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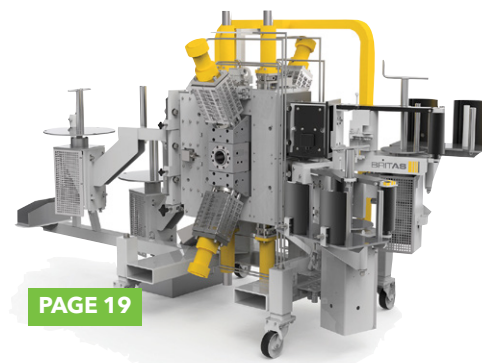
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Hexpol buys into recycler Almaak

Sweden's Hexpol is to pay €70m to acquire 70% of the shares of Almaak, a German specialist in production of recycled engineered polymer compounds.

Hexpol CEO Georg Brunstam said that the deal was in line with its strategy of growing its presence in production of thermoplastic compounds and speciality polymer compounds with high levels of recycled content. He said it also

strengthens the group's presence in Europe.

Almaak employs some 190 people and posted sales of around €75m last year. Its production plants at Krefeld and Doberlug-Kirchhain house 16 compounding lines and provide a capacity of around 60,000 tonnes/yr. It handles PP, PA, PC, PBT and a variety of PC blends. Previous owners Olaf Eichstädt and Thomas Schmeinta will stay with the company.

Almaak has made significant investments in equipment and technology to secure growth in its market, which is focused largely on the European automotive industry. "Almaak is very well positioned in a growing market with a high level of specialty expertise. Together with Hexpol's knowledge and resources, we see many opportunities for accelerated growth," said Jan Wikström, President of

Hexpol Thermoplastic Compounding.

The deal is expected to complete in Q2 2022, subject to customary closing conditions, and includes an option for Hexpol to buy the remaining shares.

Sweden-headquartered Hexpol has production operations in 14 countries and generated sales in 2021 of SEK16bn (€1.55bn).

➤ www.hexpol.com

➤ www.almaak.de

Amazon researches 'net-zero carbon' plastics packaging

Online retail giant Amazon has joined the BOTTLE consortium set up by the US Department of Energy to develop bio-based technologies for plastics packaging.

The company said its growing team of materials scientists will participate with consortium partners in the development of technologies and materials

that "will enable the full life cycle of plastics to be net-zero carbon".

Amazon said the aim is to create new energy-efficient technology that can break down different kinds of plastics and turn them into new materials that can be used to make the same types of plastics or new plastics. In cases where the materials do not enter the recycling stream, the molecular structure of the new materials will be designed to biodegrade in natural environments.

➤ www.aboutamazon.com



PSC buys US recycler

US-based bulk product handling and logistics specialist PSC Group has acquired recycling and compounding company Thermoplastics Services (TSI), based in Dequincy, Louisiana. The move follows on from PSC's acquisition of Akrotex Extrusion and Recycling in Orange, Texas, in December 2021.

Joel Dickerson, CEO of PSC Group, said: "Today's leading petrochemical producers are increasingly committed to environmental stewardship and sustainability, and the acquisition of TSI provides the capabilities and scale needed to further establish PSC as the comprehensive sustainability solutions provider across the industry."

TSI produces recycled compounds for customers.

➤ www.pscgroup.com

Polystyrene venture goes bust

Polystyrene Loop BV in the Netherlands entered bankruptcy on 8 March. The company was the vehicle for a project to build a demonstration plant to recycle polystyrene foam waste using the CreaSolv dissolution process to separate PS from HBCD flame retardant.

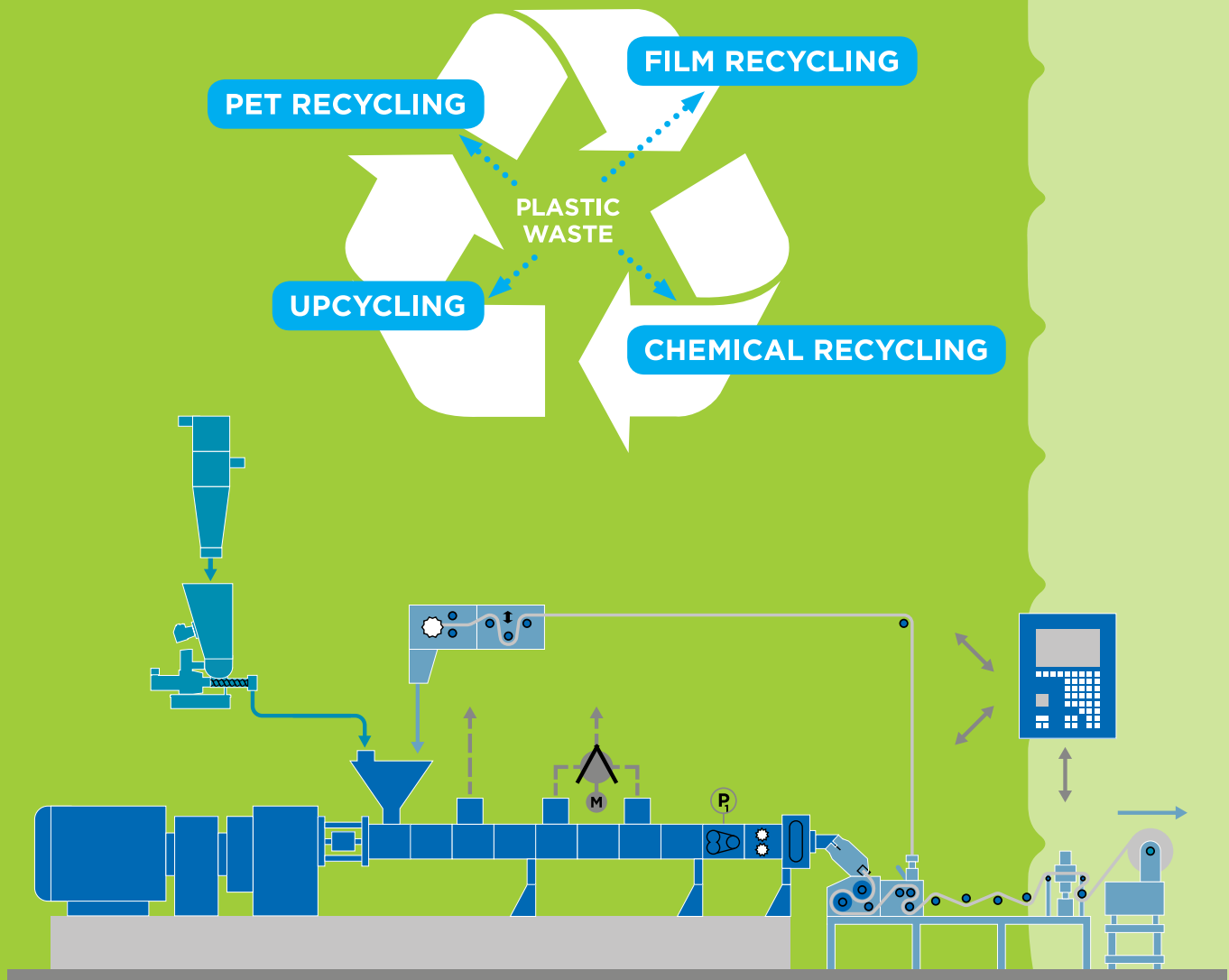
Start-up was delayed by unexpected issues, plus Covid-related problems and soaring energy prices, which contributed to severely impact liquidity. Attempts to restructure finances by the management and supervisory board proved unsuccessful.

➤ <https://polystyreneloop.eu>

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Project to recycle PSU products

Solvay said it is partnering Mitsubishi Chemical Advanced Materials (MCAM) in a project for recycling medical products made from polysulfone.

The initiative focuses on used medical equipment made using Solvay's Udel high-performance polysulfone (PSU) material. Solvay and MCAM are investigating the implementation of logistics for recovery, recycling, and reprocessing of Udel PSU medical components, with the aim of recycled material being suitable for reuse in the original applications.

The expertise developed by MCAM to wash and mechanically purify waste material will be combined with Solvay's ability to evaluate the chemistry of the end-of-life polymer, to develop a recycling strategy that will provide customers with materials that fully meet all specifications.

➤ www.solvay.com

➤ www.mcam.com

Companies struggle with UK's plastics tax

The UK's Plastic Packaging Tax came into force on 1 April amid warnings that many companies are unprepared. A £200 per tonne levy can now be placed on producers or importers of plastic packaging if they do not include 30% recycled content.

Recycling group Veolia UK said a survey by YouGov of senior decision makers across retail and manufacturing businesses found that only 22% had already taken action regarding their plastics packaging. Of those, 66% have reduced the amount of unnecessary or avoidable plastic packaging, 58% now use recycled content, 54% have changed the packaging design to make it more recyclable and 39% have chosen alternative materials to plastic for their packaging.

"The UK's Plastic Packaging Tax is the right way to start getting businesses to push sustainability up the agenda, but it needs to go further," said Gavin Grave-



IMAGE: SHUTTERSTOCK

Above: The UK tax affects packaging from 1 April 2022

son, Veolia Northern Europe Zone Senior Executive Vice President. "A tax escalator would make choosing to incorporate recycled content in packaging both economically and environmentally preferable to using virgin materials."

Another survey conducted by the British Plastics Federation (BPF) found that less than a third of companies feel that they fully understand the tax. It said areas of uncertainty include the evidence they are required to submit and

when companies are eligible for tax credits. There is also uncertainty around calculating the amount of tax liable and other issues.

The BPF has launched an online tool, based on knowledge provided by the consultancy firm EY, that gives companies a simple way to work out whether or not their products qualify for the plastics packaging tax. The tool is available for free and is available on the BPF website.

➤ www.veolia.co.uk

➤ www.bpf.co.uk

RecyClass issues polystyrene protocol

The latest RecyClass protocol covers post-consumer polystyrene pots used for yoghurt



IMAGE: SHUTTERSTOCK

The RecyClass initiative in Europe has published its Recyclability Evaluation Protocol for Polystyrene Containers, covering post-consumer polystyrene pots used for yoghurt and other food and beverage products.

The protocol aims to guarantee the mechanical recyclability of polystyrene packaging, while maintaining protection properties, ensuring polystyrene recycling process efficiency and

encouraging innovation, according to RecyClass.

RecyClass said the document details laboratory testing methodology and represents - as accurately as possible - how the polystyrene mechanical recycling process should work at an industrial scale, allowing polystyrene containers to be recycled into applications with a higher value.

➤ <https://recyclclass.eu>

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European reporting and auditing groups team up

Two plastics recycling programmes, MORE and PolyCert Europe, have announced they are joining forces to help members of the Circular Plastics Alliance (CPA) to meet EU recycled plastics usage targets.

To monitor progress towards CPA targets, the organisations said companies will report data on volumes of recycled plastics they transform or use in

their products to the MORE platform. Auditors applying PolyCert approved audit schemes will verify the volumes reported.

"The synergy [between the two groups] will help the plastics converting industry to reach the EU target of 10m tonnes of recycled polymers used annually between 2025 and 2030," said EuPC President Renato Zelcher.

MORE said that in its

second year of operation it has collected data on 1m tonnes of recycled material used in products, which it says demonstrates that the converter community has widely accepted the MORE tool in Europe.

Since March 2022, the annual MORE survey has been open for plastics converters to use.

> www.moreplatform.eu

> www.polycerteurope.eu

IN BRIEF...

Morssinkhof-Rymoplast is investing €30m in expanding its film recycling capacity with a new 8,700 m² facility in Markranstädt, Germany that will be capable of recycling 30,000 tpa of LDPE film per year. The company, which also has an existing facility in Markranstädt, will expand total rLDPE capacity to 100,000 tpa once the new facility is completed in Q1 2023.

www.morssinkhofplastics.nl

Alpla has acquired PET recycler Texplast, based in Bitterfeld-Wolfen, from Fromm Group and all of its shares in their joint venture, PET Recycling Team Wolfen. This increases Alpla's processing volume in Germany to 75,000 tpa of PET bottles. Alpla's total capacity is 203,000 tpa of rPET and 74,000 tpa of rHDPE.

www.alpla.com

Spanish plastics recycler **Sintac** announced its turnover increased by 108% in 2021 to reach €35m. The company sold 60,000 tonnes of recycled plastics, including PE, PP, PET, PS and ETPs.

