

K-PROFI

international edition



**Our quality promise
to plastics processors**

- › Trendsetting know-how
- › Success stories from Europe
- › Magazine Made in Germany

Parat produces exterior and interior components for commercial vehicles and caravans by injection moulding and thermoforming, among other processes. CEO Frank Peters shows the way:

Maxi formats with Class-A surface

How **Südpack** and **Vorwerk** turn film remnants into Hoover parts. How **APD Schlauchtechnik** adds liquid additives. How **Valeo** cleans vulcanisation exhaust air with electrostatic filters. How **Re-PET** is opening up strapping. And where bionic vacuums from **ClingTech Bionics** are good for.



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Valuable practical impulses from plastics processing

Dear reader

with the first issue of 2023, we are also providing you with practical impulses from the plastics processing industry. P.A.C.K. Flight Cases, for example, not only supplies the event industry with transport packaging made of hollow-chamber PVC honeycomb panels and equipped with foam inlays. Flight Cases not only supplies the event industry with transport packaging, which it manufactures from hollow-chamber PVC honeycomb sheets and equips with foam inlays, among other things. Impressions from Gabriele Rzepka starting on page 6. Re-PET Kunststoffrecycling processes leftovers from the deposit bottle system. Kay Loibl explained the advantages of the recently installed liquid phase condensation reactor to Karin Regel: page 12.

Housings of a battery-operated Hoover have recently been made from recycled goods from film manufacturer Südpack, among others. Dr Kylie König from Südpack and Dr Michael Kroh from Vorwerk explain the partnership to Karin Regel: page 14. Together with a large German injection moulding company, the start-up PlastiVation is developing an application-specific "single-product injection moulding machine", as founder Bengt Schmidt and head of development Dr Daniel Ammer explained to me: page 17. The Northern Clingfish from the Pacific provides the idea for bionic suction cups as an attachment on smooth, rough and uneven substrates. Sabine Rahner learned details from Dr Petra Ditsche from the start-up ClingTech Bionics: page 20. APD Schlauchtechnik additives melts in liquid form with the help of a nanoporous foam. Karin Regel asked Dr Alexander Müller and Hans-Peter Grabowski for details: page 24.



Gabriele Rzepka visited W. u. H. Fernholz to see how dairy and food packaging is produced by injection moulding or thermoforming: Page 28. Wiping and washing systems, among other things, are produced at the automotive supplier Valeo. Toralf Gabler reports how an electrostatic precipitator system cleans the vulcanisation exhaust air from rubber extrusion instead of afterburning: page 40.

Markus Lüling

Markus Lüling, Editor-in-chief

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In this magazine

TRADE FAIRS AND EVENTS

Trade Fair Calendar	5
----------------------------------	----------

Dipl.-Ing. Markus Lüling

Interest in and within Switzerland undiminished

“Swiss Plastics Expo” was able to maintain the number of visitors at more than 4,000 **19**

PORTRAIT

Dipl.-Ing. Gabriele Rzepka

Each piece is unique

How P.A.C.K. Flightcases provides the event industry with tailor-made transport packaging **6**

Dipl.-Ing. Gabriele Rzepka

Low-manpower and highly automated

How dairy and food packaging is produced at Fernholz in a matter of seconds **28**

Dipl.-Ing. Gabriele Rzepka

It's worth taking a look behind the facade

How Parat manufactures exterior and interior components for commercial vehicles, caravans and co with Class A surfaces for different stresses and strains **34**

TECHNOLOGY

Dipl.-Ing. (FH) Karin Regel

“LSP is the ultimate in energy efficiency”.

Re-PET reorientates itself and taps into the European strapping market **12**

Dipl.-Chem. Toralf Gabler

Electrostatic precipitator instead of afterburning

How Valeo Wischersysteme clean their vulcanisation exhaust air in an energy-saving way **40**

MATERIALS

Dipl.-Ing. (FH) Karin Regel

What does a leprechaun have to do with film recycling?

How Südpack and Vorwerk recycle plastic together **14**

Dipl.-Ing. (FH) Karin Regel

Nano foam absorbs mega amount of liquid

High-tech company develops new class of material for diverse applications **24**



START-UP

Dipl.-Ing. Markus Lüling

The single-product injection moulding machine

Why PlastiVation develops application-specific machines **17**

Dipl.-Ing. (FH) Sabine Rahner

“We are currently in a hot phase”

How ClingTech Bionics is opening up new fastening solutions with bionic suckers **20**

COLUMN

Dr.-Ing. Arno Rogalla

General AI euphoria

Why we must not get in our own way **50**

EDITORIAL 3 MARKETPLACE 46 IMPRINT 50

Trade Fair Calender

Trade fairs related to plastics processing in 2023 and 2024

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

JEC World	Paris, France	25.04. - 27.04.2023	www.jec-world.events
Interpack	Dusseldorf, Germany	04.05. - 10.05.2023	www.interpack.com
Kuteno	Rheda-Wiedenbrück, Germany	09.05. - 11.05.2023	www.kuteno.de
Rapid.Tech	Erfurt, Germany	09.05. - 11.05.2023	www.rapidtech-3d.de
Control	Stuttgart, Germany	09.05. - 12.05.2023	www.control-messe.de
Plastics Live	Coventry, UK	10.05. - 11.05.2023	www.plasticslive.co.uk
Plastics Recycling Show	Amsterdam, The Netherlands	10.05. - 11.05.2023	www.prseventeuropa.com
Plasttechnik Nordic	Malmö, Sweden	10.05. - 11.05.2023	www.plasttechniknordic.com
MedTec live	Nuremberg, Germany	23.05. - 25.05.2023	www.medteclive.com
Plastpol	Kielce, Poland	23.05. - 26.05.2023	www.targikielce.pl/en/plastpol
Oman Plast	Muscat, Oman	29.05. - 31.05.2023	www.omanplast.net
Equiplast	Barcelona, Spain	30.05. - 02.06.2023	www.equiplast.com
HanoiPlas	Hanoi, Vietnam	08.06. - 11.06.2023	www.chanchao.com.tw/hanoiplas
Plastec East	New York, USA	13.06. - 15.06.2023	www.imengineeringeast.com
Moulding Expo	Stuttgart, Germany	13.06. - 16.06.2023	www.moulding-expo.com
Compounding World Expo	Essen, Germany	14.06. - 15.06.2023	eu.compoundingworldexpo.com
Plastics Recycling World Expo	Essen, Germany	14.06. - 15.06.2023	eu.plasticsrecyclingworldexpo.com
Polymer Testing World Expo	Essen, Germany	14.06. - 15.06.2023	eu.polymertestingexpo.com
Interplas Thailand	Bangkok, Thailand	21.06. - 24.06.2023	www.interplasthailand.com
Molding 2023	Minneapolis MN, USA	29.08. - 30.08.2023	www.moldingconference.com
Plast 2023	Milan, Italy	05.09. - 08.09.2023	www.plastonline.org
Kunststoffbeurs 2023	s-Hertogenbosch, The Netherl.	20.09. - 21.09.2023	www.kunststoffbeurs.nl
T-Plas 2023	Bangkok, Thailand	20.09. - 23.09.2023	www.tplas.com
Interplas	Birmingham, UK	26.09. - 28.09.2023	www.interplasuk.com
Powtech	Nuremberg, Germany	26.09. - 28.09.2023	www.powtech.de
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
32. Intl. IKV Colloquium	Aachen, Germany	28.02. - 29.02.2024	www.ikv-kolloquium.de
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
NPE 2024	Orlando FL/USA	06.05. - 10.05.2024	www.npe.org
FIP 2024	Lyon, France	04.06. - 07.06.2024	www.f-i-p.com
Achema	Frankfurt/Main, Germany	10.06. - 14.06.2024	www.achema.de
Dt. Kautschuk Tagung DKT	Nuremberg, Germany	01.07. - 04.07.2024	www.dkg-rubber.de
Fakuma 2024	Friedrichshafen, Germany	15.10. - 19.10.2024	www.fakuma-messe.de



Left page: Managing partner Ruven Kempgen in front of a case that was not built for the event industry but for medical technology.

Each piece is unique

How P.A.C.K. Flightcases provides the event industry with tailor-made transport packaging

Man-sized cases, ship's chests, smaller and larger cases everywhere you look at P.A.C.K. Flightcases GmbH & Co. KG, Berlin. Deeply rooted in the event industry, the company has been building packaging for equipment in the show and event business for over 30 years – for lighting, cameras, screens, LED walls, loudspeaker boxes, cables, radios, microphones and much more. Initially, wood was the only material of choice, but this has changed since then. Especially for air transport, PVC hollow-chamber honeycomb panels are increasingly scoring points. Equipped with inlays made of Alveobloc slabstock foam from Sekisui that are adapted to the contours of the precious cargo, the equipment of the big bands, orchestras and shows arrives safely at its destination.

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

The Berliners have been active in case construction for the event industry since 1987. First as a subsidiary of PAM Veranstaltungsgesellschaft, now as a separate company in which the two managing partners Holger Huth and Ruven Kempgen are firmly at the helm. The affinity to the event industry is not only reflected in the product portfolio, but also in the location: since 2019, the packaging specialist has been producing on 1,000 m² of space in Pankow Park, the former site of the Bergmann-Borsig factory.

A microcosm of its own

Where components for power plants were produced in GDR times, an event hot spot has developed today. The band Rammstein has its warehouse around the corner, the

event technology company Black Box Music is right next door, and the Palastorchester is currently preparing for its next performance in the rehearsal rooms on the site. Ruven Kempgen explains: "We are very close to our customers here, have short distances and can react quickly to the needs of artists, tour entrepreneurs and event managers." In keeping with this philosophy, the case builder delivers the lion's share of its products within Berlin and the surrounding area. "We are highly specialised," Kempgen explains. "We share the business with a handful of case builders in Germany. They usually produce not only custom-made products, but also standard products. We, on the other hand, only produce one-offs." Batch size 1 is not the exception for the Berliners, but often the rule. It does not go beyond batch size 50.

New CNC machine makes work easier

For each product, the specialists create an individual piece of packaging, adapted to the respective shape of the goods to be transported. If 3D models of the goods to be transported are available, Kempgen feeds them into the CAD software Solid Works. Often, however, they are not available. Kempgen smiles: "Then I measure by hand in a very old-school way and also transfer the measured values into the software by hand." Based on this, the Berliners design the foam inlays that then line the inside of the case.

When travelling by air, hollow-chamber PVC honeycomb panels are usually the material of choice. They are light, stable, and flame-retardant. P.A.C.K. processes panels with dimensions of 2,500 x 1,250 mm, which it splits in half with a separating cut before further processing. The thickness is 7 or 10 mm – depending on the weight of the transported goods. The new Rover Plast FT 1224 portal CNC machine from Biesse has been in use since 2020. The company has already been working with a Rover A 1332 ATF for wood processing from Biesse since 2012. According to Ruven Kempgen, one of the reasons for also relying on Biesse for plastics processing was: "We have had very good experience with the machine, and we



can also use the same interface for transferring the data from the CAD programme for the new machine. The new Rover then runs the programme fully automatically. Especially the fact that we have the oscillating knife on the second Z-axis makes the work much easier.”

The new machine scores with a liquid-cooled 13.2 kW 5-axis electric spindle. All spindles come from the Biesse subsidiary HSD. According to Biesse, the Rover Plast is the only machine type in series machine construction with a combination of 5-axis spindle and separately controllable cutter unit on a separate Z-axis carrier. The oscillating blade of the cutter unit enables the production of internal 90° edges. The blade with its 5,000 oscillations/min cuts foams, XPS, thin PET and of course the PVC twin-wall sheets with ease.



The machine has a processing area of 2,400x1,200 mm and a processing height of 200 mm. While the machine for wood processing works with positionable suction cups to fix the sheets, the workpiece is held by suction over the entire surface of the new machine. This is ensured by two large vacuum pumps. The workpiece is secured from the inside by a porous wooden panel and a fleece carpet on which it lies. Kempgen explains: “We can’t get very far with the positionable suction cups when processing slabstock foam, because the material would sag and be deformed by the suction cups. Before we had the new machine, we helped ourselves with self-designed support plates. The full-surface fixation on the vacuum table on the new Rover is really a blessing.” The machine can be walked on all around during operation. Bumpers are fitted to each gantry, which cause the machine to stop when touched. A special restart process ensures that the machine continues the interrupted programme at the same point.



When the new CNC gantry machine moved into P.A.C.K in 2020, the company worked hand in hand with Biesse to present the technology to other interested parties in the Berlin area. To this end, the company opened its doors for demo presentations so that potential buyers could see the machine's capabilities for themselves in advance. Ruven Kempgen looks back: “We were the first in our region to buy the machine for plastics processing. Since we have a very good relationship with Biesse, we were happy to agree to the proposal of demo presentations. It was interesting to see what is possible with the machine. We benefited from that as well.”

Case building live

A look into the production area allows live observation of case construction. A 7-mm twin-wall sheet is currently lying in the machine, which is being transformed in several steps into a case the size of a ship's chest. The plastic cases can carry around 300 kg. If the case needs to carry more weight, the Berliners resort to wood. After the board is cut to size, the individual parts go to the assembly department. Here, an employee cuts the 4 m long aluminium profiles to

Cables, connectors and plug-in connections are safely transported in the case made of hollow chamber honeycomb panels.

Behind the scenes, the crew communicates by radio during the show. They find protection in these inlays during transport.

The new arrival from 2022: The Rover Plast FT 1224 portal CNC machine from Biesse.



Top: For the design of the inlays, the Berliners use the CAD software Solid Works.

Right: Ruven Kempgen shows the inlay for a stage light.

Far right: Inlays for two screw clamps each are produced on the new machine. First the cutter unit cuts out the rectangular outer contour, then the milling cutters work out the inner contour.



