

K-PROFI

international edition



Our quality promise to plastics processors

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

The world's leading trade fair has expanded its market leadership. Despite the positive mood, it became clear that the plastics industry in Europe is facing difficult times.

Much remains to be done after K 2025

How **Qin-Form** brings 3D inserts with optical effects to vehicle interiors. How **ttp Papenburg** is renewing the powder and granulate supply for its extruders. How **Melitek** is growing with PVC-free medical compounds. And how **Unilin Flooring** calendars PVC floor coverings with high efficiency.

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With creativity and courage, technology and process mastery

Dear reader,

Our latest practical insights show how plastics processors can achieve success through creativity and courage, technology, process control and the use of recycled materials. For example, ttp Papenburg 2024 has moved to a greenfield site with 23 extrusion lines and packaging facilities. The profile extruder has also revamped its material management system with new operating technology – synchronised supply of powder and granulate, energy-efficient, flexible and prepared for greater use of recycled materials: Page 6.

Qin-Form in Herford has perfected the thermoforming of thin-film sheets into visually appealing 3D inserts, which are back-moulded to become decorative parts for doors, dashboards or shelves in cars and trucks – with prism effects, backlit or in a chrome look: Page 12. Krupanek in Untermeitingen specialises in the injection moulding of niche products, such as packaging for gold bars. As a 'plastics manufacturer with touchpoints in all industries', the family-owned company even recommends itself for the start-up scene: Page 20. Melitek in Alslev, Denmark, has doubled its sales of PVC- and phthalate-free thermoplastic elastomers – also for food, medical and pharmaceutical products – in five years: Page 27. Unilin Flooring manufactures around 15 million m² of durable floor coverings annually in Avelgem, Belgium. A two-stage planetary roller extruder feeds a three-roller calender with a capacity of 10 t/h for the production of glass fibre-reinforced PVC sheets for adhesive installation: Page 30.

In October, the world's leading trade fair 'K 2025' took place in Düsseldorf – with a highly international offering, stable visitor numbers and growing interest from abroad. 'Trade fair atmosphere topped



economic situation' is the headline of our short follow-up report on page 34. You can find figures and data on the trade fair on page 35 and an initial assessment of the challenges facing European market participants on page 36.

On behalf of the team at K-PROFI and KI·PIE Group, I would like to thank you for your loyalty and wish you a relaxing winter season.

Markus Lüling

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Cover photo: K-PROFI/Manuel Hauptmannl



Five 5-axis CNC portal machines, most of them with two tables, ensure that the sensitive components are trimmed at the edges at Qin-Form (see article on page 12).

Trade Fair Calendar

Trade fairs related to plastics processing in 2026

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

Plastex 2026	Cairo, Egypt	11.01. – 14.01.2026	www.plastexegypt.com
Swiss Plastics Expo	Lucerne, Switzerland	20.01. – 22.01.2026	www.swissplastics-expo.ch
Warsaw Plast Expo	Warsaw, Poland	03.02. – 05.02.2026	www.warsawplastexpo.com
Plastindia	New Delhi, India	05.02. – 10.02.2026	www.plastindia.org
KPA	Ulm, Germany	25.02. – 26.02.2026	www.kpa-messe.de
Intl. IKV Colloquium	Aachen, Germany	04.03. – 05.03.2026	www.ikv-kolloquium.de
MECSPE	Bologna, Italy	04.03. – 06.03.2026	www.mecspe.com
JEC World	Paris, France	10.03. – 12.03.2026	www.jec-world.events
Circular Valley Convention	Dusseldorf, Germany	11.03. – 12.03.2026	www.cvc-duesseldorf.com
PTXPO	Rosemont IL/USA	17.03. – 19.03.2026	www.plasticstechnologyexpo.com
Central Asia Plast World	Almaty, Kazakhstan	17.03. – 19.03.2026	www.plastworld.kz
Plastpackprint Nigeria	Lagos, Nigeria	24.03. – 26.03.2026	www.ppp-nigeria.com
RePlast Eurasia	Istanbul, Turkey	26.03. – 28.03.2026	www.replasteurasia.com
Plast Alger	Algier, Algeria	30.03. – 01.04.2026	www.plastalger.com
Plastics & Rubber Vietnam	Ho Chi Minh City, Vietnam	31.03. – 02.04.2026	www.plasticsvietnam.com
Wire, Tube	Dusseldorf, Germany	13.04. – 17.04.2026	www.wire.de ; www.tube.de
Utech Europe	Maastricht, The Netherlands	20.04. – 22.04.2026	www.utecheurope.eu
Hannover Messe	Hanover, Germany	20.04. – 24.04.2026	www.hannovermesse.com
Chinaplas	Shanghai, China	21.04. – 24.04.2026	www.chinaplasonline.com
Plasttechnik Nordic	Malmö, Sweden	22.04. – 23.04.2026	www.plasttechniknordic.com
MedTec live/T4M	Stuttgart, Germany	05.05. – 07.05.2026	www.medteclive.com
Plastics Recycling Show Europe	Amsterdam, The Netherlands	05.05. – 06.05.2026	www.prseventeurope.com
Recycling and Compounding Expo	Mumbai, India	06.05. – 08.05.2026	www.raceexpos.com
Interpack	Dusseldorf, Germany	07.05. – 13.05.2026	www.interpack.com
Plastics & Rubber Thailand	Bangkok, Thailand	13.05. – 16.05.2026	www.plasticsrubberthailand.com
Plastpol	Kielce, Poland	19.05. – 22.05.2026	www.targikielce.pl/en/plastpol
Interplas	Birmingham, UK	02.06. – 04.06.2026	www.interplasuk.com
FIP 2026	Lyon, France	02.06. – 05.06.2026	www.f-i-p.com
Equiplast	Barcelona, Spain	02.06. – 05.06.2026	www.equiplast.com
HanoiPlas	Hanoi, Vietnam	03.06. – 06.06.2026	www.chanchao.com.tw/hanoiplas
KPA, Kuteno	Bad Salzungen, Germany	09.06. – 11.06.2026	www.kpa-messe.de ; www.kuteno.de
Plast	Milan, Italy	09.06. – 12.06.2026	www.plastonline.org
Plastics Recycling Show Asia	Singapore	17.06. – 18.06.2026	www.prseventasia.com
Expo Plast Peru	Lima, Peru	19.08. – 21.08.2026	www.expoplastperu.com
Vietnamplas	Ho Chi Minh City, Vietnam	09.09. – 12.09.2026	www.chanchao.com.tw/vietnamplas
Taipei Plas	Taipei, Taiwan	15.09. – 19.09.2026	www.taipeiplas.com.tw
ColombiaPlast	Bogota, Colombia	21.09. – 25.09.2026	www.colombiaplast.org
Compounding World Expo	Frankfurt, Germany	23.09. – 24.09.2026	eu.compoundingworldexpo.com
Fakuma	Friedrichshafen, Germany	12.10. – 16.10.2026	www.fakuma-messe.de
IPF Japan	Chiba, Japan	01.12. – 05.12.2026	www.ipfjapan.jp

Synchronous supply of powder and granulate

How profile extruder ttp Papenburg has made its material management more efficient

Profile manufacturer ttp Papenburg GmbH moved into a new greenfield site in April 2024. Covering an area of 14,000 m², the subsidiary of Salamander Industrie-Produkte operates 23 extrusion lines, an assembly facility and its own tool shop. While most of the extruders were moved from the traditional location in Papenburg harbour to the outskirts of the city, the building and operating technology and most of the peripheral technology are brand new – energy-efficient, flexible and prepared for the consistent use of recycled material.

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

Today's ttp Papenburg GmbH started in 1958 as a newly established division of the wood processing company W. Brüggmann & Sohn, which was founded in 1848. Initially established as Brüggmann Frisoplast for the manufacture of plastic profiles, the extruder was later renamed Brüggmann Fenster-Systeme and taken over in 2002 by Salamander Industrie-Produkte in Türkheim in Unterallgäu, a manufacturer of plastic window and door systems. The company, which had been known as Salamander Technische Kunststoffprofile in the meantime, ultimately became ttp Papenburg.

With 130 employees, ttp manufactures a wide range of different profile geometries from a variety of plastics on 23 mono and co-extrusion lines with single and twin-screw extruders up to 80 mm in diameter, as well as a wide range of downstream equipment. Additional mobile side extruders open up options for profiles made from more than two components. ttp refines its products by applying adhesive tapes, milling, punching or drilling, as well as through individual packaging concepts. In 2023, before the move, ttp processed 4,500 tonnes of plastic into around 27,000 km of profiles; in 2024, the year of the move, the figure was 21,000 km with 3,500 tonnes of material used.

Wide range of plastic profiles

ttp produces customised plastic profiles for the construction industry, but also for shopfitting, the caravan, wind power and sanitary sectors, among others. In terms of user markets, ttp is "in a state of constant change", as Daniel Wildermann, head of field sales, describes: "We are still the European market leader in price labelling profiles as mounting rails for electronic price labels on shelves for shopfitting."

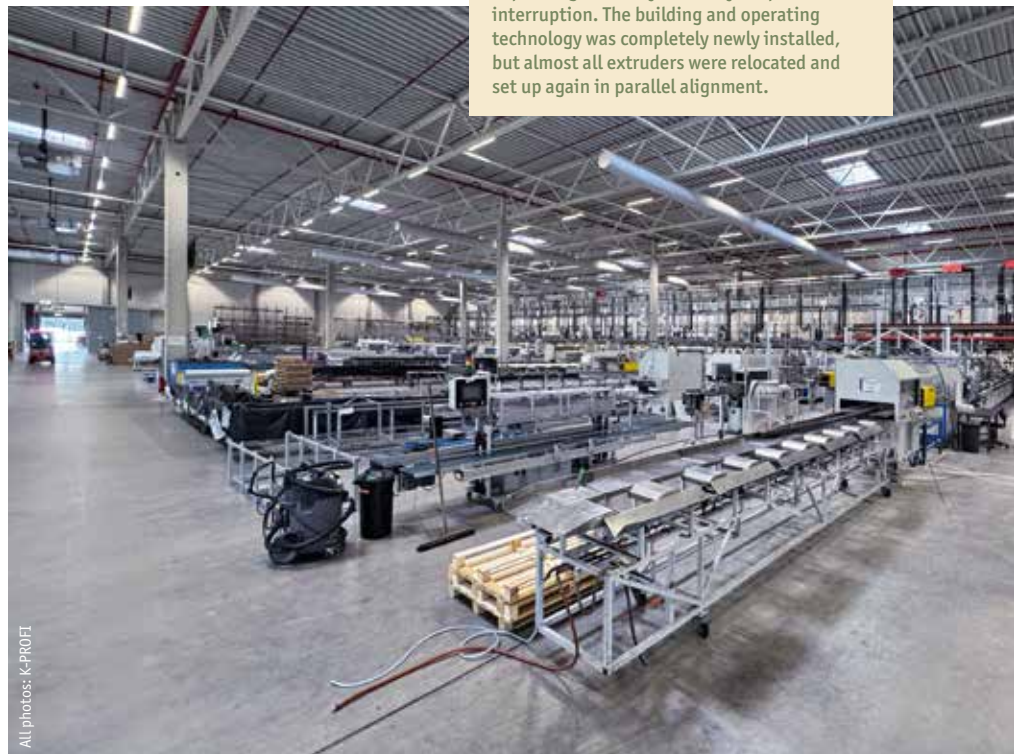
The portfolio also includes hollow chamber profiles, U-profiles, ceiling edge strips, wall connection profiles and flat strips for shell construction, drywall construction, interior construction or installation, sealing profiles for windows and doors, window accessory profiles or decorative profiles made of foamed hard PVC, sanitary profiles as seals for showers and bathrooms, impact protection and plinth strips for furniture, light covers, cash register dividers as advertising media, greenhouse profiles for hydroponic systems with inline punching and cutting, and plastic profiles for vehicles and motorhomes. Having grown up in the shadow of the world-famous Meyer shipyard, shipbuilding is also a market for ttp: "Ceiling edge

strips for cruise ships," says Daniel Wildermann. In addition to the main materials of hard PVC, semi-hard PVC and soft PVC, ABS, PS, PP, PE, PC, PET-G, PMMA and EVA as well as various thermoplastic elastomers are also processed as sealing materials.