<https://sintac.es>

New rPET facility in Abu Dhabi

United Arab Emirates company DGrade has opened a PET bottle recycling facility in Khalifa Industrial Zone Abu Dhabi. DGrade is a producer of sustainable clothing which carries out its own recycling.

The 4,000 m² facility has the capacity to recycle 3,000 kg/h of PET bottles into flake. The recycling line includes hot and cold washing to remove contaminants and Tomra Recycling optical sorting equipment to remove non-PET materials.

DGrade will reprocess up to 1bn PET bottles a year into flake for use in producing its

IMAGE: DGRADE



Above: The new factory has the capacity to recycle 1bn plastic bottles per year

Greenspun yarn, and also to provide material for local packaging manufacturers.

The company also runs the Simply Bottles recycling

initiative which works with businesses, events, and schools to increase recycling rates in the UAE.

> <https://dgrade.com>

MOL Group acquires Hungarian recycler

MOL Group has acquired plastics recycler ReMat based in Hungary.

ReMat has almost 200 employees, annual processing capacity of 25,000 tonnes, and plants located in Tiszaújváros and Rakamaz, Hungary, and a logistics hub in Bratislava,

Slovakia. MOL said the acquisition fits with its strategy to become a key player in the circular economy in Central and Eastern Europe.

In 2019, MOL acquired Aurora Kunststoffe, a recycled plastic-based compounder in Germany. Now having

a total combined annual recycling capacity of 40,000 tonnes from Aurora and ReMat, MOL says it can offer a wide range of sustainable compounds and regranulates for the automotive and packaging industries.

> <https://molgroup.info>

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Plastics Europe plans measures for transition to circularity

Plastics Europe has released a report written by UK research group Systemiq about the plastics industry's transition to circularity in Europe. It has also proposed measures including "a new and enabling policy framework that better incentivises investment and innovation by fostering a climate of creative competition".

The report, which is called "ReShaping Plastics: Pathways to a Circular, Climate Neutral Plastics System in Europe", was developed by Systemiq with the support of an independent

Steering Committee and Expert Panel that included representatives of EU institutions, NGOs, academia and industry. The study's aim was to evaluate current progress and assess the potential of different levers to help transition towards the EU's net zero carbon emissions and circularity goals by 2050.

Plastics Europe said the report "highlights the need for all up- and down-stream levers to be engaged, including mechanical and chemical recycling, the use of alternative raw materials

such as bio feedstocks, and designing products for recycling and reuse".

A new and enabling environment for the transition to circularity must make available high-quality feedstock and access to affordable renewable and low carbon energy, it said. The group's plans include:

- Developing a roadmap for Plastics Europe and its members to accelerate the industry's transition towards 2050. This will include interim targets and policy recommendations.
- Ensuring all Plastics

Europe policy positions are designed to accelerate the plastics' system's transition towards higher circularity and net zero emissions by 2050. This includes the need for transformation of upstream and downstream GHG reduction and circularity levers.

- Exploring the creation of a new multi-stakeholder platform in 2022, to ensure a step-change in the intensity and effectiveness of dialogue and collaboration with policy makers and the plastics value chain.

➤ <https://plasticseurope.org>

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Erema adds again to HQ facility in Austria

Plastics recycling technology group Erema has started construction of a new R&D centre at its headquarters in Ansfelden, Austria.

Markus Huber-Lindinger, Managing Director of Erema Recycling Maschinen und Anlagen, said: "With the new R&D centre, we are laying the foundation for further important plastics recycling milestones from Erema. We have always been characterised by our innovative strength, as proven by 115 patent families with more than 1,000 patents."

The company held a ground-breaking ceremony for the new centre on 6 April. Two halls with a total area of 1,550 m² and a new office building with 50 workplaces will be built, with completion scheduled for February 2023.

The R&D centre will offer

IMAGE: EREMA



Above: Groundbreaking for Erema's R&D centre in Ansfelden took place on 6 April. Left to right: Markus Huber-Lindinger Managing Director Erema GmbH, Markus Achleitner Upper Austria's Minister for the Economy, Manfred Hackl CEO Erema Group and Christian Partoll Ansfelden's Mayor.

cross-departmental and cross-company test machines and laboratory for R&D of plastics recycling technologies. It will provide additional material testing and systems trial capabilities.

Erema has had a string of construction projects since 2006 which have expanded

the Ansfelden site. In 2020, the company completed a construction project which increased production and office space. In January it said it was expanding production further at a new site in St. Marien, near to Ansfelden.

> www.erima.com

Green light for global UN treaty

A global plastic pollution treaty is to be developed by the United Nations to tackle the issue of waste plastics leaking into the terrestrial and marine environments.

In March, a resolution for a global treaty was endorsed by 175 nations at the UN Environment Assembly in Nairobi, Kenya. The resolution sets 2024 as the deadline for a legally binding treaty to be agreed which would address the full lifecycle of plastics, including production, design and disposal.

Plastics Europe said the resolution recognises "governments must be provided with the flexibility to adopt measures that are based on local circumstances and supported by the most appropriate enabling policies".

> www.unep.org

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Wind turbine industry seeks recycling solutions

An AMI conference hears about projects for recycling wind turbine blades and for making blades more recyclable

Fibre-reinforced polymer composites are not amenable to straightforward recycling. This difficult issue is coming to a head with the epoxy thermoset materials commonly used in composites in wind turbine blades. A wave of decommissioning of first-generation wind energy plants means that an estimated 50,000 tonnes of blades need to find an alternative to landfill or incineration. Various industry projects are trying to find solutions, as was shown at AMI's Wind Turbine Blade Manufacture conference in Cologne, Germany in November 2021.

Vestas, the Danish wind systems manufacturer, has a sustainability strategy which includes a goal of producing zero-waste wind turbines by 2040. At the conference, Troels Nielsen, Cluster Technology Specialist, discussed the company's Circularity Roadmap, including its recycling element. Vestas

aims to increase the recycling rate for its operational waste from 52% in 2020 to 94% by 2030 and 100% by 2040. It also has a goal to manufacture fully recyclable turbine blades by 2030.

Nielsen highlighted three collaborative projects in which Vestas is a partner, including the Decom-Blades recycling project in Denmark. This has three elements: shredding end-of-life blades to allow the material to be used in different products and processes; use of shredded blade material in cement production; and the use of pyrolysis to separate the polymer and fibre materials. Makeen Power is leading development work on the pyrolysis technology, based on its existing Plastcon technology, with the goal of building a pilot plant dedicated to treating wind turbine blade materials.

SusWind is a UK project which includes Vestas

Main image:
Is it really
end-of-life for
turbine blades,
or can there be
a second life?

IMAGE: SGRE



Above:
Siemens
Gamesa
Renewable
Energy says the
first six
Recyclable-
Blades will be
installed in
2022 at an
offshore wind
power plant in
Germany

among its partners, with National Composites Centre leading the project. SusWind is set to demonstrate viable technologies for recycling the existing stock of wind turbine blades and reuse the materials in second-life applications such as composite parts in electric vehicles, bridges and thermal insulation. It is also looking at alternatives to thermosets, such as bio-derived feedstock and thermoplastics, in developing composites for turbine blades. Design for disassembly is another work area in the project.

Vestas is heading another Danish project called CETEC (Circular Economy for Thermosets Epoxy Composites) which also involves epoxy resin producer Olin, the Danish Technological Institute and Aarhus University. Using a process developed by the same partners in the DreamWind project, the first stage involves thermoset composites being disassembled into fibre and epoxy. Then, using a chemical recycling process, the epoxy is further broken up into base components similar to virgin materials which can then be reintroduced into the manufacturing of new turbine blades. In his presentation, Nielsen at Vestas said the epoxy being developed in CETEC is intended to be a drop-in solution. The partners are looking at scaling of the process for production purposes.

Right: Cutting
and regrounding
of wind turbine
blades

Siemens Gamesa Renewable Energy is another wind turbine manufacturer that has given itself the task of making its products more sustainable. It is also a partner in the DecomBlades recycling project in Denmark. The company has set targets to have fully recyclable blades by 2030 and fully recyclable turbines by 2040, said Harald Stecher, Materials Engineer, at the AMI conference. Siemens Gamesa has developed RecyclableBlade which uses an epoxy that can be separated from fibres at end-of-life for recovery and recycling. The first six 81m long RecyclableBlades were produced at the Siemens Gamesa blade factory in Aalborg,

Denmark, last year. Stecher said these first six blades will be installed in 2022. Industrialisation work will continue this year and a resin factory is set to be built to support full commercialisation which is expected to be possible from 2024.

First deployment will be with energy customer RWE at its Kaskasi offshore wind power plant in Germany. Siemens Gamesa says it is also working with EDF Renewables and WPD Offshore with the aim to install several sets of RecyclableBlade at future offshore wind energy projects.

The company says on its website it has worked in close partnership with **Aditya Birla Advanced Materials** over the past five years in the development of a new resin system for RecyclableBlade. The recyclable epoxy resin system is based on Aditya Birla's proprietary Recyclamine technology. The blade is produced the same way as a standard blade and is based on Siemens Gamesa's Integral-Blade manufacturing process, which means that there is no increased implementation risk associated with the new resin system, it says.

The resin used for the RecyclableBlade has been fully validated, said Stecher in his presentation. Using the recyclable resin results in a 28% reduction in lifetime CO₂-equivalent emissions for the blade in comparison with a conventional epoxy resin.

The Recyclamine technology was presented at the AMI conference by Andreas Palinsky, Head of R&D Composites and Electrical at CTP Advanced Materials, which is part of Aditya Birla. Recyclamine is a patented technology which uses novel polyamine curing agents to make epoxy thermosets recyclable. He said that making the material this way means "at end-of-life, it can be decomposed in a very simple and controllable way".

Palinsky said CTP has developed a recyclable foam on a lab scale. Fibre-reinforced sandwich panels with Recyclamine epoxy were recycled in



IMAGE: ARKEMA

Prototype recyclable blade makes its debut

Arkema announced in March that a full-scale recyclable thermoplastic wind turbine blade, measuring 62 m in length, and made from its Elium liquid resin, has been designed and built at the LM Wind Power plant in Ponferrada, Spain.

The prototype blade was developed as part of the Zebra (Zero waste Blade ReseArch) project, which is led by French research institute IRT-Jules Verne. The project brings together leading industrial players and technical centres to demonstrate the technical, economic and environmental relevance of thermoplastic wind turbine blades on a full scale, with an eco-design approach to facilitate recycling.

The next step in the Zebra project will be full-scale structural lifetime testing to verify the performance of



the composite material used for manufacturing the wind turbine blade, and its feasibility for future sustainable blade production. The partners will also validate the recycling process for the production waste and for this initial blade after dismantling.

Arkema says: "By the end of the project in 2023, the consortium will have met the challenge of bringing the wind energy sector into the circular economy loop in a sustainable manner, in accordance with eco-design principles."

the lab using an acetic acid solution. Once dissolved, the components are filtered which separates the fibres. The polymer can then go through devolatilising and compounding to produce a thermoplastic material, which can be used for moulding or as an additive. The next stage in the project is to scale up to a pilot plant with capacity to recycle 20kg per hour of waste.

"We are confident this thermoplastic material has commercial value," said Palinsky. An example is injection moulded foot-strap inserts on a surfboard made by Cobra International. The mouldings are comprising 20% recycled thermoplastic and 80% PE.

Palinsky said applications for recycled thermoplastic and fibres continue to be researched. CTP is open for collaboration for improvements in the foaming properties and process, he said.

