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K-PROFI

international edition

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Wirthwein is involved in the injection moulding of hard and soft magnetic compounds for motors, sensors and EMC. Jan Wiedemann explains what they can contribute to electrification:

One-shot system for iron ring and magnets?

How **Alpla** minimises set-up times for colour changes. How **Röchling Medical** reduces CO_2 footprints. How **Cirrec** is pushing recycling trays for food. How **Kurz** is overmoulding metal contacts in a media-tight manner. And why the first machine manufacturers are offering **direct current operation.**

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Technologies and best practice in plastics processing

Dear reader,

Explaining trends and technologies, showing strategies and best practice, presenting successful movers and shakers in plastics processing – this is the maxim we pursue with K-PROFI international. And also with this issue.

I had the pleasure of talking to Prof. Reinhard Schiffers from the University of Duisburg-Essen about the prospects for the electrification of machines and moulds for injection moulding. The conclusion: „Electrification will be used wherever possible“ from page 5 onwards. It is not yet permitted to use PET trays made from 100% recycled material for food. This is despite the fact that Cirrec Netherlands in Duiven has received EFSA approval for its tray-to-tray process: Karin Regel's report from page 10 onwards. Erika Unjaev from Röchling Medical in Waldachtal spoke to Sabine Rahner about reducing the carbon footprint of a disposable surgical instrument: page 14.

The Alpla injection moulding plant in Föritztal has minimised set-up times for colour changes with the help of electrostatics. Maik Göpfert and Justin Maaser told me about their experiences: page 16. Kahmann & Ellerbrock in Bielefeld only produces technical parts for mechanical engineering, food and advertising technology to order. Pavlos Chartomatsidis gives Gabriele Rzepka and you an insight into state-of-the-art plastics machining: page 26. Plastic-bonded compounds can replace hard and soft magnetic metals, which is a challenge in terms of injection moulding technology. Wirthwein in Creglingen wants to drive their use via motor technology in sensor technology and EMC shielding. More details in an interview with Jan Wiedemann from page 31.

On our own behalf: If you no longer want to do without K-PROFI international, order the magazine free of charge. Details on page 43.

We wish you a good start to a successful 2024!

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Cover photo: K-PROFI/Schneider

Screw caps for drink bottles are 100% optically inspected, printed in up to three colours using pad printing (pictured) and, if necessary, laser-marked. Ionisers can be found throughout the entire product flow at Alpla – including on conveyor belts for finished products and above the collection containers for screw caps.

“Electrification will be used wherever possible”

Professor Reinhard Schiffers on the status and prospects of electrification in injection moulding technology

Injection moulding machines, injection moulds and automation are becoming increasingly electrified. At the VDI Injection Moulding Conference in Wiesbaden, Prof. Reinhard Schiffers, Head of the Chair of Design and Plastics Machinery (KKM) at the Institute of Product Engineering (IPE) at the University of Duisburg-Essen, summarised his impressions from before, during and after K 2022. K-PROFI asked him in Duisburg.

The interview was conducted by K-PROFI Editor-in-Chief Dipl.-Ing. Markus Lüling.

Photo: IPE University of Duisburg-Essen

Prof Dr Reinhard Schiffers studied mechanical engineering at the University of Duisburg-Essen. In his dissertation, he researched the improvement of process capability in injection moulding through the use of process data and developed a new type of screw stroke control. After completing his doctorate in 2009, he initially worked in R&D at KraussMaffei in Munich, where he became Head of Machine Technology in 2012. Since autumn 2017, he has held the Chair of Design and Plastics Machinery at the University of Duisburg-Essen, succeeding Prof. Dr Johannes Wortberg.

K-PROFI: Professor Schiffers, cost-efficient, i.e. highly streamlined and standardised injection moulding machines have long been the concept of Asian manufacturers. In Europe, too, special series machines were very popular with many brands around the turn of the millennium. Why do you think these ideas are now being revived?

Reinhard Schiffers: During the 2009/2010 financial crisis, there was massive cost pressure in the mechanical engineering sector. After that, things were rather relaxed for many years. Today, people are looking at costs again. Processors are now questioning the add-ons they would have bought five years ago. This means that a standardised machine is once again coming to the fore.

The development is exciting. When you see what new players are coming onto the market, you can't help but wonder whether taking a simple basis and adapting it for the European market is a long-term concept. After all, some Asians build hundreds of 4-colour machines a year for car rear lights. They have to do that well.

I think the high-end market will remain in the hands of the Europeans. But it will be difficult to get automotive suppliers to pay the price of a European machine everywhere in the long term. Global sourcing processors will no longer accept different prices for comparable technology in different markets.

You have looked at high-speed machines for packaging parts. Will there be a certain optimum machine for these high-performance requirements over time, or will the concepts of the individual brands continue to differ in the long term?

A fully electric two-platen machine with four electric motors on the injection side – nobody can actually afford that. Maintaining high injection performance electrically is incredibly expensive in terms of investment. A typical packaging machine has an injection power of 700 or 800 kW, so you have to prepare electrically, install power storage with a heavy asynchronous machine, accelerate and decelerate to smooth out the load profile and ultimately save feed-in power. In terms of consumption, electric solutions are always better than hydraulic ones. In fact, all high-speed machines today have an electric clamping unit. It is complex in terms of mechanical engineering and extremely difficult in terms of control technology to utilise the braking energy in a hydraulic clamping unit. And electrically, this is virtually standard. It is possible to recover 50, 60 per cent or even a little more of the kinetic energy and store it temporarily.

On the injection side, some are also fully electric. Sumitomo-Demag has shown such a Pac-E cap machine as a combination of E-Exis-SP and IntElect with electric drives for the main axes and 550 mm/s injection speed. I think such an application is currently the limit for achieving 550 mm/s speed and 2,000 bar pressure electrically at the same time. Machines with an injection speed of 1,500 mm/s, such as the Engel e-speed 280/50 for extremely thin-walled applications, still need hydraulics. There is a sensible boundary between the concepts for high plasticising performance at moderate injection speeds on the one hand and medium plasticising performance at high injection speeds on the other.

We have seen approaches to direct processing come and go time and again. Do you currently see a trend in favour of direct processing of highly filled or highly reinforced plastics – or for the processing of such recyclates that require degassing?

Both current concepts with a plasticising unit for melting and a second unit for injection are attractive – on the one hand Engel's with an intermediate degassing and filter unit. I don't know the efficiency of the degassing, but this can be useful for some applications to remove volatile components. On the other hand, there is the KraussMaffei concept with an easily convertible standard machine that works with shot weights from 50 grams.

I believe that direct processing will become more popular. It remains to be seen how big the niche is for the processes. Ready-to-use material is quite expensive in some places. If you have access to fillers and pigments, you could then definitely get added value from the compounder. I think the plant technology today supports this in such a way that processing is reliable.

Direct processing should be interesting for materials that are not available on the market ready for processing. Thinking about colouring is also perfectly fine. If I manage to reduce the amount of colourants added with direct processing, for example, then I have an additional advantage.

Is a two-stage process attractive for smaller clamping force classes?

I suspect that we will get a little more market volume than with KraussMaffei's IMC, for example, which was at the upper end in terms of technology and therefore cost. The two-stage variants are interesting for more users because I can run independent speeds in the two stages and thus achieve a lot of variability in the process.

Are injection moulding machines with a direct current storage unit to compensate for power peaks an outlandish idea, or do you think they are important in view of the increased use of photovoltaics?

Wittmann's idea shows how creative you can be. The KERS system with an intermediate circuit for several consumers is a good concept. The further development in the direction of a feed-in from PV systems is exciting. The efficiency of a PV inverter is around 97%. Whether I feed into the grid via an inverter or into the intermediate circuit of the machine makes little difference in terms of energy with a 3% loss. In addition, there is increased installation effort for managing the high voltages. That's why I don't believe that direct current concepts will become widely accepted in Europe, but perhaps in other markets. However, the idea is a good illustration of the high level at which we are also discussing the topic of availability and consumption of electricity in plastics technology.

An injection moulding system generates more and more data – from the machine, mould and peripherals. In your opinion, is this enough to assess the process and the quality of the moulded part? Would even a restriction to the machine data, for example, be sufficient?

We have seen innovations or further developments from many suppliers. They all claim to generate added value from the data and the data stream, wherever the data comes from and whatever information it is enriched with. The aim is to make a quality assessment, to recognise a change in the process, i.e. to learn. With unsupervised learning, I simply analyse the data stream. With supervised learning, I incorporate feedback. There are many approaches and methods in the field of machine learning.

The really interesting question will be: Who gets sovereignty in the injection moulding cell? The machine builder? The mould maker? Or those who sit around and say: We can do it better anyway because we are independent? I believe that the concepts or suppliers who manage to understand injection moulding as such to the greatest extent will prevail. I'm convinced that you need a certain level of domain expertise to draw the right conclusions. I only trust people who are immersed in injection moulding to do this. I wouldn't trust someone who only looks at it from the outside – and doesn't have the idea of building up domain knowledge in the same way.

So a pure "data geek" has poorer prerequisites?

He will find the same changes in the data, but he still needs the application engineer to decide what to do and to have an idea of the consequences of his intervention. Service providers who are closer to the industry are likely to be on better ground, at least for the next five or six years.

Will "classic" quality assurance instruments such as optical inspection or cavity pressure measurement remain essential, or will intelligent systems based on machine data be valid enough to adequately assess moulded part quality?

The question is: What added value do systems based on cavity pressure, for example, offer compared to machine data evaluation? And the answer changes the moment I have not just a single cavity, but multiple cavities. The machine only knows one volume, which is why control based on machine data will be sufficient for single-cavity moulds. The more cavities there are to fill, the more diffuse the information from the machine and its control systems about the moulded part quality becomes. With many cavities, not all cavities can be controlled by the machine. Balancing the mould or monitoring the filling levels is only possible with separate systems. We often see multi-cavity moulds in medical technology, where the need for monitoring is greater anyway and the chance of refinancing the systems is also better.

In addition, one and the same pressure curve does not automatically mean that I always get a moulded part of the same quality. The pressure curve information alone does not provide me with a reliable basis. If you need to switch to recycled material or compensate for other fluctuations, you can't take countermeasures with the pressure curve alone. However, intelligent systems such as iQ weight control from Engel or APC from KraussMaffei can

actively intervene if the viscosity or compressibility of the melt changes. Nevertheless, the certain redundancy of the external systems with those of the machine has a certain charm. The two systems then monitor each other.

The electrification of the moulds ensures independence from the hydraulics, parallelism and also the precision of movements. What other advantages do you see in "electrification"?

The situation here is similar to that of the machines: Everything that can reasonably, i.e. economically, be done electrically will be done electrically. The mould is usually a compact, "hostile" environment with very confined installation space, high temperatures and high pressures and forces, especially in the case of nozzle drives for hot runners. This is why mould manufacturers – and their customers – are still in the discovery phase and are reluctant to use linear motors, stepper motors, deflection systems or gearboxes. But wherever electrification is possible, it will be done. We see this in the many electric valve gate nozzles with adjustable opening speeds and cross-sections, in servomotors for core pulls or in the 8+8+8-fold cube from Foboha with rotary disc.

The reason for using electric drives is digitalisation: I have all the information I need for monitoring, analysing or controlling the process in the electric drives. Mould makers and hot runner suppliers want to make the mould independent of the machine. This is another reason why they are moving towards electrics – quite apart from the other effects that hydraulic oil is no longer needed and only a little lubricant. The technological development that machine and tool manufacturers are currently pursuing is remarkable. Elsewhere in the world, not many toolmakers have dozens of injection moulding machines just for developing and sampling tools.

