RESEARCH HIGHLIGHTS

DEUTSCHE INSTITUTE FÜR TEXTIL- UND FASERFORSCHUNG DENKENDORF

DITF REPORT

July 2021 – Nr. 2

CONTENTS

ADD International Conference

Digital for the first time // Partner countries Portugal and Spain

With over 650 participants, the Aachen-Dresden-Denkendorf International Textile Conference is one of the most important textile conferences in Europe. This year it is again organized by the DITF.
Already last year we had invited to Stuttgart, but due to the COVID-19 pandemic we had to postpone the conference.

Organizers and sponsors of the ADD International Conference 2017 in Stuttgart

Unfortunately, also this year the situation is too uncertain to plan a face-to-face event with an international audience. Therefore, the Aachen-Dresden-Denkendorf International Conference will take place digitally for the first time.

An online event also offers many advantages:
> Planning reliability for speakers and participants
> Industry meeting and exchange for experts from all over the world - independent of incidences and travel restrictions
> No travel costs

Approximately 60 presentations in three parallel sessions await you, and you can switch between them at any time.

Topics:
> High-performance fibers, fiber composites, functionalization, medical technology and textile engineering
> New applications and markets
> Green deal and circular economy
> Digital transformation
> Transfer session "From the idea to the practice"

Speakers from science, associations and companies such as adidas, Dornier, Myant (Canada) and DSM have been recruited. Networking will not be neglected either: There will be the opportunity to exchange ideas in discussion rooms or casually in the virtual foyer during every break. In addition, we will present about 100 scientific posters and there will be an exhibition where you can get in touch with companies. We look forward to your participation!
Would you like to get involved in the digital event? Whether with a digital exhibition stand, an advertisement in the Book of Abstracts or with one of the sponsoring packages: We will be happy to inform you!

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Manfred Hirschvogel Prize to Larissa Born

Dr.-Ing. Larissa Born, research associate at the Institute of Textile and Fiber Technologies (ITFT of the University of Stuttgart), was awarded the Manfred Hirschvogel Prize 2021 on July 2, 2021, as part of the graduation ceremony for master's graduates from the mechanical engineering faculties at the University of Stuttgart. The prize, endowed with 5,000 euros, is awarded annually at all TU9 universities – the nine leading technical universities in Germany – for the best dissertation in the field of mechanical engineering. The award-winning doctoral thesis is entitled "Fundamentals for the design and construction of a hybrid material for exterior adaptive facade components made of fiber-reinforced plastic". Dr.-Ing. Marc Hirschvogel, Chairman of the Board of Trustees of the Frank Hirschvogel Foundation, praised the innovative approach and scientific depth of the work in particular at the award ceremony. For report see page 2.

Patent sale to Technikum Laubholz

DITF and TLH strengthen their close cooperation with patent sale

The cooperation between Technikum Laubholz GmbH (TLH) and the DITF aims at developing novel and technical applications of hardwood and transferring them into marketable products. A far-reaching technology transfer now creates the basis for a sound and knowledge-based cooperation.
As a basis for technology transfer, extensive patent families were sold by the DITF to Technikum Laubholz GmbH. This has created the prerequisites for incorporating results from basic research into the development of new products. The industrial implementation of sustainable processes for the production of technical regenerated cellulose fibers and carbon fibers based on lignin and cellulose form the research focus of the cooperation between the two partners. With the sale of the patents, the cooperation partners are following a strategic guideline that will promote their cooperation and enable professional marketing of the new technologies.
At the same time, research projects are being conducted to further develop technologies, for example for processing cellulose from ionic liquids, and to introduce new types of fibers for technical use and for consumer textiles into the growing market for sustainable materials.

Versatile raw material hardwood from sustainably managed forests in the region

Thus, both partners follow the purpose of the newly established research center to develop new and technically significant products and processes based on hardwood originating from sustainably managed forests in the region. The task of the DITF is to work on the fundamentals of economic and ecological manufacturing processes for cellulose and lignin fibers made from beech wood for technical applications.
The Technikum Laubholz will link eight research teams from different institutes and serve as an interface to industry. Other research projects include the development of new processes for the production of biosurfactants and vegan food proteins based on wood.

