RESEARCH HIGHLIGHTS

DEUTSCHE INSTITUTE FÜR TEXTIL- UND FASERFORSCHUNG DENKENDORF

DITF REPORT

January 2020 – Nr. 1

AI Coaches & AI EscapeROOM

Support for medium-sized textile companies

Artificial intelligence in the industrial environment is currently on everyone's lips and is an important follow-up topic to digitization and Industry 4.0. The German government considers artificial intelligence (AI) to be one of the key technologies for the future of German economy. At the end of 2018, it defined the national AI strategy to strengthen Germany's competitiveness in the field of digitalization. The DITF have therefore received additional support within the framework of the Textile Networked Competence Center funded by the BMWi, in order to prepare application examples and procedures for artificial intelligence for the industry in cooperation with the Hahn-Schickard-Gesellschaft. Since September 2019, the four "AI coaches" of the Competence Center have been showing small and medium-sized companies what artificial intelligence can be used for and what opportunities this opens up for companies in the textile and clothing industry. "The potential for the use of artificial intelligence in the area of data analysis and evaluation is enormous," explains Sebastian Micus, who conducts on-site training courses together with Dr. Heiko Matheis for the DITF.

AI coaches Dr. Heiko Matheis and Sebastian Micus

In addition to the on-site activities of the AI coaches, the DITF is currently setting up the AI EscapeROOM, in which virtual, real and mobile demonstrators will be used to make the possibilities of AI applications for medium-sized textile companies tangible. The aim of the AI EscapeROOM is to reduce fears of contact and reservations towards artificial intelligence in a playful way. For example, the structure of an artificial neural network is explained with the help of a pressure-sensitive textile surface. An AI-based classification of body shapes for the selection of fit-specific clothing is also presented. "It is important to emphasize the opportunities that artificial intelligence offers, especially to smaller companies," says Matheis.

Point of contact:
heiko.matheis@ditf.de
sebastian.micus@ditf.de

CONTENT

Further development of the DITF strategy

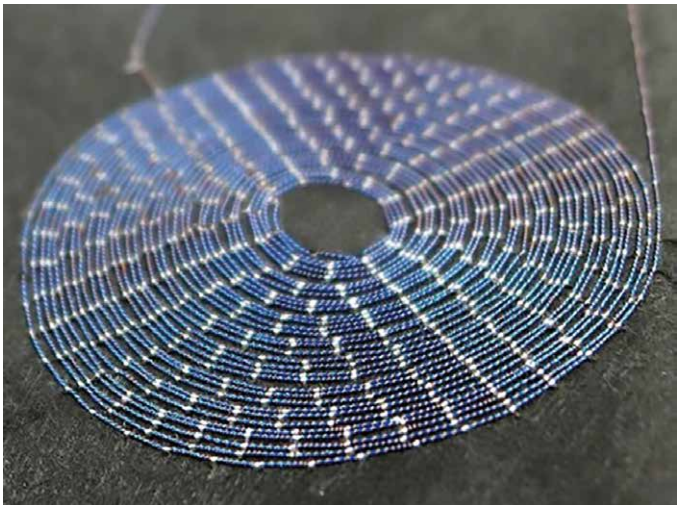
In the past year, the DITF have continued to work intensively on the strategy process that was started in 2017 and in particular have continued developing the work focused on the further development of the DITF's structures. We will inform our clients and partners in detail about the results and effects in the next DITF report after the details have been worked out. In this context, it was also determined that the DITF Board of Directors will be chaired starting this year. In the future, the Chairman of the Board will alternate between the scientific boards on an annual basis. The Chairman of the Executive Board was appointed for the first time as of January 1, 2020 by the former Speaker of the Executive Board, Prof. Dr. rer. nat. habil. Michael R. Buchmeiser, who will hold this position until the end of this year.

Wireless transmission of measured values

Textile sensor technology without loss of textile processing and usage properties

Despite ever-increasing digitalization, smart and commercially available products in the textile segment are below the forecast market expectations. The reasons for this are the loss of textile processing and usage properties due to the integration of electronic components, an increased cost structure and a partial lack of electrical engineering know-how in textile SMEs.

