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international edition

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- › Trendsetting know-how
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Funk 3D supplies automotive suppliers with kinematic components and systems. Customers from the aerospace, medical and dental technology sectors also benefit from the company's development expertise.

Innovative, curious and courageous

How **Cirp** is opening new doors with prototype and small series production. Why **Schlaeger** relies on active load management for injection moulding. How **Formtec** combines thermoforming and PUR. What **TriPlast** gets out of lightweight packaging. And why farmer **Tamás Kurucsai** extrudes and thermoforms.



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Security of supply, sorting and sustainability

Dear reader,

Energy saving is on everyone's lips. The injection moulding and assembly company Schlaeger M-Tech in Bayreuth goes one step further and, in addition to energy efficiency and generating its own electricity, also focuses on active load management. 'As large consumers, we have to think differently today,' Anton Fuchs told me (page 6).

Funk 3D in Simmersfeld is a Tier 1 exclusive manufacturer that primarily supplies automotive companies with kinematic components and systems. Carola Funk and Adam Pawolka explained to Sabine Rahner their curiosity, responsiveness and tools for bad times: page 8. Formtec in Dornstetten combines thermoformed components with PUR components to create components for commercial vehicles, caravans and mechanical engineering. Gabriele Rzepka reports on the symbiosis of the two technologies from page 16.

TriPlast in Enns can sort half of the lightweight plastic packaging generated in Austria. Recycling plant world market leader Erema gave Karin Regel a glimpse into the most modern sorting plant for post-consumer waste: page 22. Ralf Nachreiner recognised the potential of additive manufacturing back in 1994 and focused Cirp on rapid prototyping. Today, the Heimsheim-based company has two main areas of business: prototype and small-batch production, and injection moulding and tooling technology for series production. Sabine Rahner visited Thomas Lück: page 26. Hungarian farmer Tamás



Kurucsai has been thermoforming PP packaging for his home-grown vegetables for a long time. Now he is switching to PET with recycled content and also extruding the films himself in order to produce his packaging materials from a single source: Karin Regel reports from Kistelek: page 34.

The world's leading trade fair, 'K 2025', will be kicking off in Düsseldorf in just a few days. From 8 to 15 October, my team and I will be responsible for the daily trade fair newspaper K-AKTUELL, which you will find – in German, however – in many hotels and at the entrances to the trade fair. We look forward to seeing you at the KI Group stand in Hall 6, Stand C28.

Markus Lüling, Editor-in-Chief
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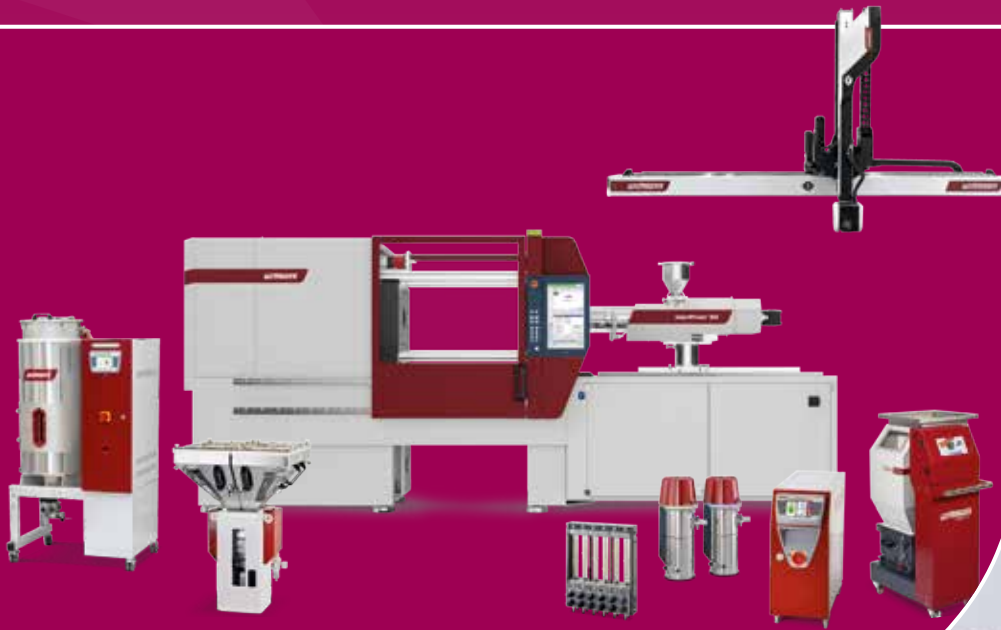


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Anton Fuchs has been the technical director of Schlaeger M-Tech GmbH in Bayreuth since 2002.

“As major consumers, we have to think differently today.”

How mechatronics expert Schlaeger M-Tech is focusing on energy efficiency and load management in injection moulding

“We can’t go on like this,” says Anton Fuchs, summarising the realisation he came to in 2010 when he systematically identified potential energy savings in the injection moulding and assembly plant. The technical director of Schlaeger M-Tech GmbH in Bayreuth is no longer focusing solely on energy savings and in-house generation, but also on active load management. In a guest lecture at the opening of the Wittmann Group’s expanded technical centre in Nuremberg, he provided an insight into the company’s activities.

As an automotive supplier, Schlaeger processes a good 1,000 tonnes of technical plastics in injection moulding, 2,300 tonnes of copper wire and 3,500 tonnes of iron every year. The majority of the material input consists of high-performance and high-temperature thermoplastics. The cycle times of the 90 injection moulding machines and 340 automated winding spindles rarely exceed ten seconds, with the shortest cycles currently standing at 1.2 seconds.

Last year, Schlaeger’s 450 employees manufactured 94 million components and assemblies, generating sales of EUR 101 million. The product range includes electric drives for the automotive and consumer goods industries as well as components for combustion engines, including injection valves, actuators, camshaft adjusters and SCR dosing systems for exhaust gas purification. Newer products include start-rotor assemblies for electric motors in the 50 W to 1 kW power range. With a 96 % share of sales, the automotive industry is Schlaeger’s dominant market. The share of e-mobility is growing steadily and has already reached one third. With less than 0.02 ppm for field and 0 km failures, the long-established company maintains a very high standard of quality.

K-PROFI: Mr. Fuchs, you have defined a roadmap to CO₂ neutrality.

Anton Fuchs: At Schlaeger, we have set ourselves the goal of becoming CO₂-neutral by 2045. Our plan includes measures to reduce emissions in Scopes 1, 2 and 3. Scope 1 covers direct emissions from our own sources, Scope 2 covers indirect emissions from energy consumption, and Scope 3 covers all other indirect emissions that arise in the value chain.

Eliminating emissions in scopes 1 and 2 is crucial to achieving CO₂ neutrality.

Exactly. For last year, we estimated emissions in scopes 1 to 3 at a total of approximately 24 million tonnes of CO₂ equivalents, of which purchased materials account for just under 90 %. However, this means that less than 10 percent of total emissions can be attributed to Scope 1 and 2. The goal is therefore, of course, to significantly reduce emissions in Scope 3.

What is your rough balance sheet?

We have improved energy efficiency by 46 percent since 2010. Since 2019, we have formally reduced Scope 1 and 2 emissions to

zero, now source more than ten percent of our energy from self-generated photovoltaic power and purchase only certified green energy. A key figure for us is the specific energy consumption per part produced. We have reduced this from 56 to less than 30 watt hours. However, the fact that we have recently been processing a proportionately increasing amount of high-temperature plastics runs somewhat counter to our goal. Nevertheless, our goal remains to double the use of materials while halving energy consumption.

How do you collect data on energy consumption?

In 2010, we rather estimated the energy consumption of injection moulding machines, assembly systems, peripheral technology and buildings on the basis of type plates and a small measurement campaign, but this enabled us to draw up an initial overall balance of all consumption categories. We now record electricity, compressed air and building services consumption at 330 measuring points and are integrating additional sensors for pressures, temperatures and media flows.

What conclusions did you draw from the data and findings?

In the core injection moulding process, we have dimensioned and designed the machine units to the “target points” of the process, selected electric machines wherever possible, avoided hydraulics and vacuum technology, but established special cooling technologies in tools, for example. We have intensively analysed the production processes in plastics technology in order to increase energy efficiency. Wherever it makes sense, we continuously improve energy efficiency in production. In doing so, we never lose sight of our goal of mass production with minimised cycle times. In the injection

moulding cells as a whole, we rely on central electric drives and recuperation on the axes, avoid the use of compressed air and actively cool our control cabinets with water.

Can you explain why you got into load management?

After several years of experience with successful energy-saving measures and with precise knowledge of our total energy requirements and energy supply situation, we looked at potential for optimisation at the plant level. For three-shift operation, we evaluated operating conditions and load profiles, checked recurring routines for their impact and thus identified phases with very high and phases with significantly lower power requirements in the daily and weekly cycles. At the same time, we examined supply aspects such as a combined heat and power plant, photovoltaics on our roofs and an electricity storage system.

What was the result?

Against the backdrop of the discussion about the development of grid fees, we decided in 2019 to actively reduce peak loads, use electricity storage to reduce loads, generate electricity using photovoltaics and implement load shifting. The use of a combined heat and power plant was less effective in our case. All this was done with the prospect that the costs for the availability of electricity will continue to rise from year to year. This was accompanied by the decision to establish an intelligent load management system to optimise energy consumption.

Which operating phases of machines are suitable for load shifting?

