German Plastics Center Testing • Education• Research• Certification• Networking



SKZ-aktuell



News for members, customers and partners

Interview with **Dr. Thomas Hochrein** **Young SKZ talents cream** off the prizes

Expert knowledge & ma-chine learning in the injection moulding process

18

4

Dear customers, Dear members and friends of SKZ,

Looking back a year, our first major event, the SKZ Conference on Silicone Elastomers, took place after a long break at the Schenkenturm on June 15, 2021. Today, it sometimes feels almost



From the content

Better protection of tool surfaces in extrude against wear and tear	ers 7
Two "Enablers" go full throttle	10 & 11
Glass fibre reinforcement in plastics - made more visible	14
Flagship project for the bioeconomy: Orange peel will provide valuable bio-based epoxy resins in the future	d 22

as if Covid had never happened. Since April, there have been regular events taking place at the SKZ again, now even without obligatory masks, and the participants are visibly looking forward to personal meetings and exchanges on site. Currently, the next opportunity – the SKZ Network Week – is just around the corner. A good and important opportunity to get to know the SKZ better and to further strengthen and expand connections. Either at the "Smart Waste Convention[®] on 28 June, the SKZ Network Day on 29 June or the Technology Day on 30 June. Three varied and intensively packed days with application-

related examples around the topics of recycling practice, the shortage of specialists and managers, energy efficiency, climate protection and sustainability. In addition to an exciting lecture programme and an attractive exhibition, there will be live demonstrations on running machines giving a comprehensive insight into the impressive SKZ Technical Centres. The SKZ Technology Day will present you with the central processes of the plastics industry up close – compounding, extrusion, injection moulding, additive manufacturing, welding and bonding.

What else happened at the SKZ?

From 1 June, the SKZ will be reorganising its management. With Dr. Thomas Hochrein as the new managing director of SKZ – Testing GmbH and ASO GmbH, and Dr. Benjamin Baudrit, who will assume the operational business of SKZ - KFE gGmbH, two genuine experts on all things SKZ will be able to provide for the further development of the SKZ with a wide range of expertise and management know-how, and will be able to draw on many synergies. In October, two important new SKZ buildings will be completed: the model factory and the quality assurance training centre, both at the Würzburg site. There are many new opportunities for cooperation between the SKZ and our customers in various sectors from testing to research, education, certification through to networking, We look forward to welcoming you to Würzburg, Don't miss this opportunity to experience the SKZ first-hand, because meeting is what keeps a network alive!

Martin Bastian Director of the Institute

COVER IMAGE: Conference Plastic Films in Mobility 2022

IMPRINT

Publisher FSKZ e. V. Frankfurter Straße 15–17 • 97082 Würzburg

Editors German Plastics Center (SKZ)

Dr. Thomas Hochrein has been Managing Director of the Analytics, Product Testing and Certification divisions of the SKZ since June 1, 2022

THE OPERATIVE BUSINESS OF SKZ – KFE GGMBH EMPLOYS DR. BENJAMIN BAUDRIT



The management of the SKZ positions itself sustainably and fit for the future: Since June 1, 2022, Dr. Thomas Hochrein has been managing director of product testing and certification as well as analytics within the SKZ Group, (i.e. SKZ – Testing and the Analytik Service Obernburg subsidiary). Dr. Benjamin Baudrit assumes the operational management of education and research within the non-profit SKZ – KFE gGmbH.

In his role as managing director, Hochrein is replacing Dr Gerald Aengenheyster, to whom Institute Director Prof Martin Bastian expressed his gratitude for his achievements in the field of product testing and certification during recent years. "The SKZ continues to be a reliable partner in plastics testing," assures Hochrein and looks forward to the tasks ahead. "Of course, the quality of our services continues to be the focus. In addition, I would also like to adapt the efficiency of our working methods and ourselves to the current markets. Our highly qualified and committed employees are the basis for this." Dr. rer. nat. Benjamin Baudrit, Prof. Dr.-Ing. Martin Bastian and Dr. rer. nat. Thomas Hochrein (f.l.t.r.) (Photo: SKZ)

Hochrein studied and graduated in physics at the Julius Maximilian University in Würzburg. After working in the plastics industry, he was a research assistant from 2007, then a business unit manager for the measurement technology department from 2011 and a divisional manager for products & processes in the research department of the SKZ from 2014. In 2017 Hochrein took over the management of education and research. After a stay abroad in the USA, he was awarded the Otto von Guericke Award of the German Federation of Industrial Research Associations (AiF) in 2009 for his research in the field of terahertz technology, which was also the basis of his doctorate.

Dr. Baudrit takes over the operational business of education and research

Hochrein remains managing director of education and research, but will withdraw from this operational business in order to be able to devote himself to his new tasks. Dr. Benjamin Baudrit has been responsible for operational matters since 1 June 2022 as the new deputy managing director.

Baudrit first studied chemistry at the Joseph Fourier University in Grenoble, France, then continued his studies with a focus on polymers at the University of Coventry, England, and at the Münster University of Applied Sciences. He took his degree at the SKZ and the University of Osnabrück. Baudrit has been working at the SKZ since 2004. He developed the research activities in the field of welding and bonding and significantly increased the relevance of the SKZ in the field of education and training for welding and bonding specialists. As a welding expert, Baudrit was able to raise the significance of practical and well-founded training for the joining of plastics in numerous standards and guidelines committees. As business unit manager in the areas of joining and products & processes as well as interim material development, compounding & extrusion, he knows the research and further education of the SKZ like no other.

"I am very pleased that in Dr. Hochrein and Dr. Baudrit we were able to win true SKZ experts with a wide range of expertise and management experience for these important tasks", says Institute Director Bastian. "I am convinced that with this new formation of the management, we have found a very sustainable, future-proof solution for the further development of the SKZ, creating plenty of synergies."



Markus Hoffmann | DipL-Ing. (FH) Press/Marketing +49 931 4104-788 m.hoffmann@skz.de

"I am very happy to be part of the SKZ"

INTERVIEW WITH DR THOMAS HOCHREIN

Managing Director Dr. Thomas Hochrein has been employed at the SKZ for 15 years. In conversation, he reveals why he needed two attempts for the SKZ, why he was initially considered a "terahertz crank" and what he loves about mountaineering. Interview: Pia Lehnfeld

Mr Hochrein, you have now been employed at SKZ for 15 years. Do you still remember the beginnings?

Of course. I had already applied to the SKZ after graduating. At that time, however, the SKZ was not yet located at the Friedrich-Bergius-Ring in Lengfeld, and that would have meant a job at what was then TeConA, today's Testing. The interview took place in a high-rise building in an ancient room with green ,60s upholstered chairs – not particularly contemporary. In addition, it would have been a position with – in my view – rather dry standards. After studying physics, I had rather imagined something different. The job was offered to me, but I declined with thanks and went into the industry.

And how did you finally get to the SKZ?

After my first application, Martin Bastian, who was then the new institute director at the SKZ, had offered that I should contact him again if I wanted to change my profession. When, after a few years in the industry, I actually wanted a career change, I remembered his words and proactively contacted him. And it worked: I got an offer as a researcher. By then the new technology centre at the Friedrich-Bergius-Ring had been built, and the atmosphere was also completely different – the rooms were bright and modern, the job sounded exciting and there was the possibility of promotion. That's why I agreed at the second attempt.

And have you never regretted it?

Not one bit. On the contrary. What I particularly appreciate at the SKZ are the numerous possibilities for development, layout and design for all those who show initiative and have good ideas. Likewise, the good mix of atmosphere and working methods, of entrepreneurial work in the business/industry on the one hand and the character of the institute on the other. I also enjoy the high flexibility of my work. The networking of industry, politics and public authorities is also extremely exciting for me. In short, I am very happy to be part of the SKZ.



When did your passion for the world of plastics first come about?

Only after my studies, really. I did a technical baccalaureate, but I wanted to study physics partly because I had good teachers there. To make this possible, I first studied Precision Engineering and Microsystems Technology at the technical college up to the intermediate diploma and then switched to physics at university. In the second half of my studies, I also oriented myself towards business administration. I was probably more of an "atypical" physics student, as I have always been more interested in practical applications. I did my diploma thesis in the industry, which was completely atypical at the University of Würzburg. It was only after my studies that I came into closer contact with real plastics: I started at an SME as an assistant to the management and supervisor for research and development. Thematically, I mainly dealt with high-performance polymers, mainly for sliding/friction applications in injection moulding and my own material development. I then moved to the SKZ; my enthusiasm for plastics has remained unbroken ever since.

You said that in your early days at the SKZ you were ridiculed for your research on the subject of terahertz. Why was that?

That's true. When I started at SKZ, I first led a research project on so-called terahertz waves. In

2007, this was still a very complex and unusable technology from the university laboratories. During my time in the USA, I was only able to take measurements at night, because during the day the vibrations from a nearby construction site interfered with the measurements – far away from any practical application. But with the help of our partners from the IHF Braunschweig, two years later we were awarded the Otto von Guericke Award of the Federation of Industrial Research Associations (AiF) for our research. I also dedicated my dissertation to this subject. And about 10 years ago, the first company actually took up this technology and is now selling it commercially on the market. Fortunately, I finally lost my former status as a "terahertz crank" (laughs).

You work part-time as a mountain guide. To what extent does this also help you as managing director at the SKZ?

The exercise, outdoors feeling and mental relaxation involved in my part-time job as a mountain guide are things to look forward to when I work in the office. Moreover, there are always very motivated and enthusiastic guests on a mountain tour. They even pay to be on a tour with me. For my employees, it's rather the other way around (laughs). Sometimes you have to put in a little more effort. On a mountain tour, however, I



often look forward to being back in my comfortable office chair. In this respect, this is a perfect mixture for mind and body. In addition, as a managing director you are rather sitting on an "ejection seat", so having a plan B as a mountain guide has a calming effect in the back of your hand (laughs).

What do you wish for yourself for the next 15 years?

I hope that the SKZ will continue to develop so well and maintain its status as an important pioneer within the industry. In addition, it is very important to me that we continue to expand our social commitment – such as our school laboratories – and become climate-neutral. I also hope that, despite growth, we can maintain and even strengthen our internal cohesion – because that is what makes the SKZ what it is.

SKZ Managing Director Thomas Hochrein in his office (Photo: SKZ)

Personal Information

Dr. rer. nat. Thomas Hochrein joined the SKZ in 2007, where he first led a research project on the terahertz subject, for which he was awarded the Otto von Guericke Award of the Federation of Industrial Research Associations (AiF) two years later. This was followed by his dissertation on Terahertz Spectroscopy: System Development and Use in Polymer Analysis", which he completed in 2018 with summa cum laude. To deepen his research work, Hochrein worked for almost a year as a visiting scholar at Rice University in Houston. In addition, Hochrein set up the new Measurement Technology Research Unit, which today is divided into the two groups of Spectroscopy and Non-Destructive Testing. He then assumed the management of Products & Processes before becoming the sole managing director of SKZ-KFE gGmbH and co-managing director in the umbrella of SKZ, FSKZ e. V., about five years ago.