The AiF project "Wireless transmission of measured values via winding yarns integrated into textile surfaces for short distances" (IGF project no.: 20210 N), which is currently in the middle of its term, addresses these problems by developing a purely textile sensor technology. This will be separated from both the energy supply and the data processing and will enable the measured value transmission inductively and thus wirelessly. Within the two-year duration of the project, intelligent tablecloths will be developed as examples, which interact with electronics integrated into a table. The following functionalities will be implemented with tablecloths: detection of seat occupancy, ordering function and an event/game application. Using specially developed wrapping threads, the first functional samples have already been realized in terms of embroidery technology, which show the detection of approach and touch in a sample table using electronics built into the table. Currently processes are underway to integrate further functionalities in tablecloths. In the further progress of the project, influencing variables of this technology will also be investigated and described, so that the results can later be broadly transferred to the industry.



Intelligent tablecloth with integrated wrapping yarns

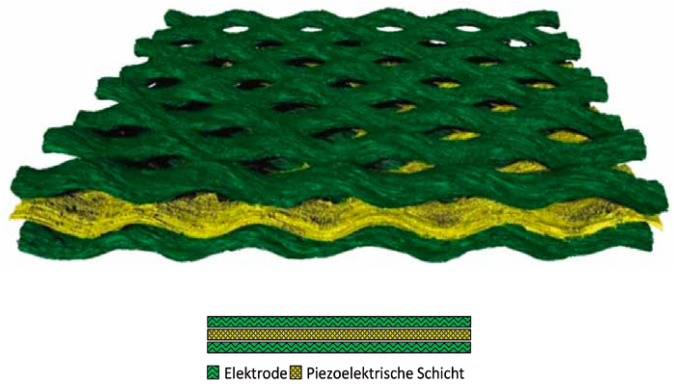
Point of contact:
christoph.riethmueller@ditf.de

Tissue-based bending sensor technology

Continuous monitoring of dynamically loaded FVK components

One form of damage to fiber-reinforced plastics (FRP) is delamination. This damage is often not detectable by conventional visual inspection. Methods such as the cyclical replacement of components or regular inspections are time-consuming and above all expensive. The detection of such defects requires complex non-destructive testing methods such as ultrasonic testing or computer tomography.

Within the research project, a fabric-based bending sensor system was developed and characterized as part of the woven reinforcement structure of FVK. The sensor fabric structure has hardly any negative influence on the mechanical properties of the component when suitably bonded and does not require any foreign materials, fiber deflections or interruptions for its function. With the help of purely textile, piezoelectric bending sensors in a multilayer fabric structure, it will be possible in future to detect possible overloads during operation, to avoid or detect possible damage and thus to considerably minimize maintenance, repair and downtime costs. The integrated sensor technology enables continuous monitoring during operation of dynamically loaded components and additionally guarantees the safety of the component. In addition, a high interlaminar shear strength can be achieved by a targeted bonding or binding of the individual layers within the multilayer fabric structure, thus reducing the risk of delamination. In the project, various FRP structures with short-circuit-proof, sensor reinforcement textiles based on multilayer fabric were produced, which showed a direct dependence of the sensor signal on the applied force. A polarization of the piezoelectric interlayer of the created samples generates a significantly increased sensor signal for each multilayer fabric structure. In the path-controlled dynamic three-point flexure test performed, the "through-the-thickness" connection showed the highest sensor signal. This connection of the layers by a z-reinforcement thread also shows a very high interlaminar shear strength.