For example, shifting the regeneration cycles on the dryers for plastic granulate. These only account for 3.6 percent (previously 4.7 percent) of total consumption, but the load

from regeneration is three times higher than the base load. Shifting the dew points from the load windows gives us an average load shedding potential of 21 kW. Whenever we purchase new equipment, we check the machines for their load shedding and decentralised storage options. In the future, we want to utilise even more options, participate in the spot market for electricity and introduce day-ahead electricity procurement.

Does load management change the seasonal pattern?

Atypical grid usage with priority for electricity storage is particularly prevalent in autumn and winter. In spring and summer, the storage capacity can feed the machines at the start of the week. As a large consumer, we have to think differently today. We not only have to reduce loads, but also integrate our electricity procurement, i.e. our loads from machines and systems, into load management and make them time-shiftable. There is a lot of talk about expensive grid expansion, but too little about reducing grid load. Another aspect is that 11 percent of our own generation and 20 percent load shifting not only bring us cost advantages, but ultimately also location security!

Your advice to other plastics processors?

Obtain, structure and evaluate energy data from all areas of the business, consistently compile the findings and make courageous decisions. Load management with possible load shifting can ultimately be the icing on the cake for all optimisation efforts. But the best measure for improving the carbon footprint is and remains: saving electricity! 

K-PROFI editor-in-chief Markus LÜling spoke with Anton Fuchs.

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Kinematic components and systems are a focus of Funk 3D, not only in manufacturing, but also in (preliminary) development, model and prototype construction, and toolmaking.



Funk 3D develops and designs complex housings for electronic components, screens and displays, covers, brackets and control units for applications in dental and medical technology, among other things.



Funk 3D comes into play primarily for smaller quantities, such as centre consoles for special or exclusive series for large car manufacturers. These projects are of no interest to large suppliers geared towards high quantities.

Turning points open the mind to new ideas

How Funk Dreidimensional is positioning itself with its own products and sharpening its portfolio

With 120 employees, Funk Dreidimensional (Funk 3D for short), based in Simmersfeld, operates as a Tier One supplier. The family-owned company supplies exclusive manufacturers in the automotive industry with small and medium-sized series, primarily of kinematic components and systems. Its focus and specialities are crash-tested components, its own products and decades of experience in the development of complete assemblies. Customers from the aerospace, medical and dental technology sectors also benefit from this range of expertise. Managing Partner Carola Funk talks with Adam Pawolka, Head of Product Management and Marketing, about responsiveness, curiosity and their tools for tough times.

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

Originally a prototype manufacturer, the company was founded in 1983 by Walter Funk and now supports its customers from development and toolmaking through to the finished product. Based at a shared location but legally structured as two separate companies, Funk Dreidimensional Entwicklung- und Vertriebs GmbH is responsible for product development, project management and model and prototype construction, while Funk Fertigungstechnik GmbH specialises in pre-series and series tool construction as well as plastic injection moulding and assembly production. Sixty percent of the products manufactured by Funk 3D are used in the automotive industry, followed by medical and dental technology, aerospace technology and consumer electronics. Funk 3D has been selling its Rear Seat Entertainment System, a patented and design-protected plug-in system, to well-known OEMs since 2011. Carola Funk is the daughter of the company's founder, has been with the company since 2002 and has been a member of the management board since 2010.

K-PROFI: What sets Funk 3D apart?

Carola Funk: Our great strength lies in our ability to support our customers from the initial idea, through pre-development and development, to prototype and tool construction, right through to the finished series product. All this takes place at a single location, so that our developers can also directly monitor the subsequent manufacture of the products. The ideas that emerge here are different from those in separate units. But not all the projects we develop and not all the tools we build go into series production at our company. In this respect, the divisions are independent.



Carola Funk runs Funk Dreidimensional as a trained toolmaker and business administration graduate: "We have been planning ahead and building up equity capital over the last ten years. That is now paying off."

K-PROFI: What kind of clients do you have?

Carola Funk: We can't name many of our clients. We mainly develop and manufacture kinematic components, not only for the automotive industry, but also for the medical sector, dental technology, mechanical engineering, building services engineering and the office furniture industry. We are active across the board and are always in demand when it comes to smaller quantities that need to be produced quickly and to a particularly high standard. Typical examples are centre consoles, air vents and steering wheel mountings for special or exclusive series for major car manufacturers. These are projects that are of no interest to large suppliers, whose infrastructure is geared towards high volumes. Speed, responsiveness and quality are crucial. And that's exactly what we can offer. Ultimately, the total cost of ownership for certain products is lower if they are manufactured from start to finish at a single location than if the cheapest offer is chosen for each individual step.

K-PROFI: Can you elaborate on that?

Carola Funk: Consumers' expectations of high-priced products are correspondingly high. Imagine a sophisticated dental treatment unit. If the quality is not right, the dentist will buy from the competition next time. The same applies to exclusive sports and premium vehicles. Our customers benefit from our extensive experience in development and pre-development. We build the first samples, models and prototypes here on site and produce small pre-series so that our customers can carry out their tests. We then build the tools and can also take over series production.

Adam Pawolka: With 120 employees, we are a relatively small manufacturer, yet we deliver directly to the assembly line as a Tier One supplier. That's what sets us apart. Every customer has their own systems, portals and requirements. That has to be managed. In addition, there are internal audits as well as external certification and customer audits. We meet the requirements of IATF 16949, ISO 9001, ISO 14001, ISO 50001 and ISO 13485. We can only achieve this thanks to our excellent teams.

K-PROFI: What is special about your model and prototype construction? How does it differ from a conventional 3D printing provider?

Carola Funk: The customers who come to us want attractive, presentable sample and prototype parts. We offer every conceivable process to achieve this, not just 3D printing. Our skilled model builders are still true craftsmen. They can carry out further processing steps on a raw part, such as rounding corners, grinding, blasting, polishing, painting and printing surfaces. With our silicone moulds, we can even produce small series that are indistinguishable from injection-moulded parts. On the contrary, some customers would prefer the quality of the first samples to be replicated in the subsequent series.



Photo: K-PROFI

In model and prototype construction, Funk 3D relies on various additive manufacturing processes as well as classic model-making methods such as vacuum casting. The trained model makers provide the finishing touches with the appropriate surface finishing.

The in-house tool and mould making department was the first expansion of the company, which was founded in 1988 as a model and prototype construction company.



Photo: K-PROFI

Adam Pawolka, Head of Product Management and Marketing, shows the rear seat entertainment system developed in-house: "Safety-relevant, crash-tested accessories and series products are our USP in the automotive sector."

K-PROFI: You have been supplying your proprietary rear seat entertainment system to renowned OEMs since 2011. What is behind this?

Adam Pawolka: We designed the plug-in system with various mountings for use in different vehicles. It includes mounting options for multimedia devices such as tablets and smartphones, storage tables with integrated cup holder, coat hanger, bag hook, etc. OEMs use this modular system to distribute their customer-specific systems in various designs under the corresponding names, such as Travel & Comfort at BMW, Reise & Komfort at Volkswagen, Style & Travel at Mercedes-Benz and Click & Go at JLR.

Carola Funk: We manufacture these additional products in accordance with the strict ECE regulations R 21 for interior fittings and R 17 for head restraints. We are also responsible for the corresponding crash tests. Some tests are carried out in-house. In addition, we use the facilities of the OEM or TÜV-Süd, where the assemblies are crash-tested and certified.

Adam Pawolka: Safety-relevant, crash-tested accessories and series products are our USP in the automotive sector. We have a great deal of experience in this area. German premium manufacturers in particular demand crash tests for accessory products, even if they are not mandatory. They simply offer safety.

Funk 3D manufactures the injection-moulded parts for the universal tablet holder of the Rear Seat Entertainment System and assembles them into a complete assembly.



Photo: K-PROFI

K-PROFI: Speaking of safety, you also operate in the medical technology industry.

Adam Pawolka: When it comes to safety-related components, the requirements of the automotive industry are not that different from those of medical technology. For applications in analysis, laboratory, dental and medical technology, we primarily develop



Photo: K-PROFI



Assembly of the in-house developed Rear Seat Entertainment System with various holders and mounting options.

and design complex housings for electronic components, screens and displays, covers, brackets and control units. Similar to our rear seat entertainment system for the automotive industry, we are currently working on our own product for the medical industry. It

involves MDR-compliant Class 1 or 2 medical devices with CE marking. Unfortunately, we cannot reveal any more details at this stage.

K-PROFI: How do you benefit from having your own products?

Adam Pawolka: We can control everything ourselves – set prices, define distribution channels, how and to whom we sell. With our own medical product, we want to further develop ourselves as a developer and manufacturer and expand our network in the industry.

Carola Funk: As a company, we are generally very innovative and curious. We like to try new things. We have many courageous employees. Evolution means trying things out, moving forward, tackling new things. You have to embrace that, and it works very well for us.

K-PROFI: What role do you play in this as managing director?

Carola Funk: My father was just like me, and I am very grateful for that. This curiosity led to the creation of the company and its continued growth. My father is now 75 years old and only visits his office here sporadically.



Adam Pawolka: "We work in injection moulding with clamping forces of up to 4,500 kN and want to expand upwards. The market is there."



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Photo: K-PROFI

Funk 3D primarily processes technical plastics and relies on a Koch system for material drying.



Photo: K-PROFI

One of three electrically driven injection moulding machines from the Zhaifu Zeres series by Chinese supplier Haitian.



Photo: K-PROFI

Funk 3D works with 14 injection moulding machines between 500 and 4,500 kN from Arburg, Sumitomo (SHI) Demag and Haitian, which are networked via the Arburg control system.

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K-PROFI: So you've known the company since you were a child.