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Manfred Hirschvogel Prize for Larissa Born

Doctoral thesis on adaptive fiber composite plastics honored

With her doctoral thesis, Larissa Born, a research associate at the Institute of Textile and Fiber Technologies (ITFT) at the University of Stuttgart, provides a basic methodology for the development of adaptive fiber composite plastics and applied it exemplarily to a hybrid material made of glass fiber reinforced plastic, elastomer and thermoplastic polyurethane. Locally compliant areas (joints) are integrated between stiff component areas by adapting the material structure. In order to be able to analyze the adaptive material properties, she also developed a new test method that allows a test specimen to be bent by up to 180°.
The novel hybrid material allows a continuous load of 5,000 180° bending cycles with only marginal loss of strength. The result of the analyses carried out is a database including a regression model on the basis of which the mechanical properties of a joint component can be adjusted.
The hybrid material has already found application in various demonstrators that have won the AVK Innovation Award and the Materialica Gold Award. "With her work, Larissa Born has succeeded in creating a completely new, material-technological basis for the development of adaptive fiber composite plastics," said doctoral supervisor Prof. Dr.-Ing. Götz T. Gresser, praising the work on the occasion of the award ceremony. "The application is not limited to the architectural context, but can equally be transferred to other fields such as automotive and aerospace. Mechanical, high-maintenance joints can thus be replaced by low-wear, compliant mechanisms."


Prize winner Dr.-Ing. Larissa Born inserting the mirror plates on the hot press

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Textile supports for indoor aquaculture systems

Development of flow-through textile-based photobioreactors for integrated algae production in shrimp indoor aquaculture

Microalgae represent the basis of the food chain in aquatic systems and bind nutrients and CO_2 to build up their biomass. Today, microalgae are cultivated for the production of various products (e.g. for human and animal nutrition, for cosmetics, as raw material for energy or the chemical industry).
In this project a novel idea is developed. The tendency of selected algae species to anchor to a solid object is used for immobilization on a textile carrier, supported by biological surface functionalization. Thus, a high growth density of microalgae can be achieved while simultaneously ensuring a high or growth-promoting nutrient supply in indoor aquaculture systems through the constant flow around the textiles and thus the algae in a biofilm reactor.
Integrating algae production into a shrimp (prawn) aquaculture system recycles nitrogen excreted by the animals and derived from feed residues through the algae into a very valuable and highly usable feed or protein source for shrimp growth. When the shrimp are fully grown, they are harvested and sold as high-quality food.
The newly developed algae production modules have been integrated into an indoor shrimp facility in Germany and are currently being tested.

Algae production module (APM) with adapted carrier textiles

Indoor aquaculture in recirculating systems is still a niche market in Germany and tries to present itself as a positive example of a responsible and sustainable method of aquaculture, in contrast to the often critically portrayed aquaculture with well-known negative headlines about environmentally damaging forms, especially in pond cultures in the tropics. In 2016, the Food and Agriculture Organization (FAO) in its report on the status of fisheries and aquaculture for Europe predicted an annual growth of aquaculture of about 3 % until 2025.

Project partners:
Gesellschaft zur Förderung von Medizin-, Bio- und Umwelttechnologien (GMBU e. V.), Dresden
ASA Spezialenzyme GmbH, Wolfenbüttel
Polyplan GmbH, Bremen
aquaMarine innovation, Kiel

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Substitution of resorcinol formaldehyde

New adhesion promoter systems for use in cord/matrix composite systems

Resorcinol formaldehyde latex (RFL) systems are among the most important finishes for high-strength yarns used in composites due to their very good adhesion properties. The most important industrial sector here is the rubber industry. However, due to the health hazards associated with the use of formaldehyde, there is an urgent need for more environmentally friendly and health-compatible processes for finishing with adhesion-promoting substances. In an AiF research project at the DITF, this task was taken up and the development and evaluation of formaldehyde-free adhesion promoter systems for industrial use was aimed at.
The sustainable, bio-based platform chemical HMF (5-hydroxymethyl-2-furfural) was selected as a promising alternative to formaldehyde and investigated with tests on a pilot plant dip system. HMF is toxicologically safe and very similar in reaction behavior to formaldehyde. In principle, HMF can therefore be used in applications comparable to those for formaldehyde.
The evaluation of alternative, environmentally friendly fiber modifications on technically important cords compared to RFL adhesion promoters showed promising results in terms of adhesion strength (e.g. in the peel test) for fibers and rubber compounds that can be cross-linked by sulfur-based systems or by organic peroxides. Existing industrial standards could be met.