SKZ achieves all-time sales high

COMPANY GENERATES REVENUE OF 41.6 MILLION EUROS

The Plastics Centre defies the pandemic: In 2021, the company generated sales of 41.6 million euros – more than ever before in its 61-year history.

41.6 million euros – this is the hefty turnover that the SKZ, headquartered in Würzburg, Lower Franconia, was able to achieve in 2021. "Never before in our 61-year history have we been able to generate such high sales – and this even in the second year of the corona pandemic. This shows us: The SKZ has developed very positively in 2021 and will emerge even stronger from the crisis," says a pleased Institute Director, Prof.-Dr. Martin Bastian.

"The pandemic was and is a 'stress test' for the SKZ and leaves its mark," explains Bastian. The impact at the beginning of the pandemic reduced company revenues to EUR 36.8 million in 2020. By way of comparison: In the pre-pandemic year 2019, it was 40.7 million euros. But in the second year of the pandemic, the positive trend reversal took place. The reason: "The business units of the SKZ have managed to adapt skilfully to the new

developments and changes in the markets and among customers," says Bastian. For example, technological alternatives have increasingly been used to make on-site visits to our customers for product and system audits, consulting and sales discussions virtual. And: "The education sector has expanded its portfolio with online or hybrid events. The important communication between our members at networking events could be managed in the form of face-to-face events, as the dates and security concepts were chosen with great sensitivity and care," Bastian continues.

SKZ plans further jump in sales

But that's not all. Institute Director Bastian is also more than satisfied with the development over the last ten years. In 2011, the SKZ generated revenues of 26 million euros. "This is a 60 percent increase in sales within ten years and a terrific success for the SKZ. This shows us: We approached our tasks correctly and sustainably, were able to convince customers, business and cooperation partners of our performance and reliability." Of course, the SKZ should not rest on its laurels, says Bastian. With the construction of the model factory and the TZQ training centre, the SKZ is finally facing a major financial challenge. Both buildings are an enormous investment in the future and a sustainable strengthening of practice-oriented research, which is a cornerstone at the SKZ. That is why we are also planning sales growth of six percent for 2022." The director of the institute is optimistic about the future. "The SKZ is Europe's largest plastics institute, and lighthouse projects like these underline and consolidate our position."

But Bastian also knows: "Without our currently 420 members and our customers, business and cooperation partners, who have remained loyal to us even in this difficult time, and especially without the flexibility of our employees, this record turnover would certainly not have been possible. Therefore, I would like to take this opportunity to express my special thanks to them."



Prof. Dr.-Ing. Martin Bastian Director of the Institute +49 931 4104-0 m.bastian@skz.de



Johannes Rudloff is successfully completing his doctorate in the field of simulation of planetary roller extruders. (Photo: SKZ)

In late 2021, Johannes Rudloff completed his dissertation magna cum laude at the Technical University of Ilmenau. In front of the six-member examination board chaired by Prof. Dr.-Ing. Jean Pierre Bergmann, he successfully defended his dissertation on "Modelling and preliminary estimation for the operating behaviour of a planetary roller extruder".

Excellent doctoral thesis on the simulation of planetary roller extruders

SKZ employee Johannes Rudloff completes dissertation with magna cum laude

As part of his doctoral thesis, Johannes Rudloff, a graduate engineer in plastics technology, dealt with the prediction of important process variables such as the melting degree, pressure and temperature within planetary roller extruders. By comparing simulation and experiment, Rudloff was able to show that these important process variables can be predicted using analytical models.

Used for particularly temperature-sensitive polymer treatment processes

With their interlocked geometry, planetary roller extruders differ greatly from conventional extruders. This gearing provides a high surface area for heat exchange between the processed material and the metal surface of the machine. For this reason, planetary roller extruders are used for particularly temperature-sensitive polymer treatment processes. The models developed by Rudloff make it possible for the first time to calculate the relevant processes. Thus it is possible to estimate, for example, how a material can be melted efficiently or what maximum cooling effects can be reached. Martin Bastian Director of the SKZ, and reviewer of the thesis, enthuses: "With his work, Johannes Rudloff makes a very important contribution to the process design of planetary roller extruders, but also to the further development of these processes. By bringing together the engineering disciplines of mechanical engineering, plastics technology and simulation in his work, he was able to prove his outstanding competence in the relevant subject areas. All this fills me with great pride." In addition, he says he was pleased that the first applications of the scientifically developed simulation methodology have already taken place in the industrial research of the SKZ. "Among other things, a new process for PVC direct extrusion could be developed using these models," says Bastian.



Johannes Rudloff | Dipl.-Ing. Compounding & Extrusion +49 931 4104-528 j.rudloff@skz.de

SKZ offers tests according to the new DIN standard for plastic recyclates

THE ACCREDITED TEST LABORATORY OF THE SKZ COOPERATED IN THE PREPARATION OF DIN SPEC 91446

The new specification DIN SPEC 91446 classifies plastic recyclates based on the available amount of data (Data Quality Levels, DQL). As a result, recyclates can be classified uniformly and can thus be compared more easily with one another. The SKZ was involved in the development of this standard and offers extensive analytical and mechanical tests to confirm the material properties of recyclates.

It is often a challenge to recycle plastic waste that can be reused in equivalent or higher quality products. The material quality fluctuates and so far there has been a lack of a uniform description, graded according to information depth, of the recyclates and their quality. This situation has changed with the introduction of the new DIN SPEC 91446 "Classification of Plastic Recyclates by Data Quality Level for Use and (internet-based) Trading".



PP post-consumer waste & compounded PP recyclate (Photo: SKZ)

The initiator for their creation was the cirplus GmbH trading platform. The specification was developed by a consortium from industry and research. A total of 16 stakeholders along the entire recycling value chain were involved – including SKZ's accredited testing laboratory.

Data scope and quality is considered

This new standard allows the classification of plastic recyclates based on the existing data depth. The recyclates are classified into four different data quality levels. For example, in order to reach the second stage "DQL 2", three analytical tests (ash content, viscosity and residual moisture) are required. For the higher stages 3 and 4, it is necessary to determine further material properties, such as density, bulk density, heat distortion resistance or material identification (by means of IR or DSC).

By issuing a product data sheet by an accredited labora-

tory, the acceptance of recyclates on the market can be significantly increased, since the material properties are proven or checked. The corresponding scope with regard to analytical and mechanical tests can be determined individually as required. The SKZ is available to the plastics industry as a reliable and competent testing service provider. DIN SPEC 91446 is available as a free download at www.beuth.de.



Dr. Bernhard Ulmer Test laboratory analytics +49 931 4104-478 b.ulmer@skz.de

Better protection of tool surfaces in extruders against wear and tear

SKZ AND FRAUNHOFER INSTITUTE FOR SURFACE ENGINEERING AND THIN FILMS (IST) - WITH JOINT PROJECT

The project "Surface modification to reduce wear of highly stressed tool surfaces in extruders of plastics processing" was launched jointly at the SKZ and at the Fraunhofer Institute for Surface Engineering And Thin Films (IST). The project investigates the reduction of wear in essential production units of the plastics industry in order to enable costeffective and sustainable production processes over long periods of time.

Steadily increasing demands on the performance characteristics of plastics lead to equally increasing proportions of fibre reinforcements, fillers and additives. The surfaces of worm shafts and extruder dies are subjected to very high stress during the compounding and processing of these functional materials. In addition, corrosive environmental conditions reinforce the stress collective as a whole. At the same time, productivity requires high pressures and short cycle times. Under these conditions, however, it is still necessary to ensure the technological objective of optimum mixing effect with maximum performance and minimum energy input. However, the complex geometry of the nozzles and the screw elements limits the selection of suitable coating methods for wear protection due to their difficult geometric accessibility.

Plasma-activated chemical vapour deposition is being investigated

In the project, plasma-activated chemical vapour deposition (PA-CVD) will be investigated for its applicability as a potentially suitable method. PA-CVD facilitates thin hard material coatings by means of a plasma-chemical conversion of gas mixtures. Multiple layers containing multilayer titanium diboride and titanium nitride phases can be produced in special processes. These have a nanocomposite structure favourable for mechanical stress. The hard and chemically very stable titanium diboride present in the phase mixture counteracts the adhesive and corrosive attack. A further method is investigated which allows boron to diffuse into the surface of the tool by thermochemical surface treatment. As a result, hard and corrosion-resistant boride precipitates are formed which have a high potential to likewise meet all the requirements of the application. Thus, project first aims at identifying and evaluating the wear mechanisms between the molten metal and the

tool surface. In order to reduce wear on the surface, the various boron-containing surface modifications are then characterized and described on a laboratory scale. Finally, an evaluation under industrial conditions is carried out to prove applicability.

The research project started in December 2021. The tests on surface modifications based on PA-CVD coatings and boron diffusion treatments are intended to provide an important contribution and added value for companies along the entire value chain, in particular for SMEs such as compounders, surface finishers and plant manufacturers. Interested companies are invited to participate in the project monitoring committee of the research project for free and to find out about the current results. Following a decision by the German Bundestag, the project (funding code 22162 N) is funded by the Federal Ministry for Economic Affairs and Climate Protection (BMWK) as part of the programme for the promotion of industrial joint research (IGF) of the Research Association Plastics Centre (FSKZ e. V.) via the German Federation of Industrial Research Associations e.V. (AiF).



Dr. Johannes Rudloff Compounding & Extrusion +49 931 4104-528 j.rudloff@skz.de



Young SKZ talents cream off the prizes

THREE YOUNG RESEARCHERS AWARDED FOR THEIR OUTSTANDING WORK

In November 2021, three junior researchers were honoured for their theses at the SKZ. The awards of the works are proof of the successful work of the new talents and the innovative strength of the SKZ.

Self-lubricating plastics: "DKB-VIU Young Researcher Award" for Moritz Grünewald

The Deutsche Kreditbank AG (DKB AG) and the Verband Innovativer Unternehmen e. V. (VIU) awarded Moritz Grünewald (26) the "DKB-VIU Young Researcher Award" for his master's thesis. Grünewald developed self-lubricating plastics during his master's thesis. For this purpose, lubricating oil droplets were encapsulated and admixed to the plastic as a powder. As soon as frictional forces act on the component, the capsule wall is broken open and the lubricant is released as required - exactly when and where it is needed. Investigations have shown that friction and wear can be reduced by up to 80 percent with the new material. "This innovative system can make a decisive contribution to the production of energyefficient and durable products and can be used, for example, in plastic gears or ball bearings," says Dr. Michael Bosse, Group Head of Material Development at the SKZ. In addition, the wear reduction offers the possibility of minimizing microplastics. The master's thesis was carried out as part of a pre-competitive research project in cooperation with the Fraunhofer IAP and numerous industrial partners. The successor project is led by Grünewald, now a research associate in material development at the SKZ.