Decking and profiles made from rice husk PVC compound

In Salamander's "Decking, Fence & Facade" division, the Papenburg-based company extrudes outdoor profile systems such as decking and floorboards as well as façade cladding made from "Resysta", a compound of

In April 2024, ttp moved to a new plant within Papenburg with only a few days of production interruption. The building and operating technology was completely newly installed, but almost all extruders were relocated and set up again in parallel alignment.



All photos: K-PROFI

rice husks and PVC. “These products look and feel like tropical wood, but unlike WPC decking, they are completely wood-free,” explains Daniel Wildermann.

To improve the colour impression and feel, ttp grinds the surfaces of the profiles and decking boards that are visible to the customer by a few tenths of a millimetre in surface grinding machines. The resulting sanding dust is extracted, knocked down, collected and reused in suitable profiles. “The dark grey core in the decking is recycled material, the brown outer layers are virgin material,” explains Daniel Wildermann, pointing to a stack of decking.

ttp now also manufactures an anthracite-coloured Resysta product line that consists of 100 % recycled grinding dust. As a manufacturer of high-quality goods, ttp takes back offcuts from installation from its market partners, granulates them and reuses the ground material in its products. “A real benefit in sales too,” reports Daniel Wildermann.

Lamination in various grades

Many profiles for use in visible areas are laminated with coloured or printed films. Lamination with thin paper films or higher-quality composite films, as used for furniture fronts, or weather-resistant and scratch-resistant films, as used for windows, is carried out at ttp’s sister plant in Włocławek, Poland. ttp in Papenburg assembles elaborately laminated PVC profiles into high-quality privacy screens and garden fences in standard and customised sizes.

New plant concept for the “greenfield site”

Planning for the new plant had already begun at ttp at the end of 2020. The material supply was completely rethought. Those responsible wanted a synchronous conveyor system that was as closed, automatic and reproducible as possible, covering the supply of granulate and regrind as well as powder.

“In 2021, we delivered a small system to the old plant and made various optimisations to three extruder lines,” recalls Thomas Ringheim, CEO of materials management supplier Labotek, thinking back to the initial contacts. “We have remained in contact ever since.” After initially discussing only the potential reduction in energy consumption in

a new plant, “we also talked more and more intensively about conveyor and dosing technology and about solutions to various process engineering tasks.” In the course of 2022, Labotek Deutschland finally received the order to supply and install the material management system, and construction began in February 2023.

In the new plant, all 23 lines produce in parallel towards the south. Accordingly, a supply platform runs across the entire hall on the north side of the hall above the extruders. This is where pipes from the pipe package with the dried granulate arrive from the west and the package with the pipes for powder arrives from the east. With a few exceptions, all extruders and co-extruders can be fed with both powder and granulate via vacuum conveyance through the pipes.

Conveyor separators are installed above each extruder on the platform, supplying it fully automatically with granulate, regrind or powder. Existing conveyor separators from the old plant were integrated into the new installation. “Being able to process both granulate and powder on an extrusion line is rather rare,” comments Sebastian Hoeft, Head of Production, but it is a prerequisite for the high degree of flexibility required to quickly fulfil individual customer requirements.

Conveyor separators are installed above each extruder on the platform, supplying it fully automatically. Most extruders can process granulate or regrind as well as powder.



A platform with, among other things, the conveyor separators for supplying the 11 extruders and 12 co-extruders extends across the entire hall. This is where the pipes with the dried granulate arrive from the west and the pipes with the powder arrive from the east.



Articulated lorries fill the outdoor silos on the eastern edge of the ttp factory premises with PVC powder.



From the outdoor silos, the PVC powder is transported via pipes (top left) to the material station in the powder processing area. From here, it is conveyed directly or after a mixing process to the extrusion lines.

Parallel supply of granulate and powder

The powders are transported via external silos from the eastern side of the site to a separate processing room. The granulates are stored in big bags in the warehouse on the western side and emptied there via five suspension stations. Pipes through the fire wall lead them to the five dry hoppers at the edge of the production hall. "In the past, many suppliers delivered their granulates in octabins. It took a certain amount of time before we switched most materials to big bags," notes Sebastian Hoeft. "In the old plant, we transported all granulates in octabins or boxes next to the respective extruders and sucked them in via lances using side channel compressors, which consumed

a lot of energy and were very loud," he recalls. "The machine operator had to move the material repeatedly over time to break up any funneling in the octabin and ensure that it was completely emptied." In contrast to before, the process is now much more efficient and therefore more resource- and employee-friendly. The conveying air for the granulate or regrind is returned in a closed circuit from the granulate separators to the drying hoppers.

"I would describe flexibility and diversity as one of our strengths," says Daniel Wildermann, describing one of the company's USPs. "With tool-bound parts, the customer places their trust in us. That's why we have to maintain a certain degree of flexibility

in production, because for many products we're only talking about small quantities per year," he explains, referring to the high demands placed on manufacturing flexibility. "We are extremely flexible for our customers, even when it comes to materials," explains Sebastian Hoeft, "which is why we take advantage of the opportunities created to flexibly control different materials via the pipelines to the point of consumption." Daniel Wildermann recalls the open handling in the old factory: "We had considerable dust accumulation everywhere on the equipment and throughout production. It is difficult to make the system completely airtight when handling and processing fine powders, but the contamination has been significantly reduced today."

The PVC granulate is now mainly delivered in big bags, temporarily stored and fed to the drying process via emptying stations.



On the western side of the plant, two dry air generators (centre) feed five drying hoppers (left) for the PVC granulate and PVC regrind. Waste heat from the vacuum pumps is fed in via a carrier fluid and EHR heat exchangers (on top of the dry air generators). The granulate is fed into the tube bundles via the material station (right).



Closed synchronous conveyor system for greater flexibility

The central vacuum supply (Labo-sync principle) offers the possibility of simultaneously conveying several batches and is based on four Busch Mink pumps. A significant advantage over the previous conventional conveyor system, which operated according to the "FIFO principle" (first in, first out), is that



Versatile vacuum pumps from Busch Mink with corresponding air filters form the backbone of the central vacuum supply and ensure the constant availability of plastic at every extruder.

material is available immediately after it is requested. Every requested material transport now starts immediately because the system can synchronously convey several different batches at the same time thanks to the central vacuum. The newly installed vacuum separators could be made more compact because only a small material buffer is required while they wait for another transport process to be completed. The four vacuum pumps operate in a frequency-controlled, flexible and load-dependent manner – sometimes only one, sometimes several at the same time. Working together as a group of four, they ensure high operational reliability and redundancy in the system at all times.

Daniel Wildermann (left), Head of Field Service, and Sebastian Hoeft, Head of Production, on stage for supplying the 23 extrusion lines with granulate and powder.



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In the milling room, ttp grinds start-up waste, punching waste and production rejects, mixes the ground material, fills it into big bags and reuses it for the middle layers of profiles.



The grinding dust from Resysta decking boards is collected, compounded into granulate by a service provider and fed back into production as an inner layer. Recycled grinding dust in various colours is extruded into dark grey decking made from 100 % recycled material.



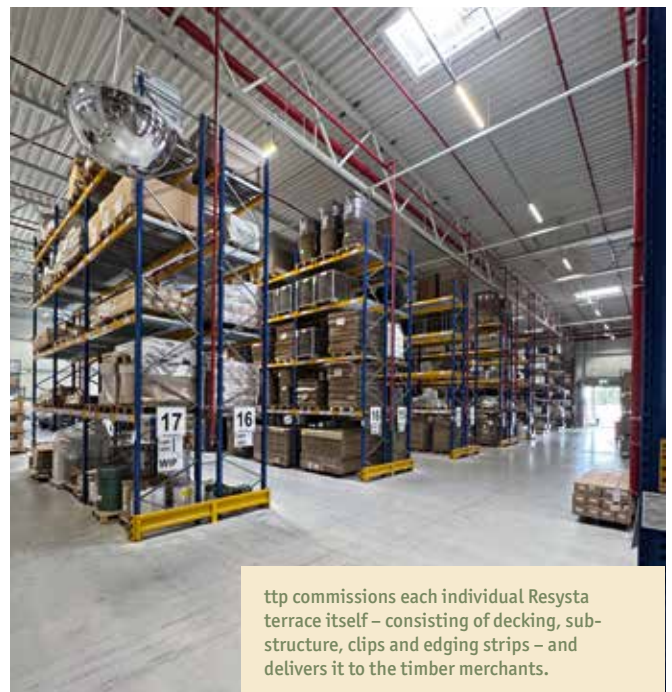
Extruded decking and profiles made from Resysta, a compound of rice husks in a PVC matrix. Subsequent machine surface grinding improves their feel and appearance.

Consistent internal recycling

In a separate milling room, ttp collects start-up waste, punching waste from post-processing and non-dimensional production goods sorted by type, grinds the material regularly, fills it into big bags and reuses the broken granulate (mostly PVC) in co-extrusion for the inner cores of hollow chamber profiles. Other plastics are also processed by external service providers and then fed back into production at ttp. The current average recycling content in ttp profiles is already more than 30 %, and the trend is rising.

Energy-optimised pre-drying through heat recovery

ttp feeds the warm cooling water from the vacuum generation into the EHR air/water heat exchangers on the two Labotek dry air generators, where its heat energy preheats the process air and significantly reduces the electrical energy required for pre-drying. The renewal of the drying and conveyor technology and the conversion of the material management system to motors with frequency converters has reduced the average grid load from almost 180 kW in the old plant to 30 kW now, as Thomas Ringheim emphasises. Since the start of production, ttp has installed a photovoltaic system covering its entire roof area, which, with an output of 1.4 kWp at full load, can generate twice as much as the profile extruder itself consumes.



ttp commissions each individual Resysta terrace itself – consisting of decking, sub-structure, clips and edging strips – and delivers it to the timber merchants.

ttp continues to process many small batches of plastics with hygroscopic additives and fillers, even though the 185 kg mixer now only runs for a few hours a day. Thomas Ringheim sees another trend in the market: "In the future, it will become increasingly important to dry masterbatch and additives for designer plastics before dosing."