In recent years, customised additive manufacturing of application and project-specific hot runner manifolds and hot runner nozzles has emerged. How do you rate the possibilities of optimising heat management, process and energy consumption in relation to the calculation and design effort?

By 3D printing hot runner nozzles, you can set different thermal conductivities, different deformations and different flow conditions. Witosa is utilising the possibilities of a new production technology and is being very realistic in the process. Hasco and Otto Männer are pursuing an interesting path with 3D-printed hot runner manifolds, as is Haidlmair with its combination of mould steel and 3D-printed yellow bronze to optimise cooling.

The new technologies will now become mainstream and we will soon see moulds that are completely designed for an additively manufactured hot runner. 2K or 3K functions will be able to be represented on a few centimetres of height or thermal separations optimised. There's still a lot to come.

I find it particularly interesting that the classic design criteria will no longer apply. If the duct is curved, I have a different volume than with a drilled hole. We will have to react to this in the design. You are very well advised to have systems that automatically find the optimum design under given boundary conditions. This can be done using genetic algorithms that vary parameters in a directed or, in some cases, stochastically randomised manner and thus generate new geometry variations that are then evaluated. We will see a few more developments in this area, quite independently of further progress in the innovative production of distributors or nozzle.

A word about developments in extrusion?

Extrusion as an industry is different from injection moulding technology. The developments here are somewhat less visible than in injection moulding, but they are also being felt everywhere. Suppliers are operating at a very high level, including in drive technology and digitalisation. But – unlike in injection moulding – in extrusion, people rarely buy a complete line from a single supplier. I also see much more expertise on the processing side in extrusion than in injection moulding, for example.

www.uni-due.de/kkm

Trade Fair Calendar

Trade fairs related to plastics processing in 2024

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

Plastfocus Expo 2024	New Delhi, India	01.02. – 05.02.2024	*www.plastfocus.org*
Warsaw Plast Expo	Warsaw, Poland	06.02. – 08.02.2024	*www.warsawplastexpo.com*
32. Intl. IKV Colloquium	Aachen, Germany	28.02. – 29.02.2024	*www.ikv-kolloquium.de*
Plast Alger	Algiers, Algeria	04.03. – 06.03.2024	*www.plastalger.com*
JEC World	Paris, France	05.03. – 07.03.2024	*www.jec-world.events*
Plastpackprint Nigeria	Lagos, Nigeria	26.03. – 28.03.2024	*www.ppp-nigeria.com*
Wire, Tube	Dusseldorf, Germany	15.04. – 19.04.2024	*www.wire.de; www.tube.de*
Hannover Messe	Hanover, Germany	22.04. – 26.04.2024	*www.hannovermesse.com*
Chinaplas	Shanghai, China	23.04. – 26.04.2024	*www.chinaplasonline.com*
Control	Stuttgart, Germany	23.04. – 26.04.2024	*www.control-messe.de*
NPE 2024	Orlando FL/USA	06.05. – 10.05.2024	*www.npe.org*
Kuteno	Rheda-Wiedenbrück, Germany	14.05. – 16.05.2024	*www.kuteno.de*
Rapid.Tech	Erfurt, Germany	14.05. – 16.05.2024	*www.rapidtech-3d.de*
Plastics and Rubber Thailand	Bangkok, Thailand	15.05. – 18.05.2024	*www.plasticsrubberthailand.com*
Plastpol	Kielce, Poland	21.05. – 24.05.2024	*www.targikielce.pl/en/plastpol*
FIP 2024	Lyon, France	04.06. – 07.06.2024	*www.f-i-p.com*
HanoiPlas	Hanoi, Vietnam	05.06. – 08.06.2024	*www.chanchao.com.tw/hanoiplas*
Achema	Frankfurt/Main, Germany	10.06. – 14.06.2024	*www.achema.de*
Plastics Live	Coventry, UK	12.06. – 13.06.2024	*www.plasticslive.co.uk*
MedTec live/T4M	Stuttgart, Germany	18.06. – 20.06.2024	*www.medteclive.com*
Plastics Recycling Show	Amsterdam, The Netherlands	19.06. – 20.06.2024	*www.prseventeurope.com*
Interplas Thailand	Bangkok, Thailand	19.06. – 22.06.2024	*www.interplasthailand.com*
Central Asia Plast World	Almaty, Kazakhstan	26.06. – 28.06.2024	*www.plastworld.kz*
Dt. Kautschuk Tagung DKT	Nuremberg, Germany	01.07. – 04.07.2024	*www.dkg-rubber.de*
Indoplas	Jakarta, Indonesia	04.09. – 07.09.2024	*www.k-globalgate.com*
Compounding World Expo	Brussels, Belgium	11.09. – 12.09.2024	*eu.compoundingworldexpo.com*
Plastics Recycling World Expo	Brussels, Belgium	11.09. – 12.09.2024	*eu.plasticsrecyclingworldexpo.com*
Polymer Testing World Expo	Brussels, Belgium	11.09. – 12.09.2024	*eu.polymertestingexpo.com*
Kunststoffenbeurs 2023	s-Hertogenbosch, The Netherl.	18.09. – 19.09.2024	*www.kunststoffenbeurs.nl*
T-Plas	Bangkok,Thailand	20.09. – 23.09.2024	*www.tplas.com*
ColombiaPlast	Bogota, Colombia	23.09. – 27.09.2024	*www.colombiaplast.org*
Taipei Plas	Taipei, Taiwan	24.09. – 28.09.2024	*www.taipeiplas.com.tw*
Fakuma 2024	Friedrichshafen, Germany	15.10. – 19.10.2024	*www.fakuma-messe.de*
Vietnamplas 2023	Ho Chi Minh City, Vietnam	16.10. – 19.10.2024	*www.chanchao.com.tw/vietnamplas*
Compamed	Dusseldorf, Germany	11.11. – 14.11.2024	*www.compamed.de*
SPS	Nuremberg, Germany	12.11. – 14.11.2024	*sps.mesago.de*
Formnext 2023	Frankfurt/Main, Germany	19.11. – 21.11.2024	*www.formnext.de*
PlastEurasia	Istanbul, Turkey	04.12. – 07.12.2024	*www.plasteurasia.com*

Food from the recycling tray?

The Faerch Group's integrated recycler is driving the transition to recyclable food packaging

Why not? It is possible to produce a new PET tray from 100% recycled food trays. However, 100% is not quite achieved, as there are still a few hurdles to overcome. This is despite the fact that Cirrec Netherlands B.V. in Duiven has received EFSA approval for its tray-to-tray recycling process, confirming that the recycled material can be reused in food contact. A three-layer structure of thermoformed trays with high recyclate ratios of 90% is possible and achieved. And this is exactly what Cirrec and its parent company, the Danish Faerch Group, are doing very successfully. So successful, in fact, that a second plant is currently being built and there are clear growth plans for the coming years. K-PROFI found out more in an interview with Director Recycling Aron Damen.

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


Photo: Cirrec

In the tray fraction from the collection systems, the average PET content is around 54%.

On average, only eight days pass between the time a food tray is filled and the time it ends up in the consumer's rubbish bin. Under the slogan "From 8 days to infinity", Cirrec is working on transforming this disparity between the time and resource-consuming production of PET trays and their disposal into an almost infinite cycle. "PET is excellent for mechanical recycling and, unlike many polyolefin fractions, can also be used for demanding applications in the food industry – without downcycling. Many functioning bottle-to-bottle cycles are already proving this today," says Aron Damen from his day-to-day production work. After all, the Faerch Group recycler currently processes 24,000 tonnes of PET waste per year and will increase its capacity to 60,000 tonnes per year with the construction of the second plant. "We are not only expanding our site in Duiven in the Netherlands with a double-digit million euro investment, but are also working on setting up further production sites in Europe," reports Aron Damen. The aim is to establish a functioning closed-loop system for food trays in every country. After all, plastic PET trays account for around 4% of consumer waste, which corresponds to an annual volume of around 150 and 180 tonnes in the Netherlands alone. However, only a portion of this is recycled.

Left: "We have already established a closed tray-to-tray cycle with a catering company for 'meals on wheels'." Aron Damen shows the collected trays that are returned to the same application during a tour of the plant.

Centre: After the final sorting – by colour – there are two input fractions for the subsequent granulation, the "natural" fraction shown and a "coloured" fraction that contains many shades of green.

Right: The thermoforming trays in the colour of the day, which varies slightly depending on the input material.


Photo: Jonas Regel


Photo: Jonas Regel


Photo: Jonas Regel


Photo: Jonas Regel

"Even if there is still a long way to go, our long-term goal is to establish a functioning tray-to-tray recycling system in every country," says Aron Damen, Recycling Director at Cirrec, outlining the objectives.

Fulfilling diverse framework conditions

There are still a number of challenges to overcome before a tray-to-tray plant is installed in every country. First and foremost, Aron Damen would like to see a change in legislation and the use of recyclates in food applications to be simplified and promoted more strongly. For example, the Central Agency for the Packaging Register in Germany requires a complete recycling infrastructure to be in place for every new material flow – until then, the material flows are generally not considered recyclable. "Although Cirrec is certified in Germany and the recycled PET trays are classified as recyclable, this is not enough. Implementing a recycling solution is particularly difficult for such a small material flow as PET trays," explains Aron Damen and specifies: "As long as the small fraction is not considered recyclable, it is not collected and sorted sufficiently. As a result, the material flow can hardly increase and it may not be worthwhile setting up the necessary infrastructure. A classic chicken and egg situation."

"In addition to classifying PET trays as recyclable, the use of recyclates in food packaging should also be promoted more strongly," says Aron Damen. Faerch uses the ABA structure in many of its thermoformed trays, whereby the B-layer is made from 100% recyclate. During production, an important framework condition must be observed for food applications: the 5% rule. This means that a maximum of 5% of the recycled material used for food applications may come from non-food applications, for example non-food trays. In order to comply with this rule, the incoming goods at Cirrec are subjected to a complex and precise inspection, as unfortunately they contain a lot of incorrect packaging. "Overall, material preparation is very time-consuming for us," reports Aron Damen during the tour of the plant, "as pre-sorting at the dual systems and other disposal companies has not yet been geared towards sorting PET trays." He backs this up with figures: "While a bale of PET bottle waste actually contains around 72% PET by mass, PET bales with tray waste only contain around 54% PET on average." The remainder is largely made up of other plastics, metals, lidding film, labels, organic waste and water.

Cirrec sources the bales primarily from the Netherlands, Germany, Belgium and Scandinavia. The processed recyclates remain within the Group and are currently only reprocessed by Faerch at the various locations. "Given the high demand within the Faerch

Group, it is not yet possible to sell our food-grade recyclates externally. However, this is set to change with the construction of the new facilities," says Aron Damen, looking to the future.

Cirrec has already implemented closed tray-to-tray solutions, for example with a catering company for 'meals on wheels'. The trays are collected by type directly from the caterer, processed at Cirrec and the recyclates are re-used for new trays for the same application. Cirrec has realised a similar closed cycle with a leading supermarket chain. Here, trays in which muffins or yoghurts are delivered to the fresh food department are collected, recycled, and kept in circulation.

