

K-PROFI

international edition

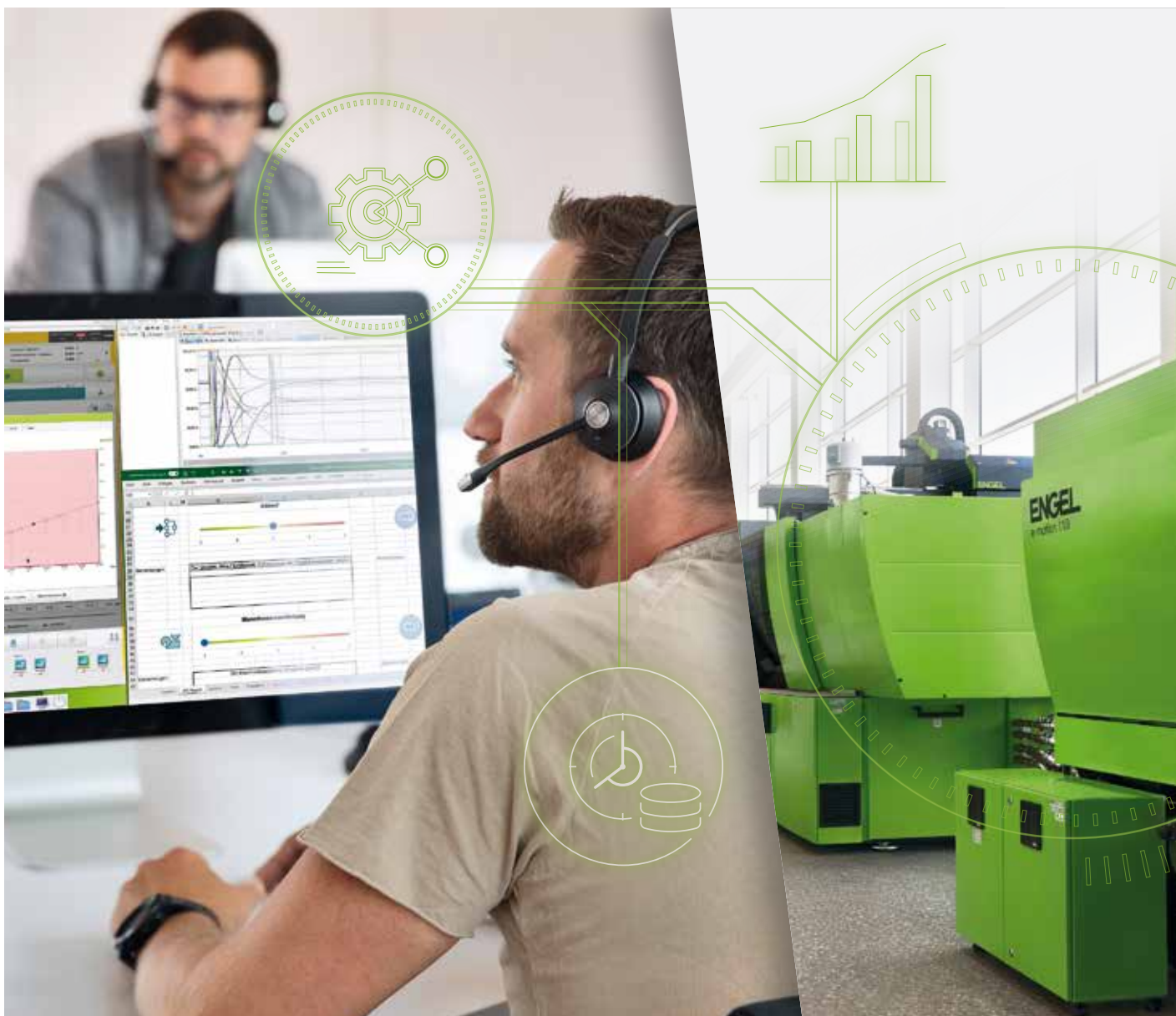
Attention, plastics processors!

- › Success stories
- › Exclusive interviews
- › Practical know-how

The Corona Lockdown has fuelled digitally assisted remote commissioning of plastics machinery and equipment:

Online tools are useful and well received

How **Trioworld** brings PE from PCR into stretch films. How **Tactotek** creates PP-based IMSE. Why **Viaoptic** sees potential in optical parts. Why **PE supplies** from the USA are booming. How **BIA** is making its galvanisation future-proof. How **HDH-Mernök** 3D prints large parts.



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Inspiration for greater success in plastics processing

Dear Reader,

You are presented with the first issue of 'K-PROFI international.' Why 'K-PROFI?' As you know from the K trade fairs in Düsseldorf, the K ('Kunststoff' and 'Kautschuk') stands for Plastics and Rubber. PROFI is the common German abbreviation for Professionals. K-PROFI is aimed at professionals in plastics and rubber processing. In the German-speaking markets, K-PROFI has firmly established itself as a printed magazine and as an ePaper since 2012. Our additional goal is to give plastics processors beyond Germany, Austria and Switzerland inspiration on how to become even more successful. Therefore now 'K-PROFI international.'

Success and sustainability – those require zero-defect production, automation, digitalisation, tailor-made materials, targeted and active use of recycled materials, efficiency in development, organisation and production. For 'K-PROFI international,' experts from our own editorial team create exclusive articles that are always created and written from the perspective of the plastics processor. In this issue, contributions are developed with processors from Germany, Austria, Sweden, Hungary, Portugal and Finland.

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Almost all trade fairs and conferences in Europe and America have been cancelled at least through the summer of 2021. All the more reason for us to provide you with exclusive information in 'K-PROFI international' on trends and developments in plastics processing and to present successful processors. Please register to receive 'K-PROFI international' immediately free of charge and without obligation by direct mailing: www.k-profi.world. The next issue will be published early in July, 2021.

Our wish for you personally: stay healthy!

Markus Lüling, Editor-in-chief

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In this magazine

MATERIALS

Sabine Rahner

Plastic with crystal-clear optical advantages

Why polymers have huge potential in LEDs, photodiodes, eyeglasses, LiDAR, head-up displays, smartphone lenses and consumer optics 6

Daniel Stricker

More and more PE comes from the USA

How the price advantages of fracking are creating a competitive disadvantage for the Western European polyethylene production 9

Toralf Gabler

„Colour is communication – colour is emotion“

What significance colour trends have and how they are created 40

Karin Regel

It's confirmed: PCR also works in high-performance applications

Why PE film manufacturer Trioworld is greatly involved with recycled material and which products have been realised so far 58



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TECHNOLOGY

Toralf Gabler

“We will bring this technology to series production”.

BIA Managing Director Dr Markus Dahlhaus talks about the substitution of chromium(VI) 12

Sabine Rahner

Smart surfaces with polyolefins

About the market opportunity for IMSE solutions in the automotive sector 20

Karin Regel

Automatic strand pelletising saves resources

Raw material and compound manufacturer Azoty stands by globally standardised plant technology 36

Sabine Rahner

“We want to update the hardware world”

How the start-up Amprove is turning lightweight construction development upside down 46

Sabine Rahner

Geometric freedom without compromise

Why the Hungarian service provider HDH is investing in a new 3D printing system 52

INTERVIEW

Markus LÜling

“We are process advocates”

How Rico creates a real advantage with a twelve-hour ghost shift ... 16

STRATEGY

Toralf Gabler, Sabine Rahner, Karin Regel, G. Rzepka and M. LÜling

Remote commissioning works

The Corona Lockdown has fuelled the digitally supported remote start-up of equipment / Status report after one year 22

PORTRAIT

Markus LÜling

“We work very much in a solution-oriented way”.

How Walther Faltsysteme benefits from more use of recycled material, flexibility and transparency in production 30

COLUMN

Dr.-Ing. Arno Rogalla

Safe new start-ups take time, especially in medical technology! 66

EDITORIAL 3 MARKETPLACE 62 IMPRINT 66

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Seven optical elements are combined in this point-of-care diagnostic.



Free-form optics for automotive applications: Design freedom says something for the use of plastic.



Plastic with crystal-clear optical advantages

Why polymers have huge potential in LEDs, photodiodes, eyeglasses, LiDAR, head-up displays, smartphone lenses and consumer optics

Plastics are in constant competition with many other materials. In optical applications, they rival above all with glass. K-PROFI spoke to Bernhard Willnauer, Managing Director of Viaoptic GmbH, which like its sister company Leica Camera is based at the traditional Hessian location of the optical industry, about the progress of substitution, new application opportunities for polymers and counter-movements.

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

Feinwerktechnik Wetzlar GmbH produced its first plastic optical component in 1965 for the brightest viewfinder of an SLR camera. This is noted in the history of Leica Camera AG's sister company, today's Viaoptic GmbH in Wetzlar. While the actual imaging optics of camera lenses are still made of mineral glass, plastic optics have since conquered every new fields of application. "We are surprised every day by the ideas customers bring to us," reports Managing Director Bernhard Willnauer. Customised optics made of COP/COC, PC and PMMA for the automotive industry, sensor technology and medical technology are the three big drivers at Viaoptic. A high degree of design freedom, low weight, break resistance as well as economical large-scale production are the decisive advantages of plastic over glass.

"I see the design freedom as the biggest advantage," says Willnauer. For example, optical applications benefit from free-form lenses and so-called aspheres, i.e. lenses with an elliptical rather than spherical basic geometry, which can bring an optical system consisting of several spherical lenses down to one lens. While these are extremely

difficult or impossible to realise in glass, they are just as easy to produce in plastic as a spherical lens "as soon as the tool is set up". This is because, in contrast to the geometric limitations in glass processing, the introduction of free-form surfaces into injection moulds is standard. And through ultra-precision machining in toolmaking, the high demands on accuracy and surface roughness of the optical plastic systems can be met.

The simple integration of fastening, centring and spacing elements is another aspect of design freedom. Just like the possibility of combining an infinite number of optical surfaces in one component. The classic glass lens (biconvex, plano-convex or concave) has two optical surfaces, a ground prism has a maximum of four. "Plastic optics with seven or eight optical surfaces, such as those used to steer the laser in a computer mouse, cannot be manufactured in glass at all". Plastic also allows the production of optical microstructures. Structures that are finer than the wavelength of light can be used to control the diffraction of light in such a way that very flat elements can be used to achieve effects similar to refractive optics, in which the light is refracted rather than diffracted. The production of plastic micro-lens arrays, where many small lenses are arranged on one surface, also has much fewer restrictions than the glass version.

Ahead by a nose in spectacles

Plastic is inferior in terms of scratch resistance, temperature resistance and (imaging) accuracy: "The achievable precision is significantly higher with glass, mainly due to the low thermal expansion".

In terms of dispersion and refractive index, plastics also cover a less extensive spectrum than glass.

Despite these limitations, plastics have prevailed especially in spectacle optics. In 2019, the share of mineral lenses in total sales of spectacle lenses in Germany was only 4%, compared to 12% in 2010. "Glass has all but disappeared here," Bernhard Willnauer discerns, even though Vioptic is not active in this business sector. Break resistance and weight are the decisive aspects. Thanks to anti-reflective and scratch-resistant coatings, plastic lenses are "almost on a par with mineral lenses". In addition, there is a wide range of colouring options for filter functions or fashion purposes.

LED and laser diode cause growth boom

Plastic optics have experienced exponential growth in technical applications since the 1990s. With the emergence of LEDs (low heat generation) and laser diodes (adjustable radiation intensity), the range of applications expanded rapidly. "Gas discharge, xenon or halogen lamps, as used before in surgical lights, generated too much heat for plastics. In car headlights, too, plastic lenses have been introduced with the LED. For the older halogen and xenon lamps, glass lenses were the only option because of the enormous temperature produced." In the new generation of matrix headlights with beam-er technology, a glass-plastic combination solves the issue, because there "the temperatures are a little higher again and the requirements for resolution and precision increase."

In addition to lighting optics, the automotive industry offers a large playing field for the use of plastic optics in sensor technology (for example LiDAR) and in imaging applications such as head-up displays. "On the other hand, in cameras used for vehicle assistance systems, glass has reasserted itself, partly because the temperature range for testing the components has now been extended to 130°C".

In medical technology, especially in endoscopy and microscopy, plastic has so far not been able to hold its own against glass. "There are frequent attempts with plastic optics in disposable applications, but usually the imaging quality is not sufficient for the desired imaging". In contrast, the optics used between the laser and the eye in laser eye surgery are typically produced in form of a sterile disposable plastic component. Bernhard Willnauer also considers optical assemblies for near-patient laboratory diagnostics (point-of-care testing), commonly called rapid tests, to be



Photo: Vioptic/Daniel Klatt

Vioptic Managing Director Bernhard Willnauer on the range of applications for plastic optics: "We are surprised every day by the ideas customers bring to us".

predestined for plastic. "The demand is great, the processes are complex, and many optical components are needed. Plastic enables here a reduction in costs".

Optics built into smartphones represent a huge consumer market. In new top models, up to five lenses with multiple lens elements are built in. "The penultimate and last generation relied on plastic lenses with a glass element to compensate for the temperature effect. Current models have pure plastic lenses, and in the next generations a



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Miniature optics made of plastic: The smaller the more difficult is the manufacture of glass lenses.

glass-plastic combination will be used again," reports Bernhard Willnauer. "Mineral glasses simply offer more possibilities in imaging optics in terms of refractive index, dispersion and temperature range. But since glass cannot be ground into aspherical lenses on the scale of mobile phone lenses, a lot of research and development is currently being invested in pressing the smallest lenses".

Into the future with even higher precision

But development is not standing still in plastic optics either, shown in the example of virtual reality headsets. The Viaoptic managing director reports on numerous new areas of application for plastic optics, such as sensors used in the smart home sector. And beyond navigation devices for surgeries, these also might include quite ordinary applications such as new signal displays in public transport for improved side visibility and colour diversity.

And even 3D printing is headed towards optics. "There is a vision that in future the optician will print the individual lenses in his back office directly after testing the eyes. The process itself still has limitations, but there are already many ideas on how to solve these. I think this will come at some point," Bernhard Willnauer is convinced.



Optics for a high-end photo flash unit made of high-temperature plastic.

The big challenge at Viaoptic and other manufacturers of technical plastic optics is a further increase in precision. "For the mass products used in optical systems, such as LEDs, photodiodes, chips, etc., the manufacturers specify relatively large tolerances across the board. If higher precision is required for the application, even more precise plastic optics are supposed to compensate for this. However, we can only achieve higher precision through better measurement technology. Therefore, we invest in inline 100-per cent-inspection with camera control and specific measuring technology, as it is used for the selection of mobile phone lenses. This trend towards higher precision through 100-percent-inspection and selection is seen in many areas".

Other areas of application may also be possible with special plastics, such as the OKP polyesters from Osaka Gas Chemicals in Japan. Compared to COP, PC and PMMA, these have enhanced dispersion and birefringence properties, as well as a higher refractive index, and are used for smartphone lenses, among other things. "However, some of these materials are so scarcely available that they only go into consumer optics and are difficult to obtain here in Europe".

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More and more PE comes from the USA

How the price advantages of fracking are creating a competitive disadvantage for the Western European polyethylene production

Vigorous fracking in the USA has opened up not only oil but also large gas deposits. The petrochemical industry there has banked on it and invested on a large scale in capacities for the polymerisation of ethylene in a low-pressure process. Many new plants for PE-HD and PE-LLD are now in operation. The result is high import pressure on the European markets.

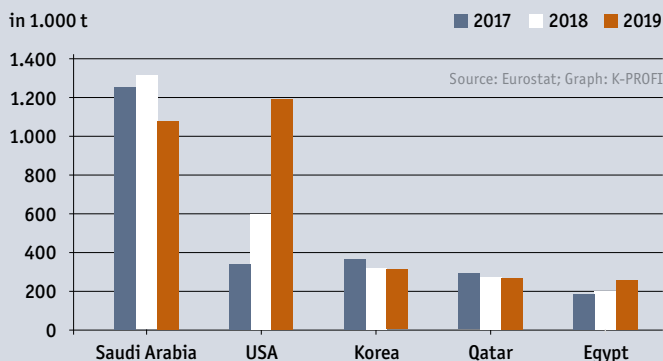
*Text: Daniel Stricker, M.A.,
Senior Market Research Consultant, KI Group*

In the middle of the last decade, a supply and price crisis emanating from polyethylene transformed the European plastics markets. The main cause was global changes triggered by the boom in oil and gas production from US "shale" deposits combined with a strengthening of the USD. Simultaneously, the EU region tipped towards an import surplus in PE, driven mainly by low-pressure PE-HD and PE-LLD grades. In this context, KI forecast a powerful surge of PE imports starting in 2017 from the many new US plants planned at the time.

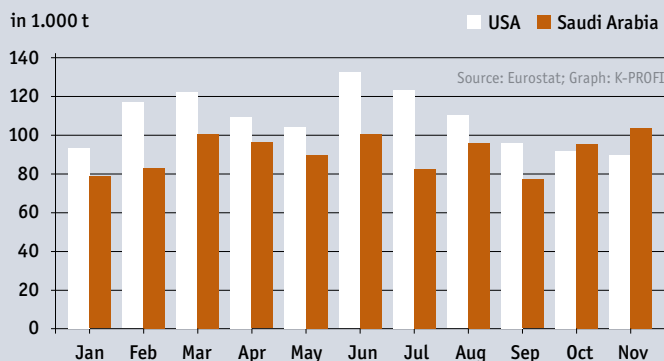
Now looking at the statistics for the second half of the decade confirms this assessment quite remarkably. From 2016 to 2019, US shipments to the EU 27 (excluding the UK) more than quadrupled to around 1.2 million t, according to official statistics from Eurostat. By contrast, deliveries by long-time PE import market leader Saudi Arabia fell from 1.2 million t previously to just upwards of 1 million t in 2019.

South Korea, Qatar and Egypt follow in second place with 200-300,000 t each. The Koreans and the country on the Persian-Arabian Gulf had already established themselves as relevant players at the beginning of the decade, while the country on the Nile has gained significantly since 2016, after the Ethyldco plant in Alexandria came on stream.

Meanwhile, in 2020, the Saudis' loss of leadership position to the USA is confirmed as undeniably sustainable. This is shown by the data available through November 2020, which indicates the USA delivered in excess of 1 million t to the EU in the first nine months



Throughout 2019, the USA replaced Saudi Arabia as the largest importer among the five strongest PE importers in the EU 27 (excluding the UK).



PE imports from the US and Saudi Arabia to the EU 27 in 2020 confirm the new balance of power – despite the US suppliers' weakness due to the hurricane season in Q4.

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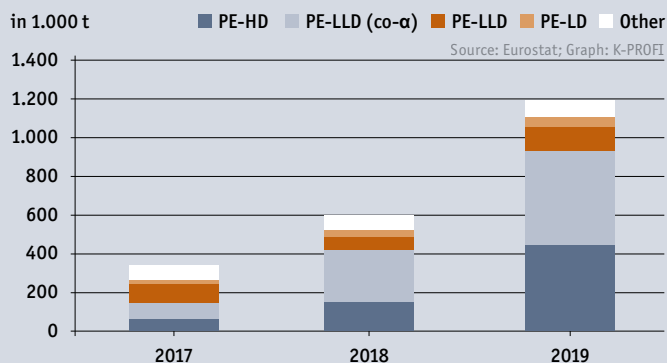
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of the year, Saudi Arabia lagging behind with 800,000 t. Surprisingly, there was only a slight dip due to the Corona pandemic, although imports have tended to decline somewhat since the middle of the year. However, from September onwards, US imports fell significantly, while Arab imports filled in the gaps. This is probably caused by the hurricane season, which led to many shutdowns on the US Gulf Coast and thus supply shortages.

