

02/2023

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EXTRUSION INTERNATIONAL

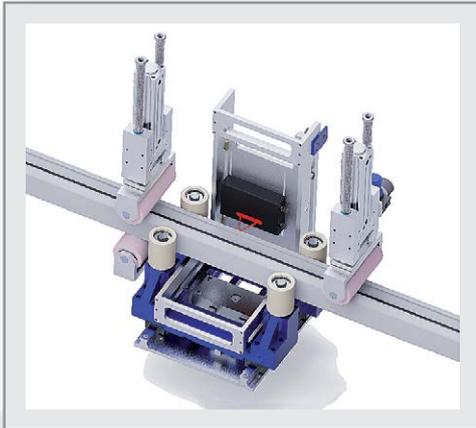


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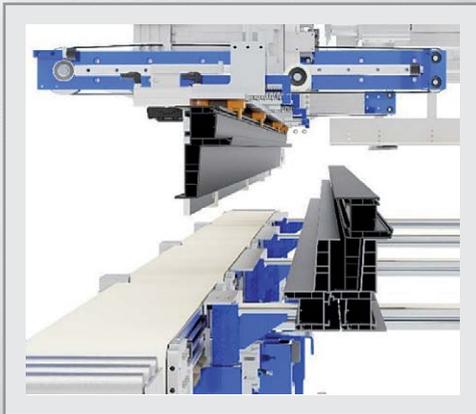
Stein Profile Stacker



Profile length measurement during extrusion

Measuring sensors are used to determine the length of individual profiles before a profile layer is formed.

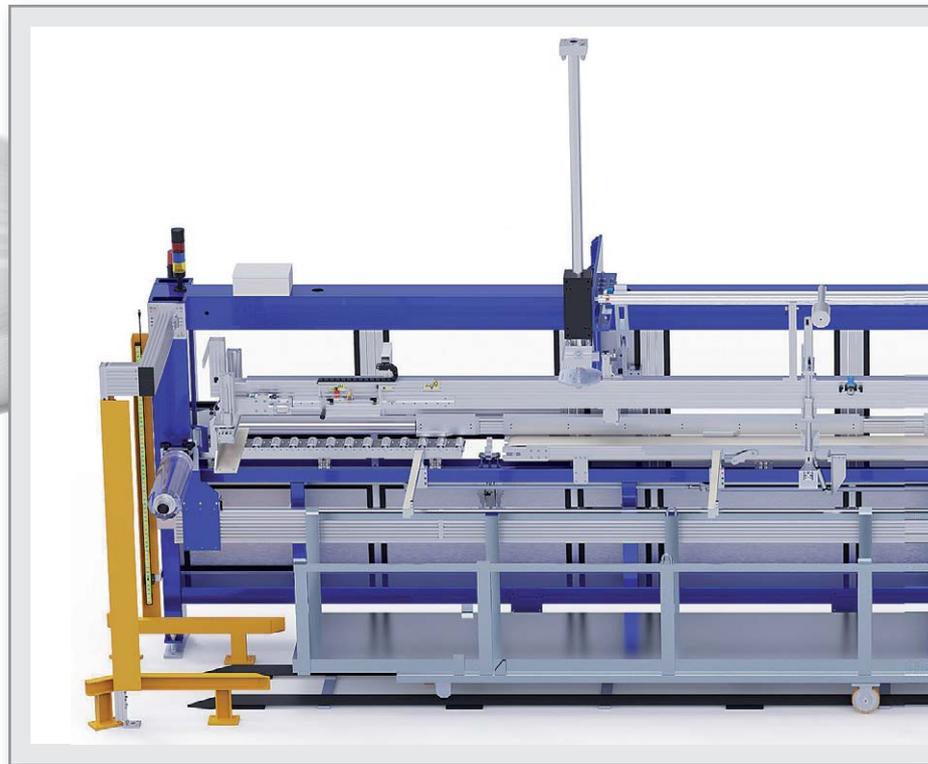
The measured length can be used to check and correct the cutting device of the extrusion line or for documentation (quality assurance) of the produced profile lengths.



Stacking of special profiles

Stein Maschinenbau offers technical solutions for stacking of heavy and large monoblock profiles.

Based on decades of experience, we can evaluate unusual profile geometries or special layer for their automated stacking.



Cassette spreader

With the help of a cassette spreader it is possible to realise the same packing density of the manual packaging.

Stein Profile Stacker



Weight determination during extrusion

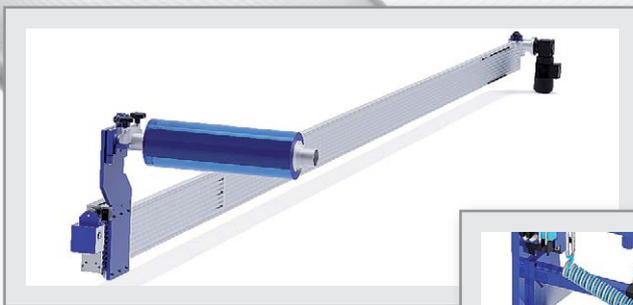
With the help of special weighing units, individual profiles can be weighed before a profile layer is formed. The determined weight can be used to optimise the extrusion.

As a specialist in the field of special machine construction, we always find a solution!



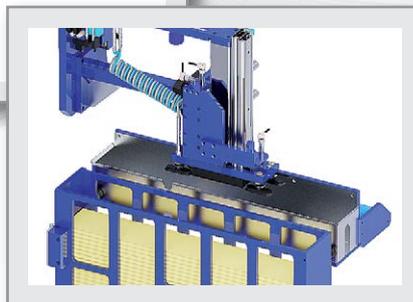
Cassette handling

The handling system allows empty cassettes to be fed into the automatic stacker and the filled cassettes to be pushed out.



Profile interlayer

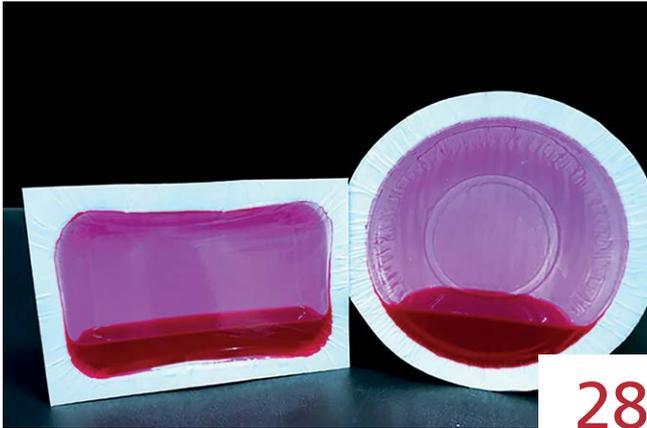
Endlessly laid as a foil between the profile layers or with individual strips laid on the layer.



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GmbH & Co. KG**

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The Fraunhofer Institute for Process Engineering and Packaging will be presenting its new technologies and solutions for business in the packaging and food industry at the interpack trade fair



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"Bausano is at the fore-front, alongside the sector's operators, to respond to the market's new requirements, with ad hoc designed technologies that implement innovative transformation methods, which are also energy-saving," says Massimiliano Fenili, Bausano's Technical Manager



34

According to leading surface treatment authority, Vetaphone, understanding the extrusion process and the effect it has on the production chain of printing and converting film is an essential key to success



35

T3 (EPZ) Limited, a member of Megh Group, ordered a Starlinger recoSTAR PET bottle-to-bottle recycling line for its new plant in Athi River, Kenya

A leading US manufacturer of sustainable decking products made of wood-plastic composites uses measuring technology made in Germany for its quality control. The PIXARGUS inline system, ProfilControl 7 DX WoodPlasticComposites, ensures 100% inspection of the entire board profile in a continuous, inline Process



38



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Project STOP and its partners reached significant milestones and successes in demonstrating a model for expanding affordable waste management and recycling solutions to help address the plastic waste challenge in Indonesia

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16 - 17 May 2023
Branchburg / New Jersey, USA
May Zaw: mzaw@leistrizt-extrusion.com

wire and Tube Eurasia

24 - 27 May 2023
Istanbul / Turkey
www.wire-eurasia.com
www.tube-eurasia.com

OMAN PLAST 2023

29 - 31 May 2023
Muscat / Oman
www.omanplast.net

PLAST 2023

05 - 08 September 2023
Milan / Italy
www.plastonline.org

SCHWEISSEN & SCHNEIDEN

11 - 15 September 2023
Essen / Germany
www.schweissen-schneiden.com

Chemical Recycling Europe (CRE)

21 - 22 September 2023
Brussels / Belgium
www.polymercomplyeurope.eu

POWTECH

26 - 28 September, 2023
Nuremberg / Germany
www.powtech.de

Interplas

26 - 28 September 2023
Birmingham / UK
interplasuk.com

Fakuma 2023

17 - 21 October 2023
Friedrichshafen / Germany
www.fakuma-messe.de

PLASTPOL – The Gateway to New Sales Markets

23 to 26 May 2023, Targi Kielce

■ According to the Plastics Europe Polska Foundation, 2021's European plastics production increased from 53.9 to 57.2 million tonnes. Poland ranks third in terms of demand for plastics (100 kg/person), right after Germany (140 kg/person) and Italy (122 kg/person). Therefore it comes as no surprise that PLASTPOL – the Polish expo dedicated to the plastic processing industry has been one of the most important events of this type in Central and Eastern Europe for years.

Poland already boasts of having a highly developed processing sector, employing over 200,000 people. According to Plastics Europe data, the local plastics production volume is estimated to reach 1.7 million tons. Therefore, PLASTPOL - Poland's International Fair of Plastics and Rubber Processing has become a popular destination for companies looking for investment and development opportunities. The upcoming PLASTPOL promises to be a focal point for industry representatives and business insiders from all around the world; from Turkey, Qatar, Germany, Italy, India and Balkan countries, showcase their products and services. However, the list of exhibitors is really extensive.

The next year in the industry will be marked by the closing production cycles. Current technology makes it possible to make machines that practically use recycled plastics.

Not only is this a pivotal change but also good news for the processing sector, because it allows for a fundamental change in thinking about plastics processing.

The analyses of global institutions, which are industry insiders have proven this trend. Matt Seaholm, president of Plastics Industry Association (PLASTICS): "The plastics industry keeps developing and introducing new technologies to the manufacturing process; this



encompasses more recyclate, less virgin materials, recyclable designs and better performance designed to protect food and beverages better, a significant reduction of waste."

PLASTPOL expo hosts over 900 companies from all corners of the world, the exhibitors use almost 34,000 sq m of exhibition space. The show is a magnet for 20 thousand visitors. The potential of Polish processing trade show is also recognised by global institutions, both the Embassy of Angola and Qatar Development Bank together with Qatar Financial Centre joined the expo to present their economic potential. Not only did they exhibit at Plastpol, but also organised a series of meetings devoted to investment opportunities as well as these countries' production industries' development prospects. For over a quarter of a century, Targi Kielce has offered plastics and rubber processing industry the space to hold successful business meetings and strengthen personal contacts.

Fakuma 2023 – It's filling up at the Friedrichshafen Exhibition Centre



■ The 28th Fakuma international trade fair for plastics processing will take place from the 17th through the 21st of October, 2023. Innovations from the fields of injection moulding, extrusion technology, thermoforming and 3D printing will be at the centre of attention. The internationally trade fair brings the entire plastics industry together. This top event is a technology signpost for plastics production and processing and will highlight further solutions dealing with the issues of sustainability, circular economy and recycling.

At the end of January 2023, trade fair promoters P. E. Schall had already registered 1169 exhibitors from 38 countries. "Halls A1 to A7 and B1 to B5, as well as the east and west foyer areas, including the east concourse, are nearly full," reports Fakuma project manager Annemarie Schur. "We're very pleased to announce that nine months before the trade fair begins, it's becoming apparent that the halls will be full again at Fakuma 2023," says Schur. 42% of the exhibitors registered thus far come from outside of Germany – more than at the last Fakuma in 2021. "One senses the significance of issues like environmental protection and the digital transformation, as well as sustainable and efficient plastics processing," explains the project manager. "Expert visitors can expect to find essential innovations for pioneering, future-oriented solutions."

Fakuma 2021 once again made it plainly evident that the trend towards digitalisation has accelerated and that future-oriented concepts are being developed in order to establish a circular economy for plastic products. And thus as a recognised business platform for innovations throughout the value creation chain, Fakuma is the ideal setting for presenting new products and technological solutions, as well as for discussing forward-looking issues and addressing relevant topics in a concise manner. For example at his technical presentation to an auditorium full of trade press and guest listeners, Professor Dr.-Ing. Martin Bastian, director of the SKZ Institute in Würzburg, pointed out what needs to be done in the industry: "We have to take on more responsibility for what's happening with

plastics. We have to ensure that plastic isn't just accepted, but rather used with enthusiasm as well. And we have to do a lot more to educate people about its benefits," says Bastian.

As a result, circular economy is one of the major themes of this year's trade fair. "Once again, Fakuma 2023 will provide a suitable platform for discussing current challenges faced by the industry and addressing them in a targeted manner," notes Bettina Schall, managing director of trade fair promoters P. E. Schall GmbH & Co. KG. Expert visitors and exhibitors will meet again this year and conduct discussions on an equal footing at high levels of expertise in an informal atmosphere. Fakuma will demonstrate the indispensability of plastic products against the background of sustainability and the efficient use of resources. Trade fair visitors can look forward to experiencing the extent to which a pioneering spirit and a targeted strategy can be leveraged to produce plastic parts in a competitive, sustainable and digitally networked manner.

Preparations for this year's edition of the Fakuma are running at full bore. As representatives of the entire exhibitor community, the exhibitor advisory board is also looking forward to the event. "Fakuma is a technical event that you shouldn't miss under any circumstances," explains Rüdiger Dzuban, marketing and sales manager at ONI-Wärmetrafo GmbH in Lindlar, Germany. "We'll experience the immense value of plastics here, because plastic is a resource and not a waste material," observes Dzuban.

An exhibitor forum with world-class technical presentations is once again in preparation as well. "Fakuma 2021 was highly acclaimed and we'll build upon this in 2023," says Bettina Schall. "Technological developments give rise to new solutions for current challenges. For this reason, we cordially invite all industry players to the 28th Fakuma to discuss important current and future issues."

CHINAPLAS 2023 – *Plastics Industry Intensifies Innovations Towards a Circular Economy*

■ Rapid urbanization and changing lifestyles have encouraged the expansion of plastics application in a wide range of industries such as food and beverage, automotive, electronics and electrical, home appliances, and healthcare. It is no surprise that the global production of plastics has reached 400 million tons each year with projected 35 billion tons produced by 2050, as announced during the United Nations Climate Change Conference (COP27) held in November 2022. Plastic consumption – especially for single-use plastics – has created a huge challenge to our environment. The industry now spares no effort to intensify innovations towards a circular economy for sustainability development.

Based on a report by World Bank, around 2 billion tons of municipal solid waste is being generated every year and this is expected to reach 3.5 billion tons by 2050. For the fast-growing regions of the world, such as East Asia and Pacific region, their plastic waste generations are expected to increase by 70% by 2050. It is imperative for the governments in this region to act fast.

Another finding by the Ellen MacArthur Foundation claimed that the world's oceans could contain around 937 million tons of plastic compared to 895 million tons of fish by 2050. The coronavirus pandemic that began in 2020 pushed single-use plastics usage by as much as 300%. These findings have put the plastics industry at task to come up with urgent solutions to alleviate the burden to the planet – and the circular economy model has been identified as the best option.

The plastics industry is transitioning from a linear model to circular economy model (Photo: Pexels)



Circular economy concept aims to reduce the amount of plastic waste generated by applying a "closed loop" system, redesigning how plastic products are taken, made, used and reused

From linear to circular

The plastics industry has long been applying the linear model, or "take-make-dispose" approach where plastics are produced, used, then disposed as waste, bringing challenge to waste management and environment protection.

As a solution, the circular economy concept aims to reduce the amount of plastic waste generated by applying a "closed loop" system where plastics is produced, used and re-used in a continuous cycle to prevent its leakage to the environment. This model is seen as an appropriate way to address the core of the issue, especially for single-use plastics, as redesigning how plastic products are taken, made, used and reused to minimize plastic waste.

Packaging, for example, accounts for the largest segment of plastic applications. Circular economy as applied in packaging requires innovations in production technologies and materials to ensure that the plastic products are reusable, recyclable, or compostable. It also places responsibility to businesses engaged in plastic packaging to ensure that disposed items are collected, recycled or composted, for re-use as input in the manufacture of new product. The vision for a circular economy includes reducing the need for single-use packaging and transitioning towards 100% reusable, recyclable or compostable to alleviate the plastic waste problem. In a study done by Nanyang Technological University in Singapore, it was found that reusable plastic bags are actually more environmentally-friendly than those from paper and cotton, but only in cities and countries with efficient waste management system.

Enhancing recycling and advancing the use of recycled materials

One of the main thrusts of circular economy is the increased rate of recycling. Post-industrial waste and post-consumer waste need to undergo recycling in order for them to be re-used. Recycling technologies have seen tremendous improvements in terms of speed, efficiency and cost-saving advantages.

