

# Plastics Recycling WORLD



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# Plastics Recycling WORLD

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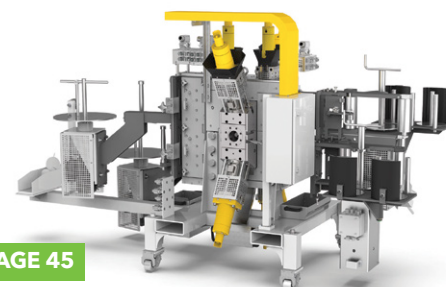
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# EU urged to adopt harmonised mass balance rules this year

The European Chemical Industry Council (Cefic) and 30 other industry associations representing major market sectors along the plastics value chain have issued a joint letter to the European Commission recommending the adoption of an EU-harmonized rule for calculating chemically recycled content through mass balance in 2023.

The letter emphasises that urgent legal certainty on mass balance chain of custody is indispensable in order to unlock investments required to meet the EU's 2050 climate and circularity



targets, and calls upon the European Commission to use the Single Use Plastics Directive (SUPD) Implementing Act as a legal basis.

Annick Meerschman,

Cefic's Innovation Director, said: "We urge the EU to adopt a mass balance chain of custody approach for calculating chemically recycled content in plastics,

which is crucial for achieving the 2030 recycled content targets. Moreover, supporting chemical recycling as a complementary solution to mechanical recycling could attract more investments in this technology and help the EU achieve its targets."

The letter also calls for clarity and coherence of the rules across other pieces of legislation. This would boost the circular economy, strengthen the EU's strategic autonomy in raw materials, and contribute to meeting climate targets, the letter said.

➤ <https://cefic.org>

## Encina in PIR carpet waste deal

Chemical recycling company Encina has announced a new recycling partnership with flooring manufacturer Shaw. Under the agreement, Shaw will provide Encina with more than 900 tonnes/yr of waste materials from its plastic fibre carpet manufacturing processes.

The partnership will reduce Shaw's greenhouse gas emissions and carbon footprint while contributing to its overall sustainability goals, say the partners.

➤ [www.encia.com](http://www.encia.com)

➤ [www.shawinc.com](http://www.shawinc.com)

## French solution for flexible film waste

TotalEnergies and recycling group Paprec have signed a long-term agreement to develop a value chain for chemical recycling of plastic film in France.

Under the agreement, Citeo, the main organisation in charge of end-of-life

household packaging in France, will provide a stream of flexible PCR plastic waste to Paprec's plant at Amiens, where a sorting and preparation line will be built.

TotalEnergies will use Paprec's output in its chemical recycling plant at

Grandpuits, which is currently under construction.

The Grandpuit chemical recycling plant is designed to process 13,600 tonnes/yr of waste plastic and is scheduled to begin operation in 2024.

➤ <https://totalenergies.com>

## New EIB study spots investment gap

The European Investment Bank (EIB) has published a new study, called *Cutting plastics pollution - Financial measures for a more circular value chain*. This analyses the inefficiencies of the plastics value chain, highlighting ten root causes of plastic waste pollution and identifying investment opportunities and policy

measures that could help address the issues.

The EU has set ambitious targets under the European Strategy for Plastics, but the report states an estimated investment gap of €6.7-8.6bn must be closed if the goal of placing 10m tonnes/yr of plastic recyclates in final products on the EU market by 2025 is to be achieved.

Policy recommendations include introducing legislative measures to tackle difficult-to-recycle plastics packaging, restrictions on composite packaging, and imposing quotas on recycling while boosting public awareness campaigns.

It also recommends loans to companies and others.

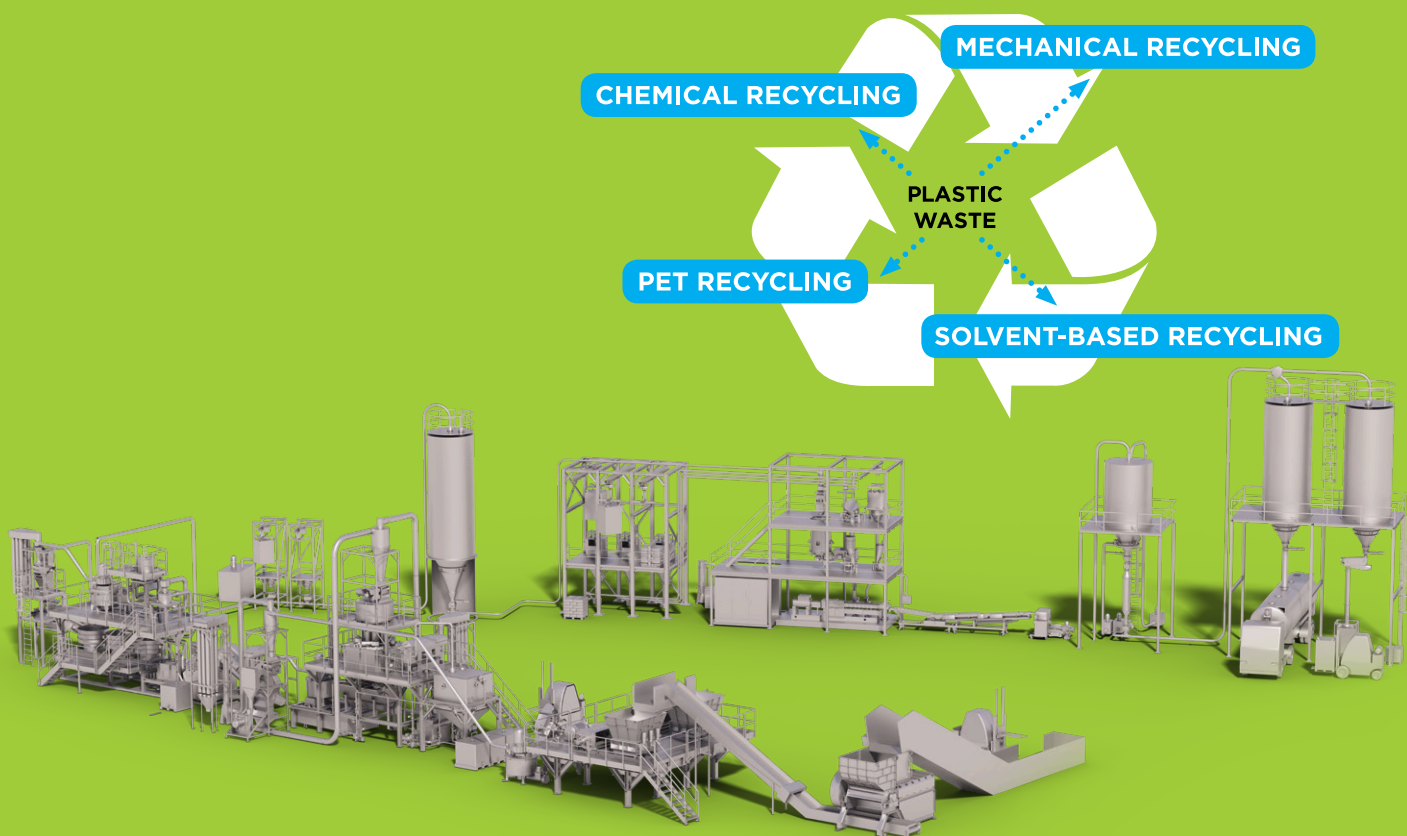
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# First PET bottle-to-bottle recycling line in Kenya

T3, a member of Megh Group, is to install the first PET recycling system for bottle-grade rPET and resin in Kenya and Eastern Africa, a Starlinger RecoStar PET 165 HC iV+ recycling line, in Athi River just outside Nairobi.

Thorough processing on the FDA and EFSA-approved system ensures that the produced rPET resin will be of highest quality and able to meet the standards of global brand owners such as Coca-Cola. It will also be used for polyester fibre production in the textile and garment industries.

The market for recycled PET in Kenya is growing, but still faces challenges around lack of input material and



**Above: PET bottle sorting at T3's facility near Nairobi**

infrastructure, low levels of investment, and limited access to market information.

"Our social mission is to ensure that no one is left behind as we develop the idea of a circular economy in Kenya," said Ikreet Kenth, CTO of T3. "Uplifting the informal sector through the

impactful methods that we use to collect the plastic waste enhances livelihoods by converting waste into a tradeable commodity, forming new trading networks and businesses, and generating employment."

> <http://themeghgroup.com>  
> [www.starlinger.com](http://www.starlinger.com)

## Recoup report on plastic toys

Plastics resource efficiency and recycling charity Recoup has completed research into the recycling of hard plastic toys in the UK and highlights some of the key issues in a new report.

The report, *Researching the Recyclability of Plastic Toys*, demonstrates the

challenges of recycling toys. Recoup investigated the current infrastructure available within the UK for collecting and recycling such items and analysed a selection of samples to determine their recyclability.

The analysis involved breaking down the compo-

nents of each toy to determine the materials used and assessing the key challenges of their recyclability. The report concluded that many toys contain electronic parts, including batteries, which makes them unsuitable for mechanical recycling.

> [www.recoup.org](http://www.recoup.org)

## PureCycle moves ahead in two projects

After signing a MOU in September 2021, PureCycle and investment company Mitsui have signed a Heads of Agreement (HOA) to develop and operate a 59,000 tonnes/yr PP recycling plant in Japan.

PureCycle CEO Dustin Olson said:

"This HOA is a major step forward in the process of bringing a true circular solution to Japan for PP plastic waste. The final options for site locations are located between major population and industrial centres, so we can optimise supply chain activities for both feed

and product."

Elsewhere, PureCycle and sustainability strategist iSustain have made an agreement to source and divert up to 10m lb of PP waste from landfills.

> [www.purecycle.com](http://www.purecycle.com)  
> <https://isustainrecycling.com>

## SK buys assets in China

SK Chemicals has signed an asset transfer agreement relating to the chemically recycled BHET and PET business division of Shuye, a Chinese company specialising in green materials, amounting to \$98.4m.

Through the acquisition, SK Chemicals has obtained a commercial production system for chemically recycled BHET and products that utilise depolymerisation technology one-to-two years ahead of other domestic companies. By using raw materials such as waste PET in China, where there is abundant supply, SK Chemicals is expecting to gain a high level of price competitiveness.

SK Chemicals' strategy is to supply chemically recycled PET to the domestic and foreign packaging markets.

In addition, the company plans to enter high-value-added markets, such as industrial specialty fibres, and sell recycled BHET to polyester manufacturers.

> <https://eng.sk.com>



# VacuFil

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- ✓ Patent pending

## Reconomy acquires in Denmark

Circular economy business Reconomy Group has acquired green tech development company Combineering. Based in Birkerød, Denmark, Combineering has been developing specialised recycling solutions for four decades.

Its large scale, scientific and proprietary circular methods have been standardised and implemented across various industry sectors, providing full legal compliance. The company's strong presence across industries including agriculture, energy, biogas, manufacturing and construction will complement Reconomy Group's existing recycling capabilities, whilst adding further expertise built on long-term customer relationships in several countries.

Combineering will continue to operate as a distinct brand within Reconomy Group.

➤ [www.reconomygroup.com](http://www.reconomygroup.com)  
➤ <https://combineering.dk>

# New packaging recycling facility set for Vietnam

European waste management and recycling group Alba and Vietnamese waste collection and plastic recycling company VietCycle are to jointly develop what they say will be the largest food-grade PET/HDPE recycling plant in Vietnam.

The planned facility will have an estimated investment of up to \$50m and capacity of up to 48,000 tonnes/yr. The first phase is set to start in 2024/25.

Approximately 3m tonnes of plastic waste are discharged on land in Vietnam and up to 730,000 tonnes released into the ocean each year. Local governments struggle to collect, transport, treat, and dispose of their growing waste streams, and the situation is



**Above: Executives from Alba and VietCycle agree deal for food-grade PET/HDPE recycling plant**

expected to worsen with rapid urbanisation coupled with increasing economic and population growth.

Axel Schweitzer, Chairman of Alba Group Asia, said: "With our holistic approach and use of digitisation, we want to help sustainably improve the living and working condi-

tions of collectors. With this project and the collaboration with our partners from VietCycle we make a huge step in this direction. The project will be part of a much-needed solution to Vietnam's growing plastic waste problem."

➤ [www.alba.com](http://www.alba.com)

➤ <https://vietcycle.vn>

## Teknor Apex buys US PVC recycler

Teknor Apex announced it acquired the business of PVC recycler and custom compounder Nu-Pro Polymers, in Wheeling, US, late last year.

Nu-Pro works with clean post-industrial streams and converts them into new PVC compounds which it says perform equivalently to prime compounds. The

company specialises in clear, natural and black reprocessed compounds in a range of durometers and supplies various markets.

➤ [www.teknorapex.com](http://www.teknorapex.com)

## Partners plan more PO recycling in Belgium

Belgian waste management service Fost Plus has signed a contract with Morssinkhof Plastics, part of the Morssinkhof Rymoplast Group, for the construction of a new recycling plant in Lommel.