The vast majority of new US plants have been built with low-pressure swing technology for the production of PE-HD and PE-LLD. While the plants built well over a decade earlier in the Middle East are mostly still designed for simple types such as unimodal PE-HD and PE-LLD (C4), the American ones use predominantly the more advanced technologies for bi- or multimodal PE-HD as well as higher-grade PE-LLD with copolymer alpha-olefins. Therefore, large plants for the production of these alpha-olefins – mostly for C6 – have been built simultaneously.

Strong growth in higher-value PE-LLD

Eurostat reacted early on to the expected wave of imports. Presumably with expert advice from the producing companies, a new subcategory “ethylene-alpha-olefins copolymers, having a specific gravity of > 0.94” was introduced in 2017 for separate accounting. After the first year when around 90,000 t of it were recorded, the US quantities blew up from 273,000 t in 2018 and to 491,000 t in 2019 – a five-fold increase in a very short time. In contrast, for simple PE LLD, imports from the US fluctuated between 95,000 t in 2017 and 121,000 t in 2019 over the same period.

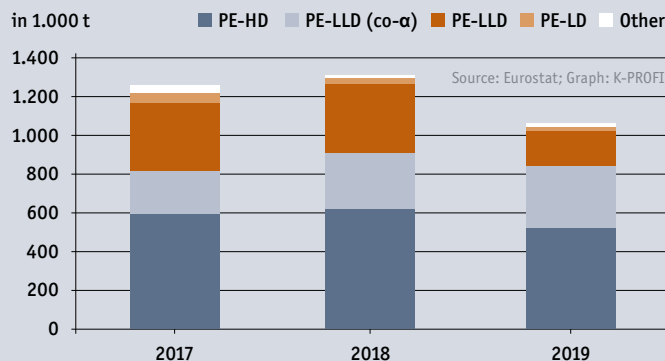


EU imports of PE from the USA increased fivefold within two years. Significantly up: PE-HD and high-grade PE-LLD types.

Meanwhile, US shipments of PE-HD increased almost more pointedly. While in 2017 it was 59,000 t, only two years later 441,000 t were recorded. However here, there is no differentiation according to specific types. It should be noted that almost all of the new US imports are, as expected, low-pressure types.

The protagonists of the upswing in deliveries are likely to be the “big three” of US production. ExxonMobil has added around 2 million t/a of low-pressure PE capacity since 2016, Chevron Phillips around 1 million t/a. Dow has brought a total of around 1.3 million t/a of new PE capacity online in the same period, but “only” 600,000 t/a of this for low-pressure PE.

It is obvious that such additional mass throughput has an impact on the previous market structure. Consequently, the numbers for Saudi Arabia, the other major supplier country for PE to Europe, already show obvious reactions. Its 2019 decline in EU imports is largely based on the simple types of PE-LLD (C4) and some PE-HD. However, at the same time, the Saudis expanded deliveries of PE-LLD (C6) to Europe, presumably in order to compensate for market share losses. On the flip side, it seems likely that the simple types of the portfolio were increasingly redirected to Asia. In particular, China, which continues to be volume-hungry, is likely to be one of the main target markets, partly because of its trade conflicts with the USA.



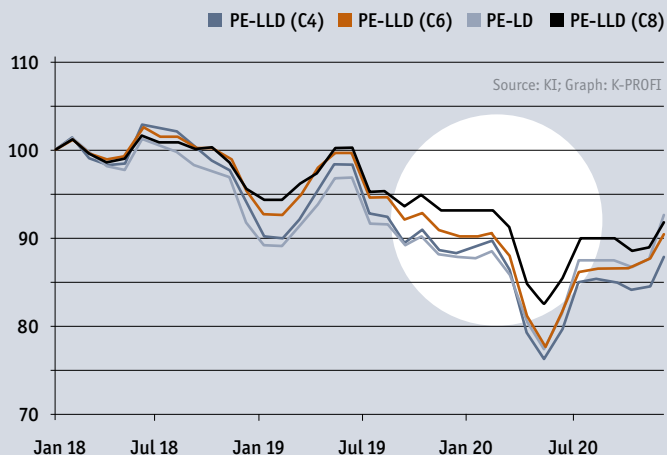
EU imports of PE from Saudi Arabia are declining, especially for simple types of PE-LLD (C4) and PE-HD.

Another obvious consequence is the shifting of the previous price structure of the various PE sectors. Indeed, throughout 2019, prices of PE-LLD (C6) film types fell disproportionately compared to other materials such as PE-LD, PE-LLD (C4) and PE-LLD (C8). This index view of the prices with a starting point in January 2018 illustrates this. The span of C6 to C8 types widened from previously around 140 to 180 EUR/t in 2020. At the same time, the absolute price level of PE-LLD (C6) clearly approached that of PE-LD.

These effects can be seen even more clearly in the portfolio of PE-HD grades. Whereas in the past mostly the simple injection moulding types were susceptible to import drifts, it is now increasingly blow moulding types that are suffering. Here, US imports already had an impact in 2018. Prices fell sharply compared to injection moulding types and have since remained at the lower level of HD film types.

For some time now, the European PE blow moulding world has been dominated by bimodal types. In this regard, the downward adjustment of the price curve is a clear indication of a new challenge for the European production of PE-HD. From 2010 to 2015, producers in Europe had already closed down around 1 million t/a of capacity. This was mainly due to the decommissioning of outdated plants for simple unimodal types, which at the time had come under pressure from imports from other regions. Now the former fallback alternatives are finding themselves also on the defensive.

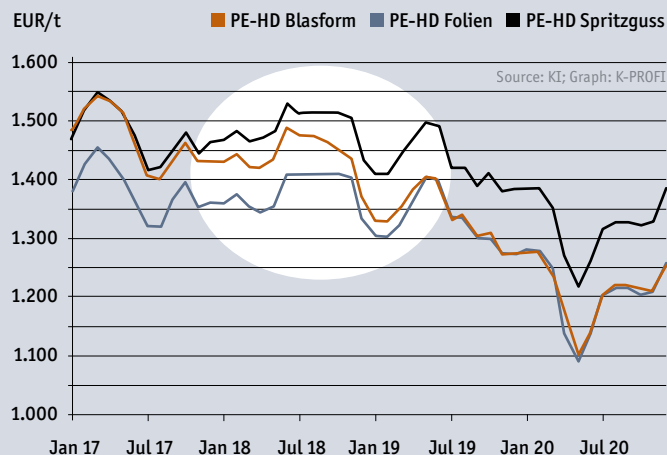
Not only will the pressure not ease, but rather it will continue to increase. In the US alone, according to the AI capacity database Polyglobe, there are more new PE plants on the project lists for 8 million t/a by 2025. Even if the Corona pandemic gives rise to some delays or possibly causes some to be axed altogether, much of it will be



Throughout 2019, European prices of PE-LLD (C6) fell disproportionately compared to PE-LD, PE-LLD (C4) and PE-LLD (C8). (Index: January 2018 = 100)

realised. In addition, PE plants for 3 million t/a are also planned in Russia on the Gulf of Finland in connection with the “Northstream 2” gas pipeline by the middle of this decade.

It will therefore become even tighter for PE production in the traditional Western European industry hubs, which will also be pressed for breathing room as oil prices rise again. Accordingly, in December 2019, for example, ExxonMobil had announced a shutdown extension



Downward trending prices for blow-moulded grades of PE-HD in Europe indicate growing import pressure due to US volumes.

of the plant for PE-LLD (C6) in Gravenchon, France, due to economic pressure. Some successful customer protests were reported, which were dependent on materials from there. However, it is probably only a matter of time before conversions take effect at the processors, and production is stopped. One thing seems certain: more plants at European sites will follow.

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“We will bring this technology to series production”.

BIA Managing Director Dr. Markus Dahlhaus talks about the substitution of chromium(VI).

Chrome-plated plastic parts are highly valued design and functional elements in among others, the automotive industry. For decades, electroplating with chromium trioxide (CrO₃) – also called chromium(VI) – was the standard. Due to its risk to the environment and the health of exposed employees, the unregulated use of chromium(VI) in the EU was supposed to end in September of 2017. Subsequently, only use authorised by the EU Commission should have been possible. The authorisation for the use of CrO₃ will be reviewed from time to time in fixed intervals and will end when safe and economically viable alternatives are available. Therefore, work on alternatives has begun way before the deadline. K-PROFI spoke with Dr. Markus Dahlhaus, Managing Director of BIA Kunststoff- und Galvanotechnik GmbH & Co. KG in Solingen, Germany, about the current state of affairs and the challenges of the changeover.

K-PROFI: How much time do you have left before you have to replace the chromium(VI) technology?

Dr. Markus Dahlhaus: Today, nobody can say exactly when, because the decision-making processes in the EU are difficult to predict. In 2017, we applied in both, the German Galvanised Plastics Association (FGK) and the European consortium, for the continued use of chromium(VI) for plastic galvanisation in the automotive industry. The applications were positively evaluated by the ECHA. This means it was recognised that safe handling of the chemical is possible and that the economic benefit outweighs the risk. ECHA then submitted its recommendation for authorisation with a review period of twelve years to the EU Commission for a decision.

The Commission reviewed the application and in the summer of 2020 requested the applicants to submit further data, including undertakings to replace chromium(VI) and concrete substitution plans. We have done this in detail in both consortia. Now, these plans are available for all EU citizens to comment on, and will then be re-evaluated by ECHA before the EU Commission then makes its final decision. Until the Commission has rendered a decision, everyone can continue to use the chemical. This is fortunate since otherwise we would have had to abandon this industry in Europe.

Does that mean an abrupt end is also possible?

Theoretically, yes. Politicians are free to decide and can also decide to put an end to the industry from one day to the next. However, that is very unlikely, because transitional periods of seven to twelve years have been granted in the context of other authorisations that have already taken place. However, this does not mean that we can slow down; we are working intensively on possible substitutions.

What is today's status of substitution of chromium(VI) in your production lines?

In principle, we have to distinguish between two process steps in which chromium(VI) is used. On the one hand, it is used in the form of chromosulphuric acid for the pre-treatment of the plastic parts and on the other hand for the actual chrome plating.

At BIA, we have been involved with substitution technologies from a very early stage. We put the first chromium(III)-based chrome-plating plant into operation back in 2007. At the same time, we tested an alternative process for pre-treatment. The results were so poor, however, that we had to abandon the trial after a short time.



Dr. Markus Dahlhaus: “We have committed ourselves to convert all our plants to chromium(VI)-free chrome plating by 2025.”

Chrome-plated pushbuttons from the interior of an Audi.

In automotive interiors, chrome-plated plastic parts are among the high-quality design and functional elements.



The chromium plating itself, on the other hand, worked efficiently. However, the parts did not sell well in the market, because the chrome layer was slightly different in appearance from the one produced the conventional way. And that simply did not go over well with customers – especially in the automotive industry.

The topic was again revisited in 2011 when there were signs that at least some car manufacturers were now more open to it. We, therefore, put the chromium(III) plant in Solingen back into operation and initially gained some experience with components for bathroom fittings.

Within the BIA Group, we recognised chrome plating with chromium(III) electrolytes as the future at an early stage and have, since 2012, equipped all new plants with the option of trivalent chrome plating, although customers still prefer hexavalent chrome plating.

Since 2014, we have been producing a portion of the parts with chrome(III) in a plant at our Slovakian site in Nitra for the French automotive industry, which was already more open to this technology at that time. In China, where technology changes can be carried out more easily without regulations, chromium(III) technology is readily seen as a competitive advantage in view of the transition process in Europe. Therefore, from the outset, all our plants there also have the possibility to produce chrome(III) surfaces.

In Germany, we have existing chromium(VI) production lines, which makes the conversion more complex. Nevertheless, we are taking an aggressive approach and are in a position to ramp up production with chromium(III) at short notice.

What hurdles do you have to overcome?

The challenges are less technical. With the chromium(III) process, we meet all the requirements such as corrosion and wear protection. For example, we used this technique to produce the radiator grille for the Peugeot 208 – one of the best-selling French small cars. So far, more than 5 million units have been produced without any complaints.

The problem for some car manufacturers was that the chrome surfaces produced with one process or the other showed slight colour deviations from each other. And this is where German OEMs in particular, with their high demands on the appearance of quality, are sensitive. This is hardly noticeable on a single component. But it is not tolerated if, for example, several adjacent pushbuttons in a car cockpit differ visually from each other. In the meantime, however, we have made significant progress here, so that there are hardly any visible differences. In the near future, this aspect should no longer play a role at all.

In addition, there is the concern that a new process will cost more money. The chromium(III) process is also a little more expensive, but when calculated for the individual components, it has hardly any effect. But at first, OEMs are always discouraged by such a thing.

Therefore the changeover can only happen step by step. The car parts that we produce at our Slovakian location are all new to the product portfolio. This means that when a new vehicle was designed, we immediately offered chromium(III) plating. In such a case, it is relatively easy to qualify.

It is difficult to convert a currently produced component from chromium(VI) to chromium(III). The hurdles on the part of the automotive industry, especially in Germany, for a new qualification are then very, very high. But we have to get to work on this, too, because some of our products have a very long lifespan. For example, a control pad is used in various vehicles of a large premium manufacturer. Development began in 2002, we electroplated the first series parts in 2007 and we are still producing them today, with no end of series in sight.

Have you set a target date for the changeover?

We and the other companies represented in the FGK have committed ourselves to convert all our plants to chromium(VI)-free chrome plating by 2025. To this end, we at BIA are proceeding in line with an internal plan to gradually convert all plants accordingly. In Slovakia and China, all lines are already equipped accordingly. Our new plant in Mexico will start directly with the option of chromium(III). In Solingen, we have just started the conversion or new construction of one of our four plants to chrome(III) processes. And at the Forst site, one of the two plants has been converted in the meantime.



For chrome plating, the parts are mounted on support frames.

Does this also apply to pre-treatment?

Unfortunately, there is still no satisfactory technical solution without chromium(VI). Within a working group at the FGK, we regularly conduct trials with alternative chemical processes and exchange the results among ourselves, because no company can do this development work alone. At the moment, however, we have to say clearly: with these processes, we do not yet meet our specific requirements for a prepared plastic surface.

Where are the problems?

In addition to 1K components, we also electroplate 2K components, e.g. made of ABS or ABS/PC and PC, where the PC component cannot be chromium-plated because it is to

be translucent, for example. The chrome-free pre-treatments, however, often work with swelling agents that damage the PC. Without these swelling agents, however, the ABS is not effectively penetrated by the lye, so that the coating does not work properly afterwards. Also, the processes do not always manage not to coat the support frames on which the parts to be treated are mounted.

In 2020, we conducted a second large-scale ring trial at the FGK, the results of which were significantly better than those of the first test. However, the process is not yet suitable for widespread use. Our tests on the components – for resistance to temperature changes, thermal shock or corrosion, among other things – still show too little overlap. Depending on the geometry and component composition, sometimes one process works better and sometimes the other. We are still missing the method that is equally applicable to at least a large portion of the parts.

Do you also test other surface pre-treatment methods besides chemical ones?

Yes, of course, we are always looking at the latest alternative technologies. In principle, plasma pre-treatment would also be

conceivable. However, this is not suitable for our purposes in large-scale production. For example, while we can pre-treat 200 parts on a carrier in four minutes in an immersion bath, plasma treatment in the vacuum chamber requires one minute per component. In addition, plasma works too selective for complicated part geometries. The liquid in the immersion bath, on the other hand, quickly gets into every corner.

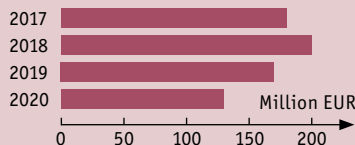
We have also tested PVD coating as an alternative to galvanisation. On the one hand, this cannot keep up with the costs, on the other hand, the quality and thus the reject rate is too high for a decorative process. Since a protective lacquer layer is also necessary, the brilliance and feel are not comparable with a real chrome coating. PVD technology can, however, be useful for niche products, for example when it comes to permeability for radar beams. In contrast to a thick galvanically applied chrome layer, this works very well with a thin PVD layer.

When do you expect a breakthrough for chrome-free pre-treatment?

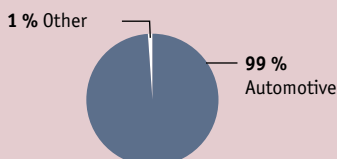
In the submitted substitution scenario, the current state is defined as research for the reasons already mentioned. We expect it to take at least three years before we can move to the next step, testing. After testing, we will work with the



Turnover



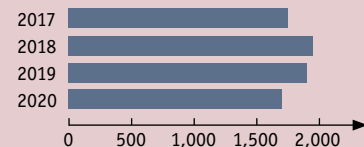
Main customer industries



History

- 1996 Foundation
- 2005 BIA night design
Selective radiolucency of Cr surfaces
- 2013 BIA Texture Chrome
3D texturing of Cr surfaces
- 2013 Production in China
- 2014 Production in Slovakia
- 2016 Introduction of printing process – Expansion of night design technologies
- 2020 Own paint shop
- 2021 Production in Mexico

Employees



Core competences

Development and production of chrome-plated plastic parts and assemblies for the international automotive industry.

Management



Jörg Püttbach
Owner and
Managing Director



Andreas Fiedler
Managing Director
(Personnel and Finances)

converted technology in the field. It may take three to four years to convert the equipment. After that, we can convert the components. This will also take some time. Since we manufacture many automotive products, we have a relatively long lead time. In addition, we still have to go through the application procedures for production at the appropriate governmental entity. Such an approval procedure can sometimes take up to a year and a half. This means that we have to prepare the documents for the authorities one and a half years before the start of production. All in all, we expect it to take at least another twelve years until a fully functional process is state of the art.

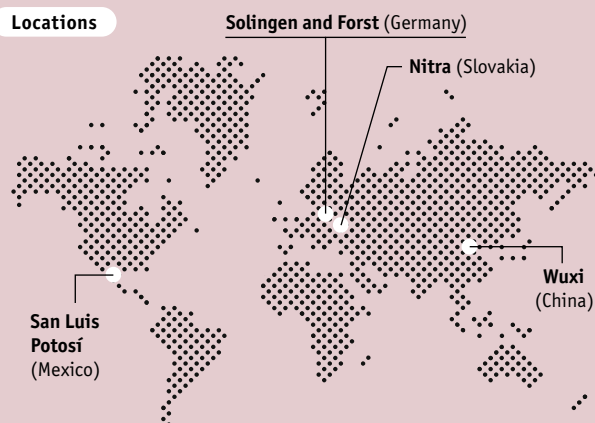
However, we are already testing the technology in the FGK in the first plants with bypass trials. We are now also building such a plant in Solingen. Contemporary to classical pre-treatment, alternative technology can be tested on many different parts under series conditions parallel to series production. Because you have to examine it very carefully. Errors in pre-treatment are usually not immediately obvious. But if, for example, cracks appear in the coating later on and someone possibly gets injured on a door handle, the damage is immense.

