RESEARCH HIGHLIGHTS

DEUTSCHE INSTITUTE FÜR TEXTIL- UND FASERFORSCHUNG DENKENDORF

DITF REPORT

June 2022 – No. 1

CONTENT

Techtextil – Beyond innovation.

Visit us at the Frankfurt Trade Fair – Hall 12.1 Stand C 80

Despite all the routine in the new communication formats, the personal contacts and direct exchange with customers and partners were still very much lacking during the Corona pandemic. All the more reason for us to look forward to Techtextil from June 21 to 24 as the first major trade show in a face-to-face format and would like to take this opportunity to extend a warm welcome to all visitors. We look forward to seeing you there! At Techtextil, the leading international trade fair for technical textiles and nonwovens, the DITF will be a partner for the fourth time at the joint Baden-Württemberg booth, which is organized and managed by Baden-Württemberg International in cooperation with AFBW and Südwesttextil.

Together with 15 textile companies from Baden-Württemberg and the AFBW, the DITF will present their development work and new products. The joint trade show appearance has proven to be very successful in the past years, as all participants benefit from the intensive exchange among each other and from the extended networking with new interested parties.

The thematic focal points and selected exhibits of the DITF trade fair presentation are based on the research fields that have been newly set within the framework of the DITF Strategy Development 2026: New Materials, Lightweight Construction, Health, Sustainability and Digitalization. The latter two research fields in particular are the focus of many research projects due to the digital transformation process and the enormous challenges posed by climate change, or are taken into account as an indispensable partial aspect in almost all developments. While technical innovations for higher productivity, greater effectiveness and flexibility were the determining factors for many years, the thematic priorities have now shifted significantly.

At the same time, the DITF will also be showcasing their developments and services in the Mittelstand 4.0-Kompetenzzentrum *Textil vernetzt*, which will be represented at the trade show with its own booth in Hall 12.1 booth D74B.

From June 21 to 24, the DITF will be exhibiting at Techtextil in Frankfurt, Germany

Cooperation with Saint-Gobain

Following extensive cooperation negotiations, the DITF were able to conclude an agreement on cooperation and joint development in the field of oxide ceramic fibers with the French Saint-Gobain Group at the end of 2021. The aim is to jointly create the conditions for establishing production of oxide ceramic fibers in Europe. These are an essential component of fiber-reinforced ceramic materials (CMCs: Ceramic Matrix Composites), which are becoming increasingly important for a wide range of high-temperature applications in the high-tech sector. Since there is currently only one manufacturer of high-quality oxide ceramic fibers in the world, the planned production is intended to provide a "second source" that has been requested for many years. (For report see page 2).

Cooperation for the production of oxide ceramic fibers

Innovative DITF development on the leap to industrial production

The DITF have concluded an agreement with Saint-Gobain (France) on cooperation and joint development in the field of oxide ceramic fibers. The cooperation aims at jointly creating the conditions to establish a production of oxide ceramic fibers in Europe.
Oxide ceramic fibers are an essential component of fiber-reinforced ceramic materials (CMCs: Ceramic Matrix Composites), which are becoming increasingly important for a wide range of high-temperature applications. The fiber reinforcement results in a damage-tolerant, no longer brittle ceramic material that is superior to monolithic ceramics and is therefore technically and economically highly interesting. Potential applications include components in industrial furnaces, charge carriers for temperature treatment and, in the high-tech sector, components in stationary gas turbines with high efficiency, gas turbines in aircraft with lower fuel consumption or in space applications. A significant increase in the industrial use of these CMCs is predicted for the coming years, and with it a growing demand for ceramic fibers.

At the DITF, research and development in the field of ceramic fibers has been carried out continuously since 1990, so that extensive and well-founded know-how exists. For several years, a pilot plant for the production of the so-called OxCeFi ceramic fibers has been operated in Denkendorf, representing the complete production chain. The results and the state of the research were presented in a number of scientific publications and at various international conferences, which drew the attention of several companies to the research results and the expertise of the DITF. After an extensive evaluation and negotiations with several potential partners, Saint-Gobain emerged as the ideal collaboration partner, as the expertise of the two partners ideally complemented each other. Since there is currently only one manufacturer of high-quality oxide ceramic fibers in the world, the planned production is intended to provide a "second source" that has been requested for many years.