Moritz Grünewald wins the "DKBVIU Young Researcher Award". Award ceremony on 4 November in Berlin. F.I: Dr. Klaus Jansen (Managing Director of VIU e.V.), award winners Moritz Grünewald and Elke Gentschew (DKB AG). (Photo: VIU)



Improving the quality of post-consumer recyclates: "REHAU Technology Award 2021" for Rebecca Wolff, Special Prize Category

Rebecca Wolff (26) receives the "REHAU Technology Award 2021" in the special prize category for the investigation of suitable methods for increasing the quality of post-consumer recyclates. In her award-winning master's thesis entitled "Production of high-quality recyclates from postconsumer plastics", she dealt in particular with the removal of solid foreign substances using CO₂-supported filtration, and the extraction of odour-forming substances via degasification using entrainers, also with CO, and water. "During the work, it was possible to show that these methods can be used to effectively improve the quality of the recycled material during processing on the twin-screw extruder in combination with suitable process parameters," says Johannes Rudloff, Group Leader of Compounding and Extrusion at the SKZ. "With her research results, Rebecca Wolff created a sound scientific basis that can be transferred directly to the industry, to expand the fields of application for post-consumer recyclates and hopefully to advance their increased use." Rebecca Wolff's master's thesis was carried out as part of a research project within the framework of the SME-Innovative programme (funded by the Federal Ministry of Education and Research (BMBF) at the SKZ and was scientifically supervised by the Nuremberg University of Technology.



Rebecca Wolff wins the "REHAU Technology Award 2021", Special Prize Category. Rebecca Wolff was honoured with the award at an online award ceremony on November 10. (Photo: SKZ)

Accelerated determination of stress relaxation in thermoplastics: "REHAU Technology Award 2021" for Linda Phetsananh, Bachelor Thesis Category

Linda Phetsananh (26) wins the "REHAU Technology Award 2021" in the bachelor thesis category for her work: "Method development for the accelerated determination of stress relaxation in thermoplastics under long-term static load".

Phetsananh is studying plastics technology at Darmstadt University of Applied Sciences. She first completed a practical phase in the Component Properties Research Group at the SKZ in 2020 and then wrote her bachelor's thesis, which was rated 1.0 by Darmstadt University of Applied Sciences. In her work, Phetsananh was able to lay the foundation for an innovative method for the accelerated determination of the stress relaxation of thermoplastics and thus for the long-term design of plastic components. With this method, it is possible for the first time to predict the relaxation behaviour of plastics up to around 100 years in just about three to four days.



Dr. Johann Erath Research management +49 931 4104-472 j.erath@skz.de



Linda Phetsananh wins the "REHAU Technology Award", Bachelor Thesis Category. Linda Phetsananh was honoured with the award at an online award ceremony on November 10. (Photo: SKZ)



On 26 November 2021, the SKZ celebrated the topping-out ceremony of the Training Centre for Quality Assurance (TZQ) in the Würzburg district of Lengfeld. (Photo: SKZ)

SKZ celebrates topping-out ceremony of its Quality Assurance Training Centre TZQ

FURTHER TRAINING AND QUALIFICATION OF SPECIALISTS IN THE PLASTICS INDUSTRY

A good five months after the model factory, the SKZ celebrated the topping-out ceremony of the Quality Assurance Training Centre (TZQ). Commissioning of this state-of-the-art training centre is planned for autumn 2022.

Topping-out celebrations have become a matter of routine for the SKZ. After the model factory at the beginning of July, it was now the turn of another building on 26 November 2021: the Quality Assurance Training Centre (TZQ). "I am pleased that what was once in people's minds is now in front of us," said SKZ Managing Director Dr. Thomas Hochrein at the welcome. The groundbreaking ceremony of the TZQ took place in February.

The TZQ is primarily intended to serve the further training of specialists from the plastics industry, added Christoph Kreutz, head of the TZQ. The SKZ sees itself as a reliable partner of medium-sized companies. "With the construction of the TZQ, the SKZ wants to contribute to ensuring that the plastics industry can maintain its high quality, as in "Made in Germany". "Although this industry is a very innovative one, it is also struggling with a shortage of skilled workers. Large rooms, state-of-the-art equipment and innovative methods are intended to counteract this. The SKZ wishes to offer around 90 courses per year in the new training centre. Kreutz expects five to ten participants per course. "Only through a high level of qualification and further training of skilled workers can the industry remain competitive in the long term," Kreutz is convinced.

Strong practical relevance

A strong connection to practice is particularly focussed on. "We at SKZ have decades of experience in training and further education and thus know how important practical relevance is," Kreutz continues. A highlight of the new building will therefore be the intelligent networking of training rooms and technical centres. "Mobile partition walls allow the technical centres to be connected directly to the rooms," explains Dr. Johann Erath, construction project manager at the TZQ.

The new TZQ will cover about 1,000 square metres – almost half of which will be pure training rooms. The TZQ is being built in the immediate vicinity of the Technology Centre and the new model factory of the SKZ in the Würzburg district of Lengfeld. Both the Bavarian state government and the federal government support the project, which is planned with around ten million euros. Of this, the federal government (from funds of the BMWi) bears 50 percent and the state of Bavaria (from funds of the StMWi) 25 percent of the eligible total costs of about 9.5 million euros. The remaining costs are borne by the SKZ. The commissioning of the TZQ is planned for October 2022.



Christoph Kreutz | DipL-Ing. (FH) Head of Quality Management +49 931 4104-554 c.kreutz@skz.de



Top team for the start into the LSR world: F.I.t.r.: Prof. Dr.-Ing. Martin Bastian (Head of Institute SKZ), Frank Burkhardt (Local Sales KraussMaffei), Georg Schwalme (Head of Injection Moulding SKZ), Markus Scheuerlein (Project Manager Mould Making Toolcraft), Thomas Lender (Head of Injection Moulding Toolcraft), Cordula Wieland (Expert Sales TEC KraussMaffei), Christian Rössler (Head of Sales South KraussMaffei) (Photo: KraussMaffei)

Two "Enablers" go full throttle

SKZ AND TOOLCRAFT JOIN FORCES WITH KRAUSSMAFFEI TO ENTER LSR TECHNOLOGY

Difficult, for specialists only and not compatible with conventional thermoplastic processing - this was the image that prevailed for many years when it came to liquid silicone (LSR), but now more and more companies are discovering this interesting material for themselves. SKZ and Toolcraft (Georgensgmünd, near Nuremberg), an innovative specialist in precision components, are cooperating to explore the possibilities and limitations.

KraussMaffei is heavily involved as a machine partner.

Toolcraft is a true enabler. "What is conceivable will be feasible" is the motto of founder Bernd Krebs, and so since 1989 very different areas of activity have developed, in which they are involved: Machining, additive manufacturing, robotics, injection moulding and mould making. The team uses the wide range of available methods to present customers with unusual solutions. Again and again, Toolcraft has started with technologies from scratch, and so the leap into silicone is not a major one.

The SKZ, on the other hand, is the top dog in southern Germany when it comes to training, research, testing and certification in the field of plastics processing. The renowned symposium "Silicone Elastomers" takes place there every year, but the SKZ has not had an LSR processing plant on its premises so far. In the wake of increasing electromobility with its high temperatures in the

engine compartment and the growing importance of elastomers in medical technology, however, the topic has become more and more interesting.

A win-win situation for all three partners

When KraussMaffei received enquiries from Toolcraft and SKZ about LSR machines at about the same time, it quickly became clear that a "triple-win situation" could be created here, and all those involved were brought together: SKZ Institute Director Prof. Dr.-Ing. Martin Bastian and Georg Schwalme, Head of Injection Moulding, Thomas Lender (Head of Injection Moulding) and Markus Scheuerlein (Project Manager Mould Making) from Toolcraft, and finally Frank Burkhardt (Local Sales) from KraussMaffei and Cordula Wieland, Expert Sales TEC and expert for silicone processing. There was also valuable support from the Nexus company, which contributed its experience in dosing technology. Since this is an intra-Bavarian cooperation, it is even possible to receive country-specific funding for research projects. Thus, the SKZ can support its network member Toolcraft with targeted analyses in the implementation of the new technology - and at the same time acquire the expertise it needs to provide customers with sound advice and initiate innovative developments. The start was a two-day training course by the Department of Plastics Technology at the University of Kassel. Prof. Martin Bastian comments: "The colleagues there are very good and the exchange with them is extremely valuable for us." Georg Schwalme adds: "If we master the process itself, we will be able to build the bridge - as with thermoplastics - from basic research to operational practice."

One all-electric PX for the SKZ and one for Toolcraft

The two all-electric machines from KraussMaffei are now in place: a PX 50-180 SilcoSet at the SKZ and a PX 121-180 SilcoSet at Toolcraft. This shows the great advantage of owner-managed medium-sized companies: Being independent and able to invest in something that does not promise immediate return. Thomas Lender clarifies: "In theory, we can already do 100 percent with silicone, while in practice it is zero. We think it will take about two years to get a grip on this technology, but we'll just take that time." KraussMaffei was also awarded the contract to become Toolcraft's LSR machine partner because of the people involved: "From the very beginning, we felt welcome and taken seriously, and the professional support from Cordula Wieland is priceless anyway."

Encapsulated PX 121 for cleanroom applications

How thoroughly Toolcraft approaches the project is shown by the fact that the PX 121 is mounted encapsulated in a hall, which is later to be upgraded to a cleanroom area class 7. It has also been given a bit more locking force and plasticizing volume as well as widened tool clamping plates in order to have maximum flexibility. Since with LSR the dwell time within the plasticizing unit is not as critical as with thermoplastics, very small products can also be produced by a comparatively large unit and the increased stroke of the clamp pays off because the tools build deeper through cold runners and insulating plates. The APC plus machine function will help to achieve a high weight consistency in the products. It regulates the switching point from shot to shot via the mass viscosity and stored material parameters, which is important for silicones in that the batch fluctuations are much more pronounced here than with classic thermoplastics. A hanging 6-axis robot is then responsible for article removal.

First LSR project for medical technology

As the first LSR project, Thomas Lender and Markus Scheuerlein have chosen a stopper with a part weight of 0.5 grams, which has so far been made of solid silicone (HTV). There are relatively few material types with medical approval, so that a switch to LSR is an option. However, the latter has very low viscosity, which makes toolmaking extremely challenging. With a texture such as water, the tools must be perfectly sealed and in most cases a vacuum is even applied. Temperature control is also reversed as compared to thermoplastic proces-

sing in order to prevent premature curing. While the plasticizing unit and the cold runner are cooled, the cavity is brought to a temperature of about 190 °C.

So far, tool creation for LSR has mainly been in the hands of highly specialized suppliers with a regional focus in Austria. However, because they increasingly produce silicone parts themselves and the prices for tools

and cold runners are comparatively high, more and more companies are looking for alternatives. Toolcraft will also build its own tool and relies on its own experience with precision moulds. Markus Scheuerlein's team is currently manufacturing about 50 percent for their own use and 50 percent for customers, and plans are, of course, to offer LSR moulds externally at a later date.