Carola Funk: I first trained as a toolmaker here and then studied business administration before joining the company permanently in 2002. In 2010, I became managing director of Funk Fertigungstechnik GmbH and in 2013 also of Funk Dreidimensional Entwicklung- und Vertriebs GmbH.

K-PROFI: What milestones have shaped the company?

Carola Funk: It was the crises. Before the turn of the millennium, we were active in the PC industry. Overnight, the business collapsed. It was a crazy crisis for us. But with our experience in housing design and development, we were able to win a customer from the medical industry, for whom we still do a lot of work today. During the automotive crisis in 2008/2009, our main customer at the time withdrew 80 percent of our orders. From today's perspective, that was great: we were open to new ideas again. During this time, we really worked hard, including developing e-mobility solutions with the University of Darmstadt, laying the foundations for our own product and approaching new customers in the automotive industry. We opened many doors. And then came the "meltdown": everything was successful, and it all happened at once. In my opinion, crises are important. Even when everything falls apart. You learn to restructure and think in new ways.

K-PROFI: As a family business, do you see yourself at an advantage here compared to larger corporations?

Carola Funk: Yes, we can operate more sustainably. That makes the situation more pleasant.

K-PROFI: What is the current situation for Funk 3D?

Carola Funk: Despite the general crisis, we are well positioned. Of course, we pay more attention to certain aspects than in very good times. We are also restructuring a little at the moment. Last year, we reduced our inventories. Every order is checked. These are the tools of the trade for bad times. Such small things make a big difference when the company is fundamentally stable. I focused on liquidity ten years ago. We started to carefully consider every financing and

investment and plan well in advance. In line with the motto "cash is king", it was extremely important to me to create a buffer during the boom times so that we would remain liquid in bad times. We are now reaping the benefits of these decisions.

K-PROFI: What are your current plans?

Adam Pawolka: We are currently working in injection moulding with clamping forces ranging from 500 to 4,500 kN. Many of our competitors are also active in this area. We want to expand this to 6,000 or 8,000 kN

so that we can also produce larger components – think of dental chairs, for example – and narrow down the circle of competitors. We can see from the enquiries that the market is there.

Carola Funk: When we built our new premises in 2019 and expanded our floor space by a third, we already dimensioned the foundations accordingly. However, increasing the clamping force would require further significant investment. Among other things, we would then also have to upgrade our tool-making facilities with larger machining



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Assembly and packaging take up a large area within the new building, which was completed in 2019.

centres and would need a hall crane with a higher load capacity. The political situation is not stable enough for such investments at present. We have therefore put these plans on hold. But times will get better again. Life always has its ups and downs.

K-PROFI: What is Plan B?

What has the current crisis drawn your attention to?

Carola Funk: We are putting our energy into developing not only our own product for medical technology, which I mentioned earlier, but also into other areas of expertise. In future, we want to focus more on electronics in addition to kinematics.

Adam Pawolka: We are also expanding our business with our rear seat entertainment system, both in terms of customers and industries. This means that we are gaining new customers from the automotive sector, while also seeing great potential for the fastening system in the rehabilitation industry.

Carola Funk: Aerospace technology is relatively new for us. Here, too, it's all about the quantities we want to produce. There is strict risk management in place. As a supplier, you have to be set up for the long term. Clients look closely at who can deliver 100 per cent quality on a permanent basis. And we are one of them. 

www.funk3d.com

Carola Funk (right) and Annika Beck from Sales: "Evolution means trying things out, moving forward, tackling new things. You have to embrace that, and it works very well for us."





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How Formtec uses thermoforming and PUR to manufacture complex components for commercial vehicles, caravans and mechanical engineering



Photo: K-PROFI/Hartmann

The fittings box for a mobile crane consists of four compact PUR components and seven thermoformed components. Stefan Kübler and Tanja Bossenmaier critically examine the functionality.

The first fittings boxes have already proven themselves on the construction site in the mobile crane.



Photo: Liebherr

Combining thermoformed components with PUR components to form a harmonious finished product is one of the areas of expertise of Formtec Kunststofftechnik GmbH, founded in 1993 and based in Dornstetten. Whether it's instrument panels for huge mobile cranes or engine hoods for construction machinery, the end products are also visually impressive. The combination of both processes is part of everyday business for the plastics specialists, as is the manufacture of PUR composite components. K-PROFI was given an insight into the production processes during an on-site visit.

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

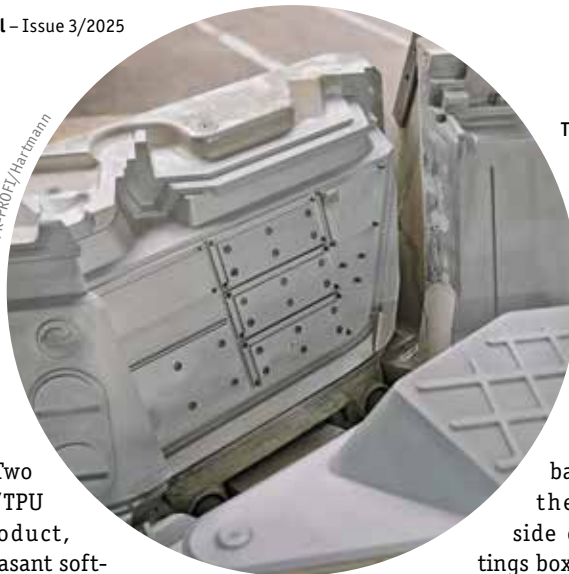
Managing Director Dirk Haumann outlines his company's business area: "We specialise in small quantities, which is why many of our processes are manual. Automation is rarely worthwhile for batch sizes of 20 to 400 components. Despite a high proportion of manual work, we are able to manufacture high-quality, ready-to-install components. That's what sets us apart."

In three plants, two in Dornstetten and one in Sinntal-Altengronau, the company generated a turnover of EUR 23 million in 2024 with 140 employees. The lion's share of its products goes to the caravan, construction and agricultural machinery, vehicle construction and mechanical engineering industries. "However, we are now also looking to other markets and expanding our portfolio, for example in the fields of medical technology and rail transport technology," says Haumann, describing the business.

Perfectly coordinated

The fittings box for a Liebherr mobile crane is clearly visible in the company's assembly department. The base chassis consists of four compact PUR components. Seven thermoformed components are added to this. Four of the seven thermoformed components are

Photo: K-PROFI/Hartmann



The tool for the base body of the driver's side of the fittings box contains nine pneumatically controlled slides and five loose parts to enable the numerous undercuts to be removed after the moulding process.

decorative parts. Two consist of an ABS/TPU semi-finished product, which ensures a pleasant soft-touch feel. Two decorative strips are made of ABS/PMMA silver metallic. The air duct is manufactured by the Black Forest-based company from ABS using a thermoforming process as a lower and upper shell, which are then bonded together.

Stefan Kübler, PUR project manager, explains the appeal of PUR components: "During the manufacturing process, we can already integrate connecting elements such as inserts and threaded bolts, which we will need later when assembling the complete component." A glance at the tool used to manufacture the

base body of the driver's side of the fittings box shows exactly what he means. The

resulting component is 1,640 mm long and the tool contains nine pneumatically controlled slides and five loose parts to enable the numerous undercuts to be removed after the moulding process. In addition, there are countless inserts and threaded bushings.

The PUR production facility in Dornstetten operates six high-pressure systems and one low-pressure RIM system, all supplied by Hennecke and Unipre. For visual reasons, the plastics specialist subsequently paints

all visible PUR component surfaces of the fittings box to achieve the desired finish. This ensures that the PUR components harmonise with those from the thermoforming process.

Assembling the fittings box is a complex task. Sixty inserts, bushings and threaded inserts, 2.50 metres of heating hose and 100 individual parts such as air nozzles, flow nozzles, screws, clamps and the like are required to turn the four PUR and seven thermoformed components into a ready-to-install end product. Tatjana Bossenmaier, Project Manager for Thermoforming, explains what is important: "It must be clear in advance which components need to be joined together and how. At the end, all the individual assemblies are glued and/or screwed together. Everything

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The PUR mould is polished to a high shine, as this is where rear upper parts for a caravan are produced using the in-mould coating process.



A typical PUR component is the hood for a wheel loader. The surface is painted.



A look inside the wheel loader hood: Formtec foams core holes for subsequent thread inserts in the upper mould and thread bushings in the lower mould, as well as injection-moulded stud bolts for attaching the steel frame.

"We specialise in small quantities. Despite a high proportion of manual work, we are able to produce high-quality, ready-to-install components," confirms Dirk Haumann (2nd from left) with Thomas Krauss (left), Tatjana Bossenmaier and Stefan Kübler (right).



has to fit together perfectly, which is why the tolerances should be kept to a minimum. When designing the components, it is important to consider where and how the adhesive surfaces and gaps should be positioned in order to achieve sufficient holding force. It is equally important to precisely match the wall thicknesses of the different components in order to achieve an optimal overall appearance."

Specially manufactured load carriers ensure internal and external transport of the fittings box and all other complex assemblies. According to Bossenmaier, the company has come up with a simple but efficient solution to ensure that none of the many individual parts that are assembled to form the whole are forgotten: "Every single part

During assembly, employees weld and glue components, install lights and cabling, and often assemble a ready-to-install component.



has its own specific function. Not a single one can be missing. That's why there are checklists at every assembly station where employees tick off each item as soon as it has been installed. Once the component has been fully assembled, an employee who was not involved in the assembly carries out a final check."

The fittings box is currently in series production. As it is used in three mobile crane model series, the width varies from model to model. The assembly on the driver's side always remains the same, while the dimensions on the passenger side vary to suit the different crane model series.