I am sure that we will get this technology ready for series production in the next few years. But converting the components accordingly will be a laborious process. Nevertheless, I advise all our customers to ask for new components to be chromium(VI)-free if possible, but to accept that we will still start with the classical pre-treatment. And when the chromium-free pre-treatment is ready for series production, we will change over. That's the only way we can get a foothold in this field. ■

www.bia-group.com

*K-PROFI editor Toralf Gabler
spoke with Dr Markus Dahlhaus.*

Locations



Source: BIA; Graph: K-PROFI



Danny Kelm
Managing Director
(Production)



Dr. Markus Dahlhaus
Managing Director
(Technology and Development)

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Photo: Rico



Photo: Rico

Managing director Dr Markus Nuspl:
“Realizing the last five per cent process quality
is the real challenge.”

Production manager Dipl.-Ing. Alexander
Widmayr: “With the master computer system
I can monitor which ghosts are not working.”

“We are process advocates”

How Rico creates a real advantage with a twelve-hour ghost shift

Last summer, the Austrian company Rico Elastomere Projecting GmbH reported nightly “ghost shifts” at its Thalheim site. Without any personnel, more than 60 injection moulding machines produce elastomer parts made of liquid silicones (LSR) and multi-component parts in thermoplastic and LSR combinations, which are considered particularly crucial in processing, for at least twelve hours. K-PROFI spoke with Managing Director Dr. Markus Nuspl and Production Manager Dipl.-Ing. Alexander Widmayr about the prerequisites and precautions for this special framework.

During preliminary talk, it came to light that Rico has already been running ghost shifts for many years. What made you decide not to publish this until the summer of 2020?

Dr. Markus Nuspl: There is a general belief that silicone processing at night is not possible without any physical person in the plant. We always first have to prove unmanned production to our new customers by showing them around our production facility before they believe us. Ghost shifts are often dismissed as a marketing gag, but with us they simply are reality. That's why we made this set-up official only last year. Ghost shifts are a challenge and, in the beginning, rough business, but if you set the processes up with uncompromising quality standards, they run very stably. Until then, the road is rocky and hard (laughs).

Apart from ghost shifts, what else does your production philosophy consist of?

Dr. Markus Nuspl: We started out as a mould making company. Over ten years ago, more and more customers kept asking if we could take on smaller productions. From there injection moulding of small orders and small series continued to evolve. The bedrock for our ghost shifts is perfectly matched moulds from our mould making department and suitable automation and logistics concepts so that they can run for twelve to 14 hours a night without any problems. The special thing - and this is where my inner “quality geek” comes in - is that this production concept only works if you produce top quality. Our employees prefer if there are no night shifts. This liking in turn motivates all production employees to keep the quality high. It is also beneficial for the company not to have to carry out night shifts - a real win-win situation.

Alexander Widmayr: We have to incorporate quality into the production unit. The moulds have to be handed over at their best level and have to be continuously maintained with foresight, and this equally applies to the machines and the equipment around them. We try to cover it all with our staff between 6 a.m. and 6 p.m., complete performance checks and thus have the machines ready for the night.

Your product mix allows you to manufacture through the night without product changes or testing routines?

Alexander Widmayr: Yes, we have many long-running machines. That makes it harder to plan, but it can almost always be set up that way. In a worst-case scenario, a machine might stop shortly after 6 p.m. in the ghost shift, but that is the absolute exception.

How does your working hours schedule look like?

Dr. Markus Nuspl: Employees are in the building from Monday to Sunday between 6 am and 6 pm. Roughly speaking, we have staggered working hours for each employee - either from 6 a.m. to 2 p.m. or from 10 a.m. to 6 p.m. - with a time overlap essentially between 10 a.m. and 2 p.m. Because of Covid, we have had to adapt our shift configuration a bit more to equalise staff across the seven days as much as possible.

What steps did you take to introduce the 12-hour ghost shift?

Dr. Markus Nuspl: It was a process. There were several projects where such an approach was appropriate. Single-wire sealings, for example, the classic silicone injection-moulded part, are produced by the billions, they fill five or six boxes at night and will go through without a problem. With larger parts, often multi-component parts, a large volume is produced in a few hours.

Alexander Widmayr: We have to plan very precisely how to remove the volume from twelve hours of production off the machine. Wherever possible, we have the robot manoeuvre the products directly into the final packaging so that there is as little handling effort as possible.

Which inline inspection techniques and QA measures reduce the risk of rejects at night?

Dr. Markus Nuspl: We are process advocates, which means we champion this principle: we produce quality and thus reduce the required inspection steps. This is done by a sophisticated tolerance band monitoring within the machine controls with automatic separation of rejects. If a process really gets out of hand, the machine stops automatically. This is how we avoid large-scale measuring and testing technology. All machines are operated

according to this principle - across all products and across all upstream and downstream processes, from insertion technology to multi-component injection moulding and tempering to packaging. In conjunction with our customers, we continuously develop concepts to increase the added value for the customer.

This means that you put a lot of effort into mould sampling and process qualification in advance.

Dr. Markus Nuspl: Exactly, that is key. Realising the last five per cent of process quality is the real challenge.

Alexander Widmayr: As a result, we produce less than 50 ppm rejects off the machine.

Do you utilize only your own moulds or do you also use moulds from other manufacturers on the machines?

Alexander Widmayr: Currently we only have Rico moulds on the machines. But we also have mould customers who create some parts themselves and buy others from us. Often, they make simpler silicone parts themselves and let us produce the more complicated ones. Our Rico Group sister companies in Switzerland and the USA also run moulds with Rico technology.

What were the big hurdles and challenges for ghost shifts?

Dr. Markus Nuspl: It was often difficult in the beginning. Our creative technicians were originally looking for a certain production solution. The ghost shift was not yet playing a role in it. In the end, we developed each concept and solution further so that it also met the requirements of ghost production. Today, we include automation and logistics for unmanned production in all projects from the outset. The ability to handle the volume of production that occurs during a ghost shift logistically, is just as much a challenge in the designing of the overall system, as is the injection moulding and demoulding.

Do you build automation and fixtures yourself or in cooperation with others?

Dr. Markus Nuspl: We have professionals for automation technology in-house who work closely with automation specialists, mechanics and mechatronics in German-speaking countries. We work with the best specialists.

Your machines don't look like they come from Upper Austria ...

Dr. Markus Nuspl (laughs): The Rico founders and shareholders started a close cooperation with Arburg many years ago. This great



More than 60 injection moulding machines work the ghost shift for up to 14 hours, seven days a week.

Photo: Rico

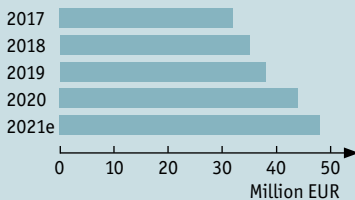


Source: RICO; Graph: K-PROFI

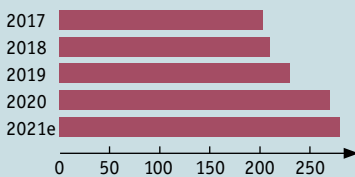
History

- 1994 Foundation of the company**
Start of mould making
- 2009 Injection moulding**
Start with five injection moulding machines
- 2016 Foundation of the Rico Group**
Merger of four companies
- 2018 Expansion of production**
Addition of production hall 4

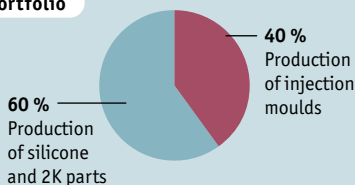
Turnover



Employees



Portfolio



Management



Dr. Markus Nuspl
Managing Director



Ing. Martin Rapperstorfer
Sales Manager



Roland Angerer
Technical Manager



Dipl.-Ing. Alexander Widmayr
Production Manager

Cover cap for a microswitch, which was already on display as a trade fair application at injection moulding machine manufacturer Arburg.



partnership is also an important piece in the mosaic of Rico's success story.

Do you then also have the host computer system from Arburg?

Alexander Widmayr: Yes, we introduced the host computer system ALS in 2017 and also connected it to our ERP system.

Is the monitoring from the host computer sufficient for you to assess the situation?

Alexander Widmayr: Thanks to the seamless process monitoring, we can always see how well our production is running, even at night. Even before the introduction of the host computer system, we had ghost shifts,

although not with the transparency we have now. Today I can see which ghosts are not working (laughs).

How should one imagine messages from the host computer system?

Alexander Widmayr: I'm always online, I get all the information on my mobile phone. Joking aside: When we have time-critical projects running, we have an employee on call. If one of these important machines reports a malfunction and shuts down, the system sends an e-mail to the person in charge. Between 10 p.m. and 6 a.m., however, no one physically comes to the plant. The only exception is a widespread loss occurrence such as a major power failure. The corrections and optimisations to the processes are then done during the day.



This two-component membrane for the "sippa home" drinking container from Iuvas enables people with limited mobility or dementia to drink without tipping the container.

How often do you change over the moulds?

Alexander Widmayr: It varies from week to week, but usually four or five changes per week. We optimise our production frequencies so that we have to change over the moulds as rarely as possible. Our goal is to produce with one machine for as long as possible.

Dr. Markus Nuspl: We produce complex silicone and many multi-component parts as long-runners - and that with moulds with up to 256 cavities, which means that we get up to several hundred million pieces per year from one mould. Small orders and small batches are handled by our sister company Silcoplast in Switzerland, which is equipped for this purpose. That's why we have master supply agreements with most customers and also serve them with quantities that we have produced in stock. Otherwise, our effort would never be profitable for lower quantities.

Will twelve hours soon become 14 or 16 hours?

Alexander Widmayr: Technically, that would definitely be feasible; you can push the ghost shifts further. But there are also limits because buffering the production volume requires a lot of space, conveyor belts cannot be randomly long, buffer warehouses cannot be randomly large. We do not have any plans to extend night shifts further.

How do you see yourself positioned against the competition with your production concept?

Dr. Markus Nuspl: We certainly have a unique selling point among all injection moulders here in the region. Silicone processing in injection moulding has its pitfalls. As far as we know, ghost moulds are currently only used with Rico moulds in the industry. We know of only one mould customer who also produces in ghost shifts.

The interview was conducted by K-PROFI editor-in-chief Markus LÜling.

Rico Elastomere Projecting

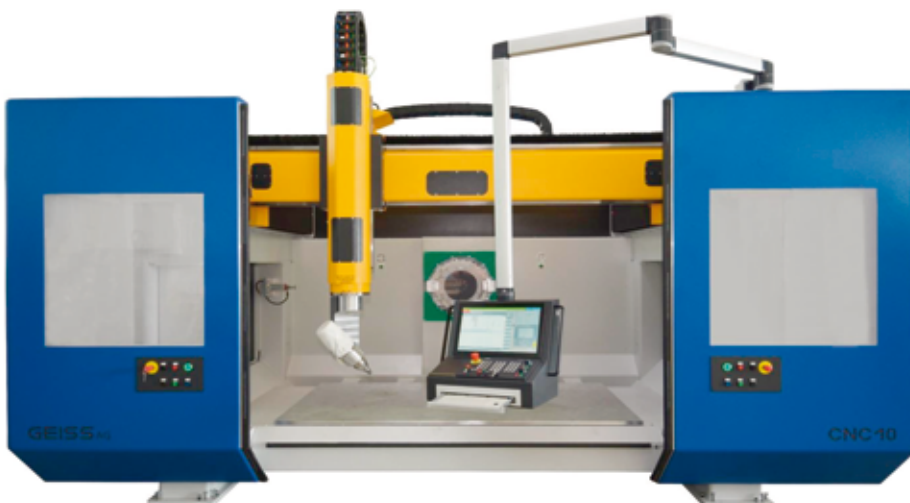
Rico Elastomere Projecting GmbH, based in Thalheim near Wels/Upper Austria, develops and produces injection moulds, automation and elastomer parts. Injection moulded parts are produced in single-, two- or multi-component injection moulding from liquid (LSR) and solid silicones (HTV). Moulds and injection moulded parts are used in a wide range of industries such as the sanitary and household industry, the automotive industry, medical technology or the electronics industry. Rico Elastomere Projecting is the core and founding member of the Rico Group, which, with four locations in Austria, Switzerland and the USA, encompasses an international technology and production network for individual elastomer and plastics projects.

www.rico.at; www.rico-group.net



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were an idea generator for new machine concept.



Smart surfaces with polyolefins

About the market opportunity for IMSE solutions in the automotive sector

Injection-moulded structural electronics (IMSE) should soon be possible from polyolefins. The Spanish material producer Repsol and the Finnish company Tactotek Oy, developers of the IMSE manufacturing process, are working on a technique, in which printed electronics and electronic standard components are integrated into injection-moulded parts. Tactotek explained which requirements are necessary at the request of K-PROFI.

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

K-PROFI reported on development projects for injection-moulded structural electronics solutions as well as potentials, partnerships and licensing of this technology solution by Tactotek in issue 6/2020, among others. The IMSE technology comprises the printing of flexible circuits onto foils, their assembly with electronic components such as LEDs, sensors or antennas, the preforming or thermoforming of this functional foil adapted to the component design, and the final injection moulding using a foil back-moulding

technique. This involves injection moulding between a decorative foil and the three-dimensionally preformed functional foil, which is only a few millimetres thick.

"Most IMSE parts are made of polycarbonate," reports Dave Rice, responsible for marketing and business development at Tactotek. In addition to PMMA and TPU (for flexible components), blends and fibre-reinforced materials have already been confirmed as suitable for IMSE, he says. "We are following market demand so that the materials reflect the component properties that customers want." For example, highly transparent materials are commonly used because lighting aspects play an important role in most IMSE components.

With the properties of polyolefins – lightweight, chemically durable, temperature-constant mechanical and electrical properties, and stable in steam sterilisation – the spectrum of potential IMSE applications can be further expanded and new design and integration possibilities can be explored, he said. Polyolefins are the most common plastics used in automotive manufacture. "The broad

The overhead control unit illustrates the potential of IMSE in automotive interiors: eight touch keys, a slider, a printed Bluetooth antenna and various LEDs are integrated into a 3.5 mm thin component with a seamless design surface.



Photo: Tactotek

applicability directly expands the market opportunity for IMSE solutions. Several of our customers have specific applications that require PP." The collaboration with Repsol aims to optimise the polyolefins to meet the requirements of the IMSE process, including high optical transparency. Both companies are currently developing the technology to produce smart surfaces from polyolefins with a focus on the automotive sector.

Tactotek decides whether new materials are suitable for the IMSE manufacturing process in what it says is a time-consuming and cost-intensive validation process. Since no standardised testing exists for structural electronics, Tactotek developed its own processes. Among other things, it tests whether the material is compatible with the process and the various layers of the decorative and functional film. "Although we don't expect any significant challenges with polyolefins, they are not exempt from this validation process." For example, he said, it must be ensured that no chemical interactions occur between the polyolefin films as well as the polyolefin melt and the

electrically conductive inks, dielectrics and graphic inks contained in the "material or film stack" during processing. Finally, the high temperature and pressure values that occur during the thermoforming and injection moulding process cannot cause melting or component washout and thus affect the electrical circuitry.

Based on the findings from the PP validation, which has been ongoing for several months, Dave Rice expects PP to be available to licensees of the technology as both, a film and injection moulding material validated for IMSE. Repsol had invested in Tactotek at the end of 2019 through its Repsol Corporate Venturing investment fund. ■

www.repsol.com
www.tactotek.com

Projects with development partners show the opportunities IMSE offers for the production of smart high-tech surfaces. The German-language report "When plastics and electronics merge" from K-PROFI 6/2020 is directly available at: www.k-profi.de/heft/20066.

IMSE principle: Flat films are printed with conductive tracks, and electronic components are glued and preformed (below). Film insert moulding is used to sandwich a surface decorative film (top) and the three-dimensionally preformed functional film.



Illustration: Tactotek

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Remote commi

The Corona Lockdown has fuelled the digitally supported

Remote functions in the service industry have already been in use for two decades and have become indispensable as an online diagnostic tool for remote maintenance of daily customer support. In recent months, there have been more and more reports of online commissioning of machines and equipment – not only from the plastics industry. In order to gain some insight into how far such opportunities for plastics processors have developed, K-PROFI interviewed a few selected providers. What are the prerequisites? What preparations do customers have to make? What experiences have been made so far?

An exclusive compilation by Toralf Gabler, Sabine Rahner, Karin Regel, Gabriele Rzepka and Markus Lüling, editors K-PROFI

Before the beginning of last year, online-supported commissioning was apparently the exception and was only used sporadically. For example, Koch-Technik carried out the first online commissioning about ten years ago, however, these are rather rare. The reason: the supplier's dosing and drying units are delivered almost fully functional and can be installed by the customer nearly without tools in a few simple steps. At Wittmann-Battenfeld, on the other hand, commissioning takes place almost everywhere in the world via the international local branch offices. The headquarters of the injection moulding machine manufacturer provides additional online support for special systems only in isolated instances via common communication platforms. The peripheral technology specialist Wenz Kunststoff reports on its first commissioning via the Internet nine years ago, a very demanding installation of a large refrigeration plant in northern Germany, which was started in 2012 and completed in 2014. Due to ongoing construction work, the plant had to be continuously adapted to changing circumstances as it grew. Here, normal commissioning would have been much more elaborate and time-consuming, the management is convinced.

Commissioning works

remote start-up of equipment / Status report after one year

The first Corona lockdown in spring 2020 accelerated progress virtually overnight. The thermoforming machine manufacturer Kiefel has used remote options for almost every project in the past year. Since the first remote commissioning of a thermoforming line for trays at a customer's location in Israel in April 2020, ten further online commissionings in packaging and several process commissionings in medicine have followed. The circumstances are similar at the Heilbronn-based competitor Illig, which has also completed several online start-ups in the last year.

At GWK, the first online commissioning was carried out via a remote-control process in spring 2020. Since then, the temperature control and refrigeration specialist has commissioned four more, partly complex, plant systems online from a distance. Extrusion plant manufacturer Leistritz has also documented several online start-ups since March 2020.

Since the beginning of the Corona pandemic, the rubber injection moulding machine manufacturer Desma has been carrying out internal customer acceptance tests at its Fridingen site digitally for the most part. Remote commissioning, on the other hand, is the exception rather than the rule for the machine manufacturer, as it worries that the legal situation regarding warranty and machine safety is not clearly defined: Until the final acceptance by his own service technicians, the customer alone is responsible for the operation. Namely the debut in May 2020 in Spain, when a machine was commissioned by the customer with remote support via the remote maintenance tools embedded in the Smart-Connect 4.U platform – without their own service technicians on site.

Prerequisites, preparations and installation of the equipment

Visual aids already play a major role in preparing for digital commissioning, in addition to written assembly instructions, commissioning instructions and checklists with illustrations. Several machine

Graph: K-PROFI; Individual elements: mariyapvi / Tukluc Design / DGL Graphics srl / kornikun / Jane Kelly – stock.adobe.com



manufacturers offer their customers training documents and preparatory online and video tutorials in addition to equipment lists. One basis for the subsequent assembly is, for example, the digital video and photo documentation of the machine acceptance or the factory acceptance test (FAT) and the subsequent packaging for shipping, as done by the thermoforming technology experts Illig and Kiefel. This helps with the identification and localisation of the assemblies in the various packages for the customer.

On the customer's side, the staging of lifting equipment, the preparation of the installation site, the setting up of the connections and the presence of experienced application and maintenance personnel such as electronics engineers, mechanics and application technicians are essential. When setting up the systems, many suppliers rely on the support of an available expert via video call. Leistritz decides according to the customer's level of technical knowledge whether the customer can handle the installation itself or whether the extrusion and compounding equipment manufacturer has to step in.

