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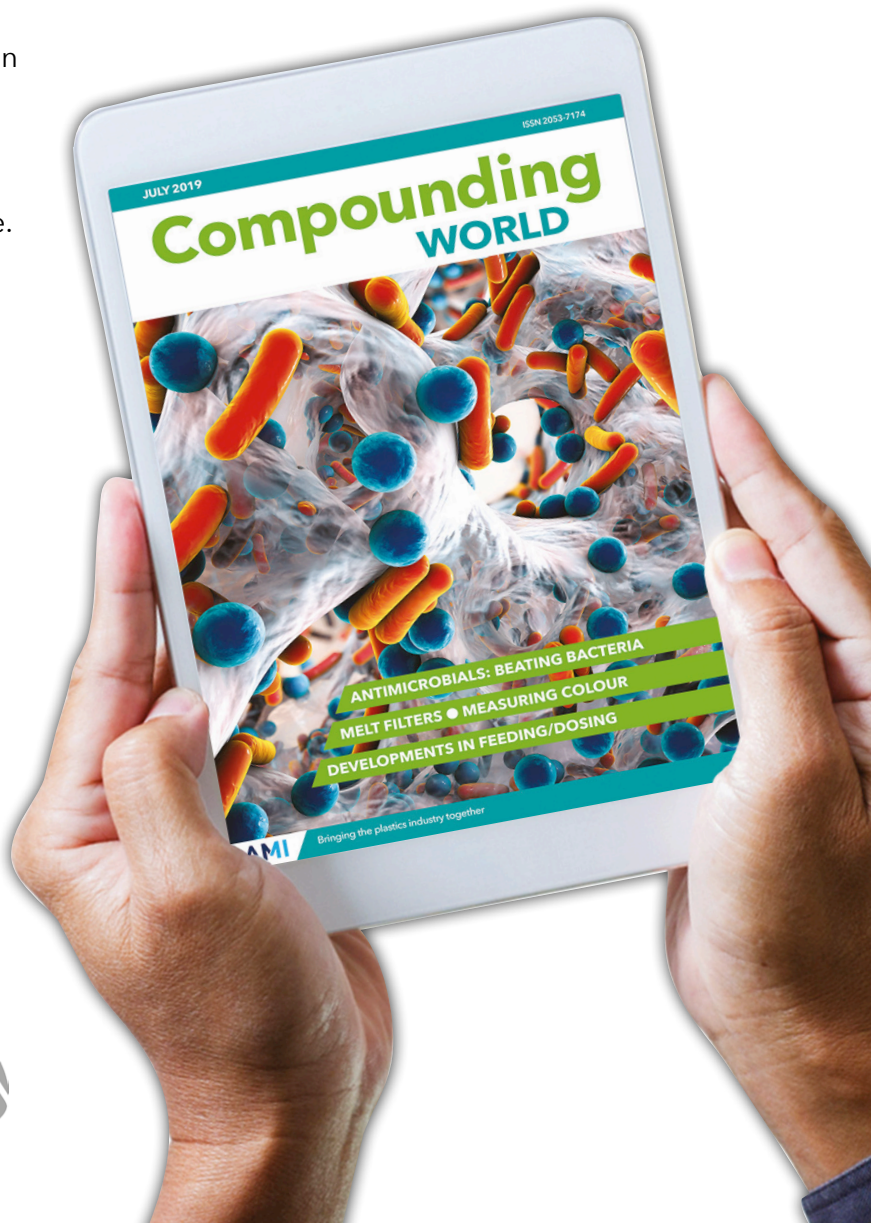
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# Compounding WORLD

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# MOL and Meraxis plan to make recycled polyolefin compounds

Hungarian chemicals group MOL has partnered with Swiss trading group Meraxis in a project that will see it commence production of high performance recycled polyolefin compounds for global distribution.

Under the deal, Meraxis will supply high quality post consumer recycled polyolefin materials that will be blended with MOL's virgin polymers to create the new product line, which MOL refers to as "re-compounds." Initially, production will be located at the Aurora Kunststoff recycled compound facility at Neuenstein in Germany, which MOL acquired in 2019.

"Compounding is an important avenue for the transformational journey to become a leading chemical player in the Central and Eastern European region," said Gabriel Szabó, MOL Group's Executive Vice President of Downstream. "The partnership will



IMAGE: COPERTON

**Coperton extruders in the Aurora Kunststoff compounding plant in Germany**

allow us to quickly develop recyclate re-compounds that meet the customer's requirements and complement our virgin compounding development."

"MOL Group has been committed to a closed-loop circular economy for years now," said Dr Stefan Girschik, CEO of the Meraxis Group. "We aim to use the combined expertise of the two companies to meet the increasing

demand for high-quality plastic recyclates in the automotive, construction and packaging industries."

Meraxis was formed in 2019 through the merger of MB Barter & Trading and Rehau's group purchasing division. It generates sales of around €2bn.

> [www.molgroupchemicals.com](http://www.molgroupchemicals.com)

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

IMAGE: ASCEND PERFORMANCE MATERIALS



**Polibend's plant at Mozzate in Italy is now part of Ascend**

## Ascend closes Poliblend deal

Ascend Performance Materials has completed its previously announced acquisition of Italy's Poliblend and Esseti Plast. The move, announced back in February, expands its portfolio beyond PA into

other engineered plastics, recycled resins and masterbatches.

The acquisition, which also includes the Poliblend Deutschland distribution operation, gives Ascend a second production facility in

Europe. "We now have production, product development and testing capabilities in North America, Asia and Europe, giving us additional scale," said Phil McDivitt, president and CEO.

> [www.ascendmaterials.com](http://www.ascendmaterials.com)

## Feddersen invests in Protec

Feddersen Group has taken a 75% share in Norwegian firm Protec Scandinavia and the whole of its Swedish subsidiary, which will be integrated into the Norwegian business, from Pemel Holding.

The Protec businesses trade in plastics machinery and equipment. Feddersen said it plans to add distribution of engineering plastics as part of its strategy to expand its regional presence in Northern Europe.

> [www.kdfeddersen.com](http://www.kdfeddersen.com)

Germany's Energiewend programme marks the first use of Borlink HVDC cable compounds at 525kv

IMAGE: BOREALIS



## Borealis plays part in German renewables

Borealis and its Borouge subsidiary announced earlier this month that its Borlink crosslinked PE (XLPE) HVDC cable compounds will be used in the majority of Germany's renewable energy grid 'corridor projects'.

The Energiewend projects mark the first use of the Borlink XLPE HVDC compounds at 525kV. Borlink cables will be used in the northern part of the SüdOstLink, which consists of one 2GW circuit with approximately 500km of

cable, and along the entire SüdLink corridor, which includes two 2GW power cable systems and runs for more than 2,500km.

The projects are part of three separate corridors through which renewable energy from Germany's wind and solar power installations will be transmitted from north to south with minimal losses.

■ Separately, Borealis completed its previously announced acquisition of a controlling stake in South Korean compounder DYM

Solution. Based in Cheonan, DYM supplies the wire and cable industry worldwide, specialising in semi-conductive, halogen-free flame retardant rubber and silane-cured compounds.

Borealis said that the acquisition will add complementary products to its existing wire and cable portfolio, while providing an immediate capacity increase to help further secure supply and geographically extend its asset footprint and supply base.

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

### IN BRIEF...

Swiss compounding machinery maker **Buss** is to be represented in India and the Middle East by Reifenhäuser India Marketing and Reifenhäuser (MEA). Both companies are joint ventures between Germany's Reifenhäuser extrusion machinery group and Reifenhäuser India Marketing founder Manish Mehta. [www.busscorp.com](http://www.busscorp.com)

**Repsol** and plastics recycler **Acteco** have agreed a project to increase capacity for recycled polyolefins at Acteco's plant at Ibi, near Alicante in Spain. The materials will be used in Repsol's Reciclex range of recycled content polyolefins. [www.repsol.com](http://www.repsol.com) [www.acteco.es](http://www.acteco.es)

**Circularise**, a blockchain system for tracing materials and sharing data, has raised €1.5m from the EU's H2020's SME Instrument Phase Two "to fuel the continued growth of the collaborative project". [www.circularise.com/plastics](http://www.circularise.com/plastics)

## Ineos deal adds flexible recyclates

Ineos Olefins & Polymers Europe has secured a supply agreement with waste management company Saica Natur covering recycled LDPE and LLDPE that will enable it extend its Recycl-IN range to include flexible packaging applications with over 60% post-consumer recyclate (PCR).

Recycl-IN combines recycled plastic with what Ineos refers to as "highly engineered virgin polymers" to give properties equivalent to standard virgin grades. According to the resin producer, this new development

"pushes technical boundaries" by incorporating higher levels of PCR and addressing demanding applications such as stretch and lamination films for detergent and personal care pouches.

Saica Natur is a subsidiary of the Saica Group, one of Europe's largest suppliers of recycled paper for corrugated board. It has activities in Spain, France, Portugal and the UK. Its Natur Cycle Plus operation specialises in recovering post-consumer LDPE film for use in recycling.

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



IMAGE: INEOS

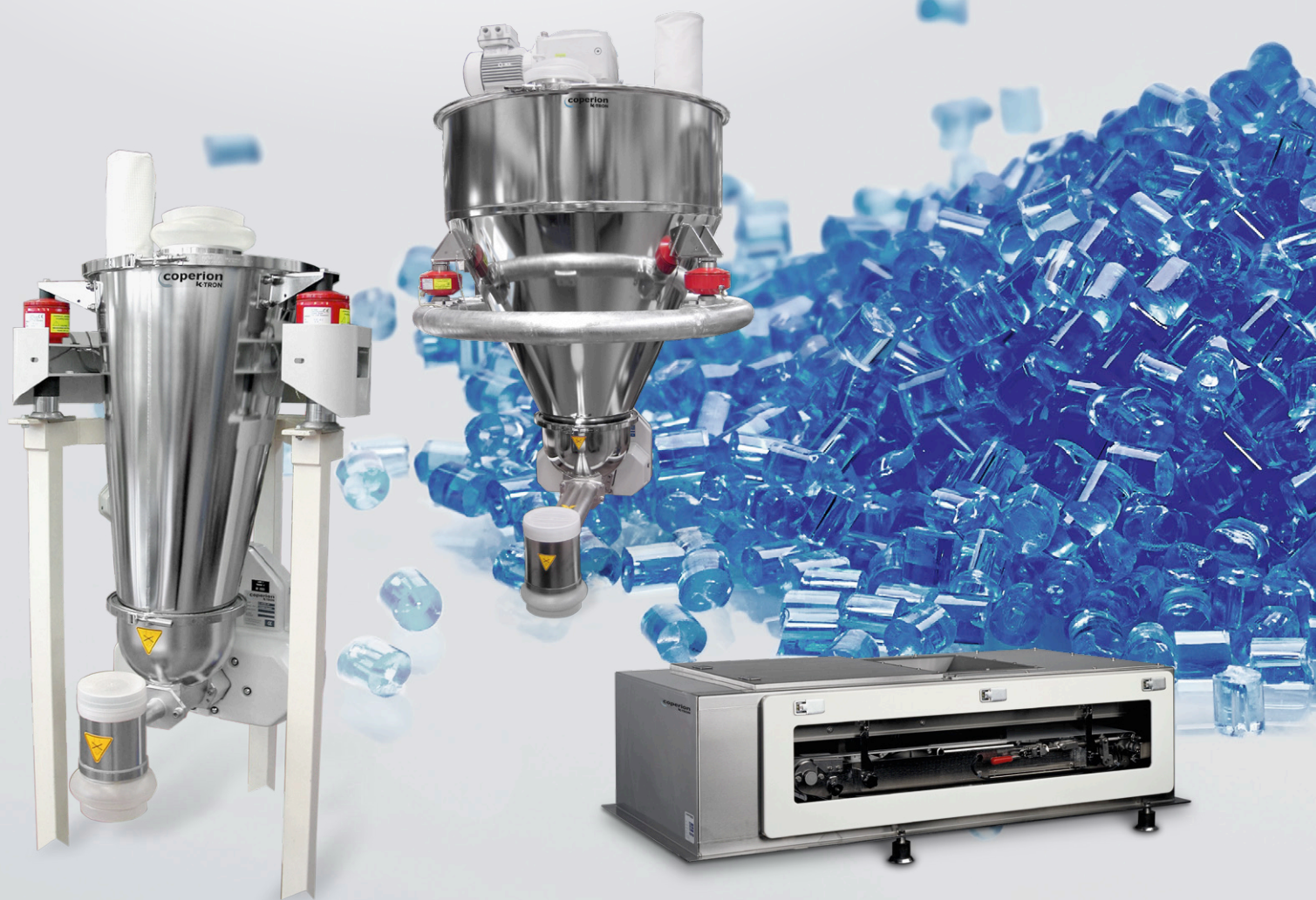
**Ineos will extend its Recycl-IN polyolefins to stretch film grades**



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# AMI postpones American expos

Compounding World publisher AMI has announced the postponement of its four focused North American plastics industry exhibitions, which were scheduled to take place at the Huntington Convention Center in Cleveland, Ohio, US, in November 2020. The shows will now take place on 3-4 November 2021.

The decision to delay the North American editions of the Compounding World Expo, Plastics Recycling World Expo, Plastics Extrusion World Expo and Polymer Testing World Expo has been taken due to the on-going uncertainty created by the Coronavirus pandemic. It follows the postponement of the European editions last month. Those will now take place on 1-2 June 2021 at Messe Essen in Essen, Germany.

Commenting on the US show postponement, AMI's Head of Exhibitions, Rita Andrews said: "We have been reviewing the fast-changing situation in America daily, and have been consulting with exhibitors, the venue and local authorities. Our primary concerns are for the health and safety of all attendees at our events and delivering the very best audience for



The first Compounding World Expo in May 2019 attracted more than 4,300 visitors

our exhibitors. With these factors in mind, we have taken the decision to postpone the expos to next year."

Rescheduling the European and North American events will end uncertainty and allow exhibitors, speakers and attendees to plan effectively for the new dates, according to Andy Beevers, Events Director at AMI. "We have had tremendous support and understanding from the industry during this process and are now all looking forward to returning

to Essen and Cleveland with successful shows next year," he said.

Admission to the four expos and their five conference theatres will continue to be free of charge. Registration for the European events will re-open later this year; registration for the North American events will restart next year. Visitors that have already registered for the 2020 events will be able to simply renew their free tickets for the 2021 exhibitions.

> [www.ami.international/exhibitions](http://www.ami.international/exhibitions)

IMAGE: AMI

## Birla sites gain IATF approval

Birla Carbon said that all 16 of its manufacturing facilities across the globe have now gained the International Automotive Task Force (IATF) certification.

It said it is the first carbon black manufacturer to achieve this certification, which extends requirements of the ISO quality management system for automotive customers.

> [www.birlacarbon.com](http://www.birlacarbon.com)

## Coperion extends remote refurbishment options

Responding to the challenges on travel as a result of the Covid-19 pandemic, Coperion has completed its most complex compounding installation modernisation using its ServiceBox online monitoring and failure recording system.

The project involved a control software update and mechanical overhauls on a customer's high capacity ZSK250 twin screw compounding extruder. It

included a gearbox update, mounting a new coupling, installation of a ZS-EG side devolatilisation unit, and updating the EpcNT control with a rebuild of the control cabinet and monitor.

A three-strong engineering team based at Coperion's Stuttgart plant in Germany worked directly with the customer to ensure the software and mechanical updates were completed correctly. According to

Stefan Lachenmeyer, Head of Coperion's Extruder Modernisation Team, the project represents a milestone in the company's ability to coordinate mechanical and software modernisation tasks using remote communication technology.

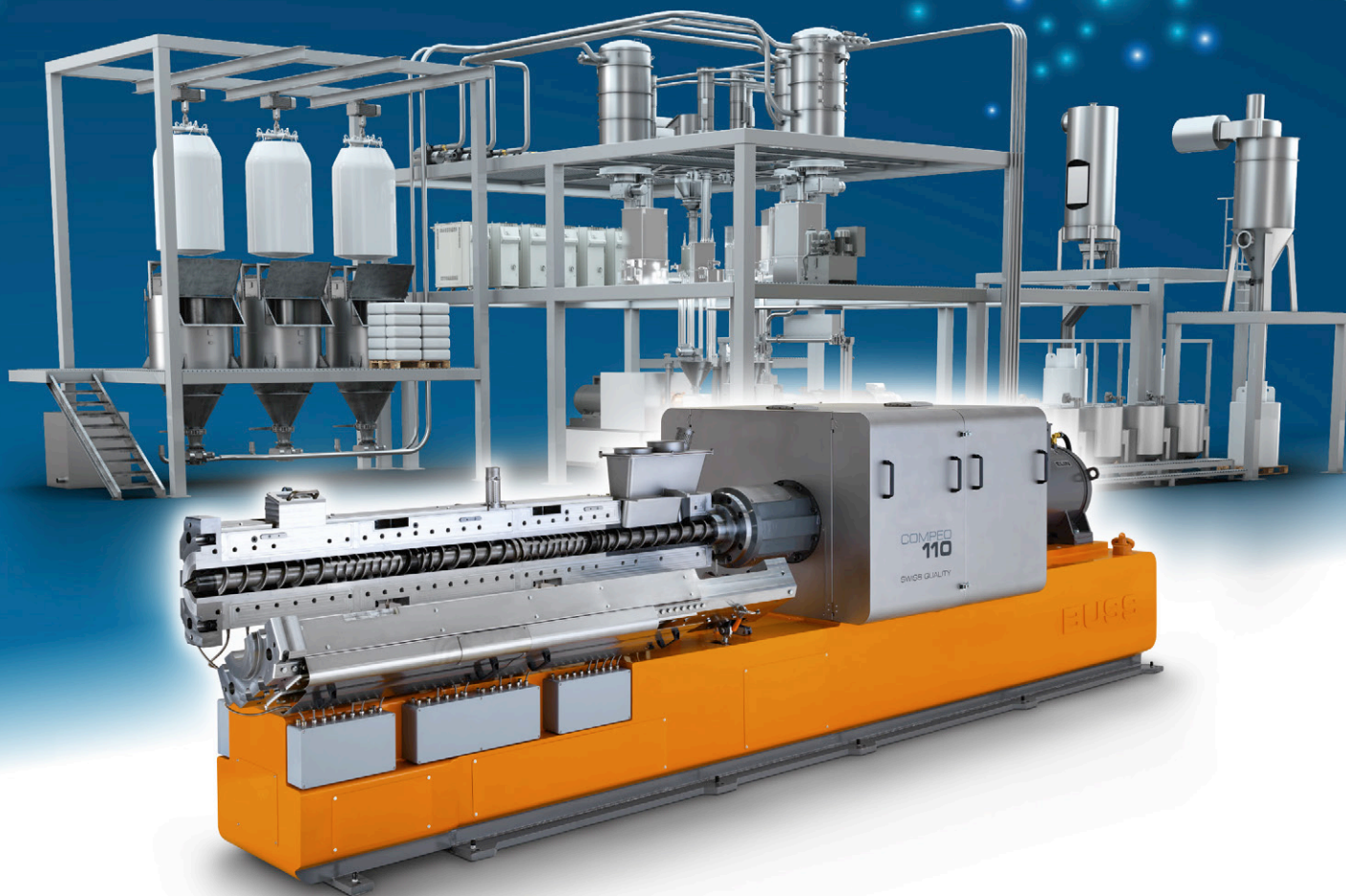
ServiceBox has previously been used only for remote software updates, the company said.