PUR components with near-Class A surfaces

A few steps further on, Plant Manager Thomas Krauss points to a PUR mould in which visitors can see their reflection: "The mould is polished to a high shine because we use it to produce rear panels for caravans using the in-mould coating process." To do this, an employee applies a thin layer of 2K paint to the surface of the tempered tool. After the 2K paint has briefly aired and formed an elastic paint skin, the worker closes the tool and inserts the PUR components. Here, too, functional parts such as bushings and inserts are integrated into the upper tool. When the component is demoulded after around 15 minutes, it emerges from the mould completely coated with a near-class A surface finish. "We have to reproduce the entire visible component structure in the lower mould only" explains Krauss, illustrating the challenge. The components are pre-picked and delivered to the OEM on load carriers.

During our visit, side rear panels for a caravan are being produced on a T1 from Geiss using a 2+2 mould.



Photo: K-PROFI/Hartmann



Photo: Krone

The field chopper in action: the cladding made from thermofomed components confidently withstands everyday use in the field.

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The CNC systems are designed as tandem machines. If very large components need to be milled, the tables are coupled together.



The worker manufactures fibre-reinforced PUR composite components on these special mould carriers. Currently, they are producing entry steps for the caravan industry.

Another typical PUR component is the engine hood for a wheel loader. The OEM also manufactures this in three different versions with different depths of the engine hood. Thomas Krauss explains: "We manufacture a hood and then mill it to the required depth." As with some of the PUR components, the inserts for subsequent threads in the upper mould and finished threaded bushings in the lower mould, as well as injection-moulded stud bolts for attaching the steel frame, are also foamed directly into the mould. After removal from the mould, the engine hood must be left to rest for around

48 hours, after which the visible area is painted. Formtec also manufactures the air ducts inside the hood from PUR. In the final step, all individual parts and component parts are assembled: the air duct, the hood, an inserted steel bonnet through which the exhaust pipe passes, and the steel brackets as connecting elements to the chassis, including closing mechanisms.

Using PUR technology, the company produces some enormous components – with mould sizes of 2,200 x 1,800 mm and shot weights of up to 40 kg. But even small

On a large cutting table, the sheet material runs off the roll in strips and is automatically cut to size. A worker prepares the sheet sets for the caravan entry steps.



components with shot weights of only 200 g are part of everyday work, according to Krauss: "We work with nine different PUR systems and countless different tools. We have RIM compact systems, integral rigid foam systems, integral semi-rigid systems and fibre pressing processes at our disposal. This enables us to meet our customers' requirements perfectly."

"We need an attractive overall appearance"

In addition to the PUR systems from Plant 2, five thermoforming systems from Geiss and Cannon fill the halls in Plant 1, with four more in Plant 3. During K-PROFI's visit, side rear panels for a caravan are being produced on a Geiss T1 using a 2+2 mould from a 4 mm ABS/PMMA sheet measuring 900 x 700 mm. The semi-finished product is covered with a protective film to prevent scratches. Immediately after removal, the worker separates the four rear panels – two for the right side and two for the left side – on the adjacent saw.

However, a very special project for Bossenmaier is the complete cladding for a field chopper for Krone. The cladding consists of a total of seven thermoformed complete assemblies, which are manufactured from ABS/PMMA semi-finished products of varying thicknesses for the visible area and from ABS regenerate semi-finished products for reinforcement elements and non-visible components with different drawing depths. "In this project, many components have to be butt-jointed during assembly – for example, the side hoods on the left and right and the front guard. This means we need similar wall thicknesses in these areas so that the difference in height is not too great and the overall appearance is visually appealing. As the material thicknesses vary across the entire component due to the open process, we have to select different starting material thicknesses depending on the geometry and component height," says Bossenmaier, describing the challenge.

The three-part front guard alone is quite a challenge. The three viewing elements made of ABS/PMMA are connected from the rear by thermoformed inlays made of recycled ABS, which are placed over the parting edges. The connecting elements for the lights are moulded directly into the inlays during the moulding process. The logo in the middle viewing element is moulded positively using the tool and then covered with green film.

The thermoformed components are finished on 5-axis CNC machining centres – six of these are located in Plant 1 and four more in Plant 3. The CNC systems are supplied by Moroff & Baierl and Anderson and are designed as tandem machines. Bossenmaier explains: “We can couple the tables for very large components. If we have smaller components, on the other hand, they work in parallel.”

Fibre composite components for high stability

In addition to the large PUR foam and thermoforming systems, the company also has three special mould carriers on which it manufactures fibre-reinforced PUR composite components. A typical component is entrance steps for the caravan industry. These must be robust and have high mechanical strength. Formtec uses mats made of hemp, sisal or kenaf as fibre material, supplemented by glass fibre mats. Krauss explains: “The use of glass fibre mats on the visible sides can improve both strength and appearance.”

On a large cutting table, the mat material runs in strips from the roll and is automatically cut to size. The worker assembles the cut pieces of the various materials for a caravan step into a mat set. Another worker wets the mat set with the PUR system at a spray station. He then places some of the sprayed cut pieces in the press, places a pre-formed EPS core on top and then the remaining PUR-soaked cut pieces on top of this. The press closes with a force of several kN, the material reacts under heat, and after about 15 minutes, the press opens. “The PUR filling level for the steps is about 30 to 40 percent. The rest is fibre material,” explains Krauss. The fibre protrusions are trimmed by cutting edges in the tool.

Versatile and flexible

There is something different to see at every turn at Formtec. Both the technology and the component density are immense. Haumann can only confirm this: “We manufacture an extremely wide variety of components. As a result, we often have three to four tool changes per day in the PUR area and five to six on the thermoforming machines. This makes us very flexible and enables us to respond to customer requirements.” But when is a component produced on a thermoforming machine, when do the Black Forest-based company choose PUR, and when does a combination of both technologies come into play? Bossenmaier answers without hesitation: “PUR components are much more complex to manufacture, and the tools and the entire process are significantly more expensive. If a component can be produced using the thermoforming process, we opt for thermoforming.” But it doesn’t always work. PUR components can be manufactured with significantly thicker walls and more complex geometries, such as undercuts. And they are more stable.

The Black Forest-based company uses temperature-controlled aluminium tools for both technologies. While thermoforming tools usually do not require undercuts, these are much more common with PUR due to the functional integration offered by the process. “This enables our customers to cover a wide range of component properties and requirements with us as their supplier,” emphasises Dirk Haumann. 

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“We want to get more out of plastic waste”

What Austria's most modern sorting plant for post-consumer waste can achieve

Around 50 % of all lightweight plastic packaging generated in Austria can now be sorted at TriPlast in Enns in Europe's tallest, at 25-metre-high, and most modern sorting plant – 100,000 tonnes per year. At the Pre-K event held by global recycling plant leader Erema, journalists were given a glimpse inside the impressive facility, where 2,500 m of conveyor belts run above and below each other, sorting 20 tonnes of plastic waste per hour. A total of 24 single-type fractions are produced. “In order to comply with upcoming regulations, the depth and quality of sorting will become even more important in the future,” says Managing Director Jürgen Secklehner.

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

2,500 m of conveyor belts carrying plastic waste run above and below each other in the impressive sorting plant, achieving a sorting capacity of 100,000 tonnes per year.





TriPlast Managing Director Jürgen Secklehner would like to see consumers take a more responsible approach to waste. Electronic components and lithium-ion batteries in particular repeatedly cause problems in the sorting plant.

A total of 24 output fractions

In addition to the hollow body fractions in light/white and coloured PE, the same fractions are produced from PP. Output fractions also include PP films and PET trays, six different film fractions, separated according to the colour or size of the film waste, as well as

paper composites and beverage cartons. Of course, there are also metal fractions such as tinplate and aluminium. Finally, around 20 to 25 % of sorting residues remain.

This fraction, along with all 2D and 3D polyolefin residues, is sent to Sekundär Rohstoff Produktion GmbH (SRP) in Pöchlarn, Lower Austria, where it is further processed in a special process. “ARA developed the EU-patented upcycling process and implements it together with the plant operator,” explains Jürgen Secklehner. Upcycling is a special process for obtaining polyolefin flakes with

“We already operate several sorting plants in Austria,” explains Jürgen Secklehner, managing director of TriPlast GmbH and ARAPlus GmbH, Vienna, “but none as large as TriPlast. The new plant in Enns not only has enormous capacity to supply our customers with urgently needed secondary raw materials but also achieves a special sorting quality.”

The TriPlast plant was built by the Austrian collection and recycling system Altstoff Recycling Austria AG (ARA) together with the family-owned company Bernegger from Molln and the German company Der Grüne Punkt GmbH & Co KG from Cologne for a total investment of EUR 65 million. In just ten months, a modern plant and 60 new “green jobs” were created. In addition to 2,500 m of conveyor belts, 160 km of cable and 2,250 t of reinforcing steel were used, and a total of 38 near-infrared sorting devices from Tomra were installed.

The annual capacity is 100,000 tonnes of input material from yellow bags, 70 % of which comes from Austria and 30 % from Germany. Work is currently carried out in three shifts from Monday to Friday, with the possibility of expanding to 24/7 operation, which could even achieve a capacity of 120,000 tonnes per year. The yellow bins and bags are sorted into 24 different fractions, which are purchased by processors in Central Europe for further processing thanks to their high quality. “Our light white PE hollow body fraction is used to manufacture cosmetic packaging, for example,” says Jürgen Secklehner, delighted with the excellent sorting results.