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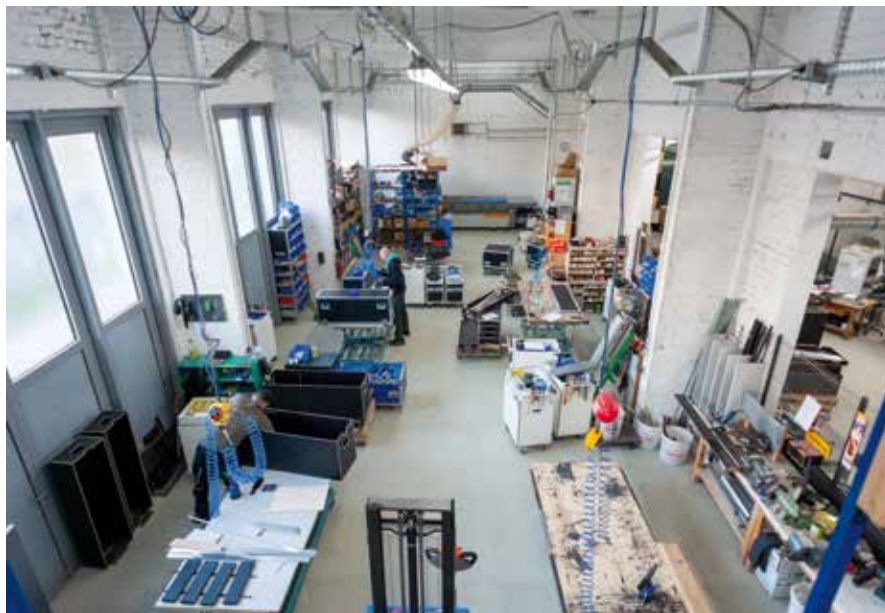
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Holger Huth, one of the managing partners and founder of P.A.C.K. Flightcases.



A lot of craftsmanship goes into the custom-made products of the Berlin case makers. In the background, the CNC gantry machine from Biesse.

the size of the case. The all-round aluminium profiles hold the cases in place and ensure stability. In this stage of production, the cases are punched, screwed, and riveted – all by hand. “The dimensions of each individual case are different. They depend on the goods being transported. And we then design the necessary inlays individually and precisely for each case,” explains Ruven Kempgen. CNC operator Maik Grebe, for example, is currently producing inlays for two screw clamps each. In future, they will find their place in a case together with a projector, cables and all the necessary connections. First the cutter unit cuts out the rectangular outer contour, then the gantry moves back and works out the inner contour with a 12 mm cutter. In the next step, a 6 mm milling cutter takes over the finishing touches and finalises the inlay.

All inlays made by P.A.C.K. Flightcases are from Alveobloc. The block is made of laminated roll foam and has a uniform, closed cell structure. The material is made from the physically cross-linked polyolefin Alveolen and is available in different colours. Ruven Kempgen recalls: “We tried several suppliers. With many, the tools smear. We finally ended up with Alveobloc because we can run high feed rates without the foam smearing.” The main colour of the cases and inlays is black. “But we also supply cases and inlays in special colours, because some organisers use their own colour design,” Kempgen describes his business.

Continuous growth

The event business accounts for 80 % of the Berlin-based company’s turnover. In addition, the specialists build packaging for medical technology, for measuring instruments or for racing. X-ray machines, motorbikes or highly sensitive measuring equipment end up in some cases. Every year, around 80 m³ of slabstock foam and 800 m² of twin-wall sheets pass through the hands of the eight employees in production. In addition, there is still a

high proportion of wooden cases, because these are always in demand when the material travels by train or truck instead of by plane. The reason: wood is cheaper and can be loaded with more than 300 kg. In addition to the cases, the company also takes on the construction of scenery and stages made of plastic and wood, produces 3D logos, decorative elements, studio furniture – in fact, everything that is required in show business. Kempgen makes it clear: “This is really just a side business that we take on exclusively for our case customers.”



With a total of 13 employees, the Berlin specialist generated a turnover of 1.2 million euros last year. The small business of 1988 with a production area of 50 m² has developed into a company that has held its own in the special arena of the event industry and has grown continuously. Ruven Kempgen reveals the reasons for this development: “I think that our network, the personal contacts to the artists and the event companies, is the key to success. This has proven to be successful, and I am confident that we will continue to grow with our custom-made products.”

www.packcase.de
www.biesse.com

The CNC Rover Plast fully fixes the PVC hollow honeycomb panels for subsequent machining.



Far above: Black dominates the cases, but special colours such as red or blue can also be realised – in all conceivable sizes.

Above: An employee cuts the 4 m long aluminium profiles to the size of the case. The all-round aluminium profiles secure the cases and ensure stability.

Left: Scenery and stage construction is a side-line business for P.A.C.K. Flight-cases, which the company only does for its case customers.

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“LSP is the ultimate in energy efficiency”.

Re-PET reorientates itself and taps into the European strapping market

Bielefeld-based Re-PET Kunststoffrecycling GmbH has always stayed out of the fight for the highly desirable PET input from the deposit bottle system. Instead, for the past eight years it has been buying up the leftovers and processing them. With success. Nothing has changed in this respect since K-PROFI visited the company almost four years ago.* In the case of the output goods, however, everything has changed: the material quality, the sales market and the advanced machine technology that makes it possible. In the present interview, shareholder Kay Loibl explains the enormous advantages that the recently installed liquid-phase condensation reactor brings to PET reggranulates and thus to his company.

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



With his team, Kay Loibl has opened up a new sales market for recycled PET.

integrations of fibre producers or processors also led to sales difficulties for Re-PET. “We therefore completely repositioned ourselves and tapped into the European strapping industry for ourselves,” Kay Loibl is pleased to say and explains how this was possible. After all, PET strapping places completely different demands on material quality than PET fibres. The main factor responsible for the changes is the recently installed liquid-state polycondensation (LSP) jump reactor from Gneuss Kunststofftechnik GmbH in Bad Oeynhausen.

Energy-efficient and economical technology

Re-PET has been working with Gneuss for some time. First, they bought a multi-rotation system (MRS) extruder, which is responsible for melting, degassing and finally pelletising the very inhomogeneous input material. “With the MRS, we were previously able to produce r-PET with an IV value of 0.64 dl/g, which was perfect for the fibre industry, but not sufficient for the strapping industry,” clarifies Kay Loibl. A plant extension was needed. After very successful preliminary tests in Gneuss' pilot plant in Bad Oeynhausen, Re-PET opted for the purchase of a Jump reactor and was not disappointed. “Now, depending on customer requirements, residence time and input quality, we achieve an output IV of

0.76 to 0.90 dl/g, ideal for strapping applications. The feedback from our new customers about the improved quality shows that we made a good decision.” Kay Loibl and his team can not only turn low-grade residual materials into high-quality PET reggranulate with the now existing plant combination of MRS, Jump and corresponding additional equipment, which the reproprocessor put together himself, they have also found a new sales market for themselves and work very quickly and energy-efficiently. “Liquid phase condensation is currently the ultimate in terms of energy,” Kay Loibl is certain and compares it with other systems available on the market.

One step further

A well-known process for the production of r-PET with a high IV value is solid-phase condensation, in which granulates are condensed in a reactor with a residence time of up to 12 h under vacuum. As the name suggests, liquid phase condensation, on the other hand, works directly with the melted and filtered PET melt. “We continuously convey the melt, which has a temperature of around 280 °C, directly into the jump reactor, where the temperature is about the same and there is also a vacuum of less than 1 mbar,” Kay Loibl describes the installed process.



An IV value of up to 0.90 dl/g makes Re-PET's output goods ideal for strapping applications.

With its 50-member team, Re-PET produces 14,000 t of output goods based on PE and PET from about 20,000 t of waste input goods, consisting of PET scraps, screenings, reject flakes and PE bottle caps, using a sophisticated processing technology. The PET reggranulate has so far been sold mainly to the fibre industry. But: “The market in the Far East is dead”, is the experience of Kay Loibl, who explains this as follows: “Especially in China, where a large part of our PET reggranulate has been used so far, a separate recycling system is being set up. Good for the country, bad for us. Here we can no longer score with our European prices, partly due to the high transport costs.”

The fibre market in Europe, which was an alternative for Re-PET, is also changing. “In the PET sector, the seller's market has become a clear buyer's market.” Consolidations as well as backward or forward

Inside the reactor there are slowly rotating elements so that a polymer film is formed whose surface is constantly renewed. In combination with the applied vacuum, glycol, volatile components and moisture are effectively removed from the melt. The residence time, the applied vacuum, the degree of filling and the rotational frequency of the built-in stirring and mixing elements can be used to shift the polycondensation reaction in favour of the products. After passing through a calming section in the reactor, the melt is transferred to the downstream pelletising process. "We achieve an IV value of 0.87 to 0.9 in an hour at the most. That's great!", Kay Loibl praises the Gneuss system.

The machine builder also names the exclusion of oxygen, which prevents yellowing of the polymer, as well as the easy cleaning of the reactor as advantages of his system. For Re-PET, the possible yellowing of the material is not so important, as green materials are usually used for strapping applications. "The strapping manufacturers who use our material report back to us that they achieve better stretching results with our material and have fewer strap breaks," says a pleased Kay Loibl, who now wants to go one step further based on this positive feedback. "We have submitted an application to EFSA for our reprocessing process and hope that we will soon be able to sell our r-PET to the thermoforming industry for food applications."

www.repet.com
www.gneuss.com

The Gneuss Jump reactor condenses the PET recyclate within just one hour.



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Recycled materials from Südpack are used for the VK 7 cordless Hoover with squeegee from Vorwerk.

Photo: Vorwerk

What does a leprechaun have to do with film recycling?

How Südpack and Vorwerk recycle plastic together

No, the leprechaun (Kobold) is not the little green man who makes new granulates out of film scraps at night. The Kobold is the one for which recycled film, among other things, is now being used. Its exact name: Kobold VK7 cordless Hoover with SP7 suction wiper. It comes from Vorwerk and has recently been made of injection-moulded parts from recycled materials. The supplier of the recycled material is the film manufacturer Südpack, which operates its own compounding lines at its site in Schwendi and produces high-quality individual recyclates here. Dr Kylie König, Business Development Manager Compounding at Südpack, and Dr Michael Kroh, R&D, Principal Materials Engineering at Vorwerk, explain the not-so-ordinary project in more detail and present the activities of both companies on the subject of recycling.

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

Vorwerk Elektrowerke GmbH & Co. KG, which has its headquarters in Wuppertal, is well-known for its hoovers and Thermomixers. The long-standing company sells the Kobold VK 7 alone about 400,000 times a year, the Thermomix about 1.2 million times, in addition to other products. Most of the production takes place in Wuppertal, where the majority of the 1,660 employees work. Other production sites are located in Cloyes, France, and Shanghai, China. The products are sold all over the world by about 85,000 independent associates who offer direct sales, including advice and demonstrations.

With this very successful system, the Vorwerk Group generates an annual turnover of about 3.3 billion EUR. "Sustainability has always been a top priority for us, after all, our products are characterised by an enormous lifespan", Dr. Michael Kroh of Vorwerk is convinced and emphasises that many hoovers, or blenders are already 30 or 40 years old and thus in use over several generations.



Photo: Vorwerk

Dr Michael Kroh, R&D, Principal Materials Engineering at Vorwerk



Photo: Südpack

Dr Kylie König, Business Development Manager Compounding at Südpack



Photo: Coperion

Jochen Schofer, Head of Sales Recycling at Coperion

But of course, Vorwerk also wants to meet the current demands for greater use of recycled materials and a lower CO₂ footprint.

Sustainable materials desired

Dr. Michael Kroh says: “Our goal is to switch all the materials we use in-house to a sustainable alternative. This includes recycled materials as well as materials from renewable sources (e.g. biomass balancing or chemical recycling) or plastics based on renewable raw materials, but also the replacement of more CO₂-intensive raw materials with alternatives.” By this he means, for example, replacing PA with PP, the polymerisation of which requires significantly less energy.

And this is where Südpack comes in. “The PP compound we buy from Südpack consists of more than 40 % recycled material,” says Michael Kroh. He is enthusiastic about the very trusting cooperation and the speed of the project. “We had the first talks about a year ago, the production tests have been completed and the first batch of material has already been ordered.” In addition, further recompounds are being sampled. A long-term cooperation is planned. “Since all the raw materials we use are continuously put to the test, we are very happy to have found a competent and reliable partner in Südpack.”

Südpack is one of several raw material suppliers for Vorwerk, as the company not only has to ensure its material procurement, but also needs very different raw materials. As an example, Dr. Kroh names the tub of the TM 6 “Black Edition”, which was produced from 100 % recycled ABS. “For the recycled material, the CO₂ equivalent is 0.22 kg, while for virgin material it is more than fifteen times that at 3.46 kg.”

The challenge of colour

The special features of the Südpack recompound used to produce the white PP housing parts of the Kobold SP7 (the attachment for simultaneous wet wiping and vacuum cleaning) are its quality and its colour: signal white. Both are ensured by the high-quality raw materials, the enormous recipe knowledge and, of course, the processing technology. “Südpack pursues a clear zero-waste strategy based on several pillars,” explains Dr Kylie König (*see K-PROFI 9/2022, p. 64ff. and www.k-profi.de/*

heft/220964). One pillar is the company’s own compounding plant in Schwendi, not far from the company headquarters in Ochsenhausen. “Here we process our film residues from production into high-quality regranulates.”

For this purpose, the post-industrial waste is collected in the main plant according to the exact formula and, due to its purity and cleanliness, offers ideal conditions for high-quality compounds. “The formulation knowledge here in-house is enormous thanks to the many years of experience

for the various film formulations,” Dr Kylie König points out. Both the formulation knowledge and the extensive testing facilities are now also being used for compound development. “We have already put together a certain basic portfolio of different compounds, including for the automotive and household sectors, but we also develop customised formulations.”