The flow of granulates and powders is displayed in the Labonet plant control system. One control station each for powder processing and granulate dryers allows personnel to intervene. When an employee switches the supply, they select the suction address in the control system and the material is conveyed to the machine fully automatically. Two large monitors in the middle of the extrusion hall, visible from everywhere, display "machine alarms" or "conveyor alarms" to indicate which line an operator needs to intervene on. To do this, ttp retrieves the data required for its systems from the Labonet control system.

Even greater cleanliness remains a goal

"For reasons of cleanliness and employee safety, as well as for insurance reasons, we want to keep more and more material out of the production hall," says Sebastian Hoeft, looking ahead. "We are currently working with Labotek to find ways of transporting masterbatch and additives to the plants in closed containers



The Labonet control system visualises all the paths taken by the powder from the silo and the granulate from the big bag to each individual extruder.

rather than in sacks." This will reduce forklift traffic in the extrusion hall to the transport of semi-finished and finished products. ■

www.ttp-kunststoffprofile.de
www.salamander-outdoor.com
www.labotek.de

Sebastian Hoeft, Head of Production at ttp, Jasmin Hanselmann from Labotek Germany, Thomas Ringheim, CEO of the Labotek Group, and Daniel Wildermann, Head of ttp Field Service, express their satisfaction with the successful installation and the improvements and savings achieved together (from left to right).



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Patrick Kolbus (left), Head of Sales and Project Planning, and Production Manager Nils Wehmeier are proud of the new addition to the machinery at Qin-Form: "With the new system, we can reduce the reject rate to almost zero."



Design and high-tech go hand in hand

How Qin-Form uses thin-film foil to produce visually appealing inserts for the automotive industry

What would a vehicle be without decorative elements? Whether on the door, dashboard or boot – decorative components in stylish designs, with prismatic effects, backlit or with a chrome look – even the simplest vehicle would be inconceivable without them. Qin-Form GmbH, based in Herford, is one of the companies responsible for creating an appealing ambience in cars and commercial vehicles. The company has perfected the manufacture of wafer-thin thermoformed inserts with 3D contours, which are then back-injected. The thin film comes from a roll or as a sheet, usually PC or ABS, and always with decorative printing. The proportion of PC films processed is rising steadily, because: “Light is very often involved. For this, we need a transparent material,” explains Nils Wehmeier, Head of Sales and Project Planning.

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

The manufacturing challenges are complex. The inserts must have extremely tight tolerances in order to be used in the injection moulding process. It is very important that their design is tailored to the injection moulding cavity and the parameters of the injection moulding process. Specifically, this means that they must be capable of automated handling, and the thermal expansion upon contact with the cavity and the hot melt must be taken into account by the designers at Qin in their component design from the outset. Nils Wehmeier makes it clear: “We are involved in our customers’ developments at a very early stage, because the design of the injection mould for a component and the design of our inserts influence each other.”

Sensitive and delicate

The latest addition to Qin is a very special candidate, manufactured by Rudholzer in close cooperation with Qin: a fully automated thermoforming system for printed sheet material. “We wanted a system that could process the very sensitive and very thin sheets with high quality and repeat accuracy. Each individual sheet is expensive, so we want to reduce the scrap rate to zero,” explains Production Manager Patrick Kolbus. The sheets are usually made of transparent PC, which is screen-printed with the desired design on the reverse side. The sheet thickness is between 250 and 750 µm. The risk of material waste is due, on the one hand, to

the fact that it is so delicate and thin and, on the other hand, to the fact that the surface and the print image must not be damaged or displaced.

During the visit to Qin, 1,200 × 800 mm PC sheets with a thickness of 500 µm are running on the system for the front panel of an electric vehicle. The material is screen-printed on the back, with some areas of the film being opaque and others translucent. Thanks to screen printing, it is possible to flexibly manufacture front panels



The front panel of an electric vehicle can be customised with screen-printed inserts. At injection moulding partner RESRG, the insert is pre-moulded with a 3 mm PC layer, and in the next step, the retaining edge is back-moulded.

with customer-specific designs, even in small batch sizes. Nils Wehmeier provides some insight: “This front panel is a joint project in which the entire supply chain, from the material and ink manufacturer to screen printing and the production of the entire component, works hand in hand.” Qin is responsible for the precise film forming and high repeat accuracy of the inserts within the development process. At the injection moulding partner, RESRG (formerly Rehau), the inserts are inserted precisely into the mould, where a 3 mm thick PC layer is pre-injected

The thermoforming machine for printed sheet material is fully automated.





Oliver Beiner, Nils Wehmeier and Patrick Kolbus (from left to right) explain how it is possible to form highly sophisticated decorative inserts from very thin film.

Transport carriages guide the sheets through the system from the camera inspection to the heating stations and the moulding station to the final inspection.



in the first step. The component is then transferred to the turntable mould for the next step, which involves back-injecting the retaining rim made of black ABS. The component is then flooded directly with PU in the mould.

Through the process on a carriage

But before that can happen, Qin first has to produce the inserts. The PC sheets required for this are all perforated around the edges and marked with pressure marks. The perforations and pressure marks on the sheets are used to position the material precisely in the machine. A worker places a stack of sheets at the front of the machine and aligns them using fixing points. An articulated arm robot picks up the top sheet from the stack and places it on a transport carriage behind it. Patrick Kolbus explains: "The gripper places the perforated edge of the sheet precisely on the pins of the product-specific transport frame of the carriage." This ensures that the sheet is aligned exactly as required for the forming process.

The carriage moves with the sheet to the next station: optical inspection. A camera system compares the positioning of the sheet with a specified template. Only then does the material move into the pre-heater and then the main heater, which consists of a large number of individual ceramic radiators, each of which can be controlled separately. The radiators gently heat the film to the required moulding temperature. Nils Wehmeier explains why Qin has invested in this sophisticated heating technology: "We often have sheets where one area is printed in deep black and another in reflective silver. Here, I have to work with different heating temperatures across the sheet in order to heat the material evenly." In addition, the Herford-based company uses different temperatures for the top and bottom heating, as the printing ink on the sheet tolerates less heat than the unprinted side. The heat input from above for material printed on the reverse side may be slightly higher. According to Patrick Kolbus, pre-heating is also an important element for the perfect process: "The

At the end of the process, the formed inserts are transported out of the system on the carriage and deposited by the robot at the removal point.



coating system reacts much more sensitively to heat than the polycarbonate. Preheating makes it possible to gently warm up the entire film structure."

The heating section is followed by the forming process in a closed area. The upper and lower tools are encapsulated so that no dust particles can contaminate the surface. The sheet is pulled onto the tool contour by means of a vacuum from below, and compressed air at only 6 bar ensures the necessary contour sharpness of the component. The aluminium tool developed by Qin is mounted on a temperature-controlled base structure.

The final quality control check is carried out on all inserts at the end of the production process. Here, an employee checks the decorative elements of the Ford Kuga.



The end-of-line inspection takes place just a few steps away from the system. Cameras subject each individual component to a quality control check.

After successful forming, the component moves on to the next station on the transport carriage. During the next camera inspection – now on the formed component – an automatic comparison with the target sample is carried out. The inspection data is sent to the machine operator, who keeps an eye on all the details. Managing Director Oliver Beiner makes it clear: "The most expensive part of manufacturing our inserts is the material. If defective parts were not detected immediately, it would very quickly become very expensive for us."

After the inspection station, the transport carriage moves the finished component out of the system to the assembly and removal level. The vacuum gripper removes the component from the carriage and places it on the removal table. This is where another employee comes into play. He performs another visual quality check before placing it in the punching machine set up next to the system to cut off the edge trim. The punching machine was also specially designed for Qin, explains Oliver Beiner: "We needed a very precise device that could process components measuring up to 1,580 × 900 mm and with thicknesses between 250 and 1,500 µm. You can't get that off the shelf."

Depending on the size of the item and the thickness of the film, the system works with an optimal number of transport carriages that circulate continuously and form one sheet after another into the front panel. The frame for holding the individual sheets on the transport carriages is individually adapted to each product – up to a maximum of 1,580 × 900 mm.

The system produces in rapid succession. The cycle for the panel currently being manufactured takes just a few seconds. Despite intensive quality monitoring during the process, each individual component is subjected to another quality check in a test cabin located in a separate room just a few steps away from the system. Under standard lighting, cameras from above and from the side check whether the component is correctly formed and within the specified tolerances. Patrick Kolbus proudly explains: "We produce film components on this system with the highest precision – and with great repeat accuracy."

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Things are quite different in the neighbouring hall. Here, a Kiefel KMD80 produces decorative elements for the door of the Ford Kuga from a roll. The material, a printed ABS film of 500 µm, runs from the roll into the system. The gravure film is covered with a protective film to protect the sensitive surface. This is automatically removed and wound up. In order to remove all particles before the forming process, the material undergoes numerous cleaning steps before entering the heating section. Only then does it enter the preheating and main heating sections, which are equipped with pilot radiators at the front and rear to monitor the temperature of the film. The forming station is encapsulated. With vacuum from below and compressed air from above, the door strips are produced simultaneously in several temperature-controlled cavities. In the next station, the component is pre-punched directly in the system, but the three components are not separated. Patrick Kolbus explains the reason: "We cannot do the final punching in the machine because the component tolerances for the insert are much too tight. Therefore, we can only pre-punch online."

The inserts are removed manually: a worker carefully removes the connected strips from the conveyor belt with gloves and subjects them to a visual inspection. Oliver Beiner explains why: "The film is too sensitive and the cycle times are too high to handle it automatically. The system produces so quickly that if a defect is detected too late, we would very quickly produce a lot of waste." However, when producing trays or other non-sensitive components, Qin uses the system's handling system for finishing.

Employees check the quality as soon as the parts are removed.



These decorative elements for the door of the Ford Kuga are produced from the roll.

Next to the Kiefel system is another fully automatic machine from Parco. The machine can process both sheets and rolls. This system is also completely enclosed. The air is filtered and the system room is kept at positive pressure to keep dust particles out. In the material feed area, ionisation ensures that the plates and films are electrostatically discharged. The machine is very flexible in its application. Patrick Kolbus explains: "We can run small and large tools here, and the system works very precisely and quickly. It is also possible to process very thin film. In addition to many series projects, we often use this system for sampling. We have also processed countless screen printing film sheets here."

Clean contours from CNC and punching

As in any thermoforming operation, CNC machining is also essential at Qin. Five 5-axis CNC portal machines from MKM and Geiss, most of them with two tables, take care of trimming the edges of the delicate components. The two tables of the MKM machines are located on two different levels, enabling parallel machining of two components with the double-head milling machines. Like almost everything at Qin, the milling machines are also something special, according to Nils Wehmeier: "We cannot use normal milling tools. The manufacturer has adapted them to our requirements in terms of blade and cutting geometry."