The linchpin for any online activities is a good and stable Internet connection, a bandwidth test, and the tuning of the transmission software and online equipment. Set communication times have been a proven model for Leistritz: During the phone calls, work or the next steps/instructions are explained and distributed for the customer to complete by the next time. In order for Desma to access the machine directly, the customer must ensure in advance that the machine is connected to a network that can be reached externally.

In the past, it was necessary to connect a VPN tunnel to the machines, Wenz Kunststoff recalls, which often caused problems with the IT. That's why today VNC sessions, MS Teams and similar tools are used. In plants that have web-based management, sharing the screen is possible. Wenz Kunststoff equips the latest systems with a VPN client, which customers can then use to connect to the VPN server at the supplier. If network or Internet access is not possible at the customer's site for IT security reasons, Wittmann-Battenfeld can communicate via separate GSM access, which the manufacturer of injection moulding machines and peripheral technology offers as its very own service solution, for example in Germany.

Communication and remote access during commissioning

A contact person is needed on site who has a high level of understanding of the plant and the process. Ideally, he should speak at least English, says GWK, formulating its wishes with regard to communication during the actual commissioning. This also works with an interpreter but makes things more complicated. It even makes sense to involve technicians from the manufacturer of the production machine in the online



Andreas Brand

Head of Field Services & Training Center
Klöckner Desma Elastomertechnik,
Fridingen, Germany

**"In 2020, we trained
1,350 people from
application and
maintenance
departments at the
customers' through
100 webinars in six
languages."**

Photo: Klöckner Desma

commissioning, especially in the case of complex systems and processes such as varithermal applications.

Remote access to the devices or systems during online commissioning is common and realised by each manufacturer under its own "label": Desma, for example, uses its remote access tools embedded in the SmartConnect environment to view direct information from the PLC, the safety PLC, frequency converters and the operating unit (HMI) and to adjust them remotely if

necessary. Kiefel accesses via its "MB-Connect", additionally looks at the visualisation of the plant via "Ultra VNC Viewer", Illig via its "Illig Availability", Leistritz via its "mGuard", the material management specialist Labotek via the "Totally Integrated Automation Portal" (TIA) as well as via the Secomea VPN connection to the Siemens control and the SQL database. Wittmann views the Windows functions in its Unilog B8 control system as an advantage in terms of operation and online communication between the factory or branch and the customer, for example via Teamviewer.

For all providers, the accompanying communication goes through all imaginable and available channels: Messenger services such as WhatsApp on the company mobile phone, video conferencing tools such as Teams, GoToMeeting, Skype, Webex or Zoom, plus "classic" via telephone and e-mail. Smartphones, tablets and portable high-end cameras in real-time transmission mode are the "tools of choice" for Illig. Desma enables the storage of such insights from cameras of mobile phone apps or laptops as well as video recordings in a virtual space. Leistritz also relies on virtual smart glasses equipped with a camera, microphone and a display for video, image and sound recordings. This enables the customer to visualise all instruction steps quickly and directly on-site at the machine. The consistent conclusion across all suppliers: everything goes that helps and is accepted by the customer.

Eliminating potential hazards for operators and plant technology

Most suppliers depend on the reliable design of their plants and equipment, which includes safe commissioning by professional personnel on the customer side. They use online remote functions to analyse and assess the specific situation on site. Live images of the plant also aim at the elimination of hazards. "One source of danger in varithermal plants is the tubing. We can check this visually via video conferencing tools and then inspect it sensorially by testing for leaks with cold media and pressure drops," explains supplier Wenz.

At Kiefel, the inspection of the safety equipment looks like this: The customer walks by the relevant spots of the equipment with a mobile camera, while the expert in the manufacturing plant is looking virtually over his shoulder, giving appropriate explanations

and answering any questions that arise. Afterwards, the customer confirms his knowledge by signature. The manufacturers emphasise that the authority to operate the machine lies solely with the customer. The actual changes in the control of the equipment should be made by the personnel at the machine, says Wittmann.

In the case of commissioning via remote service, the customer must assume more responsibility, GWK also emphasises; even if the experts instruct the customer while observing the safety instructions and repeatedly point out possible dangers. A certain residual risk can only be minimised through appropriate training of the operating personnel at the plant operator, Leistritz affirms.

About experiences, challenges and reservations

The experience gained with online commissioning and the associated challenges is highly dependent on the circumstances, such as the technical equipment at the customer's site, the number of participants and their level of experience, etc. In ideal circumstances, commissioning can even be



Thomas C. Ringheim
Managing Director
Labotek Germany, Wuppertal

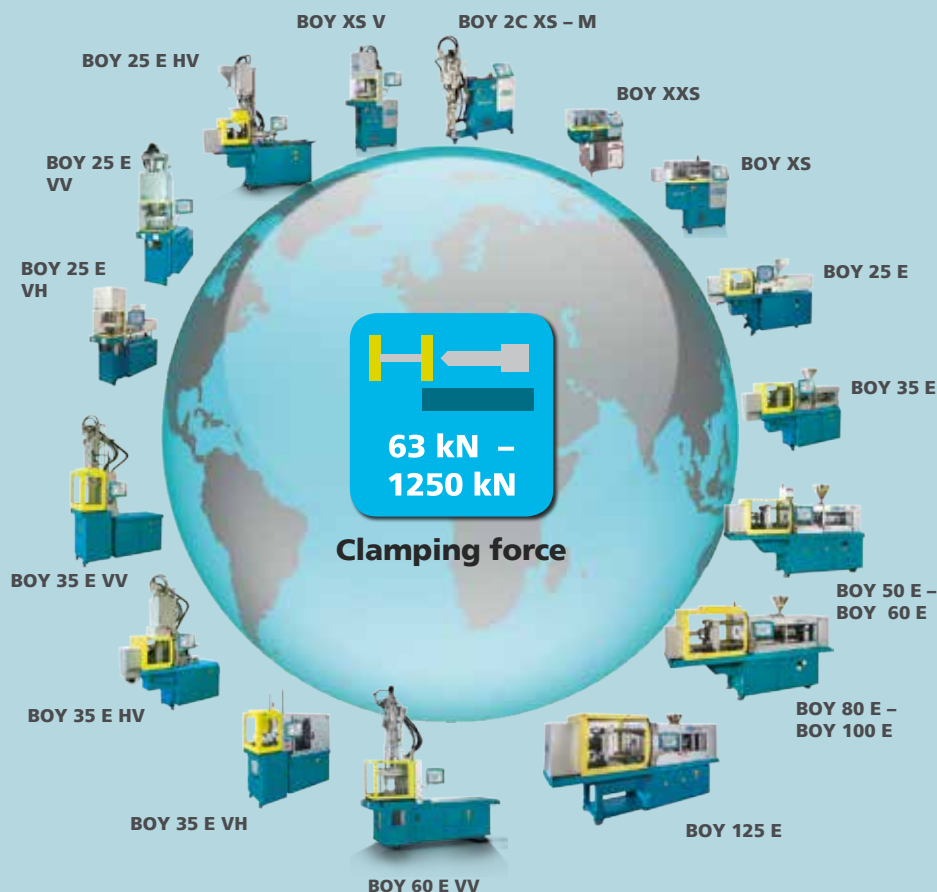
"The biggest challenge in online commissioning is to convince the customer of the security of the system."

Photo: Labotek

faster, especially since travel times are eliminated, reports Wenz Kunststoff. GWK has also had mostly positive experiences and has identified the qualification of the customer's employees on-site as an essential prerequisite for successful implementation. This is also the case at Desma, where a webinar series on operation, maintenance and application technology established in 2020 hopes to increase the technical skills of the customer's staff. The insight at GWK: more intensive and active involvement of customers during commissioning increases their understanding of the plant technology, the functions and the process. The rapport with the plant grows.

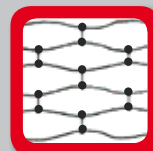
Challenges include setting up the IT interfaces, maintaining the connection without interruptions when transferring large amounts of data, operating in different time zones and language barriers, which are more difficult to overcome online than in personal contact on-site.

The biggest challenge is to convince the customer that the system is secure, reports Labotek. Customers have to be encouraged to make use of the online options, says Kiefel: "It is the machine manufacturers'

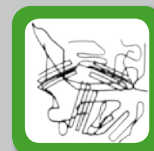


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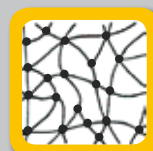
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job to reduce reservations on the customer side and to offer the greatest possible transparency in the process. Overall, the machine manufacturers give the thumbs-up: Meanwhile, first service visits were made to some installations. The technicians found that the systems were in perfect condition: the remote commissioning worked.

More time for online commissioning?

In regard to how the duration of an online commissioning compared to an on-site commissioning, a mixed picture emerges, as expected. Not least because of the differences in the complexity of the systems, the customer's familiarity with the delivered machines, the skills of the commissioning personnel at the processor and the reliability of the internet connection.

As a general rule, online commissioning takes longer than an on-site job by a technician. On the other hand, the technician does not have to travel to and from the site. GWK has found that the training effort for the customer's staff is reduced. To some extent, they already receive intensive training during commissioning.

Desma also estimates that on average the commissioning time for its injection moulding machines is about 40 % longer. While the online commissioning of standard machines in the packaging industry at Kiefel takes only marginally longer, significantly more time has to be planned for special machines for the medical sector. Calculated on an hourly basis, Leistritz finds the effort for remote commissioning approximately similar. Nevertheless, the commissioning engineers on the supplier side have to be in constant "standby" mode in order to answer customer questions without waiting times.

The machine manufacturers in particular rely on the already low effort. Both at Koch-Technik and Labotek, the time required is comparable. In the meantime, Illig achieves the same set-up times for its machines remotely as for a conventional commissioning, including the necessary travel times to and from the site: The thermoforming expert's goal is to further shorten the times.

Differences in warranty and cost?

Do the same warranty conditions apply after online commissioning? As a general rule, there is no difference, says Kiefel, speaking



Mathias Bachmair
Head of Project Management Medical
Kiefel, Freilassing, Germany

"With simultaneous views by several cameras, both sides get a comprehensive overview, even with a very large plant."

Photo: Kiefel

"The warranty is specified in the contract and is independent of whether commissioning takes place on-site or online."

Bernd Niemann
Head of Service, Leistritz Extrusion
Technology, Nuremberg, Germany



Photo: Leistritz

for most of the interviewees. Professional support ensures that installation and commissioning are carried out properly. That is why the warranty can be applied the same way as with conversions and software updates on existing machines. Competitor Illig also assumes this without saying. The warranty is agreed upon in the contract and is therefore independent of whether commissioning takes place on-site or online, Leistritz emphasises. The customer is always informed that he has is responsible for damages caused by disregarding the instructions or by independent, uncoordinated actions. An unequivocal yes to the identical warranty also comes from the peripheral technology, namely Koch-Technik, Wenz Kunststoff and Labotek.

GWK adds a qualifier: With online commissioning, the customer almost always has to assume at least some risk. So far, however, everyone has been willing to go along with it. After all, as a supplier, they were able to help customers get processes up and running on time despite travel restrictions. As a general rule, GWK carries out an inspection at a later date. The machine manufacturer Desma has a similar take: It can provide a technical warranty for the independent installation under his guidance. However, the customer has to take over responsibility for the operation of the machine until the manufacturer's final inspection.

The cost depends on the scope and duration of commissioning and depend on the individual case, Wittmann states. This statement rings also true in the differentiated answers, as does the statement that the travel and accommodation cost for the external commissioning contractor does not apply. Leistritz and Kiefel note that in individual cases, e.g. if the systems are highly complex, if the employees on-site have a low level of knowledge or if the costs for setting up the communication technology are high, higher costs could be incurred. Desma does not observe any changes in the costs: the commissioning at and by the customer is cost-neutral, especially since a service technician goes to the site at a later time for a final inspection regardless. Illig foresees as few additional costs just as Koch-Technik.

For Wenz Kunststoff and Labotek, the costs are generally lower because time-consuming journeys, overnight stays, etc. are not necessary. Kiefel points out another feasible

way: As a general rule, the expenses for on-line commissioning are offset against the originally calculated costs. For any amount credited, the customer receives, for example, a service visit and training as soon as travelling is possible again. With experience gained on the supplier and customer side, GWK is looking towards the future. At any rate, online commissioning increases the flexibility and possibilities to react to travel restrictions. Customer feedback to date can be summarised as follows: Online commissioning saves enormous costs. A delayed production start-up would have been very expensive for the customer, not to mention a disruption in the supply chain.

Conclusion

Online commissioning appears to be possible across the board. Good procedural preparation, competent personnel on both sides, a stable internet connection, cameras on the machine to be commissioned, visualisation options for its control and a real-time video connection between supplier and customer are favourable prerequisites for keeping duration and costs within limits. Training of the personnel on the customer side and corresponding webinars in advance are mentioned by the machine manufacturers as a sensible qualification measure and are offered by the same.

IT problems, language barriers and time differences between supplier and customer make online commissioning more difficult. Warranty agreements seem – apart from individual cases – to be largely independent



Ralf Pacius
Division Manager Service and Tool Systems, Illig Mechanical Engineering, Heilbronn, Germany

"Smartphones, tablets and high-end cameras with real-time transmission are the tools of choice."

Photo: Illig

of an on-site presence of an installation technician on the part of the supplier. As the complexity of the installation increases, so does the effort required to overcome the physical distance, the time required and also the costs. Simpler, tool-free installations and those that can be easily tracked and quickly completed by the supplier via

a connection to the control system can be carried out at a lower cost because otherwise not inconsiderable travel costs are eliminated.

Outlook

Where is the journey headed? It is quite conceivable that even after the Corona times, online commissioning and acceptance will remain attractive for both customers and suppliers. Experience has proven that it is possible. High-quality digital tools, new ideas from the experiences of the past months and the knowledge of what works well and what does not open up new paths. Suppliers whose customers are at home several hours away by plane thus have the opportunity to serve them faster and more cost-effectively. With every on-line commissioning, safety and efficiency increase – on the customer and supplier side. It does not seem unlikely that the Corona crisis will act as a catalyst for the new tool of online commissioning. 4

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More than 152,000 visitors came to Chinaplas in Shenzhen in mid-April. This year, 98.5 % of the visitors were Chinese.



All photos: Adsale/Chinaplas 2021

Great hope for trade fairs in presence

Registration deadline for K 2022 is already the end of May 2021

Trade Fair	Location, Country	Fair runtime	Homepage
InterPlas Thailand 2021	Bangkok, Thailand	23.06. - 26.06.2021	www.interplasthailand.com
Plastec West 2021	Anaheim CA, USA	10.08. - 12.08.2021	www.plastecwest.com
Indoplas 2021	Jakarta, Indonesia	11.08. - 14.08.2021	www.indoprintpackplas.com
Kuteno 2021	Rheda-Wiedenbrück, Germany	07.09. - 09.09.2021	www.kuteno.de
Equiplast 2021	Barcelona, Spain	14.09. - 18.09.2021	www.equiplas.com
Kunststoffen 2021	's-Hertogenbosch, The Netherlands	15.09. - 16.09.2021	www.kunststoffbeurs.com
T-Plas 2021	Bangkok, Thailand	22.09. - 25.09.2021	www.tplas.com
Interplas 2021	Birmingham, UK	28.09. - 30.09.2021	www.interplasuk.com
Compounding World Expo	Essen, Germany	29.09. - 30.09.2021	www.compoundingworldexpo.com
Plastics Extrusion World Expo	Essen, Germany	29.09. - 30.09.2021	www.extrusionworldexpo.com
Plastics Recycling World Expo	Essen, Germany	29.09. - 30.09.2021	www.recyclingworldexpo.com
Taipei Plas 2021	Taipeh, Taiwan	28.09. - 02.10.2021	www.taipeiplas.com.tw
Fakuma 2021	Friedrichshafen, Germany	12.10. - 16.10.2021	www.fakuma-messe.de
Vietnamplas 2021	Ho Chi Minh City, Vietnam	13.10. - 16.10.2021	www.chanchao.com.tw/Vietnamplas
Plastics Recycling Show Europe	Amsterdam, The Netherlands	04.11. - 05.11.2021	www.prseventeurope.com
ArabPlast 2021	Dubai, UAE	15.11. - 18.11.2021	www.arabplast.info
Formnext 2021	Frankfurt/Main, Germany	16.11. - 19.11.2021	www.formnext.de
JEC Forum DACH	Frankfurt/Main, Germany	23.11. - 24.11.2021	
Plast Eurasia 2021	Istanbul, Turkey	01.12. - 04.12.2021	www.plasteurasia.com
Interplastica 2022	Moscow, Russia	25.01. - 28.01.2022	www.interplastica.de
Plast India 2022	New Delhi, India	17.02. - 21.02.2022	www.plastindia.org
JEC World 2022	Paris, France	08.03. - 10.03.2022	www.jec-world.com/events
Plastimagen 2022	Mexico City, Mexico	08.03. - 11.03.2022	www.plastimagen.com.mx
ICE/CCE/InPrint	Munich, Germany	15.03. - 17.03.2022	www.ice-x.com
Swiss Plastics Expo 2022	Lucerne, Switzerland	15.03. - 17.03.2022	www.swissplastics-expo.ch
PlastExpo Nordic 2022	Helsinki, Finland	16.03. - 17.03.2022	
France Innovation Plasturgie	Lyon, France	05.04. - 08.04.2022	www.f-i-p.com
Chinaplas	Shanghai, China	25.04. - 28.04.2022	www.chinaplasonline.com
K 2022	Düsseldorf, Germany	16.10. - 23.10.2022	www.k-online.com



There are still 17 months to go before the doors open for the 'K 2022' world fair in Düsseldorf, Germany. The trade fair organisers from the Rhine hope that by then the Corona pandemic will be under control enough for the industry and plastics technology to be able to present themselves on the usual scale. But watch out: The registration deadline for exhibitors is already the end of May 2021!

According to current planning, there are still plastics trade fairs in Thailand, the USA, Germany, Spain, the Netherlands, Great Britain, Taiwan, the United Arab Emirates and Turkey in the trade fair calendar between the end of June and the end of 2021 (see table).

„Chinaplas“, the only major trade fair of 2021 so far, attracted 152,000 visitors in mid-April. For the first time, the South China edition was held in Shenzhen instead of Guangzhou – with more domestic interest than ever before. The international audience was subject to rigid quarantine rules this year, staying away from all but 2,400 intrepid visitors.

The need to explore and discuss technology and innovations in person, despite live broadcasts and diverse digital offerings, seems unbroken. ■

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All photos: K-PROFI/Thelen

Head of Corporate Communications Robin Funke and authorised officer Dominik Lemken with typical folding boxes.



All modern load carriers are marked with labels or RFID tags via IML processes.

“We work very much in a solution-oriented way”.

How Walther Faltsysteme benefits from more use of recycled material, flexibility and transparency in production

Despite the Corona crisis, or perhaps because of it, Walther Faltsysteme GmbH gained new customer projects in 2020, achieved record sales and invested in new machinery and automation. With collapsible reusable transport containers and a wide range of system and special solutions for storage technology and logistics, the family-owned company has established itself in niche markets for more than 40 years. K-PROFI learned about success criteria and challenges in product development, customer requirements and production during a visit to Kevelaer on the Lower Rhine in Germany.

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

At an exhibition stand in their own hall, authorised officer Dominik Lemken and head of corporate communications Robin Funke welcome their customers in Kevelaer in the district of Kleve. What cannot be shown to large audiences at the moment due to a lack of trade fairs such as “Logimat” or “Fachpack”, is here as a showroom – furnished to Corona distance standards, equipped with audio and presentation technology and stocked with a cross-section of the product range of collapsible transport containers and load carriers made of plastic. “The topic of sustainability is in our DNA,” says Robin Funke proudly: “All of our folding boxes have been awarded the Blue Angel.”