This is also the case for Vorwerk. “We start by talking to the customer to find out exactly what he wants and needs, then we produce an initial test material based on



battenfeld-cincinnati

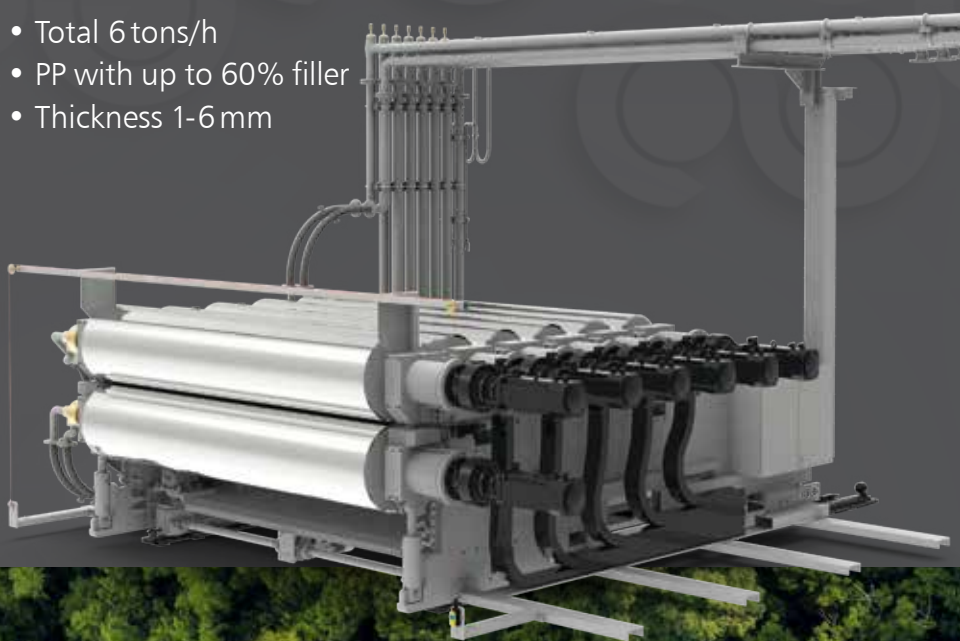
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Photo: Vorwerk

The compound with a recycled content of over 40 % impresses with its high scratch resistance in the cover of the squeegee.

that, modify it if necessary and then go into production,” says Dr König, describing the procedure. The challenge in the recipe for Vorwerk was the colour. Producing a signal white from residual materials, even if they are post-industrial residues, is not entirely trivial. “We work closely with various masterbatch manufacturers who help us find the colour.”

The PP compound for Vorwerk is based on PP/PE/PA composite film remnants mixed with virgin material, but consisting of over 40% recycled material. “We were even able to improve the scratch resistance in the end product, the cover of the squeegee, compared to before.” Vorwerk is not only very satisfied with the mechanical properties of the compound, but also with the colour setting. “In the nozzle of the squeegee, we now actually use different polymers for different parts, all in signal white, and this is only noticeable when you know it,” says Dr Michael Kroh, praising the compound supplier.



Photo: Südpack

The starting material for Südpack's compounds is its own clean film scraps.

Processing challenge

For the production of its high-quality compounds, Südpack relies on Coperion from Stuttgart, among others, and operates ZSK twin-screw extruders at its compounding plant in Schwendi. “There are again two challenges in processing the multilayer compounds: the first is optimum dispersion of the polyamide content in the PE matrix. Otherwise, this leads to speck formation in the finished injection moulded component,” explains Jochen Schofer, Head of Sales Recycling at Coperion.

Together with his team, he therefore offers all customers and those who would like to become customers the opportunity for pilot plant trials. “Südpack has also taken advantage of this service. Together we developed the right screw configuration and the right process unit design for the desired recipe,” continues Jochen Schofer, naming challenge number 2: “Multilayer residues have to be degassed particularly well in order to remove all volatile components.” That’s why Südpack works with a two-stage high-performance degassing system. The combination of very fine dispersion and high-performance degassing ultimately leads to the high-quality compound that Vorwerk uses for its nozzle cover.

Incidentally, since recycling and such tasks are increasingly in demand, Coperion presented the ZS-B Megafeed at K 2022. The side feed unit enables the efficient feeding of particularly light and fluffy residual materials, e.g. film shreds, compresses them before they reach the compounder and thus not only allows a higher throughput and thus efficiency, but also makes it possible to feed particularly difficult materials into the extruder in the first place. “In the future, we will also offer a combination of a shredder and a ZS-B Megafeed to enable further processing options for residual materials and thus make our contribution to the circular economy,” summarises Jochen Schofer. ■

www.suedpack.com

www.vorwerk.com

www.coperion.com



Photo: Coperion

Südpack received support with formulation and system configuration in the Coperion Technical Centre.

The single-product injection moulding machine

Why PlastiVation develops application-specific machines

The Munich-based start-up PlastiVation Machinery GmbH is pursuing the development of an application-specific injection moulding machine. Together with several partners, including a German plastics processor for development and the Chinese injection moulding machine manufacturer Tederic for industrialisation, the machine is expected to be ready for the next K trade fair in October 2025. In the meantime, the young company is setting up sales for Tederic in Germany. Why a new product for a fully occupied market? K-PROFI spoke to founder and managing director Bengt Schmidt and head of development Dr Daniel Ammer.

Text: Dipl.-Ing. Markus Lüling, Editor-in-Chief K-PROFI

"After three hours, the spark was ignited," Bengt Schmidt explains the decisive conversation with an investor active in drive technology at the beginning of 2021, whose original approach was to acquire an existing company from the plastics industry and win him over for the management. But at the end of the exchange of ideas, a unique business model for the plastics industry emerged: "The development of an application-specific injection moulding machine and the establishment of German sales as a commercial agency for Tederic".

The PlastiVation brand – composed of "Plastics" and "Innovation" – was born at the "peak of the Corona crisis", entered in the commercial register on 29 March 2021 and became externally active when the company moved into its Munich premises in October 2021. A whopping 25 employees are now on the payroll. "We have around 300 years of experience in plastics," emphasises Bengt Schmidt, stressing that he is running "a purely German, purely Bavarian mechanical engineering start-up with German management". He found the first employees in his personal network of industry experts: "We place the highest value on only hiring people who know plastics technology."

The envisaged injection moulding machine already has a name: "Hurricane". As the name promises, it should go fast. "Most start-ups begin from scratch, with one, then two employees and so on. With us it's different thanks to the investor. We can plan with a certain foundation, we know the material, we can think about the entire project early on, but we also want to get to

implementation quickly," explains Dr. Daniel Ammer.

Customer-focused machine for a selected target application

Why do we need a new machine at all? Where and how should the Hurricane differentiate itself from existing brands? Dr Daniel Ammer: "We want to bring a more customer-oriented product to the market. The machine will be incredibly customer-focused for a select target application." There is no really optimal machine for the identified market segment yet. Schmidt and Ammer do not want to be more specific, but they position themselves as follows: the product will not compete with classic machines from premium manufacturers, but they will start "slightly below" and then "go down". In the past, European players in Europe and the USA have already been very successful with machines for these application markets, Schmidt emphasises.

PlastiVation is planning a division of tasks: the mechanics of the Hurricane will come mainly from China, the drive technology, the human-machine interface (HMI) and the process intelligence from Europe. "We're leveraging China to make Germany successful," says Bengt Schmidt, specifying, "Our plan is to use the best components at a good cost basis from China and combine them with process know-how and engineering from Germany." The new machine will "of course" have all-electric drive technology, Schmidt points out, efficiencies close to 99 % and sensor-free condition detection on the motor are advantages over

hydraulics and sensors. "Our engineering concept is novel," says Dr Daniel Ammer. From day one, he says, PlastiVation has digitised every possible step in the company so that it runs unmanned. Bengt Schmidt: "In a traditional company, ERP systems are adapted to the company, but the company actually has to be adapted to the software." Many long-established players have a hard time with the "switch to consistent digitalisation", Schmidt says.

The Munich team is not doing the development alone. As a development partner, PlastiVation has gained a global industry leader from the target customer group that operates several hundred machines as a large plastics processor in northern Germany: "We have our machine challenged by them on an ongoing basis. The target customer accepted the challenge and signed a development agreement in 2022. "The industrialisation partner is Tederic, from whom we can get a hull machine optimised to our needs," says Dr Ammer. "We are also in talks with potential project partners in other technology areas," Schmidt emphasises. For example, a partnership with a Swiss supplier for propulsion technology is "in the pipeline". Dr Daniel Ammer: "Starting with our narrow application segment, we are looking at what useful functions are available in the industry and in neighbouring industries to help our goal of a specific injection moulding machine. We can cleverly combine a lot of things to optimise for specific applications."

In October, PlastiVation filed its first patent – for faster cross-linking of rubbers. "And at K, with Tederic, we were the only Chinese brand that is connectable with OPC-UA interface for cross-manufacturer communication and thus to Umati, the world language of production," the managers look back on the last few months. At K 2022, the running Tederic machine had already sent live data via the internet to the Umati demonstrator. Plasticising screws, drives, process variants, savings in energy input, oil and water temperature

– all this can be limited to specific applications and a limited range of materials is processed. Another goal is to increase the use of recycled material. The selected application and many digital tools still offer a lot of potential for improvement, emphasises Dr Daniel Ammer.

Those responsible do not see any danger posed by the dependence on the Chinese supplier Tederic. Dr. Ammer: “All suppliers have global value chains, because some components are not even available in sufficient quantities from Europe. In view of the global political situation, all suppliers are in the same boat, and the question is likely to become which organisation can best adapt to the respective situation.” Bengt Schmidt plans final assembly in Germany. He considers personnel costs in the local mechanical engineering sector to be overrated. Much more decisive, he says, is availability and reliability, which is not given at all European production locations.

Schmidt estimates the German market for injection moulding machines at 550 million euros annually. Of this, about 30 % belongs to the targeted applications, and even a small market share of only 5 % for his machine would not be enough for a critical company size. So, the Hurricane needs other markets such as the USA and China. For the latter market, Tederic with its sales and service network would be the ideal sales partner; for the USA and other markets, it would have to be examined whether this should be done by the company itself or together with Tederic. The plans envisage a presentation at the next K trade fair in October 2025. Immediately afterwards, international sales are to start “at the push of a button”.

Distribution of Chinese standard machines for the broad market

At present, PlastiVation acts as the German sales agency for Tederic; beginning in 2026, the Hurricane will complement

Tederic’s machines. Schmidt reports that the Chinese company first started in Germany many years ago with an agent as a “one-man show”, and in a second attempt with its own sales company – both without lasting success. “We identified a single processor in Germany who acquired Tederic machines, and that was through other channels.”

So PlastiVation started cold-calling at the beginning of 2022 with “zero customers”. Market cultivation and customer support are decentralised and carried out by a six-person sales team, while customer service, headed by Wolfgang Ballas, also relies on freelancers and established service companies. Tederic’s electric machines have attracted the greatest interest, but hydraulic machines have sold the most so far, Schmidt reports. “We see ourselves as a

Founder and Managing Director Bengt Schmidt (right) and Head of Development Dr Daniel Ammer in PlastiVation’s Munich technical centre.



supplier, but with our own development. We call the component manufacturer when something goes wrong and don't have to ask the machine manufacturer." Classical competitors such as agents and sales representatives without development are always dependent on the support of the machine manufacturer, he says.

The opening of PlastiVation's in-house 800 m² technical centre with twelve Tederic exhibits in July 2022 was attended by 250 customers and interested parties in Munich. "At K 2022 in October, we presented an 11,200 kN machine and more than doubled our project numbers. We now have at least one machine from each Tederic series – electric, two-platen and toggle – in the German market. And at the end of the year, we placed our first large-scale machine."

Founded in 2003, Tederic is owner-managed and listed on the stock exchange, has more than 1,000 employees, many of them young, over 140,000 m² of production space and an "extremely good cost base". Immediately after its foundation, the company started exporting, quickly built up a worldwide distribution network and placed more than 20,000 machines in 130 countries. The manufacturer currently produces several thousand machines a year and sees PlastiVation as a partner for further developments in Europe, reports Bengt Schmidt.

Money from a Luxembourg investor

"For us, 2022 was a terrific year. Everyone in the team rolled up their sleeves and contributed to the success. We are looking forward to 2023," Schmidt sums up. This also

pleases his backer, a Luxembourg venture capital fund that attaches great importance to sustainability in the company's development. The fund "looks at things without reservation and is very interested in technology. He also welcomes the economic goal for PlastiVation of reaching the break-even point in the current year 2023 if the general conditions remain favourable. Appearances at the "Swiss Plastics Expo", "Kuteno" and "Fakuma" trade fairs should help to strengthen the company's market presence throughout the year. ■

www.plastivation.com/tederic

Interest in and within Switzerland undiminished

"Swiss Plastics Expo" was able to maintain the number of visitors at more than 4,000

After a three-day run, Messe Luzern once again recorded the number of visitors to Swiss Plastics Expo as 4,100 at the end of January. This was exactly the same number as in 2020 immediately before the outbreak of the Corona epidemic. However, the exhibition space occupied, and the number of exhibiting companies declined further – to less than 200.

The exhibitors now listed included industry media, although they did not have their own stand. As a result, the fair appeared smaller than ever before, as both halls of the site were not completely filled, the aisles seemed wider and the layout airy. On the second day during the visit of K-PROFI, the event was lively, intensive discussions could be observed at many stands. In the exchange with the exhibitors, a residual uncertainty about the economic course of the year 2023 was still evident, especially since free capacities among tool-makers and mould suppliers indicate a somewhat lower project activity. Nevertheless, the Swiss market was clearly too important for many German suppliers to "skip" the fair.

The fair was again carried by machine builders, peripheral technology, tool suppliers, mould makers and plastics processors. More than ever before, the international supplier brands shaped the appearance of the fair. Swiss industrial representatives, formerly the largest exhibitors, now only operated with stands on the side-lines or as "sub-exhibitors" of their largest brand in the portfolio. Numerous compounders and local colourists, traditionally represented at the fair, were absent. The top dogs of the Swiss plastics machinery industry were again glaringly absent.



Photo: Messe Luzern

However, the quality of the exhibits from the machine manufacturers did not diminish at all. And here we came full circle to the argument for establishing the Swiss Plastics Expo in 2008 – that shortly after the K fairs, exciting exhibits from Düsseldorf should find their way to Lucerne to all those for whom the journey to the World Fair is too far. The principle is to continue after K 2025: The next Swiss Plastics Expo is planned for 20 to 22 January 2026. Markus Lüling ■

www.swissplastics-expo.ch

“We are currently in a hot phase”

How ClingTech Bionics is opening up new fastening solutions with bionic suckers

The Northern Clingfish from the Pacific Ocean provided the idea for the product of the start-up ClingTech Bionics from Sankt Augustin. The highlight: bionic suction cups equipped with the Clingfish effect hold with high forces not only on smooth but also on rough and textured, uneven substrates. In autumn 2022, the young, internationally active company launched the first small series. Managing director and founder Dr Petra Ditsche heads research and development. The marine biologist provides insight into her business idea and reports on potentials, hurdles, partners, successes, and goals.

