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DEPARTMENT OF TEXTILES

ANNUAL REPORT 2013

UNIVERSITEIT GENT

FACULTY OF **ENGINEERING AND ARCHITECTURE**

Cover:
Close-up of multi-nozzle electrospinning equipment with over 100 nozzles at the department.

‘Centre of Excellence’
for
Textile Science
and Engineering

Turning research
into
value added
industrial products

CONTENTS

VOORWOORD

Het jaar 2013 kan worden beschouwd als een jaar waarin het Zevende Kaderprogramma van de Europese Commissie naar het einde loopt en de voorbereiding begint in de onderzoekswereld en in de industrie naar HORIZON 2020. Deze overgang zorgt voor een zekere bezorgdheid, aangezien continuïteit in onderzoek en ontwikkeling zeer belangrijk is. De uitdagingen die naar voren komen bij het lezen van het HORIZON 2020-programma blijken bovendien groot en vergen de juiste organisatorische aanpak om effectief klaar te zijn.

Het onderzoek dat door financiering mogelijk wordt gemaakt, bepaalt in Europa (en wereldwijd) meer en meer de kwaliteit van het aangeboden onderwijs en levert de ideeën voor een vernieuwende aanpak van processen en producten. Die vernieuwing zorgt voor de nodige competitiviteit en maakt het mogelijk om een maatschappelijk bestel op hoog niveau intact te houden.

De link tussen onderzoek en onderwijs (en omgekeerd) is dus bepalend voor onze welvaart, maar zorgt voor een werkomgeving die steeds veeleisender wordt en dat geldt zeker voor de textielsector. Die sector ervaart bovendien steeds meer wisselwerking met andere sectoren en disciplines. Dat is ook zichtbaar in de activiteiten van de vakgroep. Het is die intense wisselwerking die de basis legt voor nieuwe ideeën en het nodige enthousiasme creëert om niet begane paden te verkennen.

Nanovezels, nanoproducten, biomaterialen, interactief textiel, geavanceerde textielpolymeren, multicomponentstoffen, gefunctionaliseerde en uiterst efficiënte textielmembranen, ecologisch verantwoorde brandvertragers en veredelingsproducten, op textiel gebaseerde lichtgewichtstructuren voor een milieuvriendelijkere mobiliteit, nieuwe energieopslaande vezels, zelfsturende (productie)systemen, duurzaamheid, … zijn sleutelwoorden.

Dat zijn de moderne onderzoeksonderwerpen voor studenten, onderzoekers en leidinggevend personeel bij de vakgroep, ondersteund door gespecialiseerde technici en gedreven administratieve medewerkers. Een brede samenwerking met lokale collega's, nationale, Europese en mondiale gelijken is hierbij essentieel.

Het opdrachtenpakket is dus niet gering. De vakgroep tracht echter de invulling daarvan in een kwaliteitsvol kader te brengen. Hoe dit gebeurt, vindt u terug in dit jaarverslag over 2013.
Veel leesgenot!

Prof. dr. Paul KIEKENS, dr.h.c.
Vakgroepvoorzitter
Textielkunde

Universiteit Gent, mei 2014

FOREWORD

2013 can be considered as the year in which the Seventh Framework Programme of the European Commission is coming to an end and in which the research community and industry are preparing for HORIZON 2020. This transition gives rise to a certain concern since continuity is very important in research and development. Moreover, the challenges that come up when reading the HORIZON 2020 programme turn out to be vast and require the right organisational approach to be fully prepared.

Research that is made possible through funding ever more determines the quality of education offered in Europe (and worldwide) and provides ideas for an innovative approach of processes as well as products. This innovation makes it possible to maintain a high level social order.

The link between research and education (and vice versa) is crucial to prosperity but leads to an increasingly demanding work environment, which is certainly the case in the textile sector. Furthermore, the sector is experiencing more and more interaction with other sectors and disciplines, which is reflected in the department's activities as well. This intense interaction is leading to new ideas and entails the necessary enthusiasm to explore off the beaten track.

Nano-fibres, nano-based products, biomaterials, interactive or smart textiles, advanced (bio)polymers for special or niche textiles, multicomponent textile products, functionalised and highly performing (textile) membranes, environmentally friendly flame retardants and chemical finishing agents, textile-based lightweight structures for a better mobility, novel energy collecting and storing fibres, self-organising (production) systems, sustainable processes and products, advanced protective and comfortable textiles … are key words!

These are modern research topics for the students, researchers and managerial staff at the department assisted by specialised technicians and motivated administrative personnel. A broadly based cooperation with local colleagues, national, European and international peers is essential in this context.

The set of tasks is not minor. However, the department tries to implement these tasks in a high quality environment. How this is done, is reflected in this annual report.
Enjoy reading it!

Prof. dr. Paul KIEKENS, dr.h.c.
Head of Department

Ghent University, May 2014

GENERAL

The Department of Textiles is an integrated part of the Faculty of Engineering and Architecture of Ghent University. It is directed by prof. dr. Paul Kiekens. The department meets the requirements of a modern academic entity, i.e.

- University education,
- Scientific research and
- Technical-scientific services for the textile industry and users.

A team of about 40 people having a degree in different disciplines makes use of very modern research and analysing equipment and a very well-equipped library. About two thirds of the personnel are academic scientists and engineers and about one third is administrative and technical personnel.

STRUCTURE OF THE DEPARTMENT

CHEMICAL AND PHYSICAL TEXTILE TECHNOLOGY headed by prof. dr. Paul KIEKENS

Advanced and high performance textile materials (prof. dr. Paul KIEKENS)
Nanoparticles based products and developments: composites, flame retardancy,…

Biotechnology (dr. Tom GHEYSENS)
Biotechnological functionalisation, specific enzymatic surface modification, enzymatic and microbial modification of fibres, biomimetics

FIBROUS STRUCTURES headed by prof. dr. ir. Lieva VAN LANGENHOVE

Smart textiles (dr. ir. Carla HERTLEER)
Conductive textiles, textile sensors, dressing material, impedance spectroscopy, textile antennas, electrotherapy, medical applications

Weaving (dr. Simon DE MEULEMEESTER)
Research and design of stretch fancy yarns
Simulation of weft insertion on airjet and rapier looms

Carpets (ing. Didier VAN DAELE)
Automated assessment of carpet wear, carpet resilience, static electricity

FIBRE AND COLOURATION TECHNOLOGY headed by prof. dr. ir. Karen DE CLERCK

Fibre technology
Fibre morphology and characterisation, electrospinning and nanofibres

Colouration technology
Colour-changing materials, dye diffusion processes, dye-polymer interactions

Electrospinning

POLYMER PROCESSING TECHNOLOGY headed by prof. dr. ir. Gustaaf SCHOUKENS

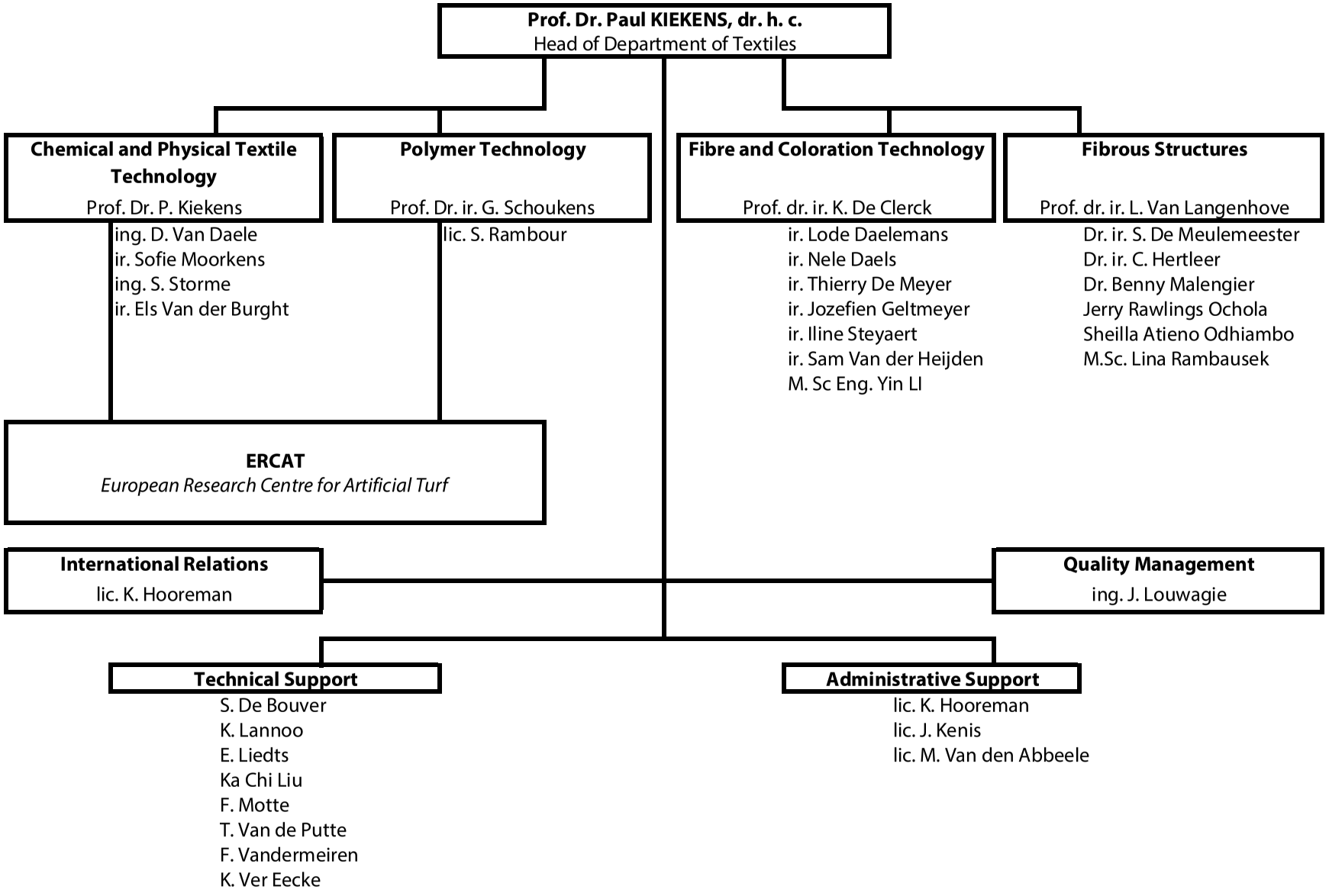
Polymer morphology
Mechanical properties, dimensional stability, permeability of polymer films, crystalline structures, recycling of polymers

Polymer rheology
Viscosity, viscoelasticity, flow stability, molecular weight, molecular weight distribution, extrusion, injection moulding

Polymer reactor engineering
Polymer nanoparticles, polymer nanostructure, polymerization kinetics, long chain branching

Biopolymers
Chitin, chitosan, deacetylation, acetylation, solution properties, biomedical applications

ERCAT: European Research Centre for Artificial Turf (lic. Stijn RAMBOUR)
New polymers, FIFA testing, improvement of resilience, woven artificial turf


Prof. Dr. Paul KIEKENS, dr. h. c.
Head of Department of Textiles
Chemical and Physical Textile Technology
Prof. Dr. P. Kiekens
ing. D. Van Daele
ir. Sofie Moorkens
ing. S. Storme
ir. Els Van der Burght
Polymer Technology
Prof. Dr. ir. G. Schoukens
lic. S. Rambour
Fibre and Coloration Technology
Prof. dr. ir. K. De Clerck
ir. Lode Daelemans
ir. Nele Daels
ir. Thierry De Meyer
ir. Jozefien Geltmeyer
ir. Iline Steyaert
ir. Sam Van der Heijden
M. Sc Eng. Yin LI
Fibrous Structures
Prof. dr. ir. L. Van Langenhove
Dr. ir. S. De Meulemeester
Dr. ir. C. Hertleer
Dr. Benny Malengier
Jerry Rawlings Ochola
Sheilla Atieno Odhiambo
M.Sc. Lina Rambausek
ERCAT
European Research Centre for Artificial Turf
International Relations
lic. K. Hooreman
Quality Management
ing. J. Louwagie
Technical Support
S. De Bouver
K. Lannoo
E. Liedts
Ka Chi Liu
F. Motte
T. Van de Putte
F. Vandermeiren
K. Ver Eecke
Administrative Support
lic. K. Hooreman
lic. J. Kenis
lic. M. Van den Abbeele

VISITORS

Visiting students

Several students from abroad stayed at the department to follow lectures and to perform research in the framework of their thesis or were involved in different kinds of laboratory tests.

During her stay, Yasemin AKSÖZ (Anadolu University, Turkey) focussed on research for her Master thesis.

Aybüke GÜNDEMIR (Ege University, Turkey) worked on the topic "smart textiles", more specifically on the polypyrrole and copper coating process of polyester and Kevlar yarn.

Karsten MORTIER (Ghent University, Belgium), Martina HAGNELL (University of Borås, Sweden) and Laura VELDENZ (Tampere University of Technology, Finland) took part in the international programme Master of Textile Engineering (E-TEAM).