The plant, the fifth such facility in Belgium, which will be operational in October 2024, will create 65 jobs and recycle around 40,000 tonnes/yr of PP

and PE packaging.

Wim Geens, MD of Fost Plus, said: "Thanks to the efforts of our fellow citizens, who ensure that all packaging ends up in blue bags, we are among the best in Europe when it comes to recycling. This new plant is the last step in the creation of a local circular economy that makes Belgium a recycling hub at the heart of Europe."

The €30m plant is being built in the Kristalpark III industrial zone, the location offering added strategic value. In addition, the presence of the largest solar park in the Benelux, with more than 300,000 solar panels, provides potential for a sustainable operation, using solar energy.

➤ [www.fostplus.be](http://www.fostplus.be)

➤ <https://morssinkhofplastics.nl>



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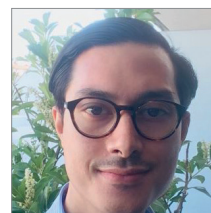
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# Study sets out shift to circular plastics system in Norway

A new study by Systemiq has set out a roadmap to accelerate the transition to a circular plastics system in Norway by 2040.

The *Achieving Circularity* study outlines the current consumption of plastic in seven major sectors; packaging, household goods, construction, textiles, electronics and electricals, automotive, and fishing and aquaculture, which combined cover 80% of plastic consumption in Norway.

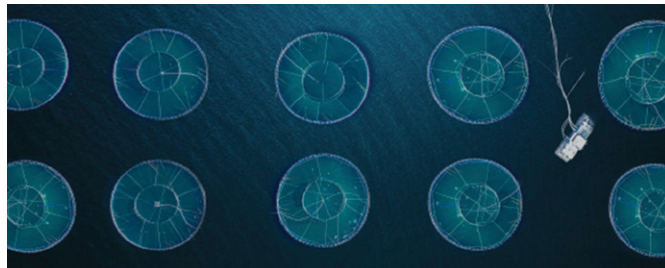
The report found only 22% of plastic across the seven sectors is reused or recycled and 70% of plastic is incinerated, which represents 7% of Norway's GHG emissions. The adoption of measures in the plastics value chain can increase circularity to 70% by 2040. It also states that the cost is not prohibitive, requiring an annual additional investment of NOK 570m for 20 years, and the transformation could create 1,300 additional jobs compared to 2020.

Yoni Shiran, Partner and Plastics Lead at Systemiq, said: "This study offers evidence-based recommendations on priority areas for a highly developed country's plastic system. This transition requires an ambitious combination of both upstream and downstream solutions, and will require leadership and collaboration across industry, public sector, investors, and civil society."

However, the study also

says that achieving this transition will require ambitious policies, innovation, capital investment, cross-value-chain collaboration, consumer engagement and labour force reskilling.

➤ [www.systemiq.earth](http://www.systemiq.earth)



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*The potential for growth in PET fibre-to-fibre recycling has caught the eye of technology companies keen to highlight the suitability of their systems for fibre applications. David Eldridge reports on developments from the K2022 exhibition*

# PET machinery groups explore fibre recycling

Polyester fibre manufacturers use huge volumes of PET in the yarn products they supply to the textiles industry. Yet the waste arising from fibre spinning has not been seen as suitable for recycling into new fibre products. That situation is starting to change, though, as the move to circularity in the clothes market is placing a new emphasis on reusing waste generated in the value chain. Spotting an emerging trend, PET recycling machinery groups are demonstrating that high quality fibre-to-fibre recycling can be achieved with their solutions for decontamination and intrinsic viscosity (IV) control, as recent developments at BBE, Erema, Gneuss and Starlinger show.

During K2022, **BB Engineering** showed the know-how it is able to bring from the fibre-producing sector to the growing plastics recycling industry. The VacuFil system it exhibited is a PET recycling line which can process post-production and post-consumer material in configurations that include fibre-to-fibre and bottle-to-pellet. The company also

showed its VarioFil R+ system, a variant of its VarioFil fibre spinning lines which can process rPET directly to partially oriented polyester yarn (POY).

BB Engineering is not new to the plastics industry. It is a joint venture between film extrusion line producer Brückner Maschinenbau and fibre spinning line producer Oerlikon Barmag. Speaking to *Plastics Recycling World* at K2022, executives said BB Engineering had been formed to manufacture extruders and from there it went on to develop melt filters and recycling lines, which can process a variety of input materials including bottle flakes, films, start-up lumps and textile waste as well as fibre waste.

Klaus Schäfer, Managing Director, says the exhibits at K2022 show how fibre waste can be used in an integrated system where the recycling line delivers melt direct to the spinning line. At the same time as K2022, a BBE and Oerlikon Barmag open house event at its facility in Remscheid demonstrated VacuFil Visco+ recycling technology in operation

**Main image:**  
**Polyester fibres: a potential source of waste feedstock as well as an end-market for PET recyclers**



IMAGE: BB ENGINEERING



**Above: BB Engineering's VacuFil PET recycling system can process post-production and post-consumer material**

with a connected VarioFil spinning plant.

Schäfer emphasises the advantage of BB Engineering's know-how in fibre production in the development of recycling technology. He says the company places a priority on its application know-how, the filament being produced from recycled PET. "We know very well what high-quality filament needs," he says. While competitors make granule- or flake-to-fibre systems, BB Engineering's fibre-to-fibre systems are designed to exploit the growth potential of post-production recycling by POY manufacturers using in-house lines.

Until recently, yarn producers have avoided using recycled process waste for two reasons, says Schäfer. The virgin material's IV reduces from 0.65 dl/g to about 0.6 dl/g during extrusion and spinning, making the scrap material unsuited to going through the processes again without an IV lift. The second deterrent to reusing production

waste is contamination from spin oil and dust coming from the processing conditions. So there are two important requirements in fibre-to-fibre recycling technology, melt homogeneity and decontamination, both of which BB Engineering has addressed.

The VacuFil technology combines gentle large-scale filtration and targeted IV regulation to maintain consistency in high quality rPET melt. The technology was launched in 2019 but was developed further to integrate it with the company's VarioFil spinning plant. A key component in the PET recycling system is the patented Visco+ vacuum filter which removes volatile impurities quickly and reliably, says the company. Visco+ is now also available as a separate upgrade component for existing systems.

"As a melt filter, the Visco+ operates like a liquid-state polycondensation [LSP] unit," says BB Engineering. "A maintenance-intensive reactor or a deposit-prone stirring unit are not required. Moisture is removed from the PET in the filter, which – in conjunction with an adjustable residence time – results in the desired IV increase in the vacuum. This enables a controlled IV build-up of up to 30%."

The IV is continually monitored via an integrated viscosity measurement unit and is adjusted when there are fluctuations. The company says Visco+ "provides an enormous material surface compared to the volume and continuously renews this. To this end, contamination can be removed particularly effectively from the starting material by means of automatically-regulated high-performance vacuum (1-30 mbar)". (Read more on Visco+ in the feature on Melt Filtration starting on [page 45](#).)

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Discussing the VacuFil Visco+ line demonstrated in Remscheid, Matthias Schmitz, Head of Engineering Recycling Technology, says the very short residence time of the melt in the Visco+ unit, compared with LSP, means much better colour control can be achieved. Then, before transfer to the VarioFil plant, the melt is submitted to fine filtration down to 15 microns using a candle type filter, which he says is part of the normal process in spinning.

**Erema Group** is known for the breadth of its plastics recycling technology, processing a wide range of source materials such as PET bottle flakes and PE film. But at K2022, it announced it has branched out into a new area by setting up a business unit dedicated to recycling fibres and textiles. The Austrian group says the initial focus of the unit will be on PET and its aim is to develop fibre-to-fibre recycling solutions. It points out that while packaging applications account for only one-third of the PET material stream, about two-thirds of the total volume of PET is used in fibre applications.

"While growth rates in the production of fibres and textiles are high, the circular economy has hardly become established in this segment," says the company.

Erema opened its own fibre test centre last year, where a cross-company team is working on recycling solutions for fibre-to-fibre applications. The centre also operates a fully equipped and variable industrial-scale recycling plant. It includes the peripheral technology required for fibre materials and is available for trials using customers' material streams, it says.

In the fibre test centre, fibre waste from filament

fibre production was recycled into high-quality pellets. Using filament technology, a 3 dtex fibre was spun, which was processed into knitted fabric for use in clothing or technical textiles.

"With Erema's Vacurema and Intarema technology and Pure Loop's Evo technology, our company group already has an extensive range of machines for fibre and PET recycling applications. For ecologically and economically sound recycling, however, new technological solutions are needed to use the recycled fibres in higher-value end applications and to achieve a functioning circular economy," says Wolfgang Hermann, Business Development Manager Application Fibres & Textiles.

In its development work, Erema's technologies have been combined with a new IV optimiser. Hermann says: "This extends the residence time of the PET melt, which is particularly necessary in fibre recycling to efficiently remove spinning oils. Our recycling process also increases the IV value of the PET melt after extrusion back to the specific level that is essential for production of the fibre."

The quality of the rPET produced using this method is so high, according to the company, that it can be used to manufacture ultra-fine fibres up to 2 dtex with an rPET content of 100%. Post-production PET fibre can be further processed into rPET filament fibre, carpet yarn and staple fibre. Erema is also planning to turn to post-consumer recycling with the later development of technologies for recycling mixed fibre textiles from textile collection sources.

Like BB Engineering, recycling and compounding technology company **Gneuss** held an open house event during part of K2022 to show the capability of its recycling systems to process PET

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**Right: Erema has started work in a new fibre test centre where post-production PET fibre has been recycled into high-quality pellets and then spun for production of knitted fabric**

fibre waste. Over two days, more than 150 guests visited the Gneuss Technical Centre in Bad Oeynhausen, Germany, where its Omniboost Recycling System was shown processing post-production PET fibre waste.

The material had a residual moisture level of 6% and an IV of 0.64 dl/g. In the demonstration, the fibre waste was fed into the Omniboost system with a throughput rate of 150 kg/h and the viscosity was increased using the Gneuss liquid melt phase IV booster technology.

"The visitors were impressed by the speed of the IV boost: with a residence time within minutes, the IV was increased to 0.66. For an IV boost to 0.84 a residence time less than half an hour was required," says Gneuss.

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

The MRS Extruder has a section of extruder screw with a number of satellite screws, which rotate in the opposite direction to the main screw. This creates "a huge surface area" and ensures a rapid surface area exchange rate, says Gneuss. The high degassing performance and minimal stress on the material means the system can decontaminate post-consumer PET to food contact requirements.

In the demonstration, the polymer melt exits the extruder and is filtered with the Gneuss RSFgenius Melt Filtration System, which achieves fine filtration without pressure or flow disturbances and with minimised polymer loss. The melt then flows into the Gneuss Jump liquid phase IV booster reactor. The viscosity of the melt is measured both on the inlet and outlet of the reactor. The viscosity is boosted to the required level by regulating the vacuum level, residence time and surface area exchange rate in the reactor vessel.

With consistent viscosity, the material can be fed while still in the melt phase to the production process, such as fibre spinning and strapping tape, says Gneuss.

**Starlinger Recycling Technology** is another PET recycling machinery group that has made inroads into the growing market for fibre waste recycling. Three types of RecoStar lines are offered to recycle fibre, textile or non-woven scrap: RecoStar Dynamic is suited to hygroscopic and humid material due to cutting and preheating in the Smart feeder; RecoStar Universal allows processing of fibres,



IMAGE: EREMA

filaments and non-wovens in the Active shredder without pre-cutting; RecoStar PET processes pre-ground material, allowing the use of PET post-consumer bottle flakes as an alternative, cost-effective input material for fibre producers.

Starlinger reported in 2021 that a RecoStar Universal 165 H-VAC iV+ had been installed by Turkish yarn producer Korteks at its new polymer recycling facility in Bursa. With an initial production capacity of 7,200 tpa, the system was installed to recycle clean in-house polyester fibres from production scrap together with washed post-consumer PET flakes at a ratio of 50/50.

A feature of the Korteks system was a Rapid Sleeve Changer (RSC) candle filter developed by Starlinger to allow finest melt filtration down to 15 µm with an output of 1,000 kg/h. The RSC filter was specially designed for polyester fibre recycling. The line was also fitted with a ViscoStar SSP unit for IV increase to make sure that the produced regrenulate was suitable for filament yarn production.

Bottle-to-fibre recycling is another capability of Starlinger's PET recycling lines. In October last year, the company said Ganesha Ecopet had opened a facility in Warangal, India where a RecoStar PET 165 H-VAC system fitted with an RSC melt filter processes washed PET bottle flakes for Go Rewise brand polyester filament yarn applications and reaches an output of approximately 14,000 tpa.