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



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# China's Poly Plastic orders 28 Maag pelletising lines

Chinese masterbatch producer Poly Plastic Masterbatch (Suzhou) has placed a major order for pelletising equipment with Maag as part of an upgrade of its 27,000m<sup>2</sup> plant at Suzhou.

The contract includes 28 pelletising systems with a combined throughput of 25,000kg/h. It includes two automatic Jet Stream systems, 6 EBG conveyor belt systems with Baoli S dry-cut strand pelletisers and 20 WSG water bath lines with Primo E dry-cut strand pelletisers. The equipment will be installed in the second quarter of next year.

Poly Plastic Masterbatch (PPM), which was set up in 2002, specialises in the development and manufacturing of PET, PA and additive masterbatches used for dope dyed yarn. Its product range includes colour, black, additive and delustre masterbatches for fashion, sport fabric and carpet application.

The company operates from two production



**Poly Plastic Masterbatch General Manager Yiming Xu (left) with Maag China Sales Manager Band Chen**

locations, at Suzhou and Siyang, and has a total production capacity of around 37,000 tonnes, placing it among China's leading masterbatch producers.

PPM is a new customer for Maag. The machinery manufacturer said PPM selected it because its equipment met its high demands for machine and pellet quality and could supply and support all the different pelletising technologies from its operation at Shanghai.

■ Maag Group has also strengthened its digital

capabilities with the purchase of Germany-based XanTec, a manufacturer of advanced industrial control systems used in production plants, pelletising systems and extruders.

Group president Ueli Thuerig said: "This acquisition fits perfectly with our strategy to strengthen our digital capabilities. It is also, he added, "aligned with our goal to continue expanding our portfolio with industry-leading systems and solutions".

> [www.maag.com](http://www.maag.com)  
> [www.ppm-sz.com](http://www.ppm-sz.com)

## Hromatka buys into Guzmán

Austria's Hromatka Group, a family-owned business that distributes thermo-plastics across C&E Europe and makes the SAX line of polymer compounds, is to buy a majority stake in Guzmán Polymers of Spain. This includes Guzmán's international subsidiaries and 50% stake in Augusto Guimarães & Irmao in Portugal.

Based in Valencia and part of Guzmán Global, which is also family-owned, Guzmán Polymers employs 125 and turns over about €180m annually through distribution of around 80,000 tonnes/year of plastics in Southern Europe. It has worked with Hromatka for 15 years.

Hromatka said the move will expand the geographical scope of its distribution business. It said the fit between them is fully complementary. New York-based investment bank DC Advisory advised Guzmán Global.

> [www.hgmaag.ch](http://www.hgmaag.ch)  
> [www.guzmanglobal.com](http://www.guzmanglobal.com)

## Conventus Polymers extends its offering

Conventus Polymers is to distribute Evonik's Vestakeep PEEK compounds for all industrial applications in the US and Canada. It will also handle the EMS-Grivory range of specialty polyamides in the US and Canada.

The Evonik agreement includes wire and cable, automotive, defence, electrical and aerospace but not the medical and healthcare portfolio.

Vestakeep compounds are said to offer a combination of properties including chemical, temperature and abrasion resistance, lubricity, high rigidity, low weight and versatile processability.

The EMS-Grivory grades are based on amorphous, cycloaliphatic, long-chain PA12, PA1010, PA612, PA610, partially aromatic and polyphthalamide (PPA) chemistries. Conventus will be

targeting primarily injection moulded non-automotive metal replacement of zinc and die cast structural components, as well as applications requiring high transparency, chemical resistance, and toughness. Target application sectors include electrical, plumbing, oil and gas, consumer, healthcare, and lighting.

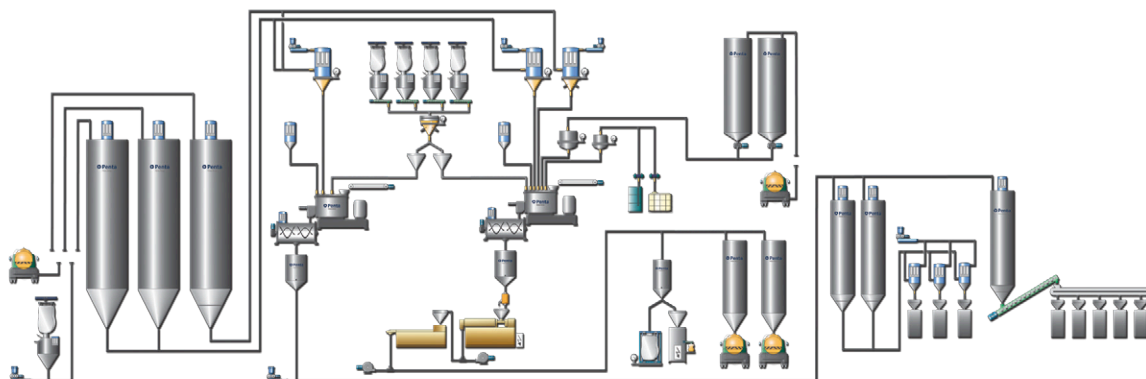
> [www.conventuspolymers.com](http://www.conventuspolymers.com)



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# KM lays foundation stone for new extrusion systems facility

KraussMaffei laid the foundation stone earlier this month for its new 66,500m<sup>2</sup> extrusion systems production plant at Laatzen, near Hanover in Germany.

The new facility will be completed by Q3 2022 and will replace the company's Kleefeld factory – the traditional home of the Berstorff extrusion business – which it says could not be expanded any further. It will allow all KraussMaffei extrusion activities to be located under one roof.

Around 750 people will work on the site, which will include a 10,000m<sup>2</sup>



**Left: Construction of KraussMaffei's new extrusion plant at Laatzen in Germany is now underway**

Innovation Centre, within which customers will be able to run complex preliminary line trials under realistic production conditions before ordering new machines. The centre will house 20 machines ranging from laboratory

to production-scale.

KraussMaffei is working with commercial real estate developer VGP on the project. It recently completed construction of a new factory for the company's Burgsmüller subsidiary in Einbeck in Germany and is also building the new KraussMaffei Technologies HQ at Parsdorf near Munich (the foundation stone for that was also laid this month).

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

## Nova and Merlin plan PCR PE

Nova Chemicals and Canadian plastics recycler Merlin Plastics Supply have announced a long-term agreement that will see Nova offer PE resins containing post-consumer recycle (PCR).

Under the deal, Nova will provide Vancouver-based Merlin with financing to expand its processing plant at Delta in the province of British Columbia. The investment will enhance Merlin's processing of PCR for food packaging applications, with commercial quantities expected to be available from 2021.

➤ [www.novachem.com/pcr](http://www.novachem.com/pcr)  
➤ [www.merlinplastics.com](http://www.merlinplastics.com)

## Domo Chemicals launches PEEK alternative to PAI

Domo Chemicals has launched Thermec K, which it describes as a PEEK compound that can provide a cost-effective alternative to PAI in a variety of engineering applications without impacting performance.

Developed at the company's laboratory in Mumbai, the new compound is said to be suitable for numerous industrial applications, including bushings and bearings, pump components, medical instruments and food processing machinery.

PAI has generally been the polymer of choice in these applications because its mechanical properties are better than those of PEEK. However, it is also

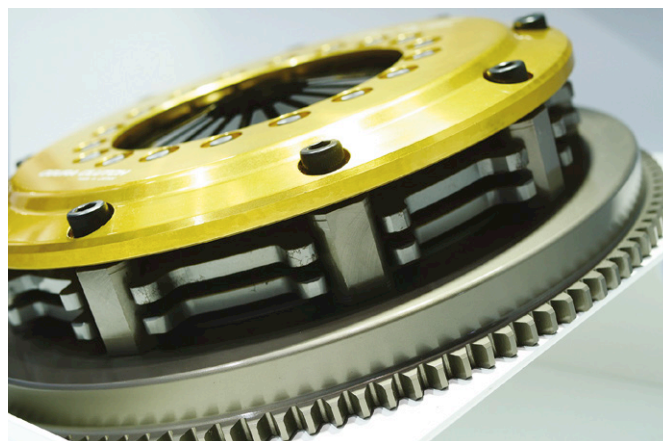


IMAGE: DOMO CHEMICALS

**Domo says its Thermec K PEEK will match PAI performance at lower cost**

more expensive. By blending PEEK with a solid polymeric lubricant, Domo said it has been able to match the friction and wear performance and dry lubrication properties of PAI.

Thermec K is suitable for

use in low wear, high friction applications up to 200°C. It offers a density of 1.32g/cm<sup>3</sup>, compared to 1.42g/cm<sup>3</sup> for PAI, and can also be processed on standard injection moulding equipment.

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



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# Leistritz to build pilot for PET chemical recycling



IMAGE: SHUTTERSTOCK

German extrusion equipment maker Leistritz and Rittec Umwelttechnik have agreed a strategic partnership to launch and commercialise Rittec's RevolPET monomer recycling technology. The deal includes plans to construct a 10,000 tonne/yr pilot plant by the end of 2021.

The two companies have previously worked together on the development of the RevolPET technology, which depolymerises PET polymer to create a raw material for reuse in the same applications. In this new phase of development, Leistritz will contribute its twin screw extrusion machinery and project management expertise.

"We have been working intensively in this segment for years," said Leistritz Managing Director Anton Fürst. "Downcycling or non-recyclable plastic compounds are the limiting factor here. With the RevolPET approach we are taking a big step towards successful chemical recycling."

> [www.leistritz.com](http://www.leistritz.com) > [www.revolpet.eu](http://www.revolpet.eu)

## Americhem acquires in Denmark

US-based compounder Americhem has bought Denmark's Controlled Polymers, which it said it will integrate into its Engineered Compounds division (AEC).

Controlled Polymers specialises in production of medical compounds and masterbatches, with a particular strength in the hearing aid market. It also supplies the packaging, consumer goods, electronics, construction, and automotive sectors, claiming to distinguish itself "through flexible lot sizes, industry-leading lead times and exceptional colour matching capabilities".

Americhem said the acquisition will further expand its global reach and will support "increased product offerings, extended service capabilities, and broadened technical expertise".

Controlled Polymers was acquired from Blue Equity and Chrispa.

> [www.americhem.com](http://www.americhem.com)  
> [www.conpol.com](http://www.conpol.com)

# Epsan launches ABS/PA grades

Turkish engineering plastics compounder Epsan has added a line of ABS/PA compounds to its portfolio, which it will market under the Epimix name.

The Epimix portfolio includes three products: high impact modified; 8% glass reinforced; and 15% glass reinforced grades. It has already started working on specific colour develop-

ments with a number of automotive OEMs, the company added.

"Epimix ABS/PA grades have excellent followability and matt surface finish" according to Seckin Simsek, Research and Innovation Engineer At Epsan.

The new compounds are targeted at automotive interior applications such as seat trims, loudspeaker

grilles, centre console frames, door bezels, air vents, instrument cluster housings and folding trays that require a high quality unpainted finish, good mechanicals and high dimensional stability.

Epsan operates from two production plants in Turkey and has an annual capacity of 45,000 tonnes.

> [www.epsan.com.tr](http://www.epsan.com.tr)

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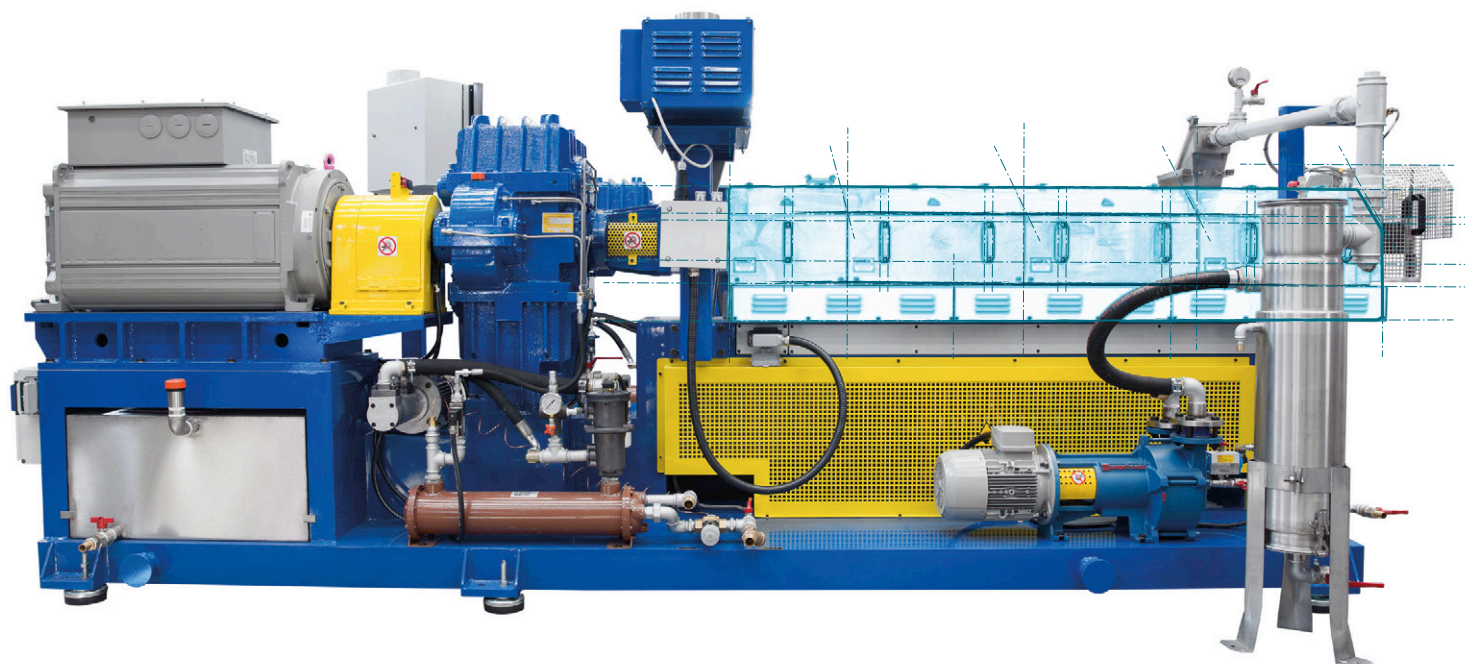
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*Bioplastic consumption is slowly but steadily growing and, with the circular economy gaining pace, beginning to move beyond packaging to more demanding engineered applications. Mark Holmes reports*

# Steady gains for bioplastics

The production and use of bioplastic compounds continues to grow, albeit at a modest pace. Packaging, where consumer demand for sustainable solutions is strongest, remains the biggest opportunity area but other applications are also developing. Bespoke bioplastic compounders, as well as compounders replicating existing ranges with raw materials from renewable sources, are now identifying opportunities in automotive, consumer and industrial goods while manufacturers of specialist fillers are developing products that can take bioplastic compounds to a new level.

Despite the high interest in bioplastics, growth rates are generally in line with overall polymer demand. In its most recent market update, **European Bioplastics** predicted growth of more 15% over the next five years. That forecast was delivered at the trade association's 14<sup>th</sup> European Bioplastics Conference in Berlin, Germany, in December last year, so before the emergence of Covid-19. Clearly, the sector will have been impacted by the pandemic but most would expect bioplastics to at least hold their own against conventional polymers

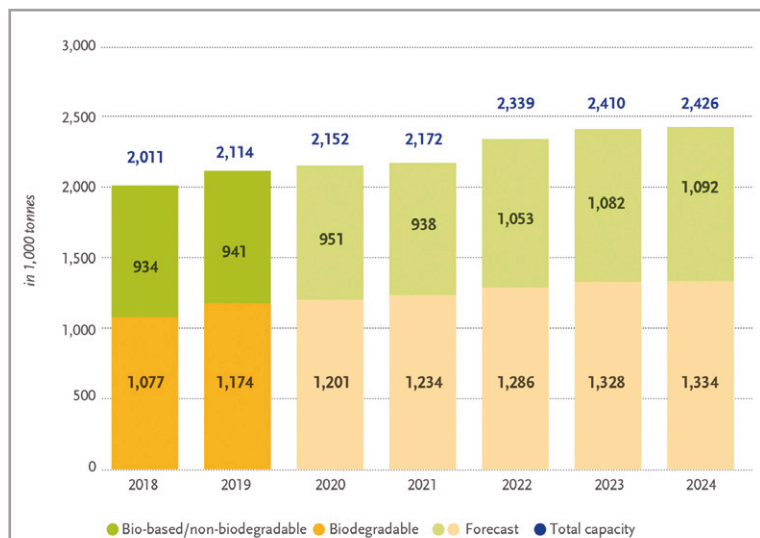
considering what European Bioplastics Managing Director Hasso von Pogrell describes as a "steadily increasing demand for sustainable products by both consumers and brands alike."

