

# K-PROFI

international edition

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

Wirthwein Group CTO Holm Riepenhausen complains that the plastic raw material alone accounts for 80% of CO<sub>2</sub> emissions.

## Determine and optimise the CO<sub>2</sub> footprint

How **Polymaterials** optimises compounds with AI. What **Polifilm** expects from self-lamination. How **IonKraft** brings barriers into containers. How **Wetropa** wants to foam only non-crosslinked PE by 2025. How **Re-Strap** leads strapping in a circle. And how **Sund** gets to 100 % sustainable input.



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# Creativity, courage and determination

Dear reader

exciting projects, creative founders and courageous start-ups in the plastics processing industry characterise this issue. A chemically resistant layer system from plasma gives plastic hollow bodies a high barrier, but keeps them recyclable. IonKraft founder Dr Montgomery Jaritz explains the opportunities starting on page 6. Matthias Schäfer wants to bundle PET strapping, waste in industry and trade, with Re-strap and close the material cycle. Can you also profit from his start-up? The answer starts on page 10.

The Wirthwein Group wants to determine and optimise the CO<sub>2</sub> footprint of its injection moulded parts. Marcus Wirthwein and Holm Riepenhausen lament that the greatest imponderability comes from outside the company: Page 12. Polymaterials is driving digitalised compound development with AI. Dr Jürgen Stebani and Dr Bernd Kopera explain successes in engineering plastics, biopolymers and recyclates, among others, from page 16. By 2025, Dirk Breitzkreuz wants to convert all foam packaging of the Wetropa Group to non-cross-linked and 100% recyclable PE-LD and establish closed cycles with its own products: Page 22.

Polifilm in Weißandt-Görlau has developed self-laminating PE films for digital and online printing. We elicited details about the first product from Alexander Schulte-Derne: Page 32. The Raan Group in Herborn has developed an app that consumers in Canada have been using



for a year to contribute to the circular economy and increase recycling rates. Stefan Siegl explains from page 34 that it won't work without consumers in Germany either. The Hamburg-based Sund Group wants to use 100 % sustainable raw materials and recycles by 2030. Karen Queitsch and Clemens Eichler explain their strategy using rubbish bags and disposable gloves: Page 36.

We wish you relaxing summer days!

*Markus Lüling*

**Markus Lüling, Editor-in-chief**

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# “Someday we’ll coat drums, maybe even IBCs”.

Start-up IonKraft breaks new ground in plasma coating and offers new design for recycling



All photos: IKV



**IonKraft GmbH in Aachen still has a long way to go to reach its goal of making all plastic packaging for barrier applications recyclable, but the eight-member team has already achieved remarkable things in a short time: They have found industrial partners, developed a chemically resistant coating system with a high barrier, built the prototype of an industrial coating system, carried out lots of laboratory tests and built up enormous expertise. Dr Montgomery Jaritz, the company's founder, already had expertise in plasma coating thanks to his doctoral position at the Institute of Plastics Processing (IKV) in Aachen, but with his start-up he is entering new territory in several respects, which he explains in more detail in an interview with K-PROFI.**

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

Applying barrier layers in the plasma process, especially to disposable PET bottles, has a long tradition at the IKV. Extensive knowledge is already available here. Dr Montgomery Jaritz benefited from this during his time as a research assistant at the IKV and participated in the further development with his research. Since the coating of disposable PET containers with thin glass-like layers is also state of the art on the international market today, he went one step further and worked on a special coating that is resistant to lyes and acids and can thus also be used for returnable bottles.

With IonKraft, the company he and his founding partner Benedikt Heuer have launched, Jaritz is going one step further. “With IonKraft, we are specifically targeting companies that produce or use extrusion blow-moulded hollow bodies for chemicals, pharmaceuticals, agricultural chemicals, oils or solvents,” explains Dr Jaritz. New territory for him personally: away from consumer goods packaging to technical applications, away from injection moulded to extrusion blow moulded hollow bodies, away from small 1 l to 2 l containers to large containers up to 20 l.

## Environmental compatibility required

However, the IonKraft technology also means new territory for the chosen industry, which has so far protected its containers or canisters from the aggressive and volatile materials by fluorination or

Company founder Dr Montgomery Jaritz is certain that the new plasma technology will open up numerous attractive applications in the packaging industry: “We are already looking for a mechanical engineering partner who will build plasma systems for industrial use with us.”

Mechanical engineer Stefan Wilski is instrumental in building the prototype for the plasma coating of hollow packaging bodies.

multi-material composites. “The fluorination used is very effective,” Dr Montgomery Jaritz knows from many discussions with potential customers. For this purpose, the hollow body or canister, usually made of PE-HD, is exposed to fluorine gas in a corresponding chamber, whereby fluoropolymers are formed on the surface that have a very good barrier effect against the filled media such as solvents, acids and lyes. The disadvantage, however, is that fluorine gas is corrosive and toxic, so that extensive and expensive safety precautions are necessary, which makes this process unattractive for packaging manufacturers. “Compared to the fluorination process, our plasma process is non-hazardous, environmentally friendly and costs a fraction.”

Another issue that is troubling the industry is the environmental issue and the potential ban on all fluoropolymers. As an alternative to surface fluorination, therefore, multi-material composites with EVOH are already available today, which also have a good resistance. However, here again there is the problem of recyclability, which is generally known to be rather poor with multi-material composites. With a wafer-thin plasma layer that has the desired resistance to the various media, this problem could also be solved. “Our layer is only about 100 nm thick, which is negligible compared to the wall thickness of the canisters and does not interfere with recycling at all, as has already been confirmed by an independent institute,” explains Dr Montgomery Jaritz. “So, we can produce a wafer-thin, recyclable, environmentally friendly barrier layer that allows monomaterial solutions for packaging aggressive substances.” In addition to PE-HD, the layers can also be applied to hollow bodies made of other polyolefins or PET, and even complex geometries as well as more flexible packaging than the rigid canisters are conceivable, since the layers have a high bending stability.

#### Ahead of the business plan

“Initially, we are focusing our start-up on the designated market of containers for chemicals with volumes of up to 20 litres,” says Dr. Jaritz, describing his business plan in more detail, and is very pleased that he and his team already have seven customers with great interest in the new technology. Among the customers are chemical manufacturers as well as blow moulders

and fillers, with whom IonKraft is currently carrying out the first proof-of-concept projects with the prototype it has built.

“Within six months, we built the prototype, including the complete electrical system and its own control system,” Dr Montgomery Jaritz proudly reports and praises his dedicated team, which consists of a total of four full-time engineers as well as student assistants. In addition to building the prototype, they also developed a suitable coating system and put it through its paces. For the coating system, which is applied

to the canister in a low-temperature plasma, a special monomer mixture is used that contains, among other things, silicon for the oxygen barrier and can cover the desired broad property spectrum of resistance to lyes, acids and solvents. It takes a few seconds to coat a canister, with the cycle time depending heavily on the size of the container.

“The coating line can be operated in manufacturing directly after the extrusion blow moulding line. Since the cycle times for producing larger canisters are also a few

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seconds, this can be perfectly timed and provide an economical process," is Jaritz certain, who in the long run would like to sell both the equipment and the recipe know-how to interested customers. "We are already looking for a partner who will build the corresponding machine technology with us." All in all, the young entrepreneur is very satisfied with the results his start-up, founded a year ago, has achieved. "We are already ahead of our business plan now."

### Support and first prize received

Dr Jaritz's team was primarily supported by the IKV, whose premises and, above all, testing facilities the spin-off can easily use. "Without the support of the IKV, we certainly wouldn't have managed to get so much up and running in such a short time." Just as important, of course, is the financial security IonKraft receives from the Exist funding programme of the Federal Ministry of Science and Climate Protection

(BMWK). "The programme supports start-ups that come from research and continue to do research together with a university. You can imagine how pleased we were when we were awarded the grant last year and were able to put our innovative idea into practice," Montgomery Jaritz reports. The funding programme supports the company over a period of two years and finances the four full-time employees as well as the necessary materials and test runs.

But that's not all: last year the start-up won 1st place at the RWTH Innovation Award. "For us, the award is proof that our plan to apply recyclable coatings to monomaterial packaging is right in line with the spirit of the times and we feel absolutely validated in our plan." Dr Jaritz is certain that the new technology opens a whole host of possibilities. In addition to coating ever larger containers, up to and including drums or perhaps even IBCs in the distant future, the novel coating could also serve as an enabler for the increased use of recyclates.

"Our coating system provides a strong migration barrier. It is often unclear what contaminants a recyclate contains, which is why most recyclates cannot be used in the food or cosmetics sector. Our layer can serve as a functional barrier between the recyclate and the filling material and thus significantly expand the range of uses for the recyclate," says Dr. Montgomery Jaritz, daring to look beyond the end of his nose and eagerly awaiting many more research and development approaches. **K**

[www.IonKraft.com](http://www.IonKraft.com)

A very thin layer is formed on monomaterial packaging in the low-temperature plasma, making it resistant and at the same time keeping it recyclable.



# Trade Fair Calender

Trade fairs related to plastics processing in 2022 and 2023

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

|                                             |                               |                     |                                                                                      |
|---------------------------------------------|-------------------------------|---------------------|--------------------------------------------------------------------------------------|
| <b>Achema</b>                               | Frankfurt/Main, Germany       | 22.08. - 26.08.2022 | <a href="http://www.achema.de">www.achema.de</a>                                     |
| <b>Indoplas 2022</b>                        | Jakarta, Indonesia            | 31.08. - 03.09.2022 | <a href="http://www.indoprintpackplas.com">www.indoprintpackplas.com</a>             |
| <b>2<sup>nd</sup> Intl. IKV Symposium</b>   | Aachen, Germany               | 05.09. - 06.09.2022 | <a href="http://www.ikv-aachen.de">www.ikv-aachen.de</a>                             |
| <b>31<sup>st</sup> Intl. IKV Colloquium</b> | Aachen, Germany               | 07.09. - 08.09.2022 | <a href="http://www.ikv-kolloquium.de">www.ikv-kolloquium.de</a>                     |
| <b>Drinktec</b>                             | Munich, Germany               | 12.09. - 16.09.2022 | <a href="http://www.drinktec.com">www.drinktec.com</a>                               |
| <b>Inovaplastic/Feiplastic</b>              | Sao Paulo, Brazil             | 13.09. - 16.09.2022 | <a href="http://www.feirainovaplastic.com.br">www.feirainovaplastic.com.br</a>       |
| <b>Kunststoffen 2022</b>                    | s-Hertogenbosch, The Netherl. | 14.09. - 15.09.2022 | <a href="http://www.kunststoffenbeurs.com">www.kunststoffenbeurs.com</a>             |
| <b>Colombiaplas</b>                         | Bogota, Colombia              | 26.09. - 30.09.2022 | <a href="http://www.colombiaplast.org">www.colombiaplast.org</a>                     |
| <b>Powtech</b>                              | Nuremberg, Germany            | 27.09. - 29.09.2022 | <a href="http://www.powtech.de">www.powtech.de</a>                                   |
| <b>Fachpack</b>                             | Nuremberg, Germany            | 27.09. - 29.09.2022 | <a href="http://www.fachpack.de">www.fachpack.de</a>                                 |
| <b>Taipei Plas</b>                          | Taipei, Taiwan                | 27.09. - 01.10.2022 | <a href="http://www.taipeiplas.com.tw">www.taipeiplas.com.tw</a>                     |
| <b>K 2022</b>                               | Dusseldorf, Germany           | 19.10. - 26.10.2022 | <a href="http://www.k-online.com">www.k-online.com</a>                               |
| <b>SPS</b>                                  | Nuremberg, Germany            | 08.11. - 10.11.2022 | <a href="http://sps.mesago.de">sps.mesago.de</a>                                     |
| <b>Compamed</b>                             | Dusseldorf, Germany           | 14.11. - 17.11.2022 | <a href="http://www.compamed.de">www.compamed.de</a>                                 |
| <b>Formnext 2022</b>                        | Frankfurt/Main, Germany       | 15.11. - 18.11.2022 | <a href="http://www.formnext.de">www.formnext.de</a>                                 |
| <b>Vietnamplas 2022</b>                     | Ho Chi Minh City, Vietnam     | 23.11. - 26.11.2022 | <a href="http://www.chanchao.com.tw/vietnamplas">www.chanchao.com.tw/vietnamplas</a> |

