RESEARCH HIGHLIGHTS

DEUTSCHE INSTITUTE FÜR TEXTIL- UND FASERFORSCHUNG DENKENDORF



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Tested quality – DITF protective masks

To help stabilize the supply situation of medical face masks during the corona crisis, the DITF had reacted guickly and converted their research facilities for mask production. Since May, the DITF have been able to produce CPA protective masks together with partners from the regional textile industry. The masks, which are tested according to the highest CPA standard by the testing institute itf Rosenheim GmbH, fulfill all legal and functional requirements. The material achieves an aerosol separation efficiency of over 97 percent. In the meantime, the Regional Council of Tübingen has also given the green light. It has been officially confirmed to the DITF that the protective mask "can be provided for the purpose of infection protection". Has this aroused interest? You can order the masks directly from the DITF.

Order at www.ditf.de/atemschutzmasken

AI EscapeROOM opened The playful way into the world of artifical intelligence

After a delay caused by the corona lockdown, the AI Escape-ROOM could now be successfully opened in Denkendorf – in the specially converted DITF research cube.It is the first of its kind in Germany and was designed and built by the DITF together with Hahn-Schickard. The AI EscapeROOM makes applications of artificial intelligence playfully experienceable and playfully entered the world of artificial intelligence in the AI EscapeROOM. The DITF and Hahn-Schickard have developed an innovative concept for the exciting and easy to understand communication of AI algorithms. In the AI Escape-ROOM the participants can expect an exciting time travel into the year 2083. 6 use cases based on different methods of the world is saved. The exciting game is over.

The AI EscapeROOM is a demonstrator of the Mittelstand 4.0 Kompetenzzentrum *Textil vernetzt*, which networks small and medium-sized companies in the textile industry, textile machinery and related sectors in the development of their digital fitness and the implementation of AI-based applications are



"The AI EscapeROOM offers various possibilities to experience AI and its applications in a playful way. In cooperation with AI, we successfully saved the world in 37 minutes in a self-experiment."

ESCAPE-ROOM "Summary: Crazy game, great fun"

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and shows with virtual, real and mobile demonstrators the possibilities of AI applications for medium-sized businesses. The aim is to reduce reservations and fears of artificial intelligence and to give the participants impulses and digital implementation ideas for their work in the company.

The first teams have already taken advantage of the offer

Al have to be solved in a team. In doing so, the participants get to know intelligent products and digital services in a playful way and discover the benefits of Al for their company "in passing". If all brainteasers and puzzles concerning Al principles such as deep learning, classification, neural networks, dimension reduction and clustering are solved interactively, supported. The initiative will be supported within the framework of the program Mittelstand Digital funded by the BMWi. You too can test the AI EscapeROOM. We cordially invite you.

Make an appointment: Dr.-Ing. Heiko Matheis, heiko.matheis@ditf.de

DITF are founding members of innBW e.V. Innovation Alliance Baden-Württemberg receives office in Stuttgart and founds association

For many years, the DITF have been coalition partners in the Baden-Württemberg Innovation Alliance (innBW), the third column of the state's research landscape alongside the universities and the four major research institutions. The main task of the innBW is the transfer of findings from basic research into ready-for-market products, processes or services for industry. The merger of 13 non-university application-oriented research institutes now received a legal framework as a registered association. The founding meeting took place in the presence of all 13 founding members on 24.06.2020 in Stuttgart. Chairman of the association will be the previous spokesperson Prof. Dr. Alfons Dehé (head of the institute Hahn-Schickard). deputy chairman Prof. Dr. Katja Schenke-Layland (director of the NMI Natural and Medical

Sciences Institute at the University of Tübingen). At the same time, an office headed by Anke Fellmann will be opened in Haus der Wirtschaft in Stuttgart.

With this reorganization, the research community intends to further expand its contacts with companies and to position itself even more effectively. The aim is to transfer new technologies, including those from energy, information and health research, to companies in Baden-Württemberg. Minister of Economic Affairs Dr. Nicole Hoffmeister-Kraut welcomed the decision.