Ezgi ISMAR (Istanbul Technical University, Turkey) focussed on research for her Master thesis. Miss Ismar made experimental studies and tried to convert polyacrylonitrile (PAN) nanofibre webs to carbon nanofibres. A PAN nanofibre web was produced followed by an oxidation phase and finally carbonization was applied to obtain a PAN-based carbon nanofibre.

Tiziana MEGJIDI (University of Bergamo, Italy) concentrated on the topic "Development of a textile-opto-electronic sensor for smart textiles".

Konstantina PARITSI (TEI Piraeus, Greece) stayed at the Department for a full academic year and worked on the research project "Electrospinning, chromic materials, blend nanofibres and wound dressing materials".

Aline RWAMASIRABO (ENSISA, Mulhouse, France) performed a traineeship : her tasks comprised a.o. electrospinning tests, hydro-tests on nanofibres and spectrophotometer measurements.

Loukia TOMOUZOU (University of Cyprus) came to the Department as an IAESTE-student. Miss Tomouzou was involved in e.g. the preparation and production of nanofibres by means of electrospinning, ageing and weathering tests on artificial turf and strength tests on carpets, artificial turf, fabrics, etc.

Mindaugas VIZBARAS (Kaunas University of Technology, Lithuania) came to Ghent for one semester and followed a few courses.

Muhammad ZAHID (Politècnico di Torino, Italy) worked on the topic "Electrospinning of gelatin nanofibres using different solvent systems for application in wound dressings".

Visiting researchers

Shpresa CASLLI (Polytechnic University of Tirana, Albania) obtained an Academic Staff Scholarship in the framework of the Erasmus Mundus Action 2 Basileus project.

Igor JORDANOV (photo) (Ss. Cyril and Methodius University, Skopje, Macedonia) received a scholarship for a postdoc mobility of six months (Basileus 4 project).

Yin LI (Taiyuan University of Technology, Shanxi Province, China) has started PhD-studies with the support from the China Scholarship Council.

Jerry Rawlings OCHOLA (Moi University, Kenya) undertook a research stay at the Department of Textiles as part of the Institutional University Cooperation Project with Moi University and VUB.

INTERNATIONAL RELATIONS

Looking for textile research partners?
Looking for high-level textile education?

Let AUTEX be your partner!

AUTEX members:
35 leading universities from 28 countries

AUTEX Mission:
co-operation in high-level textile education and research

AUTEX Objectives:

- Joint development of high-level courses
- Student and staff mobility plus networking
- Creation of active research partnerships
- Promotion of member activities

AUTEX members joined at the annual AUTEX meeting in the Algarve/Portugal

Sofie Moorkens received the E-TEAM award during the Autex Conference organized by TU Dresden in May 2013.

AUTEX Activities:

- European Masters in Textile Engineering (E-TEAM)
- Symposia and conferences
- Research activities and projects
- Online Autex Research Journal

web: **www.autex.org**
e-mail: **secretariat@autex.org**

AUTEX FULL MEMBERS:

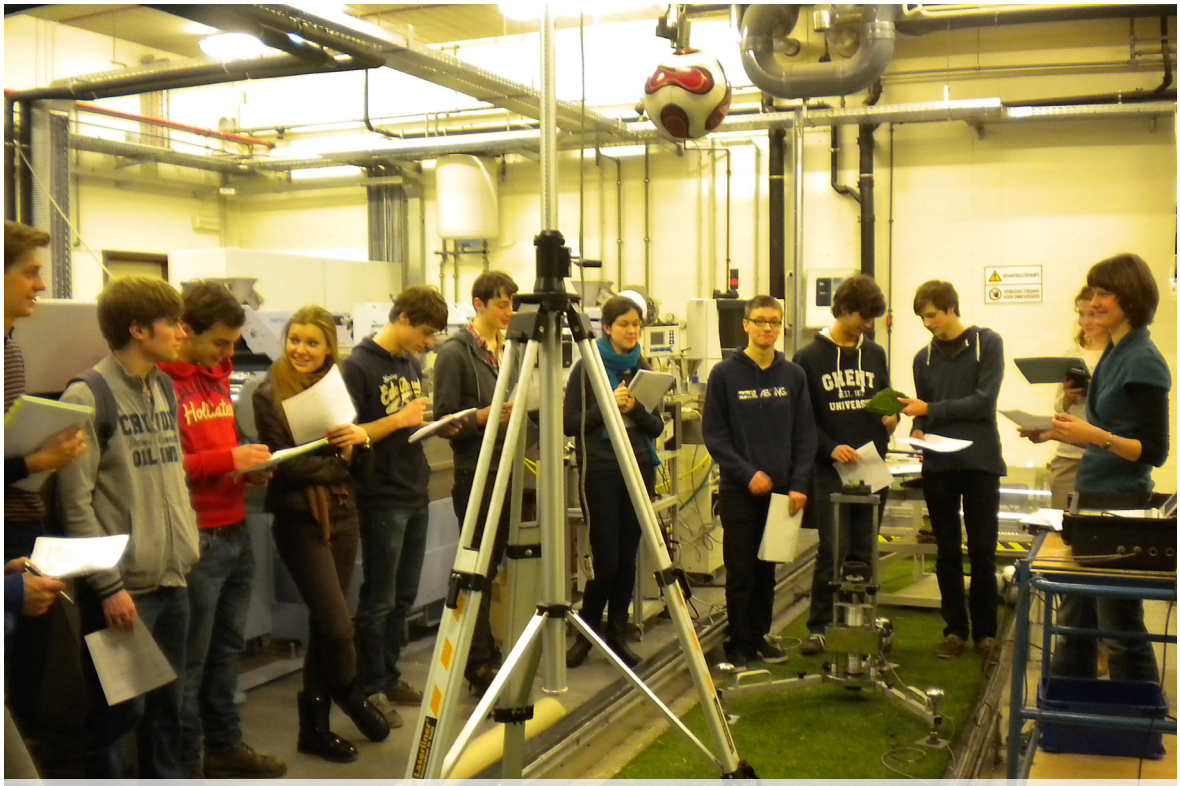
Universiteit Gent, Department of Textiles, Belgium
University of Zagreb, Faculty of Textile Technology, Croatia
Technical University of Liberec, Faculty of Textile Engineering, Czech Republic
Tampere University of Technology, Fibre Materials Science Institute, Finland
ENSAIT, Ecole Nationale Supérieure des Arts et Industries Textiles, France
ENSISA, Ecole Nationale Supérieure d'Ingénieurs Sud-Alsace, France
TU Dresden, Institute of Textile Machinery and High Performance Material Technology (ITM), Germany
Technological Education Institute of Piraeus (TEI), Greece
Politecnico di Torino, Department of Materials Science and Technical Engineering, Italy
University of Bergamo, Department of Engineering, Italy
Kaunas University of Technology, Faculty of Mechanical Engineering and Design, Lithuania
ESITH, Ecole Supérieure des Industries du Textile et de l'Habillement, Morocco
University of Twente, Faculty of Engineering Technology, the Netherlands
Lodz University of Technology, Faculty of Material Technologies and Design, Poland
University of Minho, School of Engineering, Portugal
"Gheorghe Asachi" Technical University of Iasi, Faculty of Textiles and Leather Engineering, Romania
University of Belgrade, Faculty of Technology and Metallurgy, Serbia
University of Ljubljana, Faculty for Natural Sciences and Engineering, Department of Textiles, Slovenia
University of Maribor, Faculty of Mechanical Engineering, Department of Textiles, Slovenia
UPC, Universitat Politècnica de Catalunya, Department of Textile and Paper Engineering, Spain
University of Borås, the Swedish School of Textiles, Sweden
ENIM, University of Monastir, Tunesia
Ege University, Faculty of Engineering, Textile Engineering Department, Turkey
Istanbul Technical University, Faculty of Textile Technologies and Design, Turkey
Uludag University, Faculty of Engineering and Architecture, Textile Engineering Department, Turkey
Heriot Watt University, School of Textiles and Design, UK
University of Leeds, School of Design, UK
University of Manchester, School of Materials, UK

AUTEX ASSOCIATE MEMBERS:

RMIT University, School of Fashion and Textiles, Australia
Wuhan Textile University, China
Shinshu University, Faculty of Textile Science and Technology, Japan
National Textile University, Faisalabad, Pakistan
Ivanovo State Polytechnical University, Textile Institute, Russia
North Carolina State University, College of Textiles, USA

Secretarial support :

lic. Katrien Hooreman (katrien.hooreman@ugent.be)



EDUCATION

MASTER OF SCIENCE IN MATERIALS ENGINEERING

Students who obtained a Bachelor degree (3 years of higher education) can proceed to a Master (2 years) and opt for our **"Master of Science in Materials Engineering"** with main subject **"Textiles"**.

The programme is in Dutch and focusses on the properties and production of natural and synthetic textile raw materials (fibres), processing these materials into semi-finished products (yarns, fabrics, nonwovens, …) and applying finishing (functionalization) techniques for specific applications (high-quality fabrics, interior textiles, technical textiles, …).

Further, the technology, the behaviour of fibres and yarns during processing and the fundamental properties of the structures are highlighted whereas textile materials and processes are explained with special attention to the development of products with specific functionalities (flame retardancy, crease resistance, antibacterial properties, …).

Company visits are integrated in several courses to obtain a better understanding of the industrial reality and to become aware of the diversity, challenges and opportunities in the textile world.

EUROPEAN TEXTILE ENGINEERING ADVANCED MASTER (E-TEAM)

E-TEAM is a unique two-year **Master** programme in the field of textile engineering and science, organised as a full-time programme, lectured in **English**. All **major European Universities** offering textile education participate in the programme, which has a distinct international character.

E-TEAM is organised at multiple locations: the international students move to a different university each semester. This way, they study at minimum three different universities, geographically spread over Europe. The courses are taught by specialised lecturers from the host university as well as from other participating universities. Each lecturer passes on his or her specific knowledge in a course module covering usually one, possibly two weeks. As such, the programme benefits from the strengths of existing **textile expertise in Europe** and covers all modern areas related to textiles.

The last semester, each student chooses a university to write a thesis, often in cooperation with industry.

Next to the traditional lecturing, active techniques are often used such as case-studies, presentation of papers, practical work in laboratories, visits to industry etc. The students acquire many non-technical skills such as knowledge of languages, **cross-cultural experience**, organisational skills and self-reliance.

E-TEAM aims to stem the tide of the continuous lack of interest for textile education among young people. To this purpose, textile education is brought in a **multidisciplinary** way and the strengths of the most renowned education specialists in the domain of textiles in Europe are brought together.
The programme fulfils the demands of a global industry continuously striving for technological innovation, creativity, quality and adequate management.

The programme is **the ideal start to an international career!**

Students taking part in the edition 2012-2014 follow(ed) lectures at **Tampere University of Technology, Finland** (autumn 2012), **Ghent University, Belgium** (spring 2013) and **ENSISA, Mulhouse, France** (autumn 2013).

Students taking part in the edition 2013-2015 follow(ed) lectures at **TU Lodz, Poland** (autumn 2013); **UPC Barcelona, Spain** (spring 2014) and **Ege University, Turkey** (autumn 2014).

The locations for the edition 2014-2016 are : **Ghent University, Belgium** (autumn 2014); **Uludag University, Turkey** (spring 2015) and **ENSISA, Mulhouse, France** (autumn 2015).



From left to right: E-TEAM students with Prof. L. Almeida, Minho University, Portugal; E-TEAM students with Prof. F.J. Carrión-Fité, UPC Barcelona, Spain; E-TEAM students edition 2013-2015.

E-TEAM

European Masters Programme in Textile Engineering

A joint enterprise between Textile Departments of major European Universities

This **two-year programme** (**2014 - 2016**) is organised at
three or four different locations within the group of participating universities

Venue Autumn Semester 2014 Ghent University, Belgium

High Performance Fibres
High Technology Fibres
Technical Textile Manufacturing Technology / Production of Technical Filaments
Nanotechnology in the Textile Branch
Instrumental Analysis
Mechanics of Textile Materials
Biomaterials
Industrial Information Systems
Innovative Methods for the Product Development for Garments and Technical Applications in the Ready-Made Industry

Venue Spring Semester 2015 Uludag University, Turkey

Composites
Textile Composite Structures for Impact Protection
Applications of Technical Textiles
Medical, Transportation and Construction Textiles
Intelligent Textiles
Biotechnology
Applied Textile Process Engineering
Advanced and Specialized Textile Processing - Dyeing and Finishing
Functional Finishing

Venue Autumn Semester 2015 ENSISA Mulhouse, France

Advanced and Specialized Textile Processing – Mechanical Aspects
Garment Technology
Automation and Process Control
Ecological and Environmental Aspects
Recycling
Quality and Environmental Management
Management, Logistics and Distribution
Supply Chain Management

Participating universities

Universiteit Gent	Belgium
University of Zagreb	Croatia
Technical University of Liberec	Czech Republic
Tampere University of Technology	Finland
ENSAIT Roubaix	France
ENSISA Mulhouse	France
Technische Universität Dresden	Germany
Technological Education Institute of Piraeus	Greece
Politecnico di Torino	Italy
Kaunas University of Technology	Lithuania
ESITH Casablanca	Morocco
Universiteit Twente	The Netherlands
Technical University of Lodz	Poland
Universidade do Minho	Portugal
Gheorghe Asachi TU of Iasi	Romania
University of Ljubljana	Slovenia
University of Maribor	Slovenia
Universitat Politècnica de Catalunya	Spain
University of Borås	Sweden
Ege University	Turkey
Istanbul Technical University	Turkey
Uludag University	Turkey
University of Leeds	UK
Heriot Watt University	Scotland, UK
North Carolina State University, CoT	USA

Spring semester 2016 - Thesis at one of the participating universities

General information : Ghent University
Department of Textiles
Technologiepark 907, 9052 Zwijnaarde (Ghent)
BELGIUM

Web: autex.UGent.be/eTeam
e-mail : secretariat@autex.org
Tel. : +32 (0)9 264 57 50
Fax : +32 (0)9 264 58 46

Coordinators : Ghent University, Belgium
Uludag University, Turkey
ENSISA, Mulhouse, France

General coordinator : Prof. dr. Paul KIEKENS, Ghent (Belgium)

RESEARCH & INNOVATION

The European Textile and Clothing Industry has set up a permanent expert network to develop scenarios and a strategic development agenda for long term competitiveness of this sector based on research, technology and innovation.