|                                      |                          |                     |                                                                                          |
|--------------------------------------|--------------------------|---------------------|------------------------------------------------------------------------------------------|
| <b>Swiss Plastics Expo</b>           | Lucerne, Switzerland     | 17.01. - 19.01.2023 | <a href="http://www.swissplastics-expo.ch">www.swissplastics-expo.ch</a>                 |
| <b>Plast India 2023</b>              | New-Delhi, India         | 01.02. - 05.02.2023 | <a href="http://www.plastindia.org">www.plastindia.org</a>                               |
| <b>ICE/CCE/InPrint</b>               | Munich, Germany          | 14.03. - 16.03.2023 | <a href="http://www.ice-x.com">www.ice-x.com</a>                                         |
| <b>Koplas</b>                        | Goyang-si, South Korea   | 14.03. - 18.03.2023 | <a href="http://www.koplas.com">www.koplas.com</a>                                       |
| <b>Plastico Brasil</b>               | Sao Paulo, Brasil        | 14.03. - 18.03.2023 | <a href="http://www.plasticobrasil.com.br">www.plasticobrasil.com.br</a>                 |
| <b>European Coatings Show</b>        | Nuremberg, Germany       | 28.03. - 30.03.2023 | <a href="http://www.european-coatings-show.com">www.european-coatings-show.com</a>       |
| <b>Interpack</b>                     | Dusseldorf, Germany      | 04.05. - 10.05.2023 | <a href="http://www.interpack.com">www.interpack.com</a>                                 |
| <b>Plasttechnik Nordic</b>           | Malmö, Sweden            | 10.05. - 11.05.2023 | <a href="http://www.plasttechniknordic.com">www.plasttechniknordic.com</a>               |
| <b>Omanplast</b>                     | Muscat, Oman             | 29.05. - 31.05.2023 | <a href="http://www.omanplast.net">www.omanplast.net</a>                                 |
| <b>Equiplast</b>                     | Barcelona, Spain         | 30.05. - 02.06.2023 | <a href="http://www.equiplast.com">www.equiplast.com</a>                                 |
| <b>HanoiPlas</b>                     | Hanoi, Vietnam           | 08.06. - 11.06.2023 | <a href="http://www.chanchao.com.tw/hanoiplas">www.chanchao.com.tw/hanoiplas</a>         |
| <b>Plastec East</b>                  | New York, USA            | 13.06. - 15.06.2023 | <a href="http://www.imengineeringeast.com">www.imengineeringeast.com</a>                 |
| <b>Moulding Expo</b>                 | Stuttgart, Germany       | 13.06. - 16.06.2023 | <a href="http://www.moulding-expo.com">www.moulding-expo.com</a>                         |
| <b>Compounding World Expo</b>        | Essen, Germany           | 14.06. - 15.06.2023 | <a href="http://eu.compoundingworldexpo.com">eu.compoundingworldexpo.com</a>             |
| <b>Plastics Recycling World Expo</b> | Essen, Germany           | 14.06. - 15.06.2023 | <a href="http://eu.plasticsrecyclingworldexpo.com">eu.plasticsrecyclingworldexpo.com</a> |
| <b>Polymer Testing World Expo</b>    | Essen, Germany           | 14.06. - 15.06.2023 | <a href="http://eu.polymertestingexpo.com">eu.polymertestingexpo.com</a>                 |
| <b>Plast 2023</b>                    | Milan, Italy             | 05.09. - 08.09.2023 | <a href="http://www.plastonline.org">www.plastonline.org</a>                             |
| <b>T-Plas 2023</b>                   | Bangkok, Thailand        | 20.09. - 23.09.2023 | <a href="http://www.tplas.com">www.tplas.com</a>                                         |
| <b>Interplas</b>                     | Birmingham, UK           | 26.09. - 28.09.2023 | <a href="http://www.interplasuk.com">www.interplasuk.com</a>                             |
| <b>Fakuma</b>                        | Friedrichshafen, Germany | 17.10. - 21.10.2023 | <a href="http://www.fakuma-messe.de">www.fakuma-messe.de</a>                             |
| <b>Plast Imagen</b>                  | Mexico City, Mexico      | 07.11. - 10.11.2023 | <a href="http://www.plastimagen.com.mx/en">www.plastimagen.com.mx/en</a>                 |
| <b>IPF Japan 2023</b>                | Chiba, Japan             | 28.11. - 02.12.2023 | <a href="http://www.ipfjapan.jp">www.ipfjapan.jp</a>                                     |



Used PET strapping is neither easy to bundle nor easy to dispose of, ...



... but it is easier to handle when chopped up.

## Smart logistics for stubborn waste

Start-up Re-strap wants to close the material cycle for PET strapping

**Some 100 kg here, some 100 kg there, the waste quantities of PET strapping that accumulate in industry and commerce are typically rather small. And yet: “Even if we are admittedly dealing with micro material streams, these are high-quality residual materials that can replace virgin material,” Matthias Schäfer, idea generator and founder of Re-strap GmbH in Kurtscheid in the Westerwald, is certain. In an interview with K-PROFI, he explains the market situation and the first steps of his company in Germany as well as his perspective in the European market in more detail.**

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

Highly tear-resistant PET strapping, which has become established throughout Europe in recent decades for securing goods instead

of metal strapping, has long since been made from 100 % recycled material and is thus considered resource-saving. What is not resource-friendly, however, is that it still often ends up in incinerators after use. “It’s a shame,” thinks Matthias Schäfer, “after all, polyethylene terephthalate in particular can be recycled several times without any problems.”

The trained businessman has been working in the waste disposal and recycling industry for more than 20 years, started his own business as a recycling consultant last year and has now founded Re-strap GmbH. “I have always been particularly interested in strapping,” he says, explaining the motivation for his new company, which was launched on the 1st of March. Since then, he has already received more than 100 enquiries. “I am thrilled by the enormous response,” the best proof for him of the importance of the topic.



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### With minimal investment

Everyone knows them, the strapping bands that are placed around packages on a pallet and are so stubborn after opening that they are neither easy to bundle up nor easy to dispose of. It's exactly the same on a large scale. Where to put the stubborn tapes? How can they be recycled sensibly and economically? Re-strap offers the solution: "Basically, there are three economic questions for a company that accumulates a lot of strapping: How to reduce the time-consuming handling? Where can the space be found to store the bulky straps sensibly? And how much does it cost to dispose of them?"

Re-strap therefore recommends the following approach: Every partner company should purchase a strap chopper that immediately produces sections of 8 to 10 cm in length from strapping straps. "Incidentally, this is the only investment that a company interested in our solution has to make," explains Matthias Schäfer, who directly adds that the investment remains quite manageable at up to 5,000 EUR. Otherwise, there are no costs. On the contrary: the customer can save costs simply by not having to store and dispose of the strapping.

"The entry threshold is very low," Matthias Schäfer is convinced, "every customer receives two Re-strap collection boxes the size of a Euro pallet from us against a deposit to collect the chopped strapping." Two boxes are minimum for the entrepreneur, four boxes are optimal. Each box can hold 250 kg of recyclables, and the boxes can be

stacked perfectly on top of each other, minimising storage requirements. When a box is full, Re-strap takes care of the rest. "We work with a logistics partner who collects the filled boxes from our customers." In the long run, however, and to ensure a high quality of service, Schäfer believes that a specialised fleet makes sense, especially if he expands his radius from Germany to Europe, which is his declared goal for the future.

"About 50,000 tonnes of PET strapping are produced and used in Europe every year, of which about 10,000 tonnes are being used in Germany," Matthias Schäfer estimates and therefore sees enormous potential in Europe-wide market development.

### It pays off for all involved

Of course, the customer receives payment for the collected and shredded PET straps. In figures it looks like this: "The disposal and logistics costs for the customer are currently up to 300 euros per tonne of strapping. If he is willing to collect them for us, the  $\pm$  sign in his cost calculation can be more or less reversed. Even after deducting the logistics costs, a positive return on recyclable material remains for the customer from the provision of two boxes. In addition, he saves considerable internal handling costs."

A clear win-win situation that benefits the conservation of resources. Even though the manufacturers of strapping are already very interested in the secondary raw materials, a closed material cycle, i.e. from the strapping back to the strapping, is not yet



Matthias Schäfer, here with a collection box, wants to close the material cycle of strapping.

established at this point in time. First of all, the question has to be answered how much recycled strapping the new product can take without any loss of quality.

For Matthias Schäfer, however, this is not a problem at all: "In any case, we close the recycling loop by using the residual materials in a high-quality product. This includes, for example, the use in durable products in the automotive industry." For Matthias Schäfer, the discussion about cradle-to-cradle solutions misses the point a little: "The most important thing is that high-quality secondary raw materials are not incinerated and thus lost. The way in which the material is recycled is not the decisive factor." ■

[www.re-strap.de](http://www.re-strap.de)





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# “The most important component carries the greatest uncertainty”

How Wirthwein tries to determine and optimise the CO<sub>2</sub> footprint of plastic parts

**Determining the CO<sub>2</sub> footprint of a plastic product is not easy, especially since the biggest uncertainty factor comes from outside the processing plant. The Wirthwein Group provides insight into its approach to bringing transparency to the footprint and discloses results and considerations.**

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

As a family-owned company with 22 production sites in six countries, 3,500 employees, 400 million EUR turnover and several hundred injection moulding machines, the Wirthwein Group, headquartered in Creglingen, Germany, supplies customers in the automotive, railway, electrical industry, household appliances, medical technology, and interior design sectors. “Materials account for the largest share of costs in our production – 60 per cent on average,” reports board spokesman Marcus Wirthwein, “the second most important factor, after personnel costs, is electricity consumption, followed by all other factors.”

It's a similar story with the CO<sub>2</sub> footprint. “The plastic we process accounts for about 80 per cent of the emissions,” analyses Holm Riepenhausen, Chief Technology Officer, “around 10 per cent is accounted for by narrower plastics processing, operating technology such as compressed air, recooling and lighting, and 10 per cent by other tasks such as logistics, IT and administration.” At Wirthwein, too, the usual performance indicators of emission reduction/sales (CARR ranking)

and energy consumption/quantity of material processed (M-SEC, P-SEC, S-SEC) describe the efforts to achieve the most energy-efficient and low-CO<sub>2</sub> production possible, but they are subject to many external factors that call the validity of the values into question.

## CO<sub>2</sub> footprint missing for 90 per cent of materials

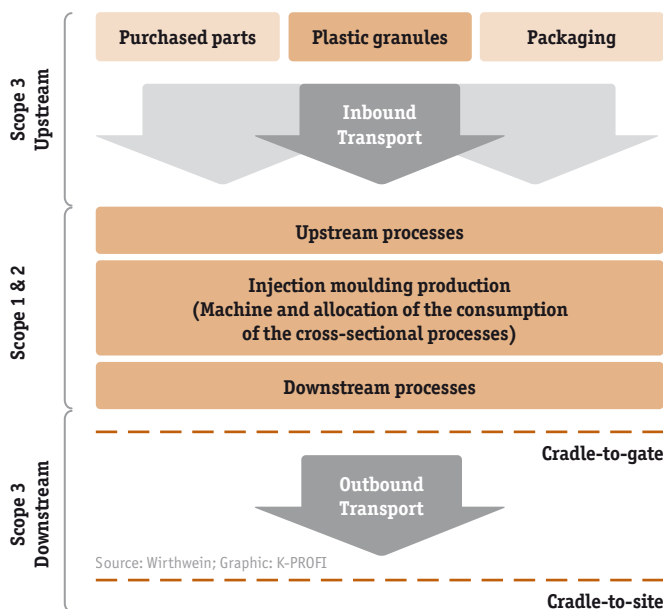
“Given that materials account for 80 per cent of the CO<sub>2</sub> footprint, the real lever for reducing the CO<sub>2</sub> footprint lies in the decision on materials and processes. In a Tier 2 or Tier 3 position, I as a processor have only limited influence on the product design. And on whether I use a foaming process and thus reduce my material input, whether I can use sandwich technology to put recycled material into the core, or whether I use material with a better CO<sub>2</sub> footprint. I can advise, but I cannot determine the component concept,” Holm Riepenhausen regrets, “the key to good efficiency or CO<sub>2</sub> balance lies elsewhere – in a product and material design that is essentially determined by our customers.” Particularly obstructive to this is the still low transparency on the materials side. “For more than 90 per cent of the Name Grades used, we currently don't get any CO<sub>2</sub> values from the plastics producers,” complains the technical director, “so the most important component brings with it the greatest uncertainty.”

Are alternatives to stock materials an option? Holm Riepenhausen: “As far as CO<sub>2</sub> values of Name Grades are known, alternatives can be identified. In the broad classification of polycarbonate (PC), polyamide (PA), polypropylene (PP), one can try to work with the material whose energy requirement in production is the lowest – in more technical applications that would be PP. We are also interested in the topic of biopolymers because that would also bring significant advantages.”

## Biggest savings expected in the highest specific energy consumptions

Wirthwein looked all the more closely at the two 10-% blocks of their CO<sub>2</sub> footprint. From an emissions point of view, the many production sites close to the customers prove to be a competitive advantage. An energy management system that has been in use for many years has already created transparency in detail. “All consumers are tackled decisively,” says Holm Riepenhausen.