The SKZ is strong in the field of additive manufacturing – thanks to its delicate possibilities and excellent transparency, this technology is also suitable for toolmaking in the LSR sector (Photo: KraussMaffei)

Support down to the smallest detail

The SKZ will receive help both internally and externally for the upcoming tests. At the SKZ site in Horb (Black Forest), there is a training manager who used to work in silicone processing. An ideal situation. And yet Cordula Wieland, the KraussMaffei expert for thermosets, can always help with a few tricks. For example, with the recommendation to buy a freezer. Especially if you are still at the experimental stage and a few weeks may pass before you can continue, it saves a lot of work if the unit is frozen in the meantime.

The dream team of SKZ and Toolcraft will make its way with the support of KraussMaffei. In two years' time, we will have another look.



Georg Schwalme | Dipl.-Ing. Head of Injection Moulding and Additive Manufacturing +49 931 4104-372 g.schwalme@skz.de





There were lively discussions at the three-way event of SKZ, Toolcraft and KraussMaffei on the occasion of entering into LSR processing. (Photos: KraussMaffei)

What is the ecological footprint of your products? FURTHER TRAINING AT THE SKZ ON THE SUBJECT OF LIFE CYCLE ASSESSMENT AND CARBON FOOTPRINT

The issues of "sustainability", "climate protection" and "resource conservation" have arrived in the plastics industry. For this reason, experts from the Plastics Centre SKZ offer a modular training course on how to calculate life cycle assessments and carbon footprints of plastic products.

The objective of the European Green Deal is to achieve a 55% reduction in CO₂ emissions by 2030 and climate neutrality by 2050. The Taxonomy Regulation adopted for this reason serves as a framework to facilitate sustainable investment. As a result, companies in all industrial sectors are feeling the pressure to examine and optimise the carbon footprints of their products. Large companies in particular, which are often at the end of the value chains, do not wait for further regulations to come into force by politicians, but communicate ambitious climate strategies with concrete measures and savings targets.

There is often a lack of know-how in companies

In the value chains of the plastics industry, it is precisely plastics processors who, as suppliers, are required by their customers to calculate life cycle assessments or carbon footprints for their



products and to show corresponding key figures. In this way, OEMs can prove that they are pursuing the objectives of the European Green Deal. However, small and medium-sized companies in the plastics processing industry in particular often lack the know-how to calculate the life cycle assessment or the carbon footprint of their products.

As the largest German service provider for the plastics industry and with more than 15 years of experience in the field of sustainability assessment and optimisation, the SKZ offers modular training tailored to life cycle assessment and carbon footprints with the following individually bookable teaching modules:

The carbon footprint of a plastic product is an important criterion for sustainability and envi-ronmental performance. (Photo: lassedesignen / stock.adobe.com)

- Basics of life cycle assessment according to ISO 14040/14044 with clear explanations based on company-specific relevant materials and processes
- Introduction to LCA data and databases (GaBi Professional, Ecoinvent, etc.)
- Introduction to the GaBi Professional software
- Creation of life cycle assessments (from company-specific example processes) by the course participants
- The CO₂ footprint of materials according to ISO 14067
- CO₂ compensation through certificates

This individual one-to two-day training (depending on the number of booked teaching modules) can be requested directly from Dr. Hermann Achenbach, Group Head of Sustainability and Circular Economy at the SKZ. The course can be conducted on a company-specific basis at the SKZ or as an in-house event at the customer's premises.



Dr. Hermann Achenbach +49 931 4104-266 h.achenbach@skz.de

Splendid prospects?

SKZ OFFERS TEST SYSTEM FOR DETECTING UNDESIRABLE GLOSS EFFECTS

High gloss is often associated with value. However, where gloss can lead to glare or other undesirable effects, matt surfaces are preferred. The SKZ has recently offered a robust test system for detecting unwanted gloss effects.



Glossy effects are not always welcome. The SKZ offers its own measuring systems to detect and avoid unwanted gloss effects inline. (Photo: far700, stock.adobe.com)

In the production of plastic products, undesirable gloss effects often occur. Possible causes include different contact pressures in the tools for extrusion or injection moulding, or also in chemical processes. This results in an inhomogeneous appearance and the impression of quality is reduced. It is therefore advantageous to be able to detect undesirable gloss effects inline even during production.

Thus, defective products can be immediately sorted out, and countermeasures can be taken in good time.

SKZ supports companies in the selection of suitable test procedures

Operating as a broad industrial and research service provider in the plastics sector, the SKZ is available to interested companies as an advisory and developing partner for selecting and integrating suitable test procedures. Particularly the individual circumstances that limit the use of commercially available standard test systems are taken into account. The SKZ is available with customer-specific special solutions.

In addition to the development of data processing methods and test procedures tailored precisely to the needs of customers, training, system maintenance and support are also part of the SKZ offer.



Giovanni Schober | Dipl.-Ing. (FH) +49 931 4104-464 g.schober@skz.de

New Research Unit "Networked Materials" at the SKZ

MANAGEMENT IS ASSUMED BY DR. ANDREAS KÖPPEL

At the SKZ in Würzburg, a new research group is being set up in the field of material development, compounding and extruding (MCE), which will focus on cured materials. The SKZ is thus responding to an increased demand from the industry for curing material systems and will strengthen and further expand its competencies in this regard.

For Dr. Benjamin Baudrit, head of the MCE division at SKZ, the establishment of the "Cured Materials" group within the MCE division is the ideal complement to the previous focus on thermoplastics. "As topical polymers, thermosets and elastomers are in high demand on the market," says Baudrit.

Dr. Andreas Köppel, previously working as a research assistant in materials development, will assume the management and development of the new group. "I am very much looking forward to these new tasks, in particular to further developing and expanding expertise in the field of cured materials at the SKZ," says Köppel.

Conducting material research and analyses

The thematic focus of the new research group will initially be on the implementation of material research and analyses as well as on formulation development, compounding of powder coating systems and thermoset moulding compounds. In addition, the research work in the field of silicone rubbers is to be accelerated. Various extruders – such as twin-screw extruders, planetary roller extruders and a kneader with extensive metering technology – are available for this work at the technical centre in Würzburg. In close cooperation with the injection moulding sector, it

is also possible to process thermoset moulding compounds and silicone rubbers on special injection moulding machines at the SKZ.

Courses for education and training are also planned

The know-how gained by the new research group from their research activities will also be incorporated into training and further education at the SKZ, as from 2022 new courses on various topics from the field of "cured materials" will be established.

Furthermore, companies interested in cooperation can contact the SKZ or Andreas Köppel directly at any time.



Dr. Andreas Köppel +49 931 4104-132 a.koeppel@skz.de

Strengthening plastic recycling in the construction industry SKZ INVOLVED IN UBA STUDY ON DURABILITY, RECYCLABILITY AND USE OF RECYCLATES

The Federal Environment Agency (UBA) has published a recent study on the recycling of plastics in the construction industry. This shows that there is still a lot of room for improvement! The SKZ was also involved in the study.

After packaging, the construction sector is the second largest application area for plastics: Approximately 2.6 million tonnes were used in 2017. However, in many cases there is currently a lack of suitable specifications for the recycling of plastic construction products, and the quantities are also insufficiently recorded. This was ascertained in a recent study by the Federal Environment Agency (UBA). In order to be able to recycle the accruing quantities to a high standard in the future, the study proposes that constructional product standards be supplemented with specifications regarding durability, recyclability and the use of recyclates. Separate collection of plastic waste for recycling should be improved. In addition, the recycling of sector-specific packaging should be ensured. This study presents in detail the use of plastic products and the possibilities of the use of recyclates in the construction sector, the quantities of plastic used, return systems, recycling techniques, current use of recyclates and construction product packaging made of plastic. The authors - including Dr. Phillip Bendix, Dr. Holger Berg, János Sebestyén, Laura



In the construction industry, there is a lack of suitable specifications for the recycling of plastic construction products. This was ascertained by a UBA study in which the plastics centre SKZ was also involved. (Photo: Ingo Bartussek - stock.adobe.com)

Perschel and Michael Ritthoff from the Wuppertal Institute as well as Daniela Eckert, Robin Kocina and Dr. Hermann Achenbach from the SKZ – The Plastics Centre - have identified potentials for increasing the use of high-quality recyclates and have presented existing obstacles and options for action for the political and business sectors.

Dependency on the area of application of plastics

Current use of recyclates as well as technical and quantitative potentials are highly dependent on the area of application of the plastics. The biggest obstacles for the use of recyclates are product service life, dismantling capability and technical requirements. "Due to the increasing quantity of plastics in the construction sector, the question of their recyclability is becoming increasingly important. We are pleased to be able to demonstrate the recycling potential and re-use possibilities of recyclates by this study, "says Dr. Hermann Achenbach, group leader of Sustainability and Circular Economy at the SKZ.



Dr. Hermann Achenbach +49 931 4104-266 h.achenbach@skz.de



To all our new members: Welcome to our network!

PROF. DR.-ING. MARTIN BASTIAN, INSTITUTE DIRECTOR SKZ



Conference season 2022 successfully started at the SKZ!

NUMEROUS EVENTS HAVE TAKEN PLACE SINCE APRIL

The Network & Event team, more precisely Robert Davis, Eva Engelmann, Sylvia Schmidt, Nathalie Spiegel, and Bettina Dempewolf as the leader are very happy about the successful start and about the upcoming events! High-quality lectures, accompanying exhibitions and many interesting opportunities for networking - all this is finally possible again in face-toface fashion. You can find out which events will start in the next few days and weeks at: https://www.skz.de/en/training/conferences Bettina Dempewolf | Dipl.-Kffr. (FH) +49 931 4104-136 b.dempewolf@skz.de Impressions from various conferences in 2022 (Photos: SKZ)

Plastic to grip and grasp

NETWORKING AND TECHNOLOGY DAYS AT SKZ ATTRACTED NUMEROUS VISITORS

At the end of June, the SKZ invited participants to Würzburg and offered an extensive and informative programme. The participants were able to inform themselves in technical lectures, visit the pilot plants, experience live demonstrations on the machines and exchange ideas with plastics experts.