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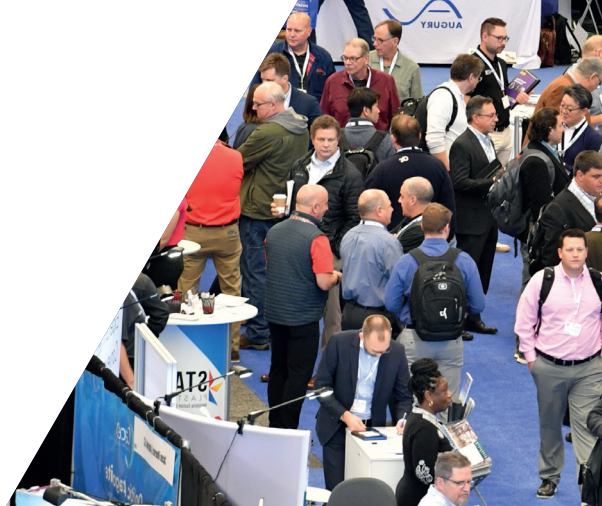
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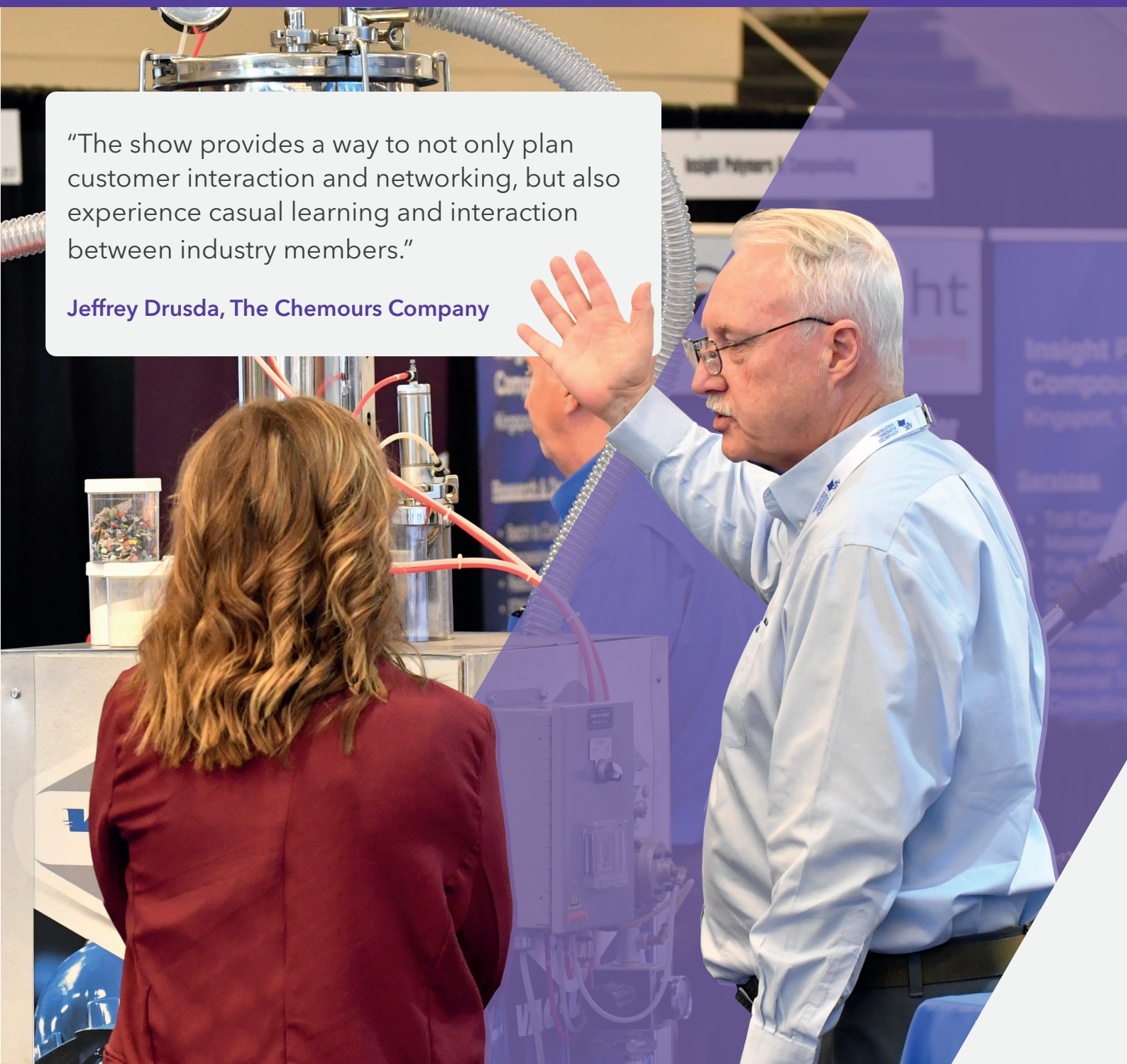
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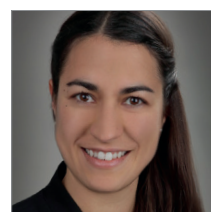
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# Wider choice of additives encourages upcycling

*The development of new additives and masterbatches for improving the quality and stability of recycled plastics provides many new opportunities for upcycling, writes Mark Holmes*

Recyclers and manufacturers of recycled plastics are benefitting from the expansion and improvements in additive and masterbatch technology to enhance their products. For example, significant improvements in stabilisation, rheology, malodour, physical and mechanical properties and compatibilisation are now possible through the development and deployment of new additives and masterbatches.

**Baerlocher** reports a vibrant environment in the current market for additives for recycling plastics. "The market is demanding higher post-consumer recycled (PCR) content," says Henrik Eriksson, Technical Product Manager. "Innovative recyclers are investing in improving their product through washing, sorting, filtration processes and odour removal. However, they are now also using additives to meet application needs, driven by brands and regulations."

He says: "Packaging has the highest sense of

urgency because the daily interaction with consumers impacts the consumer-packaged goods brands. However, durable goods such as automotive and appliances are also working towards increasing PCR content. In the US, states are passing legislation requiring minimum recycling content and extended producer responsibility (EPR). In the EU and UK, new legislation and tax penalties are also increasing the speed to increase PCR content."

Eriksson adds that with feedstocks having different compositions and levels of contamination, stabilisation is required to make PCR more suitable for use. However, polyolefins in PCR feedstock are not stabilised to the extent of maintaining a maximum part of their original properties because of the two additional heat histories that come with recycling. In addition, contamination, melt filtration operations and high throughput requirements take a significant toll on the final properties. These

**Main image:**  
**Völpker has developed products that are providing field-tested and ready-to-use solutions in plastics recycling**

quality deficiencies are then often mistaken for compatibility issues, when there is simply a fundamental lack of process stabilisation.

When PCR content is increased from 10-15% to 30-50%, processing and final quality typically becomes an issue. "Nobody wants to increase the weight of the part or the thickness of the film to increase PCR content, which goes against sustainability and the productivity gains made by the plastics industry," says Eriksson. "A specific case where we have seen that our additives are useful include maintaining thickness and performance of stretch film with increased PCR content. Another case concerns extrusion blow-moulded rHDPE bottles, where our additive can avoid structural compensations when the PCR content is increased."

The current short term technical requirement is to help brands increase PCR content in rigid and flexible packaging, adds Eriksson. One way of doing this is to increase the amount of high-performance PCR available. Existing quantities of such materials are highly sought and are in little need of further improvement, even if the potential to improve them further is there. Instead, more value is created if poorer performing materials can be

lifted to a level where they can be introduced into demanding applications currently in place.

Baerlocher says that it engages with the entire value chain, working with technology companies and polymer producers to develop more recycle friendly resins that are designed to accept higher PCR content. The company also gets involved with recyclers, helping with additives and optimising processing conditions to preserve the polymer during the melt filtration process. Additionally, it works with converters solving processing and quality problems while increasing PCR content.

To do this Baerlocher has invested in application development to improve understanding of using resin stabilisation in extrusion blow moulding. This has involved running production trials with key global equipment companies, such as Erema, Bekum and W Muller, as well as ExxonMobil Chemical, to develop new sustainable plastics for the packaging industry, while also working with recyclers PreZero and Envision Plastics.

Baerlocher has developed Baeropol T-Blends, formulated with its Resin Stabilisation Technology (RST), which is a range of customisable additive blends. These act as an antacid and produce a



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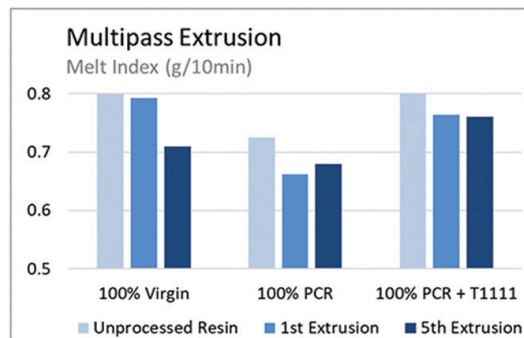
synergistic effect with primary and secondary antioxidants to stabilise polyolefin resins. Baerlocher says that the RST packages create value beyond the use of typical binary antioxidant blends. The technology enables superior stabilisation of PCR used for a wide variety of packaging applications. Collaborating with HDPE plastics recycler Envision Plastics enabled the development of a new grade of PCR HDPE with improved consistency and processability, and ultimately resulted in high quality packaging applications. The new rHDPE grade was tested at Bekum America's facility using an F-style 10-litre bottle with a handle. Results revealed the tested rHDPE 100% PCR content displayed more robust processability and enhanced final bottle specifications versus the control.

Baerlocher is also enhancing PCR and post-industrial (PIR) resin for film through collaboration with members of the Association of Plastic Recyclers (APR), such as US recycler Revolution. Baeropol T-Blends have been used during the development phase of new higher performing PCR resins for film applications. Additionally, Baerlocher is leading projects with other companies involving the use of stabiliser technology to enable higher-volume, more-consistent and better-quality PIR and PCR resin supply versus conventional antioxidants. One of these projects, with a major UK post-consumer plastics packaging recycler and flexible packaging solutions provider, has resulted in new commercial product development that has led to the company exceeding the UK's new law in which packaging not containing 30% PCR receives a penalty.

According to **BYK**, ecological and economic interests, regulatory demands from politicians, and public opinion are creating an increased interest across all industries to recycle plastics and to increase sustainability in all areas. "However, recycling for high-value applications is often not possible or only possible to a limited extent," says Jörg Garlinsky, Head of Global End Use Thermoplastics - Industrial Applications. "Contaminants,

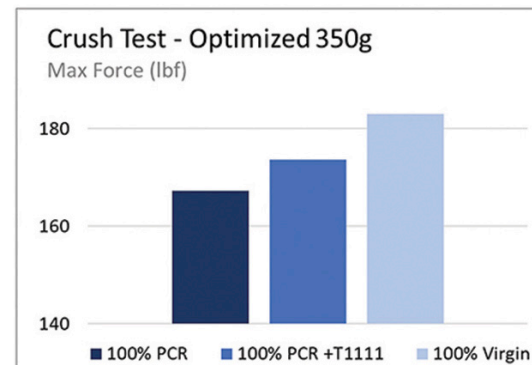
**Figure 1:**  
**Baeropol T-1111 stabilizes the melt index of PCR to improve processability**

Source:  
Baerlocher:



**Figure 2:**  
**Crush test for PCR bottle with Baeropol T-1111 outperformed the PCR control**

Source:  
Baerlocher:

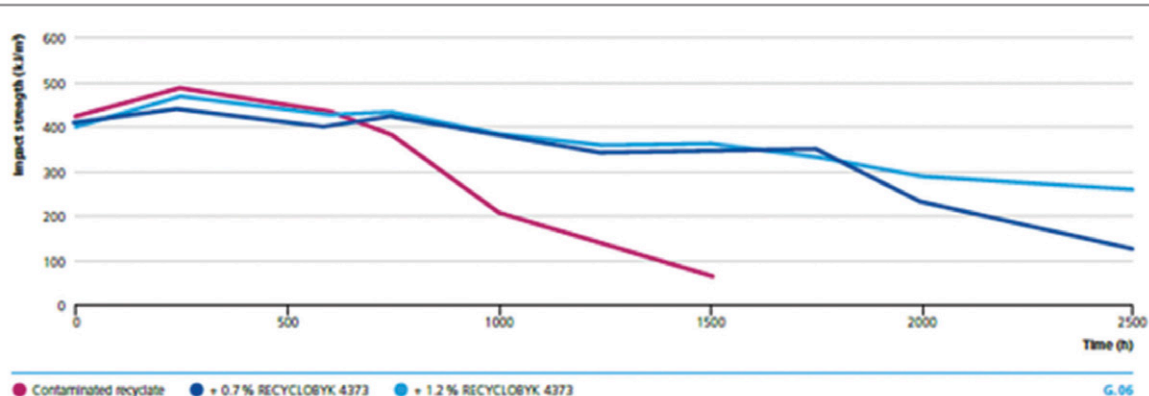


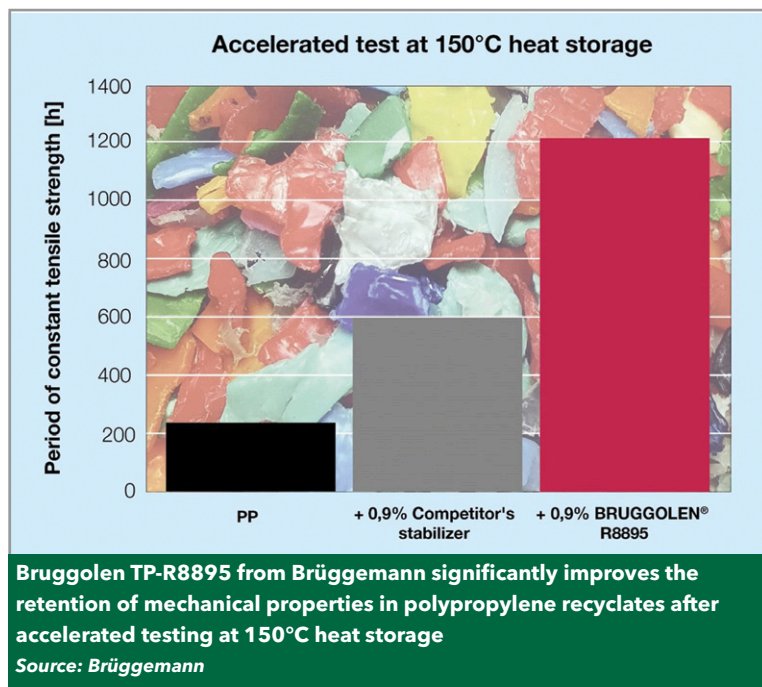
fillers used in previous applications, expended stabilisers, odours and lack of performance limit the areas of use to the lowest price range for applications with inferior quality. BYK's product range Recyclobyk has been specifically developed to restabilise plastics during reprocessing and for their subsequent new applications, improving the mechanical properties."