The consumer plays an important role

Organic waste poses a particular problem in tray recycling. "We have a lot of organic waste, such as the famous potato salad, which is thrown away with the tray," reports Aron Damen and would like to see more consumer education and involvement. It is not only emptying leftovers that would be very helpful for reprocessing, but also the separation of metals and plastics. "Our waste often contains aluminium cans that have been crushed into plastic trays and have to be laboriously removed before we can recycle them."


Photo: Cirrec

Cirrec is currently building a new plant at its site in Duiven in order to expand its processing capacity to 60,000 tonnes per year.

The testing effort is enormous: both the incoming goods and the processed fractions are closely monitored for food suitability.


Photo: Cirrec

And Aron Damen has one more wish for consumers: "The recyclates we produce can have slightly different colours. There is a 'colour of the day', so to speak, which makes the whole process authentic. We hope that the tolerance of colour nuances will increase for packaging manufacturers, food producers and consumers. We are on the right track here and are already noticing that consumers are sensitised to this issue and show understanding."

From pre-sorting to bagging

MEvery preparation process at Cirrec starts with the bale analysis described above. Then pre-sorting begins. "In this step, we repeat what has already been done by the waste disposal company but is not sufficient for our requirements," explains Aron Damen. After the bale is opened, the first sorting step takes place, which removes metals and non-ferrous metals and carries out an initial ballistic separation according to waste size. All small parts are then sorted out in a drum, as these are generally unsuitable for processing. Three NIR sorters now take over the separation into fractions, of which the good fractions are shredded in a mill, cleaned in the hot washing unit and any composites are delaminated.

PET and polyolefins are now separated using a float-sink separation stage. After screening, washing and drying again, the actual sorting begins. "We start again with metal separation before the fraction is separated according to the polymers in the next NIR

Cirrec in the Faerch Group

Cirrec is part of the Faerch Group, which in turn is part of the Danish A.P. Møller Holding A/S. Faerch operates 34 production sites worldwide, in which around 6,000 employees process 325,000 tonnes of plastics into rigid packaging, primarily thermoformed packaging for well-known manufacturers in the food industry. Faerch's mission is to lead the transformation of the rigid food packaging market into a truly circular economy. As an integrated recycler within the Faerch Group, Cirrec supplies the production facilities with food-safe PET recyclates and is considered a pioneer in tray-to-tray recycling. Cirrec currently employs 80 people, who work in a 5-shift system and operate the recycling plants 24/7.

sorting system," explains Aron Damen. The PET fraction obtained in this way is transferred to the air separator, where particularly light film waste is separated, as it is unsuitable for processing due to its low quality.

Finally, the PET waste is separated by colour in the last NIR sorting stage. "We differentiate between the two fractions 'coloured' and 'natural', whereby coloured is usually a type of green and natural results in an impure transparent," continues Aron Damen. Incidentally, the Director Recycling describes this separation step as the most expensive, as for every flake that is recognised as non-PET by the NIR sensor and discharged via an air nozzle, around 10 more flakes are sorted out – most likely good flakes. In other words, a loss of material.

Before the two fractions are now filtered, decontaminated, and finally granulated in the Erema recycling plant, the fractions undergo another quality check in the in-house laboratory. "The effort involved in producing our food-grade regranulates is understandably enormous, as we have to ensure that there is no risk to health whatsoever." This results not only from the EFSA test, but also from close monitoring by means of toxicological reports and independent NIAS tests.

The new, second processing plant for PET trays in Duiven is due to go into operation in November. "Just like the first plant, the new one will also work with our self-developed software," says Aron Damen, emphasising a special feature of his company. The NIR sorter in the first separation stage, which comes from Steinert, also works with artificial intelligence. This serves to improve sorting performance and eliminate the manual re-inspection that previously removed non-food items.

Aron Damen assumes that PET will become the material of choice for food trays, as PET trays can be made entirely from recyclates and can be recycled into nine food-safe applications after use without any loss of quality, thus keeping them in circulation. If PET were the only material for food trays – similar to beverage bottles – pre-sorting would be significantly simplified and the material quality increased.

In addition, mechanical PET recycling has the highest savings potential per tonne of polymer compared to other materials and methods, with a saving of around 1,800 kg of CO_2 equivalent.

www.cirrec.nl

Consumer education and co-operation are essential in order to reduce the proportion of organic residues in the PET tray fraction.

Photo: Cirrec

Showing what is already possible

How Röchling Medical wants to bring more sustainability into product development

How can medical technology products be developed and designed more sustainably? Erika Unjaev, Senior Specialist R&D at Röchling Medical Waldachtal AG, spoke to K-PROFI about the goals, challenges, and solutions for reducing the CO_2 footprint using the example of a disposable instrument for minimally invasive surgery.

The Röchling Group, headquartered in Mannheim, has made sustainability one of its most important strategic areas for the future. Last year, the Röchling Board Sustainability, which is positioned directly below the Group Executive Board, was established to prepare the corresponding strategic decisions in order to accelerate concrete implementation steps. In Waldachtal, Röchling Medical produces sophisticated plastic parts, assemblies, and medical devices on 2,400 square metres of clean room space, certified in accordance with ISO 8. The implementation of classic sustainability solutions at product level, such as recycling, circular economy or the use of alternative materials, is much more difficult in medical technology than in other industries. As Erika Unjaev explains, sustainable approaches are therefore already considered in the early stages of product development.

K-PROFI: You presented a sustainable trocar at the Nuremberg trade fair 'MedtecLive with T4M'. How did the idea for this demonstration project come about?

Erika Unjaev: When it comes to making products more sustainable, there is an incredible amount of theoretical knowledge, but there are no concrete examples of best practice, especially when it comes to medical devices. Our aim was therefore to illustrate the principles and approaches of Design for Sustainability using a specific application example. In other words, to apply everything we come across in the literature to a medical device and go public with the results. In medical technology in particular, with its regulations, there is still a lot of reluctance simply to do not do anything wrong.

What goals did you set yourself?

Our aim was to implement the various principles and approaches of "Design for Sustainability" as far as possible in the product and to incorporate the findings into further product developments. In general, our strategy at Röchling is to make product development more sustainable.

What was the biggest challenge?

There are already many trocars on the market, and they all fulfil the same function. The challenge was to break away from current solutions, to think innovatively and holistically, to create something new that is more sustainable.

By consistently implementing the design-for-sustainability principles in the development of a new trocar, Röchling was able to more than halve its ecological footprint.

Photo: Röchling Medical

The redesign includes eight instead of twelve components, five instead of three material variants, detachable connections, and reduced weight without any loss of functionality.

Photo: Röchling Medical

And how did you achieve this in the design?

Five different materials are used in a standard trocar. We can now work with three types. Trocars generally consist of at least twelve components. We have reduced the design to eight components and have also been able to reduce the weight by 32 per cent. The components are usually glued together, but our trocar consists solely of detachable plug-in connections. This makes assembly and disassembly faster, more effective, and easier.

How did you measure the success of your endeavours?

When designing and developing the new Trokar, we systematically worked through all the principles of "Design for Sustainability" using a checklist, implemented these as far as possible and adapted the design. Only after we had calculated the global warming impact of the new trocar did we use a comparable trocar and determine its CO_2 equivalent. The result was that we were able to significantly reduce this by 51 per cent in terms of materials and processing.

What were the biggest levers for reducing the CO_2 footprint?

The change of material alone reduced the footprint by 33 per cent. We switched to PP and bio-based PLA from Biovox. That was the biggest factor. The redesign was the next biggest factor at 18 per cent. By combining components, we were able to reduce the number of moulds required. However, there are also 'soft' criteria for which the CO_2 footprint cannot be calculated. These include, for example, the fact that we have included material labelling of the individual components as part of the "Design for Circularity" to support a circular economy. This is the prerequisite for enabling hospital staff to separate waste materials in the first place.

Are there corresponding efforts to separate waste in the hospitals?

We are in close contact with doctors via various networks. There are an extremely large number of projects in hospitals that want to reduce their environmental impact. Because there is often a lack of staff and space, the focus is on pre-sorting and separation in a downstream process. We therefore want to incorporate the aspects of recyclability and recycling into products that we are now developing.

Photo: K-PROFI

Development Specialist Erika Unjaev: "The change of material to bio-based medical grade compounds alone reduced the footprint of the trocar by 33 per cent."

What are the next steps in the project?

The Trokar is a finished product at the design and development stage. In this respect, the demonstration project is complete. At the material level, we are of course continuing to monitor which sustainable materials are coming onto the market. We are currently still relying on silicone for seals. Biovox has now announced biobased soft-modified materials. We will test and check the functionality of these and other sustainable materials. We have realised that physical prototypes are important in contact with our customers. With bio-based materials in particular, there is often a lack of confidence that the strength is sufficient. We need to provide samples of parts so that customers can get their hands on them.

Your summary?

We have learnt a lot from this project. The key to more than 80 per cent of a product's ecological footprint lies in the design and development phase. We are in the middle of implementing a sustainable product development process. In medical technology in particular, it takes years for a product to reach the market. This makes it all the more important for us to make development more sustainable now. Our customers anticipate the issue in different ways. We try to sensitise them to this in every project and to demonstrate the possibilities of sustainable product development.

www.roechling.com/de/medical
www.biovox.systems

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

Quick visual inspection instead of time-consuming disassembly

How Alpla uses electrostatics to speed up colour changes during injection moulding

The Alpla injection moulding plant in Föritztal has consistently minimised set-up times for colour changes and product changeovers. Today, two ion blower nozzles on the dosing hopper help to avoid deposits in the material flow, eliminate the need for cleaning and rule out sudden colour casts in the product. Plant Manager Maik Göpfert and Project Manager Justin Maaser report on the key steps and their experiences in the production of screw caps and other closures during the on-site visit.

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

Photo: K-PROFI

Retrofitted dosing unit on a 4,200 kN capping machine: compressed air flows are ionised at the feed of the regrind and under the non-return flap and fed into the hopper.

The Alpla site in Föritztal in the Sonneberg district of Thuringia emerged from a design office with a small toolmaking shop founded in 1991. The company founder had developed numerous plastic packaging solutions, such as glue sticks, shower gel bottles with hangers and functional closures. Relatively early on, the office was already realising designs for the packaging company Alpla.

After years of intensive cooperation, Alpla took over the firm, scaled up toolmaking, added injection moulding production and merged the business with Lübecker Kunststoffwerk GmbH, which already existed at the time. To this day, Föritztal is the only one of the 14 German Alpla sites with injection moulding production and produces around 4 billion different closures in 350 colours every year in 24/7 operation with 140 employees. Successively expanded and extended, the plant now operates 30 all-electric or hybrid injection moulding machines of various brands with clamping forces ranging from 800 to 5,000 kN.

Specialist for coloured screw caps and closures

Alpla mainly produces moulded parts. For some years now, several machines for more complex closures have been equipped with removal and assembly automation. Here, the assembly injection moulding of 2K closures from multi-cavity moulds is completed within a cycle time of less than ten seconds. Due to the lack of space on the main level of the production hall, Alpla has placed the hot runner controllers on platforms and the technology for the seamless inspection of screw caps on a long podium.

Photo: K-PROFI

Two of the 30 injection moulding machines in Föritztal are already equipped with electrostatic technology in the material flow, the other machines will follow shortly.

The site is partly supplied by its own mould shop, while other moulds are sourced from partners. The number of compartments in the hot runner moulds starts at four but is between 48 and 96 for most of them. Alpla processes around 12,000 tonnes of material in Föritztal every year, almost exclusively polyethylene (PE) and polypropylene (PP). The raw material is transported from six outdoor silos to the mixing plant in the basement. Here it is combined with masterbatch in Tschritter mixers to form ready-to-process compounds and conveyed to the individual injection moulding machines via a pneumatic vacuum system.

