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K-PROFI

international edition

Our quality promise to plastics processors

› Trendsetting know-how
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Andreas Raap at Durotherm is automating his machinery to replace even more parts in sheet metal with plastic – and in higher quantities:

More automated thermoforming for larger quantities

What opportunities and risks **Trelleborg** sees in a PFAS ban. How **Alpla** minimises set-up times for colour changes. How **Röchling Medical** reduces CO_2 footprints. How **Gargiulo** optimises its material drying. How **Apra-plast** produces large-area parts cost-effectively. And why **Otto Graf** recycles itself.

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Stefan Burtscher, Proecess Development at Lercher Werkzeugbau, Austria

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Successful makers from the plastics processing industry

Dear Reader

The possible PFAS ban in Europe, the low demand for recycled materials, the economic downturn and various location problems are currently stirring up the plastics industry. The impending ban on per- and polyfluoroalkyl substances (PFAS) is alarming manufacturers, processors and users. We delve into the topic with Prof. Dr. Konrad Saur from the seal manufacturer Trelleborg Sealing Solutions (page 6).

Apra-plast produces plastic housings and other components using milling and bending technology – without tools. Why Managing Director Jürgen Könen sees the company "really big with small quantities", from page 10. "Sustainability has arrived in medical technology" is our summary of the newly formed "MedtecLive with T4M" in Nuremberg, which reports growing popularity. Exhibitors from the plastics industry paint a more differentiated picture of the situation: page 20. With Werner & Mertz we look at the use of recycled materials in the food industry and the concepts that are needed for this: page 26.

Otto Graf has dedicated itself to rainwater management systems. Jörg Drägert and Andreas Steigert explain why Graf uses recyclates almost exclusively and has even built its own recycling plant: page 30.

Gargiulo produces profiles made of PA66-GF for window systems. Fabio Gargiulo shows that his new material management only ever dries as much raw material as the extruders are currently consuming: page 36. Durotherm is automating its machinery to replace even more sheet metal with plastic – and in higher quantities. Andreas Raap provides insights into the thermoformer's vision: page 40.

On our own account: If you no longer want to do without K-PROFI international, order the magazine free of charge. Details on page 51.

We wish you a successful autumn 2023!

Markus Lüling, Editor-in-chief
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In this magazine

Cover photo: K-PROFI/Hauptmannl

"There is no one-to-one replacement".

What opportunities and risks the seal supplier Trelleborg sees in the announced PFAS substance ban

The impending ban on PFAS substances (per- and polyfluoroalkyl substances) is causing nervousness among manufacturers, processors and users. Trelleborg Sealing Solutions in Stuttgart, as a supplier of sealing solutions, worked out the current pain points in a workshop with users. Endangered business models, too short a timeline for the development of alternatives and negative effects on spare parts availability are only a small section of the concerns. K-PROFI spoke to Prof. Dr. Konrad Saur, Vice President Innovation & Technology, on the side-lines of the event about Trelleborg's role and position.

Text: Dipl.-Ing. (FH) Sabine Rahner, Editor K-PROFI

All photos: K-PROFI

Prof. Dr. Konrad Saur encourages participation in the ECHA consultation process to influence the legislative process.

The carbon-fluorine bond is the strongest chemical bond in organic chemistry. This high stability is an advantage in application, at the same time it is the reason for the restriction procedure of the ECHA. Because they are difficult to break down, the low-molecular per- and polyfluorine compounds accumulate in the environment, in drinking water and in food. The Memorandum of Understanding of the European Chemicals Agency (ECHA) concerns all substances with -CF2 or -CF3 groups, does not distinguish between low-molecular substances and polymers and therefore also includes fluoropolymers such as PTFE, FKM and others.

K-PROFI: What do you think of the ECHA proposal on PFAS re-regulation published in February?

Prof. Dr. Konrad Saur: The restriction proposal is based on the REACH Regulation. This includes the evidence for the classification of the substances. These are missing

Trelleborg's focus is on customised developments; catalogue goods only account for 40 % of sales.

in the proposal. Persistence alone is not a sufficient criterion. Fluoropolymers have been classified as polymers of low concern' for many years. On the other hand, there are clear indications that low-molecular PFASs are harmful to the environment and to health. However, the planned ban does not distinguish between low molecular weight PFAS and fluoropolymers. Many industries do not appear in the assessment of alternatives. In addition, the availability of alternatives is estimated far too optimistically. The time required for the release of alternatives is vastly underestimated. Safety-critical applications in particular require lifetime testing. Type approval for vehicles and aircraft cannot be obtained within 18 months. To put it bluntly: The dossier is based on factually incorrect assumptions, is incomplete and therefore open to attack.

What possibilities are there for exerting influence?

The consultation procedure will run until mid-September. Every company can ensure that its voice is heard, either by itself or through its industry or sector association. In addition, anyone can approach ECHA as a submitter and justify how the individual application and the time needed to develop alternatives have not been adequately taken into account. We are happy to support this, because we are concerned with good, reasonable and resilient regulations. Every submission has to be answered by ECHA. This drags out the process. This is followed by a political process in which arguments can also be heard.

Which classes of materials are affected?

In its current version, the ban covers the fluoroelastomers FKM, FFKM and FVMQ, as well as PTFE and all materials to which this compound is added or which are coated with it. In addition, PFASs are contained in many solvents, cleaning agents, lubricants and coolants. Their manufacturers will have to change their additive packages, so one has to keep an eye on possible changes in the properties of, for example, hydraulic oils. And, of course, the many applications of other PFAS substances are affected, because in total the planned restriction affects thousands of individual chemicals.

What is the situation like for you as a seal supplier?

In the synthesis of fluoropolymers, our raw material suppliers sometimes still use the critical low-molecular PFAS solvents, which can be introduced into the end product in very small amounts in isolated cases. We are purely a downstream user. All our FFKM and PTFE are fully polymerised and already completely free of these short-chain solvent impurities. We test this extensively using gas chromatography. We hope that in the near future we will also have reached this stage with all FKM. Today, there are already a large number of FKM grades that are produced without the PFAS surfactants. In general, all our raw material suppliers are currently converting to so-called PFAS-surfactant-free processes and developing new polymerisation processes. However, this conversion will not succeed overnight. This is another reason why these PTFE or FKM materials will not be one-to-one the same as we know them from the established processes. The chemical-physical properties are not identical. There will be no 'clean' PTFE as a one-to-one substitute. This is where our expertise comes into play: in the compounding of the final formulations, we then realise the high-performance materials. These are put through their paces in our materials laboratories and test centres before we approach our customers.

What steps are you currently pursuing?

The applications in which we support our customers are probably among the most demanding. That is why we are one of a few pilot customers of our raw polymer suppliers. We are in the fortunate situation that we can be the first to process these new development polymers, develop formulations and see how they behave in the finished product. Over many iteration steps, we can thus help shape where the journey goes. We see ourselves as a development partner at the side of the users. We need to know from them what goals they are currently pursuing. Are they aiming for PFAS-surfactant-free fluoropolymers or do they want to get away from fluoropolymers completely? For the first scenario, we are sure that we will be able to offer clean and working solutions by 2024/2025. Currently, we are spending an extremely high amount of time and effort on testing and approving these alternatives. To this end, we are investing heavily in the equipment and capacities of our laboratories and test benches. This distinguishes us from suppliers who tend to follow a dealer approach and limit themselves to catalogue goods. For our approximately 40 percent share of standard products, we also pursue the approach of converting all materials to the new polymer generation. Our customers also buy from us the security and reliability that the future materials have been put through their paces and are suitable for their segment and specific application.

And what is your approach for a complete abandonment of fluoropolymers?

Fluoropolymers are highly expensive and are therefore used where they are really needed. In plasma applications in semiconductor production, for example, there is still no alternative to FFKM. We have been working for decades to develop and evaluate alternatives to PTFE and FKM. We are still very committed to these materials because nothing comes close to their huge range of applications. However, we do find materials in application niches that work without compromise in terms of 'form, fit and function'. One example for food contact is ultra-high molecular weight polyethylene, which is already proving itself as an alternative. We have a wealth of experience and know which materials come close to PTFE or FKM in a small application window, depending on the desired property. To qualify alternative polymers, we test, for example, high-performance materials that are currently used for construction elements with regard to their functionality for seals. At Trelleborg, we know polymers such as POM, PA, PEEK,

At the 'Creating Innovations' workshop, Trelleborg worked out the current PFAS pain points in direct exchange with customers.

PI or PEI from structural applications and now have to make them suitable for sealing applications. Often this also involves a design change so that the seal has less contact with the medium. But there is a whole rat's tail attached to these design changes. Just think of the spare parts obligations in plant construction, for example. A redesign is unthinkable here.

What are the consequences of this situation?

We and our customers have to expend more effort for a broader material portfolio. This makes us less efficient because we buy smaller quantities and process smaller batches. So, it becomes more cost-intensive. But this is also an opportunity for us, because we are able to offer alternatives in the first place. Our competences are in materials, testing and design. For market competitors who have specialised in a niche and whose entire experience lies in one class of materials, who do not have access to the new formulations and who buy from compounders who may not have the comprehensive laboratory and testing equipment that we do, advising their customers on the materials of the future will be a challenge. In research and development, the PFAS topic already ties up more than half of our capacities. The laboratories use about a quarter of their capacities for testing and qualifying alternatives, and this will increase significantly.

How far has the PFAS issue reached the users?

The entire industry is concerned with the topic. We receive corresponding questionnaires, often with the simple question of whether a product contains PFAS. If you know the materials, the question is easy to answer. However, we notice that especially in the case of assembly components, there is a great lack of information about which materials are in use. A globally standardised exchange and management system for material data, like the IMDS in the automotive industry, does not exist in mechanical and plant engineering. If you buy a pump today, you can't tell whether it contains PTFE or FKM components.

Your summary: risk or opportunity?