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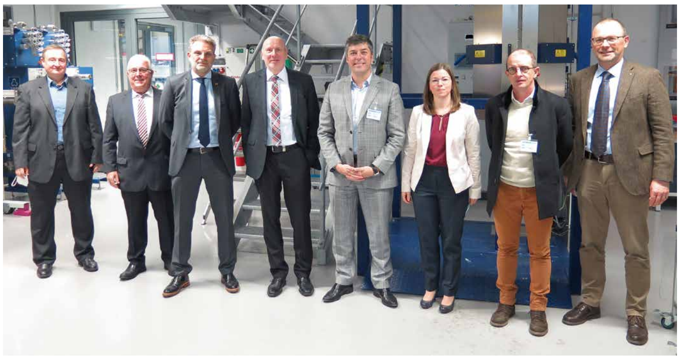


Meeting with Saint-Gobain Ceramic Materials for contract signing at the DITF in Denkendorf

Saint-Gobain
Saint-Gobain is a listed French industrial group. The companies united under its umbrella employ approximately 167,000 people with annual sales of over 38 billion euros. Founded in 1665, Saint-Gobain is one of the oldest companies in the world and is represented in 72 countries worldwide. Saint-Gobain is, among other things, a manufacturer of innovative ceramic materials and products, which are combined in the Ceramic Materials business unit.

SHORT NOTES

Six middle school girls used this year's Girls' Day on April 28 to take a look behind the scenes at the DITF and immerse themselves in the world of textile research. Through exciting lectures, experiments and games, the girls learned about the work as textile researchers in the Service Center for Testing Technologies, the Competence Center High Performance Fibers and the Management Research department. The focus was on ceramic fiber development, clothing technology and fiber recognition, among other things. A big thank you goes to Leonie Reinders, Ulrike Hedenetz, Alexander Mirosnicenko and Stefanie Hiss, who gave the girls an understanding of their respective subject areas in an exciting and at the same time informative way and conveyed concrete future perspectives.

ThinKing of the Month Award in May
Once a month, Leichtbau BW presents the ThinKing, an innovative and sustainable lightweight construction solution made in Baden-Württemberg. In May, Leichtbau BW honored the DITF's planer cutter in extreme lightweight design. The planing tool for woodworking in optimized CFRP design, for which a patent has been filed and which was developed with the help of numerical simulation, has 50 percent less weight thanks to the lightweight design and enables a 1.5-fold increase in production.

Roll film!

Annual report 2021 is online!
On 64 pages, the DITF Annual Report presents the highlights of the DITF from the past year – from A like autonomous living wall systems and acoustically convertible textiles to Z like cell carriers for regenerative medicine and biohybrid organs. The report provides insight into details of our research, ideas and innovations from the DITF. Online at ditf.de or as a print copy.

Order: sabine.keller@ditf.de

300 guests celebrated 100+1 years of DITF

Stuttgart, Haus der Wirtschaft: Let's celebrate the textile future!

Like so many events, the anniversary celebration of the DITF had to be postponed. And so it was 100+1 years of textile research that was celebrated on 22.2.2022. Under the motto "Let's celebrate the textile future", the DITF had invited guests to the Haus der Wirtschaft in Stuttgart. A varied program with speeches, lectures, entertainment, an exhibition, music and good food awaited the more than 300 guests from politics, business, science and the employees of the DITF.