Recent trends in recycling indicate the growing interest in chemical recycling technologies, which break down plastics into building blocks to convert them into secondary raw materials that can be used to produce new raw materials. The growing popularity of pyrolysis, an advanced recycling technique where thermal decomposition of materials at high temperatures in inert atmosphere is applied, has attracted attention especially since it has been found to be ideal in recycling polyethylene (PE) and polypropylene (PP). Chemical recycling is ideal for multi-layered or heavily contaminated plastic; another advantage is that the process can turn out high quality recycled material.

But the prevailing technology for plastic recycling remains mechanical recycling – which includes steps such as sorting, washing, shredding, grinding or granulating. Mechanical recycling has become better and more efficient in turning out good quality secondary materials. Digitalization, artificial intelligence and automation



Bottle-to-bottle recycling has been taken to a higher level in processing post-consumer PET bottles to high-grade rPET material

have contributed to more efficient recycling operations that many companies offering recycling technologies have added these to the capabilities of their machines.

As the market for recycled plastics has been promising, recycling systems have been upgraded to meet rising demands. Bottle-to-bottle recycling has been taken to a higher level in processing post-consumer PET bottles to high-grade recycled PET (rPET) material,

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making it possible to produce bottles from as high as 100% recycled PET (rPET). Also, bottle-to-bottle recycling has been able to meet the high safety standards required for food packaging with no risk of contamination. Another innovation is the development of techniques in recycling of multi-layer flexible packaging that now, 100% of multilayer film production waste can be recycled.

Processing technologies are now well able to adhere to the circularity targets. Injection molding systems, extrusion technologies and blow molding systems capable of processing recycled materials are the result of huge investments poured into R&D by companies to adapt to this trend. In the same manner, materials solutions geared toward improving the properties of recycled resins, such as additives and stabilizing agents, have been supporting the plastics industry's bid for sustainability.

Asia's adoption of circular economy presents huge opportunities

The adoption of circular economy in the plastics industry presents multiple opportunities for recycling technologies, plastics production systems that are capable of processing recycled materials, and new materials with



The market for products made from recycled plastics is growing as consumers become more environment-conscious (Image: Pexels)

recycled content or content from renewable sources. It also offers opportunities for producers of finished plastic products who are eager to meet market trends and consumer preference for environmentally-friendly products. It is projected that by 2030, a circular economy could generate an additional US\$4.5 trillion in annual economic output, according to the United Nations Environment Programme.

Countries in Asia have started to provide the necessary framework towards a circular economy. China is spearheading this direction as the country has started its circular economy journey since the 1990s.

Innovations for Circular Economy at CHINAPLAS 2023

At CHINAPLAS 2023 more than 3,900 exhibitors will present their latest innovations in adherence to the circular economy concept.

To showcase and highlight how the industry is transitioning towards a circular economy, 4 eco-friendly thematic zones, including Recycling Technology Zone, Recycled Plastics Zone and Bioplastics Zone, Eco-friendly Additives Zone, will be set in CHINAPLAS 2023. Over 200 machine makers and materials providers are about to showcase full array of sustainable solutions in these 4 theme zones with over 13,000 sqm, to meet the demand of both large enterprises and SME manufacturers.

www.chinaplasonline.com



Countries in Asia have started to provide the necessary framework towards a circular economy

Exhibitors at wire and Tube are looking forward to their Düsseldorf trade fairs 2024

■ Following the successful restart of wire and Tube in June 2022, preparations for the 2024 events are already in full swing. Three weeks after publication of the early-bird offer, more than 500 exhibitors have already registered for their leading trade fairs in Düsseldorf from 15 to 19 April 2024.

This emphasizes once more: the industries are committed to Düsseldorf as a location. The registrations received came from Germany, Europe and overseas. Many regular exhibitors and a large number of new exhibitors have already secured an attractive position in the Düsseldorf exhibition halls thanks to the early-bird offer.

➔ Messe Düsseldorf GmbH
www.wire.de
www.Tube.de



(Photos: Messe Düsseldorf, Constanze Tillmann)

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Successful Webinar Series goes into the Third Round

■ The SIGMA Technical Talks have proven themselves well over the past two years. But even today, there is still a need to learn for free and in a time-efficient manner. Therefore, there is a new edition of the webinar series in this spring with new and current topics from the world around SIGMASOFT®.

SIGMA Engineering is organizing weekly webinars again since late February. They are each about 60 minutes long and showcase interesting details and news about SIGMASOFT®. The individual areas of focus are as diverse as the applications of this simulation suite.

The webinar "DoE" demonstrates and discusses systematic virtual experiment planning and its automated execution and evaluation. "Virtual Thermoplastics" covers how more accurate simulation results can be achieved through practical improvement of material laws. The event "Elastomer" focuses on the



precise impact of vulcanization on component mechanics, presenting a novel approach. Further insights into MIM (Metal Injection Molding) are provided in the webinar of the same name. All webinars are live events and participants participate with questions.

"The good feedback of the last years has encouraged us to relaunch this series of webinars for professionals," says Timo Gebauer, CTO of SIGMA. "This year, in shorter events, we are presenting individual parts and new possibilities of our software.

Our customers - like us - have realized in the last two years that long trips can often be efficiently replaced by a web meeting. Therefore, the SIGMA Technical Talks will continue to be an offer for exchanging with us on technology and innovation."

Participation is free of charge for all interested parties. The dates take place in German and/or English. Events in other languages are already in the calendar."

Registration at

► SIGMA Engineering GmbH
www.sigmasoft.de

Symposium "Innovations using Fluoropolymers"

■ The debate surrounding the European Chemicals Agency's (ECHA) recently proposed ban on per- and polyfluoroalkyl substances (PFAS) is red-hot. The symposium "Innovations using Fluoropolymers" of the German Plastics Center (SKZ) on May 3 and 4, chaired by Dr. Michael Schlipf, will offer, among other things, the opportunity to participate in a panel discussion with experts on this topic.

With the planned ban on PFASs, the EU could for the first time ban an entire group of substances with more than 10,000 chemicals – including fluoropolymers. This polymeric group of substances is part of the PFAS group exclusively due to the structural elements CF₂ and CF₃. Their chemical behavior differs substantially from that of the low-molecular PFAS representatives.

Fluoropolymers are practically irreplaceable in their technical applications. In order to successfully meet the requirements of new trends, existing products are continuously developed and new products are created. In addition to product development, the continuous improvement of processing methods also plays a central role, especially with regard to economically advantageous system solutions. Newly adjusted property profiles for fluoropolymers and the development of new compounds and material composites create material properties that were considered impossible until recently. All major new megatrends such as e-mobility, 5G data transmission, green hydrogen or meeting the aims of the EU's "Green Deal" can only be realized through



The SKZ symposium on May 3 and 4, 2023, will address the significant contribution of fluoropolymers in current megatrends and the ongoing PFAS debate (Image: SKZ)

the use of fluoropolymers. All these innovations are developed in compliance with complex regulatory frameworks and sustainability aspects as well as an end-of-lifecycle consideration.

With Dr. Michael Schlipf, member of the board and chairman of the fluoropolymer group of the pro-K Industrieverband "Halbzeuge und Konsumprodukte aus Kunststoff" e.V., the international SKZ symposium "Innovations using Fluoropolymers" will be chaired by a prov-

en and recognized expert in the field of fluoropolymers. Schlipf is a guest lecturer at Aalen University in the field of "Plastics in Mechanical and Lightweight Engineering" and has played a key role in organizing the processors and manufacturers of fluoropolymers in the pro-K.

The renowned SKZ symposium will focus on the important role of fluoropolymers in current megatrends, as well as existing and new materials and their applications, especially in the field of innovative drive concepts and regenerative energies. Especially for the chemical industry, biotechnology and the pharmaceutical industry as well as the electronic/semiconductor industry, innovative

system solutions are needed – through fluoropolymers. Marcel van den Noort and Deepak Kapoor from Gujarat Fluorochemicals GmbH in Hamburg will also address the ongoing debate on the PFAS ban in their presentation "Advocacy efforts for the exemption of fluoropolymers from PFAS restriction proposal". Similarly, the closing discussion at the end of the first day will be dedicated to addressing the ongoing PFAS restriction.

For more information and to register:

➔ www.skz.de/bildung/tagung/innovations-using-fluoropolymers

NPE2024

■ The Plastics Industry Association (PLASTICS) announced that NPE2024 has sold 1,024,462 sq. ft of exhibit space at this year's in-person Space Draw event – a new record high with 982,000 sq. ft. sold in 2018. More than 1,100 exhibitors selected space across 1,259 booths in preparation for the return of the trade show on May 6-10, 2024 in Orlando, FL.

"We are thrilled to see this level of commitment 14-months ahead of the show opening," said Matt Seaholm, President and CEO of Plastics Industry Association. "The plastics industry has undergone incredible amounts of changes over the last few years and industry leaders are eager to showcase their latest innovations. The swift pace of floor space selections is a testament to NPE's significance as the largest plastics products, materi-



NPE2024

The Plastics Show

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INDUSTRY ASSOCIATION

als and manufacturing show in the Americas. NPE2024 will represent the full plastics ecosystem and supply chain – and servicing key markets like automotive, consumer, recycling, packaging, medical and building and construction. It's an incredibly positive indication for NPE2024 and for the plastics industry as a whole."

NPE is held every three years as a five-day focal point event for the plastics industry.

NPE2024 will feature the newest and most innovative plastics, mate-

rials and manufacturing solutions will be on full display in one space. The latest product and service advancements will be highlighted in seven technology zones including: Advanced Manufacturing Zone, Bottle Zone, Business Solution Zone, Materials Science Zone, Moldmaking Zone, Recycling & Sustainability Zone and the Packaging Zone.

➔ **PLASTICS**
www.plasticsindustry.org
NPE.org

rPET recycling solutions

viscoSHEET

Up to 100 % rPET and inhouse flakes processable at guaranteed iV-Levels for direct food contact.



ArabPlast 2023

■ ArabPlast, which will be held at the Dubai World Trade Centre from 13 to 15 December 2023, is the leading trade fair for plastics, rubber, petrochemicals and packaging in the MENA region.

Since 2004 Al Fajer Information & Services and Messe Düsseldorf have maintained a partnership, whose continuation was secured by the signing of a contract in Düsseldorf on 27 February 2023. "ArabPlast is the leading communication and business platform for the plastics and rubber industry in the Arab world," says Erhard Wienkamp, Managing Director of Messe Düsseldorf, and he adds: "I look forward to continuing our successful cooperation with Al Fajer Information & Services."

The Gulf States are not only top producers and exporters of petrochemical products but also suppliers of first-class plastics products. The robust economic conditions in the region ensure an excellent investment climate, which also results in increased demand for plastics.

The latest edition of ArabPlast, held in November 2021 and still impaired by the pandemic, was a resounding success, counting 217 exhibitors and more than 11,200 visitors from 129 countries.

ArabPlast provides experts and decision-makers from the region with an excellent opportunity to meet with raw material and technology vendors from around the world. For ArabPlast 2023 official national pavilions from Germany, Denmark, Switzerland, Egypt, Austria, Italy and Turkey are already planned.

ArabPlast's success is based on Messe Düsseldorf's good relations established with the companies of the global plastics and rubber industry. Messe Düsseldorf owes its expertise especially to its role as organiser of K in Düsseldorf. Just recently in October 2022 at its 70th anniversary, K, which is held every three years, succeed-



From left to right: Nadhal Mohamed, General Manager, Al Fajer Information & Services; and Erhard Wienkamp, Managing Director of Messe Düsseldorf (Photo: Messe Düsseldorf)

ed in bringing together 3,020 exhibitors from 59 nations with more than 177,000 visitors from all over the world.

"With the support of our international partner, Messe Düsseldorf, the organiser of the world's No. 1 trade fair for plastics and rubber, K, ArabPlast developed into the leading event in the Middle East," says Nadhal Mohamed, General Manager, Al Fajer Information & Services.

ArabPlast is part of the Global Gate service brand, which bundles Messe Düsseldorf's worldwide range of international platforms for the plastics and rubber industry. With its own events and strategic alliances with leading regional trade fairs for the plastics and rubber industry – such as ArabPlast – Messe Düsseldorf offers the industry tailor-made business platforms in relevant growth markets.

► www.arabplast.info

New Packaging Regulation – Views from the Packaging Supply Chain

■ At a conference entitled "Packaging regulations and the impact on the packaging supply chain" organised recently by AMAPLAST (Italian Plastics and Rubber Processing Machinery and Moulds Manufacturers' Association) and UCIMA (Italian Packaging Machinery Manufacturers' Association), leading figures from the packaging industry and institutions discussed the critical issues arising from the New Packaging Regulations and the various strategies that have been adopted. The importance of the topic for the industry was reflected by the presence of more than 150 companies.

"We are not opposed to change," said Riccardo Cavanna, Chairman of Ucima. "The problem is that this regulation is creating confusion. We have always played an important part in spurring the industry to achieve significant results in terms of the circular economy, but we need a concrete approach that builds on the progress made so far. Our shared goal is to protect the planet."

"The technical feasibility of the new regulation is by no means certain and requires careful analysis," added Dario Previero, Chairman of Amaplast. "By working together, our associations are able to voice the concerns of companies and help to find the best possible solution."

Following the opening remarks given by institutional representatives, the speakers illustrated the key points of the New Regulation. Confindustria presented the strategies adopted to protect the sector and the entire supply chain and to ensure that the reform would be balanced and capable of strengthening the Italian packaging waste management system as a model that needs to be preserved and protected.

Marco Ravazzolo (Confindustria – Industrial and sustainability policies) said: "We are unable to accept the way the new European regulation shifts the paradigm from recycling to reuse. This approach is not supported

by scientific data. Just think of the enormous quantities of water needed to enable reuse."

Senator Luca de Carlo, Chairman of the Senate Committee on Industry, Commerce, Tourism, Agriculture and Agri-Food Production, added: "We mustn't allow ourselves to be intimidated by ideological fashions that criminalise plastic. Italy is a model in terms of recycling and must be defended."

Francesca Stevens, Secretary General of EUROOPEN (The European Organisation for Packaging and the Environment), offered a broader perspective: "In Italy, Confindustria and the government are vigorously engaged in defending the interests of the Italian packaging supply chain. The resistance in other countries is less active, but everyone needs to work together because the road ahead is fraught with risk."

Next to speak were the business leaders, who together with Giflex (Flexible Packaging Group) discussed the critical aspects of the regulations in their respective sectors during a round table discussion.

"I believe that this regulation will slow growth rather than accelerate it," argued Alberto Palaveri, Chairman of Giflex. "There is a risk that our companies will end up poorer and consumers will be less protected in terms of safety."

Walter Bertin, Chairman and CEO of Labomar Spa, echoed Palaveri's comments and pointed to the results already achieved: "There are products on the market that already have a low environmental impact thanks to recycling. It's risky to call into question years of development."

Alessandro Lazzarin, Chairman of Latteria del Montello (Nonno Nanni), stressed the importance of these kinds of



events: "At our company we are very attentive to what is happening because the regulations have a major impact on our approach to development. At this stage we need greater clarity, so we welcome these meetings."

The conference was strongly promoted by the two associations as an important opportunity to meet local companies, in this case those based in the Veneto region, and give them the chance to present their businesses and speak out on important issues for the sector. The event was held at the Galdi company headquarters.

► AMAPLAST

www.amaplast.org/it/

UCIMA

www.ucima.it

Interplas 2023 – Celebrating 75 Years of Connecting the UK Plastics Industry

■ Following a successful in-person event in 2021, Interplas is set to continue its development in 2023. Almost 400 exhibitors are already confirmed on the show floor, with over 12,000 attendees expected from across industry visiting to discover the latest innovations in plastics manufacturing processes, technologies, materials and services.

For 75 years, the event has seen plastic transform our way of life. Today, at a time of great change in the plastics industry, Interplas is more important than ever to ensure vital intelligence, innovation and technology reaches the UK market.

Interplas is set to take place across two halls at The NEC in Birmingham, featuring the biggest names in global plastics processing, as well as

exciting features such as the Knowledge Pavilion, where visitors can source information and advice; and the Interplas Insights Conference, a dedicated area of the show floor where visitors can hear from industry experts on a variety of insightful topics from the latest in recycling to digitalisation.

The Interplas Introducing Stage will also be a key feature at the event, recognising forward-looking technologies, whilst providing technical advice. In addition to this will also be the popular Diversity in Plastics networking session which continues to champion inclusion and equality in the plastics industry.

CEO, Duncan Wood, said: "After a fantastic response to the 2021 edition of the event, we are incredibly

excited to bring the whole community back together again this September. This year is a particularly special year for us, as it is our 75th birthday, and there is already a real sense of momentum building amongst the industry. We have a host of exciting enhancements for 2023 including ever more ways to maximise networking and matchmaking to ensure exhibitors get return on their investment and visitors get fantastic takeaways from their visit."

Interplas takes place at Birmingham, UK, on 26th-28th September 2023. Visitors can register for free at:

► Interplas Events Ltd

www.interplasuk.com



Acquisition

■ Piovan Group's strengthening continues with further expansion into Germany, Europe's reference market for plastics by supporting German ProTec's systems – ensuring continuity and qualified assistance to some of the company's customers.

Piovan Group acquires a selection of assets of German competitor Protec Polymer Processing GmbH, an international supplier of systems for the plastics industry, currently in receivership.