Arkema has developed an acrylic thermoplastic as a recyclable alternative to thermoset resins for use in wind turbine manufacturing. Pierre Gerard in Arkema's R&D department said at the AMI conference that for composites, Elium liquid polymer is diluted in a reactive monomer blend with processing additives. An initiator (organic peroxide and/or photoinitiator) is used as a second component. The polymerisation can be adjusted to fulfill manufacturing process requirements. For wind blade manufacturing, Arkema offers Elium grades for infusion, pultrusion and hand lay-up/repairs.

Arkema is a partner in the Effiwind collaborative project investigating the use of Elium-based composites in wind turbine blades. After presenting details of the project's work on the materials, design and manufacturing, Gerard described the possible recycling processes for the end-of-life blades. The blades are reduced in size by first cutting and then grinding. This ground material can be compounded with PMMA or ABS, to produce pellets with, for example, 60% ABS and 40% Elium composite for use in injection moulding. Direct manufacture is a possibility by using hot compression on the ground material to produce thermoformable sheets.

Closed loop recycling of Elium-based wind blades can be achieved via chemical recycling. In this, the ground blades are put through a thermal depolymerisation process. Fibres are separated, leaving an 82% Elium monomer that can be purified to 99% r-Elium monomer for further use.

■ This year's edition of the **Wind Turbine Blade Manufacture** event takes place in Dusseldorf, Germany, on 13-15 December 2022. Find out more at the event website.

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New melt filters respond to PCR demands

Melt filtration systems for post-consumer plastics need to deal with high levels of contamination and high throughputs. Peter Mapleston reports on new technology in the market

Producers of equipment for filtering contaminated plastics are upping their game. There are numerous developments that will help recycling companies deal with the high levels of contamination that are typical of post-consumer recyclate (PCR). And with PET being the most recycled of all plastics, it is no surprise that many of the developments are targeted at this material.

NGA Group company **BritAS** unveiled its ABMF PET-C melt filter for contaminated PET at the Fakuma 2021 plastics exhibition in Friedrichshafen, Germany, last October. The ABMF PET-C is an addition to the company's ABMF series of automatic belt melt filters. Company CSO Thomas Lehner says it relies on established BritAS basic technology, but is equipped with special features and technically optimised. During each filter change, a clean screen mesh is inserted automati-

Main image: The Ettlinger ECO 350 melt filtration system has capacity up to 2,500 kg/h

cally and without production having to stop. Up to three screen belts can simultaneously be inserted, which allows an exact adjustment of different filter fineness.

The new unit has a filter fineness of up to 20 µm and a claimed melt loss of less than 1.0%. BritAS says that while the main focus is on PET, it can also be used for low-viscosity plastics such as polyamides. "Especially for high levels of contamination, the ABMF PET-C is the perfect solution," says Lehner.

Lehner says the filter mechanics and control offer a fully-automatic, practical operation in double-cavity mode, which does not require any temporary storage of the melt. During the screen movement, the extruder does not have to be stopped.

Output is ensured by the use of screen belts with Dutch weave mesh. "Operating costs of the melt filter are reduced due to the optimised interior of the ABMF PET-C as well as the re-designed heating," the company says. The ABMF PET-C is available with a filter surface of up to 3,200 cm² and a maximum output ranging from 1,030 kg/h to 4,800 kg/h.

Last June, **Maag Group** company **Ettlinger**, which specialises in continuously operating high performance melt filters, unveiled a new generation of its ECO products for use in PET recycling. The company said new features take into account the need for systems with a higher product



IMAGE: MAAG

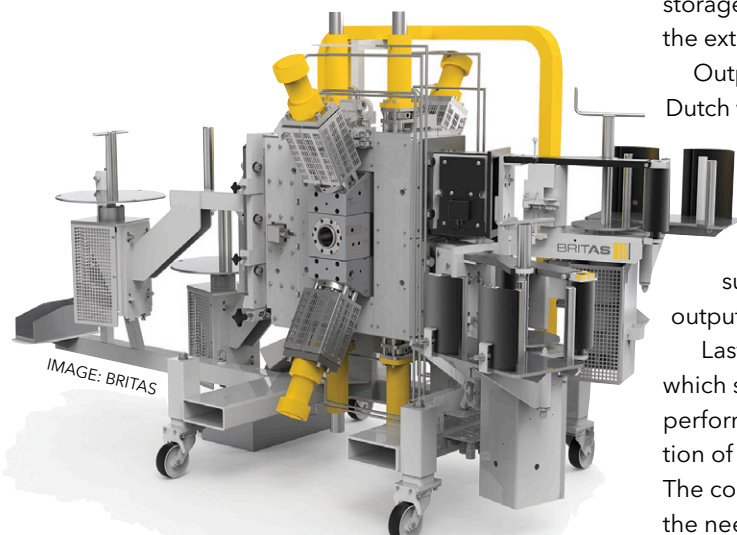


IMAGE: BRITAS

Left: The ABMF PET-C from BritAS

Right:
Ettlinger ERF
1000 high-
performance
melt filter

throughput; first versions are available in sizes suitable for medium-sized recycling lines. The ECO 350, capable of achieving capacities of up to 2,500 kg/h, replaces the old ECO 250, and the ECO 500 (4,000 kg/h) replaces the ECO 250 Twin. The ECO 200 (1,200 kg/h) completes this range.

Ettlinger's melt filter technology is based on the principle of self-cleaning with a continuous flow of melt from the outside to the inside of a rotating, perforated drum. A scraper removes the contaminants that are held back on the surface and feeds them to the discharge system. As with ERF filters, which are designed for higher contamination, the new ECO filters also have a modular structure, giving users a wide range of options for adjusting the filter properties to the respective task.

Uwe Kellner, Managing Director of Ettlinger, says: "PET recyclers are reporting ever-increasing volume flows, resulting in a sharp increase in the capacity utilisation of many machines. At the same time, buyers have more stringent requirements regarding the purity of the recycled material. Consequently, many of the filter systems in operation today are reaching maximum capacity. Our developments have been tailored to these changes in the market. We have achieved enhanced performance without compromising on filtration efficiency. The new designs combine screen sizes up to 60 µm with a minimum loss of PET through the discharge."

As with other systems, the ECO melt filters are designed to process very low viscosity polymer



feedstock – PA for example, as well as PET. The closed discharge system prevents the occurrence of black specks. For this reason, the classic application for ECO melt filters is extrusion systems where PET bottle flake is converted into food packaging films, packaging tape and fibres, as well as PET repelletising and compounding processes. ECO melt filters are suitable for single-screw or twin-screw extrusion lines, irrespective of the pelletising system or other down-

stream units, and can achieve throughputs from 150 kg/h up to 4,000 kg/h.

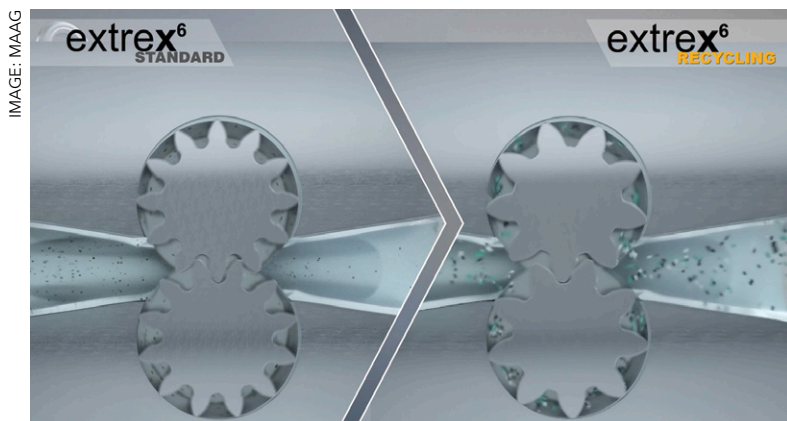
Maag highlights not only the inherent qualities of its melt filtration system, but the way it fits together with neighbouring components in recycling systems that it also produces. "Spherical, cylindrical, or micropellets – perfect recyclates demand a recycling system in which one plant component meshes smoothly with the next," it says.

"The high-performance melt filters in different sizes cover extreme parameters including high contamination levels of up to 16%, high throughputs of up to 12,000 kg/h, and filtration fineness grades of up to 60 microns," says Maag.

Maag is best known for its melt pumps. A melt pump can be installed at the beginning of the recycling line to ensure precise uniform pressure to balance any in-process fluctuations, thus helping ensure high-quality pellets. The pump also minimises loading on the extruder. The precise and stable volume flow rate reduces the extruder's pressure demand, delivering greater efficiency and extended service life, Maag notes.

To protect the melt pump from damage by dirt particles larger than 500 microns in size, the use of a coarse-mesh prefilter is usually recommended. Maag says that in some circumstances, this is now no longer necessary. This is because it now has a version that has been enhanced for processes involving higher contamination levels and larger particles found in recycling operations. "The Extrex6 recycling version looks just like the standard model. The real advance is on the inside, in the gear shafts and bearings," says Andreas Makert, Manager Business Development Recycling Systems at Maag Germany.

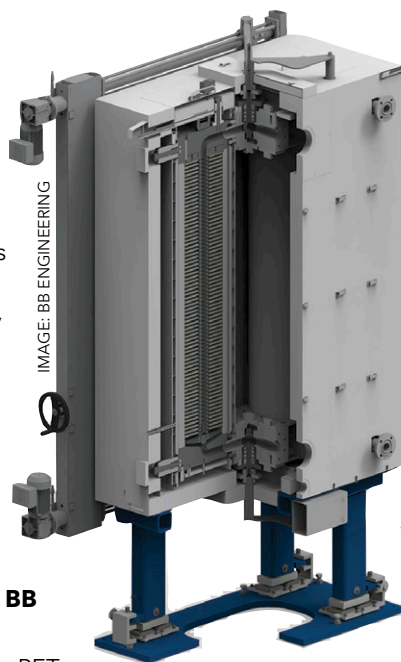
The new version of the Extrex6 features special tooth clearances, bigger toothing gaps, and new



Above: The recycling version of Maag's Extrex6 melt pump (right), with its different tooth configuration, is specially designed for processes involving higher contamination levels and larger particles

types of bearings protected to prevent large-sized particles penetrating into their lubrication gaps, all of which allows tolerance for particles up to 4 mm in size, depending on the pump rating. "That means there is no need for a protective filter upstream of the pump, as a study at a European customer demonstrated over a period of several months," the company says. Service life of the pump doubled, even in post-consumer recycling where the highest contamination levels are found.

In February, German company **BB Engineering** reported that it had delivered a melt filter for recycling PET flakes to polyester manufacturer Indorama Polyester Industries (Thailand). It said Indorama will be using the type NSF38 filter in its recently assembled recycling system for producing rPET granulate from flake PET bottle waste. The granulate is subsequently processed into fibres in



spinning systems.

The NSF38 filter enables continual filtering: the system switches from one filter to the other during the process without the need for conversion shut-downs. It has a filter surface area of approximately 16m² on each side, with throughputs of between 1,000 and 1,900 kg/h.

The filter inserts each contain 19 pleated filter candles. The filter medium comprises a sintered metal fibre nonwoven with a filtration fineness of 25 µm, sufficient to ensure that the melt remains free of contaminants and gels.

BB Engineering is a joint venture between Oerlikon Barmag and Brückner Group, focusing on the development, engineering, design and manufacturing of extrusion and filtration technologies as well as complete spinning lines.

Nordson BKG says that, since the introduction of its first backflush melt filter over 30 years ago, it

Right:
Rendering of
BB Engineering's
NSF38



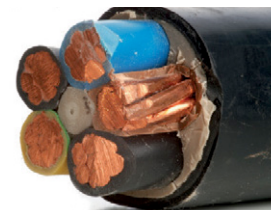
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has continually evolved its machinery for recycling processes. "The peak of this development has been the BKG HiCon V-Type system with the FlexDisc," says the company. "The melt filter is uniquely capable of pressure-constant operation, and the BKG FlexDisc enlarges the available filtration area significantly, allowing higher throughputs with fewer screen changes."