300 guests accepted the invitation "Let's celebrate the textile future"

Professor Michael R. Buchmeiser, Chairman of the Board of the DITF, giving the welcoming speech

In his anniversary speech, Professor Michael R. Buchmeiser covered the long arc of textile research from 1921 to the present day. The claim of the founding fathers – consistent application orientation – still characterizes textile and fiber research in Denkendorf today. With product and technology-oriented innovations along the entire textile value chain – from the molecule to the finished product – the DITF support the economy and thus makes an important contribution to securing the location. The look back showed an impressive joint achievement, for which Michael R. Buchmeiser thanked all those involved and in particular the employees of the DITF. The importance of textile research in Denkendorf for all future topics was also reflected in the greetings of the Parliamentary State Secretary in the Federal Ministry of Economics, Dr. Franziska Brantner, and the Minister of Economics of the State of Baden-Württemberg, Dr. Nicole Hoffmeister-Kraut. They found much praise for the work of the DITF. Exciting keynote speeches by Dr. Antje von Dewitz, VAUDE, Professor Klaus Müllen, Max Planck Institute for Polymer Research, and Peter Donrier, Lindauer Dornier, took up central future topics such as sustainability and digitalization and visibly inspired the guests. Dr. von Dewitz used the example of VAUDE to show that environmental and climate protection do not slow down economic success, but can instead ensure growth. Although textile companies are not yet considered environmentally friendly, they have great innovation potential and can take on holistic responsibility.

Minister Dr. Nicole Hoffmeister-Kraut MdL praised the importance of the DITF for Baden-Württemberg's textile industry

"Is the future black?" was the question Professor Müllen pursued in his lecture. He was referring to the diverse contributions that carbon materials and carbon structures can make to innovations – from sustainable energy generation to personalized medicine. He advocated interdisciplinary research and bringing science and industry together. In both areas, he said, the DITF are proven bridge builders.

Dornier amazed the audience with the realization that the topic of digitization in weaving is nothing new, because the fabric is the digital product par excellence. It is always a matter of the two variants, whether the weft thread is guided above or below the warp thread. Joseph-Marie Jacquard punched this information onto punched cards as early as the beginning of the 19th century and used it to create complex fabric patterns. He inspired mathematics to use the same method to digitally solve algebraic equations using zeros and ones. Thus, he said, weaving is the basis of digital transformation.

The anniversary event was hosted by Mirko Drotschmann, the "MrWissen2go" known from many science programs. He did an excellent job of presenting the anniversary and the scientific background in a gripping manner. During the break, the "Physikanten & Co." provided amusing and at the same time instructive "edutainment". An exhibition in which the twelve competence and technology centers of the DITF showed examples of their research completed the successful framework for the anniversary celebration.

Instead of giveaways, the DITF erected a fog catcher (textile, of course) in Peru and thus supported a project of the Wasser-Stiftung.

DITF.100
LET'S CELEBRATE THE TEXTILE FUTURE!

DITF Anniversary Film

A film on the occasion of the DITF anniversary takes a journey through time and shows impressions from the foundation of the German Research Institute for Textile Industry in Reutlingen-Stuttgart to today's pilot plants and laboratories of the modern research center in Denkendorf. Here, from the 1970s onwards, all areas of research came together: from chemistry to mechanical engineering, process engineering to economics.

Roll film!

SensorStrick 4.0 research project

Detect faults early and save costs

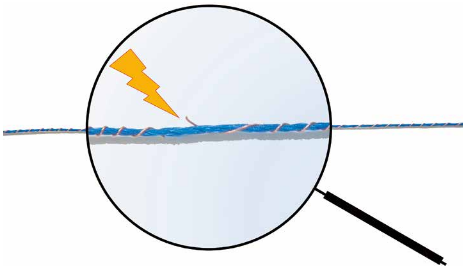
Digitized manufacturing processes enable individualized production. A low defect rate is particularly important for e-textiles, as defects in the smart additional functions in textiles are often only detected at the end of the value chain. As a result, textile wearables become very expensive and there is no longer any added value to non-textile wearables such as smartwatches. The DITF are developing a global "Industry 4.0 approach" for process management that starts with yarn production and extends through all process chains.

