

Plastics Recycling WORLD

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WORLD EXPO

Cleveland, OH, USA
13-14 November 2024

PLASTICS RECYCLING PLANT DEVELOPMENTS

RECYCLING ADDITIVES REVIVE PROPERTIES

MEETING THE ODOUR CHALLENGE HEAD ON

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Plastics Recycling WORLD

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COVER PHOTO: BAUSANO

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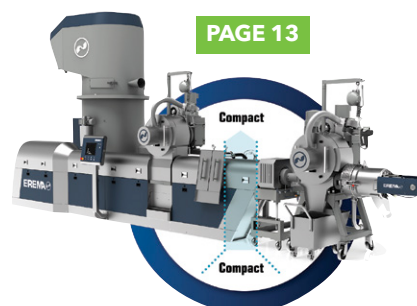
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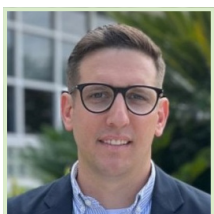


**Robert
Wahlmüller**

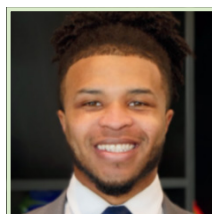


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ExxonMobil is sued over recycling 'myth'

The US state of California is taking ExxonMobil to court in a dispute over plastics pollution and the effectiveness of plastics recycling.

California Attorney General Rob Bonta announced on 23 September, the filing of a lawsuit against ExxonMobil alleging that the company intentionally misled consumers and continues to do so "by engaging in an aggressive campaign to deceive the public and perpetuate the myth that recycling will solve the crisis of plastic pollution".

The lawsuit follows a wide-ranging investigation into fossil fuel and petrochemical industries that has lasted over two years.

In a complaint filed in the San Francisco County Superior Court, the California Department of Justice alleges that ExxonMobil has been deceiving Californians for half a century through



Rob Bonta, California Attorney General

"misleading public statements and slick marketing" implying that recycling would address the ever-increasing amount of plastic waste ExxonMobil produces.

Bonta said: "For decades, ExxonMobil has been deceiving the public to convince us that plastic recycling could solve the plastic waste and pollution crisis when they clearly knew this wasn't possible."

A statement said: "More

recently, ExxonMobil continues to deceive the public by touting 'advanced recycling' as the solution to the plastic waste and pollution crisis." It claimed that 92% of plastic waste processed through ExxonMobil's advanced (chemical) recycling technology does not become recycled plastic, but rather primarily fuels.

ExxonMobil's initial response was to blame the California state government for the failure of its plastics recycling system. In a statement, an ExxonMobil spokesperson said: "For decades, California officials have known their recycling system isn't effective. They failed to act, and now they seek to blame others. Instead of suing us, they could have worked with us to fix the problem and keep plastic out of landfills."

➤ <https://oag.ca.gov>

➤ <https://corporate.exxonmobil.com>

New circular R&D project in Finland

Finland's VTT Technical Research Centre has been named coordinator of the PlasticsCircularity initiative, a joint research project between VTT, institutes, universities and seven business partners.

The project, part of the Business Finland funded SPIRIT programme led by Borealis, approaches the circular economy of plastics from the points of view of regulation, business models, and technological solutions.

VTT said that currently, only high-quality and sufficiently large waste streams are part of the cycle with there being no functional recycling system for plastics that are difficult to recycle. The PlasticsCircularity project will investigate the related bottlenecks and seek workable solutions.

➤ www.vttresearch.com

Success in wind turbine blade project



The ZEBRA project has created a closed loop system for wind turbine blades

The ZEBRA (Zero waste Blade ReseArch) project, led by the French Institute for Technological Research, IRT Jules Verne, says it has made significant leap forward in creating a circular economy in the wind energy sector through recycling thermoplastic wind turbine blades.

The project successfully recycled Arkema's Elium resin and Ultrablade fabrics from wind turbine blades and manufacturing waste through thermolysis, achieving a yield of over 75%, before reformulating them back into usable materials.

The project partners said this closed-loop process could be vital in addressing the growing challenge of end-of-life blade management in the wind energy industry.

➤ www.irt-jules-verne.fr

➤ www.arkema.com

IN BRIEF...

An affiliate of KT Capital has acquired a majority interest in turnkey systems integrator **Recycling Equipment Incorporated (REI)**, which operates from facilities in Newton, North Carolina, and Fort Worth, Texas.
www.gogreenrei.com

RIGK has joined the **MyRecycledContent** database, an initiative by European industrial return systems aimed at promoting the use of recycled plastics in packaging, as the initiative's German partner. The platform provides a centralised data registry that helps companies find packaging solutions containing certified recycled content.
www.rigk.de
www.myrecycledcontent.eu

UK-based **Duclo Recycling**, part of the Duo Packaging Group, has invested more than £160,000 in manufacturing capabilities, including a new Erema laser filter which will work as part an existing system.
<https://duclorecycling.com>

Investor takes majority stake in Bollegraaf

Norwegian investment firm Summa Equity has acquired a majority stake in Bollegraaf, the Netherlands-based group involved in sorting technology and plants for plastics and other material waste streams.

"We are convinced that in partnership with Summa, Bollegraaf can accelerate further growth and drive the transition to a circular economy," said Edmund Tenfelde, CEO of Bollegraaf. "Together with Summa, we can invest in innovation and advanced technologies and improve the solutions for our clients through strategic acquisitions. Summa's industry advisor network is also playing a crucial role in uncovering new opportunities to enhance our efforts."

Bollegraaf is a long-established engineering group and supplier to waste management companies. To date the group has installed over 4,000 systems around the world and says it has built a solid reputation

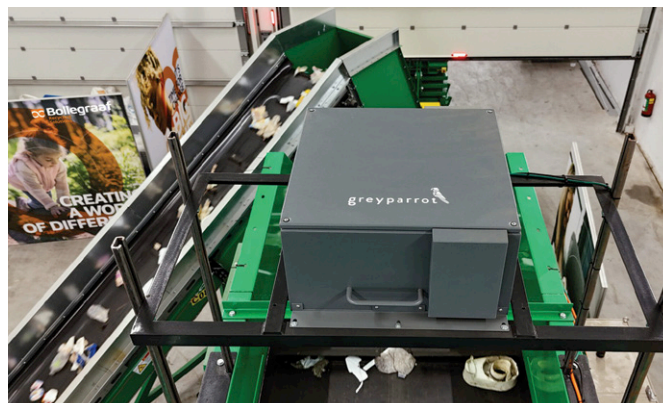


IMAGE: BOLLEGRAAF

Bollegraaf has invested in AI sorting technology company Greyparrot and will be its worldwide distributor

based on the quality of its equipment in terms of separation performance, robustness, and ease of maintenance.

The group operates under the brand names Bollegraaf Recycling Solutions and Lubo Recycling Solutions and is represented in North America by Van Dyk Recycling Solutions.

Bollegraaf has entered partnerships focused on plastics recycling including an agreement earlier this year with UK-based Grey-

parrot. As part of the agreement, Bollegraaf has transferred its AI vision business to Greyparrot and is investing \$12.8m, while obtaining a stake in the company.

It will also serve as a worldwide distributor and strategic partner for Greyparrot's Analyzer AI camera systems.

Summa's acquisition is pending regulatory approvals and is expected to close in October.

➤ www.summaequity.com
➤ www.bollegraaf.com

Latest circular economy company rankings

BloombergNEF has assessed 20 brand owners and 20 plastic producers for its latest Circular Economy Company rankings, which measures companies' progress toward a circular economy based on publicly announced targets and commitments.

Coca-Cola, L'Oréal, and PepsiCo have been named the leading brand owners while on the plastic producers' side, LyondellBasell, Braskem, and Dow make up the top three. Indorama

Ventures and SCG Chemical also scored well, with Ineos and Chevron Phillips dropping out of the top ten. Borealis fell from top position to sixth.

Most of the ranked producers are pursuing chemical recycling projects.

L'Oréal and Danone have the highest current share of packaging from bio-based or recycled sources, accounting for over 30%. However, 2025 targets will require them to increase this figure by around 8-10%

per year, much faster than they have achieved in the past.

BloombergNEF says overall, the analysis reveals a general slowdown with regards to achieving a circular economy, with many companies highlighting difficulties in sourcing sustainable feedstock and materials and a lack of infrastructure for sorting and recycling, all against the backdrop of rising costs.

➤ <https://about.bnef.com>



Vanden®

Vanden Recycling: Delivering a Global, Transparent, and Secure Recycled Supply Chain

For manufacturers seeking a trusted partner in securing recycled feedstock and a compliant, transparent home for their plastic waste, Vanden's proven track record offers more than just peace of mind—it delivers results, and certainty in the uncertain world of recycled plastics.

As industries increasingly prioritise sustainability, the need for efficient, reliable, and traceable feedstocks and recycling solutions has never been more pressing. Operating across 12 locations and serving over 1,000 clients in 45 countries, Vanden is a key player in the global plastic recycling sector is making strides by delivering reliable sources of high-quality recycled materials.

At the core of Vanden's mission is a commitment to creating a seamless and secure supply chain for recyclable plastics. The company's presence in key markets worldwide allows them to provide localised industry expertise, native-speaking teams, and tailored advice to clients in each region. Supplying diversified and reliable feedstocks to brand owners, petrochemical companies and plastic manufacturers who need to meet recycled content targets.

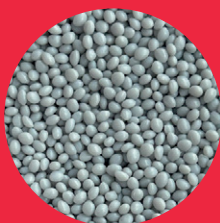
One of the standout features of Vanden Recycling is the rigorous material analysis process, conducted through its own technical labs. These labs conduct in-depth tests, identifying plastic types, contamination levels, multilayer compositions, melt flow index (MFI), ash content, filler content and more. This detailed analysis ensures that materials are correctly identified and controlled at every step, from sourcing to reprocessing. The success of any recycled plastic material hinges on this level of precision. As Vanden emphasises, "Correct identification of material quality at the source and the subsequent control through the production process is the main factor affecting the success of the plastic re-entering the supply chain."

A crucial aspect of this operation is its commitment to transparency and traceability. In today's regulatory environment, businesses need to be able to demonstrate that their plastic waste has been properly recycled and reintroduced into the production cycle. With a transparent and traceable process, companies buying or selling plastics with Vanden can rest assured their material flows are being managed responsibly and in full compliance with environmental standards, and they are contributing to the circular economy.

Maintaining a steady flow of materials through the recycling supply chain can be challenging, especially during periods of market volatility. However, Vanden's global presence and extensive market access give businesses a critical advantage. The ability to provide a diversified supply chain that ensures consistency in all market conditions.

What distinguishes this recycling network is its holistic approach. Beyond simply trading plastics, they inspect, analyse, and reprocess materials, carefully matching buyers and suppliers based on specific requirements. The company's commitment to delivering certainty throughout the plastic value chain is not just a claim—it's reflected in the way they prioritise transparent, traceable and responsible practices, from compliance, quality control to logistics.

For manufacturers seeking to integrate recycled plastic into their supply chains, working with a partner that offers expertise, reliability, and a transparent process can make all the difference – this global recycling network is helping reshape how plastic waste is managed in a more sustainable and accountable way.



**> Rethink.
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> vandenrecycling.com**

Germany expects 15% drop in machine sales

Orders for German plastics and rubber machinery are likely to keep falling until the end of year, says the trade body that represents manufacturers.

"The weak demand is affecting all markets equally – but the European domestic market in particular," said Ulrich Reifenhäuser, chairman of the board of the VDMA's plastics and rubber machinery association. "Major markets such as China and the US are also weakening, though we see glimmers of hope at a lower level in Mexico and India."

From January to August this year, incoming orders fell by 16%. Because all



IMAGE: MESSE DÜSSELDORF/TILLMANN

Kühmann: "We have to be prepared for a 10-15% drop in sales this year"

existing orders have now been processed, this is directly reflected in sales – which fell 7% over the period, he said.

Thorsten Kühmann, the

organisation's managing director, said this would mean revising sales forecasts downwards.