We currently see a risk if we do nothing. But we see an opportunity if we act together. We can influence the legislation and meet with a lot of openness and understanding experts at the ECHA who are interested in banning the really dangerous, i.e. short-chain PFAS. I am sure that the substance ban for problematic PFAS will come, at the earliest after the summer of 2027. For me, a good outcome is differentiated: problematic short-chain PFAS that accumulate in the environment via aquatic systems must be banned. We need requirements and defined transition periods for this. Today, we can already produce fluoropolymers partially free of PFAS surfactants and are working with raw material manufacturers on complete elimination. Even for completely fluorine-free polymers, there are promising solutions in individual application niches. We will then have to do without a broadband material; such alternatives will have a much narrower application window. Incidentally, the competent authorities in Great Britain have exempted fluoropolymers from the regulation. Hopefully this will also succeed in the EU.

www.trelleborg.com

All photos: K-PROFI/Hauptmann

Jürgen Könen knows his company inside out.

"Since we don't have any investments in tools for milling-bending technology, we can offer our customers low-cost housings," explains Jürgen Könen.

Big with small quantities

How Apra-plast manufactures plastic enclosures and parts using different combinations of technology

Producing housings without tools, with round or angular edges, with large or small radii – that is the core competence of Apra-plast Kunststoffgehäuse-Systeme GmbH (Apra-plast) from Daun. Be it casings for dental laboratory milling machines, TENS devices, EEG devices, ticket readers for an airline or measuring devices of all kinds, they all have one thing in common: they are produced in small batch sizes. Managing director Jürgen Könen puts it in concrete terms: "We are very big when it comes to small quantities. Since we don't have any investments in tools in milling-bending technology, we can always offer our customers cost-effective housings when we're talking about ten to a few thousand pieces per year."

Text: Dipl.-Ing. Gabriele Rzepka, Editor K-PROFI

The specialist sees itself as a solution provider for enclosures of all kinds. Depending on the requirements, thermoforming or vacuum casting are used in addition to milling and bending technology, if necessary. In addition, 3D printing with a total of seven machines of different sizes and technologies plays an important role. This is where functional components, struts, prototypes, jigs, samples and also the master models for vacuum casting are created. "We use different printing processes from FDM, SLS to MJ and SLA so that we have the right printer and the right material for the respective application," Könen makes clear.

The experts at Apra-plast look at the customer's requirements and design ideas for the future enclosure and develop the optimal solution based on this. According to Könen, the company often relies on a combination of different technologies: "For example, if we have to guarantee absolute impermeability for the bottom shell of an enclosure, we produce it as a thermoformed component and the sides using milling and bending technology. This is always the first choice when it comes to two-dimensional radii and when we can glue the elements of the enclosure together." The absolute plus points here are the non-existent tooling costs and the very high flexibility. If, for example, an enclosure is to be 20 mm larger after two years, the recess for the digital display slightly larger, the slope of the side panel slightly flatter – all this is no problem. Because this only requires minimal changes to the design and CNC programming.

Nothing off the peg

A tour of the production facility makes it clear what Könen means. In the heart of the factory with a total of 13 three-axis CNC portal milling machines from Mécanumériс as well as five angle bending machines and two round bending machines, in addition to scanner housings, printer and measuring instrument covers, straight side covers are made from a 4 mm ABS semi-finished product for dental milling machines. At the same time, the Illig UA100g thermoforming machine produces the front unit for this. The reason: The front has three-dimensional contours that cannot be produced using the milling-bending technique. After deep drawing, the front is milled in the 5-axis CNC machining centre from Belotti.


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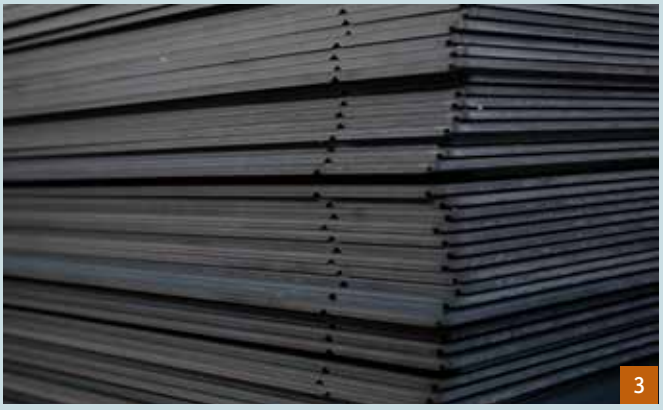
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The side parts also have their work cut out for them. First, one of the 3-axis CNC portal milling machines mills the contour from one white and one black co-extruded ABS-PMMA sheet each, which are glued together in the next step. The machine also mills a groove in the white component of the side trim exactly at the bending point. The charm of the milling-bending technique also lies in the fact that the entire milling process is two-dimensional and the components can therefore be milled without the need for complex workpiece fixtures. After milling, the next step is digital printing, where, among other things, a Mimaki UJF-7151 plus applies the necessary lettering. A Mimaki FFX200 2513 EX is also available for large areas to be printed or components in larger quantities.

Bending with specially designed machines

After this preliminary work comes the bending process. Könen explains: "We work exclusively with bending machines that we have developed ourselves together with a partner from special machine construction. We don't have any off-the-shelf machines." The plant for the production of the side cladding is about 2 m long and has a quartz tube radiator that is just as long. "How long we heat and at what temperature is a big part of our know-how. We have a lot of experience here. Basically, we know which values we have to set for which material and which bending angle. Then we make a sample part, look at the residual wall thicknesses and the material and do the fine tuning," Könen describes the process. Once the temperature, heating time and cooling time are fixed, these settings for the product no longer change. Once the side wall of the enclosure is heated up, the bending beam moves up and creates the desired angle – in this case it is 90°. After the cooling time, the worker removes the component and the process starts again.

In addition to the five "classic" bending machines, which work with quartz tube radiators or heating wires, there are two round bending machines in the halls. Könen proudly explains: "These are our babies, we developed them ourselves. Here we can bend large radii without tools and thus realise interesting designs for our customers. This gives us a unique selling point." The managing director does not really want to show his cards, too much development work is involved in the process. At least this much he reveals: "With this process, we heat the material over a wider surface. The radius is created by the component stops and by how we place the workpiece to be bent."

Assembly is a fundamental part of manufacturing

At the company from the Vukaneifel, only final products leave the halls. For this reason, assembly is essential. In the assembly hall, employees glue the elements together, weld in threaded inserts, mount front panels, for example, or join elements using an ultrasonic welding system from Herrmann Ultraschall.

The lion's share is made up of the gluing technology. The employees manually apply the solvent-based adhesive and join the individual parts. In the case of critical glued seams, they fix the components with clamps or in holders. Könen describes: "With us, one person always glues a complete project. It's important to join the individual parts together reliably and without twisting."

1 On the 3-axis CNC portal milling machines, the employees mill the contours and the groove for the enclosure elements.

2 The groove at the top and bottom of the plate, where it is subsequently bent, is clearly visible. This is how an element of a scanner housing is created.

3 Finished milled plates are ready for the next step. On the right of the picture the groove can be seen where the component will later be bent.

4 The worker places the side parts of the dental milling machine casing with the groove above the quartz tube radiator.

5 The bending die holds the component on one side, a steel strip serves as a stop so that it cannot slip.

6 After the quartz tube radiator has heated the side part along the groove, the bending beam moves up and forms the desired angle.

7 Large radii produced on the round bending machines allow greater design freedom.

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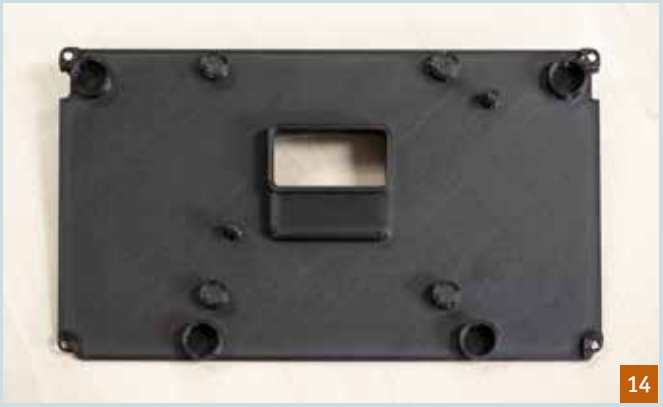
High degree of design freedom

The specialist can start manufacturing an enclosure very quickly because the material is ready in the warehouse. The standard range consists of 13 colours and panel thicknesses between 2 and 15 mm. Semi-finished products made of ABS, PS, PC, PMMA and also co-extruded sheets made of ABS/PMMA or with a PMMA film in different fire protection classes are available.

In addition to plastic components, the company often uses a material combination of plastic and metal. For example, the housing for digital radios for fire brigades and police is made of ABS, the front of anodised aluminium and the base plate of steel. Könen explains, "The transformer of the devices is so heavy that the bottom of the housing is much better represented by metal." This is not a problem for the company, because within the Apra Group, Apra-norm manufactures metal enclosures, which the plastics experts can help themselves to.

The enclosure of a control unit comes with a material combination of an anodised aluminium front, a body of ABS and an internal copper conductive lacquer for electromagnetic compatibility (EMC). For other enclosures, cooling plates made of metal or assembly elements from 3D printing are incorporated into the plastic. "We can realise many functionalities and designs thanks to our manufacturing processes, the variety of materials and the bonding technology," Könen is pleased to say.

The housing of a control unit consists of a material combination of an anodised aluminium front, a body made of ABS with an internal copper conductive lacquer for electromagnetic compatibility (EMC).



8 Before the bending process, the Mimaki JFX200-2513EX prints logos and lettering on the components.

9 The front of the dental milling machine cladding is created in the deep-drawing process due to the three-dimensional contours. These cannot be produced using the milling-bending technique.

10 After thermoforming, the necessary windows and recesses are milled in the CNC machining centre.

11 The milled fronts are ready for final assembly.

12 Numerous assembly steps are often necessary. Here, threaded inserts are welded into an enclosure element.

13 Gluing is indispensable – it not only joins plastic to plastic, but also plastic to metal.

14 Back panel for a measuring converter produced with the help of FDM 3D printing. Bars, recesses and fastenings are printed directly, eliminating the need for further processing steps.