The melt pressure-controlled venting start is another feature of the BKG HiCon V-Type. This helps operators automate and stabilise their process, especially the operating pressure, the company says.

Changing the screen is obviously a critical step in the filtration process. On piston-type screen changers like the HiCon V-Type, when the piston moves out of the housing, air gets into the cavity, and this needs to be vented. The air is displaced by the melt flooding into the cavity once the piston moves back into the housing. Filling the cavity too quickly can result in pressure fluctuations, which can be a major problem in film and sheet lines, causing breakages, thins spots, and fisheyes. Nordson says that on its filters, the piston design allows a controlled melt inflow, preventing such fluctuations.

"The melt pressure controlled venting start takes the control of the melt inflow to another level," says the company. Customers can determine a maximum allowed pressure drop according to the processed material and the end product requirements. Pressure is monitored closely as the cavity fills up, and if it drops beneath the allowed value, the piston moves back, reducing flow. It then moves forward in smaller steps to ensure the melt is withdrawn from the production flow sensitively.

"Tying the filling of the cavity to the operating pressure reduces the amount of operator intervention, improves the process stability, and overall improves the quality of the final product," says Nordson BKG.

With the constantly rising demands on recycled product quality, pressure consistency



Above: BKG HiCon V-Type system with the FlexDisc

Real time oil quality sensor and data collection and monitor from US company Early Warning Technologies



Oil monitoring unit to protect gearboxes

Process + Filtration Products in the USA provides technologies for filtration of polymers, water and oil. It sells Rajhans Plastics Machinery RJC and RJSC dual-channel screen changers, made in India. The company, headed by Bob Vogel, also has a business called Early Warning Technologies (EWT), which offers sensor-based technologies and a dedicated alarm and monitoring system to provide alerts of potential failure of engines and equipment using lubricating or hydraulic oils.

He says one of the key factors in proper performance of gearboxes is maintaining the protective qualities of the lubricating oil. Oil will, over time, lose its lubricating protective qualities. This will be as a result of being subjected to excessive heat, the effects of shear, contamination by dirt and water or particulates. The deterioration of the oil will eventually cause gear components, seals and other parts of the gear box to wear requiring maintenance or replacement.

EWT's oil monitoring program incorporates an oil quality sensor and Express Monitor technology developed by Tan Delta Systems to provide continuous monitoring of the oil by sampling it every 60 milliseconds with a sensitivity of 15 ppm.

The real time data collection and analysis will indicate trends and sources of accelerated oil degeneration, pinpointing the exact time and its nature. Sensor data is captured and displayed in a traffic light format for an immediate visualisation of the oil condition. The monitor also shows the TD Number index, representing oil quality values from new to end-of-life, rate of change and temperature. EWT's technology group provides support in data interpretation and identifying potential sources of oil degeneration.



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has become one of the most critical customer requirements over the past years, it says. To meet this demand, Nordson BKG last year expanded the availability of the pressure-controlled venting start to all its continuous melt filters.

Fimic says it has been working for many years on improving its filtration technologies to meet growing challenges of recycling post-consumer and post-industrial plastics. It is alone in offering five different models of automatic melt filters, covering diverse applications and output requirements.

The RAS system, the company's flagship product, is a scraping filter known for its flexibility and strength. It has a rotating scraper with two blades and can deal with very high contamination levels in post-industrial and post-consumer materials, thanks to the adjustable discharge valve system.

The ERA melt filter, which evolved out of RAS, was a response to the need for double filtration in

a single machine with two consecutive filtration chambers using punched or laser screens.

RAS+REF can operate in scraping mode or in backflush mode, offering an extra option for recyclers wanting to treat materials with mesh screens too.

"It is an ideal option for woven mesh processing with exceptional final results," says Fimic.

The TEN melt filter with automatic screen changer allows continuous filtration on woven mesh, with the additional option of adjusting the speed of

the screen change according to the melt pressure to guarantee regularity and quality of post-industrial waste, without the need for constant supervision by the operator.

Fimic says its GEM model is the largest melt filter on the market. "GEM combines the power of RAS with the winning idea of the ERA double filter," it says. It combines two identical screens (600 or 700 mm diameter), two scrapers and two valves, achiev-

Right: Fimic's TEN melt filter with automatic screen changer allows continuous filtration on woven mesh

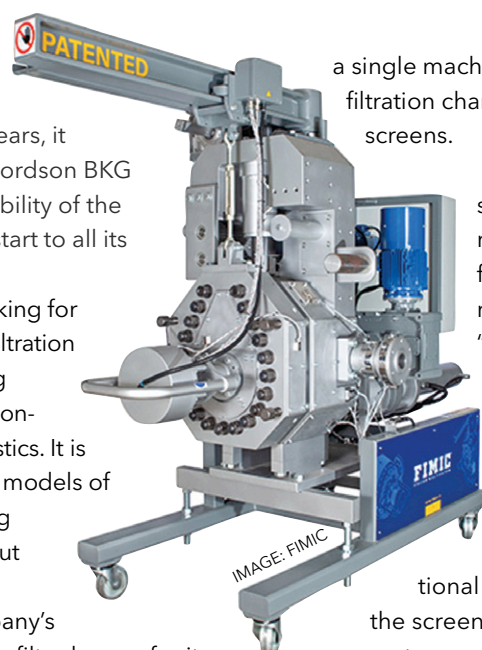


IMAGE: FIMIC



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Right:
W. Müller says
the compact
screen changer
for EBM
extruders is
safe to operate
manually. To
simplify the
process, for
example, a
cordless
screwdriver
can be used

ing a surface area of 5.552 cm² or and 7.592 cm².

MP3 is an Italian extruder of premium rigid plastic for thermoforming parts in furniture, automotive, building, sanitaryware, and elsewhere. At its factory in Bologna, it produces high-quality heavy gauge multi-layer sheet using PMMA, ABS, and HIPS, as well as thin gauge PET, PP, and HIPS. In addition to the closed loop recycling of all internal PET scrap, it is now focusing on increasing the amount of recycled internal scrap from styrenics in its final products.

Five years ago, MP3 replaced three of its existing screen changers with **Gneuss** SFXmagnus units on one of its sheet co-extrusion lines, because it wanted to use high percentages of recycled material without compromising product quality. Gneuss says that the upgrade allowed MP3 to add up to 50% regrind without either process disturbances or quality issues, even with a high contamination load.

The SFXmagnus has an extremely large active filtration area for its overall external dimensions, which means that it is especially well suited for retrofitting to existing lines. As with all the Gneuss Rotary Filtration Systems, the screen packs can be changed during normal production, without pressure spikes or other disturbances.

In 2020, MP3 retrofitted another line with three SFXmagnus systems and a further line was retrofitted with another three units early this year.

German blow moulding equipment company **W. Müller** has developed a new compact screen changer for its extruders, to facilitate the use of PCR in bottle production. The screen changer can be retrofitted and does not require any special safety precautions, as it does not have its own drive. It can be operated manually or, for example, by using a cordless screwdriver without effort.

For PCR processing, Müller offers the ReCo3 system for its extrusion units, consisting of three



IMAGE: W. MÜLLER

independent extruders. The PCR layer is enclosed in the middle by two layers of virgin material. The extruders are mounted vertically for this process. Managing Director Christian Müller says: "Traditionally, there are no screen changers for such extruders, we are one of the very few suppliers on the market. Normally, the changers are too long to install vertically without risking the stability of the extruder."

He says: "A retrofit of a ReCo3 system with the matching screen changers in most cases is possible without any problems. In this way, we are able to offer every interested company to get started with PCR processing."

The compact design is possible because the screen changer is integrated into the connection piece between extruder and extrusion head. By retrofitting a screen changer, the extruder is not significantly extended.

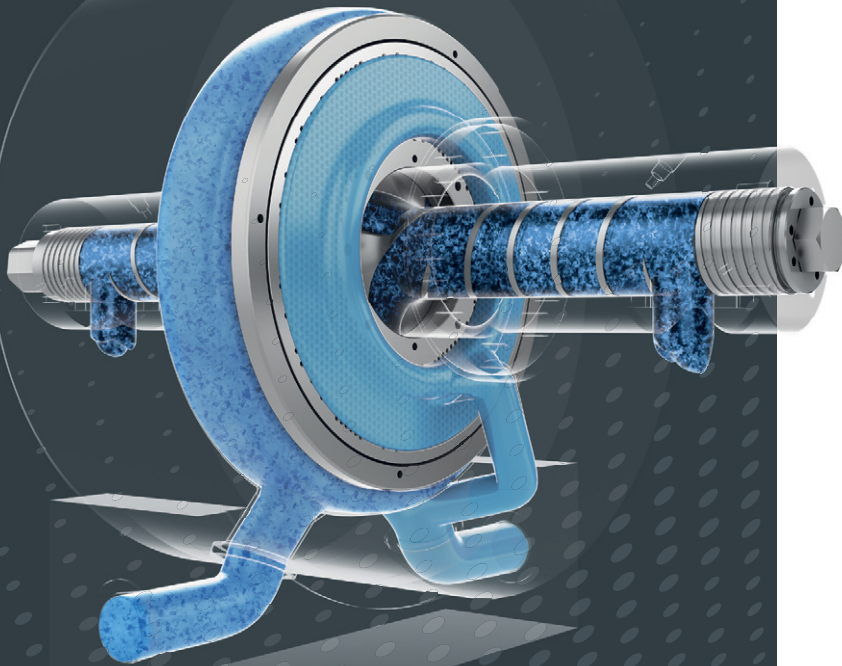
Below: One of
several sheet
coextrusion
lines at sheet
extruder MP3
that now use
Gneuss
SFXmagnus
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IMAGE: MP3



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Elizabeth Carroll provides insight into the new recycling report from AMI



Elizabeth Carroll, Consultant
Recycling & Sustainability

European mechanical plastics recycling exceeded 8 million tonnes in 2021 despite feedstock insecurities caused by Covid-19 slowdown

The waste plastics value chain is a complex and dynamic sector, with an evolving operating environment. New legislation and targets for the recycling of plastics and the use of recyclate are changing the way the whole plastics industry must operate. The mechanical plastics recycling industry, therefore, has become the focal point for investments, acquisition, and expansion.

Capturing the value of plastics through reuse and recycling not only helps retain a product which currently primarily derives from the earth's finite natural resources, but also helps prevent the leaking of plastic waste into the ecosystem and helps create a circular economy. Because of this the plastics recycling industry is gaining growing attention.

Although the volume of commodity plastic entering the waste stream on a yearly basis is extremely large, estimated by AMI as 35.6 million tonnes in 2021, feedstock availability should not be taken for granted. Much of this waste is currently uncollected for recycling or 'lost' at the sorting stage and ends up in landfill or used by EfW plants. Feedstock is therefore a finite resource, characterised by bail price fluctuations and variable quality and supply.

Municipal waste collection varies by country, in both set up and the plastic fractions they collect. Of the various feedstock sources, municipal waste feedstock is forecast to have the highest growth rate to 2030. This is due to collection systems improving and capturing further plastics fractions, as is the case in Belgium and France. Other countries are also looking at increasing collections.

Plastics recyclate production was 8.2 million tonnes in 2021 and is forecast to grow at a rate of 5.6%/year to



2030. To put this figure into context, one must review it in tandem with the 35.6 million tonnes of commodity plastic that entered the waste stream in 2021. This implies that Europe achieved an overall plastic recycling rate of 23.1%, far lower than one might have assumed. That being said, certain waste streams, for example, PET bottles, achieve far higher recycling rates, due in part to bottle deposit schemes and/or established collection systems in place across Europe.

The coronavirus pandemic has had an impact on both the volume of waste being collected for recycling as well as simultaneously reducing the demand for recyclate, as factories closed or reduced production. However, to date it has not seemed to have had a long-lasting effect, as the industry has in general bounced back.