Company founder Rolf F. Walther had seen collapsible containers on a trip to Japan in the late 1970s and developed the idea of a foldable plastic container from there, the first one available in Germany. “The success was diligently copied, many competitors emerged, all of whom also produced folding boxes – with striking similarities to ours,” as

Dominik Lemken looks back. “In the early 1980s there was a special dynamic,” explains the authorised officer, “department stores like Karstadt, Kaufring and Kaufhof also wanted to restock goods during business hours but didn't want to move pallets through the aisles with a pallet truck.” This is how the ‘department stores’ shipping tower’ came into being, a combination of a trolley and foldable load carriers, usable for a wide range of assortments. The ‘volume-reducible containers’, the official name for folding boxes of all kinds, are the company's staple product – with a focus on the “extremely high volume reducibility” of 80 %.

Injection moulding machines with a clamping force of around 10,000 kN and stack family moulds are standard at Walther for the production of folding boxes.



Today, the core markets for the second-generation owner-managed company are Germany and Europe, where the folding systems go to numerous companies and retail chains such as Continental, Aldi Süd, Edeka and the Vaillant Group. Despite its status as a niche player among large competitors, Walther posted record sales last year in 2020. "Our trade customers have seen growing sales in Corona times and needed many load carriers. We benefited from this," Robin Funke sums it up. Finally, folding boxes were increasingly used by retail and e-commerce customers, and the pandemic supported the strong growth in e-commerce.

Digitalisation of logistics as a driver of business

The massive investments in logistics structures and in the automation and digitalisation of logistics are placing ever new demands on load carriers. "The push towards automation is most noticeable in the German-speaking D-A-CH region and in Scandinavia, where skilled labour is scarce and wage costs are high," Dominik Lemken has observed. "Logistics centres are being built everywhere – in each case according to the customers' requirements, often automated small-parts warehouses in the form of high-bay warehouses with fully automated, driverless storage and retrieval machines. The automation and thus our containers must be tailored to these requirements." Accordingly, many criteria lead to individualisation: the variety of assortments, the dimensions of the containers, the degree of automation in order picking and more. Dominik Lemken explains which customer benefits fuel individualisation: "On the one hand, there are functional requirements, i.e. the containers must be conveyable and identifiable in the warehouse and compatible with the automated conveyor system. On the other hand, there are also visual, marketing-driven demands, for example when a container becomes visible at the point of sale."

Many manufacturing processes under one roof

"We work very much in a solution-oriented way," Dominik Lemken emphasises the flexibility that comes with having control over several different processes. Despite the "natural focus on injection moulding", the Kevlaer-based company also produces solutions with and for large load carriers that are thermoformed or made up of extruded



Authorised officer Dominik Lemken views the company as being "very strongly solution-oriented" – also due to its mastery of several plastic manufacturing processes.

trilaminate, "we are not just oriented towards utilising our own production capacity." They do not operate this production in their own facility, but in their shareholding, Formex Plastik, only a few hundred metres away from the company headquarters and on a smaller scale with other partner companies.

"With a close interaction of functions, projects can be realised at very short notice," emphasises Robin Funke. Series of between

10,000 and 15,000 and 1 million units are usual orders of magnitude. Entry barriers to new series are often the high tooling costs. "Thermoforming – admittedly with fewer degrees of freedom than injection moulding – might be an interesting alternative now and then," says Dominik Lemken.

Walther is one of the few companies in its sector to maintain its own tool shop. In addition to maintenance and small repairs, it is

View into the injection mould for the pallet deck: the robot removes the finished deck on the left and places the TPE inserts for the next pallet on the right.



The three runners of the pallet come out of the second injection moulding machine.



used for the production of prototype moulds and adaptation designs in development projects when new options can be presented through small changes to existing moulds. Occasionally, the experts there also work on new series moulds, for example when customers do not want to involve other partners in a project at an early stage of development.

Use of recycled material a "huge topic"

"We are trade-heavy, we have many customers in the trade. Traditional retail logistics has a logistics centre from where the individual shops are supplied. This is a classic area of application for volume-reducible load carriers. Here, the use of recycled material is a big deal. We produce our new half-pallet with more than one-third of PCR granulate. Maybe a little more would be possible, but we are pushed very much by functionality in professional logistics. In the past, form followed function. Today, a container must also look good, which is why product designers are also involved," Dominik Lemken reports.

"This quickly leads to the question: How far can I increase the use of post-consumer recyclates (PCR), knowing that thanks to good sorting, preparation and additives I can achieve pretty good properties but not nearly as good as those of virgin material? There is still a small gap," says Dominik Lemken, "we have to see how far we can push but still maintain the application characteristics. From a purely technical point of view, we can produce load carriers from 100 % recycled material, but the application requirements require a balancing act. For many requirements, for example, a dark grey load carrier is sufficient, in which we can easily incorporate larger proportions of recycled material. But certain brand colours simply can't be depicted with PCR."

In its reseller programme "Boxline", Walther also offers online the folding box series "Green Line", which is injection moulded mainly from recyclate and is positioned somewhat more favourably in terms of price than the equally dimensioned products made from virgin material.

One large injection moulding machine instead of many small ones

Whereas in the past the usually eight individual parts of a folding box were produced, assembled and fitted on many small injection moulding machines with a clamping force of 3,000 or 4,000 kN, at Walther this is now done by a model of around 10,000 kN with a larger automatic assembly unit that operates fully automated for large series and partially automated for smaller batches. Stack family moulds for all eight parts in two levels have become a standard for the production of folding boxes. The two demoulding robots on the same gantry convey the individual parts in the longitudinal axis of the machine beyond the clamping unit and deposit them there in the assembly unit. The insertion grippers place any necessary inserts and labels – or RFID tags – during the same operation. The transfer of labels from the magazine to the gripper and from the gripper to the mould, as well as the finished injection-moulded parts, are monitored visually and the attachment of the correct label to the container is verified.

New patented half-pallet with PCR

Our new patented half pallet has replaceable runners," Robin Funke underlines an advantage of the product that has been produced for a year. Furthermore, TPE inserts on the underside of the pallet deck

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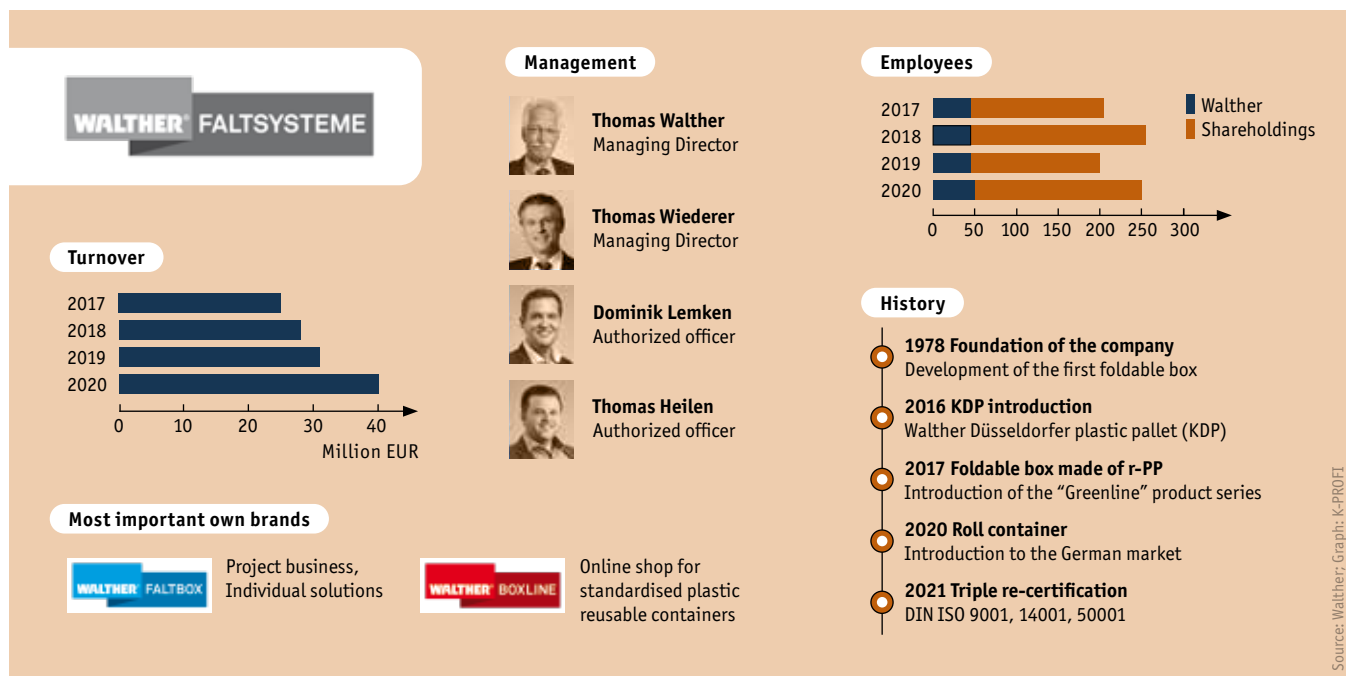
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provide slip resistance for the forks of lift trucks, and various openings in the deck allow for easy manual handling. The main requirements for a skid pallet are high rigidity, so that it deflects as little as possible, if at all, but also high impact strength, so that it can withstand fork impact and guarantee moving in the roller bearings at all times. Walther has used simulations, filling studies and test series to determine which formulation with short and long glass fibres is necessary, how they must be distributed and aligned in the polypropylene and how a rheologically optimised moulded part filling might look like.



In the fully automatic pallet assembly, the robot presses the deck onto the three runners.

Formex produces the new pallet on a pair of 11,000 kN machines. One machine produces the three runners from PP-GF in a triple mould, the other the pallet deck from a PP/rPP mix with inserted anti-slip elements made of TPE.

According to Dominik Lemken, the gravimetric metering of the three individual components is important. Two large material streams from a special, filled and reinforced rPP are combined with PP virgin material and a masterbatch. Walther has installed systems from Koch-Technik uniformly for all machines – whether with two large material streams or only with masterbatch. From the silo farm by Eichholz to the material management, the injection moulding machines (from KraussMaffei and most recently from Engel) and the six-axis robots from Kuka to the recooling technology from L&R, Formex has integrated a relatively fixed circle of system partners. "What we are good at ourselves is the assembly periphery around the systems," Dominik Lemken is convinced: robot grippers and fixtures are "both", built in-house and purchased. A separate department designs the essential elements of the automation lines.

Pallet moulds with wide-slot hot runner nozzles

Since spring 2020, Walther has been operating two moulds from the Austrian mould manufacturer Haidlmair for the new

half-pallet with a "Flat Die Unit" hot runner wide-slot nozzle from the Haidlmair subsidiary FDU, after conventional round nozzles with valve gate nozzles had reached their limits at 6.5 kg shot weight. The FDU Midi version with a 22 mm melt channel makes it possible to get more material into the mould in less time with lower filling pressure and less shear. It also favours a homogeneous distribution of the fibres. In regards to the pallet deck, in moulds with a conventional hot runner and connection via shut-off nozzles, the high friction repeatedly caused localised temperature peaks, material degradation and ultimately adhesion of the rPP. "Not everything is better with the wide-slot nozzle than with a valve gate nozzle, but the wider injection cross-section is very positive. In direct comparison to a mould with a classic valve gate nozzle, we were able to reduce the cycle time by about 10 per cent," reveals Dominik Lemken, which had the main effect of a shorter filling time and a slightly shorter cooling time. Dominik Lemken: "Here, local, shear-related temperature peaks are lower, especially when processing recycled material, and we have to dissipate less heat."

More transparency in injection moulding

The team in Kevelaer is clearly striving for a high degree of transparency in production. Mouldflo water distributors monitor temperatures and flow rates in all cooling



A typical injection mould for five of the eight elements of a folding box.

circuits, the new Engel-duo machines monitor the process with help of cavity pressure and numerous machine parameters, optimise the consistency of the moulded part weight with the help of the "iQ weight control" software and are capable of communication through interfaces for MES systems via OPC/UA (Euromap-77).

Comparing the same products, the same moulds and the same requirements, Walther took a close look at the energy consumption of the large machines before the latest investments. The servo-hydraulic Engel machines with ecoDrive concept have an

electric metering drive. Thus, Walther records a significantly lower specific energy consumption in kWh/kg of processed material with its new machines, which had already been noticed during tests during a prototype production. Dominik Lemken: "The efficiency compared to the older machines has improved very considerably."

At Formex, the acquisition, bundling and visualisation of production data from the machine and sensors in the injection mould are made possible by the "Mould Monitoring" hardware, which is mounted directly on the mould. Defined parameters are pre-processed in the device and transferred to a cloud-based system via LAN in the company's own plant and via the mobile network from partner plants. In this way, those responsible can view the current productions in real-time from anywhere at any time. The system from Haidlmair's Digital Moulds subsidiary provides information about malfunctions, the condition of the mould, exceeding of tolerance bands for relevant process parameters or, for example, creeping in cycle times.

Walther has now equipped five moulds with this system. "In recent years, we have not been able to expand our own production at Formex as quickly as our order volume has increased. That's why we have also outsourced individual moulds to partners. With Mould Monitoring, we monitor the condition and parameters regardless of whether the mould is operating in our own production or at a partner company. This gives us very valuable information." 



For the new pallet, as on all the machines, gravimetric metering of virgin material, recycle and masterbatch ensures the exact composition of the injection moulding compound.

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Automatic strand pelletising saves resources

Raw material and compound manufacturer Azoty stands by globally standardised plant technology

Backward integration for the German Akro-Plastic and an extension of forward integration for the Polish Grupa Azoty are two of the advantages of the consulting and contract manufacturing agreement between the two companies. The contract partners explain in a joint interview with K-PROFI which other plus points result from the contract and the agreed construction and commissioning of a state-of-the-art compounding plant including automatic strand pelletising systems at the site in Tarnow in Poland.

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

Akro-Plastic, a specialist in application-oriented plastic compounds, is known for its high and 100% reproducible product quality. The compounder achieves this both for the PA compounds it primarily manufactures and for products based on standard thermoplastics such as PP or on high-performance materials such as PEEK. In addition to the formulation, the extrusion plant technology used plays a major role in the production of the high-quality compounds. And with this, Akro-Plastic "drives" its very own strategy called ICX-Technology (Innovative Compounding and Extrusion Technology): Not only in the plant in Niederzissen, Germany, are all 25 existing compounding lines set up exactly the same – with the same components from the same machine



For over a year now, the modern compounding plant with a total capacity of more than 20,000 t/a has been running in Tarnow, Poland.



Especially with high throughputs and a large number of strands, the automatic strand pelletizing system makes the operator's work much easier.

Akro-Plastic produces around 165,000 tonnes annually at its sites in Germany, China and Brazil and, more recently, if needed, also at its cooperation partner, Grupa Azoty, in the new plant in Tarnow in Poland.

Backward integration for compound manufacturers

suppliers. But also, both the production processes and the material logistics always follow the same, logically structured path.

The main component of every compounding line is the extruder, which at Akro-Plastic logically comes from the sister company Feddem in Sinzig, Germany. And it is precisely this sister company that has developed the ICX technology for this purpose. "The ICX technology enables our customers to ensure the same quality of the products at any location worldwide when using raw materials of the same quality together with a certified quality management and corresponding testing laboratory," explains Dieter Groß, Managing Director of Feddem GmbH & Co. KG.

For Grupa Azoty Compounding's (GAC) plant in the countryside of Tarnow, right next to the chemical company's existing site, Feddem took over the planning for the entire technology and production building. This included the design, manufacture and commissioning of the entire new compounding unit, which consists of several levels and contains all the upstream and downstream equipment. The training of the Polish employees in the plant and the processing technology was conducted by Akro-Plastic staff, who continue to provide assistance to their partner in case of any questions. "We are very happy to have a raw material manufacturer as a partner company in the Eastern European market, where we can manu-

facture our products exactly in accordance with our standards and additionally have a handle on order peaks," says Dr Marcel Sittel-Faraj, Head of Technology & Project at Akro-Plastic, explaining the backward integration for his company.

Increased forward integration for raw material producers

Grupa Azoty, a publicly traded chemical company, generates about one third of its €2.6 billion revenue from caprolactam, the starting component for PA6 production,



All compounding lines are equipped with Feddem extruders, which can be flexibly adapted to any process task by means of extension units (at the back of the picture on the right)



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and is the only company in Poland to produce POM and PA6. Through the partnership with Akro-Plastic and the construction of the new GAC plant for the production of readily usable compounds, the chemical group significantly expanded its capacity – and thus intensified its forward integration. Ever since its grand opening at the end of 2019, the new compounding line with a total capacity of more than 20 t tonnes has been in operation. “We are very satisfied not only with the new line, but also with the support provided by Feddem and Akro-Plastic,” says Dariusz Cholewa, Managing Director GAC in praise of his partners. With the new products, Grupa Azoty serves about 50 % of the domestic market and primarily other EU countries, just as it does with the already established products.

Technology sets standards

Like at all other Akro-Plastic sites worldwide, GAC also uses ICX technology for compound production. “This not only ensures the tightest batch tolerances, but also enables the production of glass fibre-reinforced PA compounds, for example, which have higher strengths than comparable pro-



In Niederzissen, Germany, as well as in Tarnow, AZO installed all components necessary for material logistics.

Photo: AZO



Photo: Akro-Plastic

Thanks to the ICX technology, compounds can be produced in consistent quality, which is checked by the in-house laboratory.

ducts from the market competitors,” says Dr. Sittel-Faraj, once again underlining the advantages of the technology. And Dariusz Cholewa adds: “We deliberately chose the expertise of our cooperation partner and are thrilled with the performance of the compounds.” Thanks to the higher strength, the glass fibre content can be reduced, which in turn has a positive influence, meaning being reduced, on the wear of the material, on the machine technology.

Speaking of machine technology: all lines in Niederzissen as well as those at GAC are equipped with knead-block-free twin-screw extruders from Feddem. These feature flexibly extendable processing units and universally configured screws so that all products can be processed on the same machine – at GAC mainly PA6 with different glass or mineral fibre contents. “The advantage of the extruders are the processing segments, which can be easily flanged on or off depending on the length required,” explains Christian Becker, Head of Maintenance at Akro-Plastic. In this way, it is not the product that has to be adapted to the machine, but the machine to the product, which in turn ensures the high qualities.

The complete downstream equipment also comes from Feddem. The mechanical engineering company attaches great importance to details that improve everyday production and minimise errors. For example, a screw tip that extends into the strand head to avoid material deposits, and height-adjustable strand guide elements in the water bath. Fixed suppliers for other plant components are: AZO for the complete material logistics, Schenck Process for the weighing and dosing technology, BSG for the control units, Schneider Electric for the frequency converters, Elin for the motors, Henschel Antriebstechnik for the gearboxes, Gough Engineering for the screening systems and Maag Automatik for the strand pelletisers.

Automation makes everyday production easier

"We generally work with strand pelletisers, whereby we have two different models in use," explains Dr. Marcel Sittel-Faraj. In addition to conventional water-bath strand pelletisers (WSG), both companies also operate automatic dry-cut strand pelletising systems (JSG), all from Maag Automatik. Each pelletising unit is mounted on a mobile frame so that it can be used flexibly and easily at the desired position or line. Whereas with a WSG the strands have to be extruded from the continuous casting head into the water bath, passed through it and then threaded into the pelletiser by an operator, the JSG works almost unmanned. In the JSG, the extruded strands first slide onto a water-cooled



"With Grupa Azoty, we have found a strong partner in the Eastern European market," Dr. Marcel Sittel-Faraj, Head of Technology and Projects, is convinced.

chute before being deposited onto a conveyor belt. Here they are dried and automatically fed into the granulator.