Enduring battle against build-up and contamination

At many points in the material flow, Alpla detected various types of build-up, primarily due to dead corners in the mixers and electrostatic charging in the dosing hoppers. Although these material build-ups did not lead to bridging in the hopper, they came loose in an uncontrolled manner and caused a variety of problems in processes and products. Justin Maaser: "Especially with light-coloured articles, we had a sudden colour shift for a short time after the colour change."

Maik Göpfert elaborates on the problem: "With green for medium sparkly water alone, we have around 35 colour nuances for masterbatch, depending on the brand, which are set very precisely. With the large quantities that we use, the risk of colour deviations due to suddenly dissolved deposits is simply too great. It is important that the entire material conveyor chain is free of dust and foreign colours so that we can produce as safely as possible overall."

Increased problems due to the supply of regrind

With around 2,500 product changes per year, the personnel costs for cleaning and downtime add up to a significant amount. Justin Maaser: "We have set ourselves the goal at the site of minimising set-up times for colour changes and product changeovers. That's why, in a major project with our technology supplier Eltex-Elektrostatik, we looked for solutions to eliminate dead corners and prevent colours and masterbatch from sticking." Work began on the Tschritter mixers, which have now been optimised and rebuilt without dead spots.

The second key point of intervention is the dosing hoppers. "In standard devices for average applications, ionisation is often not feasible in terms of cost, even though it would often bring a technical advantage," says Jan Barth, sales and application engineer at electrostatics specialist Eltex. Alpla operates grinders on almost all machines in order to grind the resulting waste directly and feed it back into the hopper via a hose using vacuum conveying. "Where we suck in and feed in regrind, the build-up in the metal hoppers is significantly greater than with pure virgin material with masterbatch," Justin Maaser has observed on the electrostatically charged regrind. There is considerably more dust in the regrind. Due to its low weight, even small electrostatic charges are enough to cause the material to adhere to machine parts. As a result, the individual hopper has to be dismantled and cleaned high up on the machine when the colour is changed.

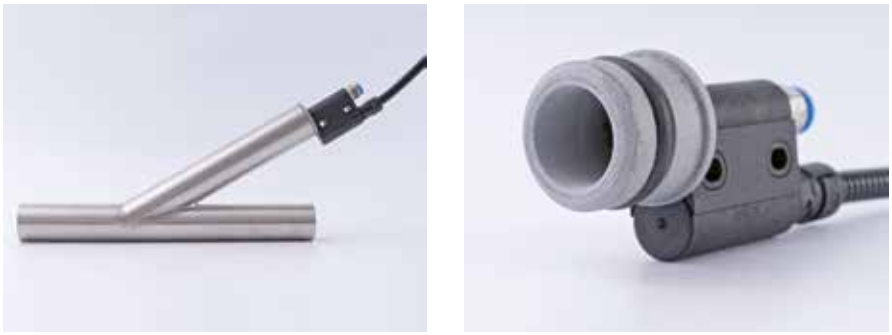
Maik Göpfert (left) and Justin Maaser have been working on the new solution for preventing deposits at Alpla in Föritztal for a year and a half.


Photo: K-PROFI

Discharging capacity too low with discharging electrodes in the hopper

For this reason, the considerations focussed on an alternative. Jan Barth: "Discharging electrodes are often placed in the viewing window of the hopper, where granules are already inside. In this case, they do work, but only in the immediate vicinity of the electrode due to the large amount of material. The dust in the chamber causes the tips to become dirty very quickly and the function collapses."

As a result, the new approach was to use an ion blower nozzle instead of the discharging bars and to keep its high-voltage head out of the material flow. Justin Maaser recalls: "On a sample machine, the first step was to insert the round blowing nozzle in the upper part of the hopper in hopes that it would remove the build-up throughout the entire hopper." The design in a Y-adapter, in which the ion blower head (type: Eltex tubeBlow EAR36E) blows in ions with the direction of flow, ensures that no particles reach the nozzle and that the discharge performance remains constant. This makes it possible to operate the discharge without major maintenance. In order to achieve the discharge effect, the ion blower nozzle must be connected airtight from the outside, for this purpose Eltex provides tube adapters for 35, 42 and 47 mm diameters, which are pressurised with a small flow of compressed air.



Photos: Eltex

Y-adapter (left), in which the ion blowing head (right) blows ions into the air stream in the direction of the flow.

Ionising nozzles in a closed Y-adapter as a solution

The ioniser was installed in such a way that it can operate virtually maintenance-free. "The situation has actually improved significantly in the upper half of the hopper, but not below the non-return flap," says Justin Maaser. The cleaning times have already been reduced. "Nevertheless, it became clear that we needed a second access point below the non-return flap. That went relatively quickly, especially as the idea of the Y-piece came from Eltex. The only challenge was the dosing of the compressed air. How much air can we blow in via the pipe without destroying the vacuum of the conveyor system?"

The two ion blower nozzles on a hopper are supplied by a common power supply unit, which requires a maximum power of 15 W when controlled with 24 V. A coloured LED indicates the function and, if necessary, a defect. Pulsed compressed air with a maximum pressure of 2 bar is also required. When considering the costs, Jan Barth says: "The compressed air for the bypass flow is probably more expensive than the electricity for ionisation." What happens during a colour change today? Justin Maaser is satisfied with his project: "From 15 minutes of assembly high up on the machine, we have reduced the colour change process to two to three minutes of visual inspection and an

Ionisers can be found throughout the entire product flow at Alpla – including on conveyor belts for finished products and above the collection containers for screw caps.

Photo: K-PROFI

The assembly injection moulding of 2K closures from multi-cavity moulds is completed within a cycle time of less than ten seconds with the help of assembly automation.

Photo: K-PROFI

Screw caps for drink bottles are 100% optically inspected, printed in up to three colours using pad printing (pictured) and, if necessary, laser-marked.

Photo: K-PROFI

occasional blowing out of the hopper with compressed air." Maik Göpfert: "In the case of critical colour changes, the employees check one more time."

Electrostatic also for discharging products

Jan Barth summarises the experience with the introduction and adaptation of the new equipment: "When using electrostatics, you have to pick up the customer technically. This is not a run-of-the-mill product. But: The best product in the wrong place is useless." This is why Eltex is trying to differentiate itself by employing sales staff with a strong technical background. The origins of the use of electrostatics at Alpla in Föritztal lay not in the cleaning of the material flow, but in the unloading of products into pallet cages. Maik Göpfert: We always try to unload our products in the flow as far as possible."

Complete transfer to all 30 injection moulding machines

Justin Maaser summarises his project: "We installed the system, tested it for a year and a half and haven't changed anything technically. There are now only slight build-ups, but we are not at the point where we need to carry out a cleaning. I reckon we could produce for three years without maintenance." A second screw cap machine has now been equipped with the new technology, and the other 28 machines will follow. Maik Göpfert: "We are equipping all machines because we have a lot of product changes everywhere." Alpla's in-house technicians take care of the mechanical and electrical assembly. Maik Göpfert: "The system can be retrofitted quickly and easily – plug and play."

Overall, this has resulted in a win-win situation for Alpla and Eltex: Alpla has recorded less waste and lower labour costs, Eltex has developed a new product with direct feedback from the market (which will be on display at Fakuma) and opened up an initial industrial application for this product.

Have the two partners actually discussed a possible dedusting of the compound? "Yes, dust-free pellets are possible, but the effort involved is not economically feasible," Maik Göpfert has determined, "delivery, mixing and conveying always generate new abrasion anyway." Jan Barth comments: "More recycling means more use of regranulate and regrind. Against this background, grinding is a greater source of dust than the granulate itself, because regrind contains considerably more dust than any virgin material."


Photo: Eltex

Jan Barth from Eltex advised and supported the Alpla team with his expertise in plastics technology and electrostatics.

www.alpla.com
www.eltex.de

Managing Director Jochen Merz: "We were able to show that there is no loss of impermeability across all work steps."

„This is an incredibly good connection"

How insert technology specialist Kurz simplifies media-tight overmoulding

Meywald developed a coating for metal strips that ensures that they can be overmoulded tightly.

Some developers have already cut their teeth on media-tight overmoulding of metal contacts. Managing Director Jochen Merz and his team at the Kurz Group in Haigerloch are no exception. Now years of effort are paying off and Jochen Merz can say: "It works." This success is the result of a joint development with Dr.-Ing. Meywald GmbH & Co. KG from Bad Arolsen, which specialises in coil, rope, and wire coatings. Jochen Merz reports on a fruitful symbiosis - in both senses of the word.

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

Jochen Merz has accompanied the company's development for almost three decades. He started with an apprenticeship as an industrial mechanic, later completed a dual study programme and then worked in work preparation, tool design, project planning, quality management and engineering within the Kurz Group before joining the management in 2016, which has been his sole responsibility since 2018. The Kurz Group includes several legally independent companies whose management and administration are combined under the umbrella company Kurz Holding. These include IKO-Formen, founded by Isidor Kurz from Owingen in 1946, which initially focused on the construction of stamping, bending, and forming tools and, since 1954, injection moulding tools. In addition to IKO, the group includes Kurz Kunststoffe GmbH, founded in 1980, and Kurz Plast Kft in Hungary, founded in 1996, both of which concentrate on injection moulding production. The headquarters in Haigerloch-Owingen currently employs 55 people, the company in Hungary 120. The Kurz Group has established itself as an expert in complex insert technology with a high number of overmoulded inserts, among other things.

The sealed overmoulding of the eleven specially coated inserts in three different lengths takes place during the production of the pre-moulded part (right).

K-PROFI: Is your focus on insert technology due to IKO's history, i.e. its experience with stamped and bent parts?

Jochen Merz: The topic of stamping was actually a thing of the past at Kurz; our focus in injection moulding and toolmaking was on complex multi-component technology for many years. For example, we produced the first multi-component housing for Siemens' outdoor mobile phone. Then, at the turn of the millennium, we received an enquiry about insert parts. It was for a switch for a rear window heater. Although our owners were not enthusiastic, I was able to discuss the opportunities with Hans Herbert Stelzl, the technical director at the time and later managing director and revitalised the topic. Germany is too expensive a location for simple components. We need high-value parts. By focussing on insert technology, we can map a larger value-added process.

How long have you been involved in sealed overmoulding?

Since the second insert technology project, a brush holder for Bosch electric motors. Parts produced by a market competitor had to be recalled due to leaks. We were able to redesign the brush holder in such a way that there was not a single complaint over the entire duration of the project. This allowed us to familiarise ourselves more and more with the topic.

What exactly is the problem here?

With such components, it must be ensured that no moisture penetrates the component from the outside. Due to its shrinkage and creep, the plastic does not bond completely with the insert during overmoulding. There are always tiny invisible gaps through which moisture can penetrate due to the capillary effect. As a result, there is a risk of short circuits or fault currents in the electronic components or that contacts will corrode.

How can this be counteracted?

Normally, such plug contacts have to be sealed at great effort after overmoulding. There are various methods of post-treatment. In some applications, silicone rings are applied around each individual insert. I have been working in this field for a long time and we have already tried out a lot at Kurz. Among other things, we were part of the development group at the Plastics Institute branch in Villingen, which was involved in a joint project on the sealing properties of metal-plastic connections. From experience, I can say that nothing has ever worked really well without extensive post-treatment.