The **"European Technology Platform for the Future of Textiles and Clothing"** was launched by the European textile and clothing industry represented by Euratex, the European Apparel and Textile Organisation. The platform joins all interested stakeholders: the textile and clothing industry itself, related industries and service providers, the research and education community and public authorities at all levels.

9 thematic working groups have been set up, in 5 of them the Department of Textiles is represented:

1. New speciality fibres & fibre-composites for innovative textile products
   (prof. dr. Paul Kiekens, prof. dr. Karen De Clerck)
2. Functionalisation of textile materials & related processes
   (prof. dr. Paul Kiekens, prof. dr. Karen De Clerck)
3. Biomaterials, biotechnologies and environmentally friendly textile processing
   (prof. dr. ir. Gustaaf Schoukens, prof. dr. Karen De Clerck)
4. New textile products for human performance (medical, protective, sports)
   (prof. dr. ir. Lieva Van Langenhove)
5. Smart textiles and clothing
   (Prof. Van Langenhove is chairing this group on behalf of AUTEX)

cost

European Cooperation in the field of Scientific and Technical Research

The department participates in a number of COST actions:

COST Action FA0904 on *Eco-sustainable Food Packaging Based on Polymer Nanomaterials (PNFP)* aims to exploit the potentiality of polymer nanotechnology in the area of food packaging treating in a complete way the demanding needs of the users, such as health, environment, taste, cost and the specific requirements of the food industry. Already 28 COST countries and 5 non-COST countries (Canada, New Zealand, the United States, Algeria and Brazil) joined this Action.
www.costfa0904.eu

COST Action FP1003 on *Impact of renewable materials in packaging for sustainability - development of renewable fibre and bio-based materials for new packaging applications* focuses on packaging solutions based entirely on renewable resources in order to remove the serious disadvantages associated with future paper and board packaging solutions that continue to rely on non-renewable materials. Already 19 COST countries and 1 non-COST country (New Zealand) joined this Action.
www.action-fp1003.eu

COST Action MP1206 on Electrospun Nano-fibres for bio-inspired composite materials and innovative industrial applications. By forming an interdisciplinary knowledge platform the COST Action will strengthen the European R&TD on electrospun nanofibrous materials and nanofibrous composites and will generate fast progress in the state-of-the-art. The COST Action will cover scientific breakthroughs and innovations in the electrospinning process itself, nanofibrous materials and nanofibrous composite advancements and the post-treatment processing of electrospun materials. Applications in the biomedical and technical fields as well as health, societal and environmental issues are considered. Already 25 COST countries and 8 non-COST countries (Australia, Canada, China, Japan, New Zealand, Puerto Rico, Singapore and the United States) joined this Action.
www.electrospinning-cost.eu

COST Action MP1105 FLARETEX on *Sustainable flame retardancy for textiles and related materials based on nanoparticles substituting conventional chemicals*
www.flaretex.eu

This COST Action started in Spring 2012. It is chaired by Prof. Paul Kiekens and Ghent University has been appointed Grant Holder.

The main aim of the COST Action is to form a European multidisciplinary knowledge platform on sustainable flame retardancy in order to facilitate the rapid development and commercialisation of fire safe textiles and related materials of low toxicity and ecotoxicity, using all the available or novel technologies. In particular, this platform will help to promote cooperation between researchers from different scientific disciplines, efficiently exchanging ideas and strategies in order to lead developments in fire safety, fire retardants (FR) and environmentally friendly fire retarded textiles and related materials.

The COST Action MP1105 is organised in 4 Working Groups (WG) :
* WG1 : Novel flame retardants:
New and environmentally friendly (halogen-free) nanobased Flame Retardant (FR) systems are investigated and/or developed. Synergistic effects derived from combining nanoparticles with conventional FRs and their potential effectiveness are studied. Molecular modelling of thermal degradation will be applied in order to get new insights into the mechanisms by which new FRs affect the flammability of textile (based and related) materials.
* WG2 : Toxicological/environmental aspects:
FRs obtained in WG1 are being investigated for their fire toxicity, ecotoxicological and environmental impacts (LCA). The risks and benefits of using flame retardants in consumer products will be analysed both qualitatively and quantitatively. In general, the appropriate human exposure and environmental life cycle risks will be assessed .
* WG3 : Processing/Applications/Commercialisation:
Application processes (such as plasma coating, spinning, sol-gel, (photo)chemical, …) of the novel FRs to textiles or textile related materials are being studied, developed and optimized. The general aim is to minimize the amount of novel FRs but still assuring the best fire performances of the treated materials. Work in WG3 will facilitate the mechanism to commercialize the best products/processes through intensive cooperation with the industrial partners
* WG4 : Testing/Standardisation:
According to the requirements needed for the different application (sub)sectors, new test methods and performance standards can be developed. Durability tests for the novel FR will be standardized as well. Flammability tests might be superseded by fundamentally based small-scale test methods for making material property measurements that can be used as input to validated end-use computer models.

Highlights in Networking in 2013 :
- Scientific workshop on 'Innovative Flame Retardant Systems (applications and testing)', Maribor, Slovenia, 27-28/03/2013 : 65 participants (photo)
- MC meeting + Scientific workshop on 'Nanoparticles for flame retardancy: challenges and risks', Krakow, Poland, 15-16/05/2013 : 85 participants
- Scientific workshop on 'Electrospun Nano-fibres for bio-inspired composite materials and innovative industrial applications in textiles' (in cooperation with MP1206), Istanbul, Turkey, 30-31/05/2013 : 63 participants
- COST MP1105 workshops in Fire Retardancy and Protection of Materials Conference (FRPM'13), Lille, France, 30/06 – 4/07/2013: 225 participants
- Scientific workshop 'Multifunctional textiles based on hybrid coatings and nanoparticles', Naples, Italy, 17/09/2013: 62 participants
- WG4 Standardization meeting 'Flame retardant textiles/textile composites: Legislative landscape, EU vs. member states', Bolton, UK, 14-15/10/2013: 50 participants
Further, 7 Short-Term Scientific Missions (STSM) have been performed within the 1st Action year.

A COST Action gives the chance to young scientists to have a working experience abroad of minimum one week and maximum 3 months. These Missions (Exchange Visits) are aimed at strengthening the existing networks by allowing scientists to go to an institution or laboratory in another COST MP1105 member state to foster collaboration, to learn a new technique or to take measurements using instruments and/or methods not available in their own institution. Interested applicants must use the on-line registration tool https://e-services.cost.eu/stsm and submit his/her full application to the STSM coordinator, Prof. Victoria Dutschk, V.Dutschk@utwente.nl, and to the Chair of the Action, Prof. Paul Kiekens, paul.kiekens@UGent.be.

By the end of 2013 already 24 COST countries and 1 non COST country (South Africa) have joined the Action.

Contact:
COST.MP1105@UGent.be
Chair of the Action: Prof. dr. Paul Kiekens (Paul.kiekens@UGent.be)
Scientific Coordinator: ir. Els Van der Burght (Els.Vanderburght@UGent.be)

Science Officer : Dr. María Moragues Cánovas, COST Office (maria.moragues@cost.eu)

SMART TEXTILES

COMMERCIALIZATION CLUSTERS OF ORGANIC AND LARGE AREA ELECTRONICS (FP7-ICT-2011-7-288881)
www.colae.eu

COLAE is a pan-European initiative to promote the commercial exploitation of organic and large area electronics in Europe. The project combines 18 partners from 12 countries, representing all major European OLAE competence clusters. The aim is to speed up the commercialization and adoption of organic and large area electronics by promoting collaboration between industry clusters throughout Europe.

The Department of Textiles is a partner in the European funded project. Its main task is to establish a link between Organic Large Area Electronics and the field of Smart Textiles. This will be achieved through involvement in different work packages: Feasibility Network, Towards Virtual OLAE Foundry and Open Innovation Model for OLAE Industry. The department wants to make end-users aware of existing technologies and train people from different fields like electronics or material science, informing them about the options to apply organic electronics in textiles and vice versa. In the work package 'Feasibility Network', the department will answer questions from companies and use its network of European research centers to give feasibility advice. In addition, the department supports the work in mapping the European R&D landscape related to smart textiles. A network hub of expertise will be built up, which companies can use to assess the viability of implementing their product ideas using OLAE technologies. As for the 'Towards Virtual OLAE Foundry' work package, it supports the alignment process of the OLAE centres towards becoming a service provider for SMEs and LSEs by effective resource management. The objective of the work package 'Open Innovation Model for OLAE Industry' is to develop and disseminate the relevant open innovation models for the OLAE sector by taking into account market requirements and needs as well as the strengths of the OLAE industry value chain.

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Smart Textiles Week: Workshop and Smart Textiles Salon 2013, Vol. 3

The so-called Smart Textiles Week was organized by the Department of Textiles (UGent) at the Museum of Industrial Archaeology and Textiles (MIAT) in Ghent and at the Textiles Open Innovation Centre (TIO3) in Ronse from June 3rd to 6th 2013. The Institute for permanent education (IVPV UGent) supported the organization of the event.
The week was composed of three major parts:
• LECTURES packed with theory related to Smart Textiles,
• TOOLTIME, a workshop in which a smart textile project was put into practice and
• SMART TEXTILES SALON 2013, an interactive exhibition showcasing the latest prototypes from topnotch academic and industrial research, as well as prototypes close to market introduction.
Lectures were given by Prof. Lieva Van Langenhove (UGent). A guest lecture with the title "Life cycle analysis (LCA) and Eco-design for Smart Textiles" was given by Natascha van der Velden (TUDelft, NL). The transfer of this knowledge into hands-on practical implication was guided by Riccardo Marchesi (INTEX/plugandwear.com) with assistance of Evelyn Lebis (SaturdayLightFever). The participants in this workshop had to create a smart textiles luggage travel balance that indicates when the luggage reached weight limitations. For successfully completing the Smart Textiles Week, ECTS credits could be collected by the participant.

On June 6th 2013, the third edition of the interactive exhibition Smart Textiles Salon Vol.3, was held at the Textile Museum MIAT in Ghent, Belgium. Like in earlier editions, the Department of Textiles at Ghent University put together a comprehensive set of prototypes from the field of smart textiles and wearable electronics. An impressive collection of 30 prototypes was shown to the audience, representing state-of-

the-art research, conceptual design and products close to their market introduction. Presenters from all over Europe came to showcase their technology.

In addition during the event, the second module of the TRITEX e-learning course on smart textiles was launched. The online e-learning tool introduces the user to the world of smart textiles, and gives information about the materials and functions that can be achieved with smart textile technology.

The Smart Textiles Salon was supported by the following projects:
•SYSTEX, a coordination action for enhancing the breakthrough of intelligent textile systems (EC FP7, www.SYSTEX.eu)
•COLAE, which aims at accelerating the commercialization of organic and large area electronics (EC FP7, www.COLAE.eu)
•2BFUNTEX, boosting collaboration between research centres and industry (www.2BFUNTEX.eu) and
•TRITEX, valorizing research and innovation in textiles (Interreg IV project, www.E-TRITEX.eu)

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SYSTEX STUDENT AWARD 2012

In order to stimulate and promote student projects in the area of smart textiles and electronic systems embedded into textiles, the Department of Textiles launched an Annual Student Award during the SYSTEX project.
Competitors are invited to present their projects by describing the objectives and results obtained during their PhD, university project or personal work. The project needs to be based on the development of a prototype, both design and technical projects are considered and evaluated. The winner of the award is invited to present his/her project during an event in the field of Smart Textiles and receives a prize.

In 2013, our department proudly presented the SYSTEX Student Award 2012 to Ms Eve Lubbers from TU/e Technical University Eindhoven, The Netherlands.

