XIIIth INTERNATIONAL İZMİR TEXTILE & APPAREL SYMPOSIUM

IITAS 2014

02-05 APRIL 2014
İZMİR - TURKEY

BOOK OF ABSTRACTS

Organizer

Ege University Faculty of Engineering Department of Textile Engineering

XIII[th] INTERNATIONAL İZMİR
TEXTILE & APPAREL SYMPOSIUM

BOOK OF ABSTRACTS

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XIII[th] International İzmir Textile and Apparel Symposium
e-book ISBN 978-605-338-043-6

Meta Basım Matbaacılık Hizmetleri
87 Sok. No. 4/A Bornova
Tel: (0232) 343 64 54 E-mail: metabasim@gmail.com
İzmir, Mart 2014

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14:00 **REGISTRATION**

18:30 **OPENING CEREMONY**

OPENING SPEECHES

E. Perrin Akçakoca Kumbasar
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Candeğer Yılmaz – Rector of Ege University

2nd "Innovation Competition" Award Ceremony of the Turkish Textile Employers' Association

Rieter Award Presentation Ceremony

PRESENTING GRATITUDE PLAQUES - Presentation of gratitude plaques to **organizations** for their valuable contributions to XIIIth International İzmir Textile and Apparel Symposium (IITAS 2014) and to **DILO GROUP** company which granted a nonwoven machine reconstruction to Ege University Textile Engineering Department.

20:00 **Dinner hosted by Turkish Textile Employers' Association**

09:30 – 10:00 İbrahim Şenel
Republic of Turkey Ministry of Economy, Undersecretary, Turkey

10:00 – 10:30 Muharrem Hilmi Kayhan
Turkish Textile Employers' Association, Chair of the Executive Board, Turkey

10:30 – 11:00 Coffee Break

11:00 – 11:30 Overview of Textile and Apparel Sector
Hikmet Tanrıverdi
İstanbul Apparel Exporters' Association (IHKIB), Chair of the Executive Board, Turkey

11:30 – 12:00 Future Vision for Textile Industry
Sabri Ünlütürk
Aegean Textile & Raw Materials Exporters' Association, Chair of the Executive Board, Turkey

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Christian Schindler
International Textile Manufacturers Federation (ITMF), Director General, Switzerland

14:30 – 15:00 Textile Technology Transfer to Turkey-Exemplary on Market Trends and Running Projects
Uwe Merklein

15:00 – 15:30 Anna Sobczak
European Commission, DG Enterprise and Industry, Unit "Textiles, Fashion, Design and Creative Industries", Policy Officer, Belgium

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16:00 – 16:30 **Coffee Break**

20:00 **Dinner hosted by VDMA Textile Machinery**

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Handan Salihoğlu

CHT Tekstil Kimya San. Tic. A.Ş., Turkey

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Korgün Şengün

MKS – DevO Kimya San. Tic. A.Ş., Turkey

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Vehbi Canpolat

Turkish Textile Finishing Industrialists Association, Turkey

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Selen Eser, Hakan Kurt

Safir Endüstriyel Kimyasallar, Turkey

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[1] Hochschule NIederrhein – University of Applied Sciences, Germany
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Yusuf Menceloğlu[1,2], **Burcu Saner Okan**[2,3]
[1] Sabancı University, Turkey
[2] NanoTego Nano Teknolojik Ürünler Araştırma Geliştirme Kimya Sanayi ve Ticaret A.Ş.,Turkey
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[1] *Ege University, Turkey*
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[1]*Namık Kemal University, Turkey*
[2] *Yünsa Yünlü San. ve Tic. A.Ş., Turkey*.. 164

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[1]*Ege University, Turkey*
[2]*Sun Textile A.Ş., Izmir, Turkey* 166

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[1] *Textile Research Institute, Poland,*
[2] *Wroclaw Medical University, Poland.* 195

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[1] *Dokuz Eylül University, Turkey*
[2] *Ege University, Turkey* 202

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Ege University, Turkey 204

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APRIL 03, 2014

TEXTILE TECHNOLOGY TRANSFER TO TURKEY EXEMPLARY ON MARKET TRENDS AND RUNNING PROJECTS

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

PROBLEM/ CHALLENGE

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

Turkey is currently very active in pushing innovation by doing more research and development activities at Universities as well as pushing R&D efforts in companies.

Beside the efforts in pushing the research and development activities, it is necessary to consider the global market and scientific trends. To achieve this goal the questions which should be asked are can business push technology instead of just waiting for the pulling market, create innovate business opportunities instead of just being a follower and focus on the future without neglecting the present.

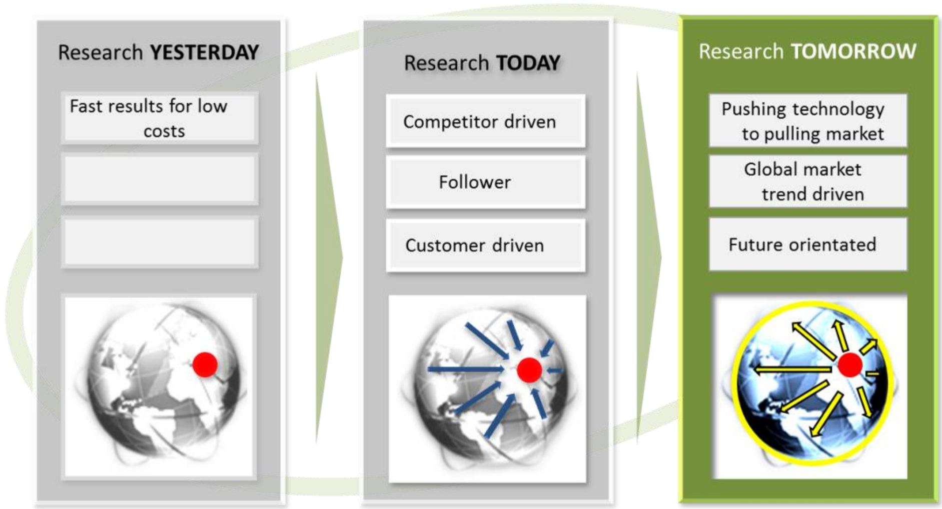


Figure 1. Research vision for Turkey

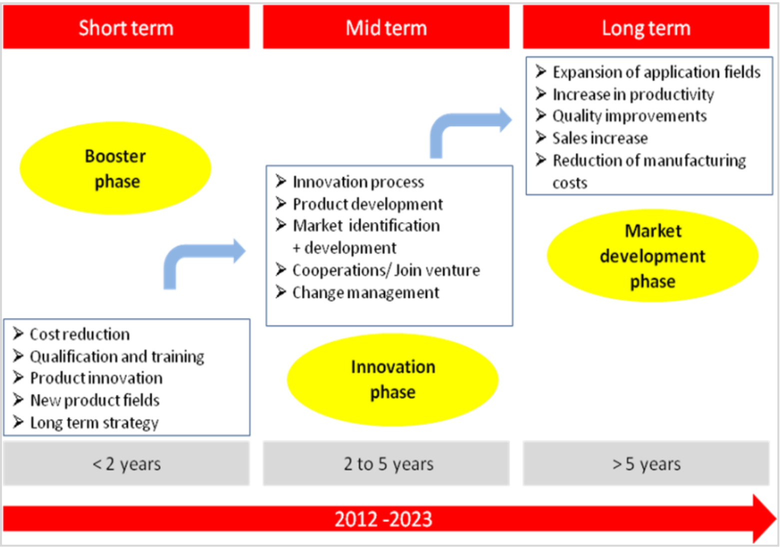
The most important challenge is changing the focus of the current management and developing a more sustainable business. Therefore it is necessary to create a way for short, mid and long term success.

What is the future role of Universities, Industry, Associations, market and the end consumer?

What is the way for this necessary change?

CONCEPT/ STRATEGY

Our projection for supporting this change in the management of Turkey is based on a three phase strategy, which makes fast results possible without losing the focus on the final target.



Booster phase
F.e.: **Cost reduction** by optimization of work flow, energy and material consumption

Innovation phase
F.e.: **Innovation** in the fields of textile reinforced concrete TRC, light weight products, alternative power supply

Market development phase
F.e.: **Expansion** of application fields - Textile reinforced concrete from building to techno parcs (Fig. 3) or independent residential development

Figure 2. Method of resolution

Example for the market development phase

Figure 3. Techno parc concept

Innovative features

- ➢ Independent power supply
  - ○ Wind energy
  - ○ Solar energy
  - ○ Geothermal energy
- ➢ Utilization of rain water
- ➢ Waste water treatment
- ➢ Textile reinforced concrete for earthquake protection
- ➢ Research center

CONCLUSION

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

Key Words: Technology transfer, textile reinforced concrete, earth quake protection, market trends

DEVELOPING AN OBJECTIVE EVALUATION METHOD FOR FASTNESS GRADING

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In this project, it is aimed to develop an objective grading approach for the assessment of color fastness of textile materials using image processing methods on acquired digital images of treated and untreated samples.

Keywords: Color fastness grading, image processing

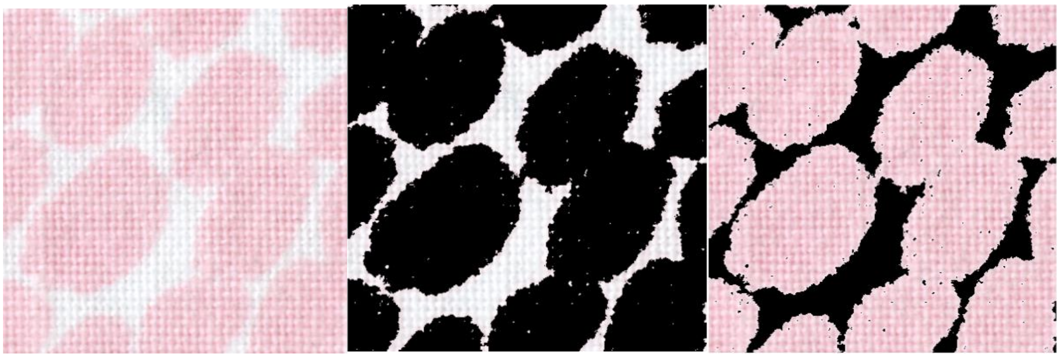
Color fastness which is an important property for textile materials both for customers and producers is conventionally evaluated by visual assessments against a grey scale. This kind of assessment procedure which requires experienced operators might lead to high variations between different laboratories. Color fastness grading approaches can be divided into two main categories:

1- Visual assessment method: International Standards Organisation (ISO) recommended two standards[1,2] (ISO 105-A02 and ISO 105-A03) which are the most common assessment approaches in textile industry. They require experienced operators and assessment results are highly subjective.

2- Instrumental assessment methods: Later ISO recommended alternative standards[3,4] and formulae (ISO 105-A04 and ISO 105-A05) which require spectrophotometers for measuring CIE L*a*b* values of treated and untreated samples. The assessment is realized with the formulae given by these standards[3,4]. Although this method is an objective instrumental approach, it is not widely used in textile industry due to the limitations of the spectrophotometers. Particularly, the limitations of measuring small samples and multi colored samples decrease the method’s effectiveness. Lately an alternative instrumental approach is proposed[5,6] which uses digital images for measuring CIE L*a*b* values of the samples and using the same method of the ISO formulae[3,4] for assessments.