Piezoelectric bending sensors in a multilayer fabric structure

Point of contact:
paul.hofmann@ditf.de

Twist shifting for rovings

Higher proportion of recycled fibers in the yarn can be achieved

The raw cotton costs in the staple fiber spinning mill amount to more than 40 % of the yarn production costs. The addition of recycled staple fibers in yarn production enables a reduction in material costs and the manufacture of sustainable and environmentally friendly products. However, increasing the proportion of short fibers by using recycled fibers is problematic. The loss of adhesion due to the higher proportion of short fibers must be compensated for by increasing the twist so that flyer sliver breaks are avoided and the unwinding of the roving in the ring spinning creel is guaranteed.
This topic is taken up by a current AiF research project, which is optimising the twisting element on ring spinning machines: By developing a device for twist shifting of roving frames on ring spinning machines, the degree of twist increase in the processing of short fibers can be reduced while maintaining the same process reliability. The new device shifts the twist in such a way that, on the one hand, the roving is present at the drafting system entrance with considerably less twist (25 % – 75 % less roving twist) and, on the other hand, there is sufficient twist in the section between the roving bobbin and the twisting device for undisturbed unwinding. The twist shifting leads to a reduction of the drafting forces as well as to an improvement of the yarn evenness. The proportion of recycled fibers in the yarn can be increased. Thus, raw materials or recycled materials that have not been considered so far can be used more often.
The basic principles of the twist shifting effect were investigated in the project on a self-built pre-drafting force measuring device with two-coloured zebra rovings. The settings of the apron width were optimised in relation to fiber length and roving twist. The twist distribution system was adapted and tested on a spinning tester and a ring spinning machine.

Twisting element in front of the drafting system of a ring spinning machine

Point of contact:
juergen.schneider@ditf.de

ITVP: worldwide exclusive license with Evonik

Effective immediately, the ITVP will produce a range of resorbable homopolymers (PGA), co-polymers (PGLA), and block copolymers (PGA-CL and PGA-TMC) exclusively for Evonik. These glycolide-based polymers are offered by Evonik as RESOMER G, RESOMER GL, RESOMER GC, and RESOMER GT and close the gap in the RESOMER portfolio for polymers with a short degradation time of less than two months. The polymers are specifically designed for the production of monofilaments and multifilaments as well as other processing options such as 3D printing, injection moulding, nonwoven technologies, etc.
In addition to pure polymer synthesis, the ITVP and Evonik also offer cooperation in the area of further processing of the polymers into textile-based medical products. This cooperation, ITVP's entire product portfolio, and its services in the development and testing of medical devices will be the focus of the company's presence at the T4M Technology for Medical Devices trade show in Stuttgart from May 5 to 7, 2020.

EVONIK
KRAFT FÜR NEUES

Nonwoven Innovation Academy at the DITF

From 15 to 17 October 2019 the DITF hosted EDANA, the European Nonwovens Association. More than 100 participants from research and industry from all over the world met at the Nonwoven Innovation Academy to report and discuss new technologies and products in the nonwoven industry and their applications.
The visit to the DITF was the opening event for all participants. On a special platform, top experts, from the mechanical engineering industry to the furniture group, presented future topics of the nonwovens industry and sustainability and had intensive discussions with the participants in a small circle. The following two days were dedicated to technological and scientific presentations in the plenum.

Wrapped and bedded in algae

Innovative products made from SeaCell™, a cellulose fiber made from eucalyptus wood and brown algae extracts

SeaCell™ is a fully biodegradable, extremely absorbent, breathable and naturally antibacterial cellulose fiber made from eucalyptus wood and algae extracts. It is produced by smartfiber AG, Rudolstadt, using the innovative and environmentally friendly Lyocell process. Luisa Kahlfeldt, master student at the ECAL in Lausanne, explicitly devoted herself to this cellulose fiber in her master thesis with the technical support of the DITF. The result was two monomaterial products: a reusable diaper and a sleeping bag without zipper and buttons.

Sensu sleeping bag without zipper and buttons

Sleeping bag Sensu

Sensu's design aims to challenge and improve the construction, materials and sustainability of traditional sleeping bags. Sensu's fabric or filler is 100 % SeaCell™. The sleeping bag is constructed without zippers, buttons or other fastening mechanisms, thus avoiding the usual mix of materials that is difficult to dispose of. The sleeping bag is held together by a series of innovative double layers, providing versatility and comfort. The use of SeaCell™ makes the sleeping bag extremely breathable, extremely soft and naturally antibacterial thanks to the brown algae. At the same time, the material provides excellent insulation, thermoregulation and moisture absorption – SeaCell™ absorbs moisture 50 times faster than cotton. For many nature-loving outdoor consumers, the sustainability of their equipment is very important. The innovative sleeping bag Sensu provides valuable suggestions for new alternative product developments.