Rigid packaging represents the largest end use market for recyclate, utilising close to over 2 million tonnes in 2021, thanks in part to the large volume of PET which is collected and recycled for food grade applications. Volumes are expected to increase further, as AMI expects the commercialised and scaled production of food grade

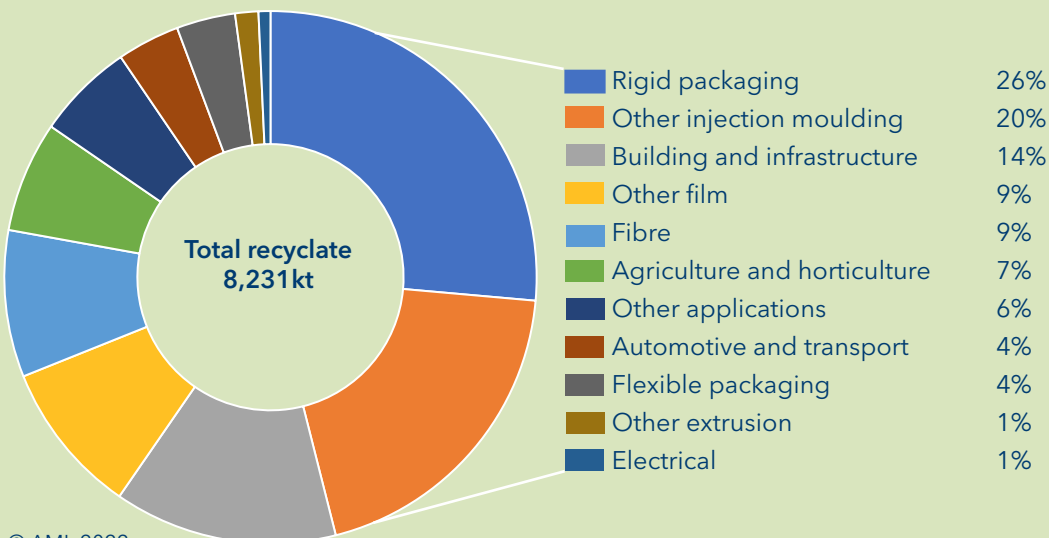
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End use applications for recyclate 2021



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rPP and rPS within the timescale of the report, creating new closed loop systems, as we already see for rPET.

AMI sees within the 2030 timeframe of its report, additional absorption of recyclate volumes into applications that to date absorb have negligible levels, particularly in Western Europe. Uses for recyclate are becoming more diverse, and the ability to absorb recyclate into higher value applications is also increasing, creating added value for the industry.

The biggest constraint in regards to the utilisation of recyclate is the inability to secure a consistent supply of a high quality. While the industry strives for greater circularity and thus a higher share of film-to-film, and other closed loop or upcycling, it has to be acknowledged that even with improvements in collection systems and sorting and recycling technology a variety of end use markets need to be developed for the different recyclate qualities available on the market.

When considering plastics recycling, the role of chemical recycling must also be considered. A significant proportion of post-use plastics is at present either technically or commercially unviable for mechanical recycling. Chemical recycling is considered as a solution to address this material. Compared to incineration with energy recovery and landfilling, chemical recycling is considered the better option. Chemical recycling operations are being developed across the world, most are currently either laboratory or pilot scale, although a number of industrial scale facilities have started to come on stream.

In Europe, the last couple of years have seen a flurry of chemical recycling announcements and press releases by various companies in different parts of the chemical industry value chain. Chemical recycling will thus have a role to play in the achievement of greater circularity in the plastics value chain, however, to what extent, remains to be seen.

Expanding on its highly successful 1st edition, **Mechanical Plastics Recycling 2022** quantifies the market for mechanical recycling for the following polymers: PE, PP, PVC, PS and PET, whilst analysing the supply and demand balance, along with an evaluation of current production by country. The report also looks at feedstock supply and the waste plastics value chain. A detailed review of the end use applications for recyclate has been given, with an examination of potential future absorption.

The report is relevant to all those involved in the plastics industry value chain, from resin producer through to brand owners/end users of plastic products. The report delivers a comprehensive quantitative assessment of the current industry situation and forecasts where this critical aspect of the plastics industry will go in the future.

In addition to its consultancy work, AMI organises specialist events including **Plastics Recycling Technology**, **Chemical Recycling Europe** and **North America** and **Plastics Recycling World Exhibitions** hosted in **Essen, Germany** and **Cleveland, USA**.

For more information, please contact Elizabeth Carroll, Consultant, Recycling and Sustainability
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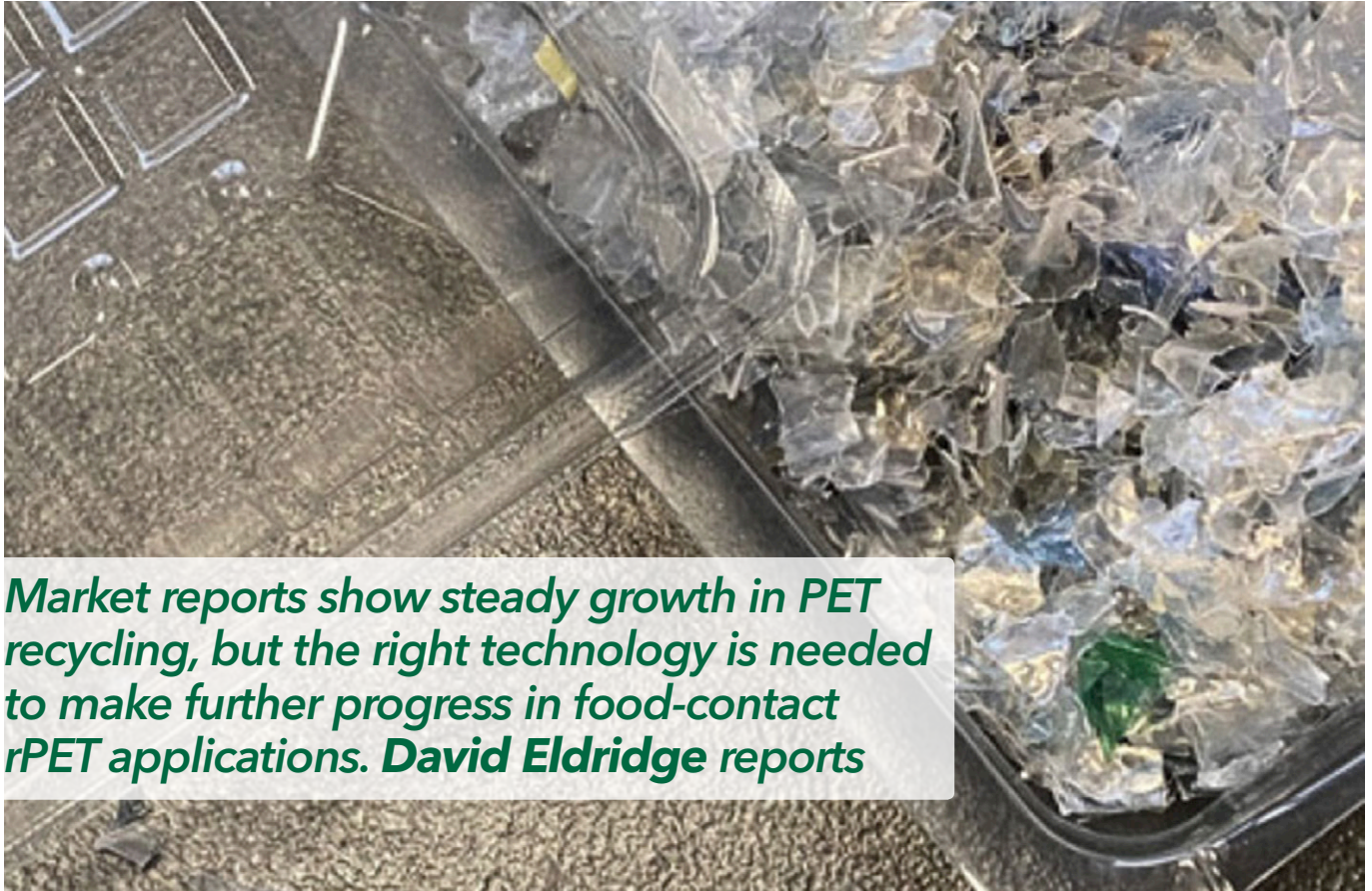


IMAGE: AMB

Market reports show steady growth in PET recycling, but the right technology is needed to make further progress in food-contact rPET applications. David Eldridge reports

RPET progress: growing use in bottles and trays

The market for recycled PET (rPET) is well established and shows no sign of slowing down. Support for rPET's growth has been given extra momentum by EU packaging legislation which aims to increase sustainability, and by brand owners committing to their own targets for incorporating recycled plastics in their packaging. The upward trend for rPET is particularly strong in food-contact bottle and tray applications.

AMI Consulting estimates that the amount of recycled plastics produced in Europe in 2021 was 8.2m tonnes in 2021 and it forecasts production to grow by 5.6% per year to 2030 (AMI Consulting is part of AMI which publishes *Plastics Recycling World*). In its new report, *Mechanical Plastics Recycling – European Market 2022*, it says PET bottles achieve higher recycling rates than the 23.1% average for all plastics recycling in Europe. This is partly due to bottle deposit return schemes (DRS) and established collection systems in many

of the European Union's member countries.

In the report, rigid packaging is estimated to have used approximately 2m tonnes of recycled plastics in 2021, which was driven by the large volume of PET collected and recycled. Volumes are expected to increase further, says AMI Consulting. It notes other positives supporting the European mechanical recycling industry, such as improvements in plastics waste collection in various countries. However, it also sees constraints on market growth, such as difficulties for recyclers in sourcing a consistent supply of high-quality plastics waste.

Another recent report is *PET Market in Europe State of Play 2022*, published by **Plastics Recyclers Europe, Petcore Europe** and drinks associations Unesda and Natural Mineral Waters Europe. In the report, it is estimated that 1.7m tonnes of rPET flakes was produced in 2020. It said there was steady growth for rPET in trays and sheet applications, which account for 32% of the market,

Main image:
AMB Packaging
has started the
Tray Revive
initiative in Italy
to close the
loop for PET
tray recycling

Typical set-up of a Coperion recycling system for processing PET flakes into PET pellets that can be used to manufacture bottles. 1 SWB (Smart Weigh Belt) feeder; 2 ZSK twin screw extruder; 3 Addition of PET flakes; 4 Devolatilisation of volatile components; 5 Discharge via gear pump and filter; 6 Water bath; 7 Strand drying; 8 Strand pelletising

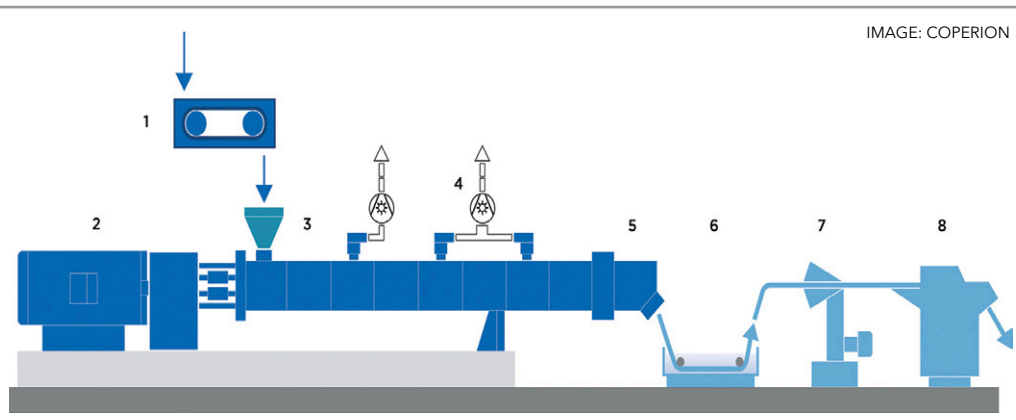


IMAGE: COPERION

followed by a 29% share of the rPET taken by food contact bottles (the remainder is used in fibres, strapping and small-scale applications).