In this edition, the award comprised:
• Participation in the Smart Textiles Salon in June 2013 (including travel, accommodation and fees for the framework training programme)
• Publication on the SYSTEX platform
• A voucher for 3 months Innovation and Business Development Coaching from the Textile Incubation Centre (TIC).

The prize was awarded in recognition of Eve's outstanding student work in the field of smart textiles and wearable electronics. Eve won the competition by submitting a report with the title 'UNLACE – Interactive Lace Lingerie'. Unlace is an interactive lace lingerie garment which allows partners to connect by becoming more aware of touch, time and warmth. The man's touch on the woman is sensed by the garment, after which the surrounding threads slowly heat up and change from black to skin color, 'undressing' the woman and guiding the man's hand to another spot to touch. The old craft of bobbin lace making was the inspiration for this project. By combining this technique with unconventional and smart materials, Unlace was developed.

Eve Lubbers,UNLACE – Interactive Lace Lingerie

The new call for applications related to the SYSTEX Student Award 2013 will be launched in Spring 2014.

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Science in the street

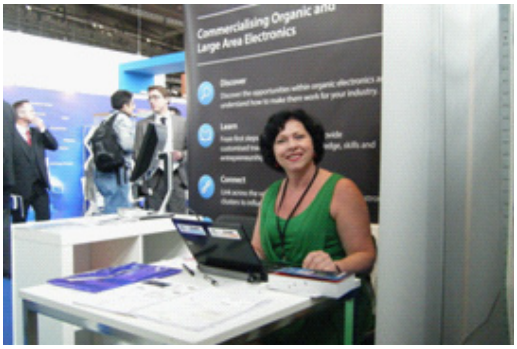
With a tent or a fair stand full of activating experiments we toured several districts in the city of Ghent. We wanted to give – often underprivileged – children the opportunity to experience what science is all about.

During the summer months (August till October), the areas in the 19th century belt were visited by the mobile lab. People and children passing by, who had e.g. been informed through the activity calendar of vzw Jong, could take part without engagement, have a look around and ask some information. We aimed especially at children between 7 and 12 years old and their parents.

By giving them the experience of science at a very young age, we hoped to increase their enthusiasm for science and technique. In the long run, this could change the educational choices they make in secondary school and bring about a higher intake of underprivileged groups in higher education. In the meantime, their parents could get acquainted and ask questions to UGent staff members about higher education and the social relevance of science and technique. Every time, another researcher of UGent, Hogent or Artevelde came to present his or her research.

Science in the street at the Brugse Poort on September 25th, 2013

Participation in Techtextil at Messe Frankfurt in June 2013



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E-LEARNING SMART TEXTILES

www.e-tritex.eu

MODULE 1
FUNCTIONAL & SMART TEXTILE MATERIALS

Need a **headstart** in smart textiles?

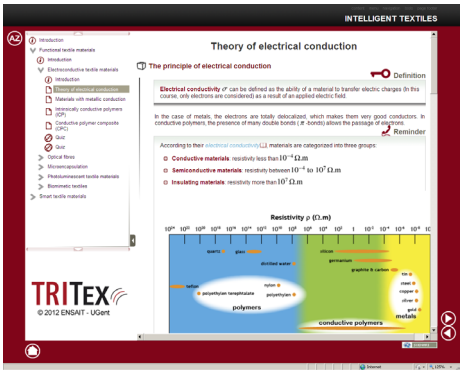
Module 1 provides the **physical and chemical concepts** of smart textiles with clear working principles and practical examples

MODULE 2
SMART TEXTILE SYSTEMS

Need **in-depth insight** in smart textile technologies?

Module 2 describes the **building blocks** needed to develop smart textile **systems** illustrated with pictures and schemes.

SUBSCRIBE
www.e-tritex.eu/form-e-formation



TRITEX
TRANSFER OF RESEARCH AND INNOVATIONS IN TEXTILES

MODULE 1
TOPICS

Functional textile materials
- Electroconductive materials
- Optical fibres
- Microencapsulation
- Photoluminescent materials
- Biomimetic textiles

Smart textile materials
- Chromic materials
- Phase change materials
- Shape memory materials
- Hydrogels & superabsorbents
- Auxetic materials
- Shock absorbing materials
- Piezoelectric materials

MODULE 2
TOPICS

Smart Textile Systems
- Definition
- Electrodes and sensors
- Actuators
- Data processing
- Energy production and storage
- Interconnections
- Data communication system

HOW?

COURSE
online AVAILABLE 24/7
for a period of 12 months

INTERACTION
- online with experts
- in seminars/workshops

CERTIFICATE
granted after passing of test & participation in seminar/workshop

RATES

Module 1: € 1000 (no VAT)
Module 2: € 1000 (no VAT)
Modules 1+2: € 1500 (no VAT)
These prices apply for customers from the Euroregion North of France - Flanders

Group rate: 50% discount on subsequent subscriptions

INCLUDED IN THE PRICE:
- online access to course
- seminar on smart textiles
- workshop
- forum access
- certificate
- printed course material

Cooperation/Coopération
ENSAIT & UGent - Dept. of Textiles
With support of / Avec le soutien de :

European Union European Regional Development Fund
INTERREG IV France • Wallonie • Vlaanderen
EFRO Europa investeert in Vlaanderen
Vlaanderen In Actie
met steun van het Agentschap Ondernemen
Provincie Oost-Vlaanderen

ALL4REST - INTEGRATED SOLUTIONS TO IMPROVE THE QUALITY OF REST (FP7-SME-2010-1 262652)

http://all4rest.aitex.net/

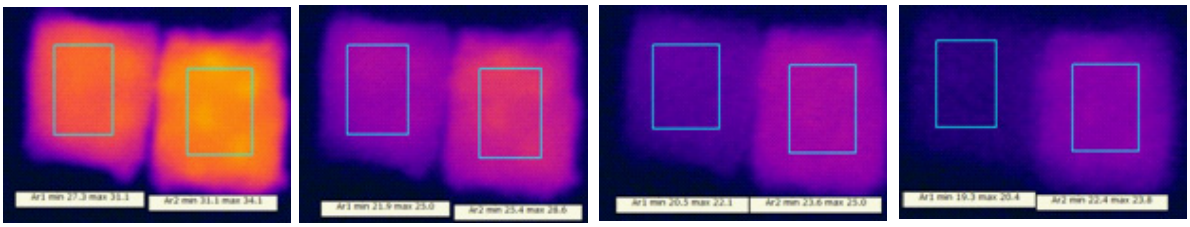
All4Rest is a European SME driven project that involves 13 partners coming from Spain, Germany, Portugal, The Netherlands and Belgium. The project started from the need to improve people's rest and sleep quality in order to avoid stress and pathologies related to sleep disorders.

To this end, four specific R&D lines were proposed, strategically chosen for the SMEs involved:

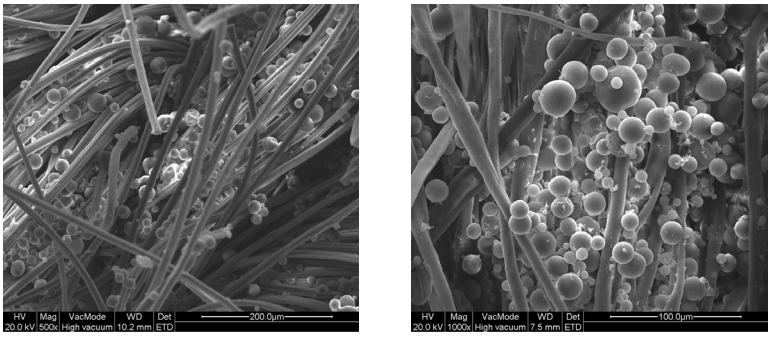
- green materials and processing technologies for the development of improved comfortable resting systems
- encapsulated systems for comfort improvement: defining suitable materials to develop microcapsules and scent inks in order to improve thermal comfort
- heatable/cooling textiles for thermal comfort improvement
- textile integratable sensors for body movement and temperature

These innovations are integrated to develop **new rest systems**. The intention is to have them characterized and validated by specific comfort evaluations tools. The relation between the quality of sleep and tactile/ thermal comfort will be studied in quantitative and qualitative terms.

In the framework of this project, student Mert **Özçelik** from *Istanbul Technical University*, **Turkey**, performed his thesis at our department. He studied the effect of microencapsulated phase change materials (PCMs) integrated into mattress ticking on its thermal behaviour. Since PCMs create a thermal buffer, they can increase the thermal comfort while sleeping.



Thermographic images show that a fabric treated with PCMs (right) cools down slower than a fabric that is not treated (left).



SEM images of yarns with microencapsulated PCMs

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HYDRAX (IWT SME INNOVATION AND CROSSTEXNET ERA-NET PROJECT 120252)
Duration: 03/2013 - 02/2015

Hydrax is an SME project developed together with the company ELASTA and submitted under the CrossTexNet programme. It involves several partners from the North of France region: the SMEs Kindy, Afitex and SARL Tissus and the research partners HEI (Hautes Etudes d'Ingénieur) and ENSAIT (Ecole Nationale Supérieure des Arts et Industries Textiles).
The HYDRAX consortium aims at developing a textile-based thermal flux meter which can be used in textile applications in order to detect temperature differences, such as in firefighting gear, sports and medical textiles or in geotextiles.
The final objectives of HYDRAX are:
* to develop a self-propelled textile sensor that detects and analyses the presence of various liquids;
* to characterize and measure the heat and mass transfer by means of the textile sensor;
* to design a textile flow meter that is flexible, adaptable, sensitive, resistant (to certain applications), autonomous and that can be integrated in a system (clothing, geotextiles…);
* to develop a realization process of a high-performance textile flow meter taking into account simplicity, ecofriendliness and affordability.
HYDRAX will define the requirements of every application separately. As a function of the application, the consortium will study some mechanisms more in detail, such as burns with firemen, heat and mass transfer of the skin to the environment with body supervision, or humidity and fluid control through fabrics with medical and geotextiles applications.

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SMART@FIRE (EU FP7-PROJECT 317898)
Duration: 15.11.2012 – 15.02.2016

More than 100 firefighters across Europe die in action every year while saving others. They lose their way in smoke, become surrounded by a sea of flames, get cut off by sudden rising water and continually find themselves in perilous situations.
Brigades need innovative ICT solutions that continuously measure environmental parameters and a firefighter's vital functions. Sensors determine their position in buildings and on the field; eg. in the case of forest fires. Localisation systems assess situations better – both on the ground and at a distance (Data transfer). All this is integrated into an equally innovative 'smart' firefighter suit.
•Smart@fire is a European project (2,2 million euros) aimed at encouraging and financing companies and researchers specialised in ICT, sensors, transmission, localization and visualization systems or smart textiles.
•961 European fire and rescue services were asked to indicate their innovation expectations. It showed there is a great demand for localization, visualization and transmission systems that can function optimally in the most difficult situations.
•Entrepreneurs and researchers from all over the EU will come together in unique sessions for exchanging knowledge and experience with fire brigade procurement officers.
•Prototypes will be developed and tested with financial support of the European Commission (FP7).
•The ultimate goal is to develop cost-effective and functional Personal Protective Equipment on a large scale for a broad market.

Combining strengths and expertise from various countries and sectors, Smart@fire is a joint research and development project for companies and researchers on demand of fire services. For this, it employs a unique and novel procurement method developed by IWT that consists of three stages, preceded by a large scale needs assessment conducted with 961 fire and rescue services.

* STAGE 1: Smart@fire first organizes market consultations in France, Germany and Belgium, where potential suppliers and procurement officers can engage with each other. Find the dates and themes and register online at www.smartatfire.eu.

* STAGE 2: Next is the pre-commercial procurement in which Smart@fire will arrange THE DEVELOPMENT OF WORKING PROTOTYPES AND A TEST RANGE OF PERSONAL PROTECTIVE EQUIPMENT (PPE) with integrated ICT-solutions, all with a view to eventual large-scale production.

* STAGE 3: Based upon positive test results, EU fire and rescue services will purchase the developed smart suits by launching a final joint EU tender.
For more information: see **www.smartatfire.eu**

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SMARTPRO - SMART TEXTILES AND WEARABLE INTELLIGENCE:
from smart prototypes to industrial and practical products
(IWT, VIS programme, 10/2013 - 09/2017)

We define smart textiles and wearable intelligence as the collection of (textile) materials and (textile-based) products incorporating one or more electronic components and/or communication capabilities.

In this context, Centexbel, Sirris, IMEC, HoGent, KHBO, DSP Valley, UGent, KULeuven and iMinds have started the SMARTpro project, financed by IWT.

The focus is not on the development of "new electronic systems or prototypes" but on the industrial processability and applications of smart textiles and wearable intelligence in :
* safety and intervention
* (home) care
* sports and leisure
* technical applications

Therefore, we choose to work exclusively with reliable and modular electronic systems and software. We will build on the knowledge already acquired in many other European and other R&D projects.

Complex systems will be avoided. "Keep it simple" and "less is more" are guidelines determining the selection of e-systems and industrial application or assembling techniques.

Who are the end-users and industries who may benefit from mature smart textiles and wearable intelligence technologies? We would like to involve companies (suppliers, manufacturers, process equipment developers...) from a variety of backgrounds, such as textiles, confection, ICT and electronics.