The association's pre-Covid analysis forecast global bioplastics production capacity to increase from around 2.1m tonnes in 2019 to 2.4 m tonnes in 2024. Biopolymers such as PHA (polyhydroxyalkanoate) are expected to drive this growth. PHAs entered the market at a larger commercial scale than earlier bioplastics and capacity is forecast to more than triple over the next five years (PHAs are bio-based polyesters that are biodegradable and offer good physical and mechanical properties).

Production capacities for bio-based PP are also expected to grow over the coming years, as is capacity for bio-based PE. Earlier expectations for expansion of production of bio-based PET, however, have not been realised. In fact, production has declined over recent years as the focus of development has shifted to PEF (polyethylene furanoate), a new polymer that is expected to enter the market in 2023. PEF is comparable to PET but is fully

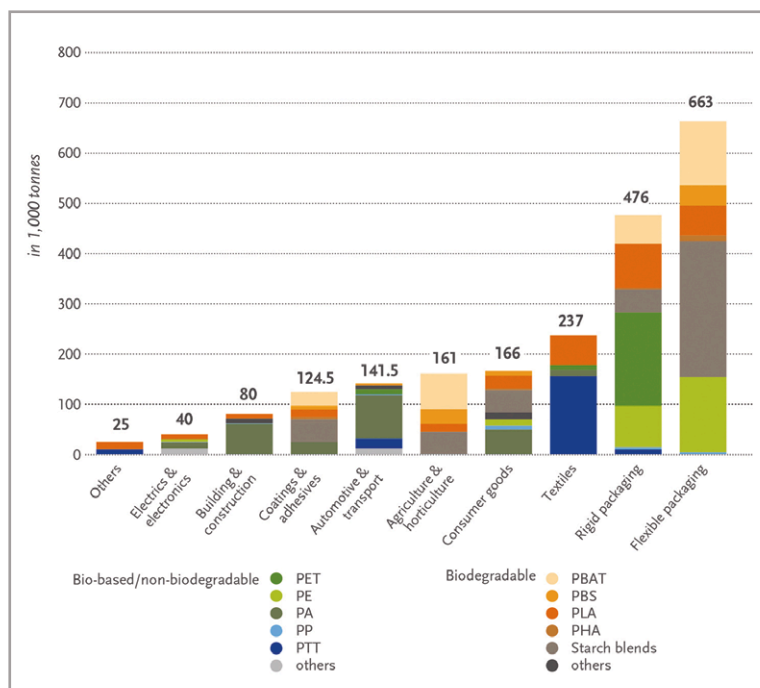
**Main image:**  
**Bioplastics continue to attract attention but focus may be moving from alternative polymers to renewable versions of established plastics produced from plants such as sugar cane**





**Global bioplastics production capacity 2018-2024 (forecasting prior to the Covid-19 pandemic)**

Source: European Bioplastics/Nova Institute



**Global bioplastics production by application 2019**

Source: European Bioplastics/Nova Institute

bio-based and offers better barrier and thermal properties. It is said to be an ideal material for beverage bottles.

Packaging remains the largest field of application for bioplastics with almost 53% of the total bioplastics market in 2019. The European Bioplastics data reveals that sectors such as automotive and transport and building and construction are significantly increasing their relative share. Bio-based, non-biodegradable plastics, including bio-based PE, bio-based PET, and bio-based PA, currently make up around 44% of global bioplastics production capacities.

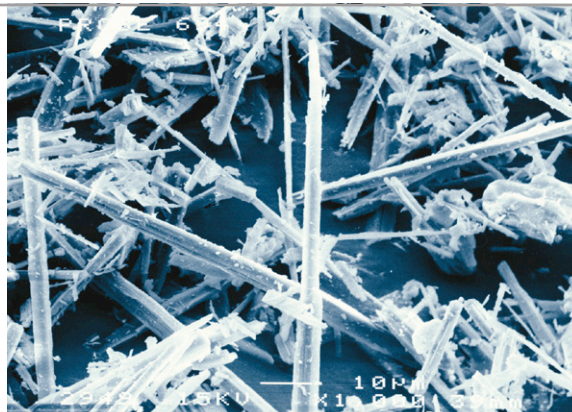
### Consider lifecycles

When looking at the current market situation for plastics it is important to pay consideration to the entire lifecycle, according to Péter Sebő, Head of Marketing and Market Development at **HPF Minerals**, a division of Quarzwerke. "Bioplastics can be used in an increasing number of application areas," he says. "Green polymers are increasingly in focus, with an expected highest growth rate in the automotive and electronics sectors of around 8-10% per year. However, we still have to be aware of the fact that bioplastics are divided into two groups of materials that are not necessarily identical: biodegradable plastics that can be composted and bio-based plastics that are made from renewable raw materials, but barely degrade."

Sebő says that biodegradability can be appealing in certain applications. "The use of biodegradable plastics is particularly interesting where this degradability has a special benefit; for example, flower pots that are metabolised into biomass in the soil, mulch foils that are ploughed in, or organic waste bags that can be disposed of together with organic waste. However, manufacturers and processors of bioplastics face major challenges, such as price, availability and quality, in order to be able to compete with fossil fuel-based raw materials. Otherwise, they have to offer other benefits that justify the price difference from the consumer's

**Right: HPF Minerals has developed a range of short and long needle Tremin 283 wollastonite filler/reinforcement grades for bioplastics**

Source: Quarzwerke/HPF Minerals





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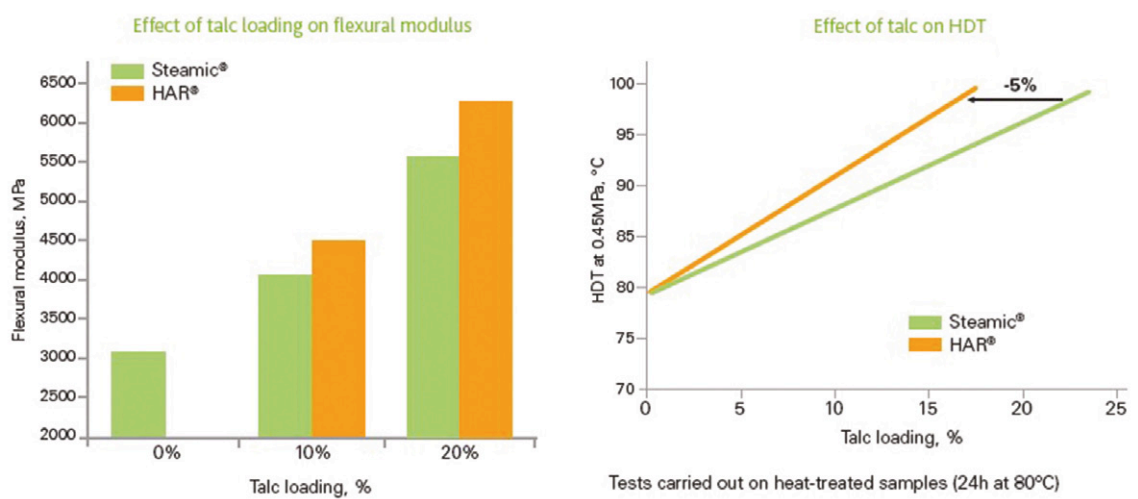
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Graphs show the effect of Imerys Steamic and HAR talc filler in PLA on flexural modulus and heat distortion temperature

Source: Imerys



perspective. Recycling or composting is this advantage for many applications."

Nevertheless, requirements for bio-based plastics are largely comparable to those for petroleum-based plastics. "For example, tighter spatial conditions require higher heat resistance," says Sebö. "Thinner-walled components require improved rigidity and higher strengths are required to replace metal components. The required property profiles can often not be met by biopolymers alone."

HPF Minerals has developed a range of short- and long-needle, as well as coated, Tremor wollastonite functional fillers designed for use in a wide variety of biopolymers. "Freedom from distortion and high impact strength are required," Sebö says. "With long-needle properties, higher stiffness can be achieved. The proportion of these fillers in PLA compounds can be 20-40% by weight, for example."

He says bioplastics reinforced in this way offer a multitude of possibilities in a wide variety of applications. "Wollastonite-reinforced PLA compounds can provide a number of properties, such as excellent rigidity, high dimensional stability (short-needle) and improved impact strength. We are also developing fillers for bioplastics that can also be used for additive manufacturing or automotive applications to meet the requirements that up to now have been restricted to synthetic polymers."

**Imerys** is also supplying fillers for bioplastic compounds and reports demand for bio-based and biodegradable materials is constantly rising. Challenges the bioplastics industry faces are wide ranging, the company says, and include the need for sustainable solutions that meet compostability and biodegradability targets, as well as the availability of feedstocks and raw materials. Broad processing windows are essential and mechanical properties and thermal resistance require attention

as many bioplastics tend to be inadequate for most applications. Unsurprisingly, cost-effectiveness is also a top priority.

The company has developed a number of talc products for use as fillers in bioplastic compounds. "For rigid applications, process-wise talc improves the melt strength of PLA and polyhydroxyalkanoate (PHA) and eliminates strand breakage during cooling and facilitates compound granulation," says Anaïs Berjeaud, Development Manager Plastics & Rubber at Imerys. "As an effective nucleating agent, the use of talc can significantly increase the crystallisation speed of some biopolymers."

In terms of performance, Imerys says its Steamic, Jetfine and HAR talcs can act as reinforcing agents in biopolymers such as PLA, PBS (polybutylene succinate) and PHA. This can improve heat deflection temperature, dimensional stability, barrier properties and stiffness. All these properties are key requirements for improving and optimising the final properties of bioplastics.

## Compostable options

Talc can also be used in compostable biopolymer formulations complying with European standard EN 13432. Imerys says its Eco-Delink engineered calcined kaolin has been developed specifically to enhance compostability. The addition of Eco-Delink not only considerably reduces the cost of a biopolymer formulation, but also significantly improves its processability by increasing melt strength and reducing tackiness. "At 20% loading in PHA, Eco-Delink provides faster degradation, as well as improving processing conditions," says Mike Bird, Development Manager Plastics & Rubber.

For bioplastic film applications, Imerys says it also offers specific engineered calcium carbonate grades that can help maximise processing, optical and mechanical properties and reduce the cost of



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IMAGE: BIO-FED



**Above: M VERA GP1012 from Bio-Fed is designed for thin wall applications that require high stiffness, such as coffee capsules**

bioplastic formulations. It adds that future tailored industrial minerals will add more functional value to bioplastics, boosting both performance and sustainability and enabling them to address presently-unmet needs from the entire value chain.

PLA producer **NatureWorks** has collaborated with Flo, a major European food packaging manufacturer that is increasingly engaged in research of sustainable high-quality products, to introduce three additional coffee capsule formats in its GEA family that are industrially compostable and fully bio-based. The GEA capsules are all made with industrially-compostable Ingeo PLA resin from NatureWorks, which is used to produce lidding, filters and capsule body.

The new capsules extend the application of the GEA capsules beyond the original A Modo Mio system, to include Nespresso, Lavazza Blu, and Keurig coffee systems. According to Flo, the construction of each has been tuned to achieve the ideal pressure needed to deliver maximum taste, crema and aroma from each system. According to Natureworks, recent testing carried out at the Accademia Italiana Maestri del Caffè (AICAF) has verified that the GEA capsules maintain the flavour and aroma of the coffee for more than 11 months

(testing is still ongoing). It says this is sufficient to meet the needs of the most demanding coffee roasters and consumers.

### Capacity expansion

Italian compounder **Sirmax** last year acquired a 70% share in Microtec – a manufacturer of BioComp biopolymer compounds. It is preparing to double its output of biocompounds and this year installed two new ZSK lines from **Coperion**. The ZSK 70 Mc18 twin screw extruders have been specifically designed for the production of bioplastics. The 70 mm screw diameter units are equipped with ZS-B side feeders and ZS-EG side devolatilisation units.

“With Microtec’s capabilities and Coperion’s technology expertise, it is possible to develop bio-based materials for traditional areas of application, such as automobiles and household devices. Even the application spectrum for non-durable products, such as single-use flatware, trash bags, and food packaging can be expanded in this way,” says Massimo Pavin, Chief Executive Officer of Sirmax.

“Long term, we are planning to expand our bioplastics production to 16,000 tonnes per year. Investments will support the production of a wide range of sustainable compound which will increase the actual Sirmax product portfolio, in line with the multi-product strategy of the company,” he says. The additional capacity will be used to produce compounds based on starch biopolymers, co-polyesters (PBAT), PLA and PBS.

Akro-Plastic’s **Bio-Fed** division has extended its M VERA range of its home compostable and soil-degradable compounds. Depending on the application profile, these biodegradable compounds are suitable for short or long-term use and can be fully or partly produced from renewable raw materials. As well as grades for film extrusion, the company also offers compounds for injection moulding.

The new M VERA GP1012 grade has been

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**Right: Japan's Seven Café is using Kaneka's PHBH bioplastic to produce drinking straws**

specially designed for injection moulding of parts with wall thicknesses up to 1mm. The company says it is particularly suitable for applications requiring high stiffness (it offers a tensile modulus of 2,000 MPa), making it a good choice for production of a wide range of parts such as household articles, packaging and coffee capsules.

"This compound consists of almost 100% high-quality, renewable raw materials and is excellently suited for the production of rigid objects," says Ulf Malcharczik, Business Development Manager at Bio-Fed. According to the compounder, food safety approval has also been granted. "Our customers are increasingly demanding products that meet all these mechanical properties, as well as the raw material origin and a corresponding end-of-life scenario," he says.

### Alternative straws

Kaneka's PHBH plant-based biodegradable polymer is being used for production of straws by Japan's Seven Cafés, and has been introduced in almost 21,000 Seven-Eleven stores across the country since last year (the 8mm diameter straws have been adapted to suit the distinctive bead-shaped ice cream used in Café Latte Sweets.

PHBH is a 100% plant-based biodegradable polymer developed by Kaneka. The polyhydroxybutylhexanoate polymer is a type of PHA and is said to offer good biodegradability under a wide range of environments. The resin (PHBH is used by Kaneka as a tradename) has attained OK Biodegradable Marine certification, which recognises biodegradability in seawater. It is also on the



positive lists for the US FDA, Japan Hygienic Olefin and Styrene Plastics Association and the European Commission.

German bioplastics specialist **FKuR** has expanded its portfolio of bio-based thermoplastics for packaging, consumer product, sporting goods and technical part production. The latest additions include two glass-reinforced grades within the Bio-Flex and Terralene product family, both offering high rigidity, and three Terraprene TPE grades, one characterised by a high bio-content and the other two their oil-free formulation.

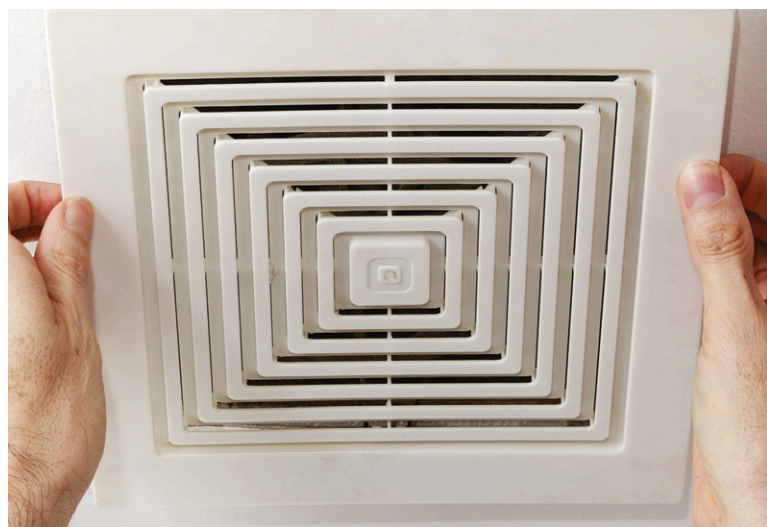
The company says Bio-Flex GF30 is a PLA based compound with a glass fibre content of 30%. This combines a relatively high stiffness of around 8,400 MPa with an equally high tensile strength of 70 MPa. Due to the high glass fibre content, the notched impact strength is also good, at 6.4 kJ/m<sup>2</sup>, while wear resistance is also better than for unreinforced types. The grade is suitable for applications where high mechanical strength is required but not resistance to high temperatures or fire. The company cites examples such as housings, castors, gears, sports equipment, orthotic devices, pipes and pipe systems.

According to FKuR, Bio-Flex GF30 offers a calculated bio-based carbon content (BCC) of more than 70%. BCC is a measure of new organic carbon in a material (plant-derived, for example) compared to old organic carbon (oil-derived).

Terralene GF30 is a bio-based PE compound with a glass fibre content of 30% and a calculated BCC of more than 94%. The stiffness of 4,800 MPa is significantly higher than that of mineral-filled grades. Wear resistance is also superior to unfilled grades. Pitched as a bio-based alternative to petrochemical-based glass reinforced PE grades, it is said to be suitable for production of engineering parts such as tubes, dowels and brackets, and orthotic devices.