The next room houses roller and contour punches. They are physically separated from the milling machines. Patrick Kolbus explains why: "The milling machines cause turbulence due to the compressed air cleaning of the components. We don't want this dust on the punches." An employee is currently processing a set of Audi rings. Two punching processes are carried out in parallel in the punch. The worker places the chrome-look rings in the left-hand component holder and

Five 5-axis CNC portal machines, most of them with two tables, ensure that the delicate components are trimmed at the edges.





The punching machines are located in the room next to the CNC machines. An employee punches out an insert.

punches the inner and outer contours. The punched rings from the previous step are in the right-hand component holder, and an additional horizontal cut is made from behind. Nils Wehmeier explains why: "We developed this contour together with the injection moulding machine manufacturer. The robot can grip the rings by the tab and insert them into the injection moulding tool, where they are fixed to the tab and also injection moulded."

Material handling only with kid gloves

For all inserts, the most important thing is the film – whether it is a printed sheet or from a roll. Often transparent, with sophisticated designs, radar and LiDAR transparent for many components, and always expensive. The film suppliers are therefore recruited from a handful of companies: Akzo Nobel, Nisssha, Wavelock and Kurz. Qin only processes material that has been qualified by OEMs, Tier 2 or Tier 3. The PC sheets are printed individually according to customer requirements by Qin's partner companies, but: "Here, too, the choice is not great.

An employee is currently processing a set of Audi rings. Two punching processes are carried out in parallel in the punching machine.



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The younger generation takes a critical look at the insert: Nico Hansmeyer, Samuel Beiner and Patrick Kolbus (from left to right).

The panel machines produce housing cladding for medical technology and industry. An employee removes the cladding for a treatment chair.



There are few specialised companies that can print the sheets in such a way that the ink is chemical and UV-resistant and at the same time easily deformable," Nils Wehmeier explains.

All materials have one thing in common: they need to be handled with kid gloves. The candidates coated with a soft lacquer system that only hardens after the forming process in the in-house UV system are particularly sensitive. Other film systems are coated with a UV lacquer that hardens in daylight. "Speed is of the essence here," smiles Patrick Kolbus. This sheet material is specially packaged to protect it from daylight. The packaging is only opened shortly before processing. "We really have to handle the material very carefully so as not to damage the surfaces. That's why our employees wear cloth gloves and handle the films very gently," says Patrick Kolbus, giving an insight into the daily challenges.

Portfolio of more robust components

Things are more robust in another business area of the thermoformer. Qin uses two Geiss machines to process sheet material into covers for medical equipment such as examination chairs, hospital beds, dentist chairs, trays and technical parts. The selection of materials used here is much more varied: PS, ABS, ABS/PMMA, PP and even PC. The component dimensions vary greatly, from small covers measuring 30 × 15 mm to machine covers measuring up to 1,400 × 1,200 mm.

During the visit, a Geiss T10 is currently producing the cover for the frame cladding of a treatment chair from an 800 × 850 × 5 mm ABS-PMMA sheet in a 1-cavity aluminium

mould. The drawing depth is 300 mm and the geometry is complex. In order to distribute the material evenly during the forming process, the semi-finished product is pre-blown with compressed air after the heating process. Only then does the mould move in from below and the material is applied to the mould contour by means of vacuum pressure. After cooling, a short blast of air follows and the component is demoulded and ejected, where it is removed by a worker.

The Herford-based thermoformer has been privately owned since 2014. The private investor from Herford bought the company from the Agoform Group at that time. The projects that were in progress at the time, the employees and the machinery were moved

to Herford. Nils Wehmeier recalls: "We registered the change of name with the OEMs and were able to continue all ongoing projects. At that time, we had 18 employees; today, we have grown to 40." Qin's roots are in the automotive industry. The company meets all the necessary certifications, logistics and manufacturing requirements. However, the product portfolio has grown in the meantime and new pillars have been added. 

www.qin-form.de

www.geiss-ttt.com

www.rudholzer-technology.com

"The most expensive part of manufacturing our inserts is the material. If defective parts are not detected immediately, it would very quickly become very expensive for us," explain Nils Wehmeier and Oliver Beiner (left).





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15
NATIONS

16
SESSIONS

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With a keen interest in new projects

How Krupanek continues tradition, tackles new challenges and is not just recommended for the start-up scene



The experienced management trio with owner Peter Krupanek (right), his twin brother Daniel (centre) and Project Manager Felix Biedermann. The palm fronds come from the company's own production.

Photo: Krupanek

The appeal of the challenge drives those responsible at the family-owned company Krupanek in Untermeitingen, which has 45 employees. When the Berlin-based start-up Lab2 developed a product idea exclusively for Degussa Goldhandel, Krupanek accompanied the project through to series production and then took over the series manufacturing of the packaging for 1 g gold bars. The manufacturer, which specialises in niche products, produces the transparent precision items in credit card format on Boy injection moulding machines. Boy is firmly established as a supplier in the clamping force range up to 1,250 kN. K-PROFI spoke with the two partner companies about their long-standing cooperation and the core competencies of a “plastics manufacturer with touchpoints in all industries”.

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

Peter Krupanek introduced the winding of coils for a medical sound wave therapy device because the client could not find a reliable supplier.

“90 per cent of our business involves smaller orders in the range of 5,000 to 20,000 pieces, even though we produce both single pieces and large quantities. We are the plastics manufacturer. Small series are our core business and our speciality, and we have mastered this,” explains owner Peter Krupanek. In addition to injection moulding, stamping and bending are also a focus. The majority of the injection-moulded parts are finished into complete assemblies in the company’s own assembly hall. This includes a medical sound wave therapy device. Krupanek accompanied the development, injection moulds different coloured housing parts with LED illumination, refines them using pad printing, assembles circuit boards, winds coils, assembles them into a functional device, carries out functional tests and lasers the serial number for the traceability of the medical device.

Peter Krupanek explains why Krupanek winds the coils itself: “Originally, finished coils were to be supplied, but the client was unable to find a reliable supplier. So, I visited a supplier of enamelled copper wire, did my homework, got hold of a used machine and simply started winding. After a week, we were the supplier of the coils ourselves.” Doing things yourself is in the family’s genes. The late Peter Krupanek Snr. started plastic processing when he founded KE Plastik GmbH in 1971.

Most of the injection-moulded parts are refined into complete assemblies or devices. Krupanek sets up its assembly lines or establishes alternating workstations for this purpose in this hall.



Photo: K-PROFI

The assembly of fully functional devices in small batches is a key focus at Krupanek. This also includes the assembly of circuit boards.

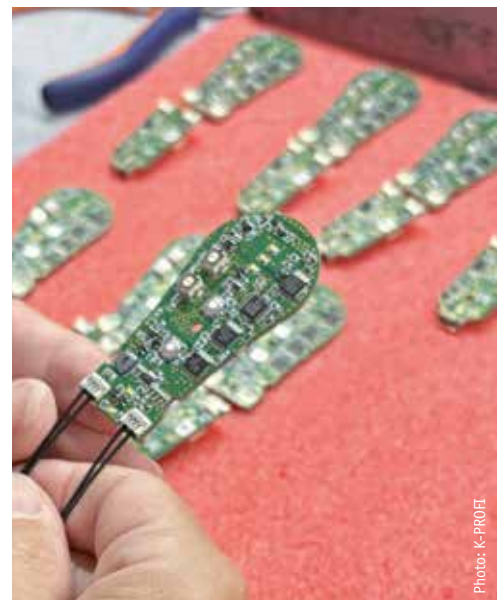


Photo: K-PROFI

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Photo: K-PROFI

In 2006, the two brothers took over the customer base of KE-Plastik GmbH, which was founded by their father in 1971. Daniel Krupanek (right) is responsible for injection moulding production, while owner Peter Krupanek manages the company.

Daniel Krupanek is responsible for the regular field tests of Boy equipment. The LR 5 linear handling system also underwent critical testing here before its market launch.



Photo: K-PROFI

In 2002, his son Peter Krupanek took over a stamping and forming technology business, supplied the catering market and, a year later, expanded into the manufacture of plastic products. In 2006, the two companies merged. "My twin brother Daniel and I took over our father's customer base. Whether it was stamping, injection moulding, mould making, electronics or machine repairs, we always enjoyed getting stuck in and trying out new things."

The compact design was decisive in the purchase

The fun and enthusiasm continue to this day, confirms Daniel Krupanek. He heads up injection moulding production and has gained in-depth knowledge of machine technology. A total of 18 injection moulding machines cover the clamping force range from 250 to 4,500 kN. Eleven machines are from Boy, including two Boy 2CS additional injection units for the manufacturer-independent upgrading of the injection moulding machines for two-component injection moulding. The first Boy machines were installed at Krupanek back in 2013. At that time, the brothers had a small hall at their disposal in Untermeitingen.

Krupanek has been working with Boy machines since 2013 and, in addition to their compact design, particularly appreciates their repeat accuracy and precision.

The compact design of the Boy machines with their two-plate clamping unit was impressive. "We replaced three machines at the time, starting with a Boy 55, then adding a Boy 100 and a Boy 35. Every square metre of space saved was valuable," recalls Peter Krupanek.

Even when the hall and production area almost tripled in size in 2015 due to the move within Untermeitingen, Krupanek remained loyal to Boy. The machines had proven to be efficient and reliable. A close, friendly working relationship developed. Krupanek became a preferred partner for Boy for field tests and put the Procan Alpha 4 machine control system, the Boy LR 5 linear handling system and the Boy 125 E injection moulding machine model through their paces before their market launch. "As machine manufacturers, we cannot replicate the experience gained here under production conditions," says Daniel Sattes, Technical Consulting and Sales at Boy, with conviction. Boy benefits above all from the varied and rare applications in terms of tools and materials, which are hardly to be found in this form at any other processing company. Krupanek was therefore able to contribute to improvements and further developments

The 350 kN machine was one of the first of the eleven Boy injection moulding machines now available, covering a clamping force range from 250 to 1,250 kN.



Photo: K-PROFI



Photo: K-PROFI



Photo: K-PROFI



Photo: K-PROFI

For the transparent and thin PC half-shells, the Boy 60 E works with high injection pressures and highly polished mould inserts.

Krupanek accompanied the development of the Degussa Gold Card with Lab2. GmbH until it was ready for series production. An elegant credit card-sized package with eight slots for 1 g gold bars.

of the machines in many ways with its ideas. “Daniel Krupanek soon knew more than our technicians at Boy,” jokes Daniel Sattes. The technical consultant and sales representative responsible for the Bavaria region also appreciates the open doors at Krupanek. “I am welcome to come here at any time with interested parties for machine demonstrations. With the exception of our smallest Boy XS E with 100 kN, Krupanek now has our complete clamping force portfolio.”