The transaction involves certain assets previously belonging to material handling, dosing and Recycling divisions – markets where the Piovan Group itself operates and is world leader in the production of systems for automating production processes with plastic, recycled plastic and bio-plastic materials.

The transaction will take place through the controlled FDM with the triple purpose of: increasing the Service/post-sale activities, offering customers upgrades and retrofits

of old Protec systems with new Piovan Group solutions, and supporting joint customers in the difficult situation caused by the bankruptcy proceedings of Protec Polymer Processing GmbH.

Piovan Group, which is actively engaged in the development of products and solutions dedicated to the recycling and circular economy supply chain, going forward will also supply Protec's solutions in the recycling field, such as plastic regeneration and crystallization.

In line with the group strategy the transaction strengthens the Piovan Group's presence in the German market and in the key strategic segment of after sales services.

"Protec, previously Somos, is among the oldest European companies operating in automation for plastic and recycle plastic industry with a large installed base of unique solutions and a well-established customer base," says Filippo Zuppichin, CEO of Piovan Group, "It is a great honour



Filippo Zuppichin

and responsibility for Piovan Group and FDM to continue such an important tradition and offer their customers the possibility of enjoying such a long technological partnership."

"For FDM it is an important step to further expand and establish the service area. We are pleased to be able to offer all customers the usual service in the field of service and spare parts supply," says Guido Faust, General Manager of FDM.

► Piovan S.p.A.
www.piovan.com

Digital Platform for the Closed-Loop Recycling of Plastic Food Packaging

■ Only 9% of the 4,372 kt of plastic used in packaging each year in Germany are recycled. And it is precisely in the case of food packaging that the safe use of recycled is more difficult. The reason for this is often a lack of information on the recycled content and recycled quality of the existing packaging. SKZ, together with six consortium partners, wants to change this in the research project "Open Circular-Collaboration-Platform for Sustainable Food Packaging from Plastics", or COPPA for short. In the project, which is funded by the German Federal Ministry of Food and Agriculture (BMEL), an open platform is to be developed that provides information on secondary materials throughout the entire cycle by means of a digital product passport, thus paving the way for the circular management of food packaging made of plastics.

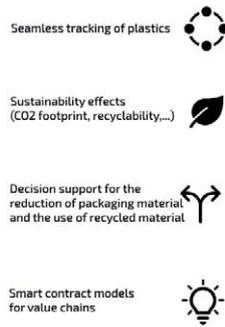
The amount of waste generated from packaging is steadily increasing. Particularly in the case of plastic packaging for food, there is still great potential for material avoidance and recycling. In addition to technical challenges, the main obstacles are lack of transparency and information on the origin, quality, quantity and future availability of recycled. The project objective of COPPA is therefore the development and demonstration of an open and scalable Circular Collaboration Platform (CCP). The CCP is a cross-company information concept that recyclers, reprocessors and converters of plastics, packaging manufacturers, brand owners and food retailers use to establish a seamless tracking of plastics from packaging. The CCP enables accurate and efficient information exchange on the recycled content

and quality of plastic packaging. At the same time, by linking relevant environmental information, COPPA makes the increase in individual and industry sustainability performance calculable and provable for sound communication. The project result is intended to represent a practical demonstrator that will be accessible to all companies in the entire food chain at the end of the implementation phase. COPPA is thus intended to drive forward the circular economy in the area of plastic food packaging, conserve natural resources by reducing the use of materials and the associated reduction in the use of fossil raw materials, and contribute to climate protection.

In addition to the project consortium, other associated partners from the "plastic packaging for food" value chain are indispensable

as project advisory board or for testing and further development of the CCP. Companies wishing to become part of COPPA can contact the SKZ.

The cooperation partners: The SKZ and the Wuppertal Institut für Klima, Umwelt, Energie gGmbH contribute knowledge in the field of sustainability and circular economy. The Forschungsinstitut für Rationalisierung e.V. (FIR) of RWTH Aachen University is active in the field of business transformation. GS1 Germany GmbH, as a standardization organization, underpins the market-based orientation of the CCP. The European EPC Competence Center GmbH (EECC) operates in the market as a leading provider of traceability solutions, while Infosim GmbH & Co. KG covers the areas of



Circular economy scheme for recyclates as a basis for COPPA (Image: SKZ)

network management and ERP systems. The consortium is rounded off by the Reifenhäuser Group, which supplies equipment for the production of plastic packaging.

➔ SKZ

Dr. Hermann Achenbach,
h.achenbach@skz.de
www.skz.de

Personalia

Change in Technical Management

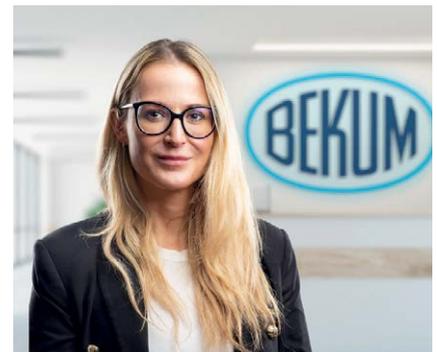
Stefan Lehner-Dittenberger succeeds Dr. Wilfried Lehmann, who is retiring, as Technical Manager. Dr. Wilfried Lehmann was Technical Manager at Bekum in Berlin for more than 10 years.

Stefan Lehner-Dittenberger has already taken over as Technical Director on December 1, 2022. Lehner-Dittenberger is a trained mechanical engineer at the Vienna University of Technology. He has been with Bekum since March 1, 2020 as head of design for large blow moulding machines and automation technology in Traismauer, Austria, and brings with him a high level of management and design experience. In his new position, he is now also responsible for the design of all blow moulding machines as well as extruders and extrusion heads, designed and manufactured by Bekum.

Since the transition of this function was planned for the future, Lehner-Dittenberger was already able to familiarise himself extensively. The new development of the small and large blow moulding ma-



Stefan Lehner-Dittenberger



Stefanie Georgi
(Both images, sources: Bekum)

chines of the 8 series, which were presented for the first time at the K 2022 trade fair in Düsseldorf, already carries his signature.

New Area Sales Manager

Stefanie Georgi has joined Bekum as Area Sales Manager at the Traismauer location. "We are excited to welcome Stefanie Georgi to our international team," said Oliver Wolff, Director Sales & Marketing at Bekum.

Georgi has a master degree in engineering with the focus on machine and processing technology. She can look back on many years of experience in different responsibilities in

the plastics industry in Germany and Switzerland.

As Area Sales Manager at Bekum Georgi will be responsible for the sales of small, packaging and industrial blow moulding solutions in Germany, Spain and Portugal. Regarding the new challenge, Georgi says: "After a long time as project manager, I am grateful to become part of the Bekum family. I am looking forward to apply my previous experience from the blow moulding industry and to start new challenges together with Bekum, especially in the sales area team."

➔ Bekum Maschinenfabriken GmbH
www.bekum.com

Market Study: Plastic Films

■ Is the plastic bag going extinct? By no means has it come to that. Yet consumption of plastic carrier bags has been falling ever since the EU and various governments started to take action against them. Simultaneously, new opportunities are emerging for manufacturers of thin plastic webs. Ceresana has analyzed the European market for plastic films for the second time. This includes flexible plastic bags and sacks, but also packaging films, shrink and stretch films, agricultural films and other films, such as construction films. The new study covers films made of polyethylene (PE), polypropylene (PP), PET and PVC as well as other plastics (as aggregates).

The study in brief

Chapter 1 details the Europe-wide demand and production of plastic films (in 1,000 tonnes) as

well as the revenues generated with plastic films (in billions of USD and EUR). Furthermore, the study analyzes the demand of plastic films broken down by the different plastic types and broken down by the individual application areas. Moreover, the production is split by plastic types.

In Chapter 2, production of (split by plastic type), demand of (broken down by plastic type and application), and turnover generated with plastic films are provided for 21 individual countries:

Production split by plastic types, demand split by plastic types, demand split by application.

Chapter 3 provides company profiles of the most important manufacturers of plastic films in Europe, clearly arranged according to contact details, revenue, profit, product range, production sites and brief profile. Detailed profiles are provided by 87 manufacturers.

Market Study: Plastic Films



Ceresana
Market Research Since 2002

► Ceresana

www.ceresana.com/en/market-studies/packaging/plastic-films-europe/

Top Management Strengthened

■ On the back of consecutive record years for sales, Vetaphone has moved to boost the strength of its management structure with an eye to the future.

Despite the difficult trading conditions imposed by the global pandemic and subsequent supply chain issues, Vetaphone has continued to enjoy a double-digit growth rate in recent years and with a declared ambition to sustain a 15% uplift year on year going forward, it has made several key changes at senior level.

First, is the appointment of Jan Eisby to take up a new position as Chief Business Officer (CBO), where he will share with his brother and fellow Director Frank Eisby, the task of focussing on the long-term strategy for the company.

Second, is the appointment of Kevin McKell as Chief Sales Officer (CSO), with the overall responsibility for Sales, Marketing, and Support functions at the company. This is a natural progression from his previous position as Vice President Technical Sales and will further strengthen Vetaphone's customer-facing activities.

The division of duties will see Frank, in his role as Chief Executive Officer (CEO), concentrate on the development of products and technology from the sales and production perspective, with Jan looking to build customer relationships through R&D, and an educational programme of knowledge sharing.



(Left to right) Jan Eisby (CBO), Kevin McKell (CSO), and Frank Eisby (CEO)

The overall aim is to free-up the Eisby brothers by leaving day-to-day running of the company to the Management Group, allowing them to focus on Vetaphone's ambitious plans for the development of the business and its technology up to 2025 and beyond.

It will also be the start of major investment in the Vetaphone Academy, which promises exciting times ahead for this innovative and progressive technology leader.

► Vetaphone A/S
www.vetaphone.com

Reorganization

■ AZO Global Product Center GmbH & Co. KG is operational as a new company of the AZO Group since January 01, 2023.

"A consistently future-proof setup - that is our goal," is the clear message from Rainer Zimmermann, CEO and owner of the family company AZO. The specialist for automation solutions has its headquarters in Osterburken, Germany and is now managed by the second family generation. After a longer planning phase caused by the multi-crises, the company sees itself confirmed in this goal: "The distribution of risks and the orientation towards the needs of our customers guide us in this phase of reorganization. We want to be a resilient and reliable partner worldwide"

The first step in this direction has been taken with the establishment of the AZO Global Product Center. The new company is where the products that AZO sells worldwide are created – from the first draft to the detailed customer-specific adaptation design and production to documentation. In this way, AZO focuses on entrepreneurial responsibility and market orientation. AZO's solutions are in demand in more than 60 industries – the specific know-how of the raw material experts is the great asset.

The newly established AZO Global Product Center has around 240 employees. It is important for the company to emphasize: "For our customers, we will still be available as a reliable and safe partner in the usual way."



CEO Rainer Zimmermann (left) and Managing Director Hartmut Eckert

AZO Global Product Center GmbH & Co. KG is led by Hartmut Eckert – a "home-grown" of AZO. After his education and numerous further training courses as a technical business economist, business economist and REFA engineer, he became a member of the Executive Board in 2018.

AZO's CEO, Rainer Zimmermann, is also Managing Director of the new company.

► AZO GmbH + Co. KG
www.azo.com

Continued Investments in Production Capabilities Announced

■ 2 state-of-the-art production lines have been purchased from SML for delivery into North America in the 2nd and 3rd quarters of 2023. One is to be installed in a new wing of Sigma's Belleville, Ontario plant and the other will replace a legacy line in Tulsa Oklahoma. Both lines will significantly increase capacity at their respective locations. These investments follow on from similar ones for Sigma's Riverside, California and Shelbyville, Kentucky plants and underline the group's commitment to ensuring secure supplies for its customers.

The new North American lines will produce the latest generation, 9-layer films and have been configured for maximum flexibility so allowing rapid product changes to meet local demands.

The Sigma group also continues to invest outside the North American market. Sigma Plastics Asia in Thailand, established in 2019 marked the group's expansion into the southeast Asia market. Following the success of this venture, the group has now moved into the European market with the formation of Sigma Stretch Film of Europe based in Poland.

The new European business builds on the recently acquired Marflex plant which already ran SML machines. Shortly after the acquisition, Sigma announced purchase of another stretch film line to boost site capacity.

As with the two North American production lines, this is the latest generation, 9-layer machine from SML and is set to be delivered from Austria in quarter 3 of 2023.

Further capacity increases are planned for both Poland and Thailand with a new line for Poland anticipated for 1st quarter 2024.

► SML Maschinengesellschaft mbH
www.sml.at



Start of Production at PET Recycling Team Targu Mures

■ Around 18,000 tonnes of post-consumer-recycled PET (rPET) per year – the packaging and recycling specialist ALPLA, Ecohelp SRL (Romania) and United Polymer Trading AG (Switzerland) begin production at their joint recycling plant in Targu Mures. The three companies invested around 7.5 million euros in the construction and equipping of the plant on an adjacent site to the existing Ecohelp site in Targu Mures. Now, the first extrusion line for the production of high-quality rPET granulate from PET flakes has entered into operation. The joint venture partners will host the official opening ceremony on 4 May 2023.

„The growing importance of local recycling processes calls for increased commitment in the region. Together with our partners, we combine strengths, increase the processing quality of the recycled PET material and ensure the long-term supply of the southeast European market,” says Georg Lässer, Director Business Development, Procurement and Sales Recycling at ALPLA. Expansion potential has already been identified – the plant has space for a second extrusion line, which would double capacity.

The joint venture, which was established in autumn 2021, combines the skill sets of the three companies involved. ALPLA brings its many years of expertise as a global recycling specialist and packaging manufacturer, while United Polymer Trading (UPT) has an extensive distribution network for plastics and recycled material. The local company Ecohelp supplies the material in the form of recycled PET flakes based on PET bottles from household waste. The food-grade rPET granulate obtained from this process then serves as the starting material for new preforms and bottles.

“The collaboration is a great example of how to improve local recycling and ensure sustainable economic



At the new plant, the joint venture PET Recycling Team Targu Mures run by ALPLA, Ecohelp and UPT produces recycled PET granulate based on bottles from household waste for the production of new preforms and bottles (Copyright: ALPLA)

development. We are filling a gap in the market for high-quality recycled material in Romania and neighbouring countries,” says Mihail Moloiu, General Manager at PET Recycling Team Targu Mures. The new recycling plant has created around 20 new jobs.

ALPLA is investing 50 million euros a year until 2025 in the ongoing expansion of its recycling activities. With its activities for the production of high-quality recycled materials, the global company is promoting complete recycling in as many parts of the world as possible.

► ALPLA Werke Alwin Lehner GmbH & Co KG
www.alpla.com

Licence Secured with Proprietary High-Pressure Technology

■ ECI Group has signed license and engineering agreements for process technology and engineering design with a confidential Chinese client for two lines of EVA production using ECI Group's proprietary Hybrid Technology offering. This technology is capable of producing 400kta EVA total, each line producing 200kta. The plant will be part of the client's integrated project to be located in Guangxi Province, China. ECI Group will provide the technology, design, and training for the two lines, as well as support through commissioning, start-up, and production.

Repsol, the multi-energy company, as ECI Group's partner, will provide its extensive technical, operational, and commercial expertise. Repsol has several LDPE, EVA, and EBA plants in its industrial complexes in Spain

and Portugal and has over 40 years of experience producing award-winning polymer products in its high-pressure facilities.

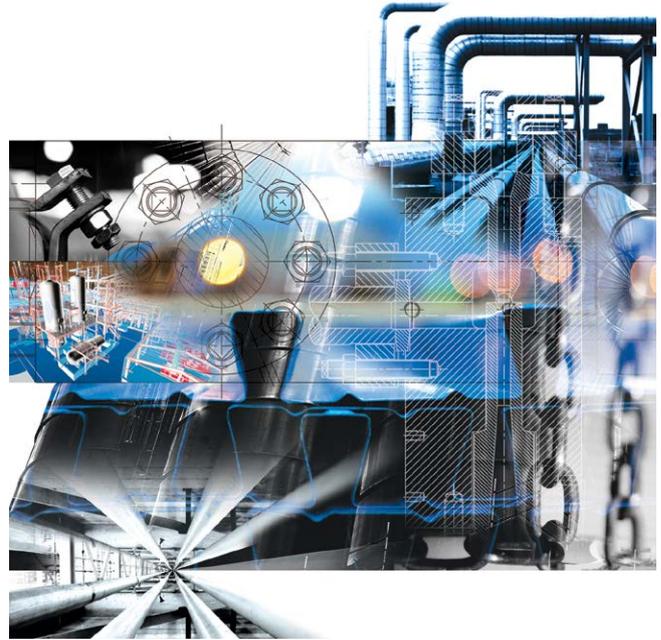
ECI Group's Hybrid Technology offering is unique in the industry as it allows for production of EVA and other high-value copolymers at capacities of 200 kta and higher, which was previously only possible with tubular reactors. The Hybrid technology offers the higher capacities of tubular lines with the expanded product capability of autoclave lines. In addition, ECI's various proprietary design features and enhancements contribute to the overall effectiveness of the process and result in higher production with lower operating costs.