Dr Petra Ditsche's research activities fill a long list. She completed her doctorate in 2009 under Prof. Dr. Wilhelm Barthlott (University of Bonn), the discoverer of the lotus effect. “The step from looking at how something works bio-physically to thinking about how we can use that for technology has always been part of my thoughts since my doctoral thesis,” says the studied hydrobiologist at the

beginning of the conversation. Among many others, the Friday Harbor Laboratories of the University of Washington were among her positions from 2012 to 2016.

K-PROFI: Dr Ditsche, your start-up is a spin-off that goes back to research activities at the University of Washington and the University of Bonn. What decisive insights did you gain there?

Dr Petra Ditsche: Together with Prof. Adam Summers, I researched the Northern Clingfish in Washington. This clingfish lives in the surf zone, where it can attach itself to the rough rocks with high holding forces using its ventral suction cup. It defies even strong currents and swells there. And it even works for dead fish. This showed that the suction cup is not coupled with an active system. This makes the Clingfish suction cup particularly interesting for technical use.

We investigated the structures and discovered that, among other things, the interplay of solid structures – in the fish mostly the skeleton – and the extremely soft, hierarchical structures of the ventral sucker is crucial for being able to hold on to rough surfaces. The elastic suction cup rim is covered with papillae made of tiny rods, whose tips in turn subdivide into the finest filaments. These hierarchical microstructures enable the adaptation to surface irregularities of different sizes. These structures also increase friction so that the edge of the suction cup is not pulled towards the centre as quickly. The suction cup sticks longer and withstands higher loads.

You then transferred these principles to technical suction cups. When was the first prototype created and how did the journey continue to the start-up?

A week before my project position in Washington ended, we achieved the breakthrough with the first working technical suction cup prototype. That was in 2016. There was already a lot of media interest during the research, so the idea quickly became known, and we received repeated enquiries from industry over the years. Back in Germany, I further developed the prototype on my own and, after a few more crucial development steps, applied for a patent for the principle in agreement with Washington. At the University of Bonn, I was later able to advance my business idea with an EXIST start-up grant starting in 2020, including building demonstrators for specific applications in the lab, writing the business plan and finally founding ClingTech Bionics in September 2021.

Dr Petra Ditsche, CEO and founder of ClingTech Bionics, is in charge of research and development and had the Clingfish effect technology protected as a trademark across the board.



Are there already products on the market?

We could manufacture the first small series in autumn 2022. Our pilot customer Aquablast from the USA sells underwater box bags that can be reversibly attached to the pool floor with our Clingfish Effect suction cups.

You talk about the Clingfish Effect. What do you mean by this?

In line with the fish's ability, the Clingfish Effect stands for the suction cups' ability to hold on rough, textured, and uneven surfaces. We have protected the technology across the board as a trademark, i.e. analogous to the lotus effect, the term serves as a recognition mark for the technology and not just for a specific product.

What have been the biggest hurdles so far?

A huge problem in the start-up phase was to transfer the patent I had applied for to the company and, in doing so, to comply with

the legal requirements of the various areas such as tax law, corporate law, etc., without running the risk of high personal taxation without receiving any income. Here I must honestly say that the German bureaucratic jungle almost prevented the foundation. Another big challenge was to finally transfer production from lab scale to series. We achieved that for the first application in about one and a half years.

How do you produce the bionic suction cups?

Unfortunately, I can't reveal too much. Injection moulding plays a role, combined with other methods. For some applications, we use thermoplastic elastomers. Alod developed the TPE specifically for this application and its requirements for us. In addition, other materials are integrated. In production, we work closely with two partners. The production lines differ corresponding to the fields of application of the suction cups. The materials are usually adapted to the specific application. There are passive and active suction cups. With

the production concept for the passive version, we are close to large-scale production. This is now the really hot phase.

Do you manufacture standard suction cups or are the products adapted to each individual application?

The suction cups are often adapted to specific applications. Ideally, however, certain types can cover several areas. Like the pool suction cup, for example. This has been developed to be compatible with chlorine, to withstand sunlight, to cope with changing tensile-compressive loads in different directions, etc. This makes it easy to transfer to other underwater or sanitary applications. At the moment, of course, we are learning with every enquiry and every application, and the pool of experience is constantly growing.

In which applications do you see the greatest potential for the Clingfish effect suction cups?

The Clingfish effect suction cups work not only on smooth surfaces, but also on

The Northern Clingfish, native to the Pacific Ocean, lives in the surf zone where it can use its ventral suction cup to attach itself to the rough rocks with high holding forces.





Photo: ClingTech Bionics

In the production concept for this passive suction cup variant, ClingTech Bionics is on the verge of large-scale production.

distinctly rough, textured and uneven, bent surfaces – above and below water. This is what makes us stand out. A great many possible applications are conceivable, and we are also constantly learning through the numerous enquiries we receive. A large market for our passive suckers is certainly in household and sanitary applications. Just think of rented flats where it is not allowed to drill into tiles. In addition, the underwater sector, e.g. with aquariums or ponds, is interesting. Among the more curious applications is the non-invasive marking of marine animals such as turtles or whales,



Photo: Aquablast

The underwater boxing bags of the pilot customer Aquablast, which are reversibly attached to the pool floor with Clingfish effect suction cups, illustrate the high load.

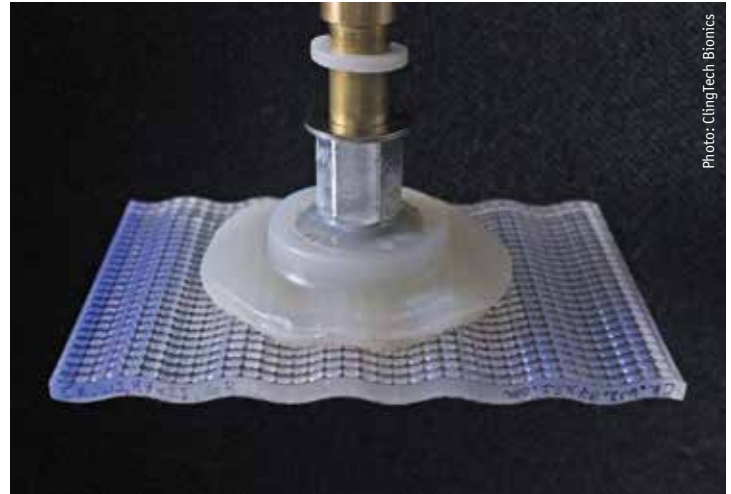


Photo: ClingTech Bionics

Transferred to active suction cups, the technology also opens up new possibilities for handling structured and uneven plastic surfaces.

which is close to my heart as a biologist. For the active suction cups, logistics and robotics offer a wide field. However, we still need a little more development time here. For special applications of active suction cups for industrial process chains and robotics, we cooperate with various partners, including Schmalz GmbH.

Where are the limits or what requirements do surfaces have to fulfil?

The prerequisite is that the vacuum can be maintained permanently. This means that the surface – regardless of its surface structure – must not be air-permeable or porous. Walls with plasterboard or even spruce wood, just as an example, are too open-pored. In terms of size, there is a lower limit of about 1.5 or 2 cm in diameter. Here the advantages cancel each other out. Towards the top, the following applies: the larger the suction cup, the more structured the surface can be. So far, we have not reached an upper limit.

What kind of stress can the bionic suction cups withstand?

That also depends on the size and cannot be stated in general terms. For the pool suction cup with 80 mm diameter, the normal force is at least 25 kg, depending on the substrate. In the shearing direction, i.e. laterally, just under 10 kg can be attached. With our 65-mm prototype, the normal force is in the order of 20 kg. In any case, the load-bearing forces are no lower than those of conventional suction cups, but with the added advantage that they also hold on structured and uneven surfaces.

What possible applications do you see for the plastics industry?

In the field of logistics, for example in the handling of packaging of all kinds, including bottles, a wide range of applications is conceivable. The passive suction cups can, for example, connect plastic elements with rough surfaces. We also always look forward to ideas from potential users. They usually know best where there is a need for reversible fasteners on structured and/or bent surfaces and where our technology can provide a solution to an existing problem.

Your business model is focused on the B2B sector.

We work with corporate customers, provide application-based advice, and openly communicate what works and what doesn't. In the long term, in addition to developing and selling the suction cups to business customers for their applications, we can also imagine licensing, especially for large customers. Companies that are already active in this field can possibly expand fields of application with our solution and thus close gaps. My hope is to be able to cooperate here instead of encountering competition or confrontation.

In general, partner companies play a big role for us. We cannot do it without cooperation and joint developments. A valuable and outstanding partner for the further development of the materials was and is Allod. A start-up is often not yet able to give precise forecasts on material purchase quantities, but Allod has nevertheless supported us from an early stage. We feel we are in very good hands here.

What goals are you pursuing with your start-up?

At the moment, it's about establishing the technology. After the step into small-scale production last autumn, we are just about to start large-scale production. We want to achieve this decisive step this year. Of course, we want to grow. An important immediate goal is to push the pool vacuum as an existing product for other areas of application and to expand the range of different sizes. And in the medium term, we want to tap into the large logistics market and make processes more efficient with Clingfish effect suction cups.



Photo: Clingtech Bionics

Clingfish effect suction cups offer high holding power even on rough, textured and even uneven surfaces.

The interview was conducted by Dipl.-Ing. (FH) Sabine Rahner, editorial office K-PROFI.

www.allod.com
www.clingtechbionics.com
www.aquablastfit.com
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First hoses made of recycled PVC that can be produced by APD thanks to the cooperation with Sumteq.

Nano foam absorbs mega amount of liquid

High-tech company develops new class of material for diverse applications

APD Schlauchtechnik GmbH from Viersen is now taking another step towards more sustainability and climate neutrality. This is made possible by the nano-porous foam from Sumteq GmbH in Düren, which can be loaded with a large amount of liquid plasticiser to release it again during processing in the extruder. Sounds complicated? It is not. During the on-site appointment, K-PROFI learned from Sumteq Managing Director Dr Alexander Müller and Manager Sales & Marketing Hans-Peter Grabowski in which applications the novel material is in demand, in which quantities it is available and can be used, and to what extent it contributes to sustainability.

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

“APD Schlauchtechnik's core products include spiral hoses made of rigid and flexible PVC. During the start-up of a production line, start-up scrap is produced during the adjustment work for series production, which was previously ground and sold to a reprocessor”, Hans-Peter Grabowski presents the initial situation at his customer

from Viersen. The hose manufacturer's goal was to be able to process this material in-house in order to reduce waste quantities and transport routes and to improve the material utilisation rate. By processing its own high-quality residual materials, the company is now killing three birds with one stone – it is increasing the degree of material utilisation in its own products, protecting the environment through reduced raw material purchases, and gaining additional flexibility.

Hans-Peter Grabowski explains how it works: “Our nanoporous, open-pored foam Sumfoam is loaded with up to seven times its weight in liquid plasticiser and then dosed into a conventional extruder like an additive with the PVC formulation to be processed in the desired quantity. Here, under the effect of temperature and shear forces, the foam releases the plasticiser into the polymer mix, providing the desired PVC hardness level.” The residues of the polymer foam remain in the PVC melt and, due to their weight share of less than 1 %, have no influence on the mechanical properties or on the recyclability of the PVC, which is to be classified as a monomaterial.

“Since the hose manufacturer can regulate the amount of plasticiser added himself, our solution gives him maximum flexibility,” emphasises Dr Alexander Müller. APD can now purchase PVC according to availability and then adjust the degree of hardness itself by adding the foam particles loaded with plasticiser. In principle, of course, it was already possible to meter in plasticisers as desired, but metering liquid plasticisers into a standard extruder is not trivial. “For dosing liquids into the extruder, the processor not only needs the right dosing pump and the appropriate cylinder segment to connect it. There is also more frequent leakage,” Hans-Peter Grabowski knows from his work in the hose industry. Sumfoam simplifies the dosing of liquids enormously, brings flexibility and requires no additional equipment.

Well-packaged liquid

In addition to plasticisers, other liquids can also be packed into the open-pored foam. “Sumfoam can be loaded with almost any liquid,” says Dr Alexander Müller, describing the many possible applications. Hydrophobic media and aqueous mixtures do not pose any problems, only solvents cannot be used if they attack the polymer PMMA, the basis of Sumfoam. “We carry out loading tests for interested customers and their specific applications and deliver a dry liquid back to them as a test batch, with which they can then carry out their own production tests,” says Hans-Peter Grabowski, describing the procedure.

In addition to the high loading capacity, the advantages of the foam include the fact that it binds the liquid so well that no unwanted migration can occur, that it is loaded within a very short time and that this already works at room temperature. The topic of liquid loading is currently very trendy, which has not only brought the company significant growth since its founding in 2014, but also offers a wide range of enquiries. “We exhibited at K this year for the second time and received an enormous response and many enquiries,” Alexander Müller is pleased to report.

Among the current trend topics is microencapsulation of fragrances, for example. Thus, Sumteq presented a customer project at the fair in which the open-pored foam was loaded with perfume and



Dr Alexander Müller

mixed into a printing ink for a T-shirt. The T-shirt now has scented lettering. “The highlight of our product is that the open pores are retained so that the fragrance, which weakens over a longer period of time, can be ‘reloaded,’” Alexander Müller explains further. This filigree application is possible, he says, because the foam particles can be produced in any size, including particularly small ones.



Substances from left to right: yellow-dyed plasticiser, Sumfoam flakes, Sumfoam with absorbed plasticiser, plasticiser-loaded Sumfoam plus waste PVC. In the foreground: PVC.



With Sumfoam, the thermal insulation plaster is light but stable and has a high insulating performance. It is particularly interesting for heritage-listed houses or half-timbered houses with curves.



Originally foamed granulate with a grain size between 5 and 10 mm, it can be further ground into flakes or powder.

Microencapsulation is also a topic at Sumteq in connection with cyclodextrin, a molecule that is able to absorb unpleasant odours. “Customers are interested in the possibility of loading our foam with cyclodextrin in order, for example, to equip sportswear directly in such a way that it absorbs the smell of perspiration,” says Hans-Peter Grabowski, naming another area of application.

