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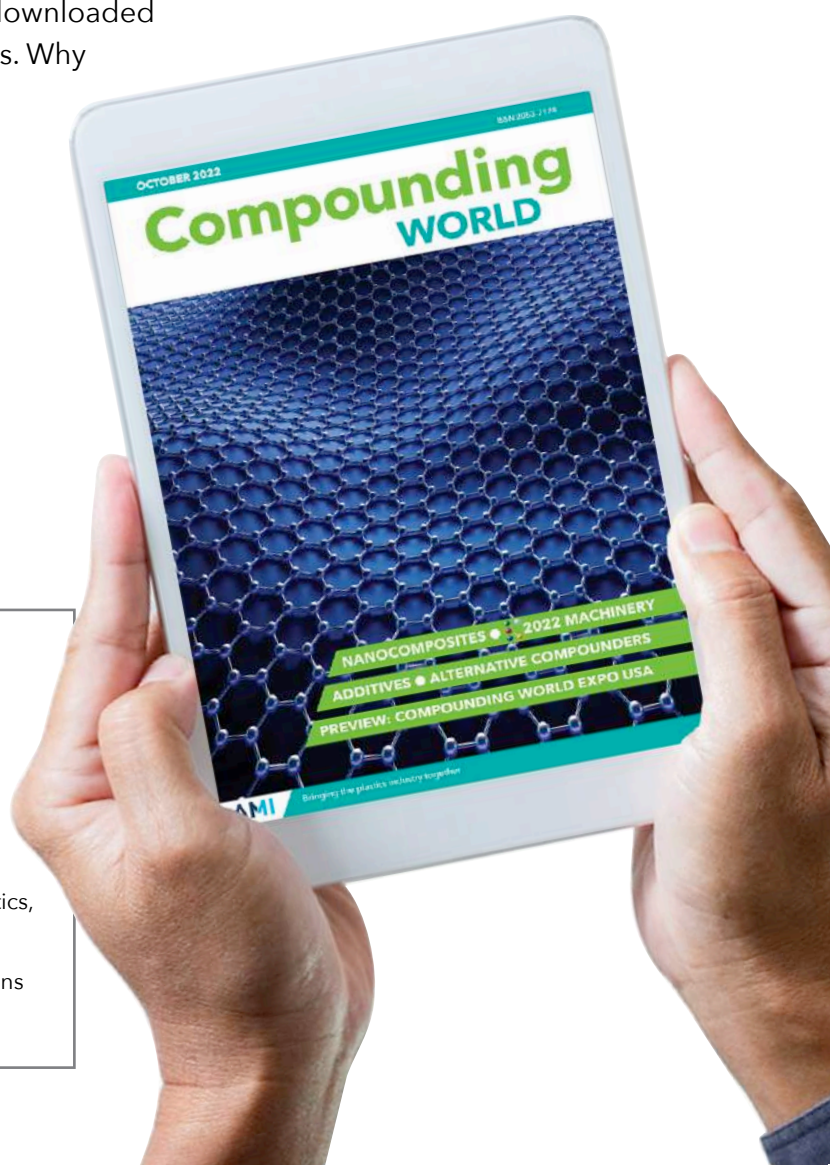
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# Compounding WORLD

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# Aurora acquires EnCom Polymers and continues growth journey

Polymer compounding group Aurora Material Solutions (previously Aurora Plastics), which is headquartered in Streetsboro, OH, US, has acquired EnCom Polymers.

Based in Evansville, IN, and founded in 1999 by Rick Kaskel, EnCom is a privately-owned manufacturer of customised specialty engineered thermoplastics, colour-matching services, and related materials technology solutions. It has traditionally been active in the automotive, building and construction, consumer goods, electrical/electronics, healthcare, industrial, solar, and transportation industries.

Darrell Hughes, CEO of Aurora Material Solutions,



**The acquisition of EnCom strengthens Aurora's position in engineered thermoplastics**

said: "EnCom increases Aurora's exposure to a mix of additional materials and end markets that are very attractive, and provides us with a significant synergy opportunity. Through

collaborative efforts, we plan to further accelerate EnCom's growth, creating a bright future for our customers and employees."

The acquisition marks the sixth transaction by Aurora

since 2017, and further strengthens its position in engineered thermoplastics. EnCom will be grouped with Enviroplas, acquired by Aurora in 2022, to create an engineered thermoplastics business segment.

The combined company's range of custom compounding and technologies now includes rigid engineered thermoplastics, PVC compounds, flexible engineered thermoplastics, and other specialty compounds such as custom thermoplastic polyolefin, low-smoke zero-halogen compounds (LSOH), flame retardant concentrates, and purge compounds.

> [www.auroraplastics.com](http://www.auroraplastics.com)  
> [www.encompolymers.com](http://www.encompolymers.com)

## Peak-PCI adds medical options as alternatives to PTFE

US-based custom and toll compounder Peak Performance Compounding (Peak-PCI) has launched a new line of low friction PEBA and TPU compounds for use in extruded and injection moulded medical devices.

The company says the Synnergy low COF grades are formulated to provide an alternative to PTFE and can be customised with colourants and additives to meet the needs of manufacturers of parts such as interventional and diagnostic catheters and compo-

nents. All pass USP Class VI testing for biocompatibility.

The company says two studies have shown that lubricious catheter liners produced using Synnergy Rx formulations provided a 14-68% lower COF compared to competing samples manufactured in Pebax 63D when pulled at varying pressures (4, 6, and 8 psi).

The introduction follows the commissioning late last year of two new small-scale compounding lines. The 22mm and 32mm twin screw lines are equipped for

small lot compounding, colour trials, and DoE development work.

"Product development is one of the most important facets of the manufacturing process," said Todd Marchand, Peak-PCI President. "The integration of these cutting-edge twin-screw extruders affirms our company-wide dedication to no minimum order quantity."

In 2022, the company commissioned a white room at its compounding plant in Leominster, MA.

> [www.peak-pci.com](http://www.peak-pci.com)

### IN BRIEF...

**ECHA's** Biocidal Products Committee (BPC) says it is supporting approval of silver zinc zeolite for Product-Type 9 applications including plastics antimicrobials. Silver zinc zeolite is an existing active substance used to treat polymers and accomplish an antimicrobial effect, which it achieves by interacting with the cell membrane of microorganisms, interfering with electron transport processes, binding to nucleic acids, inhibiting enzymes and catalysing free radical oxygen species.

<https://echa.europa.eu>

## Trinseo to close site in Germany

US-based polymer producer Trinseo said it plans to close its polycarbonate (PC) production site in Stade, Germany, and in future will obtain all the PC it needs for its downstream businesses through external purchases. The action is expected to increase annual profitability by \$15m.

"Unfortunately, we continue to see demand soften, and price declines due to the oversupply caused by offshore producers pushing material into the EMEA market," said CEO, Frank Bozich. "We anticipate these conditions to continue in 2024 and beyond. Additionally, our fixed operating costs at Stade are significant, placing a further strain on our financial viability at this location."

The company said it is committed to the integration and application of modern recycling technologies, such as PC dissolution and depolymerisation, to help customers develop more sustainable product offerings and is exploring options for viable locations for recycling plants that meet customer needs.