BYK adds that its products can neutralise the negative effect of impurities and increase impact strength. Just 0.2% paint residue in recyclate causes a significant drop in impact strength during ageing. After around 1,500 hours, an impact strength of approximately 15% of the original value can be measured. Recyclobyk 4373 compatibilises the paint impurities and restabilises the material so that after 1,500 hours, 90% of the

**Impact strength of recyclate contaminated with paint (ageing at 135°C)**

Source: BYK





original impact strength is still present.

**Brüggemann** has introduced three new additives for improved stabilisation of polyolefin recyclates. The company says that these additives result in recyclates with good mechanical and processing properties, making the need for the addition of virgin material unnecessary. All Bruggolen R grades are supplied as dust-free additive blends in compacted granule form for easy and homogeneous distribution.

Two of the stabilisers are for polypropylene recycling. Bruggolen TP-R2090 can be used to recycle PCR and PIR waste, whereas Bruggolen TP-R8895, through its increased acid scavenger content, is especially suitable for recycling PP from battery cases. Both additives result in recyclates of a quality that cannot be achieved via conventional re-stabilisation.

For polyethylene recycling, Brüggemann has developed Bruggolen TP-R2162, which also contains new repair technology and is particularly suitable for LLDPE recyclates used in film extrusion. The repair mechanism results in film with increased initial mechanical strength and a significantly reduced number of defects. Laboratory tests, for example, show an increase of around 25% in tensile strength and 10% in elongation at break, even at minimal dosage levels of 0.3%.

These properties of the polyolefin recyclates are made possible by a specially developed technology. For the first time, it is possible to repair defects to the molecular chains that occur during processing and subsequent use and which impair quality. The recyclate is not only protected from further

damage by re-stabilisation, but, by repairing the polymer chains, the resultant mechanical strength more closely matches that of virgin polymer.

**Adeka** has developed the ADK Cycloaid UPR series of additive solutions to boost the performance of recycled plastics. "In recent years, various governments have announced regulations and set targets to reduce the environmental impact of plastics," says Marie-Raphaël Morvillier, Technical Director. "These targets and regulations, such as those related to single use plastics in particular, are intended to increase the recycling of plastics. In parallel, brand owners and OEMs have committed to integrate more recycled resins into their products."

She says: "Mechanical recycling has emerged as a prominent method of recycling plastics, where material from industrial and post-consumer sources are recovered via mechanical processes to provide PIR and PCR recyclates. Utilising PCR is more challenging than PIR because PCR has been contaminated or degraded during its previous life. Consequently, PCR has several challenges such as odour, migration, low mechanical properties, low thermal stability and discolouration, which are less of a problem with PIR."

The company says that the ADK Cycloaid UPR series is designed for mechanically recycled plastics with the prospect of broadening their applications. Two types of additive packages are offered to provide different benefits.

ADK Cycloaid UPR-001 is an additive package for improving long term thermal stability (LTTS) of recycled plastics and preventing thermal degradation during processing. Tests show that UPR-001 improves the LTTS of a PP compound containing 70% PCR dramatically, taking it to the same level of performance as a PP compound with 30% PCR without UPR-001. This means that UPR-001 enables the ratio of recycled plastics to be increased while maintaining performance not possible without it. As well as replacing virgin plastics with recycled ones, UPR-001 can also be used for upcycling PCR plastics by improving the LTTS to meet the requirements of the final application.

ADK Cycloaid UPR-011 is an additive package that provides an improvement of mechanical properties, as well as thermal stability, to recycled plastics. Tests show that UPR-011 can improve properties such as the tensile modulus of several recycled compounds containing different ratios of PCR-PP. UPR-011 shows continuous performance improvement for all recycled compounds with increasing ratios of PCR-PP. Compared with standard additives, this also demonstrates that the



performance of UPR-011 does not deteriorate through increased contamination from higher levels of PCR-PP. Therefore, UPR-011 can contribute to both upcycling of recyclates and further replacement of virgin plastics, says the company.

Under European Union regulations and plastics tax implementations, demand from the end market for high quality recyclates has increased and performance demands are increasing, according to **SI Group**. "The awareness of plastic recyclers and compounders is increasing that additives can play a role in improving the performance of final products and blends," says Irfaan Foster, Market Development Director. "The combination of legislative push and brand owner/consumer pull is driving an increase in recycling content across all applications, requiring a switch from downcycling to closed loop recycling and/or upcycling."

He says: "Demand for increased recycled content in more challenging applications also requires the prevention of polymer degradation throughout the whole value chain to maintain properties and performance through stabilisation. In addition, increased collection of plastics puts pressure on feedstock quality for recyclers through more cross-contamination and variation, meaning that compatibilisation is important to enable upcycling. UV protection also needs to be addressed with disposable and single use packaging plastics being widely collected and turned into recycled content for more durable applications. For example, an automotive component with higher performance demands needs additives for long term heat and light protection."

SI Group says that its Evercycle product range is

specifically designed for mechanical recycling to produce higher performing products that enable the converter and end market to increase circularity, by preventing downcycling and enabling an increase of recycled content. Evercycle LD-101S and PP-101S are non-dust blends to improve melt stability in both flexible and rigid stream recycling, while Evercycle LD-104P is a masterbatch solution to improve gel control and increase mechanical performance in transparent film, both for recycler and converter. In addition, Evercycle PET-102D and PET-103D are tailored additive solutions to prevent quality losses in PET bottle-to-bottle recycling, closing the loop and preventing downcycling into other applications.

Based on its experience in the development of montan wax-based additives for engineering plastics, **Völpker Spezialprodukte** says that it has developed products that are providing field-tested and ready-to-use solutions in plastics recycling. "Völpker manufactures the Cevo products on a recently completed compacting plant," says Dr. Lutz Matthies, Head of Business Development. "Compacted pellets are suitable for the manufacturing of dryblends used by injection moulders, for example. Heat-bonded, dust-reduced powders from this plant can be handled and dosed easily and are appropriate for occupational safety. The fact that the ingredients of the individual Cevo formulations do not have to be melted also makes the new plant more energy-efficient and increases our production capacity to 500 kg/h."

He says: "Requirements for recycling additives and processes are particularly high. The polymers are thermally pre-stressed and partially degraded

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and therefore usually have poorer mechanical characteristics. There is often contamination with non-compatible foreign polymers, which must be handled. Therefore, the aim is to improve the properties of regenerates and compounds based on recycled plastics and adjust their quality in such a way that higher-quality end products can be manufactured. Our montan wax-based Cevo formulations combine the mechanisms of dispersion, stabilisation, compatibilisation and chemical intervention in the chemical structure of the polymer, depending on the application."

Cevo-process A-3110 is a one pack especially developed for thermally pre-stressed polyamide. In PA recycling, the repeated thermal stress on the polymer leads to chain degradation, which is reflected in a reduction in viscosity. This is accompanied by a loss of mechanical properties, particularly toughness. The formulation contains heat stabilisers which – in synergy with other ingredients – also promote a partial re-polymerisation of decomposed polymer chains. Further degradation of the polymer during the extrusion process is suppressed by the reduction of friction peaks, and the flow characteristics are enhanced. The one pack improves the homogeneity of filler distribution and leads to an increased surface quality. For example, it can be used in agglomerated material based on milled PA fibre waste. Applications include automotive engine covers – glass fibre/mineral filled at a dosage of 0.5-0.8%.

Cevo-master D-2050 is a reactive modifier to

improve the flowability of polycarbonates. The company says that it produces fast-flowing regenerates and compounds based on PC regrinds of higher viscous extrusion qualities. The use of this additive allows the production of easy-flowing PC re-compounds for injection moulding that have properties similar to those of virgin material, such as Lexan 121R.

Further investigations have shown that Cevo-master D-2050 is also well suited for converting high-viscosity PA6 (cast polyamide) into a low-viscosity grade during the compounding process.

Cevo-master B-6000 is a masterbatch that promotes the processability and quality of a wide range of recycled polyolefins. In PCR and PIR materials, the additive reduces the processing problems caused by impurities of foreign polymers due to its compatibilising effect. The flow behaviour of the compounds/regenerates can also be increased in a targeted manner. In parallel, the use of Cevo-master B-6000 leads to a more stable process and basic stabilisation of the compound. The distribution of further additives, for example dyes, is also supported. Cevo-master B-6000 is also suitable as a toughness improver.

In addition, in PET recycling Cevo-process J-3400 and Waradur OPplus can reduce friction peaks during the extrusion process and help improve surface qualities and disperse fillers like talc, particularly when high filler loads apply.

**Ampacet** has introduced ThermProtect, which utilises multi-functional stabiliser technology to address the market need for powerful antioxidant masterbatches designed to be used in PCR-rich formulations. The company says that ThermProtect can improve aesthetics, processability and functionality while minimising the adverse effects of contaminants in PCR. ThermProtect joins Ampacet's R<sup>3</sup> Sustainable Solutions products, a range of masterbatches designed to support circular economy initiatives.

Developed to meet the challenges of materials with higher PCR content, ThermProtect stabilises polymers subjected to multiple heat histories and contaminants. Contaminants in PCR, such as inks, slips, fillers, catalyst residue and other contaminants, degrade both aesthetics and functionality. This degradation manifests itself through viscosity changes, black specks, gels, discolouration, plate out, off-odours and reduction of mechanical properties/embrittlement.

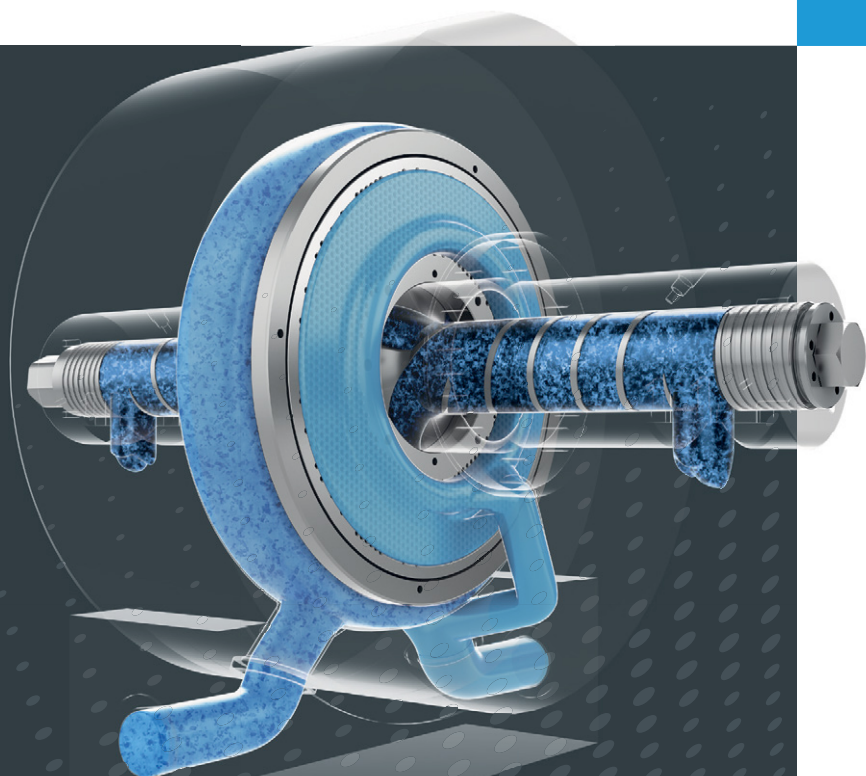
While traditional phenolic and phosphite antioxidants provide thermal stability at moderate temperatures, Ampacet's technology features high performance antioxidants that provide thermal

**Right: Völpker manufactures Cevo products on a recently completed compacting plant**



IMAGE: VÖLPKER





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stability at high temperatures and reduce gel formation in recycled PP and PE. ThermProtect also uses speciality radical scavengers, which react with alkyl radicals to immediately stop oxidation, and acid scavengers, which react with acids to eliminate the degrading effects of inks and other contaminants in PIR and PCR. As a result, it is possible to increase recycled content for rigid and film applications, achieve long-term stability of recycled content, extend the life of polymers and achieve sustainability goals.