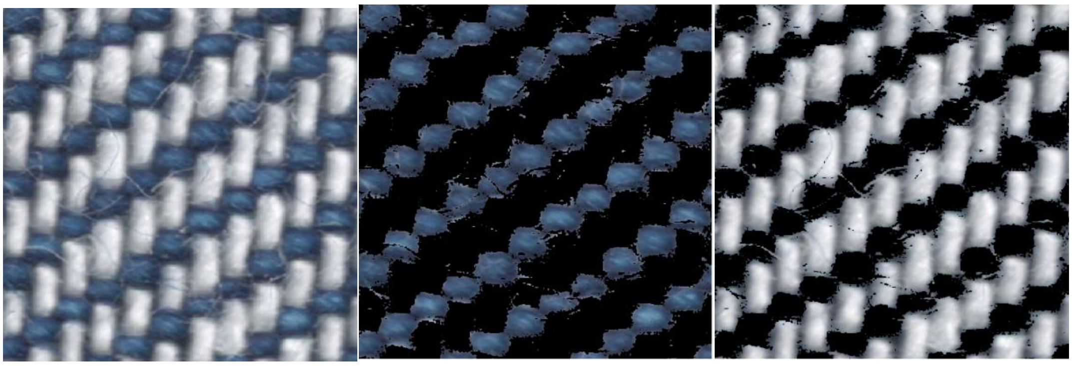
In this project it is aimed to develop an objective grading approach using image processing methods for the measurements of small samples, printed fabrics or fabrics produced using colored yarns. First step of the project is to acquire the digital images of the treated and untreated samples. We have two choices in image acquisition step which are digital line scan cameras and digital area cameras.

Second step of the project is to develop the mathematical model for fastness grading which is based on the digital images of treated and untreated sample pairs. Using digital images of the samples gives wide choices of applications by means of image processing methods which cannot be realized with ISO standards due to the limitation of spectrophotometers. In this respect color segmentation methods will lead to efficient tools for assessments of printed fabric samples or fabrics produced with colored yarns.



(a) (b) (c)

Figure 1. Printed fabric a-original fabric image b-segmented white regions from the original fabric image c- segmented printed regions from the original fabric image



(a) (b) (c)

Figure 2. Denim fabric a- original fabric image b- segmented warp yarns from the original fabric image c- segmented weft yarns from the original fabric image

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APPLICATION OF ONE STEP DYEING AND FUNCTIONAL FINISHING PROCESSES BY GREEN NANOCOATING METHOD

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A research performed by Iler in 1966 is the first study about directing the inorganic colloidal particles by electrostatic forces for the layer by layer deposition method. Iler proved that the multilayer structures were self assembled by dipping the material sequentially in oppositely charged two colloidal solutions containing silicate and alumina particles. In the early 1990s, Layer-by-Layer (LbL) deposition method was developed as a surface film coating technique by Decher's group. LbL deposition method was firstly applied only for polymers, and then for nanoparticles and multivalent chemicals. LbL self assembly method includes sequentially dipping of the solid material in solutions composed of anionic and cationic molecules.

In this study, dyeing and finishing of cotton fabrics will be tried to be accomplished in one step by process of Layer-by-Layer deposition method. This method was performed firstly according to the dipping procedure. The biggest drawback of the dipping process is that it takes a long time in the adsorption of layers. In recent years, different methods were tried to be developed such as spraying, spinning and covalent binding. The spraying process needs special equipments and the dimensions of the materials are too small in spinning method. Covalent binding method can be applied in a limited number of groups of chemical substances. Therefore, applying of the multi-layer coating method to textile materials in a trade manner needs a new application principle. This project work covers the useability of a new nanofabrication method in which the dyeing and functional finishing processes can be applied in one step and at the same time in the textile industry in our country and abroad. In this study, as a new approach, layer by layer method will be applied on cotton fabrics by padding machine according to padding principle. By LbL deposition method, nano-sized and dye layers will be added to modified cotton fabrics surfaces for improving functional properties without making major changes in the weight, volume and comfort properties of the material.

Firstly, cationization process will be applied on 100% woven cotton fabric, to obtain cationic charges on the surface. For dyeing process, reactive and acid dyestuffs; for functional finishing process, TiO_2, ZnO, Al_2O_3 and halloysite nano clay nanoparticles will be used.

The research project will be carried out by an experienced team on the using of LbL method to give functional properties on cotton fabrics according to dipping procedure. In addition, since the research findings obtained from this study will also be feasible for other functional finishing processes in textile sector, this issue will contain important data to shed light on the new studies. Besides the academic level of the projects, it constitutes developing a new method for the textile industry and will be a reference for the direct application.

Key Words: Layer-by-layer deposition, dyeing, functional finishing processes

PRODUCTION OF POLYESTER FILAMENT WITH PERLITE ADDITIVE

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In this project, perlite material, having various performance properties and using in food, drug and agriculture sectors as of harmless for health, were inserted into yarn structures during production of polyester synthetic yarns. The studies that were made under the project were been the first ones considering perlite usage in textile in Turkey and in the world from the aspects of literature survey and experimental.

Perlite is an inorganic raw material which is found in nature and approximately 74% of world perlite reserves exist in Turkey. Perlite has lightness, heat and noise insulation because of the existing air filled holes in its structure. In addition, it has flammability and resistance to chemicals because of its chemical composition.

In the project, perlite material was supplied from the market and its granule size was minimized to below 1 micron. Then, perlite properties were tested to determine the material characteristics. Surface of the nano perlite was modified because of agglomeration after grinding, and it was converted to masterbatch granule form to mix with polyester cips.

The granules were inserted into the structure of polyester continuous filament yarns during melt spinning process. Woven fabrics were produced by using polyester yarns including perlite by 1.25%. The hydrophility, heat and noise insulation properties of the fabrics were tested. In order to compare the reults, reference polyester filament yarns and reference woven fabrics were produced with same parameters, but without perlite addition.

The granule size of perlite was reduced from 28.4 micron to 0.47 micron by grinding process. Although there are differences between the mechanical properties of polyester yarns including perlite by 1.25% and reference polyester yarns, the mechanical properties of polyester yarns including perlite were remained within commercial usage limits.

According to the tests performed on fabrics, it was seen that contribution of perlite led to a marked improvement especially on hydrophility and on noise insulation. Water absorption time of the fabrics including perlite was shortened by maximum 54% compared to reference fabrics. This result pointed that water absorbency of hydrophobic polyester fabrics was significantly improved. According to noise insulation test results, the fabrics including perlite had higher values of sound absorption coefficient than the reference fabrics after 2000 Hz.

This Project was supported by TUBITAK (Project No. 109M269) and completed. A patent application was made under the name of “Polyester Yarn with Additive and Its Production Method” (Application No. 2013 / 05887 and Application Date: 16 May 2013).

Keywords: Perlite, polyester filament, woven fabric, performance properties

DEVELOPMENT OF PHOTOVOLTAIC TEXTILES (SOLAR TEXTILES) BASED ON CARBON NANOTUBE YARNS TO PRODUCE ELECTRICITY FROM SUN LIGHT

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The need for energy has been increasing with the increase of world population and consumption and this is one the most difficult problems to be solved by mankind. The solutions should be environmentally friendly and without exhausting the limited resources. Therefore, many researchers have been working on this problem. As a result of these efforts, the 21st century will become the fossil fuels replace with renewable clean energy resources.

This work aims at contributing to solution of the problem by incorporating the two essential elements for mankind- the sun and textiles. There are some attempts to cover such a need but they are no further than basic application of solid solar panels on textile surfaces. This study presents the results of development of weavable Dye Sensitized Solar Cells (DSSC) produced by flexible yarns of conductive multiwalled carbon nanotubes (MWNTs) leading to the power conversion efficiency above 3%. This was achieved with a specific design and careful consideration of the yarn function in the DSSC so that a textile surface producing its own energy would become a reality.

The current available studies for such an aim are quite new and limited. In addition to that, mainly rigid wires or similar materials have been used and efficiency levels are low. Cai et al. obtained 1.9% efficiency with all-carbon electrode-based fiber-shaped dye-sensitized solar cells. Francis et al. managed to accomplish 1.76% efficiency with electro-spun rutile fibres. Hou et al. ahchieved as high as 5.5% efficiency by wrapping carbon fibre/PEDOT:PSS electrode along a Ti wire based photonade. Lv et al. designed a fiber-shaped DSSC by using TiO2 coated Ti wire as electrode and Pt wire as counter electrode reaching efficiency of 5.05%. In another work, Lv et al. studied the effect of electrolyte refreshing effect on the photoelectrochemical performance of fibre-shaped DSSCs. Law et al. achieved 1.5% efficiency with their nanowire DSSCs. Chen et al. obtained 2.94% efficiency with their CNT fiber based DSSCs. These works show that there are just a few studies on real fiber DSSCs. The highest efficiency obtained with CNT fiber based DSSCs was 2.94% that showing the need for further studies on weaveable solar cells which was the motivation of this work.

This work includes main stages of carbon nanotube yarn production, preparatory processes for electrodes, preparation of solar cells and testing by a solar simulator. By this presented MWNT based photovoltaics, 3.4% PCE value was obtained which is the highest level reached in literature. Also, new designs and improvements studies on the system have been explained.

Keywords: Flexible DSSCs, Photovoltaics, MWNTs

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APRIL 04, 2014

SESSION I

AN IMPRESSIVE TOOL ON TOTAL QUALITY APPROACH USTER® CLASSIMAT 5

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USTER® ***CLASSIMAT 5*** uses advanced sensor technology to detect potentially damaging outliers

USTER® ***CLASSIMAT 5*** instrument beyond traditional classification – and identifying both foreign matter and polypropylene defects. As part of an integrated testing and monitoring regime from laboratory to finished package, it provides the essential framework for the production of consistent quality in spun yarns.

With latest-technology sensors and class-leading software, **USTER®** ***CLASSIMAT 5*** can both measure and quantify a wider range of defects than ever before. It introduces automatic identification of disturbing defects – known as outliers – for all fault types. This feature helps spinners understand how to eradicate these defects using yarn clearing, so they can deliver the quality their customers require.

Taking quality assurance further, **USTER®** ***CLASSIMAT 5*** *also* provides objective assessment of quality consistency, based on testing and quantifying outliers in a large sample size of 200 kilometers.

Illustration of the YARN BODY™

The **YARN BODY™** concept is now acknowledged to be the best approach for identifying disturbing defects. It was introduced with the USTER® *QUANTUM 3* yarn clearer and has proved its reliability on extensive yarn varieties. **USTER®** ***CLASSIMAT 5*** shows the **YARN BODY™** alongside a numeric classification of thick and thin places. The degree of contamination is also profiled, showing up graphically as a dense area for colored foreign matter and vegetable matter, as well as numerically. For the first time, polypropylene defects are classified as either short or long.