Vacuum casting or injection moulding?

Not only Apra-plast but also Apra-norm processes plastic. The latter injects housings, handles, hinges, brackets and customised components. But where does vacuum casting fit into the picture here? Könen explains: "With vacuum casting and 3D printing, we are often involved in the development of injection-moulded parts that later go into series production at Apra-norm. For the most part, the tolerances in vacuum casting are comparable to those in injection moulding, and so we can produce samples with little effort, which we then optimise with the customer in the final stages before it goes into large-scale production."

Another area of application is again the small quantities. Light traps are currently being created for a test device in which several test specimens are tested simultaneously with the aid of a light beam. If not all test stations are occupied, the tester places the light trap in the empty test station where the light beam dies. In this way, the device can work even if it is not fully occupied.

Light trap manufactured by vacuum casting. The tolerances in vacuum casting are largely comparable to those in injection moulding.

The master model of the light trap was created using 3D printing. It is then encapsulated in silicone to create the mould. Two moulds lie in the vacuum casting machine and are each connected via a hose to a stirring tank in which the two components, isocyanate and polyol, are dosed in at a slight vacuum and stirred for a few minutes. Then the polyurethane flows into the waiting moulds and hardens. "The term vacuum casting is actually misleading. We only work with a few millibars of negative pressure, just enough to prevent bubbles from forming," says Könen, explaining the process. Once the material is hardened, the light trap is removed from the mould, sanded and painted.

The process also makes it possible to encapsulate metal, circuit boards, screws and other elements and thus integrate them into a component. Könen affirms: "For smaller quantities or special applications, vacuum casting makes technical and economic sense. If the quantities become significantly higher, we think about alternatives."

View into the vacuum casting process: The mixture of isocyanate and polyol is stirred at a slight vacuum and poured into the two moulds below.

Many synergies in the group

Three independent companies in Germany and one sales company each in France and Poland now belong to the Apra Group. They all make enclosures: Apra-plast from plastic, Apra-gerätebau from metal and Apra-norm from metal and plastic. Each company benefits from the other's components and production technologies. For example, Apra-plast uses injection-moulded handles, hinges and the like or metal base plates from Apra-norm, and vice versa the latter uses vacuum casting, 3D printing or cladding elements from Apra-plast. The group, which today has around 440 employees, was founded in 1969 by Wolfgang Appenzeller and Wilfried Rademacher. Today, the company is still in the hands of the family. It started with metal housings, and in the 1970s toolmaking and injection moulding were added. In 1991, the founders launched an alternative to conventional injection moulding with milling and bending technology under the name LTP Plastic Housing Systems – at that time still in cooperation with a French partner. In 2004, the group separated from its partner and renamed LTP Apra-plast.

Apra-plast alone employs 80 of the 440 people in the Apra Group. Of the group's EUR 54 million turnover in 2022, Apra-plast generated EUR 7.5 million. Business is good for the milling and bending technology specialists. "We are bursting at the seams and are in the process of expanding our production area by 2,500 m² – plus new office buildings. The signs are pointing to growth," says Könen happily.

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Tape-sandwich technology reduces weight and GWP values

A motorbike seat base produced using the new tape-sandwich process was a world premiere recently presented by the two development partners Engel and KTM Technologies at the “Engel Mobility Days 2023” in Linz. The new process combines higher stiffness with a more compact component design and lower weight with high cost-efficiency in manufacturing.

The aim of the joint development work was to make a motorbike seat base more compact and lighter while maintaining at least the same component properties. “We are placing more and more electronic components in the vehicle and need space for them,” Hans Lochner, Team Leader Material and Applications at KTM Technologies in Anif, explained the challenge. Due to the electrification of powertrains, this trend not only affects two-wheeled OEMs, but the entire mobility industry, according to the expert from the concept development specialist. In order to offer added value for the mass markets in addition to the technical advantages, a cost-efficient production process is needed, for which Engel and KTM are pooling their expertise. The third partner in the alliance is the Belgian toolmaking company Feronyl.

Up to now, the seat bottoms of KTM motorbikes have been purely thermoplastic injection moulded parts. The required rigidity is achieved by geometric stiffening – for example via ribs – which leads to a relatively high component thickness of up to 9 mm. In order to reduce the necessary installation space and create more room for the electronics, KTM took a close look at composite materials and production processes and, together with Engel, set up a production process that is characterised by particularly high efficiency. The result is tape sandwich technology.

In the tape sandwich process, very thin, single-layer tapes or fabrics with PP matrix are inserted into both cavity halves of the injection mould without preheating.

All photos: KTM Technologies

Until now, the seat bottoms of KTM motorbikes have been purely thermoplastic injection moulded parts with geometric stiffening, for example via ribs, and up to 9 mm thick. The tape sandwich reduces the installation space and, even when using fossil PP, the GWP value by 27 %.

Two-thirds more installation space with identical rigidity

"In the tape sandwich process, we work with very thin, single-layer reinforcement materials such as tapes and fabrics with polypropylene matrix, which are inserted into both cavity halves of the injection mould without preheating before the cavity is filled with polypropylene," explains Franz Füreder, Vice President Automotive & Mobility at Engel. "Due to the specific mechanical properties of the sandwich structure, we can already meet the required stiffness for motorbike seat bases with a single-layer UD tape. This means that the new process requires significantly less energy and simpler plant technology than conventional processes. Production costs can thus be significantly reduced." The material bond between the tape and the matrix takes place without prior heating of the fibre structures and solely through the heat of the melt, emphasised Hans Lochner.

In the case of the technology demonstrator seat bottom, the necessary installation space could be reduced by 66 % and the weight by approx. 26 % with identical stiffness. "The new sandwich construction, in which the reinforcing fibres are as far away as possible from the neutral fibre, offers maximum stiffness while minimising the necessary use of fibres," says Hans Lochner. Another advantage of the sandwich structure is that standard thermoplastics can be used in components subject to high mechanical stress, as the performance of the component is controlled solely by the tape structure. "We can afford to use recycled materials without having to fear losses in the mechanics," Lochner underlined, "we virtually come up with a frying oil PP to a structural component."

Global Warming Potential drops by up to 85 per cent

The development partners tested different materials, including bio-based and recycled PP types in addition to PP from fossil sources. Compared to the production status – a seat made entirely of fossil PP – the Global Warming Potential (GWP) drops by 85% with the tape-sandwich technology when using PP from renewable sources. This is possible because even very thin components achieve a high degree of rigidity. The consistent monoplastic approach also contributes to the reduction of greenhouse gases in the overall view. "With this new development, we are opening up an affordable and sustainable solution for the mobility of the future," emphasises Franz Füreder.

In a first step, the tape sandwich technology will be used for motorbike components of the KTM family. The two partners offer the process jointly and develop solutions tailored precisely to the respective lightweight construction application. *Markus Lüling*

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“Sustainability has arrived in medical technology”.

Newly formed “MedtecLive with T4M” completed second go-round in Nuremberg

At the second MedtecLive with T4M at the end of May in Nuremberg, visitors met medical technology specialists and those who want to become one. The organizer NürnbergMesse drew a positive balance after three days of the exhibition, referring above all to the increase in numbers of visitors. Exhibitors from the plastics industry painted a more differentiated picture in discussions with K-PROFI. The start-up Biovox attracted the visitors’ interest with its bio-based medical grade plastics.

Text: Dipl.-Ing. (FH) Sabine Rahner, Editor K-PROFI

After the merger of the previously independent trade fairs MedtecLive (Nuremberg) and T4M (Stuttgart), ‘MedtecLive with T4M’ is held alternately in Stuttgart and Nuremberg every year. From 23-25 May 2023, around 4,000 visitors (3,200 in Stuttgart last year) from 46 countries came to the Nuremberg exhibition centre. Here, 397 exhibitors from 27 countries (previous year: 430 exhibitors from 23 countries) showcased innovations and trends in medical technology with a focus on the top themes of regulation, sustainability, transformation, new manufacturing processes as well as IT and software. “We have thus clearly consolidated our position as the central trade fair for medical technology manufacturing,” says Christopher Boss, Executive Director Exhibitions at NürnbergMesse with conviction.

Numerous exhibitors from the plastics industry took advantage of the network of large joint stands, such as those of VDMA, VDWF, Innonet Kunststoff, Swiss Medtech, Medical Mountains, Bayern Innovativ and the Netherlands. The VDMA alone provided a platform for 29 members, including FKT Formenbau und Kunststofftechnik, Hepako Präzisionsgummiartikel, Toolcraft, Hahn Automation and Zahoransky. Marc Schmidt, Account Development Manager at Zahoransky, was already present at the premiere in Stuttgart, which was still under the effects of the pandemic, and had expected a larger crowd for Nuremberg: “I wished for more visitors. On the other hand, I am surprised about visitors from Turkey and Saudi Arabia.” Zahoransky is best known worldwide for its toothbrush production concepts, although medical technology already accounts for half of sales. “In medical technology, we want to increase our level of recognition even more and are supporting this plan by taking part in the fair.“

Glass replacement for pre-filled syringes

With highly automated production lines for pharmaceutical primary packaging, Zahoransky enables its customers to achieve 100 per cent aseptic production from injection moulding to ‘ready to fill’ status, no-human-touch to packaging, so to speak, and thus a one-stop shopping solution. Marc Schmidt sees COC/COP-based materials as having an advantage over glass in crucial products such as vials or syringes in terms of barrier properties and pH value. They do not have to be washed, dried and sterilised before filling. With ‘Prima Z Syringe’, Zahoransky offers the first production line with a 16-cavity mould on the market for the manufacture of staked-needle syringes, i.e. syringes made of plastic with an overmoulded and not glued needle. "The 16-cavity overmoulding of the needles is a special challenge. We see a growth market in pre-filled syringes.“

Additive series production suits medical technology quantities

A system solution is also the focus of the Austrian 3D printing company Cubicure from Vienna. Founded in 2015 as a spinoff of the Vienna University of Technology, the company developed the Hot Lithography process, a 3D printing method with a specially developed and patented heating and coating mechanism. “We see ourselves as a technology provider for additive series production and stand for system solutions consisting of material and machine. Some of our

Marc Schmidt of Zahoransky: “We enable 100 per cent aseptic production from injection moulding to ready-to-fill status.”