"Being an excellent research location and an innovative industrial state at the same time, makes Baden-Württemberg strong. This is why the expansion of technology transfer between research and science and in particular small and medium-sized



Foundation meeting innBW e.V. in Haus der Wirtschaft, Stuttgart

companies is a focal point of the state government's work," emphasized Minister Dr. Nicole Hoffmeister-Kraut at the foundation ceremony. "Here innBW plays a decisive role. With the now completed professionalization of the structure, the institutes of the innBW will be able to make an even greater contribution to strengthening the innovative capacity of the Baden-Württemberg economy in the future".

Armin F. Knauer deceased

DITF mourn former member of the board of trustees

The board of directors, the employees and all committees of the DITF mourn the death of the former member of the DITF board of trustees and the former Southwest Textile President Armin F. Knauer. He died on 26th July 2020 at the age of 76 years.

With Armin F. Knauer, the DITF loses a formative personality who, with his comprehensive expertise and great commitment in many functions, was instrumental to the textile industry and textile research. He was a textile expert with heart and soul. Armin F. Knauer has accompanied the DITF for more than 10 years as a member of the board of trustees. With his expertise and his untiring commitment, he played a major role in the successful development of our research institute.

As managing partner of the HOS Group (Heinrich Otto & Söhne, Wendlingen), Armin F. Knauer has been guiding the fate of one of the most traditional groups of companies in the textile industry. In addition, he assumed a large number of honorary functions with great commitment and always showed himself to be committed to the common good. He was a longstanding member of the Southwest Textile Board of Directors with various offices on the Presidium, and from 2009 to 2011 Knauer was President of the Association.

As part of his many and varied honorary activities, Knauer was also involved as Vice President of the Gesamtverband textil+mode, as Treasurer of the Friends of the Theodor Heuss Foundation, as an honorary commercial judge and in the Stuttgart Region Chamber of Industry and Commerce. At Volksbank Kirchheim-Nürtingen eG, Armin F. Knauer was a member of the supervisory board for many years and was on the board of trustees



Photo: Armin F. Knauer

of Kreissparkasse Esslingen-Nürtingen. In 2012, Armin F. Knauer was awarded the Cross of Merit on Ribbon of the Order of Merit of Federal Republic of Germany for his wide-ranging activities in the fields of business, society and culture.

The DITF will remember his work for the research institute and the textile industry in honorable memory.

Lindauer DORNIER initiates development of reusable masks at the DITF

Production of One Piece Masks made of precision woven fabric in Jacquard weaving technique

Initiated by weaving machine manufacturer Lindauer DORNIER, DITF have started a project for the development of reusable medical face masks based on high precision air jet weaving technology. The project creates the prerequisites for setting up the development, testing, approval, start-up production and cleaning service for reusable medical face masks within 4-6 months together with renowned industrial partners from the region and the Hohenstein Institute for Textile Innovation gGmbH.

The project, together with two other outstanding corona projects, was selected from 120 applications submitted nationwide and is supported with 195 thousand euros by the Ministry of Economics, Labour and Housing.

The supply situation for medical face masks has now stabilized and there is no longer an acute emergency situation as at the beginning of the corona pandemic. Nevertheless, oral and nasal protection (MNS) is still a scarce commodity. The supply situation for protective equipment is extremely tense due to global demand. In order to avoid supply shortages in the future, pragmatic solutions are being sought which, in cooperation with regional textile machine manufacturers and textile producers, will guarantee a secure supply in Baden-Württemberg and make the state independent of deliveries from Asia.

At the same time it is important to further improve the wearing comfort and protective function when developing new masks. For the most complete protection possible, the masks must fit comfortably and tightly in the cheek area. There is currently still considerable potential for optimization here. In addition, conflicting requirements regarding air permeability and microbial separation efficiency must be met. The medical face masks do not have to be sterile, but they must necessarily be lowgerm (disinfected). Last but not least, ecological aspects that speak against the use of disposable products must be taken into account.

The now approved project under the direction of Dr. Hans Jürgen Bauder, division manager for weaving technologies at the DITF, addresses these requirements with a completely new manufacturing approach: While the common protective masks are made of nonwoven fabric and thrown away after a single use, the Denkendorf researchers are focusing on "readymade" one-piece masks made of high-performance precision fabric using jacquard weaving technology. An innovative manufacturing concept for flexibly adaptable masks with significantly improved wearing comfort and thus higher protective function is realized. According to initial calculations, the manufacturing costs are 6-8 cents/ mask and thus offer a realistic base for mass production.