In the 10 % block, which concerns pure plastics processing, the focus is on the machines and systems that use the most energy – measured in kWh/kg. Holm Riepenhausen: “We have a stringent plan in place, staggered according to the savings effect. They work best for those materials that physically cause the highest specific energy consumption. We attach great importance to energy-efficient technologies. We evaluate each investment according to efficiency using a TCO approach. We aim for an annual progress of minus three percent



Along the value chain, every material, every machine, and every process step have a CO<sub>2</sub> footprint.

“For more than 90 per cent of the Name Grades used, we are currently not getting any CO<sub>2</sub> values from the plastics producers,” Holm Riepenhausen, technical director of the Wirthwein Group, notes.

in specific energy consumption. We have established that as a realistic target, and we see this as being possible in our machine fleet for the next five to ten years.”

### Every operational measure has a CO<sub>2</sub> effect

The underweighted control variables within the 10-% block – consisting of operating technology, in-plant logistics, IT and administration – are also in view. “I don’t want to highlight any one factor, but for all factors of energy management there is an action plan on how we make progress. Compared to the 80 per cent block, these are drops in the ocean, but you still have to take care of your own sphere of influence. Because every measure ultimately has not only an emissions effect but also a cost effect,” Holm Riepenhausen emphasises.

“At the moment, no comprehensive, serious CO<sub>2</sub> balancing can be done because the main influencing variable is not consistently available. Nevertheless, we have to give our customers a decision-making tool. Therefore, we first work with standard values and, if necessary, make the advantages or disadvantages of individual materials transparent in a difference analysis.” Holm Riepenhausen wants to take care of this non-transparent 80-% block of the CO<sub>2</sub> footprint in a concerted effort – with product design, process and material selection and an evaluation tool that allows a comparative balance and helps to make the right decisions: “We are not waiting for an SAP tool that may one day be considered the industry standard. We know where we have to go – via ABC analyses, in self-supply, in optimising emissions and saving costs. Energy-efficient production is also cost-effective, and the ecologically right decision is also the economically right one,” he is convinced. “In addition to cost calculation, CO<sub>2</sub> calculation will also be needed in the future.”

### Tools for determining the CO<sub>2</sub> footprint are useful

“Therefore, along the value chain, every material, every machine and every process need a CO<sub>2</sub> footprint.” Sooner or later, all suppliers will be obliged to provide footprint data, the two board members predict. Until then, however, tools will be needed to help make decisions. “We can’t wait until all material data is available and until the system competition among the tool providers has been decided,” Holm Riepenhausen concludes: “There are already tools on the market, some of which, like the Reach system, are very elaborately designed. Nevertheless, they do not solve the problem of not knowing the material footprint.”

Even though those responsible at Wirthwein expect further developments on the supplier market in the near future, they have decided to set up a tool for CO<sub>2</sub> balancing themselves. “We use it to advise our customers on the selection of materials, processes and logistics concepts. Because regardless of the unavailability of material values, I can suggest a product layout that leads to a CO<sub>2</sub>-optimised product. What works well is to compare individual Name Grades or manufacturing at individual sites. In the comparison I get a real delta value that is also tenable in itself,” Holm Riepenhausen has analysed, which is why Wirthwein wants to actively offer his customers the assessment via the tool this year: “It won’t be certified, but it will be an effective decision-making aid.”



Photo: K-PROFI/Schneider

### Identical and transfer parts can improve the balance sheet

Looking beyond just the moulded part can also help decisions. “We should also put a CO<sub>2</sub> sticker on every mould,” suggests Marcus Wirthwein, “that would also favour takeover parts from previous models.” Many parts in successor models of the automotive industry would look slightly different with unchanged requirements and would not have a positive effect on the CO<sub>2</sub> balance, but lead to emissions in the development and production of the new tools: “With new model series, common part strategies are always set up, but why do I have to redesign proven parts every time? If I use parts from the same mould for one model longer, what is the footprint? Maybe we need to attach a CO<sub>2</sub> value not only to the components, but also to the tools.”

Despite the extensive discussion about the use of recycled material in many non-critical applications, it is still difficult to implement. Holm Riepenhausen: “We have offered our customers large-scale trials in which we increase the recycle use quota for some products gradually, batch by batch and clearly shown slowly to see whether the quality is maintained with the use quota. No customer accepted the offer.” And he points out a contradiction: “Even the use of production recycle or circulating material from our own production is prohibited by some customers, although they demand elsewhere that more recycle should be used. There are still a lot of reservations to be still have to be cleared up.”



Photo: Wirthwein

“If we still have to supply customers in Germany from many hundreds of kilometres away instead of over the fence for cost reasons, that is also greenwashing to me,” complains Marcus Wirthwein, board spokesman of the Wirthwein Group.

### The use of recycled materials still fails due to reservations and concerns

Despite the extensive debate about it, the use of recycled material is still difficult to implement in many non-critical applications. Holm Riepenhausen: “We have offered our customers large-scale trials in which we increase the recycle use quota for some products gradually, batch by batch and clearly documented slowly in order to see whether the quality is maintained with the use quota. No customer accepted the offer.” And he points out a contradiction: “Even the use of production recycle or recycled material from our own production is prohibited by some customers, although they demand elsewhere that more recycle should be used. There are still a lot of reservations to overcome.”

Confidently, Marcus Wirthwein goes one step further: “We would even be prepared to take back all the parts we produce – vehicle components, lye containers, track fastenings, fan wheels – if these cycles could be organised and worked. We know exactly which material we used to make which parts, even a long time ago, and where the recycle from these could be well reused.” Marcus Wirthwein: “The cycle has to fit. And it just doesn't fit. Not yet.”

He adds another thought: “Perhaps we need to focus more on CO<sub>2</sub>. OEM customers in particular must be prepared to support the change process in favour of the CO<sub>2</sub> balance and perhaps use a different material.” If all testing and application requirements remain as high as they are, nothing will change, he notes, offering an example from automotive supply: “Our window frame trim was mostly

PA-GF15. Now we make them in PP. With the 1:1 change to PP, they don't pass the old climate change tests, but with a few design tweaks to the part and some sensible adjustments to the test parameters, they pass the test in PP today.”

### Part of the solution is more in-house energy generation

In addition to reducing energy use, Wirthwein wants to generate more green energy itself. Holm Riepenhausen: “The key figure to improve ourselves is own generation in proportion to our own energy consumption. This is how we can measure our progress, in terms of both generation and savings. We set ourselves clear targets here – but not for CO<sub>2</sub> emissions per euro of turnover, because we don't consider that to be reputable. The share of self-generated green energy – photovoltaics, wind and combined heat and power plants are already operated by Wirthwein – in consumption is to grow from 20 to at least 30 per cent by 2035,” he announces.

“If we really want to become completely independent and completely green, this is only possible with appropriate energy storage systems, of which we must create even more capacities.” The company has also become active in this area, as Marcus Wirthwein explains: “Many years ago, we participated in the start-up JenaBatteries, which develops metal-free redox flow batteries as stationary large-scale power storage systems. We manufacture the distribution plates for these storage systems as well as bipolar plates for fuel cells. At wind

|                                     | Emissions per component<br>[g CO <sub>2</sub> e/piece] | Emissions per kg product<br>[kg CO <sub>2</sub> e/kg product] | Share of emissions<br>[%] |
|-------------------------------------|--------------------------------------------------------|---------------------------------------------------------------|---------------------------|
| Scope 3 Upstream material           | 438,45                                                 | 1,75                                                          | 80,68                     |
| Scope 3 Upstream purchased parts    | 20,20                                                  | 0,08                                                          | 3,72                      |
| Scope 3 Upstream Packaging          |                                                        |                                                               | 0,00                      |
| Scope 3 Upstream Transport          | 3,56                                                   | 0,01                                                          | 0,66                      |
| <b>Result Scope 3 Upstream</b>      | <b>462,21</b>                                          | <b>1,84</b>                                                   | <b>85,05</b>              |
| Scope 1+2 Injection molding machine | 13,36                                                  | 0,05                                                          | 2,46                      |
| Scope 1+2 Surcharge production      | 5,28                                                   | 0,02                                                          | 0,97                      |
| Scope 1+2 Downstream processes      | 19,80                                                  | 0,08                                                          | 3,64                      |
| <b>Result Scope 1 and 2</b>         | <b>38,44</b>                                           | <b>0,15</b>                                                   | <b>7,07</b>               |
| Scope 3 Downstream transport        | 42,81                                                  | 0,17                                                          | 7,88                      |
| <b>Result Scope 3 Downstream</b>    | <b>42,81</b>                                           | <b>0,17</b>                                                   | <b>7,88</b>               |
| <b>Total</b>                        | <b>543,46</b>                                          | <b>2,16</b>                                                   | <b>100,00</b>             |

Wirthwein's own CO<sub>2</sub> assessment tool (shown here with data from a specific product example) is not certified, but it does allow comparative balancing and is an effective decision-making aid.

and solar farms or at energy hubs, electricity can be stored close to the generator and fed into the grid at different times. The production of green hydrogen could also be supported in this way.” Holm Riepenhausen: “We increase the share of self-generated energy, save in production, and as an enabler we manufacture products for storage and actively do something to make the energy transition possible. That's quite a neat approach for a company of our size.” Offsetting any activities through third-party CO<sub>2</sub> projects is something Marcus Wirthwein rejects: “Buying CO<sub>2</sub> certificates means greenwashing to me.”

### Price still beats ecology

Despite all considerations, Marcus Wirthwein still sees a large discrepancy in the value chain: “The customer says: If the price is right, you are welcome to produce our component in Germany with a better CO<sub>2</sub> balance, but if the price is not right, please deliver from abroad. At some point in the price negotiation, production location and CO<sub>2</sub> suddenly no longer play a role: price beats ecology.” This leads to the fact that even customers geographically close to a Wirthwein location are not necessarily served from there. Marcus Wirthwein: “If we still have to supply customers in Germany from many hundreds of kilometres away instead of over the fence for cost reasons, that is also greenwashing to me. Some products are driven all over the country and then it is claimed that they are CO<sub>2</sub>-neutral. We're not saving the environment with that, definitely not.”

Another challenge is the global competition that has emerged due to different certificates and different criteria in the individual countries. Marcus Wirthwein: “One customer wants this certification, another wants that standard. There needs to be real comparability with uniform criteria and uniform measurement procedures!”

### Affordable expansion of renewable energy and clear prices for pollution called for

What framework conditions and initiatives are needed to improve the situation? Politics and associations would have to pull together, and institutions – SKZ, KUZ, Fraunhofer Institutes – would also have to cooperate, says Marcus Wirthwein: “My appeal to the federal government: If we are guided by the CO<sub>2</sub> footprint, we must also recognise this intention somewhere. On the one hand we want CO<sub>2</sub> certificates and recycle use, on the other hand it should not cost anything.”

Holm Riepenhausen supports the point of view: “We need good legislation – cross-sectoral, cross-regional or even global – with clear pricing for pollution. There must be no loopholes in the implementation of the Carbon Leakage Regulation (BECV) that puts German industry at a disadvantage.” With a view to renewable energies, he demands: “If individual pioneers get too far ahead of the overall target, this leads to the unhealthy shifts. It doesn't help if I want to present myself as particularly green and want to use exclusively green energy years earlier than others. Because it is not sufficiently available. The redistribution of a good that is not sufficiently available leads to skyrocketing prices without the corresponding CO<sub>2</sub> effect. Therefore, politics must shape the framework conditions in such a way that the real expansion of renewable energies roughly corresponds to the political goals in terms of time and capacity. The expansion must follow the targets, keep pace and be affordable in time.” 

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All photos: K-PROFI/Avisto München

Polymaterials CEO Dr Jürgen Stebani clearly illustrates the systematic and time advantages of trial plan-supported digital modelling: “From tens of thousands of possibilities, the software defines a trial plan of just under 500 recipes. It takes us about eight to ten weeks to compound these 500 formulations and examine the 500 test specimens.”

## “We have a small data problem”.

How Polymaterials is driving digitalised compound development with software tools and artificial intelligence

**In addition to polymerising new plastics, Polymaterials AG focuses on developing application-specific optimised plastic compounds. The company, which has sites in Kaufbeuren and Leverkusen, has won many founder, innovation, and industry awards since 2000. The High Throughput Screening (HTS) for polymer materials has received several awards. CEO Dr Jürgen Stebani and the head of compounding technology, Dr Bernd Kopera, report on developments in engineering plastics, biopolymers, materials for 3D printing and recycles. The focus is on targeted compound development with the help of artificial intelligence and HTS and their benefits for raw material manufacturers and plastics processors.**

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

“In the decade from 2000 to 2010 we worked a lot on fuel cells, battery materials, polymer electrolytes, and in recent years a lot on polymer components for cosmetics, paints and varnishes. Currently, a big topic with more and more enquiries are biogenic raw materials and, on a case-by-case basis, technical tasks related to the recycling

of plastics, be it details of chemical recycling or material upcycling.” Polymaterials is 100 % plastics-focused - but with two different focal points at two different locations.