All photos: K-PROFI

Cubicure managing director Dr Robert Gmeiner sees the hot lithography process as a complement and not a competition to injection moulding.

The Biovox founding trio (from left) with Dr Vinzenz Nienhaus, Carmen Rommel and Dr Julian Lotz: "We are the first to test bioplastics according to the requirements applicable in the VDI guideline 2017 for medical grade plastics."

lithographically processable materials meet the highest fire classes such as UL 94," assures Managing Director and CTO Dr Robert Gmeiner. On the one hand, a wide range of materials is available, including a lithographically processable elastomer developed with Evonik, and on the other, Cubicure develops customised special photopolymers. "We see ourselves as a complement to injection moulding. The smaller and more complex a plastic component, the more likely it is that 3D printing should be taken into account," states Dr Gmeiner and specifies: "For every component that is smaller than a human hand and of which no more than 10,000 are required, 3D printing should be taken into account in the considerations. Especially for the medical technology market, this unit size range is interesting." Cubicure, founded in 2015 and visible on the market since 2017, has grown on its own. With currently 60 employees, turnover is "heading towards 10 million euros".

Start-up for medical grade bioplastics

"We are the first to test bioplastics according to the requirements applicable to medical grade plastics in the 2017 VDI guideline," reports Dr Vinzenz Nienhaus, who founded the Darmstadt-based start-up Biovox together with Carmen Rommel and Dr Julian Lotz in 2021. Medical technology cannot do without plastics. This should be possible with a significantly reduced CO_2 footprint – by up to 70 per cent, according to Biovox – when using Biovox's compounds. The three founders presented the potential of bio-based plastics for medical technology in the start-up area. To this end, Biovox has developed an entire system of materials, each with adjustable properties as well as different levels

of transparency, which can be used to meet the high regulatory requirements under the Green Deal as well as in the medical sector. "Most of our compounds are based on PLA," says Nienhaus. At the same time, all Biovox materials have proven biocompatibility (ISO 10993) and quality management is ISO 13485 certified. "We offer a range of standards for different risk classes of medical devices," confirms COO Carmen Rommel and adds: "Sustainability has arrived in medical technology. Many companies have released corresponding budgets for sustainable innovations."

One such company is Röchling Medical Waldachtal AG. It is presenting a joint development just a few metres away from the Biovox stand. How can medical technology products be developed and designed more sustainably? A development team led by Erika Unjaev, Senior Specialist R&D, answered this question using the example of a trocar, i.e. an instrument for minimally invasive surgery. In order to reduce the CO_2 footprint, Röchling took action at several points. For example, the new design saves material without restricting functions and quality. Instead of five previously, only three material variants are used and the number of components could be reduced. Other aspects include tool design for cycle time reduction, easier disassembly and savings in packaging. In addition, Röchling replaced the fossil materials with biobased medical grade compounds from Biovox. "With these aspects in mind, we developed a trocar that causes 51 per cent less CO_2 equivalents compared to

Erika Unjaev and Stefan Jäkle provided information on sustainable product development. Röchling Medical halved the CO_2 footprint of a minimally invasive device.

Acad founder Alexander Kalusche (right) and product development manager Vladan Avramovic' know about the interesting development environment of medical technology.

the conventional series product, at almost the same cost," reports Sales Manager Stefan Jäkle.

From development to small series

"Medical technology is an interesting development environment," knows Alexander Kalusche, Managing Director of the Acad Group from Heilsbronn. However, Kalusche, the founder of the company, considers the sometimes rigid and strict regulations in the industry to be an obstacle to innovation: "Ideas disappear due to a lack of money. The regulations are throwing the small players out." Acad Group, which started in 1991, operates in three divisions. Acad Engineering does product development for automotive interiors, Acad Systems develops housings for medical technology and Acad Prototyping supplies components and manufactures pre-production and small series. The largest division is Prototyping. With its own tooling system, Acad creates the possibility to produce parts in the original material within five working days and creates the basis for validation and optimisation loops. This also enables start-ups to produce initial components and small series at manageable costs. Acad has been manufacturing since 2004 and developing for medical technology since 2009. "This sector has grown strongly in recent years. The sector already accounts for 40 per cent of our development work," reports Vladan Avramovic, Head of Product Development. One highlight is the housing development for the completely redesigned electric breast pumps Alyssa and Bellis from the Swiss company Ardo Medical AG. Acad produced the prototype injection moulds for all plastic components and sampled the hard and soft component parts in the original medical-grade material.

Mixed summary

With a journey of only 30 km, the Nuremberg trade fair location is ideal for Acad: "For us, this is an in-house trade fair. We have been exhibitors at the medical technology fair in Nuremberg from the very beginning and last year we were also present in Stuttgart," says Alexander Kalusche. Product Development Manager Avramovic is pleased about the good and interesting discussions and enquiries. Cubicure Managing Director Dr Robert Gmeiner is not satisfied with the hall concept in Nuremberg after a successful trade fair appearance in Stuttgart in 2022: "You can hardly tell in one hall that there is

"Alliance for sustainable medical technology"

According to a study by Health Care Without Harm, the healthcare sector is responsible for 4.4 % of climate-damaging emissions worldwide, and for as much as 5.2 % in Germany. Biopro Baden-Württemberg GmbH from Stuttgart, Biovox Connect, the network for sustainable medical technology initiated by Biovox and based in Darmstadt, and Forum MedTech Pharma e.V. from Nuremberg are working to support the healthcare industry in a sustainable transformation. With the signing of a joint Memorandum of Understanding at a press conference at MedtecLive with T4M, the institutions reaffirmed their cross-state cooperation to strengthen the sustainable development of the medical technology industry in Germany. Among other things, the alliance organises and hosts a monthly online event on issues, challenges and opportunities related to sustainability in medical technology.

Numerous exhibitors from the plastics industry took advantage of the network of joint stands, such as Innonet partners ArburgAdditive, Gindele and Priomold.

a second one." The majority of the interviewees complained about a general lack of visitor interest. Some are therefore considering whether they will exhibit in Stuttgart at all next year. Others, however, are convinced that the one decisive contact is enough. The range of products and services at MedtecLive with T4M covers the entire value chain. Next year, Stuttgart will be the meeting place for the medtech industry in southern Germany from 18 to 20 June 2024.

www.medteclive.com; www.acad-group.de
www.biovox.systems; www.cubicure.com
www.roechling.com/medical
www.zahoransky.com

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Regranulates should not get up one's nose

Why the road to the use of recycled materials in the food industry is still long

Photo: Werner & Mertz

Immo Sander of Werner & Mertz: "To close material cycles, the packaging and the contents must be tested for their design 4 recycling."

"We look at the end product far too often; we have to start at the very beginning," says Immo Sander, head of packaging development at Werner & Mertz GmbH in Mainz, referring to a continuous design for recycling for packaging and contents. Closing loops can only work if all aspects are taken into account, from the design of the consumer product to waste treatment and the new consumer product. "This can only be done step by step. And there is still a long way to go before regranulates arrive in the food industry," estimates Immo Sander, based on his experience with laundry and personal care products in recent years.

Text: Dipl.-Ing. (FH) Karin Regel, Editor K-PROFI

With its well-known "Frosch" brand, Werner & Mertz is one of the pioneers of sustainable cleaning products. After the first eco-cleaning agent, the Neutral Cleaner, was launched in 1986, today there are about 80 different Frosch products, which are highly accepted by consumers in Europe as well as in Japan, South Korea and the USA. But it is not only the content of the products that should be sustainable at Werner & Mertz, but also the packaging itself. That is why the detergent manufacturer has been using recycled materials for its packaging for many years.

What was already not easy with neutral and toilet cleaners – the use of 100 % recycled goods – is even more difficult for personal care products. For cosmetics, it has only been possible to a limited extent so far. "Together with 38 European brand owners in the cosmetics, hygiene, detergents and cleaning products industry, recycling companies,

plastics manufacturers and plastics processors, we form the CosPaTox consortium, which is working on the development of safety guidelines for the use of recycled post-consumer plastics in cosmetics packaging," explains Immo Sander. CosPaTox stands for Cosmetics, Packaging and Toxicology and, in addition to the goal of defining safety standards, also pursues the implementation of on-site measurement methods for recyclers.

Werner & Mertz has already succeeded in a small revolution in 2019, when the company launched the first shower gel bottles of the "Frosch Senses" brand, which are made of 100% recycled HDPE, using material from the yellow bag. "We succeeded in this step together with Grüner Punkt and the Austrian plant manufacturer Erema," reports Immo Sander, who praises his partners and the enormous development work behind the project. Erema already had a wealth of experience in decontaminating PET for bottle-to-bottle recycling. Now it has succeeded in transferring the decontamination to HDPE.

Odour removal played an important role in this context, for which Erema developed the Re-Fresher plant technology. The recycling plant manufacturer presented this, along with many other plant concepts, at the beginning of June during an open house at the company's headquarters in Ansfelden. With around 400 guests, Erema celebrated its 40th company anniversary and the inauguration of a new 1,550 m² R&D centre with the Discovery Day.

Photo: Werner & Mertz

Frosch Senses brand shower gel has been on supermarket shelves since 2019 in a bottle made of 100 % r-HDPE.

Plant technology for odour removal

Soiled post-consumer waste in particular often has intense odours clinging to it from product residues in the packaging in the yellow bag. In many packages, perfumes migrate into the plastic and are then responsible for unpleasant odours in the later recyclate. For this reason, Erema recommends that the Intarema TVEplus recycling system be used first to process the recyclate. This system uses multiple degassing to remove the highly volatile fragrances and the subsequent laser filter to remove all the particles. Finally, residues such as wood, paper or silicones, which could burn, also cause unpleasant odours.

