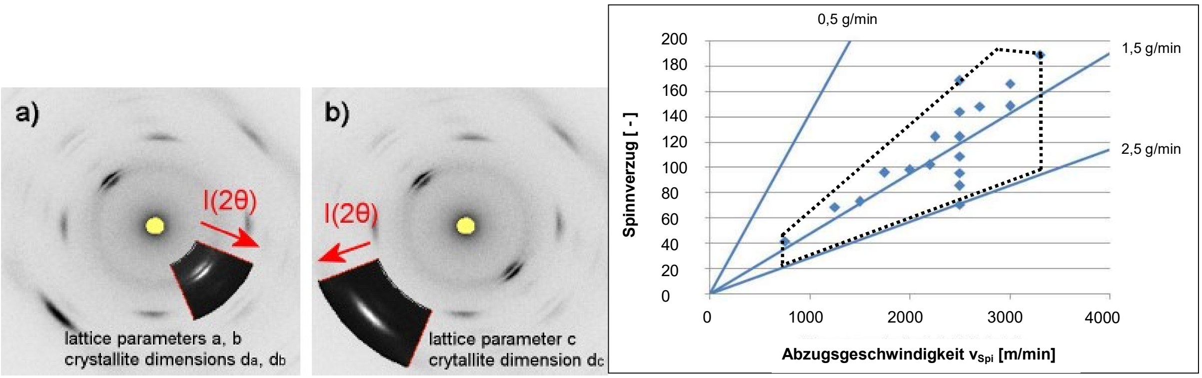


Figure 1 left: Exemplary selections of single x-ray reflexes of different crystalline phases
Figure 1 right: process window draw down ratio over draw down speed for the LOY / POY spinning of PVDF. Straight lines mark constant melt through-puts

Offline draw-winding and draw-texturizing was possible for the above mentioned process parameters (Table 3). While draw-winding does not alter the fiber surface, draw texturizing harshly damages the surface of the filaments. Figure 5 and 6 show SEM images of the surfaces after processing.

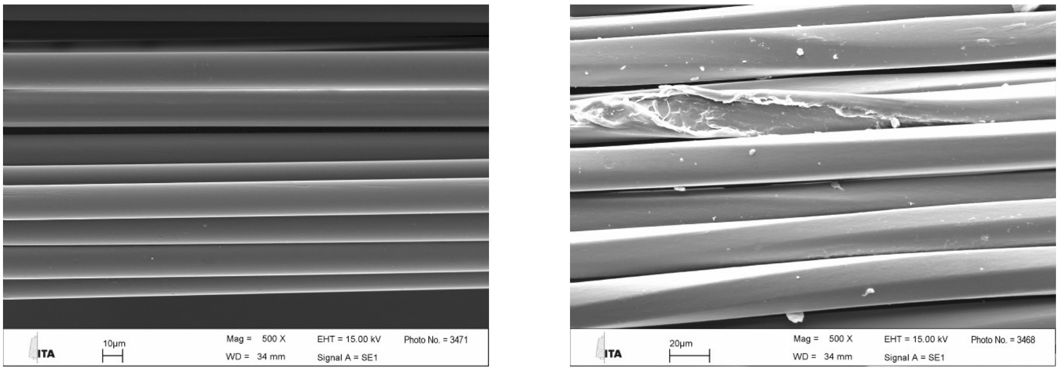


Figure 2-left: SEM image of draw-wound PVDF filaments
Figure 2-right: SEM image of draw-texturized PVDF filaments

The production of PVDF-fibers via melt spinning is analyzed with the introduced WAXD method under variation of the drawdown ratio. The crystallinity slightly improves with higher ratios in combination with the formation of a small amount (3%) of the β-phase. The draw-winding process is analyzed by processing the melt-spun yarn with the POY take up speed of 2500 m/min with different draw ratios and drawing temperatures. The formation of the β-Phase increases distinctly with total draw ratios higher 1.3 in combination with a decrease of the degree of crystallinity. This is supposed to be an effect of morphological changes in the fiber. Drawing temperatures higher then 80°C at constant draw ratio also affect a noticeable increase of β-Phase contents (Figure 3). Processing temperatures higher than 130°C result in a plateau of constant degree of β-Phase, but also show an improvement of the overall crystallinity. This is probably caused by formation of new α -phase crystallites, which are not fully converted to the β-phase.

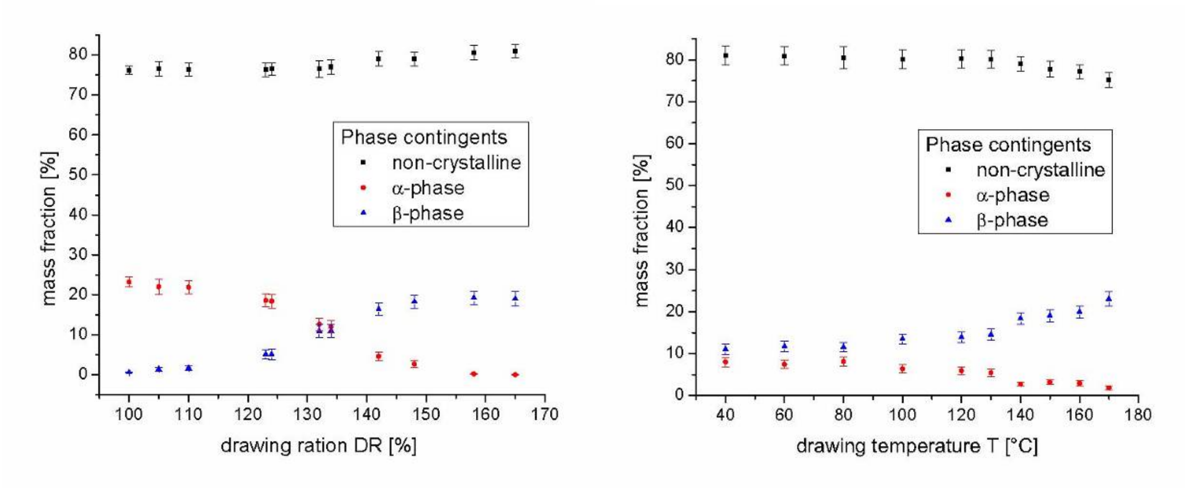


Figure 3-left: Mass fractions of non-crystalline, α- and β-Phase in dependency of draw ratios
Figure 3-right: Mass fractions of non-crystalline, α- and β-Phase in dependency of drawing temperatures

Conclusions

PVDF is a fibre forming polymer with promising properties. Melt-spinning of PVDF to fine multi-filament yarns is a research topic at ITA. Very fine filaments (dpf < 3) can be produced with satisfying yarn properties. Trials and characterization of PVDF yarns have shown that the piezo-active β-phase is forming through melt-spinning. Process parameters promoting the β-phase have been identified. Further research will be carried out.

Acknowledgements
Special thanks shall be expressed to the Deutsche Forschungsgemeinschaft (German research foundation), which funds the project GR 1311/10-2.

Key Words: Melt Spinning; Polyvinylidene fluoride, PVDF, WAXD, structure formation

References

1. A.C. Sperati, Fluropolymers, Poly(vinylidene Fluoride) in Handbook of plastic materials and technology. ; New York, Wiley p.131 (1990)
2. F. Fang, Z. Zhang, W. Yang, J. Appl. Polym. Sci., 103, 1786 (2007)
3. E. Wintermantel, S.W. Ha; Medizintechnik : Life Science Engineering; 4. Auflage, Berlin, Heidelberg, New York; Springer (1996)
4. T. L. Ward, R. R. Bererito, R. J. Berni, and D. M. Soignet, Text. Res. J., 43, 646 (1973).
5. J. M. Samon, J. M. Schultz, B. S. Hsiao, S. Seifert, N. Stribeck, G. Collins, C. Saw, Macromolecules, 32, 24, 8121 (1999)
6. Y. Wang, M. Cakmak, J. L. White, J. Appl. Polym. Sci., 30, 2615 (1985)

ELECTRICAL CONDUCTIVITY BEHAVIOUR OF SILVER/COTTON BLENDED YARNS UNDER CHANGING VOLTAGES

Deniz Duran[1], Hüseyin Kadoğlu[2]
[1] *Emel Akın Vocational Training School, Ege University*
[2] *Textile Engineering Dept., Engineering Faculty, Ege University*
deniz.duran@ege.edu.tr

Abstract

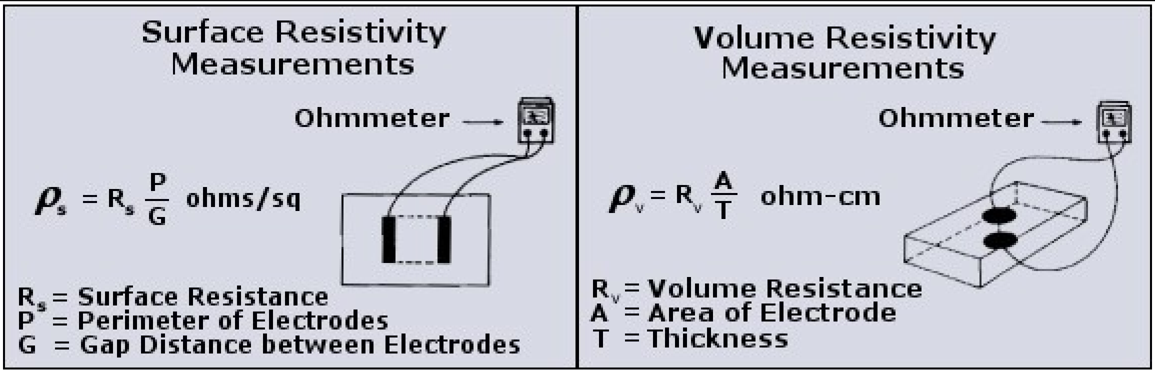
Recently, electrically conductive fibres and yarns have become the focus of interest for many scientific researches.
Textile materials can be turned into electrical conductors by using different methods such as adding carbon or metals in different forms such as wires, fibres or particles; using inherently conductive polymers or coating with conductive substances. [1]
Conductive textile applications, previously not feasible with standard textiles because of limitations in their ability to conduct current, are now becoming practical. It is almost certain that, in the near future, fabrics will not only protect the wearer from the environment, but will also have intelligent built-in features, such as multifunctional sensors or computing devices. In contrast to rigid electronic components, the electrotextiles are truly flexible, soft, and comfortable to wear and touch. [2] Up to now, different conductive textile structures have been developed for various applications. [3]
Application areas which conductive textiles are used can be summarized as follows;

- smart clothing,
- comfort and well being,
- civil engineering,
- protective clothing,
- medical applications
- military applications [4,5]

Electrical conductivity of the fabrics can be evaluated by measuring surface or volume resistivities. Surface resistivity is the resistance to leakage current along the surface of an insulating material. The electrical resistance between two parallel electrodes in contact with the specimen surface and separated by a distance equal to the contact length of the electrodes. Surface resistivities are reported in ohms per square (Ohm/cm^2). Volume resistivity is the resistance to leakage current through the body of an insulating material. Volume resistivity is numerically equal to the direct-current resistance between opposite faces of a one-meter cube of the material (Ohm-cm). [6]

In this paper, electrical conductivity behaviour of silver/cotton blend ring spun yarns with different blend ratios was studied. Yarn production was realized on a ring frame. For evaluation, the yarns were integrated into identical woven fabric structures. Weaving process took place on a projectile weaving loom. Measurements were performed according to ASTMD 257 standard by using a resistivity test fixture.

Basic principles of surface and volume resistivity measurement methods are shown in figure 1.



a) b)

Figure 1. Principles of a) surface, b) volume resistivity measurement methods [7]

Changes in surface and volume resistivities of the fabrics with the change in applied voltage, electrification time and blend ratio were investigated. Results obtained will be given in the full text.

Key Words: Conductive ring spun yarns, surface resistivity, volume resistivity, conductive textiles

References

[1] Kim, B., Koncar, V., Devaux, E., Dufour, C., Viallier, P., Electrical and Morphological Properties of PP and PET Conductive Polymer Fibres, Synthetic Metals, 2004

[2] http://www.sti.nasa.gov/tto/Spinoff2006/ip_7.html

[3] Aniolczyk, H., Koprowska, J., Mamrot, P., Lichawska, J, Application of Electrically Conductive Textiles as Electromagnetic Shields in Physiotherapy, FIBRES & TEXTILES in Eastern Europe October/ December 2004, Vol. 12, No. 4 (48)

[4] Kadoğlu, H., Duran, D., Electromagnetic shielding with conductive textiles, Proceedings of CIRAT-3 the third international conference of applied research in textile, pp 48-52, ISBN, Sousse-Tunisia, November 2008

[5] Vassiliadis, S., Provatidis, C., Prekas, K., Rangussi, M, Novel Fabrics With Conductive Fibres, Intelligent Textile Structures-Application, Production&Testing International Workshop-Thessaloniki-Greece, May 2005

[6] http://www.ides.com/property_descriptions/iec60093.asp

[7] http://www.boedeker.com/esdmatls.htm

ELECTROLESS PLATING OF TEXTILE SURFACES WITH NANOSILVER PARTICLES FOR ELECTROMAGNETIC SHIELDING

E. Önder Karaoğlu[1], N. Sarıer[2], M. Sabri Ersoy[1]
[1] *Istanbul Technical University, Department of Textile Engineering, Istanbul, Turkey*
[2] *Istanbul Kültür University, Department of Civil Engineering, Istanbul, Turkey*
onderem@itu.edu.tr

Recently electromagnetic interference (EMI) shielding and electrostatic discharge materials are receiving enormous attention due to the rapid proliferation of electronic and telecommunication systems [1,2]. EMI shielding is the process of limiting the flow of electromagnetic fields between two locations by separating them with a barrier made of the material with specified electric and magnetic properties. Shielding effectiveness (SE) is used for measuring the reduction of electromagnetic (EM) field strength through shielding by barrier material. In EMI shielding materials, reduction of EMI is accomplished mainly by reflection and absorption of EM radiation at a certain frequency. Depending upon the SE at different frequency ranges, these materials have been used for the encapsulation of different microelectronic devices, computer housings, switches, connector gaskets as well as textiles for dust and germ free clothing, data transfer in clothing, military applications. The required conductivity levels are approximately 10^{-3}–10^{-7} Sm^{-1} for electrostatic dissipating and greater than 10^{-2} Sm^{-1} for electromagnetic shielding applications. High conductivity and high dielectric constant of the materials contribute to high SE. Very recently, metal or metal oxide covered electrically conductive textiles are under investigation due to their flexibility, low density, easy processibility and low cost.

The aim of our study is to develop silver nano particle deposited cotton fabrics by employing Tollens reaction as an environmentally friendly electroless plating process, which is also easy and cheap (See Equation 1). The surface resistivity and SE values of the samples were determined in order to explore their feasibility for the development of the textiles with EMI shielding properties.

$$CH_2OH(CHOH)_4CHO + 2[Ag(NH_3)_2]^+ + 3OH^- \rightarrow 2Ag^o + CH_2OH(CHOH)_4COO^- + 4NH_3 + 2H_2O \quad \textbf{(1)}$$

First, the cotton fabric (341 $g.m^{-2}$) with a 15 cm diameter circular shape was obtained. 10 mL of polyurethane resin Impranil XP 2611 (Bayer) was sprayed on the design surface of the cotton fabric as a basecoat agent. After the application, the layer is dried at approximately 80 ^oC for about 60 minutes. The basecoat layer with a uniform thickness of approximately 20 micrometers was thus formed on the design surface of the cotton fabric.