The focus of the project is on the technical design of the woven face mask, which is to be made available for production to the 15 textile companies in Europe, which operate a total of more than 200 jacquard weaving machines. The production settings of the masks developed at the DITF can be immediately transferred to existing



Mouth protection masks with the precision of an airbag: Hans-Jürgen Schmidt (left), Managing Director of DORNIER and Lars Öller, Head of Technology Center Weaving Machines, show a mouth protection prototype that can be woven in one piece on DORNIER jacquard weaving machines. (Photo: CF)

production facilities. This would enable the 15 weaving mills to produce over 2 million masks per day in the short term – a significant contribution to further stabilizing the supply situation for protective masks.

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Project partners

Mask production

Lindauer DORNIER: Provision of the air-jet weaving machines Stäubli AG: Project partner for jacquard weaving technology Global Safety Textiles: Production of the warp beam and drawing-in of the warp threads TWD-Fibres: Supply of antimicrobial filament yarns and textured yarns

Mask reprocessing and testing

Textile Care Mayer: Washing process, reprocessing Ortenau Clinical Center, Offenburg: Evaluation of the masks and the overall concept from the user's perspective

Hohenstein Institute for Textile Innovation gGmbH: Testing of masks according to the specifications of EN 14683; Expertise on biocompatibility, washability and reprocessing

Usability of Smart Textiles

Diffusion-inhibiting coatings for textile-integrated, electrical structures

Broad market access for Smart Textiles is often hindered by the fact that the necessary usability of the products is not ensured. Mechanical stresses such as stretching and rubbing damage the integrated electrical functional elements after a short time. Chemical influences often destroy them completely. High stresses can occur both in use, e.g. due to weathering and abrasion, and in care, e.g. when washing. For important fields of application such as functional clothing, medicine, interior design and architecture, textile electronic elements such as sensors, actuators or other intelligent functions have therefore not yet become widely accepted.

Within the scope of the joint industrial research project, the application potential of protective coatings for electrical functional elements in textiles was therefore investigated. These coatings maintain the textiletypical properties (flexibility, shape adaptation, textile feel, etc.) while ensuring permanent flexural strength, washability and functionality. The project succeeded in significantly increasing the chemical barrier effect of the protective layers by adding water-based binder systems with phyllosilicates and at the same time realizing an application by screen printing. Demonstrators with exact arrangement and positioning of these thin, diffusion-inhibiting layers in relation to printed circuit tracks and an adapted contacting possibility proved the functionality. The technical solution approach was systematically investigated for various



Demonstrator: Coated heating textile, left: Macroscopic image; right: infrared image taken with a thermal imaging camera

applications of Smart Textiles and targeted at markets with high potential. The production of illuminated lettering on awnings was identified as a first promising field of application. Many companies in the textile chain can use the novel coating to meet the predicted increase in demand for printable, electrically conductive coatings with high adhesion and stretchability as well as conductive yarns. For example, textile printers can add textile sinkers to their traditionally fashion-oriented product range.

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Porous fibers as drug carrier

Effectiveness of porous dressing materials for drug delivery

The functionalization of medical devices is currently a great challenge for manufacturers but also an opportunity for medicine. Textiles are of particular importance in this context. In addition to the monitoring of healing processes with textile-integrated electronics (Smart Textiles), the controlled release of active ingredients creates a significant additional benefit for the medical device by supporting and regulating healing processes and reducing side effects. This goal is being pursued by a current development at the DITF, which supports the healing of chronic wounds by a defined release of growth factors from wound bandages. The challenge lies in the time-defined, targeted release of the active ingredients from the wound bandage directly into the wound bed. In a publicly funded project (AiF 19523 BG), the DITF developed porous polymer fibers from which the active ingredient is released with a time delay.