Repeatable and precise in production

The exchange takes place in both directions. The mutual support is based on a friendly relationship and is a matter of course, emphasises Peter Krupanek. The direct line to Boy, from the development department to the technical department to the management, allows them to react quickly and flexibly to different production requirements. As an example, the owner cites an injection moulding

The current Lab2 managing director developed the bicycle box when he was 16 years old. Krupanek is now implementing the idea, manufacturing the injection-moulded parts and assembling the complete boxes.

Peter Krupanek invested in the development and injection moulding tools for the MoveMaster hybrid joystick, which is highly sought-after in the gaming scene, and is now a co-partner.

solution for marbled components required for a customer application: “Boy already had experience with marbling and immediately provided us with the technical templates for replicating the mixing head and the software adjustments for linking the Boy 2CS unit to our Yizumi injection moulding machine.”

Daniel Krupanek particularly appreciates the repeatability and precision of Boy’s servo-hydraulic injection moulding machines. They are the first choice when it comes to high-precision components, such as the thin, transparent half-shells for the Degussa Gold Card. High injection pressures and highly polished mould inserts ensure that the cavities are filled precisely with polycarbonate. The individual parts are then ultrasonically welded via minimal contact surfaces. An integrated turntable opens and closes the eight slots for 1 g gold bars from Degussa. The idea for this elegant packaging for gold for the purse came from the Berlin-based product development start-up Lab2. Its Managing Director, Aaron Holzhäuer, became known in 2022 as a 16-year-old participant in the TV show “Die Höhle der Löwen” (The Lion’s Den) with his product idea of a lockable bicycle box he had developed himself. Krupanek already accompanied the development of this innovation, marketed under the BeeMyBox brand, and now manufactures all the plastic components and assembles the box into a packaged product ready for shipment.



Photo: K-PROFI



Photo: K-PROFI



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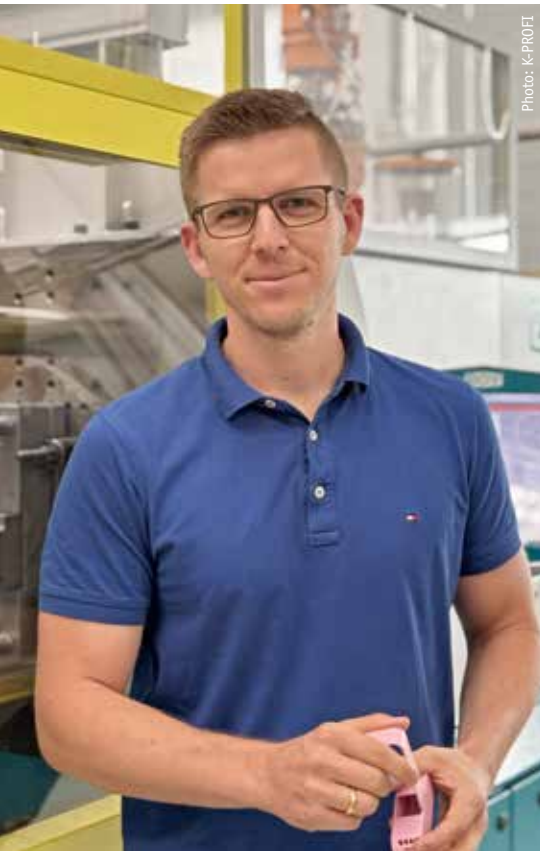


Photo: K-PROFI

Felix Biedermann, a trained toolmaker, studied mechanical engineering while working and is a certified technical business economist. Today, he is the project and development manager at Krupanek.



Photo: K-PROFI

Krupanek took over the equipment and expertise for the brush plug from its former supplier. The autoclavable hand washing brushes are the company's own product and are sold wholesale to clinics and other customers.

FDM printer with a build size of up to $800 \times 800 \times 1,000$ mm, used here to construct product-specific transport protection.



Photo: K-PROFI

Housing for tracking sea containers: Krupanek converted a 3D printer to apply the silicone seal.



Photo: K-PROFI

These polygon reflectors for solariums are produced using high-precision injection moulding on a Boy 100 E and are then coated with aluminium vapour.



Photo: K-PROFI

Partner for start-ups and traditional products

“We are currently receiving a lot of enquiries from the start-up scene in Berlin,” reports Peter Krupanek. Word has spread that Krupanek successfully accompanies product ideas through to series production and has the necessary network at its disposal. Together with designer Jakob Diezinger, for example, a manual espresso machine was developed that is ready for injection moulding – without the use of electricity, but with a spring-loaded torque wrench to adjust the brewing pressure. The first Emanuele manual machines, manufactured by Krupanek and assembled with 65 individual components purchased from external suppliers, were delivered in July 2025. The MoveMaster hybrid joystick, a hybrid of keyboard and mouse, has been on the market for several years. Initially hidden away in the gaming scene, an influencer video triggered a boom. “We are constantly sold out,” says Peter Krupanek, who became a co-partner of MoveMaster GmbH in Deggendorf through his investments in development and injection moulding tools. Krupanek manufactures the housing components on a Boy 125 E, assembles the complete hybrid device with circuit boards, cable harnesses, buttons, etc., performs functional testing, packages and ships to end customers.

In addition to constantly changing new projects, Krupanek also continues to produce traditional items, some of which originate from the activities of Peter Krupanek Snr. These include industrial cleaning brushes

Small production runs regularly require a decision to be made as to whether 3D printing is an economical alternative to injection moulding. In addition to initial samples, Krupanek also offers additively manufactured small series.

for optical applications. The brushes are a Krupanek product, as are autoclavable hand washing brushes, which are sold to clinics and medical practices through wholesalers. Five years ago, Peter Krupanek even learned how to stuff brushes for the hand washing brushes because the previous service provider had to close his business due to old age. “I learned how to stuff brushes there and then passed it on to my employees after we took over the brush stuffing equipment and transferred it here.”

Management trio of experienced tool specialists

Keyword: do it yourself. Those responsible are convinced that approaching tasks with an open mind and unconventionally, as well as finding practical solutions, are part of Krupanek’s recipe for success. There was only one project that the management trio had to abandon: setting up their own large tool shop. “That was very painful for us, but here in Germany you can’t find enough people for it.” Krupanek outsources around 100 injection moulding tools per year. The two-man in-house tool shop can produce two to three tools in addition to classic maintenance and repair work. It offers the necessary flexibility when things have to be done very quickly. The experience flows into all



projects. Krupanek was recently involved in the development of plastic disc springs for a large bed manufacturer. “We carried out the load calculations, selected the material, designed the components, 3D-printed the initial samples and designed the tools,” emphasises Felix Biedermann, who is responsible for project and development management at Krupanek.

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Krupanek introduced 3D printing back in 2012 and is constantly expanding the technology. The company now uses the latest generation of FDM printers – from powerful desktop systems to large-scale industrial systems with a build volume of $800 \times 800 \times 1,000$ mm – supplemented by high-resolution stereolithography technology. The 15 3D printing systems are used for prototypes, initial samples and small series, as well as increasingly for system structures, assembly aids and removal grippers in the company's own production. The inventors have also converted a 3D printer so that it can apply a silicone sealing bead. This is used in a data logger that is used to track sea containers. Krupanek manufactures the robust housing shells with silicone seals for this purpose.

“People have lots of ideas”

Laser deflection mirrors, coffee grinders, polygonal reflectors for solariums, supply air silencers for boiler manufacturers, fronds for artificial palm trees, stepper motor end caps for the aerospace industry, fins for German Life Saving Association (DLRG) stand-up paddle boards, hand sanders for manicures and pedicures with sapphire and diamond-coated grinding attachments, belt buckles for prisons in Germany, holders for toilet cleaning tablets from a sustainable brand, trackers for sea containers or high-quality perfume bottles for Jette Joop – the list of small-batch products “made in Germany”



Photo: K-PROFI

With the exception of purchased parts such as decorative stones and circuit boards, Krupanek manufactures, prints and assembles the components for electric nail files for manicures and pedicures.



Photo: K-PROFI

As part of the development of this sustainable toilet block holder, Krupanek printed the first prototypes and designed the tool and packaging, among other things.

is endless. Krupanek is also open when it comes to materials. Within the plastics sector, the spectrum ranges from polyolefins, ABS and PPA to high-performance materials such as LCP, PEI and PEEK, and from glass beads to glass, carbon, Teflon and aramid fibres for reinforcement. In addition to plastic, wood, glass, metal and stone are also processed as required. The manufacturing network also offers painting, chrome plating and even 24-carat gold plating. “We really enjoy this diversity with touchpoints in all industries,” confirms Peter Krupanek.

And Felix Biedermann adds: “If you’re looking for a common thread in our activities, it’s the thrill of the challenge. Many customers are amazed at what we can do.”

Peter Krupanek takes a positive view of the economic situation: “Business was a little quieter for a few months, and project awards were more hesitant. Nevertheless, our figures are better than last year, and there are many projects in the pipeline that will start soon. People have lots of ideas.” But Krupanek himself is not short of ideas either. The space is being expanded to accommodate the numerous sample models and approved parts. Digitalisation is being driven forward. Employees are gradually being equipped with their own tablets, and work instructions are now communicated via video clips and voice messages. After three years of establishing the Sage ERP system and linking it to the Asana project management tool, Krupanek wants to take the next step and is now starting its own AI development for production planning, including data exchange with Boy injection moulding machines. The changing projects and the many supplier parts for assembly increase the complexity of production and personnel planning. Further injection moulding machines are to be replaced and exchanged for Boy machines in the clamping force range up to 1,250 kN. “The cooperation with Boy will continue,” Peter Krupanek is convinced. 

The friendly cooperation between Boy and Krupanek is also underlined by Carolin Metzker and Julia Kröll (from left) from Boy Marketing and Daniel Sattes (2nd from right), who represents Boy in the Bavaria region in technical consulting and sales.



Photo: K-PROFI

www.krupanek.de
www.dr-boy.de

“We are growing with PVC-free medical compounds”

Why alternatives are in demand in the pharmaceutical, medical and food industries and how Melitek manufactures them

“What we have achieved in the last ten years, we can happily repeat in the next five,” smiles Kim Laursen, who, together with his brother Jesper Laursen, is managing partner of the Danish company Melitek A/S in Alslev. What he means is the doubling of turnover that his company has achieved with the production and sale of PVC-free speciality compounds. The market for thermoplastic elastomers in the medical and pharmaceutical sectors is booming, he explains in an interview with K-PROFI, attributing this to the desire of many companies to offer phthalate-free products and specialties. Kim Laursen explains in more detail why this is the case, exactly which raw materials the company offers and on which compounding lines they are produced in an interview with K-PROFI.

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

Melitek Managing Director Kim Laursen (left) relies on the compounding expertise of KraussMaffei, represented here by Managing Director Ralf Benack.





Melitek began producing its own compounds for medical and pharmaceutical products in 1998 and has gradually expanded this to five compounding lines over the last 27 years.