Composite of dipped cord and NR-SBR rubber after peel test

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Goalkeeper gloves with finger protection

Over-extension protection prevents up to 90 percent of previous injuries


Glove test rig

Often, a fingertip length decides between victory and defeat. When we currently see a goalkeeper elegantly deflecting the ball over the crossbar at the European Championships, we can hardly imagine the forces acting on the fingertips and the danger of injuring oneself in the process. Together with their project partner T1TAN GmbH, the DITF are developing an effective finger overstretch protection for soccer goalkeeper gloves.

"The research task is very demanding," explains Hans-Helge Böttcher, a scientist at the Technology Center Knitting Technique. "The textile material must not only protect the fingers from extreme stress, but must also be flexible and not restrict sensory perception." That, he says, is the reason why no effective protection is yet available on the market.

The glove developed at the DITF is designed to prevent 90 percent of injuries caused by overstretching. To this end, a mechanical concept was developed that absorbs the force in the fingertips and optimally transfers it to the forearm via the wrist cuff – without the glove deforming. The central functional element of the overstretch protection are load-absorbing textile structures with specific force-elongation mechanics. These structures are sewn on from the finger end joint of the outer hand to the finger end joint of the inner hand and are thus firmly anchored in the glove. The glove and its functional individual elements have been designed and arranged to create a geometrically high form fit that optimally guides the flow of forces.

The great advantage for the athlete is that the protective device can not only be individually adjusted to each hand length, but the appropriate pretension can even be set for each individual finger. This design replaces the previous plastic splints attached to the outer hand. These so-called "finger frames" have the disadvantage that they easily bend beyond their stretch limit.

The wrist is enclosed by a cuff made of a particularly strong and elastic material and, with the help of load-bearing textile straps, transfers the tensile forces to the forearm via channels in the palm.

To test the effect, a "glove test rig" was set up at the DITF. It consists of a ball cannon and a specially developed hand dummy for the goalkeeper's glove. The ball cannon shoots at speeds of 20 – 120 kilometers/hour and from different ball ejection angles. A pressure cell is installed behind the glove, which averages the "residual impact force" on the hand. This is so low in the newly developed goalkeeper glove that the goalkeeper is effectively protected against overstretching of the fingers.

The research project is funded under the ZIM program and will be completed in September 2021. "It is quite possible that the new technology will already be standard at the World Cup in Qatar," says Oswald Rieder, head of the Technology Center Knitting Technique.

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Obituary Prof. Dr. rer. nat. Karlheinz Herlinger

On the death of the former head of the Institutes for Textile Chemistry and Chemical Fibers

Professor Karlheinz Herlinger passed away on February 18, 2021. With him, the DITF lose a personality who rendered outstanding services to scientific research and development in the field of textile and fiber chemistry over decades.

Professor Herlinger took over the management of the Institute for Chemical Fibers in 1968. With the establishment of industry-oriented research topics, Professor Herlinger already set the right accents at that time in order to bring together scientific reputation and industry-oriented research.

In 1972, Herlinger also took over the chair of textile and fiber chemistry at the University of Stuttgart. During his time as a university professor, Prof. Herlinger supervised a total of 123 doctoral theses in the fields of textile chemistry and chemical fibers. Together with the chair, Professor Herlinger also took over the management of the Institute for Textile Chemistry in Stuttgart-Wangen. The new building and relocation of the institutes from Stuttgart-Wangen to Denkendorf was also completed under Professor Herlinger.