### **Biogenic raw materials and precursors replace conventional monomers**

Polymaterials' polymer pilot plant in Leverkusen synthesises new plastics, for example, by replacing conventional monomers with biogenic raw materials or with alternative precursors with a polymerisation capacity of no less than 250 to 300 t/a. In 2006, Polymaterials took over equipment and experienced operating personnel from Bayer AG's polymer research department: With boiler plants for solution polymerisation and autoclaves for the production of high-performance polyamides, for example, as well as downstream facilities, a wide range of options are open. “In Leverkusen, two planetary roller extruders (PWE) from Entex Rust & Mischke are running, the WE50 and WE70 models, with many advantages for us polymer chemists: the PWE shear the material less, so we can essentially introduce energy via heating and thus have a much better influence on what happens in the

extruder. Other areas of application are polymer processing, solvent extraction, and reactive extrusion. In the PWE, the dwell time of the melt is much longer than in twin-screw machines. This is more likely to allow industrially useful bulk polymerisation, so we polymerise in the extruder, take the melt to the cooling belt and then pelletise.”

Customers here are often large companies with projects in the six-figure euro range, but also medium-sized companies with individual projects in the lower five-figure range. “If the project goes far beyond our horizon of experience, we turn it down,” Dr Jürgen Stebani delimits, “we also turn down things that are too quirky, as well as ideas that are too REACH-heavy or products with too much approval work.” Current REACH legislation stipulates that a polymer synthesised from listed monomers is not subject to approval. “So we always rely on market-available monomers whenever possible in order to comply with REACH right from the start,” emphasises the CEO.

#### Technical centre in Kaufbeuren compounds, injects and tests new formulations

The R&D team with the compounding pilot plant in Kaufbeuren develops application-specific and property-optimised plastics and plastic blends. In addition, chemists and engineers work on the development of plastic compounds with digital support. Here Polymaterials operates a twin-screw extruder from Theysohn for polymer preparation as well as for the production of concentrates, an extrusion line for the production of filaments of new 3D printing polymers or of new support materials that help in the generative construction of moulded parts and can be dissolved in aqueous alkaline after 3D printing.

Two all-electric 2K injection moulding machines from Engel are preceded by large gravimetric direct metering carousels for eight raw materials per plasticising unit. The test specimen moulds with exchangeable cassettes come from Axxicon, and now and then customer moulds with specific geometries are also clamped. Polymaterials itself carries out tests that go quickly: Various mechanical tests as well as HDT and MVR. For large or lengthy routines, DKI in Darmstadt or PSM Polymer Service in Merseburg are available, for example. During the visit of K-PROFI in Kaufbeuren, new mechanical testing equipment from Zwick-Roell is being commissioned.

#### The demands on compound development are growing

Dr. Jürgen Stebani and Dr. Bernd Kopera explain that formulation developers are always faced with an almost unsolvable task when they want to achieve a certain property profile with a completely new formulation. Typical variables for a systematic selection are about five base polymers and, in principle, a large number of stabilisers and co-stabilisers.

- › a large number of stabilisers and co-stabilisers,
  - › a large number of functional additives such as processing aids, flowability improvers or demoulding aids,
  - › a variety of fillers and
  - › a variety of reinforcing agents
- and all of them in any desired concentration. In addition, many of the components also interact with each other.

“The compounder tries to meet the target as closely as possible, for example, certain target values of modulus of elasticity and elongation at stretch as well as low-cost prices for the components,” says Dr.

Jürgen Stebani, explaining the common practice. Usually, the compounder then proposes a compromise product and discusses it with the customer and, if necessary, the user. With, for example, 20 years of experience with his materials, a plastics finisher and compounder has several hundred formulations in his portfolio that he knows very well. “If a customer asks for a new, previously unknown property profile, the compounder tries to satisfy it by varying formulations. In this way, he creates dense clusters of formulations closely around known base polymers and property profiles.” If one tries to calculate the interrelationships of polymer, additives and fillers from this data with adaptive software, it cannot really work well, according to Dr Jürgen Stebani: “You cannot calculate the whole intergalactic space because you know the Milky Way and yet another galaxy.”

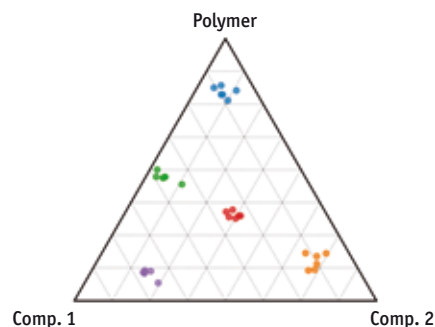
#### Tens of thousands of possible combinations condense to a few hundred

Polymaterials' approach is to determine interactions between all the constituents used and to capture them in formula form - on the computer through knowledge of molecular interactions. Dr. Bernd Kopera

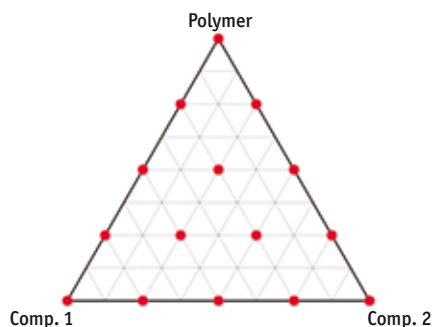


Dr Bernd Kopera, head of compounding technology at Polymaterials, explains that various criteria and target variables can be combined and optimised in the data models, such as mechanics, resistance, flow properties, weathering, flame retardancy or colour impression: “What can be measured, we can also optimise.”

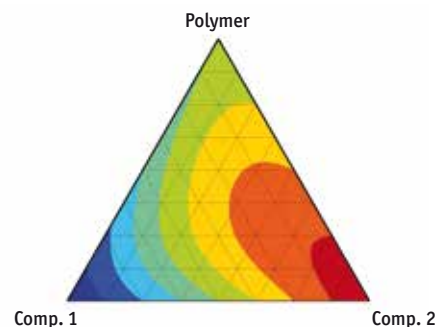
## Principle of digital compound development



Several hundred formulations as dense clusters tightly around known base polymers and property profiles form the classic empirical knowledge of the compounder.



Statistical design of experiments (DoE) defines suitable formulations, which are compounded, injected into test specimens and examined for specific criteria.



The software determines the influence of each individual component on specific properties of a compound.

uses a modified image to illustrate this: “The classical compounders create very good maps of islands, but we create a complete map of the world.” Faced with this requirement, Dr Jürgen Stebani formulates the challenge: “In plastics processing, we don't usually have a Big Data problem, we have a Small Data problem.”

“Each customer comes with their own raw materials, their own suppliers, their own preferences. These can be different types of the same material, different blend partners, different additives, different fillers, and different reinforcing agents each with individual concentration limits. Based on these components, we make a so-called DoE (Design of

Experiments) experimental plan. We use a standardised tool for statistical experimental design. From tens of thousands of possibilities, the software defines a meaningful experimental plan of just under 500 formulations. A compounder would certainly spend more than a year working on this plan. We usually need about eight to ten weeks to compound these 500 formulations, to injection mould the corresponding test specimens and to examine them with all the bells and whistles from planning to compounding and injection moulding to test evaluation.”

After creating the data model from the measurements of the compound properties, the computer recognises the interactions

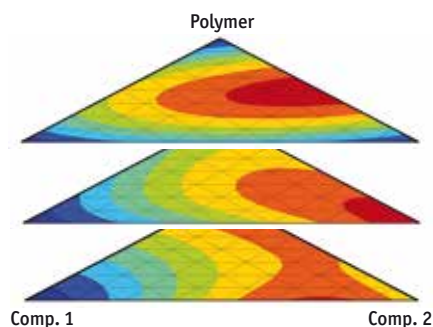
between the individual components. Then comes the fine-tuning based on a skilful selection of components. Even a formulation that has already been determined to be technically optimal can ultimately be optimised for operational practice, for example, if small components of individual additives are eliminated to reduce complexity, or if the proportion of high-priced additives is reduced for cost reasons or these are substituted by low-cost alternatives. In this way, the user approaches a recipe with the tool that is presumably best suited for him. In the event of supply difficulties with a material, the system also enables a quick and efficient search for alternative raw materials.

“The customer receives this data as a model and can use and re-use it at any time if the developer is trained on the software. The determined data and the model generated from it are the property of the client. From that moment on, the application engineer does the calculations before placing an order with the compounder. He can answer questions at the customer's site like: 'Can you supply me with a product that has comparable properties but 500 MPa more Young's modulus?' He can then explain if it is possible and how much higher the price must be. We have created such models for a wide variety of materials - for commodities, engineering plastics or even for biopolymers,” explains Dr Bernd Kopera.

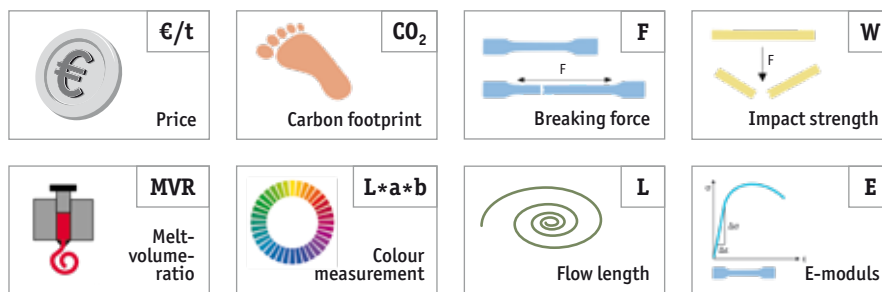


Two fully electric 2K injection moulding machines from Engel produce test specimens for the computer-defined batches.

Translated with www.DeepL.com/Translator (free version)



From all the test results, the model determines the molecular interactions between the components used and records them on the computer in the form of formulas.



Source: Polymaterials

In the model determined, formulations can be calculated and optimized with regard to various target criteria. Criteria can be mechanical or rheological parameters, the CO<sub>2</sub> footprint as Global Warming Potential (GWP), the color impression or the manufacturing costs.

### The optimisation can be geared to different target criteria

He sums up the solvable requirements for plastics processors as follows: "What can be measured, we can also optimise." In this way, different criteria and target variables can be combined in the models – mechanics, resistance, flow properties, weathering, flame retardancy or colour impression. Is Polymaterials also concerned with customer-specific standards and OEM approvals? Dr Bernd Kopera: "Yes, then we set up a measurement methodology for screening if necessary. After that, the customer has to go to an accredited testing laboratory with the optimised compound and get the corresponding test certificate."

Dr Jürgen Stebani: "What we always pay attention to with the customer is whether the test plan becomes too complex to find a solution at a reasonable cost. However, in comparison to this in general practice, the problem is that with the typical one-factor method - I keep all variables fixed except for one, and when this is optimised, I vary the next one - you can only guarantee one thing, namely that I won't end up in the optimum," he smiles, "we calculate multi-dimensional models and break them down to different axes of property relationships. We see optima that go beyond what the client can see in the self-determined, two-dimensional view." Here, he looks back at adhesion tests on 2K moulded parts as an example:

"Although we have two 2K machines and can combine both components from up to eight components via the dosing carousels, customers have never varied both components at the same time. One was always fixed and the second varied."

The software-supported methodology of Polymaterials does not necessarily lead to the desired result, as Dr Bernd Kopera admits: "It can also be the result that a goal is not achievable in principle, e.g. that a required modulus of elasticity and a desired high notched impact strength cannot be reconciled with the selected components. But then the customer's developer at least knows that definitely."

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Do large compounders and masterbatchers use such models? Dr Jürgen Stebani: “As far as we know, large compounders are active in this field, but to our knowledge none in the way we do and none in the consistency we do.” Despite the major limitation of trials by the DoE trial schedule, the effort cannot be reduced infinitely. “Concrete solutions are feasible in a few weeks,” the CEO outlines the effort, “we usually do about a hundred compounds in three weeks.” The price for such a model is 40,000 to 60,000 EUR. “But for a large supplier who uses a model intensively as a power user, so to speak, the expense is quickly put into perspective.”

#### Willingness to use digital tools is growing

The digitalised approach to compound development is not yet widely known, let alone established, in the industry. On the part of interested parties, there are often reservations about Polymaterials' approach, admits Dr Jürgen Stebani: “We experience concerns because we work against the traditional approach to compound design - especially from older experts who have a great deal of experience.” Companies say: “It's all in our lab journals. They enter it all into computers, begin calculations and find out that they have inconsistencies in their data, for example in testing methods, that they are missing important data or that there is a lack of consistency in how important parameters have been recorded.”