"Especially with high throughputs and a correspondingly high number of strands, the JSG saves significantly on man hours," Dr. Marcel Sittel-Faraj reports from practical experience. In a large plant with an output of up to 3 t/h, such as the one in Tarnow, about 60 strands are extruded. It is almost impossible to drive these into a water bath and thread all of them into the pelletiser by hand. Here, the JSG represents a noticeable simplification. "In addition, the automated process minimises material losses because it starts up very



"To ensure high product quality, we adapt the machine to the product and not vice versa," emphasises Head of Maintenance Christian Becker.

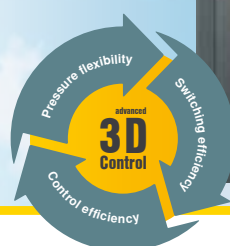
quickly and also is back up and running smoothly quickly after a product change-over," emphasises Alexander Helm, Product Manager at Maag Automatik. Especially in the production of polyamide compounds with glass fibre contents of up to 50 %, the strands tend to be brittle, so that their guidance onto the chute and conveyor belt ensures fewer strand breaks and thus supports process stability and efficiency and contributes to more sustainability in production. ■

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**“Colour is
commu-
nication**

What significance colour trends have
and how they are created

**colour is
emotion”**

Nothing is as fast-moving as trends. This is also and especially true for colours. That's why manufacturers of pigments, masterbatches and compounds think about future colour trends – on the one hand, to create new formulations with foresight and on the other hand to give their customers in plastics processing sound advice. Now – as the quantum physicist Niels Bohr, among others, put it – forecasts are difficult, especially when they concern the future. K-PROFI therefore, asked several relevant manufacturers about their approach and experience with this subject.

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

Depending on the product category, colours take on very different tasks. In the industrial sector, they are often used for visual differentiation, e.g. blue as a marker for "cold" and red for "warm". Different sizes and types of assembly or consumable parts can be identified at first glance by different colouring and thus minimize possible confusion. Orange has established itself for high-voltage components in electric vehicles. A change could have fatal consequences, which is why such established quasi-standards last over very long periods of time.

"In the consumer goods sector, colour should excite the customer and encourage him to buy," says Manfred Fischer, Head of Marketing at Grafe. And it has the power to do just that. "Because colour is emotion, colour is personal, colours have meanings – colour is communication," says Finke's Managing Director Felix Finke, describing its influence on the senses.

Undoubtedly, there are colours that are timeless, such as gold, which has stood for noble and high-quality characteristics for centuries. In this respect, Lifocolor has developed a product line that is expected to be long-lasting with its new gold masterbatches in various nuances. The changing presence of many colours, however, is due to the fleeting and ever-changing taste of times.

Colour trends for consumer goods and packaging

Various manufacturers such as Avient, BASF Colors & Effects, Gabriel-Chemie, Grafe, Lifocolor or Milliken therefore regularly publish trend collections in sometimes elaborate campaigns and actively market them to manufacturers of corresponding end products. Lifocolor Marketing Manager Jessica Knoch summarises the product segments in which this is important: "Colour trends play a particularly important role in the consumer goods sectors. Here, buyers choose their own products for daily use to express their personality, taste and emotions. These sectors, where plastic once more plays a major role as a material to be coloured, include industries such as packaging, cosmetics and personal care, sports and leisure, household and garden, toys, stationery and office supplies."

Manfred Fischer of Grafe thinks the main focus is on all industries whose products are aimed directly at end consumers and exist mainly in a certain time frame: "Examples are the packaging industry with special editions for a certain period of time, the clothing industry, but also the electronics industry. Ultimately, the product launched must strike a chord with the times. And here, colour is a very important criterion that has to excite the customer."

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Less relevance for technical products

For some manufacturers, this approach has little or no relevance because their customers' products have a different focus or they themselves take different approaches. For example, Barry de Groot, Marketing Manager at Granula, says: "Our customer base consists mainly of plastic processors who produce technical parts. Colour trends are not an issue there." At Treffert, the focus is on functionalising plastics. "We choose the respective colours individually for each product and each customer," explains Sales Manager Oliver Langner.

Therefore, Finke has developed so-called colour inspiration boxes for the different colour ranges. With these demo tools for blue, red, yellow and green, customers can get more vivid, concrete ideas of their own colour vision and thus find the suitable colour for their very special product.

External expertise and customer experience

In addition to the expertise of their own colour designers, manufacturers who are themselves active in trend research use a wide variety of external sources. In addition to Pantone and the Color Market-

"But the most important element of our trend research is a close exchange with our customers. In this way, we have very good insights into the wishes for the future of our end consumers as well as the challenges that exist along the value chain for their implementation," explains Juliane Krüsemann, who is responsible for cross-industry trend scouting at BASF's Colors & Effects division. Lifocolor also relies on cooperation with processors. For example, the annual colour and design trend service Colour Road is produced in cooperation with the film manufacturer Renolit, which is active in a wide variety of user industries.

"It's details, the iridescence, the little nuance or special effects that make a colour attractive."

Felix Karl Finke, Managing Director, Karl Finke

"But in the automotive and electronics industries, too, presentation is key," as Lanxess knows. Even though the company does not actively conduct colour trend research itself, it keeps a close eye on the market. "We are in regular contact with our customers' developers," says Michael Fahrig, trade press spokesman. This means that we can not only react promptly to enquiries, but also discuss feasibility during the development phase. "And if we have increased requests for a certain colour shade or a colour direction during the development phases, this in itself shows us already a clear trend."

The distinction is in the details

"Finke's colour specialists have been gathering knowledge about colour trends for many years," Felix Finke reports. Experience has shown, however, that customers usually come with very clear colour ideas for their projects. Often, however, it is the details, the shades, the small nuances or special effects that make a colour attractive and lead to a decision. For example, there are countless ideas about yellow. "Greenish, reddish, translucent, transparent or with special effects," the managing director lists a few examples. "Colour creates its own colour impression for each individual observer."

ing Group, colour catalogues such as the trend books of A+A Design are placed at the top of the list. "We are primarily guided by the Pantone colour trends. You can even attend online webinars on this topic," reports Andreas Kruschinski, Sales and Marketing Manager at Color Service. "But looking at the market in different sectors such as fashion and furniture is also very helpful here," emphasises Dirk Stursberg,

Zeitgeist and basic temperament are front and centre

"However, we do not view our trend collections Colour of the Moment as a prediction of certain fashion colours in the future, but rather as an observation and fulfilment of a current zeitgeist", Juliane Krüsemann summarizes the goals of such analyses. Manfred Fischer from Grafe explains: "We view our colour trend campaigns as inspiration for the product designers, who of course also have their own colour ideas and often modify the suggestions. The important thing for us is to strike the basic temperament."

Jessica Knoch from Lifocolor clearly illustrates the complexity of the matter: "The input from the international trend institutes and colour designers represents a very good

"When it comes to consumer goods, buyers choose products for everyday use to express their identity, likings and emotions."

Jessica Knoch, Marketing Manager, Lifocolor

Managing Director of Batchwerk. Colour expert Helmut Müller of FBW proceeds in a certain order: "In our experience, a first glance at the fashion world will reveal the general direction where things are heading when one looks around there. Then usually follows the cosmetics and thus the packaging industry. And if the colour trends are accepted by the end customer, lifestyle products and wall colours will follow suit."

pre-selection for our Colour Road. It already concentrates observations of early adopters on repeated trends that will become established. The colours are then taken up in different sectors and they are perceived as trends by consumers the more often they encounter these colours, creating corresponding desirability. The well-researched colour trend selection must then of course fit the specific product."

"Upcoming colours must be able to be implemented in a wide range of substrates."

Manfred Fischer, Marketing Manager, Grafe Group

Multiple influences on trends

According to the experts, the influences that can lead to certain trends are as diverse as the world of colours itself. "Very often, it is what is currently moving people and what is also on one's own mind," Gabriel-Chemie says. "Regional and even country-specific differences are also often apparent. Therefore, tuning in to the respective regional market is important to observe and understand how consumers think and feel there."

Jessica Knoch of Lifocolor points to industry-specific and seasonal differences: "For example, since the cosmetics industry is strongly oriented towards the fashion industry, there are often selection criteria and gradations in warmer and cooler shades of colour trends, depending on the summer and winter seasons. Similarly, for gardening items or outdoor sports equipment and toys, brighter, more intense or warmer colour gradations are often used for summer than for skiing accessories or other winter items, for example."

Lydie Tuchbreiter, who takes care of pigments for plastics at BASF Colors & Effects as New Business Development Manager, observes certain steady or recurring preferences that go into colour trends: "These relatively objective criteria include, for example, culture- and season-specific colour trends in end-consumer markets, such as friendly pastel shades in the Easter season, while highly chromatic colours and glossy effects are in demand at the end of the year." But application-specific constants are also taken into account. "For example, highly chromatic coloured and effect pigments play an important role in the toy industry, while in furnishings, for example, more natural colours are used, and eye-catching effects tend to be used for accentuation." And long-term preferences in particular, such as dark window frames in the construction industry, are having a noticeable influence on market volumes, she adds.

Manfred Fischer of Grafe says: "Of course, there is always a bit of a 'crystal ball' involved, but you can deduce a trend from the history of the colours we develop over

a certain period of time." In this way, he says, social currents and themes add to it, which can be linked to a colour atmosphere. "Think of the topic of digitalisation – there, people tend to envision shades of blue and green instead of a bright sunny yellow." In addition to sensual-emotional influences, there are ultimately also potentially technically limiting factors to consider. "For example, we always have to take into account that the upcoming colours can be implemented in a wide range of carrier materials," Fischer illustrates these aspects.



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Atmosphere well captured

In view of the many influencing factors and uncertainties, the industry considers the "hit rate" of its colour predictions to be successful. "Our experience has shown that the

the warmth of human contact in the social isolation caused by the pandemic," explains Judith de Vliet, Head of the ColorForward team. The yellowish-green hues are also an expression of a need for more nature in the increasingly digital environment.

"We don't view our trend collections as a prediction of certain fashion colours, but as an observation and fulfilment of a current zeitgeist."

Juliane Krüsemann, Trend Scout, BASF Colors & Effects

trend reports of our Colour Road experts prove their worth," emphasises Jessica Knoche of Lifocolor. "In subsequent seasons, a large part of the predicted trends become visible at the point of sale in many sectors." Helmut Müller of FBW is also convinced: "We were always quite good with our assessments." At Gabriel-Chemie, they say, "Many colour trends change from the time they are set to the year of the prediction, but overall, we capture the atmosphere very well for our markets." And Dirk Stursberg of Batchwerk puts a concrete figure on it: "So far, we have always launched a colour trend series with about twelve colours at the end of the year. About a third of them usually matched and were also ordered."

Focus on naturalness and human warmth

The companies view the upcoming colour trends influenced by the Corona pandemic and its side effects, among other things. For example, Avient's colour experts ex-

In Milliken's new ColorDirection, too, clear and bright colours stand for optimism and nature. The company views the use of such colours as an opportunity to reflect these positive values in products and packag-

haptic special effects in combination with marbling, laser markings, modern effect colours and special natural colours. The high degree of distancing and isolation intensifies the need to touch and experience products with all the senses. The "Re-wake your senses" series aims to reawaken and sensitise sensory perceptions such as smelling, feeling and seeing.

Lifocolor is expected to present its new trend report Colour Road 2022 under the motto "In touch with colours" at the end of April. Jessica Knoch already reveals that the trend colours will be much more natural: "The need for sustainability, authenticity as well as closeness and touch, which is especially in times of the Corona crisis often craved, finds expression in it." More subdued shades of blue, green and brown, which the company wants to produce exclusively with biodegradable colourants for plastic colouring, are moving into the foreground. "In this way, we want to show how

"After the fashion world ... comes the cosmetics and thus the packaging industry. If the end customer accepts the colour trends, lifestyle products and wall paints will follow."

Helmut Müller, Colour Expert, FBW

ing and thus to channel consumers' decisions accordingly. FBW views colours that emphasise naturalness front and centre. While the focus is currently on all shades of green in connection with the theme of

colour trends and sustainable plastic colouring can go hand in hand," says the marketing manager. ■

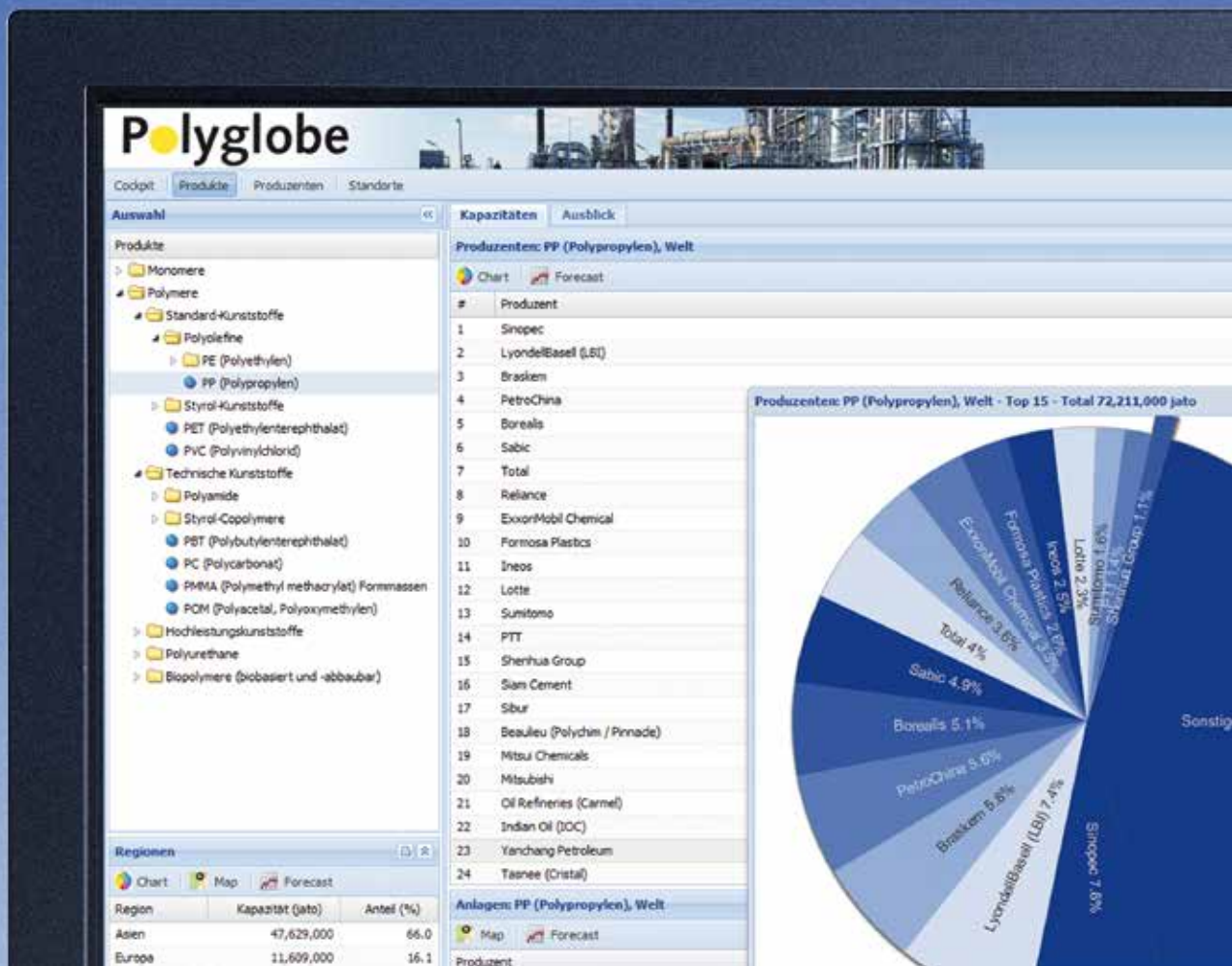
"High levels of yellow convey the warmth of human contact in the social isolation caused by the pandemic."

Judith de Vliet, ColorForward Team Leader, Avient

pect the entire colour palette for 2022 to be dominated by yellow tones. The other greens, reds, oranges and blues included in the current ColorForward collection also have a high yellow content. "This conveys

nature, earth tones will also be on the rise in the future. Social contacts are also a theme in the new colour and trend series Colour Vision by Gabriel-Chemie, which is characterised by a multitude of optical and

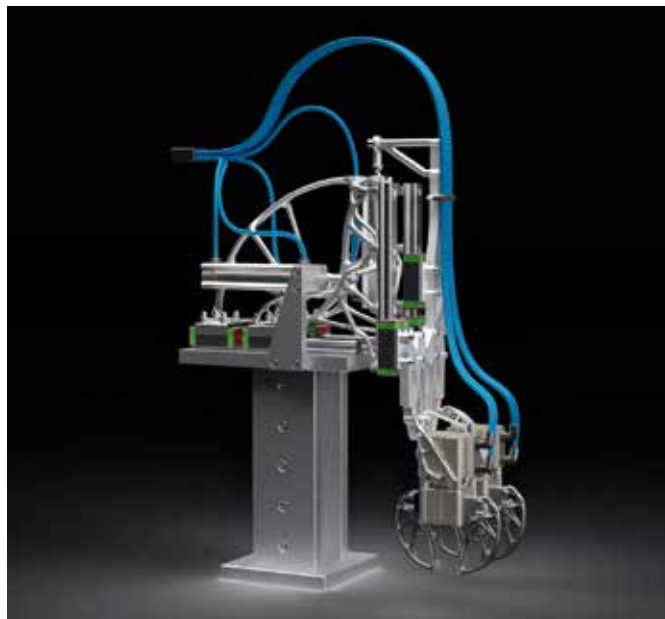
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Compared to the original design (left), 52 % moving mass was eliminated via optimisation by Amprove.

“We want to update the hardware world”

How the start-up Amprove is turning lightweight construction development upside down

Using less material through efficient components, lightweight construction while saving costs and increasing productivity: These goals are interesting for everyone. This is where the start-up Amprove from Stuttgart comes in with simulation-driven component development and replaces the conventional manual design process. Dennis Middeldmann is Head of Simulation and Co-Founder of the development service provider and supplier of high-performance structural components. He illustrates the potential for mechanical engineering and plastics processing using the example of a pick-and-place handling unit in which the moving mass could be reduced by more than half.

K-PROFI: What is the idea behind Amprove?

Dennis Middeldmann: The idea behind Amprove is to combine design and simulation in order to develop components that fulfil their function with as little material as possible. This means that the components are tailored to the specific application and optimised again and again during development with regard to the cost/benefit ratio to eliminate additional costs through lightweight construction. This idea came to us when we founders worked together in research and development in the automotive industry. In the process, we saw that simulation-driven component development has only been used to a limited extent so far and that its great potential could be transferred to a lot of other industries. After all, lightweight construction

does not only play a role in the automotive industry. As a general rule, component development is based on manual design steps. You design, look at the result in a simulation, then go back to the design, with this result to the simulation and so on – an endless loop that almost always leads to suboptimal components. Therefore, we have been working on a solution how to unite design and simulation. By realising that the potential is huge and we wanted to push the topic industry-wide as soon as possible, Amprove was born.