For highly elastic smart textile products, yarns are used that often consist of both conductive and non-conductive components. For example, conventional highly elastic yarns are wound with conductive fine wires for this purpose. The elasticity of the yarn component is largely retained in this way. During knitting, however, the yarns are subjected to such high stresses that the conductive yarn components can be damaged. Since this often does not break the entire yarn, the defect is not detected during the knitting process in current production procedures. In extreme cases, the finished knitted part is a reject. In the case of fully-fashioned knitted parts, the damage is particularly great because of the relatively low productivity of the flat knitting process and the relatively high loss of production time. In order to detect faults in electrical properties during the manufacturing process, the SensorStrick 4.0 research project is recording process and environmental data during production at various process stages.

For this purpose, wrapping and flat knitting machines are equipped with distributed sensor technology that measures temperature, humidity, light, proximity and yarn tension as well as yarn speed. In addition, microphones monitor noise in the immediate production environment. These acoustic measurement data indicate vibrations, for example, and can be evaluated particularly well with AI. In wrapping yarn production, the detected process variables are used directly to control the process parameters.

In addition, new low-cost sensors are being developed. For running yarns, for example, a principle has been developed with four measuring tubes that measure quickly and without contact how conductive the yarn running through is and what its sensory properties are. These sensors are designed in such a way that they can be used in as many textile processes as possible without costly adaptation.

The yarns are thus monitored both during the wrapping yarn production and in the subsequent knitting process. If a break occurs in the conductive yarn component, it is detected immediately. Humidity and ambient temperature do not affect the measuring accuracy. Process monitoring not only works for knitted fabrics, but also for other textile surfaces.



Damaged conductive component of a Yarn

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Marked sewing threads for plagiarism protection

Infrared light absorbing pigments provide effective protection

Investigators, customs authorities and textile companies have so far been unable to reliably detect counterfeit textiles. They fail time and again because of the criminals' skill and creativity. Scientists at the DITF and the DWI Leibniz Institute for Interactive Materials e.V. have therefore developed security-marked sewing threads that provide a remedy in a recently completed research project.

These contain small (approx. 100 nm) infrared light-absorbing pigments that can be made visible using an IR camera (see figure). In the project, various pigments (including LaB_6, Cs_2WO_4) were investigated and compared. The sewing threads produced can be easily dyed and adapted to the needs of textile manufacturers. Thus, it is possible to use them as discreet, distinct and easily detectable security markings.

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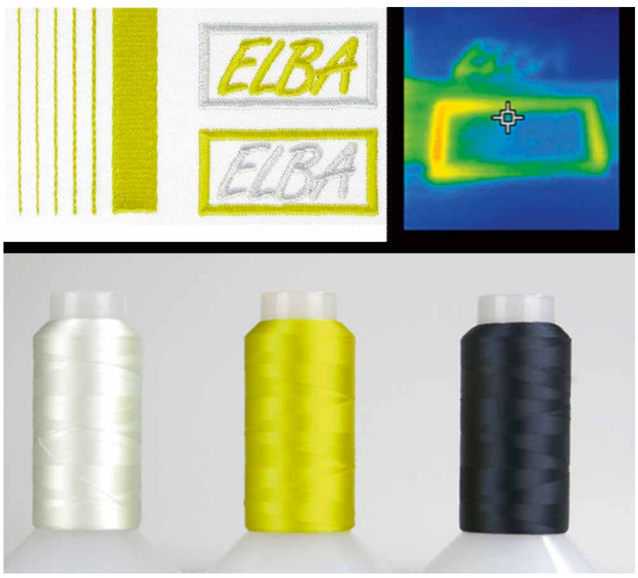

Top: Embroidery "Emblem", yellow PET sewing thread with safety marking (left) and thermal image of the embroidered logo under irradiation with a NIR laser. Below: Undyed and yellow/black dyed PET sewing thread with safety marking.

ZIM Project PelFit

Biofeedback-based pelvic floor training using smart textiles

About 14 percent of all women and nine percent of all men in Germany suffer from bladder incontinence. The likelihood of incontinence increases with age. To improve continence performance, those affected need to train their pelvic floor muscles. The DITF, together with the project partners Charité, Comazo GmbH & Co. KG, IQE GmbH and GJB Datentechnik GmbH in the ZiM project "PelFit" to develop a smart textile suitable for routine use that monitors pelvic floor training with the aid of biofeedback.