"The expected lowest point in terms of incoming orders has not yet been reached," he said. "We have to be prepared for a 10-15% drop in sales this year."

He said orders could improve towards the end of the year as central banks cut interest rates.

"Due to the lag in production, it will take until the middle of next year for this to be reflected in sales," he said – estimating that 2025 sales may fall by as much as 5%.

➤ www.vdma.org

Previero acquires Parini

Asset manager Ambienta has announced that one of its platform companies, mechanical recycling technology company Previero, has acquired fellow Italian company Parini which manufactures equipment for the mechanical separation of waste and the removal of contaminants.

"We are excited and honoured to join forces with Previero," said Fabio Parini, General Manager at Parini. "By merging our robust technical expertise with Previero's exceptional R&D capabilities and market leadership, we are confident that this partnership will not only strengthen our platform across the plastic recycling value chain but also significantly elevate our integrated solutions."

Mechanical sorting is a critical step in the recycling process, said Previero, alongside its own focus area of pre-processing, in ensuring high output quality and overall plant efficiency.

➤ www.previero.it

➤ www.parinisrl.it

New LYB and Dacia collaboration

LyondellBasell (LYB) said the exterior of the all-new Dacia Duster features Starkle material made using LYB's CirculenRecover portfolio.

The PP compound used in the exterior feature includes 20% recycled content derived from post-industrial waste diverted from the manufacturing process of goods such as flexible packaging. The material is then used in exterior parts such as bumpers, trims, and body side mouldings, offering a mould-in-colour effect with eye-catching particles to highlight the use of recycled content.

➤ www.lyondellbasell.com



IMAGE: LYONDELLBASELL

UK supermarket schemes are criticised

UK supermarkets Tesco and Sainsbury's have been accused of misleading customers over their front-of-store recycling schemes for flexible packaging after an investigation by The Everyday Plastic campaign.

In July 2023 and February 2024,

Everyday Plastic and the Environmental Investigation Agency distributed 40 tracking devices in bundles of plastic bags and wrappers which were dropped at collection points in Sainsbury's and Tesco stores.

The investigation found that none of

these bundles went on to be closed-loop recycled, and that 70% which reached a known final waste facility destination was burnt, with the rest being downcycled into lower value products.

➤ <https://www.everydayplastic.org>

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The merger of Coperion and Herbold Meckesheim unites decades of expertise and comprehensive process know-how in a variety of plastics recycling applications. Customers now have access to individual components as well as complete recycling systems from a single source, supplying highest end product quality and throughputs at maximum efficiency.

www.herbold.com www.coperion.com



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Blue Polymers breaks ground on new western US facility

Joint venture company Blue Polymers has broken ground on its new polyolefins recycling facility in Buckeye, Arizona, which it says will help meet growing demand for sustainable packaging throughout the western USA.

The 162,000 sq ft (49,300 m²) facility is expected to create more than 60 permanent jobs when it opens in the second half of 2025. It will specialise in recycling PE commonly used in milk jugs and laundry detergent bottles, and PP used in food packaging such as margarine tubs and yogurt cups.

Phoenix-based Republic Services, a joint venture partner in Blue Polymers, is developing a network of regional recycling facilities which produce high-quality, colour-sorted recycled plastics directly from national curbside collection operations. A network of four regional facilities is being planned.

Each Republic Services Polymer Centre will be paired with a Blue Polymers facility, with the Buckeye facility processing materials from Republic's Las Vegas Polymer Centre which opened last year.

"Blue Polymers was created to meet the need for high-quality recycled plastics for use in consumer packaging and other applications," said Tim Oudman, Senior Vice President of Sustainability Innovation at Republic

Services and a member of Blue Polymers' board of directors.

Ravago is the other partner in the Blue Polymers joint venture.

➤ <https://bluepolymers.com>

➤ www.republicservices.com



IMAGE: BLUE POLYMERS

SOLUTIONS BEYOND TOMORROW



For a closed loop:
Recycling solutions made by Krones

It's important to look beyond tomorrow, which is why Krones regards plastic waste as a valuable resource and is working on recycling innovations that contribute to steadily advancing the circular economy round the globe.

krones.com

KRONES

AMI confirms Cleveland expo speaker programmes

The programmes have been announced for the four free-to-attend conference theatres at the AMI Plastics World Expos, which take place on 13-14 November in Cleveland in the US.

More than 100 industry experts will speak in the four theatres that are focused on plastics recycling, compounding, extrusion and testing. The two-day conference programmes feature a selection of technology talks, keynote presentations and training seminars, as well as business debates.

"The free conference programmes are always a major draw at the Plastics World Expos in Cleveland and provide a fantastic opportunity for attendees to explore key industry

trends and emerging technologies," according to Andy Beevers, events director at AMI.

A wide range of topics and technologies will be covered in the conference sessions, including: PFAS challenges; graphene opportunities; market trends; AI for new product development; regulatory developments; enhancing bioplastics; factory digitisation; upcycling plastic waste; computer simulation; the future for plastics packaging; process optimisation; methods for boosting recycling rates; and applications in EVs.

There are more than 100 speakers, including senior representatives from companies such as Accredo Packaging, ADS Pipe, Amcor, American Chemistry

Council, AMI, Ampacet, Blue Diamond industries, EFS Plastics, Keller and Heckman, KW Plastics, Revolution Company, Routsis Training, Teknor Apex, TerraCycle, Valeron and WM Thermoforming.

The conference theatres run beside four focused exhibitions – the Compounding World Expo, Plastics Recycling World Expo, Plastics Extrusion World Expo and Polymer Testing World Expo – which feature more than 370 suppliers of machinery, materials and a range of industry services.

View the full programmes under the four tabs [here](#) and register for a free ticket to the conferences and exhibitions [here](#).

➤ www.amiplastics.com

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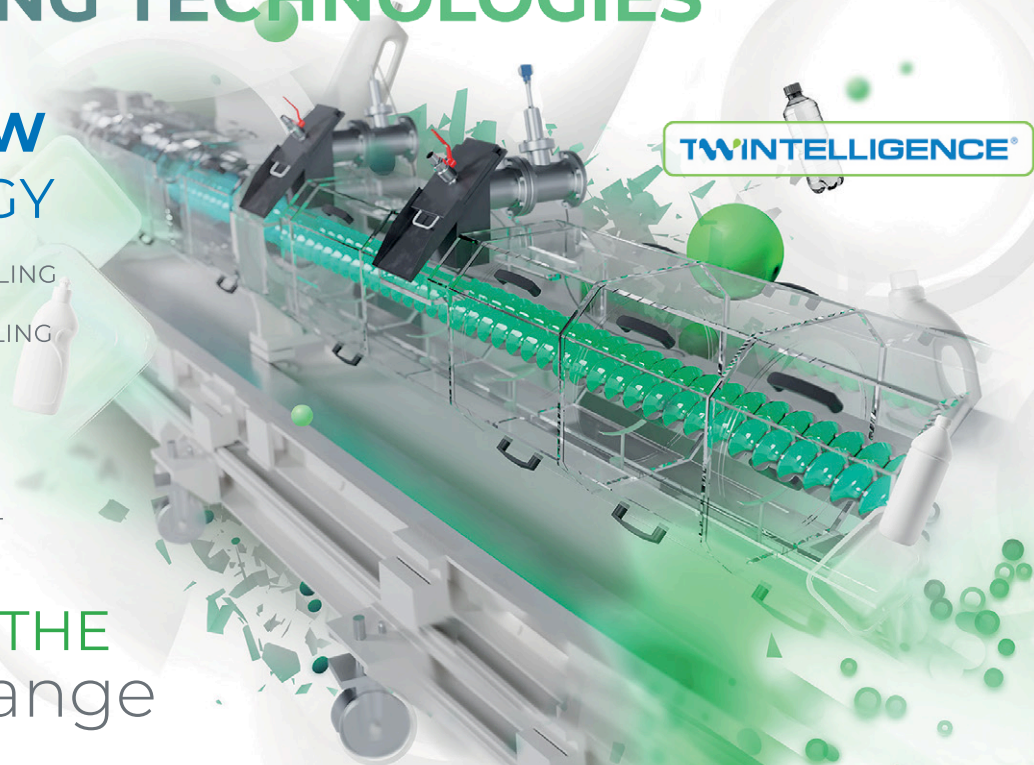
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The right combination: plastic recycling plants

Developers of plastics recycling lines are finding ways to help companies transform PET, PP, PE, PS and polyal waste. Chris Saunders reports on recent projects

The latest developments in recycling lines reflect a growing commitment to addressing the challenges posed by plastic waste through technological innovation, regulatory support, and industry collaboration. One such venture announced in June sees **Coperion** and **Herbold Meckesheim**, both operating companies of Hillenbrand, join forces to construct an entire plant for PET bottle-to-bottle recycling from a single source on behalf of Indian packaging manufacturer **Magpet Polymer**.

"We have united the advantages of Coperion and Herbold Meckesheim technologies," explained Jochen Schofer, Head of Sales Recycling at Coperion. "All process steps, from mechanical pretreatment to producing finished recyclate, are optimally coordinated to produce PET of high-quality and with maximum energy efficiency."

The bottle-to-bottle lines designed by Coperion and Herbold Meckesheim enable all recyclates to be processed together, even if they exhibit different intrinsic viscosity (IV) values or fluctuating bulk densities. Furthermore, the solution saves on operating costs and energy consumption when compared to conventional PET recycling processes. This is because the system first processes the bottles into flakes using granulators with forced feeding and washing system technologies that efficiently process the PET to minimise material loss due to fines formation and maximise yield. This preprocessing is followed by conveying and feeding into a ZSK twin screw extruder where the regrind is melted, dispersed, and processed into a homogeneous mass. Due to its high 18 Nm/cm³ torque, the PET's residence time in the extruder is extremely short.



IMAGE: BAUSANO

Processing takes place at low temperatures so polymer chain degradation is minimal and the product quality high as volatile components such as monomers, oligomers, and water are removed. Following discharge from the extruder, the still-warm material stream is transferred via a gear pump to an underwater granulator and a Solid State Polycondensation (SSP) reactor, where it is condensed and decontaminated. The company says that the system is designed for a throughput of 5,500 kg/h and will deliver PET recyclate that is approved by the European Food Safety Administration (EFSA) and the US Food and Drug Administration (FDA) for direct contact with food.

Herbold Meckesheim and Coperion are holding an event on 6 and 7 November at Coperion's new Recycling Innovation Centre in Weingarten, Germany. Industry experts will discuss currently available technology and process solutions and the entire recycling process will be on view in live presentations. Coperion launched operations in the centre in 2023 with state-of-the-art, individually configurable recycling plants where recyclate can

Main image: Bausano has developed a plant to transform the LDPE-aluminium mixture from carton recycling into core tubes

IMAGE: COPERION



Above:
Coperion
launched its
Recycling
Innovation
Centre in
Weingarten,
Germany in
2023

be conveyed, fed, extruded, compounded, pelletised and deodorised. The new centre works in a complementary way with the Herbold centre in Meckesheim to simulate and test the recycling of plastics.

At AMI's Plastics Recycling World Expo in Brussels in September, Florian Mitterecker, Sales Manager at **Starlinger Recycling Technology**, presented new technology from the Austrian group. The ViscoZERO technology from the Starlinger group's Viscotec business unit is a melt phase decontamination reactor that has been designed for supercleaning post-consumer waste.

Supercleaning

At the event, Mitterecker discussed ViscoZERO used in a line comprising extrusion, decontamination and odour-reduction units for post-consumer PP, PE or PS food packaging waste, producing regranulate that can be reused in the production of food-contact packaging. He focused specifically on how the system can meet the needs of polyolefins consumers wanting to use recyclate in packaging loops such as cap-to-cap and bottle-to-bottle, but also in other demanding areas such as automotive.