Others don't want to share much of their wealth of experience because they are worried about losing their prominent position. “People are already asking themselves: where will I be with my experience

## Examples of successful digitally supported developments

**Example 1:** Polylactide blends that are supposed to be close to PBT or ABS. Then we specify PBT or ABS as the target product. Polymaterials had to examine 1,500 variants, and the database calculates a polylactide blend with a comparable property profile.

**Example 2:** Alternatives to compounds made from PA12, which has already become a scarce commodity: PA610, PA11 or PA1012 are possible alternative polymers. The test plan was set up - also with blends of the three polyamide types - and the test design was adapted to match a PA12-like property profile.

**Example 3:** Additive packages for the reprocessing of recycle: After sorting, certain plastic mixtures remain - and this, for example, in seasonally changing composition. The compound model then determines which additive packages can be used to specifically raise the property profile to a level that allows products with certain quality criteria to be made from them.

**Example 4:** Optimising a colour impression: An injection moulder makes day-night designs and has incorporated blue colour masterbatch into ABS. His potential customer complains that the colour impression is not blue enough, but too greenish. Polymaterials has run through the conceivable mixing ratios with the colour components - pigments, black, titanium white and others - with a model, measured the colour locations and the opacity left behind and determined a suitable formulation that best matches the desired colour impression.

**Example 5 (“Mapping”):** A producer makes several standardised types of plastic in large quantities. He asks himself which property profiles he can achieve by combining them and whether he can thus meet certain critical parameters. For example, the raw material costs of the compounds of no more than x EUR/kg can also be a target criterion.

if a model will calculate in the future. But the model only changes the perspective of experience, not the experience. In the picture: We paint ‘navigation maps’, but we still need the expert's assessment: When it snows, I don't take the pass road. And if I see where the Italian restaurants are in town, I know which one has the best cook. There is a synergistic interaction between our results or models and the client's knowledge. The results from the forecasts and the experience of the processor are always complementary and supplement each other in an ideal way.”

Dr. Jürgen Stebani is confident, however, that Polymaterials' approach will quickly catch on: “Meanwhile, we are faced with the desire to increase the use of bioplastics and do not have 15 or 20 years

to build up sufficient empirical knowledge. And young people are coming along today who no longer want to spend a decade in one and the same field working their way up, for example, to become the 'compound pope'. They say to themselves: there must be somewhere to find it and go in search of it. That's why it's easier for us to get our ideas accepted today than it was a few years ago. In addition, the positive experiences with digitalisation in logistics and the discussions about Industry 4.0 in production have created access to alternative approaches and increased the willingness to follow data-driven paths."

What should processors consider as customers of compounders? Dr Jürgen Stebani: "Processors should think beyond their traditional materials portfolio and take more into their own hands. We are experiencing such a change in thinking patterns in dealing with, for example, 3D printing versus injection moulding. Today, young people at plastics processors are saying: I want the same result, and the process is secondary. And no longer: I always want to use the same, familiar input material if possible."

### In-house developments of 3D printing and bio-based plastics remain the goal

Over a good 20 years, Polymaterials has built up infrastructure, know-how and organisation. "The goal for the next three to five years is to move into in-house production via contract manufacturing," specifies Dr Jürgen Stebani. At present, the technical centre at Chempark Leverkusen can only produce sample quantities at most - 250 to 300 t/a in total. "We are talking to customers about being able to build up production of about 1,500 t/a." At the same time, scalability is assured, he emphasises: "We always make sure in the laboratory that what works in a glass apparatus will also work in a large steel vessel."

The goals for Kaufbeuren are somewhat larger compounding for sample quantities and smaller contract production directly for customers. "There's a lot of potential there with processors who don't want or can't involve established players. We try to generate enough money from our R&D contracts that we can fund our own R&D." In-house research focuses mainly on 3D printing materials and biopolymers. ■

[www.polymaterials.de](http://www.polymaterials.de)



During K-PROFI's visit to Kaufbeuren, a new notched bar impact testing machine from Zwick-Roell is being commissioned.

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All photos: K-PROFI/Hauptmann

Reduced to a twentieth of their volume, the production waste is returned to the material supplier, sorted by type, who reintroduces it into the production cycle without any loss of quality.

Dirk Breitkreuz explains his philosophy:  
 “We want to create the conditions for a closed material cycle in which foam packaging can also become foam packaging again.”



# The many lives of expanded PE

Why Wetropa banks exclusively on non-cross-linked polyethylene and how a closed cycle is created

**Foam packaging is the core activity of the Wetropa Group. Part of the production is already based on non-cross-linked PE foam, i.e. material that is 100 % reusable and can also be produced in a climate-neutral way. By 2025, the entire portfolio should be converted to non-crosslinked PE-LD. Managing Director Dirk Breitkreuz explains how the company intends to build up closed cycles with its own products during a visit of K-PROFI in Mörfelden.**

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

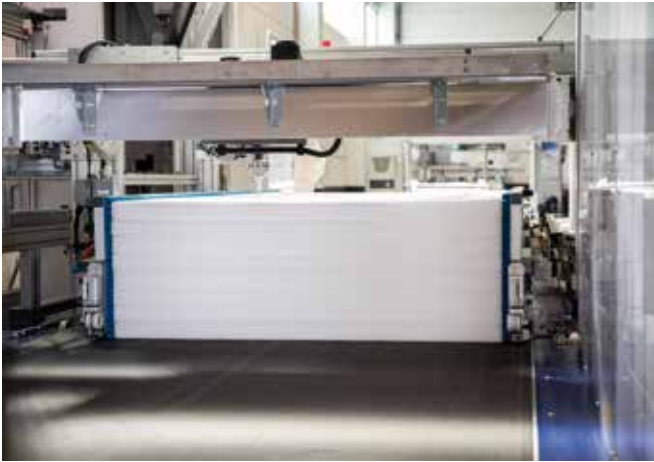
Wherever the eye wanders at Wetropa, it encounters gigantic stacks of foam sheets and countless packaging variants made of the soft, porous material. Transport packaging for sensitive parts such as electronic components, containers for the chemical industry, medical technology, construction, or elements for the solar industry make up the lion's share.

For about 40 % of the packaging, it is not only the technical properties that matter, but also the appearance. Case inserts for tools or presentation inserts for cosmetics are among them. They should protect the product and look attractive at the same time. Until now, cross-linked PE has often been used, because it is finer-cellular, available in many colours and therefore more attractive for some customers.

By 2025, however, Managing Director Dirk Breitkreuz wants to switch the entire product range to non-cross-linked PE-LD, which is 100 % recyclable and produced in a climate-neutral way: “We currently still work with about 40 % cross-linked polyethylene. Since the material cannot be returned to the material cycle, we are gradually replacing it with non-crosslinked PE-LD in close cooperation with our customers. Together with JSP, we have developed Arplank as a very good alternative. Arplank has excellent technical and optical properties. We want to create the conditions for a closed material cycle in which foam packaging can also become foam packaging again. This is only possible with non-cross-linked mono-material.”

## First step: CO<sub>2</sub> balance

The path to a closed material cycle began at Wetropa in 2019, when the company decided to have a CO<sub>2</sub> balance prepared and henceforth to produce in a climate-neutral manner. To do this, it brought ClimatePartner on board. Breitkreuz makes it clear: “We wanted to know our carbon footprint. Most companies don't even know what they produce in terms of CO<sub>2</sub> equivalent. Only if we know where which amount of CO<sub>2</sub> is produced can we optimise processes and work in a more climate-friendly way.” No sooner said than done! Climate Partner calculated the carbon footprint based on international standards.



Top left: One of the vertical CNC contour cutting machines produces packaging for solar components from 50 mm thick white foam sheets.

Top: Detail from the CNC contour cutting machine, which now replaces the more energy-intensive waterjet cutting in many cases.

Left: The finished product at the end of the cutting process.



A key milestone is to return all production waste to the material cycle. Around 20 % of the foams are offcuts. The company collects this in-house, sorted by colour and white. Two plants shred the material, which is then fed into a compactor and reduced by three quarters of its volume. Round, manageable packages come out of the plant and are returned to the respective material suppliers. They crush and granulate the secondary raw material and mix it with the virgin material, which currently accounts for about 35 %. "Our goal is to achieve a share of 80 % recycled material. Technically, that's no problem, but we simply don't have enough input. The market does not yet offer that," explains Breitzkreuz.

Last year, the packaging specialist offset around 4.1 million kg of CO<sub>2</sub>e through solar energy, forest, and marine protection projects around the globe. Offsetting costs money. According to Breitzkreuz, this is an excellent motivation to actually live sustainability: "We want to reduce the costs for the compensation payments, because they hurt. That's a good thing! Only when something hurts does the pressure to act increase and something changes."

Today, the block welding machine replaces manual hand welding equipment in many cases. This reduces the energy need.



### ReFoam material concept

Wetropa's new material concept goes by the name of ReFoam. It includes five non-crosslinked expanded PE-LD with different densities and technical properties. The foam specialist has been working with four of them for a long time, with the newcomer Arplank only since the beginning of 2022. Due to its very uniform cell and wall thickness

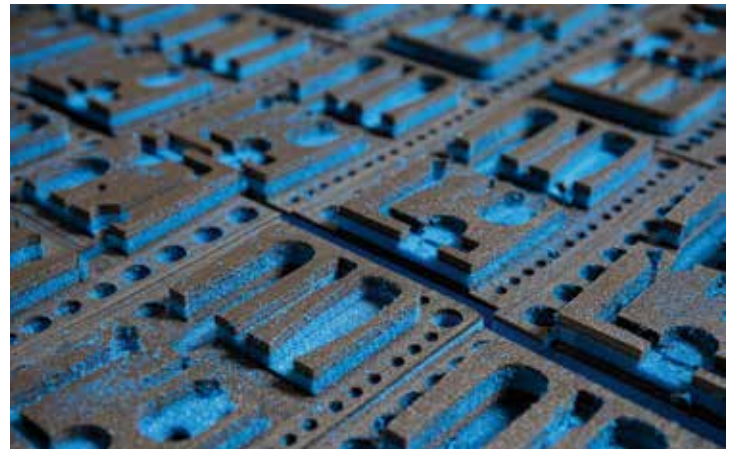
Two pre-cut elements are prepared for the welding process by an employee.



and fine pores, the expanded closed-cell PE LLD is the candidate to replace cross-linked foams. However, according to Breitreuz, the development was about more than that: "We wanted a sustainable material that also deserves the designation. Arplank scores with up to 40 % less density with the same cushioning properties as cross-linked materials. This saves us resources. It is also fully mechanically recyclable and does not require any chemical propellants." The technical properties are also impressive: The compression set is between 4 and 6 %, depending on the density. Conventional chemically cross-linked materials with comparable density are between 13 and 18 %. The foam is suitable for scratch-sensitive surfaces, is resistant to water, oils, most chemicals and does not off-gas.

"Colouring is not easy with the non-cross-linked foams," explains Breitreuz. Produced in an extrusion process, foamed with isobutane, pressure, temperature and humidity already influence the foam structure. "If colour is added, we quickly have problems with batch uniformity," Breitreuz continues. The ReFoam product concept offers pink for the conductive foams, black, white, and now also blue. The material manufacturers are working on other colours.

As part of the ReFoam portfolio, Wetropla guarantees climate-neutral products from the production of the foam to the gates of its customers. For this purpose, the suppliers state the CO<sub>2</sub> equivalent that was incurred in the production of the semi-finished products. "It is not at all commonplace to get this information from suppliers. Many don't know their CO<sub>2</sub> emissions at all, others don't want to name them. We only work with suppliers who cooperate with us on this," says Breitreuz, giving an insight into the details.



Finished milled and not yet cleaned tool inserts from one of the eleven CNC machining centres.

### Increasing openness for sustainable solutions

Legal requirements are increasing, more and more OEMs are demanding 'green' solutions, investors and banks are asking for sustainability when financing new projects – there are numerous good reasons for climate-friendly products. In conversation, many customers can be persuaded to accept small compromises in appearance if they receive a more sustainable packaging solution in return. But according to Breitreuz's experience, there is one thing that cannot be changed: "Sustainability must not be more expensive, then the customer will no longer go along with it."



## Innovations

### Thermoforming of UV-varnish coated materials and curing in one process



For high-quality decorative parts, when thermoplastic films or sheets with special coatings for special properties such as scratch resistance are used. Therefore these coatings have to be molded without any damage first and afterwards activated by UV light. The temperatures during activation of coating haven't to be a negative influence on shaping. For this reason, GEISS has developed a system for processing uncoated or coated thin-walled films or thick plates based on the current thermoforming machine series, in order to produce both the thermoplastic component and, if necessary, the UV curing in one cycle.