The new antioxidants in the range include ThermProtect 1001145-N, which contains high performance phenolic, phosphite antioxidants plus alkyl radical and acid scavengers for recycled polyolefins and is used primarily for non-FDA film applications. ThermProtect 1001265-N meets FDA requirements and contains high performance phenolic and phosphite antioxidants, and acid scavengers.

ThermProtect antioxidants are designed for PE and PP applications, including blow-moulded packaging and products, industrial products, such as garbage bags and can liners, shrink films and carrier bags and building and construction prod-



**Left: ThermProtect from Ampacet can improve aesthetics, processability and functionality while minimising the adverse effects of contaminants in PCR**

ucts, such as composite lumber, crates and buckets.

The antioxidants join two ThermProtect PET additives recently introduced to the European market. ThermProtect 7000121-E contains high performance phenolic and phosphite antioxidants to reduce yellowing in recycled PET and is used primarily for injection stretch blow moulding (ISBM), injection and extrusion thermoforming processes. ThermProtect 7000119-E contains high performance phenolic and phosphite antioxidants plus a blue toner for further reduction of yellowing in recycled PET.

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In full Austrian tradition, Starlinger recycling technology has created a PET recycling line that raises bottle-to-bottle recycling to the next level:

**recoSTAR PET art**



**Techmer PM** has developed rPET Revive under the company's HiTerra sustainable solutions brand. The solid pellet masterbatch is generally added at 0.5-1% to increase intrinsic viscosity (IV) and reduce yellowness of rPET. The company says that this technology has generated the most value in thermoformed PET sheet applications where processors are incorporating both rPET and their own reprocessed scrap at high levels, especially when forming round shapes from the rectangular sheet. With HiTerra rPET Revive, processors can maximise rPET while maintaining physical properties, processability and appearance.

Synthetic fibre manufacturers have historically been heavy users of recycled PET and have also seen benefits to incorporating rPET Revive, says Techmer PM. Another use is in 100% recycled content bottles where thick neck finishes make yellowed PET more noticeable to consumers. Blue tints can mask this yellowness, but the result is a grey hue. HiTerra rPET Revive does not use any colourants and can even deliver a brighter, cleaner appearance than virgin resin, the company says.

**Rowa Masterbatch** has developed a chain extender for recycled plastics that reacts with the ends of polycondensate chains. The polymer chains of degraded polymer, with a low molecular weight, are combined with one another and form longer-chain polymers. The company says that studies have shown that the melt flow index (melt volume-flow rate, MVR) of degraded PET can be restored with a dose of 5% Rowalid PET-A103A SP. The impact strength of PET extruded multiple times is almost doubled, while transparency is maintained. This means that a high proportion of regrenulate can be mixed with new PET without significantly worsening the physical properties.

One of the major challenges for mechanical recyclers is efficient cleaning, sorting and process-

ing of the recycled plastic waste stream, reports

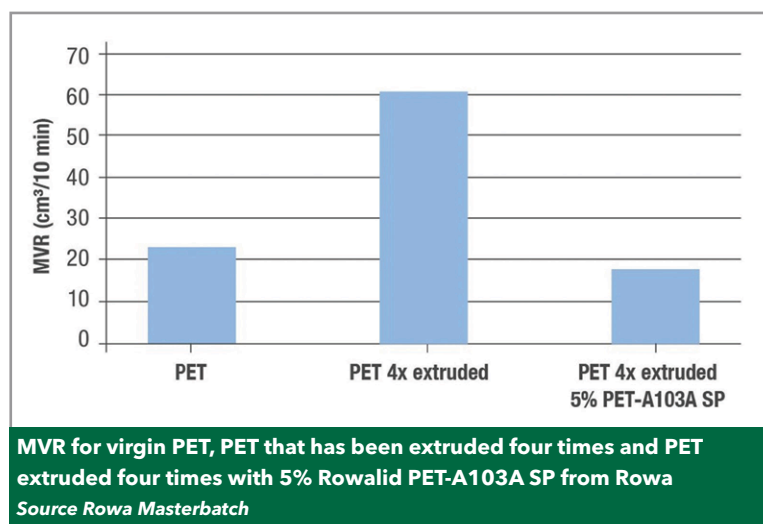
**Evonik**. To meet these needs, the company has developed the new Tego Cycle line of products designed to assist mechanical recyclers in improving every step of their process and the quality of the final recycled product.

Tego WA 111 is a wetting agent, improving float-sink sorting efficiency by preventing bubble formation on plastic flakes. The company says that Tego WA 111 is also a highly effective de-inking and de-metallising aid, removing inks and metals from recyclable substrates that might otherwise contaminate the final product. Evonik also offers Tego Cycle DW 210, an effective dewatering aid for drying separated plastic after sorting and which is biodegradable. Tego Cycle DW 210 also reduces the water content of plastic flakes or particles by up to 70% compared to drying without additives, providing significant time, cost and energy savings for mechanical recyclers.

According to **Milliken & Company**, the current market for additives for recycled plastics is extremely robust and provides exceptional growth prospects. Allan Randall, Global Product Line Manager Plastic Additives DeltaMax/DeltaFlow, says: "The main trends and influences driving new developments in additives for the plastics recycling industry are the increasing demands from the market for specific physical properties of recycled materials. To meet these demands, it is crucial to optimise the melt-flow, stiffness, impact properties and shrinkage characteristics of these materials using additives. This provides an opportunity for further development and expertise in this space to create more value-added additives that meet the needs of the end-users in their applications."

He continues: "As a plastic resin, polypropylene has a number of desirable sustainability benefits. It has a modest carbon footprint to manufacture, is durable, relatively lightweight and inherently recyclable. What prevents recycled polypropylene from being used more widely in injection moulded components, until now, has been its shortcomings in melt-flow, impact and stiffness properties. Our products enhance the properties of rPP and make it suitable for more applications, thereby helping to close the loop in more end uses. Our goal is to enable more and better utilisation of rPP."

Milliken has developed a number of additives for the recycled plastics market. The company says that DeltaMax performance modifiers for rPP simultaneously improve both impact and melt flow in recycled resins, enabling converters to make parts stronger, lighter and faster than before. They also improve the sustainability profile of the





industry and provide a range of other processing, energy reduction and system cost benefits. The net effect is that converters, brand owners and OEMs can now meet market needs for higher impact driven by e-commerce shipments and increasing automotive safety standards, while keeping a keen eye on improving sustainability and costs.

DeltaFlow viscosity modifiers for rPP are based on the latest viscosity-modification chemistry and are solid concentrates designed to specifically help PP recyclers by increasing the melt flow rate of rPP for injection moulding processes. This reduces energy use and enhances circularity. The technology also has lower volatile organic compounds (VOCs) and improved organoleptics and complement advances being made in recycling machinery. DeltaFlow-optimised resins allow for lower processing temperatures, which can enable converters to reduce processing temperatures, reduce energy use, boost productivity and improve processability.



The company adds that Hyperform HPN additives provide faster, easier and more finely tuned PP resin performance and enhance injection-moulded rPP resins. The additives resolve production issues that converters can encounter with traditional nucleators, such as shrinkage, warpage and the trade-off between stiffness and impact performance. It also enables energy savings and increases productivity.

Milliken recently partnered with Erema and PreZero to highlight the use of Hyperform HPN performance additives in rPP compounds. "Using post-consumer waste collected by PreZero, the company leveraged its formulation expertise using Erema recycling technology and Milliken's additive to make recycled PP resins," says Vivian Luk, Global Product Line Manager Plastic Additives Hyperform HPN. "Milliken's performance additive upgrades the rPP by improving the material's physical properties while also reducing the cycle time needed to process it. These additives also provide for better

**Left: Milliken recently partnered with Erema and PreZero to highlight the use of Hyperform HPN performance additives in rPP compounds**



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dimensional control and crystallisation stability during the post-injection moulding period."

Milliken also has future developments in mind. "We are exploring opportunities across various areas such as melt-flow optimisation, impact enhancement, and food-contact approved products," says Randall. "Additionally, we are interested in addressing VOC and organoleptic concerns to further facilitate the adoption of products in this space. Apart from creating new additives, we are also considering the adjacent markets that currently do not have sufficient representation from PCR materials. We believe that developing these markets and making PCR materials readily available for all appropriate applications is an area with great potential for growth."

Impact modification is an important topic for recycled plastics, according to **SK Functional Polymer**. The company adds that achieving the same level of mechanical properties with recycled materials as traditional virgin plastics is a key goal for the future. "One of the biggest current industry trends is mechanical recycling to reduce waste and lower the carbon footprint of plastics," says Nicolas Esselin, Market Development Manager, Com-

pounds. "SK Functional Polymer anticipates growing demand in this area and has solutions to improve the mechanical properties of plastics coming from mechanical recycling."

Esselin adds that a major problem in using these materials is the need to compensate for the loss of properties of virgin resins and compatibilise the plastic blends. New sustainable solutions in impact modification can also assist in compatibilisation. Other technical issues include developing solutions to adjust the rheology of recycled plastics for efficient processing. Indeed, injection moulding and extrusion require quite different rheology. From the same recycled blends, SK Functional Polymer offers solutions to increase or lower the viscosity, according to processing technology requirements. A further issue is to improve mechanical properties, such as tensile strength, impact strength and elongation at break. In lightweight solutions, the use of glass fibres is particularly important, but so is a good coupling agent to provide the right properties. The company says that it has a large range of coupling agents for compounds filled with mineral, inorganic and organic materials. In applications where the recycled feedstock is contaminated, a compatibiliser is

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required to homogenise the finished product and reach required final properties. This can be achieved by using Lotryl copolymers, Lotader reactive resins and Orevac grafted polyolefins.

**Sukano** has launched a newly formulated transparent impact modifier for cold, flash frozen and room temperature applications under the Sukano rPET product portfolio. The company says that the new impact modifier masterbatch can allow replacement of specialised co-polyester resins with modified recycled or virgin PET resin, permitting the end application to be mono-material and recyclable.

"With our newly formulated Sukano impact modifier portfolio, customers have a recyclable alternative at hand to replace products made of copolyester or GAG film structures, for instance, while enjoying the benefits that go beyond mechanical properties modification," says Alessandra Funcia, Head of Marketing at Sukano and Chair of the Working Group Functional and Opaque PET packaging at PETCore.

The company adds that the impact modifier offers improved durability and toughness, enhanced impact resistance, higher rPET content and

shatter resistance, without a loss in transparency. It also provides safe packaging for consumers by reducing sharp edges and leads to fewer shards, avoiding contamination. This helps improve productivity and yields by avoiding line interruptions and generating more high-quality parts. The masterbatches provide additional functionality as a cutting aid, improving die cutting in production, speeding up lines and avoiding any cross-contamination through splinters.

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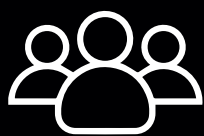
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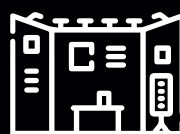
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## SECURE YOUR DISCOUNTED PLACE



*The Chinaplas show opens its doors in Shenzhen this month. We take a look at the event and some of the companies that will be exhibiting*



# Shenzhen is set for Chinaplas 2023

The Chinaplas show runs again this year, following the late cancellation of last year's event in Shanghai due to travel restrictions imposed as part of the country's 'Zero Covid' response to rising Covid infection numbers in early 2022.

The 2023 event will be the 35<sup>th</sup> and is being held at the Shenzhen World Exhibition and Convention Center (SWECC) in Shenzhen on 17-20 April – the Chinaplas show alternates annually between Shanghai and Shenzhen.

Adsale, the show's organiser, expects more than 3,900 exhibitors at the event, including many from overseas. It says the event will include nine overseas 'country pavilions' from countries including France, Germany, Italy, Japan, the UK and the US.

Since the Covid pandemic hit in 2020, travel to China has not been easy. While the 2021 event in

Shanghai attracted more than 152,000 visitors, fewer than 2,500 were from outside of China. However, Adsale says the restrictions that have prevented foreign visitors from attending in recent years have been relaxed considerably. It says only a negative PCR test is now required to enter the country and there is no quarantine required on arrival.