The SKZ Network and Technology Days were already able to establish themselves as an industry event before Corona. This trend is continuing successfully now as well. This year, too, a total of about 600 visitors accepted the SKZ's invitation. The central event formed an excellent platform for cooperation between and with experts from all areas of the plastics sector as well as from business, science and politics. Already at the pre-event in the garden pavilion of the Juliusspital, the opportunity for a lively exchange over food and drink was used extensively. Prof. Dr. Pauline Iden, Chair of the Board of Directors, and Institute Director Prof. Dr. Martin Bastian opened the Network Day the next day with powerful words. In his plenary lecture, Bastian addressed the topic of smart recycling in particular. Recruiting, promoting and training young talent is a central concern of the SKZ. That is why the SKZ Young Talent Award was presented again this year as part of the network day. The prize of 2,000 euros - sponsored by Netzsch GmbH - went to scientist Tobias Göbel. The afternoon programme was dominated by the burning issues of the industry: the shortage of skilled workers, sustainable business, energy efficiency, cyber risks and the transformation of German industry and its impact on the plastics sector. A large industrial exhibition was held in parallel. Exhibitors used the exhibitor tour during the lunch break to present their company and product innovations. On the following day, the SKZ Technology Day, the SKZ opened its pilot plants and thus enabled visitors not only to grasp plastics, but also to understand them. The guests received in-depth technical information from the areas of injection moulding, additive manufacturing, compounding and extrusion, joining as well as digitisation and metrology in the four parallel lecture sessions. "We are delighted with the posi-



Numerous visitors informed themselves about current trends and innovations in the field of compounding. (Photo: SKZ)

tive feedback and the numerous technical and interesting discussions. The guests visibly enjoyed their stay in Würzburg. That is the greatest praise for us," says Division Manager Bettina Dempewolf.



Bettina Dempewolf | Dipl.-Kffr. (FH) Head of Network & Event +49 931 4104-136 b.dempewolf@skz.de

Glass fibre reinforcement in plastics - made more visible

The problem

Glass fibres are a frequently used filler for improving the mechanical properties such as the strength of a plastic. It's not only the filler content that is of significance however, but also the homogeneity of the distribution and the orientation of the glass fibres within the component. Incorrect distribution/ orientation can lead to undesirable properties up to and including failure of the injection-moulded component.

Glass fibre orientations can be visualized in the commonly used ground section only if a very large number of fibres lie parallel to the plane of the ground section. This is, however, only approximately the case in very close vicinity to the surface.

The solution

Analytik Service Obernburg uses not only sanding but also thin sanding to analyze the orientation of the glass fibres.

Example 1: Better visualization of the glass fibre orientation

Because the fibres in the interior of a component are always oriented slightly obliquely to the grinding plane, in incident light (corresponds to a normal grinding preparation) only the piercing points of the glass fibres are visible through the surface (Fig. 1). As with a section of sausage, the resulting area is very small and it is difficult to assess the orientation. On the other hand, glass fibre orientation can be seen very clearly with a thin section (Fig. 1).

Example 2: Inspecting crack formation

in glass fibre reinforced components

An incipient crack can be seen in the ground section with very good polishing of the ground surface (arrow in Fig. 2) and can easily be confused with scratches. In contrast, in the case of the thin section preparation, the crack can be clearly seen in transmitted light and the glass fibre orientation in the environment can be analyzed (Fig. 2). In the above case, the crack has spread from the top right to bottom left. In the right-hand region of the image, the glass fibres are oriented largely perpendicularly to the plane of the ground section and can hardly influence the propagation of cracks. In the left part of the image, however, glass fibre orientation changes, and crack propagation has been stopped.



Fig. 1: Glass fibre orientation in incident light (left, corresponds to a ground section) and as a thin section (right) in transmitted light. Both image sections were taken at the same location. (Image: ASO)



Fig. 2: Examining crack propagation in relation to glass fibre distribution/ orientation (comparison of the same spot in incident light (left) and transmitted light (right)). (Image: ASO)

The advantages

The described method of thin grinding permits a significantly better visualization of the orientation of glass fibres in a polymer matrix. It can also be used if the glass fibres are not parallel to the direction of grinding. In addition, it is possible to make statements about the polymer located between the glass fibres. The results can be used to optimise the injection moulding parameters or the tool in critical areas as part of the development of new products. In the event of damage, it is possible to find the causes of quality problems (e.g. breakage of a component).



Rainer Ziel | Dipl.-Phys. and surface analysis +49 6022 81-2645 r.ziel@aso-skz.de

Inspection of furniture surfaces SURFACE INSPECTION OF FURNITURE AND FURNITURE PARTS, EXTENSION ELEMENTS AND COATING MATERIALS

Furniture surfaces must be resistant in order to meet aesthetic requirements in the long term. But what happens if red wine or fruit juice is spilled on a dining table and, worse even, left to dry overnight? Can the affected area be simply wiped or do stubborn stains remain that can only be removed by grinding the surface at a workshop? Common solvents or cleaning agents are often used for removing stamping ink or ballpoint stains from desk work surfaces. Can this result in permanent disfigurement? What happens in a surgery with frequent disinfection of the work surfaces? Will there be unsightly scratches on a desk after a short time if files are moved back and forth on it? Analytik Service Obernburg checks the quality of coatings according to DIN standards and provides safety through informative product labelling of their furniture items.

DIN 68861-1: Behaviour under chemical stress

According to DIN 68861-1, the resistance of furniture surfaces to chemical stress caused by acids, alkalis, organic solvents, aggressive beverages and foodstuffs as well as cleaning agents and disinfectants defined in the standard is tested. Surface changes are classified according to DIN EN 12720 on the basis of the evaluation of discolourations, gloss differences and structural changes by, for example, swelling, fibre elevation, cracking or blistering in grades from 5 (no change) to 1 (strong change).

DIN 68861-2: Behaviour under abrasion stress

The usability of furniture surfaces with regard to abrasion resistance is evaluated according to DIN 68861-2. The resulting stress groups range from 2A (highest resistance) to 2E (lowest resistance). The abrasion resistance of furniture surfaces is tested in accordance with DIN EN 15185 using a so-called Taber abraser. The number of revolutions of the test specimen is measured under a defined frictional load, which is necessary in order to produce defined wear.

Further analyses on furniture surfaces

A further expansion of the test methods for the resistance of furniture surfaces is possible. Tests of the behaviour under scratch stress according to DIN EN 68861-4, for example, or the behaviour under dry (DIN 68861-7) or moist heat (DIN 68861-8) can be implemented in the medium term.



Andreas Hohm nagement +49 6022 81-2671 a.hohm@aso-skz.de

Functional powder coating for plastics

MODIFICATION OF POWDER COATINGS BY NANOMATERIALS

Surface coatings are mainly used for protecting decorative parts or for functional purposes, achieving the desired material properties exactly where they are needed.

Coatings of plastics are carried out for the most part by the application of wet lacquers. An alternative method is powder coating. Powder coatings are more durable and, thanks to the elimination of critical volatile organic compounds, more environmentally friendly than wet coatings.

Within the framework of various projects, the European Centre for Dispersion Technologies (EZD) is working on the modification of powder coatings by nanomaterials in order to produce functional (e.g. super-hydrophobic, antimicrobial, scratch-resistant) surfaces on plastic components.

Modification of powder coatings

A superhydrophobic effect can be achieved, for example, by using silanized metal oxide nanoparticles. The effect of silver nanoparticles in particular is known for antimicrobial properties. Hard particles, such as tungsten carbide, are used in particular for increasing abrasion and scratch resistance. The dry-blend method by means of a drum hoop mixer was used for incorporating the above-mentioned particles into the powder coating material. In addition, spray tests were carried out using a powder spray gun with corona charging. The substrate used is a conductive polycarbonate. **Super-hydrophobic coating:** In the tests, a hydrophobic surface with a water contact angle of 102° could already be determined even for the reference lacquer. With all nanomaterials used, an increase in the water contact angle could be detected (silicon dioxide 114°; aluminium oxide to 150°). The best results were achieved by titanium dioxide (2.0% by weight). The water contact angle increased to almost 160° and thus superhydrophobic surfaces could be produced.

Antimicrobial coating: Antimicrobial action was determined both with E. coli bacteria and with betacoronavirus 1. In the case of E. coli bacteria, an inhibition of the bacteria after 18 h of 99.997% was found at a nanosilver concentration of 0.01% by weight. In the case of the betacoronavirus, a virus reduction of 99.175% at a nanosilver concentration of 0.1% by weight was already found after 2 hours.

Scratch-resistant coating: Scratch resistance was determined by means of scratch hardness testing in accordance with ISO 1518. Even the reference has a very good scratch resistance of 15 N. This was further increased by adding tungsten carbide and a mixture of tungsten carbide and titanium carbide. When used at 3% by weight, no

Spray test using a corona-charged powder spray gun. (Photo: EZD)

scratches could be produced on the material. At 1.5% by weight, the WC-TTK with 27 N performs better than WC at 21 N.

These experiments showed that nanomaterials in powder coatings cause an immense change in the properties. As a result, the possible uses of plastics as a component can be expanded and their service life can be increased by higher scratch resistance, while cleaning costs can be reduced thanks to superhydrophobic surfaces, and the risk of infection thanks to antimicrobial surfaces.



Andreas Schneider | Dipl.-Ing. (FH) Coating materials +49 9287 99880-16 a.schneider@skz.de



Successful particle size determination by means of laser diffraction

The EZD successfully participated in the interlaboratory comparison PT LS BAM-5.5-2021 "Particle size determination of ceramic powders using the laser scattered light method according to ISO 13320:2020".

The analyses followed ISO 13320:2020 and the specifications of the Federal Institute for Materials Research and Testing (BAM), the organiser of the round robin test. Three powders were dispersed 6 times each in aqueous media, measured and evaluated according to the Mie theory. The laser diffractor "Mastersizer 3000" from Malvern GmbH (now Malvern Panalytical GmbH) was used. The particle sizes of all three ceramic powders were determined 100 % correctly.

Laser diffraction (also called static light scattering or laser scattered light method) is widely used in industry as well as in research because it covers a large measuring range from hundreds of nanometres to a few millimetres and can also be used for powders as well as for suspensions. In this method, a collimated light beam from one or more mono-chromatic light sources is passed through the dispersion, where it interacts with the particles and the scattered light component is collected by a series of detector elements. Optical models, such as the Mie theory and the Fraunhofer approximation, which can be used in the micrometre range, provide a mathematical description and help to calculate particle size distributions.

At the EZD, laser diffraction can be used to measure solids both dry (as powder) and wet (as suspension) in equal measure. The characterisation of suspensions is possible in aqueous media as well as in solvents such as ethanol, isopropanol, acetone or petroleum ether. If you have any questions about the method or the correct application for determining the particle size of your particles, simply get in touch with our experts at the EZD.



Ceramic powders examined as part of the round robin tests (Photo: SKZ)



André Nogowski | Dipl.-Ing. Analytics +49 9287 99880-17 a.nogowski@skz.de

Expert knowledge & machine learning in the injection moulding process

SKZ AND FRAUNHOFER IPA RESEARCH THE MONITORING AND CONTROL OF THE INJECTION MOULDING PROCESS



Illustration of the Industry 4.0 injection moulding cell of the SKZ (Image: SKZ)

Methods of machine learning (ML), such as neural networks, are currently conquering the industry. However, they have two major drawbacks: First, they need large amounts of data to learn relationships that any process expert has long understood. Secondly, it is difficult to understand how an ML method comes to its conclusion, which makes it difficult to accept these systems. With "Bayesian networks", an alternative is available that avoids these disadvantages.

What are Bayesian networks?