By simultaneously engaging the end-users and other actors (care providers, sports clubs, security services, intervention services, laundries, recycling companies…) in the project, we are also focusing on the users' specifications and needs in the different application fields.

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CRYSALIS - the revival of textiles (Interreg IVa 2 seas project ; 08/2011 - 09/2014)
www.crysalis-network.eu

The department of Textiles produced an introductory film on Smart textiles, funded by a Science Communication Grant from Ghent University. The film was co-financed by the "CRYSALIS project of the city of Renaix (Ronse)".

The film glamorizes the different components of smart textiles, the potential and the remaining action points. Are you curious to see the result? Please have a look at the website (http://textiles.UGent.be -> research/research-themes/smart-textiles).

Other partners in CRYSALIS are the University for Creative Arts (UK), Integria (UK) and the city of Calais (FR). The ultimate aim of this international project is to promote textiles in Europe by attracting new customers, students, entrepreneurs and workers and to stimulate the transfer of technology and expertise. The movie on Smart Textiles is just one of the tools developed to achieve this goal.

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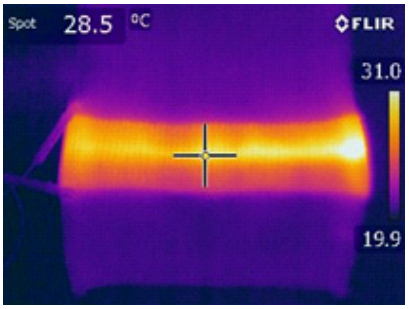
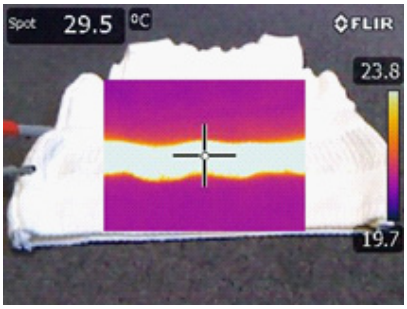
THERMOGRAPHIC CAMERA

In the early days of 2013, the Department of Textiles applied for an innovation project in the field of education. The budget was assigned and used to purchase a thermographic camera, which, amongst others, can be applied to visualize heating of materials.

Textiles are not merely used in clothing; there are also many other industrial applications. Special properties, such as thermal insulation and flexibility are of vital importance. Nowadays, due to recent developments in the field of smart textiles, electroconductive yarns are being used more frequently for all kinds of applications (medical, heating, …). Electroconductive textiles, for instance, contain metal fibres or their surface is coated with a metal layer. At this moment, students use a four-point measurement to check their electroconductivity. Any corresponding heat generated by the current can only be 'sensed'.

With an **infrared thermographic camera**, it is possible to visualize on screen the insulating/warming properties. Such a camera is also capable of showing any minor heating caused by running a small amount of electrical current through a conductive yarn. The plan is to use the thermographic camera during classes and practical exercises. The properties described are then immediately visible for all students.





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RESEARCH ON FIBROUS TRANSISTORS: PH.D. WORK

In the department's research group on smart textiles, focus is laid on giving electronic functions to textile structures. Therefore, central attention is paid to one of the smallest, but fundamental, building blocks in smart textile systems: the transistor.

Transistors play a significant role in electronic circuitry and fulfil various functions, such as the amplification and switch of electronic signals and power. Nowadays, many research groups in the textile world are working on textile versions of their rigid electronic companions. At the Department of Textiles, Lina Rambausek is working on the realization of a concept which incorporates many research challenges: building a transistor on a filament. The main goal of this Ph.D. project is to produce a transistor in a truly textile version.

In detail, this involves research on materials and process technologies, such as fiber coatings, as well as on conductive, semi-conductive and insulating materials. The Ph.D. work concentrates on transferring the structure of a non-textile transistor onto a filament. Hence, the challenge is to overcome the difference in shape and rigidity between the two substrates: from flat and rigid to a flexible substrate with curvature. To achieve this, polyester filaments are equipped with four different layers. First, a gate layer is applied through electroless deposition of copper. Then, a dielectric layer is added by dip-coating in polyimide and subsequently in TIPS-Pentacene, which is a soluble organic semi-conductor. Finally, the source and drain electrodes are printed or evaporated onto the structure. Process technologies are chosen with an eye on future production. Therefore, wet processes and continuous production, as used in textile industry, are preferred.

Since this research topic deals with a multidisciplinary field, collaboration with various other departments of Ghent University (Department of Inorganic and Physical Chemistry, Department of Electronics & Information Systems (ELIS)) as well as with other universities and research institutes (Hasselt University, IMEC) is essential. Furthermore, the work is strongly linked to the COLAE project, as the research includes work on organic semi-conductors.

Picture lab setup

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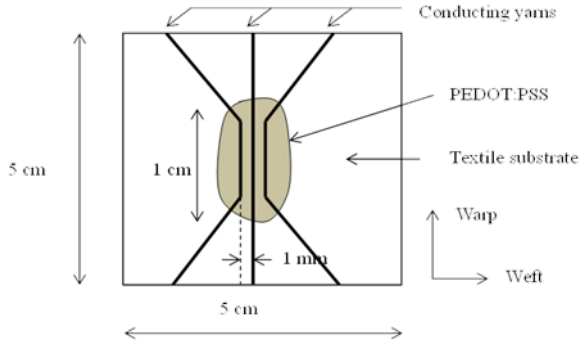
Textile “Capatteries” made from PEDOT:PSS and pure stainless steel filament yarn electrodes: PH.D. WORK

The aim of this research is to develop an all textile energy storage device for smart textile applications. The energy supply/storage device is an important component of a smart textile system, as it provides the required energy to power it. Current prototypes of smart textiles employ detachable, rigid, weighty batteries; they reduce the comfort of wearable clothing. Thus, there is need to produce lightweight energy storage devices, which are flexible and embedded within the textile structures. This should be done without compromising the comfort and other desirable aspects of the textile.

A ‘capattery’, which is a hybrid of a battery and a capacitor, has been developed from a conductive polymer PEDOT:PSS used as the electrolyte and pure stainless steel filament yarn as the electrodes, well embedded in the textile substrate. The conductive yarns are sewn onto a textile substrate and then systematically coated with the PEDOT:PSS material, resulting into a light and flexible structure. The capatteries are precisely defined in the figure below.

The developed devices can be charged for 2 hours at a constant voltage of 1.5V. However, they experience a self-discharge. The discharge curve is characterized by an immediate quick voltage decay as soon as the device is disconnected from the charging within a few seconds, then the voltage is maintained at about 0.4V over a long period of time. The self-discharge takes as long as 16 hours, before the capatteries are considered empty. The charge-discharge process can be repeated severally, up to 15 times before any degradation is observed. The physics/chemistry behind the charge storage is still under debate. Overcoming of self-discharge of the device would bring better results of the device.



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BIOTECHNOLOGICAL FUNCTIONALISATION OF TEXTILE MATERIALS

Biotechnology

Today's challenge is to turn the enormous potential of biotechnology into an opportunity for the European industry for production and synthesis of textile materials with advanced functionalities. The European textile industry has a great demand for innovative high-tech materials with special properties and added functionalities, like smart and biomedical textiles.

The general aim of our research is to give specific functions to textile materials using modern biotechnology. The research will result in new, specific knowledge and technologies to create biotechnologically modified textile materials with unique properties. The application of functional textile (bio)polymers is typically in the field of (bio)medical, safety, care and signalling/detection, but also in less obvious application areas such as e.g. tissue engineering, separation technology and potentially even in aerospace research. Application of biotechnology is not just limited to biological materials; enzymes are able to modify synthetic materials as well.

Surface Functionalisation

The research is based on a concerted multi-disciplinary approach. This will result in a drastic increase of knowledge, thereby creating the possibility to produce biotechnologically functionalised textile materials with unique surface properties and functionalities.
The focus is on:

- Enzymatic modification and functionalisation of PET
- Chemo-enzymatic surface functionalisation of textile materials
- Incorporation of biocatalysts into textile fibres
- Biomimetics in textile and fibre engineering

Control of biocatalytic action at correct time and length scales is a prerequisite to achieve the desired functionalities. Therefore sophisticated technologies and processes will be explored in order to design novel production processes for textiles that exhibit the desired functionalities.

The research on biotechnological functionalisation of textile materials will build upon expertise available at several biotechnological research groups at Ghent University, VIB and from other European universities, hence generating new research needs. The results will open up innovative applications in various pharmaceutical and medical disciplines.

NO BUG - NOVEL RELEASE SYSTEM AND BIO-BASED UTILITIES FOR INSECT REPELLENT TEXTILES AND GARMENTS

(FP7-NMP-2008-SME-2-228639) ; 10/2009 - 10/2013
www.no-bug.info

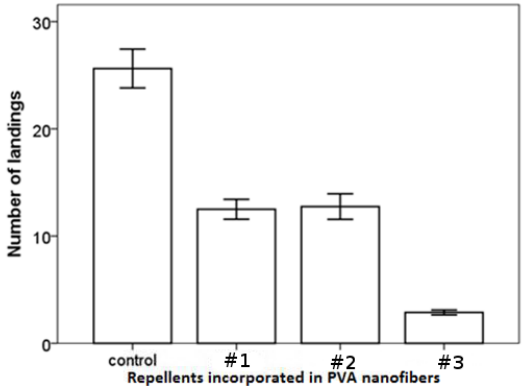
Results of the No Bug project

No Bug was a project within the 7th framework programme of the European Commission. The purpose was to develop new ways of integrating insect repellent agents in textiles. The No Bug project had to find a solution for several problems with existing products: the used agents were harmful (to humans or in waste water), insects became increasingly resistant to the products and the way to apply the products shortened the duration of protection.

No Bug Methods
First, Laboratory of Entomology, Wageningen University, Department of Biology, Ghent University and CNRST selected insect repellent agents to work with. About 4 promising natural components were selected and the partners also identified workable biorepellents. In a first phase, these would still be combined with permethrine, which is a commonly used, but non-repellent, toxic component.
The participating companies Devan and Utexbel adapted their own products to the selected insect repellent products: new microcapsule products (Devan), and adapted coating techniques (Utexbel).

At the same time, new techniques were developed to increase the duration of protection of the products. The department of Textiles checked the possibility of creating functionalised fibres with the selected components by melt extrusion and electrospinning.
We managed to completely embed a new component in a polyester masterbatch. Also biorepellents could be used in melt extrusion. Apart from that, the components were successfully used in electrospinning. The resulting nanofibre structures were similar to the reference, but obviously repellent, see figure.

No Bug Tests
The products were typically tested by the so-called 'arm in cage test': a person puts his arm in a cage full of insects. New testing methods were developed for No Bug, specifically adapted to textiles. At UWageningen scientists created a textile bioassay enabling fast measurements for textile materials. At the same time, Refotde (Cameroon) set up an adapted field experiment. This setup was used to test the No Bug prototypes of the partners (Hol-Tex, BodyWear, Paul Boyé, JMT).



Decrease of the number of insect landings
for 3 different No Bug insect repellent products,
compared to a control product.

A test person with No Bug pyjamas in Cameroon

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ACHILLE - APPLIED COMFORT AND HEALTH IN LIGHT LEISURE EQUIPMENT (IWT and CROSSTEXNET and ERA-NET PROJECT 100814) 10/2011 - 10/2013

CROSSTEXNET

More than 12 million people in Europe suffer from chronic skin conditions such as dermatitis, psoriasis or atopic eczema.

The Achille project aims at the functionalization of bed textiles, sports gear, protective clothing or baby clothes in order to offer a higher degree of comfort and protection to the skin. The project focuses on the use of vegetable extracts to repair a possibly damaged skin.

The aim is to find a textile release system, from which active components can slowly be released under the influence of friction, temperature or pH and which have a long-term effect on the skin.

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FIBRE & COLOURATION TECHNOLOGY

FIBRE TECHNOLOGY

ADVANCED CHARACTERIZATION OF FIBRE MORPHOLOGY

Many of the current and future projects within the Department of Textiles involve some means of characterization of the fibre morphology. The morphology of fibres is in general very different from that of bulk polymer materials due to the high degree of orientation in the fibres. Also fibres often require separate dedicated sampling techniques due to their specific structure both at macro and at micro level.

Therefore a considerable effort has been spent within the department to develop new or optimize existent techniques for the characterization of fibre morphology. The analytical tools used are diverse with the focus being on thermal analysis (thermo-mechanical analysis, differential scanning calorimetry and modulated differential scanning calorimetry), spectroscopy (Fourier transform infrared spectroscopy and microscopy, DRIFTS, ATR, Fourier transform Raman spectroscopy and UV-VIS-NIR spectroscopy) as well as on microscopy (confocal laser scanning microscopy).

FUNCTIONALISED NANOFIBRE MEMBRANES FOR WATER FILTRATION: PHD WORK

funded by Ghent University's Special Research Fund AOG-BOF 2009: Functionalised nanofibre membranes for water filtration (2010-2014)

The aim of this work is to gain insights in steady-state electrospinning and functionalisation of nanofibre membranes and to evaluate their potential in water filtration. Electrospinning is the most efficient method for the production of nanofibrous structures, which have unique characteristics such as high porosity, high absorption capacity, small pore size and high specific surface area. Thanks to this, they can be used as filtration membranes.