Chinaplas 2023 will have a strong focus on sustainability and will feature a series of special events and presentations on the topic. An example is its Recycling & Circular Economy Conference and Showcase, which takes place on 16 April, the day before the show opens. During the event itself, a number of Tech Talk sessions will showcase a selection of sustainable technologies and applications.

➤ [www.chinaplasonline.com](http://www.chinaplasonline.com)

**Main image:  
The Chinaplas  
show kicks off  
in Shenzhen  
on 17 April**



**Below:**  
**Coperion's**  
**Chinaplas**  
**display**  
**includes a**  
**range-topping**  
**ZSK 58 Mc18**  
**twin screw**  
**extruder**



**Cargill** will exhibit for the first time at Chinaplas 2023, presenting the range of specialty plastics additives it acquired when it bought Croda Performance Technologies last year.

The Crodamide range of slip and anti-block additives – which will get a new name at the show – will head up the display. The company will also present its Ionphase permanent static control solutions, Atmer anti-static and anti-fogging additives, Incroslip torque release additives, IncroMold mould release and anti-scratch products, and IncroMax additives for engineering polymers.

➤ [www.cargill.com/bioindustrial](http://www.cargill.com/bioindustrial)

**Clariant** will present a number of additive solutions, including: AddWorks PKG 158, which offers performance enhancement for packaging; and its AddWorks PKG 906 Circle and AddWorks AGC 970 G stabilisers, which are valuable in plastic film recycling and extend-

ing its service life. Clariant says its additives have a broad spectrum of functionality and safety features.

➤ [www.clariant.com](http://www.clariant.com)

**Coperion** will show a ZSK 58 Mc18 twin screw extruder with specific torque of 18 Nm/cm<sup>3</sup> equipped with a Coperion K-Tron K-ML-SFS-KT20 twin screw loss-in-weight feeder, together with an STS 25 Mc11 laboratory extruder equipped with a Colomax Systems C/S-LW-NT28 twin screw loss-in-weight feeder.

The ZSK machine is from Coperion's highest performing range. The ZSK 58 Mc18 model at the show was assembled at the company's manufacturing plant at Nanjing.

Coperion will be sharing its stand at Chinaplas with Herbold Meckesheim, which produces turnkey plants for plastics recycling and was acquired by Coperion's parent Hillenbrand last year. Together, they will be showing a PET recycling plant simulation at Chinaplas, demonstrating their expertise in numerous plastics recycling processes. Visitors can look directly into the process steps and view the construction and functionality of key technologies.

➤ [www.coperion.com](http://www.coperion.com)

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**CMG Granulators** will be showing its new G17 granulator series which has a capacity range from 5 kg/h up to 90 kg/h. CMG says the G17 series achieve the highest degree of productivity, regrind quality, efficiency of operation and application flexibility.

➤ [www.cmg-granulators.com](http://www.cmg-granulators.com)

**ExxonMobil** plans to show a number of materials with sustainability benefits, including its Exceed S polyethylene, Achieve polypropylene, Vistamaxx performance polymers, and Exxtend technology for recycling of plastic waste in a range of applications.

It will demonstrate solutions with sustainability benefits that have been made through collaboration.

It will also showcase solutions designed for recyclability by reducing the number of components – such as all-PE stand-up pouches (SUPs) and laundry seed packaging.

➤ [www.exxonmobil.com](http://www.exxonmobil.com)

**Maag Group** will show two examples from its range of pelletising equipment – including strand and underwater types – as well as examples from its gear pump and melt filtration lines.

A Baoli-3 strand pelletiser designed for use with both hard and soft materials will be on display.

A Zhuli underwater pelletiser designed for use with standard products such as filled polyolefins, polyesters and TPEs will also be on show.

Other Maag Group products at the show include an Ettlinger ERF 350 high-performance self-cleaning melt filter and Extrex gear pumps, including a new design optimised to handle recycled polymers.

➤ [www.maag.com](http://www.maag.com)

**SI Group** will present its latest additive developments, including its newly-developed Evercycle additives for restabilisation of recycled PE, PP and PET and its Weston 705 antioxidant.

Evercycle PET-102D pellet and PET-103D liquid grades are intended for colour control of recycled PET. Stabilisers Evercycle PP-101S and LD-101S are for, respectively, HDPE and PP rigid packaging and flexible packaging.

The company recently expanded its Weston 705 antioxidant manufacturing capacity in China, a move intended to improve security of supply for its customers in the Asia region and globally.

➤ [www.siigroup.com](http://www.siigroup.com)



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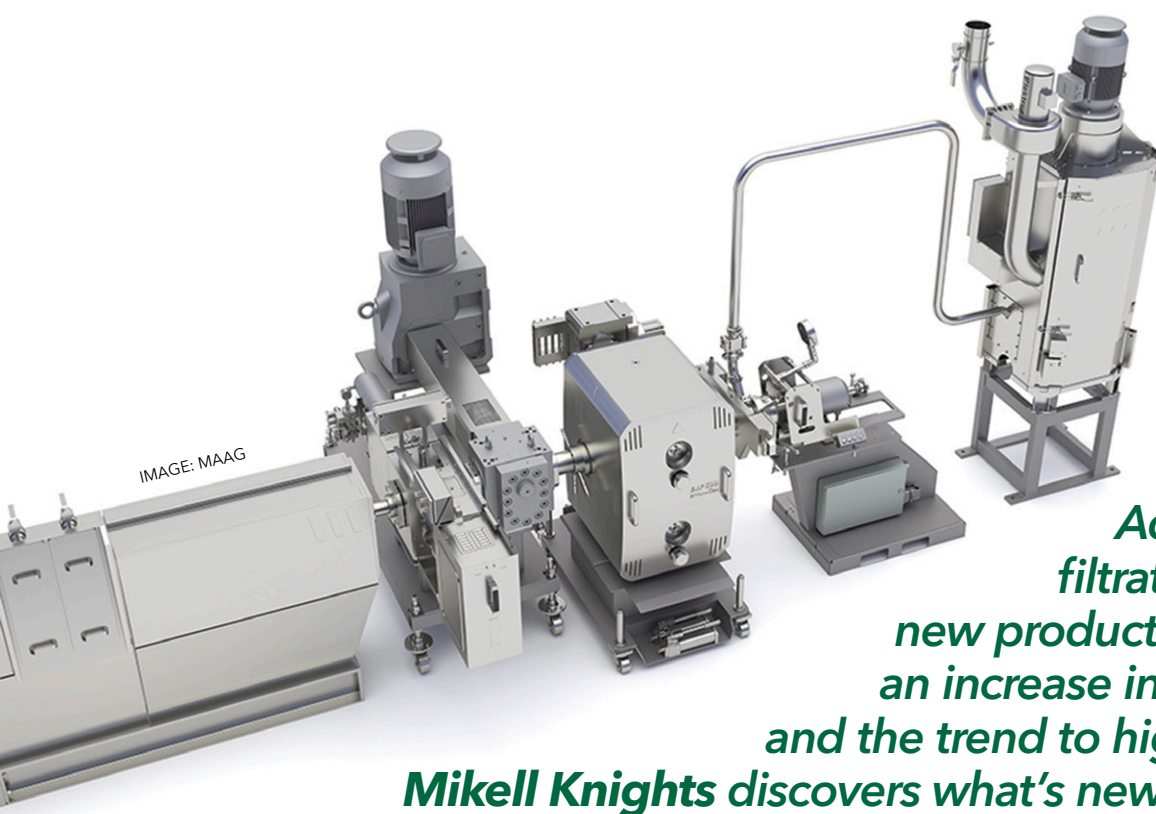


IMAGE: MAAG

*Advances in melt filtration have led to new products that deal with an increase in contamination and the trend to higher capacities.*

*Mikell Knights discovers what's new from suppliers*

# New filters tackle highly contaminated waste

The latest offerings in melt filtration for recycled plastics are designed to handle higher contaminant levels and types while minimising melt loss and production downtime. Suppliers say the plastics industry's drive to become more circular means technologies capable of processing a wider range of contaminated materials into high-purity grades are needed by plastics recyclers. For many suppliers their newest introductions include automated filter cleaning and designs that minimise process variations.

Italian plastics recycling technology specialist **Fimic** says rising demand for recycled PET has led to increasing competition for available material, which remains somewhat limited. Recyclers serving producers of food grade and non-food grade PET are turning toward more contaminated PET waste streams as feedstock material from which to produce high quality recycled plastics.

Demand for rPET supply has many drivers, such as new regulations and taxes coming into force on packaging made solely from virgin plastics. At the same time, major brands in their supply chains have started to evaluate their carbon footprint and to

take mitigating actions like packaging redesign and light weighting, reducing the use for virgin materials, increasing reusability, and setting targets for minimum recycled plastic content in their products.

The rise in rPET demand and in prices are incentivising investments in new recycling capacity, with global rPET capacity forecast to boom over the next five years, says Fimic.

Those forecasts are confirmed by sources such as **Plastics Recyclers Europe**, the European plastics recycling association, which reported in March that installed plastic recycling capacity in EU27+3 nations grew by 17% in 2021, boosted by an estimated €1.75bn in investments. Total capacity in the EU27+3 nations stands at 11.3m tonnes, with more than 730 recycling sites represented. According to PRE, Germany, Spain, Italy, UK and France are the countries with the highest installed capacities, representing 66% of the total market, which had €8.7bn in turnover.

Fimic says it has been working for many years now on improving its filtration technologies to meet the ever-increasing quality needs and different materials characteristics of recyclers, who now deal

**Main image:**  
**Maag recycling line with melt filtration system from its Ettlinger business**



**Above: Fimic says its RAS filter is suited to food-contact and non-food-contact PET recycling**

with more contaminated sources of PET waste.

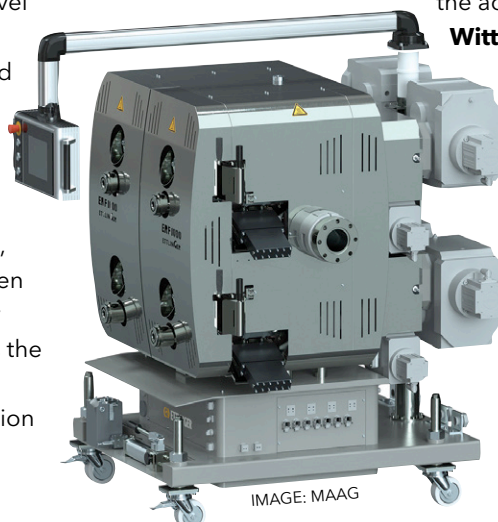
Fimic has installed two of its RAS-type filters on PET recycling lines processing highly contaminated PET waste streams, where in these cases the contamination of the input material reaches levels as high as 5%, way higher than the typical ppm contamination previously used for food grade applications, says the company. Fimic defines these waste streams as "not coming from hot-washed bottle flakes only. Examples include PET lumps from petrochemical waste or from strapping production, waste fibres and PET straps."

In the first project, the RAS filter is used as the first in two filtration steps where the applied filtration is 150 or 120 microns using a laser screen and achieves an output performance of 2,000 kg/h. In the second project, the RAS filter is the only filtration step in the application, where the applied filtration is 80 microns on a laser screen and achieves an output performance of 700 kg/h. Effective filtration maintains the high throughput even when the intrinsic value (IV) levels on the infeed material are different and inconsistent.

### Contaminants issue

The RAS filter system, Fimic's flagship filtration product for recycled materials, is designed to handle high contaminant levels in post-consumer and post-industrial waste. It is designed with a rotating two-blade scraper that traps the contamination that collects on the filter then automatically discharges what it has collected via an adjustable discharge valve. A touchscreen controller allows the user to set the pressure level as a start point signal to activate the scraper. The speed adjustable scraper can also be set to run continuously in the case of large amounts of contamination. Fimic offers the RAS filter as a laser screen, punched screen or mesh screen design. It can be designed for specific requirements, such as the type of plastic material to be filtered, production rate, filtration level required and type of contamination.

**Right: The new Ettlinger ECO 1000 model can achieve throughput rates up to 10,000 kg/h**



At last year's K show, **Maag Group** company **Ettlinger**, a designer and maker of high-performance continuous melt filtration systems, informally introduced the newest and largest model in its ECO series of filtration technology, which is developed for PET and PA recycling.

### Upsizing filters

The new ECO 1000 model can achieve throughput rates up to 10,000 kg/h, depending on the filter fineness, which ranges from 60 microns to 1,800 microns. The unit joins the ECO 200, which handles up to 1,200 kg/h, the ECO 350, which achieves capacities up to 2,500 kg/h and the ECO 500, which can process up to 4,000 kg/h. The new ECO 1000 was part of a high-performance recycling demonstration held in the open-air fairground Recycling Pavilion during the K show.