Table 1. Reagents used for electroless silver plating on cotton fabric by Tollens reaction

Sample name	n of $AgNO_3$ (mmol)	n of NH_3, (mmol)	n of NaOH (mmol)	n of Dextrose (mmol)
P1	2.0	4.0	3.0	1.0
P2	1.0	2.0	1.5	0.5

For the preparation of Tollens reagent, 20.0 mL of 0.1 M $AgNO_3$ (aq) was added to a 150 mL beaker. While stirring at 200 rpm, 4.0 mL of 1.0 M NH_3 solution was added into the solution drop wise until a gray-black precipitate formed and then the mixture just cleared. At this point silver diamine was formed. Then, 3.75 mL of 0.8 M of NaOH was added. If the gray-black precipitate formed, again a few drops of ammonia was added drop wise until the solution, called Tollens reagent, just cleared. Subsequently, in the silver coating step, Tollens reagent and 2.0 mL of 0.25 M dextrose solution were sprayed on the surface of the basecoat layer. The silver plating layer with a uniform thickness of approximately 0.1 m was then formed on the surface of the basecoat layer. Afterwards, the surface of the silver plating layer was washed by spraying distilled water on the surface of the silver plating layer. The samples were cured at 70°C for 30 min in an oven.

Surface resistivity of the silver plated cotton fabric samples, P1 and P2, and untreated cotton fabric, P0, were measured by 4-point method using Fluke 8846A Multimeter with a precision of 0.1 mV in voltage and 0.1 nA in current, where the relative humidity was 50% and ambient temperature was 23°C. Surface resistivity measurements were repeated 5 times on different sites of each sample. The average surface resistivity values are given in Table 2. Shielding effectiveness (SE) was measured according to ASTM-D 4935-99 standard in the frequency range of 30MHz to 900 MHz. Test set-up was composed of Electro-Metrics EM-2107A sample holder and Agilent-N5230-A network analyzer.

Table 2. Surface resistivity values of untreated and silver plated cotton fabric samples

Sample Name	Surface Resistivity(MOhmsquare^{-1})
P0	>1000
P1	34.47
P2	43.71

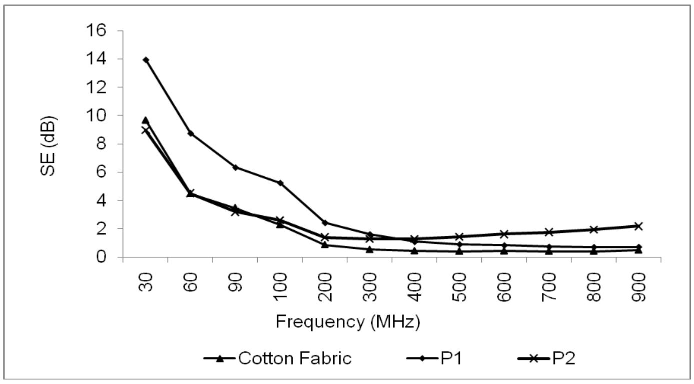


Figure 1. The variation in SE of non-plated and plated fabrics depending on the frequency of incident EM radiation between 30 to 900 MHz.

Shielding effectiveness of silver plated cotton fabrics depends on amount and distribution of silver nano particles deposited on the surface. Silver plated cotton fabrics obtained can be used as EMI shielding materials especially at low frequencies. This study is based on the ongoing research project(TUBITAK MAG 107M126).

Key Words: Electrical conductivity, electromagnetic shielding, silver nano particle, Tollen's reaction, electroless plating

References

[1] Sudha J.D., Sivakala S., Prasanth R., Reena V.L., Nair P.R., *Composites Science and Technology* , 2009, Vol.69, 358–364.
[2] Christopher J. von Klemperer, Denver Maharaj, *Composite Structures*, 2009, Vol.91, 467–472.

ELECTRORHEOLOGICAL FLUIDS AND APPLICATIONS: CURRENT TECHNOLOGY AND TRENDS

K. Prekas[1], S. Vassiliadis [1], M. Rangoussi[1], E. Siores[2], T. Shah[2]

[1] *Department of Electronics Engineering, Technological Education Institute of Piraeus, Greece*

[2] *Centre for Materials Research and Innovation, University of Bolton, UK*

prekas@teipir.gr

Electrorheological materials (ERM) have recently attracted an intense research interest due to their property to toggle their state between fluid and solid upon the application or removal of an external electric field. Modern ERMs consist of conductive particles dispersed in a non-conductive liquid medium. Silicon oils are typically used for this purpose. The viscosity of the ERM is controlled by a varying external electrical field, thanks to the fibrillation of the conductive particles that form long chains within the liquid medium. This so called (positive) electrorheological phenomenon (ERP) has long been observed, [1], [2]; yet, preparation of materials (suspensions, in fact) that exhibit a strong and exploitable ERP has only recently been achieved, [3]-[7]. This has resulted in a renewed research interest in ERMs, motivated mostly by applications in the area of automotive industry (clutches, brakes, absorbers, bumpers, etc.)

In the present work, the exploitation of the ERP in textiles is investigated, in connection with electrically conductive yarns and fabrics, [8], [9]. Yarn and fabric conductivity, obtained through a variety of chemical procedures (polymers etc.), has been extensively studied to date from a DC current / thermal point of view. The application of an AC electric field evokes the ERP on fabrics immersed in an ERM. The novel composite structure obtained in this way possesses properties that are useful in a variety of application fields, including wearable computers, pervasive computing as well as personal and body area networks, [10], [11]. The purpose of this work is (i) to survey current research trends as to the modern ERM properties, preparation and use, e.g., [12], and (ii) to address practical, feasibility issues related to the preprocessing of the ERM and the textile materials in order to obtain a composite structure of steady and controllable properties.

Key Words: Electrorheological materials, conductive textiles, viscosity, composite structures

References

[1] Winslow, W.M., “Induced Fibration of Suspensions,” J. Applied Physics, 20, 1137-1140, 1949.

[2] Shulman, Z.P., Gorodkin, R.G., Korobko, E.V., and Gleb, V.K., “The Electrorheological Effect and its possible uses,” Journal of Non-Newtonian Fluid Mechanics, 8, 29-41, 1981.

[3] Conrad, H., “Properties and Design of Electrorheological Suspensions,” MRS Bulletin, The Materials Science of Field-Responsive Fluids, 23, No. 8, 35-42, August 1998.

[4] Wu, C.W., Chen, Y. Tang, X., Conrad, H., “Conductivity and Force Between Particles in a Model Electrorheological Fluid: I Conductivity,” Intl. J. Modern Physics B, 10, (23/24), 3315-3325, 1996.

[5] Chen, Y., and Conrad, H., “Electrostatic interactions for particle arrays in electrorheological fluids: II. Measurements”, International Journal of Modern Physics B, 8, (20/21), 2895-2902, 1994.

[6] Winslow, W.M., "The Evolution of ER From Discovery to Application," Progress in Electrorheology, Edited by K.O. Havelka and F.E. Filisko, Plenum Press, New York, 1995.

[7] Block,H., Kelly, J.P., "Review Article: Electro-rheology," J. Phys. D: Appl. Phys.21, 1661-1677, 1988.

[8] Akbarov D., Kiekens P. and Kudratillaef A., "Straightforward and environmental friendly metallization of synthetic fibres", NATO, SfP 978005.

[9] Ramachandran T. and Vigneswaren C., "Design and Development of Copper Core Conductive Fabrics for Smart Textiles", Journal of Industrial Textiles, Vol. 39, No. 1, 81-93, 2009.

[10] Wade E., Asada H., "Cable-free wearable systems using conductive fabrics transmitting signals and power", Proceedings of the SPIE, Volume 5758, pp. 285-295, 2005.

[11] Provatidis C., Vassiliadis S., "On the Performance of the Geometrical Models of Fabrics for Use in Computational Mechanical Analysis", International Journal of Clothing Science and Technology, Vol. 16, No 5, pp. 434-444, Oct. 2004.

[12] Guegan, Q., Foulc, J.-N. (2008) Dielectric response of electrorheological fluids: Application to the electrical characterization of particles suspended in liquid medium, IEEE International Conference on Dielectric Liquids, ICDL 2008, art. no. 4622494.

SPACER FABRICS: THEIR SURFACE STRUCTURES AND COMFORT PROPERTIES

Gözde Ertekin, Arzu Marmaralı
Ege University, Faculty of Engineering, Department of Textile Engineering, Bornova, Izmir, Turkey
gozde.damci@ege.edu.tr

Spacer fabric is a three dimensional knitted fabric which consists of two fabric layers combining with a spacer yarn. The production of these fabrics can be performed using weaving or nonwoven techniques besides warp and weft knitting processes. Knitting technology is the most commonly used technology for the production of spacer fabrics. Weft knitted spacer fabric is produced on a double jersey circular machines or V-bed flat knitting machines. To produce spacer fabrics using circular knitting machine requires the use of at least three different yarns for each course of fabric. These are; a) yarn for the cylinder needles; b) yarn for the dial needles and c) a spacer yarn, generally monofilament yarn connecting the two layers by tucks [1]. The distance between the two fabric layers can be set by the dial height adjustment. There are two techniques of producing spacer fabrics: tucking on dial and cylinder needles at the same feeder and knitting/plating on the dial needles and knitting on cylinder needles [2].

General properties of spacer fabrics are lightweight construction, hard wearing surface, elasticity, high air permeability, transport of moisture and high water vapor permeability, … etc.. These properties are related closely to comfort [3].

Comfort is a pleasant state of physiological and physical harmony between a human being and the environment [4]. One of the most important functions of the clothing is to ensure the thermal stability of the human. It creates a barrier between the skin and environment. The barrier influences not only the heat exchange by the convection and radiation but also the heat exchange by the evaporation of the sweat [5]. There are a lot of fabrics' properties that influence the comfort. Thermal insulation properties, air and water vapour transfers are considered as the most important parameters for comfortable feeling. Also air gap between layers of the fabric, spacer yarn types and surface structure of the fabric are affected the comfort, too.

In this study, the effect of surface structures on the thermal comfort properties of spacer fabrics was investigated. For determination of the effect of surface structures on the comfort properties, the other parameters such as dial height and type of spacer yarn are kept constant. The non-porous and porous structures were selected for the back side and face side of fabrics respectively and a spacer fabric with a non-porous structure on both sides that knitted at the same machine settings were used for the comparison. The measurements were performed for the both side of fabrics. Air permeability, thermal conductivity, thermal resistance, thermal absorptivity, water vapor permeability and weight values were measured and analyzed statistically.

The results show that:

- The spacer fabrics with porous structures on the face side have higher air and water vapor permeability than non- porous structures on both sides.
- On the spacer fabrics with porous structures, thermal resistance increases while thermal conductivity decreases.

- The spacer fabrics with porous structures on face side have the lowest thermal absorptivity values and they give warmer feeling.
- The surface structure (porous/non-porous) doesn't affect the weight values significantly.
- For winter clothes, the spacer fabrics having porous structures are recommended with their higher thermal insulation and warmer feeling at initial touch.
- With high air and water vapor permeability, the spacer fabrics with porous structures can also be used for beds and sport shoes to prevent perspiration.

Acknowledgements
The authors thank to Boyteks A.Ş. for the fabric production and to Ege University Scientific Research Project Office for the financial support.

Key Words: Thermal comfort properties, surface structures, circular knitting, spacer fabrics

References

1. Bruer, S.M. et. al., Three Dimensionally Knit Spacer Fabrics: a Review of Production Techniques and Applications, *Journal of Textile and Apparel, Technology and Management*, 4, Issue 4, 2005, pp1-30.
2. Anand, S., Spacers – At the Technical Frontier, *Knitting International*, 110, No.1305, 2003, pp38-41.
3. Fuchs H., 2003, 3D Automotive textiles – a comparative evaluation, 42nd International Man-Made Fibres Congress, Automotive Textiles, Dornbirn, FuchsHilmar.pdf.
4. Önder, E., Sarıer, N., Improving thermal regulation functons of textiles, WTC 4th AUTEX Conference, 2004, France.
5. Matusiak, M., Modelling the Thermo Physiological Comfort of Apparel Textiles, AUTEX 2007, 2007, Finland.

ABRASION PROPERTIES OF SEAT FABRICS

Funda Göksel, **Nurcan Aydın, Melek Köstem, Kenan Yıldırım**
TUBITAK Bursa Test and Analysis Laboratory, Bursa (Turkey)
funda.goksel@tubitak.gov.tr

Abrasion resistance of fabrics is important performance parameter for seat upholstery. The appearance change or defect on the fabric usually occurs due to rubbing of some materials to fabric surface during usage. There are many test methods to determine abrasion behavior. Abrasion behavior can be affected both from rubbing materials, fabric structure, fabric surface and fabric materials. This study is covered investigation of the affect of both abradant type and fabric type. As a seat upholstery fabric knitted surface, woven surface and coated fabric are used. The test was carried out according to Martindale test – appearance evaluation method (ISO 12947-4), with using standard wool abradant, hook abradant and abrasive paper. Six different fabrics were used in the aspect of fabric composition. The first one is composed of woven fabric as a upper surface, foam as a filling and a non-woven as lining. The second one is composed of woven fabric as a upper surface, foam as a filling and a circular knitted fabric as lining. The third one is composed of technical front surface of warp knitted fabric as upper surface, foam as a filling and a circular knitted fabric as lining. The fourth one is composed of woven fabric as a upper surface, foam as a filling and a knitted fabric as lining. The fifth one is composed of PVC coated circular knitted fabric as a upper surface, foam as a filling and warp knitted fabric as lining. The last one is composed of PVC coated non-woven fabric. The surfaces of four fabrics are filament based, the other two fabrics are resin coated based. Test results are evaluated statistically for determining the type of rubbing that effect seriously which type of fabric.

Key Words: Seat fabrics, abrasion resistance, abradant type, Martindale tester

THE EFFECT OF NAPPING PROCESS ON THERMO-PHYSIOLOGICAL COMFORT PROPERTIES OF 2-YARN FLEECY FABRICS

Nida Oğlakcıoğlu, E. Perrin Akçakoca Kumbasar, Arzu Marmaralı
Ege University, Engineering Faculty, Textile Engineering Department, Bornova, Izmir, Turkey
nida.gulsevin@ege.edu.tr

Garments manufactured for specific activities are growing worldwide. Many fibers, fabrics and finishing treatments are offered on the market and different kinds of clothing are adapted for particular uses: sports, industrial jobs, very hot or cold weather [1]. Knitted fabric structures have long been preferred in many kinds of clothing especially in sports and casual wears due to their stretch and permeability properties and provide outstanding comfort qualities [2].

The clothing comfort is related to several parameters. Among these parameters thermo-physiological properties (heat, water vapor and air transfer) play an important role. To design a high performance garment, a designer has to consider various technical factors [1, 3] such as fiber type [4, 5], yarn properties [6, 7], fabric structures [2, 8] and finishing treatments [5, 9].

In this study, the effect of napping process on thermo-physiological comfort properties of 2 yarn fleecy fabrics, which are commonly preferred as outdoor garments for active or sportswear, were investigated. 100% cotton fleecy fabrics were selected in accordance with the most common and commercially available fleece-knitted fabric type. To determine the thermal comfort characteristics thermal conductivity, thermal resistance, thermal absorptivity, water vapor permeability, air permeability, thickness and weight values were measured (Table1) and statistically evaluated.

Table1. Thermal comfort properties of 2-yarn fleecy fabrics

	Gray Fabric	Bleached	Bleached + Napped
Thermal Conductivity (W/mK)	0,0461	0,0487	0,0455
Thermal Resistance (m^2 K/W)	0,0260	0,0301	0,0274
Thermal Absorptivity ($Ws^{1/2}/m^2K$)	97,25	100,00	92,00
Relative Water Vapor Permeability (%)	42,47	41,30	41,13
Air Permeability (l/m^2s)	1246,00	334,60	579,20
Thickness (mm)	1,18	1,46	1,25
Weight (g/m^2)	185,67	225,00	184,33

The results indicate that:

- With *bleaching* treatment thickness, weight and thermal resistance values increase, while water vapor and air permeability values decrease.
- The *napped fabrics* have the lowest thermal absorptivity values and they give warmer feeling. Besides, these fabrics have lower thickness and weight values, so they provide higher air permeability than bleached fabrics.
- For active and sports wears, the napping process is recommended for fleece knitted fabrics in order to improve the comfort properties especially for lightweight, high air permeability and warm touch feeling.
- As it can be seen during finishing process, the comfort properties of fabrics changed significantly. That's why the fabric characteristics have to be obtained after the finishing processes for real life usage performance.