The basis are extruded fibers of different polymers compounded with a water-soluble component. After washing out this component, the fibers have interconnecting pores into which the active ingredient is introduced within a carrier by a vacuum process. The active ingredient carrier, a hydrogel based on a polysaccharide, preserves the active ingredient activity and simultaneously serves as a diffusion matrix. The active ingredient release characteristics



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SEM image of the cross-section of a porous fiber to release active ingredients

depend on the cross-linking of the gel and the fiber porosity. The effectiveness of the novel wound bandage materials for, in this case, the formation of new blood vessels in the wound bed was successfully demonstrated in an in vitro cell culture model at the cooperation partner, the University Hospital Frankfurt/M. The model, based on human skin equivalents, contributes significantly to the understanding of drug release for the treatment of chronic wounds. The work was recently published in the journal "Tissue Engineering". A photo with a knitted mesh made of the porous fibers even made it onto the cover picture.

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EU funding initiative SmartX

Promotion of small-scale projects on Smart Textiles

Within the framework of the EU funding initiative SmartX, SMEs are supported for small projects on Smart Textiles. A consortium of 13 European organizations under the leadership of the Textile European Technology Platform (ETP) in Brussels acts as the coordinating body for this "European Smart Textiles Accelerator".



The DITF are consortium partners of the initiative. The aim is to promote the market-readiness of innovative prototypes of combinations of textiles and electronics.

The results of the first of three rounds of calls for proposals

are nine funded projects, each involving up to four SMEs from a total of eight European countries. The total funding amounts to more than 700,000 euros. The projects, most of which are one-year projects, started in June/July 2020.

For example, the aim of the Dynaback project – with the SMEs Dynaback, BG and Amohr, DE – is to use sensors to measure body tension and posture in the back, to analyze and evaluate it using software and, if necessary, to send a warning message, for example to a cell phone, regarding an unhealthy sitting position. The sensor and the electronics are integrated into the outer garment, such as a shirt. With the help of the funding totaling 120,000 euros,

the integration of the sensors and handling in particular are to be improved.

Within the framework of the recently completed 2nd call for proposals, 30 applications are currently being evaluated by an independent panel of experts; results are expected towards the end of the year.

3rd call for proposals – Take part!

If you are active in the field of Smart Textiles with developments for combining textiles with electronics and are looking for support and partners for the market maturation of your innovative prototypes, please visit our SmartX-Community with more than 400 members. Apply for the last call for pro-



Bright information about SmartX

posals starting in December 2020! The DITF cordially invites you to an information event on November 4th, 2020. www.smartx-europe.eu

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Project completion Retail 4.0

Virtual Retailer feedback and Augmented Shopping

Digital technologies are conquering the fashion industry and opening up new possibilities from virtual product development to the direct involvement of customers and retailers. The research project Retail 4.0 dealt exactly with this topic and developed innovative solutions for feedback and coordination processes between manufacturers, traders and customers in the retail industry using Virtual (VR) and Augmented Reality (AR).



Color selection with augmented reality glasses

The prototypical implementation of the solutions took place in the development center of the project-accompanying manufacturer Brax, at the DITF and the TH Cologne as well as in the system environment of the IT companies Assyst and Avalution. Different scenarios for collection creation (B2B) and for customer communication (B2C) were tested. Right at the beginning of the project, it became clear that collaborative AR solutions in the B2B area. for example the field of view, are currently not a solution approach for broad use in industry due to technical restrictions such as the field of vision.

In the B2B area, however, the focus was on a collaborative VR approach with interaction to a platform. This enables virtual, location-independent

coordination in a VR-based showroom. This allows retailers to influence the development of their collections and work together in a meaningful way even in times of pandemics, for example.

In the B2C area, an approach was developed based on the "Bring your own device" principle. Here, items of clothing are integrated into apps on mobile devices. This solution offers customers not only a unique shopping experience but also individual size and fit recommendations.

The research project was funded for three years by the German Federal Ministry of Education and Research (BMBF). The "DigitalLab" at the DITF serves as a VR/AR test environment for the prototypical implementation in the project and will



Feedback on the collection using virtual reality glasses

be used as a basis for further research and development projects in the context of collection creation. It is open to interested parties as a demonstrator and for their own test scenarios.