After the extruder and filter, the granulate is sent to the re-fresher in the second stage, where it is exposed to hot air for a defined period of time. This removes the hardly volatile fragrances, including the so-called VOCs (volatile organic components), and the result is a virtually odourless granulate. VOCs also include limonene, the content of which can be reduced to a minimum during the treatment time in the re-fresher. One of the advantages of the system technology is its low energy consumption. This is achieved by utilising the inherent heat of the granulate coming from the extruder.

Understanding waste

Thanks to the Re-Fresher technology, but also to its own development work in cooperation with the material manufacturer, Grüner Punkt, Werner & Mertz managed three years ago to obtain permission to use r-HDPE for its shower gel bottle with a human toxicology report. "Our recipe for the Frosch Senses shower gel, which is available in varieties such as pomegranate, aloe vera and orange blossom, also meets the highest ecological standards," Immo Sander further emphasises. Like all Frosch products, the shower gels are vegan, free of microplastics, pH-neutral and thus protect the waters.

This is precisely where Immo Sander focuses: "We all have to think together about the effects that formulations for the contents, i.e. for detergents and cleaning agents as well as for cosmetics of all kinds, have on the environment, but also for recyclates." After all, it is not only the odorous substances but also, for example, printing inks and adhesives that cause hurdles in plastics recycling. And there is one more thing that is close to his heart: "We finally have to start thinking more globally. The packaging waste streams are becoming more European, so we also have to put the same packaging and packaging materials on the market across countries." This is the only way to achieve the required recycling quotas and the only way to pave the way for recyclates in the food industry.

Photo: Erema

During the Discovery Day in Ansfelden, Erema showed a re-fresher in action, which ensures odour removal during regenerate production.

www.werner-mertz.de
www.erema-group.com

Trade Fair Calendar

Trade fairs related to plastics processing in 2023 and 2024

All information without guarantee. Short-term cancellations or postponements are possible at any time.

Omanplast	Muscat, Oman	10.10. – 12.10.2023	*www.omanplast.net*
Fakuma 2023	Friedrichshafen, Germany	17.10. – 21.10.2023	*www.fakuma-messe.de*
Vietnamplas 2023	Ho Chi Minh City, Vietnam	18.10. – 21.10.2023	*www.chanchao.com.tw/vietnamplas*
Plast Imagen	Mexico City, Mexico	07.11. – 10.11.2023	*www.plastimagen.com.mx/en*
Compamed	Dusseldorf, Germany	13.11. – 16.11.2023	*www.compamed.de*
Formnext 2023	Frankfurt/Main, Germany	14.11. – 17.11.2023	*www.formnext.de*
PlastEurasia	Istanbul, Turkey	22.11. – 25.11.2023	*www.plasteurasia.com*
SPS	Nuremberg, Germany	28.11. – 30.11.2023	*sps.mesago.de*
IPF Japan 2023	Chiba, Japan	28.11. – 02.12.2023	*www.ipfjapan.jp*

Plastfocus Expo 2024	New Delhi, India	01.02. – 05.02.2024	*www.plastfocus.org*
Warsaw Plast Expo	Warsaw, Poland	06.02. – 08.02.2024	*www.warsawplastexpo.com*
32. Intl. IKV Colloquium	Aachen, Germany	28.02. – 29.02.2024	*www.ikv-kolloquium.de*
JEC World	Paris, France	05.03. – 07.03.2024	*www.jec-world.events*
Wire, Tube	Dusseldorf, Germany	15.04. – 19.04.2024	*www.wire.de; www.tube.de*
Hannover Messe	Hanover, Germany	22.04. – 26.04.2024	*www.hannovermesse.com*
Chinaplas	Shanghai, China	23.04. – 26.04.2024	*www.chinaplasonline.com*
Control	Stuttgart, Germany	23.04. – 26.04.2024	*www.control-messe.de*
NPE 2024	Orlando FL/USA	06.05. – 10.05.2024	*www.npe.org*
Kuteno	Rheda-Wiedenbrück, Germany	14.05. – 16.05.2024	*www.kuteno.de*
Rapid.Tech	Erfurt, Germany	14.05. – 16.05.2024	*www.rapidtech-3d.de*
Plastics and Rubber Thailand	Bangkok, Thailand	15.05. – 18.05.2024	*www.plasticsrubberthailand.com*
Plastpol	Kielce, Poland	21.05. – 24.05.2024	*www.targikielce.pl/en/plastpol*
FIP 2024	Lyon, France	04.06. – 07.06.2024	*www.f-i-p.com*
HanoiPlas	Hanoi, Vietnam	05.06. – 08.06.2024	*www.chanchao.com.tw/hanoiplas*
Achema	Frankfurt/Main, Germany	10.06. – 14.06.2024	*www.achema.de*
Plastics Live	Coventry, UK	12.06. – 13.06.2024	*www.plasticslive.co.uk*
Plastics Recycling Show	Amsterdam, The Netherlands	19.06. – 20.06.2024	*www.prseventeurope.com*
Dt. Kautschuk Tagung DKT	Nuremberg, Germany	01.07. – 04.07.2024	*www.dkg-rubber.de*
Compounding World Expo	Brussels, Belgium	11.09. – 12.09.2024	*eu.compoundingworldexpo.com*
Plastics Recycling World Expo	Brussels, Belgium	11.09. - 12.09.2024	*eu.plasticsrecyclingworldexpo.com*

“We are the good guys!”

Why Graf, as a manufacturer of rainwater management systems, is becoming a raw material specialist

Jörg Drägert, head of raw material management at Graf, shows the fractions from the yellow sack that are processed into high-quality regranulates in Herbolzheim.

Photo: K-PROFI

Almost all countries in the world have long had to deal with the issue of water scarcity on the one hand and flooding on the other. Droughts, heat waves, heavy rainfall – the climate is changing – clever solutions are needed to be able to react to the changes. Otto Graf GmbH Kunststofferzeugnisse from Teningen has dedicated itself to precisely these solutions. “Water is our theme,” is how Jörg Drägert, Head of Raw Materials Management at Graf, formulates his company’s mission. Together with Marketing Manager Andreas Steigert, he explains in more detail during K-PROFI’s visit to the ultra-modern recycling plant in Herbolzheim which plastic solutions the company has in store, why recycled goods are used almost exclusively for the many different plastic products, why Graf built its own recycling plant, what challenges the company faces and why they are “the good guys.”

Text: Dipl.-Ing. (FH) Karin Regel, Editor K-PROFI

Rainwater management and environmental protection are closely related and are considered a corporate task at Graf. What could be more logical than using recycled goods to manufacture products for environmental protection? But why does it have to be an in-house recycling plant? Jörg Drägert can answer this question quite simply: “We can’t just use any recycled material in our products, we need high and reliable quality. After all, we give up to 30 years guarantee on our products.” And so, with the support of the Environmental Innovation Programme of the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety, which aims at the use of novel technologies and the construction of exemplary production facilities, Graf took 35 million euros in hand four years ago and built in Herbolzheim probably one of the most modern recycling plants with a floor space of 23,000 m² including an extensive laboratory and a production hall.

From wine to water

The success story of today's Graf Group began when senior partner Otto F. Graf founded the company over 60 years ago, initially offering plastic containers, barrels and tanks for winegrowing and wineries. As early as 1974, he recognised the potential of rainwater and offered the first rainwater barrels on the market under the slogan "Rainwater is free". The company developed rapidly and is now considered the European market leader of rainwater management products and systems, employs more than 700 people worldwide, sells its products in more than 80 countries, and achieved a turnover of more than 180 million EUR in 2022. "Today we know rainwater is not only free, but a very valuable resource that we urgently need – just like the resource plastic," explains Jörg Drägert, who, together with the then Plant Manager Gerd Berkenkamp, had the idea of using recycled goods very early on. It is important to him: "We don't do downcycling! We replace virgin material and save around 100,000 t of CO_2 emissions per year by processing and reusing plastics." Today, 75 % of the raw materials processed at Graf are recyclates. In the medium term, the value is to be increased to 85 %.

Using own products

The Herbolzheim site is special in every respect. First of all, Graf obviously uses its own products to collect rainwater, which is used for operational processes. For example, a Carat XXL tank stores 52,000 litres of rainwater from the roof area, which is used as process water for the cooling circuits of extruders and injection moulding machines as well as cooling water for spraying the free coolers. In addition, rainwater is used to operate the toilet flush and the washing machine. Graf stores 187,200 l of fire-fighting water in four additional rainwater tanks. "With these measures, we save about 20,000 euros a year in operating costs," reports Jörg Drägert. Further savings and environmentally friendly aspects result from the proximity of raw material production to the production sites in Kehl, Neuried, Dachstein and Teningen as well as from the low primary energy demand. "Our production plants are particularly energy-efficient and, in addition, we use the waste heat from those to heat the building and only use LED lights," emphasises Jörg Drägert, who planned the facility with a lot of passion and who had and has a great supporter in Otto P. Graf, the current managing director and son of the company founder. Andreas Steigert mentions in passing that photovoltaic systems are installed at all locations and that only green electricity is purchased.

Graf has invested a total of EUR 35 million in Herbolzheim in a state-of-the-art recycling plant covering an area of 23,000 m².

Photo: Graf

A total of twelve Unisort Blackeye NIR sorters from Steinert with HSI camera sort the dark fractions at Graf.

In the fully equipped laboratory there is of course also a weathering cabinet – after all, the products for water management should last for generations.

Special feature: black sorting

Today, 10 truckloads of recycled goods arrive in Herbolzheim every day. "We receive the pre-sorted and washed PO fractions with grain sizes of 10 to 20 mm from municipalities, waste disposal companies and other partners," Jörg Drägert begins with the incoming goods and points out all the stations of the material flow during the tour of the plant. "Our way of working is unique so far," says Andreas Steigert, referring to black sorting. Traditionally, recyclers use the light PE or PP fractions from the PO fractions, which at the same time means that about 50 % of the incoming goods are waste. Graf is completely different: here there are twelve Unisort Blackeye NIR sorters with HSI cameras from Steinert GmbH in Cologne. These sorters are able to separate dark objects according to their type of plastic, which was previously either impossible or insufficient due to the strong absorption. "We use a highly complex sorting process, have connected several sorters in series and sort each plastic particle at least once positively and once negatively," explains Jörg Drägert. The result of the

sorting process is four fractions, a light and a dark PP fraction as well as a light and a dark PE fraction. "In this way we achieve a usable share of the input material of around 90 %," Andreas Steigert emphasises. And even some of the sorted-out leftovers are still processed into end products, if the quality requirements allow it. "Our company works almost waste-free," says Andreas Steigert.