An essential component of the smart textile is the textile integration of highly sensitive embroidered electromyography (EMG) sensors, which measure electrical activity based on action currents of the relevant muscles. The embroidered EMG electrodes are made of conductive embroidery yarns and their size and geometry can be adapted to the shape of the muscle. Before each training session, the anatomical position of the EMG sensors is determined. The collected EMG signals during the training session are to be analyzed for visual guidance of the patient in order to be able to prevent tightening of the abdominal and gluteal muscles as well as overtraining of the external bladder muscle.

Smart textiles with integrated, highly sensitive, embroidered electromyography sensors (EMG) for training the pelvic floor muscles

Technical challenges include differentiation of muscle group activities, correct electrode positioning, and disinfectability and washability of the smart textile at high temperatures.

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Technical textiles in the Neolithic period

DITF laboratory researches the use of lime bast and flax

The beginnings of textile manufacturing date back more than 30,000 years. Not only clothing, but also technical textiles were made from sometimes surprising materials. In the joint project THEFBO, led by the Landesamt für Denkmalpflege in Baden-Württemberg (LAD), prehistoric textile craftsmanship was researched on the basis of more than 2500 textile fragments from pile dwelling settlements at Lake Constance and Upper Swabia. The DITF were responsible for material testing.

When people became sedentary, they intensified the cultivation of the linen plant as a source of oil and fiber. Its fine threads were used for set nets in fishing and plant materials, especially bast from the bark of the linden tree, were made into ropes, baskets, sieves, bags, or backpacks. Flax could not compete with the properties of lime bast, at least in the Neolithic period. Therefore, the THEFBO project investigated the question of why nets were nevertheless primarily made of flax. To clarify this, the Service Center for Testing Technologies at the DITF carried out extensive material tests on samples made of flax and of lime and willow bast. Among other things, the fiber length and fiber fineness as well as the twist fineness were determined, various tensile tests were carried out in dry and wet condition and the water absorption capacity was investigated. The results showed a very different yarn quality, which resulted primarily from the natural conditions and the preparation of the baste, and did not allow any statistical evaluation. A decisive factor for the quality of the twisted yarns was also the "human factor", which can rarely produce a consistent quality. In contrast, modern materials and manufacturing processes are comparable with each other and highly standardized.

Lime bast: The quality of the bast layers and the splicing threads made from them depends on their proximity to the wood of a tree. Spinning proved to be tedious and difficult, splicing was not a problem

Research work provided valuable information about the properties of raw materials in terms of their tensile strength, water absorption capacity or resistance to weathering. Flax, for example, was probably so popular for the production of gillnets because, in addition to its long fibers, it was easy to spin and the required large quantity of twine could be produced more quickly. Due to the high water absorption capacity of flax, the nets were more stable standing upright in the water than comparable nets made of lime bast.

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In search of alternatives to RFL

Replacing toxic chemicals in the manufacture of tires and conveyor belts

The quality of composite systems made from cords of high-strength fibers such as polyester, aramid or polyamide and matrix materials of rubber is largely determined by the adhesion properties of the fibers to the matrix. In the established manufacturing process, adhesion promoters made of resorcinol-formaldehyde-latex (RFL) are used to improve the adhesion properties. The DITF are demonstrating new ways of replacing formaldehyde, which is harmful to health, with substances that are technically equivalent but do not pose a health hazard.

In car tires, conveyor belts and V-belts, as well as in many applications in the manufacture of technical products, rubber materials are reinforced by cord. High-strength fibers made of polyester, polyamide or aramid are used. They provide the necessary strength and rigidity of the overall composite and counteract external forces. As a result, deformation, elongation and torsion of the material can be kept low.

However, these demands on the fiber composite material can only be met if there is sufficiently high adhesive strength between the fibers and the matrix (made of rubber or caoutchouc). Otherwise, delamination of the material composites, which are built up in alternating layers of fabric and rubber, is to be expected. Material failure would be the consequence.