The ECO series is designed as a self-cleaning melt filter technology whereby a scraper removes solid or elastomeric particles that are deposited on the outer surface of a rotating, perforated steel drum as the melt continuously flows from the outside to the inside of the drum. Laser-drilled conical holes in the steel screen are designed for the melt to pass through while the contamination remains on the surface of the drum. The scraper continuously removes the contaminants, which are fed to a discharge system. The melt filter system is designed to maximise contaminant removal while minimising melt loss.

Ettlinger also offers its ERF series of high-performance melt filtration systems, which are designed to process a wide range of polymers, including LDPE, LLDPE, HDPE, PP, PS, ABS, PC/ABS, TPE, TPU and POM. The ERF series can handle materials with up to 16% by weight contamination and are offered in four sizes with throughput rates ranging from 150 kg/h to 10,000 kg/h.

Maag also expanded its business vertically with the acquisition late last year of

### Witte Pumps & Technology, a

Tornesch, Germany-based supplier of gear pumps and aftermarket parts and services for the chemical, plastic, and polymer processing industries. Maag will combine its gear pump business with the newly acquired Witte Pumps business to establish a new integrated Gear Pumps business unit. The former owner of Witte Pumps &



Technology, Dr. Sven Wiczorek will lead the new business unit under the new Maag ownership.

**Nordson** introduced a new melt filter technology for blown film applications that handles high contents of recycled materials. Introduced at last year's K show, Nordson's new BKG HiCon K-SWE-HD/RS melt filter is based on its backflush technology and enables the use of contaminated recycled material while keeping the blown film process stable and the end product quality high, says Christian Schroeder, Global Segment Manager for the recycling market at Nordson.

"Existing filters provide the necessary process stability and deliver clean, homogenous melt for a high-quality blown film when virgin material is used." However, "the change from using only virgin materials to including recycled material is huge and needs new innovative technology to support that transition," Schroeder says. That transition is being brought about by the social call for more sustainability in the plastics industry.

Producing quality blown film is not an easy task, says Schroeder. A film bubble reacts sensitively to changing process conditions. A minor change in the

material's temperature, viscosity or pressure can have a negative impact. "Adding recycled materials to the mix is an additional disruptor to an already delicate process. Depending on their size, contaminants can cause optical flaws and bubble ruptures, leading to line shutdowns," Schroeder says. Processing recycled material generates more waste than that of virgin polymers because melt is removed from the filter during backflushing and venting. Nordson's new filter is designed so this action

**Above:**  
**Nordson**  
**developed its**  
**BKG HiCon**  
**K-SWE-HD/RS**  
**melt filter for**  
**blown film**  
**applications**

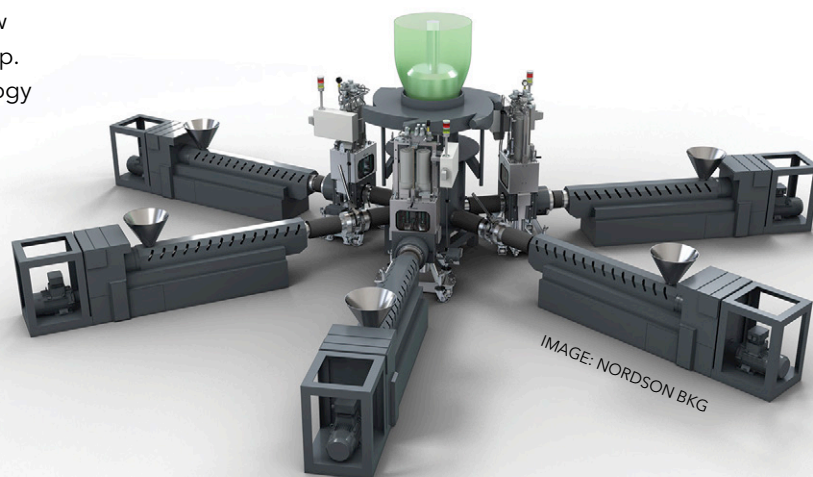
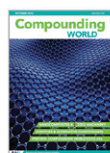


IMAGE: NORDSON BKG

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occurs in a clean and maintenance-friendly way.

To cope with the high process pressures in blown film applications, Nordson made patent-pending changes to its proven backflush technology that allows for pressure to remain constant even under difficult conditions, to ensure high film quality, says Stefan Woestmann, Process Specialist. To achieve pressure consistency, each screen change is a sensitive step in the filtration process.

"This is a significant issue in blown film lines since the film is usually very thin and reacts sensitively to such events," says Woestmann. The empty cavity must be filled with melt after the screen change, but not too fast or pressure fluctuation can likely result.

The BKG HiCon K SWE-HD/RS melt filter is designed with Nordson's patented melt pressure controlled venting start approach that fully automates the filling of the screen cavity after a screen change, for maximum pressure consistency. Filling is done carefully so that no air entrapment endangers the process or the end product. In addition, the safety cover can be opened vertically, allowing the operator to reach the filter piston from all sides which facilitates cleaning during maintenance.

**Powerfil**, the melt filter business of **Erema**, has released a new laser filter with 50% more screen surface area than the previous model (LF 2/354) to increase productivity and improve results in quality-intensive recycling applications. The new LaserFilter 2/406 can be used in recycling plants where throughput capacity needs to be increased while maintaining other processing parameters. The new LaserFilter handles impurity levels up to 5%. It provides filtration as fine as 70 microns while continuously cleaning the large screen with a scraper technology. Powerfil will offer the proven Erema melt filter type as individual components for existing Erema machines, and for third-party extrusion systems.

Powerfil offers four models of the LF 2/406 filters, which have a scraper speed of 1-10 rpm and a maximum operating pressure of 320 bar. These are: the LF 2/406 with a total filter

area of 1,947 cm<sup>2</sup> and throughput capacity of 300 kg/h to 3,000 kg/h; the LF 2/406 twin with a total filter area of 3,894 cm<sup>2</sup> and a throughput capacity of 1,200 kg/h to 5,200 kg/h; the LF 2/406 triple with a total filter area of 5,841 cm<sup>2</sup> and capacity of 2,700 kg/h to 6,900 kg/h; and the LF 2/406 Quattro with a total filter area of 7,788 cm<sup>2</sup> and capacity from 3,700 kg/h up to 9,000 kg/h.

Powerfil offers both its continuous performance laser filter and its SW RTF filter with a robust, partial area backflush system, suitable for use by manufacturers as well as recyclers because the high-performance filters can be used to process post-consumer plastics, post-industrial films with paper labels, and clean PET material.

Erema's melt filter technologies are available in numerous sizes and variations, depending on the required throughput level and level of contamination, and can be integrated easily into an existing recycling plant. "For applications with a focus on melt quality and filtration fineness, this increase in screen area ensures lower pressure and temperature at the same throughput rate, allowing even finer screen to be used for even better results in quality-intensive plastics applications," says Robert Obermayr, Head of the Powerfil business unit.

### Improving rPET

**Britas** expanded its technology offerings with the introduction of its Automatic Belt Melt Filter (ABMF) PET-C, a new fully automatic melt filtering PET technology that features a double-cavity design for high output rates. The new model, shown to the public for the first time at last year's K show, is equipped with Britas' basic proven ABMF technology, such as fully automatic operation, continued production even during screen change, fine filtration level and low melt loss, along with special features and it is technically optimised.

The system is applicable for post-consumer plastic waste with a focus on PET and PET-like materials, including low-viscosity plastics such as PA. It was developed to meet the growing demand and necessity for improved quality of rPET materials. Optimising the continuous melt flow without interruption or stoppage during change of filter screen resulted in the development of the double cavity system, the company says.

The ABMF PET-C filter is available in four models with a filter area ranging from 1,140 cm<sup>2</sup> to 3,200 cm<sup>2</sup>. Up to three screen filters can be used at the same time, allowing users to set the exact filter fineness, up to 20 microns, for a high level of filtration, while holding melt loss below 1%. The system delivers a maximum output up to 8,000 kg/h depending on contamination and material properties.

The filter mechanism and control system work in combination to provide fully automatic operation in double-cavity mode, resulting in no intermediate storage of melt. The extruder continues to run during the screen feed, ensuring process reliability, says Britas. Use of screen belts with a Dutch

**Below: The new Erema LaserFilter (LF) 2/406 from Powerfil**

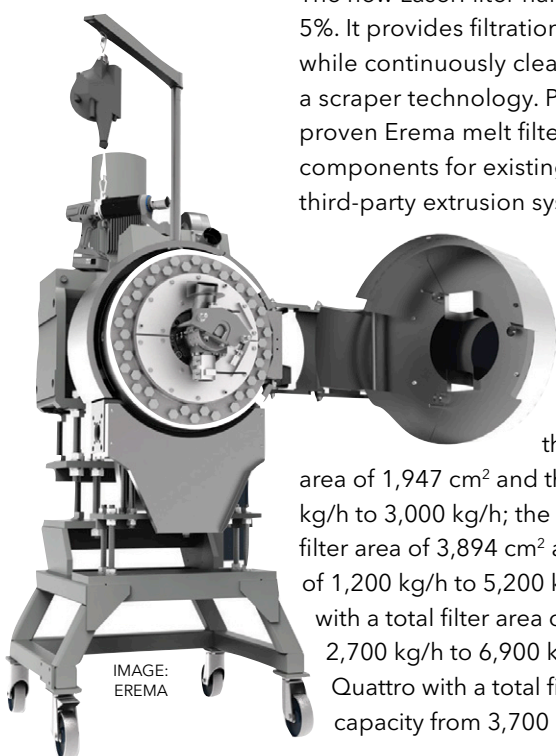


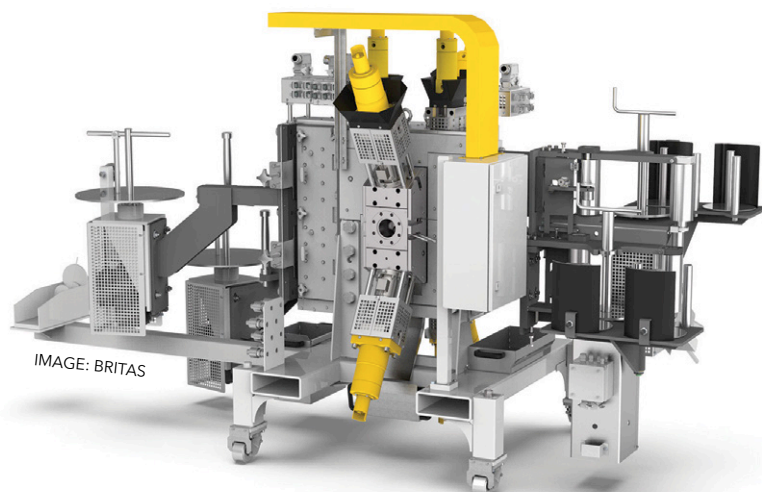
IMAGE:  
EREMA



weave ensures high output, while the revised heating system keeps the operating costs of the melt filter low.

Britas also presented its CMF-BF continuous piston screen changer technology with a backflush function at the K2022 show. Designed for less contaminated industrial and production plastic waste, the CMF-BF can clean the filters automatically as it is designed with two backflush pistons in an attachment module which enables the backflush cleaning process of the filter to occur automatically. When a filter change is required, one of the two backflush pistons is first moved into the backflush position. This interrupts the melt flow of the corresponding filter. A small flow of clean melt is branched off and directed backwards through the filter, where it cleans the filter and is discharged to the outside.

Users can select from four filter types for use with the CMF series, including discontinuous and continuous variants. The series is offered in seven models with screen area from 2 x 45 cm<sup>2</sup> to 2 x 314 cm<sup>2</sup> and throughputs from 80 to 1,260 kg/h depending on model. The melt filter system handles process temperatures up to 350°C and



process pressures up to 350 bar.

German company **BB Engineering** expanded its portfolio to include a patented large-area vacuum filter especially for processing polyester waste. Instead of operating as a classic PET melt-filter, the screen surface is used as an innovative system applying liquid-state polycondensation and vacuum to produce material with the desired IV value.

Its Visco+ vacuum filter, already known as the key component of BB Engineering's VacuFil

**Above: Britas has developed the ABMF PET-C system to meet demand for improved quality of rPET materials**

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## CHOOSE THE FUTURE FOR YOUR CHILDREN

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ITALIAN MELT FILTER

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IMAGE: GNEUSS



**Above: Gneuss SFXmagnus filtration system**

recycling system, is available as a separate but easy-to-integrate upgrade component for existing systems.

The Visco+ can be a solution for IV homogenisation from an existing production system that incurs IV fluctuations. The special filter technology can actively intervene and balance out any irregularities, says BB Engineering. The vacuum filter can also be a solution in a process where the final viscosity of the material is insufficient. It can increase the IV without negatively impacting material residence times.

### IV control

BB Engineering says its unique, patented process allows for fast and flexibly controllable viscosity build-up and reliable viscosity monitoring of the polyester melt. Depending on the intended end use, the melt can be adjusted to achieve the requisite melt properties including IV, purity and homogeneity, which can be adjusted while processing is ongoing.