Previous CLASSIMAT® generations used 23 different classes, giving good coverage of all detected faults. However, there has been enormous progress in yarn quality – yarns have become more even, with the result that smaller defects are now viewed as disturbing. These small faults can now be detected and classified by the **USTER®** ***CLASSIMAT 5,*** extending the existing classification table to include a total of 45 classes.

To support previous classification standards – well-established in yarn trading – and allow a gradual transition to the latest level, **USTER® *CLASSIMAT 5*** also converts test values for thick and thin places to match earlier USTER® *CLASSIMAT 3* and USTER® *CLASSIMAT QUANTUM* classes.

Outlier classification

Even a few substandard bobbins can damage fabric appearance and seriously impact on productivity in downstream processes. Experience shows that poor quality in only a small percentage of a yarn lot can often cause an entire delivery to be rejected by the customer. These bobbins, containing defects outside the normal distribution in any fault category, are termed **outliers**. For the first time, they can be measured and quantified in the laboratory by **USTER® *CLASSIMAT 5.*** The outliers can then be effectively controlled using yarn clearing to remove them at the winding stage, using data from **USTER® *CLASSIMAT 5*** to optimize clearer settings.

The ultimate goal of preventing these defects by pinpointing the root causes in the spinning process is critical to ensure consistent quality. And the first step here is to measure and quantify them with **USTER® *CLASSIMAT 5***. "With a proper assessment of outliers using **USTER® *CLASSIMAT 5*,** and tools to eliminate them, spinners have a practical and sustainable method to ensure and verify quality consistency", *s*ays Uster Technologies Product Manager Sivakumar Narayanan.

USTER® *CLASSIMAT 5* – yarn classification system

COMPACT SPINNING WITH K 46
EXCELLENCE IN ECONOMICAL PRODUCTION OF HIGH-QUALITY-YARNS

Urs Flach
Rieter Machine Works Ltd., Switzerland

Rieter is most likely the best known name in spinning machinery. Nearly 220 years of history and a future oriented technology driven spirit makes Rieter to the well-known address in this industry. Unique as a system supplier from bale opener to all four types of spinning machines, Rieter is able to give a detailed overview about details, advantages and special characteristics of all spinning processes. However, focus of the speech will be the well-established compacting system, the only system with solid drum as well as single suction duct resulting in extremely low energy consumption.

Mechanical spinning started together with Rieter's founding with the so called "spinning mule" and, more famous, the "selfactor". Together with the selfactor, already the ring spinning history started at the beginning of the 19th century. First produced only in England, Rieter became a leader very soon. From the beginning of the 20th century, it displaced other systems completely until the Czech development rotor spinning was shown at ITMA 1967 first time. Rotor spinning was booming in the late 70th, 80th and 90th before a renaissance of ring spinning, especially for Denim changed the picture again. This was in parallel with the movement of spinning capacity out of Western Europe and the USA to emerging markets.

In 1999, the third player was shown first time at ITMA: Compact spinning with its up to now unbeatable properties. First companies were Rieter's K machines as well as Suessen's EliTe for retrofitting system, still today the leader's in this market.

The newest player, started less than 10 years ago, is the airjet-spinning with again different properties and advantages. Extremely high spinning speeds but limited applications regarding fiber type and yarn count make it today to a niche player which need not to be true for the future.

Spinning processes vary but also show similarities

The ring and compact spinning processes with their low spinning speed of about 20 to 30 m/min consist of 3 process steps when being compared to other systems: roving, spinning winding. Roving reduces the sliver weight to about 1/5 to 1/10 and give some twist. This is required as the ring and compact spinning machines are not able to make this reduction economically. Ring and compact spinning itself consist of reducing roving weight to final yarn count by faster running outlet rollers than inlet rollers and the following twisting process where the spindle revolutions are brought into the yarn. The twist goes up to the spinning triangle by itself and allows a uniform twist level. Compact spinning adds a compacting and parallelization process after the drafting but before twisting in. Afterwards the small cops are re-wound to larger packages on the winding machine for both systems.

Rotor spinning (which is also called open-end spinning) works completely different. It consist only of one process step processing sliver and resulting in ready-made packages. It starts with the separation of the fibers with a small drum similar to a card. These single fibers are then fed with the help of underpressure into a turning rotor. By centrifugal force fibers will be kept in the rotor groove. If you now touch this fiber bundle with a yarn end (which is supplied from the front center) and pull back, the fiber will built up new yarn by enlarging the existing. Processing speeds are about 100 to 200 m/min delivery speed.

Air-jet spinning is working again with a drafting system like ring spinning. In difference, twisting is achieved by tangential air-pressure which winds the fibers around the existing yarn body. Processing speed can exceed 400 m/min.

Applications of the different systems

Ring spinning is the most universal system regarding yarn count and fiber type. High strength, low mass variation and higher hairiness make it to the ideal yarn for many applications. Compact spinning has quite similar applications but drastically reduced hairiness and higher strength predestine this yarn for all high value applications like shirting and bed sheeting but also quality knitting applications. Compacted yarn is finer than Ne 20 in most cases.

Rotor yarn is a quite harsh yarn with high durability and low requirements regarding raw material. It is mainly used for coarser yarns, work wear and technical applications.

Air-jet yarn, today mainly used for viscose and certain blends, owns a very high pilling resistance but tenacity is lower than ring yarn. It is mainly used for knitting today.

Key differences of Rieter's compact system to others

Rieter's K system differentiates in 3 points to all other systems:

- Solid compacting drum instead of a wearing out apron
- Single suction duct for compacting and fiber collecting tube
- Air-guide element to reduce energy consumption

The solid drum results not only in wear freeness but also in a more accurate spinning environment. This allows, in combination with the special spinning geometry, higher spinning speeds than any other system. It is also one reason than Rieter can achieve the compacting with lower energy consumption.

The system uses the main suction channel similar to a normal ring spinning machine to feed both, the suction system to take up fiber material in case of a yarn breakage as well as the compacting process. This results in about 75% less energy consumption for compacting than an additional suction system of all apron compacting devices. In addition, Rieter covers the compacting process with the so called air-guide element which results in even lower energy consumption.

For longer machine, Rieter supplies this system with double sided suction: not only from footstock but also from head stock. Reason for that is given by physics: too long channels increase energy consumption disproportionately. That's also the reason why Rieter divides suction exactly in the center.

But compacting is just the dot on the "i". Other advantages like the balanced 4-spindle belt drive for lowest energy, the well tested spinning geometry and many more give an ideal base for successful spinning. This does not end with the installation as Rieter is a partner for life and always on customers' side with support and consultation.

KARL MAYER WARP PREPARATION
LATEST TECHNOLOGIES IN SECTIONAL AND SAMPLE WARPING

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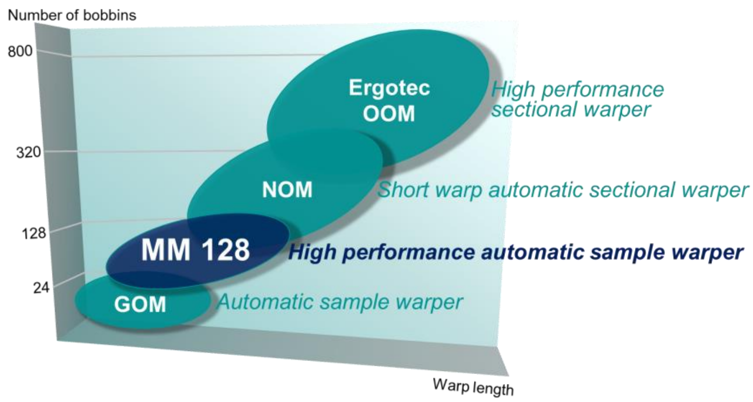
The textile business in Turkey has a long successful tradition. But also Turkey feels the high pressure comming from the Asian competition. That's why fashion design gets more and more important to have a unique selling point. With fashion design also a high number of pattern is required. That's why also the weaving preparation must be more and more flexible and has to guarantee highest productivity to be competitive.

Like the mission statement of KARL MAYER already says: "We care about your future", we, as KARL MAYER, know about this development and helping the customers to compete.

Our new sample warping machine, Multi-Matic® 128, is developed for these challenges and fits into the product portfolio.

The production data of our Italian customers, where the machine is already successfully running, shows, that we can reach a much higher productivity in comparison to our fomer sample warping generation GOM. For a shirting application with cotton Nm83/1, 9504 ends, a warp length of 406 m, 8 colours, a working width of 1800 mm and leasing seperation for sizing, we can reach a more than 7 times higher productivity. Together with a maximum warp length of 1500 m, the Multi-Matic® 128 can also be used as a production machine, which brings the customer highest flexibility effort savings.

Beside this the highest Price/ Performance ratio depends on the warp length, the number of end and the design (Picture 1). Which machine is the right machine for the customer needs, can be calculated by our new Expert System. With your data we help you to find the machine, which gives you the highest performance by spending low money.



Picture 1. Best Price/Performance ratio

NEW DRIVE SOLUTIONS TO INCREASE PERFORMANCE AND QUALITY OF A COTTON COMBER

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Turkey is one of the most important processors of cotton in the world. The majority of the more than 6,500,000 ring spindles and more than 600,000 rotors are processing cotton. Of the 1.2 million tons of fibers processed in Turkey, 1.0 million tons are cotton.

For years, Turkish spinning mills have been successful in improving value creation. A practical approach is to spin finer yarns. Increasing the spinning limit requires combing of the cotton, i.e. removal of short fibers.

The conventional approach used has changed little during the last decades. The performance of the comber is limited by the necessary rotation reversal of machine elements. The mechanical gears used for this purpose have reached their performance limit. Furthermore, the torsions caused by high-frequency rotation reversal have a negative effect on combing quality. It is not possible to achieve comparable process conditions on all eight parallel comb heads.

Toyota Industries, Japan, and the textile machinery company **Trützschler**, Germany, have formed a development group to overcome the problems mentioned above by applying new technical concepts.

Both sides provided very specific know-how for the project. Toyota is experienced in special drives for weaving machinery. Similar to the comber, here the drives are also subject to high-frequency reversal in rotation. Trützschler's experience lies with high performance drafting systems, self-optimisation functions, and levelling systems for sliver.

The result of this cooperation is the new comber, the Toyota-Truetzschler TCO 12.

By eliminating the conventional oil bath gear it has been possible to break through the performance limit. Instead, individual drives are used for the first time. Since the available space for driving the detaching rollers is very limited, very small motors had to be developed. The solution is water-cooled motors instead of space intensive motors with cooling fins.
The diameter of the detaching rollers is only 25 mm. At high nip rates the otherwise one-sided oil bath gear drive results in high torsion and twisting of the rollers. With the new motors, these rollers are synchronously driven from both sides by one motor each. This reduces torsion by 75%.