Sumo cloth diaper

Sumo is 100 % SeaCell™ and was developed for multiple use. The material is extremely soft, depending on the version, and is ideal for a product with direct skin contact. Seaweed is rich in essential substances such as vitamins, trace elements, amino acids and minerals. The natural moisture level of the skin allows an active exchange of these beneficial substances between the fiber and the skin. Thanks to the patented high-tech lyocell process, the positive properties of the algae are permanently retained in the fiber, even after several

Reusable diaper "Sumo" made from SeaCell™

washing cycles. In combination with the smooth, hydrophilic and warm feeling eucalyptus wood fibers, this gives a perfect combination.

A patented technology ensures that the reusable diaper fits correctly: the leg openings are made of knitted fabric to ensure the necessary elasticity. Other parts are made of woven fabric with a cord-like structure. In order to maintain the monomateriality, the fastening is also released without button and velcro. Parents can adjust the size on a long strap. Knotting is best on the back. No toddler can pull on the bow.

The development has already received three awards, including the James Dyson Award and the Special Vitra Award. At the same time, the material developed by Dezeen has been awarded as one of the ten most innovative materials of 2019.

Point of contact:
stephan.baz@ditf.de

NOTED BRIEFLY

AVK Innovation Award

In cooperation with partners, the DITF have developed a new fiberglass mesh for lightweight construction, which is used in the backrest of car seats. The submission "Design and process development for functionalized fiber composite structures with complex shaped hollow profiles (FuPro)" won second place in the "Processes/Procedure" category of the AVK Innovation Award 2019.

The AVK – Industrievereinigung Verstärkte Kunststoffe e.V. has been awarding special innovations in the field of fiber reinforced plastics (FRP)/composites for many years.

The awarded research team (from left to right): Prof. Dr.-Ing. Markus Milwich, Dr.-Ing. Hans-Jürgen Bauder, Dagmar Ewert, Dr.-Ing. Stefan Schindler

International Bionic Innovation Competition

Maryam Aliabadi, scientist at the DITF, was awarded third prize in the International Bionic Innovation Competition at the International Symposium of Nature-Inspired Technology 2019 together with her project partner Zhan Bin from Jilin University (China). The prize was awarded for their work on "Improved micro-oil droplet coalescence for oil-water separation by spider silk-like structures".

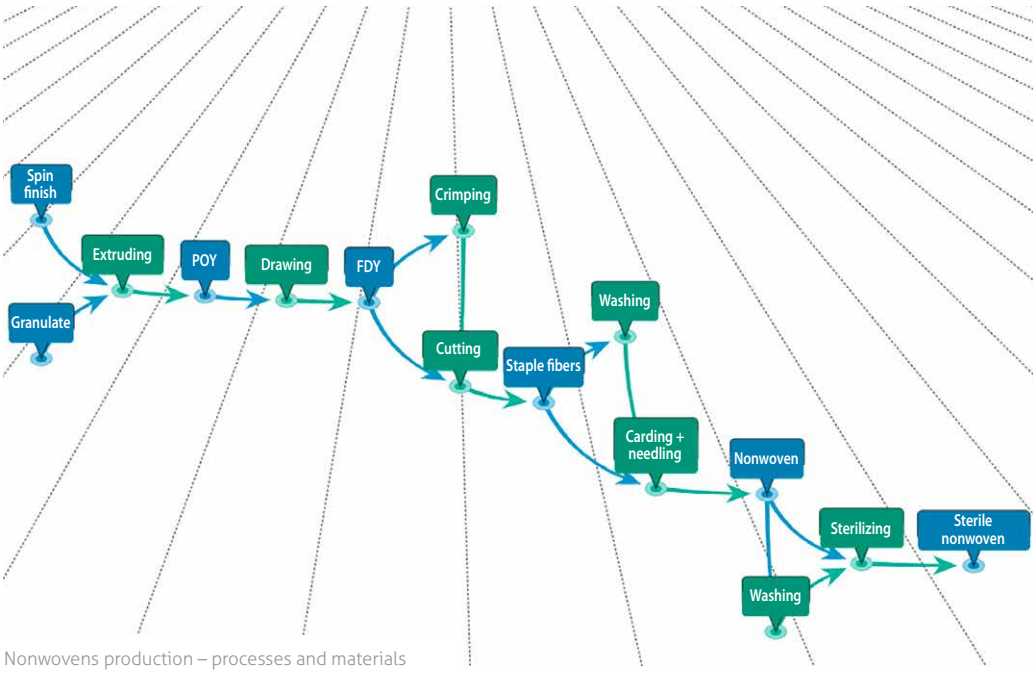
Far right prize winner Maryam Aliabadi from the DITF