Bayesian networks are made up of different nodes, which interrelate with each other. By defining these nodes and their connections to one another, expert knowledge is introduced into the topological structure of the network, the respective strength of a connection in turn being learned by data. Bayesian networks therefore require overall smaller amounts of data than other methods, since fundamental relationships are already encoded by the network structure. If the quantified (i.e. "trained") Bayesian network is used, for example, for process monitoring, it is possible to directly calculate which node is responsible for the deviation of a target variable, say component quality, and to what extent. The network can also issue a recommendation for action in order to correct the deviation from the target variable. The information on the

(probable) cause of the deviation helps the machine operator to understand the recommended action of the network and to trust it.

llot injection moulding cell at the SKZ

With great support from the project consortium and the working group "DigInject - Digitization of Injection Moulding", an injection moulding cell is being created which is equipped with various peripheral devices and various measuring technology and is available for the test series. Using the communication standards OPC-UA or EUROMAP and MQTT, the SKZ employees link the devices and thus ensure comprehensive cycle-related data collection. This includes, among other things, data on the injection moulding machine, such as injection speeds or internal mould pressure, as well as data on the drying, metering and temperature control systems. Further measuring technology such as an image processing system for the optical detection of component dimensions, a thermography camera and a balance for determining the weight of each injected component are also integrated. All data is displayed to the machine operator in real-time on a dashboard, stored and made available to the Bayesian network for process monitoring.

In the ProBayes research project (IGF project no. 21815 N), the SKZ, together with Fraunhofer IPA, is developing Bayesian networks for injection moulding. With the procedure described above, the transfer of expert knowledge into the network is realised, for example, by the directed connection of the "tool temperature" node to the "demoulding temperature" node. The quantification, i.e. the strength of the connection between the two nodes, is carried out with the aid of measurement data. The project is based on a two-pronged strategy: on the one hand, on the simulation of the test series in Moldex3D and, on the other hand, on the execution of real test series on an injection moulding machine.

The first data have already been collected in extensive series of experiments and can be shared with interested scientists and companies. It is also possible to participate in the committee accompanying the project in order to obtain information on the current progress of the project. The two-year project will end in April 2023. The project is funded by the Federal Ministry for Economic Affairs and Energy (BMBF) via the AiF as part of the programme to promote joint industrial research (IGF) of the Plastics Centre Research Association.



Jonathan Lambers | M. Sc. Digitization +49 931 4104-427 j.lambers@skz.de

SKZ ensures product quality as an EU certification mark

"A BRAND PROVIDES A GUARANTEE"

Since 22 May 2021, the SKZ has been registered as an EU certification mark (word mark). It was registered in the Register of European Union Trade Marks at the corresponding office of the European Union.

The European certification mark has been anchored in trademark law since the beginning of 2019. It is a useful addition to the previous marks, as it protects the quality and not the origin of the products. The guarantee function is therefore in the foreground. More specifically: The new mark type confirms certain characteristics of products or services, such as quality requirements. The main features of the certification mark are neutrality; monitoring or control, and transparency. "In the future, this registration of the SKZ as a certification mark will open up new perspectives with regard to the testing and monitoring of product properties in order to certify consistently good quality," says Dr. Gerald Aengenheyster, Managing Director of the Testing Division at the SKZ. Among other things, the registration of the SKZ as an EU certification mark includes the following classes:

- 07: Plastic machine parts, in particular pipes, hoses and containers; machines for working plastics
- 12: Parts of vehicles made of plastics, in particular pipes, hoses and containers.
- 17: Semi-finished products made of plastic, in particular pipes, hoses, connecting pieces, fibres and extruded plastic in the form of rods, profiles, granules, blocks, foils and sheets; sealing, packing and insulating material made of plastic, recycled plastics; hoses made of plastic.



19: Plastic building materials, in particular pipes and panels.

A certification mark already known to the public is, for example, the "green button". For various textile products, this ensures that the offering companies comply with certain due diligence obligations for human rights and the environment.



Sandra Leuckert | Dipl.-Ing (FH) Head of new certification programmes +49 931 4104-214 s.leuckert@skz.de

Solid or liquid?

MEASURING SYSTEMS AT THE SKZ SHOW THE CURRENT AGGREGATE STATE OF PLASTIC PRODUCTS IN REAL-TIME

The degree of melting and hardening are essential parameters whose metrological detection makes economical production possible, thereby avoiding product complaints and allowing process optimization. New measuring systems at the SKZ allow the spatially resolved inline detection of the degree of melting.

Has my plastic material melted yet? What temperature, pressure and throughput can be set during compounding in order to achieve economical production? Compounders often need years of experience to answer such questions correctly, but unmelted material can still reach the nozzle.

Has the adhesive hardened to such an extent that further process steps can follow? In this case, processors often rely on manufacturer's information, which, however, relates exclusively to the adhesive, but does not take the glued component into account. Ambient conditions such as temperature and humidity are of decisive importance. Here, too, the user's wealth of experience often plays a very important role.

It would therefore be helpful to use a measuring method which can quantify the state of aggregation and thus the degree of melting of plastic melts or the curing state and progress of adhesives and other systems in real time.

Use of contactless ultrasound and terahertz technology

Both are possible today, thanks to measuring systems from the SKZ. The use of contactless ultrasound or terahertz technology provides the necessary metrological prerequisites for this. Scientists at the SKZ have gained years of extensive experience with these non-destructive measurement methods. During the last ten years, these systems have been developed and adapted to the needs of the plastics industry. Today, the SKZ can offer robust measuring systems for



Measuring systems from the SKZ display the current aggregate state of plastic products in real time – the degree of melting and curing can thus be reliably monitored. (Photo: SKZ).

a wide variety of applications. Thus, for the first time, the SKZ not only supports the transfer of non-destructive measurement methods into industrial use, but also directly sells individually adapted measurement technology.



Giovanni Schober | Dipl.-Ing. (FH) Group head Non-destructive examination +49 931 4104-464 g.schober@skz.de

Load limits for durable design of thermoplastics

NEW METHOD FROM THE SKZ ALLOWS EASY ESTIMATION

The long-term mechanical behaviour of plastics is very complex. Reliable design of thermoplastic components in the area of long-term or fatigue strength is correspondingly difficult. Taking into account application-related influencing factors, the SKZ Plastics Centre has developed a new method. This permits a simple estimation of load limits for the durable design of thermoplastics.

For thermoplastic components, there has hitherto been no generally applicable procedure for verifying long-term or fatigue strength. A particular challenge is the determination of material usage limits in order to prevent material damage and future component failure. Previous design methods have usually included considerable testing efforts and costs or, when global reduction factors and high safety coefficients are used, mostly give very conservative results, which is contrary to the desire for lightweight construction and resource efficiency. Thus, in order to determine such limit values, an energy-based design concept was developed, which, on the basis of intermittent tensile tests, permits material application limits to be detected by evaluating the elongation amplitude. By subdividing

the converted energy into stored and dissipated energy components, a critical dissipated energy density can be determined which is characteristic of the material's damage limit. Below this damage limit, the material is "durable" in the sense that even after very frequent loading or long loading periods, there is no micro-damage, which can later lead to component failure.

Practice-oriented thanks to simple testing technology

The novel method was developed from the point of view of permitting an application-related design with little testing effort. The restriction to simple experiments which are carried out with universal testing machines makes it possible to define load limits with direct consideration of application-related influencing factors. Thus, for example, by using a temperature control chamber, it is possible to determine load limits for temperatures which deviate from the standard climate. Damage limits can also be determined as a function of anisotropy of the material properties caused by fibre reinforcement. Due to the direct consideration of strength-reducing influencing factors during the material testing, it is thus possible to get by without global reduction factors. The innovative testing method also makes it possible to dispense with time-consuming and cost-intensive long-term tests.

Universally usable for thermoplastics

The applicability of the new process was demonstrated in the context of a research project on different thermoplastics (amorphous/partially crystalline, brittle/ductile, fibre-reinforced/nonreinforced). The load limits determined were compared with common design methods (stressrelated or expansion-related) and achieved good matches.

Along the value chain of plastic components, numerous companies will benefit from an application-related determination of the load limits of their plastic types used. Cost-intensive longterm tests or wholesale measuring methods are avoided. This increases the safety and service life of products, saves material and avoids expensive recourse claims. The planned perspective incorporation of the procedure into standards and guidelines will provide users with additional security in the design and allow a more efficient layout for development processes.

The method was developed as part of Research Project 20522N of the FSKZ e.V. and is sponsored via the German Federation of Industrial Research Associations (AiF) within the framework of the Programme to Promote Joint Industrial Research (IGF) by the Federal Ministry of Economics and Climate Protection (BMWK), following a decision by the German Bundestag.



Malte Nebel | M. Sc. Component properties +49 931 4104-133 m.nebel@skz.de



CRB test according to ISO 18489 possible at the SKZ

PRODUCT PORTFOLIO OF THE PLASTIC PIPE CENTER EXPANDED

With the introduction of a new version of DIN EN ISO 1555-1 (PE piping systems for gas supply), the Cracked Round Bar (CRB) test according to ISO 18489 was also included in the standard. The SKZ now offers this test.

With the CRB test, the resistance to slow crack growth of PE 100-RC materials as well as that of pipes and fittings can be checked within a few days. For this purpose, a cylindrical, centrally notched solid rod is tested under a cyclically alternating tensile load until it breaks. The test specimens are machined from pressed plates or from the tube wall. In March 2022, the CRB test was added to the test portfolio of the Plastic Pipe Center at the SKZ. To carry out the CRB test, a dynamic universal testing machine LTM 3 from Zwick/Roell was purchased, which is already in continuous use due to the high demand.



Tobias Bauer | Dipl.-Ing. Plastic Pipe Center +49 931 4104-121 t.bauer@skz.de

Cracked Round Bar (CRB) test according to ISO 18489 (Photo: SKZ)



Adhesive setting in focus

NON-DESTRUCTIVE MONITORING OF ADHESIVE BONDS BY MEANS OF MAGNETIC RESONANCE

Over the past two years, intensive research has taken place at the SKZ on the non-destructive monitoring of adhesive setting in adhesive bonds by means of unilateral nuclear magnetic resonance (uNMR). The results confirm the great potential of this measurement technology for a process-oriented test of setting degrees, outlining the way to industrial implementation.

As one of the key technologies of the 21st century, bonding is used in many areas of industrial production. In particular, the increasing demand for modern designs and increasingly complex lightweight solutions serves as a driving force here. "Proper setting is a key criterion for the optimal functioning of adhesives. While numerous laboratory procedures exist for testing adhesives, no systems have been used so far for the nondestructive testing of adhesive bonds during the production process," explains SKZ scientist Dr. Norbert Halmen.