While the client declined to provide a comment citing project confidentiality, they noted that they had re-

viewed a number of technology options and made the decision to select ECI Group’s hybrid technology for a number of important reasons including the unmatched product range, lower operating costs, the design built for future product development capabilities and the reputation of Repsol as a long-standing producer of high-quality products.

Commenting on the signing of the contract, Joaquin Flores, President and CEO of ECI Group, said: "This latest award is a game-changer for the industry. Clients now have access to a flexible slate of high-value products at world scale capacities. Our proprietary Hybrid Technology provides our client with the best combination of production, reliability while lowering operating costs and providing a superior product range. We are proud that this client chose ECI’s technology after carrying out a detailed analysis of the technology against competitors’ existing offerings, and we look forward to successfully delivering two lines of this first-of-a-kind design with the support of our partner Repsol’s market knowledge and product expertise."

➔ ECI Group
www.ecigrouponline.com



ECI Group has signed license and engineering agreements for process technology and engineering design for two 200kta EVA lines using ECI Group’s proprietary Hybrid Technology offering

Plastics Recycling Awards Europe 2023

■ Starlinger recycling technology has been shortlisted for the prestigious Plastics Recycling Awards Europe 2023 for their new recoSTAR PET art recycling line in the category "Product Technology Innovation of the Year".

"We feel grateful and honoured being shortlisted for the Plastics Recycling Awards Europe with our latest technology innovation recoSTAR PET art. This new machine concept builds on Starlinger’s solid foundation of manufacturing PET bottle-to-bottle recycling lines for more than 15 years and has been designed to take mechanical PET recycling to the next level," said Paul Niedl, Commercial Head of Starlinger recycling technology.

With its innovative design, Starlinger’s recoSTAR PET art PET bottle-to-bottle recycling line saves 21 % in production costs (©Starlinger)



In technical development, the focus of Starlinger recycling technology has always been on achieving highest production efficiency and keeping energy consumption and maintenance time as low as possible. The newly conceived PET bottle-to-bottle recycling system recoSTAR PET art does not only consume 25 % less energy compared to the previous model, it also requires 46% less maintenance time, has a 21 % smaller machine footprint, and a production output increase of 15 %. In total, bottle-to-bottle recyclers can save about 21 % in production costs with the new system.

In addition to supplying world-leading and brand owner-approved PET recycling technology, Starlinger also offers recycling solutions for a variety of other post-consumer plastic scrap and industrial plastic waste. The specially developed odour reduction process ensures smell-reduced regranulate from post-consumer olefins such as PP and PE which are a widely used material for e.g. milk or detergent bottles. The company’s scope of supply also includes recycling solutions for agro- and geo-textiles, nonwovens, heavily printed and hygroscopic plastic films, or waste from textile production.

The Plastics Recycling Awards Europe 2023 winners will be announced on 11 May, during the second day of the Plastics Recycling Show Europe taking place at the RAI Amsterdam.

➔ Starlinger recycling technology
www.recycling.starlinger.com
www.prseventurope.com

Sustainability Report Presented

■ Starlinger has presented the first sustainability report for the year 2022. It provides information about the CSR policy that Starlinger has included in its corporate strategy, and measures the company has already implemented. The sustainability report is available in German and English.

Clarissa Graf has been responsible for Corporate Social Responsibility (CSR) at Starlinger since 2019. Together with her team, she defines CSR measures and ensures their implementation as part of the corporate strategy. "Starlinger's first sustainability report can be seen as a summary of where we currently stand," explained Graf. "It sets out the CSR policy that we have defined for our company with regard to environment and society, and

For decades, sustainability has been an important topic at Starlinger. Already in 1987 the world market leader for woven plastic packaging plants supplied the first recycling lines to reuse the production waste during woven plastic sack production (©Starlinger)



provides an overview of measures which have already been taken in various areas such as resource and energy management, procurement, training and professional development, or health and safety."

Sustainability has been a topic at Starlinger for decades. The first Starlinger recycling lines were built back in 1987 with the idea of making full use of the production waste in woven bag manufacture. Today, machines for the recycling and refining of a wide range of plastics are managed under separate business units and form an important pillar of the company.

Starlinger applies an economical use of resources and energy efficiency both in the technical development of the systems and in their manufacture. Measures recorded in the Sustainability Report 2022 and already implemented in the company include the use of renewable energies, a waste management system, sustainable procurement from local and regional suppliers, or the reduction of business trips through the increased use of video conferences and VR glasses for remote support in solving technical problems.

In 2020, the company applied for membership of respACT, Austria's leading corporate platform for responsible business. Since March 2022, Starlinger has also been one of the signatory companies of the UN Global Compact, a global pact between the United Nations and over 16,000 business members who work together for a sustainable future.

The Starlinger sustainability report in English:

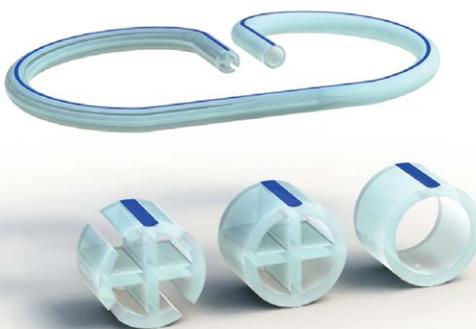
➔ Starlinger & Co Ges.m.b.H.

www.starlinger.com/Company/CSR/Sustainability_Report_en

Reciprocating Head Introduced Automated Extrusion Process Drastically Changes the Extruded Profile

■ Guill Tool, a global manufacturer of extrusion tooling, has released its new reciprocating head. The traditional tip and die assembly is replaced with a linear reciprocating assembly that changes the tube's profile within a given length. This process is repeated throughout a single extrusion run without interruptions. Cutting capability, in association with the extrusion speed, cuts the finished product to length.

While cost and value stream activities are reduced, quality is improved. Only one extrusion run is needed to produce a finished product, as op-



posed to multiple extrusion runs with tooling changes along with a manual assembly operation to connect different tubing shapes. Guill's new reciprocating head eliminates

an assembly operation. It also eliminates in-process inventory. Thus, there is no need for storage of various tubing shapes and connectors needed for assembly, fulfillment of orders and replenishment of finished goods.

Furthermore, the reciprocating head eliminates a connecting piece, allows JIT production and products made-to-order. Lastly, it reduces total run time from receiving the order to shipping. For more information:

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www.guill.com

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Simply Unique Packaging – New small and large Packaging Machines for Food & Beverage, Pharma, Consumer and Industrial Packaging

■ At the exhibition Interpack (hall 13, booth B32), Bekum will inform about 20 new machine models for small to large container volumes. With the presentation of the new 8-Series at K 2022, Bekum convinces with more energy-efficiency, greater flexibility and shorter delivery times. The focus is on the presentation of many exclusive technical solutions, the expansion of digital service support and the processing of recycling materials and calcium carbonate (chalk) in a three layer technology.

20 new Machines for all Blow Moulding Applications and Industry Segments

With the market launch of the new 8-Series Bekum now also offers all-electric small blow moulding machines with 60/120 kN clamping force and 280-520 mm carriage stroke for small bottles. The new all-electric long-stroke machines with 500 kN clamping force and 1080/1280 mm carriage stroke for highest output complete the packaging machine line for bottles, canisters and containers, which starts with 150 kN clamping force and 520 mm carriage stroke. Another highlight are the newly developed large blow moulding machines with hybrid-electric clamping unit up to 3,000 kN clamping force (patent pending for large canisters, (L-ring) drums and IBCs named XBLOW, in a new industrial machine design.

The packaging and long-stroke machines are equipped with a new and exclusively Bekum available e-Twin-Toggle all-electric clamping drive via double toggle lever with a unique bearing system and with low wear. Globally standardized control platform Bekum Control 8.0 with Industry 4.0 package and AI Health Monitoring provides maximum system availability, also available as retrofits for proven Bekum machines. In the 8-Series highly efficient HiPEX 36D extruders in new

Production possibilities: Clear PET handle cans and beverage packaging of HDPE & PP



Newly designed electric blow moulding machine for packaging EBLOW 807D with many innovative features (All images are from Bekum)

sizes up to 720 kg/h throughput with high melt homogeneity and 20% energy savings are applied.

Circular Economy – Material sayings with tri-extrusion technology

For a number of years now, Bekum has been committed to the circular economy and has been delivering solutions for the cost-effective use of correctly sorted PE or PP post-consumer recycled materials. By using Bekum's simulation-based development of new 3-layer spiral mandrel heads for packaging and industrial lines called tri-extrusion technology, it is possible to create resource-efficient blow-moulded containers. During this three-layer process, the recycled material (PCR) is embedded in the middle regrind layer between thin-walled inner and outer layers, which are manufactured from virgin materials. Of particular ecological concern is the ability to achieve the highest possible PCR loading in the middle regrind layer, taking into account the geometry of the moulded part, in order to reduce the overall consumption of new plastics within the production cycle.

The ability to guarantee that the plastics have been correctly sorted is crucial for this. It is only possible to easily recycle the three-layer product at the end of its useful life and reintroduce it into the circular economy if the inner layer, the outer later and the regrind layer are all made of the same material.

In addition, the use of PCR in the middle layer can often bring about a reduction in the cost of manufacturing containers.

More efficient than Energy efficiency class 10

Bekum uses energy-saving drives that feed their braking energy back into a DC link, allowing it to be used in the extruder drive, a permanent consumer. This reduces the effective energy consumption for carriage and clamping plate movement to about 1 kWh per operating hour for small blow moulding machines.

In combination with the new energy-optimized HiPEX extruders, this makes a specific energy consumption of less than 0.26 kWh/kg (EBLOW 408D show demonstration value at K 2022) possible – and this exceeds to the most efficient Class 10 according to EUROMAP 46.1.

► Bekum Maschinenfabriken GmbH
www.bekum.com

Chemical Recycling of Hard-to-Recycle Plastic Waste into New Plastic Pipes

■ Neste, Borealis, Uponor and Wastewise have successfully produced pipes made of cross-linked polyethylene (PEX) which was based on feedstock gained from chemically recycled post-industrial waste plastic from PEX pipe production, using an ISCC PLUS certified mass-balancing approach. The partner companies believe this project is among the first implementations of chemical recycling of PEX.

PEX pipes are an important contributor to energy efficient heating and safe plumbing due to their robustness, temperature resistance and longevity, yet the interconnected polymer chains make them nearly impossible to recycle with conventional recycling technologies. The project shows that chemical recycling can close the circularity loop for hard-to-recycle waste plastic, turning it into high-quality polymers feedstock and enabling the consecutive manufacturing of products with quality and properties identical to those in their previous life.

The cooperation sees Wastewise use their novel pyrolysis-based chemical recycling technology to liquefy industrial waste from Uponor's PEX pipe production, breaking the polymers down back into their building blocks, which creates an oil-like recycled intermediate. This liquid is then co-processed in Neste's oil refinery in Porvoo, Finland and upgraded into recycled Neste RETM, a high-quality drop-in feedstock for the production of new polymers. Borealis is feeding this raw material into their steam



cracker and consequently polymerizing it into polyethylene as part of the company's Borcycle™ C, chemical recycling portfolio. Finally, Uponor is using the polyethylene to create new PEX pipe systems, which can then be used in the construction sector for heating, plumbing and cooling purposes once more – eligible even for sensitive applications with high requirements, for example those used for drinking water systems. The whole value chain is traceable via ISCC PLUS certified mass-balancing.

Due to the involved parties' commitment to pushing circular solutions for polymers and the solution's drop-in character, the partners were able to establish the value chain in a rather short period of time. Little more than six months passed between the start of the project and the production of the first pipes made with chemically recycled PEX waste.

The partnership holds potential for further cooperation beyond production waste: The PEX pipes made by Uponor have already been op-

PEX pipe production at Uponor
(Source: Uponor)

timized from a resource efficiency point of view by reducing their wall thickness and increasing lifetime. At the end of their long life, mechanical recycling is so far the first recycling option, but it also means downcycling the materials, e.g. into other construction materials or items. With chemical recycling, though, the PEX waste pipes can be turned into fully functional PEX pipes again. Moving forward, the partners will evaluate further opportunities for cooperation. Aside from broadening the waste material pool, this may also include higher recycled volumes.

► Borealis AG
www.borealisgroup.com
Neste
neste.de
Uponor GmbH
www.uponorgroup.com
WasteWise Group Oy
www.wastewise.fi

Practical Digitalization Solutions for Needs-based, Secure Processes

■ The Fraunhofer Institute for Process Engineering and Packaging will be presenting its new technologies and solutions for business in the packaging and food industry at the interpack trade fair from May 4 to 10, 2023 at the VDMA booth C54 in hall 4. These new developments can help companies establish digitalized value creation processes and take their first step into the circular economy.

Training up machine operators from any location with virtual reality and digital twins

Fraunhofer IVV is developing digital training systems based on virtual reality (VR) to provide support for vocational training and continued professional development for operating and technical staff. This enables the staff to master the steps involved in processes such as changeovers. The systems will also assist with developing in-depth process understanding as quickly as possible – a necessary step for eliminating and avoiding faults on a long-term basis. The training program can be run as a stand-alone application on VR terminals; there is no need for the machine itself to be present for the training activity. Learners are able to make mistakes and gather experience without impeding a machine's availability for other uses or even risking damage.

The VR training scenarios are based on a CAD model of the machine and the corresponding process model. This is coupled with a curriculum that is individually tailored to the specific tasks involved in operators' work and includes a range of learning modules. Visitors to the booth will have the opportunity to try out the training system for themselves using the example of a production plant for thermoformed packaging.

Consultation services for developing future-proof, company-specific digitalization strategies

When it comes to challenges such as ensuring the resilience of processes, implementing the circular economy or addressing skilled worker shortages, digitalization can offer solutions. Fraunhofer IVV assists companies undergoing transformation processes – i.e., implementing concepts such as networked production, the industrial internet of things and data exchanges encompassing the entire value chain – by developing company-specific technology and assistance solutions, individually tailored software for supporting system integration and AI applications for the production process.



Self-directed, virtual-reality-based staff training allows users to develop specific, long-lasting process knowledge without halting real-life production or consuming resources (All pictures © Fraunhofer IVV)

Ensuring product safety with intelligent cleaning technologies

The quality of manual processes for cleaning machines, plants and production environments can vary widely. These processes are not reproducible and, in view of the ever worsening shortage of skilled workers, pose major challenges for companies. In view of this, Fraunhofer IVV is working on intelligent technology solutions for automating manual cleaning processes.

At the interpack trade fair, Fraunhofer IVV will demonstrate their AR-based technology CleanAssist, alongside two variants of their Mobile Cleaning Device. These pioneering technological applications enable efficient, resilient production processes that ensure a high level of quality. Cleaning processes can be documented in a fully automated manner using intelligent sensor technology and a digital twin. This means that, it is possible to genuinely validate cleaning processes.

Quality assurance with digital assistance

CleanAssist is the first virtual cleaning assistant for manual cleaning. Tracking sensors on the cleaning lance can be used to analyze and document the rate of volume flow applied (i.e., the rate of cleaning efficiency), as well as spray shadows. A digital twin is transferred to the real-world cleaning environment with the help of an AR device; the actual progress of the

Thermoformed fiber-based packaging with a quality-assured, easily separable barrier layer

cleaning is displayed to the user in real time. This means that areas that have been overlooked, insufficiently cleaned or cleaned too much are visualized to the staff and thus belong to the past.

Cleaning 4.0 – fully automated and flexible

The Mobile Cleaning Device (MCD) is an intelligent, modular cleaning robot. Fraunhofer IVV will present two models at interpack for different applications. The first model is an autonomously moving device and can be used for automatic cleaning of entire production environments. The fully integrated contamination sensor technology in the MCD automatically detects the degree of contamination and allows the cleaning process to be documented. An innovative adaptive jet cleaner (AJC), which rotates on three axes, takes care of the cleaning. The second model, an inline version of the Mobile Cleaning Device (Inline MCD), can be used to automatically clean processing plants and process lines. The Inline MCD is additionally equipped with a variety of cleaning nozzles and brushes; during the cleaning process, it travels along the same path as the product through the process equipment, via conveyor belts or rail systems.

First step into the circular economy – natural fiber-based packaging solutions and material substitutes

The packaging industry is facing growing demands for recyclable packaging systems – in response, Fraunhofer IVV is developing customized, fiber-based packaging systems and technologies that can reliably control the processing behavior of paper and alternative materials in high-speed machines.

Exhibits will demonstrate the variety of shapes of thermoformed fiber-based packaging that can be created and what can be achieved when 3D molded parts are combined with embossing processes in consumer packaging. They will also show how molded parts can be combined with functional – and sometimes, even organic – barriers.

By focusing on efficiency, safety and feasibility, Fraunhofer IVV offers holistic support for companies making the switch to alternative materials and recycles. At interpack, the institute will provide insight into advanced forming, joining, measuring and monitoring technologies, as well as research services along the process chain – these range from material selection and characterization to process and machine analysis



and packaging design. To this end, Fraunhofer IVV is developing inline monitoring technologies, specifications for process parameterization and needs-based process and machine designs; they are also conducting onsite efficiency analyses in industrial production environments.