And what is the advantage of your new development?

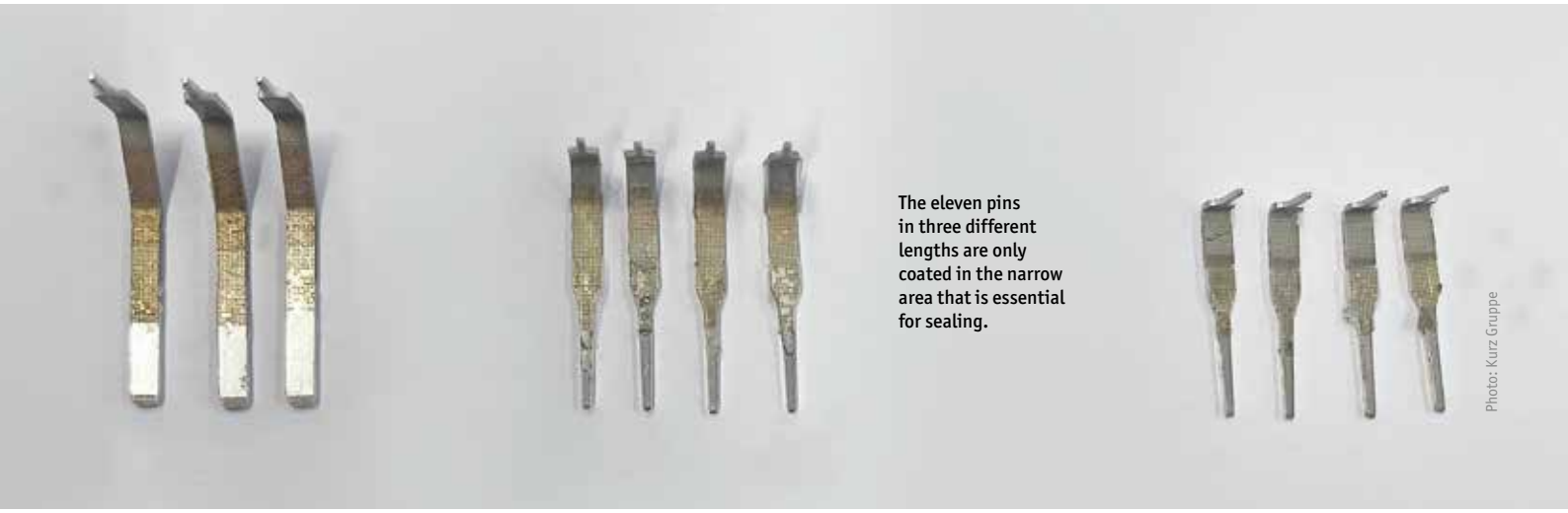
We use specially pre-treated stamped parts so that a media-tight connection is created directly during overmoulding. On the one hand, this is more cost-effective and, on the other, it opens up new possibilities in component design.

How did the idea come about?

The idea itself came from Dr Volker Meywald, until recently senior partner at Dr.-Ing. Meywald in Bad Arolsen, who sadly passed away this summer. The Meywald company specialises in coating technology for continuous products. Dr Meywald had considered developing a coating for metal strips that would ensure that they could be tightly overmoulded. We found the topic highly exciting and suitable for us. That's why we stepped in as a project partner for the injection moulding side. Meywald is responsible for applying the coating, while we provided the input for handling the coated inserts in the injection moulding process. The new technology needs this symbiosis, we are exclusive partners.

What is special about this coating?

It is a polymeric multi-component coating that has a certain elasticity and ensures a good bond between the plastic and metal even several weeks after the coating has been applied. This period of time is important because there are further process steps between coating and overmoulding, such as punching, bending and separating. In the component that we selected to verify the technology, we overmould eleven pins in three different lengths. This means that three different strips have to be coated and laser-treated after galvanisation. The highlight and challenge here is that the coating can be applied all the way round, i.e. including the edges, but geometrically limited to a width of around 2 to 3 mm. The coating is therefore not applied in a bath. Only the narrow area essential for sealing may be coated. The rest must remain free of the coating for functional reasons. Meywald's expertise also lies in realising this on a strip length of 50, 100 or 500 m..



The eleven pins in three different lengths are only coated in the narrow area that is essential for sealing.

Photo: Kurz Gruppe

How did you go about verifying the technology?

First, we built a simple tool in which we could statically insert a punched strip, overmould it and then test how tight the component was. It was a simple box. We made many loops with several coating variants until we reached an optimum. This allowed us to verify that the approach basically works. However, an optimised test carrier is not enough to arouse interest on the market. I wanted to use a tangible component from real life to prove what is possible with this process. It had to be an example that our customers could relate to with their portfolio and their requirements. We selected a series component that is used in all-wheel drive vehicles for torque distribution between the front and rear axles. So far, the customer has not required tight contacts, but the component is ideal as a demonstrator. Eleven pins have to be overmoulded here. The challenge is much greater than overmoulding a single contact. This is a good way of demonstrating that the process is stable and not just a show effect.

Photo: Kurz Gruppe

This series component (connector body) is used in all-wheel drive vehicles for torque distribution between the front and rear axles.

How did you test the tightness?

We built a test adapter on which we can pressurise the sealed area with air and then see whether bubbles appear in a water bath. In a further step, we only filled the connector collar with water, pressurised it and filmed it again to see whether the connections were tight. We carried out various test series and tested freshly moulded, tempered and conditioned parts. The tightness was just as good freshly moulded and after 24 hours in the oven with relaxed stresses as after conditioning of the hygroscopic polyamide. These factors had no influence on the tightness. We cannot currently test at pressures higher than 6.5 bar, as this component would then burst. But it shows that this is an incredibly good connection. We have thus created a basis. Endurance tests are still pending.

How long have you been working on this development and what stumbling blocks have you encountered?

We started five years ago and have experienced ups and downs. Of course, it didn't work right from the start. It took a lot of effort until we achieved the required time span of several weeks. After setbacks, we had to completely rebuild the processes in between. We also spent a lot of money on the test set-ups. Then, during the overmoulding process, the insert coating quickly clogged the mould vents. We were able to solve this with our experience as an injection moulding company and toolmaker.

What level of maturity do you attest to for the new technology?

The process is ready for series production. We realised a pseudo-series process for the example component. The strips were coated. After punching, bending, and separating, a two-stage process follows. The inserts are fed manually via a pusher to a vertical machine and

Kurz focussed on the plug-in connection of the component during the sealed overmoulding development project (left). The view into the showcase shows pins and pre-moulded part (centre back) as well as a further insert in the centre.

overmoulded into a pre-moulded part. The pre-moulded part step is carried out because the tolerance requirements for this component are very high in terms of position and flatness. The pre-moulded parts are then overmoulded with a further insert on a rotary table machine to form the finished component. This level corresponds to the series. Of course, we will have to cover specific requirements for each new component. We always have to consider what can be improved or simplified. For example, whether punching, bending, and separating can be done more cost-effectively at the coater. At the moment, the metal strips are coated at Meywald and then sent to a service provider for the next steps before the pins are bent and separated and then sent to us.

However, this means that they are always coated first and then bent. Isn't there a risk that the coating will be damaged during the subsequent steps?

That was exactly what we wanted to show. That we can handle this, that it works and that there is no loss of tightness across all work steps. We fit the mould with eleven inserts. The process would be much simpler with one or two inserts. But: it works.

How do you envisage the future of your sealed overmoulding technology?

I hope that we can excite our customers with it and realise the added value of sealed overmoulding in series projects. We are already in concrete talks with one customer. With every application in which we demonstrate the feasibility of this technology, sealed overmoulding will gain momentum.

www.kurz-gruppe.de
www.meyband.de

Into the future with direct current

How renewable energies can be utilised without conversion losses and how independence can be expanded

The development of a direct current network is considered an important building block for a resource-saving, climate-neutral industry. Wittmann Battenfeld presented the concept of a DC-powered injection moulding machine for the first time at K 2022 and further developed the technology in time for Fakuma 2023. Boy also featured an injection moulding machine powered by a 650 V DC network at its Fakuma stand. The suppliers explain the background to their activities and categorise the potential.

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

"In a direct current system, it is easier to balance power demand and supply compared to the alternating current grid," is one finding from the direct current research project DC-Industrie2. The research project, funded by the German Federal Ministry for Economic Affairs and Climate Protection, was completed in March 2023. The findings are currently being further pursued by the Open Direct Current Alliance (ODCA), a ZVEI working group with 33 companies from industry, academia, and research, which was founded in November 2022. Its aim is to build a global direct current ecosystem and establish direct current technology across all applications.

After all, the use of direct current is associated with several advantages. These include the efficient integration of renewable energies, lower resource consumption, reduced feed-in power and stable grids. In industrial model systems, it has been possible to save up to 20% energy in some applications and reduce copper consumption in the lines by half. The DC-Industrie2 system concept, which is available at dc-industrie.zvei.org/publikationen, describes how companies can utilise the advantages of direct current technology.

Technology with a future

Machine manufacturer Wittmann Battenfeld had already presented the operation of an injection moulding machine with direct current at K 2022. The concept study on the use of direct current from renewable energies such as solar systems without the need for inverters was met with great interest. "We developed the concept study with a long-term perspective," explains Michael Wittmann, Managing Director of the Wittmann Group. Its use is dependent on the establishment of a direct current grid infrastructure at the user's premises. This will not happen next year or the year after, but is a technology with a future in view of the expansion of photovoltaic and battery systems, believes Wittmann-Battenfeld Managing Director Rainer Weingraber.

Mario Bruckner (left), Project Manager DC, and Managing Director Michael Wittmann in front of the EcoPower 180/750+ B8X, which was supplied with direct current via a sodium-nickel-salt battery (right) independently of the exhibition network.

Photo: K-PROFI

The all-electric EcoPower injection moulding machines from Wittmann Battenfeld are equipped with a Kinetic Energy Recovery System (KERS) as standard, which converts kinetic energy into electrical energy during braking processes. This energy is usually used within the machine, e.g. for cylinder heating, in order to reduce energy consumption. A DC version of the robot, which is supplied via the DC link of the EcoPower, can also feed excess energy back into this DC link when the axes decelerate. If the injection moulding machine is operated in a DC network, the braking energy can be fed into this network in order to supply other connected machines with this energy or to store it in batteries.

Self-sufficient without AC/DC

Wittmann Battenfeld is working with Innovenergy AG as a partner for such a DC infrastructure. The Swiss company specialises in ecological salt battery technology and reports that the topics of energy efficiency, limiting the connected load of existing AC infrastructures, independence and self-sufficiency as well as reliability in the event of grid interruptions are becoming increasingly important.

With a so-called DConnect concept, renewable energies (photovoltaics or wind power), energy storage systems and consumers can be connected via a dedicated DC grid in order to utilise the energy generated directly and with almost no conversion losses. Only the surplus electricity is fed back into the grid. This allows DC/AC/DC conversion losses from the photovoltaic system to the machine to be reduced by up to 15 %. Innovenergy helps to ensure a seamless transition between an existing AC installation and a DC microgrid.

Innovenergy presented this concept together with Wittmann Battenfeld at Fakuma 2023, where a solar power storage system fed the EcoPower 180/750+ B8X injection moulding machine, which was equipped with a Wittmann WX142 removal robot in DC version, autonomously and independently of the trade fair power grid. The sodium-nickel salt battery with a capacity of 45 kWh ensured uninterrupted operation during the day of the trade fair. Additional electrochemical capacitors, known as supercaps, were used to compensate for short-term load peaks on the injection moulding machine.