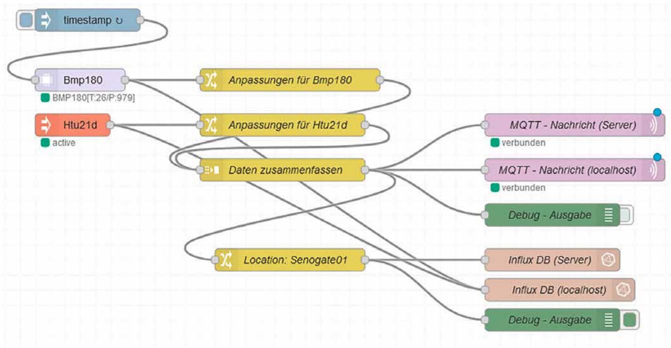
For more than 25 years, Professor Herlinger played a decisive role in shaping the direction of textile chemistry research in Baden-Württemberg, always taking into account the concerns of the local textile industry. The DITF mourn the loss of Professor Herlinger, whose work is still reflected in the success of this research institution today.

Professor Karlheinz Herlinger

First IIoT demonstrator in Microfactory multifunction lab in operation

In the new Microfactory multifunction lab, the first demonstrator was realized as part of the Mittelstand 4.0-Kompetenzzentrum *Textil vernetzt* project. An environmental sensor node from partner Hahn-Schickard and a Bosch sensor were integrated into the Industrial Internet of Things (IIoT) environment. The sensors collect environmental data such as temperature, humidity and air pressure.

This data is transmitted to clouds at various points in the intranet and internet and stored there. In the cloud, the data can be visualized and further processed. Among other things, the data is displayed at the headquarters of the Kompetenzzentrum *Textil vernetzt* in Berlin.



Programming of the IIoT demonstrator with Node-Red

The technologies used are Node-Red, MQTT and Grafana. The Node-Red graphical programming environment is used to create the data flows from the sensors to the cloud. MQTT (Message Queuing Telemetry Transport) is the standard data protocol used primarily for communication between machines. Grafana is an application for the graphical representation of data.

In the next step, the demonstrator is to be extended so that it can then also transmit and display data from a knitting machine. Here, the DITF are working together with the Stoll company. With the central storage of the data in cloud systems, predictive maintenance and quality can be implemented more easily. The demonstrator shows in many ways how IIoT works, how data can be easily collected, processed and centrally stored. The IT environment created in the Microfactory multifunction lab provides the server and network infrastructure for this, so that further sensors can be integrated quickly and cost-effectively.

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Sqetch and DITF launch the KompakT project

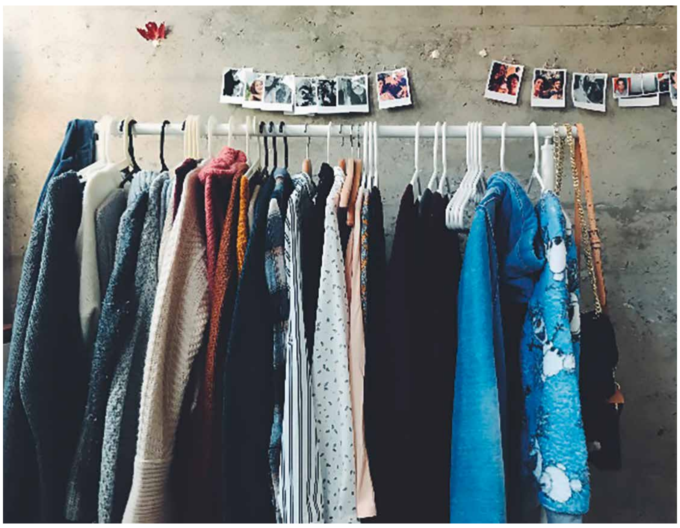
Establishment of a digital co-creation platform for sustainable fashion concepts

Sqetch and DITF jointly launched the two-year KompakT project on April 1, 2021. The aim here is to largely remove the barriers that arise from the complexity of supply chains in the fashion and textile industry and that often stand in the way of implementing innovative fashion concepts.