Modern regranulate production right from the start

The four sorted fractions are processed directly into regranulates in Herbolzheim, which are then further processed either by injection moulding, extrusion blow moulding or rotational sintering in one of the other plants. The following steps are taken to achieve this: Each fraction first passes through a metal separator and a classifying screen into a raw material bunker. From here, the recyclate enters one of the Rapid granulators before it is dosed into one of MAS' four conical co-rotating extruders, melted and in some cases already added. Via a melt pump and a total of four filters as well as an online rheometer, the melt finally reaches the underwater pelletiser. Now the regranulate is ready and waiting in one of the twelve huge outdoor silos with a diameter of 10 m and a capacity of around 1,000 tonnes to be removed to its destination. "Because of the way we work and the use of up to 100 % recycled material in our products, we can deliver both the granulates and the end products to any place in the world in a climate-neutral way." Depending on what colour and material specification the end product is to have, the final additivation of the regranulates takes place. "We use the light fractions for all products that should have a specific colour, for example green, and the dark fractions for all black end products. For the latter, we sometimes mix in some carbon black," reports Jörg Drägert.

Material flows are the challenge

"Recycling means testing, testing, testing," says Jörg Drägert, who is very proud of the fact that Graf has integrated itself backwards with the recycling plant in Herbolzheim and produces its own materials to the desired specification. He is convinced: "Everything we have done here, nobody has done before us." This includes the laboratory equipment, which really leaves nothing to be desired. "Anyone who works with recycled goods has to test even more than someone who processes virgin goods. We make premium products, some of which have to last for generations, so we need premium plastic granulate." However, this is exactly where he sees problems coming, not only for his company, but for the entire industry. On the one hand, recycling quotas are to be increased everywhere, but on the other hand there are too few recycled goods to meet these quotas. In addition, he says, both competition and price pressure are enormous. "We are doing real circular economy. We are the good guys", the last sentence comes up several times during the interview and can be easily appreciated from the explanations and the way of working. Nevertheless, Jörg Drägert is rather unhappy with the current situation: "We pay for being the good guys with a higher material price. Even though I am convinced that this is the right way in the long term, it is short-term and economic nonsense." The challenge, he said, is to ensure material flows. "Every day the pioneering work is to find new sources of raw materials and win them for ourselves. This is the only way we can continue to offer an environmentally sound product with a high quality."


Photo: K-PROFI

The infiltration troughs can be optimally stacked for transport and can be arranged flat next to or on top of each other in the application.


Photo: Graf

Andreas Steigert shows a model of a rainwater tank, which is one of Graf's core products and is delivered climate-neutral worldwide.

Everything for rainwater

About the products: Graf is the leading company in Europe today when it comes to rainwater management, from infiltration to treatment and retention. The product range thus first of all includes systems for the infiltration and retention of rainwater. Here, storage systems made of plastic, so-called infill trenches, have established themselves. They

have a high infiltration volume with low weight and are resilient and durable. Some of the infiltration trenches are manufactured in Herbolzheim directly from the black 100 % regranulates produced in-house on Engel injection moulding machines. "The highlight of these infiltration trenches is that they can be stacked inside each other for transport and take up little space, but can be flexibly arranged above and next to each other in the application," Andreas Steigert formulates an advantage that Graf also pays attention to in its products. Good logistics. Another example: While the large rainwater tanks in particular are manufactured using the rotational sintering process, the tanks up to 6,500 l are produced from two half shells. "For their production, we operate one of the world's largest Engel injection moulding machines with a clamping force of 55,000 kN," says Jörg Drägert, pointing out another special feature of the company. The advantage of two half-shells is obvious. During transport, less air and more product are accommodated in the same space. "Eight times more receptacles fit into a container if they consist of two parts as opposed to one-piece solutions", clarifies Andreas Steigert. Graf's other products include above-ground and underground rainwater collection tanks including a water treatment system, retention systems and finally, by tradition, a few items for winegrowing, such as barrels and mash containers. "In addition to large tanks and barrels, we also produce all the small injection-moulded parts that are needed for connecting the tanks, for example, ourselves," explains Andreas Steigert. That's why Graf operates many other injection moulding machines in addition to the large ones, including some from KraussMaffei. For the extrusion-blown articles, most of which are produced at the Neuried site, the rainwater expert relies on blow-moulding machines from BBM. The approximately 2,000 different articles are sold worldwide. "We are a classic German company with an export share of more than 50 %," says Jörg Drägert. Customers include DIY stores and building materials retailers.

www.graf.info
www.steinertglobal.com

In any case, Jörg Drägert is concerned about the procurement of raw materials: "Only if we secure the sources of raw materials can we continue to offer an environmentally friendly product in the future."

Photo: K-PROFI

Drying on demand – energy-efficient, gentle on materials, space-saving

Why profile extruder Gargiulo relies on total plant competence for conveying and metering technology

On 21 profile extrusion lines, Gargiulo GmbH in Nehren produces profiles for window and door systems made of PA66 with glass fibre reinforcement. "Our main product is extruded thermal breaks for aluminium composite systems," explains Fabio Gargiulo, who runs the company with his sister in the second generation. However, the main actors in the factory, which K-PROFI was fortunate enough to visit during the tour of the plant and which is one of the company's five locations, are not the extruders lined up in rows, but the material supply solution including drying and heat recovery. "Only as much raw material is dried as the extruders are currently consuming," says Fabio Gargiulo, who is completely satisfied with the customised special solution of his peripheral technology provider.

Text: Dipl.-Ing. (FH) Karin Regel, Editor K-PROFI

All photos: K-PROFI

Christian Keller from Labotek is happy to accept Gargiulo's challenges and works with the profile extruder to find energy-efficient solutions.

Fabio Gargiulo has relied on Labotek for a long time and appreciates the all-round service and complete solutions.

In the two DH 4000 dry-air containers, only as much material is dried as the extruders require.

The DFD 1000 dry air unit is equipped with frequency-controlled blowers and produces only the amount of dry air needed for the current throughput.

"Gargiulo and we are united by our interest in energy-efficient solutions," summarises Christian Keller, project manager at Labotek Deutschland GmbH, Wuppertal, and presents the original requirement that the profile extruder had: "Gargiulo approached us due to an expansion of its production capacities – there are to be up to 26 profile lines in this plant in the future – and, in addition to an energy-efficient one, wanted a space-saving drying system that works with silos and no longer retrieves the raw materials from octabins or bagged goods."

Labotek accepted this challenge and installed the following total solution: for the PA66 raw materials to be processed, everything starts with delivery by a silo train and storage in one of the two 47 m³ double-chamber silos in front of the production hall. This means that a total of four batches can be stored according to type. From the silos, the requested raw materials reach one of the two drying containers with a volume of 4,000 l via material conveyor lines. The dry air for drying is generated in three frequency-controlled dry air generators with an air capacity of 1,000 m³/h each.

The highlight of the solution is that the drying containers are never full, but always dry only as much material as is currently needed, i.e. the quantity that the extruders are currently processing. Simply put: the throughput of the extruders controls the drying capacity of the dryers. In the maximal case, this could be 1,600 kg/h, but due to product changeovers and/or cleaning and maintenance work, not every extruder demands the maximum output. Special feature number two is that the dryers are designed as

Managing Director Fabio Gargiulo is justifiably proud of the development of foamed PET profiles; after all, his company is the only one that can extrude them with a length of 7 metres.

The loss-in-weight 6-fold dosing station feeds the extruder, which runs underfed and produces foamed PE profiles.

Gravi Dryer versions, i.e. they stand on load cells and the exact requirement is weighed in. In contrast to systems with level indicators for volumetric filling, this ensures that the amount of material in the drying container is adapted to the actual demand.

"With this solution, we prevent over-drying and maintain the rheological and mechanical properties of our input goods," explains Fabio Gargiulo with conviction. "Compared to a conventional drying system, the solution saves around 30 % of the energy costs," adds Christian Keller. Since the dry air generators are equipped with frequency-controlled fans, they also only generate the amount of dry air needed for the current throughput.

Saving even more energy

The external heat recovery system (EHR) contributes to further energy savings, which amount to another 5 to 8 % compared to conventional systems. The waste heat from the two water-cooled compressed-air compressors supplies the EHR with water at up to 76 °C, so that in the best scenario only 4 °C have to be added electrically to preheat the dry air in the heat exchanger.

The dried PA66 granulates are conveyed to the respective extruders via a ring line. A special feature is that this line is not extruder-related, but material-related. A total of three different types, for example from supplier A and B, can be requested by the extruder depending on the recipe and setting. "As a third component, we supply a certain amount of recyclate to each extruder via the ring line," says Gargiulo's Technical Manager Arnold Klein, describing the three conveying circuits.

Incidentally, the company produces recyclates itself by crushing start-up waste or trimmings in an Amis mill on site, storing them in one of the silos and drying them. "All conveying circuits are supplied with vacuum via five claw pumps, whereby each pump is equipped with a self-cleaning filter and thus ensures material dedusting," Christian Keller from Labotek further introduces the overall solution. Last but not least, the central Labo-Net control system manages all material drying and handling functions.

Even more peripheral technology

"We already have a long and trusting relationship with Labotek," Arnold Klein praises the peripherals supplier. He is particularly satisfied with the all-round service that the profile manufacturer, who works 24/7 in three shifts, definitely needs. The one-stop solutions that Labotek can offer thanks to its cooperation with other component manufacturers such as Movacolor, Tria, Pulsotronic and Maguire are also an advantage for Gargiulo.