The new additions to FKuR's bio-based Terraprene TPE compound family include SI 701 and SI 801 grades, which offer calculated BCC values ranging from 55-75% and are available in hardnesses ranging from 40-80 Shore A. Properties are said to be similar to conventional TPE-S grades while typical applications include two-component injection moulding, where they offer good adhesion to polyolefins. Terraprene CI 250 84A and Terraprene CI 450 93A are oil-free TPEs with a

**Below: Ventilation covers are one potential application for the latest glass fibre reinforced Bio-Flex and Terralene compounds from FKuR**







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IMAGE: AVIENT

**Above:**  
Avient's  
ReSound OM  
TPEs contain  
bio-content and  
are suitable for  
overmoulding  
applications

Shore A hardness of 84 or 93. They offer a soft-touch surface and good resistance to kinking and deformation, allowing them to substitute TPE-O and PVC in many injection moulding applications.

### Renewable TPEs

A number of new TPE grades are also available from **Hexpol TPE**, which recently extended its Dryflex Green range of bio-based TPE Compounds. The series now includes grades based on styrenic block copolymer (TPS) and thermoplastic polyolefin (TPO) technologies, with renewable content said to be more than 90% (ASTM D 6866-12). Hardness values range from 15 Shore A to 60 Shore D.

Dryflex Green TPE compounds contain raw materials from renewable resources, predominantly plant-based polymers, fillers, plasticisers and additives. According to Hexpol TPE, they can usually be used as a drop-in solution for conventional TPEs without the need for tool modification. Mechanical and physical properties are comparable to petrochemical-based TPEs. The grades offer good bonding behaviour to PE and PP in overmoulding applications, with special grades available that will bond to ABS, PC/ABS and PET. They are said to be recyclable and easy to colour, with some grades also compliant with food contact regulations.

The materials can also be used for automotive interior applications and have been tested for compliance with Vehicle Interior Air Quality (VIAQ) and other relevant standards regarding odour, fogging and VOC. Hexpol TPE says odour and fogging tests on representative Dryflex Green grades demonstrate low emissions performance. For example, a 75 Shore A Dryflex Green compound with a renewable content of 20% showed VOC (42,8 µg/g) and Fog (474 µg/g) in the thermodesorption test according to VDA 278 and odour 3.0 in the VDA 270 C3 test. Such results

**Right: Bio-based Dryflex Green TPEs from Hexpol meet automotive interior emission requirements**

mean the materials are a good choice for applications such as floor mats, cup holder liners, fascia, trim and inlay mats.

**Kraiburg TPE** has also been developing thermoplastic elastomers containing variable proportions of renewable raw materials. The company says that while it is technically possible to produce bio-based materials with very high proportions of renewable raw materials, the costs for such materials are usually high and mechanical properties can be limited. However, it says its modular approach to formulation allows it to develop customer-specific materials with different proportions of renewable raw materials that meet requirements in terms of specific mechanical properties such as tensile strength and elongation. Other typical requirements include good processing, heat resistance and adhesion to ABS/PC or PP and PE.

Kraiburg says it sees tremendous potential for custom-engineered thermoplastic elastomers with adjustable proportions of renewable raw materials of up to 90%. Potential applications exist in the consumer, industrial and automotive markets, such as toothbrushes and hypoallergenic elastic watch straps to fender gaskets.

**Avient** (formerly PolyOne) has developed its ReSound OM – overmoulding – TPEs as the latest addition to its sustainable solutions portfolio. The new formulations use between 40 and 50% bio-renewable content, derived from sugarcane and offer hardness levels and performance comparable to standard TPEs. Commercially available in all regions, the product portfolio consists of four overmoulding grades suitable for use with rigid polypropylene and one for overmoulding onto ABS.

All ReSound OM grades are formulated for durability, delivering property retention and UV resist-

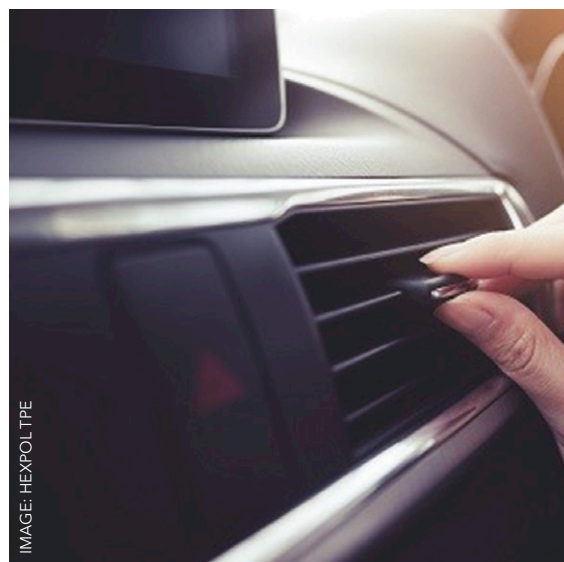


IMAGE: HEXPOL TPE



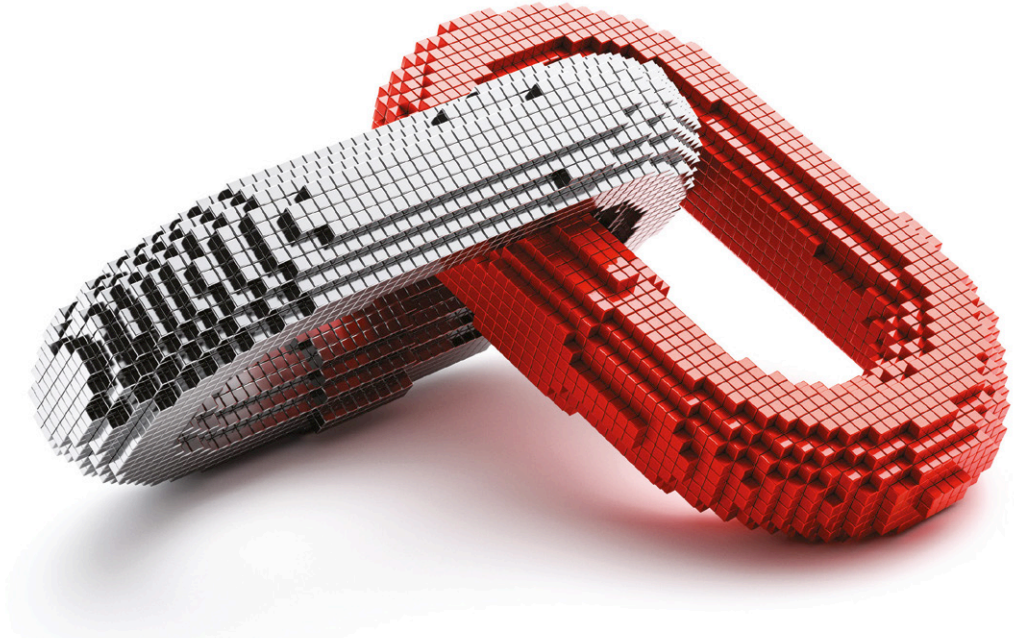
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ance comparable to traditional TPEs. The new grades also provide easy colourability, which is a major requirement for applications in target markets such as cosmetics packaging, personal care products and consumer electronics. With an opaque natural colour, the TPEs can use traditional or renewable colorants.

### Adopting balance

One of the more recent introductions to the bioplastics sector is the concept of "mass balance." This approach recognises the difficulty of accurately identifying the specific source of raw material used in a particular sack of plastic resin produced in a traditional plastics plant by applying a mathematical model that considers inputs and outputs. As the source of the inputs and scale of the outputs is known, a specific "mass balance" value for aspects of the plant's production – such as renewable content – can be calculated.

One of the company's in the front line of this approach is **BASF**, which is using mass balance techniques to allocate renewable substitutes for petrochemical-based feedstocks based on plant and waste oils in its production plant. The technique is also used in its ChemCycling programme to calculate recycled content. Earlier this year, the company announced a further extension, saying it aims to provide customers with carbon footprint data – Product Carbon Footprint – for every product it manufactures by the end of next year. "By calculating the CO<sub>2</sub> footprint, we bring both together and create much greater transparency for our customers regarding the specific emissions for each BASF product," says Dr Martin Brudermüller, Chairman of the Board of BASF. "This enables us to develop plans together with our customers to reduce CO<sub>2</sub> emissions along the value chain up to the final consumer product."

Another key player in renewable feedstocks is **Neste**, which has converted its business from petrochemical to renewable hydrocarbons. It has recently announced cooperations with Covestro and Borealis. **Covestro** will be supplied with renewable hydrocarbons to replace some fossil raw materials used to date in the manufacture of polycarbonates. Initially, the collaboration aims to replace several thousand tonnes of fossil raw materials. And last year **Borealis** started production of PP using some Neste renewable feedstock in its production facilities at Kallo and Beringen, Belgium.

Another polymer major producing renewable material under a mass-

balance approach is **SABIC**, which is supplying its certified-renewable TruCircle PP to Finnish forest products giant **UPM**. It has developed a wood-based bio-composite material – Formi EcoAce – that combines PP polymers produced using wood-based feedstock from UPM's biofuels affiliate of UPM with wood fillers and cellulose fibre reinforcements. The companies say the bio-composite compound can be used as a drop-in solution in many cases. It is near 100% renewable according to the International Sustainability & Carbon Certification (ISCC) mass balance principle (ISCC is a chemical industry standard for managing and tracing sustainability characteristics of circular and/or bio-based materials).

Typical end-use applications for UPM's Formi EcoAce are expected to include food contact, personal care and consumer goods made by injection moulding or extrusion. Aside from the renewable content, a further attraction of the material is its wood-look appearance and warm, silky surface haptics. The companies say the compound can be produced in different colours and a wide range of shades.

### CLICK ON THE LINKS FOR MORE INFORMATION:

- > [www.european-bioplastics.org](http://www.european-bioplastics.org)
- > [www.quarzwerte.com](http://www.quarzwerte.com)
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**Right: UPM's Formi EcoAce wood fibre reinforced bio-composite contains TruCircle certified-renewable PP from SABIC**



IMAGE: SABIC



# A new approach to nonwovens

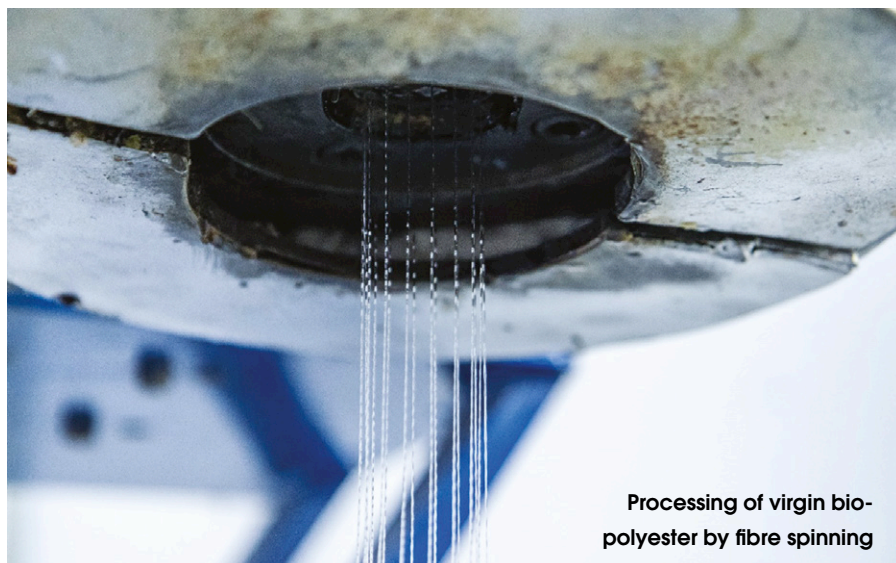
**Unipetrol RPA has been working to develop renewable formulations for single-use nonwovens that offer compostability without performance or processing compromises**

Nonwoven fabrics have revolutionised the production and performance of hygiene products such as diapers but it is becoming ever clearer that benefits in service bring challenges at end of life. Hygiene products are almost always disposable single-use products and diapers, for example, lead to significant waste volumes that cannot be upcycled. Much ends in landfill, where it may cause environmental problems for the future.

The European Union is bringing in new legislation aimed at restricting single-use plastics and this is likely to become a worldwide trend. Diapers and other nonwoven hygiene products may not be within the scope of these regulations but, as the materials cannot be re-used or re-processed into another product, new approaches are needed to develop better end-of-life solutions while maintaining performance.

Typical nonwovens and fabrics are made from non-renewable petrochemical resources such as polypropylene or polypropylene/polyethylene blends. This is not a “green” solution — each child will use at least five single-use diapers a day creating thousands of tonnes of non-recyclable and non-degradable plastic waste every year.

Czech petrochemical and refinery producer Unipetrol RPA cooperated with the Polymer Institute Brno to develop a



**Processing of virgin bio-polyester by fibre spinning**

new approach to plastic nonwovens. The main criteria were to ensure easy processing, to maintain end-product properties, comply with relevant legislation on human safety and body contact, and to ultimately reduce environmental impact at end of life. A key focus was to use renewable plant-based bioplastics that biodegrade under industrial composting conditions.

Meeting all the required criteria, and particularly the performance, was accepted as a challenge but a slight deterioration in final product properties was considered acceptable if compensated for by the added benefits that could come from the switch to a

compostable polymer. A compromise was to be found between material processing, product service life and subsequent waste management.

The goal was to enhance biopolymer processing using fibre spinning technology to obtain nonwovens with properties and behaviour comparable to typical polypropylene fibres but with the additional benefit of industrial compostability. Laboratory scale tests have shown good results for blends based on bio-polyesters in combination with anti-hydrolysis, melt-thickening and surface modification additives. These ensure high melt strength and eliminate fibre failure during processing.

The new fibre formulations show performance comparable to polypropylene fibres in terms of soft-touch and strength while maintaining suitable elongation. The polyester-based formulations can also meet UV stability requirements without the need for additional additives. All of the components are non-toxic and meet FDA and pharmacopoeia restrictions.

Tests show the nonwoven formulations can be used in the same applications as standard polypropylene nonwovens. They will now be pilot tested at production scale in cooperation with a major Czech nonwovens producer and compostability behaviour will be evaluated.



**Nonwoven fibres produced with the new compostable bio-based polyester formulations**



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*Increasingly stringent regulatory, environmental and performance demands mean pigment producers are looking beyond aesthetics in their developments. Peter Mapleston finds out more*

# Pigments move beyond aesthetics

The latest developments in pigments for plastics are a response to market demands that go well beyond aesthetics. Increasingly, they are providing answers to environmental questions. The trend to substitution of heavy metals, through the use of new inorganic and organic pigments, has been ongoing for some years. Now, that has been supplemented with a growing interest in pigments derived from renewables. And, more recently, a strong focus on pigments that can replace carbon black.

Carbon black is a highly effective pigment but it has a big disadvantage in applications such as single-use packaging, where it makes the plastics material virtually invisible in the automated Near Infrared (NIR) sorting equipment used in post-consumer recycling operations. So a host of new alternatives is now being made available from various suppliers. These are not as black as carbon, but in many cases that may work in their favour, with brands opting for very dark blues or blacks for a slightly different look.

However, innovation is not focused solely on environmental concerns. With the continuing

growth in the use of engineering plastics in applications that, for various reasons, benefit from colour, new pigments are emerging that offer the heat resistance to survive high temperatures in both processing and in use. This article takes a look at some of the latest moves by pigment suppliers to the plastics industry.

**Milliken** is one of the world's largest colorant producers, with products for polyurethanes as well as thermoplastics and particularly – through its long-established ClearTint polymeric colorants – for PP-based consumer packaging. Its 2017 acquisition of Keystone Aniline Corporation – an important supplier of dyes, pigments, pigment dispersions and polymers – extended its offering into amorphous thermoplastics such as PS, PET, acrylics, and engineering thermoplastics (ETPs).

Recently introduced products for ETPs include pigments suitable for resins with processing temperatures from around 250 to 300°C, and in some cases higher, says Sami Palanisami, Market Manager KeyPlast Colorants for Plastics. For some time, he says, there has been a lack of vibrant

**Main image: Colour has to be matched by long term stability, favourable environmental profile, and compliance with increasingly stringent regulations in development of today's performance pigments**





**Right: This yellow is one of a line of 12 new colours for engineering thermoplastics in the KeyPlast Resist range from Milliken**

colours that could withstand these sorts of temperatures, due largely to the withdrawal of cadmium-based pigments. "We saw some gaps in the market, especially in oranges," he says.

The company introduced a range of 12 products to fill this perceived gap at K2019 late last year under the Keyplast Resist banner. They are suitable for use with resins such as polyamides, polysulphones, modified PPO (SABIC's Noryl, for example), and a number of other high-heat polymers and alloys. The range includes five reds, one orange, three yellows, a green, a blue, and a violet black.

### The PA challenge

PA resins in particular have provided significant colouring challenges in the past due to their chemical composition, Palanisami says. "At first, many thought this problem to be related to the high heat processing requirements for nylons. But subsequent research revealed that normal colorants are reacted with the amide group and ruined by discoloration due to the loss of conjugation in the colorant molecule."

Palanisami explains that precisely-controlled colouration is often required in PA applications, such as components for power tools, automotive components, gears, and appliances. He says KeyPlast Resist grades can be used effectively with unfilled, glass reinforced, and flame retardant compounds. "They are high purity and perform well in the high-temperature and chemically-reductive conditions typically associated with high-performance polymers," he says.

The KeyPlast Resist grades are said to be highly soluble in the polymer matrix and disperse well without leaving specks or streaking. As they are



IMAGE: MILLIKEN

non-nucleating, they will not induce warpage or create dimensional stability issues, the company says. They are also non-abrasive, so they will not affect glass fibre properties.

Milliken says the new products were well received at the K show, and this has resulted in some fast approvals at polymer suppliers.

Milliken says it is continuing to work on developments in the KeyPlast Resist range, with the aim of further improving thermal and light stability. Palanisami says

he sees good prospects for products in applications such as electric vehicles, for example, where yellows, reds, and oranges are required for ID purposes. Pigments for such purposes must withstand high temperatures in both processing and use. He says the company is also carrying out more approval testing to ensure colours perform to specification in compounds containing a variety of different additives.