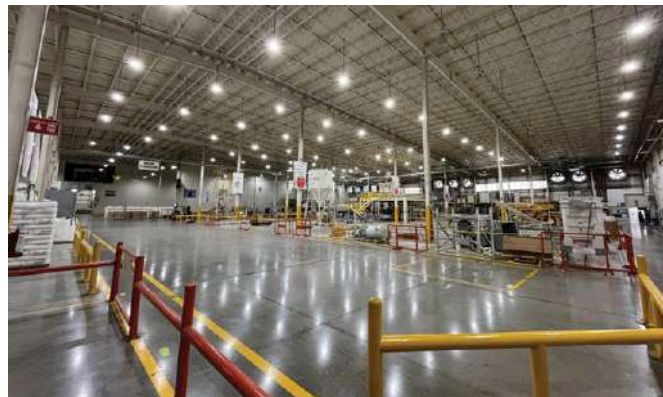
[www.trinseo.com](http://www.trinseo.com)

# Geon grows with plant expansion in Mexico

Performance polymer compounds manufacturer Geon Performance Solutions has announced plans for a \$1.3m expansion of its Ramos Arizpe, Coahuila, Mexico, site which will add a production line and upgrade existing resources for polyolefin compound manufacturing.

As one of Geon's four Technology Centres of Excellence, the Ramos Arizpe facility currently has a range of in-house technical resources and integrates with the company's Global Solutions Centre in Avon Lake, OH, US. The company says it provides a location for its teams to collaborate closely with customers to develop materials, applications and manufacturing plans, as well as generate other opportunities.

The facility is ideally



positioned to provide reliable solutions to customers, including original equipment manufacturers and Level 1 and Level 2 suppliers. The expansion, expected to be completed this year, will add more than 5,400 tonnes of capacity to the group annually.

"On the heels of our recent acquisition of Polymax, which expanded our portfolio to add thermo-plastic elastomer technology, we are excited to now

announce the capacity expansion in Ramos Arizpe, Mexico," said Geon Chief Commercial Officer, Wendy Herbst. "Both are key components of our strategy to expand our solution offerings geographically and within our markets."

Geon acquired Polymax in December 2023. The company has two full-service manufacturing sites in Nantong, Jiangsu, China, and Waukegan, IL, US.

[www.geon.com](http://www.geon.com)

## Celanese to shut Belgian plant

Celanese is to close the engineering materials compounding operation at Mechelen in Belgium it acquired from DuPont in November 2022. The move is designed to optimise costs. Production is set to

permanently cease by the end of September.

As a result of the closure the company expects to record expenses, excluding employee termination costs, of \$60-75m, consisting primarily of accelerated

depreciation of fixed assets and other facility-related shutdown costs.

The company is also in the process of closing its PA66 and HPN polymerisation units in Uentrop, Germany.

[www.celanese.com](http://www.celanese.com)

## Riverdale Global plans new US facility

Riverdale Global, which specialises in liquid colour management, has announced a satellite location in Grafton, WI, US.

The 11,000 m<sup>2</sup> facility will service

local customers and serve as the new Color Research and Development Laboratory, outfitted with the latest advanced liquid colour equipment.

The company says the new lab will

expand the company's development and colour match capabilities and bring colour matching closer to local customers.

<https://riverdaleglobal.com>



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# Gabriel-Chemie invests to strengthen logistics

Masterbatch producer Gabriel-Chemie has broken ground on a €7m expansion at its headquarters in Gumpoldskirchen, Austria, which when completed will add 3,200m<sup>2</sup> of additional warehousing capacity.

Chief Finance and Operations Officer Andreas Berger said: "This warehouse extension underscores our commitment to further strengthen Gabriel-Chemie's position as a future-oriented masterbatch manufacturer."

The expansion will include the installation of a flexible rack system providing an additional 5,000 pallet spaces making open



IMAGE: GABRIEL-CHEMIE

air storage spaces obsolete. The building will be equipped with a photovoltaic system contributing an additional 320 kWp.

The expansion will

strengthen the role the Gumpoldskirchen site plays within the Gabriel-Chemie Group, especially in the field of supply chain and logistics.

> [www.gabriel-chemie.com](http://www.gabriel-chemie.com)

## TrimTabs builds CNT unit

UK-based process technology company TrimTabs has appointed Engsolve to build a new production unit to manufacture carbon nanotubes (CNTs) from diverse hydrocarbons at its facility in Bridgend.

The company said the production unit is the first step in commercialising TrimTabs' patented production system and will allow continuous production of low-cost, highly differentiated CNTs at close to commercial scale. The feedstock comprises waste plastic and other hydrocarbons.

There are multiple market applications for CNTs, notably within the battery, supercapacitor, fuel cell, concrete, composites, electricity transmission and superconductor industries. The new unit will move the technology readiness level (TRL) through the qualified gate system from TRL 6 to TRL 9.

> <https://trimtabs.co>

# Positive FDA notification for SI

Developer and manufacturer of performance additives SI Group said the US Food & Drug Administration (FDA) has granted Food Contact Notification (FCN) 2326 for phosphite antioxidants Weston 705 and

Weston 705T, and extended the use of these phosphite antioxidants to PET polymers.

Weston 705 and Weston 705T are nonylphenol-free stabilisers that already have broad approval as Food

Contact Substances for use in various polymers for food-contact packaging around the world, including the US, Canada, the EU, and China. The new FDE grant went into effect on 1 March.

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

# LG Chem's packaging from CO<sub>2</sub> feedstock

## Containers made from PEC



In collaboration with Cosmax, at the Cosmoprof exhibition on 21 March in Bologna, Italy, LG Chem unveiled cosmetic containers made from polyethylene carbonate (PEC) produced from carbon dioxide captured from factories and ethylene oxide.

PEC is primarily used for cosmetic containers and food packaging materials, but can also be mixed with other products to create a wide range of applications, from flexible films to sturdy cases.

The Cosmoprof exhibition features around 3,000 companies showcasing materials, packaging and design.

> [www.lgcorp.com](http://www.lgcorp.com) > [www.cosmax.com](http://www.cosmax.com)





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[www.ShamrockTechnologies.com](http://www.ShamrockTechnologies.com)



# Kafrit adds to US colours business

Masterbatch producer Kafrit Industries has acquired Badger Color Concentrates, a manufacturer of colour concentrates and liquid colourants with locations in Mukwonago, WI, and Kings Mountain, NC, in the US.

The acquisition marks a significant milestone in Kafrit Group's growth journey by adding a complete line of specialty colour and additive concentrates to its already differentiated polymer solution portfolio. The group now employs more than 550 people in

eight companies and has an annual turnover of more than \$300m.

Daniel Singer, Kafrit Group's CEO, said: "This acquisition aligns with our strategy to strengthen our position as a service and technology leader to the global plastics industry. We see significant opportunities to enhance the depth and breadth of our service offering to our existing and future customers in North America."

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

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



## New lab for BYK

Additive producer BYK is constructing a new laboratory building at its site in Wesel, Germany.

The 5,100m<sup>2</sup> project is set to cost around €25m with the aim being to provide a suitable environment to allow the company to work closely with customers to generate new innovations. In the planning, particular importance is being attached to efficient energy consumption and other green measures.

"BYK is networked with its customers worldwide and, with this innovative laboratory complex, it will be creating space for effective communication as well as for developments and cooperation with our customers and distributors," said BYK Division President Jörg Hinnerwisch.