In the completed two-year research project NMRBond, intensive research was carried out into the use of non-destructive measurement technology for numerous different adhesives. The SKZ used unilateral nuclear magnetic resonance (uNMR) for this purpose. This method is a special form of magnetic resonance tomography known



from medicine, adapted for material testing. It uses low-field permanent magnets (about 0.5 T) and allows short-term non-invasive testing of adhesive layers right through the bonded components. In the research project, adhesive bonds with moisture- and light-hardening 1-component adhesives as well as 2-component adhesives with different adhesive chemistry and reaction kinetics were examined. Various laboratory methods which are customary in practice were used as a reference for hardening, including differential scanning calorimetry (DSC), dielectric analysis (DEA), plate/plate rheometers, nearinfrared spectroscopy (NIR spectroscopy), tensile shear testing and centrifugal adhesion test (CAT). The results of the uNMR showed a good correlation with these methods, so that it was possible to develop hardening degree models in a targeted manner. Recommendations for action show how

Schematic illustration of the relationship between NMR signal and adhesive hardening (Figure: SKZ)

the uNMR can accompany adhesives from development to application as a non-destructive test option and enable the future user to monitor adhesives close to the process.

In future research activities of the SKZ, the focus will continue to be on plastics analysis, as the Niederfeld NMR also offers promising approaches for this.

IGF project 20564 N of the Research Association for the Promotion of the SKZ is sponsored via the German Federation of Industrial Research Associations (AiF) within the framework of the Programme to Promote Joint Industrial Research and Development (IGF) by the Federal Ministry of Economics and Climate Protection (BMWK), following a decision by the German Bundestag. The SKZ is grateful for the financial support it has received.



Dr. rer. nat. Norbert Halmen Spectroscopy +49 931 4104-466 n.halmen@skz.de



In the future, natural fibre-reinforced epoxy resin will be obtained from orange peel. (Photo: SKZ)

Flagship project for the bioeconomy: Orange peel will provide valuable bio-based epoxy resins in the future

INTERNATIONAL ORANGEOIL RESEARCH PROJECT WITH PARTICIPATION OF SKZ

Sustainable alternatives are needed to reduce the use of petroleum-based polymers. The international OrangeOil project, in which the SKZ and Fraunhofer IMWS, among others, are involved, offers a promising approach. The aim is to develop a bio-based epoxy resin system from orange peels – a residue from the production of juice and marmalade.

The hitherto widespread use of polymers obtained from petroleum is becoming increasingly problematic. The bioeconomic approach provides more sustainable solutions, so that products are produced using renewable raw materials, biological residues and innovative processes. Natural oils and their recovery from organic waste and production residues are of particular interest to the chemical industry. They do not have to be obtained directly from agricultural or energy crops and do not compete for arable land for primary food production. The OrangeOil project perfectly meets these requirements and develops epoxy resin systems from orange peel. Orange oil is an essential oil with one of the highest growth potentials on the world market with annual growth rates of approx. 10%. The project thus makes an important contribution to the development of new production technologies and new materials for the processing industry and meets both economic and climate and environmental protection requirements.

Wide range of applications of bio-based epoxy resins

Bio-based epoxy resins made from orange oil will in future be able to serve a wide range of applications in automotive, rail vehicle, ship and sports equipment construction as well as in interior and exterior architecture. The aim of OrangeOil is to develop a bio-based two-component system for special applications, such as the use as a pure resin layer of floor coverings and as a matrix component in fibre composites. The combination of the resin with natural fibres in biocomposites is particularly attractive because of its excellent properties such as low density, high specific stiffness and the sustainability of the basic material.

As part of the project, the partners SKZ, Fraunhofer Institute for Microstructure of Materials and Systems (IMWS) and TÜBITAK Marmara Research Center are investigating the production and handling of the components resin and hardener. After its production, orange oil is epoxidized and used for the production of samples (pure resin and reinforced plastics). Bio-based resins and fibre composite plastics are comprehensively characterized. The biogenic material is optimally matched to the processing technology and reproducible process control is ensured by the creation of robust technical rules.

Interested companies can participate

The OrangeOil project started on 1 October 2021. Interested companies are invited to free participation in the project monitoring committee of the OrangeOil research project (NR 299 EGB), to help shape the studies and to learn about the latest results. The project is funded under the CORNET (Collective Research Networking) programme. The initiative links national and regional Community research programmes from different countries to enable international research projects for the benefit of small and medium-sized enterprises. In Germany, CORNET is based on joint industrial research (IGF) funded by the Federal Ministry for Economics and Climate Protection (BMWK).



Dr.-Ing. Jana Fiedler Composites +49 345 53045-84 j.fiedler@skz.de

SKZ - The Plastics Centre We solve this with certainty!



LIVARSA efficiency solution helps save energy (Photo: DOC RABE Media / stock.adobe.com)

SKZ saves around 126,900 kWh of electricity annually with LIVARSA efficiency solution

REDUCED CO, EMISSIONS AND A MORE EFFICIENT COMBINED HEAT AND POWER PLANT

This is a model project: At its headquarters in Würzburg, the SKZ has introduced a new energy efficiency solution that has led to a reduction in its electricity consumption by 4.7 percent: The technology used by LIVARSA GmbH (www.livarsa. com) is an MSR solution (measurement, control and regulation unit) installed centrally behind the transformer. It improves the power and mains quality and thus ensures that the current in the 400 volt mains flows through a significantly lower resistance so that power transmission becomes significantly more efficient.

"We generally see ourselves as pioneers and early adopters in the plastics industry. In this function, we want to offer our members solution scenarios for current and future challenges in the industry, "says Dr. Jürgen Wüst, deputy managing director and authorised signatory at the SKZ, explaining the decision for the LIVARSA solution. "Resource conservation and the reduction of CO₂ emissions are clearly among them. In many cases, companies are already obliged to do so by law. With the LIVARSA-MSR system we show a simple way to become active in this respect".

Challenge: Implementation without interruption of operations

The decision to introduce the efficiency solution was made in the summer of 2021, and the MSR technology was implemented at the Würzburg

site in December 2021. A particular challenge was the fact that the power supply could not even be suspended for a short period of time, since this would have resulted in an interruption of the 24/7 tests of plastic parts, some of which were carried out in the SKZ test laboratory over a period of months. In the worst case, there could have been failures or unacceptable disturbances in longterm tests. As a result, costly and time-consuming repeat tests would have had to be made.

It was necessary to find a technical solution that would allow the installation of the MSR system without interrupting the power supply. In cooperation with Stoll Energiesysteme GmbH, a long-standing electrical installation partner of LIVARSA GmbH, a concept for the implementation of the hardware during operation was finally developed - i.e. current-carrying at 20,000 volts. This was possible because the power supply in the test laboratory is fused via two transformers. In this way, one of the two was able to keep the power supply constant for the tests, while the efficiency system was installed on the other. As part of a detailed schedule for the installation, all steps were precisely recorded, since several of the switching operations on the medium-voltage side of the energy supplier were necessary.

Combined heat and power plant with higher efficiency

Within three man-days, this unusual installation was completed. Since then, the LIVARSA solution as a centrally installed filter technology has improved the quality of the low-voltage grid and thus reduced electrical energy losses. The result is not just a saving in energy, but also a reduction in CO_2 emissions of the SKZ by 53 tonnes per annum.

In addition, the SKZ also benefits from a higher efficiency of its combined heat and power plant in order to significantly reduce CO₂ emissions during particularly energy-intensive tests. The efficiency of between 75 and 77 percent before implementation of the energy efficiency solution was increased to an average 80 percent. Consequently, the efficiency (= thermal effect) of the power plant could be significantly increased, which in turn makes its acquisition and ongoing operation more economical.

The efficiency project was financed by a "Saleand-lease-back" model, based on the "pay-asyou-save" principle of Siemens Financial Services. This was a budget-neutral investment, since it is paid for from the guaranteed savings.



Dr. Jürgen Wüst Assistant general manage +49 931 4104-238 i.wuest@skz.de

SKZ at Peine receives Haitian injection moulding machine as a gift

IMPORTANT PART OF PRACTICE TRAINING NOW PERMANENTLY AVAILABLE

The injection moulding machine manufacturer Haitian presents the SKZ at Peine with an all-electric Zhafir Venus 1200. This machine was previously used as a loan in further training.

Niels Herz, Haitian International Sales Manager Germany, brought a nice surprise when visiting the SKZ in Peine. "We give you our injection moulding machine ZHAFIR VENUS 1200 / 300 as a present - it is your property from now on," said Herz. The SKZ team's joy is enormous, because the injection moulding machine has been in successful use since 2013 and has thus become an important component in the course offer of the SKZ site in Lower Saxony. "Until now, the machine was a loan to the SKZ," Herz continued, "but in consultation with our management, we decided to hand it over on a permanent basis. It is important to us to be visible in education and training centres."

Machine already in practice

The all-electric injection moulding machine ZHAFIR VENUS 1200 / 300 with a clamping force of 1,200 kN, a screw diameter of 40 mm and other

additional options, such as an injection-embossing program and extended mould protection functions, is used at the SKZ for training purposes for fitters, merchants, trainees, toolmakers, tool designers and many other target groups.

"Mr Herz succeeded with his surprise," says site manager Annette von Hörsten. "Our courses are based in practice. At least 50% of the lessons are held at the technical centre. The participants must start up the machine themselves, set parameters, change the tools and put into practice what they have learned in theory. That is why it is so important that we are supported by leading machine and peripheral device manufacturers," von Hörsten continues.

The SKZ would also like to express its thanks on behalf of the management for the generous support it has received and looks forward to further fruitful cooperation!



Annette von Hörsten Site Manager Peine +49 5171 489-35 a.hoersten@skz.de



Rodney Hamza (HT Vertriebs GmbH), Horst Tiedemann (Managing Director HT Vertriebs GmbH), Niels Herz (Haitian Sales Manager Germany), Annette von Hörsten (Site Manager SKZ Peine) and Andreas Grzeskowiak (SKZ Senior Trainer) (f.l.t.r) in front of the Haitian injection moulding machine (Photo: SKZ)

Are they dense?

NOVEL MEASURING SYSTEM FOR LEAK TESTING OF PACKAGING

Leak tightness plays an important role in the packaging of the products. After years of development at the SKZ, a test method is commercially available for the first time, which measures and evaluates the leakproofness of products in a matter of seconds. No matter whether it is glass, plastic or metal – all material combinations, with and without colouring, can be reliably tested.

A large number of everyday products, grocery items in particular, but also medicine and drugstore articles, benefit immensely from reliable, impermeable packaging. Even the smallest unrecognized leaks quickly lead to the premature spoilage of food and subsequently to dissatisfaction among customers who have paid for an actually good product with a current expiry date. In extreme cases, leaky medical packaging with ineffective or non-sterile drugs can have far more serious consequences. For this reason, packaging and containers have hitherto been tested for possible leaks using water baths, pressure or test gas. However, since these methods are generally time-consuming and thus costly, leakage tests cannot be carried out for all product and packaging types while being economical at the same time; instead they are usually carried out on a random basis.

Test system works on a product-independent basis

Here, the SKZ offers a novel measuring system for leak testing, which has been consistently developed into a new product in recent years. The test system works almost independently of material, geometry, colour and thus product, is mobile and can be easily integrated into the production process. The SKZ is happy to provide interested parties with further information and free preliminary examinations.