The recycling system consists of a Starlinger RecoSTAR Dynamic recycling extruder with or without degassing, a continuous melt filter or power-backflush filter, the ViscoZERO melt phase decontamination reactor, a subsequent belt melt

filter or power backflush filter before the underwater or water ring pelletiser, and an optional PCUplus pellet flusher at the end of the process. This modular approach, said Mitterecker, is intended to meet the varying needs of customers. Customers may want different modules, he said, which Starlinger expects to learn more about as production data comes back from the first three lines that have been sold (the first was installed at an Austrian customer).

The first tests during development were carried out on PET packaging, but it was notable what happened with other polymers. In testing the ViscoZERO system with PP, PE and PS, it did "much better than expected", said Mitterecker. The results were strong enough that Starlinger has applied to the FDA in the US for approval for the system to be used for PP caps (approval was pending in September). The company hopes to also get FDA approval for the system when processing HDPE and PS.

"With this new machine setup we present a super-cleaning solution for post-consumer packaging made of polyolefins such as PP and PE or polystyrene at this year's NPE," said Paul Niedl, Commercial Head of Starlinger Recycling Technology, before the US exhibition earlier this year. "Especially PP, PS and HDPE post-consumer packaging waste degrades during recycling; thus, the produced material can only be used in lower-grade applications. With the new technology, the material is upgraded in the process and thus suitable for use in high-grade applications including direct food-contact packaging."

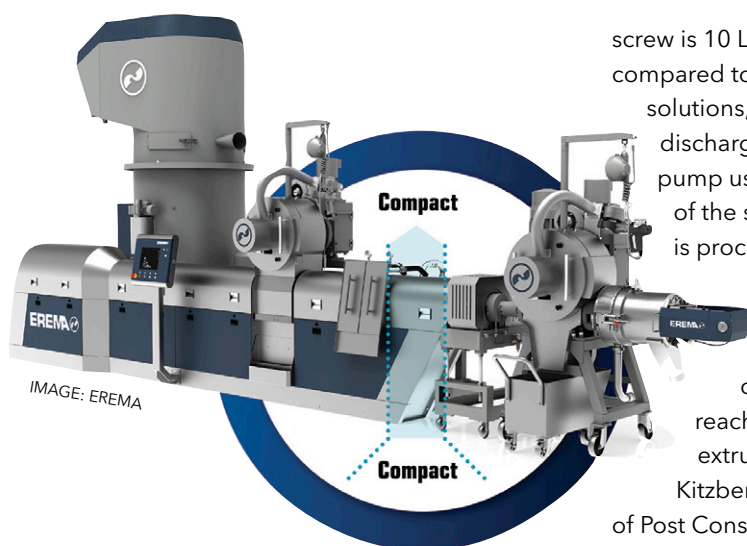
Bottles and more

The ongoing growth of the PET industry, especially in Asia and Africa, is boosting the demand for recycling solutions across the board. Austrian recycling machine manufacturer **Erema** says in the last three years alone, it has delivered 100 systems for the bottle market. Almost 60% of these are bottle-to-bottle solutions, while the rest are divided between bottle-to-sheet, PET strapping, and the growing bottle-to-fibre

Starlinger recycling line featuring RecoSTAR Dynamic recycling extruder, the new ViscoZERO melt phase decontamination reactor, melt filter, pelletiser and PCUplus pellet flusher



IMAGE: STARLINGER



segment. "We offer the right systems for specific requirements, including for direct food contact," said James Qiu, General Manager at Erema Shanghai.

Product quality

The central element in Erema's process is its tried-and-tested Vacurema technology, which was initially launched 25 years ago and has been in continuous development ever since. The main advantage of Vacurema machines is the SafeFlake technology contained in the vacuum reactor, which combines decontamination, drying, and IV treatment. When PET flakes are pretreated in vacuum at the correct temperature, moisture and migration substances are effectively removed prior to extrusion preventing any hydrolytic and oxidative decomposition of the melt in the extruder. The quality of the pellets remains consistently high even if the quality of the input varies, while the costs associated with acquisition, ownership, and energy consumption, are comparatively low.

"The potential for plastics recycling on the American market is enormous," said Robert Wahlmüller, CEO of Erema North America, in the run-up to the NPE 2024 exhibition in Orlando, Florida. "Our order books are well filled."

At its NPE stand, the company placed a special focus on the Intarema TVEplus DuaFil Compact double filtration system first launched at K 2022. The system was designed for recycling challenging materials with high levels of contamination and moisture, such as film waste with paper labels, agricultural film, and washed film from household waste. A key feature of the machine is the consistently gentle treatment of the melt throughout the entire process, a result of combining the TVEplus system with DuaFil Compact technology. Compact configuration of the machine means the extruder

screw is 10 L/D (length-to-diameter ratio) shorter compared to previous Erema double filtration solutions, and there is no longer a need for the discharge metering zone. A dedicated melt pump used to increase the pressure upstream of the second filtration unit ensures the melt is processed more uniformly.

"Our DuaFil Compact technology decouples pressure and temperature build-up, which reduces the overall melt temperature so that it reaches its highest in the 'plus zone' of the extruder prior to degassing," said Clemens Kitzberger, Business Development Manager of Post Consumer Applications at Erema Group. "This increases the degassing volume by up to 33%, while at the same time reducing retention time and energy consumption."

Since K 2022, Erema has sold around 20 Intarema TVEplus DuaFil Compact systems. One has been delivered to Recupac, a recycling and waste disposal company based in Chile. "As the business unit for waste management at Coipsa, a group of packaging companies in Chile that are fully integrated in all phases of the circular economy, we process more than 150,000 tonnes of different materials every year," said Philippe Morizon, General Manager at Recupac. "With this compact recycling machine, we can produce high-quality pellets that are used to make film and other applications in the packaging sector. There were many arguments in favour of this machine. Particularly important factors were its low energy consumption and high degree of automation, which saves on operating personnel. I am confident we will meet our customers' expectations, and the initial results are very promising."

Polyal application

Aseptic cartons are composed mainly of cardboard (75%), and have thin LDPE (20%) and aluminium (5%) foils inside, which poses a recycling challenge. The cellulose from the cardboard can be extracted and fed back into the recycled paper chain, leaving a byproduct from the solid residues of PE and aluminium that needs an outlet for its reuse. **Bausano**, the Italian extrusion technology company, has developed a plant to transform the LDPE-aluminium mixture (called polyal) into core tubes.

The polyal recovery plant consists of a single-screw extruder with double degassing and forced loading system, making it suitable for managing the density of the material and ensuring smooth flow within the machinery. Prior to extrusion, the material undergoes a densification process, which

Left: The new Intarema TVEplus DuaFil Compact is significantly shorter than the previous Erema double filtration solution



IMAGE: BAUSANO

Above:
Bausano's
method starts
with the
customer's
specific polyal
formula and
then works out
structured
analyses to
customise each
extrusion line
for manufactur-
ing core tubes

is essential to increase its firmness and transform it into a manageable compound suitable for further processing. The final output is a robust tube with a smooth surface considered ideal for winding reels of cloth, film, paper, and other materials.

Bausano's method starts with the customer's specific formula and then works out structured analyses to customise each extrusion line. Following a preliminary evaluation, the work is transferred to the company's laboratory, where materials are analysed using a capillary rheometer to understand their viscosity as a function of the shear rate. Starting with the rheological characterisation of the molten material, Bausano's team of engineers are able to optimise the design of the screw and extrusion head. A subsequent test, conducted on a Brabender plastograph, provides crucial information for predicting the behaviour of the cast material during all processing steps.

Rheology

In this case, the use of the plastograph made it possible to accurately record values for the mixture's melting speed, rotor torque and energy required for the process. Using software for fluid-dynamic analysis, the data obtained was compared with the rheological characteristics of materials already known to be compatible with extrusion. The comparison showed that the process parameters of the polyal processed by the customer were in line with those of materials easily extruded using Bausano technology, ensuring optimal output levels in terms of both quantity and quality.

"Bausano's distinguishing feature lies in the know-how of its experts, declined in a consultative and customer-oriented approach," said Marco Masiero, Extrusion Test Manager at Bausano. "Cutting-edge extrusion technologies, such as those developed by Bausano, open up new horizons in the recycling of post-consumer plastic waste."

While Bausano's MD Twin Screw Extruders and E-GO R Single Screw Extruders are designed for recycling PVC and polyolefins respectively, the forward-thinking company says it is also collaborating with the Politecnico/University of Turin in Italy on research into artificial intelligence (AI) and predictive maintenance. This partnership aims to create more efficient and environmentally friendly manufacturing processes, ensuring optimal operation and reduced waste through advanced AI-driven maintenance strategies.

Recompounding

At NPE 2024, Italy-based **Sirmax** highlighted the successful integration of its US recycling and PP compounding facilities in Anderson, Indiana, reaffirming its commitment to sustainability and the circular economy. "The vertical integration we have undertaken allows us to differentiate ourselves in the market and meet client demands for more sustainable materials in the automotive and household appliance sectors," said Lorenzo Ferro, US country manager for Sirmax. "This is accomplished without compromising on traceability and the high-quality standards required for premium virgin materials, which are already being supplied today."

The PP compounding plant has a capacity of 46,875 tonnes/yr and consists of seven lines, five dedicated to production and two to R&D activities. The recycling plant operates two lines and a total capacity of 17,856 tonnes/yr. Due to low availability and quality of post-consumer streams in the US compared to Europe, the company has focused on post-industrial recycled (PIR) waste streams with the material coming from a range of sources including flexible and rigid packaging. Ferro said OEMs and processors are not only looking to meet performance specifications but also seeking to fulfil key sustainability goals and Sirmax's integrated system, which includes production processes and full control of supply sources, ensures greater reliability and consistency in recycle-content compounds.

Sirmax's 2025-27 industrial plan earmarks €30m in new investments, partly at its Anderson facility.

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- > www.sirmax.com

Stabilisers and property and process improvers are hard at work to protect plastics through use, recycling, and reuse. Jennifer Markarian writes about current products



IMAGE: GABRIEL-CHEMIE

Let's go round again: additives revive plastics

The trend towards increasing recycled plastic content continues as countries move toward plastics circularity. At the same time, there is a growing expectation that recycled plastics should have good performance. Additives play a key role in enabling compounders and recycled resin suppliers to meet this expectation.

"The gap between virgin plastic and recycled plastic performance needs to be closed not only by boosting performance of recycled-virgin blends by compounding, but also by ensuring in the recycling step of the value chain that the best quality recycled resin is produced," said Jeroen Frederix, **SI Group** Market Development Manager, Circular Economy. "It is important to ensure polymers are well protected during the recycling process, where unfortunately today we see that polymers after a first lifetime [may] enter the recycling process with insufficient protection against further heat cycles." To this end, SI Group has developed its Evercycle

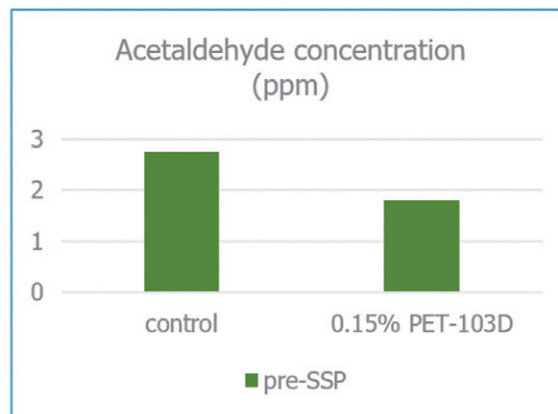
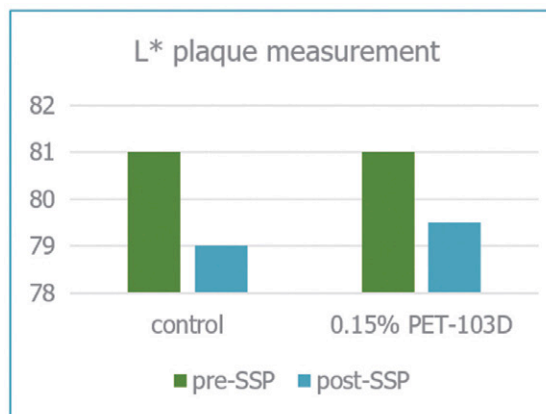
product portfolio for plastics recyclers which include optimised stabilisation packages for specific material streams and end applications.