A reduction of the torsion results in greater uniformity of combing conditions at all eight combing points. The noil quantity and variation of the quality parameters such as nep reduction and short fiber separation, is significantly reduced.
Usually the drafting system is driven by means of the main shaft of the comber. The Toyota-Truetzschler innovation uses individual drives here as well. In this specific case, digitally-controlled, maintenance free servo motors are applied. For the first time, this solution allows a

levelled drafting system as known from high-production draw frames to be used in a comber. This significantly improves the length variation values of the sliver. As a result, the yarn count variations are lower.

Implementing the drafting system technology of state-of-the-art autoleveller draw frames allows the integration of permanent quality monitoring into a comber for the first time. The sliver mass is monitored before the comber sliver is deposited into the can.

The precise sequence of the output motion of the detaching rollers has a direct impact on piecing quality, and thus on sliver evenness. Thanks to the individual drives and permanent quality monitoring, an automatic optimisation of this complex motion sequence is possible. During a self-learning process, the machine control automatically detects the setting with the best sliver evenness.

Key Words: Comber, Toyota, Truetzschler

Comment:
This new comber is currently being tested around the world, also in Turkey. The results from the Turkish test partner will be available next April, at which time they can be presented.

AUTOCORO 8
THE HIGH-TECH REVOLUTION IN ROTOR SPINNING

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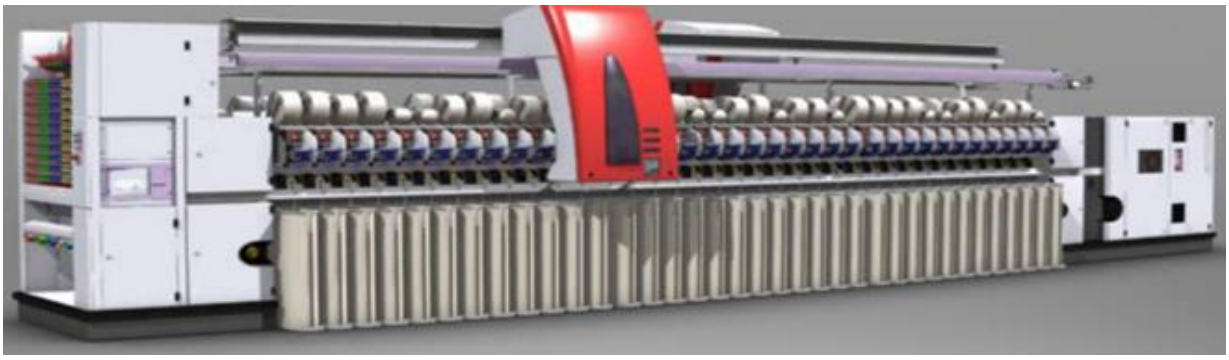
The first **revolutionary Autocoro 8 Open End machine** was presented during the exhibition of ITMA Barcelona in 2011. Based on a long period of intensive hands on R&D activities, the Autocoro 8 Open End machine provides extensive possibilities in sophisticated yarn spinning. Up to now, worldwide more than 500 machines were successfully installed at more than 400 companies, which appreciate the flexibility to produce different yarns in the yarn count range of Ne 3,5 - Ne 60 utilizing different materials.

After the first Open End machine which was manufactured in 1969, the first revolution in rotor spinning was achieved in 1978 by Schlafhorst with the first central automation. The second revolution occurred in 2011 with Autocoro 8 Open End machine which has independent automation system. Because each movement on spinning position is driven by individual motor, the spinning process is carried out precisely.



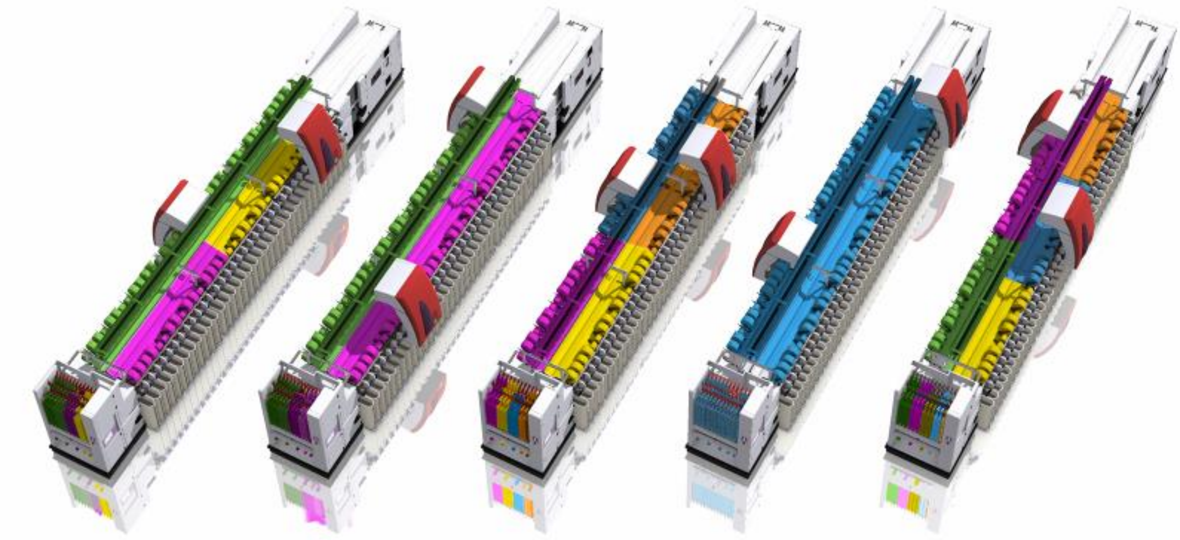
Picture 1. Autocoro 8 Open End machine with individual driven spindle system

On conventional open end machines, rotors are driven by Twin-Disc and tangential belt systems. This system requires periodical maintenance and frequent modernization due to abrasions. In contrary, precise control of rotor speed is obtained since the rotor is driven by **unique rotor motors** on Autocoro 8 Open End machine without any mechanical friction. Rotor speeds are significant higher thanks to reduction of rotor dimension and weight, with the result of less temperature on the rotor itself. The rotor motors are designed to achieve up to 200.000 rpm production speed.

Picture 2. Smaller and lighter rotor driven by individual rotor motor

Each spinning position has its own **piecing system**. The machine efficiency is at all time high level even in case of high yarn breaks, because 12 piecing are carried out in the same time. The DCU (Doffing and Cleaning Unit) is just responsible for doffing and preventive cleaning of spinning boxes. In addition, because the number of mechanical parts are less compared to the regular robot used on conventional Open End machine, it allows less and easy maintenance.

Up to **5 different lots** can be in production on Autocoro 8 simultaneously. Small orders can be produced on a defined section of the machine. It gives advantages not only for production planning and costs, but also for customer satisfaction because the orders can be faced in a short production period. In addition, while one lot production is finished the following lot starts for production with **seamless lot change** function. Therefore, there is no loss of machine efficiency even during frequent lot changes.



Picture 3. Autocoro 8 Open End machine has the ability to produce up to 5 lots simultaneously

PilotSpin function gives the possibility to do trials on a defined section of the machine while the machine is in ongoing production mode. All trials with different materials, yarn counts and settings for the yarn types which would be in production can be carried out prior production release.

Thanks to **DigiPiecing** technology, the quality of piecing area is nearly the same as normal yarn in respect of appearance and tensile strength. It does not cause yarn break in the following processes and does not create thin or thick places on the fabric.

DigiWinding technology prevents bulging on package formation while the package allows more yarn length up to 10 %.

Because of individual drive of yarn guide, **take-up speed** is up to 300 m/min independent from machine length.

The **Flexpack** option ensures package production up to 7 kg and 350 mm diameter.

The Autocoro 8 has a machine length of up to 552 spinning positions at present. The space requirement is significant less compared to conventional Open End machine which has the same number of spinning positions.

Energy consumption with Autocoro 8, based on the production unit in kg is up to 20 % less compared to a conventional Open End machine.

During the presentation, the incredible features of the Autocoro 8 Open End machine will be explained more in detail based on true facts of successful customer reference installations worldwide.

POSSIBILITIES FOR MANUFACTURING TECHNOLOGIES FOR MODERN FABRICS

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DORNIER, which has its roots in aircraft manufacturing, has been producing weaving machines for almost 60 years now.

In the beginning DORNIER built shuttle looms but since 1967 has been producing rapier weaving machines which were complemented by air-jet weaving machines in 1989.

The development of the Turkish textile market shows very clearly that large investments will be made here in the next years. Today Turkey is the fifth largest single market for weaving machines worldwide.

The contemporary weaving machine market shows that DORNIER rapier and air-jet weaving machines, equipped with state-of-the-art electronics, are eminently suitable for energy-efficient working. High performance and best fabric quality can be achieved, which is crucial for the clothing sector.

With the patented SyncroDrive® drive concept, DORNIER has established a new technology for the modern furniture and decoration weaver. This concept enhances the performance of Jacquard weaving machines and reduces the stop values by half.

In the terry sector, the DORNIER terry air-jet weaving machine ServoTerry® is a benchmark for fabric quality. Due to the patented soft beat-up it is possible to achieve highest speeds and finest terry quality with consistent piles and lowest stop values. Different pile heights can be programmed easily at the machine panel.

The DORNIER system family offers advantages especially for technical weavers. Depending on the product and the material to be processed, the customer can choose the right filling insertion method.

Through the consequent further development of the air-jet weaving machine, it was possible to reduce the weaving costs considerably over the last years, as exemplified by airbag weaving.

Due to the filling insertion with positive filling transfer and open shed filling insertion, the DORNIER rapier weaving machine is the ideal tool for producing technical fabrics. Today this machine is industrial standard for processing carbon, glass or aramid.

With the Open Reed Weave (ORW) technology, DORNIER sets new standards in the creation of patterning.
With this technology it became possible to integrate embroidery in the weaving process so that weaving and embroidery can run at the same time on DORNIER weaving

machines. The ORW technology allows various patterns and is used especially for curtains, but also for clothing fabrics.

Also fabrics that require additional strength directions (multiaxial strength) beside warp and weft can be produced with this technology. This opens up a new field for producing fabrics for industrial applications.

These examples demonstrate that the Lindauer DORNIER GmbH offers a wide range of possibilities for energy saving, quality improvement and higher performance as well as new technologies for fabricating new products.

STÄUBLI`S ACTIVE WARP CONTROL SYSTEMS – SUCCESS IN WEAVING

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Weaving preparation – through active and automatic drawing-in of warp ends is a decisive stage prior to weaving – is gaining importance for modern weaving mills to remain competitive and to provide quick response in a demanding market environment. Ever changing demands and short delivery times require flexibility in warp production and the ability to adapt to the buyers' needs. The capacity and throughput times in weaving preparation need to be designed to fulfil the requirements of the weaving shed in order to avoid downtime. Modern solutions to optimize and rationalize the weaving preparation process are part of the presentation.

In order to match the specific needs of the market a mill has to optimize weaving machines with the right shed forming technology. Adequate under-motions and frame drive systems are available to match high speed requirements of state-of-the-art weaving machines. Focus will be given to latest generations of shed forming systems which guarantee high speed and performance as well as high quality and production reliability.