Vision for the transformation

"We want to spark curiosity," says Alfred Schiffer, Managing Partner of injection moulding machine manufacturer Dr. Boy, pointing to the solar modules hovering above a Boy 35 E. Boy has equipped the machine with the DC power option and supplied it with power via a 650 V DC grid during the trade fair. With an average power requirement of approx. 1.5 kW, this machine, which is equipped with an electrical removal handling system, can be supplied via a PV system when the sun is shining.

The exhibit should be seen as a vision in the context of the upcoming transformation and already shows what is possible. In addition to lower conversion losses, there are further advantages with DC supply: high voltage values ensure low currents, allow smaller cable cross-sections, reduce the number of supply lines, thus saving material and simplifying human safety. "Interference suppression filters can be omitted, and the braking energy can be better utilised," says Alfred Schiffer.

Managing Partner Alfred Schiffer sees the Boy 35 E, which is supplied via a DC grid, as a solution for saving energy.

One way of increasing efficiency is to supply production machines via an independent direct current system rather than the usual alternating current network, according to Boy. For this purpose, a so-called Active Front End (AFE) is connected to the standard three-phase 400 volt alternating current network. After active input conversion with integrated stabilisation, a direct current network with a voltage of 560 to 840 V DC is available. The AFE automatically provides a feed-in and feed-back direction that has an equally high degree of efficiency. Additional buffering can be created with battery systems. Photovoltaic or other energy generation systems can then be integrated directly into the system without further conversion. Supplying the inverters directly with the DC link voltage saves energy and improves electromagnetic compatibility (EMC). The resulting braking energy is used to charge the battery instead of converting it into heat via a braking resistor.

dc-industrie.zvei.org
www.dr-boy.de
www.wittmann-group.com

„Only to order“

How the full-range supplier Kahmann & Ellerbrock supplies its customers with technical parts

Products for everyday technical production in the food industry, mechanical engineering, trade, advertising technology or trade fair construction often come from Kahmann & Ellerbrock in Bielefeld. The product range extends from occupational safety articles to adhesives, sealants and technical components through to semi-finished and finished plastic parts. Authorised Signatory and Head of Logistics and Production, Pavlos Chartomatsidis, explains: “We are one of the leading technical wholesalers in East Westphalia-Lippe and Brandenburg, where our subsidiary Plaschna is based. The lion’s share of our customers come from the East Westphalia-Lippe region, which we supply with our own fleet of lorries.” In addition to trading in finished products, the company also manufactures plain bearings, spacers, ball joints, shaft guides, track rollers, gear wheels, blanks made from semi-finished products and much more. “We only manufacture these products to order, just in time. Sometimes we only produce a handful of parts, sometimes it’s several thousand – depending on what the customer needs at the moment,” says Chartomatsidis, describing the day-to-day work in plastics processing.

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

Pavlos Chartomatsidis makes it clear: "We only manufacture products to order, just in time."

There are just as few limits to the variety of materials that can be processed as there are to the variety of parts. From PE, PP and PVC to engineering plastics such as PA or POM to high-performance plastics such as PEEK, PEI or PTFE and transparent materials such as PC, PETG and PMMA, everything is included. The Bielefeld-based company often does not even know where exactly the milled part, the cut, milled and drilled plates will be used later. "We receive the component drawing and the CAD/CAM data. From this, we create the respective milling programme according to the customer's specifications," explains Chartomatsidis.

The new machine

The new star in the halls of the full-range supplier is the 5-axis CNC portal milling machine Rover Plast A FT 1531 with free-running spindle and additional drilling head from Biesse. It only moved in three months ago and is already in full operation. The working area is 3,100 x 1,100 mm and the maximum machining height is 200 mm. The system has two tool changers with a total of 21 tools, eight of which are always running and 13 of which are available as "pick-ups". Chartomatsidis particularly appreciates the division of the vacuum chambers: "The table is divided into different zones, all of which I can control separately. This allows us to optimally and securely fix both very small and very large components." Multi-zone technology is the magic word.

The worker starts the programme stored in the software for the counterpart of a rail guide ...

... and Pavlos Chartomatsidis shows the finished product.

Here, an employee cuts the blank for the production of a spacer guard.

Photos: K-PROFI/Menke

The next step is to set up the new Rover Plast A FT 1531 to produce the small ball.

The worker carefully places the blank at the fixing point, ...

This allows the vacuum to be concentrated on the area affected by the processing. Even parts measuring just 100 x 100 mm are held firmly on the phenol table during processing. As vacuum is only applied to the zones that are required for the respective machining operation, this also saves energy. The vacuum is provided by two powerful, inverter-controlled 290 m³ vacuum pumps at the foot of the machine.

In addition to the hardware, the software was also important to Chartomatsidis: "I need a system that can read in different formats and with which I can then also process them. The software additionally needs to be easy to use. We are really very happy with Biesse's own software B_Solid." Once the data has been read into the software, the machinist programmes the milling paths, simulates the machining process, and calculates the production time. The programme carries out a collision check and checks whether the machine is being used optimally. During nesting, the software optimises the processing of the semi-finished product so that the processing time is short and material consumption is as low as possible. Once the milling programme with the corresponding tools has been created, it is stored in the library. If the same part is produced again a few weeks later, all it takes is the press of a button – and machining can begin.

A look inside the Rover

The machine is currently demonstrating its capabilities in the production of a spherical spacer guard made of PE. The blank measures 150 x 100 x 120 mm and is positioned at a so-called fixing point. This is necessary in order to hit the starting point for the machining process reliably and to clamp the workpiece securely. Although the blank looks tiny on the huge table, the vacuum fixation holds it securely on the table during machining and the round ball quickly emerges from the cuboid. As this is a small batch size of just a few pieces, the company does not use nesting here. Chartomatsidis explains: "When we produce larger batches, we naturally mill out several parts at the same time from a large plate. We often only leave a 0.1 mm gap between the parts. We then break out the parts and deburr them manually." The machine works with a tolerance of ± 0.1 mm for the spherical spacer guard. "However, we can go down to 0.01 mm accuracy if it is necessary for a milled part," confirms the dedicated Authorised Signatory. Once the small hemispheres are finished, it is the turn of the counterpart of a rail guide. The milling head works along the lines piece by piece and produces the semi-circular guide in no time at all. In contrast to the distance guard, the 5th axis is not used here. Chips are not visible during the machining process. Two large

The product gradually emerges from the blank. Any chips produced are immediately extracted.

The result is the cleanly milled spacer guard.

Photo: K-PROFI/Menke

... to clamp it securely.

extraction hoses transport them directly from the milling and drilling head upwards via the extraction system into a container. Kahmann & Ellerbrock has such extraction hoses in its own product range.

Big becomes small

Just a few steps further on, a worker places previously cut 1,700 x 800 x 6 mm PET-G sheets into a drilling/milling machine – always three sheets on top of each other. The employee manually sets the distances between the drill holes and drills the five holes step by step. "It takes the longest to set up the machine. The processing is quick," smiles Chartomatsidis. This batch consists of nine panels. After drilling, they go into the table milling machine, where the specified radii are milled. The resulting panelling is then ready for transport to the customer.

In the hall next door, two large panel dividing saws from Holzma, each measuring 3,000 x 2,000 and 4,000 x 2,000 mm, dominate the action. They can process heights of up to 120 mm. Hovering above the smaller saw are transparent PMMA sheets measuring 3,050 x 2,050 x 3 mm, which shimmer green thanks to a film covering them. An employee uses a vacuum gripper to remove the sheets from the pallet and carefully places them on the processing surface of the saw. After three panels are placed on top of each other, the man carefully aligns them and cuts off a narrow edge all round. This is the only way to ensure the desired 90° angle, as there are always small deviations when the panels are extruded. After this preparation, the worker produces twelve identical small panels. The Bielefeld-based company often produces these panels for advertising partners or picture frame manufacturers. Here, too, the batch sizes vary considerably, as do the annual quantities, Chartomatsidis reports: "We produce 10,000 polystyrene sheets per batch for a company that manufactures picture frames, so we often end up with over 100,000 pieces a year. But sometimes a customer only needs a single panel, for example for an exhibition stand."

Sheets measuring 208 x 85 mm are cut from a 1,000 x 600 x 5 mm PVC sheet at the other end of the hall on a small saw. For all cuts, the plastics processor makes sure to optimise waste. Scraps are not disposed of but are sent to the technical scraps warehouse or barcoded and sold to a recycling expert. The company decides whether the offcuts can still be utilised internally or whether they should be processed according to defined criteria, which include the type of material and the size of the offcuts.

The worker layers several PMMA sheets on top of each other, aligns them and cuts them to the required sizes.

Several work steps are necessary before the final size is achieved.

Warehouse for giants and dwarves

The offcuts warehouse is just as sophisticated as the panel warehouse. Each remnant is given a barcode that reveals its storage location, material and dimensions. The pieces created from the offcuts wait in small shelves for their next use. "We sometimes work with very expensive high-performance plastics, so we want to lose as little as possible. Before we take a new large sheet from the high-bay warehouse, we always check the stock in the remnants warehouse first," Chartomatsidis makes clear. The warehouse management system can be used to call up whether a suitable piece is available for a customer order at the click of a mouse.

If there is no suitable candidate, the high-bay warehouse comes into play. The right panel can always be found here. Semi-finished products of all sizes, colours and materials are stacked in long aisles up to the ceiling. However, the employees do not have to search for long, because here too, each storage location and its contents are stored in the WMS.

Short delivery times are part of the company philosophy

Around 20 of the company's 135 employees work in production. The four divisions with the highest turnover are Plastics and Elastomers and Industrial Safety, which each contribute around a third to the turnover. In 2022, the wholesaler generated sales of EUR 42 million. Fritz Kahmann and Hermann Ellerbrock founded the company 73 years ago, and it is still in the hands of the Ellerbrock family today, after the Kahmann family left the company in 2009.

A key element of the company philosophy, then as now, is the short delivery time. Most products go directly from the warehouse to the customer. But even in plastics processing, where a part is first manufactured according to customer requirements, things always move very quickly. Chartomatsidis sums it up with satisfaction: "Customers receive 95 per cent of our products within 24 hours. For more complex parts from CNC production, the delivery time is sometimes 14 days. But compared to other market competitors, this is also really fast."

www.ke.de
www.biesse.com

In the remnants warehouse, employees can find out which semi-finished product is available at the click of a mouse. This allows them to quickly decide whether a suitable remnant is available for a new product.

K&E stocks countless semi-finished products in the high-bay warehouse. This is the only way to realise the very short delivery times.

One-shot system for iron rings and magnets?

What magnetisable plastics can contribute to electrification

Replacing hard magnetic and soft magnetic metals with plastic-bonded compounds has been pursued for years. Technologically, many challenges come together when switching from machined sintered metal to injection-moulded magnets: Design, component design, filling simulation, magnetic simulation, mould technology, material science, compounding and process engineering are time-consuming and sometimes cause complex dependencies. The additional work involved in design, tooling and process engineering compared to conventional injection moulding is considerable. Nevertheless, Wirthwein SE in Creglingen, together with partners such as ebm-Papst, the Institute for Digitalisation and Electrical Drives (IDA) at Heilbronn University and Würth Elektronik, has risen to this challenge and developed a rotor made from injection-moulded hard magnetic plastics. In addition to the use of hard magnetic compounds in electric motors, Wirthwein is also working on the use of soft magnetic compounds. The potential uses of soft magnets extend beyond motor technology into mass applications such as sensor technology and EMC shielding. K-PROFI spoke to Jan Wiedemann, Head of Innovation and Material Development.