Key Words: 2-yarn fleecy fabrics, thermo-physiological comfort, thermal properties, relative water vapor permeability, air permeability

References

[1] Fohr, J. P., Couton, D. & Treguier, G., Dynamic Heat and Water Transfer Through Layered Fabrics, Textile Research Journal, 2002, Vol. 72(1), 1-12.
[2] Emirhanova, N. & Kavuşturan, Y., Effects of Knit Structure on the Dimensional and Physical Properties of Winter Outerwear Knitted Fabrics, Fibres & Textiles in Eastern Europe, 2008, Vol. 16, No 2(67), 69-74.
[3] Pac, M. J., Bueno, M. A., Renner, M., Warm-Cool Feeling Relative to Tribological Properties of Fabrics, Textile Research Journal, 2001, Vol.71 (9), 806-812.
[4] Weder, M., Rossi, Rene´ M., Chaigneau, C. & Tillmann, B., Evaporative Cooling and Heat Transfer In Functional Underwear, International Journal of Clothing Science and Technology, 2008, Vol. 20, No. 2, 68-78.
[5] Gunesoglu, S., Meric, B., Gunesoglu, C., Thermal Contact Properties of 2-Yarn Fleece Knitted Fabrics, Fibres & Textiles in Eastern Europe, 2005, Vol.13 (2/50), 46-50.
[6] Ozdil, N., Marmarali, A., Kretzschmar Donmez, S., Effect of Yarn Properties on Thermal Comfort of Knitted Fabrics, International Journal of Thermal Science, 2007, Vol.46, 1318-1322.
[7] Behera, B. K., Ishtiaque, S. M., Chand, S., "Comfort Properties of Fabrics Woven from Ring-, Rotor-, and Friction-spun Yarns", J. Textile Ins., 1997, Vol.88 (3), 255-264.
[8] Oğlakcioğlu, N., Marmarali, A., Thermal Comfort Properties Knitted Structures, Fibres & Textiles in Eastern Europe, 2007, Vol.15 (5-6/64-65), 94-96.
[9] Frydrych, I., Dziworska, G., Bilska, J., Comparative Analyses of the Thermal Insulation Properties of Fabrics Made of Natural and Man-made Cellulose Fibres, Fibres & Textiles in Eastern Europe, 2002, Vol.10 (4/39), 40–44.

PERFORMANCE PROPERTIES OF DIFFERENT TYPES OF MILITARY FABRICS

Gonca Özçelik Kayseri[2], Gamze Süpüren[2], Nilgün Özdil[1]
[1]*Ege University, Emel Akın Vocational Training School, Bornova-İzmir, 35100 Turkey*
[2]*Ege University, Textile Engineering Department, Bornova-İzmir, 35100 Turkey*
gonca.ozcelik@ege.edu.tr

Textiles have a large application area in the military industry. Military fabrics have to fulfill different purposes. They have to be designed to protect from extreme weather conditions, ballistic impact and nuclear, biological and chemical threats. They have to be durable, functional and comfortable. There are different studies, which aimed to create structures with low weight and high wear comfort for military fabrics, since the innovations increased the comfort expectations of the fabrics.
Different types of military fabrics including multilayered constructions, different structures and raw materials were used in this experiment. The physical properties and thermal comfort characteristics (thermal and water vapor resistance, water repellency etc.) of the fabrics were investigated and compared according to the specified standards.

Key Words: Military fabric, performance properties, thermal resistance, water vapor resistance

A STUDY ON THE MECHANICAL BEHAVIOUR OF TECHNICAL PARAGLIDING FABRICS

Emrah Temel, Faruk Bozdoğan
Ege University, Engineering Faculty, Textile Engineering Department, Bornova, Izmir, Turkey
emrah.temel@ege.edu.tr

The application areas of fabrics made from high-performance technical fibers are very wide. One of the application areas is the paragliding fabric. The most important and obvious feature in paragliding sport is the canopy fabric. Paraglider is a flying machine with no rigid structure, weighting less than one tenth of its pilot takes to the skies. The whole lifting surface is made of a material that weights less than 50 g/m^2. That material is capable of supporting 12 time of the pilot weight, and is made of much thinner cloth than the average T-shirt.

Paragliding fabrics have evolved throughout the years since early 1960s till now, not only in their shape, but also in the fabric material used. In the production of paragliding fabrics various high performance fibers and coatings are used. Currently most woven paragliding fabric is constructed out of Gelvenor (Nylon), Skytex (Nylon), Toray (Nylon) and Dacron (Polyester) but nylon remains the most popular material.

In this study mechanical properties of paragliding fabrics, which have the same structure but in different flight hours, are analyzed. These fabrics are made of Gelvenor (Nylon) and they have different flight hours; 0 hour, 200 hours and 400 hours, respectively.

When a paraglider is flying in the air, air molecules have to pass along the up side and the bottom side of the canopy. Thus, the lift is generated on the paraglider, which carries the pilot weight. But on the other hand these air molecules generate an air resistance while passing through the canopy. This resistance causes an abrasion on the fabric, and this air abrasion and UV light effect brings out the aging effect in a long time period. So, it is an obligation to detect subtle differences between these different paragliding fabrics and to interpret the changes of flight hours of a material on the supermolecular level, for the importance of our life safety. In this research we tried to illuminate this point.

Key Words: Technical textiles, paragliding fabric, canopy fabric

References

1) BUNSELL, A. R., Handbook of tensile properties of textile and technical fibres, Part II Tensile properties and failure of synthetic fibers, pp209, Woodhead Publishing Limited and CRC Pres LLC, 2009
2) ESENER, C., Yamaç Paraşütü Kumaşları, Yamaşüt, sayı:3, sayfa 38-41,
3) Fairchild's Dictionary of Textiles, 7th edition, pg. 474
4) OERI, A., EWALD, J., User Innovation in Paraglider Design, November 9th 2008, ETH Zurich
5) POYNTER, D., The parachute manual: A Technical Treatise On Aerodynamic Decelerators, vol.1, 76-77
6) UDDIN, N., MASHUD, M., Wind Tunnel Test of a Paraglider (flexible) Wing Canopy, International Journal of Mechanical & Mechatronics Engineering, Vol: 10 No: 03, p.7-18
7) www.fingerlakesparagliding.com
8) www.ojovolador.com/eng/read/reports/porcher/index.htm
9) www.paragliding-tales-and-reviews.com/paraglider-fabric.html
10) www.wisegeek.com/what-is-ripstop-fabric.htm

FUNCTIONAL DESIGN OF COMPOSED TEXTILES STRUCTURES FOR SHOES UNDERLAYERS

M.J. Geraldes, M.R. Bento, N. Belino, M. Nunes

Science and Technology Textile Department, University of Beira Interior (UBI)
Rua Marquês D´Àvila e Bolama, Nº1 – 6200-001 - Covilhã, Portugal
geraldes@ubi.pt

Actually, the Portuguese shoes industry is in a consolidation phase and it`s preparing new challenges.

Innovation is the best way to make the competitive difference between Portuguese shoes and the others one.

The sport, lazer and work shoes are each day more sophisticated, specially with comfort, performance and security, once consumers are increasing daily the demand for well-being, comfort, functionality and, as refered before, security. For this new materials and new structures are applied in the shoe`s construction.

The development of textiles structures to shoes construction is each time bigger, according with the report published by Textiles Intelligence, entitled "Fibers and Fabrics for Performance Footwear". According this report, the specialized shoes market is divided in two sectors: sport shoes, lazer and security shoes in the work shoes.[3]

About sport shoes, the most important property is the improvement of user`s performance. So, they must be light, and with good properties of moisture and thermal transferences and also a good adherence.[4]

In work shoes, the textile structures applied, must have a good flame resistance, antistactic properties and also good thermal properties.

Beside to talk about sport, lazer or work shoes, one of the most important properties to be considered, is the moisture transfer from the foot to outside.

So, it`s of great importance the development of textile structures able to control the moisture transference phenomenous.

The feet are one of the most sensible part of the human body. In deed, it`s well-being, protection and comfort are very important to the human comfort. For this reason, the aim of this investigation work is the development of functional knitting structures, which when applied as shoes underlayers give us the thermophysiological comfort maximization.

It has been produced knitting structures with two layer, the outside layer with cotton and the inside layer with polyester. The inside layer is in a direct contact with the skin of the foot, but only trough contact points and no in contact surfaces, once this layer presents no compressible polyester files. This kind of structure construction increases the free convection thermal phenomenous, trough the presence of channels with air which intensify the thermal and physiological transferences.[2]

The behaviour comparison between the two layers and one layer structures has also been done, and it was possible to conclude that one specially two layers structures presents the best thermophysiological behaviour, and also comparatively with the structures actually applied in the shoes industry.[1]

Key Words: Comfort, mass transference, heat transference, composed structures

References

Bento, M.R., 2008: "Concepção de Estruturas de Malha com Elevada Capacidade de Transferências Térmica e Fisiológica para Aplicação em Calçado Desportivo". Tese de Mestrado, Universidade da Beira Interior.

Geraldes, M.J.,2000: "Análise Experimental do Conforto Térmico das Malhas Funcionais no Estado Húmido", Tese de Doutoramento, Universidade do Minho.

Llana,S., 2002: "A Study of the Discomfort Associated With Tennis Shoes", Journal of Sports Science, pp. 671-679.

Shishoo,R, 2005: "Textiles in Sport", CRC Press LLC, USA, pp 70-84.

AN ALTERNATIVE METHOD FOR SPLIT STITCH TECHNIQUE

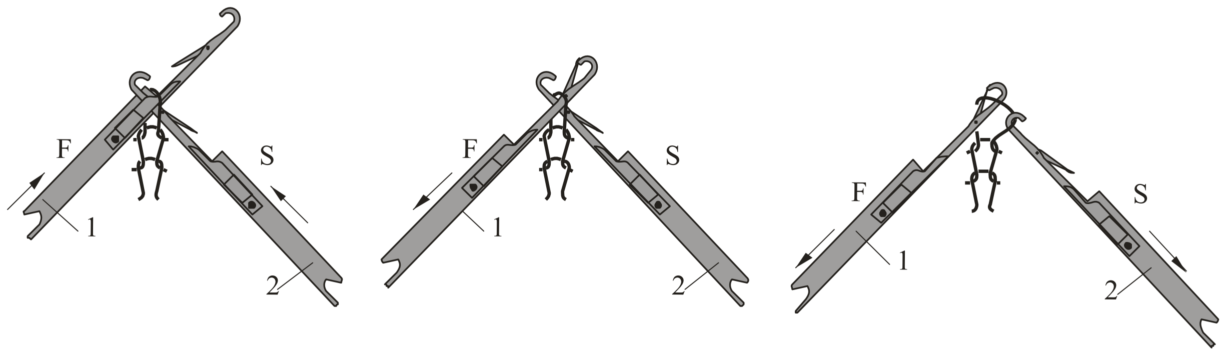
Mihai Penciuc, Mariana Ursache
"Gheorghe Asachi" Technical Universit of Iasi, Faculty of Textile, Leather and Industrial Management, Department of Knitting and Clothing Technology, Iasi, Romania
mpenciuc@gmail.com

The paper presents a new method for covering the holes in knitted fabrics as a consequence of loop formation on empty needles. Usually, on modern computerized flat machines, the solution for covering the holes is represented by Split Stitch technique. The new method of covering the holes can be considered an efficient alternative to the Split Stitch technique because it eliminates the disadvantages caused by Split application on flat knitting machines requiring a special Split cam, mounted on a certain knitting system. Besides this, it requires a knitting scheme conditioned by the position of Split cam. Also, on certain flat machines, special Split carriers are required.

In the field of knitting technology, Split stitch technique refers to the technique of stitch transfer and loop forming which means that when knitting with a latch needle, a loop is transferred to an opposite bed nedle but immediately, the delivering needle receives a new yarn whilst at transfer height and this is drawn through the transferred loop. In the literature there are mentioned two methods for split stitch technique on flat machines equipped with latch needles and compound needles [1, 2].

The knitting machine builders have developed their new flat knitting machines models (with integrated cam systems) such as they can perform the Split stitch technique in the conventional way. In this case, the loop is transferred to an opposite bed needle and immediately, the delivering needle receives, whilst at transfer height, a new yarn which is drawn through the transferred loop.

In the case of the new method, the receiving needle takes and shares half of a loop with the delivering needle in the opposite bed, without yarn feding. This is possible by changing the position of lowering cam after stitch transfer for the delivering needle as it does not cast off its loop (figure 1.c).



a. **b.** **c.**

Figure 1. Transfer stages in case of the new split technique

In figure 2 (a, b, c) are presented three examples of application of the new split method to cover the holes which appear when knitting on an empty needle.

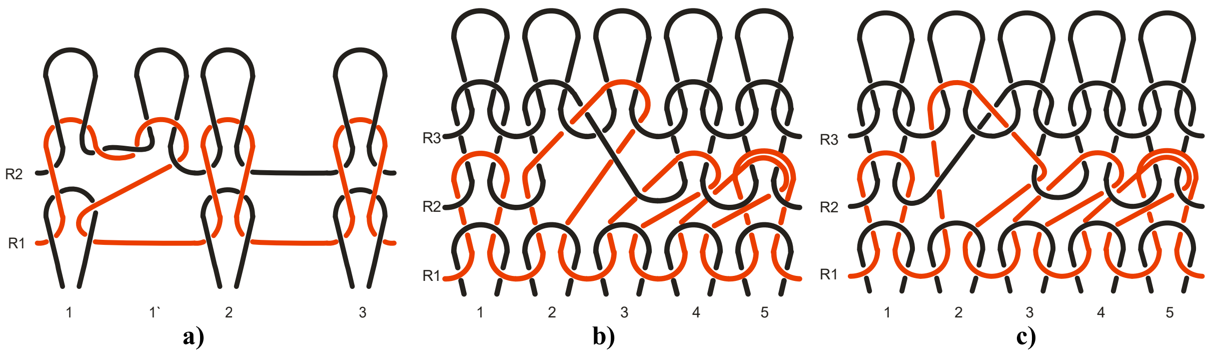


Figure 2. Applications of new Split method

By applying the new method, the loop forming mechanism can be simplified through removing the Split cam and, in some cases, the specialized Split carriers as well.

The new method can be applied on the knitting machines equipped with transfer zones placed before or after the knitting systems while the conventional method can be applied only on machines with integrated systems.

Key Words: Split stitch technique, Split cam, flat machines, transfered stitches

References

[1] Spencer, D.J., *Knitting Technology – A Comprehensive Handbook and Practical Guide*, Woodhead Publishing Ltd, Cambridge, 2001, 236-237.

[2] Dan, D., Penciuc, M., New method of stitch transfer – split method, *Romanian Journal of Textile and Leather,* 4/2001, p.79-84.

[3] *** *CMS 5xx, 7xx, 8xx, 9xx - OKC-Operating instructions*, H Stoll Gmbh&Co, Reutlingen, 2007.

[4] *** *Special-Pattern,* Stoll Service Center, H Stoll Gmbh&Co, Reutlingen, 1998.

INVESTIGATION OF THE LOW TEMPERATURE DYEABLITY OF CATIONIZED SILK FIBERS

Rıza Atav, Osman Namırtı
Namık Kemal University, Engineering Faculty, Department of Textile Engineering, Corlu, Tekirdag, Turkey
ratav@nku.edu.tr

In the literature there is a lot of study on adding amine groups to cotton fibers by pretreating them with cationic agents and hence modification of their dyeing properties. Based on this idea, cationization treatment was applied to silk before dyeing and it was aimed to improve dyeability of fibers with milling acid dyes. Anionic dyes are bound to silk fibers over (+) charged ammonium groups which are formed in acidic mediums. It is expected that the increase in amine group content in fibers after pretreatment with cationic agents will improve dyeing properties of fibers. In this study, dyeability of silk fibers at lower temperatures (90ºC) instead of boiling temperature without causing any decrease in dye uptake and hence color yield was investigated.