Plastics Recyclers Europe and its partners say: "Driven by producers' pledges, who have made a range of commitments and goals to incorporate recycled content within their bottles, and with the mandatory recycled content targets - the share of food-grade rPET in PET beverage bottle production is set to continue to grow rapidly."

The report says that by 2025 there are expected to be 19 EU Member States with PET bottle DRS capacity. At the moment, seven countries with established DRS achieve sorted-for-recycling rates of 83% or higher. Collection rates, as well as quality, are likely to increase substantially, it says, due to the EU Single Use Plastics Directive's requirements for member states to achieve a 77% collection rate for beverage bottles by 2025 and 90% by 2029.

The associations say: "The significant increase in PET collection and recycling sends a positive signal to the market and will boost confidence in further accelerating PET's circularity."

For PET recycling to continue making progress, the report says further R&D and innovation are needed in almost all stages

of the value chain. Technology suppliers in PET recycling are indeed working on innovation in various areas, particularly in PET bottle and tray recycling.

Coperion says rPET flakes can now be processed without pre-drying into pellets using its ZSK twin screw extruders. In a bottle-to-bottle process, the pellets are condensed in a Solid State Polycondensation (SSP) reactor, and processed into bottles again with the quality of virgin material. Coperion has received clearance for this process for food-contact uses from the US Food and Drug Administration (FDA).

The company says other technologies require pre-drying, crystallization or agglomeration of the rPET flakes following washing. But that is not necessary when the shredded PET is fed directly into the ZSK twin screw extruder and compounded. Coperion says that in its bottle-to-bottle process, rPET flakes are fed into the ZSK extruder using high-accuracy Smart Weigh Belt feeders or gravimetric feeders from Coperion K-Tron. Other regrind materials, new materials, or mixtures can be added. It says melting, intensive devolatilisation, and complete homogenisation take place in the ZSK process section before the melt is transferred via a gear pump and filter with an automatic screen pack changer to a strand or underwater pelletiser for pellet production. The pellets are then condensed in an SSP reactor.

The company says: "Thanks to the highly efficient plastification within the ZSK extruder, Coperion systems for this bottle-to-bottle recycling process achieve throughput rates between 2 and 8 tonnes per hour, therefore recycling companies profit from very high product quality, reduced operating and logistic expenses as well as from energy cost savings up to 30% in comparison to conventional PET recycling methods."

The bottle-to-bottle process is very gentle on the material, says Coperion. "The residence time in the ZSK extruder is very short and dispersion is very

Below:
Coperion ZSK twin screw extruders are used for PET bottle-to-bottle recycling

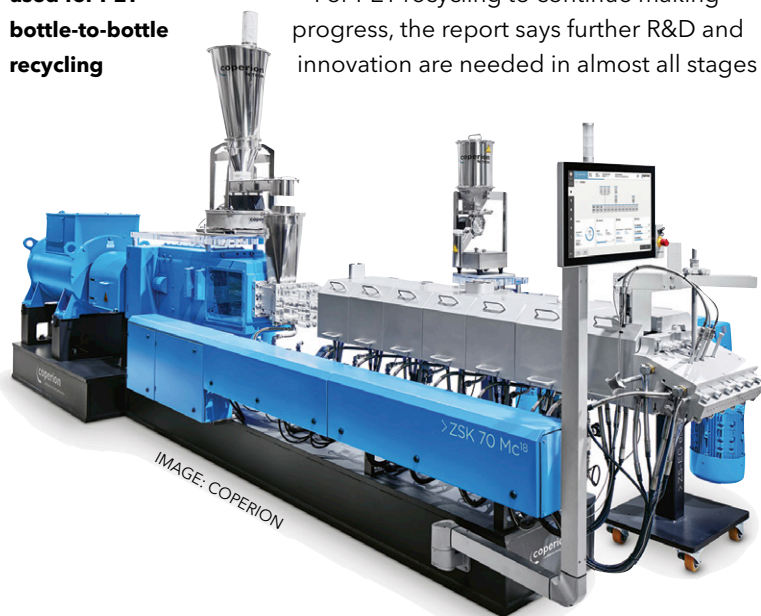


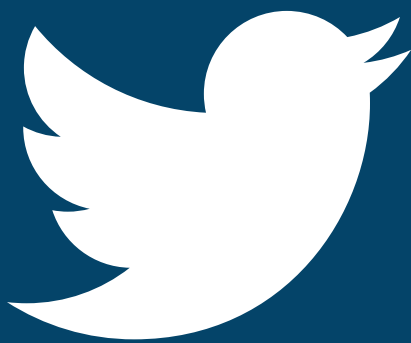
IMAGE: COPERION

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good. The ZSK extruders' high torque enables processing at low temperatures and with almost no viscosity loss. ZSK extruders' self-cleaning enables rapid recipe and colour changes. Thanks to the ZSK twin screw extruder's very good devolatilization options, volatile components such as monomers, oligomers, and water are reliably removed and channelled away from the exhaust flow in suitable separators before discharging the process section."

Direct processing of rPET flakes has further advantages, according to Coperion, including reduced operating costs and energy consumption as well as lower logistic expense. Jochen Schofer, Business Segment Manager, Recycling & Direct Extrusion at Coperion, says: "With FDA certification, we have officially confirmed the high product quality of the PET recyclates. With the Coperion solution, we make a technology available to recyclers that is economical and at the same time allows them to make a decisive contribution to the plastic industry's path towards a circular economy."

In April, **Starlinger Recycling Technology** supplied its first PET bottle-to-bottle recycling system operating in Turkey. The RecoSTAR PET 215 iV+ system for Başatlı is equipped with one of the biggest extruder sizes that Starlinger is currently building and produces up to 2,400 kg per hour of food-safe rPET. The project is being evaluated by the European Food Safety Authority (EFSA).

Başatlı Boru Profil is a producer of industrial steel pipes, hollow sections and sheets located in Kocaeli Province, which branched out into the PET recycling market in 2019. Its rPET flake production up until now has been used in non-food PET packaging, fibres and strapping. Starlinger says the food-grade rPET pellets processed with its FDA, EFSA and brand owner-approved recycling equipment will be supplied to the bottle-to-bottle industry for preform production.

"Başatlı is one of the pioneers in PET bottle-to-bottle recycling in Turkey. We are happy that they have chosen PET recycling equipment from Starlinger for their ambitious project," says Paul Niedl, Commercial Head of Starlinger Recycling Technology. "With this investment, Başatlı contributes significantly to establishing a PET bottle recycling system in Turkey."

Starlinger has also signed a deal to supply a PET recycling system to BariQ based in Giza, Egypt, which it says is the biggest PET bottle-to-bottle recycler in the Middle East and North African region. The system comprises a RecoSTAR PET 215 HC iV+ line including a ViscoSTAR 350 SSP reactor. It has an output of 2,700 kg/h and will enable BariQ to increase its total production capacity to 35,000



IMAGE: BAŞATLI

tonnes of food-grade rPET pellets per year. Starlinger Group's Viscotec business builds solid state polycondensation (SSP) reactors for increasing intrinsic viscosity (IV) and the ViscoSTAR 350 SSP reactor is the biggest size of the latest reactor generation, providing extended processing capacity and residence time while it keeps the footprint of the new recycling line compact.

BariQ started production of food-grade rPET with a Starlinger PET recycling line in 2012 and holds a positive EFSA opinion and an FDA Letter of Non-Objection (LNO). It is also the first non-European recycling company to be registered with ECOEMBES Spain. In November 2021 BariQ was acquired by INTRO Resource Recovery, a member of INTRO Group, to strengthen its waste management portfolio.

As part of the new agreement, BariQ will also upgrade its existing Starlinger RecoSTAR PET 165 iV+ recycling line with a new melt filter for fine filtration and an additional SSP reactor. Starlinger says: "This setup not only increases the line's output, it also allows the production of rPET types beyond the regular bottle-to-bottle grades, guaranteeing best decontamination results and 24/7 production of rPET with highest quality specifications."

BariQ is also investing in new sorting equipment from Tomra Recycling to ensure optimum quality of the input material. BariQ said that the high variability of the input material and the rising quality requirements of customers are the biggest challenges the company has been facing since it started operations in 2012. BariQ sources its post-consumer bottles mainly from local collection and GCC countries. Starlinger says: "As bottle quality and decontamination vary greatly, the recycling equipment must be able to handle such demanding conditions in order to achieve top rPET quality and meet customer requirements."

Ahmed ElKasaby, Chief Operations Officer at BariQ, says: "During the past decade, Starlinger

Above:
Starlinger
Recycling
Technology has
supplied a
RecoSTAR PET
215 iV+
bottle-to-bottle
recycling
system for
Başatlı in Turkey



IMAGE: VIRIDOR

Above: Viridor's £317m facility in Avonmouth, UK, was formally opened in March

Viridor opens major UK recycling facility

In March, a large-scale UK recycling facility for plastics packaging, which is expected to cut the UK's plastic waste exports by circa 8%, was opened by government minister Jo Churchill. Waste management group **Viridor's** £317m facility in Avonmouth co-locates plastics recycling and an energy recovery facility in one building. The facility has the capacity to reprocess over 80,000 tpa of packaging waste including bottles, tubs, and trays, and is producing rPET, rPP and rHDPE.

The Viridor facility - which is expected to produce 60,000 tpa of recycled plastics, including 18,000 tpa of food-grade PET - is well equipped with sensor-based sorting technology from **Tomra Recycling**. The technology company says 15 Autosort units and six Autosort Flake units have been installed at the plant. Following a standard mechanical pre-sorting process, the infeed material is split across three dedicated sorting lines, one for PET, one for HDPE and one for PP.

The Autosort units use near infrared (NIR) technology and visual spectrometers to identify and separate materials according to material type and colour. The Autosort Flake units then sort the material to the highest purity levels required by Viridor for onward sale as food-grade material. At Viridor Avonmouth, the four targeted end fractions are clear PET, natural HDPE, jazz (coloured) HDPE and PP.

Amut's Ecotech plant engineering business designed and developed Viridor's Avonmouth facility with an integrated washing plant using Amut technology. Piergianni Milani, Amut Group's President says: "We are extremely proud to contribute with our technology, to this environmentally-friendly waste management project, aimed at giving plastic a new life, and thus helping to respect the planet. As a leading innovator we keep on delivering our clients advanced solutions matching with the prevailing circular economy model."

has supported us with their reliable equipment and technology, meeting the highest quality specifications and rising quality requirements of the customers, and handling the entire variability of raw materials. As for the new line, the technical discussions with Starlinger started two years ago, ensuring that the line is equipped with the latest technology and meets all standards to achieve top quality in rPET resin production. Believing in the decontamination efficiency of Starlinger technology and their excellent customer support, BariQ again choose Starlinger for the expansion project."

The expansion is expected to be finished in 2023. BariQ then aims to recycle 3.5m PET bottles per year, producing 35,000 tonnes of food-grade rPET for new bottles and saving 80,000 tonnes of CO₂. BariQ supplies the food-grade rPET to major converters and brand-owners in Europe and worldwide.

The contracts for the new equipment were signed during a ceremony held on 13 February 2022, at the BariQ plant located in the CPC Industrial Park, 6th October City, Giza.

It's not just bottle-to-bottle recycling for which PET is receiving attention. More projects and installations are appearing in which rPET trays are the final object of production. **Amut** and **Erema** have a strategic partnership focused on PET recycling lines which are integrated with sheet extrusion to produce rPET sheet for thermoforming food trays. Last year, the partners installed and commissioned Alto Packaging's first extrusion line for food grade PET sheets in New Zealand.