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High performance cellulose fibers

HighPerCell is a registered trademark for high-tenacity regenerated cellulose fibers

HighPerCell has recently become a registered trademark of the DITF for a new, high-strength regenerated cellulose fiber, which is produced in a direct dissolution process using ionic-liquid technology (IL). This process offers the advantage over the conventional viscose process



Ionic Liquid (IL)

that no derivatization of the starting materials is necessary. This makes the process safe and cost-effective. The fibers are spun out as continuous fibers. Due to their high strength they can be used as high-performance fibers in many technical products. Possible applications are the use as tire cord, as precursor fibers for the production of carbon fibers or as reinforcing fibers in fiber composites.

The solution and spinning process of HighPerCell can be specifically adjusted to the desired fiber properties. Thus a wide range of applications can be served with this fiber type. In addition to the special technical properties, the ionic-liquid technology is convincing as a particularly sustainable and environmentally friendly process: The solvent is almost complete-



Spinning of cellulose fibers

ly recovered and can be reused. By registering the process as a protected trademark, the DITF have initiated the commercial exploitation of the process and the product. Both fiber manufacturers and end users such as tire manufacturers have already shown interest in HighPerCell.

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Research project Functiotex

Digital textile printing enters the third dimension

Digital textile printing has proven to be a cost-effective method in industrial production. Flexibility for the production of small batches, the realization of complex designs and a complete digitalization of production are further decisive advantages, which have been reflected for years in the increasing growth rates of digital printing technology. New digital printing processes and ink formulations have been developed at the DITF for years. A newly launched research project called "Functiotex" follows on from this expertise: A new type of functional ink is applied to textile surfaces via digital printers and is used to form three-dimensional structures. The inks used will be foamable.

The special advantage of combining digital printing with foamable inks is the possibility of applying foam structures to

the textile substrates in a regionally limited way. In this way it is possible to print very small and detailed patterns. The dry-



Functional foam on textile surface

ing and fixing of such foam structures is carried out by means of so-called NIR technology (Near Infrared). This has the property of providing a high energy input over a short period of time, heating only the water of the ink and thus specifically fixing only the foams without thermally affecting the textile carrier.

Possible applications result from the anti-slip properties of the foams. The technology will be of interest for clothing textiles (e.g. slip-resistant socks) as well as for technical applications where a defined surface structure is required from textiles.

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Environmentally-friendly materials for a sustainable society

Cellulose-chitin blend fibers in the focus of the Year of Science

The Science Year 2020/21, which is being initiated by the BMBF for the 20th time this year, is dedicated to the topic of the bioeconomy. The aim is to make current research topics transparent and accessible to the public. Developments in research can thus not only be accompanied in open discourse, but also influenced – so that research topics will always be reflected in the service of society in the future.

The bioeconomy provides a forum for interdisciplinary and urgent topics of our time. The aim is to show the possibilities of an economy that is moving away from the use of finite, fossil raw materials and towards sustainable and resource-saving processes. The DITF have been pursuing this task in its research areas for many years. The Science Year Bioeconomy is the occasion to present a novel fiber made of natural raw materials. The research group of Dr. Frank Hermanutz can look back on decades of experience in the production of cellulosebased fibers and now presents novel blend fibers made of cellulose and chitin using the lonic-Liquid Technology (IL).

Chitin is obtained from the shell of crabs, a waste product that is cheap to obtain. It is particularly skin-friendly and is therefore suitable for use in medical products. However, chitin is hardly soluble in water and is difficult to process. "We have developed a process to combine chitin with the biopolymer cellulose and spin it into fibers in one step," explains Dr. Antje Ota, research associate at the Competence Center Biopolymer Materials of the DITF. "The blend fiber is



particularly skin-friendly and has great potential for use in medical technology for wound dressings. In addition, the fibers are manufactured in an environmentally friendly process". The special feature of the manufacturing process is the use of ionic liquids, a group of substances that has excellent dissolving properties even for substances that are difficult to dissolve. From a large number of commercially available ionic liquids, the most suitable one has been found, so that it not only dissolves both polymers, chitin and cellulose, equally well, but is also perfectly suited for use in the fiber spinning process. The ionic liquid is completely washed out and recycled after coagulation of the fibers in a precipitation bath.