Experiments were carried out with degummed 100% silk plain woven fabric. Albafix E (Hunstmann) and Telon Red M-R (C.I. Acid Red 114) (Dystar) (Figure 1) was used as a cationization agent and milling acid dye respectively.

Dye uptake curves of treated and untreated silk fibers at 100ºC and 90ºC is given in Figure 1.

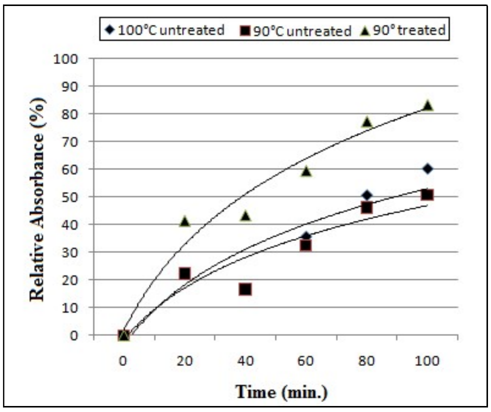


Figure 1. Dye uptake curves of treated and untreated silk fibers

Based on this investigation it can be said that anionic dye uptake of the silk fibers can be obviously increased by pretreating them with cationic agents. This situation will provide dyeing temperatures to be reduced without causing any decrease in color yield. Reducing the dyeing temperature is very important for luxury fibers like silk. Because fibers which are dyed at lower temperatures will have better luster and their strength loss during the dyeing process will be reduced. Furthermore, reducing the dyeing temperature means energy saving in dyeing process of silk fibers and this is very important in terms of dyeing costs.

Key Words: Silk, dye, cationization, color yield

THE EFFECT OF AMINO POLYCARBOXYLIC ACIDE BASED SEQUESTERING AGENT USAGE ON REMOVAL OF HYDROLYZED REACTIVE DYE IN THE POST-DYEING

Rıza Atav[1], Abbas Yurdakul[2], E. Perrin Akçakoca Kumbasar[2]
[1] *Namık Kemal University, Engineering Faculty, Department of Textile Engineering, Corlu, Tekirdag, Turkey*
[2] *Ege University, Engineering Faculty, Department of Textile Engineering, Bornova, Izmir, Turkey*
ratav@nku.edu.tr

One of the most important issues in reactive dyeing is water quality. As generally known the usage of hard water in dyeing and/or hardness which is caused by salts affects dyeing process negatively. In this case, sequestering agent usage is recommended, but inaccurate sequestering agent usage causes damage instead of benefit. Our previous study has demonstrated that the usage of amino polycarboxylic acid based sequestering agent in reactive dyeing process decreases the color yield. From this point of view, it was thought that the usage of amino polycarboxylic acid based sequestering agent, which affects dyeing adversely by interacting with dye molecule, in hot rinsing step could increase the dye hydrolyzate removal. Therefore, the usage of amino polycarboxylic acid based sequestering agent in hot rinsing step (95ºC) of reactive post-dyeing was investigated spectrally.

Relative (%) absorbance values of samples washed in the presence of sequestering agent are given in Figure 1.

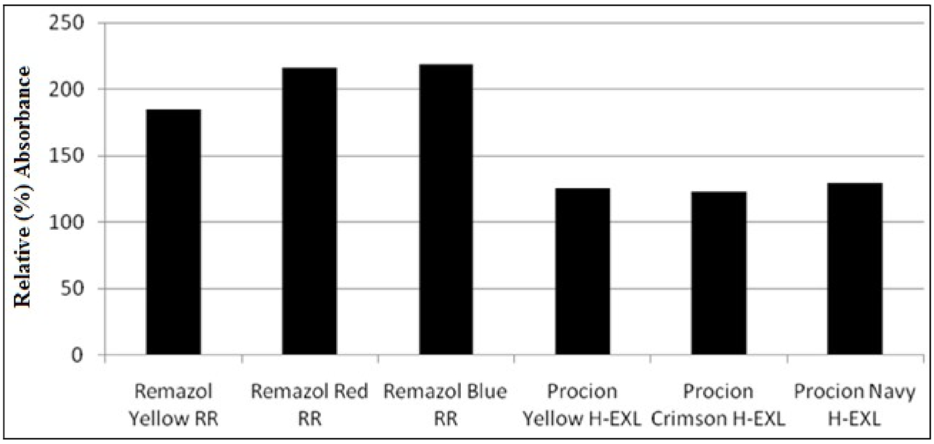


Figure 1. Increase (%) in absorbance value of water used in hot washing cycle in the presence of sequestering agent

According to the experimental results, it can be concluded that EDTA usage in the first hot washing cycle of reactive post-dyeing will increase hydrolyzate removal efficiently especially for vinylsulphone based reactive dyes.

Key Words: reactive, washing, hydrolyzate, sequestering agent, EDTA

SURFACE MODIFICATION OF NATURAL FIBRES BY SOL-GEL METHOD WITH CHITOSAN-TiO_2 NANOPARTICLES

Buket Arık[1], **Aslı Demir**[2], **Esen Özdoğan**[1], **Necdet Seventekin**[1]
[1] *Ege University, Engineering Faculty, Textile Engineering Department, Bornova, Izmir, Turkey*
[2] *Ege University, Emel Akın Vocational Training School, Bornova-İzmir, Turkey*
buket.arik@ege.edu.tr

The sol-gel processes based on the hydrolysis and condensation of metal alkoxide compounds have been used in various technical applications like preparation of special glass, ceramic and coatings. The kinetics of the hydrolysis and polycondensation reactions can be described with the help of the equations shown below;

$$M(OR)_x + H_2O \rightarrow M(OR)_{x-1}OH + ROH$$

$$2M(OR)_{x-1}OH \rightarrow (OR)_{x-1}M\text{-}O\text{-}M(OR)_{x-1} + H_2O$$

$$M(OR)_{x-1}OH + ROH \rightarrow (OR)_{x-1}M\text{-}OR + H_2O$$

In these equations; M refers to metal species (Ti, Si, Al, Zr, etc.), and R refers to alkyl groups (methyl, butyl, ethyl, etc.). These reactions generate an oxide skeleton in the solution. When this solution is exposed to the air or heating, the solution gels and becomes rigid (1).

Recently, there has been great interest in the use of antimicrobial coatings to protect living and non-living subjects from biocontamination. For this reason, various sol-gel systems with antimicrobial properties have been developed in recent years. The sol-gel systems with antimicrobial activity can be observed in two main parts;

- ✓ Photoactive titania coatings with anatase modification act germicidally (antiseptic) upon UV exposure, due to photooxidation of organic contaminants at the surface;

- ✓ Sol-gel coatings with embedded colloidal metal or metal compounds (especially silver) act antimicrobially even in the dark, due to the oligodynamic effect caused by released metal ions (2).

In addition to this, to provide an ideal protection against microbial attacks, combination of two systems can also be thought. For example, the studies about titania coatings with embedded silver or silver compounds have been found in the literature (3-5). A combination like that will be more advantageous because it will confer antimicrobial effect under all conditions that can be encountered.

In this study, application possibilities of sol-gel method for medical purposes in textile industry were examined. To this end, the coatings with chitosan biopolymer known to have wound healing and antimicrobial effect and titaniumdioxide (TiO_2) that has antiseptic effect under UV light were applied to the cotton fabrics by sol-gel method. After that antimicrobial activity and washing durability of these coatings were evaluated.

The chitosan, titania (TiO_2) and chitosan/titania based solutions prepared in different ratios were applied to cotton samples with a wet pick up of 90%. Then the samples were exposed to drying and curing processes. To evaluate the washing durability, the treated samples were washed in Linitest Plus (Atlas), with a liquor ratio of 50:1. Washing process was carried out at 60^0C for 30 minutes. Before and after the washing process, antimicrobial test according to the ASTM E2149-01 standart was made to the samples both under UV and dark conditions. To the results, chitosan/titania based solutions were found to be more effective in terms of antibacterial activity and washing durability than only chitosan coated and only titania coated cotton fabrics. It’s also concluded that sol-gel method was suitable for surface modification of natural fibres especially cotton.

Key Words: Chitosan, titania, cotton, antimicrobial, sol-gel method

References

1. Xu, P., Liu, X., Wang, W., and Chen, S., Improving the antibacterial and UV-resistant properties of cotton by the titanium hydrosol treatment, *J. Appl. Polymer Sci.*, 2006, Vol.102, 1478-1482.
2. Mahltig, B., Gutmann, E., Meyer, D.C., Reibold, M., Dresler, B., Günther, K., Fabler, D., and Böttcher, H., Solvothermal preparation of metallized titania sols for photocatalytic and antimicrobial coatings, *J. Mater. Chem.*, 2007, 17, 2367-2374.
3. Herrmann, J.-M., Heterogeneous photocatalysis: state of the art and present applications, *Topics in Catalysis*, 2005, 34, 49-65.
4. Vamathevan, V., Amal, R., Beydoun, D., Low, G., and McEvoy, S., Silver metallisation of titania particles: effects on photoactivity for the oxidation of organics, *Chemical Engineering Journal*, 2004, 98, 127-139.
5. Tran, H., Scott, J., Chiang, K., and Amal, R., Clarifying the role of silver deposits on titania for the photocatalytic mineralisation of organic compounds, *J. Photochem. Photobiol.*, *A*, 2006, 183, 41-52.

THE BIODESIGN OF TEXTILES STRUCTURES

Geraldes, M.J, Daniel S, Belino, N, Rocha,P2,Nunes, M.

Beira Interior University,Textile Department, Covilhã, Portugal
geraldes@ubi.pt

Currently, the competitiveness of the textile sector is essentially determined by the capacity to understand and react to the needs of its customers. In this context, it's possible to say that the research in the textile field is in the way of a great revolution, assuming global proportions. So, the appearance of the called "Functional Materials", has contributed decisively for the establishment of new borders for the use of textile products. The incorporation of this type of materials has converted commodities into articles with great technological content and with high performance, in different situations of risk and discomfort.

Specially the underwear clothing segment, as all the others of the textile sector, is every day more competitive and aggressive, and the trade marks, manufacturers and retailers wants the consumer's preferences. Consumers are increasing daily the demand for well-being, comfort, functionality and security.

When in a direct contact with the skin, this type of materials plays an important role in the well-being of its user during the multiple activities. The moisture, secretions, mycoses, etc., that an developed in the process of interaction between the skin and the cloth, specially the underwear, can be avoided, total or partially, using materials with suitable performance for the needs of each body area [H. Soutinho, 2006].

With this work we intend to present new functional structures [J. Gacén, 1999], with bioactive fibers, and to optimize and evaluate the real bioactive and also thermal performances of this bioactive materials, taking in to consideration the application envisaged, [A. Franzo, 2005].

For that, we started with the development of functional yarns with new bioactive fibers blended with a conventional and natural fiber – cotton. The bioactive fiber choosed was a bioactive polyester fiber, more exactly the T350 BA polyester fiber.

So, the first step of this work was the spinning of open-end yarns with different compositions, to evaluate the minimal percentage of the bioactive fiber wich give us the best relation "good bioactive behaviour versus low cost".

The second step has been the experimental evaluation of the bioactive behaviour according the NP EN ISO 20645 – 2005 and the AATCC TM 147 – 1998 methods.

The bacteria and fungus selected was respectively the *Staphylococcus aureas* (SA), *Staphylococcus epidermis* (SE), and *the Klebsiella pneumonial* (KP) bacteria and the *Candida albicans* (CA) fungus, (Daniel, 2007).

The thermal behaviour was evaluated using Alambeta Instrument with the samples in the dry and wet states, to simulate the wear of these structures, (Geraldes,2000).

As conclusion of this study, it`s possible to affirm that the Bioactive T350 BA fiber percentual variation has no influence in the thermal properties.

Also, the NP EN ISO 20645 – 2005 and the AATCC TM 147 – 1998 methods are the most appropriated first analyses methods to evaluate the bioactive behaviour and with them it`s possible to conclude if the textile is bioactive. However, it`s not possible to affirm that the textile is not bioactive, (Daniel,2007).

References

A. Franzo, 2005: "Performance Evaluation of Bioactive Fibrous Materials", E-Team Master Thesis, University of Minho, Portugal.
Daniel,S.,2007: "Desenvolvimento e Criação de um Portfólio de Fios Funcionais para Malhas", Tese de Mestrado, Universidade da Beira Interior.
Geraldes, M.J.,2000: "Análise Experimental do Conforto Térmico das Malhas Funcionais no Estado Húmido", Tese de Doutoramento, Universidade do Minho.
H. Soutinho, 2006: "Functional Design of Underwear Cloth", Master Thesis, University of Minho, Portugal.
J. Gacén, 1999: "Fibras Bioactivas, Antibacteria, Antimono, Antiácaros", Revista de la Indústria Têxtil, 376.

CURRENT STUDIES ON ENZYMATIC MODIFICATION OF PET FABRICS

Burcu Karaca[1], **Gönül Yavuz Oklap**[1], **Aslı Demir**[2], **Esen Özdoğan**[1]
[1] *Ege University, Faculty of Engineering, Department of Textile Engineering, Bornova, Izmir, Turkey*
[2] *Ege University, Emel Akın Vocational Training School, Bornova, Izmir, Turkey*
burcu.karaca@ege.edu.tr

Polyethylene terephthalate (PET) based polyester fibers are the most produced fibers in man-made fibers due to its significant advantages over other fibers such as high strength, stretching properties, wrinkle recovery, abrasion resistance and resistance to most chemicals and environmental conditions. However the lack of polar groups on the surface of PET fabrics leads to hydrophobic characteristic and causes several difficulties during wet treatments and utilization as well [1].

The conventional treatment of PET fabrics with strong alkaline treatments at high temperatures changes the hydrophobic surface structure. Besides creating more hydrophilic surface, alkaline hydrolysis cause serious weight and strength losses and also increase waste water load and energy consumption [2].

Recent years enzymatic treatments of textile materials have been an attractive research area in textile industry as an alternative to conventional harsh treatments since enzymes are selective for their substrates and need mild conditions. By this alternative way fiber damages and environmental pollution can be reduced [3]. Since biotechnological methods have been successfully adopted on natural fibers, applying these methods on synthetic fibers become an important case to study.

First researches have stated that there was no enzymatic effect on polyester fibers [4]. However in late researches, changes in the physical properties such as tensile strength, viscoelasticity and extension behavior have been observed [5]. Polyester fabrics treated by various bacterial and fungal esterases have shown an increase in water wettability and absorption values [6-11], improvement in pilling, oil stain removal and dyeability properties [12,13].

Papers and researches have stated that instead of harsh alkaline treatments, enzymes of hydrolase and esteras classes modify PET surface by hydrolyzing ester linkages and creating polar hydroxyl and carboxylic groups so that the hydrophilic property of PET is getting better [4-13]. Also it is suggested that eco-friendly alternatives can be adopted for PET fabrics to overcome hydrophobicity problem but further researches, investigations on compatibility of this alternatives with subsequent wet treatments. In addition, more analyses and comparisons with alkaline treatments on performances of PET fabrics after enzymatic treatments are necessary.

Key Words: enzymatic treatments, PET fabric, hydrophilicity, surface modification

References

[1] MCLNTRYE, J.E.: Synthetic Fibres: Nylon, Polyester, Acrylic, Polyolefin, Woodhead Publishing Limited, 1 85573 588 1, England, (2005)

[2] O'NEILL, A. & CAVACO-PAULO, A.: Monitoring Biotransformation in Polyester, Biocatalysis and Biotransformation, (2004) No.22, pp 353-356,

[3] FISCHER-COLBRIE, G.; HEUMANN, S. & GUEBITZ, G.: Enzymes for Polymer Surface Modification, In Modified Fibers with Medical and Specialty Applications, (2006), pp. 181-189

[4] TOKIWA Y. & SUZUKI T. : Hydrolysis of polyesters by lipases, (1977).