Amut says the advantage of combining Erema's Vacurema PET recycling technology and the Amut Inline Sheet production technology is the avoidance of an extra process stage. It says: "This is because the melt goes straight from the Vacurema 1716 T Basic to the Amut plant without the detour of pelletising. The post-consumer PET material is already decontaminated and pre-dried prior to extrusion in the vacuum reactor of the Vacurema Basic, with a throughput of up to 1,500 kg per hour. After high capacity filtration by Erema's SW-RTF backflush filter and online IV measurement, the melt goes directly into the Amut Inline Sheet plant where it is processed into thermoforming sheet from 0.15 mm to 1.2 mm thickness. The monolayer thermoforming sheet produced from pure rPET is not only 100 % food contact compliant, it also fulfils the FDA and further regulations. At Alto, it is further processed into trays and food containers."

Amut also provided downstream equipment to Alto, ranging from the Automatic Tdie, three rolls stack calender with automatic gap control and

motorised cross axing unit, lamination unit for welding and barrier films, thickness control gauge to anti-static silicone coating unit, fully automatic two shafts turret winder and in line edge trims grinding and recycling.

In Italy, plastics packaging group **AMB** has launched the Tray Revive project aiming to create closed loop PET tray-to-tray recycling. The company is already active in bottle-to-tray recycling, but says "it soon became clear... that demand for recycled bottles would divert rPET away from tray solutions. It is expected that the demand for bottle-to-bottle recycling from the bottle industry will use up to 0.5m tonnes of rPET, therefore causing shortages for the production of recycled tray material."

AMB is partnering with an Italian recycler in the Tray Revive initiative to collect and recycle the material from post-consumer PET trays. This tray material is recycled in flake form, but is then used specifically to manufacture new tray products rather going into the rPET stream for bottle production. AMB adds: "As the demand for PET flakes is continuously growing, European design recycling guidelines for multilayer PET/PE transparent trays are currently being developed."

A focus on quality is emphasised by AMB. The raw material comes from a 95% food tray waste stream and undergoes a strict process of analysis. Post-consumer tray material is processed to avoid contaminations, and the quality of the flakes is then evaluated. AMB assesses the material for its impact on the extrusion process and its mechanical performance. The extruded sheet is then subject to controls that evaluate its optical aspect and quality



IMAGE: AMUT

as well as its impact on the thermoforming process. "All these checks ensure that AMB customers can rely on the outstanding quality of the final trays: mechanical performance and thermoforming performance on FFS remain unchanged, and the gauge remains the same as for standard PET/PE or Mono PET," says the company.

Amut and Erema have a partnership offering PET recycling lines integrated with sheet extrusion

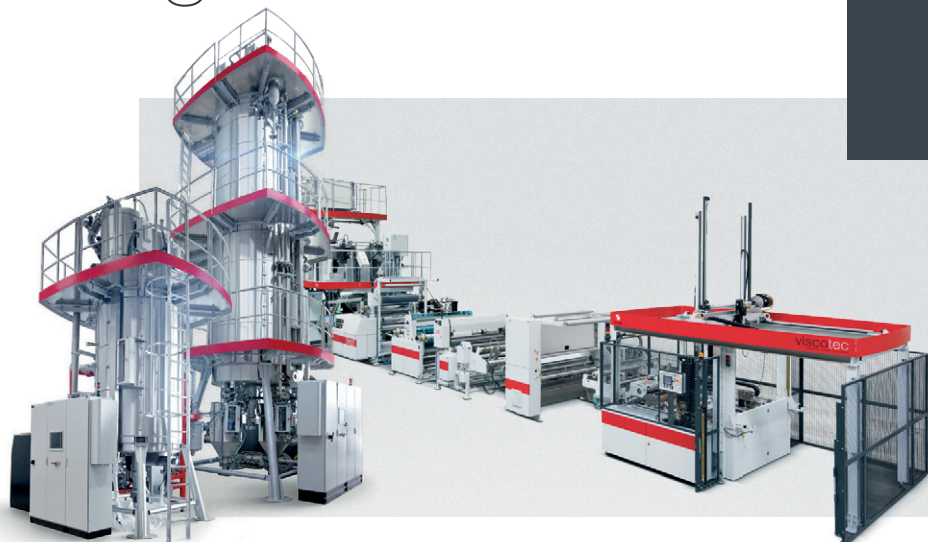
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Adding more functionality to materials

Additives can help the plastics recycling cause in all sorts of ways, from performance enhancement to delayed decomposition and traceability. James Snodgrass finds out what's new in the world of additives

A rosy future is predicted for the additives market, as is to be expected after an enforced pause in productivity. The latest report from Ireland-based Research and Markets indicates good growth for the global plastics additive markets in the next five years (the report lists the market segmentation for the additives sector into packaging, consumer goods, construction, automotive and others). The pause caused by the global Covid pandemic, of course, has "had a detrimental impact on the market", says the company. But it forecasts the global plastics additive market to rise from \$46.6bn in 2020 to \$59.9bn by 2027, with a CAGR of 5.6%.

One company anticipating growth is **BASF**. The German multinational announced in March 2022 that it is to increase production of HALS (hindered amine light stabilisers) at two of its European factories: Lampertheim, Germany and Pontecchio Marconi, Italy, in reaction to growing demand for light stabilisers in the durable plastics market. HALS are used to protect plastics from light degradation – whether from exposure to the sun or from artificial lighting – and help extend the working life of plastics.

Achim Sties, Senior Vice President, Performance Chemicals, Europe, at BASF, says: "We see a growing demand for sustainable materials used in applications like automobiles, construction materials, and greenhouses, to tackle the global

challenges of today and the future. As a globally leading manufacturer and supplier of light stabilisers, we are expanding our production footprint to be able to meet the growing demand of our customers. The complementing infrastructure investment will also help to increase the resilience and efficiency of our operations."

In March BASF signed a strategic agreement with Zhejiang Reef Technology in China (a subsidiary of Veolia Huafei Polymer Technology, which is a joint venture company of France's Veolia Group). Under the agreement the companies have pledged to develop "state-of-the-art recycle formulations for applications used in the automotive, packaging and consumer industries".

Under the agreement, BASF will provide its new IrgaCycle additive products and technical consultancy and support for recycled polymer formulations conducted at BASF's test facilities.

Hermann Althoff, Senior Vice President, Performance Chemicals, Asia Pacific, says: "Our goal is to help deliver higher quality, safer and more effective products while supporting the plastic circular economy and helping reduce the use of virgin plastic material. In this way, we support our customers and partners to achieve their sustainability targets and create sustainable innovations together."

Shirley Wu, General Manager at Reef, says: "We

Main image:
Milliken has launched its DeltaFlow range of viscosity modifiers for recycling

wanted to partner with a world-class manufacturer of plastic additives like BASF to improve the quality of our recyclates. With its in-depth expertise in plastic additives, BASF supports us in this core area by improving the processing and long-term stability of highly contaminated recycled plastic fractions."

BASF states that its IrgaCycle additives help increase the percentage of mechanically recycled content in several end-use applications in areas such as packaging, automotive and mobility, and building and construction. The additives are designed to address specific quality issues associated with recycled resins, such as limited processability, poor long-term thermal stability and insufficient protection from outdoor weathering.

Two universities in the UK have recently revealed their research into plastics recycling. Researchers at **Brunel University London** discovered that bottles containing recycled PET (rPET) can contain higher concentrations of Food Contact Chemicals (FCCs) than bottles made using virgin PET. FCCs are commonly found in packaged food and drink, with most considered safe in modest concentrations. However, looking at rPET bottles, the researchers found that of the 150 FCCs they were tracing, 18 were found to be in higher concentrations than regulations permit. The researchers believe this suggests problems with the process of PET recycling, leading to contamination.

"We found these chemicals can come from various sources, such as the catalysts and additives used during production and degradation during PET production, and degradation that can happen across a bottle's lifecycle," says the study's leader, Eleni Iacovidou, a lecturer from Brunel's Centre for Pollution Research and Policy.

However the report, published in the Journal of



Above: Zhejiang Reef Technology will use BASF IrgaCycle additives to improve the processing and long-term stability of recycled plastics fractions strongly contaminated with paint, ink or adhesive residues, such as car bumpers

Hazardous Materials, recognises that factors other than catalysts and additives could be responsible for high levels of FCCs, including the conditions in which bottles are filled and stored, and exposure to high levels of sunlight and humidity.

Iacovidou says: "By investing in new super-cleaning technologies, we can maximise the likelihood of decontaminating recycled PET to levels similar to virgin PET." Though Iacovidou believes the ultimate solution is to start weening ourselves off the use of PET altogether.

Also in London, at Imperial College's White City campus, researchers have developed what they claim to be the world's first biodegradable plastic that can also be recycled. A technology startup, **Polymateria**, based at **Imperial College London**, has created a plastic film for packaging, and a rigid version of the material, for disposable drinking cups, that decomposes within 226 days.

At the heart of what Polymateria calls "biotransformation" is a plastics additive that alters the properties of the plastic to make it attractive to the microbes and fungi that will ultimately digest it. Products made with the company's plastic will bear a "recycle date" to indicate that the plastic hasn't begun its decomposition and will still be suitable for mechanical recycling.

Polymateria CEO Niall Dunne says: "For too long, it has been assumed that biodegradable material cannot also be recycled. Our technology is changing perceptions. Products containing our technology should be recycled as a matter of priority, but any items escaping the system will return to nature at the right time without causing

Below:
Polymateria
has developed
an additive
allowing
bio-based
plastic to be
recycled before
decomposition



IMAGE: POLYMATERIA

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any harm. As enablers of a circular economy, we invite the industry to join the growing number of partners working with us to bring a circular economy vision to life."

The startup has recently won a \$100m contract to license its technology to the USA's Formosa Plastics. It has also entered an agreement to supply the plastic to the giant Japanese-owned convenience store chain 7-Eleven. Famous for its Slurpees, nearly 12 million of these carbonated slush drinks, served in clear plastic cups, are consumed every day, from 7-Eleven's 77,711 (as of 21 January 2022) outlets in North America, Asia and Scandinavia.

In a move they say will "reduce the carbon footprint of plastic", USA-based firms **Heartland** and **Ravago Americas** have executed a joint development agreement to create "the next generation of plastic resins"

Ravago is one of the world's largest plastic recyclers and compounders. Heartland is a manufacturer of engineered hemp additives, which is reportedly "building America's first reliable industrial hemp supply chain to provide additives for manufacturers that use plastics". Heartland claims its hemp is carbon negative because it absorbs more carbon from the atmosphere while growing than is used in its production and distribution, and that its engineered hemp additives reduce the carbon footprint of virgin plastics by as much as 44%.

Heartland has worked alongside Ravago to engineer hemp materials as renewable additives for plastics. Ravago's R&D team guided Heartland in engineering products that do not require plastic compounders and moulders to invest in retooling.



IMAGE: MILLIKEN

After the 2022 farming cycle, Heartland estimates it will be able to process over 45m kg of hemp additives that will be available for plastic compounding. Ravago and Heartland say they will continue to research and develop products to serve the automotive, packaging and building materials, and markets.

Milliken has launched a range of viscosity modifiers specifically designed for PP recyclers, thereby expanding its recycling additives portfolio. The new DeltaFlow range of viscosity modifiers is available in different forms for different applications. Recyclers can use DeltaFlow as a solid concentrate to increase the melt flow rate of recycled polypropylene (rPP) for both extrusion and injection moulding processes. DeltaFlow is available in free-flowing pellets, which makes the product easy to feed, safe to handle and dust free.

Milliken says that PP resins that have been

Above: Milliken has worked with the Italian confectionery giant Ferrero on making the packaging of Ferrero Rocher chocolates more sustainable

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A team led by Prof Michael Shaver at the University of Manchester has developed an additive to enable traceability of recycled content

optimised with DeltaFlow can be processed at lower temperatures, allowing converters to reduce cycle times, boost productivity and improve processability. The company claims the additives will make rPP a genuinely feasible alternative to virgin resin in many end-use applications. The advantage of this is that brands can help meet their sustainability goals by using more rPP in their products.