For many years now, there has been discussion about the use of PVC compounds in the manufacture of pharmaceutical and food packaging as well as medical products such as bags for intravenous fluids, connecting tubes, catheter tubes and the like. The reason for this is the plasticisers used, in particular phthalates, which ensure that the rather brittle PVC plastic retains its flexibility and soft feel. Since phthalates are not firmly bound in the plastic, they can diffuse out of food packaging, for example, and be ingested by humans or enter the bloodstream directly from medical products. Even though the carcinogenic effect on humans has been relativised in recent years, the question of developmental and reproductive toxicity effects still remains. This is one of the reasons why many companies are looking for PVC-free alternatives and one of the reasons for Melitek's growth.

Wide range of products for many applications

Kim Laursen reports: "After initially trading in compounds for medical and pharmaceutical products, we started our own production in 1998 and have gradually expanded it over the last 27 years." Today, Melitek employs more than 60 people and operates a total of five compounding lines, including a laboratory facility for development projects and small orders. The maximum production capacity is 50,000 tonnes per annum, with orders between 1 and 2,000 tonnes of compound being fulfilled for mainly European customers according to recipes developed in-house.

The company manufactures modified PP compounds that are flexible even without plasticisers, do not absorb medicines due to their chemical resistance, are sterilisable, sealable, transparent and easy to process into films. "One advantage of PP film products made from our compounds is that they provide a good water vapour barrier and high strength, which allows the film thickness to be reduced to 200 µm instead of 350 µm for PVC," says the managing director, highlighting a sustainable advantage. The PP compounds are used for films for IV bags, food bags and dialysis bags, with one or more chambers as required.

Polyolefin-based TPE and TPO compounds are also part of the Melitek range. These are used, for example, in the manufacture of medical tubing, where they score highly thanks to their durability, pressure



During the tour of the plant, Kim Laursen explains exactly what is important in compounding systems so that he and his team can produce high-quality PVC-free special compounds for customers in the medical sector.

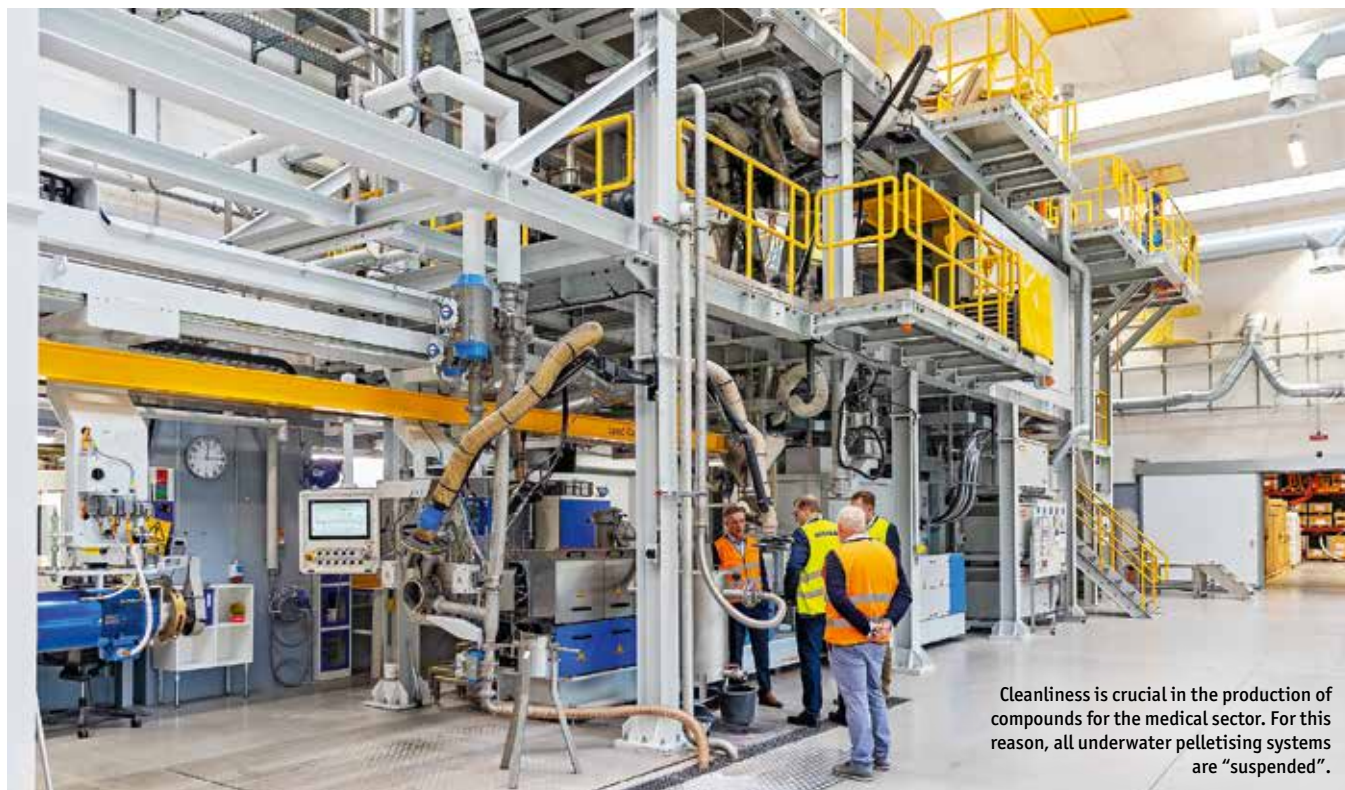
resistance and kink resistance, combined with flexibility and softness. If medical plugs, connectors, shut-off connections or drip chambers are produced, Melitek recommends its unfilled TPE/TPO elastomers with Shore hardnesses from 10 A to 65 D. Like all compounds, they can be sterilised and exhibit good chemical resistance in use, are transparent, have good processing properties and are suitable for both overmoulding and coextrusion. "We are very pleased that our innovative raw materials have enabled us to win many customers, including some of the largest manufacturers of medical devices in Europe," says Kim Laursen proudly. Of course, this high level of acceptance did not come about by itself; after all, companies that had previously worked with PVC raw materials had to adapt their moulding and welding machinery to the new materials.

Extrusion systems in the test centre proved convincing

For its compounding systems, Melitek relies heavily on the extrusion system manufacturer KraussMaffei Extrusion from Laatzen (formerly Berstorff from Hanover). "Before purchasing our first compounding system in 1998, we ran a few test runs, back then still in Hanover. This was very important and informative for us, as we had little experience of compounding at that time." Kim Laursen purchased a compounding line with a ZE 75A UT twin-screw extruder and a laboratory system with a ZE 25A UT. He opted for complete solutions in which all components came from a single source and were coordinated with each other.

A lot has happened since then. Today, Melitek knows exactly how to manufacture its products and what is important to the company when it comes to extrusion systems. "After our business developed well, we purchased a third compounding line with a ZE 75A UTX in modular design in 2012," reports the managing director. The modular design was chosen not only because it is a particularly compact solution, but also because of its clarity and cleanliness. The entire compounding system is housed in several containers that already have a media supply and only need to be connected to each other on site.

Even though Melitek does not manufacture in a certified clean room, cleanliness is naturally essential when producing compounds for the medical sector. For this reason, all underwater pelletising systems



Cleanliness is crucial in the production of compounds for the medical sector. For this reason, all underwater pelletising systems are “suspended”.

are “suspended”. This means easy accessibility, flexibility and good cleanability. Next, in 2014, Melitek purchased another small system with a ZE 30A UTX.

The latest system, which was installed in 2021, is also a complete system, as before, this time with a ZE 98 from the new Blue Power series. “With an output of 3,000 kg/h, the latest system not only doubles the output of

the system with ZE 75A UTX, it was also custom designed for Melitek,” says Ralf Benack, Managing Director of KraussMaffei Extrusion GmbH. “Melitek attaches great importance to the protection of its employees, which is why the motor and gear block is enclosed for sound insulation,” Ralf Benack continues. And Kim Laursen adds: “We are also very satisfied with the new ZE Blue Power extruder because of its low energy consumption.”

Safety is paramount

“If we make a mistake in the production of our compounds, in extreme cases it could cost a human life,” says Kim Laursen, who is well aware of the importance of accuracy and reproducibility. That is why he values the systematic approach of KraussMaffei Extrusion’s systems, which enable consistent results to be achieved. “We take responsibility for quality assurance for all orders. After developing the formula, we first produce a test quantity of compound, which is checked by the customer and approved for their application before we start production.” For quality control within its own company, Melitek operates an FTIR spectrometer in its laboratory, among other things, which is used to regularly examine production samples. The managing director is convinced that the journey of PVC replacement in the medical, pharmaceutical and food industries is far from over and that his company will continue to grow in the coming years. ■

www.melitek.com
www.kraussmaffei.com

For quality control, Melitek operates an FTIR spectrometer in its laboratory, which is used to regularly examine production samples.



See – Feel – Invent

How Unilin successfully produces and markets high-quality PVC flooring

Photo: Moduleo

Modern PVC floor coverings such as the “Moods” collection from Moduleo can also be laid as individual mosaics thanks to a multi-step process that Unilin Flooring integrates from raw material handling to finishing and packaging.

Unilin Flooring only shuts down its extruders to feed large calendars for cleaning and maintenance purposes for two weeks in summer and two weeks in winter. Otherwise, they run continuously at a capacity of over 10 t/h, fortunately without any malfunction, around the clock, all year round. The production capacity is more than 15 million m² of PVC floor coverings, which could cover more than 2,000 football stadiums. After all, these durable and robust floor coverings have been further developed in terms of appearance and feel and continue to enjoy great popularity. CEO Dieter D’Hondt and Product Manager Frédéric Dhaene know exactly what their customers want in terms of colour, shape, thickness and installation technology, and have the right solution for every requirement. Even though the plant appears to produce the same thing over and over again, there is no room for boredom here. This quickly became clear during the tour of the huge factory premises.

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





Photo: K-PROFI

CEO Dieter D'Hondt presents a PVC tile reminiscent of concrete and explains why PVC flooring continues to enjoy great popularity.

For 14 years now, a two-stage planetary roller extruder from Entex has been running at the Unilin Flooring production plant in Avelgem, Belgium, feeding the three-roller calender to produce glass fibre-reinforced PVC sheets. 'With an output of up to 12 t/h, the 400S planetary roller extruder is the largest we have installed for calender feeding,' reports Karl Wallis, European Sales Manager at Entex Rust & Mitschke in Bochum, who has been involved from the very beginning and maintains good contact with his customers.

Anyone who thinks that, after such a long time, the plant would need to be modernised or modified is mistaken. Only one adjustment was made last year, when Unilin wanted to incorporate more and more recycled material into its formulations and needed greater wear protection in the extruder's processing unit. Dieter D'Hondt comments: "We greatly appreciate the reliability of the Entex machine solution." In addition to reliability, he emphasises the versatility of the system as a particular advantage, which he explains in more detail during the conversation. The large-scale calendaring plant is versatile in terms of the recipes used, with variable proportions of chalk, additives and recycled materials, but also in terms of output and thus the product portfolio that can be manufactured. The latter is very important for plastics processors in order to be able to satisfy regional markets and specific customer requirements.