The company says it is also investing heavily in new proprietary chemistries beyond those it currently uses. It says it plans to introduce products based on new molecules in the red and orange range early next year. Target applications will include high-speed charging systems for EVs.

### Regulatory drivers

Regulation and performance are critical factors in pigment selection in today's marketplace, according to Scott Heitzman, Business Development Manager - Plastics, **Sun Chemical Performance Pigments**. "In many cases, replacing diarylides or heavy metal yellows for better compliance in injection molded parts is now a regulatory requirement or technical need," he says.

Heitzman cites the example of the company's new Fanchon Yellow 191 279-9191 pigment as both an economical and high-performance red shade yellow. It is globally-compliant and FDA approved in conditions B-H up to a 1% loading. It also delivers heat fastness in most polymer systems to 275°C to 300°C. He also highlights its new phthalocyanines (PCNs). Fastogen Blue 248-55AE is a hemi-chlorinated PB 15:1 specifically designed for injection moulding that will deliver "durable red shade blue colour at high temperatures and performs very well at low concentrations across a variety of polymers," he says. Also new is SunFast Green 264-77FF, which was originally intended for colouring fibre but is now finding use in injection

**Below: Many pigment suppliers see opportunity in EV technology, which places high demands on colorants**

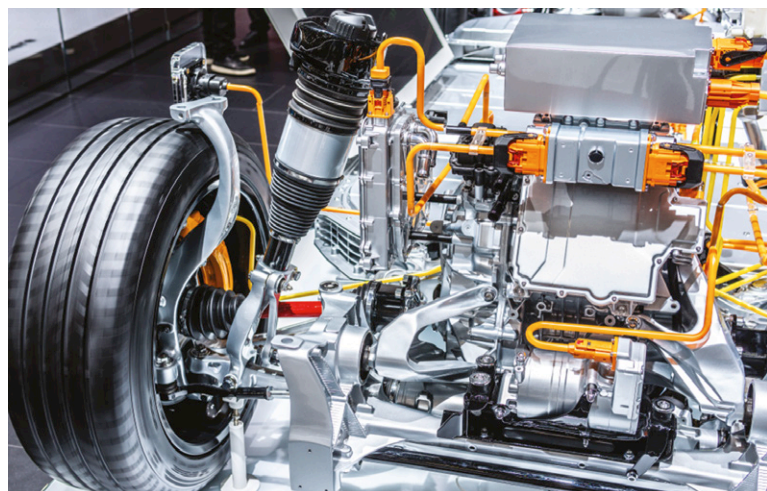


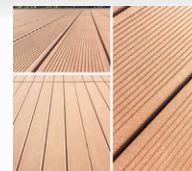
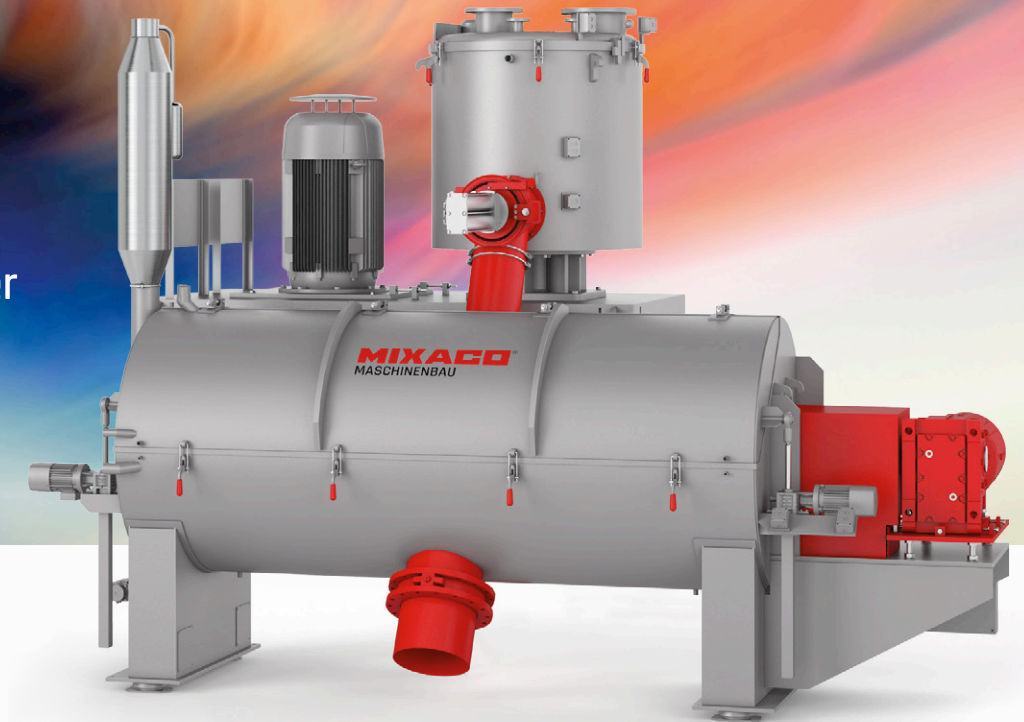
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moulding applications where it can help solve dispersion problems and improve colouring of thin wall-section parts.

**Lanxess**, which is the world's largest manufacturer of iron-oxide pigments and a leading producer of chrome oxide pigments, is also active in developing colours with improved thermal resistance. Its Colortherm brand features a range of synthetic red iron-oxide pigments that are said to provide better thermal stability than comparable pigments. The company attributes this to its proprietary Laux production process, which involves heating the pigments to temperatures as high as 800°C to force traces of water that could cause a colour shift out of the crystal lattice. As a result, the pigments can be processed at temperatures well in excess of 300°C without problem.

Development of a portfolio of pigments for high temperature applications has also been a priority at **BASF Colors & Effects** (at the time of writing part of BASF but it is in the process of being acquired by Sun Chemical parent, DIC). Its latest product launches include Sicopal pigments in the red, turquoise and green colour space, as well as Cinquasia Rubine K 4370 FK, which is optimised for use in Unfilled and glass reinforced PA compounds.

**Below: Clariant is one of several pigment suppliers offering black products suitable for automated NIR recycling sorting systems**

### Sustainability matters

Aside from the thermal challenges, many new developments in colorants are addressing environmental concerns and the growth of the Circular Economy. "The organic pigment market will face various challenges driven by the acceleration of the plastics sustainability agenda," says Philippe Lazzerme, Head of Marketing in the Business Unit Pigments at **Clariant**. "Everything indicates that the

packaging market will be the most impacted. The largest brand owners and packaging producers have committed themselves to use less plastic packaging. Those who continue using plastic packaging will potentially increase the amounts of recycled polymers to up to 70% within the next decade."

The challenges faced with recycled polymers are manifold and most definitely extend to colour, says Andreas Buder, Global Technical Marketing Manager Plastics in the Clariant pigments business. "First of all, the ground tone is greyish and extremely inconsistent. It will be a particular challenge for packaging designers and masterbatch producers to create and match a specific color which should still be visually appealing."

Lazzerme and Buder say that to support both designer and colour matcher, Clariant Pigments has worked with Konica Minolta and Matchmycolor (owner of the Colibri colour communication, matching, and quality control software tools) to prove the suitability of its "Clariant pigment calibration set" to match recycled polyolefins. The pair say that using this calibration set and the Konica software "it becomes increasingly easy to match a strong and appealing colour in just a few steps." The company currently offers the calibration set to its customers and to downstream companies that may need it.

The other important challenge, they say, is the safety, not only of the recycled polymers, but also of the workers compounding and processing the recycled polymers. "To avoid the release of harmful substances after a certain number of recycling loops the use of particular stable pigments is essential. The chemical structure of a pigment doesn't allow any conclusions about its suitability for recycling," Buder says.

Potential pigment-related NIAS (Non-Intentionally Added Substances) can originate from reactants used for synthesis or the pigment itself as they differ in their stability, he says. "Depending on process conditions, exposure during product life, and reprocessing conditions during recycling, some materials might be less stable and migrate or evaporate more easily. Therefore, it is essential to rely on pigments that have been accurately tested under recycling conditions."

### Alternative blacks

For post-consumer recycling to succeed, effective high speed sorting of plastics into different polymer types is critical. To this end, Clariant Pigments has developed a black colorant – Graph-tol Black CLN – and two black polymer soluble dyes – Solvaperm Black PCR and Polysynthren Black H – for sorting of black polymers by NIR



IMAGE: CLARIANT



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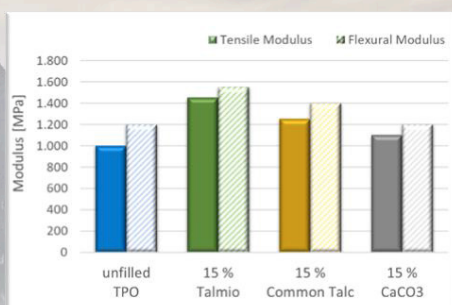
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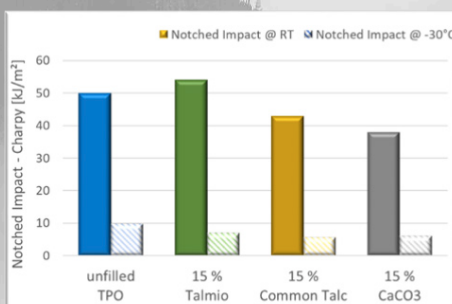
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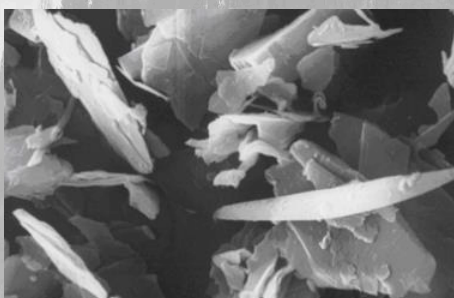
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**Above: Ferro has added two NIR-detectable black pigments to its product slate**

sorting devices. They provide an alternative to carbon black, which normally cannot be recognised by NIR sorting scanners because it absorbs the radiation (it should be noted that carbon black producer **Cabot** says it is working with a number of partners to develop sorting technologies for post-consumer plastics capable of identifying materials containing carbon black).

For packaging applications, Clariant says the Graphtol Black CLN pigment is intended for polyolefins while Solvaperm Black PCR is developed for PET, PS, and PC. Both are food contact approved in selected countries worldwide. Polysynthren Black H is intended for packaging and E&E applications using PC, PMMA, ABS, PBT, compact and expanded PS, as well as PET. "Of particular significance, Polysynthren Black H is one of very few colorants suitable for polyamides, the largest family of engineering plastics," Clariant says.

At **Shepherd Color**, Marketing Manager Mark Ryan says that to address sustainability and recycling issues, the company "has gone beyond the visual into the hyperspectral by using wavelengths of light outside of our visual perception." He says the company has applied its 40-years of experience in IR Black pigments to provide a highly effective solution to the challenge of sorting black plastics. Shepherd Color Black 10P925 is optimised for colouring black food trays, especially in polyolefin resins, and has a dark, neutral mass tone colour.

The Black 10P925 product is designed for virgin plastics; the company has developed Black 10P950 for post-consumer recyclate. "PCR can come in a range of colours and Black 10P950 provides high colouring strength to help overcome the inherent colour while still maintaining the NIR visibility properties needed to allow the material to be sorted again," says Ryan. Both are said to be highly inert, inorganic pigments that are heat stable and non-migratory in a wide range of plastics. The company also says they will not degrade or change colour over multiple extrusions, and hold a wide

range of regulatory approvals around the world.

**Ferro** has also introduced new NIR-detectable black pigments for packaging applications. Its inorganic pigments 24-3950 FCP (PBr29) and Nubifer NB-803K FCP (PBk33) are formulated to reflect light from the emitter, allowing recycling system sensors to correctly identify and sort the plastic. Developed over two years, the NIR reflecting blacks are part of the company's food contact plastics product range, which includes European AP89(1) certification for each lot and compliance with the requirements of EU 10/2011 regarding plastic packaging in contact with food. They also carry FDA approval (FDA 21 CFR 178.3297) for use at up to 5% based on final formulation.

**BASF Colors & Effects** recently-launched Sicopal Black K 0098 FK. It was developed to optimise the recycling of black plastics, particularly packaging, and has now received food contact approval in both Europe and the US. The company says compliance will be extended in the near future to include other regions.

Within the **AF-Color** branch of independent compounder Akro-Plastic, the portfolio of master-batches has also been extended to include carbon black-free color formulations. These are marketed under the AF-Color IR name.

## Cool solutions

Taking another angle on black and NIR, **Lanxess** has developed a black pigment that it says reflects 20% more of the sun's near-infrared radiation (NIR) than conventional products. Plastic roofs and façade elements that are coloured with Bayferrox 303 T heat up less when exposed to solar radiation, meaning that the building's internal environment can be kept cooler. "The temperature in a polymer matrix coloured with Bayferrox 303 T is as much as 8°C lower than when a conventional black pigment is used," says Stefano Bartolucci, Global Market Segment Manager for Plastics in the company's

**Right: Food trays pigmented with Sicopal Black pigment allow NIR sorting in recycling operations**



IMAGE: BASF COLORS & EFFECTS



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**Right: Lanxess has developed a black pigment that reflects 20% more of the sun's near-infrared radiation (NIR) than conventional products, controlling thermal heating**

Inorganic Pigments Group (IPG).

Use of the pigment can also extend the service life of a plastic component considerably, as the thermal decomposition of the polymer matrix is reduced due to lower heat absorption. In addition, the difference between daytime and night-time temperatures is less extreme so plastic components are exposed to reduced thermomechanical stresses, which can lead to crack formation or even bursting. "Bayferrox 303 T's characteristics also make it suitable for use in the automotive industry, to colour the dashboard for example, which is exposed to high and sustained solar radiation," says Bartolucci.

### Colouring bioplastics

Colouring of bioplastics is gaining increasing importance, and is usually achieved with colour masterbatches consisting of a polymer carrier material and the respective pigments. The AF-Eco colour masterbatches from the **Bio-Fed** branch of Akro-Plastic are made with biodegradable carrier polymers. The portfolio now includes a broad range of biodegradable masterbatch carriers and products include carbon black-free dark types. "These new products have been developed to meet the requirements of every biodegradable plastics application and their increasing complexity, also minimising the interactions with other polymer components of the compound," says the

IMAGE: LANXESS



company. It says the AF-Eco products contain pigments certified in accordance with the OK Compost Industrial and EN 13432 standards on biodegradability of plastics (EN 13432 limits the non-biodegradable material content to a maximum of 5% and 1% per individual pigment).

The **BASF Colors & Effects** brand now also includes a growing portfolio intended for use with compostable materials that meet EN 13432 requirements. Further innovations from the company include what it describes as a colour collection optimised for contemporary plastic design. It says the collection "shows how new colorants enable current consumer trends and highlight how sustainable pigments meet the industries diverse demands for safety, reliability and brilliance in plastics coloration."

The most relevant pigment consumption trends include high chemical purity, waste management and demanding engineering plastics, according to Marc Dumont, Head of Global Industry Management Plastics at BASF Colors & Effects, who adds

## Colour forecasting in a time of Covid

Every year, many of the leading companies involved in colour put out their views on trends for the coming months. Most of those have been researched over many months and pre-dated the global impact of the Covid-19 pandemic.

The first post-Covid forecast comes from Ampacet. Discussing colour trends back in April the company's Insight and Innovation Director

**The Covid-19 pandemic will have an impact on future colour trends**

Linda Carroll said: "Prevailing, regional socio - economic conditions have always been a primary influencer of colour direction. This current pandemic, however, will influence colour preference on a global scale in four areas.

"The desire for health and wellness will be reflected in the desire for clean, aquatic blues and lifted, organic green palettes. Our personal sanctuaries have been threatened during this period of unrest, which will result in consumers gravitating to the global colour of trust and integrity, blue."

Carroll explained this would certainly have an impact on colour trends. "The pandemic infused a pervasive feeling of gloom and futility. Fortunately, human resiliency will prevail, and many will gravitate to colours of optimism and hope found in vibrant oranges (colour of fierce independence) and bright, sunshine yellow values," she said.

"Finally, our desire for balance will be tempered by a sense of trepidation due to the unknown economic impact of the pandemic. As a result, earthy browns, and their clear association with physical and intellectual grounding, and the enriched purples - the colour of mystery and spirituality, will find devotees."

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**Right: Bio-Fed offers a full portfolio of masterbatches made with biodegradable carrier polymers**

that the global plastics industry also faces increasingly stringent regulations in sensitive applications such as food contact materials and toys. Accordingly, Colors & Effects has been extending its Utmost Purity pigment range, which it launched last year with the introduction of Irgazin Red K 3840 UP. This has now been joined by Heliogen Blue K 7097 UP. Dumont says the pigments are intended to allow users to keep ahead of regulatory changes and are supported by food contact certificates.

For consumer goods, where bright colours and sparkling effects are often an important selling factor, Colors & Effects has launched Irgazin Rubine K 4082, which Dumont says is an improved Rubine DPP pigment. "Its extreme transparency turns it into an excellent formulation partner for brilliant effect pigments like Lumina Royal Russet to achieve vivid lava reds with strong sparkling effects," he says. High chemical purity also enables the new pigments to meet global regulations for food contact.

### Expanding capacity

Canada's **DCL Corporation** – the result of the 2018 merger of Dominion Colour Corp and Lansco Colors – has been building new high performance pigment capacity that was commissioned a few weeks ago. "We believe this may be the first investment in new capacity of its kind in North America for decades," says Frank P Lavieri, Executive Vice President Sales & Marketing at the company. "We intend to manufacture Hansa and benzimidazolone yellows primarily for the coatings industry, and calcium salt azo yellows (Yellow 62, 168, 183, 191) and Yellow 155 primarily for the plastics industry. We feel that this new capacity will meet a need for high quality pigments available with short lead times."