Fraunhofer Institute for Process Engineering and Packaging IVV www.ivv.fraunhofer.de

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New Pelletizing Extruder Covers a Wide Range of Applications – *Suitable also for Used PVC Window Recycling*

battenfeld-cincinnati has responded to the rising demand for higher throughput rates and more flexibility concerning materials to be processed by developing a new pelletizing extruder series for PVC. At the K 2023 booth, a model from the new aglomEX counter-rotating parallel twin screw extruder series was presented for the first time. This series includes two variants – with or without electrically driven shear gap adjustment (EMS) – and several machine sizes.

aglomEX processing units are based on the twinEX models which are already well established in the market, and just like these now provide processing units of up to 34 D. The aglomEX has a processing length of 34 D instead of 28, and the aglomEX with EMS 28 D instead of 22. Due to their 6 D longer processing unit, aglomEX extruders offer an about 20 % higher output than the previous PVC models.

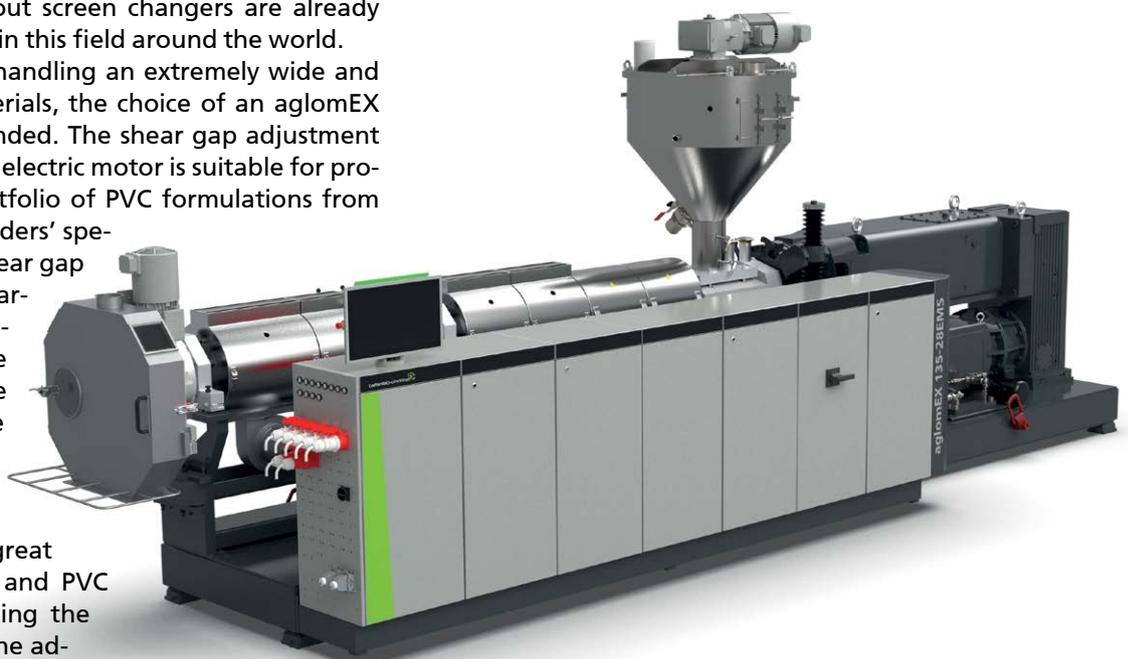
With their sizes 93, 114 and 135, conventional aglomEX models achieve output rates of up to 1,500 kg/h. They can handle both dry blend processing and recycling of PCR materials, for example from the Rewindo collection system. In developing this series, battenfeld-cincinnati was able to draw on its many years of experience in processing recycled materials. Numerous machines with and without screen changers are already successfully operating in this field around the world.

For PVC processors handling an extremely wide and varying range of materials, the choice of an aglomEX with EMS is recommended. The shear gap adjustment system powered by an electric motor is suitable for processing the entire portfolio of PVC formulations from soft to hard. The extruders' special design shapes a shear gap between screw and barrel. This gap can be altered by adjusting the relative position of the barrel to the movable screw to set the requested shear rate. EMS ensures optimal plasticizing for a great variety of dry blends and PVC formulations while using the same pair of screws. The advantage for the operator

is that time-consuming and costly changeover work is no longer required and the EMS can even be steplessly adjusted to varying material grades during production. aglomEX models with EMS are available in the two sizes, 114 and 135 mm for outputs up to 2,000 kg/h.

aglomEX models are universally applicable, meet the requirements of the industry for high output rates and processing of PCR materials, and they are also designed with optimal access for easy cleaning, and for intuitive operation via their modern control system.

► **battenfeld-cincinnati**
Bad Oeynhausen/Germany
Vienna/Austria
www.battenfeld-cincinnati.com



Processing of Increasingly Green Plastics – *Innovation Opens Up to Circular Economy*

Today, more than ever, the plastics industry is showing increased sensitivity to environmental issues with a view to fostering a circular economy, in terms of plastic production and consumption. Focus that also translates into concrete actions by the European Union, which has included this material among those with the highest priority for action in the framework of the Action Plan for the Circular Economy. In more detail, the so-called Plastics Strategy and the Single Use Plastics (SUP) Directive were developed to guide the move towards a more sustainable model.

In this sense, the need emerges to adopt a unified strategy that tackles the challenge in a synergetic manner, focusing on three pillars: reducing the consumption of virgin polymers, recycling post-industrial and post-consumer waste, and replacing its use with bioplastics made from plant-based raw materials.

"We are facing a real paradigm shift that is influencing the development of the latest generation of extrusion machines capable of operating with even greener formulations" says Massimiliano Fenili, the company's Technical Manager, who continues: "Our customers

are becoming increasingly environmentally aware and are investing in advanced technologies and in a virtuous policy of recovery and recycling." And he concludes: "In this scenario, Bausano is at the forefront, alongside the sector's operators, to respond to the market's new requirements, with ad hoc designed technologies that implement innovative transformation methods, which are also energy-saving.

This is a role that Bausano - a leading international player in the design and production of customised extrusion lines for plastics processing - successfully fulfils, by virtue of its in-depth knowledge and expertise of the pros and cons of each material and production process. A platform of solutions that Bausano, starting from the same technological root, constantly enhances to achieve ever higher levels of sophistication that meet every technical challenge related to the different formulations. With this in mind, Bausano, in addition to the already popular plant fibre-plastic composites, designs innovative extrusion lines that can also process blends that integrate environmentally sustainable plastics, such as PLA, with the plant component (rice husks, coffee grounds, banana peels, seaweed, almond shells, avocado kernels, cork and other plant residues). A further case of excellence, in terms of sustainable innovation by Bausano, is the processing of an even more sustainable formulation of Wood Plastic Composite (WPC), no longer only obtained from a combination of PVC and sawdust, rice husks, etc., but also from plastic



waste together with the plant component.

In such a scenario, Bausano's added value, in addition to the technological core of its extruders, lies in product engineering with tests aimed at creating customised configurations capable of securing a competitive advantage for its customers, such as:

- ABS (acrylonitrile butadiene styrene) terpolymer derived from the recovery, post-consumer, of electronic equipment (WEEE) undergoing testing with an unprecedented experimental line under the banner of maximum production performance;

- LDPE (low-density polyethylene) thermoplastic polymer from bottle caps with up to 60 per cent post-consumer material, for an output of 750 kg/h by twin-screw extruders of the MD series;



- High-density polyethylene HDPE, derived from bottles, with up to 60 per cent post-consumer component and productivity equivalent to 200 kg/h using E-GO series single-screw extruders;

- PLA-based WPC, with polylactic acid component required by the customer between 60-80% and sawdust component between 20-40%, for an output of 100 kg/h with MD series twin-screw extruders;

- Biodegradable PBAT (adipic acid copolyester) thermoplastic, gener-

ates 900 kg/h for the production of flexible packaging.

Several critical issues have been resolved by Bausano in the course of these extrusion processes. Firstly, post-consumer waste, besides being characterised by a great variability of characteristics, is often affected by oxidation-degradation processes, which can alter its physical and mechanical properties. Secondly, materials from renewable sources pose just as many challenges, stemming from the complex handling of their rheology and the limited thermal processing range.

"The most recent guidelines issued at European level show that the reduction of virgin plastic consumption is one of the cornerstones of the new directives. Among the sectors in which plastics volumes remain particularly high is packaging. In order to limit the exploitation of natural resources, it is therefore essential to promote the use of viable alternatives, which are both envi-



ronmentally friendly and high-performance," says Massimiliano Fenili, Technical Manager at Bausano, who continues, "In this context, corporate strategies must also be renewed to contemplate long-term sustainable development goals, considering these changes as an opportunity to search for novel and pioneering solutions".

► Bausano & Figli Spa

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"A world without plastic is not possible, so let's make it sustainable and circular"

Interview with Bernd Roegele (Picture), president of the Equiplast Organising Committee since 2014

From 30 May to 2 June, the International Plastics and Rubber Event Equiplast 2023 will be held at Fira de Barcelona's Gran Via venue simultaneously with Expoquimia and Eurosurfas. Expectations are high for this industrial Spanish trade fair, which will bring together solutions and processes from plastics processing companies to respond to new challenges linked to the circular economy, technology transfer and digitalisation. This interview is about the event and the context,

as well as about the commercial offer and activities that professionals from the plastics sector and user industries will find.

Equiplast 2023 will be your fourth edition as president of its Organising Committee. Only a year and a half has passed since the last edition, held in September 2021 in the middle of the pandemic. What will the trade fair you are preparing for this May be like?



Bernd Roegele: Holding the event in September 2021 was quite a challenge. It was the first plastic trade fair

since the beginning of the pandemic and it was a great achievement considering the circumstances at that time. With regard to the event we are preparing for this year, I think we are doing a great job, supported by the companies and organisations on the organising committee, by the new team at Fira de Barcelona and by the good response we are seeing from the sector.

The forecasts are good, as we expect 220 exhibitors from 12 countries to participate and more than 19,000 professionals to attend. Alongside this commercial offer, attendees will also find Expoquimia and Eurosurfas, events with which we will once again coincide and with which we have important synergies. All in all, there will be more than 450 companies with stands and more than 800 brands represented in 21,000 m² net area, which means that Hall 3 of the Gran Via exhibition centre will be at 100% capacity. A success!

You have been at the head of the Equiplast organising committee for eleven years now. What is your assessment of this period?

Roegele: Eleven years already? That's right, I remember that May 2012 when I was offered the presidency of the organising committee. It was an honour! If I have to take stock, I have to say that they have been intense years, complex years, years of excitement, of nerves, years of making difficult decisions and years of satisfaction, above all for the support received by the other members of the committee and by the Fira de Barcelona team. The truth is that I have had to deal with complicated editions (2014, the end of the economic crisis, 2017 the Catalan Procés, 2020/21 Covid-19), but here we are and we continue to fight for Equiplast, as the benchmark event for our sector in Spain.

Do you think the plastics industry is very different now than it was then?

Roegele: The plastics sector is constantly evolving to provide industry with solutions to new needs

and, in this sense, it is developing applications for more sustainable production adapted to the times. To answer the question directly, the plastics sector is not very different now than it was 12 years ago, but it is moving, researching and developing new processes in which raw materials and transformation machinery coexist, always focused on the circular economy, and we will see this at Equiplast.

Despite all the efforts made by the plastics sector to become more sustainable and environmentally friendly, one of the biggest difficulties is to deal with the demonised public image of plastics, which is also reflected in the regulatory framework. What more can companies in the sector do to turn this situation around?

Roegele: Companies in the sector have been working for years to reverse this situation. Together with the chemical industry, more sustainable plastics are being developed and machine manufacturers are adapting their production processes to these materials. There are more and more applications for producing plastic parts with a higher content of recycled material. We are an active part of the circular economy and many companies collaborate with institutions such as the Ellen MacArthur Foundation, which was established in 2010. We also incorporate Industry 4.0 technologies to optimise processes, generating less waste and increasing energy efficiency.

As a complement to the commercial offer, what other activities will there be at Equiplast?

Roegele: We will have the Re-thinking Plastics exhibition where attendees can see and touch different articles made from recycled, biodegradable or renewable plastics. With this exhibition we are showing our industry's commitment to the environment. We have been working for years to ensure that plastic never becomes waste, but rather a new raw material for different uses. Also, in the knowledge section, to-

gether with Expoquimia, we are inaugurating the "Best in class" programme through which we will give voice to the success stories of different industries that use plastic or chemical solutions, equipment and technology that have implemented innovative projects in the field of the circular economy, digitalisation or technology transfer. We will also be holding the Eurocar Conference, together with Eurosurfas, specifically for the automotive sector.

What can this year of the fair bring to companies and professionals in the plastics sector?

Roegele: Equiplast is the benchmark trade fair event for the Spanish plastics industry. It is our meeting place, to promote sales and business, to make commercial contacts, but also to discuss issues of sector debate and generate shared knowledge. The current situation, which is complex due to different factors affecting our industry, whether due to technological, regulatory, energy or economic changes, requires an Equiplast with a very practical focus that allows our attendees to explore, select and acquire the best solutions in plastic materials, as well as machinery and process and transformation technology to successfully face the challenges ahead, especially environmental ones. I am convinced that Equiplast 2023 will bring a new impetus to our sector.

Finally, how do you see the future of the plastics industry?

Roegele: Optimistically. We cannot imagine a world without plastic. There is no substitute today. But we have to be environmentally friendly, reduce the quantity as much as possible, and above all take back and recycle it, and go for its circularity.

Thank you for this interview.

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The Importance of Surface Treatment at the Extrusion Stage of Film Production

According to leading surface treatment authority, Vetaphone, understanding the extrusion process and the effect it has on the production chain of printing and converting film is an essential key to success.

Plastic film has become so much a part of our daily life that we often don't even notice it's there – hidden in plain sight you might say. But its importance is undeniable, certainly in the form of flexible packaging, and this is where its natural ability to repel liquids creates issues in the printing, laminating, and converting processes that are inherent in its production.

The fundamental issue is that of adhesion. Plastic poses a problem when it comes to the adherence of a liquid. Use a ballpoint pen to write on a plastic bag and you can smudge the ink by rubbing your thumb over it. The problem is a mismatch of surface energy between the two, and this is resolved by modifying the molecular structure of the plastic surface. This process is known as corona treatment and starts at the very beginning of plastic film manufacture, when it is extruded.

Controlled corona

By applying a carefully controlled electronic discharge at close range to the plastic film, the chemical make-up of its surface layer is changed by breaking down the long molecule chains which then allows the liquid to adhere. By increasing the surface energy of the plastic film, which is measured in dynes, it is possible to perform a range of different printing and converting processes that would otherwise prove impossible. And, this process of surface treatment starts at the very beginning of plastic film manufacture, when it is extruded.

But, like most industrial processes, it is not straightforward. Different plastic film formulations have different levels of surface energy, which is measured in Dynes, and different processes demand different Dyne levels to be successful. Basic materials like PP, PE-LD, PE-HD, and BOPP have a range of native Dyne values from 29 to 32. However, the Dyne level requirement, for example, of printing with solvent-based inks, or water-based inks, or for coating or laminating vary from 40 - 42 at the low end to 46 - 56 at the high end. To achieve these higher Dyne levels, the corona system will require more power.



The Vetaphone C model is a high-power corona treater for blown film applications

And it all starts with the extrusion process, which can raise dyne levels from 32 to 52 or more, whereas after extrusion, the polymer chains take 48 to 72 hours to post-crystallise, with additives like slip agents and those for anti-fogging migrating back to the surface and in turn affecting the adhesion level.

Securing correct treatment at extrusion is vital for two reasons: first, because dyne levels decline over time – typically 4 to 6 dynes over a period of 2 to 3 weeks before stabilising; and second, because subsequent 'boost' or 'bump' treatment may be required later, depending on the intended process, and this may not be possible if corona treatment during extrusion was poor. Increasing Dyne levels at extrusion is easy, but after a period of crystallisation, additives like slip agents and those for anti-fogging migrate back to the surface and reduce the Dyne level and lower adhesion. Correct treatment at extrusion is therefore vital for two reasons: first, because Dyne levels decline over a period, and second, because subsequent 'boost' or 'bump' treatment may be required depending on the intended process, and this may not be possible if corona treatment during extrusion was poor.

Blown film extrusion

In this process the film is extruded vertically and wound into one flat tubular or two reels that are then converted by printing/coating/sealing into the final packaging product. Blown extrusion is typically for PE based materials, and the corona station is usually located at the top where the flattened tubular film is treated on the outside only. It is then split in two and can be either treated additionally, which is rare, or alternatively on the inside before being wound onto reels. On some extruders, the winder operates in both directions, so just one double-sided corona treater can be used.

The reels are then passed through a converting process where the welding takes place, and as corona treatment is notoriously the enemy of welding, because the oxidation generated by the corona process weakens the welding area, it is important to evaluate the likely effect in each case.

Blown film extrusion includes multi-layer polymers like LDPE, LLDPE, mLLDPE and MDPE, and applications include pallet hoods, collation shrink film, stretch hoods, lamination film, deep freeze film, heavy duty film, protective film, and food packaging film. These are single layer up to normally 3 layers but can be up to 11 layers in the case of food packaging film

Cast film extrusion

In Cast film extrusion, the substrate is produced from a flat die and wound as a single film after being side trimmed. In this type of installation, the corona treater is usually located before the winder but after the first

edge trimming zone. Because the edges of the cast film are thicker than the rest of the web they need to be cut off before entering the corona station and winder to prevent any damage to the rubberised rollers.