[5] SATO M.: Deterioration of filaments and films of polyethyleneterephthalate with enzyme of Cladosporium cladosporioides, (1983)

[6] HSIEH Y.-L. & CRAM L.A.: Enzymatic hydrolysis to improve wetting and absorbency of polyester fabrics, Textile Res. J., (1998), pp. 311-319.

[7] YOON, M.Y.; KELLIS, J. & POULOUSE, A.J.: Enzymatic modification of polyester, AATCC Review, Vol.2 (2002), pp.33-36

[8] ALISCH, M. et al.: Biocatalytic modification of polyethylene terephthalate fibres by esterases from actinomycete isolates, Biocatalysis and Biotransformation, (2004) No.22, pp.347-351

[9] FISHER, G.C. et al.: New Enzymes with Potential for PET Surface Modification, Biocatalysis and Biotransformation, Vol.22 (2004), pp. 341-346

[10] SILVA C. et al.: Cutinase — a new tool for biomodification of synthetic fibers, J Polym Sci, (2005).

[11] MULLER R-J. et al.: Enzymatic degradation of poly(ethylene terephthalate): rapid hydrolyse using a hydrolase from T. fusca., Macromol Rapid Commun, (2005).

[12] ANDERSEN B. et al.: Method of treating polyester fabrics. US Patent Nr. 5,997,584 (1999)

[13] ODA K. & KIMURA Y.: Method for decomposing polyesters containing aromatic moieties, a dernier reduction method of fiber, and microorganisms having activity of decomposing the polyester, (1998), Jap. Patent JP19980319251.

THE EFFECT OF ULTRASONIC TREATMENT ON FABRIC PROPERTIES

Ayşegül E. Körlü[1]**, Kerim Duran**[1]**, Seher Perincek**[2]**, M. İbrahim Bahtiyari** [3]
[1] *Ege University,Engineering Faculty, Textile Engineering Department, Bornova, İzmir, Turkey*
[2] *Ege University, Emel Akın Vocational High School, Bornova, İzmir, Turkey*
[3] *Erciyes University, Engineering Faculty Textile Engineering Department, Kayseri, Turkey*
aysegul.ekmekci@ege.edu.tr

Textile processes usually consume too much energy and need longer processing time, more water and chemicals because of limited mass transfer in conventional pretreatment and finishing processes. The efficiency of the wet finishing process is increased by raising the mass transfer towards to the inner parts of the textile material. Intensifying mass transfer by conventional methods, such as operation at elevated temperatures, are not always feasible, due to undesired effects such as fabric damage. Textile material can be described as a porous medium and it is not homogeneous. Woven textile material has two different pores being interspaced between yarns and fibres. Because of the pores between the fibres are smaller, their resistance to the liquid flow is greater and they cause a large part of the liquid to flow through these pores between the yarns without penetrating into the pores between fibres. While the mass transfer between the yarns is realised by convection, diffusion is the way of mass transfer from the fibres to the solution. The step determining the speed in mass transfer is diffusion, since it happens more slowly than convection. Warmoeskerken mentions two terms as stagnant region and convective region in order to describe the flow towards the yarns and mass transfer. There is no flow in a stagnant region of yarn. Convective region is the outer side of a yarn. The flow can penetrate to a certain degree into convective area. Mass transfer is realised by molecular diffusion in the stagnant region, and by convective diffusion in the convective region. Since convective diffusion is faster than molecular diffusion, the stagnant region determines the speed of removing the impurities. This means to contract the stagnant region by mechanical energy in so far as it is possible. Ultrasonic energy provides us with it.

Two different pure cotton woven greige fabric (46 g/m^2 and 151 g/m^2) were used for experiments. Ultrasonic treatment of the fabric was realised in an ultrasonic tank with a volume of 21 l. The frequency of the ultrasound waves generated by the sonicator plate was 42 kHz. Treatment of fabrics was carried out with/without the use of ultrasonic for 10, 20 and 30 minutes. The treatment bath didn't contain any any chemicals and auxiliaries in except of pH adjustment. The mediums were acidic (pH3-3,5), basic (pH10,5-11,5) and neutral (pH6,5-7,5). Some of the treated fabrics with ultrasound were washed with 1 g/l detergent. But the others were unwashed. In this study, the effects of ultrasound on whiteness degree, hydrophility, loss of weight were investigated. The results were compared using ANOVA and Duncan Post Hoc tests. As seen in Table 1, pH values had significant effects on whiteness (F = 4,16 / Sig. = 0,02) and moisture retain (F = 10,311 / Sig = 0,0). But it was significant for hydrophility and weight loss.

Table 1. ANOVA tests

Source	Dependent Variable	Mean Square	F	Significance
pH	Weight	2,835	0,508	0,604
	Hydrophility	1,349	0,635	0,533
	Whiteness	20,890	4,160	0,020
	Moisture retain	1307,073	10,311	0,000

It was found that ultrasonic treatment wasn't enough to remove impurities. But the better results were obtained from the ultrasonic treatment with ultrasonic washing. The highest whiteness degrees were from light fabrics treated in acidic medium. Ultrasonic treatment didn't have any effect on desing degree of the fabrics. Ultrasonic washing influenced positively hydrophility.

Acknowledgement

We thank our students Pınar Oruç and Ebru Bademci for their kind help during the experiments.
This research is supported by a joint grant from TUBITAK of Turkey and the Ministry of Education, Science and Sport of the Republic of Slovenia. (Grant No:106M332)

Key Words: pretreatment, whiteness, hydrophility, ultrasound, cotton

References

DURAN K., Marechal A. M., Körlü A. E., Fakin D., Bahtiyari M. İ., Vajnhandl S., Perincek S., Usage of High Frequency Ultrasound in Cotton Finishing, AUTEX 2009 World Textile Conference, İzmir, (2009), pp:1-9. (CD kitabı)

DURAN K., Perincek S., Körlü A. E., Bahtiyari M. İ., Ultrason Teknolojisinin Tekstilde Kullanım Olanakları, Tekstil ve Konfeksiyon Dergisi, 17, 3, 162-166, (2007)

KARABOĞA C., Tekstil Terbiyesinde Ultrason Tekniğinin Kullanılabilirliği (M.Sc.), Ege Üniversitesi, (2005)

KARABOĞA C., Körlü A.E., Duran K., Bahtiyari M. İ., Use of Ultrasonic Technology in Enzymatic Pretreatment Processes of Cotton Fabrics, FIBRES & TEXTILES in Eastern Europe, 15, 4, 97-100, (2007)

KÖRLÜ A. E., Bahtiyari M. I., Marechal A. M. L., Vajnhandl S., Duran K., Perincek S., Usage of Ultrasound in Textile Finishing, ITMC, Casablanca-Morroco, (2009), pp. 311-316

MARACHEL A. M. Le, Vajnhandl S., Dr. Fakin D., Volmajer J. V. University of Maribor, lovenya, 2007, Tekstil Sektörü ve Ultrason, 11. Uluslararası İzmir Tekstil ve Hazır Giyim Sempozyumu, İzmir, (2007) pp: 1-11. (CD kitap)

MOHOLKAR, V.S., Intensification of Textile Treatments, (PhD), Sonoprocess Engineering, Universty of Twente, (2002)

MOHOLKAR V.S., Warmoeskerken M.M.C.G., Integrated approach to optimization of an ultrasonic processor, AIChE Journal, 49, 11, 2918-2932, (2003)

PERİNCEK S., Ozon, UV, Ultrason Teknolojileri ve Kombinasyonlarının Ön Terbiye İşlemlerinde Uygulanabilirliğinin Araştırılması, (M.Sc.), Ege Üniversitesi, (2006)

PERİNCEK S., Uzgur A. E., Duran K., Doğan A., Körlü A. E., Bahtiyari İ. M., Design parameter investigation of industrial size ultrasound textile treatment bath, Ultrasonics sonochemistry, 16, 1, 184-189, (2009)

PERİNCEK S., Bahtiyari İ. M., Körlü A. E., Duran K., New Techniques in Cotton Finishing, Textile Research Journal, 79, 2, 121-128, (2009)

THAKORE K.A., Smith C.B., Clapp T.G., Application of ultrasound to textile wet processing. American Dyestuff Reporter, 79, 30–44, (1990).

WARMOESKERKEN M. M. C. G., Vlist V. D. P., Moholkar V. S., Nierstrasz V. A.; Laundry process intensification by ultrasound, Coloids and Surfaces A:Physicochemical and Engineering Aspects, 210, 2-3, 277-285 , (2002)

LASER FADING AND SAND BLASTING OF DENIM FABRICS

Ayşegül E. Körlü[1], **Gökmen Karagöz**[2]
[1] *Ege University,Engineering Faculty, Textile Engineering Department, Bornova, İzmir, Turkey*
[2] *Ege University, Graduate Schoolof Natural and Applied Sciences, Bornova, İzmir, Turkey*
aysegul.ekmekci@ege.edu.tr

Denim trousers are commonly known as ‘‘blue jeans’’and very popular for many years. For the purpose of supporting customers' purchasing behaviour and to address their aesthetic taste, companies have been trying in recent years to develop various techniques to improve the visual aspects of denim fabrics. These techniques mainly include printing on fabrics, embroidery, mechanical finishing and washing the final product. Laser fading and sand blasting processes are very interesting. Especially, the laser fading process is acknowledged as a very strong alternative compared to the conventional physical and chemical processes used for aged-worn look on denim fabrics.

In this study, cotton (100%) woven fabric was used to investigated the fading effect of laser and sand blasting on denim fabrics. The fabric was 3/1 Z twill weighing 384 g/m^2. Laser beams (80, 100, 120 sec/m^2)were used for the fading of denim fabrics. Denim fabrics were subjected to sand blasting at two different pressures (4-6 bars). The effects of laser beam and sand blasting on tearing strength and color fading were investigated.

Fading and strength loss of the fabric increased as the burning intensity of laser raised. Different burning intensity was used for different effects of the denim garment. For example, it must be 100-150 sec/m^2 for rodeo effect.

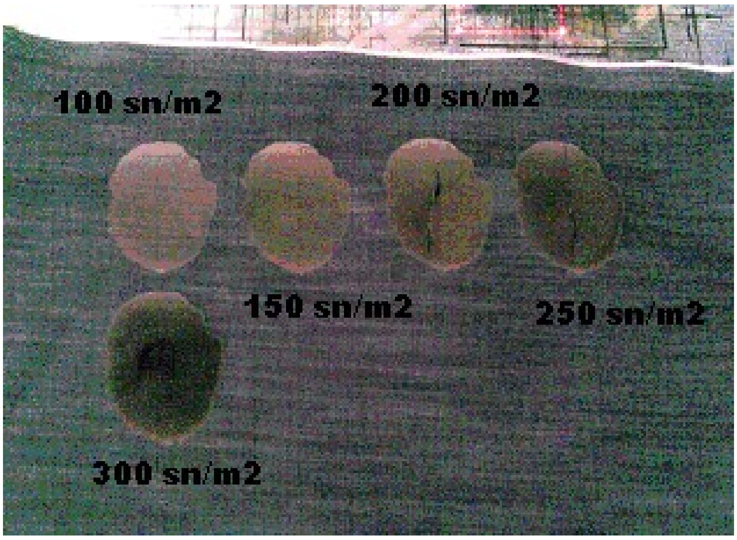


Figure 1. Fading of laser treated denim fabric

Increased sand-blasting pressure resulted in more damage and fading. In sandblasting, strength decreased approximately 20 % when the highest fading was obtained.

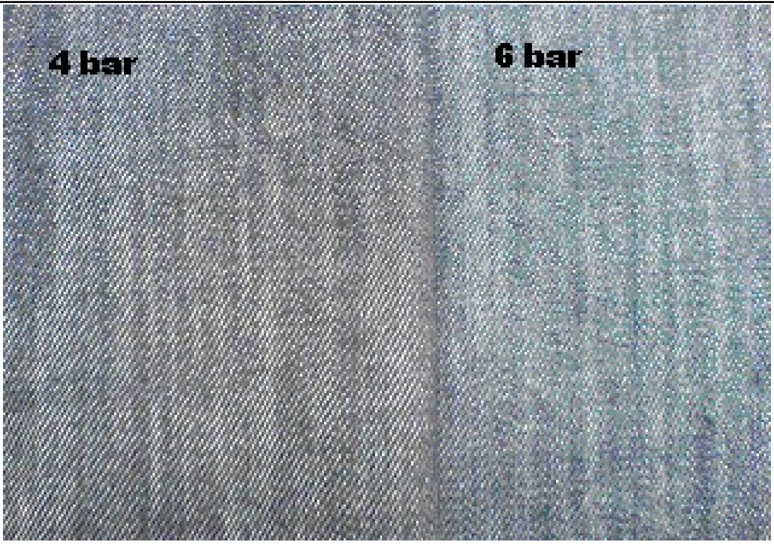


Figure 2. Fading of sand blasted denim fabrics

Key Words: Denim, sand blasting, laser fading, finishing

References

ÖZGÜNEY A. T., Özçelik G., Özkaya K., Laser Soldurma Prosesinin Denim Kumasların Renk ve Mekanik Özellikleri Üzerine Etkisinin Belirlenmesi, Tekstil ve Konfeksiyon Dergisi, 2, 133-138, (2009).

KARAGÖZ G., Denim Yıkama İşlemlerinde Ortaya çıkan Zararlar, Nedenleri ve Çözüm Olanakları (M.Sc.), Ege Üniversitesi, (2009).

ÖZGÜNEY A. T., The Comparison of Laser Surface Designing and Pigment Printing Methods for The Product Quality, Optics & Laser Technology, 39, 1054–1058, (2007).

TARHAN M., Sarıışık M., A Comparison Among Performance Characteristics of Various Denim Fading Processes, Textile Research Journal, 79, 4, 301-309, (2009).

ÖNDOĞAN Z., Pamuk O., Öndoğan E. N., Özgüney A. T., Improving the Appearance of All Textile Products from Clothing to Home Textile Using Laser Technology, Optics & Laser Technology, 37, 631-637, (2005).

ÖZDEMİR D., Duran K., Bahtiyari İ. M., Perincek S., Körlü A. E., Ozone Bleaching of Denim Fabrics, AATCC Review, September, 38-42, (2008).

ULTRASOUND IN TEXTILE FINISHING AND DYEING

Ayşegül E. Körlü[1], Kerim Duran[1], Alenka Majcen Le Marechal[2], Ana Marija Grancarić[3], Anita Tarbuk[3], Simona Vajnhandl[2], Seher Perincek[4], Darinka Fakin[2], and İbrahim Bahtiyari[5]

[1] *Ege University,Engineering Faculty, Textile Engineering Department, Bornova, İzmir, Turkey*
[2]*University of Maribor, Faculty of Mechanical Engineering, Institute for Textile Materials , Maribor, Slovenia*
[3] *University of Zagreb, Faculty of Textile Technology, Zagreb, Croatia*
[4] *Ege University, Emel Akın Vocational High School, Bornova, İzmir, Turkey*
[5]*Erciyes University, Engineering Faculty Textile Engineering Department, Kayseri, Turkey*
aysegul.ekmekci@ege.edu.tr

Many applications of ultrasonic energy have been found in science and technology. Nowadays, ultrasonic energy has been used in dyeing, washing and the enzymatic process, because it increases the mass transfer effect. Mass transfer is usually in limited levels in conventional pretreatment and finishing processes and they consume too much energy, water and produce enormous amounts of textile wastewater which is heavily charged with unconsumed dyes and other chemicals. In order to overcome these problems novel processes are being introduced or studied. It is to point out that the same or better results were obtained than with existing techniques under less extreme conditions, i.e. lower temperature and lower chemical concentration.