Part of the Altana Group, BYK has a global network of subsidiaries.

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

## Bondalti makes bid for Ercros

Portuguese chlor-alkali/aniline chemicals group Bondalti has made an unsolicited offer to buy Ercros, a Spanish PVC, chlorine derivatives, and pharma ingredients manufacturer. The offer from Bondalti values the Spanish company at €329m.

Family-owned Bondalti has a long-standing presence in the Spanish market, where it employs more than 200 people. It currently has production units in Torrelavega and Alfaro, as well

as a logistics centre in Vigo and four offices in Barcelona, Madrid, Pontevedra and Logroño.

Provided the transaction is completed, Bondalti will maintain a headquarters in Barcelona, as well as a presence in the regions where Ercros operates (Catalonia, Valencia, Aragon, and Madrid).

Bondalti said its objective, once the transaction is completed, is to delist Ercros shares from the stock exchanges, after which it will

become part of a group with sales of around €1.3bn.

João de Mello, Bondalti's chairman, said: "The partnership with Ercros allows the creation of a group with the scale and financial strength required to meet the challenges facing the European chemical industry. This will strengthen the company's growth strategy and competitiveness in the markets, enabling it to gain scale."

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

> [www.ercros.es](http://www.ercros.es)

## Chris Smith retires from AMI

Chris Smith, the long-serving Editor of *Compounding World* and Editor-in-Chief at AMI Magazines, has retired from the AMI group. He has been succeeded by David Eldridge.

Smith had an unbroken career working in connection with the plastics industry, from starting in injection moulding through a transition to journalism and progressing to being a highly regarded editor of plastics magazines and chair of plastics conferences. After writing for plastics publications at EMAP and Crain Communications, he joined AMI Magazines in 2011 and became the launch editor of *Injection World*. In 2017, Smith took over as editor of *Compounding World*.

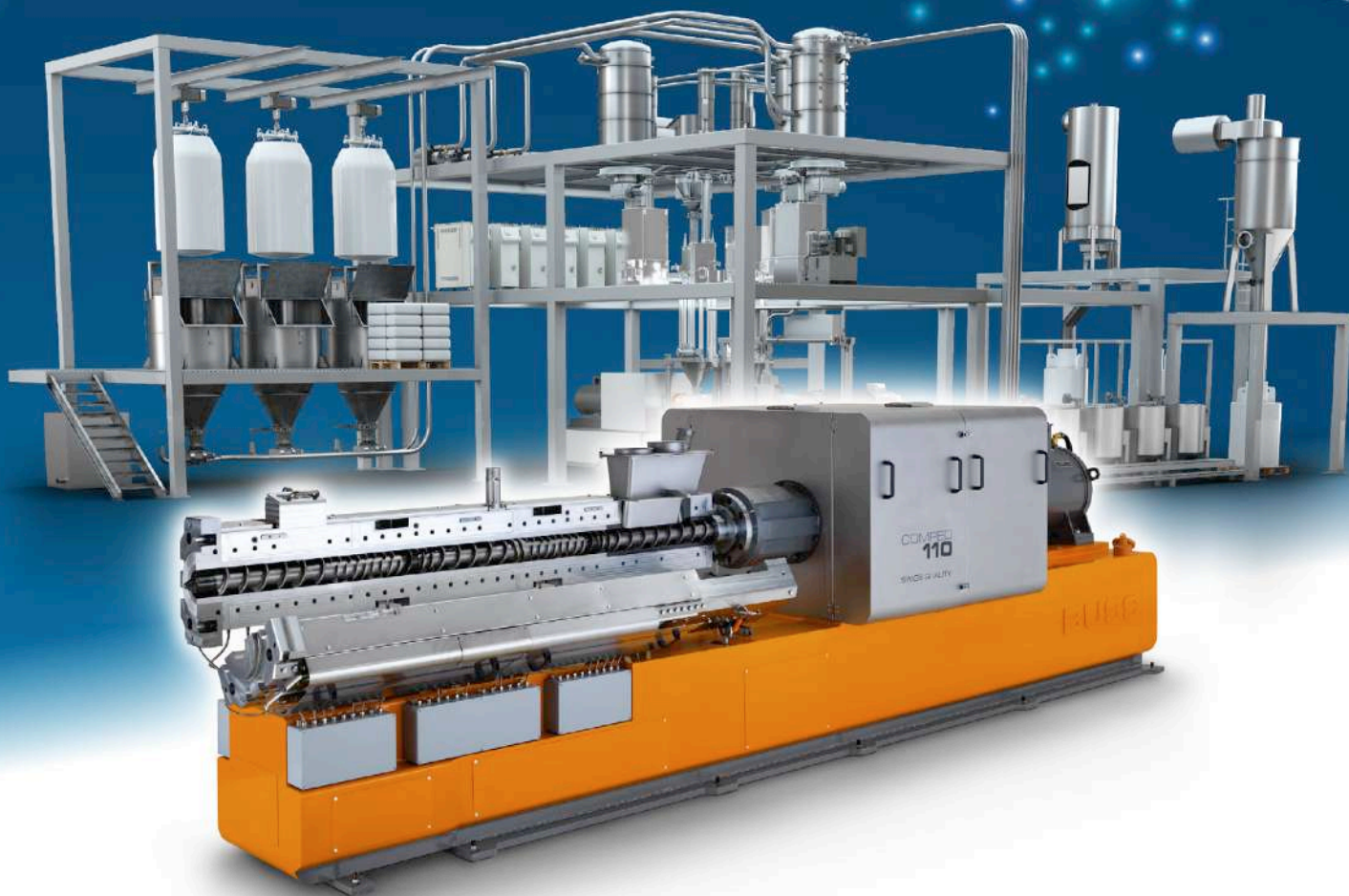


Andy Beevers, Head of Events and Magazines at AMI, said: "With his trademark encyclopaedic knowledge about plastics materials and processes, Chris has been a highly-valued member of the AMI team. We will greatly miss him but wish him the very best in his well-earned retirement."



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## IN BRIEF...

**Evonik** is to cut up to 2,000 jobs, the majority in Germany, as part of a €400m restructuring and cost cutting programme dubbed Evonik Tailor Made. All structures and processes of the company have been analysed extensively, and based on this analysis the company will design and establish a new organisational structure by the end of 2026.

<https://corporate.evonik.com>

**Albis** has extended its distribution agreement with **Bekaert** allowing it to offer the company's Beki-Shield steel fibre conductive additives, which can provide electrically conductive properties in compounds, prevent electrostatic charges, or protect against electromagnetic interference, across almost the entire EMEA region.

[www.albis.com](http://www.albis.com)

[www.bekaert.com](http://www.bekaert.com)

# Shipping rules change to prevent pellet spillages

In response to several high-profile instances of maritime littering, at a meeting in February at the International Maritime Organisation (IMO) headquarters in London, a sub-committee on Pollution Prevention and Response (PPR 11) agreed draft recommendations for the carriage of plastic pellets by sea.

The recommendations, which include using good quality packaging strong enough to withstand the shocks and loadings normally encountered during transport, transport information clearly identifying those freight containers containing plastic pellets, and freight containers containing such pellets being properly stowed and secured, were submitted for



IMAGE: SHUTTERSTOCK / FEDERICO ROSTAGNO

urgent consideration, and approved by the Marine Environment Protection Committee at MEPC 81 the following month.