Adhesion is increased by the use of adhesion promoters. Chemicals based on formaldehyde resorcinol latex (RFL) have proven effective. They are applied to the fibers as so-called dips and ensure that their adhesion to the matrix of rubber is significantly improved. RFL is established as an adhesion

Coating plant in the DITF pilot plants

promoter, but it has a significant drawback: since 2014, formaldehyde has been classified by the EU as demonstrably carcinogenic and mutagenic. The chemical industry is therefore in urgent search of alternatives that do not pose a health risk.

The DITF have taken on the problem and developed a new, formaldehyde-free coating system. It is based on the substance hydroxymethylfurfural (HMF), which can be extracted from wood. HMF is formed during the thermal decomposition of carbohydrates. It is found in many heat-treated foods such as milk, coffee or fruit juices and is not considered to pose any health problems according to current scientific knowledge.

The HMF dips developed at the DITF are also promising from a technical point of view: For yarns made of polyamide 6.6, a simple impregnation is sufficient to achieve the desired adhesion improvement. Yarns made of polyester or aramid require an additional prior plasma treatment or a sol-gel finish to achieve the necessary adhesion improvement. The HMF dip can be applied under the same conditions and with the same technology used for RFL dips. At this point, therefore, no additional investment is required to replace the adhesion promoter in production.

The advantages already demonstrated are to be expanded. Replacing resorcinol in the dip formulation is the next research goal. This is because resorcinol also has a human-toxic effect. In cooperation with industrial partners, the DITF is currently investigating the extent to which resorcinol can be replaced by lignin. The special feature of the lignin used is that it is obtained from annual plants. Thus, in contrast to the frequently used wood lignin, it is chemically much more active and offers more potential for further processing into a technically advantageous adhesion promoter.

Both approaches carry the idea of sustainable management throughout: the new adhesion promoters made from HMF and lignin are based on natural raw materials. Problem solving within a sophisticated, technical application while adhering to sustainability aspects reflects the commitment of research to societal requirements. For small and medium-sized industry, the research results provide the basis for innovation and thus a real advantage in international competition.

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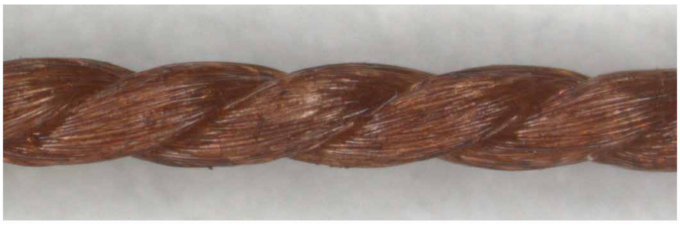
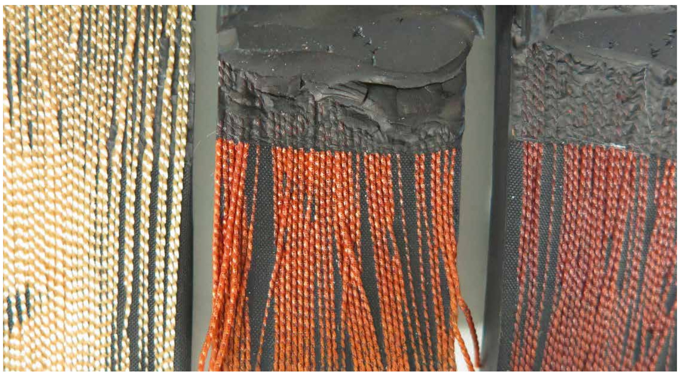


PA6.6 yarn with HMF adhesion promoter (macroscope image)