Own production right from the start

The described applications of liquid absorption in plastics processing as well as microencapsulation are subject areas that have emerged since the company was spun off from the University of Cologne. “This has enabled us to open up innovative areas of application for our novel class of materials,” says a delighted Dr Alexander Müller, who founded the company after completing his doctorate as a physical chemist together with his partner Dr Roland Oberhoffer, also a chemist, and business economist Michael Hoffmann. “Dr Oberhoffer and I developed Sumfoam while we were working at the University of Cologne, and we did it on a mini scale. In our apparatus it was always possible to produce exactly one foam bead.”

A lot has happened since then. The company has moved to the Isola Chemical Park in Düren, now employs 40 people, has developed a process to produce its product on a large scale and has been offering around 1,000 tonnes of its product in ten variants since the beginning of this year. The chemical park was very important for Sumteq because the company really starts at the very beginning of its production chain. Alexander Müller explains: “We buy MMA and produce PMMA ourselves by suspension polymerisation in the specially built reactor. We then foam the PMMA particles to form the Sumfoam beads.”

The company has also developed and built the machine technology for foaming itself. During foaming, the volume of the PMMA particles increases approximately 10-fold, so that from now on around 10,000 m³ of foam beads are available for customer projects. “We



The finest form of Sumfoam. Even with the finest grinding down to 0.05 mm, each particle contains countless pores.

grind the beads into coarse flakes or a fine powder with a particle size below 50 µm, depending on the customer's requirements,” Alexander Müller explains further, emphasising that “even the smallest particles retain their full functionality, i.e. open pores and liquid absorption.”



Hans-Peter Grabowski



Flakes ground from the original foamed granulate are available in various sizes between 1 and 2.5 mm, depending on customer needs and application.

insulation and sheet goods." With its products, which are admittedly significantly more expensive than well-known systems such as polystyrene foams, Sumteq does not want to enter the mass market. "Even though we achieve about twice the insulation properties of polystyrene with our products, because of the price we focus on applications where conventional foam products reach their limits."

In the case of insulating plaster, these are, for example, complex facades, heritage-listed houses, or even half-timbered houses with curves that cannot be insulated with board products. "With our board products, we don't sell the insulation performance, but the space gain, because we get by with layers half as thick with the same insulation properties," says Hans-Peter Grabowski. And this is a great advantage, especially when insulation measures are necessary in the interior of rooms. Fill-in insulation is mainly a topic in the Netherlands and Great Britain. Here there are two-shell houses that can be well insulated by blow-in insulation with Sumfoam. In conclusion, Alexander Müller and Hans-Peter Grabowski emphasise that insulation will remain an important mainstay of the young company, but that they would like to open up many new areas of application for the new class of materials in the future and look forward to further customer enquiries. 

Starting with insulation

The material was initially intended for the application in which many foams are used: for insulation. This area is also one of the company's three product pillars – along with liquid loading and microencapsulation. "For insulation applications, we offer three products," explains Dr Alexander Müller, "an insulating plaster, a fill-in

www.sumteq.com

www.apd-schlauchtechnik.de

High-pressure cell used to foam the first nanoporous granulate, exactly one bead.



Low-manpower and highly automated

How dairy and food packaging is produced at Fernholz in a matter of seconds

Yoghurt, mascarpone, cream, buttermilk – the packaging for dairy products of all kinds whizzes out of the machines at breakneck speed and often ends up in the carton fully automatically. Whether injection moulding or thermoforming, whether containers or lids, at W. u. H. Fernholz GmbH & Co. KG in Meinerzhagen, the visitor encounters everything. The company is a specialist for dairy packaging – and has been since it was founded in 1963 by the brothers Werner and Helmut Fernholz.

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

Today, Til Fernholz is the third generation of his family to be a part of the company as plant manager of the factory in Meinerzhagen. The young man looks back: “My grandfather’s brother had a farm and supplied the dairies with milk. My grandpa himself was the younger brother, so he didn’t inherit the farm and instead learned at Battenfeld. The idea of setting up his own injection moulding business for packaging dairy products was therefore obvious. My

grandfather had the injection moulding know-how, and his brother had the customer base.” The dream team of Werner and Helmut Fernholz was successful. With an injection moulding machine and support from Battenfeld, the siblings got started in the mid-1960s and quickly developed a considerable clientele in the dairy business.

The machinery grew with their success, and in the mid-1970s the first thermoforming machines moved in. These were RDMs 37/10 from Illig, which are still running today. The company still produces small series and individual special articles on them today. A two-chamber yoghurt cup made of PP is being produced here. The punched grids are rolled up and later ground in a separate mill before being returned to the extrusion line. “The machines still work wonderfully in terms of quality,” Fernholz describes the use of the “oldies”.

Yoghurt cups and co. every second

Today, the main business in thermoforming is done on the highly automated lines, next to which the old machines look like dwarfs. Fernholz uses several RDM 70K and 73K machines from Illig for large-scale cup production, sometimes with quantities of more than 100 million per year. In addition, there are nine other, smaller cup lines from Illig. The new line operates with inline extrusion. It is currently producing a 1.5 mm PP monofilm that leaves the extrusion at 140 °C and enters the machine’s heating station. Heated to 200 °C, the film enters the forming station, where a 24-cavity mould forms and punches cups weighing 6.5 g, with an upper diameter of 75 mm and a drawing depth of 120 mm. The machine feeds the punching grid remnants upwards away directly into the integrated Illig mill, from where they are conveyed back into the extruder. The connected automation system comes from Brink in the



View of the “Desto” cup production.





Many machines work with inline extrusion. PP film is produced here, which the RDM 73 K forms into cups on a 24-cavity mould.

Netherlands. The stacked cups are automatically counted and reach a gripper via a conveyor module running off to the side, which removes the individual stacks and places them in the carton lined with a hygiene bag. Once the carton has been filled, it is closed manually and moved out of the system. The next empty carton enters the automation cell via a conveyor belt from the waiting position. Fernholz looks to the future: "The next step will be to expand from a carton erecting unit with automatic bag insertion to conveying the filled cartons onto the pallet. The second large RDM will be automated in the same way within the next one to two years. The aim



is to deploy the few skilled workers available where they are indispensable. The rest of the production should function with as little manpower as possible."

Nothing works without logo, decoration and labelling

In order to provide the cups with the appropriate brand logos, lettering and decorations, the company relies on both printing and labels. Here, the customer decides what it should be. During the walk-through production, the dry offset printing machine is decorating a cup that will later contain crème fraîche. The machine takes the cups from the supply piles and prints them with eight clichés that pick up the colours and print them on the cup according to the artwork. The cups are then UV-dried. The press operates at 460 cycles per minute. The cups are automatically conveyed from the drying unit to the packaging station. There, five stacks with a defined number of cups are placed in a template, from which a gripper places all five stacks as one layer in the queued carton. Once 1600 cups have been packed, the carton is closed manually.

According to Fernholz, the advantage of printing in contrast to the sleeve is obvious: "We realise direct prints on the cups that can compete with the quality of conventional labels or sleeves in terms of colour fastness and brilliance. Unlike sleeves, however, the thin layers of ink on the surface of our mono-material cups do not interfere with recycling."

Alternatively, several labelling systems are available. The packaging specialist buys the labels externally on rolls. The self-adhesive labels on the reel run into the system from where the label tape is guided at a sharp angle, and they peel off the tape. A plastic presser forces the individual label onto the passing cup. Two brushes then vigorously brush the label onto the cup so that it can no longer peel off. A camera monitors the applied label for accuracy and correct positioning. "We use mono-material for all our packaging. The label is either made of the same material as the cup or of paper, as neither interferes with the recycling process," Fernholz affirms.

"Desto" saves resources

Another development by the Meinerzhagen-based company is the so-called "Desto" cup. "The less plastic, the better," Fernholz smiles. For this purpose, the company produces very thin-walled inlets made of PP, PS, rPS, PET or rPET. A cardboard band, which gives the cup the necessary stability, reinforces it. "With this process we can save up to 60 per cent plastic compared to conventional cups," Fernholz emphasises. The band can be made of cardboard with a recycled content of up to 90 %. Once the contents of the cup are used, the band can be removed by crumpling the cup – the consumer can easily dispose of the components in the paper waste and the yellow bag.

The machine that puts the band around the cup comes from Weyh-müller. An operator manually inserts the thermoformed cup stacks into the machine, and a conveyor belt transports the stacks to a carousel in front of which they are separated, and each placed on one of ten rotating mandrels. Next to the cup infeed is the infeed for the paper banderole. These also come from a stack onto a conveyor

After the forming and die-cutting station, the cups pass to the automation system, where they are packed into cartons.



The “oldies” from the 1970s are still working reliably and are currently producing 2-chamber yoghurt cups made of PS.

belt, where they are automatically provided with a glue seam and glue dots and then placed around a cup. With 160 cycles per minute, the machine ensures rapid Desto cup production.

In-house film production ensures sustainability

When it comes to sustainability and recyclability, mono-materials play an important role. For this reason, the family-owned company has always kept film extrusion in its own hands. There are ten Kuhne extruders at the Meinerzhagen site. Since 2009, the packaging specialist has been producing PP and PS films on three Battenfeld Cincinnati extrusion lines at its second production site, the film plant in Schkopau. Fernholz makes it clear: “Film production from mono-material for dairy packaging is not trivial. The key points are the formulation and the extrusion parameters. We have built up a lot of know-how in this area over the years.” At both sites together, the company processes about 2,000 t of plastic per month and produces about 2.5 billion pieces of packaging per year. More than half of the films produced are sold to third parties. Fernholz specifies: “In Schkopau we only produce sales film. The lion’s share is film for FFS lines in dairies. Of course, a large quantity also goes to thermoforming companies and technical applications.”

Recently, films have also been made from rPS, which is produced from PCR. Fernholz collaborates with Trinseo for this purpose. The materials manufacturer obtains the recycled polystyrene by chemically recycling PS waste. In a dissolution process, the waste is mixed with solvents and then the PS is separated from additives and impurities in several cleaning steps. The result is a material that can also be used for direct food contact. Fernholz explains the status quo: “We are the only manufacturer in Europe to use rPS. We already process the material in films for food packaging and for non-food applications. The middle layer of the film is currently made from rPS, the outer layers still from virgin material.”

The situation is different with rPET. Here, films made of rPET for direct food contact are already being produced in Meinerzhagen and processed into trays on site. According to Fernholz, the next step will be rPP: “Unfortunately, only very small quantities of rPP are available at the moment. We hope that the situation will change by the end of 2023. That’s when we expect the first commercially available quantities.”



Dry offset printing provides logos, lettering and decoration. At 460 cycles per minute, the machine passes a lot of cups per day.

Mono also applies to trays

The films are not only used to make all kinds of cups for dairy products, but also trays – again for the food industry and here mainly for meat products. The trays are produced on four KMD steel rule machines from Kiefel. The latest model, the KMD 78.2 Speed, can also be found in the production area. There, during the visit, lids made of a 360-µm PP film run off the belt from a 10-cavity mould. The film



These cups from dry offset printing will later contain crème fraîche.

is produced offline for the KMDs. The machine forms and punches the lid in the same station, so the separate punch is switched off. The automation comes from the Kiefel subsidiary Mould & Matic. A conveyor belt transports the lids to the stacking station, where they are manually removed and packed. Fernholz explains: "This is about a PP tray with the PP slip lid that is currently in production. Again, the focus is on the mono-material packaging approach. Fitting the lid to the tray is a challenge because of the shrink properties of PP. And manufacturing the thin 360-µm film was not easy either, because the tensions in the PP film are critical in the production of high-quality, perfectly functioning lids. We are really proud that we succeeded and that we can now offer a PP monotray with lid."

Another example is a mono-PET tray with PET sealing film for packaging poultry. The tray has to be designed in such a way that it offers good sealability. The edge is particularly important. If the poultry touches the sealing edge during filling, the packaging can no longer be sealed securely. Fernholz makes it clear: "We have modified the PET tray so that it can be filled with poultry and sealed with a PET film. To do this, we cooperated with the manufacturer of the sealing film and the manufacturer of the sealing equipment." Unlike the cups, which look different for each customer, the standardisation is higher for the trays. "We can sell



Til Fernholz relies on silos for material supply: "To be able to handle the quantities we produce, we switched to silos early on. Today we only manage small quantities for special orders and colour in big bags or sacks."

one tray standard to different customers. That is rarely the case with cups," Fernholz makes clear.

Injection moulding still at play

But not all packaging solutions at Fernholz are based on the pillars of film and thermoforming. Injection moulding still plays an

important role. The company has 15 machines with clamping forces between 1,000 and 5,500 kN in operation. Thirteen are from Netstal, two from Arburg, and the new acquisition is an all-electric Engel e-motion with a clamping force of 2,800 kN. All machines work with IML automation from different manufacturers. The Engel machine is currently producing PP lids for mascarpone cups on a 6-cavity mould. The lids are decorated with IML as required for Lidl, Aldi, Edeka and the like. Next door, a Netstal machine with a clamping force of 5,000 kN produces the matching PP cups on an 8-cavity mould. Fernholz has solved the last step of packaging up to the carton on its own using its own robot concept.

On another Netstal injection moulding machine, here with a clamping force of 5,500 kN, yoghurt cups made of PP are produced on an 8-cavity mould that hold 500 g of product. The cup itself weighs 16.8 g. The injection-moulded packages are heavier, the moulds many times more expensive than with thermoforming. Nevertheless, the demand is there. Fernholz explains the reasons: "Injection-moulded packaging has a better wall thickness distribution, so it is more stable. We have a customer who ships filled cups and needs high stability and high compression. The look and feel of injection moulded products is also superior as they are heavier and decorated by IML. We cater to the needs of our customers and can offer both thermoformed and injection moulded packaging solutions. However, in terms of volume, thermoformed packaging is ahead."

Round-the-clock operation

In order to be able to handle batch sizes of more than 100 million cups for the high-runners and an average batch size of 30 million cups per product variant and year and numerous trays in thermoforming production as well as cups in injection moulding, the Meinerzhagen-based company relied on material storage in silos early on. Today, 17 silos serve the machinery via a pneumatic material supply system. Depending on the material and silo size, they can hold between 40 and 70 tonnes of plastic. The regrind produced offline is stored in eight bag silos. Only very small quantities for special orders and colour are supplied in big bags and sacks.

The self-adhesive labels on the reel run into the machine at a sharp angle and peel off.





The PP slip lid is a Fernholz development. Fitting the lid to the tray was a challenge due to the shrinkage properties of PP.