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Photo: Erema

Erema Managing Directors Markus Huber-Lindinger (left) and Manfred Hackl hope that K will provide positive impetus for the currently sluggish recycling industry and believe their company is well equipped to meet future challenges.

end of 2026, it will process up to 41,000 tonnes of plastic sorting residues per year. The aim of the investment is to supply even more high-quality recycled materials for sensitive applications such as food packaging, thereby strengthening the circular economy and raw material security in Austria and Europe.

Agglomeration as a preliminary stage to chemical recycling

High yields and the possibility of recycling plastics are also important to machine manufacturer Erema GmbH, Ansfelden. “By 2050, there will be 9.7 billion people living worldwide. This clearly means that the demand for primary packaging will increase and, at the same time, the demand for high-quality recycled materials,” says Erema Managing Director Manfred Hackl. Consequently, he cannot understand why the recycling industry is currently struggling so much.

Fluffy film waste with a high bulk density can be processed into free-flowing, reusable reggranulate using the new TwinPro system.

a purity of over 90 % from the residual fraction. “And it’s done purely mechanically, without any further NIR separation.” However, the ARAlus managing director does not reveal any more about the innovative process, which reinterprets the typical process steps of shredding, screening and separation.

In addition to the polyolefin fraction, CO₂-optimised substitute fuels for the cement industry and a further small metallic fraction

are produced in Pöchlarn. Jürgen Secklehner is certainly proud of these innovative solutions: “We are now able to sort the majority of lightweight packaging so well that it can remain in the cycle and does not have to be thermally recycled.”

Shortly after K-PROFI’s visit, ARA, Bernegger and Der Grüne Punkt announced plans to build a new upcycling plant for the enrichment of polyolefins at the TriPlast site in Enns at a cost of EUR 35 million. From the



Photo: Erema

Hackl is certain that the situation will change: “So far, every K I have attended has sent positive signals to the market. Why should it be any different this time?” he asks confidently as he prepares to travel to Düsseldorf for the 11th time in his career. In addition to its stand in Hall 9, Erema will once again be showcasing a recycling centre with machines in operation and many successful recycling projects in the outdoor area.

Among the new developments is the new Agglorema machine series, which is specially designed for processing heavily contaminated post-consumer waste. “This system can be used to process large quantities of film rejects with high and fluctuating moisture content from sorting plants into agglomerates with a high bulk density, which are then ideal as feedstock for chemical recycling,” Managing Director Markus Huber-Lindinger told journalists.

The motivation behind the development of an agglomeration unit was the desire to support chemical recyclers in the recovery of low-quality waste fractions. Since many chemical recycling plants require standardised and free-flowing input material, Agglorema is designed to close the gap between heavily contaminated waste streams with a low bulk density of 30 kg/m³ and moisture contents of up to 12 % and a process-reliable reactor feed.

Mechanical recycling remains number 1

Agglorema achieves a throughput of up to 2.3 t/h, whereby input material is homogenised, degassed and preheated in a preconditioning unit without preparation before being fed into the extruder. This produces a partially melted melt strand and transfers it to a water-cooled melt mill, which forms agglomerates with bulk densities of 280 to 380 kg/m³. Erema offers the Chemarena system for direct processing of the melt without agglomeration. “In recent months, we have commissioned several Chemarena systems with capacities between 2 and 3.5 t/h, in which the melt is fed directly into the reactor of the chemical recycling plant,” explains Markus Huber-Lindinger.

“With our new systems, we are supporting all efforts in the recycling industry to get more out of waste materials and recycle as much as possible,” says Manfred Hackl, presenting the strategy. Nevertheless, in his opinion,

chemical recycling is a supplement to mechanical recycling, which should remain the first choice. In this context, he once again emphasised the strategic partnership with washing plant manufacturer Lindner in order to be able to offer joint solutions. “Together, we are not only working to eliminate interface problems, but also looking for energy-optimised solutions.” In future, it should be possible to use the waste heat from the extruder in the washing plant, thereby saving energy in the overall process.

As an example of a successful mechanical recycling solution, Erema presented the Twin-Pro system, in which a twin-screw extruder is connected directly to the preconditioning unit (PCU). This allows high-quality regrind to be produced from input materials that previously posed a challenge, such as lightweight films with high bulk densities. ■

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How Cirp, a service provider for prototype and small series production, is succeeding in opening new doors



Ralf Nachreiner recognised the potential of additive manufacturing back in 1994. As a young scientist, he founded Cirp GmbH and focused on rapid prototyping. Today, the company, based in Heimsheim near Stuttgart, has 65 employees and two main areas of business. In addition to 3D printing, Cirp has also established injection moulding and tooling technology, initially introduced as a prototype technology, for series production. The broad and consultation-intensive field of application ranges from laser-sintered individual children's foot prostheses and 3D-printed detailed embryo models for medical training to prototype and model production for the automotive industry and injection moulding of e-bike drive components. Thomas Lück, Head of Sales and Innovation, talks to K-PROFI about the company's own research and what distinguishes Cirp from pure online portals for 3D printing.

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

When Ralf Nachreiner founded Cirp over three decades ago, he transferred his affinity for research to his own company, which he runs together with his wife Petra. "I was previously a research assistant at the Fraunhofer Institut für Arbeitswissenschaft und Organisation (Fraunhofer Institute for Human Factors and Organisation) in Stuttgart. As generative manufacturing became an increasingly common topic, I delved deeper into the subject and decided to start my own business offering consulting services in this area," reports Ralf Nachreiner. However, it was only when he entered the market as a manufacturing service provider and began collaborating with model makers that the young scientist, who was new to the industry, was taken seriously. "We gradually acquired the missing technologies and know-how in-house, aligning ourselves with market needs."

Cirp grew up with the strong automotive industry in the Stuttgart region and its demands. "We learned early on that original materials and processes are needed for prototypes that are worth testing. That's why we also started manufacturing injection-moulded parts around 25 years ago. To do this, we developed a master tool concept for which we can manufacture highly standardised CNC-milled aluminium inserts," explains Thomas Lück. Standardisation in terms of sizes and radii, the handling of undercuts, etc. enables

the tool designer to concentrate on a few project-specific issues and to manufacture tool inserts for the master tool very quickly. "Our record time is one working day from the customer order to the first injection-moulded parts worthy of testing," says Thomas Lück. Long-term customer relationships are particularly helpful in this regard. It is then already known how to design sealing surfaces for media-carrying components, for example, or how to deal with correction loops for tight tolerances.

From single units to series production

Cirp has also developed into a series supplier through rapid tooling. "We have mastered the necessary formalism, which goes far beyond ISO 9001 certification," says Lück. This includes various digital processes, entry into the IMDS international material data system for the automotive industry, quality control, tactile and optical measurements, computer tomography, initial sample test reports, container management, etc. "Whether injection moulding or 3D printing, we deliver directly to the OEM's production line or to Tier 1 and 2. In consultation with our partners, we still keep the processes lean so as not to lose our speed and flexibility." Cirp covers series

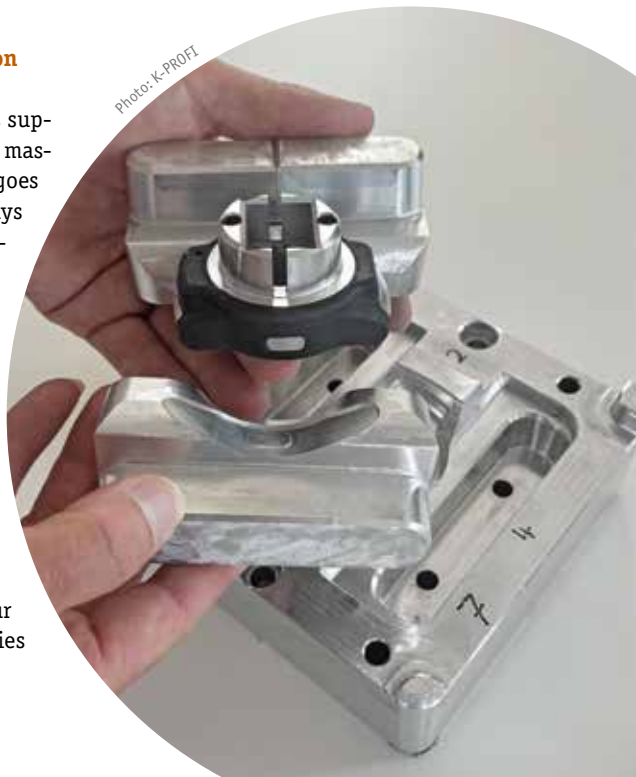
Left: Cirp conducted research into additive manufactured lattice structures, such as this customised bicycle helmet, as part of the European MOAMMM project and wrote its own software to easily fill volume models with a customised lattice structure.

Petra and Ralf Nachreiner are the managing partners of Cirp GmbH, based in Heimsheim near Stuttgart.



requirements for exclusive vehicles or special vehicles, for example, where the quantities can be only in the three-digit range.

Rapid tooling with a proprietary master tool concept. The highly standardised, CNC-milled aluminium inserts are ready for injection moulding after just a few working days. Here for 130 housing protection components for a smartwatch.





On the left, the “puzzle pieces” for the rapid tooling tools are being milled; on the right, seven injection moulding machines are ready for use. The largest, with a clamping force of 4,500 kN (rear right), is from Sumitomo (SHI) Demag.