Cast film extruders have a higher capacity and faster running speed than their Blown film counterparts, so a corona treater capable of delivering a higher power is required to achieve the best result. Cast Polypropylene, normally called CPP and different to stretch film, is used for a wide range of packaging, and normally requires corona treatment. If an oxygen barrier is required, the outer LDPE or PP layer is normally corona treated for the next printing or laminating process. Diaper film is typically LDPE.

How to get it right

Extrusion is a composite process so there is a definite need for specialist knowledge to ensure the best results are obtained. As substrates become more complex to meet new packaging and safety criteria, the need for a detailed understanding of the surface treatment process and what it can offer becomes more important.

With more than 70 years of experience and research data, Vetaphone is unrivalled in its ability to advise, educate and assist production personnel at every stage where surface treatment technology is required. Often misunderstood, it is a process that if managed correctly pays dividends throughout downstream processing from the moment of extrusion.

 Vetaphone A/S
 Fabriksvej 11, 6000 Kolding, Denmark
www.vetaphone.com

First PET Bottle-to-Bottle Recycling Line in Kenya

T3 (EPZ) Limited, a member of Megh Group, ordered a Starlinger recoSTAR PET bottle-to-bottle recycling line for its new plant in Athi River, Kenya. With this project, T3 aims to contribute to the establishment of a circular economy with a positive impact on both the environment and the society in the country.

Driven by the need to stop pollution of the environment in the country, preserve natural resources, and increasing awareness about the benefits of recycling, the market for recycled PET in Kenya is growing. Megh Group company T3 (EPZ) Limited is going to install the first PET recycling system for bottle-grade rPET and resin in Kenya and Eastern

Africa, a Starlinger recoSTAR PET 165 HC iV+ recycling line, in Athi River just outside Nairobi. The food-safe rPET will be used in bottle pre-form production and for polyester fibre production in the textile and garment industries as well as for the group's automotive trims and textile business Megh Singh Cushion Makers. T3 sources the post-

consumer PET bottles for recycling through various collection strategies. With thorough collection and sorting methods and processing on the FDA and EFSA-approved Starlinger recycling system T3 ensures that the produced rPET resin will be of highest quality to meet the standards of global brand owners such as Coca-Cola.

“As we were trying to develop a project to produce our own textiles for the automotive sector, we realized that there is a big need for recycled materials in the textile and packaging industry”, explained Gurpreet Kaur Kenth, CEO of T3. “Given the global shift from virgin to recycled materials with increasing consumer awareness and demand for sustainable products, there is growing need for recycled polyester in Kenya. We see the opportunity of closing the loop in Kenya through bottle-to-bottle recycling and have a number of reasons why we started this project. The main one is the impact we can have both on the environment and the local communities. Recycling is one of the most effective ways to reduce waste and conserve natural resources. When bottles are recycled, we are reducing the need for new raw materials. This helps conserve non-renewable resources such as oil and natural gas, which are used to make plastic. At the same time, bottle collection provides a source of income for the informal sector of waste pickers.”

Benefits for the environment and the community

The plastics recycling industry in Kenya is still in its early stages and faces challenges such as lack of input material and infrastructure, low levels of investment, and limited access



Around 1,334,000 tons of plastic become waste in Kenya each year (UNIDO. (2021). *STUDY ON PLASTIC VALUE CHAIN IN KENYA*. Retrieved on Feb. 20, 2023 from https://unido.org/sites/default/files/files/2022-01/Plastic_value_chain_in_Kenya.pdf). With the new Starlinger PET bottle-to-bottle recycling line T3 will be able to convert used PET bottles in a valuable secondary resource for new bottles and textiles (Pictures ©T3)

to market information. T3 has developed an extensive collection system throughout the country with the aim of building the right incentives for waste collectors, who are extremely marginalised. “Our social mission is to ensure that no one is left behind as we develop the idea of a circular economy in Kenya”, said Ikreet Kenth, CTO of T3. “Uplifting the informal sector through the impactful methods that we use to collect the plastic waste enhances livelihoods by converting waste into a tradeable commodity, forming new trading networks and businesses, and generating employment. In addition,

the reduction in the need for new raw materials helps to reduce environmental pollution and the carbon footprint, and to conserve resources for future generations.”

Asked why T3 opted for a Starlinger system, Gurpreet Kenth said: “Starlinger is a leading supplier of recycling technology for plastics and has decades of experience in the field. The company has a strong track record of delivering high-quality recycling solutions with recycling lines that are designed using the latest technology. They provide great ongoing support, have top-tier engineers who ensure the machines are made to perfection, and value customer relations a lot. Starlinger is a company that wants to build relations and make a difference in the world. Our shared values convinced us to go ahead with their technology. Our goal has always been to put Kenya on the global map when it comes to recycling, and being the first company in Kenya to produce not only rPET but food-grade recycled resin will help us to achieve that.”

In T3's Athi River facility the input material is thoroughly sorted before further processing. The FDA and EFSA-approved Starlinger PET recycling process ensures safe reuse of the recycled PET in bottle-to-bottle applications



→ Starlinger recycling technology
Furtherstrasse 47a, 2564 Weissenbach,
Austria
www.recycling.starlinger.com

Megh Group
www.themeghgroup.com

“You get a measurement you trust”

HÖHLE uses SIKORA’s X-ray measuring systems for inline quality control of microducts

HÖHLE is a manufacturer of first-class microducts that are used for building fiber-optical networks to house optical fiber cables as a protective channel. Located in Estonia, the company uses SIKORA X-ray measuring systems in its plant for quality control during the extrusion of microducts. The cooperation between both companies is based on their mutual commitment to deliver high quality products to fulfil the customer demands.

Known for short lead times and flexible services to its customers, HÖHLE puts high emphasis on the quality of the microducts they produce. Thus, they only use pure raw material of the highest quality and have also included continuous online measuring and control systems in the manufacturing process. For measuring the inner and outer diameter, wall thickness and eccentricity of the microducts the company has installed three X-ray based X-RAY 6000 PRO devices from SIKORA in their lines to measure microducts within diameter ranges between 3 and 20 mm. “The advantage of the X-RAY systems is that you are confident about the measured values and you get correct product dimensions immediately with the start-up of the line with 'one shot',” explains Toomas Koobas, CEO at HÖHLE, and adds, “For microduct production, continuous inline monitoring is the key factor when talking about quality. This can be achieved with SIKORA devices.”

Special at HÖHLE is the use of three separate monitors of the ECOCONTROL 6000 processor system connected to each X-ray device. These allow the operators to have constantly access to the current measuring values. The real-time visualization is the secret of a perfect process control. Compared to alternative technologies for quality



From left: Toomas Koobas, CEO, and Production Manager, Marko Hoolma, at HÖHLE in the microduct production plant in Estonia

control such as ultrasound, X-ray technology provides consistent measuring values without being affected by temperatures, or material. There is no need for coupling media and there is no calibration required. “With X-ray you get a measurement you trust and a guarantee of compliance with microduct specifications,” says Koobas.

For utmost quality control HÖHLE also uses SIKORA lump detectors in their lines. These systems detect the smallest non-conformities on the microducts surface. The operator receives immediate information in case of a fault and can take necessary actions. The combination of X-ray measuring systems and lump detection during the manufacturing process ensure the highest microduct quality for highest customer satisfaction.

For utmost quality control HÖHLE includes the LUMP 2000 for lump and neckdown detection in the microduct extrusion lines

HÖHLE uses the X-RAY 6000 PRO for dimension measurement during the production of microducts



WPC Deck Boards Perfectly in Shape

ProfilControl 7 DX WoodPlasticComposites provides 100% dimension measurement of WPC deck boards

A leading US manufacturer of sustainable decking products made of wood-plastic composites (WPC) uses measuring technology made in Germany for its quality control. The PIXARGUS inline system, ProfilControl 7 DX WoodPlasticComposites, ensures 100% inspection of the entire board profile in a continuous, inline process. As a premiere, the system inspects even highly critical features, such as the grooved edges of the boards, with the highest accuracy – and with minimum handling effort, from quick commissioning and set-up through to automated switch-over from one product variant to another.



Looking for decking that leaves nothing to be desired? Decking that is designed to last, be resistant to fading, has a natural look, and is safe for children and pets, as it resists splintering and is non-slippery? You can get all this from composite decking. Wood-plastic composite decks are the sustainable alternative to traditional

Resistant to fading, designed to last, easy to maintain, and safe: The new ProfilControl 7 DX WPC inline measurement system from PIXARGUS ensures that decking and cladding made of wood-plastic composites are of perfect shape

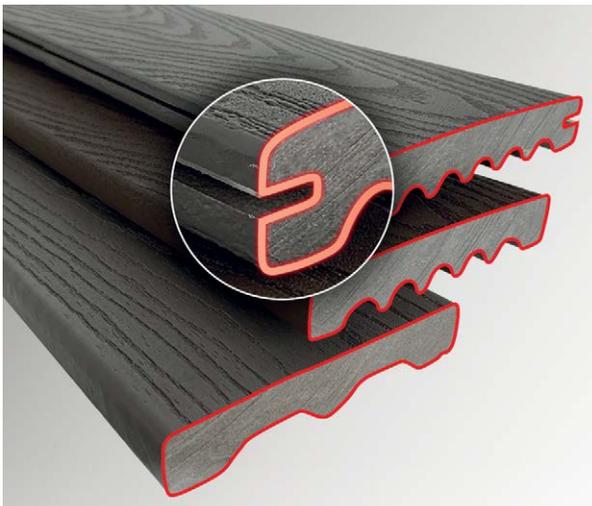
wood decks made from exotic hardwoods.

Thorough quality inspection is also essential for these innovative WPC products. A new inline inspection system from PIXARGUS – ProfilControl 7 DX WoodPlasticComposites – is now available to ensure that all of the deck boards leaving a manufacturing line are of perfect shape. The system is of compact design and based on PIXARGUS' proven and success-

ful PC7 inspection technology. One such system is now successfully in use at a leading decking and cladding boards manufacturer in the USA.

OPC-UA interface is the pathway to fully automatic manufacturing

This renowned US deck board producer has recently made great strides in automating its production processes. In 2022, all process steps, machines and equipment were networked and linked with the higher-level control systems.



ProfilControl 7 DX WPC from PIXARGUS ensures 100% inspection of the entire board profile in a continuous, inline process. As a premiere, the system inspects even critical features, such as the grooved edges of the boards, with high accuracy

The company now uses the new smart inspection system from German measuring specialists PIXARGUS to make quality control of its extruded deck boards a fully automatic process.

The camera-based digital inline inspection system ProfilControl 7 DX WPC from PIXARGUS comes with an OPC-UA interface that allows it to smoothly and seamlessly integrate with the manufacturer's process chain and communicate with the various control units and downstream processes in real time.

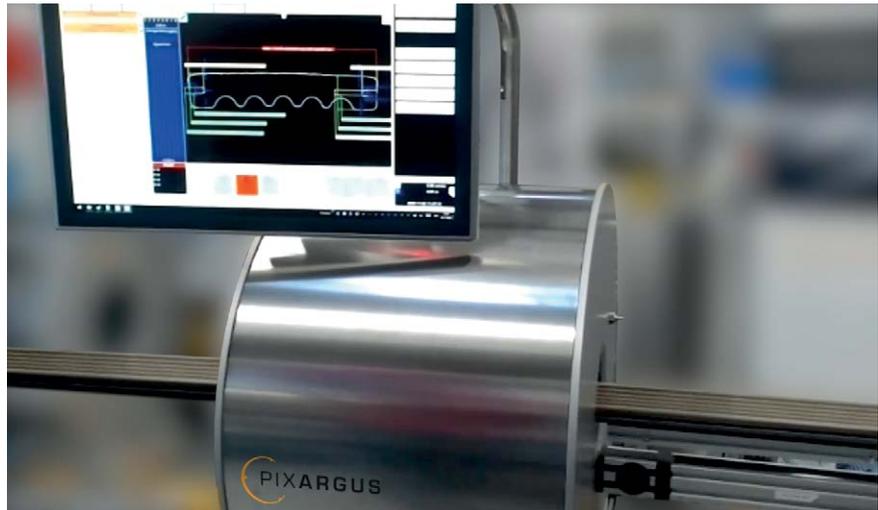
Automatic product grading and stacking

In addition to providing 100% inspection of the deck boards in a continuous process, the measuring system's smart software is also instrumental in grading the products fully automatically. Boards graded as defect-free are automatically stacked ready for dispatch.

Automated product switching

The link between the PIXARGUS system and the manufacturer's higher-level control systems also enables automatic switching from one product variant to another. Upon a signal received from the line control system, ProfilControl 7 DX WPC automatically adjusts to the inspection parameters of the

Specifically adjusted cameras can inspect even very deep and narrow grooves



new product – during running production.

A first in quality control: 100% inspection even of critical features such as deep grooves

After the deck boards have been cut to length, the eight high-resolution cameras of the ProfilControl 7 DX WPC system capture the contours of the boards in an inline process, checking all radii, angles, distances, lengths, heights and widths. For the use case at the US deck board manufacturer, PIXARGUS has positioned the cameras in such a way that also the entire grooved edges of the deck boards can be measured. These grooves will later accommodate the fasteners to install the decking.

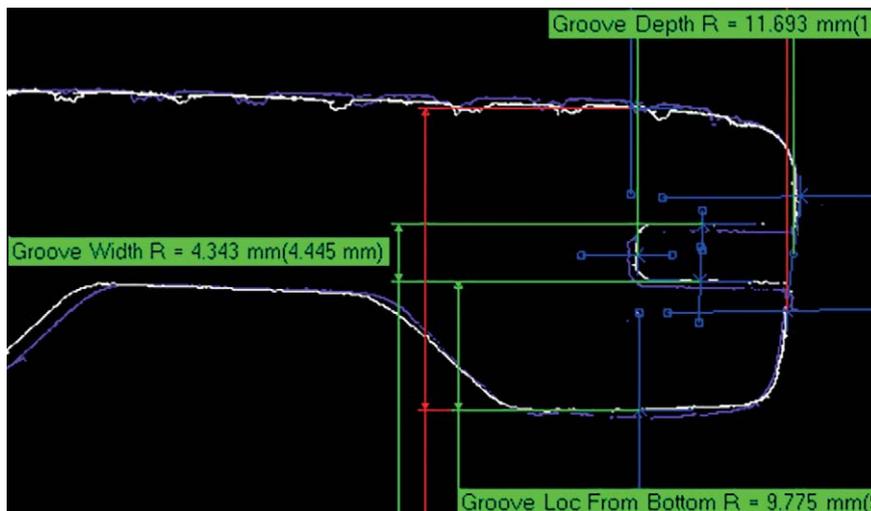
While the standard measuring systems the US customer had used in the past were only able to measure either the height or the depth of the groove, ProfilControl

Thanks to its OPC-UA interface, ProfilControl 7 DX WPC can be easily and seamlessly integrated into manufacturing lines and process chains. The measuring system provides quality data for downstream processes and adapts automatically when production switches

7 DX WPC uses a specially adapted sensor head to measure both parameters of the highly challenging groove geometry simultaneously with just one measurement (see screenshot below).

Turnkey solution designed to cope with the most challenging production conditions

ProfilControl 7 DX WPC is supplied calibrated ex works. The process reliability and measuring accuracy are in compliance with MSA type-1 and type-3 studies. This means the system fulfills even the most exacting internal QM requirements. It is designed for up to 250 mm wide products and stable operation under the most challenging production environments. The sensor unit is protected by an enclosure. This makes the measuring equipment highly resilient to contamination. The new PIXARGUS system has already proved highly successful at the US customer's operations.



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Data-driven Prediction the Tensile Strength of Blown Film Due To Digital Shadows

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Institute for Plastics Processing (IKV)
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In addition to the optical and barrier properties, the mechanical properties are used as an important quality factor. The qualitative relationship between the influencing variables and the resulting film properties is largely known, but the findings are, depending on the model, highly machine-dependent. Ohlendorf [Ohl04] derives a property model through an empirical-statistical approach, which already allows a high prediction accuracy for the prediction of the Young's modulus and the film shrinkage. However, a prediction of the tensile strength is not yet possible with sufficient accuracy. An extended modeling approach therefore provides for modeling which, in addition to the known parameters, also takes into account the stretching and cooling behaviour in the tube formation zone.

Around 40% of the plastic processed throughout Europe is used in the production of packaging, of which plastic films make up a considerable amount [Nen19c]. In Germany, too, the packaging sector represents an important branch of industry with an annual consumption of around 4.4 million tonnes. In addition to packaging, films are also used in medical products, in the automotive and electrical industries, and in the agricultural and construction sectors [Nen06]. Because plastic films can be further processed into a wide variety of products, machine producers are faced with increasing challenges: Advancing globalisation and the associated worldwide price competition. To remain competitive in the long term, it is often necessary to position oneself in the market by means of unique selling points such as increasing productivity with high product quality [Dis13].