Consequently, the MEPC adopted amendments to article V of Protocol I of the MARPOL Convention (Provisions concerning reports on incidents involving harmful substanc-

es) and added a paragraph to say that "In case of the loss of freight container(s), the report required by article II (1) (b) shall be made in accordance with the provisions of SOLAS regulations V/31 and V/32."

The amendments are expected to enter into force on 1 January 2026.

➤ [www.imo.org](http://www.imo.org)

## US industry groups hit back at 'flawed' anti-recycling report

In February, US-based environmentalist organisation the Centre for Climate Integrity released a new report 'The Fraud of Plastic Recycling' in which it was claimed that petrochemical companies have consistently lied to the public about the benefits of plastic recycling.

The report, widely reproduced in the mainstream media, drew a furious response from industry groups. Ross Eisenberg,

President of America's Plastic Makers (part of American Chemistry Council), said: "Unfortunately, this flawed report cites outdated, decades-old technologies, and works against our goals to be more sustainable by mischaracterising the industry and the state of today's recycling technologies. This undermines the essential benefits of plastics and the important work underway to improve the way

plastics are used and reused to meet society's needs."

These sentiments were echoed by Matt Seaholm, President and CEO of the Plastics Industry Association, who said: "This report was created by an activist, anti-recycling organisation, and disregards the incredible investments in recycling technologies made by our industry."

➤ <https://plasticmakers.org>

➤ [www.plasticsindustry.org](http://www.plasticsindustry.org)

## Nordmann distributes BYK in UK

Nordmann has taken over the distribution of BYK's comprehensive range of plastics additives in the UK and Ireland. BYK products for fibre-reinforced composites and PVC plastisols are well known within the sector for their mechanical and aesthetic advantages and excellent processing qualities.

➤ [www.nordmann.global](http://www.nordmann.global)

➤ [www.byk.com](http://www.byk.com)



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# Enabling progress in medical devices

*Innovations in medical compounds lead to development of new technologies for patients. Regulatory and market trends also drive changes.*  
**Jennifer Markarian reports**

Plastics have enabled huge technical advances in medical devices, including the production of surgical tools, wearables, and implants for just a few examples. Plastics also aid performance in packaging, in sterile containers and innovative drug delivery forms. In addition, they are the dominant materials for bags, tubes and other equipment for pharmaceutical and biopharmaceutical manufacturing.

These wide-ranging fields of application employ a variety of polymer and additive types, all of which must comply with standards and regulations for their particular use. This typically involves stringent testing and tracking as well as production in “clean” areas that may include dedicated lines or even dedicated facilities to avoid contamination.

One of the biggest challenges for some applications in these markets is that once a material is approved for use, any future changes must be documented and sometimes require new approval. Innovation continues, however, with the latest developments designed to meet changing needs in sterilisation and materials, as well as considerations for sustainability.

Materials used in medical devices and other medical applications must be designed to withstand sterilisation processes, which can include steam (in an autoclave), vapourised hydrogen peroxide (VHP), ethylene oxide (EtO) gas, and radiation by gamma rays, electronic beam, X-ray, or ultraviolet-C (UV-C) light.

Gamma irradiation has been widely used by manufacturers of bags, tubes, and connectors for single-use bioprocessing equipment for biopharmaceutical manufacturing. Demand for these



components has been growing, and there has been concern that the available gamma irradiation capacity in the US would not be adequate. As a result, component manufacturers have been looking at X-ray irradiation as an alternative sterilisation approach.

The global industry organisation, the US-headquartered **Bio-Process Systems Alliance (BPSA)**, evaluated both gamma and X-ray sterilisation methods and published its research as a **guide in July 2023**. BPSA says that the data indicates that the impacts of X-ray and gamma on the plastic components are equivalent, and that the report data can be used to support risk assessments.

Another issue affecting sterilisation availability in the US is a proposed rule from the federal Environmental Protection Agency (EPA) that could change the standards for EtO emitted from the commercial sterilising facilities, which are widely used for medical device sterilisation. As a result, alternative sterilisation methods are being considered.

“Increasingly stringent environmental regula-

**Main image:**  
**Ineos Styrolution's sustainable NAS ECO material is used in new Eco-inject autoinjectors**

**Right: Luran S MED is a range of styrenic compounds from Ineos Styrolution targeted at injection moulded housings for portable medical devices**

tions are challenging the medical device industry to find materials that support compliance,” says Maureen MacDonald-Stein, Director Portfolio Strategy and Marketing in **SABIC’s** Specialties business. “In the case of upcoming reductions in EtO emissions, we offer specialty thermoplastics that help device makers to smoothly transition to other sterilisation methods without impacting key material properties.”

SABIC says its Ultem HU polyetherimide (PEI) resins, for example, are compatible with a number of sterilisation methods and retain their strength, dimensional stability, and aesthetics under exposure to repeated sterilisation cycles. The company’s PEI compounds are available as both unreinforced and glass-fibre reinforced grades.

**Fluoropolymer alternatives**

A pending regulatory change threatening to affect materials for medical markets is the anticipated restriction of per and polyfluoroalkyl substances (PFAS) in the US and EU. PFAS make up a class of several thousand different fluorine-containing chemicals which are used in many applications. There are concerns over their effects on humans and the environment, as well as their persistence and bio-accumulation. Fluoropolymers such as polytetrafluoroethylene (PTFE) and polyvinylidene fluoride (PVDF) are currently grouped together by regulators as part of the larger category of PFAS.

“In the face of proposed European and individual US state regulations severely restricting or banning the use of PFAS, customers in the health-care industry and other markets are seeking self-lubricated solutions that don’t incorporate these chemicals,” says Ralph R Buoniconti, SABIC Senior Specialist Regulatory.

New specialty compounds in SABIC’s LNP Lubriloy portfolio are presented as alternatives to polymers lubricated with PTFE for reduced friction and enhanced wear resistance. Medical applications include, for example, drug delivery pens and



pumps, and various latches, gears and bearing surfaces. Lubriloy products are available today in PC, PA66, POM, PPE, PC/ABS, PPA and PBT-based formulations. The new grades include unreinforced and reinforced products with up to 30% glass fibre.

Fluoropolymers are also employed to make parts used in biopharmaceutical manufacturing. BPSA responded to the European Chemical Agency’s (ECHA) proposed ban on PFAS with a statement

requesting that “pharmaceutical and biopharmaceutical processing, including its supporting supply chain, be regarded as a sector, and permitted the same exemption, or unlimited derogation, as medicinal products.”

The BPSA is concerned that extending the proposed broad restriction of PFAS to cover fluoropolymers could have unintended consequences on the global manufacturing of biopharmaceutical products, ultimately impacting availability of existing medicinal therapies, including vaccines, as well as the development of new therapies,” according to BPSA Executive Director, Chris Clark, (see the BPSA [statement](#)).