Meanwhile, **Lanxess** has added to its technical services for pigment customers. Its IPG business



unit now has an expanded technical centre in operation at its largest site in Krefeld-Uerdingen, Germany. The facility is equipped to carry out automated measurement of thermal stability in customer-specific plastics applications. "From sample-loading to colorimetric analysis, all the necessary modules can be actuated via automated processes," says Bartolucci. "That allows us to carry out highly specific tests with supreme accuracy."

Lanxess now also offers extensive pigment expertise for colouring filaments for 3D print applications. At the Uerdingen centre it can carry out in-depth tests on the effects of pigments, and advise customers on colouring with iron-oxide pigments. "For example, in the case of short dwell times and relatively low shear forces in the processing machines, it is necessary to ensure good dispersibility," says Bartolucci.

"The pigments need to be easy to distribute and must reach their final colour strength quickly," he says. "At the same time, we can demonstrate ways of partially reducing the organic pigment content in a filament formulation by means of iron oxides, when the application calls for better weather stability." Bartolucci also says that, in contrast to organic colorants, inorganic pigments provide high temperature and weather stability at relatively low costs, as well as excellent migration resistance.

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- > [www.pigments.com](http://www.pigments.com) (DCL Corporation)

**Below: Lanxess has expanded its technical centre at its largest pigments site at Krefeld-Uerdingen, Germany**







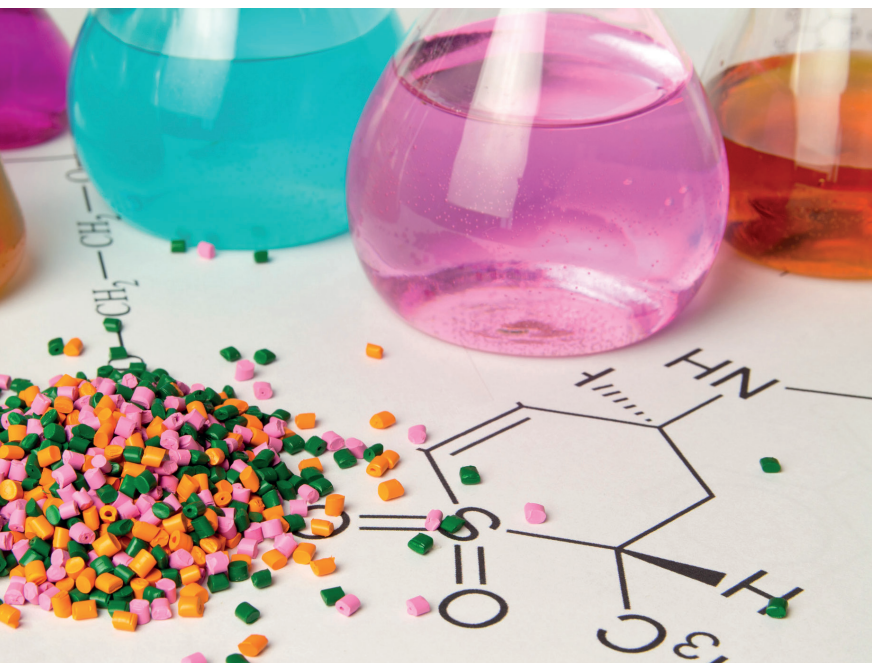
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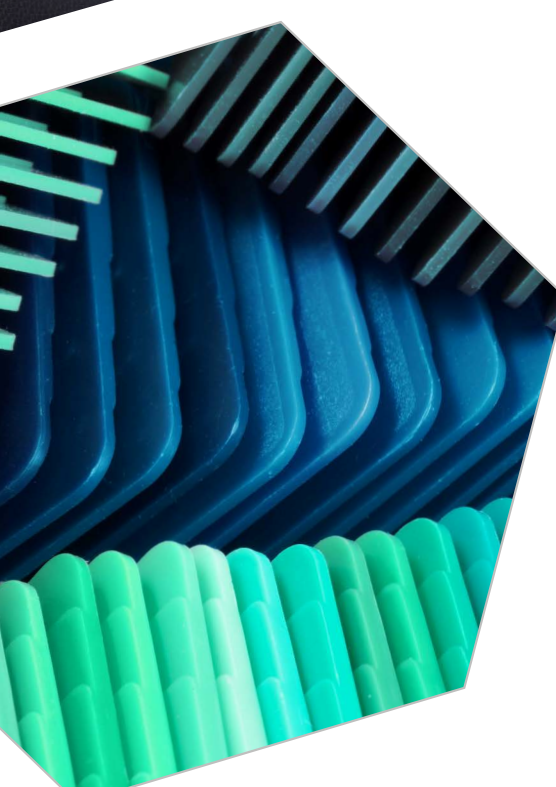
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# Bringing stability to plastics



IMAGE: SHUTTERSTOCK

*Requirements for polymer stabilisers are changing. Thermal and UV stability remain the prime considerations but recycling and emission performance now also come into the mix.*

**Peter Mapleston reports**

Whether next to a high power output car engine or sitting under the sun for months on end, many plastics need an effective stabilisation package to enable them do their job. Whether the parts are injection mouldings, or extruded pipes, wire coatings, tapes, or filaments – all benefit from extra stability. Most often in terms of stabilisation we are talking about polyolefins, but certainly not always – a great deal of effort is also put into keeping engineering thermoplastics such as polyamides (PAs) performing at their best.

The importance of stabilisation is also being enhanced by legislative and consumer attitudes towards more sustainable plastics solutions. Achieving the goal of a Circular Economy, where plastics will have more than one useful life, is likely to call for improvements in stabilisation of recycled materials. A major challenge for industrial and post-consumer recycled polyolefins, for example, will be to maintain the original virgin resin proper-

ties, such as mechanical, aesthetics, visual, and odour, to enable the recycled resins to be used in higher value applications.

"From an antioxidant perspective it is critical to maximise polymer protection during the reprocessing encountered in recycling operations to maintain the melt flow and colour of the resin," says Irfaan Foster, Director - New Business Development at **SI Group**. Last year, the company launched an innovative new range of solutions, under the brand Ultranox LC. The grades are designed to extend colour control and melt flow protection to enable recycled polyolefins to be used in more colour-sensitive applications, and so open up new applications, Foster says.

Ultranox LC PP301 is described as a cost-effective colour protection solution exceeding the performance of commercially available high performance phosphites; Ultranox LC PP501 is the next generation colour protection solution designed

**Main image:**  
Whatever the application, plastics must be appropriately stabilised to withstand exposure to heat and UV during their expected service life

**Right: Meeting Circular Economy goals means using stabilisation to lift the performance of recycled polymers**

specifically for fibre applications; Ultrinox LC PP701 provides "state-of-the-art" colour protection for BOPP applications that need to be stearate-free. "Besides providing excellent colour and melt protection, these solutions provide improved gas fading protection and a larger operating window for colour control," says Foster.

The Ultrinox LC series products are available in a non-dusting easy-to-feed form, simplifying operations for polyolefin reprocessors. They are approved in various countries for food contact applications.

### Polyolefin recycling

The new area of recycling and compounding of recycled polyolefins is being targeted by **Baerlocher** with its Resin Stabilisation Technology (RST) platform, which acts synergistically with traditional antioxidants. In its pure form, it is aimed at polymer producers and virgin resin compounders who can use it to expand the performance window of existing stabilisers or to work around solubility or cost constraints of certain additive formulations.

In polyolefin recycling applications, Baerlocher has taken advantage of the physical form of 100%-active additive blends enabled by Baeropol RST - a dust free pastille. "Recyclers are not used to employing additives and powders are usually a no-go," says Technical Product Manager Henrik Eriksson.

Eriksson says there are "clear unmet" needs with respect to recycle performance at many converters. "For example, MFI fluctuations can be a major issue for a converter, as they bring a constant need to adapt the settings to changes in raw material flowability. A raw material equipped with a process



IMAGE: SHUTTERSTOCK

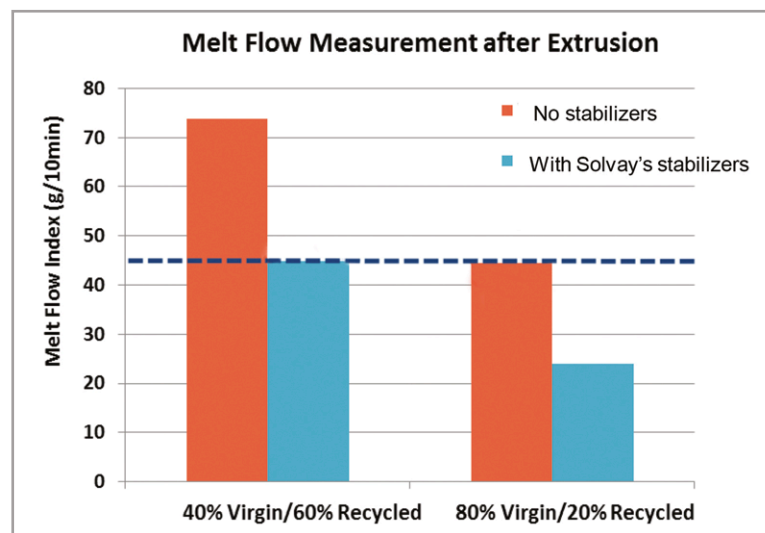
stabiliser based on the Baeropol RST-technology will perform in a much more stable way in this sense."

The challenge Baerlocher has taken on is to explain how Baeropol RST can help the recyclers capitalise on the unmet needs of converters, focusing on practical matters such as handling and processing issues rather than reaction mechanisms and performance diagrams, Eriksson says. "The typical recycler-to-converter value chain does not respond to the same extent to the 'chemistry-intense' product promotion that is commonplace in the additives industry," he says.

"Once tried, the performance of the Baeropol RST-technology quickly proves itself and the recyclers find that their customers are willing to pay for the small added cost it brings along. The struggle is to get to that point, but as we have learned to speak the language of the recyclers the commercial implementations have continued to grow," he says, adding that Baerlocher is now looking to expand its offering for compounders of recyclates beyond stabilisers.

UV light stabilisers and antioxidants from **Solvay** have demonstrated the ability to slow the degradation of the physical and mechanical properties of recycled resins to facilitate performance competitive with virgin resins, according to Andrea Landuzzi, Global Marketing Director, Polymer Additives at the company.

Landuzzi says Solvay's polymer additives minimise changes in the melt flow index (MFI) of polyolefins. This "substantially enhances second-life performance and enables an increased percentage of recycled resin to be used. Incorporating stabilisers into blends mitigates strand breaks, reduces scrap rates, and increases overall throughput and strand quality. These improvements allow for up to triple the amount of recycled resin to be used while maintaining the MFI." Some of these gains are shown in Figures 1 and 2.



**Figure 1: Graph showing MFI of recycled/virgin PP blends after extrusion at 250°C in a twin screw extruder demonstrates how Solvay's stabilisers can provide protection**

Source: Solvay





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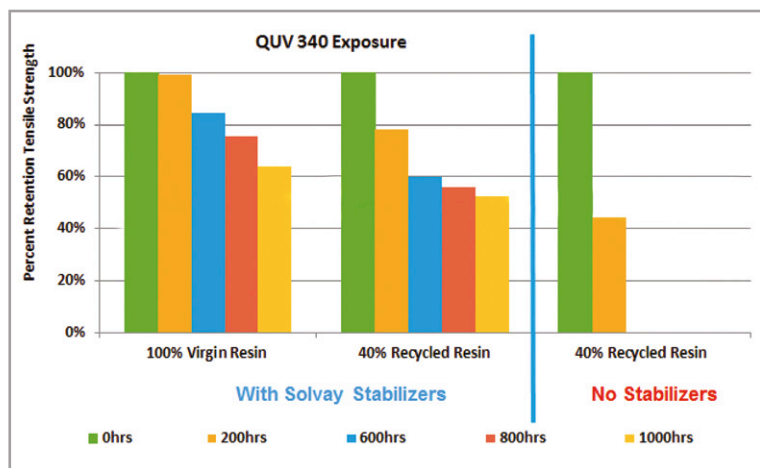
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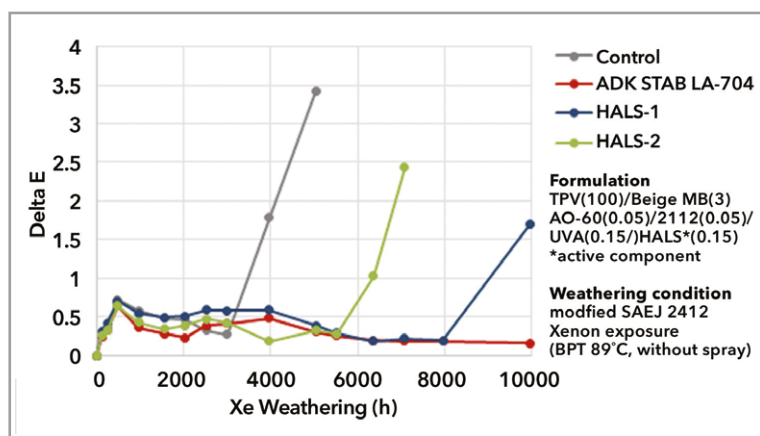


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**Figure 2: Graph showing the reduction in tensile strength of recycled PP blends with and without stabilisation after exposure to UV**  
Source: Solvay



**Figure 3: Graph showing the effect of various stabilisers on weatherability as measured by colour change**  
Source: Adeka

### Automotive demands

The performance envelope for automotive thermoplastics is being pushed harder than ever. **Byk** says current market trends are driving its new product development focus toward more rigorous solutions for PAs used in engine-compartment applications. "The need for higher temperature performance, improved property retention, barrier and chemical/moisture resistance are clear drivers," says Dan Berg, Global End Use Manager - Transportation, in Byk USA's Thermoplastics Additives and Solutions BU. "The key for the new automotive under-hood requirements is combining thermal stability with chemical stability in simple additive solutions to enable the new design concepts."

Byk-Max HS 4307 is an optimised inorganic stabiliser package for PAs that can help achieve property stability for 300+ hours at 150°C. Improvements in the pipeline should achieve stability at 190°C and 210°C. Byk-Max 4309 is a copper-free organic stabiliser for PA intended for newer

applications that can achieve 100% retention of tensile strength for 300 hours at 150°C.

Byk is also offering stabilisation packages to enable use of PP in more challenging applications under the hood. Byk-Max 4342, for example, is a blend of high-heat stabilisers and other "essential components" that can be added during processing of direct inline-compounded glass fibre reinforced PP to achieve long-term resistance (over 1,000 hours) to 150°C.

**Adeka** is another company putting a strong focus on automotive applications in the development of stabilisers. It says that, using the knowledge and experience that it has acquired over many years of stabilisation of polyolefins, it has now developed a market-ready hindered amine light stabiliser (HALS) system for thermoplastic elastomers (TPE).

Compared with conventional light stabilisation systems based on HALS-1 (HMW N-CH type) and HALS-2 (N-O Alkyl type), the new stabiliser, ADK Stab LA-704, is said to provide superior weatherability (Figure 3).

Adeka offers ADK Stab LA-704S in masterbatch form on a silica carrier for improved handling and dosing. The masterbatch, ADK Stab LA-704Si, also displays good anti-fogging behaviour. "Furthermore, this system provides excellent stabilisation and anti-NOx gas discoloration compared with traditional N-H HALS systems," says the company. It adds this makes it suitable for automotive interior parts based on TPEs, including TPE-V, TPE-O and TPE-S. Light stabilisation performance in pigmented formulations is said to be "outstanding."

### Film challenges

Fibres and tapes used in applications such as geo-textiles, roofing insulation, barrier structures as well as synthetic flooring have to withstand harsh climate conditions, including prolonged exposure to UV light, fluctuating and elevated temperature and environmental pollutants, according to **BASF**. It says HALS systems can provide a solution but standard types may sometimes negatively affect processing.

Its latest generation of HALS for the film, fibres and tapes industry is Tinuvin XT 55. Its primary application is polyethylene monofilaments and tapes. "Tinuvin XT 55 has very low contribution to water carry over and therefore enables the production line to run without disturbance," BASF says. Typical applications include artificial grass yarns.

BASF announced in January its plans to increase production capacity by 20% for its antioxidant Irganox 1520L at its site in Pontecchio Marconi,





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Italy. Irganox 1520L is a highly effective thermo-oxidative stabilizer used for a wide range of solution and emulsion polymerised polymers and TPEs. BASF says the product is unique in its ability to provide both processing and long-term heat-aging stability when used alone, at low levels and without co-stabilisers. Where necessary, it can also be used with other additives, such as secondary antioxidants, benzofuranones, light and other functional stabilisers.

Tianjin, China-headquartered **Rianlon**, is a major solution provider of anti-ageing additives and application technologies for polymer materials. Its product portfolio includes antioxidants (Rianox), light stabilisers (Riasorb), and U-packs, which are customised blending formulations. Through the integration last year of Hengshui Kaiya Chemical, Rianlon has now increased production of HALS and their key intermediates. The company says the project improves long term availability and security of supply.

Beside HALS, in addition to being a major supplier of benzotriazole UV absorber, Rianlon has focused on process development in triazine UV absorber derivatives. One example is RiasorbUV-1164, a triazine type light stabiliser, which is said to have an exceptionally strong and broad-range of UV absorption properties throughout the UV spectrum. The company says it has good solubility, low

colour, low volatility, and high inherent thermal and light stability. It is effective in stabilising PE or PP film, tape, sheet, and other resin systems such as PA, PET, ASA, PETG, PMMA, PBT and PC.