For example, the profile manufacturer has been operating a loss-in-weight dosing station for six components on one of its extruders since 2020. "Here we have combined six simple loss-in-weight dosing units from Movacolor, each equipped with its own weighing cell, into a group that is operated via a common control system," explains Christian Keller. A special feature was to design the system in such a way that it can precisely maintain throughput rates of 5 to 60 kg/h, since the extruder is usually run underfed. This is necessary in order to precisely achieve the likewise controlled

Technical Manager Arnold Klein is sure that the planned five extrusion lines can still be integrated into the drying plant.

amount of blowing gas for the production of the foamed PE profiles at all times and thus to ensure that the profiles are true to tolerance and true to size.

Even more special details

Gargiulo's history is a showcase story, as Vincenzo Gargiulo, father of the current managing director, who came to Germany as a 13-year-old child, started working for an injection moulding company, soon built moulds for it in his garage and switched to building extrusion tools in 1989. Today, profilextrudeur Gargiulo is the largest employer in the area with 170 employees and an annual turnover of EUR 48 million (2022) and operates a total of five plants, all near Nehren. The factories have a total of 64 extrusion lines, which are usually Weber extruders and Greiner downstream equipment. "In-house designs are also sometimes included," reports Arnold Klein and continues: "We assemble our profile lines according to our needs and continue to build the tools ourselves."

All extrusion lines produce profiles, composite strips, foams and seals for window and door manufacturers. Each plant works on a material-specific basis, so only PVC and ASA are processed in one, while PA-GF is produced in the plant visited, ABS in the next and foamed products in the fourth. The fifth plant is home to the research and development and maintenance departments.

Another unique selling proposition

"Our unique selling propositions include our own window system, which we produce primarily for southern Europe, and our foamed profiles," explains Fabio Gargiulo, who is not only following in his father's footsteps as managing director, but also as a developer. If Vincenzo Gargiulo developed extrudable PE foam profiles in 2007, which are used as insulation profiles in aluminium windows and façades as well as glazing rebate insulation, Fabio went one better with the development of a PET foam profile in 2018.

"We are the only company that can produce PET foam profiles with a length of seven metres," he reports proudly. PET is not so easy to foam, he continues, because the melt is very liquid. That's why he developed a reactive extrusion process and today, together with his team, produces PET profiles in different densities as continuous goods with a length of up to 7 metres. Traditionally, the profiles were milled from sheets, but this requires considerably more production steps and is less flexible in terms of geometry.

Gargiulo offers a choice of foam profiles with densities between 110 and 130 kg/m³ for insulating foams that are either glued or pushed into the interior of the window frame, and with high densities of around 200 kg/m³ for substructure profiles and window sill connections.

"A big advantage of PET foam profiles is not only that they have a very good insulating effect and reduce the U-value of window profiles even further, but also that they do not cause any problems during further processing." Foam profiles are used as an inner core in aluminium composite window systems, which are powder-coated at about 200 °C. In this process, conventional foams can collapse and thus lose their insulating effect – PET does not.

www.gargiulo.de

Vision: Fully automated thermoforming factory

How Durotherm is automating its machinery more and more in the direction of low-manpower production

All photos: K-PROFI/Hauptmann

"We have already had highly automated production for years. But we want to go even further here. This will allow us to replace more and more sheet metal parts with plastic and to produce the very high quantities required," says Andreas Raap, responsible for business development and strategy at Durotherm Kunststoffverarbeitung GmbH, Haiterbach, describing the company's vision. While the workflow of the thermoformer was already very efficiently organised in the past, allowing serial production in quantities of 20,000 and more, the sheet thermoformer now goes one step further with a new machine concept. "We want to grow, and that's why we realise projects with quantities of 50,000 components per year," Raap makes clear. This is made possible by the 'run my robot' system from Geiss.

Dipl.-Ing. Gabriele Rzepka, Editor K-PROFI

The driving force behind the ever-increasing quantities consists of the production cell 'run my robot', in which the thermoforming machine T10 with automatic plate loading and the 5-axis CNC machining centre CNC10, connected via a robot, form the core. A shuttle table is located between the two machines and a second one to the right of the machining centre. Each table has a workpiece fixture. Currently, the D-pillar trim for the VW California is being produced on the machine. Fifteen years ago, Volkswagen produced 50 vehicles a week, today it produces 680. A total of 36 different components come from Durotherm, including interior parts, roof frames, trims for the A-, B-, C- and D-pillars. Raap specifies the challenge: "The manufacturer needs all the components at the same time for assembly, not one after the other. The new system is predestined for this type of task."

'Run my robot' is fast. A vacuum gripper removes the 3 mm thick and 1,140 x 675 mm ABS semi-finished product from the sheet feeder and places it in the thermoforming machine. In a 2-cavity mould, the steps of heating, moulding, cooling take place – then the moulded D-pillar cladding moves out of the side of the machine. This is where the integrated 5-axis robot behind the machine comes into play. It removes the cladding with a vacuum gripper adapted to the component, moves from behind to the centre shuttle table and places it on the component fixture waiting there. The CNC system opens laterally and the workpiece moves in. Then the two fairings are milled out, recesses and holes are milled and drilled.

While the CNC is machining a component, the robot places the next moulded part on the component fixture on the table to the right of the CNC. At the end of the milling process, the product moves out of the machine and the already waiting component moves into the CNC from the other side. The robot takes the two covers including the edge trim from the component holder, moves to the rear and disposes of the trim in a waiting container. The robot then stacks the finished double pack of D-pillar cladding on a conveyor belt. This is the only point where the system cannot do without people: a worker takes the finished D-pillars from the conveyor and checks their quality. If the components are OK, she presses the green button on the display and the parts are automatically booked into the production data acquisition system.

1

'Run my robot' from the front: on the right of the picture is the moulding station, in the middle is a shuttle table, then follows the CNC machining centre, with another shuttle table on the right.

2

View of the rear part of 'run my robot': The robot picks up the components after the moulding process and transfers them to the CNC machining centre.

3

The heater of the T10 is bringing the ABS semi-finished product to the required moulding temperature. At the end of the moulding process, blowers ensure rapid cooling.

4

After the moulding process, the D-pillar trim produced on the 2-cavity mould moves out of the thermoforming machine. The robot picks up the component and places it on the component holder waiting on the shuttle table.

5

To ensure that the entire process of 'run my robot' works without any problems, it is necessary to vacuum the chips directly during CNC machining.

6

The gripper disposes of the edge trim above the container provided for this purpose, so that it only carries the D-pillar cladding and stacks it at the end of the line.

Raap specifies the process: "The robot always picks up the components at a defined 0-point, i.e. always at the same place. That's why we don't have to programme it for the x and y coordinates, only for the height. In addition, the system needs a device with a range of three metres to be able to handle the large components and realise the routes to the different stations."

Large quantities for mass markets

Normally, the production of a thermoformed component always consists of the steps moulding, sawing and milling. Workers manually remove the parts from the thermoforming line, then the formed parts are sawn apart, followed by CNC machining. In conventional production processes, the workers remove the chips produced during milling from the CNC machining centre and from the component after each process using compressed air. The intermediate steps of "sawing" and "compressed air cleaning" are eliminated in automated thermoforming production. In order for the entire process of 'run my robot' to function trouble-free, the chips produced must be extracted directly during CNC machining. The display of the system shows that more than 750 parts have already passed through the system this morning. But there is no trace of chips.

The disposal of the edge trimmings in the rear part of the production cell is also not trivial. The high throughput produces huge quantities of edge trim. Raap explains: "The entire material cycle has to be adapted to the large quantities. We have a shredder that is as big as a family house. An employee drives the trimmings out of the plant at regular intervals with a forklift and brings them to the shredder, where we then grind them according to type and return them to our semi-finished product manufacturers."

The new production cell is only worthwhile for high quantities. Raap explains frankly: "The market for the use of 'run my robot' is limited. For us, the system is worthwhile because we are moving more and more in the direction of mass transport – aeroplanes, trains and, more recently, buses. These are the mass markets that require high volumes. Here we are growing continuously." Six years ago, the first

customer came from the aviation industry, for whom the company produced 50,000 aircraft tables per year. Today, there are entire units consisting of back shells and table, and the number of customers is continuously increasing. Aviation and railways now account for a quarter of the total turnover, and the trend is rising.

This also has an effect on the demands on the materials, repeat accuracies and tolerances. "The industry demands tolerances of ± 0.2 mm from us and repeat accuracies similar to injection moulding. We can ensure this with the production cell," Raap explains with satisfaction. For this purpose, the company plans the component shrinkage constructively for the moulding and milling process. The moulded components enter the milling machine immediately after being removed from the thermoforming machine and are machined while still warm.

"Thanks to the fully automatic machine, all parts enter the milling machine in the same cycle, i.e. at identical intervals. This allows us to calculate the subsequent shrinkage exactly. We work here with reject rates of only two per cent – that is extremely low for a thermoforming operation," illustrates Raap.

In addition to the process requirements, material development is also a major topic at the Haiterbach-based company. Fire protection, heat resistance and high mechanical resistance are among them, because the components for the mass-transportation sector have to be light and therefore very thin-walled. In addition, the appearance must be right.

Andreas Raap describes the company's philosophy: "We want to grow, and that's why we realise projects with quantities of 50,000 components per year."

According to Raap, the processing of fibre-reinforced materials is also a must: "In the meantime, we are moulding material with a proportion of 50 per cent glass fibre, and the development is far from over. We can't work with off-the-shelf material for our customers and therefore always challenge our extruders anew. Together we get into development – with the machine manufacturers, such as with 'run my robot', and with the material suppliers."

7

The robot stacks the milled D-pillar cladding of the VW California on the conveyor belt after the end of the milling process.

8

It is only at the very end of the process that humans come into play: a worker takes the panelling from the conveyor belt, carries out a visual inspection and books the product into the ERP system.

9

Stacked and ready for transport – the finished D-pillar cladding.