“Series production does not necessarily mean high quantities. As soon as the component is not only used for testing and viewing, but has to fulfil a function in an application over a certain service life, we refer to it as series production,” explains Thomas Lück, emphasising that there is no single break-even point between additive manufacturing and injection moulding in terms of quantity. “We have already delivered 20,000 identical laser-sintered parts. It simply depends on the component. But the great thing is that our customers get both. In both cases, we have a wealth of experience in material and production-oriented design, are broadly positioned with seven injection moulding machines and 25 professional 3D printing systems and the corresponding variety of materials, provide support in the selection of the process,

and assist both in advance with data preparation and in post-processing with finishing and assembly.”

Supporting with co-engineering

Due to the development-oriented nature of the service, only a few customer applications are public. One of these is a two-component part for Fazua GmbH, Ottobrunn. The company, which specialises in drive systems for e-bikes, is now part of Porsche eBike Performance GmbH. “The 2K component is located between the battery and the motor. We advised Fazua on the choice of materials, in particular which TPE would achieve clean adhesion. For the first box of injection-moulded 2K components, we only needed three

Three working days from order placement for the first 2K injection-moulded components delivered to Fazua. With a further 14,000 pieces after ten days, Cirp secured the series start for the specialist in e-bike drive systems.

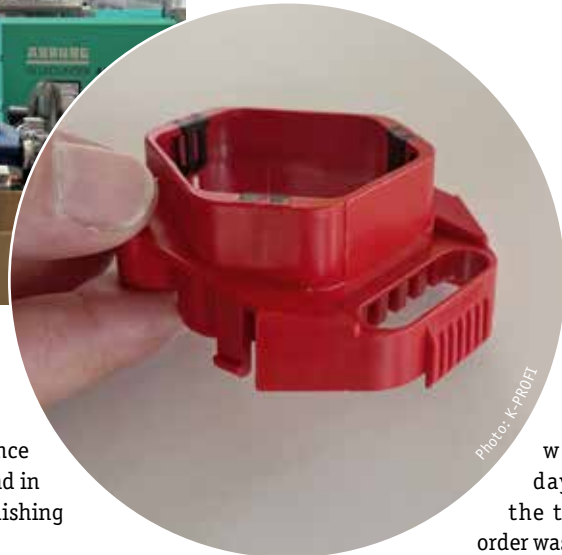


Photo: K-PROFI

working days from the time the order was placed, and ten working days for another 14,000 pieces. This enabled us to secure the entire series start-up for Fazua,” reports Thomas Lück.

For a company that offers its software in combination with a smartwatch in the workshop area, Cirp developed a protective case for the sensitive watches. “We performed a geometry scan, designed a suitable protector, checked our design with additively manufactured prototypes, created a tool insert and produced the 130 components required on the injection moulding machine,” says Lück.

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Photo: K-PROFI

The Porsche Taycan demonstrator is a prime example of the production of scaled-down models. Cirp also supplies 1:1 scale components for the early design phase of automotive development.



Photo: K-PROFI

Laser sintering takes place in air-conditioned rooms with a centrally located powder supply system developed in-house. The mixing ratio of new and recycled powder is continuously monitored.

Research for in-depth process understanding

Cirp has also established a robust series production process in additive manufacturing. The results of various research projects have been incorporated here, among other things. In the BMBF-funded joint research project IQ 4.0, the 3D printing specialists investigated the laser sintering process with a view to ensuring reproducible quality. "By air-conditioning our rooms and using sensory monitoring of the compressed air quality, among other things, we were able to significantly improve the reproducibility and stability of the manufacturing processes," says Thomas Lück happily. As part of a funded project, Cirp also invested in the function and monitoring of powder supply and processing for greater process reliability in laser sintering. In another research project, Cirp collaborated with two Fraunhofer Institutes, Siemens Mobility and an automotive spare parts supplier to investigate the potential of additive manufacturing for spare parts, especially those from the "pre-CAD era". "We learned reverse engineering, invested in the appropriate Geomagic software and introduced the scanning process with two GOM scanners as a service."



Photo: K-PROFI

Scale model of a powder silo as used by Cirp for laser sintering. The powder recycling and monitoring technology was developed in a funded research project.

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Thomas Lück is Head of Sales and Innovation, pictured here with PETG façade cladding elements from the large-format FDM printer Bigrep One, which can achieve a build volume of 1,000 x 1,000 x 1,000 mm.



For this motorcycle mask, Cirp created the design data, constructed the models, manufactured the parts using Polyjet printing, SLS (selective laser sintering) and milling, painted and polished the surfaces, and electrified the model.

The two projects mentioned are representative of a wide range of activities that were funded either by the Federal Ministry of Education and Research, the Federal Ministry for Economic Affairs and Energy or the European Horizon 2020 programme. Research continues to play a central role at Cirp to this day, enabling the company to actively push the boundaries of technologies, materials and applications, as Thomas Lück emphasises. "This allows us to open new doors. Our research activities are part of our founding history, and that sets us apart. Ralf Nachreiner is more willing to experiment than some fast followers who wait until something works perfectly before investing. This has enabled Cirp to grow beyond the automotive industry." Cirp still generates more than half of its revenue from projects for the automotive industry. Architecture, model making, mechanical engineering, the toy industry, medical technology, capital goods, white goods and electrical appliances are other important fields.

A team dedicated solely to research

For several years now, Cirp has deliberately separated its research and industrial activities. "At peak times, we worked on up to eight publicly funded research projects in parallel. Fulfilling customer requirements while conducting research is a double burden. I am now responsible for a sales team, including quality management, and a dedicated research team that we have built up over the last twelve years," explains Thomas Lück.

The Head of Sales and Innovation sees great potential for 3D printing, especially in medicine. With its technical expertise, Cirp has supported the Vivatop research project (virtual technologies and 3D printing for better operations), among others. For this project, Cirp created patient-specific internal body models that surgeons can use in combination with virtual and augmented reality applications to plan and learn challenging procedures in advance and to educate patients. "We have succeeded in producing a liver that feels and smells like the real thing, into which we can reproducibly insert a tumour and equip blood vessels with sensors so that any possible injury during surgery with an HF scalpel is detected. To achieve this, the phantom material must not only have the right consistency, but also the right conductivity. This success has greatly contributed to us being taken seriously by medical professionals and medical technology companies," assures Thomas Lück.

This led to a collaboration with Dr Bernadette de Bakker's research group, which is dedicated to prenatal medicine and embryo research at the University Medical Centre Amsterdam. Cirp has succeeded in translating data from embryos digitally reconstructed for scientific purposes into 3D prints. Using a multi-component polyjet process, Cirp now produces detailed embryo models from various stages of development on Stratasys equipment. The aim is to advance science and education in embryology, according to Dr Bernadette de Bakker. The proceeds from the online shop 3DEmbryoPrints.com, launched by Amsterdam UMC in July 2025, will be used to fund further research. "The embryo models are a good example of our strength in transparent components, finishing and 3D data processing. The great art was to choose colours and transparency on the data side in such a way that everything can be seen, i.e. even through some semi-transparent organs," emphasises the Head of Sales and Innovation.

With this patient-specific liver phantom, which Cirp has produced many times, surgeons can learn how to perform challenging liver resection in cases of tumour infestation in a realistic and reproducible manner.

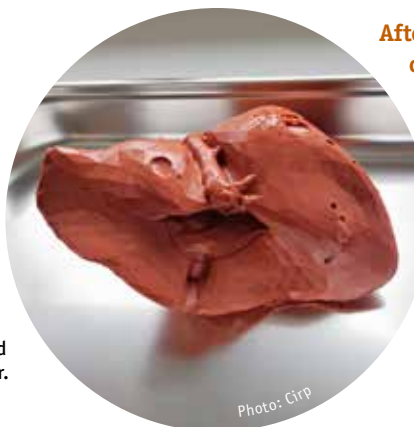


Photo: Cirp

After printing comes finishing

Thomas Lück particularly emphasises the company's expertise in transparent components: "We have mastered transparency in stereolithography, the Polyjet process, vacuum casting and injection moulding."



Photo: K-PROFI

Transparent components are a key focus. As models, they are primarily in demand for marketing and testing purposes.

For transparent embryo models, for example, special acrylates are used as photopolymers for the Polyjet process. Transparent models are of great interest for both marketing and testing purposes. "We have also manufactured transparent cylinder heads to make the flow visible." Mechanical engineers use transparent functional models on a smaller scale for demonstration purposes. Conversely, upscaled models make it possible to recognise innovations that are actually small. "Producing realistic models is one of our particular strengths," emphasises Thomas Lück. Whether illustrative and design models or architectural and miniature

models for visualising buildings, landscape elements, vehicles or other objects, pure 3D printing is not sufficient in most cases. There are also assembly and finishing steps, many of which are done by hand, such as sanding, dyeing, polishing, painting, labelling, integrating lighting or even chemical finishing processes. Cirp developed the dyeing process for SLS parts itself. Even with delicate colours, it is possible to achieve uniform surfaces, which is a challenge. "The trick is to refine the appearance of the additively manufactured models in such a way that they appear vivid, realistic and, at the same time, high-quality."

Painting is an important finishing process at Cirp. Colour tone and gloss level according to precise specifications are just as much a matter of course as the processing of textured and effect paints.



Photo: K-PROFI

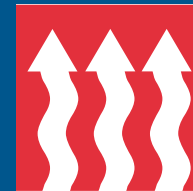
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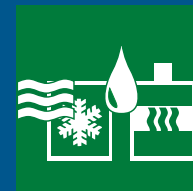
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With appropriate finishing steps such as grinding and polishing, and in some cases also chemical smoothing, Cirp achieves a high surface quality for additively manufactured components.