**Styrenics for medics**

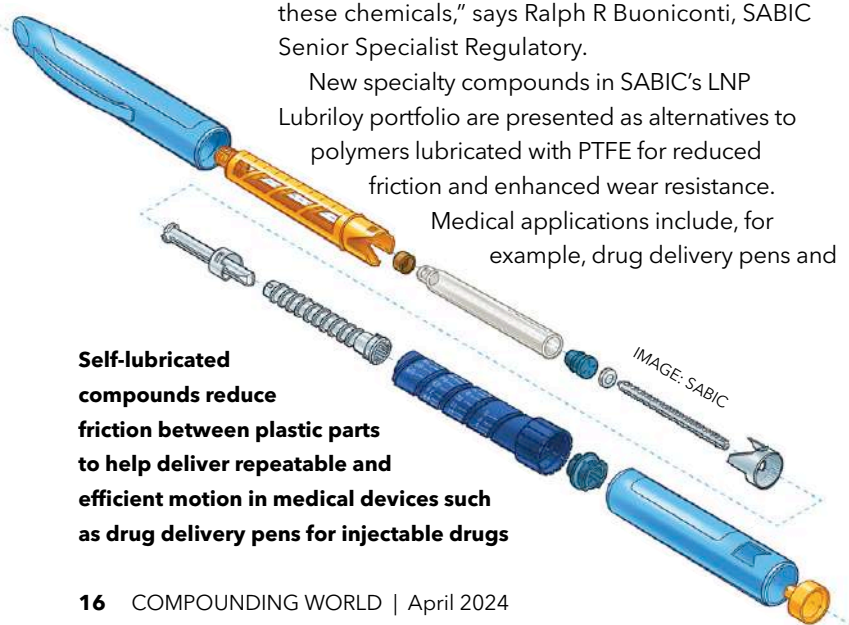
Among the latest additions to the Luran S line of styrenic compounds from **Ineos Styrolution** is Luran S MED 797S SPF30, an ASA grade targeted at small injection moulded housings for portable medical devices. Available in natural and white, the new grade provides resistance to chemicals and disinfectants, as well as good impact performance over the expected ambient operating temperature range (which the company says makes it a good alternative to standard ABS grades).

Like many grades in the Ineos Styrolution product portfolio, the new MED 797S grade is also available with a mass balance attributed renewable feedstock content. The company says its ISCC-certified 40% renewable content results in a carbon footprint reduction of up to 52% compared to fossil-based Luran S grades.

“The market segment of small, mobile medical and hospital devices is growing rapidly,” says Bernd Elbert, Market Development Manager at Ineos Styrolution. “The properties of our new Luran S MED 797S SPF30 make it a very strong contender for device housings and casings in this specific category.”

NAS ECO is another Ineos Styrolution material

**Self-lubricated compounds reduce friction between plastic parts to help deliver repeatable and efficient motion in medical devices such as drug delivery pens for injectable drugs**





made with mass balance attributed renewable feedstock content. The NAS ECO 21 BC70 styrene acrylic copolymer grade was selected by UK based Eco-inject for a new generation of single use autoinjectors, available for 1ml or 2.25ml pre-filled syringes in a single device configuration.

Ineos Styrolution says NAS ECO 21 is suited for applications demanding a strong, stiff, water-clear plastic resin with excellent thermal stability. The grade offers properties such as transparency, high surface quality, and low density. The company says the Carbon Footprint Reduction of this grade is 93%.

John Palmer-Felgate, industrial designer and Founder of Eco-inject, says: "At Eco-inject, we focus on solutions that are both economic and ecofriendly. We are striving for sustainability and elegance while also reducing cost of goods. With Ineos Styrolution's sustainable ECO materials, we can achieve just that. Using bio-based plastics dramatically reduces the carbon footprint of autoinjector devices, allowing them to meet increasingly stringent healthcare sustainability criteria. This will allow consumers to continue to benefit from using these self-administered devices in their own homes."

**Bio-derived grades**

Plastic tubing has a wide range of critical medical uses, such as for catheters and minimally invasive medical devices. Tubing, along with other components such as bags and connectors, also plays a crucial role in

sterile manufacturing of biopharmaceuticals. Fluid-flow paths can be made with single-use components that are used for a single batch of product, which eliminates the need for cleaning (and the associated water and chemical use) between batches. These systems have been found to have a lower environmental burden than conventional, multi-use systems, but the industry is also looking at options for improving circularity and further reducing carbon footprint. Using bio-based plastics is one option.

Avient's latest addition to its healthcare solutions are Versaflex HC BIO thermoplastic elastomers (TPEs). The initial grade, Versaflex HC BIO BT218, was developed as a more sustainable alternative for biopharmaceutical tubing. The TPE is formulated with nearly 40% first-generation biomass content, resulting in a lower carbon footprint than traditional alternatives. The bio-derived grade offers greenhouse gas emissions at 2.35 kg CO<sub>2</sub>e/kg product, which Avient says is a nearly 25% percent lower cradle-to-gate Product Carbon Footprint (PCF) than Avient's standard Versaflex HC BT218 grade.

"Creating specialty materials that reduce carbon emissions at the beginning of the product life cycle is one way we can support customers in fulfilling sustainability commitments and maintain critical performance demands," says Matt Mitchell, Director, Global Marketing, Specialty Engineered Materials at Avient. "The bio-based launch has sparked conversations around sustainability in medical



Left: Avient's new Versaflex HC BIO TPE offers a sustainable alternative for biopharma tubing applications










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**Right: Foot pedals made with Eurotec's Tecomid 25% glass fibre reinforced PA6 containing a permanent antistatic to dissipate static charge**



products among our customers, which we believe will be an ongoing trend."

The TPE is a 71 Shore A formulation that provides critical application performance such as weldability, kink resistance, and tensile strength comparable to other medical tubing materials, including silicone and standard TPEs. The new grade is certified for USP Class VI and ISO 10993, and is manufactured in the US with global commercial availability.

### Concentrates

Avient's Mevopur Healthcare Bio-based Polymer Solutions, launched in 2021, include colour and additive concentrates based on polymers with 70-100% bio-content to help reduce carbon footprint. Available in pre-coloured formulations, they offer a sustainable drop-in replacement for fossil-based grades.

To support its sustainable portfolio, the company also recently introduced its PCF Calculator. "This cutting-edge tool, which is third-party certified by TÜV Rheinland and aligns with the ISO 14067:2018 standard, offers an important data point for the carbon footprint of Avient's materials so customers can better understand the environmental impact of products, meet sustainability goals, and navigate the complex landscape of reducing carbon emissions," the company reported.

Antimicrobial additives can be added to

compounds to prevent growth of microbes on surfaces of parts in healthcare applications ranging from hospital beds to devices, although regulations governing these additives depend on the geographic region and the end-use.

"There is an increasing focus on reducing microbials and fungi in the healthcare industry and other markets. However, customers and providers face challenges in meeting performance and efficacy expectations, as well as perceived barriers related to processability and pricing," says Mitchell. Educating customers in this area is a focus, he says.

Avient's Cesa Withstand additives include organic and inorganic ingredients to inhibit the growth of bacteria, mould and fungi on the plastic surface. Two new available grades of Cesa Withstand for TPU film can meet antibacterial and anti-mould protection needs of medical beds as well as uses outside of healthcare. The effective reduction of bacterial activity that can be achieved on TPU film laminated plastic and/or textile surfaces has been confirmed in extensive testing to international standards, including JIS 2801. The additives have also passed strict anti-fungus testing according to JIS Z 2911, Avient reports. The masterbatches are currently manufactured in Asia and are commercially available globally.