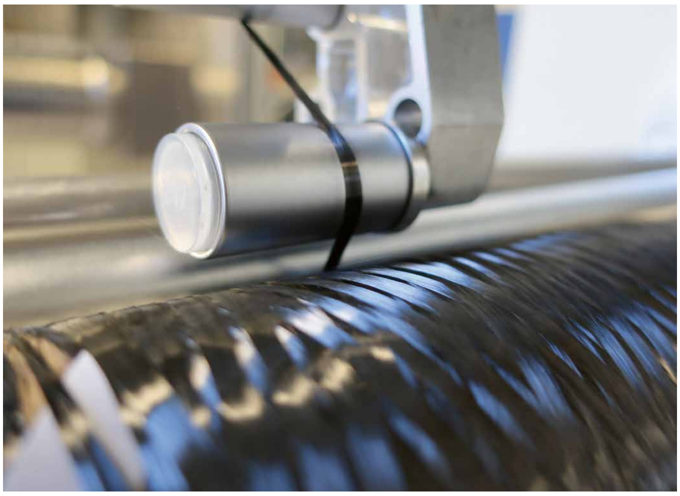


Adhesion of polyamide 6.6 to rubber: without adhesion promoter (left) with RFL-Dip (center) with HMF-Dip (right) PA6.6 yarn with adhesion promoter

Cellulose Fibre Innovation of the Year 2022 Award

Award of the DITF Research results for the production of carbon fibers from wood

For the second time, the nova Institute for Ecology and Innovation honored outstanding scientific research that provides sustainable solutions for the cellulose fiber value chain at the "International Conference on Cellulose Fibres 2022". Six products were nominated for the award that combine sustainable production processes with new technologies and applications to create cellulose-based materials.
The conference sees itself as an international forum for the development of new cellulose fibers and materials and their manufacturing processes. Exhibitors include leading fiber manufacturers; participants come from thirteen countries.
The DITF's Biopolymer Materials Competence Center received first place in the nomination process with its presentation of carbon fibers obtained from the raw material wood in a novel and sustainable process. The HighPerCellCarbon® technology describes a patented process that has been further developed under the leadership of Dr. Frank Hermanutz: As a result, carbon fibers based on biopolymers can be produced in a particularly environmentally friendly process.
The HighPerCellCarbon® process involves the wet spinning of cellulose fibers using ionic liquids (IL) as direct solvents. The filament spinning process represents the central technical part. It is carried out in an environmentally friendly and closed system. The solvent (IL) is completely recycled. The cellulose fibers produced in this way are converted directly into carbon fibers in a further development step by a low-pressure stabilization process, followed by a suitable carbonization process. No waste gases or toxic by-products are generated during the entire process sequence.
The HighPerCellCarbon® process is thus convincing in terms of sustainability in several respects: in addition to the recyclability of the solvent used, the use of wood as a raw material in particular stands for resource conservation. Petroleum-based starting materials, which are usually used in the industrial production of carbon fibers, are substituted by renewable biopolymers. Carbon fibers are used in many lightweight construction applications with significant growth rates. An environmentally friendly production process such as HighPerCellCarbon® is elementary for the sustainable management of an important industrial sector.



HighPerCellCarbon® Carbon fibers from wood

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Innovative water filtration and purification

Improved coalescence of micro oil droplets through spider silk-like structures

The demand for innovative water filtration and purification is constantly growing, especially for the separation of dispersed oil (with droplets smaller than 20 µm) from industrial and natural waters. The limitations of existing technical solutions are high energy consumption, complicated processes, long processing time and high costs.
In the recent past, the bionic development of fiber-based materials has led to tremendous improvements in the performance of technical textiles in various industrial processes. In nature, the mantis silk of arachnids has a periodic spindle node structure that exerts a directed motion on tiny water droplets, eventually resulting in large droplets that collect at the spindle nodes.
Inspired by this, the basic idea is to introduce a network of filaments of increasing cross-section into the oil-in-water emulsion, resulting in much larger oil droplets that rise much faster. For this purpose, a superwetting PVDF membrane with spindle-shaped fibers was produced using an electrospinning process. Due to the special wettability and the geometry of the fibers with spindle knot structure, the oil droplets accumulate rapidly on the membrane surface and move toward the spindle knots on the fibers, where they grow by coalescence until they are detached from the fibers by buoyancy forces. They drift to the surface of the emulsion, from which they can be easily skimmed.
This work paves the way for the design of functional surfaces in the field of droplet transport phenomena, which are of great interest for various applications such as the treatment of oily wastewater, water collection systems or microfluidic devices.