Frederix points to Evercycle PET-103D for PET bottle-to-bottle recycling as an example. During recycling, PET thermally degrades, which generates volatiles (such as acetaldehyde [AA]), causes loss of intrinsic viscosity (IV), and leads to yellowing. "Currently in the mechanical recycling process, the rebuilding of the food-grade rPET can be supported by adding blue colorants to offset the yellowing," said Frederix. "A downside of the blue colorants is that they also negatively affect the material's lightness (L*), so when being recycled multiple times, the PET bottle loop becomes darker and darker. Here, stabilisers offer a novel approach for PET recyclers in preventing problems from occurring by stabilising the PET polymer chain in the recycling process, not only preventing yellowing but also reducing AA creation and IV losses during recycling."

Main image:
Gabriel-Chemie
has introduced
the MaxiLoop
range of
compatibilisers
for plastics
waste streams
comprising
different
materials

Trial results for SI Group's Evercycle PET103D, which was compounded into 100% rPET at 1,500 ppm

Source: SI Group



SI Group is also developing stabilising packages tailored for recycled polypropylene (rPP) that will “close the performance gap” compared to virgin PP and allow compounders to increase recycled content while still maintaining properties, said Frederix. Meeting this dual challenge is important in PP for automotive applications, for example, where OEM specifications must be achieved while also working to add more rPP content, which is being driven by pressures such as the upcoming EU’s End-of-Life Vehicle Directive.

“SI Group is currently screening new stabilising blends to improve the long-term heat aging performance for automotive PP compounds. By adding advanced stabilising packages, the performance of the rPP can be enhanced at low additive dosing rates,” Frederix said.

Additive insights

Oliver Reich, head of **BASF’s** Competence Center Packaging & Circular Solutions, said that BASF has gained additional insight into the interaction of additives and their impact on the quality of recycled materials since the 2021 launch of the company’s IrgaCycle additives for recycled plastics. “As more applications beyond packaging – such as automotive, construction and electronics – prepare for mandatory recycled plastic content regulations, BASF is also looking to expand its offering beyond its current standard portfolio,” Reich said.

The automotive industry, in particular, is driving demand for more sophisticated solutions. BASF says it is combining its additive offering with other mechanical recycling solutions from BASF, such as the TrinamiX NIR detector and the Chemetall washing solution, to provide converters and recyclers with solutions out of one source.

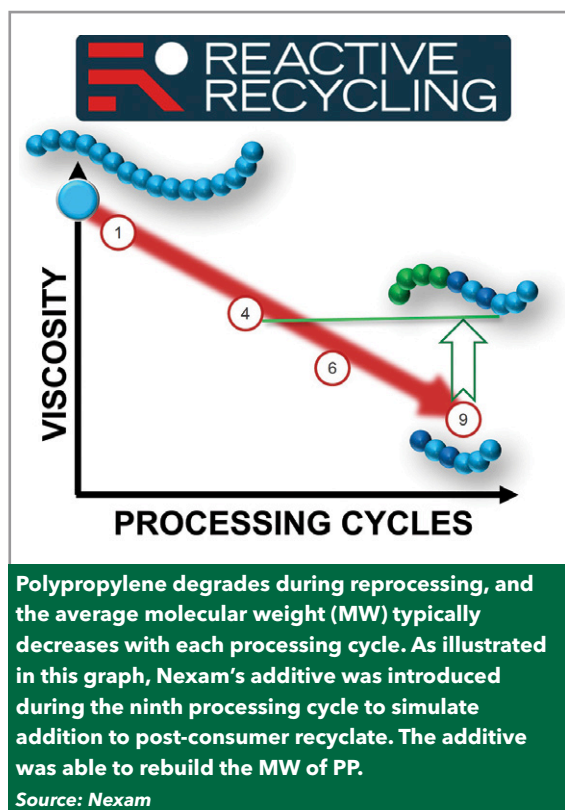
Clariant’s PKG158, which enables greater levels of recyclate to be added in rigid packaging such as blow moulded bottles or injection moulded parts, was expanded to the North American region, the

company announced at NPE 2024. The additive is designed to make polyolefins and other polymers “recycle ready” by providing long-term protection for the polymer through multiple heat histories and helping to protect against discoloration. The high efficiency of this additive chemistry allows it to provide robust stabilisation at low additional levels. It also has low migration levels and low plate-out attributes. A similar product for stabilising film products, PKG 196, was introduced at the K 2022 Show; the additive helps reduce gels and allow higher levels of recycle content in thin films and flexible packaging.

“As our customers increase their use of recycled content, we have optimised AddWorks PKG 158 for excellent processability and to enhance the resin for end-of-life plastic recycling,” said Eliandro Felipe, Head of Sales Americas for Additives Polymer Solutions.

Dover Chemical’s Doverphos LGP12 (liquid green phosphite) has seen success as a stabiliser in recycle streams, where it has been shown to reduce both the size and overall amount of gels in recycled-polyethylene film applications. Shawn Cook, Technical Manager for Plastic Additives at Dover Chemical, reports that the additive allows higher concentrations of recyclate to be used without a loss in finished product quality. In addition to acting as an antioxidant, the additive also acts as a PFAS-free and silicone-free polymer processing aid (PPA), showing both the ability to clear melt fracture in blown film and to reduce die-lip buildup in cast film, Cook said.

LGP12 is a high molecular weight polymeric phosphite, and its high phosphorus content allows it to be used at lower loading levels, both of which contribute to low migration. The additive recently received an endorsement from EFSA in the EU for food contact applications. The additive received US FDA clearance for food contact in LLDPE in 2019 and for HDPE in 2023. The company reports that it



has recently submitted requests for food-contact approval from other major global regulatory bodies.

Nexam Chemical said that its Reactive Recycling additive masterbatches for rPP can tune flow characteristics and enhance processability and quality. The technology elevates the utility of rPP so it doesn't need to be "downcycled," the company claims.

Nexamite R201 builds molecular weight (ie, decreases melt flow ratio [MFR]) of PP. Nexamite R203 is an enhanced version that also builds molecular weight of rPP. Nexamite R202, on the other hand, is a vis-breaking additive that increases MFR and reduces molecular weight, if needed to match the process.

Tuning flow

A study published in March by researchers from the Department of Applied Science and Technology at Politecnico di Torino, Italy, investigated the impact of thermomechanical degradation on PP micro-structure during multiple extrusion cycles. PP degrades structurally through chain scission that reduces molecular weight, but a reactive extrusion process with Nexam's additive was able to rebuild the chains. The experiments showed that Nexamite additive is able to prevent breakdown when added to PP and to restore the molecular weight when added to a simulated post-consumer rPP (as shown in the graph). The researchers also found that the additive acted differently depending on the

residence time in the extruder; a longer residence time introduced some branches onto the polymer backbone, which improves melt strength and is beneficial for processability. They concluded that the additive would allow "tunable" processability.

For PET, a key measure is intrinsic viscosity. Nexam Chemical said its IV-enhancing additives for rPET are seeing expanded use in multiple regions where rPET use is growing. For example, in the US, IV enhancers are being used in PET foamed sheets, that are used for replacing polystyrene in food packaging. In Pakistan's growing packaging market, locally produced rPET sheets and other types of rPET applications are using the IV enhancers, the company reported in a July press release. Nexam said it is seeing growth also in Australia, Mexico, and South America.

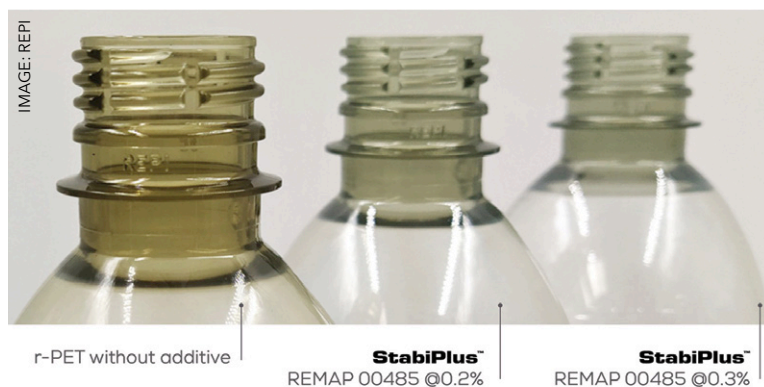
Techmer PM's HiTerra rPET Revive is an additive concentrate that counteracts the degradation experienced during reprocessing of PET. The additive works by rebuilding the polymer chains to increase viscosity and reduce yellowness.

"rPET Revive can allow for a higher regrind/recycle rate and improve productivity," said Steve Smith, Techmer PM's Market Manager for Rigid Packaging, in a release. "We selected the active ingredient to be compatible with PET resins used in fibre and moulding applications. Converters can use it in the production of thermoformed sheets, and the product is showing good potential for use in bottles, as well." The additive is suitable for food-contact applications.

StabiPlus REMAP 00485 from additive supplier **Repi** is a liquid additive that is added during PET recycling to maintain the brightness (ie, L-value) of rPET, said Karsten Fritsch, Business Development Manager Thermoplastics at Repi. While anti-yellowing additives successfully mask the yellowness that comes from discoloration due to degradation by correcting the b-value, this new functional additive prevents the drop in L-value that is typically seen in rPET. Fritsch explains that the additive can be adjusted depending on the application. The suggested minimum addition rate is 0.134%. The additive does not affect intrinsic viscosity, and it has EU and FDA food contact certifications.

Compatibilisers

Compatibilisers are particularly helpful in recycled plastics streams that may contain multiple polymers or small amounts of one polymer as a contaminant of the primary material. (A range of compatibilisers and coupling agents were described in *Compound-ing World* May 2024 issue.) Most recently, European masterbatch provider **Gabriel-Chemie** has intro-



Above:
StabiPlus from
Repi protects
rPET from
yellowing
during
mechanical
recycling

duced the MaxiLoop range of compatibilisers, beginning with ten different formulations designed for various recycling applications. The additives are designed to allow increased recycled content by improving miscibility, processability and properties.

One such use is in post-industrial recycling (PIR) of edge trims from film extrusion in the production of multilayer products. Multilayer films made of PE or PP (non-polar polymers) may contain PA6, PA66, or EVOH (polar polymers) in a barrier layer. When the PIR edge trim is put back into the film extruder, the differences in polarity and in flow properties between the polymers can result in defects such as

streaks and gels in the film. MaxiLoop HP7AB-4780COM compatibiliser masterbatch improves homogeneity during processing by increasing interfacial adhesion between the polymers, which leads to more stable processing conditions and higher product quality, especially in blown film production, according to Gabriel-Chemie.

MaxiLoop EMA7AB4820MOD is another additive masterbatch designed for recycled polystyrene (rPS), a material which can have high dust formation, brittleness, and low impact resistance. Adding the compatibilising additive improves impact resistance and tensile strength.

Evonik says that its range of Tego Cycle additives, introduced in May 2023, are designed to save energy during mechanical recycling and to improve the quality of recycled plastics. For washing, separation, deinking, and drying, the company's antifoams and wetting agents help make processes more efficient. During compounding of recycled materials, additives that improve processing include dispersants and processing aids. Additives including compatibilisers and Tego Sorb malodour reducers improve product quality.