3D printing in XXL format

Durotherm currently manufactures its component holders for all CNC machining centres classically from Ureol – including those for the new manufacturing cell. But it is quite possible that the future lies in 3D printing. For this purpose, a combination of milling machine and 3D printer from Belotti moved into Haiterbach a few months ago. Head of the CAM department Jochen Stefani illustrates: "We are researching in cooperation with Belotti how we can print component fixtures from an ABS-CF20. The material has almost no shrinkage, which guarantees high dimensional tolerances. We can realise wall thicknesses of only 3 cm and directly print the cavities for vacuum fixing of the components on the carrier. The first trials are very promising."

The printer has already successfully mastered the printing of a holder for a component that will actually go into series production – the back shell of an aircraft seat. The printer applies the material coming from the extruder integrated in the device layer by layer via a relatively wide nozzle. After the printing process is complete, the component fixture is milled over. This creates a smooth, absolutely even surface. Stefani explains, "We printed this component fixture in eight hours, and the process can certainly be optimised to six hours."

The challenges of printing large components should not be underestimated. The material provided by the manufacturer is expensive. For this reason, Durotherm wants to switch to material that is also used in injection moulding. Contacts with material manufacturers exist, and so Raap hopes for more pleasing prices: "At the moment we pay 25 euros per kilogram. We want to use a material that costs between 6 and 7 euros per kilogram. That will make the whole process much more economical."

The print conforming construction of the component fixtures is also not without its challenges. Each print area must build up on the next so that the receptacle does not collapse in on itself. With Ureol, this requirement does not arise because the final mould is created from a compact block. The big disadvantage here is the high material input, which is eliminated in 3D printing. Stefani describes the status quo: "Printing large components is still in its infancy. There are currently only two companies that supply the software for these printers. We chose the British AI Build, the alternative would have been Siemens. But AI Build exclusively makes software for 3D printers, so we chose them."

At Durotherm, the printing of component fixtures still runs under the label of testing and research. Together with partner Belotti, the experts are working on details and ideal conditions. The goal is to print prototype tools in addition to the component holders for the milling machines in the future. "But it will be some time before that happens," smiles Raap.

Section of a component fixture for the backrest of an aircraft seat from 3D printing: The over-milled surface is smooth and reflects all contours of the component. Below, in the part that has not been milled over, the layers of the printer application can be clearly seen.

Jochen Stefani illustrates: "In cooperation with Belotti, we are researching how we can print component images from ABS-CF20. The material has almost no shrinkage, which guarantees high dimensional tolerances."

New projects thanks to technological lead

At two locations in Germany and one each in Switzerland and the Czech Republic, the Durotherm Group generated a turnover of € 60 million in 2022 with 350 employees. The development site is the headquarters in Haiterbach with 130 employees. Raap makes it clear what this means: "Everything we develop here in Haiterbach we transfer one-to-one to the other locations. They all work with the same machines and according to the same tried and tested workflow. They are virtually clones of our development site."

Speaking of workflow: even those components that are not created on the automated production cell are manufactured by the company in a highly optimised production environment. The machine set-up is oriented exclusively to the production processes. The semi-finished products are staged for three or more orders per shift and machine on one side of the hall. The thermoforming machines are automated to such an extent that the components only have to be removed manually from a conveyor belt. After forming, employees punch or saw out the parts at the workstations in the next row. Directly in the next row are two CNC milling lines – one with seven tables, the other with six. One person loads all the tables on a line, and one employee removes the milled components from the other side of the line. "This sequence has a huge advantage, because we can mill seven identical components at the same time. This is the only way we can produce so many different components of a final product at the same time," explains Raap.

The focus of the thermoforming specialist is changing, the demand for thermoformed parts in ever higher quantities is increasing. Raap thus also sees the future quite clearly ahead of him: "Today we win projects through technological advantage – through special machines, alternative materials and special solutions with which we replace other materials such as steel or other processes such as injection moulding. In this way, we can offer our customers cost-effective and yet higher-quality components, because in thermoforming we still score with the significantly lower tool costs compared to injection moulding."

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Size reduction technology

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GDPR and compliance slow down

It goes without saying that laws and regulations must be complied with. However, the fact that more and more companies and organisations manage to paralyse themselves to the point of inability to act by complying with the rules is probably a German trait.

The perfectly correct approach of protecting personal data and regulating data traffic within the European Economic Area with the General Data Protection Regulation (GDPR), which came into force in 2018, leads to a lot of sand in the gears in many places. With half-knowledge and fear of doing something wrong, innovation and necessary efficiency processes are hindered and prevented.

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When dealing with universities and public institutions, as well as at larger events, you notice it very quickly. The question of whether company data such as company name, name and email address may be used and stored for an event is asked so often in many places that one is inclined to simply answer "no" at some point. Don't congresses and conferences also live from networking? In the past, lists of participants were a good instrument to specifically search for contacts and to have good conversations. – These lists of participants are disappearing more and more for "data protection reasons". My opinion: Anyone who does not want to appear on the lists should be able to make this known directly when registering. That would settle everything. Is that too pragmatic?! This is just a simple example. For a long time now, the GDPR has meant that process improvements in companies cannot be brought forward without much discussion between works councils, lawyers and employers. We are blocking our strength to become better and better agilely and quickly!

"Compliance-driven behaviour" also leads to paralysis and inefficiency. Corporations employ entire staffs to collect regular queries and evidence to serve as proof of good conduct to authorities and also "sensational reporters". Unfortunately, there has indeed been the worst misconduct in corporations in recent decades, such as the Ergo-Budapest scandal. And of course such misconduct must be stopped. However, the meticulous regulations developed below also lead to small and certainly sensible things being omitted under the guise of "compliance fears". Amateur sports clubs and schools have certainly benefited from being supported from time to time with material donations such as jerseys, sports equipment or even subsidies for class or competition trips. Only through exaggerations by individuals (building entire stadiums with certainly not clean goals) is there now not much left for the larger community. In the meantime, the fears of doing something wrong are too great. So they don't do it. There is simply a lack of a healthy sense of proportion.

In Germany and some other European countries, people are forgetting that it's not just about meeting GDPR and compliance rules, but also about being competitive. The ever-increasing hurdles and formalities inevitably lead to the search for alternative locations. So when you talk about streamlining groups, this is where you should start. – Not abolish them, but slim them down to a healthy level!

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Inspiration for plastics processors**

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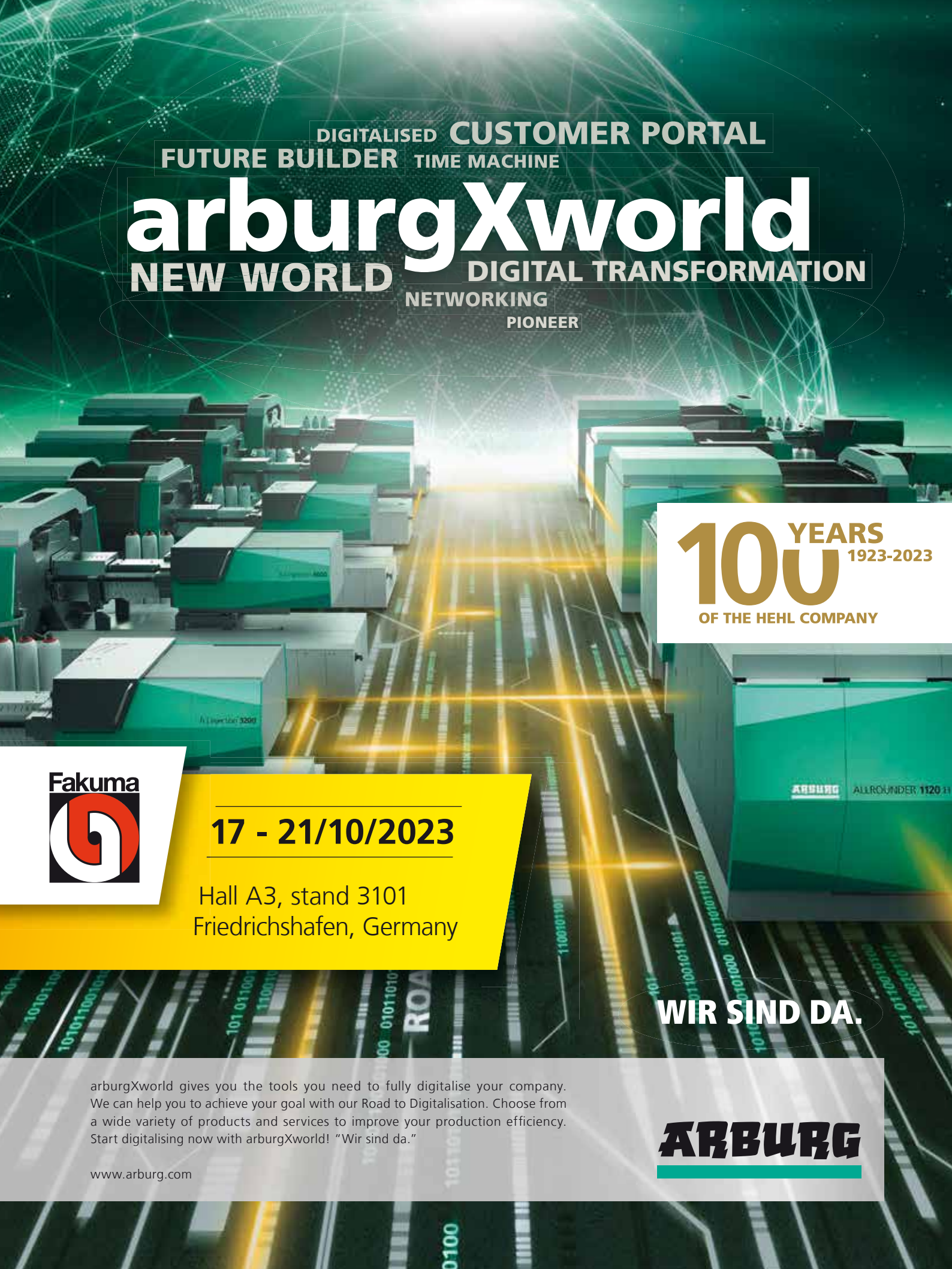

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