The lids are created on a KMD 78.2 Speed from a 360-µm PP film on a 10-cavity mould. The machine moulds and punches the lid in one station.

The tempered steel tools for the thermoforming machines are manufactured by a handful of regular partners from Germany and Benelux, as well as one from China. "The Chinese are simply very fast, work three-hour shifts and are comparable in quality," Fernholz explains. The injection moulds are also made by partner companies from Germany, Switzerland, and the Netherlands. "We have the tools manufactured externally, because that way we benefit from the know-how of the specialised companies," Fernholz describes the company's philosophy.

200 employees, 180 of them at the Meinerzhagen site and 20 in Schkopau, generated a turnover of around EUR 80 million in 2022. In Schkopau, the company runs production in three shifts, seven days a week; in Meinerzhagen, it is the same for injection moulding

production and extrusion. Just the thermoforming machines run only five days a week in three shifts. The company supplies dairies in Germany, Austria, Switzerland, and Benelux. "We have a broad customer portfolio. From on-farm dairies to the biggest dairies in Europe. We are well established in the scene, among the big five in the dairy cup business in Germany. Although packaging for dairy products is undoubtedly our core business, we also have many customers in meat packaging, and we supply films for technical products. Our goal is to develop sustainable solutions, to optimise packaging more and more. That's where our strength lies, and that's what our customers appreciate," Fernholz outlines the company's concept. 

www.fernholz.biz



Injection moulding produces lids for mascarpone packaging on a 6-cavity mould.



A Netstal machine produces 500 g yoghurt cups from PP on an 8-cavity mould.



Eight sack silos are available for the regrind produced offline.



Huge Class A surfaces, like the caravan bonnet cover shown by Frank Peters (left) and Tobias Schmid, are Parat's trademark – almost always reinforced by LFI, particle foam or double-walled constructions.

It's worth taking a look behind the facade

How Parat manufactures exterior and interior components for commercial vehicles, caravans and co with Class A surfaces for different stresses and strains

Everything that Parat Beteiligungs GmbH from Neureichenau produces is about high-quality surfaces. Be it tractors, trucks, caravans, construction vehicles – all OEMs expect Class A surfaces in this segment. CEO Frank Peters puts it in a nutshell: “A combine harvester quickly costs in the upper six-figure range. Customers want not only functionality but also an attractive appearance. The same applies to caravans, trucks or construction vehicles. The look has to be right, that's important to buyers today.”

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

The basic technology from which everything starts is deep-drawing. This is where the visually attractive “façade” is created. Extruded sheets of ABS/PMMA or ABS/PC/PMMA for high temperatures with a metallic look, brilliant pearl white with depth effects, iridescent green or rich yellow are transformed in twelve thermoforming machines into, for example, wings, fronts, scoops, or bonnets. The machinery is dominated by systems from CMS and Geiss. They have one thing in common: they are big. Panel dimensions of up to 3,000 x 2,200 mm are not uncommon. Anyone who has ever stood in front of a combine harvester, road paver or luxury caravan will understand why.

Starting point: High-quality surface

“We are a single-source supplier for many of our customers, because the quantities for many series are between 500 and 10,000 components per year. For each new series, it is important that we match the OEM's corporate colour exactly for the deep-drawn surfaces,” Peters describes the general conditions. For this purpose, the company works closely with a handful of partners who produce the panels in exactly the colour, brilliance and with the effects that are required. This often requires several iteration loops. Development Manager Tobias Schmid illustrates: “The semi-finished product supplier sets colours according to the OEM's specifications, and we produce the component sample from these plates. The sample then goes to the OEM, who checks whether the colouring fits. If not, the semi-finished product manufacturer further adjusts the colour.” The extruded sheets for the visible components all come with a protective film that is

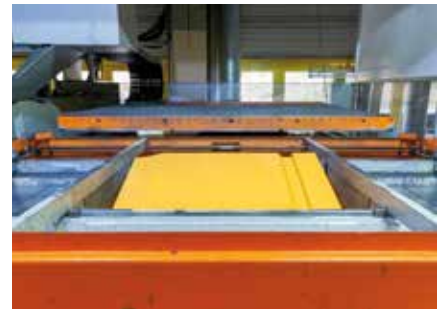
not removed during the processing steps. This keeps the surface intact. A look into Parat's thermoforming area reveals the variety of components in size, colour, and shape. Numerous mudguards of an enormous tractor in green for Fendt with dimensions of 1,870 x 670 mm, produced with a 2-cavity mould from a semi-finished product of 2,010 x 1,990 mm and a drawing depth of almost 700 mm, created from an ABS/PMMA sheet of 3 mm thickness, stand side by side. A few steps further on, a Geiss T8 produces excavator side panels in classic yellow for Liebherr from 1,200 x 1,150 mm ABS panels with a thickness of 2 mm and a drawing depth of 200 mm. Next to this, a CMS1 is working and producing interior reinforcements in ABS for a 2-shell B-pillar of a caravan on a 6-cavity mould. Front and side parts for caravan hoods in pearl white made of PS can be found a few metres further on, as well as side parts for one of the largest combine harvesters in the world in metallic black. The latter are produced by a Geiss T9 from ABS-PMMA panels with dimensions of 2,960 x 1,720 mm and a panel thickness of 2 mm. The number of different components is immense. The set-up proportion is correspondingly high. The tools are sometimes changed several times a day. According to Peters, the company takes this into account in its workflow concept: “We have divided the operation into different sections, and in each section the tools are located directly next to the machines. This ensures short distances and fast set-up times for us.”

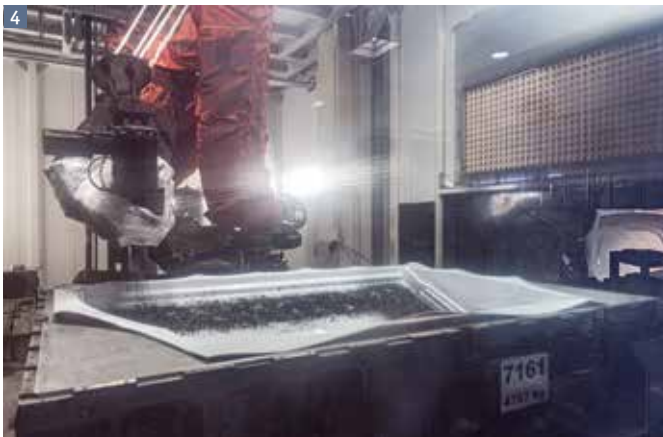
A Geiss machine produces excavator side panels for Liebherr.

The CMS1 produces interior reinforcements in ABS for a double-shell B-pillar of a caravan on a 6-cavity mould.

Well-equipped for high loads

Speaking of sections: In the thermoforming area, the pretty facades of the components are created. But that's not the end of the story. The surface is only the first step. If this has to withstand high mechanical stresses in its later life as a caravan front, side panelling, engine bonnet or comparable components, it moves on to the PU Long Fibre Injection (LFI) area. Four large double-shuttle systems and two smaller systems with stationary mould carriers, all from KraussMaffei, are in continuous operation. The green Fendt wing, for example, is a candidate for LFI technology. Two workers place the huge mudguard in the bottom mould, which has been extended out of the machine on the right. The upper tool tilts upwards by 90° and is thus parallel to the lower tool, which moves with the inserted wing surface to the left into the injection station of the machine. Here, the glass fibre enters a cutting unit as a continuous fibre and is cut to length there. Directly behind the cutting unit, the fibres are combined with the PU mixture from the mixing head. The glass





1 An employee flames and cleans the caravan bonnet cover to prepare it for long-fibre injection.

2 Two workers insert the cover into the mould of one of the four LFI double shuttle units.

3 The mould then tilts 90° and moves into the machine.

4 A robot inserts the PU glass fibre mixture into the underside of the bonnet cover. The upper mould then moves into the lower mould, the mould halves close, and the mixture reacts out.

5 A vacuum gripper removes the component from the mould. This eliminates the need for manual removal of the now much heavier components.

6 The cut glass fibres are clearly visible in the PU-glass fibre mixture.

fibre content is about 20 % by weight in relation to the PU content. The shot weight for the 1,870 x 670 mm wing is about 10 kg.

A robot fills the inside of the tractor's deep-drawn mudguard in the bottom tool with the GF-PU mixture. The lower tool then moves into the upper tool, the system closes, and the GF-PU mixture reacts out. Schmid explains: "The reaction time varies depending on the component. On average, the entire process, including fibre-PU mixture insertion, takes about 10 to 12 minutes. While one thermoformed component is being inserted, the workers are already placing the next component in the second shuttle, which is filled while the first one reacts. This allows us to shorten cycle times significantly."

Before the thermoformed surfaces enter the mould, the workers pre-treat them: Compressed air cleaning and flame treatment are indispensable steps to ensure that the GF-PU mixture fuses reliably with the thermoformed shell. And here, too, the same principle applies as in the thermoforming segment, explains Peters: "All the moulds are right next to the machines, because quick mould changes are part of productivity. The employees often change the mould after 20 to 50 components, which has to be done quickly and is done in half an hour at the latest."

According to Peters, what is charming about the LFI technology is not only the impact resistance it gives the components, but also the possibilities for function integration: "We can screw directly into the LFI surface. That is ideal for the further assembly steps. But as with any technology, there is a downer with LFI – from a quantity of more than 10,000 large components, the process is no longer worthwhile in terms of costs."

Affordable lightweight construction

However, it is not always the high mechanical stress of the components that is the be-all and end-all. Often the weight also plays an important role. Peters makes it clear: "The topic of CO₂ footprint and lightweight construction does not spare our clientele. If we can achieve the required mechanical characteristic values with lighter components, the customers cheer." Particle foam technology has therefore moved into Neu-reichenau quite recently. Initially as a prototype plant, the series plant by Fill will



The mudguard of the enormous tractor in green for Fendt has dimensions of 1,870 x 670 mm.

follow as early as the middle of this year. This can be admired before it moves into Parat during a customer presentation on 26 June at the plant manufacturer.

Peters proudly describes the new "baby": "We were looking for a technology where we could use a mono-material composite so that the component is fully recyclable at the end of its life. We evaluated many particle foam technologies. It was clear it should be a vapour-free process. With our particle foam technology, we found the right

solution." Currently, foam beads made of PS, PP, MPPE, ABS or hybrid materials can be used. The prototype plant shows the process. The foam particles are pre-heated in an oven by means of IR radiation, where they already expand vigorously. The pre-expanded beads are then fed via a dosing system into the lower mould, where the thermoformed surface is located. The upper mould then closes and compresses the particle foam. Both the lower and upper moulds operate with dynamic temperature control using water. Spacers on the upper and lower



The concept of the temperature-controlled closed aluminium mould for particle foam technology was developed by Parat in-house and has also been patented.

moulds ensure that the two shells move precisely into each other. The temperature-controlled closed aluminium mould carries the necessary residual heat into the beads so that they expand a little further, stick together and fuse with the deep-drawn surface.

According to Peters, one of the main sticking points for the new process was the tool technology: “We asked a few toolmakers, but they didn’t want to take the matter on. So we developed the tool in-house and have since patented the concept.” The entire system and process technology for the new “baby” was developed jointly by Parat, the system manufacturer Fill and the dosing system specialist Teubert. Among other things, the shrinkage of the deep-drawn surface had to be matched to the entire foaming process. The result is impressive.

The side panel of a caravan hood has already been produced using the new process. The pearl-white surface is identical to its LFI counterparts. From behind, however, it looks quite different due to the EPS foam and: The particle foam side panel weighs 40% less than its LFI twin. “In addition, EPS has a very good carbon footprint during production, and it is easily recycled back to the monomer, making it easy to chemically recycle. I am sure that PS will be one of the major thermoplastic material cycles in the future. Because that’s where we need to go – to four or five large thermoplastic cycles so that we can actually manage the materials in a closed system. The larger these material cycles become, the more worthwhile it is to build up recycling capacities for them – and the more attractive the costs become for us processors,” Peters is convinced.

The bonnet is not only lighter, but also scores with very good insulation properties and high rigidity thanks to the foam. Function integration is also easy here. This is demonstrated by the inserts for subsequent assembly. “The bonnet of the future will probably consist of two particle foam side panels and an LFI cover. This will make the entire caravan lighter. We are preaching to the choir with this approach, because we are offering affordable lightweight construction,” says Schmid happily.

The employee uses a vacuum gripper to lift the component from the workpiece carrier of the CNC machining centre.



Frank Peters: “The topic of CO₂ footprint and lightweight construction does not stop at our customers. If we can achieve the required mechanical parameters with lighter components, we are preaching to the choir”.

The final steps

Whether it’s LFI, particle foam or a double-walled deep-drawn component, they all have one thing in common: they all go through CNC machining for completion. Twelve 5-axis CNC machining centres from Geiss or Moroff and Baierl take care of the clean edge trimming and the necessary drilling. So that the workers can easily handle the huge LFI components with weights of 10 to 30 kg, the CNC machining centres are equipped with vacuum grippers that lift the components, place them on the workpiece carriers and also remove them again and place them on the pallets provided.

CNC machining is followed by assembly. Here, gluing and screwing is carried out so that the final piece is created from several components. In the case of the caravan bonnet, for example, a robot automatically applies the glue to the edges of the top part of the bonnet in a fully air-conditioned chamber. The process is monitored by an IR camera to ensure that the glue seam is correctly positioned. Then the gluing table with the top part moves out of the chamber. The workers glue the two side parts manually and then screw them together. Schmid explains: “The main load in the hood construction is borne by the glued seam, not the screw connection. It only serves to fix and reinforce it.”