The DeltaFlow additives complement Milliken's existing family of DeltaMax performance modifiers for PP. The DeltaFlow products are currently manufactured in Germany, and are offered in concentrations of 2%, 5% and 10% depending upon application and equipment requirements.

"Milliken is pleased to be adding to its portfolio of products that assist polypropylene recyclers," says Tugce Asici-van Houselt, Milliken's Sales Manager for plastic additives in EMEA. "Milliken & Company remains committed to supporting the plastics recycling industry with advanced polymer additives that allow for the increased use of recycled content by improving the properties of the recycled PP resin itself. DeltaFlow viscosity modifiers are just the latest example of this effort, which in turn, contributes to the industry's ongoing

push to promote sustainability."

Milliken has also worked with the Italian confectionery giant **Ferrero** on making the packaging of their signature product, Ferrero Rocher, more sustainable. The companies have had a long-standing working relationship, and both say they share a passion for enhancing packaging sector circularity. In the case of the new Ferrero Rocher packaging, Milliken custom-designed more than 20 formulations to find the right PP for the box, which had to be clear, lightweight and highly recyclable.

During the course of this project, Milliken was able to demonstrate measurable performance improvements including lower resource consumption and reduced greenhouse gas emissions. The companies worked collaboratively to meet Ferrero's demanding specifications to maintain the iconic Ferrero Rocher box's transparency, and guaranteeing the same high-quality product that its consumers know and love.

"At Milliken, we thrive on resolving the technical challenges brought to us by our customers," says Ruben Subira, Regional Market Manager, Plastic Additives. "This project with Ferrero is a great example of how close collaboration can help to deliver value-added solutions."

A team led by Prof Michael Shaver at the UK's **University of Manchester** has developed an additive to help "prove" the level of recycled content in plastic packaging materials on inspection without needing an audit of the supply chain. With the UK's introduction of levies on plastic packaging products that fail to meet mandated levels of recycled content, traceability is more important than ever. The team has developed a technology to test whether a particular piece of plastic is made with a percentage of recycled content or is entirely made from virgin material.

Canada-born Shaver, Director of the **Sustainable Materials Innovation Hub** at University of Manchester, and his team - including Natalie Mera-

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Pirttijarvi, Project Manager at the University's Innovation Factory – have created what they call "ReCon²" (spoken as "ReCon Squared" and intended as an abbreviation for "Recycled Content Reconnaissance"). The key to this technology is a fluorescent additive, in minute concentrations, that doesn't alter the optical properties of a plastic – at least not to the human eye – but can be detected through fluorescence spectrography (fluorimetry).

Under fluorimetry the intensity of fluorescence acts not only as an indicator of the additive's concentration but also how diluted it has become with virgin and/or other recycled polymers. This lets recyclers and compounders produce masterbatches with a recyclable concentration that is traceable through a "fluorescent signature" which can be read if and when claimed recycled content percentages are audited for veracity.

The ReCon² approach provides a rapid measurement of recycled content either in individual polymer feedstocks or in the end-use packaging products, something which existing commercially available methods cannot match.

The team has seen success with most high volume packaging plastics including HDPE, LDPE, PP and PET. They also think it could be used for PVC, PS and specialty plastics. While the process was developed for mechanical recycling, the team believes it could be adapted for chemically recycled feedstocks.

The fluorescent tracking materials are US FDA-approved for food contact packaging which do not affect the chemical properties of the polymers under processing, nor affect the taste or odour of food and beverages for which the packaging is used. But the team needs to investigate the tracker's compatibility with other additives and how it reacts in large scale trials, and is looking for early adopting partners – particularly within packaging and recycling supply chains – to accelerate the commercialisation of this technology.

Rowalid EcoPA-B095A Black rCB is a new product from Germany-based **Rowa Masterbatch**. The company says the carrier material of the masterbatch is based on high-quality post-industrial recycled PA. The colourant used is a recovered carbon black, sourced from waste tyres, which is considered a more sustainable substitute for industrial carbon black. Recovered carbon black gives plastics a black colouration, UV protection and opacity. It is obtained through the pyrolysis process: used tyres are heated to between 250 and 750°C without the presence of oxygen and subsequently broken down into smaller molecules. This process typically produces a highly aromatic pyrolysis oil (approximately 45%), crude pyrolysis carbon black (approximately 33%), recycled steel (approximately 12%), and a non-condensable hydrocarbon gas (approximately 10%). Through grinding and granulation, the crude pyrolysis carbon black can then be processed to recovered carbon black and further treated as required.

Rowa says its new black masterbatch is ideally suited for applications in automotive engineering, electronics and electrical engineering, construction, and sports and leisure products

Rowa also produces Rowalid-IR, a masterbatch solution which makes black and dark plastics detectable by NIR sorting systems.

CLICK ON THE LINKS FOR MORE INFORMATION:

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MARKET REPORT: The European Waste Plastics Value Chain and Mechanical Recycling Industry

This is the second edition of AMI Consulting's report on the European mechanical plastics recycling industry. Expanding on the previous edition, the report will provide a comprehensive analysis of the market for recycled commodity polymers, with essential insights to understand trends, address industry challenges and assess future growth potential within the region.

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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.

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MARKET REPORT: Chemical Recycling, Global Status

This report defines and analyses three different forms of chemical recycling; solvent based purification (dissolution), depolymerisation and thermal processing. This authoritative report provides you with an independent quantitative analysis of the global chemical recycling industry status in 2020, it reviews the existing technologies and forecasts how the sector will develop over the next decade.

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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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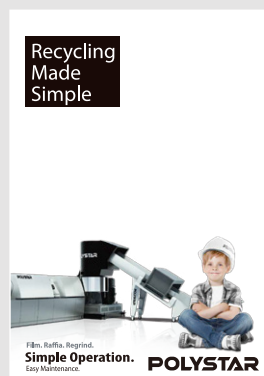
>> Plastics Recycling
How can plastic processing operations increase the proportion of recycled material used in compounds while maximizing quality?

coperion
SPECIALTY EXTRUDERS

This white paper by Coperion looks at the current state of plastics recycling technology, including technical challenges in production. Coperion explains why it thinks better results can be achieved in many recycling applications by using twin screw extruders.

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POLYSTAR: PLASTICS RECYCLING



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



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

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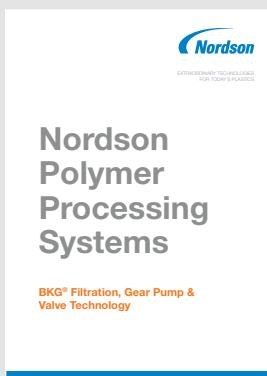
STRUKTOL: CREATIVE RECYCLING



Struktol Company of America offers a range of polymer additives designed to simplify the process of recycling plastics. Learn about its latest options for viscosity modification, odour control and compatibilisation.

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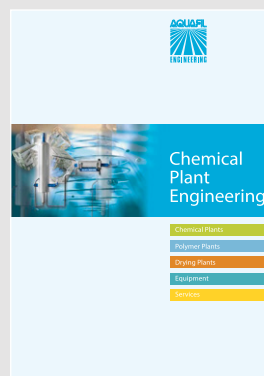
NORDSON: FILTRATION SYSTEMS



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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AQUAFIL: PLANT ENGINEERING



This 12-page brochure from Aquafil Engineering details its comprehensive range of chemical plant engineering capabilities, which include polyamide polymerisation, polyester condensation and polymer drying installations.

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Plastics Recycling World January/February 2022

The January-February issue of Plastics Recycling World looks at how PVC recycling is spreading around the world and the growing momentum in flexible packaging recycling, plus new developments in pelletisers.

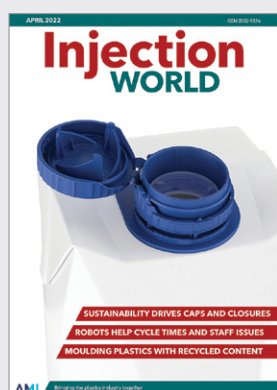
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Plastics Recycling World November/December 2021

The November-December edition of Plastics Recycling World has a lead feature on progress in chemical recycling projects around the world. Other features cover PET depolymerisation and quality measurement in mechanical plastics recycling.

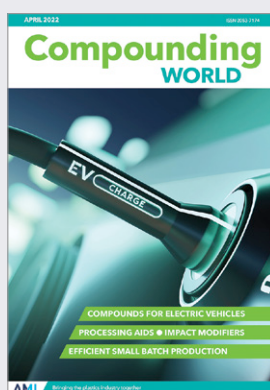
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Injection World April 2022

The April issue of Injection World has an in-depth feature on tethering and recycled content in the caps and closures sector, plus other features covering moulding compounds with recycled content, and the latest injection moulding robots.

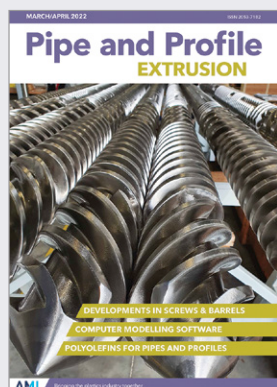
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Compounding World April 2022

The April issue of Compounding World has a cover feature on how demands on plastics from electric vehicle applications in terms of electrical performance are intensifying. Plus features on impact modifiers, small batch compounding and process aids.

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Pipe and Profile March/April 2022

The March/April edition of Pipe and Profile Extrusion looks at how optimised screw designs can lift production efficiency. This issue also explores some new highly demanding application areas for PO pipes and reviews the latest in computer simulation tools.

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Film and Sheet April 2022

The April issue of Film and Sheet Extrusion has features that shine a light on advances in photovoltaics, the advantages of polyolefins for recycling of films and the latest products from suppliers of slitters and rewinders.

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GLOBAL EXHIBITION GUIDE

2022	25-28 April	Chinaplas, Shanghai, China POSTPONED	www.chinaplasonline.com
	3-5 May	JEC 222, Paris France	www.jec-world.events
	3-6 May	GreenPlast, Milan, Italy	www.greenplast.org
	16-18 May	Plast Alger, Algiers, Algeria	https://www.plastalger.com/
	18-19 May	PlastExpo Nordic, Helsinki, Finland	https://pfsptec.messukeskus.com/
	24-27 May	Plastpol, Kielce, Poland	https://www.targikielce.pl/en/plastpol
	25-26 May	Injection Moulding & Design, Detroit, MI, USA	https://injectionmoldingexpo.com/
	10-13 June	IPLAS, Chennai, India	www.iplas.in
	26-30 September	Colombiaplast, Bogota, Colombia	www.colombiaplast.org
	27-29 September	Fachpack 2022, Nuremburg, Germany	www.fachpack.de
	3-7 October	Plastex, Brno, Czech Republic	www.bvv.cz/en/plastex/
	19-26 October	K2022, Dusseldorf, Germany	www.k-online.com
2023	9-10 November	Recycling World Expo USA, Cleveland, USA	https://na.plasticsrecyclingworldexpo.com
	1-3 December	Plast Print Pack West Africa, Accra, Ghana	www.ppp-westafrica.com
	17-19 January	Swiss Plastics Expo, Lucerne, Switzerland	https://swissplastics-cluster.ch/
	1-5 February	PlastIndia, New Delhi, India	www.plastindia.org
	13-16 May	Moulding Expo, Stuttgart, Germany	https://www.messe-stuttgart.de/moulding-expo/en/
	14-15 June	Recycling World Expo Europe, Essen, Germany	https://eu.plasticsrecyclingworldexpo.com
	5-8 September	Plast 2023, Milan, Italy	www.plastonline.org/en


AMI CONFERENCES

7-8 June 2022	Compounding World Congress, Cologne, Germany
7-9 June 2022	Plastic Closure Innovations, Barcelona, Spain
14-15 June 2022	Chemical Recycling Europe, Cologne, Germany
28-30 June 2022	Polymer Sourcing & Distribution, Hamburg, Germany
16-17 August 2022	Agricultural Film, San Diego, CA, USA
13-15 September 2022	Plastics Recycling Technology, Vienna, Austria

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