In summary, technical and industrial textiles are in demand – a quick overview of Stäubli`s activities in this field with some examples of applications will be given in this paper.

Key Words: Shedding, dobbies, cam motions, automatic warp drawing-in, weaving preparation, technical & industrial textiles

ELECTRONIC PATTERN DRIVE IN WARP KNITTING (TRICOT AND MULTIBAR LACE MACHINES)

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KARL MAYER is the world leader in producing warp knitting machines and warp preparation units. We supply high-quality products with brand-name status. With its innovations the company sets the technical standards of the trade and assists its customers all over the world with comprehensive support, covering a competent and fast service as well as practical staff training, and rendering help for the development of new products.

The production of warp-knitted products involves the use of pattern-disc controlled bars in warp-knitting machines. Each bar of a warping machine has its dedicated pattern disc, which has to be created on the basis of lapping designs by the textile development department. As new designs are created, new pattern-discs have to be produced, to manufacture the specific fabric. Though do pattern-discs offer the most precise curved form. This ensuring a very smooth machine run at highest possible working speeds along with very accurate shog motions of the guide bars. But such a pattern disc is made for a specific lapping repeat only. Besides, the pattern disc cannot always be used in a compatible way for all the guide bar positions. In other words: a pattern disc cannot necessarily be used for ground bar 1 and alternatively for ground bar 4, for example, even if both guide bars work the same lapping. Pattern discs are a reliable and time-tested technology, newer and more sophisticated technologies are beginning to change the industry.

The technology leader KARL MAYER wants to present at the XIIIth International Izmir Textile and Apparel Symposium is called “Electronic Pattern Drive (EL)”. This technology has several advantages when compared to the pattern-disc system. Whereas the pattern-disc based system requires new physical pattern discs for each design pattern, the patterning possibilities with the EL technology are without limits. Usually, a pattern disc is capable of providing patterns with a maximum of 32 courses, and a maximum shogging movement of 28 needles (1 inch, E28 gauge). The EL drive however has no limits regarding the quantity of courses per pattern and has a shogging movement of 56 needles (2 inch, E28 gauge). On electronic pattern drives each guide bar is controlled by its own motor, thus ensuring a very precise shog motion. By simple programming it is possible to obtain various lappings, along with the longest shog distances. This is made possible by servo-motors, which are programmed digitally via a USB interface. Designs can be created by two possibilities: 1) a direct input of the lapping layout (chain link) via the operator interface or 2) create the pattern on a specific Software program “ProCad Warpknit” from Texion. With that program it is possible to simulate the textile as 3D pattern on the screen before produced. When the design is ready you can uploaded it and transfer via USB stick into the system via touchscreen, the motors are automatically programmed and the design can immediately be put into production.
With this transfer from the computer to the machine easy and fast pattern changes as well as the possibility of pattern storage are big advantages. Moreover the producers save time and money to change patterns. They don’t have to order pattern discs anymore and no machine

stops due to assembly of it. Electronic pattern drives are extremely flexible, fast and easy to maintain. Electronic drives are available across all product categories of KARL MAYER, including Lace, Tricot and Raschel machines.

KNITTING TECHNOLOGY AND TECHNICAL TEXTILES

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Textile preforms produced from glass, carbon and aramid yarns, are widely used for the production of composite materials in aerospace renewable energies industries to name but a few. Weaving, braiding, stitch-bonding and warp knitting machines are suitable for the production of 2D and 3D textile structures. However their possibilities are limited when it comes to producing complex geometries. Flat knitting machines with their single needle selection, stitch transfer allow for the manufacture of such fabrics, which are generally used in the clothing industry and also increasingly for technical textiles. The article investigates the present and future possibilities of knitting technology for the technical textiles particularly flat knitting machines for composite materials.

The first application example refers to the development of weft knitted fabrics for the reinforcing of wood-textile-composites and shows how the use of flat knitted technical textiles results in a substantial improvement of the load bearing capacity. Tensile and shear strengths of wood are low and lead to poor structural behaviour, especially of connections. Thus, additional reinforcement techniques are required. The overview contains results of a study on the development of stretched knitted fabrics for the reinforcement of wooden building components. For this purpose the influence of stitches, floats and tuck loops on the structural extension limit is determined.

The other example demonstrates the application of 3D-flat knitted spacer fabric for the reinforcement of lightweight composite materials. Conventional spacer fabrics consist of two layers which are bound together by pile yarns. It is, however, necessary for the double-wall thermoplastic structural elements, to knit multi-layer grounds and bindings. Knitted spacer fabrics are produced with hybrid yarns, consisting of one high-tensile component and one thermoplastic component.

Key Words: Composite, knitting, flat knitted fabrics

COMPARATIVE STUDY OF TENSILE WOVEN FABRICS PROPERTIES WITH VORTEX AND RING SPIN YARN IN WEFT

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Recent development of VOTEX yarns made them comparable with ring spin yarns in term of visual appearance, structure and consequently properties [1,2,3,4,5]. Taking in account the production speed of VORTEX yarns which is 15 to 30 times bigger than ring spin yarns it make them competitive more than ever before. The purpose of research was to examine the influence of different way produced and as weft introduced yarns into woven fabrics on their tensile and abrasive properties. Three different mixture of fibres (1 - 50% cotton and 50 % PA6.6; 2 - 67% cotton and 33% PES-carbon and 3 - 100% micro modal CV fibres) were used for producing two type VOTREX and ring spin yarn 16,67 tex. VORTEX yarns were produced on MURATEC - (A) and RIETER – (B) air jet spinning machines and ring spin yarns on ZINSER – (C) machine from the same input material. The properties of produced yarns were measured.

Nine woven fabrics were made under same construction, settings and condition during weaving process with the only difference type of yarn in weft. The density of warp yarn was 20 ends/cm, their fineness was 8x2 tex and the weave was always twill 1/3 Z. Set density of weft yarns was 30 picks/cm. Figure 1 is presenting the simulation of fabric structure.

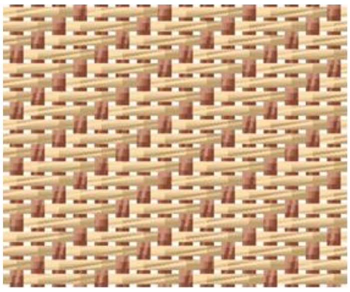

Figure 1. Woven fabric structure simulation (Arach Weave)

The tensile and abrasion properties of fabrics were measured and after statistical consideration summarized.

From the presented table is clear that the breaking tenacity of weft yarns does not affect the Warp direction breaking force of fabrics. Correlation coefficient is almost 0 (r=-0,02). On the other hand the breaking force of fabrics in weft direction correlate with breaking tenacity of weft yarn (r=0,8). If we add to that the correlation coefficient between breaking force in weft direction and breaking elongation of weft yarns (r=0,73) their common influence expressed as breaking work could be about 0,85 or more which means that only about 0,15 is remaining to the all other influences including warp yarns tensile properties.

Table 1. Results of fabrics tensile properties in warp and weft direction in correlation with tensile properties of yarn introduced in weft

	1	2	3	4	5	6
Samples	Breaking force in warp direction (N)	Breaking elongation in warp direction (%)	Breaking force in weft direction (N)	Breaking elongation in weft direction (%)	Breaking tenacity of weft yarns (cN/tex)	Breaking elongation of weft yarns (%)
1A	273,97	7,64	410,24	18,50	14,33	9,78
1B	292,25	7,85	375,45	19,03	14,00	9,35
1C	287,41	7,74	426,87	18,24	17,07	8,74
2A	283,39	8,28	304,50	11,84	11,68	5,74
2B	282,23	8,22	275,67	12,38	10,11	5,15
2C	228,83	7,91	353,91	11,10	16,35	6,83
3A	284,96	7,55	430,01	12,32	17,46	6,71
3B	281,13	7,97	382,84	12,56	16,66	7,40
3C	290,32	7,79	403,22	12,761	20,29	8,93
r (1, 2, 3, 4 :5)	1:5	2:5	3:5	4:5		
	-0,0214	**-0,6849**	**0,8005**	**-0,0253**		
r (1, 2, 3, 4 :6)	1:6	2:6	3:6	4:6		
	0,2114	**-0,6748**	**0,7263**	**0,7850**		

The breaking elongation of fabrics in warp direction correlate negatively and quite high with both breaking tenacity (r=-0,68) and breaking elongation (r=-0,67) of weft yarns. The most influential factor regarding breaking elongation of woven fabrics in weft direction is the breaking elongation of weft yarns (r=0,785) and breaking force of weft yarn has no any influence on that.

Key Words: Different row materials, ring spin yarns, vortex yarns, woven fabrics properties

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DEVELOPMENT OF 3D KNITTED FABRIC STRUCTURES FOR OFFICE SEATS

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In recent years, working long hours and spending most of this time on a chair make people have big expectations about the seat's comfort. This brings new researches about improvement of working quality and comfort. Researches have shown that health of the body and ergonomics are the most important expectations and different types of seat designs can meet them [1, 2, 3]. In this regard, improvement of the features such as air permeability, breathability, resilience is the main focus of the studies in this field.

Polyurethane foam is commonly used for upholstery material for seats in market. However, some of the disadvantages of these foams have a negative effect on person's comfort. Therefore, also parallel to developing technologies, it is required to develop functional products by using new materials on the purpose of increasing comfort properties.

The aim of this project is to develop special structures for office seats with high performance characteristics such as breathable, light weight, able to adapt to the body etc. as an alternative to the conventional products. For this aim, 3D (three dimensional) fabric structures were developed and knitted using different production parameters like yarn properties, thickness and tightness values. Then, the performance tests that considered as necessary for comfortable using like weight, thickness, air permeability, compression and aging were performed.

The test results were comparatively evaluated with the seat materials available in the market (foam) and the optimum fabric structures meet the requirements and the related standards were tried to determine.

The expected outputs of this study can be summarized as follows:

- Light weight,
- Excellent compressibility,
- Comfortable,
- High breathable / air permeability,
- Long economic life,
- Recyclable,
- High performance 3D fabrics for comfortable office seats.

Key words: 3D spacer fabric, comfort, office seat, polyurethane foam

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APRIL 04, 2014

SESSION II

LAWS, LABELS & LOGOS THE KEY DRIVERS FOR SUSTAINABLE TEXTILES AND DYSTAR'S RESPONSE

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Ecological aspects of textile production have become an increasingly significant concern for retailers and brands as they seek to protect their brand integrity and minimize the environmental impact of their supply chains. Combined with consumer demand for greener products, demand for greener processes means that brand and retailers and mills need a reliable and trustworthy partner skilled in innovation and ecology expertise.

The scope of corporate environmental concerns has now widened from companies' own activities e.g. distribution, packing waste, energy efficiency, to that of the environmental impact of the product supply chain and the potential for chemical contamination in the final consumer article.

What are the factors that have driven companies down this path? One answer to this question can be found by considering the three drivers namely **Laws, Labels and Logos**.