For several years, steady-state electrospinning of nanofibre membranes has been a research topic at the Department of Textiles. The electrospinning process and the properties of the nanofibres are studied. A single nozzle electrospinning setup using a flat collector has been successfully upscaled to a multi nozzle system capable of producing large membranes. Afterwards, the filtration properties of the membranes are determined. This is done in cooperation with the research group Laboratory of Water and Ecotechnology (LIWET) from the Department of Industrial Biological Sciences at Ghent University.

An interesting feature of these microfiltration membranes (with a pore size of 0.1 to 0.4 µm) is the high clean water permeability (CWP) (>6000 $l/m^2/h/bar$) compared to other microfiltration membranes. This allows high flux operation of the membranes. The pathogen removal efficiency of the nanofibre membranes was improved by adding different functional agents with antibacterial properties, such as inorganic nanoparticles or organic biocides.

The goal of the future work is to functionalise the nanofibre membranes with agents that will not only improve the pathogen removal efficiency of the membranes but also the antifouling properties. For example, agents that produce reactive oxygen species are being investigated. In the future, these functionalised nanofibre membranes will also be tested in a pilot scale filtration set-up.

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BIOCOT - INNOVATIVE STRATEGIES AND ASSAYS FOR BIO-ENGINEERED COTTON FIBRES WITH IMPROVED PROCESSING AND END-USER PROPERTIES (private project with Bayer Cropscience NV)

Cotton is the most important natural fibre: it represents about one third of the total world fibre consumption. Despite the intensive and long-lasting use of cotton fibre for textile applications, several steps of the cotton fibre processing are still inefficient or require large amounts of harsh chemicals. Most of the progress in improving these processes and adding new end-user characteristics to the fibre results from new or modified chemical and enzymatic treatments. Little progress is being made by improving the cotton fibre itself. The development of traits in cotton through genetic engineering is a lengthy and costly process that requires a careful selection of the target traits and approaches to be tested.

This project focuses on the first step in this process and determines, within a 2-years time scope, what modifications of the cotton fibre are required to achieve improved functionality in 3 fields:

- reactivity and dyeing
- intrinsic wrinkle resistance
- flame retardancy

It is also important to see whether the introduced modifications do not affect the basic properties of the cotton fibre in a negative way. Therefore, after imparting changes to the fibres, tests were performed with currently available standard cotton tests to get an idea about the general characteristics of the fibres. The tests that are currently available are designed to be performed on fabrics and require at least 100 g to several kilos of material. Hence one of the challenges of this project is to develop and optimize small scale tests which are applicable to extremely low amounts of fibre material.

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STUDY OF COTTON FIBRES MODIFIED AND DEVELOPED FOR HIGH-VALUE APPLICATIONS: PH.D. WORK

Today's cotton fibres have developed over the last centuries, with the fibres being longer and stronger than a few centuries ago. Many of these improvements can be attributed to continuous research and advanced breeding projects. Although quite some work has been done to optimize the mechanical properties, a possible improvement of the intrinsic chemical properties is lagging behind. In this PhD work, the aspects of the cotton fibres' chemical behaviour that would benefit from intrinsic improvements are investigated. This is done by relating the fibre properties to demanding end-user applications. Therefore, various methods are to be established to allow the characterization of the aimed traits on small-scale fibrous samples and moreover relate them to large-scale end-user tests.

This PhD is performed within the programme of the BIOCOT project.

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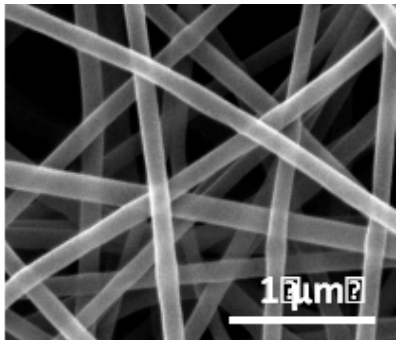
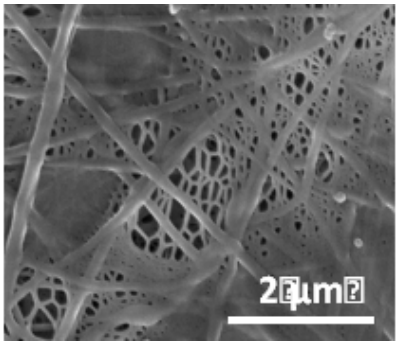
ELECTROSPINNING AND MORPHOLOGY CHARACTERIZATION OF POLYMER BLEND NANOFIBRES: PH.D. WORK

Nanofibrous nonwovens can be used in numerous sectors with great benefit due to their unique characteristics, such as high porosity, small pore size and high specific surface area. However, several high-tech applications demand material properties that can only be supplied by the electrospinning of polymer blends. Blend electrospinning enables the combination of advantageous characteristics of different polymer types, which leads to an improved quality and applicability of the resulting material. The purpose of this work is to study the morphology development and properties of nanofibrous polymer blends.

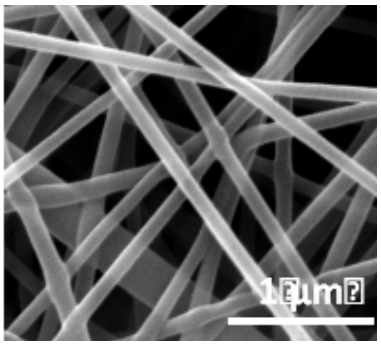
Within this project the focus is two-fold. First, research into mixtures of a synthetic and a biopolymer is highlighted. Blending these polymer types ensures a combination of electrospinnability and biocompatibility, making it possible to obtain end products with unique properties. A second focus is given to the electrospinning of blends containing a high-value functionalised polymer for the production of pH-sensitive colorimetric nanofibres. In both cases, the specific needs for obtaining reproducible materials in the absence of instabilities are looked at through a thorough morphological and advanced thermal characterization of the resultant nanofibres. This approach is to create original breakthrough insights in the international electrospinning community. This is made possible by combining the expertise of the Department of Textiles of Ghent University on electrospinning with the expertise of the Research Unit of Physical Chemistry and Polymer Science (FYSC) of VUB University Brussels on the study of polymer morphology, thermal properties and phase separation for polymer blends.



Stable electrospinning of a synthetic polymer



Unstable electrospinning of a polymer blend



Stable electrospinning of a polymer blend

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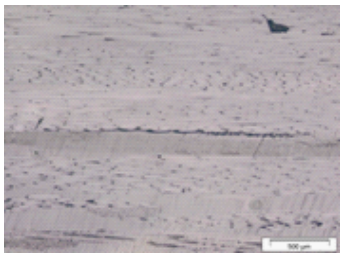
NANOFIBRES IN COMPOSITES
(IWT Strategic Basic Research fund 121156 and Special Research Fund BOF13/24J/020)
Duration: 01/2013 – 10/2017

Thermoset matrix fibre reinforced composites are widely used in industry, due to their light weight, high stiffness and strength. However, these composites still face a serious problem as the thermoset matrix is a brittle material. This can lead to failure of the composite due to relatively low out of plane impacts. It is also the main cause of delamination. Furthermore, it negatively affects the fatigue properties of the composite. Several solutions have been proposed to enhance the toughness of epoxy composites. Most of them make use of nano- or microsized filler particles, in general it is proven difficult to obtain a homogeneous dispersion of these particles. This leads to agglomerations which can induce stress concentrations and may even reduce the overall performance of the composite. Furthermore, there is a growing concern about health issues involved in the use of nanoparticles.



Thermoplastic nanofibres have the potential to provide a solution for these problems. Nanofibrous webs can be readily embedded in the resin; they have the large benefit of their inherent nanoscale distribution, which may improve the traditional limitations in (nano) particle dispersion. Owing to their macro-scale length, no health hazards are involved in the production and use of electrospun nanofibres. In addition, the nonwoven structure of the nanofibres could initiate toughening by fibre bridging. Moreover, the use of polymers with the appropriate functional groups may further enhance this bridging effect. Recent literature indicates that nanofibres may contribute substantially to the ductility and fracture toughness of the composite. Despite some of the obvious benefits of nanofibres over nano- and thermoplastic particles, the research on nanocomposites with electrospun nanofibres has been very limited. Only a few papers have been published, in which the authors made use of very small-scale samples. Furthermore, a systematic study starting from the processing parameters of the electrospinning till the resulting mechanical properties of the nanocomposites has not yet been done. But both such a study and an upscaling of the production to medium-scale samples are prerequisite for future market applications. Therefore these are the main objectives of this project.
The “nano-scale” parameters such as nanofibre diameter, nanofibre web (thermo)mechanical properties and the effect of different functionalizations will be investigated. These nano-scale parameters will be linked to macro-scale (thermo)mechanical parameters which are highly relevant to industrial applications, whereas the “nano-scale” parameters are highly relevant for a profound understanding of the impact of nanofibres on the (thermo)mechanical properties of composites.

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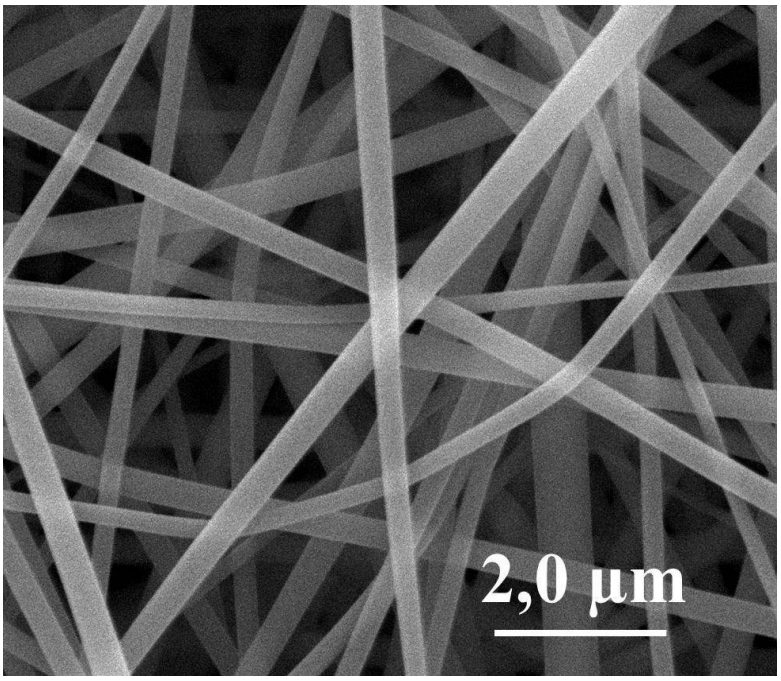
Electrospinning of flexible and functionalised nanofibres using sol-gel technology: PhD Work (IWT Strategic Basic Research fund 121241)

Duration: 01/2013 – 12/2016

Sol-gel technology is a well-known process in materials science to produce dense ceramic materials, coatings, aerogels, fibres, etc. Electrospinning is a relatively simple and versatile technique to produce nanofibrous nonwovens having various compositions. Combining the electrospinning process with sol-gel technology makes it possible to produce ceramic nanofibres. These nonwovens have unique characteristics due to the small size of the nanofibres including a high specific surface area, high porosity and a small pore size. In addition, ceramic nanofibrous nonwovens have a high temperature and chemical resistance. Furthermore, sol-gel technology offers various possibilities to functionalise these nanofibres. As a consequence these nanofibrous nonwovens can be used in multiple applications, such as filtration, composites, catalysis, sensors, etc.

In this PhD project, focus is given to stable and reproducible electrospinning of silica nanofibres. To obtain flexible nonwovens, hybrid structures of silica and polymers will be studied. Finally, further functionalisation of these nonwovens will be carried out using sol-gel technology. This is made possible by combining the expertise of Ghent University's Department of Textiles on electrospinning with the expertise of Ghent University's Department of Inorganic and Physical Chemistry (UGent-SCRiPTS) on sol-gel processes and silica-based sols.



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GAINING A FUNDAMENTAL UNDERSTANDING OF HALOCHROMIC PROPERTIES AND THE INFLUENCE OF THE MOLECULAR ENVIRONMENT HEREUPON: PH.D. WORK

This PhD is funded by a personal grant of Ghent University's Special Research Fund (BOF): "The effect of dye-polymer interactions on the halochromic properties of azo dyes via a combined experimental and theoretical approach".

In recent years, there is a growing interest in developing new sensor materials that respond to external stimuli. Applying chromic dyes onto textiles is a promising route to developing such sensors. Besides dyes that are sensitive to temperature (thermochromism), light (photochromism), electricity (electrochromism) and so on, pH-sensitive dyes (halochromism) have some important advantages. A colour change is easily observable and can thus provide a first warning signal. Furthermore, while covering big surfaces, these 'textile sensors' are capable of giving a local signal by a local colour change.