Next to flat film extrusion, blown film extrusion is the most important production process for plastic films [Nen06]. Compared to flat film extrusion, the advantage of blown film extrusion is that the film width and thickness can be varied flexibly without having to modify the line or die technology. Biaxial properties of the film can also be adjusted in a targeted manner, which, however, requires a high level of process knowledge [Lim13]. Therefore, non-knowledge-based process control, only using machine parameters like take-up ratio, blow-up ratio or frost line ratio, usually does not lead to the desired film properties, as the shape of the foil geometry is not included in the modelling. In addition to the optical and barrier properties, the mechanical properties are used as an important quality criterion. The quali-

tative relationships between the influencing variables and the resulting film properties are largely known, but the findings are highly material-dependent and often machine-dependent, which means that a calculation of the mechanical properties without extensive, empirical investigation is only possible with reduced prediction quality [Ohl04].

Ohlendorf therefore developed a material-dependent calculation model which aims to predict the mechanical properties based on process parameters, thus enabling transferability to other machines [Ohl04]. However, a validation of the model shows that the transferability is only possible to a limited extent, which is due to an incomplete description of the process state, e.g. the thermal and stretching history of each segment of the film. Therefore, in the following an approach to increase the model quality is presented to increase the transferability of the empirical process model to other production machines.

For this purpose, it is first explained how the mechanical properties of blown films are influenced by processing. Subsequently, the process model according to Ohlendorf is explained and optimisation measures for increasing the model quality are shown.

Determination of the mechanical properties of blown films

The mechanical properties of blown films are set to a large extent in the tube formation zone between the die and the frost line. They can be qualitatively attribut-

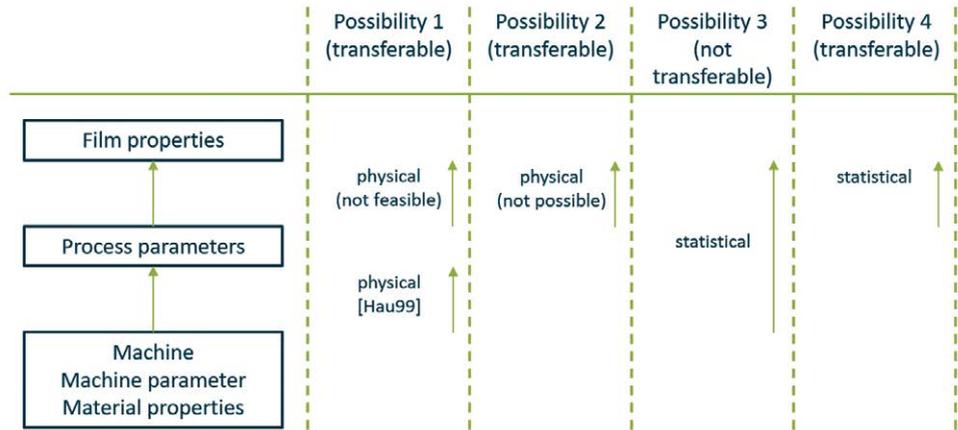
ed to the biaxial orientation state and the crystallisation state of the material.

For the orientation of thermoplastics, they must be stretched above their softening temperature (retardation). In blown film extrusion, this occurs in the direction of extrusion if the take-off speed of the film above the frost line is greater than the exit speed of the melt from the die (take up ratio > 1). Similarly, orientation of the film in the circumferential direction occurs when the blow-up ratio is greater than one (blow-up ratio > 1), which is given by nozzle and bubble diameter. The faster the material is solidified, the lower the orientation retardation and therefore, the lower the decay of molecular orientation. It can thus be stated that the interplay of the cooling process and the course of longitudinal and transverse stretching determines the biaxial orientation state of the film. If the orientation behaviour of different materials is investigated, a qualitative correlation can be found: Materials with a lower molecular weight relax faster. In general, a higher degree of orientation of the macromolecules leads to an increase in the mechanical properties in the direction of orientation.

In addition to the formation of orientations, crystallisation can exert an influence on the mechanical properties. The more the film is stretched in the tube formation zone, the more spherulite growth is inhibited and existing superstructures are destroyed. The result is a hidden structure with a high degree of crystallisation. The faster the melt is cooled, the finer the resulting microstructure. To what extent thermoplastics crystallise at all and to what degree depends crucially on the structure of the macromolecule. Semi-crystalline thermoplastics with a linear chain structure, e.g. PE-HD, can reach a degree of crystallisation of up to 70%, while branched chain structures (e.g. PE-LD) are not capable of a high packing density. However, a generally valid statement between the degree of crystallisation or the structure that forms and the resulting mechanical properties cannot be made [MHMS14].

Modelling for the prediction of mechanical properties in blown film extrusion

Analogous to other technical processes, there are different possibilities for choosing the input and output variables a model for predicting the mechanical film properties. A distinction must be made between machine, process and quality parameters. If the machine parameters are used as input parameters of the model, the model might not be transferable to other machines. Similarly, a process model reflects the relationship between process and quality parameters. Both physical



Picture 1: Possibilities of modelling for the prediction of film properties [Ohl04]

and statistical modelling can be applied for both variants. Furthermore model building methods, e.g. "grey box models", allow a combination. Picture 1 shows the possibilities of model building for the calculation of mechanical properties.

The first possibility consists in the purely physical modelling, which represents the ideal solution for the prediction of the mechanical properties with sufficient model quality. Hauk [Hau99] uses two-stage modelling to predict tensile strength. He succeeded in the first partial step, the physical calculation of the process state from the machine parameters, however, multiscale simulations are known which can derive the film properties physically conclusively from the process state, but currently they have unfeasibly high computational demands [Hau99]. As already explained, the mechanical properties depend significantly on the material- and process-dependent degree of orientation, crystallisation and their interaction, for which physically reasoned correlations, would have to be available. Due to the above-mentioned considerations, the second possibility, the physical modelling with selection of the process parameters as input variables, is not yet feasible today. A widely used method to predict film properties is the statistical modelling of the quality variables starting from the machine parameters. Since no process knowledge is developed about the behaviour of the melt in the tube formation zone, this model cannot be transferred to other machines. Furthermore, not all influences, such as material, machine or tool behaviour, are sufficiently captured and modelled. A statistical mapping from process to quality variables, which are valid for all processes and plants, allows the transfer of the model to other production plants if the modelling quality is sufficient. The disadvantage is also the experimental effort required to parameterise the model. However, since the modelling approach should be able to determine the mechanics based on the process state independently of the machine, the approach according to Ohlendorf is presented in the following and potential for improvement is shown.

The statistical process model according to Ohlendorf

The basis of the process model according to Ohlendorf is the statistical design of experiments, according to which machine parameters are systematically varied and lead to different process states and thus also to different mechanical properties of the film. Based on the resulting process state, the process parameters are collected and converted into dimensionless numbers in order to enable a machine-independent modelling. Subsequently, the film samples are examined for the required mechanical properties in longitudinal and transverse direction, e.g. tensile strength. Linear regression is used to determine the influence of the dimensionless numbers on the tensile strength. As a result, a linear model for the calculation of the tensile strength is established. The procedure for deriving the model can be taken from Picture 2.

First, the well-known, dimensionless numbers take-up ratio (TUR) and blow-up ratio (BUR) are introduced, which are regarded as a measure of the elongation in the extrusion direction and in the circumferential direction. The ratio of melt and frost line temperature describes the cooling of the tube forming zone in extrusion direction. In conjunction with the volume flow and frost line ratio, this ratio quantifies the effectiveness of the cooling ring. The influence of the film thickness on the mechanical properties is taken into account by the thickness ratio of the film thickness and the outlet gap width of the die.

$$\text{Take-up ratio: } i_l = \text{film line speed} / \text{melt speed} \quad (3.1)$$

$$\text{Blow-up ratio: } i_q = \text{bubble diameter} / \text{die outlet diameter} \quad (3.2)$$

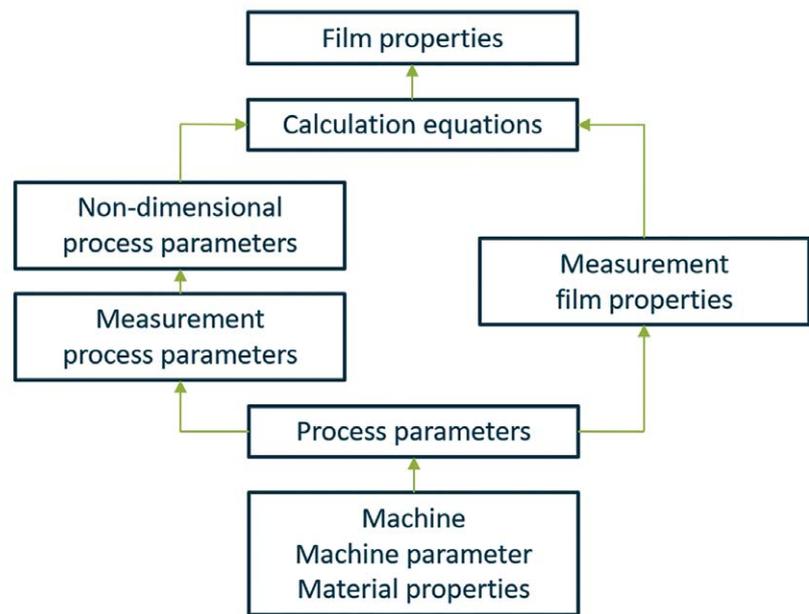
$$\text{Temperature ratio: } i_t = \text{melt temperature} / \text{frost line temperature} \quad (3.3)$$

$$\text{Volume flow ratio: } i_v = \text{melt volume flow} / \text{cooling air flow} \quad (3.4)$$

$$\text{Frost line ratio: } i_f = \text{frost line height} / \text{die outlet radius} \quad (3.5)$$

$$\text{Thickness ratio: } i_d = \text{film thickness} / \text{gap width} \quad (3.6)$$

Ohlendorf establishes a linear relationship between the established dimensionless numbers and the mechanical characteristic values (Young's modulus, tensile strength, shrinkage). Applied to a specific material like LDPE LD 150 AC of ExxonMobil Corp., Inving, Texas, United States, the following linear calculation equation can be established for calculating the mechanics:



Picture 2: Procedure of the statistical process model [Ohl04]

$$\text{Mechanical parameter} = l \cdot i_l + q \cdot i_q + t \cdot i_t + v \cdot i_v + f \cdot i_f + d \cdot i_d + k \quad (3.7)$$

Provided that the resulting process characteristics are linearly independent and the residuals are normally distributed, the regression coefficients l , q , t , v , f , d and k can be determined from the experimental space using linear regression.

To evaluate the quality of the model, the coefficient of determination r^2 is used, which can assume values between zero and one and assesses the quality the model. A coefficient of determination of one indicates that the linear relationship assumed by the model is matched perfectly by real world data. Furthermore, the average percentage deviation (a) between the forecast and the measured value is used as a further evaluation criterion.

Table 1 compares the coefficient of determination and the percentage deviation for predicting the modulus of elasticity, tensile strength and shrinkage in the longitudinal and transverse directions.

When analysing the model quality, it becomes clear that the model has the lowest accuracy when predicting tensile strength. In particular, the model does not provide sufficient accuracy transverse to the extrusion direction. It must therefore be stated that the statistical property model is suitable at most for rough estimation of the tensile strength.

Due to the modelling with process parameters, the model must be transferable to other machines. Ohlendorf therefore evaluates the transferability of the Young's modulus and the shrinkage behaviour to other production machines. Provided that the process condition is described sufficiently by the key figures introduced, no significant change in the model quality is to be expected. Table 2 shows an example of the coefficient

of determination and the percentage deviation from the real data of the model, which were collected on a blown film line of Kuhne GmbH, Sankt Augustin.

Clearly, the model does not have sufficient quality for calculating the tensile strength. Furthermore, no sufficient transferability to other machines is guaranteed.

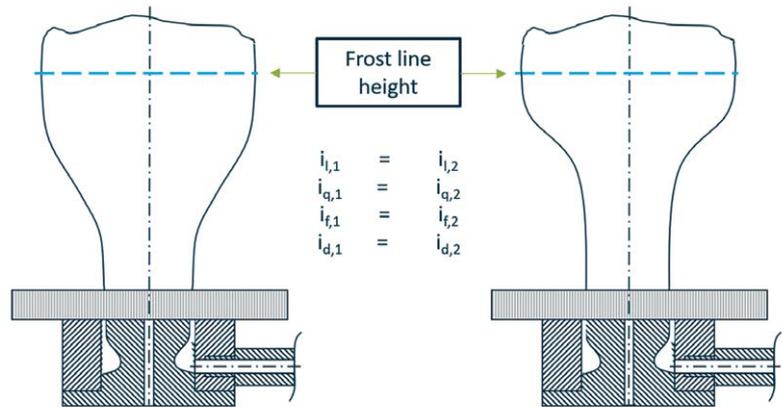
Derivation of development potentials

In the following chapter, possible deficits of Ohlendorf’s approach will be identified. Subsequently, an approach to increase model quality is presented and evaluated. As explained earlier, the mechanical properties are decisively determined in the tube formation zone. To describe the geometric deformation of any given volume of melt, Ohlendorf uses the dimensionless numbers i_l , i_q , i_f , and i_d , each of which relates a geometric quantity at the outlet of the extrusion die and the state at the frost line, at which the mechanical properties are defined. Picture 3 illustrates that the listed key figures can have the same value with different characteristics of the film geometry.

Reasons for different bubble geometries are different settings of the double-lip cooling ring or different lip designs. In addition changing process and environmental conditions, such as temperature or air flows in the production building, might change the film geometry under otherwise identical production conditions. This leads to the necessity to introduce further parameters which characterise the elongation across the bubble geometry.

A similar situation is found when considering cooling behaviour, which is described by the dimensionless numbers i_t and i_v , from which the exact cooling behaviour of the film in the tube formation zone cannot be inferred. Using only those two parameters in a linear regression model, at most a quadratic relationship between melt temperature and path length can be described. Picture 4 shows a representative cooling curve in the tube formation zone. The temperature does not decrease quadratically in the extrusion direction in accordance with the decreasing cooling capacity, but with a non-linear relationship (e.g. exponential decay). This circumstance is not considered in the work of Ohlendorf.

The process model must therefore be extended by further parameters so that an infinitesimal change in the film geometry can be assigned to an infinitesimal temperature gradient at any point in time. Therefore, new trials were conducted and significantly more data was collected on the behaviour of the film in the tube formation zone.



Picture 3: Same geometrical parameters with different bubble geometry

Investigations on the extension of the process model by digital process variables

The aim of these new investigations is to increase the model quality. This is made possible by continuously recording the film geometry and the cooling behaviour of the tube formation zone. The collected data should enable a data-driven modelling of the process to predict the mechanical properties, especially the tensile strength. This is based on the idea that if the elongation and the cooling behaviour in the tube formation zone are recorded, all the information for modelling is already available and the dimensionless numbers according to Ohlendorf no longer need to be used.

A centrally composed 2k experimental design (see Table 3) is carried out to perform the experiments, which systematically varies the control variables of mass temperature, inflation ratio, film thickness and blower power. The material used is an LDPE (type 2102NOW, Sabic, Riyadh, Saudi Arabia). From the resulting film geometry and the cooling process, additional parameters are derived to supplement the process model.

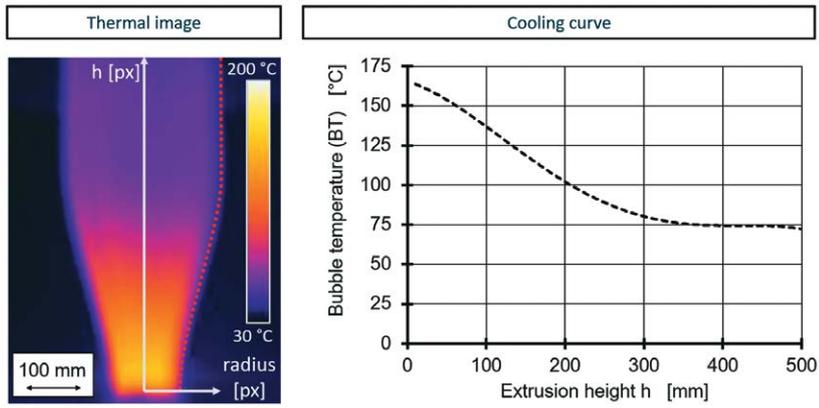
For the detection of the geometry of the tube formation zone, an optical detection or measuring system is necessary. In [Spi04] the use of a camera is proposed for this purpose. The geometry data is then derived from the generated photo material by (automatic) contour recognition. For this purpose, a camera of the model Basler ace 2 Basic of the company Basler AG, Ahrensburg, which offers the possibility of recording high-resolution images with 3840 x 2748 pixels (10.7 MP), is used. It is placed on a tripod at a defined height and defined distance from the tube formation zone. Furthermore, a suitable lightning of the tube formation zone is carried

Table 1: Coefficient of determination and percentage deviation, LD 150 AC, IKV [Ohl04]

Direction	E-module		Tensile strength		Shrinkage	
	r ² [-]	a [%]	r ² [-]	a [%]	r2 [-]	a [%]
Longitudinal	0,82	3,20	0,77	7,04	0,91	2,39
Cross	0,82	5,72	0,5	6,68	0,96	7,01

Table 2: Coefficient of determination and percentage deviation, LD 150 AC, Kuhne GmbH [Ohl04]

Direction	E-module		Tensile strength		Shrinkage	
	r ² [-]	a [%]	r ² [-]	a [%]	r2 [-]	a [%]
Longitudinal	0,12	14,61	-	-	0,55	19,73
Cross	0,27	26,81	-	-	0,85	18,73



Picture 4: Non-linear, non-quadratic behaviour of bubble temperature

range is impossible in most cases. Grey-box models combine the advantages of white- and black-box models. A well known example of grey box modelling is linear regression, which establishes the functional, statistical relationship between the input and output variables without using physical modelling. For this, an influence of a variable on the target variable must be assumed, e.g. in the context of a sensitivity analysis. If there is a basic understanding of the process, but the model quality is not sufficient, a black box model can be used. In this case, the main influences are first described mathematically (physically or statistically) and then optimized by data that is not part of the white or grey box model [NN19b]. Following Ohlendorf, the suitability of linear regression is first investigated to model the tensile strength.