The following challenges are in the foreground:

> Growing demand for small delivery volumes with short delivery times
> Increasing networking of the production partners and brand manufacturers involved in production
> Difficult to access innovation potential due to a lack of collaboration in the design, development and realization processes
> Unused joint creativity, experience and competence of producers and suppliers with regard to material properties or process diversity
> Error-proneness of globalized supply chains in the fashion industry, due to complexity, high costs and delivery times, mostly at the expense of social and environmental standards

Overcoming these barriers or challenges must therefore take into account the diversity of fashion goods and processes, also from a sustainability perspective. With the help of the co-creation platform, creative industries and fashion designers are brought together with production partners and brand manufacturers for joint value creation without digital barriers. The project KompakT enables intelligent networking in the search for partners and supports the implementation of transactions, taking into account the diversity of fashion concepts, textile materials, suppliers and services. The focus is on the configuration of product and supply chains and a simulative preview of the impact of social and ecological aspects.


Innovative, sustainable fashion concepts sought – intelligent networking along the textile value chain required

KompakT is funded by the BMWi as part of the IGP program.

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Faster, stronger, fiber reinforced

New yarns expand the possibilities in additive manufacturing

3D printing, also known as "additive manufacturing", has evolved in recent years from the simple production of low-cost plastic molded parts to a wide variety of sophisticated engineering manufacturing processes. In addition to highly diverse plastics and metals used for additive manufacturing, the nature of the printing processes themselves has reached an increasingly high level of technical specificity. For the production of prototypes and small series, this type of component manufacturing is unrivaled because it can be implemented quickly and cost-effectively. Complex components for technical applications place increased demands on printing techniques in order to meet the requirements for strength, weight and other physical properties.


Pressure body made of wrapping yarn

Different 3D printing processes for a wealth of applications
Accordingly, various printing processes have already been able to establish themselves. In laser sintering, a laser beam fuses powdery starting materials layer by layer to form the finished object. In selective laser melting, metal powders are fused in a similar process. Stereolithography and polygraphy use liquid photopolymers that are cured layer by layer. However, the FDM process is the most common printing technique, which has already spread to the consumer sector. FDM stands for "fused deposition modeling", simply translated as "melt layering". A continuous ribbon of a thermoplastic polymer is melted in the print head, which is heated to around 200 °C, and the object is then built up layer by layer. The simple handling of this technique and low printing costs undoubtedly predestine the FDM process for a wide range of applications, especially for the production of prototypes or in the consumer sector, where the technical requirements are not too high. However, significant disadvantages of the process are, on the one hand, the limited printing speeds for technical use, since the molten thermoplastic always has to cool down before a new layer can be applied. Secondly, the strength of the printed objects is limited, which makes them of only limited use for technical applications: the reason for this is the low molecular orientation of the polymers after curing. Printing processes that combine an increase in printing speed with increased component strengths are therefore indispensable for technical applications.

Fiber reinforcement creates high-strength components
This is where fiber-reinforced 3D printing inevitably comes into play. In addition to the above-mentioned advantages, this technology also enables the optimization of strength-to-weight ratios when using suitable reinforcing fibers and polymers because the fibers used give the printed objects greater strength without increasing the weight.
Two fundamentally different concepts are currently established in fiber-reinforced 3D printing: Printing with short fibers or with continuous fibers. Short fibers are added directly to the printing polymer and still enable a simple printing technique, while the strengths of the printed bodies are only moderately improved. Printing with continuous fibers is demanding, as two nozzles are needed for simultaneous printing. One nozzle extrudes the thermoplastic, the other the reinforcing fibers. It is possible to introduce continuous fibers in a defined manner in the load direction of the component. This is the outstanding advantage over the use of short fibers, with which only components of lower strength can be produced. Printing with continuous fibers is well suited to the targeted reinforcement of small-scale components. High-strength reinforcing fibers made of carbon, glass or aramid are often used here. Reinforcing fibers can either be completely fused into the matrix polymer from the second extrusion die or, in another process, "ironed" into the printed object as a tape, as it were.