All photos: K-PROFI/Schneider

Jan Wiedemann is Head of Innovation and Material Development and responsible for magnetisable plastics at Wirthwein SE in Creglingen.

The physics behind the function of electric motors, behind magnetic fields and field lines is just as non-trivial as the melt flow in the injection mould and the resulting physical properties of the moulded part. It is therefore no wonder that the injection moulding of magnetisable compounds is particularly complex. Without assuming any knowledge of electrical engineering, in the following we will highlight aspects of material technology, process engineering and mould technology.

In terms of magnetic properties alone, sintered magnets, for example, are always better than plastic-bonded magnets. However, sintered magnets are usually rectangular. If they have to be shaped differently in order to achieve an optimised field line, they become extremely expensive. Injection moulded magnets have a lower magnetic remanence, i.e. they retain a smaller magnetic effect after the magnetisation has been imprinted than is the case with sintered magnets. The great advantage of plastic-bonded magnets – whether hard or soft – lies in the design freedom for a field line-compliant design and in the significantly lower to almost non-existent eddy current losses during operation. This enables the construction of very small motors with very low power losses and extremely high RPMs with a performance comparable to standard motors.

As an injection moulding company, Wirthwein has worked on numerous sub-projects involving design and component layout, filling simulations and magnetic simulation, material science and compounding as well as tool and process technology for injection-moulded magnets. "We have gained all this expertise and all the theory behind it ourselves," says Jan Wiedemann.

K-PROFI: Mr Wiedemann, what are magnetic compounds?

Jan Wiedemann: Plastic-bonded magnetic compounds are highly filled materials with filling levels of up to 70 per cent by volume, which corresponds to just under 95 per cent by weight. Their density can reach up to 5 grams per cm³ and their flow behaviour differs significantly from that of conventional plastic compounds. In addition, the separation of the particles during processing can lead to an inhomogeneous melt and result in incomplete mould filling.

How should we visualise such magnetic particles?

Flake-like, platelet-shaped or spherical powder systems are used. Higher filling levels are possible with spherical particles because spherical fillers can be incorporated in higher proportions and are generally easier to process. The soft magnetic compounds are Wirthwein's own developments. We use internal mixers and compounding units to incorporate the metal powders and binder materials into compounds. We currently still obtain the hard magnetic compounds as "ready-to-use" types. However, there are already initial endeavours to produce these ourselves. The hard magnetic types are mostly particles made from Nd-FeB or SmFeN alloys, which fall into the rare earth segment.

Which plastic do you use as a matrix material?

We worked with the LKT at the University of Erlangen-Nuremberg, exchanged ideas with manufacturers of magnetisable polyamide compounds, assessed polypropylene (PP) against polyphenylene sulphide (PPS) as a matrix and set up several projects with the Institut für Digitalisierung und elektrische Antriebe (IDA). In the end, we decided in favour of a PP matrix for the soft magnetic compounds. For the hard magnetic types, the matrix material is usually a PA12.

The plastic matrix shields the very small iron parts or alloys from each other. The field lines of a magnetic field then only extend from one particle to the other, whereby the particle diameter has an influence. If the particles are too far apart, the transition of the field lines is disturbed. If the distance is too small, the eddy current losses increase. The geometry of the fillers influences the strength of the field, but also the flow behaviour of the melt, in particular its viscosity.

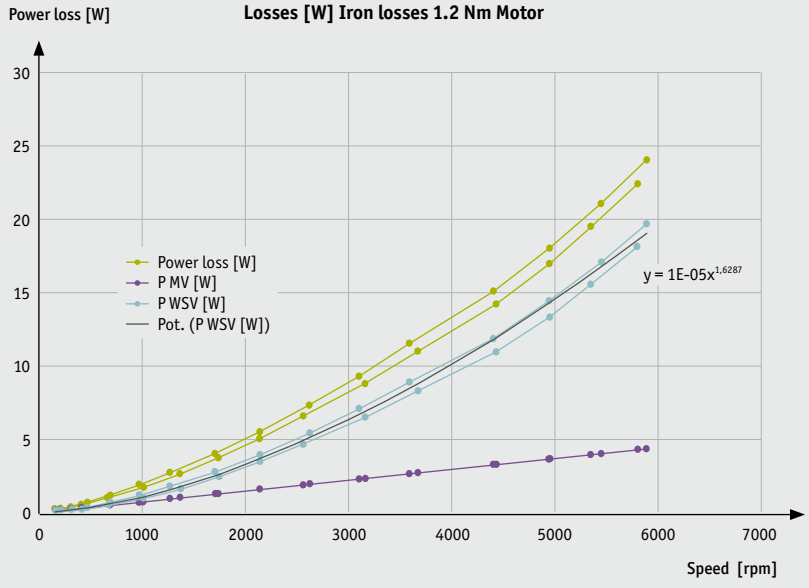
Are these fillers difficult to handle?

As a rule, the iron particles available for soft magnetic applications are relatively easy to handle. There are commercially available qualities that we obtain from suppliers abroad, including from Asia. The hard magnetic particles are already incorporated into the compound, so that there are no handling difficulties here either. One more word on the subject of recycling: In the field of hard magnetic magnets, there is increasing activity in the recovery of rare earths. Around two tonnes of rare earths can be recovered from a dismantled wind turbine alone. However, the cost of recycling from small motors is currently too high. Recycled materials do not yet have the efficiency of new materials. However, their quality is constantly improving.

What do your new developments look like?

There are various projects dealing with this topic. In one project, we are working on the functional integration of magnetic compounds in our axial fans. The aim here is to significantly reduce the size of the fan and significantly increase its RPM while maintaining the same performance and minimising losses. Furthermore, this functional integration enables us to build a new type of electric motor that can also be used in explosion-proof areas. There is a clear correlation between RPM and power or power loss.

The "P MV" characteristic curve describes the system-dependent losses during operation. These have different origins and can be reduced by optimising the bearings, for example. The "P WSV" line is eddy current losses in soft or hard magnetic solenoids, which increase disproportionately with the RPM. This means that from a certain point (e.g. in the upper case >5,000 n^{-1}), a further increase in speed leads to a disproportionate increase in losses, which on the one hand significantly increases the necessary energy requirement and on the other hand the temperature rises sharply, which in temperature-critical applications (fuel cell, e-mobility, heat pumps) leads to massive design measures to dissipate the heat from the system.



Eddy current losses (PEC) increase disproportionately with speed in soft or hard magnetic magnets.
Source: Fetzner, R.: "Verluste der PMSM", Servoantriebstechnik, 01.05.2017, p. 37

Rotor with magnetic plastic compound
Source: Wiedemann, J: Wiedemann, J.: "Rotor mit optimierter Magnetgeometrie", Wirthwein SE, Creglingen 2023

With magnetic compounds, only the system-dependent loss is present in approx. 98 % of cases. This means that there is no limit to the maximum RPMs – at least in theory. In practice, we are currently pursuing speeds of around 50,000 to 100,000 rpm in high-speed applications such as heat pumps, refrigerators or air conditioning systems. As described above, these high speeds allow us to build very small motors in order to achieve the same performance without a gearbox. Power is the product of torque and RPM, i.e. if the installation space (lever arm) is reduced, the torque decreases. In order to maintain the power, the speed must be increased accordingly. This is only possible with magnetic plastics, as classic sintered magnets would exhibit too high eddy current losses. Overall, we can say that the topic of thermal management is of essential importance to us, as you can see from our product portfolio.

In another project, we are working on the substitution of sintered magnets with injection-moulded magnets. The main aim here is to guide the field lines of the stator as parallel as possible to the alignment of the magnets (N-S) by means of a "clever" design of the magnets in the rotor in order to maximise efficiency. The photo shows a first prototype. This is currently being put through its paces in a motor test rig at our partner ebm-Papst. In addition to the design freedom of the magnet design in the rotor, another major advantage is the cost saving due to the elimination of downstream processes such as the assembly of sintered magnets in "standard applications".

A word about the manufacturing costs?

We have compared the costs for the rotor. I can't give you absolute figures, but for the same performance, the rotor made of plastic-bonded magnet material is cheaper than the conventional rotor due to the process optimisations and the elimination of assembly processes for higher quantities.

How far do you want to push functional integration?

Functional integration is essential for us in order to reduce product costs and build rotors that have significantly lower power losses with smaller installation spaces and higher RPMs than their "conventional" counterparts. Our aim is to replace the iron ring in the centre of the motor, for example, which requires a certain permeability and serves to guide the magnetic field lines, with plastic-bonded soft magnetic materials. The design of the iron ring and the magnets are highly interesting from a physical point of view – because both can theoretically be customised to the field lines due to the high degree of design freedom and can thus ensure optimum guidance of the field lines. This "design optimisation" means that a normally complicated winding structure can be dispensed with. In the "axial fan" project mentioned above, a simple printed coil geometry is sufficient to achieve good coupling and radially symmetrical guidance of the field lines through the magnet due to the functional integration and the optimised design. This coil geometry is supplied by our project partner Würth Elektronik.

Back to your question: Ultimately, we would like to have a system that is significantly more energy-efficient, smaller, and more cost-effective than the systems currently in use. By using magnetic plastic compounds, we can produce rotors in a "one-shot process", which would otherwise only be possible through several individual assembly steps.

The process technology allows you to introduce magnetism into the plastic matrix.

In the injection phase, we need magnets that couple a field so that the particles in the plastic align themselves accordingly and freeze during cooling. This is where a relatively large amount of expertise comes together – from design, flow simulation, mould technology and process control. A magnetic field exerts a force on every magnetisable particle. It is very important to have an understanding of the viscosity, the behaviour in the injection phase and the generation of anisotropy, because a molten core is obtained in the injection phase, while the surface layers solidify in isotropic alignment. This raises the following questions: Which permanent magnets do I need in the mould to align specific particles? Which field strength is required where in the mould in order to achieve which field strength in the finished part? What gradient of magnetic field will build up? And what magnetic properties of the injection moulded part can I expect in the end? After the part has been removed, it is magnetised again. This expertise is very sensitive.

Numerous influences are likely to overlap in the mould. What insights have you gained into the processes?

We used the flow curves from the Asian manufacturer and derived a model for which orientation fields and which orientation times lead to which degrees of orientation. There is no 100% orientation because of the plastic-specific cooling behaviour. We are currently verifying this model. We are injecting and I have different cooling scenarios at different points. We are still investigating the influence of holding pressure in a separate DoE. Unlike with glass fibres, it is not the geometry or the flow behaviour that determines the alignment, but the crystal along the magnetic field lines. This means that it can also be positioned at right angles to the direction of flow. This is also the subject of further research.

Jan Wiedemann shows an axial fan with a new, internal rotor in which magnetic particles are incorporated. The stator pack is arranged radially on the outer contour.

You have already mentioned applications outside of rotor technology in high-speed electric motors ...

Many applications have become very interesting as a result of general electrification and the shift towards e-mobility, also because large quantities are involved, and injection moulding is therefore becoming economically interesting as a highly integrative production technology. This also applies to sensor integration in many products, which has further potential for functional integration. Magnetisable material is also in demand here.

In addition to drives and sensor technology, electromagnetic compatibility (EMC) is also a huge issue: there are suppliers who want to replace die-cast covers with a shielding function with injection-moulded ones. This shielding can be realised in plastic with the appropriate features. It is expensive to protect electronic structures against electromagnetic interference. With our compound, we could produce covers and generate EMC.