Producing floor coverings worldwide

Unilin Flooring is one of the largest manufacturers of PVC flooring in Europe and, in addition to the large calender line that produces modular PVC planks and tiles for adhesive installation, operates another factory in Avelgem that produces modular PVC planks and tiles with click connections, as well as a third factory for vinyl sheets for adhesive installation. A total of 700 employees work here, with the Unilin Group employing more than 7,800 people worldwide and generating a turnover of EUR 2.6 billion. The Unilin Group is part of Mohawk Industries, America's largest flooring manufacturer, which employs nearly 42,000 people and manufactures and distributes ceramic tiles, carpets, hardwood floors and plastic flooring worldwide.

Unilin Flooring produces PVC flooring in around 500 designs under the Moduleo brand, which are purchased by retailers, distributors and DIY stores. "From time to time, we also produce a completely individual collection for a large project such as a hotel, an airport hall or a large shopping centre, according to the customer's wishes," explains Frédéric Dhaene. The designs differ in colour and grain, which is usually modelled on real wood, but also in the possibility of laying very modern mosaics. "Some customers want to have an eye-catcher on the floor. Then we first have to see what they want, feel the texture and finally come up with the right design." What sounds so simple requires a multi-step process that takes place in Avelgem, from raw material handling to the assembly and packaging of the finished PVC coverings.

Largest planetary roller extruder

How exactly does production work? It all starts with PVC powder from the silos in front of the building, which is conveyed together with additives and mostly chalk as a filler into the heating/cooling mixer and enters the dosing unit as a dry blend. This is equipped with a side feed so that at least 21 % recycled material can be mixed in. The plastic mixture is now fed into the planetary roller extruder (PWE). It has a diameter of 400 mm in the processing unit and a length of 2,800 mm. "We achieved the length by connecting two modules in series, i.e. two process cylinders equipped with planetary spindles, each measuring 1,400 mm," says Karl Wallis from



Photo: K-PROFI



“At our site in Avelgem, we have a production capacity of up to 15 million m² of PVC planks and tiles,” Dieter D’Hondt explains.

Photo: K-PROFI



The two-stage Entex extruder has been running smoothly in Belgium for 14 years, producing this inconspicuous grey melt strand.

Photo: K-PROFI



In the 3-roll calender, the thin glass fibre fabric is coated on both sides with the PVC mixture from the Entex PWE.

Entex, explaining the modular concept of the PWE, which is designed here as a “heavy series” with an adapted geometry for particularly good wear resistance.

In the planetary roller extruder, eight planetary spindles rotate around a central spindle, which ensures a large, constantly renewing melt surface and thus gentle but effective dispersion and homogenisation of the mixture. “A PWE is always operated with a slight underfeed in order to achieve optimum, gentle mixing of all components,” explains Karl Wallis. The Unilin process uses a two-stage design in which the melt is first cut into small noodle-like pieces at the end of the processing unit on the open start-up ring with knives, which then fall through the transfer chute into the single-screw extruder (ESE). The ESE is a progressively cut conical single-screw extruder with an initial diameter of 350 mm, which allows pressure to build up while reducing the mass temperature. The compression causes air pockets, which would lead to defects in the final PVC film, to be discharged backwards out of the screw. A vacuum pump at the transfer shaft takes care of effective degassing. The end product is an inconspicuous, grey melt strand with a diameter of about 100 mm, which is deposited on the first roll gap of the calender.

Quick changeover without conversion

In the 2 m wide calender, one side of the thin glass fibre fabric purchased by Unilin is first coated with PVC melt, monitored in the thickness measuring station and wound up after the cooling unit. In order to coat the reverse side with PVC as well, the fabric is quickly re-spun and the single-sided coated fabric is fed into the calender instead of the pure glass fibre fabric. “Since we manufacture a wide variety of products, we can decide here how thick the PVC layer should be and adjust it via the roll gap,” explains Frédéric Dhaene during the tour. If a thinner film is produced, less material is required, and if a thicker film is produced, more material is required, but this is no problem for the feeding unit.

“The PWE is so versatile that we can meet every requirement with one and the same setup.” All that is required is a slight adjustment of the process parameters for the dosing capacity, temperatures and speeds of the PWE and single screw. When a recipe change is due, the PWE impresses with its short cleaning times, as Karl Wallis explains:

“Thanks to its 45° helical gearing, the PWE has a good self-cleaning effect. When changing recipes, the machine is first emptied and then the first piece of the melt strand of the new recipe is removed before production resumes.” Short cleaning time, little waste.

Film thickness determines the end product

“Our two main products are glued PVC floors with a thickness of around 2.5 mm and Flex-Click floors with a thickness of around 4.5 mm,” explains Dieter D’Hondt. The final thickness is determined on the one hand by layering at least two of the previously manufactured, double-sided coated, 0.5 mm thick fibreglass fabrics and, on the other hand, by the four-layer structure consisting of a carrier material, PVC layers, the decor and a final protective layer. “Our unique selling point is that our end products always contain two PVC films with fibreglass fabric, making them very dimensionally stable.”

But let’s continue with the process: after the fibreglass mats coated with PVC on both sides have been manufactured, they are laminated with a decorative layer and passed through embossing rollers to give them a wood-like structure with grain and knot holes. The final protective layer is UV-treated – glossy or matt, depending on the product. By the way: premium products from the Moduleo range have a special matt coating that is modelled on real wood.

Reinventing PVC flooring

At the very end, the finished films are trimmed at the edges, which are shredded and returned as recyclate, finished, cut to their final plank size and packaged. Even though the PVC floor coverings manufactured by Unilin do not come in bright colours but usually have a wood or concrete-like appearance in shades ranging from beige to grey, they are anything but monotonous. “Our designs are trendy and among the best-selling,” says Frédéric Dhaene happily. “One of our latest developments is the adhesive technology,” he continues. “Similar to removable Post-its, we have developed an adhesive underlay called Flex Pro, which is first laid in the room and then PVC planks or tiles are stuck on top of it.” This method makes installation easier and reduces installation time.



Product Manager Frédéric Dhaene is certain that the new Flex Pro adhesive technology makes laying PVC planks and tiles easier and faster.



During the tour of the plant, Frédéric Dhaene shows the recycled material that is produced in-house by shredding edge waste and returned to the production process.

Even more creative is the mosaic concept of Moduleo’s Moods collection. “We have developed a sophisticated system of shapes that interior designers can use to create individual mosaics,” emphasises Frédéric Dhaene. Parallelograms and diamonds in different colours enable cool floor designs. And at the end of their service life, the PVC floors can be collected and 100 % recycled into new flooring. **K**

www.unilin.com

www.moduleo.com

www.entex.de



Karl Wallis (left) from Entex explains why the PWE has such a good self-cleaning effect and produces very little waste when changing materials.

Trade fair atmosphere outweighed economic situation

K 2025 further expanded its international significance – despite serious demand problems in Europe

With 3,270 exhibitors, K 2025, the largest trade fair for plastics and rubber in the Western world, almost reached the record figures of the pre-Covid event in 2019. With a preliminary total of more than 175,000 admissions and 73 % international visitors, the Düsseldorf exhibition defended its position and even further expanded its international significance. The eight days of the trade fair were marked by an excellent atmosphere.

However, a look behind the scenes revealed ongoing challenges, at least for European market participants: Plastics machinery manufacturing in the DACH region continues to suffer from a lack of orders, especially from its domestic markets. Plastics production accompanied the trade fair with bad news from several European countries. And plastics processing continues to be concerned about demand from consumers, trade, industry and the public sector. The consolation is that the industry is clearly continuing to grow globally.

Photo: K-PROFI/Manuel Hauptmannl



K 2025 facts and figures

Stable visitor numbers, more exhibitors, greater internationality and a positive atmosphere

The number of exhibitors at the event from 8 to 15 October 2025 climbed by around 250, or more than 7 %, to around 3,270, while the total net exhibition space remained virtually unchanged. This means that the record figure of 3,330 exhibitors from 2019, before the coronavirus crisis, has almost been reached again. Of the 3,262 K exhibitors from 66 countries listed in the online directory, 806 (just under 25 %) came from Germany. For the first time, the largest guest nation was China, including Hong Kong, with 492 exhibitors, overtaking Italy (401). It was followed by Turkey (212), India (183), Taiwan (115), the USA (103), France (102), Austria (85), Switzerland and Spain (75 each), the Netherlands (72), Great Britain (64) and South Korea (50). Significantly more exhibitors than in 2022 came from China, India, Taiwan, Turkey, South Korea, Japan, Czechia, Singapore, Slovenia and Vietnam. Compared to the previous event, there were 9 % more raw material suppliers and 6 % more machine and tool manufacturers among the exhibitors, but 1 % fewer plastics and rubber processors and 6 % fewer service providers.

The 18 halls of the Düsseldorf exhibition centre were fully occupied. As in 2022, the outdoor area not only featured pavilions from a number of plastics manufacturers, but also the VDMA's 'The Power of Plastics Forum' with an event room and secondary and special presentations by seven member companies of the mechanical engineering association in specially erected lightweight construction halls.

According to preliminary figures from the last day of the fair, Messe Düsseldorf registered more than 175,000 visitors from around 160 countries, roughly the same number as three years ago. At 73 %

(2022: 70 %), interest from abroad once again reached the high level of K 2019. The trade fair company has not yet published the exact visitor structure, but more than a third of foreign guests came from overseas. In 2022, the figure was 42 %. According to initial figures, India (6,400) and China (6,300 visitors) were particularly well represented. A total of 10,000 guests travelled from the USA and Brazil.

As always in times of economic uncertainty, many machine manufacturers focused their exhibits and presentations primarily on stable customer markets such as medicine and packaging. Exhibits relating to the production of flexible packaging materials in particular were also on display at many technology providers from emerging markets.

According to analyses by Messe Düsseldorf, visitors to K 2025 were once again characterised by an above-average decision-maker ratio of 67 %. According to a preliminary survey, 95 % of visitors stated that they had achieved their trade fair goals. 98 % of trade visitors rated the range of products and services on offer as excellent or were very satisfied with it. Visitors were particularly impressed by the strong presence of market leaders and the large number of innovative companies.

The next K is scheduled for 18 to 25 October 2028 – again running for eight days from Wednesday to Wednesday. If the trade fair company sets its milestones for K 2028 as usual, registration for exhibitors is likely to close on 31 May 2027.

www.k-online.com



Photo: K-PROFI/Manuel Hauptmann

COMMENT

Europe's plastics industry faces turbulent times

K 2025 highlights the need for action by players in the DACH region

The plastics industry continues to grow globally. Renowned studies confirm this. With a record 76 % of exhibitors coming from abroad, it is not surprising that the number of visitors to K 2025 from outside Germany also reached the 2019 high of 73 %. The 180,000 visitors targeted by Messe Düsseldorf were just shy of being reached. Exact figures are not yet available.