In this paper, an application of low and high frequency ultrasound on textile finishing and dyeing is discussed. Ultrasound treatment has the potential for use in bleaching due to localized high temperatures and pressures, and formation of highly active oxidizing species such as hydroxyl radicals (HO•), hydrogen radicals (H•), hydroperoxyl radicals (HO_2•) and H_2O_2. Polyester fabrics were bleached at pH 7 using 279 kHz and 817 kHz. The significant effect of high frequency ultrasound on bleaching polyester fabric is obtained for the first time. It is interesting to note, that high whiteness degrees are achieved in ultrasonic bleaching without any addition of hydrogen peroxide.

On the other hand cotton fabric was washed using low frequency ultrasound and interesting results were obtained in terms of whiteness, yellowness and hydrophility.

Comparison between conventional and low frequency ultrasound (20 kHz) assisted dyeing of wool, polyamide and cotton was performed and found that US assisted dyeing results in greater dye exhaustion under the same experimental conditions as conventional dyeing in a shorter time and so we are dealing with process intensification. More, spent dyebath presents lower ecological parameters values, what means that US assisted dyeing contribute to the reduction of water pollution.

Acknowledgements
We thank our students Ramazan Kıvanç Yakalı, Bekir Boyacı, Nihan Çelik for their kind help during some of the experiments in Turkey.

Key Words: Ultrasound, finishing, bleaching, dyeing

A STUDY ON THE IZOD IMPACT STRENGTH OF BAMBOO SLIVER REINFORCED COMPOSITES

S. Müge Yükseloğlu, Hürol Yöney
Marmara University, Faculty of Technology, Department of Textile Engineering, Istanbul, Turkey
myukseloglu@marmara.edu.tr

Woven fabrics and felt are used as a reinforcement component of fibre in composite structures. Glass and carbon fibres are the most widely used materials in multiaxial fabrics to increase the mechanical properties of reinforced composites. In this study, it has been aimed to study the bamboo sliver produced from the bamboo fibre which is known as *green fibre* to observe the izod impact strength of the composite structures that are produced. For this purpose, Nm 0.93 bamboo slivers were used by using vinyl ester resin at different reinforcement ratios to produce the hand lay-up composite structures. The produced reinforced composite samples were then tested for their izod impact strength tests and the composite structures of the samples were also inspected on the scanning electron microscope. According to the results, it has been observed that bamboo sliver reinforced composite structures have presented reasonable good impact strengths

Key Words: Bamboo sliver, reinforced composite, hand lay-up method, impact strength, fracture surface

AGING AND CLOTHING PROBLEMS

Z. Bahadır Ünal[1], E. Dirgar[2]
[1]*Ege University Engineering Faculty Textile Engineering Dept. Bornova/Izmir/Turkey*
[2] *Ege University Bergama Technical and Business College, Bergama/Izmir/ Turkey*
zumrut.bahadir.unal@ege.edu.tr

1. Introduction

In many developed countries, the elderly population is gradually increasing of its share in total population. Advancing medicine, civilization, developing technology and effective health services led to extend the average human life and to rapidly increasing elderly population in general population. The main purpose of the effort to extend human life is healthy, productive and the quality of life. Quality desired for each period of life. The basic requirement of the quality is taking the necessary measures for the health protection and development.

Primarily to nutrition, the requirements needed in each area must have a certain level. One of them is the dress standard. Especially in advanced age, together with the weakening of the muscle and the skeletal system, it becomes difficult to make a lot of pyhsical movement. Therefore, special clothing for people of advanced age should be designed. These clothes should be comfortable and easily removable beside appearance and functionality.

2. Demographic change in the world and in Turkey

In the twentieth century, as well as individuals, societies are aging too. Average life expectancy in the world and an increase in the proportion of the total population compared to the increasingly elderly population is expected to continue. This situation is also observed in Table 1.

Table 1. Distribution of population by age

	In 2005 Percentage Distribution				In 2050 Percentage Distribution			
	0-14	**15-59**	**60+**	**80+**	**0-14**	**15-59**	**60+**	**80+**
World	28,3	61,4	10,3	1,3	19,8	58,3	21,8	4,4
Advanced developed countries	17,0	62,9	20,1	3,7	15,2	52,2	32,6	9,4
Less developed countries	30,9	61,0	8,1	0,8	20,6	59,3	20,1	3,6
Africa	41,4	53,4	5,2	0,4	28,0	61,7	10,4	1,1
Asia	28,0	62,7	9,2	1,0	18,0	58,3	23,7	4,5
Europe	15,9	63,5	20,6	3,5	14,6	50,9	34,5	9,6
Latin America and the Caribbean Countries	29,8	61,2	9,0	1,2	18,0	57,8	24,3	5,2
North America	20,5	62,7	16,7	3,5	17,1	55,6	27,3	7,8

Reference: United Nations, 2007

In countries with advanced developed in 2005, 20.1% of people are thought to be over 60 years of age and 32.6% of people are thought to be over 60 years of age in 2050. In other countries, the ratio of the people over 60 years of age in total population is estimated to increase nearly doubled.

According to the Table 1, while 10.3% of the world population is over 60 age, until 2050 this figure is estimated at 21.8%.

Table 2. Percentage Distribution of Selected Age Groups of Population in Turkey

	0-14	15-64	65+
1990	35,0	60,7	4,3
2006	28,1	66,0	6,0
2015	25,3	68,2	6,6

References: TUİK and DPT data.

According to Table 2 as well as all over the world, in Turkey the number of people age 65 and over has increased steadily. In 2015 the elderly population are estimated to constitute 6.6% of the total population.

3. Expectations of the elderly in clothes

The elderly population has steadily increased as the requirements of modern life. This constitutes a considerable consumer group for apparel market. Today, virtually all clothes sold in shopping centers are for people with normal body sizes. To be designed clothes for the elderly, their expectations should be reviewed and designed clothes must be submitted to sale. Expectations of the elderly about their clothes can be listed as below (3):

- Appropriate size and modern clothing
- Functional clothing design for the elderly with limited movement
- Accordance with the changing structure of the body with old age, well-fitting clothing design
- Special designs for the disabled elderly (For example, condemned to a wheelchair)
- Creation of easy accessible shopping

Conclusion

Data in Table 1 were examined, particularly in advanced developed countries like Europe, over 60 years of age population are approximately 30% of total population. Although these figures are very low in less developed countries, in the coming years the proportion of elderly people is estimated to increase there. This requires to be designed and marketed special clothing for the elderly population.

Increasing in retirement age and death required that many people work actively on 60 years of age. Therefore, available garment design and production is required according to the fashion, to the body structures and physical activity of the elderly. There are several clothing firms who manufacture and marketing of clothing for these people in developed countries. But in Turkey, there is not any brand or company who sales these clothes. Many elderly in our country are chosen appropriate clothes from normal clothes. Many elderly people with good income prefer to buy custom tailored. This highly increases the cost of clothing. All of the elderly in our country should be easily obtain appropriate clothing for their age and pleasure. Therefore, some work in this direction must necessarily be made.

Key Words: Clothing design, clothing patterns, ergonomic, functional

References

1. United Nations statistical data, 2007
2. TUİK and DPT data
3. http://www.seniorenfreundlich.de/seniorenkleidung.html

CUSTOMIZED FOOTWEAR INSERTS FOR HIGH ARCHED FOOT-ONE CASE STUDY

Aura Mihai, Marta Catalina Harnagea, Mariana Pastina
"Gheorghe Asachi" Technical University, Faculty of Leather, Textile and Industrial Management, Iasi, Romania
amihai@tex.tuiasi.ro

1. Introduction

The footwear inserts, known as foot orthotics, have to manage and to control the dynamic characteristics of the foot and limb due with biomechanics. Many different types of foot orthoses are used to take care of biomechanical problems of the foot. [1, 2, 3]. The aim of this study is to present a designing methodology for customized orthotics inserts in case of a subject having high-arched foot. The high arch is associated with foot pain caused by excessive pressure on bone structure: heel, ball and toe. The pressure, defined as a force spread over a surface area, could cause pain if the footwear does not have a good design.

2. Method

The *Anatomical Custom Foot Orthotic (ACFO)* method has been used for this one case study [4]. The subject's foot has been scanned using a 3D scanning system (INFOOT USB Standard Model IFU-S-01). The recorded pressure maps and gait analysis measurements have confirmed the high-arched foot in this case. For registration of the plantar pressures there was used the FOOTSCAN 2D Gait Scientific System of RSScan company.

3. Results and Discussion

3.1. Plantar pressure measurements

Comparing with a normal foot, the high arched foot has different biomechanics and high values for pressures that affect specific areas. Also, the contact area of the foot against ground is reduced. In this study case, the static pressure map demonstrates a very high arch, the contact area being observed on the rearfoot and forefoot areas only. The high arch affects the gait pattern. In figure 1, one can observe how the pressure is distributed for a high-arched foot during walking phases.

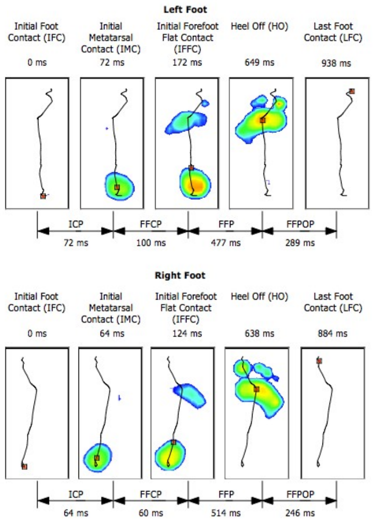


Figure 1. Plantar pressures during walking. Walking phases and their timing (Initial Foot Contact, Initial Metatarsal Contact, Initial Forefoot Flat Contact, Heel off, and Last Foot Contact) for left foot and for right foot.

The software gives some solutions regarding the areas where inserts should be added to an accommodative orthoses in order to reduce the peak pressures (figure 2). Based on clinician's prescription, the customized orthoses will be designed and manufactured.

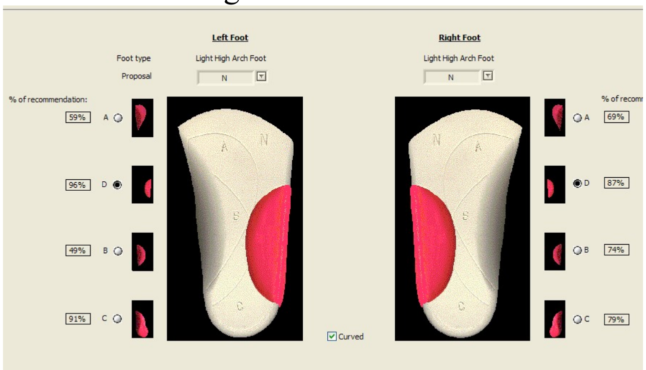


Figure 2. Suggested area for introducing insertions in order to equilibrate the plantar pressures.

3.2. Modelling the customized orthoses

The OrthoModel software from Delcam- Crispin offers a complete solution for designing/modelling a customized orthoses. Based on the designing parameters established within the modelling steps, the orthotic virtual model is automatic generated by program (fig.3-8). The files containing numerical data of the virtual model can be saved and used for manufacturing.

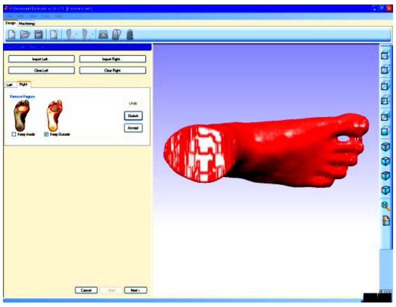


Figure 3. Selecting the foot

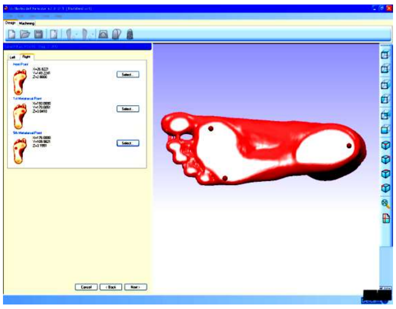


Figure 4. Selecting the key points

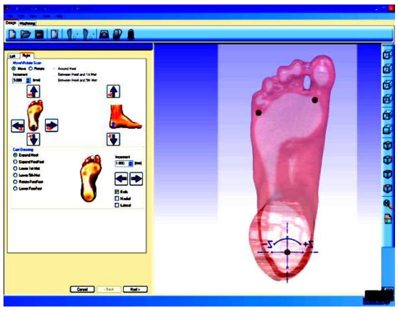


Figure 5. Re- positioning the key points

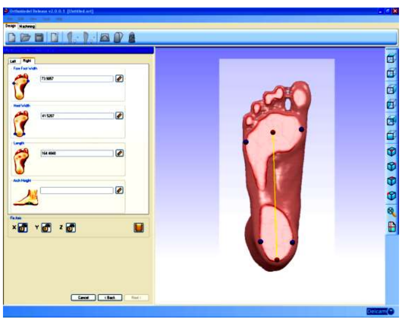


Figure 6. Measuring the foot

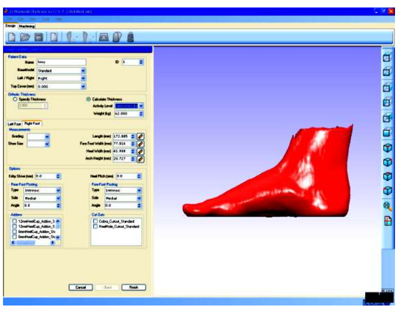


Figure 7. Additional information

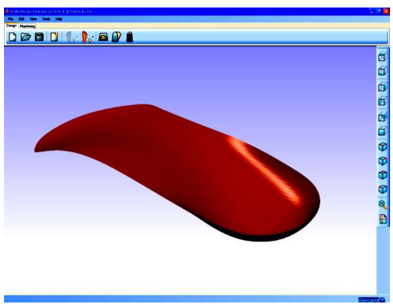


Figure 8. The orthotic virtual model

4. Conclusion

In order to successfully fulfil their functions, the foot orthotics must respond to the following topics: 1) to correspond to a medical need. The medical reason should be carefully investigated and the proper orthotics type is recommended by specialist/clinician. The modern computerized technologies for 3D foot scanning and pressures measurements gives measurable parameters for a good design; 2) to accomplish precise tasks. For example, the orthotics for high-arched foot must distribute plantar pressure and increase contact area between foot and footwear; 3) to establish how the orthotic device improves the gait disorder, therefore measurements are periodically necessary.

Key Words: Footwear, orthotics, customized, CAD

1. References

1. Payne C., Oates M., Noakes H., Static stance response to different types of foot orthoses, *Journal of the American Podiatric Medical Association*, 2003, Vol. 93(6), 492-498.
2. Yung-Hui L., Wei-Hsien H., Effects of shoe inserts and heel height on foot pressure, impact force and perceived comfort during walking, *Applied Ergonomics*, 2005, Vol. 36, 355–362.
3. Burns J., Crosbie J., Ouvrier R., Hunt A., Effective Orthotic Therapy for the Painful Cavus Foot A Randomized Controlled Trial, *Journal of the American Podiatric Medical Association*, 2006, Vol. 96, No. 3, 205-211.
4. PFOLA Technical Standards Document: Foot Orthotic Classifications, Definitions, and Summary of Manufacturing Processes Document, updated on January 24, 2006, Available from: http://www.podiatry-arena.com/podiatry-forum/showthread.php?t=19498, (04,01,2010).