### Controlling colour

The Songxtend 1105 stabiliser from **Songwon** is designed to meet requirements for HDPE blow moulding resins produced using chromium-based catalysts. It says numerous processors are now using these types of resins, which are optimised for applications requiring high stiffness and stress-crack resistance, but it says some resin producers have experienced colour problems. Songxtend 1105 is a blend based on a phenolic antioxidant and a high-performance phosphite, which the company says addresses the need for colour improvement (Figure 4). It is said to display improved hydrolytic stability compared with some other high-performance phosphites used alone or in blends.

Meanwhile, **SI Group** has launched two new formulated solutions for thermoplastic and silane cross-linkable polyolefin-based cable insulation compounds for low voltage applications. Lowinox PE 807 blend has been developed for Sioplas and Monosil applications; Lowinox PE 808 specifically for technically complex HFFR power cable applications meeting relevant standards at 90 °C under both dry and wet conditions. ➤

## Meeting the PPE demands of Covid-19

The huge global rise in demand for Personal Protective Equipment (PPE) as a consequence of the Covid-19 pandemic has highlighted the need to run production equipment as efficiently as possible. Spun-bond polyolefin fibres, which are widely used in production of PPE, need to remain stable during processing and maintain the micro-fibre structure that delivers fine pore size in nonwoven sheets. Antioxidants ensure fibre consistency with

reduced filament breakage and enable smaller pores between fibres for better high-performance filtration required for essential medical applications, says Andrea Landuzzi, Global Marketing Director, Polymer Additives at **Solvay**.

"Solvay's portfolio of antioxidants



for sterile medical applications is formulated to improve the stability of polymeric materials and promote consistent melt viscosity in polymers to meet the evolving needs of PPE manufacturers," he says.

Landuzzi highlights the company's

**Left: The surge in demand for PPE during the Covid-19 pandemic has placed a priority on production efficiency, says Solvay**

Cyanox 1790 and Cyanox 2777 products. "These antioxidants help maintain fibre dimension throughout the fibre-making process so that manufacturers can adhere to strict specifications in end-use products like masks, air filtration and gowns," he says. "They also demonstrate low colour

development due to high gas fade resistance." The latter is important as unsightly yellow discoloration during shipping and storage can negatively affect the perception of the quality of product, he explains.

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





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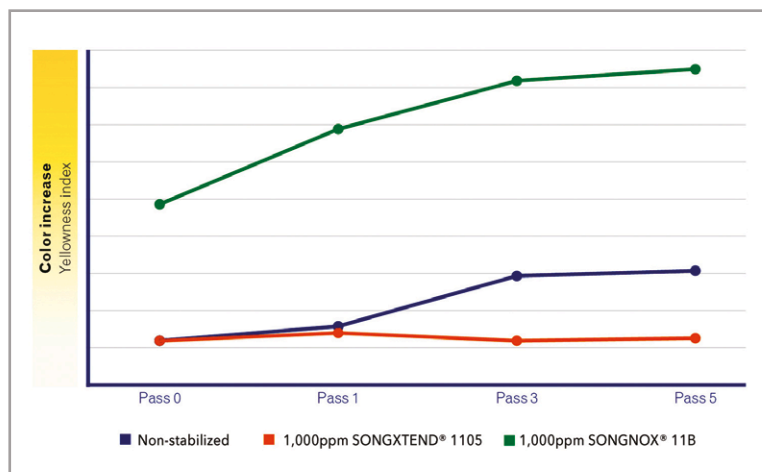
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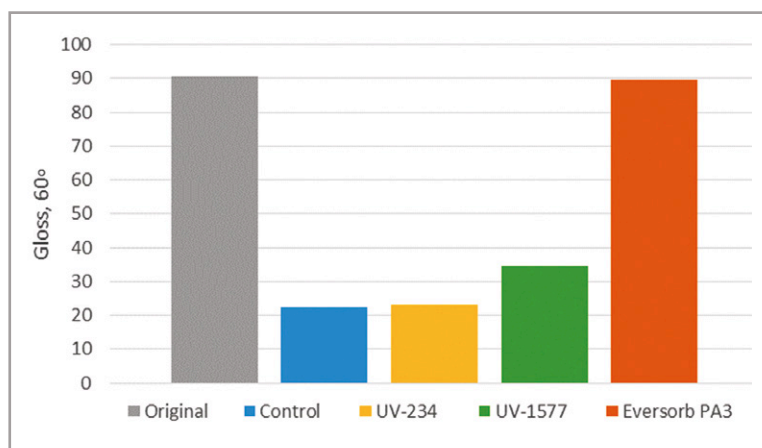


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**Figure 4: Comparison of colour development of non-stabilised and stabilised chromium-catalysed HDPEs after multiple extrusion passes using two different Songwon additive systems**

Source: Songwon



**Figure 5: Gloss values of PA resins using different stabilisation systems after 1,000h QUV accelerated testing exposure (ASTM G154)**

Source: Everlight

A major benefit claimed for the new formulations is faster crosslinking reactions at ambient temperature, which can help increase compounder productivity. They are also said to provide “excellent” metal deactivation for compounds in contact with metal conductors, increasing cable longevity.

Lowinox PE 807 and PE 808 are supplied as dust-free pellets. The premixing of the additives results in a homogenous composition in the blend, increasing dosing accuracy and dispersion in the compounds. They can be used for the traditional production of catalyst masterbatches and subsequently be diluted for use in the Sioplas process. In the Monosil process they can be used directly as supplied.

### Weathering PA

PA compounds often need UV absorbers and light stabilisers to improve weatherability. Conventional light stabilisers used in polyamide include UV-234 or UV-1577 types. However, Taiwan-headquartered **Everlight Chemical**, says as requirements for weather resistance increase these traditional light stabilisers may fall short. It has designed Eversorb PA3 specifically for polyamide. Figure 5 shows that under the 1,000h QUV weathering test (according to the ASTM G154 standard), the gloss value of PA containing UV-234- or UV-1577 is only 24% and 38% respectively of the original gloss value. The gloss value of PA containing Eversorb PA3 remains virtually unchanged.

Loss of gloss is usually the result of surface cracking. After 1,000h of QUV exposure, the control group showed significant surface cracking, with the gloss value decreased to 22. With the

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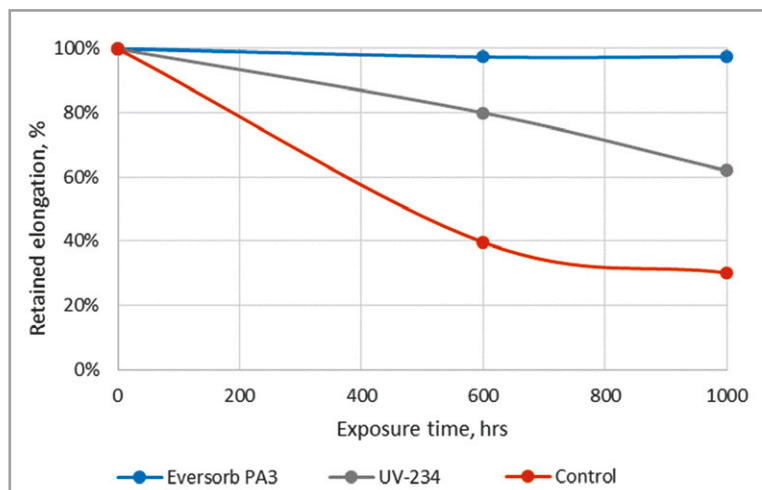
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**Figure 6: Effect on elongation of PA resins using different stabilisation systems after 1,000h Xenon arc lamp accelerated weathering test (ASTM G155)**

Source: Everlight

addition of 0.5% Eversorb PA3, the sample surface showed no cracking and the gloss value remained almost unaltered.

Severe surface cracking may also lead to impaired physical properties. After exposure of 1,000h of Xenon arc lamp accelerated-weathering test (ASTM G155 standard), the retained elongation of a PA with UV-234 decreased to 62%, while the PA with Eversorb PA3 again showed almost no difference (Figure 6).

The latest PA stabilisers from **Brüggemann** include Bruggolen TP-H1607 and Bruggolen TP-H1805. TP-H1607 is a proprietary copper-based stabiliser package that is claimed to extend long term mechanical property retention beyond the current limits for existing copper salt-based antioxidants. Tests show the grade enables heat stabilisation of unreinforced PA 66 beyond 5,000 hours at 150°C (the company claims conventional copper salt-based stabilisers level off at 3,000 hours at this temperature). The company says this high efficiency presents the opportunity to dramatically reduce copper and halogen content.

The TP-H1805 product is described as an easily processable high heat stabiliser package that lifts the limit for continuous-use temperatures up to 200°C for glass reinforced PA6 and beyond 200°C for PA66. The system does not require prior activation and is also effective at temperatures below 200°C, which the company says means compounders can develop cost efficient aliphatic polyamide-based materials for border line applications previously reserved for higher priced PPAs or other high performance polymers.

"Our goal is to offer heat stabilisers for polyamides across all temperature ranges and all applica-

tion areas," says Dr Klaus Bergmann, Head of Polymer Additives at Brüggemann. "With the introduction of these new products we are further extending our portfolio of high-performance stabilisers to provide even more value to our customers."

Elsewhere in the PA sector, **Clariant** says one of its latest high-performance stabilising additives, AddWorks TFB 117, is "raising the processing and performance bar" of PA intended for clothing, carpets and industrial textiles such as cable jackets and automotive fabrics. "The resins and fibres are easier to spin or injection mould, even at low temperatures, and retain superior strength and colour protection to extend the service life of their final application," Clariant says.

AddWorks TFB 117 has good compatibility with all PAs, including PA6, PA66, and copolymers, which Clariant says ensures productivity benefits during polymerisation. "The process is therefore more sustainable with higher throughput when compared to existing state-of-the-art additives systems: for example, 20-30% shorter polymerisation," the company claims.

The company adds that in fibre production it helps reduce filament breakage by up to 25-30% in high speed spinning whether added into polymerisation or in compounding.

"Importantly, introducing the new additive at either phase delivers stronger fibres with significantly improved light and thermal stabilities as well as mechanical properties," the company says. "The in-built light and thermal stability mean that both the consistent colour and high tensile strength is protected."

AddWorks TFB 117 is already being used to produce PA66 carpets. "Customers are also actively exploring its use in high temperature nylons for a smooth processing at lower processing temperatures," Clariant says, adding that AddWorks TFB 117 is compatible with other additives and components used in PA.

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# Regulating PVC biocides

*Biocides, which are widely used in plasticised PVC products to extend life and appearance, are tightly regulated. We find out more about the European and US regulatory systems*

Biocides—antimicrobial additives—are a near essential requirement in the formulation of flexible PVC materials for long term use applications due to the susceptibility to microbial attack of the plasticiser component, which can lead to unpleasant and unsightly issues such as staining, odour and mould growth. However, biocides contain active substances that have the potential to cause environmental and/or human harm, so their use is carefully regulated.

A challenge for both producers and users is that the two main regulatory systems of the European Union and the US operate differently, can be complex, and continually—albeit slowly—evolve. In Europe, use of biocides is regulated through the Biocidal Products Regulation (BPR) via the European Chemicals Agency (ECHA); in the US through the Federal Insecticide Fungicide Rodenticide Act (FIFRA) via the Environmental Protection Agency (EPA). Both have a similar objective—protection of consumers, workers and the environment—but their specific assessment processes and criteria lead to differences in the chemistries that can be used in each region. This can make selection a challenge for PVC formulators.

*Compounding World* has spoken to experts at two key players in the PVC biocides market – Helena Kim, Global Business Manager Plastics at Troy Corporation in the US, and Phil Clegg, Biocides Business Manager in the UK for Valtris Specialty Chemicals—to get a better understanding of how regulations shape, and continue to shape, biocide selection in the two regions. Troy is the world's leading supplier of OBPA (oxybisphenoxarsine) antimicrobials for plastics and also produces DCOIT (dichlorooctylisothiazolinone) and OIT (octylisothiazolinone) antimicrobials; Valtris is a major player in DCOIT and OIT. These three

biocides are currently mainstay products in the global market for flexible PVC protection.

## EU approach to biocides

The European Biocidal Products Regulation (BPR – Regulation EC No 528/2012) was adopted on 22 May 2012, replacing the earlier European Biocidal Product Directive (BPD). It took effect across the EU on 1 September 2013. Since that date, biocide suppliers can only market biocides, and users can only put on the EU market finished articles containing biocides, supported under the BPR Review Programme. This involves submission of a full dossier containing a data package for the biocidal active substance relevant to the Product Type (plastics and textiles fall within Product Type 9) to ECHA. This dossier is then reviewed by the Biocidal Products Committee (BPC), which issues an

**Main image:** Biocides are widely used in plasticised PVC products to prevent mould and odour growth but regulation is complex and varies between the EU and US



IMAGE: SHUTTERSTOCK

IMAGE: SHUTTERSTOCK



**Above: PVC product makers need to understand the regulatory landscape in the region they will be supplying**

opinion that is submitted to the European Commission to make a decision.

It is a lengthy and costly process and many biocides, including OBPA, were not included in the BPR Review Programme. OBPA was previously widely used across the European PVC industry. "Although OBPA registrants participated in the BPD, OBPA suppliers did not participate in the BPR Review Program for their individual commercial reasons," says Kim. "Since the BPR took effect in 2013, the PVC market in the EU predominately replaced OBPA to what was available at that time

under the BPR programme, which were isothiazolinone alternatives." These isothiazolinone alternatives include DCOIT and OIT.

Kim says Troy continues to supply OBPA in all other regions and adds that the company is assessing the viability of OBPA in the EU BPR Review Programme, saying that many PVC processors and multi-nationals with plants in the EU would like to be able to use the low cost OBPA chemistry "due to its superior efficacy against fungi and bacteria, including some of the most treatment-resistant organisms (for example pink staining bacteria) in marine conditions."

The impact of the BPR extends beyond the EU, according to Clegg. He says Valtris sees moves away from OBPA in parts of the world where PVC product makers and suppliers need to supply the European market. "When it comes to efficacy, both DCOIT and OIT are comparable to OBPA," he says. "OIT and DCOIT have become the preferred option when searching for an alternative to OBPA."

### Labelling limits

Kim says that while direct regulation of biocides (what can and cannot be placed on the market)

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IMAGE: SHUTTERSTOCK



**Above: The US and EU have different regulatory approaches to biocides and different review processes**

within the EU is through a particular biocide's inclusion in the BPR, other aspects of the BPR could also have potential to influence biocidal selection. She cites the labelling element as an example. Within the BPR, antimicrobial treated articles (which would include PVC products) require labelling either where the seller makes a claim of antimicrobial performance or where any conditions associated with the approval of the biocide require it.

Back in November 2018, ECHA's Risk Assessment Committee (RAC) issued an opinion that labelling under the EU's Classification, Labelling and Packaging (CLP) Regulation EC No 1272/2008 should be required for mixtures where OIT is present at above 15ppm, indicating that the mixture may cause allergic skin reactions. The definition of hazardous mixtures in the CLP (which is separate to the BPR) extends to paints and coatings containing OIT. The RAC has since proposed a similar CLP labelling limit for DCOIT in mixtures. It should be noted that a requirement to label under CLP is not intended as a restriction on use but a means of ensuring safe handling.

While CLP review may result in more stringent labelling of some mixtures containing biocides for some products, Clegg says it should not be assumed that a limit applied to a liquid paint would also be applied to a plastics article "where the biocide is entrapped and potential for bioavailability is low." He says it is necessary to distinguish

between labelling requirements for liquid paints and coatings, which are considered as hazardous mixtures and are regulated by the CLP regulation, and treated articles which are regulated by the BPR.

In any event, any potential labelling changes for biocide-treated articles would only come into force on completion of an assessment of the active substances in the BPR, which is not expected before early 2022, and any requirement to label would not, in itself, be a restriction on use. However, if labelling was to be required for articles treated with OIT or DCOIT it could encourage users to consider alternatives, according to Kim. "There has been a shift away from these types of chemistries in markets outside of PVC in order to avoid the labelling," she says.

### The US approach

Biocides are regulated in the US by the EPA through the Federal Insecticide Fungicide Rodenticide Act (FIFRA). As part of this regulatory scheme, the EPA operates a registration review programme. This asks suppliers to substantiate the effectiveness of their biocide product, provide updated occupational and exposure information, and provide latest information on environmental effects every 15 years. This is achieved through the issue of a Data Call-In (DCI) to all participating suppliers. The EPA issued a DCI for OBPA in 2011 and DCIs for DCOIT and OIT in 2015.

"The financial burden to participate in the DCIs for each chemistry can be in the millions of dollars, taking several years on average to complete," says Kim. "If there are multiple suppliers for the chemistry, the cost to generate data can be shared. With OBPA, however, Troy is the sole EPA supporter of this chemistry and is taking on the full financial responsibility to maintain this chemistry in the market."

Troy is nearing completion of the data package for its OBPA DCI and expects to submit the final pieces of requested data to the EPA in the second half of this year, Kim says. The DCI for DCOIT and OIT was issued later so no timeframe for submission is yet available.

## Learning more about biocide regulation

Global regulation covering the use of biocides is constantly being reviewed to minimise the risk of harm to humans and the environment. As a consequence, options available to end users is becoming more restricted. OBPA, DCOIT and OIT all provide

good performance in flexible PVC applications. OBPA is not authorised for use as a biocide in plastics in the EU; DCOIT and OIT both are. All three are authorised for use in plastics in the US; all are currently going through the EPA's regular registration review

process with a decision on OBPA expected soonest.

Learn more about the EU Biocidal Products Regulation [HERE](#)

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# Keeping the process clean

*Purpose-designed purging compounds carry an additional cost over using in-house resin. However, that premium can be repaid through savings in downtime and product wastage, reports Mark Holmes*



IMAGE: ASACLEAN

Short production runs and rapid changeovers are increasingly the norm in most compounding operations. As a consequence, the need to minimise the amount of waste or off-spec material during production is now a top priority. The use of commercial purging compounds can help achieve these goals and can also help in keeping valuable compounding extruders in first-class condition.