Evonik points to its Circular Plastics Program as

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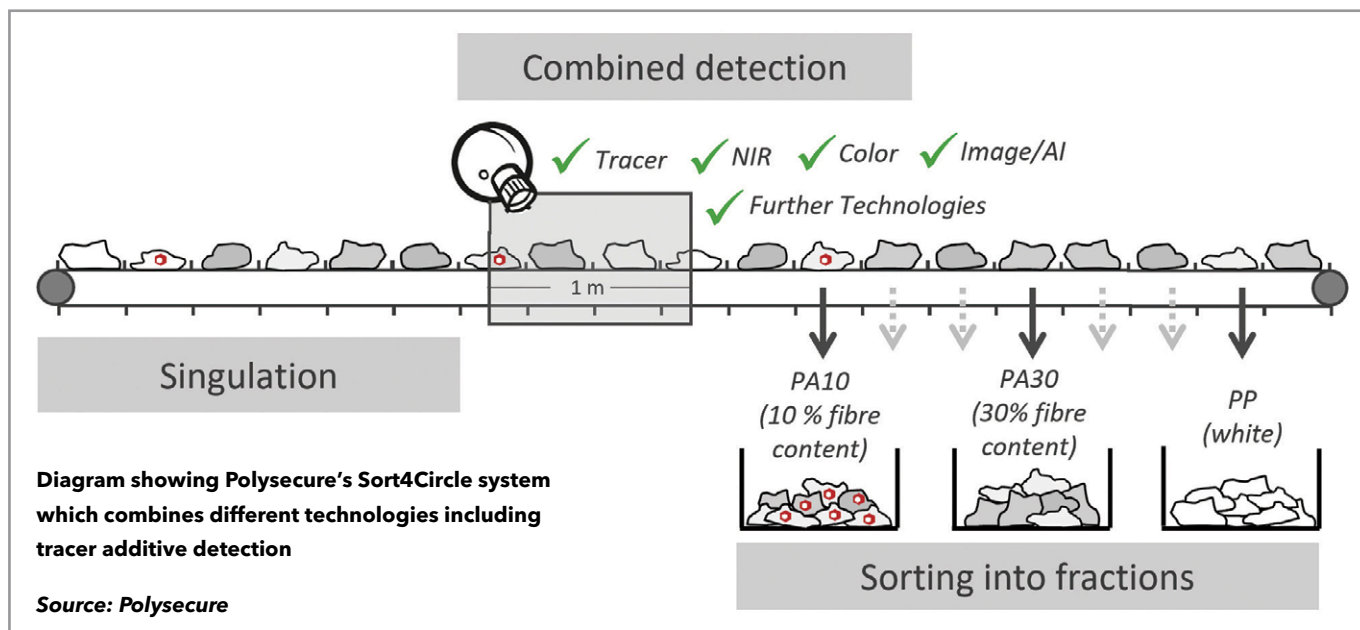


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an initiative that, combined with the Tego Cycle additives, can help speed the plastic industry's transformation to a circular economy. For example, Evonik partnered with the start-up company Wild Plastic to collect litter and make recycled trash bags. The collected material was highly contaminated LDPE, but the partners developed an efficient process to make a suitable product.

Tracking additives

Various projects over the past several years have looked at ways to "track and trace" recycled materials using additives that have been traditionally used to identify counterfeit goods. These additives can be compounded into plastics and detected throughout the supply chain. They could be used in sorting or in quantifying recycled content. Tracking additives include fluorescent markers as well as tracers that can be detected with near infrared (NIR) spectroscopy (see *Compounding World* December 2023 issue).

German technology company **Polysecure** continues to demonstrate its Tracer Based Sorting (TBS) which uses the company's fluorescent particles. Polysecure has also developed the patented Sort4Circle technology, which it says differs from the existing sorting processes that use sequential sorting mechanisms to separate a small number of material groups. Sort4Circle, in contrast, precisely identifies packages or other objects using a single-step sorting mechanism that assigns objects directly to a flexible number of fractions. A new detector module measures material characteristics, such as colour, image, and polymer type, as well as identifying markers such as fluorescent particles, to perform the sortation. The company recently announced a

project with Pforzheim University called PräziSort to further develop the technology with funding from the state of Baden-Württemberg.

In another recent project, Polysecure, automotive OEM Hyundai Motor Group and the German Plastics Center (SKZ) performed a feasibility study using the Sort4Circle single-step sorting mechanism with tracer-based sorting on shredded automotive plastics. In the first part of the study, different tracers were added to PP and PA6 at a concentration of 10 ppm during injection moulding. Using Polysecure's PIDEA system, the fluorescence signal of each object was detected. The tracer ratio and code were plotted on a chart, demonstrating complete differentiation between the PP and PA6, with no false positives.

In the second part of the study, marked and unmarked shredded plastics were put through the Sort4Circle detector. The researchers report that more than 90% of the marked objects were identified and sorted, and that the PP and PA6 objects were sorted at 99.9% purity, with only one of over 1,000 objects misclassified. They say that this type of system could be used to reliably sort similar plastics.

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View agenda and book your place



Cleveland event to host key recycling exhibitors

The North American edition of Plastics Recycling World Expo is back in Cleveland, Ohio this November and the number of exhibitors continues to grow. The free event – organised by AMI, the publisher of *Plastics Recycling World* magazine – takes place at the Huntington Convention Centre in Cleveland on 13-14 November.

The show is co-located with Compounding World Expo, Plastics Extrusion World Expo and Polymer Testing World Expo – giving ticket-holders access to four shows, more than 80 conference speakers, and over 350 exhibitors from across the entire supply chain.

The expo features one of the widest arrays of exhibits relating to plastics recycling in the US. Exhibitors include manufacturers of plastics recycling machinery and equipment, as well as suppliers of materials, additives, and related services.

“When we ran these expos in Cleveland last year, they attracted more than 5,100 visitors,” said Jenny Amaru, expos business manager at AMI.

“This provides a great opportunity to meet and compare suppliers from around the world and learn from business leaders and technical experts in the conference theatres.”

At the free conference sessions – featuring more than 80 speakers in four dedicated theatres – delegates can discover the latest innovations and best practices in plastics. Within the Plastics Recycling World Expo conference, hot topics in plastics recycling including market outlooks, technology trends and regulatory developments will be discussed in company presentations and industry debates.

On the evening of 13 November, attendees and exhibitors can attend a networking party at the Punch Bowl Social (tickets are US\$60).

On the following pages, we present some of the numerous exhibitors at the event that form key elements in the plastics recycling value chain.

For more details on the exhibition, click [HERE](#).

For more details on the conference, click [HERE](#).

Right:

**VAZ 1600
shredder from
Cumberland**

Aaron Industries

Aaron Industries is a leader in recycled polymer innovation, offering custom compounding and toll compounding services for polyolefins, manufacturing FDA-approved food contact materials from 100% recycled content.

➤ www.aaroninc.com

ADG Solutions

ADG Solutions engineers and sells systems for plastic recycling for post-consumer and industrial plastics, including extruders, filters, shredders, grinders, material handling systems, and waste-to-energy solutions.

➤ <https://adgs.net>

Advanced Cryogenics Enterprises

Advanced Cryogenics offers precision, fine-ground materials through ambient and cryogenic processes using shredders, granulators, mills, and dryers.

➤ www.acecryo.com

AEC / Cumberland / Sterling

Cumberland is a leader in size reduction equipment, including granulators and shredders. AEC provides solutions in material handling, process cooling and size reduction. Sterling is a leader in chillers and process cooling, materials handling and granulators.

➤ www.acscorporate.com

Aimplas

Aimplas is a technology centre with 30+ years in the plastics industry, offering solutions across the value chain. The Spain-based group has 12,000 m² of facilities, and 35 pilot plants are available to test all plastic processing applications.

➤ www.aimplas.net

Alfarben

Alfarben, part of the Torrecid Group, specialises in inorganic colour pigments for ceramics, glass, plastics, and construction materials.

➤ www.alfarben.com

Altech Recycling Technology

Altech produces plastic recycling lines, shredders, and crushers, exporting to 28 countries.

➤ www.altechmakina.com

Amandus Kahl USA

Amandus Kahl, a family-owned company, focuses on recycling and processing equipment, specialising in transforming hard-to-recycle materials.

➤ www.akahl.com

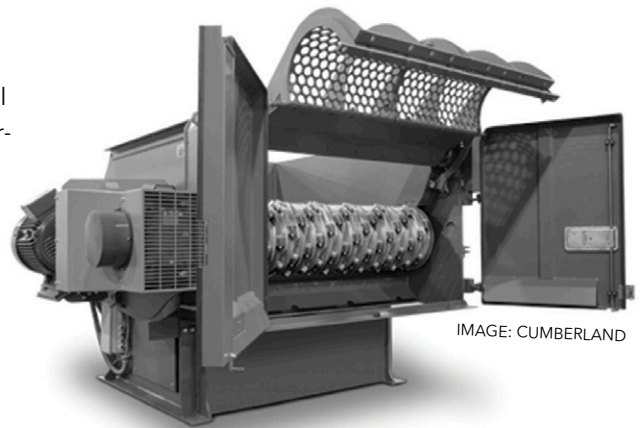


IMAGE: CUMBERLAND

Amut

Amut is a leader in extrusion and recycling technologies, offering systems for PET, HDPE, PP, and industrial waste recovery.

➤ www.amut.it

AMVT

AMVT specialises in the sale, support and service of optical sorting equipment widely used in the agriculture, food processing and plastics recycling industries.

➤ www.amvt.net

Avian USA Machinery

Avian offers a wide variety of machines: low, medium, and high speed granulators, as well as shredders and pulverisers.

➤ <https://avianusa.com>

Beier Machinery

Beier Machinery is a leading Chinese brand in the plastic industry, specialising in recycling solutions such as PET bottle washing lines and self-cleaning pelletising extruders.

➤ <http://beierpm.com>

Bio-Tec Environmental

Bio-Tec Environmental is known for EcoPure, a biodegradable additive for plastics.

➤ www.goecopure.com

Blades Machinery

Blades Machinery is a supplier of new and used plastics industry equipment, including granulating equipment.

➤ www.bladesmachinery.com

BoReTech

BoReTech provides plastics recycling systems, including PET bottle washing and pelletising equipment.

➤ www.bo-re-tech.com





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Break Machinery

Break Machinery manufactures automatic filters including laser filters for plastics recycling.

➤ <https://breakmachinery.com>

Bulk Handling Systems

BHS designs and installs municipal solid waste systems, specialising in plastics recovery and processing.

➤ www.bulkhandlingsystems.com

BUSS ChemTech

BUSS ChemTech specialises in technology for chemical recycling of plastic waste and other advanced process development.

➤ www.buss-ct.com

Cargill

Cargill is a leading global supplier of specialty additives for the plastics industry, including slip, anti-block and anti-scratch additives.

➤ www.cargill.com

CieTrade Systems

CieTrade Systems offers software solutions for trading and recycling industries, managing inventory, logistics, and finance to optimise operations.

➤ www.cietrade.com

Collin Lab & Pilot Solutions / BritAS Recycling Solutions

Collin develops intelligent pilot and lab lines for the plastics industry, while BritAS focuses on plastic waste filtration and quality control systems.

➤ www.collin-solutions.com

Compass Systems

Compass Systems provides fully integrated material handling solutions, focusing on sustain-

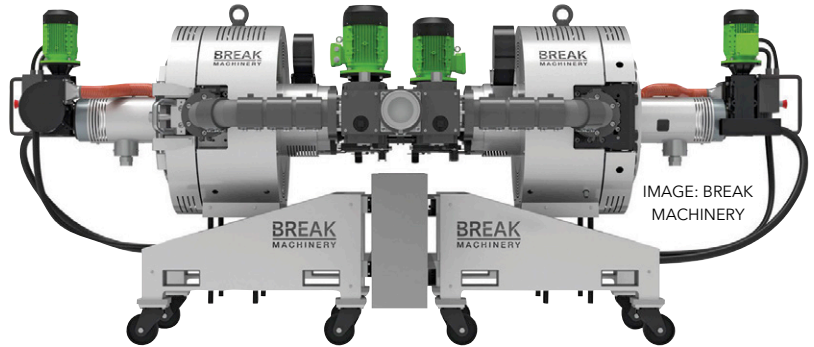


IMAGE: BREAK MACHINERY

ability and diverting materials from landfills. They serve industries such as automotive, agriculture, and material recovery.

➤ <https://compasssystems.com>

Cutmetall

Cutmetall North America provides industrial knives and wear parts for shredders and granulators.

➤ www.cutmetall.com

Diversys

The company's SaaS platform is a cloud-based system which enables real-time, precise data capture of material flow, crucial for adhering to sustainability frameworks like Extended Producer Responsibility.