ANALYSIS OF WORKING POSTURES WITH METHOD OF REBA IN APPAREL SECTOR

Meral İşler[1], A. Aslı İlleez[2], Mücella Güner[1]
[1] Ege University, Engineering Faculty, Department of Textile Engineering, Bornova, İzmir, Turkey
[2] Ege UniversityEmel Akın Vocational School, Bornova, İzmir Turkey
meral.isler@ege.edu.tr

Although rapid progress of technology and beginning of the information era expedite many areas of life but also changed the production concept. The place of machinery in the production is increasing. This situation has been accelerating and facilitating the work. On the other hand there is still some sector has been continuing their labor-intensive manufacturing and many workers have been faced with intense physical distress.
The clothing industry is generally seen as a safe place to work. Compared to other industries, there are relatively few serious accidents in clothing plants. The hazards we face are different. The major health risks in this industry do not arise from immediate, potentially fatal hazards. Instead, the risks that clothing workers face come from more subtle hazards whose effect accumulates over time.
Ergonomics mostly studied about postures in labor depended production systems. The main aims of ergonomics and work study are decrease cost, idle times and eliminates valueless activities. Decreasing work stress and fatigue will affect efficiency and costs. These will increase the importance of working postures. Because of this several methods are developed for analyzing workers' working postures. In this study OWAS and REBA methods are explained.
Reba (Rapid Entire Body Assessment) method is a useful tool to calculate the risk in manual handling and removal works. It has been developed by Hignett and McAtamney,(2000) for analyzing the posture. REBA, has been combined the structure and load of the body postures with quantitative sense. With the method of REBA can be analyzed dynamic movement also be analyzed fixed posture. Using REBA desired to be analyzed posture or movement caused by the overall risk can be expressed numerically.
The aim of the study, muscle and skeletal system, leading to discomfort and hard working attitude is to examine the regions despite all the technological advances that protect the structure of labor-intensive sectors in the clothing industry.

Key Words: Apparel sector, ergonomics, REBA, working postures

References

1. Li, G., Buckle, P., 1999. Current Techniques For Assessing Physical Exposure to Work-Related Musculoskeletal Risks. With Emphasis on Posture-Based Methods. Ergonomics Vol. 42 No: 5. 674-695.
2. Akay, D., Dağdeviren, M., Kurt, M., 2003. Çalışma Duruşlarının ErgonomikAnalizi. Gazi Üniversitesi Mühendislik Mimarlık Fakültesi Dergisi 18:3, 73-84, Ankara.
3. Akihiko, S., 2005. Measuring and Evaluating Methods for Work-related Musculoskeletal Disorders, Journal of Science of Labour. 81:1,6-15.
4. Hignett, S., McAtamney, L., 2000. Rapid Entire Body Assessment (REBA). Applied Ergonomics. 31, 201-205.
5. Gunning J., Eaton J., Ferrier S., Frumin E., Kerr M., King A. and Maltby J., 2001.
6. Ergonomics Handbook for the Clothing Industry, Union of Needletrades, Toronto.

CLOTHING PREFERENCES AND EXPECTATIONS OF THE UNIVERSITY YOUTH

Demet Öznaz[1], Fatma Çitoğlu[2]
[1] *Marmara University, Vocational School of Technical Sciences, Göztepe, İstanbul, Turkey*
[2] *Marmara University, Faculty of Technical Education, Göztepe, İstanbul, Turkey*
doznaz@marmara.edu.tr

Today, modern society perception of clothing is not only a tool that is being used to protect the body from external factors, but also has become an inevitable requirement that meet the social needs of people and identify their tangible and intangible assets.

The covering and and clothing need which is the human's one of the basic needs has been developing with various reasons, such as; cultural, social, personal and psychological and by forming with various factors such as climate, economic status and fashion it carries different meanings beyond the need of covering. The clothing preferences and expectations of the young consumers that form our country's most dynamic part of the consumer population have also been changing by depending on various elements.

Moving from this discourse, a research was planned and executed in order to determine the youth's preferences and expectations toward apparel products and what clothing means for them. Students that study for university exams have formed the field of survey and the students that study at state and private universities have formed my sample survey.

In this study, survey was administered as a method of data collection. The data collection tools that have been prepared according with the purpose were distributed randomly and the obtained data were evaluated by using SPSS 17.0 (Statistical Package Program). Results were presented in tables in percentages and frequency of values in order to reveal the differences between variables.

Key Words: Clothing preferences, clothing expectations, university youth

References

Ataç, Sibel. "Büyük Beden Kullanan Kadınların Hazır Giyim Tercihlerinin ve Sorunlarının Belirlenmesi", *Yayınlanmamış Yüksek lisans tezi,* Ankara Üniversitesi Fen Bilimleri Enstitüsü, Ankara, Türkiye, (2005).
Tüzel, Kıvanç Nazlım. "Tüketicilere yönelik satış teşvikleri ve diş macunu üreticilerinin uyguladıkları satış teşviklerin satın alma davranışlarına olan etkisi", *Doktora tezi,* Marmara Üniversitesi, Sosyal Bilimler Enstitüsü, İletişim Bilimleri Anabilim Dalı Reklamcılık ve Tanıtım Bilim Dalı, İstanbul, Türkiye, (2003).
Uğur, Mehtap. "Tüketicilerin Giysi Alış Verişinde Yaşadıkları Problemlerin Ergonomik Açıdan İncelenmesi" *Yayınlanmamış Yüksek Lisans Tezi,* Gazi Üniversitesi, Eğitim Bilimleri Enstitüsü, Ankara, Türkiye, (2006).
Aktuğlu, Işıl Karpat. "Marka Yönetimi", İletişim Yayınları, İstanbul, Türkiye, (2004).

INVENTORY CONTROL BY USING ABC ANALYSIS IN APPAREL INDUSTRY

Mücella Güner[1], **Can Ünal**[2]
[1] *Ege University, Engineering Faculty, Textile Engineering Department, Bornova, İzmir, Turkey*
[2]*Ege University, Emel Akın Vocational Training School, Bornova, İzmir, Turkey*
mucella.guner@ege.edu.tr

Increasing competence conditions in the world causes textile firms to produce rapidly and to decrease their product costs. One the most important issues about this situation is effective inventory management. A free of problem management of production and response customers' requests precisely just in time are mostly up to effective inventory management. Besides a well organized inventory control system will remove holding cost. Thus managers should be aware of inventory level and should follow an inventory control policy convenient for the production type. Inventory control system in textile and apparel industry requires regular data collection and evaluation, selection of control system which is appropriate to firm type. Especially in apparel industry, inventory control is getting harder because of independency and instability of the demands according to the seasons.

In this study, importance of inventory, inventory counting systems, inventory costs and inventory control models are investigated and ABC analysis is applied in an apparel firm. Control frequency and importance of level fabrics are determined in a firm which produces wedding and evening dress. Variables such as unit cost, delivery time of orders and fabrics and usage rate are used for analysis study.

According to the ABC analysis method, 70%, 25% and 5% of the fabrics are classified as group A, group B and group C respectively. Due to obtained results different suggestions, are recommended for control frequency of each fabric.

Key Words: Inventory management, apparel industry, inventory counting systems, ABC analysis

References

1. Aquilano, Nicholas J., Chase, Richard.: "Fundamentals of Operations Management", Richard D. IRwin, INC, 1991, s.438,445.
2. Stevenson, William J.:"Operations Management", 7. bs, Rochester University of Technology, Mc Graw-Hill Irwin, Boston, 2002, s.542, 544-548, 552, 557, 559, 563-565, 571, 548-549.
3. Fogarty, Donald W., Hoffman, Thomas R., Stonebraker, Peter W.,"Production and Operations Management", South-Western Publishing CO., 1989, s.373, 3778.
4. Buffa, Elwood S., Sarın, Rakesh K., "Modern Production & Operation Management", 8.bs, John Wiley & SONS, 1987, s. 110, 117.
5. Anderson, David R., Sweeny, Dennis J., Williams, Thomas A., "Quantitative Methods for Bussines", 7. bs, South-Western Publishing CO, 1995, s.559, 557.
6. Top, Aykut, Üretim Yönetimi, Nobel Yayın Dağıtım, 2006, s. 201, 193, 19.
7. Levin, Richard I., Rubin, David S., Stinso, Joel P.,"Quantitative Approaches to Management", McGRAW-HILL INC., 1992, s. 275, 279.
8. Lee, Sang M., Schniederjans, Marc J.,"Operations Management",Houghton Mifflin Company, 1994, s.368.

9. Turban, E., Meredith, Jack R., "Management Science", 5.bs, Richard D. IRWIN INC, 1991, s.611, 613, 620.

10. Levin, Richard I., McLaughlin, Curtis P., Lamone, Rudolf P.,Kottas,John F., "Production & Operations Managment: Contemporary Policy for Managing Operating Systems",Mc Graw-Hill Book Company, 1972, s.387, 390.

11. Dilworth, James B., "Operations Management", Mac-Grow Hill, INC, 1992, s.356,358

12. Dinney, William E.,McWilliams, Donald B.,"Management Science",Harper & Row Publisher, New York, 1987, s.412.

13. Heizer J., Render B., " Operations Management", 9. bs, Prentice Hall New Jersey, 2008, s. 488.

FEATURES OF CLOTHING DESIGN AND THE IMPORTANCE OF FASHION OF APPAREL

Saniye Taydaş
Giresun University, Şebinkarahisar Vocational Training School, Şebinkarahisar, Giresun, Turkey
saniyetaydas@hotmail.com

Clothing design is a development process of drawing of a garment will be produced, mold and plan making. The first step of a garment produced is creatived the design. The style is based on visual and tactile senses in the clothing design. Clothing design feature is provided with the changes made to certain parts of clothing. In general, in the clothing a neckline, yokes, sleeves, collars, pockets and applications in the different models is performed, decorations can be added. Creation of a garment according to the fashion model, color, line, pattern, fabric and garment accessories complement is determined according to the intended use. Fashion changes from the need arises. Effect is different for people of fashion and people do not accept the creation of a fashion has been left to his will. Change frequently and back in time as the fashion types, there are types of fashion does not change. Clothing designs and Fashion is always important for Apparel production.

Key Words: Clothing design, fashion, dress pattern, apparel

RESEARCH OF FEASIBILTY OF LEARNING CURVES IN APPAREL INDUSTRY

Can Ünal[1]**, Mücella Güner**[2]
[1] *Ege University, Emel Akın Vocational Training School, Bornova, İzmir, Turkey*
[2] *Ege University, Engineering Faculty, Textile Engineering Department, Bornova, İzmir, Turkey*
can.unal@ege.edu.tr

The main purpose of the production systems aiming at maximizing profit in clothing enterprises is to calculate the cost of the product properly. Different kinds of data are considered for the calculation of costs. In calculating the production costs or the determining the process for the production, unit time is one of the most significant issues influencing the result. In general, the former data gathered from the previous production lines are used to make calculations in the firms dealing with the garment industry. However, unit times change in accordance with the variety of learning during the production process.

Learning curves are based on the premise that people and organizations become better at their tasks are repeated. Thus it is based on a doubling of production: when production doubles, the decrease in time per unit affects the rate of the learning curve. In this study, learning curves theory, which is basically used in medical science, is used in the clothing sector. Demonstrations are conducted for some of the operations including the products which will be produced in the near future. The feasibility of the learning curves to the clothing sector is evaluated statistically. Finally the results are investigated to find out if they reflect the reality or not.

Key Words: Clothing sector, learning curves, learning fields, correlation analysis

References

1. Chuter A.J., Mackays of Chatham PLC, Kent, Introduction to Clothing Production Management, Grate Britain 1988, ss.146-153.
2. Bacanlı H., Gelişim ve Öğrenme, Nobel Yayınları, 2002, Türkiye, ss 45-192
3. Y. Özden, Pegem A. Yayınları, Öğrenme ve Öğretme, 2005, Türkiye, ss.13-15.
4. Top A., Üretim Yönetimi, Nobel Yayınevi, Ankara, 2006, ss.396-397.
5. William J. Stevenson, Operations Management Seventh Edition, Mc Graw-Hill Irvin, USA, 2002, ss.343-352.
6. Richard B.Chase, Nicholas J. Aquilano, F. Robert Jacobs, Production and Operations Management, Manufacturing and Services, Eighth Edition, The McGraw-Hill Companies, USA, 1998, ss. 445-460.
7. Sang M.Lee, Marc J. Schniederjans, Operations Management, Houghton Mifflin Company, USA, 1994, ss. 713-716
8. Albeni M., Erciyes Üniversitesi İktisadi ve İdari Bilimler Fakültesi Dergisi, Türkiye'de Teknolojik Öğrenmenin Alansal Analizi, Sayı: 22, Ocak-Haziran 2004, ss. 19-37.
9. Heizer C., Render B., Operations Management, Seventh Edition, Pearson Education Inc., USA 2004, ss. 734-740.
10. Dilworth James B., Operations Management Design, Planning and Control for Manufacturing and Services, Mc Graw-Hill, INC., USA, 1992, ss.477-486.
11. Miran B., Temel İstatistik, Ege Üniversitesi, İzmir, Haziran 2008, ss.230-235.

SOFTWARE DEVELOPMENT FOR EFFICIENCY MEASUREMENTS IN APPAREL INDUSTRY

Can Ünal[1], Mücella Güner[2], Cihat Arıkan[1]
[1] *Ege University, Emel Akın Vocational Training School, Bornova, İzmir, Turkey*
[2] *Ege University, Engineering Faculty, Textile Engineering Department, Bornova, İzmir, Turkey*
can.unal@ege.edu.tr

Work sampling is determination of pre-designated flow types' frequencies which are related with one or more identical work system by random and short time observations. With simple explanation, work sampling is determination of occurrence percentage of an activity with the help of statistical sampling and random observations. Although many processes or activities which are difficult to be measured practically with time study can be evaluated easily with the work sampling, there are some drawbacks of this method. Managers and workers can not easily understand the statistical work sampling as they understand the time study. Because good statistical knowledge and attention are the key issues for proper practice.

With this study, work sampling method which has easy observations but harder calculations for apparel workers is become much more applicable. During the software development process, 6 different versions are created according to feedback collected from the mills. Software reports the results automatically at the end of the application. As the performance of whole firm can be measured, furthermore it is possible to take individual reports. At the end of the study, results obtained from an application realized in apparel sector are given. With the help of the software, problems occurred during the production process were easily defined and priority order for solutions of these problems was performed.

Key Words: Apparel, work sampling, statistical methods, software engineering

References

1. Güner, M., 2005, "Tekstil ve Konfeksiyonda İş Etüdü", E.Ü. Tekstil ve Konfeksiyon Araştırma-Uygulama Merkezi Yayını, Yayın No:11, s. 50, 51, 73–79, İzmir.
2. Kanawaty G., Çev. Akal Z., 1991, "İş Etüdü" (ILO), Milli Prodüktivite Merkezi Yayınları: 29, s.207–218, Ankara.
3. Timur, H., 2005, "İş Ölçümü, İş Planlaması, Verimlilik (Kuramsal ve Örnek Uygulamalı)", s. 49-63,113,116-117, Ankara.
4. Barnes, M. R., 1957, "Work Sampling", John Wiley & Sons. Inc., 2nd edition, Chapter. 1-2-4-5-6-7-8-14-15-16, New York.
5. Güneşoğlu, S., Meriç, B., 2007, "The analysis of personal and delay allowances using work sampling technique in the sewing room of a clothing manufacturer", International Journal of Clothing Science and Technology, Volume 19, Number 2, 2007 , pp. 145-150(6).
6. Benli, E., Yeşilyurt, S., 2002, "İş Örneklemesi ile Yuvarlak Örme İşletmelerinde Faaliyetlerin Sınıflandırılması ve Verimlilik Tayini", Lisans Tezi, Danışman: Mücella Güner, s. 29,30, İzmir.
7. Ünal Tiber, B., 2005, "Bir Konfeksiyon İşletmesinin Üretim Hattında Rasyonalizasyon Olanaklarının Araştırılması", Yüksek Lisans Tezi, Danışman: Gülseren Kurumer, DEU Fen Bilimleri Enstitüsü, s.40, İzmir.
8. Özgür, Ö., Dönertaş G., 2000, "İş Örneklemesi ile Dikim İşçilerinin Faaliyetlerinin Sınıflandırılması", Lisans Tezi, Danışman: Mücella Güner, s.43, İzmir

9. Erden, E., 1994, "Bir Örnek İşletmede Zaman Etüdü ve İş Ölçümü Uygulama Çalışmaları"; Danışman: Sedat Şarman, s.69–89, İzmir.
10. Öncer, M., Asil, N., 1992, "İş Örneklemesi Yöntemiyle Dört Modern Mobilya Fabrikasında Kayıp Zamanların Saptanması ve Önleme Yolları" MPM Yayınları: 458, s. 63,70, Ankara.
11. Sakoğlu, O., 1991, "İş Ölçümünde Faaliyet Örneklemesi ve Bir İşletmede Uygulanması", Lisans Tezi, Danışman: Bayram Ali Su; s. 13-64, İzmir.
12. REFA, "İş Etüdü Yöntem Bilgisi", 1988, MPM Yayınları: 544, Ankara.