Research has shown that the behaviour of a halochromic dye is very dependent on the molecular environment of the molecules. When observing a certain colour change in function of the pH in solution, this colour change can greatly alter when the dye is captured within a textile matrix. In some cases the pH-sensitivity even completely disappears. In order to gain a better understanding of the influence of the environment, a combined experimental and theoretical approach is used.

Experimentally, the dye is studied in different environments (solution, dyed onto textile materials, …) and spectroscopy is the main tool for analysis. Because of the direct link to the colour of the species, UV/Vis spectra are mainly used, but also vibrational spectra (IR and Raman) are examined to gain better insight into the molecular structure. Since these spectra are often difficult to interpret, molecular modelling is addressed. In this modelling, quantum mechanical calculations are performed onto the dye molecule using advanced state-of-the-art models to take the environment into account. From this model, theoretical spectra are calculated, which are then compared to the experimental ones, giving us more insight into how the dye interacts with its environment.

The research will allow pH-sensitive dyes and textile fibres to be chosen more wisely and may even lead to developing new dyes in the near future.

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HIGH PERFORMANCE FIBRES & STRUCTURES

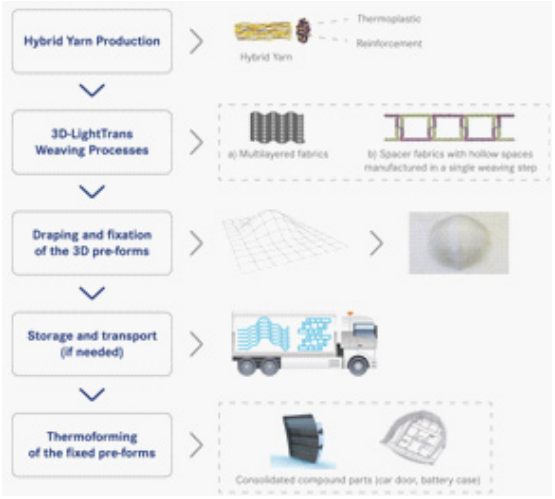
LARGE-SCALE MANUFACTURING TECHNOLOGY FOR HIGH-PERFORMANCE LIGHTWEIGHT 3D MULTIFUNCTIONAL COMPOSITES

(FP7-NMP-2010-LARGE-4-236223 ; 04/2011 - 03/2015)
http://www.3d-lighttrans.com

Textile reinforced composites combine light weight with excellent mechanical properties, while holding the potential for huge material cost savings in comparison with metal. Reinforced composites (often carbon with thermoset matrix) are used for aircraft and a few niche automotive applications, but are too expensive for the mass market due to the long processing cycles and labour intensity. Moreover, their application potential is restricted due to the processing difficulty and lack of flexibility in the realization of 3D-geometries. The 3D-LightTrans project aims to provide a ground-breaking, highly flexible, efficient and adaptable manufacturing chain for the production of integral large-scale 3D textile reinforced plastic composites. This will enable to shift them from their current position in cost intensive, small series niche markets, to broadly extended mass product applications in transportation and other key sectors.

In the 3D-LightTrans manufacturing chain, fabrics made with hybrid yarns will be processed to deep draped pre-fixed multilayered and multifunctional 3D-textile pre-forms. The fixed pre-forms can be easily stored and transported (if needed) without special temperature requirements. The final composite part is produced by thermoforming. Neither manual draping of the textile onto the forming tool nor infiltration/ curing are required, since the preforms are already fixed in the desired 3D geometry and the thermoplastic matrix is integrated in the hybrid yarn before weaving.

Within the consortium of 18 partners, the department plays a role in different aspects. We executed mechanical tests on glass rovings, hybrid yarns and thermoplastic filaments to be used in the modelling of the different process steps. Furthermore, we did investigation into the physical-chemical interface between reinforcement and matrix, related to the quality of the composite. We investigated the abrasion resistance of hybrid yarns, because preventing the yarns from being damaged during the production of the 3D-textile pre-forms is essential for obtaining good specific properties of the material. In the coming year, research will be focused on how to achieve class A surface finish quality.



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2BFUNTEX - Boosting collaboration between research centres and industry to enhance rapid industrial uptake of Innovative Functional Textile Structures and Textile related Materials in a Mondial Market.

(FP7-NMP-2011-CSA-290500 ; 01/2012 - 12/2015)

2BFUNTEX aims at developing a platform for current and future actions in research, education and technology transfer in the field of functional textile structures and textile related materials to support the textile industry in the most efficient and effective way to transform into a dynamic, innovative, knowledge-driven competitive and sustainable sector.

2BFUNTEX will be a platform for all innovation actors involved in European projects including interested companies not yet active in the field and users.

The 2BFUNTEX main objective is to support research and industrial innovation actors, i.e. universities, research institutes along with industry, in their efforts to define joint research projects and actions in the above mentioned field. The aim is to set up multidisciplinary teams oriented towards untapping the experienced potential related to functional materials and to enhance transfer of the vast knowledge available at universities and research institutes to industry and to favour rapid industrial uptake.

Basic objectives:

• **collecting all relevant information** related to ongoing research and activities in the field of functional textile structures and textile related materials using modern detection methodologies (such as the 2BFUNTEX website);
• **detection of synergies and gaps and the creation of project ideas** in the field of functional textile structures and textile related materials;
• **development of an interactive database**;
• **training and education** to increase the number of well-trained people who continue their (research) activities in functional materials related industry and to better train people already employed in industry
• **dissemination**;
• **creation of multidisciplinary teams** performing research in the field of functional materials and oriented towards industry aiming at the creation of new business worldwide.

Main results achieved so far

Creation of an Open Innovation Platform on functional textiles which is available on the project website www.2BFUNTEX.eu with a public area and an area restricted to registered users including (the numbers give the status after eighteen months, one year after the launch of the website):

- A database on projects (75 projects)
- A database on technologies available (49 technologies)
- A list of events (66 events)
- A training database (36 trainings)
- A training materials database (68 materials)

A bibliometric analysis of published literature has been performed to get an overview of research in the field of functional textiles. 3,391 publications were searched and analysed, covering a period from 1990 until May 2012. Topics were identified with their relation to each other, as well as top organizations, journals, cited references and other relevant information for each topic. In a next step, a thorough investigation and identification of patents clusters in functional textiles and fibres was done. Bibliometric analyses were performed to map patents. The basic idea was to get an overview of 'hot' patent topics and applications in the domain of "functional textiles". 8,982 patents were identified and interlinked on the basis of common terms in the descriptive abstracts in IPC codes. The results will be made publicly available on the 2BFUNTEX Open Innovation Platform.

Based on collected training materials & training needs, seven training topics were identified for future development of course modules, namely :

- Smart textiles,
- Nanotechnologies,
- Electrospinning,
- Sustainable materials (advanced sustainable practices across the global textile value chain-design and materials),
- Flame Retardancy,
- Textile recycling
- Protective functional textiles (textiles for personal protection against bacterial/viral environment; chemical, mechanical and electrical hazards and radiation).

Two scientific conferences were organized. The first one was the "2BFUNTEX session" at the AUTEX 2012 conference in Zadar, Croatia, in June 2012, attended by more than 60 participants. The second one was the "International Istanbul Textile Congress 2013 on Innovative and Functional Textiles" in Istanbul, Turkey, at the

end of May 2013 with approximately 300 participants from all over the world. The last conference was followed by a brokerage event and technoshow organized with the help of the European Entreprise Network (EEN).

Based on the analysis of the technology-innovation gaps, 8 multidisciplinary teams (MDTs) that collaborate along the following specific research topics were identified :

- antimicrobial textiles,
- smart textiles,
- nanotechnologies,
- flame retardancy,
- biotechnologies,
- electrospinning,
- plasma,
- sustainable textiles.

During the 4th 2BFUNTEX Foresight & Complexity workshop in Istanbul, Turkey, on 28 and 29 May 2013 the first three multidisciplinary teams have been set up, namely the MDTs on Electrospinning, Smart Textiles and Antimicrobial Textiles. The following topics were discussed in parallel working groups and reported on plenary sessions :

- State-of-the-art
- Goals
- Gaps and synergies

The other 5 MDTs have started in October 2013.

More information on : **www.2BFUNTEX.eu**

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WEAVING TECHNOLOGY

ODMN - Optimized Design for weaving machine Main Nozzles (IWT O&O project 120519 with Picanol n.v.) (2012 - 2014)

The ODMN-project concerns the optimization of the design of main nozzles on air-jet weaving looms. On air-jet looms, the weft is transported from one side of the loom to the other (=insertion) by means of accelerating the yarn with compressed air in the main nozzles. For a good insertion, a main nozzle requires the following properties:
1. Primordially a sufficient performance, meaning a high insertion speed that can be realized.
2. This insertion speed has to be realized without yarn damage. This damage can be of a different nature and is highly dependent upon yarn type. No yarn damage is desired in either the transient start-up phase, nor the insertion at constant speed, nor during the pressure reduction phase at the end of insertion.
3. When the next weft yarn is waiting for insertion, it has to be able to rest within the main nozzles without damage. Usually, the yarn is held in the main nozzle with a low continuous air flow.
4. On a machine at rest, the weaver has to be able to insert a weft yarn into the main nozzle in a simple way, before weaving is started. This also happens with a low continuous air flow, creating a suction effect at the entrance of the main nozzle. This property is referred to as “threadability”.

In order to realize these properties, the goal of this project is to simulate the air flow inside the main nozzle with Computational Fluid Dynamics (CFD) simulations. CFD simulations together with yarn simulations should allow to simulate and analyze the yarn behavior. Test stands have to measure air flows in order to validate CFD simulations and to determine air friction coefficients of yarns for yarn simulations. The goal of this project is to obtain a new, practically producible main nozzle design that meets the above mentioned requirements through an automatized optimization procedure.

The task of the Department of Textiles is mainly limited to yarn simulations.

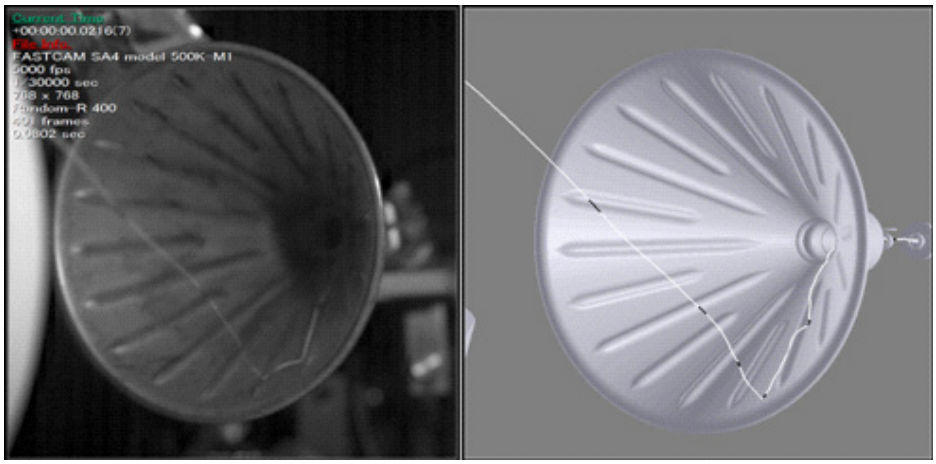

Illustration of highspeed recording of yarn insertion (left) and simulation of same (right)

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IWT O&O project on air splicing with Michel VandeWiele NV (IWT 100990)

Pneumatic splicing is a joining technique for yarn. The most commonly known method for joining two yarns is simply tying a knot. A knot however causes a local increase in diameter of several hundreds of percent and can cause blockages and stoppages when passing heddles on a loom.

For this reason, pneumatic splicing offers an attractive alternative. Pneumatic splicing joins two yarns together by means of subjecting yarn ends to a blast of compressed air in a splice chamber.

This project aims to increase the number of yarn types that can be pneumatically spliced and increase the splice strength by designing better splicing devices. The following information is relevant for pneumatic splicing: preparation of the yarn ends, shape of the splicing chamber, blowing conditions, yarn and fiber properties.

By means of test stands and high speed camera recordings, the splicing process will be studied and the splicing process will be improved in a cooperation between NV Michel Van de Wiele, the Department of Textiles, and Prof. J. Vierendeels of the Department of Flow, heat and combustion mechanics.

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Modelling and applications of braided structures: PhD work Jerry Ochola

Braided structures have very interesting properties in terms of mechanical deformability. The objective of the PhD is to establish models that allow simulations of the mechanical behavior as a function of structure and materials used.

This tool will provide understanding on how such structures can be designed for specific applications. The PhD is carried out in the framework of a VLIR IUS project on capacity building. it is a 4 year sandwich PhD, meaning that the candidate will spend each year 6 months at UGent and 6 months at his home university (Moi University in Eldoret-Kenia).