Routine purging with commercial purging compounds is environmentally conscious and can help reduce both waste and cost, according to **Dyna-Purge**. "In order to understand how purging fits into a sustainability programme, it is necessary to understand the numerous features and benefits of CPCs (commercial purging compounds)", says Kelli Ropach, International Business Manager. "Purging compounds improve part quality. Consistent and programmatic purging can clean and remove deposits and contamination, which may cause defects."

Any contaminants that make their way into a compound will eventually find their way into finished injection moulded or extruded parts. "The market demands quality and is typically qualified by a third party organisation, in addition to a corporate quality directive. This is most common in automotive, medical, and food and drug packaging applications. If parts contain black (carbon) specks, pit marks, delamination due to contamination, resin or colour streaks, the market will consider the part as sub-quality or rejected and the part becomes waste or scrap," Ropach says.

In addition, growing demand along the supply chain for cost reduction means suppliers have to look for new cost saving strategies. With resin and additive prices, utility costs, and labour rates all rising, one way to cut cost is to make sure all money is spent on production of saleable quality product, Ropach argues. "Consistent and programmatic use of a CPC will help prevent problems or defects. It will also help to reduce the time it takes to purge and the amount of material wasted or spent. Speeding resin or colour transitions increases the availability of production time."

Reduction of scrap and waste are priority targets for all processors. "These two concerns rank high in company management," says Ropach. "When scrap and waste is reduced, there is an increase in the output of acceptable quality parts and more usable and saleable yield from the resin investment. The result of lower scrap and waste therefore allows the processor a better overall yield on performance due to the reduction of lost time or recovered opportunity, energy and hourly productivity."

Reduction of scrap and waste are priority targets for all processors. "These two concerns rank high in company management," says Ropach. "When scrap and waste is reduced, there is an increase in the output of acceptable quality parts and more usable and saleable yield from the resin investment. The result of lower scrap and waste therefore allows the processor a better overall yield on performance due to the reduction of lost time or recovered opportunity, energy and hourly productivity."

**Main image:**  
**Purpose-designed purging compounds can speed up changeovers and reduce waste during product changeovers**

**Right: Carbon specks captured in a Dyna-Purge purging compound**

An effective purging strategy also helps in labour cost management. "Global labour costs are rising and talent is at a premium. Therefore, as quality improves, the value and optimisation of labour is better rationalised," she says.

### Purge analysis

Dyna-Purge says the first step towards achieving these benefits is to conduct a purge analysis. "Before starting with a cost-to-purge analysis, it is a good idea to spend some time establishing the current metrics," says Ropach. She says the process is straightforward. The first step is to record the amount and cost of the material used to purge and post purge, adding them together to determine the total material cost of the current method. The next step is to calculate the purging time in minutes, including any soak time, and multiply that by the machine hourly rate. The same should be done for any post purge time. Adding the two time metrics together reveals the total cost of downtime. Finally, the amount of scrap production measured in terms of material cost and time is added in.

Ropach says this information sets the benchmark for the current purging programme metrics, allowing a comparative trial to be run to track the metrics for alternatives. "The next step is dependent on what the current purging situation is. If existing purging is with an in-house resin, there will be a lot of room for changes and improvement. If the in-house resin is natural PE, PP or regrind to purge, for example, then the comparative trial can be used as an opportunity to test a commercial purging compound."

In most cases, a significant improvement will be seen when using a CPC over an in-house resin, according to Ropach. "It is highly likely the scrap rate is already being tracked at your company. However, this can be taken to the next level by establishing a programme to reduce this rate from the information gained in the cost-to-purge analysis. Utilising the expertise of a purging compound company, set up a plan to implement a purging program. This may require a visit, purging information posted at each machine and buckets with pre-measured amounts, for example."

The reason that commercial purging compounds typically yield better results is because they are specially designed to clean the machine, according to Dyna-Purge. The company says that using the same in-house resins that are processed in the equipment continues to add layers of contamination; purging compounds will remove it. It says its Dyna-Purge products are designed to provide a mechanical non-abrasive purge that



IMAGE: DYNA-PURGE

flows to the boundary layers and cleans on the first pass. They are said to be able to reach and remove layers of contamination in stagnation areas.

### Twin screw challenges

Compounding extrusion presents some unique challenges in terms of purging and is an area of particular interest to **RapidPurge** at present. "These machines are generally harder to clean than single screw extruders and injection moulding machines," says Joe Serell, President and Chief Executive Officer. "One of the primary reasons for this is that twin screw extruders are starve-fed. This means that the barrel is not completely full of material and the purging compound may not reach all surfaces for cleaning. Even if it does, the lack of pressure inside the machine reduces the effectiveness of mechanical purge compounds."

The RapidPurge solution to these challenges is to use chemical purge compounds for twin screw applications, supported by a foaming element. "The chemical ingredients in RapidPurge break down the resident resins and contamination on a molecular level. We do not consider foaming agents - often used effectively in purge compounds - as a chemical purge, although they are activated by heat to cause a chemical reaction. Our product is the only purge compound that works via depolymerisation," Serell claims.

"In our case, a foaming agent is utilised for two purposes. Firstly, it creates pressure inside the machine that helps the scrubbing agents do their job. Secondly, it delivers the chemical agent into the low-pressure/low-flow areas to thoroughly clean along with the mineral scrubber. This is especially important when trying to clean behind the flights. The final component of RapidPurge's twin screw purge is a high viscosity resin carrier. This helps push





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IMAGE: ASACLEAN



**Above:**  
A purging compound from Asaclean after a full machine purge showing the captured contamination

out the resin and contamination broken down by the chemical and scrubbing compounds," he says.

**Asaclean** favours a tailored approach to purging and cleaning for compounding. "As a market leader in purging we pay close attention to a diverse array of segments and resins," says Phani Nagaraj, Vice President of the company's US business. "Each segment, application and resin brings unique challenges, which include temperatures, downstream equipment, equipment size, efficiency needs and cost of the resin. We tailor product solutions to the application needs and thus have the widest product range in the industry."

Ongoing advances in compounding technology add to the processing challenges. "For example, if you are compounding super-engineering resins or resins with certain additives, you can develop serious contamination issues or layering in the screw and barrel that need special kinds of purging compounds to clean at high and low temperatures or that scrub effectively," says Nagaraj. "We have recently introduced PF and PX2 purging compounds to specifically address the needs associated with compounding and processing super-engineering resins."

### Potential savings

France-based **Polytechs** has developed a complete range of CleanXpress purging and cleaning products for extrusion and injection moulding applications. The company says that CleanXpress purging compounds have demonstrated they can make savings of up to 60% in time and 61% in energy. The purging compounds have shown particular success in wire and cable compounding through cleaning TPU and XLDPPE, as well as in pipe and tube extrusion for purging fluoropolymers, PA 12 and PA 11. For films, they can successfully purge G-PET barrier films and EVOH. CleanXpress compounds are also claimed to be ideal for

purging engineering resins, such as PA6/66, PBT, PET, PMMA and PC, as well as for biopolymers with purging possible as low as 80°C.

"CleanXpress products are increasingly not only used to clean extruders, but are also employed at weekends as a precautionary compound to avoid the formation of carbon deposits during machine shutdown," says Maarten Bloem, Sales Director. "When re-starting, it is then possible to produce the right formulation immediately after purging out the compound, eliminating any black spec problems. The compounds also provide protection for the screw and barrel."

CleanXpress purging compounds are also used as part of a preventative maintenance programme, designed for individual machines and sites. "These further improve the performance of the machines and taking precautions is always better than solving a problem after the event," Bloem says. "Customers are using their production lines more flexibly and therefore need our support to improve productivity by reducing downtime through cleaning."

Polytechs adds that, in terms of future developments, its R&D team is focusing on recycling of purging compounds, as well as further product performance improvements in general and solving specific customer problems.

### Options for PVC

UK-based PVC specialist Dugdale was acquired by Benvic in September 2019 and business growth for **Benvic-Dugdale** is now focused on meeting demand for enhanced and effective cleaning systems for end-to-end production processes, primarily companies utilising extrusion and injection moulding equipment. These purging and

**Right: Polytechs** claims time savings of up to 60% through the use of its CleanXpress purging compounds

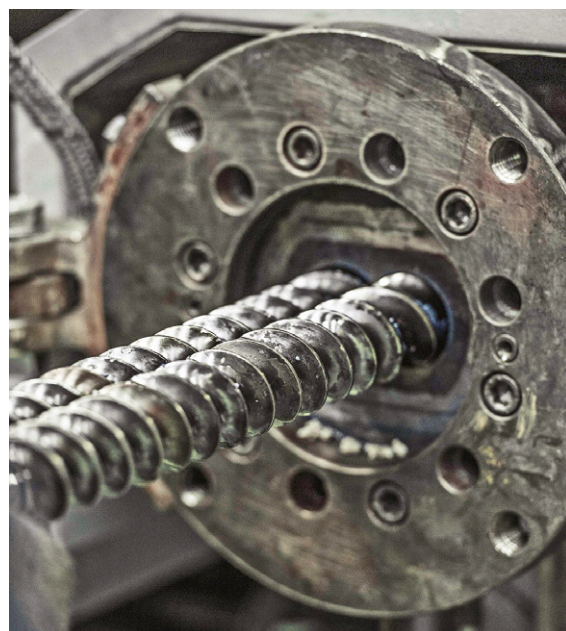


IMAGE: POLYTECHS





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IMAGE: BENVIC-DUGDALE



**Above: Benvic-Dugdale Commercial Director Andy Tombs (right) discusses PVC purging with DucaPurge user Steve Rawse, Managing Director of UK-based Injection Mouldings**

cleaning systems are marketed under the DucaPurge brand worldwide.

"Benvic support for our purging compound range comes at just the right time," says Andy Tombs, Commercial Director. "DucaPurge compounds have been devised to answer the needs of a number of polymer processing niches. Benvic-Dugdale now has sister companies in France, Italy and Spain, meaning that there are opportunities to meet these needs in new market territories as well."

The Dugdale purging strategy is to offer optimised products. "For some time it had been clear that most customers wanted much more than just a 'one-size fits all' purging compound. The Dugdale-created range has answered this need – more extensive and often bespoke, all formulated to work in tandem with Benvic's customised extrusion and injection moulding compounds, and all helping to protect customers' investment in precision production machinery, and deliver functional cost savings," he says.

Early PVC purge and freeze compounds showed

thermal stability limitations that fell well short of their intended use in high end rigid PVC applications, where processing temperatures can reach 200°C. These initial purging compounds therefore struggled to provide effective solutions.

However, the company says that it drew on its industrial experience and speciality technical knowledge to create a new range of purge compounds for PVC that used the fundamental building blocks of non-lead stabiliser technology to devise a "next generation" compound that offers elevated temperature resistance for extended periods. This makes it suitable for use as either a purge or freeze compound in an extensive range of rigid and flexible PVC materials and applications.

"The definition of 'to purge' is to remove abruptly," says Eric Grange, Benvic Marketing Manager. "This is exactly what the DucaPurge range has been designed to do – remove existing material from equipment as quickly and effectively as possible, therefore reducing downtime on material changeovers, equipment shutdowns and tool changes."

Benvic-Dugdale says its DucaPurge compound range reduces machine wear and tear, saves time and waste during material changes, and improves quality by reducing contamination from residues. All combined contribute to a reduction in overall production cost. The DucaPurge compounds cover all PVC transformation processes, including twin-screw extrusion. The compounds also provide a manufacturing solution to the thermal stability issues experienced with processing of recycled PVC grades.

#### CLICK ON THE LINKS FOR MORE INFORMATION:

- > [www.dynapurge.com](http://www.dynapurge.com)
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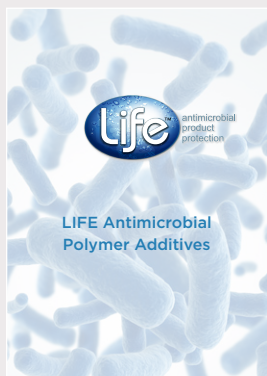
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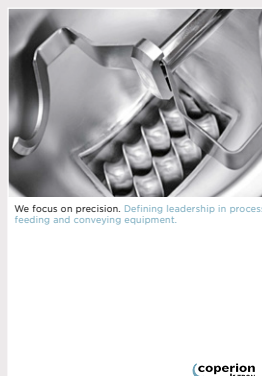
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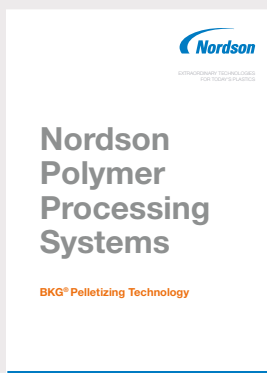
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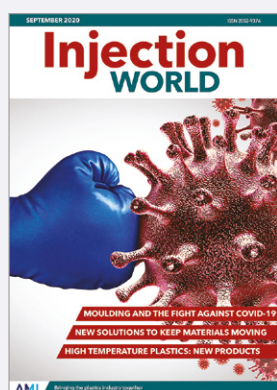
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## Injection World September 2020

The September issue of Injection World has an in-depth feature on medical technology, and how injection moulders and machinery groups are contributing to the fight against Covid-19. Plus new products in temperature-resistant polymers and the latest in materials handling.

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## Plastics Recycling World July/August 2020

The July/August edition of Plastics Recycling World looks at additives for "upcycling" recycled polymers, recycling of WEEE/ELV plastics, and washing technology. It also includes unique AMI data and analysis on recycling demand and the global impact of Covid-19.

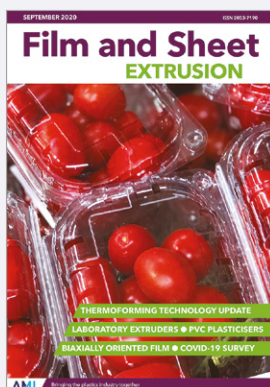
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## Pipe and Profile Extrusion September 2020

The September issue of Pipe and Profile Extrusion looks at how growth in sizes is affecting developments in large diameter pipes. Another feature covers new materials playing a role in improving performance of window profiles. Plus downstream extrusion equipment.

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## Film and Sheet Extrusion September 2020

The September edition of Film and Sheet Extrusion magazine takes a look at the latest innovations in the world of thermoforming. It also reviews developments in biaxial films, plasticisers and lab-scale extrusion machinery.

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## GLOBAL EXHIBITION GUIDE

2020	29 Sep-1 Oct	Interplas, Birmingham, UK <b>POSTPONED</b>	www.interplasuk.com
	6-9 October	Plastpol, Kielce, Poland	www.targikielce.pl
	6-10 October	IPF Japan, Tokyo, Japan <b>CANCELLED</b>	www.ipfjapan.jp
	7-8 October	Compounding World Expo Europe, Essen, Germany <b>POSTPONED</b>	www.compoundingworldexpo.com/eu/
	13-17 October	Fakuma, Friedrichshafen, Germany <b>CANCELLED</b>	www.fakuma-messe.de
	4-5 November	Compounding World Expo USA, Cleveland, USA <b>POSTPONED</b>	www.compoundingworldexpo.com/na/
	10-13 November	Plastimagen, Mexico City <b>POSTPONED</b>	www.plastimagen.com.mx
2021	1-5 December	Equiplast, Barcelona, Spain <b>POSTPONED</b>	www.equiplast.com
	5-8 December	Plast Eurasia, Istanbul, Turkey	www.plasteurasia.com/en
	9-12 January	Arabplast 2021, Dubai, UAE	www.arabplast.info
	4-8 February	PlastIndia, New Delhi, India <b>POSTPONED</b>	www.plastindia.org
	13-16 April	Chinaplas 2021, Shenzhen, China	www.chinaplasonline.com
	4-6 May	Kuteno, Rheda-Wiedenbrück, Germany <b>NEW DATE</b>	www.kuteno.de
	4-7 May	Plast 2021, Milan, Italy	www.plastonline.org/en
	17-21 May	NPE 2021	www.npe.org
	1-2 June	Compounding World Expo Europe, Essen, Germany <b>NEW DATE</b>	www.compoundingworldexpo.com/eu/
	29 June -1 July	Interplas, Birmingham, UK <b>NEW DATE</b>	www.interplasuk.com
	12-16 October	Fakuma, Friedrichshafen, Germany	www.fakuma-messe.de
	3-4 November	Compounding World Expo USA, Cleveland, USA <b>NEW DATE</b>	www.compoundingworldexpo.com/na/

## AMI CONFERENCES

19-22 October 2020	Composites <b>VIRTUAL GLOBAL SUMMIT</b>
26-29 October 2020	Agricultural Film <b>VIRTUAL GLOBAL SUMMIT</b>
2-4 November 2020	Plastics Regulations Europe, Cologne, Germany
3-4 November 2020	Chemical Recycling Europe, Hamburg, Germany
30 Nov-2 Dec 2020	Fire Resistance in Plastics Europe, Dusseldorf, Germany
26-28 January 2021	Thermoplastics Concentrates 2021, Coral Springs, FL, USA
2-3 February 2021	Polymers in Cables America, Charlotte, NC, USA
25-26 March 2021	Compounding and Masterbatch Asia, Bangkok, Thailand

For information on all these events and other conferences on film, sheet, pipe and packaging applications, see **www.ami.international**

**PLASTICS RECYCLING**  
WORLD EXPO

**POLYMER TESTING**  
WORLD EXPO

**1 - 2 June, 2021**  
**ESSEN, GERMANY**

**PLASTICS EXTRUSION**  
WORLD EXPO

**COMPOUNDING**  
WORLD EXPO

**3 - 4 November, 2021**  
**CLEVELAND, OHIO**

**www.ami.international/exhibitions**