The combining effect of the drivers referred to in the textile preceding discussion has been to raise the profile of chemical and environmental issues within the industry – a process which has been described as "greening the Textile Supply Chain". Due to the globalization of the textile supply chain these environmental drivers have been transmitted to all major textile and clothing producing regions of the world.

At DyStar We believe that globally coordinated supply chain partnership operating at a local level are essential for the realization of the sustainable textile production. Only by all the actors in the textile supply chain working together can environmental improvement be promoted through the introduction of ecologically –optimized products and cleaner production techniques .

And by establishing such co-operative supply chain partnership the industry will be able to respond to the challenges posed by Laws, Labels and Logos in the 21st century

Key Words; Sustainability, laws, labels, logos, greener textile production

OPEN WIDTH FINISHES FOR KNITTED GOODS

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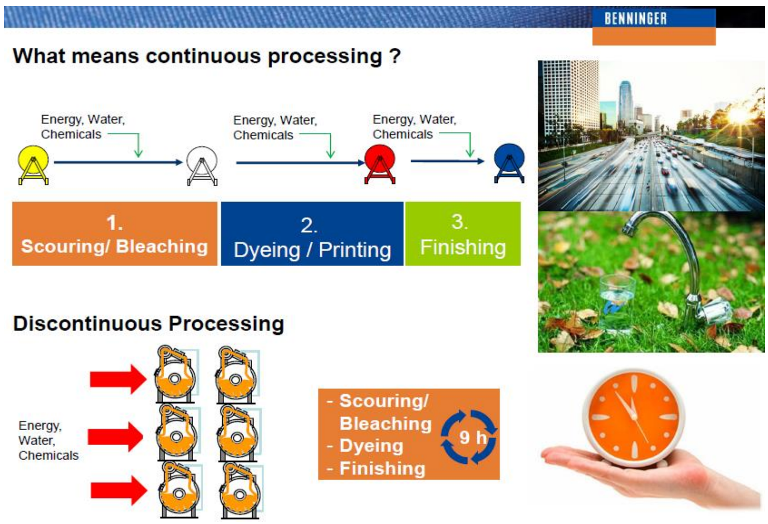
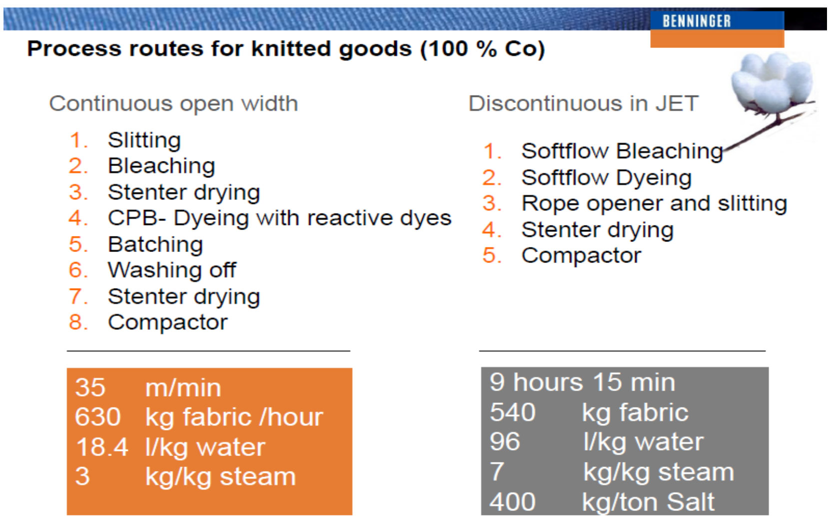
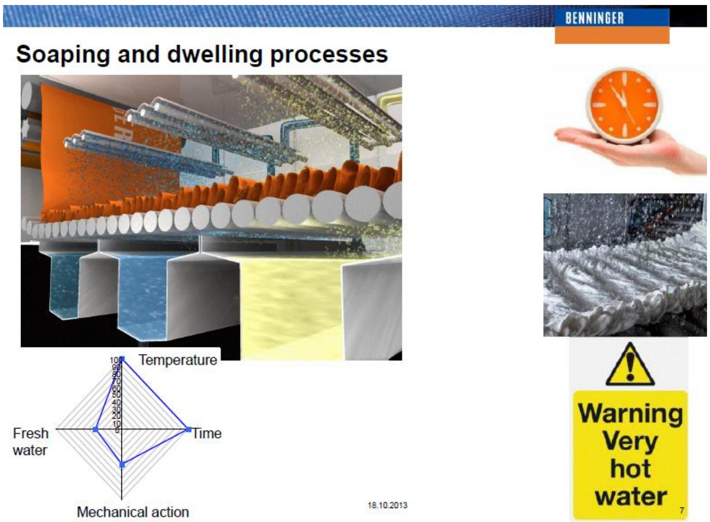
Reasons for Open Width Finishing of Knitted Goods

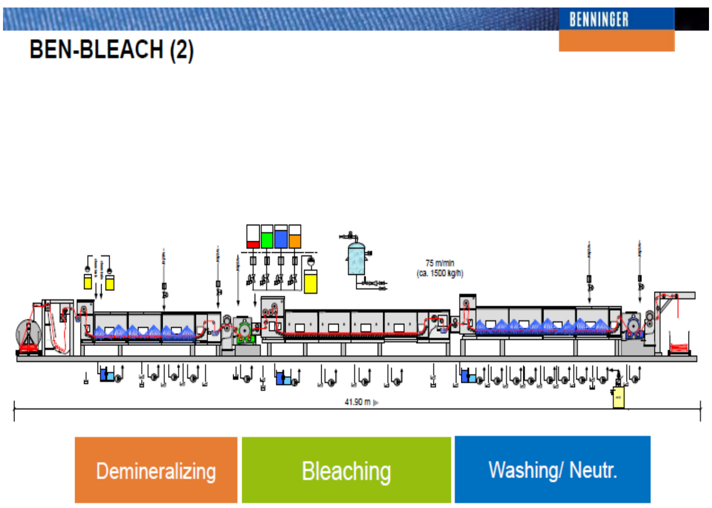
- Water saving p to 75 %
- Energy saving up to 60%
- No salt required
- Smoother surface
- No abrasion marks
- No batch to batch Variation
- 30 % less costs

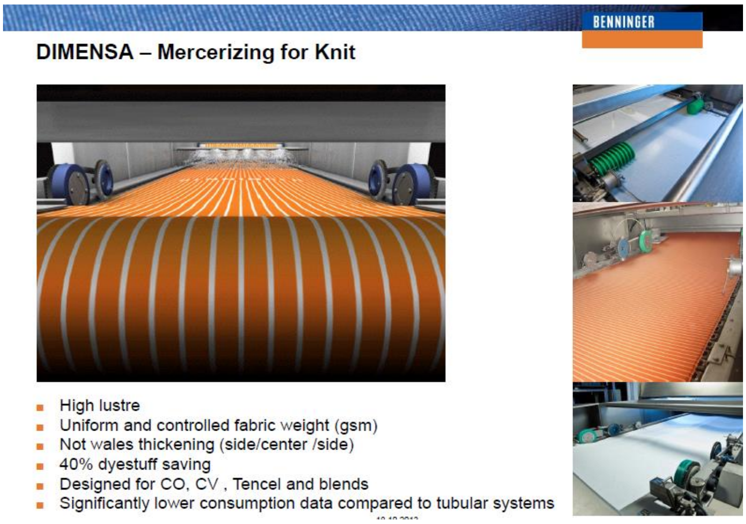





BENNINGER
TRIKOFLEX high performance washing for Elastic's
Fabric run
Counterflow
Mechanics
Temperature
Patented TRIKOFLEX Drum
40% higher washing efficiency thanks to front and back washing and counterflow guiding


BENNINGER
Soaping and dwelling processes
Temperature
Time
Fresh water
Mechanical action
18.10.2013
Warning
Very
hot
water


BENNINGER
BEN-BLEACH (2)
Demineralizing
Bleaching
Washing/ Neutr.


BENNINGER
DIMENSA – Mercerizing for Knit
High lustre
Uniform and controlled fabric weight (gsm)
Not wales thickening (side/center /side)
40% dyestuff saving
Designed for CO, CV , Tencel and blends
Significantly lower consumption data compared to tubular systems


BENNINGER
CPB DYEING FOR KNITWEAR
More than 4000 Dyepads (Knit 60 +30) succesfull in operati
Nip/trough dyeing
Just in Time Liquor preparation -CONTIDOS
Temperature Management
Anti Tailing Software
18.10.2013
KÜSTERS
10
Member of the Benninger Group

BASF ECO SPEED SYSTEM

Serkan Gökgönül
BASF Türk Kimya Sanayi ve Ticaret Ltd. Şti. Turkey

BASF Eco Speed System

Speedy, Simple, Save

Benefits over Reactive Dyes printing

– An ideally designed formulation for almost all substrate with higher quality consistency.

– High Eco-efficiency - water, energy and time saving.

– Much simpler operation and reduced chemical waste

– Fast sampling, rejections are easily detected and corrected.

INTEGRATED POLLUTION REGULATIONS AT TEXTILE SECTOR

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SUMMARY

Notification of integrated pollution regulation at textile industry, published at official newspaper, which is for minimizing and controlling of negative effect of due from textile industry producing pollutions, that, discharging emissions to soil, water and air.

According to this notification, pre operating plants like washing, bleaching, mercerization, sizing, de sizing, printing, etc. and finishing operating like dyeing plant, are responsible this notification items.

The Ministry will be provide need to required, coordination, program, policy, technology, management system, national and international collaborations and application of notification for decreasing of emission and waste which is due textile industry producing process. This is for compatibility to environment of textile industry. The Ministry where required; may want increasing of level of target of cleaner producing (eco efficiency) plan.

After notification publishing, liable plant's EIA (Environmental Impact Assessment Report) shall be include cleaner producing plan and they shall prepare cleaner producing plan and shall undertake for approval.

Textile manufacturers is responsible for emission and discharging control during producing process and all emissions, according to integrated pollution prevention and controlling approach. As well as, they shall use best available technic, preparing of developing report of applications of prepared cleaner producing plan, according to given format and they shall present to provincial environmental offices. Al parameter measurement and all analysis must be provided by authorized laboratory by the Ministry at present report. Textile manufacturers will be responsible according to indicated principles of notification for all applications of cleaner producing technics.

Developing reports of cleaner producing, shall present to provincial environment office for approval for following every.

Recently establishing plant, for taking environmental permit shall be present approved cleaner producing report according to at published Official Newspaper which is date :29 April 2009 and number :27214 " Regulation of Environmental Law Required Permits and Licenses".

Textile manufacturer is responsible shall make all works and operations, according to published at Official Newspaper which is date 12 November 2010 and number: 27757 "Regulation of Environmental Officer and Environmental Consulting Firms".