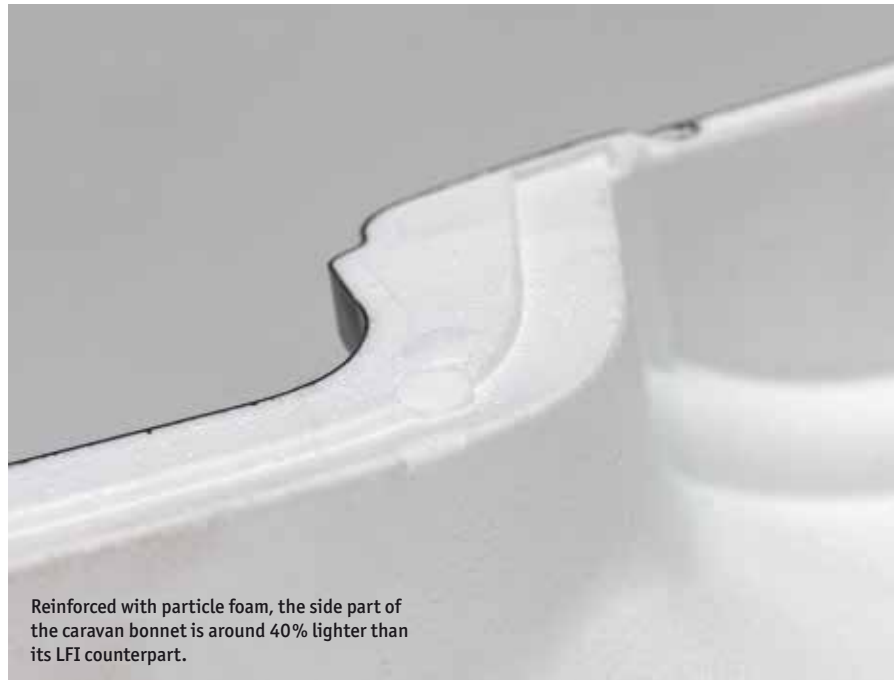
A few steps further on, two workers are assembling the necessary metal parts and telescopic rails on the roof of a road paver in order to install a slide-out as sun protection.

Looking to the future

But the status quo is not enough for Peters. The enterprising company leader already has his sights set on the next innovation. This will also involve foam: “In the middle or at the end of next year, we will introduce another technology based on the Mucell process. The focus here will be on quantities of more than 5,000 components per year.” Here, too, Parat will retain the principle of deep-drawn



The functionalisation of the particle foam components with inserts is possible without any problems.



Reinforced with particle foam, the side part of the caravan bonnet is around 40% lighter than its LFI counterpart.

surfaces. For this purpose, the thermoformed component is inserted into the mould of the injection moulding machine and subsequently backfoamed. Temperature-controlled aluminium moulds will be used for the injection moulding machines to accommodate the high-quality XXL surfaces from thermoforming. The thermoforming surface and foam will be made of thermoplastic materials. This makes it possible to produce components that have good mechanical

properties with low weight and are easy to recycle. Peters says: "We are introducing a competitive technology for larger quantities that allows us to keep up with SMC in terms of cost. This is where I see the future in tractor manufacturing. Thanks to the fully thermoplastic composite, we can use post-consumer materials in the future and realise high recycling rates. I am relatively sure that we are working on the world's first fully thermoplastic tractor bonnet with this process."

closed material cycles can be implemented in the long term. We are living in a new era of plastics technology, and we have to react to this. This can only be done with innovations, and these require investments. Sustainability is the new driver for innovation. We are very grateful that our investors are following this path, because Parat's DNA is still that of a family business," Peters is certain. ■

www.parat-kunststoff.com

Tobias Schmid: "The thermoformed surfaces always have to match the OEM's corporate colour exactly. This often requires several iteration loops between the semi-finished product supplier, OEM and us."

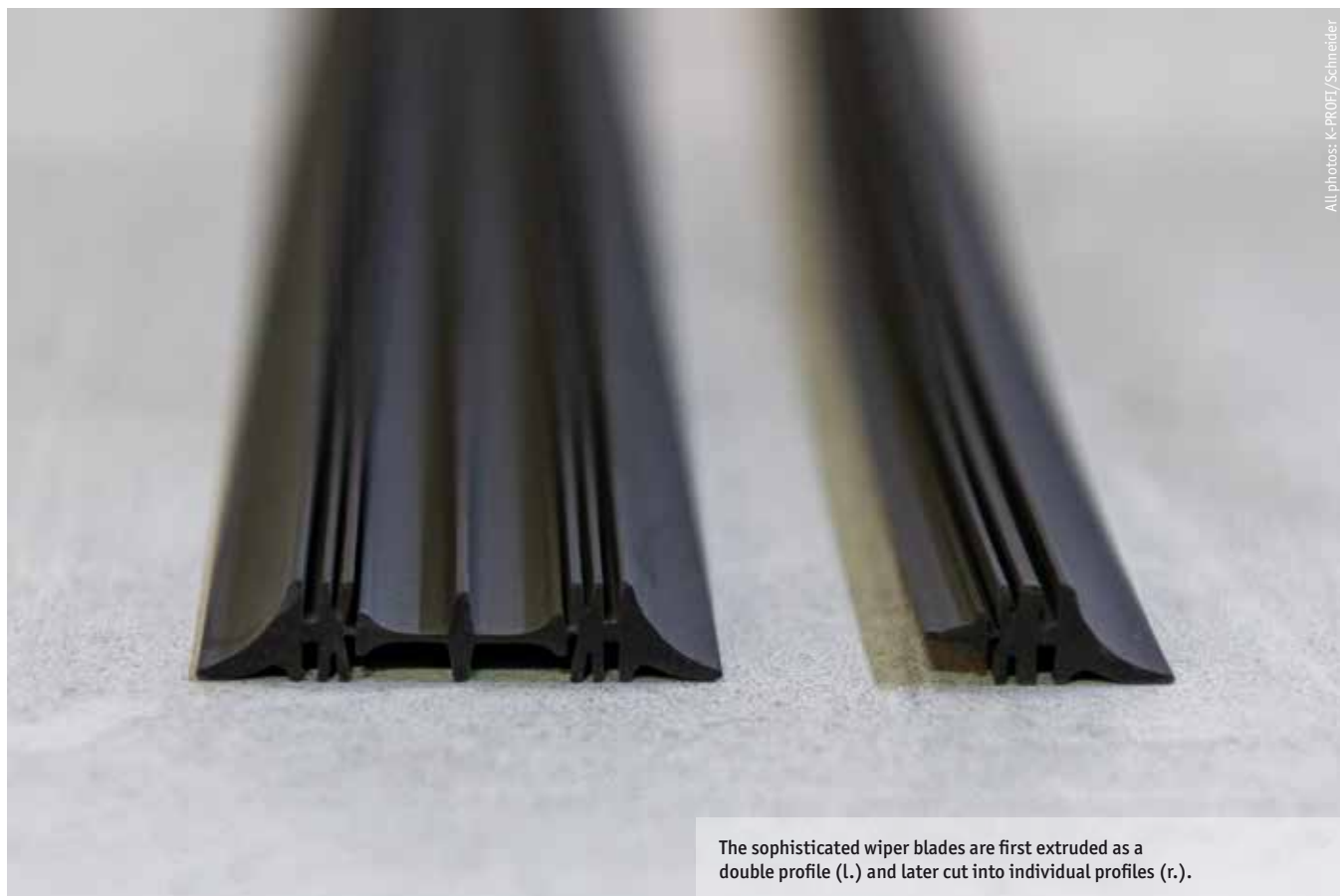


The specialist for large components with very high-quality surfaces achieved a turnover of EUR 120 million in 2022 with its 1,000 employees. Around half of the workforce works at the headquarters in Neu-reichenau, while the rest is spread across the company's other locations with 230 employees in Hungary, 220 in Romania and 70 in China. Peters attaches great importance to promoting young talent: "We always have between 40 and 45 trainees here in Neu-reichenau. As a company, we have to invest in the skilled workers of the future if we want to ensure the quality of our products in the long term and develop further with new technologies."

The company does not shy away from investing in new technologies. The particle foam process and foam back injection are the best examples. "I am sure that only those technologies will have a future that have a good CO₂ footprint and where

Two employees assemble metal parts and telescopic rails on the roof of a road paver.





The sophisticated wiper blades are first extruded as a double profile (l.) and later cut into individual profiles (r.).



Michaela Hauptlorenz is responsible for all engineering in rubber processing at Valeo Wischersysteme.

Milan Wlömer (KMA Umwelttechnik):
 “With our modular systems, we take the respective process and exhaust air into account.”



Electrostatic precipitator instead of afterburning

How Valeo Wischersysteme clean their vulcanisation exhaust air in an energy-saving way

Often, post-combustion is used to clean exhaust air such as that produced during rubber extrusion with subsequent heat treatment. Due to the high temperatures required, this is associated with a high energy consumption and CO₂ footprint. Valeo Wischersysteme GmbH in Bietigheim-Bissingen has therefore taken a new approach with an electrostatic precipitator system.

Text: Dipl.-Chem. Toralf Gabler, Editor K-PROFI

The French automotive supplier Valeo, which with annual sales of 17 billion euros is one of the top 10 in the world, has 16 production and development sites with 8,800 employees in Germany alone. German customers, which mainly include the major OEMs, account for about 30 % of the group's worldwide turnover. Andreas vom Bruch, Director Communications Germany, sees two megatopics in which Valeo is on the move: “Firstly, electrification from the powertrain via e-motors to climate management, and secondly, autonomous driving with corresponding sensor technology and driving assistance systems.”

Around 850 employees work at the Bietigheim-Bissingen site. In addition to front-end modules for the climate management of vehicles, complete wiper and washer systems for the front and rear areas are produced here. The wiper blades for these systems are produced in-house by Valeo Wischersysteme GmbH because the rubber parts, which are inconspicuous at first glance, have their work cut out for them. Under high contact pressure on the curved windscreen, they have to withstand more than half a million wiping cycles - corresponding to a distance of up to 900 km - as far as possible

without wear. The dirt mixture on the windscreen and various cleaning agents require both high mechanical and chemical resistance. And when the wiper starts to move backwards after each wiping cycle, the wiping edge of the profile tilts over a tilting bar, which is an enormous dynamic load for the elastic material. All this places special demands on design, compound development and production.

Extrusion has replaced injection moulding

Because of the required accuracy, injection moulding was considered the manufacturing process of choice for a long time. “Until the end of 2022, we also still had injection moulding production here,” reports Michaela Hauptlorenz, responsible for all engineering in rubber processing at Valeo Wischersysteme. Today, the profiles are produced here exclusively on two extrusion lines, which is more effective, but also places very special demands on the rubber compounds as well as the precision during production.

Since a wiper blade often consists of two different rubber compounds, the profile is produced in a coextrusion process. It is also extruded as a double profile with a centre strip. After vulcanisation in a salt bath, the profile strand goes inline for surface treatment, e.g. plasma/painting. The profiles are punched to the appropriate length of a wiper blade. The double profile is then cut lengthwise into two individual profiles with the centre strip removed. “Achieving the required precision with an elastic material is anything but trivial,” emphasises Michaela Hauptlorenz. The special know-how for this was developed in Bietigheim-Bissingen and the machines were built in-house.



The individual modules for exhaust air purification are arranged one above the other and thus require little floor space.

Hauptlorenz knows. A common method for cleaning this exhaust air is thermal post-combustion with operating temperatures $\geq 750^\circ\text{C}$. The method is established, reliable and low-maintenance; depending on the load of the exhaust air, the gas consumption and CO_2 emissions are correspondingly high. The mechanical engineering company from Halle, which had been working with KMA for a long time and had already realised several projects, therefore suggested an electrostatic precipitator system that would enable a reduction in CO_2 emissions and operating costs compared to afterburning.

Significant savings potential

Based on various parameters, exemplary operating cost comparisons as well as the level of CO_2 emissions can be calculated, which reveal clear savings potentials. "With an exemplary exhaust air volume of $5,000\text{ m}^3/\text{h}$, an afterburning system causes 525 tonnes of CO_2 emissions per year, while the electrostatic precipitator system causes only 12 tonnes. At current gas prices and the current CO_2 tax, operating costs of 4,800 euros with the KMA technology are thus compared to around 250,000 euros with the afterburning system - that is a saving of 98 %. Even a regenerative afterburning system (RTO) requires ten times as much energy as our environmental technology," says Friederike Schmedding from KMA Business Development, highlighting the significant difference.

For quality assurance, the geometry and surface of the profile strand are continuously monitored by control systems at several production stages - e.g. after vulcanisation and surface treatment. "This information is collated, and the sections detected as defective are automatically sorted out at the very end at the punching machine," explains Michaela Hauptlorenz.

Alternative exhaust air purification for new extrusion line

The engineering manager is particularly sought after when it comes to investing in new technology. When a new extrusion line was planned in 2019, the contract was awarded to the mechanical engineering company Rubicon from Halle/Saale, which installed

the salt bath vulcanisation in addition to the extrusion technology. "The 30-metre vulcanisation line is equipped with a salt recycling system. This filters the salt from the washing cascade and returns it directly to the salt bath in a closed circuit," Michaela Hauptlorenz explains the resource-saving process. "In addition, the gas heating is equipped with an indirect ceramic burner system, which results in lower emissions."

Rubicon also recommended an alternative exhaust air purification technology from KMA Umwelttechnik in Königswinter. "In the vulcanisation tunnel, a gaseous mixture of, for example, decomposition products from the vulcanisation process and plasticiser vapours is produced at temperatures between 180 and 220°C ," Michaela

For many companies, she says, it is an additional incentive that KMA filters are generally covered by the federal subsidy for energy and resource efficiency in industry (Module 4). "The conditions and the application process have just been improved once again," Schmedding emphasises. "Companies are allowed to start implementing the measure immediately after submitting the application at their own financial risk." This often avoids months of waiting. "The funding cap for SMEs has been raised to 900 euros per tonne of CO_2 saved. SMEs thus benefit from funding of up to 40 % of the investment costs. The funding possibilities of a specific project and the requirements of the funding provider are determined together at an early stage. It is also important to consider the payback period of the entire project."

Ready to try something new

“We didn't know this technology until then. But since KMA had a good reputation in the industry and we trusted Rubicon's know-how, we were willing to try something new,” Michaela Hauptlorenz recalls. The good cooperation with Rubicon and KMA made it easy to get there. “The process was very satisfactory for us. We didn't have to delve deeply into the topic first, but defined our requirements, according to which the concept was designed and implemented,” sums up the technology manager.

“Whereas in the past we often realised project-related, customised solutions, today we mainly offer modular systems that take into account the respective process and exhaust air,” explains Milan Wlömer from R&D at KMA. “This means we are much faster in project planning, and with the existing modular system we can meet a wide variety of requirements.” Therefore, the plant manufacturer is on the move with its energy-saving exhaust air purification systems in various segments from the textile to the food industry to metal processing. But numerous systems are already in operation in the plastics and rubber industries as well. Customers include rubber processors such as Kraiburg, M+S Silicon or Saargummi, but also film extrusion at Mondi or compounding at Ems-Chemie.