How many different components have you already optimised in this way?

It is in the middle double-digit range. These are components made of plastic and metal from different industries and different manufacturing processes.

How can plastics processing benefit from this approach? Which components are predestined for it?

Our development service can be applied to any dynamically moving component or machine component, whether made of plastic or metal. One can benefit immediately. Either one reduces the weight to be able to move components faster. Or if production acceleration does not make sense, the aspect of energy saving comes into play regardless. After all, large masses are moved in plastics processing. Furthermore, I see the

advantage that internal cooling channels can be realised for thermally stressed components due to the high design freedom of 3D printing and that the component structure can be designed with regard to targeted temperature control using our development process. This makes it possible to optimise the thermal behaviour of a machine, reduce wear, extend maintenance cycles and thus save costs.

You recently published a lightweight pick-and-place unit as a development example. Did you develop this for a machine manufacturer or directly for the end-user?

I have to elaborate a little on that. When we realised that the mechanical engineering sector still had a lot of potential for lightweight construction, we approached the machine manufacturers directly. Unfortunately, we lacked concrete use cases. Our references referred to motorsports or the automotive industry, where lightweight construction had already been practised. So, the machine manufacturers had a hard time imagining what they could gain with this development concept. To convince them, we optimised the structure of this existing pick-and-place machine without a specific order. The result was that the end users approached the machine manufacturer and wanted to use this concept. Now we no longer had to do any convincing. Ultimately, we are now in direct contact with the end-users to optimise existing machines and the machine manufacturers want to integrate this concept into their next machine generation.

Is the result already in series production?

We only released the prototype at the end of February, so it is not yet in series use. The pick-and-place machine is integrated into an assembly line at a supplier in the pharmaceutical industry, where small plastic parts are gripped. The gripper itself is interchangeable for different applications. In order to comply with hygiene regulations, like the ones that apply to the pharmaceutical industry, suitable protective covers are fitted.

Before we go into more detail about your approach: What persuasive results were you able to achieve here?

On average, we were able to save 86.5 per cent weight per optimised component. Since we still have to move the pneumatic cylinders

and the linear guides, the reduction in the moving mass for the complete machine is 52 per cent or 29.8 kg absolute. This saves the user more than half of its energy costs, in this case about 1,270 euros per year per machine. However, if the user opts for a higher production speed, which usually has a greater impact on profitability, it can increase this by 34 per cent. In addition, we were able to eliminate two linear guides and 25 screws as well as combine eleven parts into four components, so that the assembly effort was reduced and handling was simplified. The additional effort for the development and production of the optimised components pays for itself in terms of energy savings after about two years. But if automation is the bottleneck within a production line and the faster handling enables a higher overall production speed, the amortisation period can be much shorter. That is very individual.

What basic requirements did you have to fulfil for the pick-and-place unit?

The operating principle of the machine was to remain the same, i.e. it should perform the same movements with the same kinematics, the optimised components should be easy to replace, we could remove the linear slides that were not needed, but the basic functions had to remain. And then, of course, the clear requirement for maximum functionality and reliability. This also includes protection against improper machine operation. Even if the structures do not suggest this at first glance, we are on the safe side in this respect as well. The end user's primary goal was to increase production speed.

How do you start such a project?

First, we look at the initial machine: which masses are moved how fast, which loads occur in which direction, what are the overall energy needs, is a reduction worthwhile at all? Then we start to identify the components: which component could be optimised, how can it be produced economically, and from which material? We always offer these first two assessment steps to interested parties free of charge.

How do you proceed with simulation-driven component development specifically?

When it comes to the development process, we start completely differently than with a conventional design. That is, not with a

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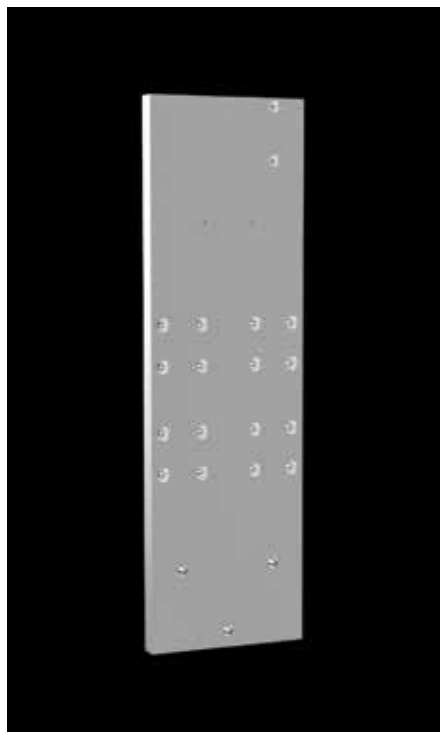


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sketch in a CAD programme. Instead, we look at how much installation space is available, i.e. where material can exist without colliding with other components. This design space is the starting point for optimisation. Then the so-called non-design space is defined, i.e. which capacities must be retained, e.g. holes, connections to other components, wall thicknesses for media guides, etc. These geometries are not to be touched by the subsequent optimisation algorithm. The topology optimisation algorithm is applied to the remaining design space. This can best be understood as the actual component design process. To put it simply, the goal of topology optimisation is to have material only in places of the component where it counteracts the load and to remove superfluous material where it is not needed. To do this, a FEM-based simulation model of the previously created design space is created and boundary conditions and the optimisation objectives are defined. For example: Minimise the mass and maintain the stiffness. In addition, restrictions are set that are adapted to the selected manufacturing process, such as demoulding direction for (injection) moulding or overhang angle for 3D printing. The optimisation algorithm then iteratively removes material from the design space until the optimisation goal is achieved.

Z-axis: Using topology optimisation and waterjet cutting, from a milled component weighing 8.91 kg to a lightweight component weighing 1.17 kg.



Compared to the previous aluminium milled component (left) weighing 0.33 kg, the plastic gripper additively manufactured using SLS weighs only 0.05 kg (one of the four components in each case).



And with this data, it goes directly into production?

After the topology optimisation, the result is returned to a fully functional solid model that can be processed in the CAD system as usual. And very important: The result of the topology optimisation is not transferred into a geometry via manual reconstruction. The geometry is created directly using the data of the optimisation result in order to avoid deviation from the optimum. Before

the component actually goes into production, the result is finally validated via various simulations with regard to operational stability, possible changes in loads during operation and manufacturability. The validation of the operational stability is a very important point that ultimately distinguishes a functional component from a simple design study.

Who manufactures the components and which manufacturing processes are even possible?

At this point, we activate our partner network and select the most suitable supplier for the customer. Before the founding of Amprove, in addition to our focus on 3D printing, we also worked with other manufacturing processes such as casting or milling. We bring this experience to bear here. And I am sure that there is still a lot of potential in component development for many other manufacturing processes, including injection moulding.

The name of your start-up suggests the abbreviation for additive manufacturing. What role does 3D printing play at Amprove?

3D printing plays a big role for us because it fully exhausts the potential of our development process. If you carry out a topology optimisation without manufacturing restrictions, you get very complex and high-performance components that can only be manufactured using 3D printing. In general, however, we optimise for various manufacturing processes, as 3D printing is not the



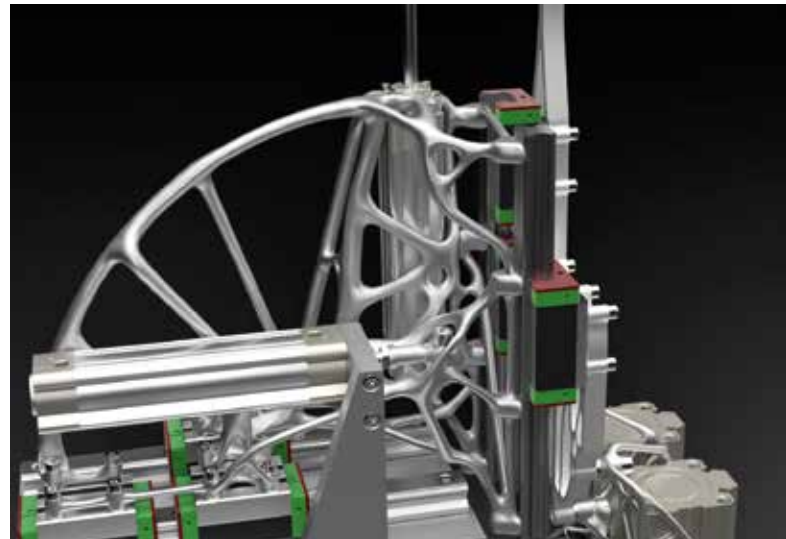
most sensible process for every application. With our network consisting of tens of partners, we also see ourselves as intermediaries and lessen the burden or entry barrier for customers who are entering new territory with 3D printing. Especially in 3D printing, prices fluctuate greatly. We can categorize the pricing and the process and know which supplier is suitable for the task at hand or even which post-processing is required.

I assume the bionic structure of the pick-and-place unit was additively manufactured. Which materials were used and why?

The gripper was made from plastic by selective laser sintering, the remaining components except for the Z-axis were made from an aluminium alloy by laser melting. Polyamide 12 was chosen for the gripper, which experiences a relatively low load and is easily replaced for applications with higher loads. In addition, plastic 3D printing is significantly more cost-effective. The basic structure of the pick-and-place machine, on the other hand, has to withstand higher loads. We optimised the base plate for the Z-axis for waterjet cutting.

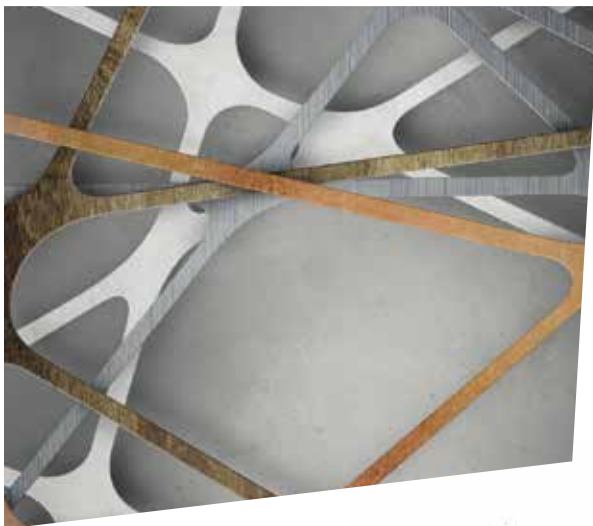
Are the structures of the grippers hollow and sealed from the environment and can they be pressurised with vacuum or compressed air to actuate suction cups or rams?

This specific application did not allow the components to be gripped with a vacuum. But of course, vacuum grippers are very often produced in the 3D printing industry. The high degree of design freedom in plastic 3D printing, which often requires no support structures, is an advantage here. Functional integration via internal



The optimised components (here the additively manufactured Y-axis) are easily exchangeable via the existing connection points. The development service can be applied to any dynamically moving component or machine component.

cooling channels or media guides for compressed air and vacuum is an important aspect here and is usually the focus of existing solutions. However, many of these vacuum grippers could still be significantly lighter. At Amprove, we optimise in the direction of lightweight construction and include functional integration in the bionic structure.



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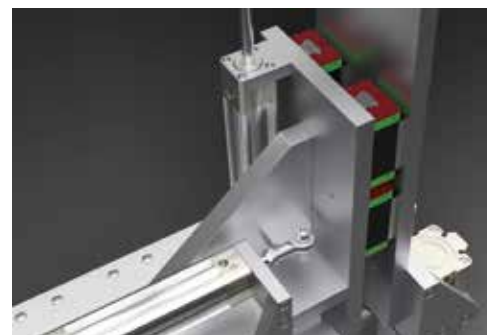
Metal plates are machined quickly and are easy to produce. How much longer does an application-specific calculation and production of the additively manufactured geometries take?

No question, metal plates are machined quickly. At first glance, you might think that our components take an extremely long time to develop. But that is only true for the conventional way of thinking in the development process. But since we take a different approach with our combined simulation and design, we are very fast and realise the component development within a few days. When we talk about production time, it depends on the process, of course. Waterjet cutting of the Z-axis is fast and the costs are lower than milling. Selective laser sintering of the plastic gripper takes a few hours. The outer dimensions here are 72x97x165 mm. Several grippers can be combined in one construction job. Many service providers even offer overnight production, so you can restock quickly. The dimensions for the Y-Z axis connection and the console of the pneumatic unit are considerably larger

at 209x420x399 mm. Meanwhile, there are fast systems for laser melting with an installation space of 600x600x600 mm in which both components can be packed. We are talking about a pure production time without post-processing of one to two days, or three to four days for a less modern system. In any case, the components reach the customer within a week.

Are standard geometries conceivable that are available "in stock" or can be produced within hours?

This is a very interesting topic that we have been discussing for some time. Actually, standardisation is not the goal of 3D printing, where we perfectly adapt everything to individual use. A standard component, on the other hand, usually has to cover a broader field of application. Nevertheless, it is quite conceivable to develop lightweight standard geometries optimised for specific loads that do not carry the oversized mass of a standard part with it. So, if a machine manufacturer wants to create lightweight components out of his standard



The moving axes of the pick-and-place unit before (top) and after the topology optimisation, which reduces the weight by 29.8 kg and combines eleven components into four.



The Amprove founding team with (from left) Yannik Eggert, Dennis Middelmann and Rami Bedewi at the presentation of the mentoring award by the "Gründermotor" initiative in February 2020.

Amprove (company's preferred spelling: amprove) is a spin-off from the University of Stuttgart and operates as a development service provider and supplier of high-performance structural components. Founded in 2019 by Dennis Middelmann (Head of Simulation), Yannik Eggert (Head of Design) and Rami Bedewi (Head of Strength), the start-up is currently funded by the "Exist" start-up scholarship, among others, and is currently affiliated with the High Performance Computing Centre Stuttgart. To develop the components, the conventional design process is replaced by a simulation-based process sequence. This results in geometries that are tailored to the application and achieve high performance with minimal material input. In addition, the development time of the components is shortened by dispensing with manual design. In order to identify components with a high optimisation potential, Amprove offers uploading for CAD data on its website.

A visualisation of the lightweight optimisation of the pick-and-place handling unit described in the interview is available here: https://Amprove.de/#Beispiel_Maschinenbau

parts, he is welcome to contact us. Keyword storage: Generally speaking, large-scale storage of 3D printed components is rather unusual, in contrast to casting, for example. But the idea of having standard geometries in stock in smaller quantities is a good one. Building a portfolio of in-house developed, efficient hardware components is also part of our vision.

What is your vision?

With consistent topology optimisation, as we do, any component can be driven to maximum efficiency and performance. Components are often used for decades without anyone thinking about optimising them further. In contrast, the software industry comes up with updates regularly. In the course of digitalisation, hardware is moving even further into the background. Therefore, our vision is: we want to update the hardware world with our development work and avoid wasting resources.

www.amprove.de

K-PROFI editor Dipl.-Ing. (FH) Sabine Rahner spoke with Dennis Middelmann. ■



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SKZ offers wide range of courses in English

Courses for plastics processing and material science

The Plastics Center SKZ offers many services for the plastics industries and has been a reliable partner for 60 years to customers in Germany and abroad. Being known as the first responder for many companies within the plastic industry to whatever problem comes up along the value chain. One of the solutions for these obstacles along the production chain is often further education. In general, the key to high production quality is qualification.

Next to its regular course program SKZ has offered education courses in English for years usually after an inquiry from one of its international customers. Since there is a growing demand for training courses in English lately, online as well as on site, the institute now launched a catalog with training courses for plastics production and material science in English. "Our customer can count on high quality education in English or German. All our most demanded standard trainings are now also available in English," explains Matthias Ruff, head of sales.

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Design objects are a typical area of application for 3D printing systems.



Filigree geometric structures are no problem for the new system.

Geometric freedom without compromise

Why the Hungarian service provider HDH is investing in a new 3D printing system

Using granulates to produce semi-finished and finished products is commonplace in the world of plastics processing. Less common in the production of 3D-printed parts. Filaments are still frequently used here. These are not only more expensive, but their processing is usually also more time-consuming than the direct use of granulates. Two of the reasons why the Hungarian service provider HDH-Mernök Kft. from Budapest now decided in favour of a new granulate-processing system: "It makes us independent of the filament manufacturer, allows us to use our own materials and produce 3D parts for our customers with great flexibility and in an enormous size," Strategic Director Dr. Eva Hegedus and Technical Director Árpád Bakos tell K-PROFI.

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

As a classic engineering consultancy, HDH is perfectly positioned to develop customised and, above all, individual solutions. The range of undertakings includes both mechanical engineering and product-specific solutions. "Especially with 3D-printed components, for example, simple prototypes or also complex geometric

finished parts, we offer our customers an easy way to gain initial experience or respectively to achieve rapid market access," says Technical Director Árpád Bakos.

The engineering company has been working with 3D printed parts for more than five years and during this time has been able to amass a wealth of experience in terms of the raw materials used, the feasible part geometries, the required machine technology and also the matching software. "Based on all of this experience, we have now decided in favour of a new system from Weber. This combination of a high-quality plant with professional software allows us to produce tools and end products that were previously impossible. This machine gives us enormous degrees of freedom without compromise," the strategic director is pleased to announce.

Two models available

On behalf of Hans Weber Maschinenfabrik GmbH from Kronach, the commercial director of additive manufacturing Manuel Kolb, answers the question of why a traditional machine builder came up with the idea of building 3D printers as follows: "We already had the know-how

Photo: HDH-Mémők

For the turbine housing, the polymer granulate melted in the extruder is deposited layer by layer.



Even large 3D-printed components can be produced with the new machine.

of plastics processing and robotics in-house and were convinced that the 3D printing sector represented a future market. That's why we decided to invest in this area two and a half years ago. The core team that was created was quickly successful, presented the first prototype and, just three quarters of a year later, the first series type."

Moreover, the wealth of experience in the design of screws and gears, the large vertical range of manufacture at the Kronach site, the well-equipped technical centre for preliminary tests and the know-how in software and control systems helped, too. Now Weber Maschinenfabrik offers two different types of 3D printing systems: the DX series and the DXR series. While the essence of the direct extrusion (DX) is the same, the two types differ in their kinematics: DX systems have a gantry system, DXR a robot that guides the extruder.

Cooperation in further development

For the DX line, the extruder is mounted on the X-Y axis of a gantry system. The overall size of the system, which has an installation

space insulation, is 1.5 m x 1.2 m x 1.3 m. Depending on the part to be produced, the die diameter on the extruder can range between 1.5 and 8 mm, and depending on the raw material used, the pressure plate can be heated up to 150 °C. Optionally, extraction systems,



pellet dryers and vacuum conveyors can be connected to the printer. While the DXR system, with its heated printing plate, different extruder sizes and die diameters, has a lot in common with the DX version, it differs in size and kinematics: the overall size can be up to 2.4 m x 1.2 m x 1 m so that the 6-axis robotic arm with a reach of 2.6 m can also operate within. An enclosure may be provided at the customer's request.

Both types of system have already been sold and put into operation, and the DX system for Budapest has presently been installed. This is a β-version of the DX system, which is to be further developed, together with HDH-Mernök, based on the experience gained on this system in regard to hardware and software. "The cooperation with Weber helps us to better prepare for new areas of application for 3D-printed parts, for example in the field of mobility, modern but complex building units and furniture. And it helps Weber to further develop

Technical Director Árpád Bakos appreciates the cooperation with machine manufacturer Weber.

the hardware and software of this still novel system technology," Dr. Eva Hegedus is convinced.