➤ www.diversys.com

Dodhia Group

The company is among the most prominent players in the textiles, chemicals, and plastic recycling industries in India with a global footprint.

➤ www.dodhiagroup.com

Duy Tan Plastic Recycling Corporation

The company operates a 65,000 m² recycling facility at the Duc Hoa Ha Plastic Industrial Zone in Long An Province, China, with a capacity of 100,000 tpa.

➤ www.duytanrecycling.com

EFACTOR3

EFACTOR3 specialises in integrated recycling systems and solutions, offering equipment for material recovery, waste processing, and plastic recycling, partnering with manufacturers like Kreyenborg.

➤ www.efactor3.com

EFS Plastics

EFS Plastics is a post-consumer mechanical recycler that focuses on creating high-quality recycled plastic products.

➤ www.efs-plastics.ca

Above: DUO melt filtration system from Break Machinery



IMAGE: COLLIN

Left: Lab Line ZK 25 P from Collin Lab & Pilot Solutions

Elementale Enterprises

Elementale Enterprises provides sustainable process engineering solutions to reduce energy and waste.

➤ www.elementale-ent.com

Equitech

The company's technology uses UV-Vis spectroscopy for the inline, real-time monitoring of processes wherein colour and/or chemical composition are critical to product quality and the productivity of operations.

➤ <https://equitechintl.com>

Erema

Erema technologies process in-house waste, post-consumer plastics, and bottle-to-bottle recycling, producing high-quality recycled pellets.

➤ www.erima.com

Fimic

Fimic offers five models of melt filters, providing filtration solutions for post-industrial and post-consumer plastics.

➤ www.fimic.it

FNA (Firefly North America)

FNA delivers high-tech systems that minimise the risk of fires and dust explosions.

➤ www.fnainc.net

Genox USA

Genox USA says it creates innovative solutions for recycling challenges, whether the need is for a single machine or a complete system.

➤ www.genoxusa.com

Hosokawa Polymer Systems

Hosokawa Polymer Systems manufactures granulators, dedusting systems, and recycling plants, specialising in plastic film, cable, and post-consumer recycling.

➤ www.polysys.com

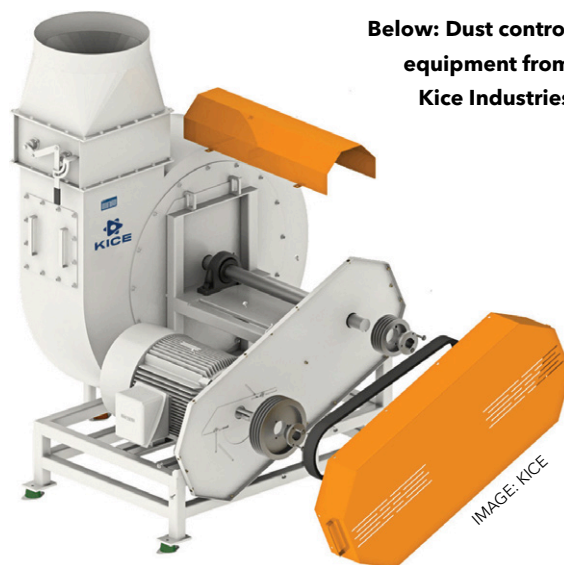
IMS Group USA

IMS Group USA provides packaging equipment and automation systems for various industries, offering custom solutions based on customer input.

➤ www.imsgrrouponusa.net

Industrial Magnetics

The company specialises in designing and manufacturing



Below: Dust control equipment from Kice Industries

magnetic equipment, including permanent and electromagnets, for a wide range of applications.

➤ www.magnetics.com

Innovative Recycling Solutions

Innovative Recycling Solutions provides equipment for reclaim extrusion, melt filtration, and plastic waste recycling.

➤ <https://irecyclingsolutions.com>

Key Mart

The company produces 100% clear PET flakes at its recycling plant in Dhaka, Bangladesh.

➤ www.keymartbd.com

Kice Industries

Kice Industries manufactures bulk handling equipment, specialising in separating dust and other contaminants from regrind plastics.

➤ www.kice.com

KiTech Machinery

KiTech, based in China, is a globally active machinery corporation, specialised in developing plastics recycling machines and system components.

➤ www.kitechpm.com

KRS Recycling Systems

Based in Niagara Falls, NY, the company specialises in recycling and sorting systems, working closely with clients to implement efficient recycling processes.

➤ www.krsrecyclingsystems.us

KW Plastics

KW Plastics is a leading recycler of HDPE and PP materials, buying post-consumer and post-industrial



IMAGE: HOSOKAWA

Right: Heavy duty granulation system from Hosokawa Polymer Systems

al scrap from over 600 vendors across North America, Mexico, and the Caribbean.

> www.kwplastics.com

Lindner Recyclingtech America

Lindner Recyclingtech designs and manufactures shredders and waste processing systems for plastics, municipal waste, and industrial materials. Lindner Washtech specialises in industrial plastic washing and sorting systems for rigid plastics and films.

> www.lindner.com

MAS

MAS Maschinen- und Anlagenbau Schulz provides advanced extrusion solutions, specialising in twin-screw extruders for plastic recycling. It also offers high-performance melt-filtration systems and waterless cleaning technology for efficient recycling of plastic film flakes.

> <https://mas-austria.com>



IMAGE: MESUTRONIC

Mesutronic

Mesutronic is a specialist in metal detection and x-ray equipment for plastics and other industries.

> www.mesutronic.us

Modix Plastique

Modix Plastique processes post-consumer LDPE materials to produce high-quality raw materials for packaging and injection moulding manufacturers.

> www.modixeco.com

Moxietec

Moxietec says its foaming technology results in greater weight savings and cycle time reductions and allows for higher contents of recycled material than conventional injection moulding technology.

> www.moxietec.com

MSS Optical Sorters

MSS designs and builds AI, NIR, colour and metal sensor sorters for the plastics industry.

> www.mssoptical.com

Left: Quicktron 03 metal detection unit from Mesutronic

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Right: A new investment in 2024 has enabled Polykemi and subsidiary Rondo Plast to handle completely new material sources, such as PA fibre waste

Nexam Chemical

The company's Reactive Recycling technology helps restore the properties of recycled polyester and polyolefin feedstocks, ensuring efficient processing and higher recycled content in moulded products.

➤ www.nexamchemical.com

Next Generation Recycling Machines

NGR's recycling technology includes patented shredder-feeder-extruder systems that reduce energy consumption and optimise production, and the LSP process for PET recycling which ensures food-grade materials through rapid decontamination.

➤ www.ngr-world.com

Omya

Omya is a leading producer of industrial minerals, such as calcium carbonate, dolomite, and perlite, and a distributor of specialty chemicals.

➤ www.omya.com

Pierret North American Division

Pierret is a global leader in feeding and cutting equipment for the textile and plastics industries, providing innovative machinery solutions to optimise production processes.

➤ www.pierret.com

PlastiWin Capital Equipment

PlastiWin specialises in buying and selling used plastics processing equipment worldwide.

➤ <https://plastiwin.com>

Polykemi

Polykemi is a producer of customised compounds including products based on high-quality, recycled raw materials.

➤ www.polykemi.se

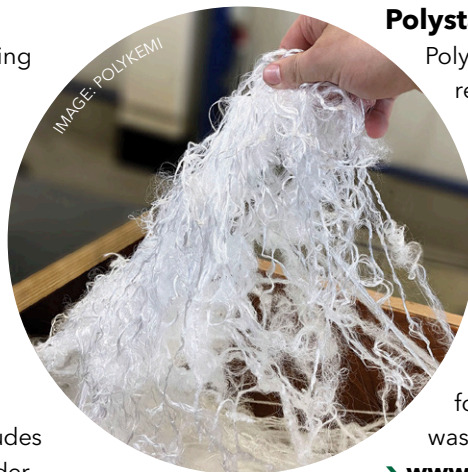


IMAGE: POLYKEMI

Polystar Machinery

Polystar provides user-friendly recycling systems for processing PE/PP packaging film and PP raffia/woven materials.

➤ www.polystarco.com

Pure Loop

Pure Loop, part of the Erema Group, offers innovative shredder-extruder technology for recycling clean production waste into high-quality pellets.

➤ www.pureloop.com

Recycling Equipment

REI provides waste and recycling equipment to help companies turn waste into revenue.

➤ www.gogreenrei.com

Return Polymers

The company specialises in post-industrial and post-consumer PVC recycling.

➤ www.returnpolymers.com

Revolution

The company produces flexible packaging products using recycled plastics for sectors including agriculture, retail, construction and transportation.

➤ www.revolutioncompany.com

RUNI Recycling Machinery

RUNI specialises in volume reduction machinery, offering compactors for various materials like plastics and food waste, helping turn waste into a valuable resource.

➤ www.compactor-runi.com

Sawgrass Sustainable

Sawgrass Sustainable produces high-quality recycled resins, emphasising the recycling of hard-to-process waste streams.

➤ www.sawgrassrecycle.com

Sensor Instruments

Based in Germany, Sensor Instruments specialises in non-contact optical measuring technology.

➤ www.sensorinstruments.de

Shini USA

Shini USA, Division of Budzar Industries, offers a wide range of plastic processing and recycling equipment, such as heating and cooling systems and granulators, serving the injection and blow

Below: Revolution recycles post-consumer material into flexible packaging products



IMAGE: REVOLUTION

moulding, thermoforming and extrusion sectors.

➤ www.shiniusa.com

Soleno

Soleno designs, manufactures and distributes high-quality products, mainly in HDPE, for the sustainable control and management of water.

➤ www.soleno.com

SonicAire

SonicAire is a manufacturer of dust control fans designed to prevent dust accumulation in manufacturing plants, increasing safety and reducing the need for costly cleanings.

➤ www.sonicaire.com

SSI Shredding Systems

The group is an expert in industrial shredding technology, offering custom solutions for waste reduction and recycling, serving diverse industries globally.

➤ www.ssiworld.com

Steinert US

Steinert is a leader in separation technology,



IMAGE: SONICAIRE

Left: SonicAire's dust control fans are designed to prevent combustible dust build-up

specialising in magnetic and sensor-based sorting systems for recycling, mining, and waste recovery industries.

➤ www.steinertglobal.com

Sulzer Chemtech

The group's product offering ranges from process components to complete process plants and technology licensing for industries including

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➤ www.sulzer.com/chemtech

Tecnofer Ecoimpianti

Tecnofer develops systems for plastic waste valorisation, specialising in high-performance recycling lines for post-consumer and post-industrial plastic waste.

➤ www.tecnofer.biz

Universal Dynamics

Universal Dynamics (UnaDyn) is a leader in automation systems for plastics processing, specialising in material handling and drying equipment.

➤ www.piovan.com/plastic/recycling

Van Dyk Recycling Solutions

The company says it is a consultant and a supplier of equipment to help recyclers and waste processors maximise profits.

➤ <https://vdrs.com>

Vanden Recycling

Vanden is a recycling company with expertise in plastic scrap trading, resin production, and plastic reprocessing, providing tailored recycling solutions worldwide.

➤ www.vandenrecycling.com

Vartega

Vartega produces recycled carbon fibre as a cost-effective alternative to virgin fibre, serving automotive and industrial sectors.

➤ www.vartega.com

Vecoplan

Vecoplan is a leader in size reduction technologies, offering comprehensive shredding, granulating, and grinding systems for plastic recycling, including durable mobile shred trucks.

➤ www.vecoplanllc.com



IMAGE: VECOPLAN

Left: Single shaft shredders are part of Vecoplan's product portfolio

Verdeco

Verdeco is a specialist in recycled PET whose products are geared towards a range of plastics processes and applications.

➤ <https://verdecorecycling.com>

Weima America

Weima manufactures robust shredding technology, including single-shaft shredders and four-shaft shredders, for processing waste in industries like plastics. Shredders are made exclusively in Germany and the group has sales and service locations in the USA, Poland, India and China.