Precise adaptation through modular design

The filter system installed at Valeo contains a double-stage air-water heat exchanger, an electrostatic precipitator, a UV light module and a catalytic carbon filter. A fan at the outlet of the system draws the exhaust air through all these modules. The flow-optimised design of the electrostatic precipitator, which allows the air to pass almost unhindered, contributes to the energy efficiency of the KMA technology. The exhaust air extracted from the vulcanisation tunnel as well as the burner arrives at a temperature of 140 to 170 °C. The air is cooled down in the first step. To cool it down, hall air is added in the first step. It is then cooled further in the heat exchanger to about 60 °C. “At this temperature, the electrostatic precipitator has a very good efficiency in relation to the cooling used,” Milan Wlömer knows. “Many gaseous residues in the exhaust air then condense into an aerosol, which enables their separation.”

Heat exchanger recovers energy

When the air is cooled, the heat exchanger heats water flowing through it from about 20 to about 60 °C. “By using this recovered energy, owners of our systems can achieve additional savings,” emphasises Friederike Schmedding, “because this comes in addition to the energy balance.” Milan Wlömer knows of numerous implemented possibilities, from complete hall or office heating systems to recycling this energy into technical processes. “If higher temperatures are required for further use, other media can be used instead of water. With glycol, for example, up to 150 °C is possible.”

“In view of energy prices, such uses to increase energy efficiency are currently very much in demand, but they must always be well thought out and take into account the mutual dependencies of processes,” Wlömer makes clear. “On the one hand, the energy must

always be available or available exactly when it is needed. Some users solve this by using a buffer tank with the heated medium. On the other hand, an alternative must be available when the energy is not needed, such as for heating a building in the summer. In the meantime, we can contribute extensive experience from numerous projects.”

At Valeo Wischersysteme, the water is currently simply cooled by an air cooler, because before it is actually used, the new exhaust air system should first prove its suitability in everyday work. “After more than a year of operation, we are confident of its suitability and are therefore working on a concept to use the waste heat to preheat the supply air for the paint shops in the future,” reports Michaela Hauptlorenz. “That would be a very good fit, because the supply and return temperatures of the cooling circuit of the heat exchanger on the exhaust air system have the same temperature level as the supply and return of the supply air heater,” adds Milan Wlömer.

Electrostatic filter and UV light ensure clean air

After the heat exchanger, the exhaust air flows through an electrostatic precipitator – the heart of the system. In electric fields generated by high voltage, the particles contained in the air first receive an electric charge at profile ionisers. The charged particles are then forced against the earthed collector plates and held in place. According to KMA, the separation efficiency is at least 95 %. Liquid components drip off and collect in a bottom trough, while sticky and viscous substances initially remain on the plates.



Michaela Hauptlorenz (Valeo) and Milan Wlömer (KMA Umwelttechnik) in front of the exhaust air purification system.



The exhaust air is extracted at several points above the salt bath vulcanisation system.

Every hour, 4,780 m³ of exhaust air flows through the electrostatic filter module of the Ultravent M series, which is designed for a throughput of 5,000 m³/h. "For higher throughputs of up to 20,000 m³/h, several modules are simply arranged in parallel," Milan Wlömer explains. "There are also technical solutions for smaller and even higher flow rates."

Subsequently, further volatile components are rendered harmless in the downstream UV light module. For this purpose, UV radiation with a wavelength of 185 nm generates highly reactive ozone, and UV light with a wavelength of 254 nm directly attacks long-chain hydrocarbons. A subsequent activated carbon filter breaks down excess ozone before the now clean air is led outdoors via the hall roof. The modules are arranged one above the other, so that the area required by the system, which is several metres high, is relatively small.

Automatic filter cleaning simplifies maintenance

"We definitely had reservations about replacing a proven technology with one that was new to us," admits Michaela Hauptlorenz. "The afterburning system is very robust and only needs maintenance once a year. With the electrostatic precipitator, we didn't know how heavy the workload would be for the maintenance staff on the line." Despite training, they would also have had to first gain their experience of how to interpret certain process parameters of the new plant in each case. "But," concludes the technical manager, "it works well." She sees a great relief in the automatic cleaning. This is another reason why the technology has been well accepted by the staff.

Milan Wlömer knows the reservations about conventional electrostatic filters. "Maintenance is often time-consuming because they have to be cleaned frequently and removed in the process." To get around this, KMA has developed an automatic cleaning system. For

this purpose, the system is flushed with warm water and a cleaning agent when the air supply and exhaust are closed. "Nothing has to be removed, everything runs automatically at a programmed time," Wlömer points out. The wash water can be used several times, depending on the degree of soiling. At Valeo Wischersysteme, it is used for two rinsing processes and then collected in an IBC container next to the system. A service provider takes care of the disposal of the water, which contains the substances filtered from the exhaust air. "This is completely uncomplicated for us," says Michaela Hauptlorenz. "We have an established disposal system here, to which a relatively small amount is now added."

Since the filter system cannot be in operation during cleaning, this is carried out once a week during the obligatory maintenance shift of the entire extrusion line. So there is no additional production downtime as a result. "In the case of production lines that must run continuously, it is possible to switch to a second filter system as an alternative, if one is available," Milan Wlömer explains. It is also possible to discharge the exhaust air unfiltered via a bypass during cleaning. "Of course, only if this is allowed or if an approved malfunction mode is permitted," the expert emphasises.

Goal: carbon neutrality by 2050

Following the overall positive experience, Bietigheim-Bissingen is now looking into converting the second extrusion line from post-combustion to an electrostatic precipitator system as well. "So far we are working out the basics. In the process, we are also planning to use the recovered energy at the same time," reports Michaela Hauptlorenz. In addition, another system is already in operation at a Valeo plant in Mexico.

"All this fits in well with our Group strategy, according to which we want to have implemented carbon neutrality by 2050," Andreas vom Bruch affirms. Already by 2030, CO₂ emissions are to be reduced by 45 % compared to 2019 across the entire value chain. Ten years ago, Valeo started with sustainability goals on its own initiative, but in the meantime, this is increasingly demanded by customers, says the Valeo Germany spokesperson.

For this reason, the Bietigheim-Bissingen site is also active in many areas. For example, production and administration are being converted to LED lights. The expansion of photovoltaics on two production buildings is planned, as well as the use of heat pumps instead of pure cooling systems. In addition, harmonic voltage recovery is planned, whereby unused electricity voltage peaks are stored and used when needed. This should reduce electricity consumption by about 10 %. 

www.valeo.de
www.kma-filter.de
www.rubicon-halle.de



Valeo operates two extrusion lines to produce the sophisticated wiper blades for the wiper systems.

Photo: Valeo



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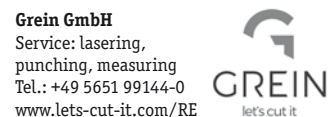
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Note

The supplier 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.

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PIEMA

Output of transparent plastic continues to increase / Most capacities located in Asia / Key applications include optoelectronics, civil engineering and automotive / New production processes are more economical

Polymerized methacrylate (PMMA) is produced by the radical polymerization of methyl methacrylate (MMA). It is a transparent, rigid, acrylonitrile thermoplastic that is resistant to dilute acids and alkalis, oils and gasoline, but not to aromatic and chlorinated hydrocarbons. PMMA is highly transparent, UV-stable and readily thermoformable. It has good weathering properties and can be joined by welding or bonding.

Global capacities for the MMA feedstock, according to PIEMA's regular capacity database (www.piegate.com), come to about 400 ktpa. More than half of the MMA produced is actually polymerized into PMMA (thermoplastics), any attempt to break down the complete market and quantify volumes for specific types and processing methods is very difficult. The MMA not used for PMMA also serves as a copolymer for other plastics, but a large proportion of it goes into non-plastic applications such as paints, surface coatings and adhesives.

"Pentagel" – a brand line introduced by **Bilux** (see **News**) – is one of the new acrylic brands among consumers, alongside "Beyonair", "Beyonair" and "Beyonair" (other brand names for PMMA include "Beyonair", "Acryon", "Acryon", "Mylar", "Beyonair", "Covacryl", "Covacryl", "Larid", "Larid" and "Temper"). The most popular PMMA products are characterized by negative molding of the surface, the casting of clear and semi-transparent products, and extrusion. Here, too, it is very difficult to gain a clear picture of the market.

According to the **Statistik** in **Statistik**, total global PMMA capacity in 2020: One of the main drivers was rising demand for LED modules. Many more of these goods are manufactured in south-east Asia. It is no wonder that 85% of global capacity is located there, spread across 21 sites. The base European production sites account for just over 17% of total global output, and the only PMMA facility in North America ranks up the remaining 1.6%.

Fluctuations in demand and unpredictable production at a number of plants have increased uncertainties in the last two decades, above all in Europe and North America. In return, many new sites have been built in Asia, where older plants have also been expanded, although this has resulted in a 6.2% per year price increase.

Plastics: Global Production Capacities 2020, by product: About 1.5 bn tpa

Product	Capacity (Gt/yr)
Other	19%
PE	33%
PP	17%
PVC	11%
PS	10%
ABS	5%
PMMA	1%
PC	1%
PA	1%
PBT	1%
PET	1%
PETG	1%
PETI	1%
PETD	1%
PETB	1%
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General AI euphoria

Why we must not get in our own way



Dr.-Ing. Arno Rogalla is an internationally active interim manager and management consultant in the plastics processing industry: redaktion@k-profi.de

ChatGPT is a must in almost every small talk group. The exponential development (1 million users after five days of free accessibility through Open AI in November; 100 million users already in January) and also the gigantic sum of 10 billion USD (for comparison: the entire budget of the BMBF for 2023 is 21.5 billion EUR), with which Microsoft, for example, is participating in further development, show what potential is seen in this generative chatbot alone. With targeted questions and in the form of a dialogue, the algorithm generates texts that are no longer different from “human-made” ones. The publication of ChatGPT achieved more popularity for AI than all the discussions about applications of AI in all walks of life have managed so far.

In educational establishments, both schools and further education institutions, the development is viewed with scepticism. They forbid its use for homework and assignments at universities. But how does a teacher expect to find out about the “assistance”? Especially with repetitive tasks, ChatGPT delivers very good results. Test reports can be found in the media that make today’s active journalists fear that their work will no longer be in demand in the future. The system has limitations, of course, but these should be seen as teething troubles. For example, it is absolutely necessary to critically check

and correct the “elaborations” of ChatGPT. But if one takes the texts as a starting point for one’s work, one can speak of a clear benefit.

In our industry, ChatGPT can certainly speed up work processes, e.g. in marketing, because “concepts” are generated in a very short time and are based on many billions of data. So, the solution will already fit quite well. The actual work shifts from the dull generation of texts to reviewing and correcting. Certainly, user manuals for a wide variety of products, for example, can be created very quickly in this way. Companies like the start-up you.com, which primarily markets a search engine based on AI and is thus building a modern competitor to Google, are working on topics such as the automatic generation of images from simple descriptions. By the way, the founder is German, and the company is based in the USA.

However, it is precisely our cherished regulations on compliance and DSGVO (Data Protection Regulation) that will significantly slow down the widespread use of chatbots, especially in corporations. Perhaps that’s a good thing, because AI must also abide by rules that preclude racism and discrimination as well as an AI “life of its own”. Quality standards must be adhered to. On the other hand, the idea just now pursued by Microsoft of generating a ready-made protocol from a Teams meeting would be quite charming. In today’s world, the voice and image recording of a video session alone is fraught with data privacy hurdles.

We can be sure that ChatGPT will be refined and change our future lives. In the USA and also in China, corporations and the state are pumping incredible sums of money into the development of AI, and there is already talk of the “fifth industrial revolution” through AI. We can only hope that this inevitable development does not pass Germany by. The possibilities are huge, and we are only at the beginning. ■

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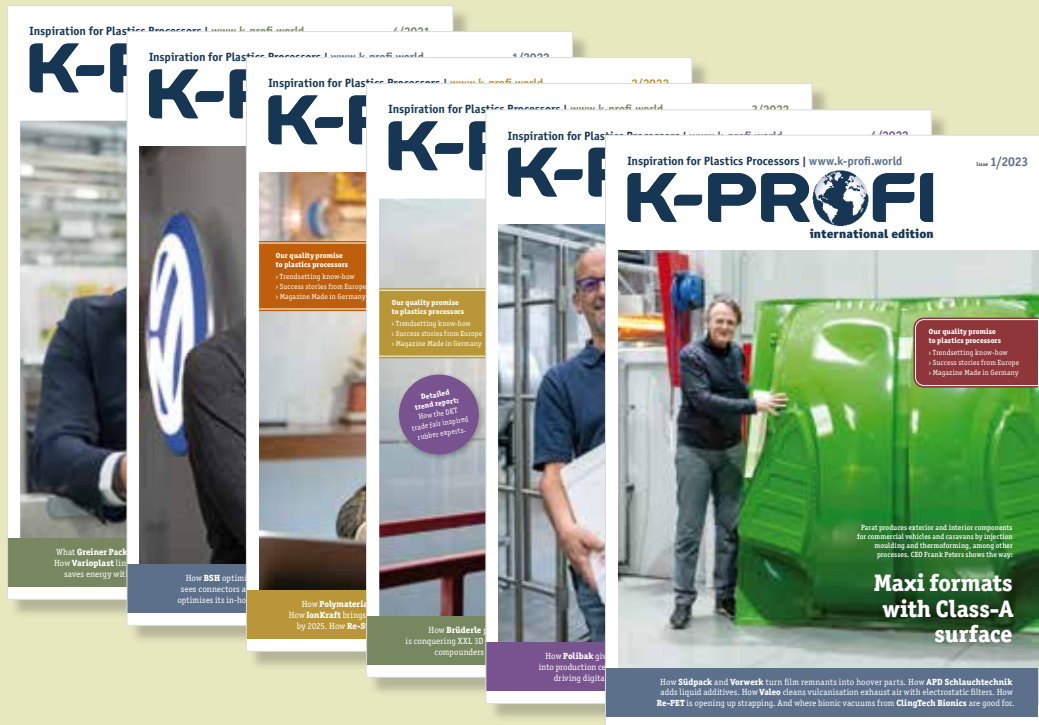
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