For a linear regression there is the requirement that the coefficients must be linearly independent or not correlated. Table 4 shows the correlation matrix of the coefficients. Correlation coefficient of 1 or -1 means that there is a strictly linear relationship between the parameters. For a linear regression, a regression coefficient between -0.2 and 0.2 is desirable for (marked in grey).

Due to the high correlation of the input parameters, they are not suitable for multiple regression, as sufficient accuracy cannot be achieved to predict the tensile strength. None of the parameters have a significant influence on the tensile strength in the longitudinal or transverse direction. The property model can therefore not be extended by adding further linear terms in the sense of linear regression. An alternative is the method of Partial Least Square Regression (PLS). The advantage of this method is that the input parameters of the model may be highly correlated or intercorrelated. If the PLS is carried out exclusively with the derived coefficients, without considering the "classical" parameters of the property model, a model quality of $r^2 = 0.602$ and $r^2 = 0.537$ results for the calculation of the tensile strength in the longitudi-

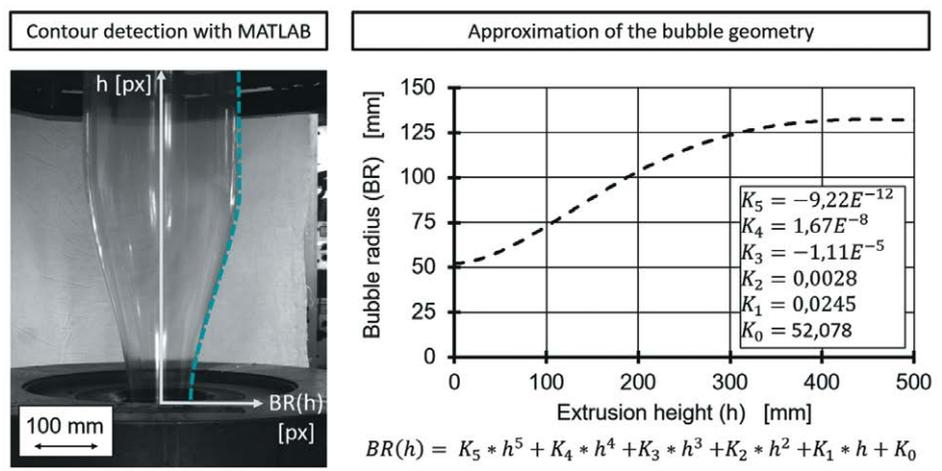
nal and cross direction. Larger values of r^2 (close to 1) indicate a high model quality, low values (close to 0) indicate a low model quality. Considered on its own, the model is therefore not yet suitable for prediction.

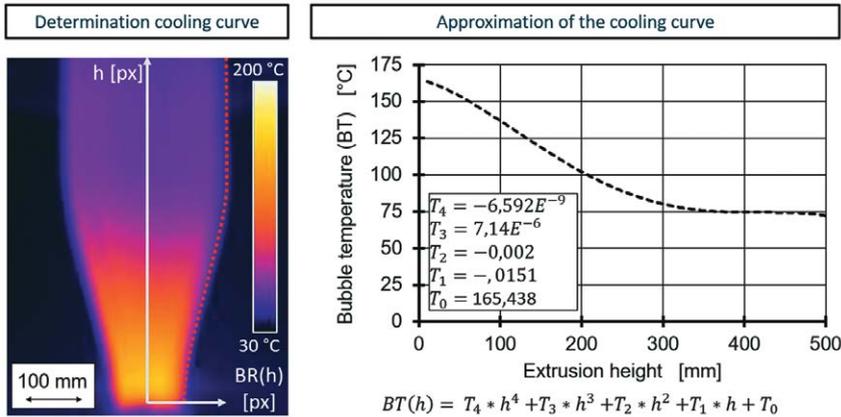
However, this finding must be set in relation to the fact that, in addition to the added coefficients, no further elementary process parameters, such as the melt temperature or the take-off ratio, have yet been included in the PLS model. In this respect, an enormous potential of the collected parameters for the improvement of model quality can possibly be assumed. Another possibility is the use of the conventional model in combination with an artificial neural network, which is likely able to represent also non-linear correlations of the derived coefficients with the tensile strength in a higher model quality (black box model as booster). A pure black box model including the parameters derived can also be considered.

Conclusions and outlook

The prediction of mechanical parameters during the blown film process is an important prerequisite for product development and quality optimization. Statistical or data-driven models are possibly suitable for modelling the influence of the process parameters on the mechanical properties. The problem of physically based models is the complex numerical solution with a high required number of input parameters. Ohlendorf derives a property model by an empirical-statistical approach, which already allows a high prediction accuracy for the prediction of the Young's modulus and the film shrinkage. However, a prediction of the tensile strength using this model is not yet possible with sufficient accuracy. This is due to an incomplete description of the tube formation zone, in which the mechanical properties are set. An extended model approach therefore should describe the stretching and cool-

Picture 5: Detection of the bubble contour and approximation by a 5th degree polynomial





Picture 6: Acquisition of the cooling process and approximation by a 4th degree polynomial

ing behaviour accurately with a high spatial resolution in the tube formation zone. In a new series of tests, the formation zone is therefore recorded by camera technology and the stretching of the film and the temperature gradient are described using polynomials. A correlation analysis of the polynomial coefficients obtained shows that they correlate strongly with each other. An extension of the property model by means of classical linear regression is therefore impossible. However, the method of Partial Least Square regression (PLS) shows that the coefficients determined in combination with the already established variables should be considered for further model building.

In further investigations, modern modelling methods, such as artificial neural networks, are to be examined.

One possibility is the development of a hybrid model (black box model as booster), which uses the property model according to Ohlendorf as input in addition to the newly described polynomial coefficient. A purely data-driven modelling (black box model) should also be considered. Furthermore, the improved process model should be investigated to evaluate whether the transferability to other machines might be enabled by the extended description of the tube formation zone.

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Symbols

Symbol	Description
a	Percentage deviation
i_l	Take-up ratio
i_q	Blow-up ratio
i_t	Temperature ratio
i_v	Volume flow ratio
i_f	Frost line ratio
i_d	Thickness ratio
L, q, t, v, f, d, k	Regression coefficients
r^2	Coefficient of determination

Abbreviations

Notation	Description
BR(h)	Bubble radius
BUR	Blow-up ratio
PE-HD	High density polyethylene
PE-LD	Low density polyethylene
PLS	Partial Last Square Regression
TUR	Take-up ratio

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Trend-setting Product Development – *Production of Innovative Technical Composite Construction Films Started*

In the past few months, the German company, Dörken, has put two new production lines from SML into operation. Highly permeable roof and facade membranes are manufactured as part of the company's product portfolio. In addition to innovative properties, a large number of the new composite films are making a statement due to their particularly resource-saving and efficient manufacturing processes. To a large extent, the products and production processes were developed in SML's Technology Center – even before the lines were planned or installed at Dörken.

When it comes to membranes for the construction industry, Dörken is European market leader. In autumn 2022, the company opened a new production site in Hagen-Vorhalle in North Rhine-Westphalia, where the two coextrusion coating and laminating lines from SML are now up and running. The tailor-made plants are setting new standards in terms of functionality, quality monitoring and the degree of automation involved.

Previous product development at SML's Technology Center

"The remarkable thing about this project is that Dörken did not carry out substantial parts of the product development process at its own plants, but on an industrial scale FlexPack® line located in our Technology Center," Dirk Beckendorff, Area Sales Manager at SML, explains. The product development process at SML took several years: Among other things, it included basic trials with the SML DoubleCoat process, test series with the most important products of Dörken's portfolio and several test runs for the development and sampling of new roofing membranes. Since it was possible to certify a number of products even before the lines were commissioned at Dörken, the over-all product development process was accelerated quite significantly. "It was important for us to benefit from the opportunity offered us by SML. In addition to confirming the known recipes and processes, we were able to use SML's pilot plant for our innovations at a very early stage. In principle, we have actively integrated SML's plant into our Stage Gate process," Christian Harste, CTO at Dörken, clarifies. Im-



Dörken-CTO, Christian Harste

mediately after the installation of the two lines, Dörken was able to start regular production.

New standards for products

One of the two multi-purpose coating and laminating lines at Dörken is equipped with SML's patented DoubleCoat technology. This technology enables a combined adhesive and extrusion coating process for the production of ultra-thin and highly breathable laminates. It allows the manufacturing of a wide variety of technical composites for the construction industry, such as vapor barriers or waterproofing membranes.

The second production line is a combined line with two integrated adhesive roll coaters for the manufacturing of highly breathable roofing and facade membranes in one production step.

The thickness of the TPU membranes can be considerably reduced, compared to conventional products available on the market. Thanks to the innovative system technology, significantly improved water vapor permeability values can be achieved, with, at the same time, excellent product properties with regard to longevity. "Our new underlay membranes are impressive with their proven durability and thus long-term protection. Extreme quality and long-term tests as well as special test procedures confirm their extraordinary resilience. With a high elasticity and integrated self-adhesive edges, this new generation of products is the perfect solution for a wide variety of applications. It enables a higher energy efficiency and a raised living comfort," Dörken-CTO, Christian Harste, states.

Intuitive operation – integrated inspection systems

A central element in both production lines is the SMILE control system developed by SML software application engineers. This enables the highly intuitive operation of the lines, tailored to the respective production process and the associated functionalities. "Integrated inspection systems and our data management tool, BitWise, ensure the comprehensive monitoring of the entire process chain at both plants. The production parameters of each product can be completely traced," SML product manager, Johannes Danter, points out. This is an enor-

mous help to Dörken when complying with the strictest quality standards, especially regarding the long-term product guarantees the market demands.

Modernisation with a significant increase in efficiency

The two production lines from SML allow a massive increase in efficiency because of their lower raw material consumption. Compared to the plant and process technology previously available, the production of the new generation of highly breathable roofing and facade membranes takes place in just a single production step. In addition, the lines operate at a comparatively high production speed of up to 120 m/min. Along with considerable time savings, the waste generated during production is reduced to a minimum.

The two new lines from SML replace several existing plants and give Dörken the opportunity to produce innovative membranes. They emphasize Dörken's claim to manufacture as economically and resource-efficiently as possible – with greatly improved product properties achieved through further development work.

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Project STOP – *Pioneering Concept to Expand Affordable Waste Management and Recycling Solutions*

Project STOP and its partners reached significant milestones and successes in demonstrating a model for expanding affordable waste management and recycling solutions to help address the plastic waste challenge in Indonesia. By the end of 2022, the programme has provided access to waste management services to over 300,000 people across three cities in Indonesia — to most for the first time — built five waste processing facilities and enabled the collection of more than 40,000 tons of waste (including more than 5,000 tons of plastics).

Project STOP is co-funded by Borealis and Systemiq, who share the same vision: to permanently stop waste leaking into the environment by supporting the establishment of low-cost waste management solutions, creating real impact through action

on the ground. The key objectives of the programme include:

- Reducing waste leakage into the environment by providing affordable, reliable and formal waste collection to all citizens;

- Promoting resource efficiency and circularity that transform waste into feedstock for recycling;
- Achieving economic sustainability;
- Benefitting the communities through improved public health and creating permanent job opportunities in waste and material sorting sectors.

The programme's first city partnership started in 2017 in Muncar, a coastal fishing community in Banyuwangi Regency, East Java, Indonesia. Active support from Project STOP for the Muncar waste management system ended in February 2022 and to date, the local government authorities are continuing to operate the system successfully. Active support for the waste management system in Pasuruan Regency, East Java, ended in February 2023. The project continues to operate in the Jembrana Regency in Bali, and has started its expansion into the Banyuwangi Regency, East Java, with the construction of a new material recovery facility (MRF).

Thomas Gangl, CEO, Borealis, said: "Project STOP's impressive results generated during challenging times enable us to demonstrate the important role of improved waste management solutions at scale, to avoid negative environmental impacts of plastic waste. This well complements Borealis' endeavours towards a circular system approach for plastics by driving reduction, reuse and design for recycling. We are proud to have achieved these results together with all our partners and thank all our local, national and international supporters and project partners for their commitment!"

Jason Hale, Director of Operations, Ocean Plastics Asia, Systemiq, said: "In 2022, we materially increased households served and tons captured in our second and third Project STOP cities. Over 300,000 people are now participating in our waste services, and it has been offered to many more. More importantly, we completed capacity building with our local partners in these cities, setting these programs on course for long-term sustainability and growth. Moreover, we created a strong foundation in the Banyuwangi Regency from which we will grow our impacts at a larger scale, while building a roadmap for other Regencies to follow. We welcome additional funders



(Copyright: Project STOP)

to support this planned expansion for 2023-26, and remain proud to deliver Project STOP in partnership with strong local and national government agencies, as well as our funders and advisors."

Scaling up waste management and recycling solutions is challenging in Indonesia because of the financing required to build and operate waste management systems, and the need for large-scale community behaviour changes and skills development amongst waste system operators. Organic waste and some types of plastic waste (particularly multi-layer plastics made from multiple types of plastics) have very low value for recycling or composting. So far, the project has achieved participation rates ranging from 50% to 87% depending on the location, and on average slightly more than 30% of non-organic recyclable materials are sent for recycling across all partner communities.

Project STOP's impact was made possible through the invaluable support from Indonesia's national and local government agencies, including the Ministry of Environment and Forestry, the Coordinating Ministry for Maritime Affairs, the Ministry of National Development Planning/National Development Planning Agency, the Ministry of Public Works and Public Housing, the Banyuwangi Government, the Pasuruan Government and the Jembrana Government. In addition to its founders Borealis and Systemiq, Project STOP is grateful to its strategic partnerships with leading organizations from international institutions, academia and private sectors: the Norwegian Ministry of Foreign Affairs, Nestlé, Borouge, the Alliance to End Plastic Waste, Siegwark, Schwarz, HP, P4G, Accenture, and Pisces.

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Open House – Presentation of New OMNIboost Recycling System

During the „K“ Show, Gneuss used the opportunity to demonstrate their OMNI Recycling System in their Technical Centre in Westphalia, Germany. On two days, more than 150 guests from all over the world witnessed demonstrations of the new Gneuss OMNIboost Recycling System for processing PET industrial fiber waste (POY). This fiber waste had a residual moisture level of 6 % and an intrinsic viscosity of 0,64 dl/g. This material was fed into the OMNIboost system with a throughput rate of 150 kg/h and thanks to the Gneuss liquid melt phase IV booster, the viscosity was increased. The visitors were impressed by the speed of the IV boost: with a residence time within minutes, the IV was increased to 0,66. For an IV boost to 0,84 a residence time less than half an hour was required.

The OMNIboost Recycling System is designed for recycling both post-industrial and post-consumer PET waste with a low bulk density, such as waste fibers, or thin film. Without the need for any thermal pre-treatment, the material is fed into the Gneuss 3C Rotary Feeder, which cuts and compacts the material as well as feeding it directly into the MRS Extruder screw.

The Gneuss MRS extruder is based on the simple and rugged single screw extruder, however it is equipped with a multiple screw section for optimised degassing. The patented multiple screw design from Gneuss has a section of extruder screw (Multi Rotation Section MRS) with a number of satellite screws, which rotate in the opposite direction to the main screw, creating a huge surface area and ensuring an extremely rapid surface area exchange rate. This ensures unparalleled degas-



OMNIboost Recycling System in operation at Gneuss technical center in Bad Oeynhausen

ing performance in the melt phase, with minimal stress on the material and can decontaminate post-consumer PET to food contact requirements without the need for thermal pre-treatment of the material prior to extrusion.

After passing through the extruder, the polymer melt is filtered with the highly efficient Gneuss RSFgenius Melt Filtration System. This system ensures that even with high contamination loads, fine filtration is possible without pressure or flow disturbances and with minimised polymer loss.

Still in the melt phase, the polymer flows into the Gneuss JUMP liquid phase IV booster reactor. The viscosity of the melt is measured both on the inlet and outlet of the reactor. The viscosity is boosted to the required level by regulating the vacuum level, residence time and surface area exchange rate in the reactor vessel. With an assured, constant output viscosity the material can be fed to the production process (for example: fiber spinning, strapping tape) whilst still in the melt phase. By ensuring that the polymer remains in the melt phase from the extruder to the final processing stage, the OMNIboost recycling process represents the fastest and most efficient way to reprocess PET where a viscosity boost is required.

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