CLEANER (SUSTAINABLE) PRODUCING

- Planning and organization
- Management confirmation
- Establishment of cleaner production team
- Determination of policy, target and goals
- Clean production plan making

CLEANER PRODUCING STEPS

- Pre-Assessment

1) Company information and flow diagram providing
2) First examine,
3) Focus point description

- Evaluations

1) Quantitative data collection
2) Mass balance
3) Flow and emission audit
4) Cleaner producing possibilities determination
5) Prioritization of possibilities

Prioritization of possibilities of examples

Type of Problem	Description of Problem	Cleaner (Sustainable) producing possibilities
Examples: -Resource generation -Energy consumption -Air pollution -Solid waste -Hazardous waste - Occupational health and safety	Examples: -Name of process -History of process -Wastage quantity and pollution - Cost of the source material loss	Examples: - How the problem can be solved - Short-term solutions - Long-term solution - Estimates of resource consumption and waste generation

- Analysis and Feasibility Study

1) Preliminary Analysis 2) Technical Analysis 3) Economic Analysis
4) Environmental Analysis 5) Selection of possibility

- applications and sustainability

1) Preparation of the Application Plan 2) Selected possibilities application
3) Performance surveillance 4) Cleaner Production Activities Sustainability

IMPACT OF ACCELERATED AGEING PROCESS ON THE BALLISTIC PERFORMANCE OF FIBROUS BALLISTIC PRODUCTS

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The ageing process of textile products is a phenomenon which occurs in a longer period and it is characterised by spontaneous progressive changes in the structure or/and surface of the fibres, whereas the intensity of the changes depends on environment conditions and the time period of material exposition to ageing process.

Considering the usage conditions, the textile ballistic products may be exposed among others to sunlight and/or environmental factors i.e. temperature or humidity. Ballistic materials get degraded due to action of the external environmental factors, resulting in lower mechanical strength, and thus the ballistic resistance is reduced.

The aim of the study was to determine an impact of external environmental factors (heat, humidity, UV) on the ballistic performance of fibrous ballistic materials.

Two groups of materials potentially applicable for developing the ballistic inserts were subject of research: p-aramid woven fabric and composite materials made of Ultra-High Molecular Weight Polyethylene (UHMWPE) fibres used for the soft ballistic inserts design. The ballistic materials were modified using the low-temperature plasma treatment with the assistance of the low molecular weight organic substrate.

The ageing tests were executed with respect to the original testing procedures developed by the Institute of Security Technologies "MORATEX" based on the guidelines of the following Standards: PN-EN 12280-1:2002 "Rubber - or plastic coated fabrics - Accelerated ageing tests - Part 1: Heat ageing", PN-EN 12280-3:2002 "Plastics -- Methods of exposure to laboratory light sources - Part 2: Xenon-arc lamps", PN-EN ISO 4892-2: 2009 "Plastics - Methods of exposure to laboratory light sources - Part 2: Xenon-arc lamps" as well as on the ASTM F1980:2002 Standard Guide on the assignment of conditions for accelerated ageing.

The ballistic performance were executed according to the methodology included to the PN-V-87000:2011 Standard „Light ballistic armours – Ballistic protection vest – General requirements and tests" for the fragment-proofness (O2 class) and bullet-proofness (K2 class) of initially designed layered systems as well as after the accelerated ageing process to show the effectiveness of the low temperature plasma treatment of the ballistic fabric materials.

The study was funded by the National Centre for Science within the frame of research project No. N N508 629940 „ Studies on the functionalization of ballistic materials".

Key Words: Accelerated ageing, ballistic textile materials, plasma treatment

THE EFFECT OF MODIFIED CNT AND PROCESSING PARAMETERS ON PROPERTIES OF CNT-PAN COMPOSITE NANOFIBER WEB

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INTRODUCTION

As reported by Iijima in 1990 [1], carbon nanotubes (CNTs) are ideal materials for reinforcing polymer materials because of their high structural, mechanical, chemical, thermal and electrical performance [2]. PAN is the one of some precursors for producing high performance fibers due to its properties [3]. It was reported that the PAN macromolecular orientation increases with increasing CNT orientation in the polymer [4] thanks to interactions exist between PAN chains and CNTs [5]. Pristine and functionalized CNTs which has been shown to be effective in improving dispersion because the functional groups on the CNTs surface counteract the van der Waals attractive forces between CNTs [6], can be dispersed in a lot of polymer matrix systems [7].

Nanofibers can be prepared from a polymer solution utilizing electrospining [8]. By this unique method, a high voltage is applied to a polymer solution between needle tip and metallic collector [9] and CNTs can be embedded in nanofibers formed as a non-woven web [10].

The homogeneous dispersion of CNT in polymer matrix and compatibility of CNT into polymer matrix are very important to improve the properties of nano composite polymer and to get expected results from nano polymer composite. Ultrasonic homogenizer is widely used to disperse the CNTs. CNTs functionalized with COOH groups upon acid treatment is generally used to improve the compatibility of CNT in polymer matrix. The incorporation of plasma modified CNTs to increase the compatibility in polymer matrix is recently become a popular subject and there is very limited study on it. In this study we employed plasma modified NH_2 and COOH functional CNTs instead of CNTs modified by acid treatment method. We also studied the effect of dispersion method for homogenization of CNTs in polymer matrix. In addition to ultrasonic homogenizer which is widely used for dispersing CNTs in polymer matrix, mechanical homogenizer and ultrasonic bath are also used to evaluate the effect of preparation method on final composite product. The amount of CNT has been changed as 0, 0.5, 1, 3, 5, 7 and 10 wt% to observe the effect of loading on properties of PAN-CNT composite nanofibers.

MATERIALS AND METHODS

PAN possessed a molecular weight of 150.000 g/mol was purchased from Sigma Aldrich. DMF from Merck was used as solvent. MWCNTs as pristine (diameter 10-20 nm, length 10-30 μm) and plasma modified CNTs (diameter 13-18 nm, length 3-30 μm) were supplied by cheaptube.

PAN was dissolved in the stable suspension of MWCNT in DMF (with 7 wt% PAN concentration and with different CNT concentration such as 0.5, 1, 3, 5, 7, 10 wt %). On electrospinning system, the feeding rate of the polymer solutions was 1 mL/h with 15 kV electrospinning voltage and the distance between the needle tip and collector was 10 cm. FTIR, DSC, TGA, SEM, tensile tester and conductivity tester were used for the evaluation.

RESULTS AND DISCUSSION

In Table 1, the effect of dispersion method on tensile properties has been given. In Table 2, the effect of plasma modified NH_2 and COOH functional CNTs on tensile properties has been given. PAN nano composites loaded with different amounts of CNT have also been studied.

Table 1. The effect of dispersion method on tensile properties

	Tensile Strength (N/mm^2)	**Tensile Strain %**	**Modulus (N/mm^2)**
10 min Ultrasonic homogenizer+ 45 min ultrasonic bath	1,84	14,73	24,29
2 h. ult. homogenizer	1,33	11,08	18,55
2 hour ultrasonic homojenizer+30 min ult homogenizer together with PAN	0,41	16,68	3,72
2 hour mechanical homogenizer	1,04	12,07	10,22

Table 2. The effect of plasma modified NH_2 and COOH functional CNTs on tensile properties

	Tensile Strength N/mm^2	**Tensile Strain %**	**Modulus (N/mm^2)**
PAN/CNT with NH_2	2,055925	15,56111	24,37093
PAN/CNT with COOH	1,622894	13,1775	22,46604

CONCLUSION

From the studies, it has been seen that the samples treated with ultrasonic bath have better results than the other dispersion methods. Plasma modified NH_2 functional CNT loaded nanofibers have better mechanical properties due to the much stronger interfacial bonding in PAN matrix.

1 wt% CNT loaded PAN among the others is the best one in point of mechanical properties.

Key Words: Plasma functionalized carbon nanotube, Polyacrylonitrile, dispersion method, electrospining, nanofiber web

ACKNOWLEDGEMENT

We would like to thank to TUBITAK for supporting this study (project number 112M877).

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APRIL 04, 2014

SESSION III

TECHNOLOGY – BASIS FOR SUCCESS

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- Technology
- Success
- Setting the basis
- Develop success

The presentation is about technology and how it is the basis for success. It shows from past to presence and upcoming future the way it influences major aspects of human life and progress in career in connection to textile education.

Looking back to trade centuries ago, leading to industrialization: steam engines, spinning machines, sewing machines.

Presence: Internet, globalization, social networks, but also new fibres, 3D printing and technical textiles.

Future: Textile facade systems for growing of plants, textile-based filters for environmental sectors, architecture, logistics, energy

What is success and how can we enable students to be successful? Have a look inside the Swiss Textile College and the way we interpret and design the demands of textile studies.

CYBER-PHYSICAL SYSTEMS IN TEXTILE PRODUCTION – THE NEXT INDUSTRIAL REVOLUTION?

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Germany industries are highly productive. Also, Germany is one of the global leaders in the manufacturing equipment sector. One reason for this is Germany's specialization in research and development. Also production of innovative manufacturing technologies and the management of complex industrial processes are well established in Germany. Germany's strong machinery and plant manufacturing industry, its globally significant level of IT competences and its know-how in embedded systems and automation engineering mean that it is extremely well placed to develop its position as a leader in the manufacturing engineering industry. Germany is thus uniquely positioned to tap into the potential of a new type of industrialization: Industry 4.0 [1].

According to the german secretariat of the Platfom Industrie and its report "Recommendations for implementing the strategic initiative INDUSTRIE 4.0", one major innovation of Industy 4.0 will be the integration of so called Cyber-Physical Production Systems (CPS), CPS will use real-time capable sensors, actors and cognition. Also the use of the Internet of Things is important for Industry 4.0. All this will have impacts on the value creation, business models, downstream services and work organization. Following features of Industry 4.0 will be implemented:

- Horizontal integration through value networks
- End-to-end digital integration of engineering across the entire value chain
- Vertical integration and networked manufacturing systems [1].

Textile process chains in high-wage countries like Germany are described by many companies along the production chain. In order to get these textile process chains on level of Industry 4.0, information flows through all levels of an enterprise needs to be connected to other member of the textile process. This enables n flexible and fast production, feasible to deal with an order of a lot size 1. In markets like automotive, many of these ideas are already realized.

But also for internal company logistics, use of digital technologies and CPS do show potential to improve productivity of companies. Machine can communicate to each other and the operators. They can inform about their status and upcoming problems like maintenance. In this case, the factory will reconfigure it-self in order to fulfil the customers production order. Textile machines with open interfaces will be highly flexible and able to independently adapt status based on an overall information platform. Can, Core and warp beam and fabric will become carriers of information. This will lead to an autonomic textile process chains.

On main aspect of the production of the future will be the human-machine interaction. The use of smart personal devices such as smartphones, tablets or head mounted display do offer a huge potential for innovation. Smart personal devices can be used to make production more transparent by providing relevant production key parameters in a sophisticated way. In addition, guidance programs can lead to optimize production or faster act in case of machine break downs. Also aspects of telemaintenance, such as repair of machine supported by the machine produces are easier possible.