TOTAL QUALITY MANAGEMENT PRACTICES IN TEXTILE AND CONFECTION COOPERATIONS

Tümay Atakan, Özdemir Ay
Trakya University, Edirne Vocational College of Technical Science, Edirne, Turkey
tmyatakan@yahoo.com

Textile and confection sector is one of the leading fields of socio-economical activity, regarding its technological state, economical efficiency and social interaction. Marketing conditions became harder within the recent years of 2000, urging this crucial sector for Turkey's economy to aim taking new and radical measures and bounding it to determine its production system focused on the quality. In this article, we studied the effects of quality management practices in difficult marketing conditions, regarding the competitive capability of textile industry.

Key Words: Textile, confection, Total Quality Management, corporation

References

1. Çetin C., Akın B., Erol V., 2001,"Toplam Kalite Yönetimi ve Kalite Güvence Sistemi", Beta Yayınları, 124.
2. Efe B., Mart 2005, "2005 Sonrasında Türk Tekstil ve Hazır Giyim Sektörü Rekabet Gücünü Nasıl Koruyacak", İzmir Ticaret Odası, 12.
3. Gökçe E., Haziran 2003, "Değişim ve Sürekli Gelişim", Hedef, İTKİB Aylık Dergi, sayı: 114, 86.3
4. Mısırlı İ., Mart-Nisan 2003, "KOBİ'ler ve Toplam Kalite Yönetimi", Hedef, İTKİB Aylık Dergi, sayı:112, 59.
5. Oraman Y., 1998, "Marmara Bölgesi'nde Faaliyette Bulunan Çeşitli Gıda Sanayi Kuruluşlarında Toplam Kalite Yönetimi ile Performans Ölçme ve Değerlendirme Sistemlerinin Analizi", T. Ü. Fen Bilimleri Enstitüsü Doktora Tezi, 37.
6. Temiroğlu a., Ocak 2003, "Kalitenin Tanımı Değişti", Hedef, İTKİB Aylık Dergi, sayı: 109, 19.
7. Yenersoy G., 1997, "Toplam Kalite Yönetimi", Rota Yayınları, İstanbul, 54.

ENVIRONMENTAL DAMAGES OF TEXTILE INDUSTRY AND ITS ROLE IN THE GLOBAL CLIMATE CHANGE

Z. Bahadır Ünal[1], **S. Yılmaz**[2]

[1]*Ege University Engineering Faculty Textile Engineering Dept. Bornova/Izmir/Turkey*
[2]*Pamukkale University, Denizli Technical Vocational School of Higher Education, Denizli/Turkey*
zumrut.bahadir.unal@ege.edu.tr

1. Introduction

Industrial productions inevitably generate waste materials. Similarly, various wastes are also generated in textile industry from raw material supply to the production of cloth. Until recently, caring for ecology in the production process was considered within the scope of ecotextile production. At present, organic production and organic fashion concepts aim to develop the consumer's awareness and to protect our world.

Developed countries of the world have mostly shifted their textile and ready garment production to underdeveloped and developing countries, and taken measures also in this way to protect the nature in their own countries. Nevertheless, in the long run, the entire world will inevitably be affected from the global climate change. Its negative consequences have given the first serious signals evidently in the end of the 20th century, and gradually increasing number of natural disasters are observed at present.

2. Organic Textile Production in Turkey and in the World

In our country, which is convenient for farming, urban development with organic farming is a promising issue for the future of Turkey. Organic farming is a labor and cost intensive way of production. The organic cotton products market represents a highly peculiar market structure. It is mostly used in the fields of cosmetics and health and for the garments which directly contact the skin such as the garments of children. The biggest market covers the European countries such as Switzerland, the United Kingdom, France, Italy and Germany. 76% of the consumption is in Europe, 21% in the US and 2 percent in Japan.

Organic fashion makes its importance felt in many fields of production and consumption from farming to readymade clothing. The products organically sold in the food markets and marketplace are tagged differently for specific buyers.

3. Conclusion and Recommendations

Global warming and abnormal nature events which have become more severe in the last 10 years necessitated taking a precaution in the entire world with the efforts of not only the people of science but also states and governments. The reduction of the negative environmental impacts of textile industry is especially based on less water, energy and finishing chemicals consumption as a result of the finishing machinery and methods developed.

Organic textile production requires:

- Using mechanical finishing techniques as much as possible.

- Selecting chemical substances and using them in a conscious manner.
- Minimizing chemical substance use as much as possible.
- Preferring less water, energy consuming machinery and methods with minimum waste generation in the environment especially for chemical finishing processes.
- Textile finishing companies to have a sufficient waste water treatment plant as an absolute condition.
- The conduct of works by considering all foregoing factors and the environment in environment-friendly textile production, especially during the utilization of filament and performing the above-stated activities.

Organic garment production means manufacturing by using organic textile. What can be done in the manufacture of organic garments can be listed as follows:

- During cloth designing stage and coloring the clothing materials, color palette of organic dying stuff should be used
- Considering less dying stuff use, color hues should be selected as very light, and dark colored highlights on the garment should be applied on small areas.
- Organic garment labels should be developed and the advertisements addressing to the customers should explain their benefits for the nature and thus the consumer awareness should be increased.
-Organic fashion use should not be considered as oriented towards development countries with high income level only, and efforts should be spent to expand it in developing markets.

Key Words: Environment, global warming, production, organic fashion

References
1. B. Güzcelioğlu, 2009, “Küresel İklim Değişikliğinin Türkiye’deki İzleri”, Bilim ve Teknik Dergisi, Mart sayısı, s. 38.
2. C. Durmuşkahya, 2009, “Küresel İklim Değişikliğinin Bitki Örtüsüne Etkileri”, Bilim ve Teknik Dergisi, Mart sayısı, s. 42.
3. Y. Lise, 2009, “Çanlar Kimin İçin Çalıyor?”, National Geographic, Temmuz saysı.
4. Z. Bahadır Ünal, Erdoğan M. Ç., 2008, “Study On Organic Cotton And Clothing Market”, The Annual Symposium of Knitting and Clothing Specialists, 13-15 November, Iaşi, Romania.
5. G. Benz, 2004, ”Ekoloji ve Kalite Açılarını Dikkate Alarak Örme Kumaşlarının Açık En Çalışılması”, X. Uluslararası İzmir Tekstil ve Hazır Giyim Sempozyumu.
6. D. Glick, 2004, “Jeo - Alarm: Büyük Erime”, Natioanl Geographic Türkiye, Eylül sayısı, s. 97.
7. F. Montaigne, 2004, “Eko – Alarm: Kaçacak Hiçbir Yer Yok”, National Geographic Türkiye, Eylül sayısı, s. 118.
8. V. Morell, 2004, “Süre Alarmı: Ne Olacak”, National Geographic Türkiye, Eylül sayısı, s. 140.
9. S. Eser, Dr. Uğur Karaaslan, 2007, “Tarımdan Tekstile Organik Üretim”, XI. Uluslararası İzmir Tekstil ve Hazır Giyim Sempozyumu.
10. A. Uygur, 2004, “Tekstil Atıksularının Renksizleştirme İşlemlerine Genel Bir Bakış”, Tekstil ve Konfeksiyon Degisi, Temmuz-Eylül sayısı, s. 175.
11. 11. Ekolojik Tekstil Üretimi Tubitak-MAM Tekstil Enstütüsü SAGEM Müdürlüğü Yayını, 1996, No:164, Temmuz, Bursa.
12. 12. N. SEVENTEKİN, 1995, ‘’İnsan Ekolojisi’’ Tekstil ve Konfeksiyon Dergisi, Eko Tekstiller Eki, Sayı:1.
13. S. ÇOBAN, 1995, ‘’Neden Eko Tekstil?’’ Tekstil ve Konfeksiyon Dergisi, Eko Tekstiller Eki, Sayı 1.
14. N. SEVENTEKİN.,Ü. DEMİRCANLI, 1995, ‘’Tekstil Terbiye İşletmelerinde Bazı Kirletici Kaynaklar ve Azaltılması Olanakları’’ Tekstil ve Konfeksiyon Dergisi, Eko Tekstiller Eki, Eylül.

DESIGN STUDENTS AND TECHNOLOGY

Matejka Bizjak, Krste Dimitrovski
University of Ljubljana, Faculty of Natural Sciences and Engineering, Department of Textiles, Ljubljana, Slovenia
krste.dimitrovski@ntf.uni-lj.si

1. Introduction

A designer like an artist designs a unique product which is the reflection of his ideas. Such product is not intended for massive production. The role of an industrial designer is completely different. Since the aim of an industrial designer is to satisfy the customer's wishes, his artistic expression is more or less limited. A well designed product for massive production is an optimal amalgamation of aesthetic and applicable characteristics with optimal price performance. The aesthetic and applicable properties of final product, in our case of a fashionable fabric, are greatly influenced by constructional parameters. A designer with solid technological knowledge is capable to achieve special visual effects and better applicable characteristics with only few changes during designing and construction process. Basic knowledge of technology and technological parameters helps a designer to adapt a new product to the available technological capacity as well as to better communicate with technological staff.

Perhaps students do not have clear ideas what is the difference between an industrial designer and an artist and frequently pose the question: Why should I study so much technology? This article tries to give the answer to this question.

The primary task of an industrial designer is to create products that would be appropriate for massive production. The designer provides optimal appearance and structure within the customer's and manufacturer's requirements and of course she/he should be capable to make a complete product development with all necessary details as sketches, technical sketches, materials, etc. On that basis the manufacturer should be capable to exactly manufacture a developed product. It is very similar in textile industry. Designers (creator, stylist) make designs and technologists (weaver, knitter, printer, etc.) manufacture products.

2. All Important Technological and Constructional Parameters in Woven Fabric Designing

The aesthetic and functional role of each product, in our case this is a woven fabric, is defined by certain properties which are in close connection or dependence with design, constructional and technological parameters. Design parameters contain: first of all aesthetic appearance, colour composition, size and shape of a design pattern, combination of woven structures and yarn colours or dyeing and printing and applicable characteristics. Constructional parameters that define the construction of an article are: raw material, yarn structure, fabric structure (warp and weft density, woven structure, etc.) and after-treatment. The determination of fabric constructional parameters belongs to the first stage of fabric production - designing.

Typical development steps in designing

- Designer materialises his ideas in drawings and sketches. Usually he or she defines basic shapes, colours and thickness (also raw material) of fabrics (sketch, computer printouts).
- Drawings must be changed into the forms appropriate for fabric construction (design pattern - repeat) and then the constructional parameters must be determined. This is a very quick and simple part of work when current advanced CAD/CAM systems are used. The economic aspect of fabric production is also very important. Chosen constructional parameters render precise all production stages. A successful fabric production on available machines and procedures depends on a designer's technology knowledge.
- Realisation - fabric production is the task of a technologist

The curriculum of Textile and Fashion Design Bachelor's degree study programme includes 30 hours (2 credits) of Woven structures 1 in 2nd semester and another 30 hours (2 credits) of Woven structures 2 in 3rd semester. This leads to the questions: How much technology knowledge about woven structures and fabric settings could a design student acquire in such a short time? And how much technology knowledge should a design student have in order to efficiently create and successfully co-operate with a technologist?

3. Conclusions

Textile designer must know very well the artistic components and constructional parameters, maybe technological parameters are less important. Basic knowledge of Technological parameters is recommended for designer´s better communications with technologist. Excellent knowledge of constructional parameters is necessity for every efficient designer who is capable to design aesthetic and functional product in a very short time.

Key Words: Textile design, technology, design student, design application

4. References

1. Bizjak, M. & Dimitrovski, K. (1998). The role of technological parameters at woven fabrics construction. Proceedings of lectures and posters/32nd ISNT, Ljubljana, 114 -121
2. Bizjak, M. (1998). How much technology should know a design student? Magyar textiltechnika. Különszám-spec. Edition, 15 – 18
3. Zupin, Ž & Dimitrovski, K. (2008). Vpliv konstrulcijskih parametrov na mehanske lastnosti tkanin. Zbornik 39. SNT, Ljubljana

USE OF LEARNING PORTFOLIO AND PORTFOLIO ASSESMENT IN ENGINEERING EDUCATION – A CASE STUDY

Mariana Ursache, Dan Dorin
"Gheorghe Asachi" Technical University of Iasi, Faculty of Textiles, Leather and Industrial Management, Department of Knitting and Clothing Technology, Iasi, Romania
ursache@tex.tuiasi.ro

The paper presents a case study of using learning portfolio and portfolio assessment in order to improve teaching and learning in engineer education at the Faculty of Textiles, Leather and Industrial Management from Iasi, Romania that is applied in case of BSc students for teaching "Knitting Technology" courses.

The purpose of this paper is to describe how the learning portfolio and portfolio assessment is working in academic context, how we have used it and what kind of experiences we have got of it. One of the objectives of the work is to apply the conceptual framework of using portfolios for formative purposes to help students to improve their learning and thinking skills.

According to Paulson et.al, [1], portfolios offer a way of assessing student learning that is different than traditional methods. Portfolio assessment is a continuous and ongoing process, providing both formative and summative opportunities for monitoring students' progress.
The summative portfolios focus on learning outcomes (skills and knowledge), demonstrate learning outcomes rather than process of learning while the formative portfolios show the process of learning and assessment is formative when focuses on the learning process.

Instructors can use learning portfolios for a variety of purposes including: encouraging self-directed learning, enlarging the view of what is learned, demonstrating progress toward identified outcome, providing a way for students to value themselves as learners [2].

As a collection of information and artefacts, the portfolio shows the students' work and progress to a specific course for a specified number of semester hours. It includes a table of contents, the work plan, the guidelines (provided by the teacher), criteria for judging merit, documentation, results of students work in forms of essays, tables, graphs, drawings, products (e.g. knitted structures). These are considered as "pieces of evidence" that demonstrate the student's level of achievement in the learning area. The portfolio is reviewed by the teacher who determines whether there is sufficient explanation and documentation to assess learning and award the grades. Among the benefits from using learning portfolio that one can take into consideration are the followings [3]: develops problem solving, presentation and thinking skills, encourages students to value their work and individual creativity, helps students to make better choices, increases responsibility and independence.

Portfolio was used as a learning tool in the third year students in case of "Knitting Technology" courses at Faculty of Textiles, Leather and Industrial Management. The students were given a set of core learning outcomes and they were required to accumulate evidence of their learning in the form of portfolio during the 6-th semester. The use of portfolio as an additional learning tool demonstrated its advantages and can be taken into consideration for making students learning more effective.

Key Words: Learning portfolio, portfolio assesment, engineering education, knitting technology

References

[1] Paulson, F. Leon, Peal R. Paulson, and A. Meyer (1991). What makes a portfolio a portfolio? Educational Leadership 48 (5): 60-63.
[2] http://www.pgcps.pg.k12.md.us/~elc/portfolio.html.
[3] http://clerccenter.gallaudet.edu/Priorities/PSG-guide.html#studentproduct.
[4] http://faculty.washington.edu/krumme/students/portfolio.html.

LIST OF AUTHORS

TÜBİTAK

Book of Abstracts was published by the financial support of TÜBİTAK.

ISBN 978-975-483-872-5