### Preventing static charge

**Ampacet's** new ProVital + Permstat is a non-migratory antistatic masterbatch that provides permanent antistatic properties to polyolefin films used in pharmaceutical applications, such as packaging for powdered pharmaceutical ingredients. The antistat is added to the external layer of packaging films, so that electrostatic charges can dissipate.

Preventing plastic from building up an electrostatic charge is also crucial in medical electronic

## Raumedic expands products and manufacturing

**Raumedic**, a global supplier of polymeric tubing and related products headquartered in Germany, launched a new effort in late 2023 to directly supply the biopharmaceutical manufacturing and life-science sectors, after more than a decade as an exclusive supplier.

It extended its portfolio for biopharmaceutical fluid processing products and launched a new brand for biocompatible tubing. It also announced it was expanding its global headquarters in Helmbrechts, Germany with a new ISO-7 clean room manufacturing facility.

The company uses a range of materials (silicone, TPEs, PVC, and fluorinated ethylene propylene) in its biocompatible fluid processing tubing. The company also makes polycarbonate connectors and prefabricates tubing sets.



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**Right: Evonik's Vestakeep i4 3DF biomaterial filament based on PEEK was used in a 3D-printed spinal implant created by US-based technology company Curiteva**

equipment. For example, a foot pedal switch in three different colours (blue, yellow, and grey) is made with **Eurotec's** Tecomid 25% glass fibre reinforced polyamide (PA6) that contains a permanent antistat to dissipate static charge.

The latest from **Polyplastics** (part of Daicel Corporation) is the Duracon POM (polyoxymethylene or acetal) PM Series for medical applications. The company has supplied TOPAS cyclic olefin copolymer (COC) for medical and healthcare uses for decades and, as a POM supplier for other markets, has now added POM to its polymers available for medical applications. One product is a standard viscosity grade (PM09S01N) and a second, high-flow grade (PM27S01N) will enable wall-thinning, miniaturisation, and lightweighting, says the company. The materials can be sterilised under hot steam and EtO sterilisation conditions. The compounds meet global market regulatory compliance requirements and can be used in a wide range of applications, including drug delivery.

Durable, high-strength polymers are used as an alternative to metals for medical implants. Besides use in conventional converting processes such as injection moulding, polymer compounds are being designed for 3D printing, which can allow production of patient-specific designs for implants.

"In trauma applications, for instance, 3D printed solutions offer an enormous time advantage over traditionally manufactured medical devices," says Marc Knebel, Head of Medical Systems at **Evonik**. "It is conceivable that patient-specific solutions can be manufactured within two or three days, significantly improving the recovery phase."

Evonik's latest is a polyether ether ketone (PEEK) Vestakeep filament with either 12% or 20% carbon-fibre content for use in 3D-printed medical implants, such as bone plates and other reconstructive prostheses. Benefits include the ability to define the alignment of the carbon fibres.

Pharmaceutical drugs can be compounded in



IMAGE: CURITEVA/EVONIK

polymers and formed into various shapes for use in extended-release drug delivery. Innovative research in this field continues. Ethylene-vinyl acetate (EVA) copolymers, for example, can be used commercially to create implants for drug delivery in several therapeutic areas such as ophthalmology, oncology and women's health, says global material provider **Celanese**. Celanese is collaborating with companies like Nanoform, Alessa Therapeutics and Glaukos to enable innovative continuous dosing solutions that can improve patient compliance and outcomes.

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*Processing aid and lubricant additives enhance efficiency during compounding and converting. Jennifer Markarian finds out more*

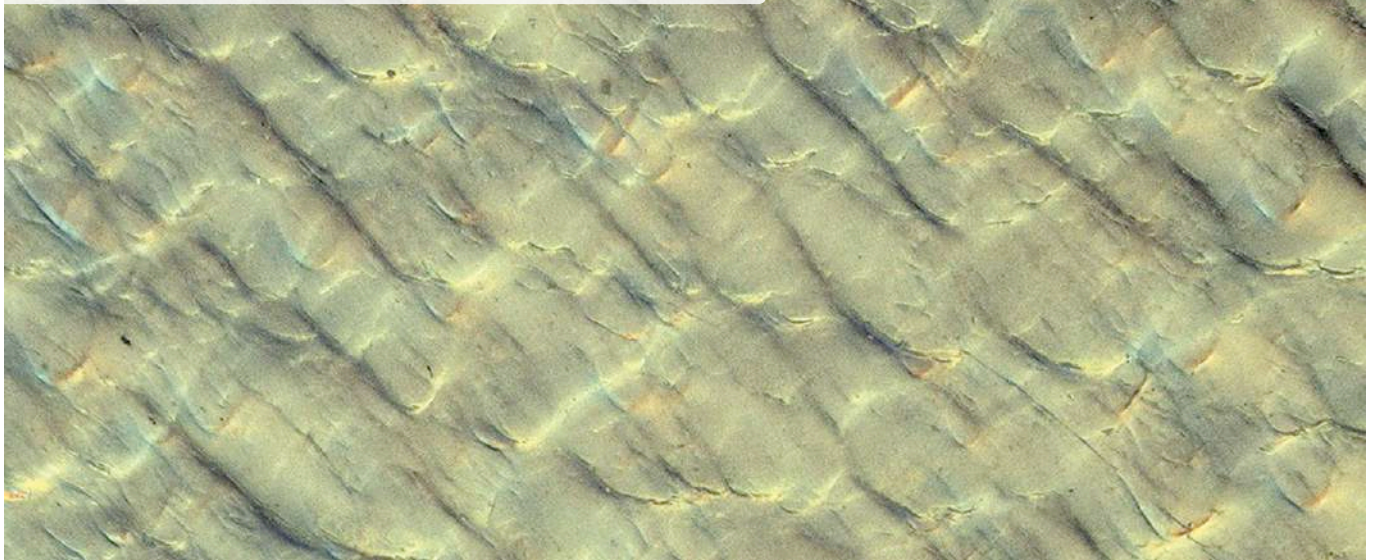


IMAGE: CONSTAB POLYOLEFIN ADDITIVES/MICHAEL WEBER

# Aiding efficient production

Optimising both output rate and product quality during the compounding process requires careful consideration of both compound formulation and processing conditions. Processing aids and lubricants provide a means to improve flow in order to achieve this balance during both compounding and the subsequent extrusion and moulding production processes.

Fluoropolymer polymer processing aids (PPAs) have long been used in plastics compounds where they have been optimised for many applications, including prevention of melt fracture in film extrusion and reduction of die build-up. Producers argue that such fluoropolymers are very different from the per and polyfluoroalkyl substances (PFAS) currently making headlines due to concerns over persistence and their potentially hazardous nature. However, all fluorine-containing materials are currently being grouped together by regulators as part of the larger category of PFAS and some regulatory restrictions are anticipated by many.

At the start of this year, the **Environmental Protection Agency** (EPA) in the US announced the automatic addition of seven PFAS to the list of

chemicals – which already includes 189 PFAS – covered by its Toxics Release Inventory (TRI). This requires operators of facilities in designated industry sectors – as well as federal facilities – that manufacture or process to report the use of TRI-listed chemicals above set quantities. The move is part of the US government's growing concern over PFAS and follows the removal of a TRI exemption by the EPA in October last year that had allowed facility operators to avoid reporting on PFAS used at small concentrations.