➤ <https://weima.com>

WIPA

WIPA provides a wide range of machines for recycling, including washing lines, dry cleaning lines, agglomerator, along with pre-treatment machines for chemical recycling.

➤ www.wipa-germany.de

Zerma America

Zerma is a leading supplier of recycling equipment, offering shredders and granulators for various materials, alongside accessories for enhanced operations.

➤ <https://zerma-america.com>

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With the increase in use of post-consumer recycled resin, there is a growing need for additive and processing solutions to remove offensive odours. Jennifer Markarian reports



Meeting the odour challenge head on

Malodours in plastic parts can come from a wide range of sources, including degradation products from plastic resin or, in the case of recycled plastics, from degraded polymer, degraded inks, or the previous contents of the package, for example. Eliminating odour is key for the consumer to accept the product. One solution is to mask the odour with a strong but pleasant fragrance. In many cases, however, masking is not enough, and the malodour must be removed via processing or additive technologies.

Odours typically come from volatile organic compounds (VOCs), some of which are regulated to control potential hazards from inhalation and some of which are “nuisance” odours that are not harmful but are unpleasant. The term “volatile” means that the molecules will evaporate easily and be released as “emissions,” which is why they can be noticed as odours (ie, detected by a person’s olfactory system). Smell is one of the important organoleptic properties (along with touch) considered in plastic part design, particularly for consumer-facing parts, such as consumer goods, packaging, or automotive interiors.

Several standard test methods are used by the automotive industry to evaluate odour in parts as related to vehicle indoor air quality, including the German Automotive Industry Association (VDA) standard VDA 270, Volkswagen (VW) PV 3900 and

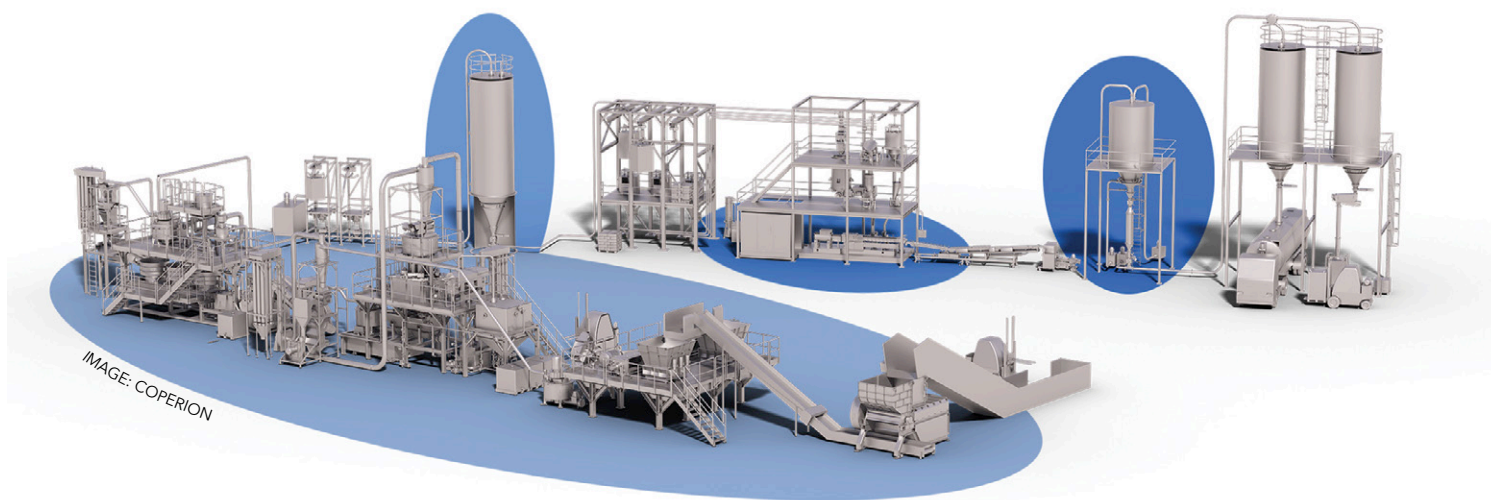
others. In addition to odour, other automotive standards identify specific VOCs and measure fogging from semi-volatile organic compounds, but the odour tests are seen as stringent standards that can be challenging for plastics parts to meet, as they use a panel of people who examine and rate odour perception.

Because malodours are prevalent in mechanically recycled plastics, equipment providers have built solutions for removing some of the odour-causing compounds with devolatilisation and other methods.

Coperion and **Herbold Meckesheim** offer a variety of solutions for deodourisation at several points along the recycling process chain. Jochen Schofer, Head of Sales Recycling at Coperion, says that multiple steps are required to be certain that the recyclate will meet high mechanical and sensory demands, will not exhibit undesired odours, and will achieve the quality needed for the intended application.

“In a first step, odours are eliminated as the waste plastic undergoes mechanical pretreatment during shredding, washing and drying. Further odours can be removed from the shredded plastic in a silo using fresh air circulation,” says Schofer. “The next, intensive devolatilisation step, which markedly improves the recompound’s sensory quality, takes place during compounding in a ZSK twin screw

Main image:
Smell is one of the most important organoleptic properties considered in consumer-facing plastic parts



Above:
Coperion and Herbold Meckesheim offer a variety of solutions along the recycling process to remove unpleasant odours from plastic

extruder. [After the process section], volatile particles are degassed from the plastic melt.”

Dissolved gas removal can be intensified with the addition of liquid stripping agents. For high quantities of gas, a ZS-EG side devolatilisation unit can maximise the extruder’s deodourising capabilities.

Two processes

Coperion also offers deodourisation systems for removing residual unpleasant odours post-extrusion and pelletising. For this step, which involves hot air flowing through the pellets in silos, Coperion has developed two different process solutions, depending upon the desired end-product quality, the temperature it requires, residence time and quantity of air.

One method uses two silos (one to warm and deodourise the granulate and another to cool the granulate with cold air). “In this process, comparatively little energy is needed to warm the product to the desired devolatilisation temperature. Moreover, the cooler’s process heat can be used to pre-warm the pellets, increasing energy efficiency,” Schofer reports.

In an alternative method, warming, degassing and cooling can take place in one silo by using two Bulk-X-Change heat exchangers. “This solution is much more compact, requiring only one silo,” Schofer says. The company offers a mobile test unit to determine specific needs for silo devolatilisation on a customer’s site. “Using freshly produced product under actual production conditions, the options for odour reduction can be

thoroughly investigated in situ, defining machine parameters to achieve the desired product quality.”

Zeppelin Systems offers deodourisation plants that remove odour from plastic recycled materials by means of a physical thermal cleaning process. These include a batch system (Fresh-TEC Deo-B) and a continuous system (Fresh-TEC Deo-C). The systems are an adaptation from the company’s degassing technology that has been used in virgin polyolefin production for decades. Several of the new, scaled-down systems optimised to maximise efficiency in the recycling industry are in daily commercial operation, says Julian König, Head of Sales, Recycling Plants at Zeppelin. The systems can be used either after producing recycled granules or after a compounding extrusion and pelletising step. A compounding extruder can remove highly volatile contaminants, but complex contaminants require extended treatment time for efficient decontamination, König says.

Both batch and continuous systems can be designed to reduce energy consumption through insulation as well as energy recovery. “Deodourisation requires material treatment with a flow of gas at a high temperature for an extended time. The energy for that process is stored in the degassed granulate leaving the system as well as in the off-gas. We have developed recuperators to harvest that energy and feed it back to the system. That leads to a significant reduction of external energy use,” König reports.

Batch systems offer lower capital expenditure, but energy-efficient, continuous systems are typically chosen for higher throughputs or less frequent changeover, such as a continuous flow of one material for multiple days.

Aimplas, the Technological Institute of Plastics located in Valencia, Spain, has participated in multiple EU projects to develop solutions for recycled plastics. The group has optimised a single-screw extrusion line for the elimination of



Left: Using Coperion’s mobile deodorising unit, specific odour reduction potential can be tested on freshly produced product under actual production conditions

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	250	0.078	4.5	57	1.2
1.5%	250	0.078	3.5	40	0.34
2%	250	0.078	3.0	28	0.3
2%	250	0.1	3.0	19	0.34

VW PV3900 Odour Test

VW PV3341 Emissions of Organic Compounds by Headspace GC

VW PV3015 Condensable Constituents

Source: CAI Additives

volatile, semi-volatile and non-volatile residues by means of supercritical agents or additives.

CAI Additives' products - LDV 8010 for ABS and LDV 1035T for other polymers including PP, TPO, TPV, TPE, and POM - remove odour-causing organic molecules during the compounding process. The company says that the additives create active microfoams in the melt in the compounding extruder. These microfoams attract and bind the polar organic molecules, and the foams containing the compounds are then vented from the extruder at the end of the barrel. Thus, the offending VOCs are physically removed from the material in conventional compounding equipment. Applications include recycled PP (rPP) and talc-filled compounds.

The additives also include certain fragrance actives for additional odour control in the resulting compound and part. These are particularly useful for the automotive OEM VOC tests for odour, which include a subjective test by a panel of people. In some cases, the additional fragrances are what brings the material over the threshold into the acceptable range, says CAI. Recent data from CAI demonstrates that the additives enable users to achieve automotive standards. In the table above, for example, CAI's LDV1035T compounded at 2% loading into a 20% talc-filled PP was able to meet the VW PV 3900 odour test (threshold of 3.0) with a vacuum drawn from the vent port near the exit of a twin-screw compounding extruder.

Additives and absorbers

AFI Chemical's Addisperse odour-eliminating additives work by binding with the odour-causing molecules so that they can be removed by venting during compounding as well as subsequent converting steps. The odour eliminator is designed to volatilise at the same time as the odour-causing compounds. Formulations must be optimised for a specific application, says Paul Albee, Consultant with AFI Global.

"Every volatile material has a specific flashpoint, and its compatibility with the polymer varies as

well," he explains. "We evaluate each application in house to balance the chemistry of the odour-neutralising additive with the formula and design it to primarily work at the conversion step. In addition, a certain amount of odour-causing material can deposit on the moulded or extruded part, and you want the odour eliminator to also be on the surface at that same point, to neutralise any remaining odour in the finished part."

Albee says that as companies are looking to use more mixed PCR streams, the challenge for removing odour becomes more complex, but says that their iterative optimisation process can find a solution. The company's ON106 and ON108 additives are good starting points for optimisation because they neutralise the main odour components found in polyolefins, he says.

Albee says that eliminating, not just masking, is crucial. "In some cases, however, we add an 'identity scent,' such as a leather or 'new car' scent for an automotive part, to mask any remaining odours."

Albee sees an increase in washing and cleaning of PCR before it arrives at the recycler, which can help with removing some of the odour-causing contaminants. Washing doesn't always solve the problem, however. For example, for recycled (non-biodegradable) mulch film from strawberry fields, the overripe strawberry scent is absorbed into the film and remains after washing and pelletising. Albee says that the neutraliser ON106 is useful for this application.

AFI Global has a development product for neutralising odours in bio-based polymers, such as PLA, and in compounds with natural fillers, such as hemp. Albee says the odour compounds are different than those in PCR, but the need to eliminate the odour is similar.

Evonik's TEGO Sorb PY 88 TQ is a zinc ricinoleate that absorbs odour and is effective for controlling odours from products such as hydrogen sulphide, mercaptane, thioether, isovaleric acid, amines and ammonia, as well as odours from pigments (eg, ultramarines, yellow pigments, or

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This report provides an introduction to six engineering polymers (ABS/SAN, PC, PA, PBT, POM, PMMA) from a recycling perspective. It delves into the waste plastics value chain, including collection and sorting from key application areas, the companies involved in waste processing, and the end-use markets for recyclate.