Giovanni Schober | Dipl.-Ing. (FH) Group head Non-destructive examination +49 931 4104-464 g.schober@skz.de



A new measuring system developed at the SKZ allows non-contact, non-destructive and largely material- and geometry-independent leak testing for a variety of different products. (Photo: Constantinos / stock.adobe.com)

The specialist degrees of the SKZ are more in demand than ever before FURTHER PARTICIPANTS SUCCESSFULLY REACH THEIR DEGREES

In addition to short-term further training, the SKZ also offers modular degrees that enable

in-depth qualifications in various plastic-specific topics. These continue to enjoy increasing popularity.

Modular degrees at the SKZ facilitate intensive qualification and are comparable to topicspecific, small training courses. The advantage of the modular design lies in its compatibility with everyday company life. The employees will be absent for a maximum of one week at a time and will be available to the company again as soon as possible. Participants and companies can determine the timeframe up to graduation. At the same time, the SKZ conveys plastics expertise in the usual quality. The number of participants is steadily increasing. "We will soon have to consider an alumni meeting," says Bernhard Hennrich, Deputy Head of Injection Moulding and Additive Manufacturing at the SKZ, during the certificate



Graduate Xingyong Wang (left) and SKZ instructor Robert Held at the certificate handover at the SKZ Technical Centre (Photo: SKZ).

handover on 22 February. This was indeed a very special moment for some participants.

This time, a private payer also proudly received his certificate. "Many thanks to Robert Held and all the other dedicated trainers and the SKZ, who also supported me with funding programmes," says Xingyong Wang, recently SKZ certified plastics developer. "Xingyong Wang even holds a record now. Never before has anyone completed the modules of the degree in such a short time," adds Julia Nägle, group leader of course organisation at the SKZ.

Counteract shortage of skilled workers

The increase in graduates is a logical consequence in order to counter the increasingly acute shortage of skilled workers. "Many companies are now using our degrees to qualify newcomers or to further develop motivated employees," concludes Hennrich.



Bernhard Hennrich | Dipl.-Ing. Injection Moulding, Additive Manufacturing +49 931 4104-243 b.hennrich@skz.de

SKZ with new "Plastics Material Expert" degree

HIGH DEMAND FROM INDUSTRY

Plastic as a material is extremely versatile – this requires a broad knowledge of the different types of plastic, their achievable properties and possible modifications. The new "Plastics Material Expert" degree takes this requirement into account.

Hardly any material group is as flexible as plastics. Versatile and adaptable, they are used in a wide variety of applications. From the toothbrush during your morning wash to your running shoes for jogging, through to the aeroplane on which you go on holiday: A wide variety of plastic materials are used everywhere to ensure sustainable, optimal performance for the respective application. This poses major challenges for processors. The staff, particularly in development, require extensive knowledge of the different types of plastics, their rheological, physical and mechanical properties as well as any possible modifications. With small and medium-sized enterprises in particular, there is often a lack of appropriate specialist staff.



Together with Andreas Büttner (Group Leader for Education in Materials, Compounding and Extrusion at the SKZ), Hartmut Kötting (Wavin GmbH, left) and Benjamin Falge (EJOT Baubefestigungen GmbH, right) rejoice in having passed their final examination to become plastics material experts. (Photo: SKZ)

SKZ provides "extensive qualification"

In order to meet these requirements and to train new experts for plastic materials, the SKZ has launched the "Plastics Material Expert" degree. "With this degree, we offer a very comprehensive and intensive qualification for plastic materials and have probably hit a nerve. Many of our customers have applied for such a qualification, and so we are all the more pleased that there was a high demand from the outset, "explains Andreas Büttner, Group Leader for Education in Materials, Compounding and Extrusion.

Meanwhile, the first two graduates – Hartmut Kötting from WAVIN GmbH and Benjamin Falge from EJOT Baubefestigungen GmbH – received their certificates after successfully passing the final examination: "We particularly appreciate the

modular structure of the degree, which ensures compatibility with everyday working life; both of us have already been able to apply knowledge from the modules in our daily tasks," said the two freshly graduated SKZ-certified plastic material experts. For more information visit:

skz.de/bildung/abschluesse



Andreas Büttner | Dipl.-Ing. Compounding, Extrusion & Material Development +49 931 4104-490 a.buettner@skz.de

Long-term material data for simulation

TEST CONCEPTS AND MATERIAL MODELS FOR OPTIMIZED LONG-TIME LAYOUT OF PLASTIC COMPONENTS

The SKZ and PART Engineering are launching a joint development project for the long-term layout of plastic components. The targeted use of time-saving test methods and novel material models is intended to drastically reduce time and costs. The intelligent processing of selected material data to accurately and comprehensively describe the long-term deformation and failure behaviour of plastics is intended to ensure greater efficiency and user-friendliness.

The procurement of long-term material data for the simulation of plastic components is often a major challenge for calculation engineers and designers. In many cases valid and meaningful data on long-term deformation behaviour (creep curves) and failure behaviour (creep stress curves) are not available. The reason for this is the great effort required to determine these data experimentally. This is because the required long-term creep tests are very time-consuming and cost-intensive.

Making testing methods more efficient

With a recently launched two-year development project, PART Engineering and the SKZ want to tackle this issue and find solutions. On the one hand, the project aims to make the required testing methods more efficient and to automate them. These advances are expected to significantly reduce testing times and costs. The SKZ uses the so-called Stepped IsoStress Method (SSM), an accelerated creep-rupture test with voltage steps. PART Engineering is developing a method to calculate creep curves even on the basis of few material data. Mathematical material models are used for this purpose. As the main objective of the project, both partners strive to completely depict longterm deformation behaviour up to the failure point. As a result, there are creep curves which describe not only the long-term deformation behaviour, but also the occurrence of failure.

Increased benefit

"We have been working in partnership with the SKZ for many years. On the one hand, as a member of the support association, but also as an industrial partner in the monitoring of research projects. We are all the more pleased that we can now intensify our cooperation in a joint development project," says Dr. Wolfgang Korte, Managing Director of PART Engineering. "The results will feed into our software products and increase the benefits for our customers. In doing so, we attach



particular importance to making the results usable in a simple manner. Our aim as a software provider is to achieve tangible added value in the form of meaningfulness or data coverage of the simulation through the intelligent processing of existing material data."

"Generating data with minimal effort"

"Even if there is no data at all, we want to enable companies to generate it with minimal effort. Our many years of experience with time-consuming mechanical tests are incorporated into the optimization of the test methodology for industrial practice," says Dr. Kurt Engelsing, Head of the Component Properties Business Unit at SKZ. "We attach particular importance to automated evaluation to increase efficiency and ease of use for the user. The new material models thus provide companies with significant time and cost advantages in the long-term design of their plastic components."

Ideal addition

Both partners complement each other in an ideal way to achieve the desired development aims. The SKZ contributes many decades of expertise in the testing of plastics and the determination of long-term data. For more than two decades, PART engineering has been a renowned address when it comes to the simulation and material modelling of plastics. The development project is funded by the Federal Ministry for Economic Affairs and Climate Protection (BMWK) as part of the Central Innovation Programme for SMEs (ZIM). The broad customer base of both partners as well as the software products of PART Engineering guarantee a dissemination of the development results into industrial practice.



Dr.-Ing. Frédéric Achereiner Component properties +49 931 4104-475 f.achereiner@skz.de

Motorised device for accelerated determination of long-term deformation and failure behaviour in plastics (Photo: SKZ)



Plastic Research provides Climate Protection and Sustainability

MdB Markus Hümpfer, MdL Volkmar Halbleib, Prof. Dr.-Ing. Martin Bastian, Andrea Weißig (from left) (Photo: AIF)

They fill the holes in our teeth, have aircraft lift off, secure buildings or replace lubricants in machines. Our everyday life and almost all economic sectors would be impossible without plastics. "Plastics are also a decisive part of the challenges of the necessary economic transformation process and climate protection," explains Institute Director Prof. Dr.-Ing. Martin Bastian at a meeting of plastics research experts with member of the German Bundestag, Markus Hümpfer (SPD).

After packaging, the construction sector is the second largest application area for plastics: Approximately 2.6 million tonnes were used in 2017. However, in many cases there is currently a

lack of suitable specifications for the recycling of plastic construction products, and the quantities are also insufficiently recorded. This was ascertained in a recent study by the Federal Environment Agency (UBA). In order to be able to recycle the accruing quantities to a high standard in the future, the study proposes to supplement constructional product standards with specifications regarding durability, recyclability and the use of recyclates. Separate collection of plastic waste for recycling should be improved. In addition, the recycling of sector-specific packaging should be ensured.

This study presents in detail the use of plastic products and the possibilities of the use of recyclates in the construction sector, the quantities of plastic used, return systems, recycling techniques, current use of recyclates and construction product packaging made of plastic. The authors – amongst them Dr. Phillip Bendix, Dr. Holger Berg, János Sebestyén, Laura Perschel and Michael Ritthoff from the Wuppertal Institute as well as Daniela Eckert, Robin Kocina and Dr. Hermann Achenbach from the SKZ – have identified potentials for increasing the use of highquality recyclates and have presented existing obstacles and options for action for the political and business sectors.

Dependence on the area of application of the plastics

The current use of recyclates as well as technical and quantitative potentials are highly dependent on the area of application of plastics. The biggest obstacles for the use of recyclates are product lifetime, dismantling capability and technical requirements. "Due to the increasing quantity of plastics in the construction sector, the question of their recyclability is becoming increasingly important. We are pleased to be able to demonstrate the recycling potential and re-use possibilities of recyclates in this study," says Dr. Hermann Achenbach, group leader of Sustainability and Circular Economy at the SKZ.



Dr. Johann Erath Head of Research Manage +49 931 4104-472 j.erath@skz.de

SAFE TO RELY!

We are the enabler for our customers.

Peine Halle Obernburg Würzburg Horb

Our mission

Since our foundation in 1961, we have been providing holistic solutions for companies and craft businesses within the plastics industry.

- ✓ We are the leading **experts** around plastics material.
- ✓ We work customer-oriented and enable our customers to top performance.
- We handle the tasks assigned to us **reliably**, conscientiously and confidentially.



We are the enabler for our customers.

We are convinced: Plastics are crucial for the challenges of our time. We help our customers develop new solutions and support them in opening up new markets and securing existing ones. For all tasks and customer requirements, our goal is:

Safe to rely!

That is what we are proud of!

We are also proud of our more than 60-year long history, which has made us the leading integrated supplier with competence and experience that can draw on an extensive network within the company and in our industries. This offers our customers real added value. That's what motivates us!

As a service provider for the plastics industry, we research, test and certify products and processes for companies and craft businesses and qualify and network people.

We say thank you to everyone associated with our company, especially our employees, partners and customers. We look forward to many more successful years of enabling the ideas of our customers.