New yarns for fiber-reinforced printing
A completely different approach is being pursued at the Competence Center High Performance Fibers at the DITF in the working group of Dr. Erik Frank. In the "FaserFab" research project, prepared yarns are used as the exclusive printing material for fiber-reinforced 3D printing. Multiple individual components are no longer necessary. Printing speeds can be reduced while at the same time lowering costs. Carbon fibers, which are developed at the DITF and optimized for printing applications, are used as particularly high-strength reinforcing fibers. For 3D printing, the fibers are prepared as yarn or tape. The polymer matrix is part of the yarn. The polymer, in this case PA6, is applied as a wrapping yarn to the core carbon fibers. Fiber-reinforced printing can then be carried out with just one spinneret – with a continuous feed of a continuous yarn. In the case of the wrapping yarn, only the wrapped fiber is melted in the printing nozzle and pressed into the core fiber.


Wrapping yarns for fiber-reinforced 3D printing

Further wrapping yarns are to be developed and optimized in this research project. For example, initial trials with PET core fibers and wrapped PLA yarns have already been successful. Furthermore, PA6.6 core fibers will be combined with PLA. Metal fiber multifilaments and glass fiber yarns will also be prepared as core yarns and optimized for smooth feeding into the 3D printer. The DITF produce the yarns themselves on rewinding machines. The core yarn materials, which are so diverse, can cover a wide range of requirements for the printed components. In addition to the use of core yarns, another approach is being pursued: Here, the prepared printing filament is to be a bicomponent fiber. This fiber consists of a high-melting core surrounded by a melting sheath polymer. The bicomponent fibers can also be produced in-house at the DITF's own spinning facilities. The core is made of PET, the sheath of PBT. Both materials have different melting points, so that only one component is melted via a defined temperature control in the printer, while the other remains as a reinforcing fiber.

The basic requirement for fiber-reinforced 3D printing is to achieve a high degree of fiber filling in the component. This is because only fiber bundles that are optimally densely packed guarantee the highest component strengths. The wrapping and bicomponent yarns described are particularly well suited for achieving high fiber fill ratios. In the extrusion die, they allow processing under high pressures, which are necessary to compact the core fibers. Initial laboratory tests have already yielded promising results: PET core fibers with a wrapping yarn made of PLA enabled components with a high degree of fiber filling and already significantly increased strengths compared to a comparative body made of pure PET. However, the die geometry and temperature profile still require improvements, especially with regard to faster printing speeds. It is foreseeable that the novel yarns to be developed at the DITF will increase production speeds and expand technical application areas for 3D-printed components. Well-known printer manufacturers have already registered their interest in the development of the printing yarns, as they expect to gain a competitive advantage in this rapidly developing market.

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Zirconium oxide-reinforced mullite fibers

New fibers with great potential for high-temperature materials

High-temperature resistant ceramic fibers – from this special field of research the DITF have already reported several times on new developments. A new type of oxide ceramic fibers, whose properties redefine the leading standard, can now be presented as the result of intensive research work.

Spinning mass for ceramic fibers

The outstanding fiber properties relate to ceramics made of zirconium oxide-reinforced mullite. This ceramic class could be spun and sintered continuously in the form of fibers for the first time. Ceramic fibers are used to produce fiber-reinforced ceramic materials. These materials are resistant to thermal shock and are suitable for technical use at particularly high temperatures. For these applications, the ceramic fibers must have a ceramic microstructure that remains stable even under these extreme conditions.

While ceramic fibers made of mullite have already met these requirements in the best possible way for some time and have become established in many technical applications, the newly presented material from the DITF expands the technical possibilities. For the first time, it has been possible to produce mullite fibers with a zirconium oxide content of 3 to 15 percent by weight. The addition of zirconium oxide leads to the formation of a novel ceramic microstructure that exhibits improved mechanical properties compared to pure mullite.

Even though the exact mechanisms of action of the zirconium oxide additive in the fibers still have to be elucidated, it is known from "normal" ceramics that mechanical properties, especially fracture toughness, can be improved by producing such dispersion structures from several components. That this can also be transferred to ceramic fibers has already been shown by the very promising results of mechanical investigations. The production of zirconium oxide-reinforced ceramic fibers builds on decades of expertise at the DITF within the Competence Center High Performance Fibers headed by Dr. Bernd Clauß. Nevertheless, a completely new orientation of the process steps in fiber production was necessary. From the production of the spinning mass via the dry spinning process to the difficult adjustment of temperature profiles in the burning steps of calcination and sintering, the production process had to be realigned. In the process, the ceramic system of zirconium oxide-reinforced mullite was researched from the ground up. The findings were incorporated into the technical optimization of the process control, and a patent application was filed for the material and process.