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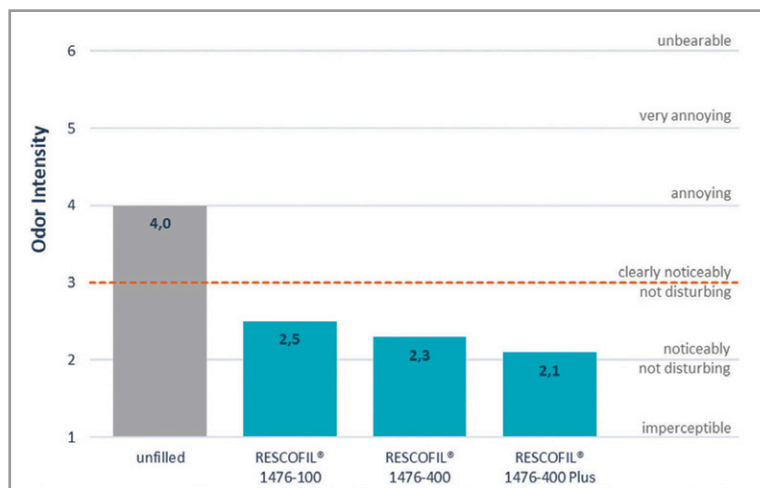
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The 2nd edition of this comprehensive report offers an unbiased quantitative analysis of the industry, enabling your business to formulate effective business strategies. It provides a detailed assessment of the current state of the mechanical recycling market, with data given by region. The following strategic areas are covered:

- An in-depth review of the waste plastics value chain.
- Detailed analysis of the plastics recycling industry, including the supply and demand balance.
- An evaluation of current commodity polymer capacity and recyclate production including an indication of utilisation.
- A review of the end-use applications for recyclate, with an examination of potential future absorption.
- Data is provided for the years 2021, 2022, and 2023, and forecasts for 2035 and 2030.

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Both reports include an interactive dataset, allowing for fast and convenient data retrieval.



Results of olfactory testing of HPF The Mineral Engineers' Rescofil odour absorber product

Source: HPF

oxidised carbon blacks). The additive is suitable for polyolefins, rubber compounds (eg, vulcanised TPE-V or EPDM) and recycled material. Evonik also supplies the additive in masterbatch form – TEGO Sorb PY 50 PE and TEGO Sorb PY 50 PP, which can be used in films made from recycled PE or PP.

The latest from the **Quarzwerte Division HPF**

The Mineral Engineers is the Rescofil product range of mineral-based odour absorbers for recycled plastic compounds. In one test, Rescofil (5% by weight) was blended into a post-consumer polypropylene recycle in a twin-screw extruder. Olfactometric testing according to the VDA 270 standard found that the Rescofil filler reduces the odour intensity of the recycle significantly below the threshold value of 3, to a level that is no longer perceived as a nuisance (see chart).

Wells Performance Materials – formerly Wells Plastics – formulates and compounds a range of additives for odour management in plastics. “Fragrances are usually the most cost-effective option but can only mask an odour [to] make the product smell of something else more pleasant,” says Julie Simmons, Regulatory Affairs Manager at Wells Performance Materials. “Fragrances are complex mixtures of organic molecules that have to have a degree of volatility to smell. This means that although they can be, and are, successfully compounded into polymers, there are temperature limitations, so not all polymers can be treated, together with life span considerations, as not all fragrances have the same degree of longevity.” ➤

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Odour absorbers are technically “adsorbers” as they bind the odour molecules to their surface rather than absorb or soak them up like a sponge, explains Simmons. “These can be non-specific or actually designed to absorb particular identified molecules causing the odour. The non-specific type are materials with high surface areas or natural zeolites that can adsorb the volatile odour molecules onto the activated surface.”

Synthetic zeolites can be designed with pore size and structure specifically to adsorb the target molecule or molecules. Odour adsorbers can be effective at reducing the odour of finished products, although Simmons says success is more limited with strong odours, such as recycled feedstock contaminated with stale wine or diesel. “Due to being relatively expensive, odour adsorbers have struggled to find extensive use, especially in the recycled market. As is often the case with additives, the successful final application will be one where the cost of the solution is compensated for by the added value provided to the final product.”

Bio-based

UBQ Materials’ biobased thermoplastic material, produced from mixed organic waste streams, is blended with other plastics for improved sustainability in building and construction, consumer durables, supply chain, and automotive applications. To meet the strict odour requirements for car interiors, UBQ developed Nclozur, an odour-reducing additive for modifying its UBQ ClimaPos materials (which are used at 5-25% as additives in plastics compounds) and its UBQ Q-Series material replacements (used at more than 25% in plastics compounds).

“Overcoming the issues associated with odour can be a stumbling block for some sustainable materials, as bio-based materials and recycled polymers have odours,” says Gil Felus, COO and CIO at UBQ Materials. Although geared toward automotive, the Nclozur modifier can be used in any application that needs odour reduction.

Ampacet’s latest additive masterbatch for protecting products from off-tastes and unpleasant odours is Organoleptic Preserver 1363, which is designed to capture off-tasting components present in polyolefin packaging. The company says that because food and beverages often come in direct contact with the packaging, low levels of flavour contaminants can migrate from the packaging to the product, affecting organoleptic properties and negatively impacting the perceived quality of the contents, which can lead to food waste. The additive does not affect colour or optical properties



IMAGE: AVIENT

of the final product and performs well at high processing temperatures.

Acetaldehyde (AA) is a degradation product of PET that is known to cause odours and off-taste, particularly in water bottle applications, which are very sensitive to organoleptic properties. **Avient’s** latest solution for this problem is ColorMatrix AAnchor technology, which has been designed specifically to address increased recycled PET (rPET) content in PET food and beverage packaging.

“Higher rPET content often requires more AA scavenger, which can lead to issues related to accumulation, such as migration and increased risk of exceeding regulatory migration limits,” says Avient. “One of the standout features of ColorMatrix AAnchor is a very low tendency for migration, thereby reducing the risk of exceeding regulatory limits, even in closed-loop recycling systems where accumulation and migration risk are highest. Improved thermal stability also offers improved processability, avoiding processing issues related to sublimation and deposition on equipment and molds, helping to improve efficiency and throughput.”

Avient says ColorMatrix AAnchor has low migration risk and does not form primary aromatic amines. It meets the highest standards of food safety and complies with EU regulations. FDA approval is anticipated in 2024.

Above:
Avient’s
ColorMatrix
AAnchor
technology
addresses
acetaldehyde
which causes
odours and
off-taste in
recycled PET

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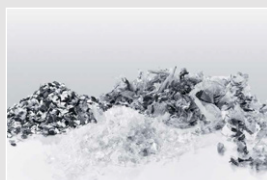
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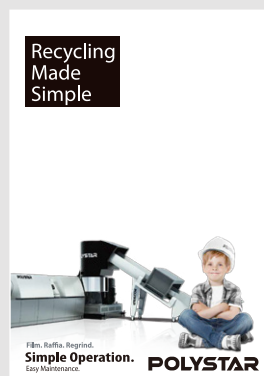
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POLYSTAR: PLASTICS RECYCLING



Recycling
Made
Simple

Film, Raffia, Regrind.
Simple Operation.
Easy Maintenance.

POLYSTAR

Recycling Made Simple is the brochure from Polystar where you can find information about all of the company's plastics recycling systems. Its Repro Flex lines can recycle post-industrial and post-consumer PE/PP packaging and PP raffia/woven materials.

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GLOBAL COLORS GROUP



global
colors
MASTERBATCHES

Find out about Global Colors Group in this brochure showcasing the group companies, their vision and focus on quality, R&D, technology and sustainability. Its portfolio includes colour, white and black masterbatches.

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BB ENGINEERING: RECYCLING SYSTEMS



BBENGINEERING
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Close the circle with rPET systems for fibers and more

BB Engineering explains in this brochure how its technologies recycle PET into fibre and pellets, covering its VacuFil recycling systems, Visco+ vacuum filter, VarioFil R/R + compact spinning lines, extruders and more.

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NORDSON BKG: MELT DELIVERY



Polymer Processing Systems
BKG® Melt Delivery & Pelletizing Systems

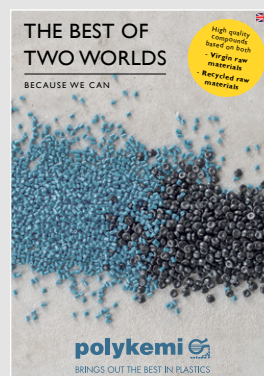
As Nordson BKG, our commitment to innovation is visible in the products we engineer. With decades of industry experience, we understand the challenges faced by global plastic processors and have tailored our melt delivery and pelletizing solutions to meet their needs with superior precision and reliability.

Nordson

The technology portfolio of Nordson BKG, part of Nordson Polymer Processing Systems, includes a full range of melt filtration systems, melt pumps, polymer valves and jet cleaners plus pelletising systems, all detailed in this brochure.

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Plastics Recycling World September 2024

Plastics Recycling World's September 2024 edition includes a cover feature on innovative technologies for sorting mixed materials, an update on the HolyGrail 2.0 project and articles on rigid PE and PP packaging and new granulators.

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Plastics Recycling World July/August 2024

The Plastics Recycling World July-August edition has features that look at washing technology, progress in WEEE and ELV recycling, and what's new in chemical recycling. Plus previews of exhibitors and speakers at Plastics Recycling World Expo in September.

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Injection World September/October 2024

The September-October edition of Injection World includes a cover feature on advances in injection moulded packaging, plus articles covering developments in TPEs and granulator technology. There is also a preview of Fakuma 2024 in Germany.

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Compounding World October 2024

The October 2024 issue of Compounding World explores the world of graphene and carbon nanotubes, reports on new additives for recycling and looks at developments in alternative compounding technology.

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Pipe and Profile Extrusion Autumn 2024

Pipe and Profile Extrusion's Autumn edition has features that explore applications for pressure pipe, recent developments in recycling and granulation, and new extruder technology. Plus a preview of the Plastics Extrusion World Expo in Cleveland in November.

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Film and Sheet Extrusion October 2024

Film & Sheet Extrusion's October edition has features covering technology for granulation and recycling, developments in extruder systems, biaxially-oriented film market and technology, and mineral additives.

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GLOBAL EXHIBITION GUIDE

2024	15-19 October	Fakuma, Friedrichshafen, Germany	www.fakuma-messe.de
	13-14 November	Plastics Recycling World Expo, Cleveland, Ohio, US	https://na.plasticsrecyclingworldexpo.com
	4-7 December	Plast Eurasia, Istanbul, Turkey	https://plasteurasia.com/en
2025	11-14 March	Plastimagen, Mexico City	www.plastimagen.com.mx
	18-20 March	Plastics & Rubber Vietnam, Ho Chi Minh City, Vietnam	https://plasticsvietnam.com
	24-28 March	Plástico Brasil, São Paulo, Brazil	www.plasticobrasil.com.br
	15-18 April	Chinaplas, Shenzhen, China	www.chinaplasonline.com
	6-9 May	Moulding Expo, Stuttgart, Germany	https://www.messe-stuttgart.de/moulding-expo
	7-8 May	PlastTeknik Nordic, Malmö, Sweden	www.plasttekniknordic.com
	8-10 May	RePlast Eurasia, Istanbul, Turkey	www.replasteurasia.com
	14-15 May	Plastics Recycling World Expo, Mumbai, India	https://plasticsrecyclingexpoindia.com
	27-30 May	GreenPlast, Milan, Italy	www.greenplast.org
	8-15 October	K2025, Dusseldorf, Germany	www.k-online.com
	4-7 December	Plast Eurasia, Istanbul, Turkey	https://plasteurasia.com

AMI CONFERENCES

21-23 October 2024	Executive Summit, Savannah, GA, USA
23-24 October 2024	Plastics Recycling Technology, Vienna, Austria
12 November 2024	Polymers in Flooring, Cleveland, OH, USA
12 November 2024	Profiles, Cleveland, OH, USA
10-11 December 2024	Recycling Flexible Packaging, Vienna, Austria
10-11 December 2024	Multilayer Flexible Packaging, Vienna, Austria
10-12 December 2024	Wind Turbine Blades Europe, Düsseldorf, Germany

For information on all these events and other conferences on film, sheet, pipe and packaging applications, see www.amiplastics.com

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