Within the EU, meanwhile, the comment period on a proposed ban ended in September last year and the final decision by the **European Chemicals Agency** (ECHA) is pending. On 13 March 2024, ECHA announced that the Agency's scientific committees for Risk Assessment (RAC) and for Socio-Economic Analysis (SEAC) would evaluate the proposed restrictions in batches. The evaluation will focus on different individual grouped sectors and begins this month – the food contact materials and packaging sector is expected to be discussed in September this year.

While regulators are debating, users of process-

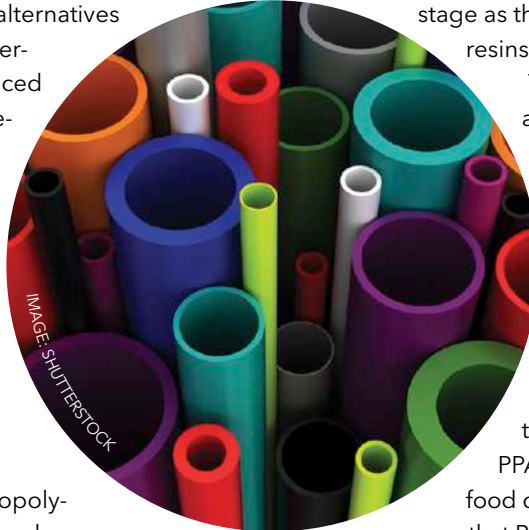
**Main image:** Process aids can help to manage problems such as the die exit flow marking due to high wall shear stress, according to Constab



**Right: Everglide PFAS-free processing aids from Mitsui & Co have improved quality and cut energy in pipe extrusion trials**

ing aids have been seeking alternatives and many additive and master-batch suppliers have introduced PFAS-free solutions. Siloxane-free processing aids have also been introduced in response to the European Chemical Agency's categorisation of the short-chain oligomers in siloxanes as substances of very high concern (SVHC).

Proposed restrictions on PFAS also affect medical compounds, which use fluoropolymers as resins as well as internal lubricants. Further discussion around this topic can be found in the Medical Compounds feature on [page 15](#) of this issue.



stage as they introduce their PFAS-free resins to the market.

Two product grades are available. Baerolub Aid 2201 is said to offer the fastest time to clear melt fracture in metallocene LLDPE - Figure 1. Another option for certain conditions is Baerolub Aid 2202, which the company says provides very good melt clearing times compared to traditional PPAs. Both additives have global food contact approvals and Nunez says that Baerlocher is prepared to scale up quickly and supply the product globally.

The latest introduction from **Dover Chemical** is the DoverClear line of PPAs, which are offered as masterbatches and do not contain either PFAS or siloxanes. Doverclear 840 is recommended for resins with a melt index greater than one, while Doverclear 841 is recommended for resins with fractional melt indices. Both feature LLDPE carrier resins and have FDA food-contact approval. The PPAs are typically used at additions of 0.5-2.5% in the final product. Other carrier resins are available.

**Driven by brands**

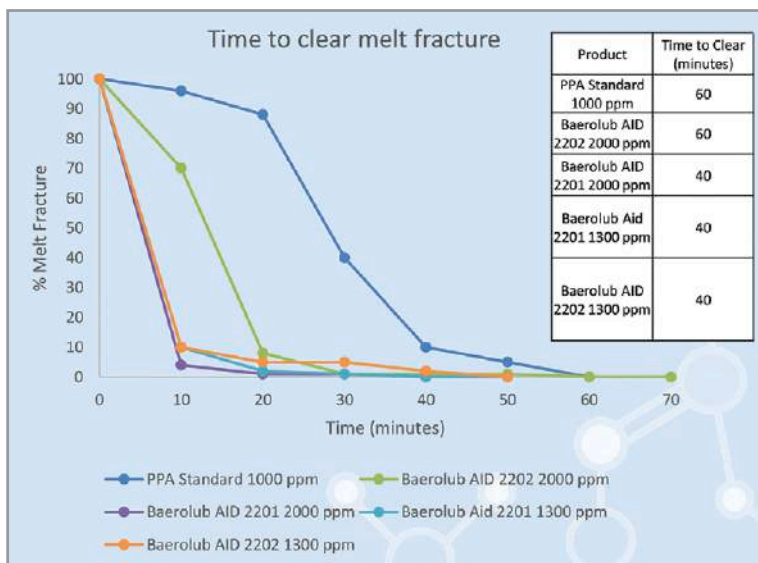
According to Roberto Nunez, Market Development Director for Special Additives at **Baerlocher USA**, it is brand-owner companies that are driving replacement of PFAS PPAs in packaging. The company's latest Baerolub Aid family of PPAs is formulated without PFAS or siloxane. The company's own tests have shown that the new PPAs perform well in blown film, with rapid clearing of melt fracture and reduced die build-up in LLDPE and high molecular weight HDPE. Nunez says that these positive results have been confirmed in multiple trials, including a long-term production environment. He says that four polymer producers have reached production

**Benefits for films**

The family of organo-modified siloxane (OMS) processing aids offered by **Evonik** includes two non-fluorine containing PPA masterbatches for films: Tegomer 6810 for PE films and Tegomer 6850 for PP films. The OMS PPA masterbatches prevent sharkskin and die buildup at a loading level of 0.5-2%, according to Chris Roland, Technical Service Polymer Chemist at Evonik in North America. Advantages of the OMS PPAs compared to fluorinated PPAs are said to include shorter set-up and cleaning time, reduced corrosive wear to the extruder, and high heat-resistance for use in cast film. The masterbatches have US FDA food-contact approval and are under review for food-contact approval review with other agencies globally.

Another recently developed OMS PPA additive from Evonik, Tego XP 21051, already carries food contact approval globally, including FDA approval for up to 0.2% in the final product. Tego XP 21052, which is both non-silicone and non-PFAS and can be used in PP and PE blown and cast film, also has global food-contact approvals and is now available for sampling.

The Everglide PFAS-free processing aid, which in the US is produced for **Mitsui & Co Deutschland**



**Figure 1: Graph showing impact on melt fracture in metallocene LLDPE of Baerlocher's latest PFAS/siloxane free AID series products compared to a standard PPA**

Source: Baerlocher

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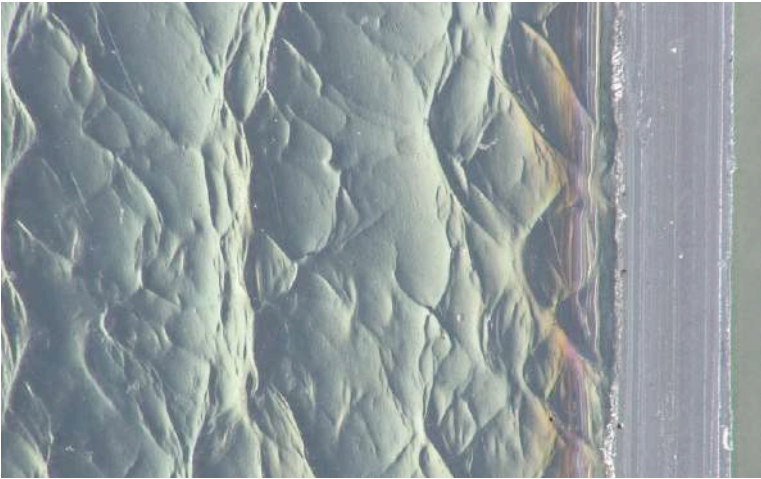
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- Agrochemicals
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- Phase Change





IMAGE: CONSTAB POLYOLEFIN ADDITIVES/MICHAEL WEBER



**Above: Although appearing similar to melt fracture, the visible roughness in this multi-layer film image is caused by melt viscosity-induced flow irregularities between skin and core layers**

by **Polymer Dynamix**, is finding use in film and pipe and profile applications. In recent production trials in extrusion of pipes and profiles, the company says quality of the pipe surface, wall thickness and diameter were maintained, and reduced energy consumption was noted.