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For internal contours, waterjet cutting is still the method of choice.

That's why the packaging specialist works out concepts with its customers that benefit everyone. For example, a customer transports a product for which the packaging design changes for each application. Accordingly, the packaging can only be used once, after which it no longer "fits". The solution: after each use, the used packaging comes back to Wetropla and makes its way through the recycling process to become new foam packaging for the same customer. With a smile, Breitzkreuz sums it up: "We sell the same material several times to one customer."

Wetropla also takes back load carriers made of PP and PE. Even during the design of the packaging, the builders made sure that the components made of the two different materials were only plugged together and not firmly connected to each other. In this way, the materials can be separated, and the PE component is ready for recycling.

Multi-using is the motto for another customer. So far, he has used four different packaging designs for computers. For this, Wetropla's designers developed a single design for all four variants by mutual agreement. The advantage: all packaging is used; nothing is left over



The result of waterjet cutting: packaging for containers in the chemical industry.

because the demand for one model might be lower than for another. In addition: the batch size increases, Wetropla only must set up the machines once and production runs with a higher degree of automation and is thus more resource and energy efficient.

"Of course, it makes no sense at all if packaging material from us ends up on the other side of the globe and is then sent back to Mörfelden. But it can then be easily recycled locally. We clearly label our products for this purpose. Our aim is that our material is recyclable, no matter where it is in the world," says Breitzkreuz, explaining his objective in concrete terms.

### CO<sub>2</sub> reduction by half till 2025

By 2025, the company wants to save 50 % CO<sub>2</sub> in its production compared to 2019. This will have a positive effect on the compensation payments and on the climate. To achieve this, Wetropla scrutinises every step of the process: starting with purchasing from upstream suppliers, product optimisation in consultation with the customer, the entire production process, right through to shipping. "We question every step and check it for optimisation potential," assures Breitzkreuz.

A look into production makes it clear what the dedicated man means. On one of the three vertical CNC contour cutting machines, packaging for solar components is being created from a 50 mm thick white foam sheet. In the past, this would have been a case for the waterjet machine. But this would consume two-thirds more energy than the non-cutting contour cutting machine. The individual elements of the packaging are then welded together to form the final product. What used to be joined together with manual welding equipment is now done in a semi-automated process in a block welding machine that can be loaded from two sides. The manual welding process is significantly more energy-intensive than the block welding machine. "We now only use the manual systems for small batch sizes or designs that cannot be welded by machine," explains Breitzkreuz.



The foam sheets are stacked in the warehouse. The lion's share consists of non-cross-linked PE.

The waterjet system cannot be dispensed with completely. If a product has a recess on the inside or if small series are involved, it is still justified. Currently, the machine produces transport packaging for glass containers for the chemical industry from a 100 mm thick black PE-LD. Water jets require a lot of energy because the high-pressure system generates 4,000 bar with which the wafer-thin jet cuts the material. There is more wear on the components than with the contour cutting machine. On the other hand, the process is more flexible. Breitzkreuz's conclusion: "We won't do without it, but today we only use it in one-shift operation, and in the past the system ran in three-shift operation."

The product created on one of the two double-table milling machines is also sustainable: a presentation packaging for tool trolleys made of Arplank. Not long ago, this would have been made of cross-linked material, but today the customer relies on the non-cross-linked and thus recyclable PE. The compressors for the compressed air that the machine operator uses to remove the chips from the freshly milled tool inserts have also been replaced with new, more energy-efficient models.

An analysis of the production process showed that six process steps were usually necessary. Wetropa wants to reduce these to four. In the past, for example, employees often split a thick foam sheet into two thinner ones. That costs time and energy. Today, the company has the sheets delivered in the required thicknesses. LEDs have replaced classic light fixtures throughout the company, and a photovoltaic system provides electricity from renewable energy sources. Transport distances should also be kept as short as possible: A



The conveyor belt takes the production waste to the shredder and then to the compactor.

maximum of 500 km from the supplier to Wetropa, the customer should not be further than 1,000 km away.

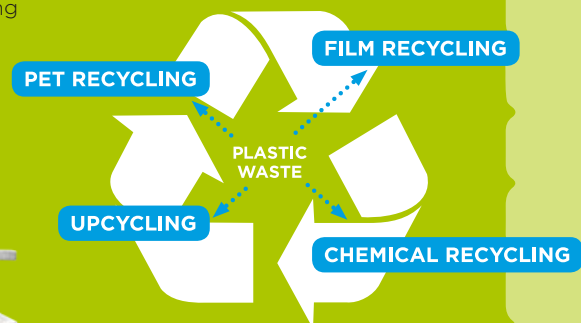
It is not uncommon for transport protection made of foam to be insufficient; instead, system packaging made of foam, corrugated cardboard and wood is needed to protect the product. Here, too, the requirement is to separate and recycle the components by type. "We always design all our packaging solutions so that the materials can be

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“We can’t achieve sustainability if everyone sits in their own closed room. It can only be achieved together with customers, suppliers, and competitors. We all must work together to make our industry greener,” Breitkreuz is certain.



An employee cleans the finished milled tool inserts from the double-table milling machine with the help of compressed air.

easily separated from each other. To ensure recyclability, we do not use any glue – neither for system packaging nor for pure foam packaging. Because that would flush another material into the cycle, making recycling impossible or difficult,” is how Breitkreuz describes the company’s philosophy.

### A look at the company

Today, there are eleven CNC machining centres at the two production sites in Munich and Mörfelden. The machinery is identical so that the two plants can compensate for each other’s possible downtimes due to illness or machine maintenance. “This helped us a lot during the Corona pandemic, because we had sick leave of up to 30 per cent at times,” Breitkreuz recalls. The company has a sales office in Zurich. The group employs 140 people in total and generated a turnover of 20 million euros in 2021. When Breitkreuz bought the company in 1995, there were just 18 employees, and the turnover was EUR 1 million.

Packaging runs through production from batch size 1 to 60,000. Complex packaging solutions are designed by the company, standard solutions can be designed by the customer itself using software and only the data is sent to Mörfelden or Munich. The designers are often particularly challenged when it comes to small batches of down all the way to 1, because: “It’s usually a matter of the product having a high value,” explains

Breitkreuz. This can be an art sculpture by a well-known sculptor that goes on a journey. Or components for business jets or helicopters that are individually manufactured for a customer and require sophisticated transport packaging.

Just like the batch sizes, the delivery times of the packaging solutions vary. “We are the last link in the value chain before a product leaves our customers’ premises. Sometimes we receive orders at very short notice, but most of the time we are involved in the development of the packaging right from the prototype stage,” says Breitkreuz, describing the business. If the job must be done very quickly, delivery times of three to four weeks can sometimes be realised; however, the usual case is eight to ten weeks from design to material order to final delivery.

### Changes only work together

One thing is absolutely certain for Breitkreuz: “We won’t achieve sustainability if everyone sits in their own closed room. It can only be achieved together with customers, suppliers, and competitors. We all have to work on it together and exchange concepts, ideas, processes so that our industry really becomes greener.” To this end, the companies involved are working together on solutions in the recycling and CO<sub>2</sub> working groups of the Foam Plastics Association (FSK). Wetropa has presented its suppliers

with a specification book containing all the requirements for them so that the foam processor can meet its targets for CO<sub>2</sub> reduction of 50% by 2025. In return, the Mörfelden company informs its suppliers about the trends in the market, which properties – heat resistance, electrical conductivity, and the like – the materials of the future will have to meet. This enables them to get involved in development at an early stage.

“The Re in ReFoam stands for Reduce, Reuse, Recycle and with our approach we don’t want to leave that as an empty phrase, but fill it with life,” assures Breitkreuz. Reduce is about using less material through clever designs, using other materials with a lower density and optimising processing machines so that less waste is produced. In recycling, Wetropa has established initial take-back arrangements with individual customers, with more to follow. “We are currently conducting many discussions to expand this approach even further,” Breitkreuz tells us. In terms of materials, the share of recycled material is increasing and Wetropa is advising on reusable packaging. Finally, the use of the non-cross-linked mono-material ensures good recyclability. “With our ReFoam material concept, the modernisation of production and the close exchange with all participants in the value chain and our competitors, we really are becoming greener,” Breitkreuz is convinced. ■

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# Only sustainable products and processes meet the requirements of legislators and customers

Prof. Dr. Ulrich Giese sees the rubber industry with its high-energy processes as having a special responsibility for reducing consumption.

The K 2022 Scientific Council is comprised of eight university professors. The expert panel supports Messe Düsseldorf in implementing the guiding themes of resource conservation, energy transition and climate neutrality at the trade fair in mid-October. K-PROFI asks the individual professors about their favourite topics, their view of the World Fair and their wishes, especially for the plastics processing industry. Prof. Dr. Ulrich Giese, Managing Director and Head of the Elastomer Chemistry Department of the German Institute of Rubber Technology (DIK), University Professor for Applied Polymer Chemistry at Leibniz University and Managing Director of DIK Prüfungsgesellschaft mbH, all based in Hanover, takes part in the third interview.

## K-PROFI: Which topics are close to your heart?

Prof. Dr. Ulrich Giese: From my point of view as a chemist and head of DIK, the following topics are central from a socio-political and scientific point of view:

As contributions to climate protection, energy saving in the processing of polymers, especially in rubbers, the replacement of fossil raw materials by renewable materials (use of e.g. effective reinforcing fillers based on renewable raw materials) and the reduction of the CO<sub>2</sub> product footprint.

As contributions to the circular economy, the development of effectively recyclable elastomers (from the selection of raw materials to improved devulcanisation processes) as well as the improvement of the service life and ageing properties of polymer materials with the aim of increasing the useful life and safety in use of elastomer and plastic components. Numerous investigations into ageing and fracture mechanics/lifetime are the subject of various projects at DIK.

**Why should the plastics industry, in particular the processing companies, concern themselves with your heartfelt topic? What concrete benefits do you see in this? As a scientist, what input would you like to see from the processing industry?**

On the one hand, the topics addressed are important from a political point of view – think of the Green Deal – on the other hand, the plastics and rubber processing industry

should also get involved here for reasons of maintaining international competitiveness for the future. Without solutions in the area of sustainability and sustainable manufacturing of products, it will neither be possible in the future to meet legal requirements nor to implement the requirements as a supplier for large-scale industry such as the automotive sector.

**In your opinion, what urgent task is plastics processing paying too little attention to across the board? And what is the resulting need for action?**

First of all, a distinction must be made between the plastics processing and the rubber industry. Even though the rubber industry with about 73,000 employees is small compared to the plastics industry, based on daily life, mobility, and many technical applications of elastomers it can be stated: “You can’t do without rubber.” The reason lies in the special properties such as elasticity, high chemical and mechanical resistance and adaptability to technical requirements.

Rubber production involves high-energy processes such as compounding (the mixing of highly viscous polymers) and, as an important difference to plastic products, vulcanisation (cross-linking). In addition to the selection of suitable materials, there is a particular need for action here in the direction of energy saving.

The social image of the polymer processing industry must also be upgraded appropriately. This includes education and presentation of the relevance of polymer materials



Photo: DIK

Prof. Dr. Ulrich Giese, Institute Director of DIK and University Professor for Applied Polymer Chemistry at Leibniz Universität Hannover

and their partial indispensability for the implementation of environmentally relevant topics.

**What do you expect from young scientists?**

Young scientists should, of course, have a high level of creativity and commitment to the subject. The basis here is an appropriate education, which certainly needs to be modernised or rethought in the domain of some universities.

**Corona or no Corona: What will make the K Fair unique again in 2022? What inspiration, what insights and what signals are you hoping for?**

The K trade fair is an important event for identifying where and for what the right plastics and elastomers are important and indispensable. But it also shows where it makes sense to do without these materials. Another point is to show where we stand in the industry in terms of recycling and sustainability and what potential there is. **K**

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# Custom-made films for fast printing

Film specialist Polifilm develops self-laminating PE film for digital and online printers

**“Similar to thermo-laminating film, only without thermo and without adhesive,” is how Alexander Schulte-Derne describes the new self-laminating PE film in simplified terms. This film, developed by the Polifilm Group with headquarters in Weißandt-Görlau, is an ideal solution for the fast-moving market of digital and online printing with at times very small order volumes. Neither high machine investments nor long curing times are necessary unlike conventional films. K-PROFI learned more from the Product Centre Leader Protective Film and Special Applications about the first product, which has now been launched on the market, the further plans as well as the advantages and disadvantages of the new films.**

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

“When Grandma Erna orders 100 labels for strawberry jam during harvest time, she wants them printed and delivered quickly,” says Alexander Schulte-Derne, giving a vivid example of the order size and urgency in the digital and online printing industry. This makes it very clear that it is not uncommon for individual, small and time-limited orders to be involved here. And it is precisely for this niche application, which of course covers far more possibilities than jam jar labels,

that Polifilm has developed the new film solution in its own R&D department. Other products include classic, individualised stand-up pouches for food and non-food products.