Revival for vacuum casting

Laser sintering, stereolithography, Polyjet 3D printing, fused deposition modelling (FDM) – Cirp operates 25 professional systems with different build space sizes for these generative processes. Vacuum casting has been experiencing a revival for two years, even though the moulding process was recently declared dead, as Thomas Lück reports. Unlike in the 1990s, additive manufacturing today extends far beyond single-unit production. Duplication is therefore usually easier with 3D printing than with vacuum casting using silicone moulds. However, one or two unique selling points still make vacuum casting attractive. "Vacuum casting allows the duplication of a perfectly finished original model," says Lück. If the original model underlying the silicone

mould is highly polished, so are the PU castings – without any further reworking. "If I were to print, I would have to polish every component." Thomas Lück sees even more advantages: "The process is closely linked to polyurethane as a material, but there are also transparent materials within the PU resins. We can set specific Shore hardnesses and even cast rubber-soft components directly with a smooth sealing surface. This is difficult with other processes."

The link between material and machine is only slowly breaking down

Thomas Lück joined Cirp in 2012, but his experience with additive manufacturing dates back to 1989. How does he view the market after 36 years? "What still amazes me is the forced coupling of material and machine in

In stereolithography in particular, it is still normal for materials and machines to be unable to operate independently of each other. Thomas Lück sees potential for the entire industry in breaking this rigid link.

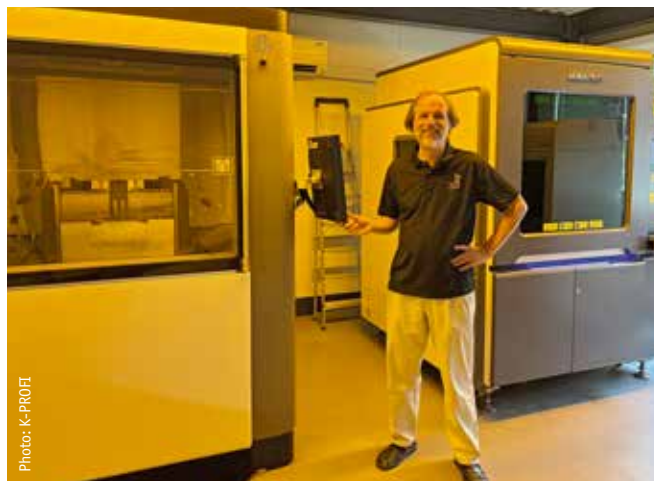


Photo: K-PROFI

some 3D printing technologies. This is holding back the industry. I don't have to purchase the material from the injection moulding machine manufacturer or possibly pay for a licence if I want to process a different material. Until now, we have only been able to negotiate this freedom in isolated cases in stereolithography. But this is exactly what we need if we want to work economically. Without the ability to respond to material innovations and material cost developments, a six-figure investment can quickly become a bad investment. In addition, as experienced specialists, we stand out from users who can only handle plug-and-play systems. We are now testing open SLA systems from Chinese suppliers. In FDM, for example, much has been achieved through its establishment in the hobby sector." More freedom in the choice of materials is also desirable because new applications bring new requirements.

One example is materials that must meet certain fire protection classes. This is a trend that is not only evident in electromobility, but also outside the automotive industry.

The expiry of patents in 3D printing triggered a real hype in the industry, especially in the 2010s. "As a company, it is a challenge to filter out the right developments. Here, too, our research network is helpful in trying out new ideas in cooperation, better evaluating technological topics and keeping the risk low. In general, with the abundance of initially revolutionary news, a certain amount of calm and restraint is needed," says Thomas Lück. And Ralf Nachreiner adds: "Although we are so broadly positioned, I still see technologies that we do not cover. The world is still very exciting." ■

www.cirp.de

Using the multi-component Polyjet process, Cirp manufactures detailed embryo models from various stages of development on Stratasys systems for use in science and education.



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A farmer with his sights set firmly on the packaging market

Why Hungarian thermoformer Tamás Kurucsai now wants to work with recycled PET

Tamás Kurucsai leaves nothing to chance. The Hungarian farmer from Kistelek has two passions – one for agriculture, where he is continuing and steadily expanding the legacy of his grandfather and father, and one for plastics processing. He is also steadily expanding the latter, with plans currently in place to quadruple capacity. Around twelve years ago, Tamás Kurucsai decided to become more independent from suppliers and prices. Since then, he has been manufacturing plastic trays for packaging his home-grown crops right next to his farm, investing in an automated packaging line, a new thermoforming plant in 2018 and now an MRS extrusion line from Gneuss to become even more independent and flexible in terms of plastic raw materials.

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

Tamás Kurucsai farms 30 hectares of land in Kistelek, Hungary, growing peppers, lettuce, cabbage, radishes, celery, corn and blueberries for Hungary and for export to other EU countries. In recent years, he has bought up many neighbouring areas, gradually expanding his land. “I want to be prepared” is his premise. That is why he first looked for new skilled workers before expanding his plastics processing operations. Now you can read the continuation of Gabriele Rzepka’s report “Packaging fresh from the farm”.

Tamás Kurucsai also wants to be prepared for changes in the packaging market. Not only has he gradually converted the production of his inline thermoforming lines from PP processing to PET processing, but he also wants to be able to use recycled materials in the future: “We have just applied for FDA and EFSA certification for our production process and hope to have approval by the end of the year.” In this way, he is preparing to be able to label his PET thermoformed trays with a specific recycled content in the future.

“Information about the recycled content on packaging will be mandatory from 2026 at the latest, when the PPWR comes into force. With my new capabilities, I will not only comply with EU regulations for myself and my current customers but also hope to attract

Tamás Kurucsai grows lettuce, cabbage and blueberries, among other things, on 30 hectares in Hungary and packages the crops right next door.

All photos: Gneuss





The Illig thermoforming machine has recently been equipped with the MRS from Gneuss, which allows PET to be processed without pre-treatment.

new customers.” At the same time, the Hungarian plastics processor is preparing for ISO certification in 2026. Standing still is not an option for the energetic farmer, who gets up at 4 a.m. every morning to get his daily work done and still has time to spend with his family and children after 5 p.m.

Doubling capacity

A lot has changed in Kistelek in southern Hungary since K-PROFI's last visit. PP has almost been replaced as a material, and PET has become the most widely used plastic for the production of thermoformed packaging on the inline lines with a conventional extrusion section and RDK 54 compressed air forming machines from Illig. Thanks to the

purchase of two additional thermoforming machines, production has already increased from 100 million trays to 200 million, and a further increase is planned. “We want to produce 400 million trays soon, thereby quadrupling our capacity,” says the farmer, who now employs 30 people in his plastics processing business. Another 50 people work in agriculture, supported by seasonal workers during the main harvest season.

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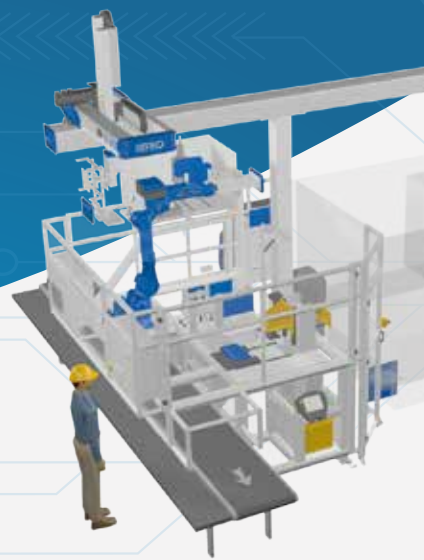
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Hall 12 / A36





The combination of high degassing performance in the extruder and good filtration in the rotary screen changer means that even recycled material is no problem.

In order to increase tray production to 400 million units, Tamás Kurucsai opted for more powerful models when purchasing thermoforming machines three and four. These are designed for a film width of 810 mm and achieve higher cycle rates during thermoforming than the first two lines.

No need for pre-treatment

With the switch from PP to PET as the main material, the Hungarian plastics processor inevitably faced the need for material pre-drying. After all, PET is a hygroscopic material that must be pre-dried in order to achieve high-quality transparent thermoforming film. This is essential even for virgin material, not to mention recycled material. For Tamás Kurucsai, this was one of

two main reasons for choosing a Multi Rotation System (MRS) extruder from Gneuss Kunststofftechnik. "I looked into the subject very intensively, did a lot of research and searched for a suitable extruder. It had to be able to process different input materials without pre-treatment and consume as little energy as possible."

He purchased an MRS 110 with a throughput capacity for PET of 600 kg/h with a vacuum pump up to 25 mbar. MRS extruders, which are based on a single-screw extruder, take their name from the "Multi Rotation System" drum in the centre of the processing unit, in which several screws rotate in the opposite direction to the main screw. This multiplies the melt surface area, allowing effective degassing and decontamination to take place.

"Our process is already FDA and EFSA certified," reports Niklas Möhlmann, sales representative at Gneuss. "We have already been able to prove that PET with a recycle content of up to 100 % can be processed on our MRS extruders without pre-treatment to produce a food-grade raw material comparable to virgin material. We therefore assume that Tamás Kurucsai will also receive the approvals for his process."

Remaining flexible

Hungary has a system for lightweight packaging similar to the yellow bag system and also collects used PET bottles, from which Tamás Kurucsai could source input materials in the future. With the MRS extruder, he not only eliminates the need for pre-drying, but also has flexibility in terms of material sources. Depending on the recipe and requirements, he will mix bottle flakes with his own regrind from punching waste and virgin material. For this purpose, the MRS is equipped with a gravimetric batch dosing unit for up to six components. Finally, a rotating screen changer RSFgenius 90, also from Gneuss, with a screen fineness of 75 µm ensures that adhering solid contaminants are reliably removed and that no imperfections or specks can form in the films. The screen changer is followed by a wide slot die and a smoothing unit from Meaf before the still warm film enters the Illig thermoforming machine directly. In combination with the MRS extruder, the inline process proves to be an energy-efficient process variant for Tamás Kurucsai. ■

www.kurucsaiplastic.hu
www.gneuss.com

When processing recycled material, it is also important to have transparent films without specks so that they can be used for food trays.