For the technical application of the novel fibers, a significant improvement of materials in specific areas such as high-temperature lightweight construction or chemical process engineering is expected. In addition, the so-called fiber ceramics will play a major role in many high-temperature processes in the fields of mobility and energy in the future.

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Zirconium oxide-reinforced mullite fibers – new fibers with great potential for high-temperature materials

DITF and drupa – the success story of the Digital Textile Microfactory continues

The drupa in Düsseldorf is the world's leading trade show for the printing industry and the meeting place for the international print & packaging community. This is shown by the key figures of this year's virtual drupa 2021: 212 exhibitors from 35 countries, 125 live sessions, 45,000 visitors from 135 countries, 144 hours of streaming. In this community, digital textile printing is increasingly coming into focus. This is evidenced by market figures with impressive growth rates. The importance is reflected in many industrial applications of this cross-sectional technology in the automotive, home textiles, furniture and apparel sectors. This leads to the fact that drupa had planned a touchpoint textile in addition to the existing touchpoints for 2020, in close cooperation with the DITF. "The outstanding expertise, core competence and references of DITF and participating content partners (ESMA) are determining factors to realize this exciting project," Sabine Geldermann, Project Director Print Technologies Messe Düsseldorf, praised the cooperation with DITF.

At touchpoint textile 2020, a microfactory with well-known companies and a focus on giveaways for the European Football Championship 2020 was planned. Due to Covid, these activities had to be cancelled. Nevertheless, the DITF continued to pursue the "touchpoint textile" strategy together with drupa and realized an independent program for the digital format. The contributions in which the DITF were directly involved are available for download on the DITF and drupa websites. The next touchpoint textile will be seen at drupa 2024 – hopefully then again live on site in the Düsseldorf exhibition halls and certainly with new ideas.

Press photo of the drupa kick-off – Hans-Peter Hiemer, assyst and Prof. Dr. Meike Tilebein, DITF

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Welcome back to the AI EscapeROOM

Artificial intelligence in the industrial environment is currently on everyone's lips and an important connecting topic to digitalization and Industry 4.0. Last year, therefore, the AI EscapeROOM was set up as part of the Kompetenzzentrum *Textil vernetzt* funded by the BMWi, where the possibilities of AI applications for textile SMEs are made tangible in a playful way with virtual, real and mobile demonstrators.

Now the AI EscapeROOM has got virtual support. With a similar game idea, your task is to solve small tasks related to the topic of AI in a purely virtual game environment. In this way, you can learn more about the basic principles of AI in a fun way and discover the benefits of AI for your company. Join in. Try it out. Learn through play.

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Exhibitions & Events

September 16 – 17	60th DORNBIRN-GFC 2021, digital – DITF lectures and digital booth
September 23	Cross-Cluster-Workshop Smart Textiles, digital – DITF in cooperation with microTEC Südwest and AFBW
October 07 – 08	28th Annual Meeting of the German Society for Biomaterials, digital – organization DITF
October 19 – 22	INDEX, International Nonwovens Exhibition, Geneva – DITF booth
October 20 – 21	SME Digital Networking Workshop: Innovation. Inspiration. Interaction. – Mittelstand 4.0-Kompetenzzentrum *Textil vernetzt* at the DITF
November 01 – 04	IFAI Expo (Industrial Fabrics Association International), Nashville, USA – DITF booth
November 09 – 10	ADD International Textile Conference, digital – DITF in cooperation with DWI – Leibniz Institute for Interactive Materials, Aachen and Institute of Textile Machinery and High Performance Material Technology of TU Dresden, ITM with its friends and supporters of TU Dresden e. V.
November 15 – 18	MEDICA + COMPAMED 2021, Düsseldorf – DITF and ITVP exhibition presentation

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