Digital material twins

For the production of implants from polymer-based nonwovens

In order to realize the goals of Industry 4.0, it is not sufficient to determine the properties of materials and products by material investigations at various points in the value-added process, especially since this is usually done on a random basis at a few representatives. Rather, a detailed description and complete recording and networking of all information arising in the product lifecycle is necessary.
A material data room using a corresponding domain description language ("material ontology") makes an important contribution to this. It can represent the digital twin of any material or product. This digital twin makes it possible to make concrete statements about the current state and history of its counterpart in the real world.
In the "MaterialDigital" research project, which is funded by the Ministry of Economics, Labour and Housing of the State of Baden-Württemberg, different research areas of the DITF and the Natural and Medical Sciences Institute at the University of Tübingen are working together in order to consider all materials within the entire process chain (see figure), starting with the extrusion of the polymer, the production of the staple fiber and the nonwoven fabric up to the subsequent testing processes for the assessment of biocompatibility.
By linking information on processes and materials, the material data room also enables the complete traceability required by the Medical Devices Act.
Corresponding tools also allow a view of the complete process across the value-added stages and, if necessary, beyond company boundaries, thus revealing previously unknown relationships between material/product characteristics and process parameters. In addition, the raw data of all processes linked to the material data room form the basis for the use of artificial intelligence methods.

Point of contact:
guido.grau@ditf.de
Web: materialdigital-bw.de



Nonwovens production – processes and materials

DITF-MR: Three new AiF projects started

Digital collection development
Individualization, flexibility and sustainability are just a few of the challenges companies in the clothing industry are facing. This is where the digital change comes in, promising the necessary potential to successfully meet these challenges. But where does one start with a gradual transformation? Where do companies see the greatest potential for digitalization? How must digitized areas in the collection development process be designed? These questions are to be answered within the AiF project "Digital Collection Development".

Point of contact:
Franziska.Moltenbrey@ditf.de

Sustainability potentials of microfactories
Sustainability is an intensively discussed and focused topic in the globalised textile and clothing industry. Microfactories offer great potential for optimising the value-added chain through digitally integrated product development and production in conjunction with modern information and communication technology. In addition to technical issues, economic and ecological sustainability is evaluated by means of material flow cost accounting (MFCA).

Point of contact:
Juergen.Seibold@ditf.de

Data driven resource efficiency
Resource efficiency on circular knitting machines has developed into a multifaceted and complex subject. This is due to the high stresses placed on materials and machine parts as a result of increasing production speeds. In the project, technical status variables are measured by means of suitable sensors. With the aid of Big Data and machine learning, new correlations are discovered in the data and causalities between process parameters are determined, thus enabling resource-efficient machine operation.

Point of contact:
thomas.fischer@ditf.de

New matrix materials for fiber composites

Curing of fiber composites using UV technology

Once manually produced individual pieces, today it is impossible to imagine industrial series production without them: fiber-reinforced composites are being used to an ever-increasing extent in almost all industrial and manufacturing sectors. Fiber reinforcement gives plastic components greater mechanical strength, they are more resistant to deformation and, together with their low weight, they play out these advantages. Modern matrix systems also convince with good heat resistance. Modern lightweight construction has only been made possible by this class of materials.