The Hungarian farmer's plastics processing plant now employs 30 people who ensure the smooth production of 200 million trays.



Trade Fair Calendar

Trade fairs related to plastics processing in 2025 and 2026

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

K 2025	Dusseldorf, Germany	08.10. – 15.10.2025	www.k-online.de
Injection Molding & Design Expo	Cleveland OH, USA	12.11. – 13.11.2025	www.injectionmoldingexpo.com
Compamed	Dusseldorf, Germany	17.11. – 20.11.2025	www.compamed.de
Formnext	Frankfurt/Main, Germany	18.11. – 21.11.2025	www.formnext.de
Plastics and Rubber Indonesia	Jakarta, Indonesia	19.11. – 22.11.2025	www.plasticsandrubberindonesia.com
Shanghai World of Packaging	Shanghai, China	25.11. – 27.11.2025	www.swop-online.com/en
SPS	Nuremberg, Germany	25.11. – 27.11.2025	sps.mesago.de
Plastics Live Ireland	Dublin, Ireland	26.11. – 27.11.2025	www.plasticlive.ie
PlastEurasia	Istanbul, Turkey	03.12. – 06.12.2025	www.plasteurasia.com
Omanplast	Muscat, Oman	09.12. – 11.12.2025	www.omanplast.net

Plastex 2026	Cairo, Egypt	11.01. – 14.01.2026	www.plastexegypt.com
Swiss Plastics Expo	Lucerne, Switzerland	20.01. – 22.01.2026	www.swissplastics-expo.ch
Warsaw Plast Expo	Warsaw, Poland	03.02. – 05.02.2026	www.warsawplastexpo.com
Plastindia	New Delhi, India	05.02. – 10.02.2026	www.plastindia.org
KPA	Ulm, Germany	25.02. – 26.02.2026	www.kpa-messe.de
Intl. IKV Colloquium	Aachen, Germany	04.03. – 05.03.2026	www.ikv-kolloquium.de
MECSPE	Bologna, Italy	04.03. – 06.03.2026	www.mecspe.com
JEC World	Paris, France	10.03. – 12.03.2026	www.jec-world.events
Circular Valley Convention	Dusseldorf, Germany	11.03. – 12.03.2026	www.cvc-duesseldorf.com
Central Asia Plast World	Almaty, Kazakhstan	17.03. – 19.03.2026	www.plastworld.kz
Plastpackprint Nigeria	Lagos, Nigeria	24.03. – 26.03.2026	www.ppp-nigeria.com
Plast Alger	Algier, Algeria	30.03. – 01.04.2026	www.plastalger.com
Plastics & Rubber Vietnam	Ho Chi Minh City, Vietnam	31.03. – 02.04.2026	www.plasticvietnam.com
Wire, Tube	Dusseldorf, Germany	13.04. – 17.04.2026	www.wire.de ; www.tube.de
Utech Europe	Maastricht, The Netherlands	20.04. – 22.04.2026	www.utecheurope.eu
Chinaplas	Shanghai, China	21.04. – 24.04.2026	www.chinaplasonline.com
Plasttechnik Nordic	Malmö, Sweden	22.04. – 23.04.2026	www.plasttechniknordic.com
Plastics Recycling Show Europe	Amsterdam, The Netherlands	05.05. – 06.05.2026	www.prseventeurope.com
Interpack	Dusseldorf, Germany	07.05. – 13.05.2026	www.interpack.com
Plastics & Rubber Thailand	Bangkok, Thailand	13.05. – 16.05.2026	www.plasticrubberthailand.com
Plastpol	Kielce, Poland	19.05. – 22.05.2026	www.targikielce.pl/en/plastpol
Interplas	Birmingham, UK	02.06. – 04.06.2026	www.interplasuk.com
FIP 2026	Lyon, France	02.06. – 05.06.2026	www.f-i-p.com
Equiplast	Barcelona, Spain	02.06. – 05.06.2026	www.equiplast.com
KPA, Kuteno	Bad Salzungen, Germany	09.06. – 11.06.2026	www.kpa-messe.de ; www.kuteno.de
Plast	Milan, Italy	09.06. – 12.06.2026	www.plastonline.org
Taipei Plas	Taipei, Taiwan	15.09. – 19.09.2026	www.taipeiplas.com.tw
Fakuma	Friedrichshafen, Germany	12.10. – 16.10.2026	www.fakuma-messe.de

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www.peek-shop.de



Polyimides

BIEGLO GmbH
D-22765 Hamburg
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www.bieglo.com
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Polyurethane systems



CANNON Deutschland GmbH
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Tel.: +49 6181 50231 00
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Recycling machines



**Next Generation
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info@ngr-world.com, www.ngr-world.com

Recycling systems



**EREMA - Engineering Recycling
Maschinen und Anlagen Ges.m.b.H.**
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Herbold Meckesheim GmbH
RECYCLING TECHNOLOGY
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Tel.: +49 6226 932-0,
Fax: +49 6226 932-495
herbold@herbold.com, www.herbold.com

Refrigeration technology



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STEUERUNGSTECHNIK**
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D-59846 Sundern-Hachen
Tel.: +49 2935 9652-0, Fax: -501
www.lr-kaelte.de, info@lr-kaelte.de

technotrans

technotrans solutions GmbH
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Werkzeugreinigung | Service
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www.technotrans-solutions.de

Weinreich

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Weinreich Industriekühlung GmbH
Hohe Steinert 7, D-58509 Lüdenscheid
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info@weinreich.de, www.weinreich.de

Sensor sorting technology



STEINERT GmbH
Widdersdorferstr. 329-331, D-50933 Köln
Tel.: +49 221 4984-0
marketing@steinert.de
www.steinert.de

Size reduction technology



TRIA GmbH
Carl-Friedrich-Benz-Str. 1
D-47877 Willich
info@triaplastics.de
www.triaplastics.de



ZERKLEINERN + VERDICHTEN

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Tel.: +49 7062 95700
info@weima.com, www.weima.com

Standards



Tel.: +49 2351 957-0, www.hasco.com



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Note

This directory gives you a compact overview of first-class suppliers and their product ranges. The clear structure from A to Z and the clear form make it easier for you to locate and to get in touch quickly.

For all those who would also like to be listed:

The directory is also available on the internet at www.k-aktuell.de/bezugsquellen and in the German version of K-PROFI. From EUR 320 you can advertise for a whole year. Get more information without obligation and request your entry form now!

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www.weiss-kunststoff.de

Temperature control units

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Fax: +49 2338 918640
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Thermoplastic elastomers



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Ultrasonic welding



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Ultrasonic welding machines



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Tel.: +49 7248 79 0
www.herrmannultraschall.com



SONOTRONIC GmbH, Karlsbad
Tel.: +49 7248 9166-0, www.sonotronic.de
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Ultrasonic systems



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Vacuum pumps and systems



Busch Vacuum Solutions
Schauinslandstraße 1, D-79689 Maulburg
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International markets – opportunities for small and medium-sized enterprises

Why small and medium-sized enterprises should also look beyond Europe

International markets are developing dynamically and offering new business opportunities. Opportunities are also opening up for small and medium-sized enterprises in the plastics industry – if they take a targeted approach and make the most of their strengths.

Many medium-sized plastics companies are currently looking at the European market with concern: rising energy costs, tighter regulation and generally subdued demand. At the same time, it is important to look ahead. New growth areas are emerging worldwide – and these are by no means only of interest to large corporations.

Of course, smaller companies do not have the same resources as large corporations to build their own factories or establish large distribution networks. However, there are practical ways to take advantage of international opportunities. For example, local partnerships through cooperation with regional distributors or producers can lower market entry barriers. On the other hand, niche strategies help small and medium-sized enterprises to score points with specialised applications, high-quality recyclates, sustainable packaging solutions or innovations, instead of entering into direct price competition.

Support programmes such as export initiatives and EU funding instruments provide assistance with internationalisation and market development. Finally, it is important to expand gradually. Initial exports via sales representatives or digital platforms are often a sensible way to get started before making larger investments.

Systematic networking and attending trade fairs (such as K 2025 in Düsseldorf in October) are essential. Contacts are the key to gaining insights on the way to making the right decisions – but also to discussing new business ideas and gauging whether they can hold their own on the international stage.

Internationalisation does not have to be a large-scale project that is only possible for corporations. Medium-sized plastics companies can also benefit from global growth regions – if they clearly position their strengths, utilise partnerships and proceed in small, well-calculated steps. Looking beyond Europe not only opens up new sales opportunities, but also provides greater stability for the future. ■



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In India, the packaging industry is growing at double-digit rates, and in Latin America, the construction and automotive industries are driving demand for plastics and good technical solutions. Africa offers long-term potential. The growing population and the emergence of a middle class are leading to increasing demand for safe food and medical packaging. In addition, opportunities are opening up to contribute European expertise in recycling and the circular economy – a market in which many countries still have room for development.

The next issue of K-PROFI international will be published in December 2025.

Imprint

**K-PROFI international –
Inspiration for plastics processors**

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Subscription

K-PROFI international is available to plastics and rubber processors as an ePaper or PDF free of charge upon registration. Registration requires some information about the person and the function in the company. Registration is possible at any time at www.k-profi.world/registration

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