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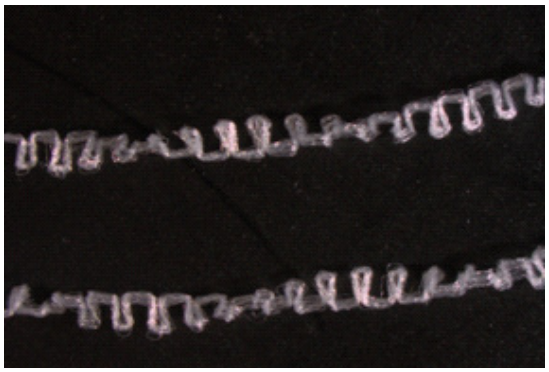
SERVICES TO INDUSTRY

TESTING & CONSULTANCY

The department keeps providing the textile industry with all the support and services it needs in its constant search for improved products and processes. Textile producers and end-users from all over the world turn to us for testing a wide variety of parameters such as strength, wear, abrasion, chemical and UV-resistance, electrical and thermal conductivity, chemical composition, fire resistance, colour fastness etc.

These **tests** are performed **on a wide range of products** such as fibres, yarns, fabrics, carpets, artificial turf, automotive textiles, but also plastics, wood, composites and other materials.

The department also provides **consultancy and advice to textile producers, traders and consumers**. As before, all kinds of technological and scientific aspects of materials and processes were studied in 2013.
Next to standard quality control tests, the department is often solicited for cause analysis of defects and for arbitration in commercial and legal disputes.



Cause analysis of stripes in knitted fabrics

Flammability test – EN ISO 9239

The department participated in DOMOTEX 2013 in Hannover, where numerous people showed interest in our testing and research activities for the floorcovering sector.

The department plays a leading role in testing artificial turf constructions for football, rugby and hockey. A separate unit called ERCAT (European Research Centre for Artificial Turf) was created for this purpose. ERCAT is also closely involved in the development of test methods for artificial turf.
See separate chapter on ERCAT on pages 49-50.

The department is a member of Ghent University's Forensic Institute (FI-UGent). When investigating criminal acts, traces of textiles can provide important information to the police and judicial authorities. A lot of textile know-how is required to successfully undertake forensic fibre analysis.
It was an obvious choice to put the department's textile and fibre knowledge at the disposal of police and judicial authorities by joining Ghent University's multidisciplinary forensic institute with our 'Forensic Fibre Research' group (www.fiugent.be).

NOTIFICATION

The Department of Textiles is recognized world-wide as a Notified Laboratory for testing of carpets according to EN 14041, of wood flooring according to EN 14342 and of 'surfaces for sports areas' according to EN 14904 (European construction products Regulation CPR 305/2011). The Notification Number is NB 1611.
The department also performs tests for CE-labeling of geotextiles.

ACCREDITATION

For several decades now, the department of Textiles has been accredited; currently according to ISO 17025. The department always valued high quality standards and the first accreditation was obtained as early as 1994.

This accreditation includes physical tests, chemical tests, tests on floorcoverings, flammability tests as well as field and laboratory tests for football (FIFA), hockey (FIH) and rugby (IRB).

STANDARDIZATION

The department is an active participant in the standardization activities on floor coverings within ISO TC 219, CEN TC 217 and CEN TC 134.

CEN TC134 WG8:
The new standard EN 1307 will be available at the end of the year 2014. The revision of EN 1471 (Textile floor coverings – Assessment of changes in appearance) is progressed to the enquiry stage.

ISO TC 219 WG1:
Revision ISO 9405 Assessment of changes in appearance.
The project leader reports that the progress on development of reference scales takes more time than estimated. WG1 asks for the standard to be adopted by TC219 to directly submit a DIS text.

Revision ISO 11856: Textile floor coverings - determination of fibre bind.
The text will be updated as soon as possible. Since the DIS was accepted by 100% of the votes, WG 1 proposes to go directly to the publication of an International Standard.

Revision of ISO 12951: Lisson test methods.
Secretary report doc N579 indicates that the DIS vote has not been launched . The CD needed to be registered in February 2013. WG1 asks for a resolution to be made by TC219 to submit a DIS text to the vote and therefore asks the project leader, Didier Van Daele, to make the DIS text available.

Warren Meade presented the joint work of "equitable testing for carpets" done by Didier Van Daele (Department of Textiles, Ghent University), Geoff Robinson (an Australian consultant working for AWTA and Woolmark) with the laboratory of Godfrey Hirst and AgResearch (see doc. ISO/TC219WG1 N1040). The focus was on the effect on the laboratory assessment and how it related to the 1500/8000 Hexapod cycles as being used by the Wool interests since 1984. The trial was done on a limited number of samples (6 wool carpets, 4 polyamide carpets) trying to include market representative styles.

The trial indicated that there was little or no change (for all wool samples and for 3 out of 4 polyamide samples) between the 1500/8000 (without underlay) and the 4000/1 2000 cycles results. Therefore, a recommendation is made to gather more evidence since a general reduction of the cycles for all fibre types would increase the productivity of the testing equipment. Results on more frequent vacuuming during the Hexapod test did not reveal an improvement of the final result. The convenor proposed to present these results to the CEN/TC 134 WG8 meeting in Oslo at the end of May so as to make arrangements on the gathering of more evidence (broader number of samples) since the development of an ISO classification scheme depends on the availability of a worldwide recognized and accepted testing scheme (ideally one apparatus, one set of cycles). The development of an ISO classification scheme should be considered if all major markets accept to adapt the ISO scheme as a basis for own (national) schemes (mutual recognitions) with possibilitiesof national related areas of application (examples of use).

The department also actively participates in the standardisation work on geosynthetics in CEN TC 189 and ISO TC 221. Several working groups held meetings throughout the year and a plenary CEN meeting was held in May in London.

Status of the work:

Adaptation of the 10 application standards to the new CPR (construction product regulation) has been prepared in 2013. Since producers have to provide DoP's in all European languages, a list of translations is being circulated to all TC members.

In Working Group 3 on mechanical testing, discussions were held on EN 13719 (pull-out test), prEN 14574 (pyramid puncture), EN ISO 10319 (tensile test) as well as EN ISO 12957-1 and 12957-2 (friction).

In working group 4 on Hydraulic testing, new versions of CEN/TS 14417 (wet/dry cycles) and 14418 (freeze/thaw cycles) were circulated for comments.

In Working group 5 on Durability, heavy discussions have been ongoing on the issue of declaration of long-term durability (up to 100 years). A first proposal has been rejected by the commission. A second proposal has then been circulated for approval. The test methods and settings of the oxidation tests have changed significantly in some cases, so producers might face a lot of extra tests to fulfil the requirements of the new standard.

The Department of Textiles also actively takes part in CEN TC 217 'Surfaces for sports areas', where it is a member of WG 6 "Synthetic turf surfaces" and WG 11 "Test methods for sports surfaces".

2013 was an important year, because a lot of standards were reviewed and updated, such as the EN 15330-1, the European classification standard for artificial turf. Discussion is still ongoing about the necessity to change the European standard from the old Berlin Athlete to the Triple A. Until now, the Berlin Athlete is still necessary for the EN standards.

BELAC
ISO/IEC17025

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UNIVERSITEIT GENT

ERCAT
EUROPEAN RESEARCH CENTRE FOR ARTIFICIAL TURF

ERCAT is the **artificial turf research and testing centre** at the Department of Textiles (Faculty of Engineering and Architecture) of Ghent University.

ERCAT is accredited for field and lab tests for the sport government bodies of **FIFA** for football, **IRB** for rugby and **FIH** for hockey.

FIELD TESTS

ERCAT is accredited by FIFA, FIH and IRB to do field tests all over the world. On the next page, you find a map with a green flag in all the countries ERCAT has already tested fields. In these field tests, the interaction between the ball and the surface, and between the player and the surface is examined.

This test is a guarantee for the quality of the artificial turf and the playing characteristics of the field.
ERCAT is also doing the complete follow-up of the installation of pitches, from subsoil to foundation layers to the installed grass.

Green flags : locations where ERCAT is or has been active

LAB TESTS

ERCAT is accredited by FIFA, IRB and FIH to do lab classification of football, rugby and hockey products. In the ERCAT laboratory, we test and investigate new artificial turf structures and yarns before fields with these materials are installed. ERCAT is testing the ball-surface and player-surface interaction, but also the wear of artificial turf.

Some test methods developed in research projects can be added to the regular laboratory tests: filament resilience, 12m-lisport, flat UV tester, …

RESEARCH

ERCAT is more than a testing laboratory. For many years, the department is performing intense research into the new artificial turf fibres and structures. The most recent knowledge of polymer and fibre technology is appealed to, supported by an extensive set of testing and measuring devices for both laboratory and field tests. ERCAT is working on new test methods: sliding tester, filament resilience, Infrared lisport, interaction between filament and infill materials, ...

For this research ERCAT has a bicomponent extruder from the company Oerlikon Barmag for the production of monofilaments. With this extruder PE, PP, PES and PA monofilament can be made, next to bicomponent yarns with a core out of one material and a outer shell out of another material.

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M.Sc. Stijn Rambour (Stijn.Rambour@UGent.be)

Bicomponent Extruder

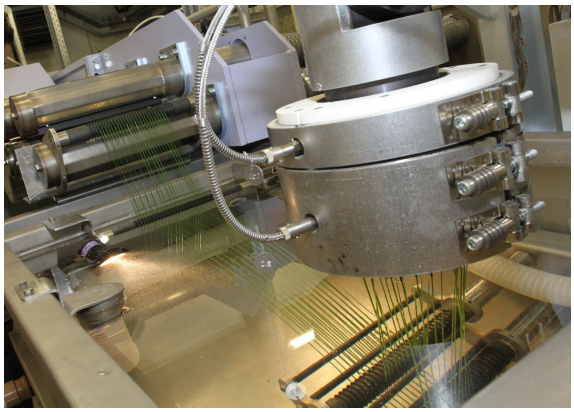
The department acquired, with the support of the *Hercules Foundation*, a **semi-industrial coextrusion line** for the production of monofilaments for artificial turf applications. The set-up allows scientific research on monofilaments produced under industrial conditions. Research is planned into new coextruded monofilaments, new polymer combinations for the production of these multilayer monofilaments and a new form of the stalk of grass for sports applications. Material choice and the optimal combination of polymers are emphasized. The aim is to integrate more sports-technical properties, optimisation of the resilience, static and dynamic transformation of the monofilaments, friction coefficient, wheather resistance and recycling of the monofilaments.

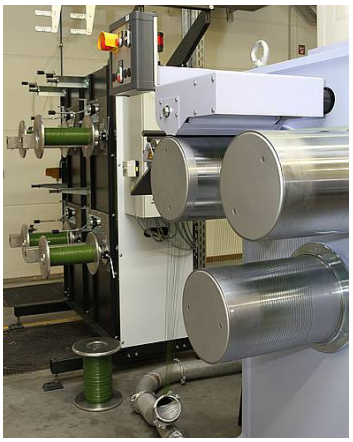
The research into multilayer monofilaments must lead to a further breakthrough in the acceptance of artificial turf for sports applications and a better temperature control of the artificial turf fields.

The **bicomponent extruder** is developed in cooperation with the company *Oerlikon Barmag* and is equipped with:

- 2 extruders with a 30 mm diameter and a 24 L/D relation;
- a barrier screw for the extrusion of polyester and polyamide
- a barrier screw for the extrusion of polyethylene and polypropylene
- 2 melting pumps
- 2 filters
- a spinning plate for monocomponent filaments
- a spinning plate for bicomponent filaments
- a water bad
- a dry system for the filaments
- 2 stretching units with 300 mm rolls
- a 3m oven for the drawing of the monofilaments,
- a spinfinish applicator and a winding unit

The coextrusion line is available for research activities in consultation with the research group “Polymer Technology”. For more information, contact Stijn.Rambour@UGent.be.





EUROPEAN NETWORK OF MATERIALS RESEARCH CENTRES

The European Network of Materials Research Centres (ENMat) consists of a number of materials research centres from different European countries. By the end of 2013, 23 materials research centres from all over Europe are a member of ENMat.

Mission of the European Network of Materials Research Centres

1. To **encourage and strengthen** the creation of knowledge, dissemination of results and beneficial use in materials science & technology.
2. To be the **leading network for materials based innovations** for students, researchers, engineers and industry in Europe.

Objectives

- To create a responsive, flexible, innovative, agile and adaptive **network** of leading European Materials Research Centres.
- To **facilitate co-operation** in interdisciplinary research, development and training amongst members, from fundamental research to innovative application.
- To encourage student and staff **mobility** and networking amongst members and invited or co-operating partners.
- To **promote** the activities and achievements of the members on a European and global stage.
- To **facilitate partnerships** amongst members and temporary partners with materials related industries.
- To invigorate *Science, Engineering and Technology (SET)* outreach through the Network.
- To identify challenges and opportunities in SET and best practice.
- To **identify the needs** of industry, in particular SMEs, in Europe and implement targeted co-operation by seeking high added value for clients/partners/sponsors.
- To respect the highest ethical recommendations to promote Sustainable Development and to overcome barriers hindering creativity.

ENMat is open to all **multidisciplinary** research centres in materials sciences in Western and Eastern Europe, which cover different topics of materials (e.g. metals, polymers, biomaterials, textiles, ceramics, composites, cement-based materials, electronics, semiconductors, wood and wood-based materials, coatings, biofilms, chemicals).

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- VTT Technical Research Centre of Finland, Espoo, **Finland**

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