Thermoset and thermoplastic processing methods are established

With the ever improving material properties, fiber composites have long since left their niche existence and are increasingly becoming a mass product. The common manufacturing methods used in series production are predominantly thermosetting plastics and, to a lesser extent, thermoplastics. The use of thermosets as matrix material leads to materials with excellent material properties. Thermosets harden by a chemical reaction, they wet and infiltrate the fiber material particularly well. Thermoplastic materials on the other hand harden by cooling from a viscous melt. The process is reversible and the great advantage is the speed of curing.

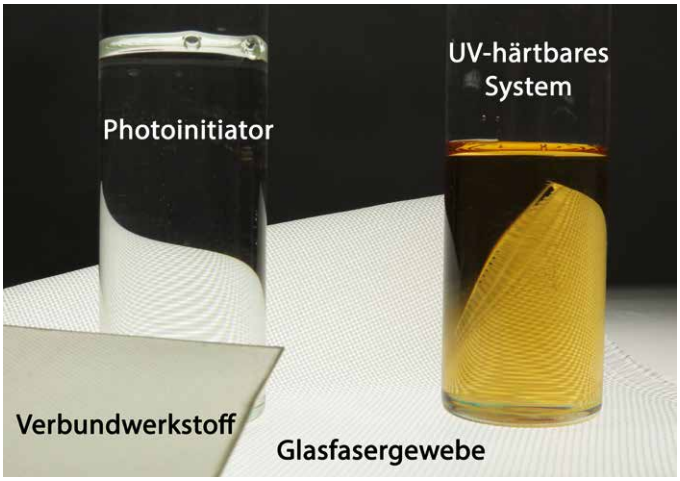
Thermosets take longer to cure, resulting in longer cycle times. While the market for industrial series production is still clearly dominated by thermoset processes, thermoplastics have recently gained considerable ground. This is because the competitive advantage of shorter cycle times is complemented by new material developments with improved physical and chemical properties.

Cycle time and energy balance determine competitiveness

In addition to cycle times, the energy balance of a manufacturing process also determines its potential to be used in large-scale production. The epoxy resins frequently used among thermosets usually react in autoclaves at temperatures of 140 °C or higher. The curing time can exceed one hour. The energy costs are correspondingly high. Special processing methods such as the HP-RTM process (high-pressure resin injection) or the RIM process (Reaction Injection Moulding) allow shorter curing times of only five or two minutes. However, this is offset by high investment costs for the complex system technology. Both processes have therefore only been used to a limited extent to date.

UV-curable plastics with new possibilities

UV-curing plastics have so far hardly been used for the production of fiber-reinforced composites. But there are great competitive advantages: Curing is fast – within seconds or minutes. The economical production of large quantities in a small time interval is thus basically possible. Irradiation with UV light is energy-saving, especially in comparison to the high energy consumption of autoclaves. And the amount of equipment required is low: UV-fixing units can be made small and flexible. At low investment costs, they will enable even large, complex components to be fixed quickly. The use of UV light for immediate curing of the matrix sounds elegant and simple. But in fact, this process also has its own complexity. In principle, only relatively thin plastic layers can be applied to the reinforcing fibers to enable complete curing by UV light. Only glass fibers that are light-conducting and do not shield the energy input are considered as reinforcing fibers. The use of UV-curable plastics has not yet found its way into industrial production, as basic chemical and process engineering coherencesare not yet sufficiently known. On the one hand, the approaches to UV curing of composites described in the scientific literature indicate the fundamental potential of this class of materials: For example, prepolymers based on epoxy acrylates and polyester acrylates have already been successfully tested and good strengths have been achieved with them. However, further, broad-based scientific studies on this topic are still pending.



Tests with UV-curable polymers for the automated series production of fiber composite components

Basic investigations in DITF research project

This is the starting point for a new research project at the DITF, which is developing comprehensive basic knowledge on the curing of fiber composites using UV technology. The aim is to gain an understanding of the optimal chemical structure of the polymer and photoinitiator system. Suitable textile reinforcing materials are to be identified as well as the most suitable fixing conditions.