Flexibility opens up new areas of application

For Eva Hegedus, the main advantages of the Weber 3D printer are the overall size, which allows the production of large components of more than 1 m and working directly with granules. "It's much more efficient to work directly with granulate instead of filament, it's also cheaper and we can use our own material mixtures, which gives us greater flexibility." Nevertheless, the manufacturing principle is the same as in familiar systems: melt is pressed through a nozzle and deposited, layer by layer, in the desired and previously set geometry.

This is the go-to process whenever between 1 and a maximum of 1,000 parts are needed. It's applicable, for example, in prototype construction, small series, toolmaking, production aids, scenery for film, theatre, opera and trade fair construction, but also to works of art, interior design and repairs. The range of materials that can be used ranges from soft TPE to carbon or glass fibre reinforced materials. "There are hardly any limits here either," emphasises Manuel Kolb. Limits, if any, arise mainly from the fact that the outer contours of 3D-printed parts are rarely completely smooth, so that reworking such as polishing, grinding or milling may be necessary. Árpád Bakos from HDH has also learned this through practical experience.

Further machine development

Weber is also working towards a solution for the problem of reworking 3D-printed parts. The company has entered into a cooperation agreement with Reichenbacher Hamuel GmbH from Dörfles-Esbach, Germany, and has developed a hybrid system that can do both: additive manufacturing and milling. "Especially when perfect surfaces and exact measurement tolerances are required, such as in the shaft area or in prototype construction in the automotive industry, then this combination with CNC milling makes sense," states Manuel Kolb from Weber and emphasises that until now several systems and several work steps were necessary for such components. 

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www.hansweber.com

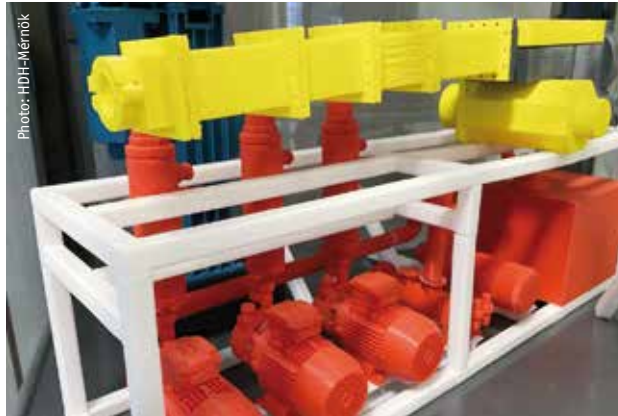


Photo: HDH-Mernik

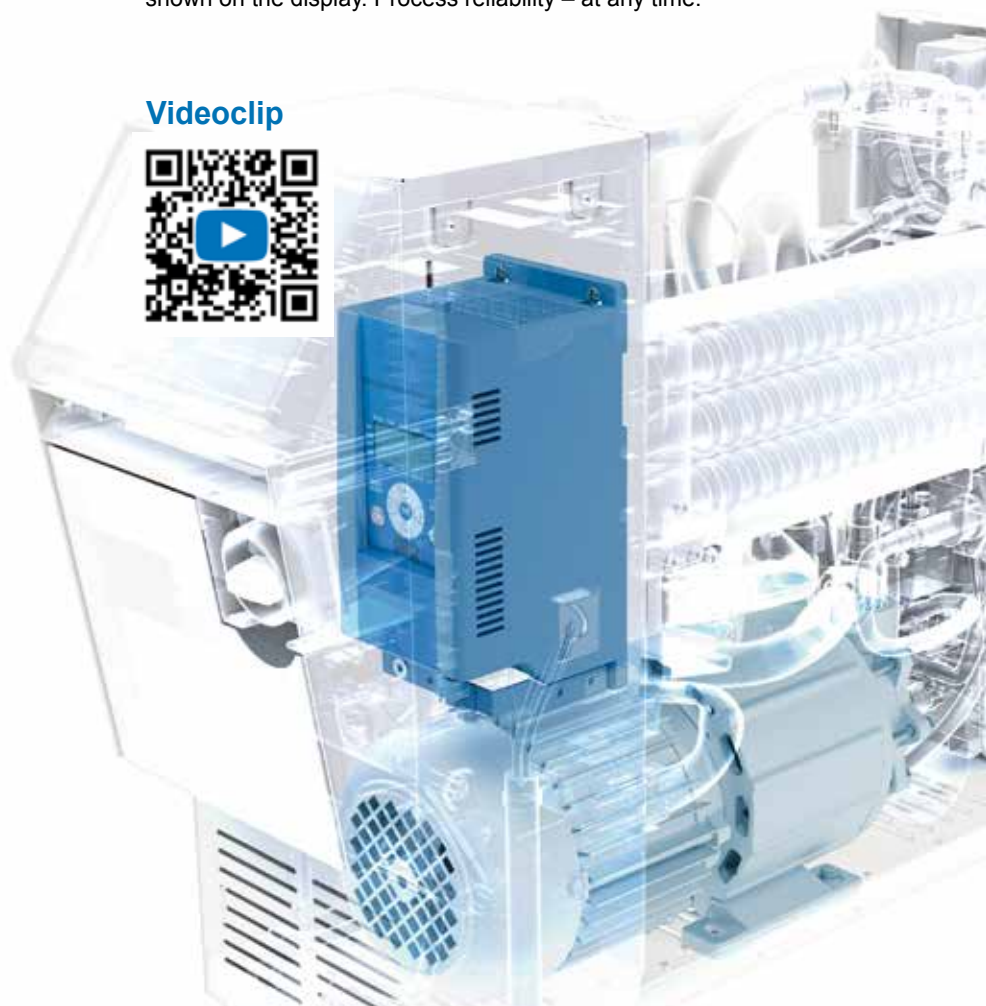
Large-format 3D printing also demonstrates its advantages in prototype construction.

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All photos: Trioworld

The machine stretch film with recycled material persuades with its mechanical property profile, which can hardly be distinguished from virgin material.

It's confirmed: PCR also works in high-performance applications

Why PE film manufacturer Trioworld is greatly involved with recycled material and which products have been realised so far

"We have been working with recycled goods since the company's beginnings in the 1970s," Andreas Malmberg, CEO of the Trioworld Group, headquartered in Smålandsstenar, Sweden, points out, explaining the company's well-founded processing know-how. The manufacturer of high-quality PE films has now succeeded in doing what was unthinkable five years ago: producing an ultra-thin stretch film with a recycled content of over 50 %. For Andreas Malmberg, this is a very important milestone: "Only with products like this and only through collaboration within will the industry succeed in improving the image of plastics, promoting sustainability and achieving the legally required recycling quotas."

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

Trioworld is the recent name of the group that arose from the merger of Europe's two leading suppliers of sustainable and high-performance polyethylene film solutions. The Swedish company Trioplast acquired the Dutch company Apeldoorn Flexible Packaging (AFP) last year. Both companies have been involved in the production of premium films for load securing and food packaging from their very beginnings, Trioplast since its foundation in 1965, AFP since the start of the company in 1968.

Today Trioworld employs 1,200 people, has a sales volume of 550 million euros and operates a total of ten production facilities in Sweden, Denmark, the Netherlands and France. For the five business segments, stretch film, industrial film, healthcare film, carrier bags and consumer packaging, the sites produce both, roll goods and converted and printed end products, that are sold worldwide.

Recycling from the very beginning

However, Managing Director Andreas Malmberg relates the new name Trioworld not only with the global positioning of his company but also with responsibility for the globe. "We are convinced that we can make the world safer and healthier with plastics, but we have to optimise the use of plastics and reduce the carbon footprint," is his premise and motivation at the same time.

He represents the use of recycled materials as the most important factor on this path. He says his company has been doing this from the very beginning, but in the early years, the reason for using recycled goods was to save costs. This is different now: "Today, for ecological reasons, no plastics processor can afford to not use recycled material," is logical to Andreas Malmberg. It is neither sensible nor permitted. The legal regulations in the EU require recycling quotas of 50 % starting in 2025. Trioworld has set itself a goal of re-using at least 30 % of the collected and processed recyclates in every plastic product by 2025, and at least 50 % by 2030.

Even if this is easier said than done, it is a matter of course for the CEO of one of the largest PE film manufacturers in Europe. He thinks of recyclers, plastics processors and brand owners as having the duty to take on responsibility for greater sustainability. It is clear, he says, that the goals of a balanced circular economy cannot be achieved alone, but only as a team. And that means along the entire value chain, from the collection and processing of used plastics to the brand owner who puts his products back on the market in sustainable packaging.

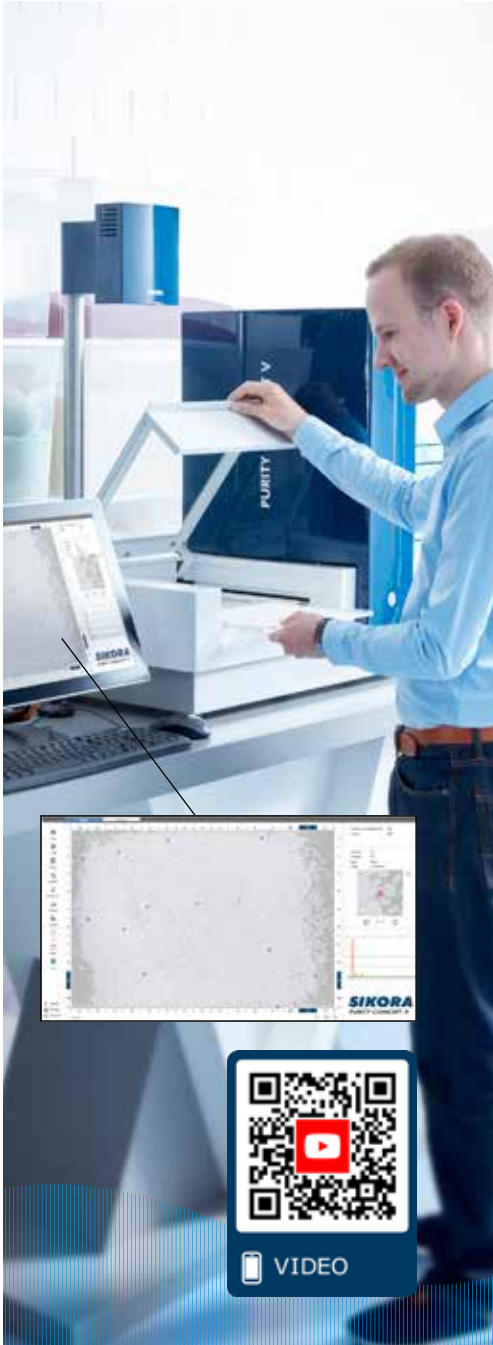
Andreas Malmberg names the beverage company Coca-Cola as one of his company's customers who is setting a good example. Coca-Cola already relies entirely on recycled PET bottles for its primary packaging. "Coca-Cola has announced that this year, after the Netherlands, all bottles in Norway will also be made of 100% r-PET," reports the managing director, who is sure that "what works with PET will also work with PE." And indeed, Coca-Cola wants to switch its secondary packaging, typically shrink and stretch films, to recycled material in the future. Coca-Cola is one of around 5,000 customers of the PE film specialist who "wants to close the loop with us", says Andreas Malmberg, explaining a possible path his company would like to take cooperatively with like-minded

customers. These also include Amazon, Aldi as well as Netto, who both collect stretch films that accumulate in their retail operations. The material, usually pallet packaging or other load securing films, is collected by the local waste management company, processed and usually returned to Trioworld as re-granulate to be used again.

Sustainability has many facets

Trioworld pursues its important corporate goal of sustainability with three concepts: "Triolearn" means the consistent thickness

reduction while maintaining or increasing product performance. "Downgauging is always a way to create more sustainable film products thanks to a reduction of material," Andreas Malmberg states. The special feedblock and tooling technology from Cloeren makes it possible to create up to 45 layers. It is now possible to produce the thinnest films, only 8 µm thick, which corresponds to about one-tenth of a human hair. In its second sustainability concept, "Triogreen", Trioworld is pursuing the manufacture of film products based on renewable raw materials, and in the third,



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Andreas Malmberg
Chief Executive Officer



Oskar Karlsson
Chief Procurement Officer

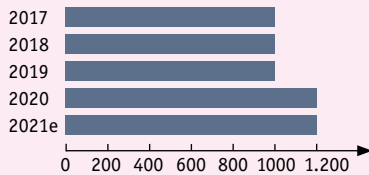


Andrew Lord
Chief Financial Officer



Ulla Hunting
Human Resources Director

Employees



History

- 1965 Foundation of Trioplast
- 1984 Foundation of Trioplast Industrier
- 1995 Internationalisation
Acquisition of Trioplanex in France
- 2018 Acquisition
by Altor Fund IV Sweden
- 2019 Acquisition in the Netherlands
Acquisition of AFP, Apeldoorn
- 2021 Renamed Trioworld
Restructuring

Locations



Own brands

Triowrap, Tenospin
Bale stretch films for agriculture

Katan Ex, Trio Infinity
Stretch films for load securing, cast films

Trio Extreme
Stretch film for load securing, blown film

Nyborg Super Stretch
Highly stretchable stretch hood

Trioloop
Films with PCR content

Triogreen
Films with a proportion of renewable raw materials

Triolean
Ultra-thin high-performance films

“Trioloop”, film production based on recycled plastics.

In total, 20% of the annual production output of around 250,000 tonnes per year in the ten plants is already made from renewable or recycled raw materials. The target for the next two years is 30 %. “We are particularly proud of the new machine stretch film “Trioloop”. After all, it contains a share of more than 60 % recycled material, of which at least 51 % is post-consumer recycle,” Andreas Malmberg presents the latest development. For the production of its films, the companies of the Trioworld Group use a total of 130 extrusion lines across all locations, both blown and cast film lines. Most of these are coextrusion lines for up to 9-layer products from Hosokawa-Alpine, Macchi, SML and Windmüller & Hölscher. On these lines, Trioworld produces films of various thicknesses with widths ranging from 40 mm to 20 m for its five business segments.

The processor produces 250,000 tonnes of film in its ten factories, partly as roll material, partly converted.

Source: Trioworld; Graph: K-PROFI



It's all about the incoming materials

Especially machine stretch film, which is used for cargo transport, must have a high performance. Around 1,200 people still die every year due to inadequately secured loads. That is why EU Directive 2014/47 sets very strict and specific requirements. At the same time, with a volume of around 1.3 million tonnes per year, this market is of high interest and continues to grow, the Trioworld managing director explains the starting point to K-PROFI. Due to these enormous demands, the use of recycled material in stretch films is definitely critical. "It only works with a very high quality of the processed fraction. And it only works if this quality can be achieved consistently." Trioworld obviously manages to do so, because according to Andreas Malmberg, the film with recycled content stands out with a mechanical property profile that is almost 100 % equivalent to that of the original film made from virgin material.

In order to launch these film products with high recycled content, which in addition to the new machine stretch film also include,

for example, FFS solutions as well as packaging films for high-resolution prints and protective equipment, a processor has to manage closely the reprocessing issue itself. Andreas Malmberg views his company as having a clear advantage here due to its many years of experience in the processing of recycled materials. Around 50 % of the recycled goods used are processed in-house, in all ten of the production facilities. In addition, materials are purchased from partner companies and processed in the two production facilities in Nyborg, Denmark and Ombreé D'Anjou, France in specially installed recycling lines including a washing plant. ■

www.trioworld.com

For Managing Director Andreas Malmberg, it is clear: "We have to reduce the CO₂ footprint when using plastics."

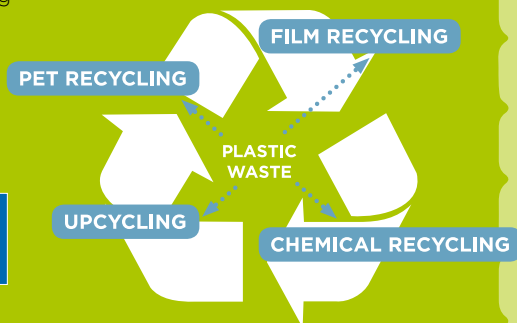
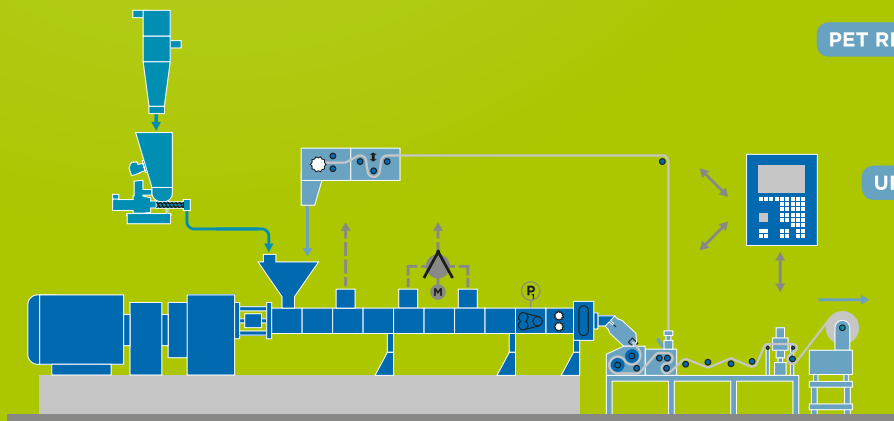


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Safe new start-ups take time, especially in medical technology!

I find the current discussions among politicians and virologists about delays in the supply of Corona vaccines more than unfortunate. In our industry, when new car models or medical products are to be launched, it is assumed that it will take years of advanced planning to guarantee a secure long-term supply to the market. But when it comes to the distribution of vaccines, it is supposed to work flawlessly within a few months?!



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

I remember very well the high-speed ramp-up of the production of a new mobile phone back in the days when there were still mobile phones from Siemens and Nokia. These extremely short-lived products were given to the manufacturer with the directive that within six months production should be up and running for about 500,000 cases following the design freeze. At that time, there were still several companies in Germany that were able to do this for the various major customers. I was able to follow a project for instance, where a new production hall was built, 21 new injection moulding machines were bought and over 40 injection moulds were built. All this preliminary work was manageable. The key, however, was the successful installation of a completely newly developed assembly line that was to join the complete housing of the mobile phone from 19 individual

components. In the end, various initial bugs led to a much slower delivery to the market than planned.

The customers were understanding when it came to all the delays as long as they saw that exhaustive work was being done to solve the problems. As a rule, it was technicians on the customer side who were aware of their company's ambitious goals and served as interpreters to marketing and sales, so to speak. In the end, they were able to jointly celebrate the successful market delivery with a delay of "only" two months, which did not detract from the success of the design. Despite all the effort, these designs usually only operate for only one year. After that, the cycle starts all over again. - This is what is technically possible. However, different rules apply to medical devices.

The qualification and validation of new processes in medical technology are most strictly defined and regulated. Even a small change in the formulation of an already approved mass-produced item requires numerous risk analyses, tests and verifications before it is allowed to enter the market. Due to the time standardised test series take, one has to wait months or years for certification of the notified bodies alone. Only then are the approvals sufficient for entering the market.

I wish that in every discussion about the "incompetence" of the large vaccine manufacturers, technicians and experts who are familiar with such production processes and could at least promote some understanding would have, for once, their input heard. After all, we all want to be injected with products that are manufactured safely and are not "good" by mere chance. Here, new products are introduced to the market, some of which are (or supposed to be) processed through completely new filling lines with the highest hygiene requirements in order to increase the output quantities. The installation, qualification and validation of such new equipment typically take years!

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