BB Engineering says the completely new and super-efficient Visco+ unit operates like a liquid-state polycondensation unit. Moisture is removed from the PET, which in conjunction with an adjustable residence time, increases the IV to the desired level while in the vacuum. This approach, which does not require a maintenance-intensive reactor or a deposit-prone stirring unit, enables a controlled IV build-up of up to 30%, the company says.

The IV is continuously monitored by means of an integrated viscosity measurement unit and reliably adjusted in the event of deviation, such as those caused by disparate input qualities, for example. At the same time, the Visco+ provides an enormous material surface compared to the volume and is continuously renewed. Contamination can be

removed effectively from the starting material by means of automatically regulated high-performance vacuum, ranging from 1 to 30 mbar.

**Gneuss Filtration Technology** introduced an additional filter size across its line of Rotary Filtration systems to ensure an optimised and cost-efficient filtration solution for a wider range of applications. Its new size 110 filter is available for its RSFgenius, SFXmagnus, SFneos and CSFprimus filtration technology. The new size 110 offers almost 20% more active screen area than the size 90 for each model, 46 to 62 in<sup>2</sup> depending on the specific model. A larger size 150 has been available with each filtering technology series that has an active screen area that is more than 50% larger than the size 90.

Gneuss says its Rotary Filtration systems operate continuously and automatically and are process ad pressure constant. They are characterised by a filter disk on which the screen cavities are in a ring pattern. Screens can be changed on the part of the filter disk that is not actively in the melt channel, while the production process continues operating.

Gneuss says its ninth SFXmagnus rotary filtration system was recently commissioned by MP3, an Italy-based extruded sheet specialist that adds the melt filtration technology to its lines to make product with higher percentages of regrind material.

MP3 produces ABS, ABS/PMMA and PS sheet for the furniture and building industry, and makes thermoformed technical parts for vehicles and sanitization markets. Five years ago, MP3 replaced three of its existing screen changers with three SFXmagnus rotary filtration systems from Gneuss on a sheet line comprised of a main extruder and two co-extruders. The line processed PS, ABS and PMMA, with up to three colour changes occurring daily. With the installation of the SFXmagnus systems MP3 can add up to 50% regrind without any process disturbances or quality issues even with the high contamination load. MP3 retrofitted to another line with three SFXmagnus units in 2020. Another line was also retrofitted with three SFXmagnus units early in 2022.

### CLICK ON THE LINKS FOR MORE INFORMATION:

- > [www.fimic.it](http://www.fimic.it)
- > [www.plasticsrecyclers.eu](http://www.plasticsrecyclers.eu)
- > [www.maag.com](http://www.maag.com)
- > [www.witte-pumps.com](http://www.witte-pumps.com)
- > [www.nordson.com](http://www.nordson.com)
- > [www.erema.com](http://www.erema.com)
- > [www.britas.de](http://www.britas.de)
- > [www.bbeng.de](http://www.bbeng.de)
- > [www.gneuss.com](http://www.gneuss.com)



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## **MARKET REPORT: Post-Consumer Plastics Packaging Waste Management Europe 2022**

A comprehensive analysis of the waste plastics value chain from the point of disposal, to the point the plastic exits a material recovery facility destined for a recycler or incineration/landfill. Essential insights are given for on a country by country basis, to help you understand the collection and sorting of plastics waste, understand trends, address industry challenges and assess future availability of feedstock for recycling.

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## **MARKET REPORT: Chemical Recycling, Global Status 2022**

Identify emerging business models, potential future leaders in the industry and growth opportunities.

Our new report offers:

- site and capacity information
- a dynamic presentation of company relationships across the value chain
- a report providing background to chemical recycling technologies and concepts, plus information on the industry's operating environment and growth drivers.

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## **MARKET REPORT: Recycling of Flexible Polyolefin Films in Europe 2021**

The study aims to quantify the market for flexible polyolefin recycling, analysing the supply and demand balance, along with an evaluation of current capacity in Europe. A detailed review of the end use applications for recycle is given, with an examination of potential future absorption. It is relevant to all those involved in the plastics industry value chain, from resin producer through to brand owners/end users of plastic products.

[> Click here for more info](#)

## **MARKET REPORT: Single use flexible plastic packaging in Europe - Regulatory context and market magnitude in the retail channel**

This report navigates through the present European legislation and discusses the impact each will have on the consumption of single-use plastic packaging. With a specific focus on flexible plastic retail packaging, this report highlights the issues being raised by recent and upcoming regulatory instruments, the trends that are driving the market to change and solutions currently being deployed.

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## **MARKET REPORT: The Global Plastics Recycling Industry 2020 - Capacities, Capabilities and Future Trends**

This report details current trends and future recycle volume forecasts in a rapidly changing environmental sector. This quantification includes the supply and demand balance, with an evaluation of the current plastic recycling capacities by region. This is done in the context of the economic disruption taking place in the first half of 2020 due to the Covid-19 pandemic and its economic consequences across markets.

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## **MARKET REPORT: Rigid Polyolefin Recycling in Europe - Capacity, technology and recycle usage**

A deep-dive analysis of the European mechanical rigid polyolefin recycling industry (PP and PE). It quantifies recycling capacities, waste streams (municipal and commercial, production scrap, other), and actual recycle volumes of pellets, compounds, regrind and flakes. It provides context on sustainability drivers and how they shape innovations in the value chain including structural and format changes.

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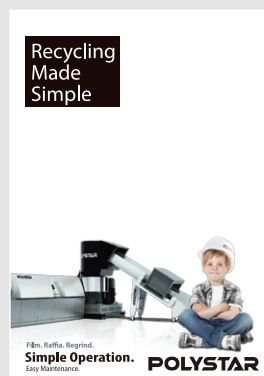
coperion  
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Whatever your recycling need - mechanical, solvent or chemical - Coperion provides a single source solution. Its offer ranges from shredding and agglomeration, through washing and conveying, on to melt processing and degassing, and pelletising.

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## POLYSTAR: PLASTICS RECYCLING



Recycling  
Made  
Simple

Film, Raffle, Reprint.  
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

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## BB ENGINEERING: RECYCLING SYSTEMS



BBENGINEERING  
The Recycling Company

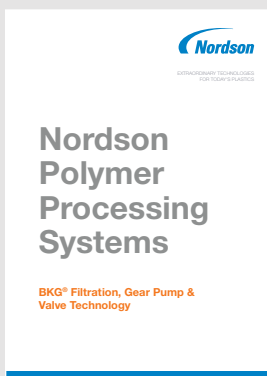
Recycling  
technologies

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: FILTRATION SYSTEMS



Nordson

ADVANCED TECHNOLOGIES  
FOR TODAY'S PLASTICS

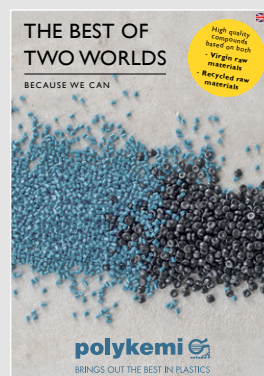
Nordson  
Polymer  
Processing  
Systems

BKG® Filtration, Gear Pump &  
Valve Technology

The BKG range of filtration systems and screen changers from Nordson Polymer Processing Systems are detailed in this six-page brochure which also features products from BKG's ranges in gear pump and valve technologies.

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## POLYKEMI: COMPOUNDS



THE BEST OF  
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BECAUSE WE CAN

High quality  
compounds  
based on both  
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materials

polykemi  
BRINGS OUT THE BEST IN PLASTICS

Polykemi's engineering compounds based on virgin and recycled materials can be used in applications ranging from housings and panels to vehicle carriers and grilles, as shown in case studies in this brochure.

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## Plastics Recycling World January/February 2023

The front cover article of Plastics Recycling World's January-February 2023 edition dives into the world of recycling polystyrene and other styrenic polymers. Other features look at solutions in recycling film-based packaging waste, and innovations in pelletisers.

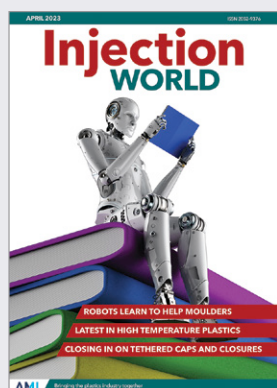
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## Plastics Recycling World November/December 2022

This edition of Plastics Recycling World takes a look at the latest PET recycling equipment that was on show at K2022 in Germany. It also explores new EU regulations on food contact process authorisation and reviews progress in chemical recycling.

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## Injection World April 2023

In the April issue of Injection World, the cover story looks at out how AI, vision systems and other technologies are helping robots assist moulders. Other features cover developments in caps and closures (including the move to tethering in Europe) and the latest in high temperature plastics.

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## Compounding World April 2023

The April 2023 edition of Compounding World explores the latest developments in impact modifiers, polyamide additives and processing aids. Plus there is a special article on small batch compounding, with advice provided by three industry experts.

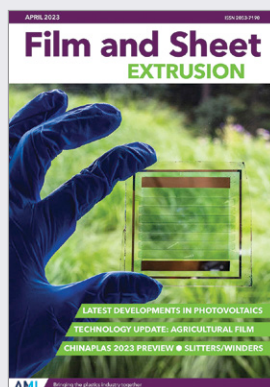
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## Pipe and Profile March/April 2023

The March/April edition of Pipe and Profile Extrusion magazine looks at monitoring of screw and barrel wear. It also reviews developments in polyolefin materials for water and gas pipe and explores innovations in extrusion simulation and PE100 systems.

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## Film and Sheet April 2023

The April issue of Film and Sheet Extrusion includes a feature on plastic substrates in organic solar cells, an article on AMI's recent Agricultural Film event in Barcelona, and the latest in slitters and rewinders. Plus, there is a preview of Chinaplas 2023.

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## GLOBAL EXHIBITION GUIDE

2023	<b>17-20 April</b>	Chinaplas 2023, Shenzhen, China	<a href="http://www.chinaplasonline.com">www.chinaplasonline.com</a>
	<b>25-27 April</b>	JEC World 2023, Paris, France	<a href="http://www.jec-world.events">www.jec-world.events</a>
	<b>13-16 May</b>	Moulding Expo, Stuttgart, Germany	<a href="https://www.messe-stuttgart.de/moulding-expo/en/">https://www.messe-stuttgart.de/moulding-expo/en/</a>
	<b>30 May - 2 June</b>	Equiplast, Barcelona, Spain	<a href="http://www.equiplast.com">www.equiplast.com</a>
	<b>14-15 June</b>	Plastics Recycling World Expo, Essen, Germany	<a href="http://www.plasticsrecyclingworldexpo.com/eu">www.plasticsrecyclingworldexpo.com/eu</a>
	<b>25-27 July</b>	Plastics & Rubber Vietnam, Hanoi, Vietnam	<a href="https://plasticshanoi.com/en/">https://plasticshanoi.com/en/</a>
	<b>5-8 September</b>	Plast 2023, Milan, Italy	<a href="http://www.plastonline.org/en">www.plastonline.org/en</a>
	<b>20-21 September</b>	Injection Molding & Design Expo, Novi, MI, USA	<a href="http://www.injectionmoldingexpo.com">www.injectionmoldingexpo.com</a>
	<b>20-23 September</b>	T-Plas, Bangkok, Thailand	<a href="https://www.tplas.com/">https://www.tplas.com/</a>
	<b>26-28 September</b>	Interplas, Birmingham, UK	<a href="http://www.interplasuk.com">www.interplasuk.com</a>
	<b>28-30 September</b>	Central Asia Plast World, Almaty, Kazakhstan	<a href="https://plastworld.kz/?lang=en">https://plastworld.kz/?lang=en</a>
	<b>5-7 October</b>	PackPrintPlas Philippines, Manila, Philippines	<a href="https://www.globallinkmp.com/packprintplas">https://www.globallinkmp.com/packprintplas</a>
	<b>17-21 October</b>	Fakuma, Friedrichshafen, Germany	<a href="http://www.fakuma-messe.de">www.fakuma-messe.de</a>
	<b>15-16 November</b>	Plastics Recycling World Expo, Cleveland, USA	<a href="http://www.plasticsrecyclingworldexpo.com/na">www.plasticsrecyclingworldexpo.com/na</a>
	<b>22-25 November</b>	Plast Eurasia, Istanbul, Turkey	<a href="https://plasteurasia.com/en/">https://plasteurasia.com/en/</a>


## AMI CONFERENCES

<b>23-25 May 2023</b>	Polymer Sourcing & Distribution, Hamburg, Germany
<b>13-15 June 2023</b>	Plastic Closure Innovations, Barcelona, Spain
<b>20-21 June 2023</b>	Multilayer Flexible Packaging, Chicago, IL, US
<b>20-21 June 2023</b>	Ocean Plastic, Houston, TX, US
<b>26-28 June 2023</b>	Chemical Recycling, Frankfurt, Germany
<b>15-16 August 2023</b>	Agricultural Film, Houston, TX, US

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