“We have just launched the first product and are in the process of building up a full portfolio for various applications,” says Alexander Schulte-Derne, describing the current status. “In the long run, we will offer different material combinations and different film thicknesses between 65 and 160 µm with widths of 500 and 1,500 mm as standard and plan to sell around 100 tonnes of it already this year.” What is a small quantity for Polifilm Extrusion, which produces around 220,000 tonnes of polyethylene film annually for the medical and pharmaceutical industries, construction and agriculture, packaging, logistics, automotive and processing industries on more than 70 blown and cast film lines, is an important milestone for the target industry.

## Mono-material laminates increasingly in demand

Typical laminating films today consist of two films: a backing layer, the actual laminating film with a thickness of between 40 and 120 µm, and a printing layer with a film thickness of 25 to 40 µm. The print layer



is first counterprinted with the desired individual print image and then applied to the lamination foil either with adhesive or with the help of heat. Known material combinations for thermal laminating films so far are PE carrier layers and PET print layers. However, against the background of the poor recyclability of multi-material composites, the players in the flexible packaging market have long been looking for alternatives.

Monomaterial composites have been on everyone's mind for a while. These consist of 95 % of one material and may contain a maximum of 5 % foreign components, which do not interfere with later recycling, but are of great importance for desired property profiles. "PET print layers are no longer up to date, we are working on a pure PE or a pure PP solution," Alexander Schulte-Derne continues. While the all-PE solution based on PE/MDOPE works well and is also the one that has already been introduced to the market as a self-laminating film by Polifilm, he says it has not yet been possible to create a pure PE-HD or PP film composite that brings the desired properties for digital printing applications.

#### Machine investment minimised

Up to now, a bag or label manufacturer who buys the two film products on reels needs to use the printing press to first reverse-print the film. Then a corresponding laminator is needed for the thermal lamination, in which the two layers of film are bonded together with the aid of heat and contact pressure. "The laminator is an enormous cost factor, especially for newcomers," says Alexander Schulte-Derne. The laminating line is then followed by a further processing unit, for example in the form of a bag converting unit.

If the laminating film manufacturer uses adhesive lamination instead of thermal lamination, no expensive lamination unit is required, but a two-component polyurethane adhesive must be applied before the two films are joined. "The disadvantage of adhesive laminations is that they usually have to cure for 48 to 72 hours, which is a downside especially for the fast-moving market of online printers," explains the Product Centre Leader. He sees another disadvantage in the fact that the application of the adhesive is rather labour-intensive, and the PU adhesive must be in the correct viscosity range for easy handling and good adhesion.

In contrast to the two commercially available variants described above, the new self-laminating films for these applications require neither a high machine investment nor high labour costs, but they are more expensive. "The new films cost up to 40 % more than thermo-laminating films, and about 20 % more than adhesive films," Schulte-Derne openly admits, but calculates that this is nevertheless definitely worthwhile in terms of the advantages and the machine investments that are not required.

#### Job size and speed as main advantages

To ensure perfect bonding of the new films, the self-adhesive laminating film has a special corona treatment. This must be activated before joining, so that with a slight contact pressure of 3 to 4 bar the



laminating and printing film form an optimal bond. The order can be shipped after just one hour. "The time-to-market is significantly reduced, which is a decisive advantage for on-line printers," Alexander Schulte-Derne is certain. This is confirmed by initial feedback from customers who are using the new foils. Suitable printing processes for the films are digital printing and printing with solvent-based inks; UV inks cannot be used so far. In specific terms, the new film consists of a coextruded multi-layer film based on PE, with appropriate additives in individual layers ensuring the desired property profile. The inner layer contains the polyolefin adhesive, which is chemically

activated by the corona pre-treatment. An MDOPE is used for the printing film. Overall, the self-laminating film contains less than 5 % foreign content and is thus considered a recyclable mono-material composite.

"Both with the film itself and with the reduced machine requirements and the resulting lower CO<sub>2</sub> emissions, we are considering the demands for sustainable products that can be recycled. Especially for the online printing industry, our self-laminating film is also a perfect solution for processing small order sizes quickly," Alexander Schulte-Derne is convinced and refers to self-laminating barrier films as a development project of Polifilm that is to expand the product range even further. ■

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# Recycling: It doesn't work without the consumer!

How an app can improve recycling rates and when this is also possible in Germany.



Every consumer can collect up to 35 points per week and thus take part in prize draws for attractive prizes.

the app. "In order to get people to click on downloading in the jungle of the many apps available, we have to actively raise awareness," Stefan Siegl reports from last year's experience. The company RecycleMe, in which around 30 experts deal with the topics of recyclability of packaging as well as regulatory developments in the context of extended producer responsibility and whose product area includes the RecycleMich app, is therefore very active in various social media channels and calls on consumers to join in. They also use events, radio, television and trade fairs for information and recruitment. "Our main target group is people between the ages of 18 and 60 and especially young families," explains Stefan Siegl and reports that the preferred recycling day of the week last year was actually Sunday, which indicates that they are families and working users.

**Recycle Everywhere** – that's the apt name of the app that many consumers in Canada have been using for over a year to make their contribution to the circular economy. The app has also been available in Vienna since last year, where it is called "Recycle Mich" and already has many users. In total, the Herborn-based Raan Group, whose subsidiaries are responsible for the development and operation of the apps, has recorded 60,000 downloads since its launch – three times as many as originally planned at that time. Stefan Siegl, Head of Digital Innovations at Recycle-Me GmbH – one of the subsidiaries of the Raan Group – explained to K-PROFI why the RecycleMich app is so important, what consumers need to do, when the app will be available throughout Austria and when the pilot project will start in Germany.

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

Recycle everything could be added because that is exactly what it is all about. In order to achieve the recycling quotas prescribed by the EU, significantly more recyclable plastic material must be taken out of the waste streams and reprocessed. "Without the consumers, the recycling quotas cannot be achieved in the long run," Stefan Siegl is sure, "still too much recyclable waste ends up in the residual waste bin."

That is why the app was developed, which on the one hand makes it easier for consumers to dispose of packaging correctly and on the other rewards them with attractive prizes for their active contribution to environmental protection and recycling. "Recycle Everywhere and RecycleMich are incentive apps that encourage users to participate with great prizes." However, that alone is not enough to make consumers aware of

## How does the system work?

Basically, anyone can download the app and do their bit for recycling. All they have to do is register with their email address and a password and they can get started. In Vienna it currently works like this: The consumer who wants to dispose of a beverage bottle or other light packaging, for example, uses the app to find the nearest yellow bin and starts the recycling process here. He takes a photo of the bin and scans the barcode of his packaging. "Thanks to artificial intelligence, the system can assign this to the corresponding user, who then gets one point credited to his account for each correctly disposed packaging," Stefan Siegl further explains. Each consumer can collect up to 35 points per week, with the company currently recording an average of 12 points per user per week. Each point is entered into the weekly prize draw, which offers up to 300 prizes. These include food vouchers

worth 10 euros, hotel vouchers or one-off prize opportunities such as technology gadgets or a Weber grill. The prizes are donated by the partner companies of the RecycleMich app, which are very interested in recycling activities. Coca-Cola Austria was involved from the beginning, shortly afterwards Henkel joined as the first non-food partner - both companies that already use recycled goods in many of their packaging and have set themselves high recycling targets. Other partners include other brand owners, food chains, but also advertising partners who benefit from the direct connection to the consumer.

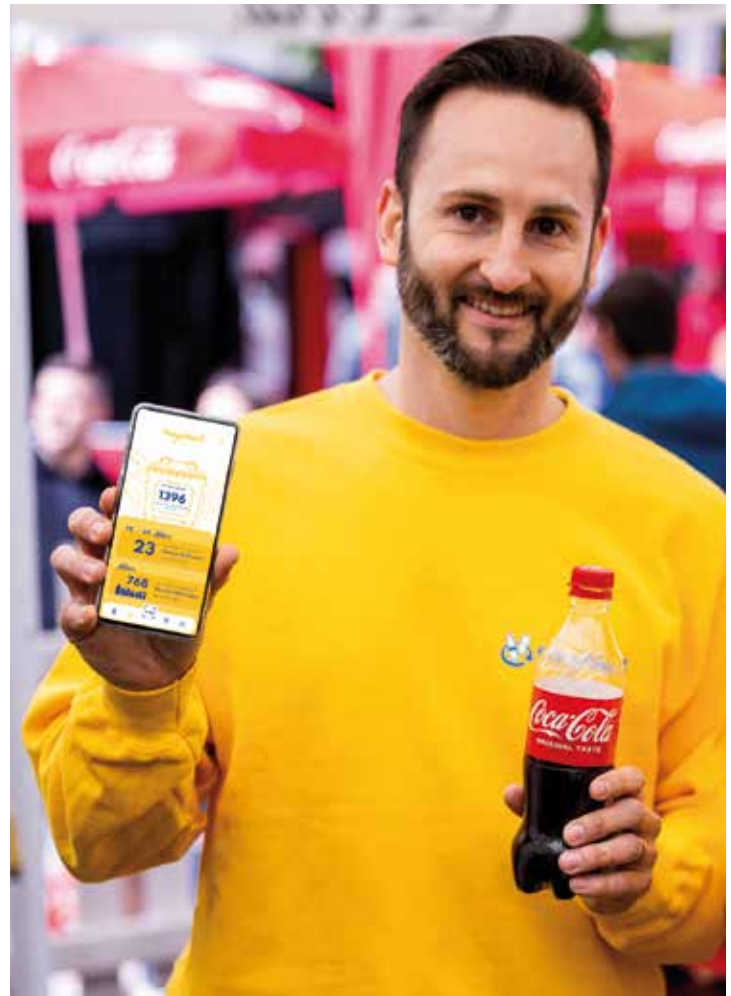
### What's next?

"In Austria, we will soon take the next step and offer the app in many regions beyond Vienna," Stefan Siegl describes the way forward. For example, RecycleMich wants to have 40,000 active app users in Austria alone by the end of the year. Also this year, a pilot project is to start in Germany, initially in Hamburg. "We are currently in talks with cooperation partners and want to be online in Hamburg by the end of the year at the latest."

In the medium term, the RecycleMich app is to be initiated throughout Europe and also in developing countries. "We are already in concrete talks here as well," reveals Stefan Siegl, who is convinced that the app could also be used for other products in the future. "Of course, glass or old batteries, for example, can be brought from the consumer to the right disposal location via similar routes." Whereby "bring" is certainly the wrong term in Germany and also in large parts of Austria, since there are established collection systems for the waste streams here, such as the yellow bin, which is on every consumer's doorstep.

"Our apps complement the established waste disposal structures. The aim is to better inform consumers and, through the rewards, encourage them to dispose of waste more precisely. In this way, less recyclable packaging should end up in the residual waste bins," Stefan Siegl once again makes it very clear. Only in a few cities, such as Munich or Vienna, are there public bins to which consumers bring their packaging. In the other places, every consumer can register their own "home base" and participate with very little effort. This lowers the inhibition threshold and thus increases the attractiveness of the

Without the consumer, the required recycling quotas cannot be achieved. That is why RecycleMe GmbH is contacting potential app users through a wide variety of "channels".



Stefan Siegl explains why it is so important to dispose of beverage bottles correctly and thus increase recycling flows and how the app can help in this regard.

app even more, so that Siegl assumes that the goal of tripling the number of app downloads can be achieved this year. In addition to consumer awareness and education, this also increases the plastic material flows for recycling. ■

[www.recycleme.eco](http://www.recycleme.eco)

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# Reconciling ecology and economy

What measures the Hamburger Sund Group is taking to achieve the recycling targets it has set itself.

Rubbish bags and disposable gloves are among the core products that the Hamburger Sund Group develops and sells. Classic disposable products that are not immediately associated with sustainability and resource conservation. But this is precisely what is particularly important to the group of companies, which includes Emil Deiss KG, Fipp Handelsmarken GmbH & Co. KG and Bingold GmbH & Co. KG. “We have set ourselves the goal of now using 100 per cent sustainable raw materials and recycled materials in all our products by 2030 instead of the previous 42 per cent,” explained Karen Queitsch, Managing Director Sustainability and Innovation, and Clemens Eichler, Managing Director at Emil Deiss, in conversation with K-PROFI and explained this in more detail using the two product examples mentioned.