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The DITF bid farewell to Professor Michael Doser in retirement

Professor Dr. Michael Doser, deputy member of the Executive Board and authorized representative of the DITF, will retire at the end of May. He has worked at the DITF for almost 32 years. Across the institutes, he was an important communicator and initiator and was particularly committed as a scientist and researcher to the development and expansion of the biomedical engineering research area at the DITF.

Michael Doser began his successful career at DITF in 1990 – then initially at the ITV Denkendorf under Professor Heinrich Planck. As a biologist with a doctorate from the University of Hohenheim and with initial experience as a research assistant at the Institute of Genetics in Hohenheim, he brought with him the right tools to rethink textile research in the direction of medical technology. With research work on pancreas and liver in the field of biohybrid organs and numerous projects in regenerative medicine – with developments for the skin, blood vessels, nerves, cartilage and bones – Doser quickly built up the Biomedical Engineering research area at the DITF into an important business field and took over its management as early as 1998. This expertise also led to the establishment of FKT testing and the development of a test seal for the evaluation and labeling of body-compatible textiles. As of today brand manufacturers such as Mey, Falke, Mattes und Ammann and Lenzing still use the quality seal. For his scientific work and commitment to biomedical technology, Michael Doser has received numerous honors and awards, including the EU EUREKA Innovation Award in the category "Inventor of Tomorrow" for the development of a textile-based closure for a tear in the intervertebral disc.

Deeply rooted in biomedical engineering through these projects, Michael Doser simultaneously became involved early on as an interdisciplinary idea generator and cooperative "liaison" for other research areas in Denkendorf. Since 2001, Michael Doser performed these tasks as deputy director of the institute – at that time of the ITV – and thus significantly shaped the fortunes of the DITF.

Successful committee work

In addition to his scientific work, Doser was involved in numerous national and international committees as well as standards committees and acted as an expert for many years, for example for the Research Directorate of the European Union. The list of his commitments is long and impressive – DGBM, BMOZ, ETP, ESAO, TERMIS, to name but a few. Particularly close to his heart was his membership in the European Society of Biomaterials, where he was active on the board for several years and was appointed ESB Honorary Member in 2018.

Several DIN, ISO and ASTM standards in the field of biological and medical testing bear Doser's signature. From 2006 to 2018, Michael Doser was head of ISO Working Group 5 on Cytotoxicity and, in this capacity, launched a standard for testing the safety of medical textiles that is still used today for testing all medical devices worldwide.

Commitment to teaching

Since 1994, Michael Doser has passed on his extensive knowledge to students, initially with lectures at the University of Stuttgart, but then also with teaching assignments at the University of Ulm and Tübingen. In recognition of his commitment to education in the field of medical process engineering and medical technology, Doser was appointed honorary professor at the University of Stuttgart.

Prof. Dr. Michael Doser, deputy member of the Executive Board and authorized representative of the DITF

Fairs & Events

June 21 – 24	Techtextil, Frankfurt a.M. – DITF booth
June 23	Innovation Day BMWK – DITF presentation
June 25	Science Day, University of Stuttgart – DITF booth
September 14 – 16	61st Dornbirn-GFC – DITF presentations and foyer exhibition
September 15 – 17	28th Annual Meeting DGBM, Essen, Germany
October 12 – 14	IFAI/ATA Expo, USA, NC, Charlotte – DITF booth and lecture
October 17 – 20	CAMX Expo, USA, CA, Anaheim – DITF presentation
November 09 – 10	36th Hofer Vliesstofftage, Hof, Germany – DITF lecture and booth
November 14 – 17	Medica/Compamed, Düsseldorf – DITF and ITVP booth
December 01 – 02	Aachen-Dresden-Denkendorf International Textile Conference, Aachen – DITF lectures and foyer exhibition

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