In general, we are also interested in the thermal conductivity of the compounds. It is essential in order to be able to build drives more compactly while maintaining the power density. If the heat dissipation works, we can achieve the same performance from less installation space by increasing the RPM.

Your interim conclusion on the activities?

We will never achieve the remanence of sintered materials with polymer-bonded magnets, but we do have consistently lower eddy current losses. So far, it has been shown that intelligent component design can produce the same, if not higher, performance with significantly lower remanence at lower costs and significantly lower energy losses. Using soft magnetic and hard magnetic materials always makes sense if you can optimise the design of the product, i.e. if you know the requirement properties and know where which coils have to be placed in a limited installation space and where the magnetic material has to be placed in order to achieve optimum performance. Injection moulding is particularly advantageous for geometrically complex products in large quantities.

www.wirthwein.de

The interview in Creglingen was conducted by Dipl.-Ing. Markus Lüling, Editor-in-Chief K-PROFI.

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D-72189 Vöhringen (Württemberg)
Tel.: +49 7454 9652 - 0
info@elkalub.com, www.elkalub.com

Lubricants/Waxes

Völpker Spezialprodukte GmbH
Fabrikstraße 1, D-39393 Völpke
www.voelpker.com

Masterbatches

Oberer Westring 3-7, D-33142 Büren
www.argus-additive.com

FBW GmbH
Forstweg 27, D-52382 Niederzier
Tel.: +49 2428 9563000
Fax: +49 2428 9563005
kontakt@fbwgmbh.de, www.fbwgmbh.de

Gabriel-Chemie GmbH
Industriestraße 1
2352 Gumpoldskirchen, Austria
Tel.: +43 2252 63630
info@gabriel-chemie.com
www.gabriel-chemie.com

Treffert GmbH & Co. KG
In der Weide 17, D-55411 Bingen am Rhein
Tel.: +49 6721 403 0
info@treffert.eu, www.treffert.eu

Material conveying systems

Werner Koch Maschinentechnik GmbH
Industriestraße 3, D-75228 Ispringen
Tel.: +49 7231 8009-0
info@koch-technik.de

WENZ Kunststoff GmbH & Co.KG
Tel.: +49 2351 459040
info@we-ku.de
www.we-ku.de www.we-ku-shop.de

Measuring, testing and control technology

Brabender GmbH & Co. KG
Kulturstr. 49-51
D-47055 Duisburg
sales@brabender.com
www.brabender.com

Bruchweide 2, D-28307 Bremen
sales@sikora.net, www.sikora.net

Melt pumps

WITTE PUMPS & TECHNOLOGY GmbH
Lise-Meitner-Allee 20
D-25436 Tornesch
Tel.: +49 4120 706590
info@witte-pumps.de
www.witte-pumps.de

Moisture meters

Brabender GmbH & Co. KG
Kulturstr. 49-51
D-47055 Duisburg
sales@brabender.com
www.brabender.com

Nozzles

herzog systems ag
Feldhofstrasse 65, CH-9230 Flawil
Tel.: +41 71 394 19 69
info@herzogsystemsag.com
www.herzogsystemsag.com

Panel sizing saws incl. software

HOMAG Plattenaufteiltechnik GmbH
Holzmastr. 3
D-75365 Calw-Holzbronn
Tel.: +49 7053 69 0
info-holzbronn@homag.com
www.homag.com

Particle foaming machines

Erlenbach GmbH
Am Rödchen 1, D-56355 Lautert
info@erlenbach.de, www.erlenbach.com

Pipe and hose systems

Michel Tube Engineering GmbH
Tel.: +49 9341 848 55 - 00
www.michel-tube.de

Plastics machining

Grein GmbH
Service: lasering, punching, measuring
Tel.: +49 5651 99144-0
www.lets-cut-it.com/RE

Plastic profiles

COMPETENCE IN PLASTICS
CH-Bischofszell
www.k-profile.com

Polyetheretherketones

BIEGLO GmbH
D-22765 Hamburg
Tel.: +49 40 401130000
www.bieglo.com
www.peek-shop.de

Sources of supply/suppliers directory

The A to Z of the plastics and rubber industry

Polyimides

BIEGLO GmbH
D-22765 Hamburg
Tel.: +49 40 401130000
www.bieglo.com
www.polyimide-shop.de

Polyurethane systems

CANNON Deutschland GmbH
Moselstraße 27, D-63452 Hanau
Tel.: +49 6181 50231 00
www.cannon-deutschland.de

Recycling machines

Next Generation Recyclingmaschinen GmbH
Gewerbepark 22, A-4101 Feldkirchen
Tel.: +43 7233 70107
info@ngr-world.com, www.ngr-world.com

Recycling systems

EREMA - Engineering Recycling Maschinen und Anlagen Ges.m.b.H.
Unterfeldstraße 3
4052 Ansfelden, Austria
Tel.: +43 732 3190 0, erema@erema.at

Herbold Meckesheim GmbH
RECYCLING TECHNOLOGY
D-74909 Meckesheim, Industriestrasse 33
Tel.: +49 6226 932-0,
Fax: +49 6226 932-495
herbold@herbold.com, www.herbold.com

Refrigeration technology

INDUSTRIEKÄLTEANLAGEN TIEFTEMPERATURTECHNIK STEUERUNGSTECHNIK
L&R Kältetechnik GmbH & Co. KG
Hachener Str. 90a
D-59846 Sundern-Hachen
Tel.: +49 2935 9652-0, Fax: DW – 501
www.lr-kaelte.de, info@lr-kaelte.de

technotrans solutions GmbH
Temperierung | Industriekühlung
Werkzeugreinigung | Service
Scherl 10, D-58540 Meinerzhagen
Tel.: +49 2354 7060-0
www.technotrans-solutions.de

Weinreich Industriekühlung GmbH
Hohe Steinert 7, D-58509 Lüdenscheid
Tel.: +49 2351 9292-92, Fax: +49 2351 9292-50
info@weinreich.de, www.weinreich.de

Sensor sorting technology

STEINERT GmbH
Widdersdorferstr. 329-331, D-50933 Köln
Tel.: +49 221 4984-0
Fax: +49 221 4984-223
marketing@steinert.de, www.steinert.de

Size reduction technology

NEUE HERBOLD Maschinen- und Anlagenbau GmbH
Wiesenstrasse 44
D-74889 Sinsheim-Reihen
Tel.: +49 7261 92480
info@neue-herbold.com
www.neue-herbold.com

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

WEIMA Maschinenbau GmbH
Bustadt 6 - 10, D-74360 Ilsfeld
Tel.: +49 7062 95700
info@weima.com, www.weima.com

Standards

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

Meusburger Georg GmbH & Co KG
Kesselstr. 42, A-6960 Wolfurt
Tel.: +43 5574 6706 0, Fax: +43 5574 6706 11
verkauf@meusburger.com
www.meusburger.com

Technical moulding

Spritzgussteile für hohe Beanspruchung
Komplexe Baugruppen · Eigener Formenbau

WEISS Kunststoffverarbeitung GmbH & Co. KG
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D-89257 Illertissen
Tel.: +49 7303 9699-0
kontakt@weiss-kunststoff.de
www.weiss-kunststoff.de

Temperature control units

Weinreich Industriekühlung GmbH
Hohe Steinert 7, D-58509 Lüdenscheid
Tel.: +49 2351 9292-92, Fax: +49 2351 9292-50
info@weinreich.de, www.weinreich.de

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Temperature sensors

Dr. Mennicken GmbH
Industrie - Elektronik

Tel.: +49 2338 91860
Fax: +49 2338 918640
www.mennicken.de

Thermoplastic elastomers

ALLOD

ALLOD Werkstoff GmbH & Co. KG
Steinacher Str. 3, D-91593 Burgbernheim
Tel.: +49 9843 98089 0
information@allod.com, www.allod.com
ALLRUNA® Werkstoffe

Ultrasonic welding

CEMAS Germany

www.cemas-germany.com

swiss sonic

Die nachhaltige Verbindung
Seemoosholzstrasse 14, CH-9320 Arbon
Tel.: +41 71 680 0805
info@swiss-sonic.ch, www.swiss-sonic.ch

Ultrasonic welding machines

Herrmann Ultraschall

Herrmann Ultraschalltechnik GmbH & Co. KG
D-76307 Karlsbad, Germany
Tel.: +49 7248 79 0
www.herrmannultraschall.com

SONOTRONIC ULTRASONICS TECHNOLOGY

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Special and standard machines
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D-76307 Karlsbad, Germany
www.weber-ultrasonics.com

Vacuum pumps and systems

BUSCH VACUUM SOLUTIONS

Busch Vacuum Solutions
Schauinslandstraße 1, D-79689 Maulburg
Tel.: +49 7622 681-0, sales@busch.de
www.buschvacuum.com

EDWARDS

Edwards GmbH
Philipp-Hauck-Straße 2
D-85622 Feldkirchen
0800 0001456 or +49 89 99191856
DEvertrieb@edwardsvacuum.com
www.edwardsvacuum.com

Vibration welding

CEMAS Germany

www.cemas-germany.com

Procrastination costs more ...

Managers also have a tendency to procrastinate, i.e. to occupy themselves with other things so that they don't have to do what is urgently necessary or perhaps unpleasant straight away. However, the later a decision is made, the more it costs. Examples include important improvement measures or personnel decisions. As a rule, costs are incurred that hurt at the moment but have a high return on investment later on.

A company in crisis delays the involvement of professionals who can lead it out of the situation faster and better than managers who are caught up in day-to-day business or are not experienced in crisis management. The consequences of this are obvious: the necessary changes are introduced later and often have to be harsher than would have been necessary at the beginning of a critical company situation. It is perfectly natural to assume that the clouds on the horizon will clear by themselves or that positive developments will occur by chance. As we all know, hope dies last.

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

The search for an important management personality such as a managing director is delayed because the cost of engaging a personnel consultant is perceived to be very high. It is now well known that the search takes time and that candidates' notice periods will naturally result in a postponement of the new person's start date in the company. Important deadlines such as the end of the quarter for terminations are often forgotten, which adds up to additional time. Sometimes I hear the argument that the new employee has to familiarise themselves with the company first anyway and won't be effective immediately. That is true! But the sooner this happens, the quicker the new broom can sweep in and make an impact. If you only "knock off" two months in such search processes, strategies can be developed and implemented more quickly, and the costs of the right personnel consultant can be recouped many times over. Everyone should be aware of the compound interest effect.

When making important investments in new infrastructure or machinery, decision-makers often take the time to repeatedly and intensively compare all offers and to renegotiate them if necessary. However, if you assume, for example, that the investment will only generate an efficiency of EUR 1,000 per day and a decision is delayed by a month, this means for 24/7 operation that EUR 30,000 has to be gained in negotiations. The same applies, of course, to new product launches or production downtimes due to delayed maintenance. Any other case can easily be modelled similarly.

One glaring example is non-decisions in the case of justified (and this is important!) positive wage adjustments for employees. A decision made slightly too late can lead to the employee leaving the company. The loss of an important employee, including the loss of expertise, unrest in the company, the search for a replacement and the familiarisation period often cost many times more than an appropriate pay adjustment would have done.

With this in mind, I wish you a keen eye for swift decisions that are necessary anyway and good luck for 2024, combined with lots of success!

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Inspiration for plastics processors**

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