This closes the circle on the subject of bioeconomy: the novel cellulose-chitin blend fiber and its manufacturing process stand for a sustainable, bio-based economy. The DITF thus show a way to replace con-

Exhibition: Die Wunderkammer der Bioökonomie

As part of the Science Year 2020/21, the Fraunhofer UMSICHT and the Folkwang University of Arts are designing and curating an exhibition: Die Wunderkammer der Bioökonomie. This will be housed in a Tiny House and will go on a tour through Germany to Rheinhessen, the Hygiene Museum in Dresden, Thuringia and Dortmund. The exhibition will also be digitally processed and can



Tiny-House exhibition "Wunderkammer der Bioökonomie" with PURCELL exhibits of the DITF; on display from October 28, 2020 at the Thuringian Open Air Museum in Hohenfelden

ventional products with resource-saving processes. In this sense, the DITF will use the Science Year to introduce the new product to the public and show how applied research can provide new impulses for a sustainable society.

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Dr. Antje Ota at the DITF Spinning Technology Center

Eine Initiative des Bundesministeriums für Bildung und Forschung



be visited independently of the tour on a website. The DITF are prominently represented in the exhibition space with their exhibits on fully recyclable, cellulose-based fibers and composites.





Digital booth of the DITF at the AFBW Virtual Composites Show. Behind the blue dots are digitally prepared information that is available to the user at the click of a mouse.

Virtual presence of the DITF

Since the beginning of the Corona pandemic, the trade fair and event industry has been upside down. Nearly all physical live events have been cancelled or postponed until next year. The DITF are therefore increasingly focusing on online formats. This provides the opportunity to maintain contact with partners and customers or to establish new connections even in these difficult times.

By participating in various virtual shows, the DITF has already been able to successfully present digital trade fair products at the gain experience. With the help of webinars and live chats the contact between visitors and exhibitors was based on produced in a simple way. Further virtual trade fairs will be on the DITF event calendar in the coming months (see www.ditf.de). Visit us virtually and take advantage of our events and trade fair offer.

ADD International Textile Conference 2020

In agreement with ITM Dresden and DWI Aachen, the Aachen-

Dresden-Denkendorf International Textile Conference 2020, which is planned for this year in Stuttgart, has been postponed to November 9-10, 2021.

SMART TEXTILES User Forum

The 9th Forum will take place virtually for the first time in March 2021. With 3-hour sessions over two days, contributions on the topic of Smart Textiles will be offered. Adapted to the online format, the focus will be on film contributions, showroom presentations and product presentations. A podium discussion with representatives from the industry will be held live in Denkendorf and digitally broadcast.

Successful conversion to DIN EN ISO/IEC 17025:2018 Testing laboratories successfully accredited by DITF and ITVP

In May 2020 the review took place for the conversion of the Textile technology and testing laboratories Technical textiles of the DITF and of the test laboratory of the ITVP GmbH to the current DIN EN ISO/IEC 17025:2018 "General requirements to the competence of Testing and calibration laboratories". through the DAkkS. After extensive preparations both laboratories could at the appraisal opposite of the DAkkS,

that the new regulatory Compe-

tence requirements fulfilled and

convincing were implemented. This concerns among others the personnel, the assurance of validity of test results and the Dealing with risks and opportunities.

With receipt of the accreditation certificates the conversion now is successfully completed and the testing laboratories of the DITF and the ITVP are future-proof accredited. An overview of the accredited testing services you will find on the homepage from DITF or ITVP.



NEW! MASKS FROM OWN PRODUCTION

DITF protective masks:

- > CPA tested by itf Rosenheim GmbH
- > 100% polyproyplene
- > 3 layers: spunbonded-meltblown layer-spunbonded
- > Integrated nose clip
- > High wearing comfort, low breathing resistance
- > Filter efficiency: > 97%
- > Developed and produced at the DITF, confectioning at Junker Filter GmbH
- > Standards: Test principle for Corona SARS-Cov-2 pandemic rapid test procedure Rev.02 according to ZLS procedure of 02.06.2020
- > Package size: 20 pieces

Price:

Euro 62.00 plus VAT for a package of 20 pieces (3.10 per piece) from 1,000 pieces: Euro 58.60 plus VAT (2.93 per piece)

Are you interested?

Order under vertrieb@ditf.de or +49 (0)711 9340-0 For technical questions please contact Ingo Windschiegl: ingo.windschiegl@ditf.de



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