*Text: Dipl.-Ing. (FH) Karin Regel  
and Dipl.-Chem. Toralf Gabler, editors K-PROFI*



“We have made sustainability a top priority and are working very hard to achieve the goals we have set ourselves,” emphasises Clemens Eichler and says that the strategy is well received and supported by the staff. Eichler himself heads Emil Deiss KG, which he says is the German-speaking B2B market leader of bin liners/waste sacks for the away-from-home sector such as commercial cleaners, healthcare, trade, and industry. “PE rubbish bags for these sectors have to meet certain requirements in terms of strength and safety, which definitely makes it more difficult to use recycled goods,” explains Clemens Eichler.

## Films from the residual waste bin

Currently, the bags, which are produced to a large extent together with RKW, already contain a share of almost 100 % recycled material, whereby this has its origin in post-industrial waste. Post-consumer waste is a hurdle, especially for the healthcare and catering sectors, because of the odour issue. And yet Sund Group deals precisely with these materials. And not only with the recyclables from the yellow bin, but even with the much more complicated films from residual waste. “Far too much plastic waste still ends up in the residual waste bin, which is not recycled but incinerated,” Karen Queitsch emphasises. At Sund-Lab, they are testing the possibilities and limits of reusing film residues from the residual waste bin. “We are examining the material very closely, using special absorbers to reduce odours and testing what percentages of these can be used in bin liner production,” explains the Managing Director Sustainability and Innovation, and immediately admits openly that single-digit percentages will be used in the first step.

Incidentally, the Sund Group receives the recyclate from the Netherlands, where a pilot project is currently underway in which PE film products are separated from residual waste, cleaned, and reprocessed using precise sorting processes. “Only with the plastic waste from residual waste can the cycles be almost completely closed,” says Clemens Eichler, who sees the path taken as the right one and hopes for further expansion.

## Bin liner production back to Europe

In his opinion, it is also important to relocate both the production of the bin liners and the raw material production itself from Asia back to Europe. “This is the only way we can combine economic and ecological interests,” he is certain. Today, he says, a tonne of PE costs about 1,100 kg in Asia, while it costs more than twice that in Europe. The use of recyclates also offers the possibility of bringing the production

Clemens Eichler: “Only with the plastic waste from residual waste can the cycles be almost completely closed.”

of the small bin liners back to Europe. Transporting PCR to Asia to replace virgin material makes no sense from either an ecological or an economic point of view, he said. "In order to realise economically sensible sustainability, we must at least shift the production of the bin liners back to Europe in order to ensure material flows here and to be able to consistently increase the recycled content," he says.

### Natural rubber reduces CO<sub>2</sub> emissions

However, recycling, or circular economy are not always possible in the first place. "Our disposable gloves are mainly made of cross-linked nitrile or natural rubber. Recycling as with thermoplastic materials is not possible here," explains Clemens Eichler. In addition, disposable gloves used in the medical sector, for example, must be incinerated after use anyway. "With the global market almost doubling since 2019 to around 500 billion units, it was important for us to look for ways to make more sustainable products here as well," Karen Queitsch emphasises. To this end, the ifeu Institute for Energy and Environmental Research in Heidelberg was commissioned to draw up the life cycle assessments of the disposable gloves. "The result is that, from an ecological point of view, natural rubber is clearly superior to nitrile rubber," Queitsch summarises. "In comparison, natural latex gloves from the Sund Group cause only about one tenth of the CO<sub>2</sub> emissions of gloves made of nitrile rubber, whose market share is over 70 per cent. The CO<sub>2</sub> emissions of PVC gloves, whose market share is falling anyway, are even almost thirty times higher."

### Better eco-balance despite higher weight

At the same time, according to Clemens Eichler, the grammage of natural rubber gloves, at a minimum of 5 g, is significantly higher than that of the nitrile rubber variant, at a maximum of 3.5 g, which is often seen as an ecological advantage. "However, when considering the overall eco-balance, the advantages of natural rubber as a renewable raw material come into play compared to mineral oil-based synthetic rubber," explains the Managing Director. "In addition, our local producers subsequently use the biomass created over the life of the rubber trees, which lasts around 30 years, to generate energy." This further improves the eco-balance of the gloves.

Sund therefore wants to significantly increase the proportion of gloves made from natural rubber in the future – and not just for environmental reasons. "Earlier problems with the natural material, which caused allergic reactions due to the proteins it contained, are no longer an issue with today's production standards," Eichler says, dispelling any concerns in this regard. In addition, there is the

More post-consumer recylcate to be used in Sund Group's waste bags in future.



Right: The disposable gloves made of natural rubber latex cause a significantly lower CO<sub>2</sub> footprint compared to nitrile rubber gloves.



Karen Queitsch: "From an ecological point of view, natural rubber is clearly superior to nitrile rubber."

"unsurpassed" elasticity, which would make sensitive work in particular much easier with such gloves. "All these advantages ultimately justify the higher price of up to 10 per cent of natural rubber gloves." Moreover, Eichler is convinced: "If the CO<sub>2</sub> emissions were monetised, natural rubber gloves could also keep up with nitrile rubber gloves in terms of price, despite their higher weight." ■

[www.sund-group.com](http://www.sund-group.com)



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# Is defence technology now becoming respectable again?

Since the end of February, our hitherto wholesome world order has been turned upside down. The Bundeswehr, equipment and defence budget have come out of their decades-long dubious reputation. Everyone is now more than aware of the need to restore defence capability as quickly as possible. The process will probably take five to ten years, and in order to succeed, encrusted procurement channels must be reformed or streamlined as quickly as possible.



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

The special budget of 100 billion euros proclaimed by Chancellor Olaf Scholz gives the soldiers hope for better times, when they will no longer have to procure the simplest functional clothing from their pocket money and look enviously at better-equipped outdoor campers. The focus of the army is once again on its original task, and I hope that discussions about grammatical gender ranks, perhaps too tough (but necessary) training content, a far too expensive "Gorch Fock" and rifles shooting around corners will quickly fade into the background.

Plastics can be found along the entire supply chain - from simple functional socks to tents to high-tech equipment. Lightweight construction and special applications such as exoskeletons can only be realised with plastics. Not only industry, but also research can contribute to meeting the highest requirements, if desired. As far as I know, plastics research in the field of defence technology has almost come to a standstill in German-speaking countries. There are also synergies with medical technology, for example, which is clearly illustrated by the example of exoskeletons: These can support soldiers in carrying the heaviest loads as well as paraplegics in regaining personal mobility and quality of life.

Mobile halls and shelters such as the development of "tent houses", which can be used in the event of natural disasters, should be adapted for the Bundeswehr as quickly as possible in a practical and robust manner. Container shelters and flexible, modular hospitals are needed in many areas of operations. All of these were sufficiently available to the Bundeswehr in the distant past but are lacking in the inventory today. And revolutionary lightweight halls are also needed by the industry.

Companies are now faced with several challenges, and the fundamental decision to include the development, production, and quality assurance of defence technology in strategic planning must be made consciously. The understandable moral objections to comprehensible business interests and necessities of this sector must be weighed by each individual entrepreneur.

Understanding the special standards and approval procedures of the military is just as much a next step as building up a specific sales organisation and production that meets the high security requirements. If access to the Bundeswehr Procurement Office (BAAINBw) in Koblenz is successful, in the past it was necessary to exercise years of patience in order to get the go-ahead. The current situation now seems to open new possibilities.

The catch-up demand of the Bundeswehr, but also of other armed forces, is enormous in light of the threat that has become apparent. Existing systems have to be (re)produced in larger numbers and new ones have to be developed with accelerated release procedures.

Hopefully, the pragmatism shown in the approval of Corona vaccines will also spread to this industry, without the development having to be completed in the field, as was the case with the Starfighter in the 1960s and 1970s. This is an opportunity for our industry that none of us would have wished for, but which must be seized. ■

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Inspiration for plastics processors**

### Editors

Dipl.-Ing. Markus Lülting, Editor-in-Chief (responsible)  
Tel. +49 (0)9123 9609-10, [lueling@k-profi.de](mailto:lueling@k-profi.de)

Dipl.-Chem. Toralf Gabler, Specialist Editor  
Tel. +49 (0)9123 9609-11, [gabler@k-profi.de](mailto:gabler@k-profi.de)

Dipl.-Ing. (FH) Sabine Rahner, Specialist Editor  
Tel. +49 (0)711 8877248, [rahner@k-profi.de](mailto:rahner@k-profi.de)

Dipl.-Ing. (FH) Karin Regel, Specialist Editor  
Tel. +49 (0)2433 938941, [regel@k-profi.de](mailto:regel@k-profi.de)

Dipl.-Ing. Janne Reisch, Esq., Copy Editor  
[janne.reisch@gmail.com](mailto:janne.reisch@gmail.com)

Dipl.-Ing. Gabriele Rzepka, Specialist Editor  
Tel. +49 (0)6172 8689940, [rzepka@k-profi.de](mailto:rzepka@k-profi.de)

### Editorial address

Luitpoldstr. 5, 91207 Lauf an der Pegnitz, Germany  
Fax +49 (0)9123 9609-29, [redaktion@k-profi.de](mailto:redaktion@k-profi.de)

### Publisher

Kunststoff-Profi Verlag GmbH & Co. KG  
Saalburgstr. 157, 61350 Bad Homburg, Germany  
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[info@k-profi.de](mailto:info@k-profi.de), [www.k-profi.world](http://www.k-profi.world)

Personally liable shareholder:  
Kunststoff-Fachmedien GmbH  
Saalburgstr. 157, 61350 Bad Homburg, Germany

### Management

Andreas Hertsch, Markus Lülting

### Advertising management

Gero Trinkaus, P.O. Box 31 24, 29231 Celle, Germany  
Tel. +49 (0)5141 99 32 026, [trinkaus@k-profi.de](mailto:trinkaus@k-profi.de)

### Distribution and reader service

Annabelle Hertsch  
Tel. +49 (0)6172 9606-23, [vertrieb@k-profi.de](mailto:vertrieb@k-profi.de)

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### Design concept and layout

Dipl.-Kommunikationsdesigner (FH) Oliver Schneider  
Tel. +49 (0)9123 9609-15, [schneider@k-profi.de](mailto:schneider@k-profi.de)

### Production

Therese Stübinger  
Tel. +49 (0)9123 9609-12, [produktion@k-profi.de](mailto:produktion@k-profi.de)

### Copyright and publishing law

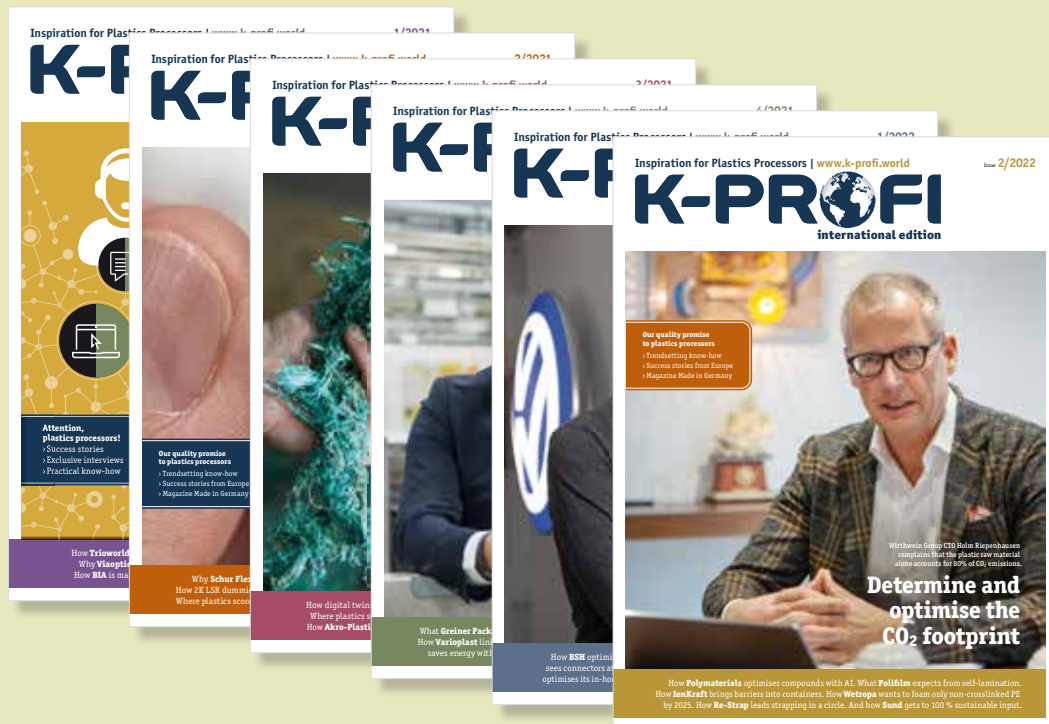
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