Self-Optimisation of textile machines is one path to Industry.4.0. Self-optimisation of the warp tension by using digital technologies was investigated at ITA. The aim of this work was to enable the loom to set the warp tension automatically on a minimum level without reducing the process stability. First step of self-optimisation is to model the process. Therefore a method was developed within the cluster of excellence „Integrative Production Technology for High-Wage Countries".Consequently, an automated sequence routine was created with the help of regression models for the model-based setting of the loom, and implemented in the weaving process. Thus, the loom was able to create its process model for a given process domain independently. Therefore the machine ran an experimental design, and automatically determined at respective test points the warp yarn tension. The operating point was determined with the aid of quality criterion such that the warp tension becomes minimal. A system test within ITA and a field test in industry demonstrated the functionality of the system, where warp tension was reduced within the self-optimised operating point [2].

Also textile products can act as CPS, in this case the products can be described as smart textiles. Textile touchpads, shirts with integrated electrodes and mattresses monitoring your sleeping quality are just a few examples of smart textiles. Smart textiles are a growing and fascinating field with enormous potential. The market of smart textiles looks extremely promising; experts forecast a double-digit growth within the next years. However, success can only be guaranteed if we have reliable and up-scalable production technologies. To serve this need we explored various textile production processes and investigated their suitability for smart textile production.

Use of digital technologies in a world of smart things will change the way we produce textile. Machine with additional sensors, actors and cognition acting in a network can lead to the fourth industrial Industy 4.0. In addition, textile products will be enhanced by sensors and actors to smart textiles also communicating with the world. But aspects of security, especially on information, need to be taken into account. Still, some experts claim: "it's already all there, we just have to use it".

Abstract is based upon a presentation at 1st International Conference on Digital Technologies for the Textile Industries in Manchester (GB); organised by TexEng Software Ltd in association with University of Manchester and support from TechniTex Faraday Ltd, the UK-based Materials Knowledge Transfer Network (KTN), The Textile Institute and The Fiber Society.

Key Words: Industry 4.0, Digital technologies, Cyber-Physical Production Systems, textile industry

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ABOUT THE CUTTING RESISTANCE MEASUREMENT OF TEXTILES

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The cutting resistance of textiles is a very important property - both from the technological and customer point of view. Textiles with higher cutting resistance cause several problems during the production of clothes, require special cutting equipment in the companies and do not allow the cutting of large number of layers. From the application point of view, there are several areas, especially in the protective clothes, where the enough good cutting resistance has to be presented and is the main parameter for evaluation of the functionality of such products, like safety gloves, safety vests etc. Independent of that, if the cutting resistance is wished or not, for both situations it has to be measured and no optimisation of the properties of the textiles can be done without reliable testing methods.

This paper gives an overview about the available testing methods, standard and devices, which are related to the cutting resistance of textiles and discusses problems about the accuracy and reproducibility of the measurements based on original experimental investigation.

All important parameter and their variance during the testing will be evaluated. The cutting force for instance can be measured with some accuracy, which depends on the accuracy of the force measuring unit.

Additionally, the deviations of the hardness and the angle of the knife influence the cutting force. The variations in the unit, which fixes the sample, have as well influence on the cutting force. All these variances have to be considered together in order to allow some integral evaluations of the accuracy of the testing method to be done.

The standard DIN EN ISO 13997-1999 [1] defines the conditions for the performing cut resistance testing as following:

The cut resistance of a material is tested by a device, where a sharp blade is pulled over a material. The cut length is between 3mm and 50 mm by using different cut forces and the device must be able to cut a material with a constant force by measuring the cut distance.
It is mentioned, that currently only the device TDM-100 Tomodynamometer of the Company RGI Industrial Products [5] satisfies these conditions. The development of the device is reported in [3], [4] and some results about protective gloves are presented in [2].

The method uses some correction coefficients to take into account the abrasion of the knife.
The result is mentioned by the force, which is needed to cut a distance of 20 mm of the sample.

Another method uses rotational knife [7] is named Couptest, according to EN 388. The measurement is based on a comparison of known test samples and those, which should be tested. A circular blade is put on the known test sample with a force of 5N, till the blade gets in contact with a conductive layer under it. The number of cycles will be counted.

Open is the question if there are different measurements ranges and what is the accuracy of the measurements.

The European Union has special directive 89/686/EEC [6] on personal protective equipment (PPE). Point 3.3 of this directive defines "Protection against physical injury (abrasion, perforation, cuts, and bites) - under the foreseeable conditions of use."

As the review demonstrates, there are only two types of devices on the market, which can be used under industrial conditions. There are known as well several investigations about the cutting resistance, using same or similar methods with modified standard testing machines.

Actually in the most sources the principle of the testing methods is described, there applications but the data about the accuracy of the measurements is difficult to find.

In the last part of the paper some theoretical analysis about the error propagation of the both test methods will be given. The analytical analysis of the error propagation allows to the developer to identify the problematic places on the methods and machines, which leads to the main errors and where more precision and costs have to be investigated, so that the entire system remains enough accurate.

Key Words: Cutting resistance, protective textiles, textile testing, accuracy, reproducibility

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INTERACTION OF TEXTILES WITH THE SKIN – FROM PERCEPTION TO IRRITATION

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The majority of textile interaction with the human body is by skin contact of clothing. The human skin is the largest organ of the body with a multitude of functions, but skin also has the largest representation in the brain [1]. Multiple sensors in the skin constantly perceive thermal, tactile, movement, touch and other external stimuli – consciously and subconsciously and result in a cognitive process building the overall subjective perception. Due to this complex system, with all its individual factors (e.g. male/female, cultural background, hormone state, etc.) sensory perception of certain fabrics is subjective and hard to evaluate. Most studies work with tactile descriptors such as “soft”, “rough”, “pleasant” etc., but lack the cognitive and neurological parameters of textile perception.

We here present first results of the so-called SOFIA-study. SOFIA is the Standardized Operating FabrIc Applicator which allows to apply fabrics on different skin sites of the test persons with reproducible application parameters. Different fabrics were applied on test persons and temporal changes in their electro-encephalogram signal (EEG) were analysed. The results show that the fabrics clearly differ in their effect on subconscious perception, which is especially important for scenarios of high mental concentration like business wear, work wear or special sports wear, the optimization and the marketing of such clothing.

When friction leads to uncomfortable perception, textiles may elicit skin irritation. Fabrics are in direct contact to the skin nearly 24/7, which makes it necessary to avoid irritation of the skin, especially for sensitive persons such as children, elderly people or people suffering from skin diseases like atopic dermatitis. In order to evaluate a fabric’s potential to cause skin irritation objectively, it has to be distinguished between chemical and mechanical irritation. While chemical irritation can occur due to the material composition, the textile finish or laundry residues, mechanical irritation potential depends on the fabric surface and construction. For this purpose, standardized test methods are essential to make different fabrics comparable. However, assessing the fabric material alone is not sufficient, as skin heterogeneity has to be taken into account as a decisive factor.

We compared several fabrics from the market in regard to their mechanical irritation potential starting with static and dynamic friction measurements on a technical skin substitute and subsequent evaluation of skin reddening, temperature and pain on test persons.

In recent years, there has been a lot of public discussion on putative irritative or adverse effects of antimicrobial textiles on the skin. The majority of fabrics use silver ions as the active antimicrobial agent [2]. Beside silver, quaternary ammonium compounds, polyhexamethylene biguanides, triclosan, or chitosan are also used. Antimicrobial agents can be applied to the textile substrates as a finish by exhaust, pad-drycure, coating, spray, and foam techniques, or the substances can be applied by directly adding into the fibre spinning dope [3]. Manufacturers claim that the antimicrobial effect is restricted more or less to the fibre surface, but mostly the amount of biocide released onto the skin from each product is unknown.

In contrast to therapy-enhancing textiles, which support physiological or healing functions, the public use of antimicrobial cloth as a consumer good should not pose any risk to the human health under normal or foreseeable use. The question of such health risks is important for the increasing number of people using antimicrobial cloth especially in sport and leisure activities, who wish to feel clean and safe or to control malodour. Adverse effects of antimicrobial clothes, especially formfitting sport and leisure underwear, on the ecological balance of the human skin microflora, are poorly studied. We therefore investigated, whether silver-finished and silver-loaded antimicrobial fabrics lead to changes in the physiological human skin microflora of healthy subjects under usual use [4].

Key Words: Friction, irritation, perception, antimicrobial

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PREDICTED TRANSFER OF LIQUIDS THROUGH MULTILAYERED TEXTILES

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Analysis of global trends in technical textiles development and production demonstrates the high priority of researches related to multifunctional textile products. A significant number of technical textiles used as a geotextile material (drainage, insulation, separation), textiles for building construction (noise absorption, absorption the toxic fumes in hospitals and public buildings), medical textiles (operational textile linings, bed sheets) etc. [1-5]. In this regard, there are some questions about the impact of the composition and structure of fabrics in textile composites for heat and mass transfer processes including the appointment of products.

Combining the textiles with different capillary-porous structure in one package type of "sandwich" gives ample opportunity to vary the properties of textile composites [1, 2]. We have offered algorithm of multilayered textile composites design from the individual textiles bonded with glue web from.

Development of multifunctional multilayer materials with predictable properties requires determination of individual properties of each textile layer and taking into account product destination.

Kinetic of sorption by each individual layer is studied on device SORP-3 (developer Textile Research Institute, Lodz, Poland) [6, 7]. This method allows fixing speed and amount of the moisture acting perpendicularly of a textile plane (Fig.1).

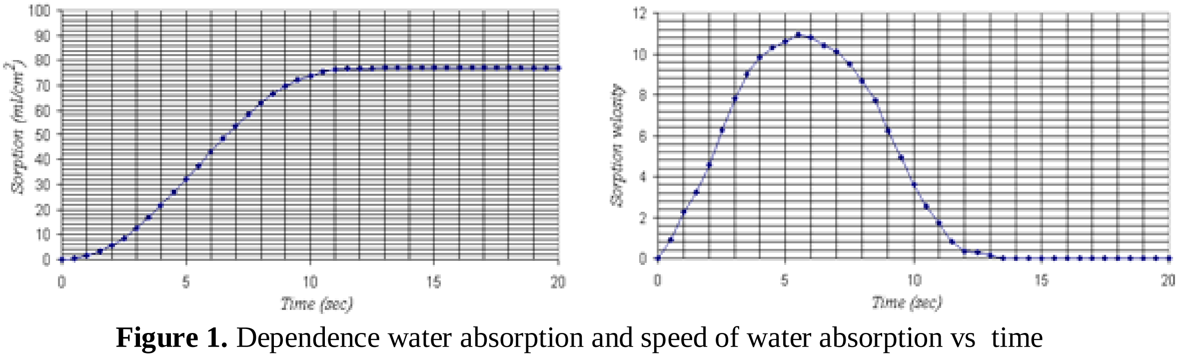

Figure 1. Dependence water absorption and speed of water absorption vs time

In our work there were investigated six textiles of different fibre compositions and structures. On Fig.2 there are the experimental data for these individual textiles.