This task requires the systematic investigation of a large number of parameters that influence the curing process from a chemical and physical point of view. The definition of an optimal viscosity and surface tension of the liquid matrix components is the first priority. The wetting behavior of the glass fibers can be controlled by these parameters. This is of utmost importance for the later fiber-matrix adhesion and thus for the stability of the composite material. A selection of polymer systems and suitable photoinitiators is tested for the achievable hardness, strength and shrinkage. This is done depending on variable fixing conditions: The type of UV radiation source, the wavelength used and the amount of energy input, controlled by irradiation time and intensity, will have a significant influence on the properties of the cured polymer. It is also important to investigate the layer thick-

nesses that can be cured in one step. The optimal parameters to achieve a uniform and good hardening with the highest possible layer thicknesses go directly into the cycle times in the later implementation in industrial production. The same applies to the curing speeds, which are also to be optimized within the scope of the investigations.
The results of the research project will help pave the way for the use of UV-curable polymers in the automated series production of fiber composite components. The expected competitive advantages of this process lie in its low energy costs, short cycle times and the flexible application possibilities of relatively small UV-fixing units.

Point of contact:
reinhold.schneider@ditf.de

IFAI Expo 2019

DITF receive Show Stopper Award

ORLANDO: The Show Stopper Awards of the IFAI Expo are presented each year to the most popular products of all exhibitors. Criteria for the award are innovation, economy and environmental friendliness. The entries are displayed on the exhibition area and the winners are selected by a panel of industry experts.
The DITF received the award in the categories "End Products" and "Chemicals, Coatings and Compounds". Dr. Reinhold Schneider received the award for his research work on UV-curing pigment inks for inkjet printing and transparent security inks for plagiarism protection.
The IFAI Expo is held annually and is one of the largest trade fairs for technical textiles in the USA, with 325 exhibitors from 64 countries at the last event. IFAI Expo also offers workshops, lectures and special shows. This year, the DITF was represented with exhibits and lectures for the third time.

Dr. Reinhold Schneider with the awards in the categories "End Products" and "Chemicals, Coatings and Compounds".

PD Dr.-Ing. Thomas Stegmaier is the new president of the International Society of Bionic Engineering ISBE

During an international conference on bionics in Changchun, China, Dr. Thomas Stegmaier was appointed new president of the International Society of Bionic Engineering ISBE in September 2019. Since its foundation in 2010, the Society has been growing steadily. Currently, the more than 2,700 members come from over 60 nations (www.isbe-online.org). The Society is dedicated to the promotion of cooperation between scientists and the advancement of knowledge and education in the field of bionics.
The DITF has been researching bionics topics for fiber-based materials for many years. The aim is to understand and model the interrelationships of structures, surfaces, sensors and data processing in living nature and to implement them in technology. In addition to self-cleaning surfaces, developments such as the fog collector, oil-absorbing materials and extremely lightweight fiber composites have already found their way into the industry. Building with textile materials is also being further advanced through inspiration from living nature, as the pavilions at the Federal GardenShow in Heilbronn show.
Further research is underway into friction-reducing surfaces, oil-water separation and puncture-resistant lightweight materials.


PD Dr.-Ing. Thomas Stegmaier, Head of the Technical Textiles, Surface Technology, Environmental Technology and Bionics Division at the DITF, in his inaugural speech as the new president of the "International Society for Bionic Engineering"

DITF 2020 events at a glance

Preview

Digital Textile Micro Factory

A success story continues: In 2020, the DITF will design and demonstrate three different microfactories in cooperation with Messe Stuttgart (TV TecStyle Visions), ISPO in Munich and drupa in Düsseldorf. The core element is the combination of 3D simulation (digital twin) with digital production processes. At ISPO, the world's largest trade fair for sporting goods and sports fashion, GORE TEX, Assyst, Juki, Multiplot and Zünd will be demonstrating a continuous process for the manufacture of individualized gloves.

For the first time at TV TecStyle Visions, Europe's leading trade fair for textile finishing and promotion, the DITF will be presenting the production of a polo shirt live with the Microfactory. In addition to HS Albstadt-Sigmaringen and the Technical University of Cologne, manufacturers and retailers such as Assyst, Caddon, HP, Juki, Kaspar Papir, Konrad Busche, MultiPlot, Rebstock Consulting, Schoeller and Zünd will be providing their software and hardware solutions as well as material and know-how.