Whether it was a reunion or a first encounter, the visit was a success, the stand crews enjoyed interacting with customers and interested parties, and there were many outstanding exhibits as usual. This mix created a good atmosphere. However, demand and investment appetite from core Europe are currently very subdued, with only more distant foreign countries showing signs of growth for domestic exhibitors of materials and equipment. The widespread conclusion of the trade fair was virtually predictable: 'The mood was better than the situation.'

Plastics production in Europe has been shrinking significantly for years, even though 2024 appeared stable. Investments are being halted, capacities relocated and sites closed. Threatening descriptions of the situation, which made it from K to the public media, reflected the situation in the chemical industry, but did little to help the external perception of the K industry.

Raw material refinement and processing technology from Europe have cemented their leading position at K. Nevertheless, many plastics machinery manufacturers are rethinking their strategy, pushing through cost-cutting measures and even reducing capacity. Who will be able to adapt to unit sales that are barely growing and may even decline in the future? Are the established strategies for manufacturing, assembly, sales and service still effective? Is it possible to strike a balance between supplying high-tech equipment and not relying on success in volume business?

This can be clearly seen at K: local recycling technology is world-class. Nevertheless, processing volumes are stagnating in Europe, while growing strongly in Asia. Even investments in the chemical recycling of plastics, which has been so heavily promoted by the chemical industry in politics, industry and society, are now being delayed, questioned or even suspended altogether by the industry itself. Bitter. The production base in manufacturing, machine and tool construction is visibly shifting towards Asia. A global redistribution of tasks seems conceivable: standard machines and raw polymers (only) from Asia? High-end machines and high-performance compounds (still) from Europe?

To date, the plastics and rubber industry has emerged stronger from crises overall. For several years now, it has been struggling in Europe, especially in high-cost countries: energy and personnel costs, bureaucratic burdens and a shortage of skilled workers are weighing heavily on the industry. Plastics processing in the DACH region is already undergoing a wave of consolidation, fuelled by increasing insolvencies, especially in the technical value chains. Most of the tool-making industry is in a prolonged crisis.

Packaging and medicine proved to be relatively stable customer markets in Düsseldorf, while technical applications were somewhat on the defensive. For many, the core problem remains the automotive value chain. The drive towards the security and defence industry was clearly noticeable, but accompanied by uncertainty as to how strongly the debt package will actually affect the procurement of military vehicles and drones or the equipping of barracks.

Never before have representatives of our industry complained so much about bureaucratic burdens as a locational disadvantage as they did at this K. Barely two sentences after complaining about excessive regulation, they vehemently called for more regulation where it would benefit the plastics industry and promote the circular economy – not only in Europe, but even worldwide. Calling for regulation that benefits one's own industry does not necessarily make general criticism of regulation more credible.

Recruiting, training and retaining staff was an important issue, and not just in the associations' programmes. The retirement of the baby boomer generation obscures the real decline in jobs. Nevertheless, the labour market seems to have become more dynamic. Young talent has become more demanding and can afford to be courted. Conclusion: skilled workers remain in demand, and the increased use of AI in production and administration alone will probably not be able to close the gap.

Once again, the most exciting new applications arose from collaborative projects: machine and tool manufacturers, plastics refiners and processors can achieve a lot when they sit down together! As expected, artificial intelligence will be a major topic at K 2025. A closer look reveals the enormous, untapped potential of digitalisation, not even taking AI into account. The industry needs much more momentum in digitalisation!

Three years ago, plastics trade editors were inundated with extremely positive trade fair reports from exhibitors. After K 2025, there is hardly any jubilant communication. Nevertheless, it remains exciting to see whether the often-cited 'good project activity' can be converted into one or two orders after all. This would be particularly welcome for machine and tool manufacturers.

It is to be hoped that K 2025 has provided every single plastics and rubber processor with guidance and support, inspiration and ideas. International interest in the trade fair has grown, thanks to more exhibitors and more visitors from all over the world. For processors and users of plastics and rubber, it should be worth making the trip to Düsseldorf again in three years' time – even if the industry will probably look quite different at K 2028 than it does today. *Markus Lüling* ■



Circular economy and K 2025

I have been visiting our industry's leading trade fair, which takes place every three years, since I was a student almost 40 years ago. Never before, in my estimation, have so many recycling machine manufacturers exhibited and presented their innovations. These range from new extruder concepts, in particular with improved degassing, to many other decontamination techniques such as hot washing and de-inking/delamination, to shredding technologies and wastewater treatment. Many of these developments aim to push the boundaries of traditional mechanical recycling. This is the only way to remove or reduce volatile components, odours and colours in order to use mechanically produced recyclates in higher-quality applications. At the same time, all these technologies are also suitable for purifying the feedstock for chemical recycling, thereby improving its efficiency. Many innovative recyclers have already invested in such future technologies.

While the mood among machine manufacturers, often driven by sales and investments outside Europe, is slowly improving, the situation for many recyclers remains difficult. Due to delayed incentives or those that will only come into effect after 2030, such as

disposal fees staggered according to recyclability or binding recycled material quotas even for more demanding applications, the markets are currently mostly unwilling to pay the necessary prices for better recycled materials. As a result, we are seeing recyclers going bankrupt and the chemical industry delaying investments in chemical recycling. On the other hand, driven by packaging and end-of-life vehicle regulations, Europe will need significantly more recycling capacity after 2030. We can therefore only hope that recyclers will survive this lean period or that their activities will at least be taken over by financially strong buyers.

It would therefore be desirable if we could obtain clarity as soon as possible on framework conditions such as the "delegated acts" in the PPWR and if recyclate users and packaging customers realised that they should not wait until the last minute to switch to recyclable packaging containing recyclate. Every engineer knows that good developments take time and that packaging that meets all requirements must pass numerous tests before it can be used safely and economically on the market. Those who hesitate

too long now may find themselves running out of time shortly before 2030, as all market participants are likely to want access to recycled materials and recyclable, and thus marketable, packaging at the same time.

Europe still has an excellent opportunity to set standards in plastics recycling and thus open up export markets for machines and recyclable products. However, we should make consistent use of the time until 2030 and protect our recycling industry. ■



Prof. Dr.-Ing. Achim Grefenstein is Senior Vice President R&D at Constantia Flexibles and Scientific Director for Circular Economy at the Institute for Plastics Processing at RWTH Aachen University (IKV).



Sources of supply/suppliers directory

The A to Z of the plastics and rubber industry

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Dedusting



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Extrusion technology



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... not the caravan market too

What motorhome manufacturers should learn from the automotive industry

For decades, the European caravan market was dominated by domestic manufacturers. Names such as Hymer, Knaus Tabbert, Trigano and Hobby shaped the image of campsites from Scandinavia to southern Italy. Caravans and motorhomes 'Made in Europe' were considered the benchmark for quality, and even British and Scandinavian suppliers fell into line. The structures were clear: Europe produced, Europe consumed – and Australia in particular was an outlet for excess capacity in terms of exports.

The parallel with the automotive industry is obvious: European manufacturers were also considered untouchable for a long time. But in the field of electromobility, Chinese brands have gained ground within a few years, not least because they invested early in battery technologies and economies of scale. For the caravan sector, this means that the days of a comfortable market lead could be coming to an end. Competition is intensifying – not only in terms of price, but also in terms of the speed of innovation and alternative drive systems.

At the same time, the European environment for new recreational vehicles has become more difficult: high interest rates are dampening financing, dealers are stuck with full inventories, and demand is falling after the boom years of the pandemic. Manufacturers are struggling with supply chain problems (e.g. chassis) and new emission standards, while customers expect digital features, sustainability and e-mobility.

'Not the caravan market too' – that may be what some board members or dealers are quietly thinking when they read the headlines about new Chinese models. And yet: competition is inevitable. The European industry can decide whether to repeat the history of the automotive industry or to learn from it. Those who invest now in quality, service, digitalisation and alternative drive systems will be able to set standards in the future. Those who wait and see may soon find that new brands are not only on the roads, but also on the campsites. **K**



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But now new players are appearing on the scene: Chinese manufacturers, led by SAIC Maxus, are also presenting their first models in Europe. What began in the automotive sector with electric vehicles is now being repeated in the recreational vehicle market. Initially ridiculed, the Chinese newcomers are rapidly gaining experience and market power through low prices and high volumes in their home market. Australia, New Zealand and the USA show how quickly Chinese caravans can gain a foothold in significant numbers. Europe could be the next step – despite strict registration regulations, demanding customer tastes and a lack of service networks.

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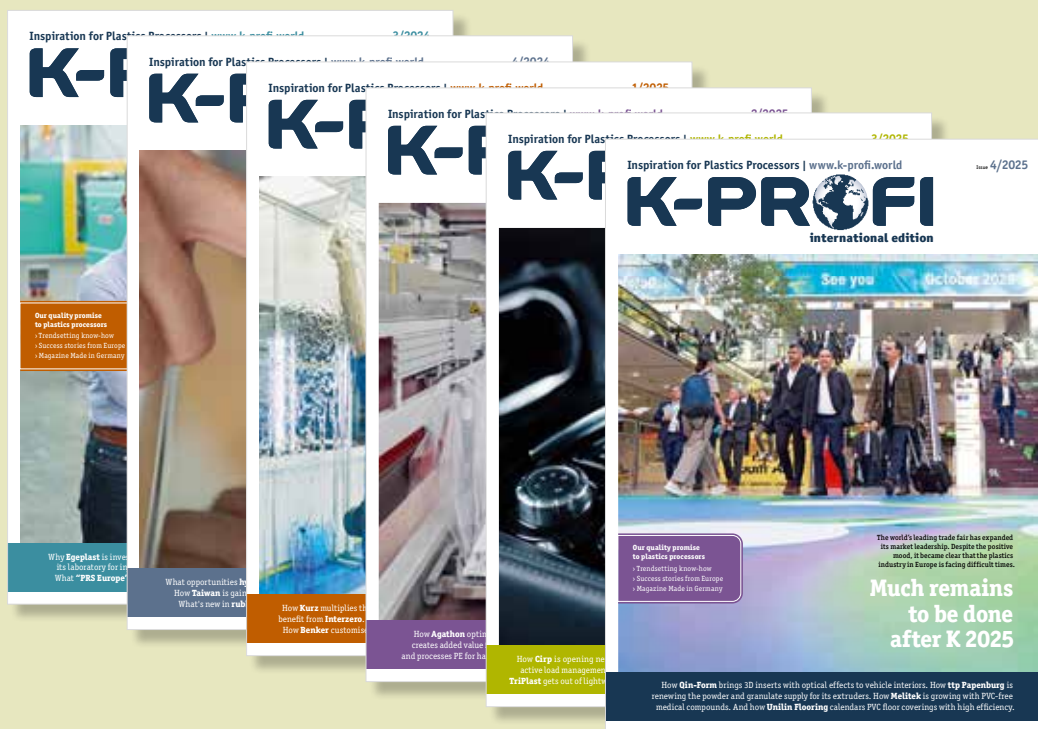
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