The drupa in Düsseldorf, the world's leading trade fair in printing technologies, is supplementing its trade fair offering with the touchpoint textile. Here, the DITF and international partners will show the Digital Textile Micro Factory. Flags and shirts are produced with a focus on the European Football Championship.

Experience how different textile products are realized in 60 minutes on different showcases, from virtual design to digital textile printing and automated cutting to ready-to-wear. Free tickets for the TV TecStyle Visions are available on our website.

AACHEN DRESDEN DENKENDORF
INTERNATIONAL **TEXTILE** CONFERENCE

ADD International Textile Conference

At the end of November 2020, the DITF will be organising the Aachen-Dresden-Denkendorf International Textile Conference for the second time and will be inviting visitors to Stuttgart. Since 2016, the DITF have been on board as organisers of the renowned textile conference and contribute their experience from 40 years of Denkendorf specialist colloquia. With up to 700 participants the conference is one of the most important textile conferences in Europe. The two-day conference offers four parallel lecture sessions with almost 100 lectures on the following main topics:

> Quo vadis textile machine concepts?
> Opportunities with new materials: High-performance fibers and fiber composites
> Competitive advantages and sustainability: functionalization, new equipment
> New challenges: Medical Textiles/Medical Technology
> New applications, new markets
> Transfer "From the idea to the practice"

The focus is on contributions with industrial relevance. Deadline for the Call for Papers is 31 March 2020. 2020 partner countries are Portugal and Spain. As every year, an accompanying poster exhibition will present current project and research results. A sponsoring program offers interested companies the opportunity to appear as a silver, gold or platinum sponsor and advertise at the conference.

Point of contact:
sabine.keller@ditf.de

Trade fairs & events

January 26 – 29	ISPO Munich 2020 – exhibition of the Digital Textile Micro Factory
Jan. 30 – Feb. 02	TV TecStyle Visions, Messe Stuttgart – exhibition of the Digital Textile Micro Factory
February 05	Denkendorf Innovation Day, DITF
February 25 – 26	8th User Forum SMART TEXTILES with guided tour at Airbus, Hamburg – TITV e. V. in cooperation with DITF and FKT e. V.
March 03 – 05	JEC World 2020, Paris – DITF at the AFBW/ bw-i/Leichtbau BW joint stand
March 25	Place2tex: Future Innovation Festival – DITF booth
March 31 – April 04	INDEX 2020 Geneva – DITF booth
April 20 – 24	Hannover Fair "Showcase Bioeconomy" – DITF Presentation
April 21	Functionalization Forum, Hohenstein – organizer AFBW, Hohenstein, DITF
April 21 – 24	ESMA Academy in cooperation with DITF: Digital Printing on Textiles, DITF Denkendorf
May 05 – 07	T4M trade fair for medical technology, Stuttgart – booth DITF and ITVP Denkendorf
May 12 – 14	Techtextil North America, Atlanta – DITF booth
May 16	Science Day, University of Stuttgart – DITF exhibition
May 16 – 17	Workshop Learning about machinery, Denkendorf – organization DITF-MR
June 16 – 26	drupa 2020 Düsseldorf – exhibition of the Digital Textile Micro Factory
September 16 – 18	Dornbirn Global Fiber Congress – DITF lectures and foyer exhibition
Oktober 22 – 24	Annual Conference of the German Society for Biomaterials, Stuttgart – organization DITF
November 03 – 06	IFAI Expo, Indianapolis – DITF booth
November 04 – 05	35th Hofer Vliesstofftage Hof – DITF lectures and foyer exhibition
November 10 – 12	Composites Europe 2020, Messe Stuttgart – DITF at the AFBW joint booth
November 25 – 26	Aachen-Dresden-Denkendorf International Textile Conference 2020, Stuttgart – main organizer DITF

DITF
DEUTSCHE INSTITUTE FÜR TEXTIL+FASERFORSCHUNG

Körschtalstraße 26 | 73770 Denkendorf
T +49 (0)711 93 40-0
info@ditf.de | www.ditf.de

V.i.S.d.P: Peter Steiger