“Motor power consumption dropped by 10%, indicating significant energy savings without compromising output,” says Moritz Winkler, Senior New Business Development Manager at Mitsui in Germany. “Further testing suggests the possibility of a 10% increase in output while maintaining the same motor load. The combined results translate to an estimated 15% efficiency gain, offering both economic and environmental benefits.”

EverGlide PA has ISO 10993 certification, which allows its use in medical applications such as

bandages, tapes, and profiles. “This approval indicates that EverGlide PA meets the rigorous standards required for materials used in medical devices, ensuring biocompatibility and the safety of these products when they come into contact with the human body,” says Winkler.

Newly introduced PFAS-free processing aids for films from **Tosaf** are reported to have shown good results in both laboratory testing and commercial extrusion of metallocene LLDPE. Optical properties, such as transmission, haze and clarity, were said to have been improved using the new additive compared to the previously used conventional processing aid. Other benefits were said to include lower melt temperature and reduced occurrence of melt fracture.

**Masterbatch options**

According to **Ampacet**, its new PFAS-free PPA masterbatches for blown film extrusion can be used at the same let-down ratios as its other common fluoropolymer-based PPA masterbatch products, including a solution for resin producers accustomed to using very low concentrations. The line includes an FDA food contact-compliant PFAS-free PPA, a globally-compliant PFAS-free PPA, and a grade that is globally compliant and siloxane-free. The company says the additives eliminate melt fracture, reduce die buildup, and offer increased throughput similar to fluoro-based alternatives.

A range of PFAS-free PPAs suitable for different polymers and conversion processes, including blown and cast film, is now available from **Kafrit Group**, which includes Israel-based Kafrit, **Constab**

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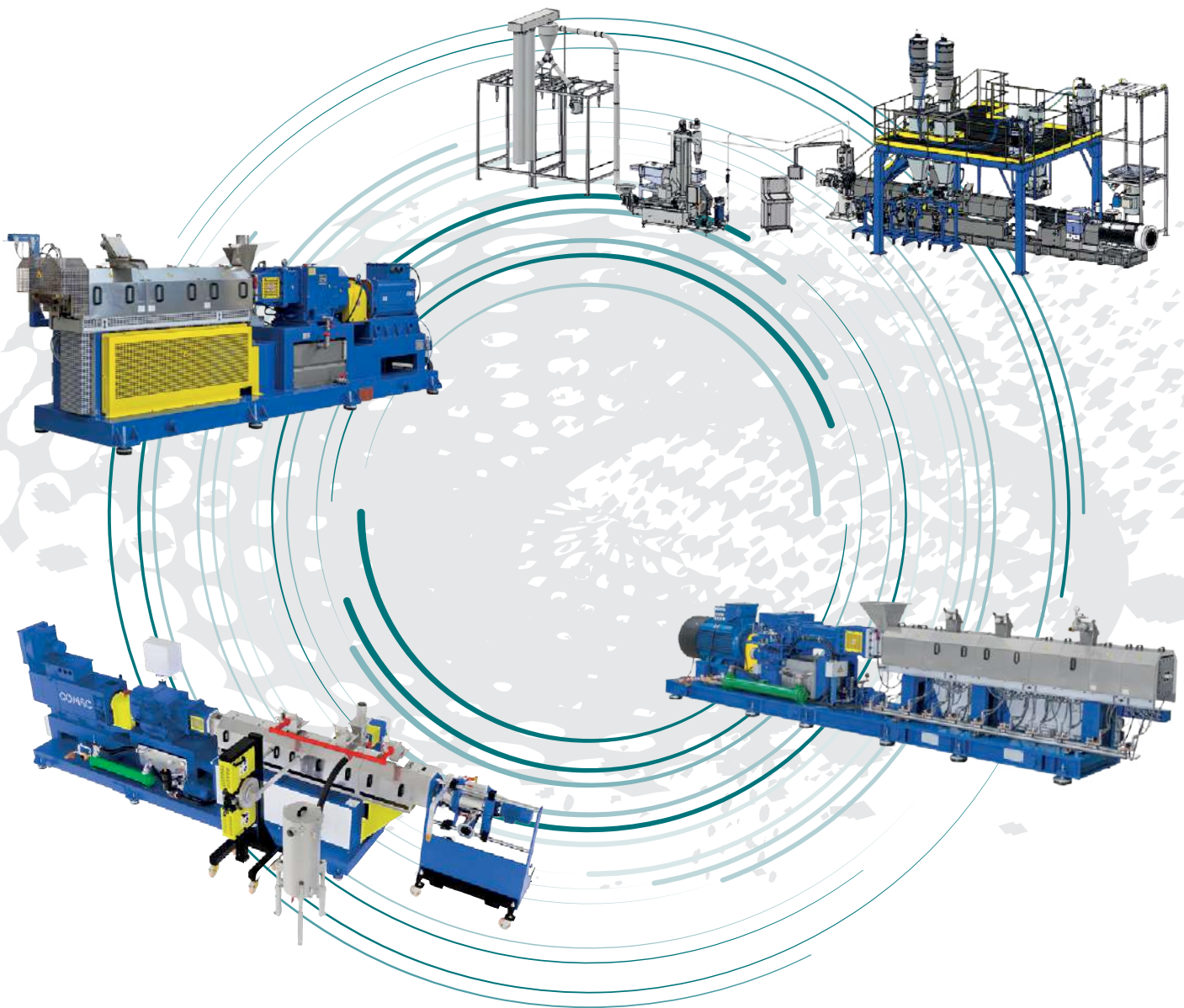
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IMAGE: SHUTTERSTOCK



**Above: Film producers should be aware of potential for interactions between PPAs in base resins and additive masterbatches, warns Ingenia Polymers**

in Europe and **Polyfil** in the US. Some of the solutions are said to be suitable for high-temperature processes running at up to 310°C (590°F), such as pipe extrusion and production of HDPE MDO [oriented] films.

Michael Weber, Technical Services and R&D manager at Constab Polyolefin Additives, says PPAs prevent melt fracture on the surface of the film, explaining that these can occur due to various mechanisms, including high wall-shear stress at the die exit and melt flow irregularities. Another type of melt fracture can occur at the interface of core and surface layers in coextruded multilayer film structures due to differences in viscosity of the individual streams of molten polymer inside the die. These flow incompatibilities affect the clarity of the film similarly to surface roughness and can also be addressed with PPAs.

“PPAs also prevent build-up of material on the die lip, which can degrade and slough off, causing

film web defects or even breaks and increased cleaning times, which indeed remains a technical challenge to new PFAS-free solutions,” Weber says.

The HiTerra T5 PFAS-free PPAs from **Techmer PM** is also said to have been used successfully in large-scale commercial applications. The company says it is now developing a second-generation HiTerra PPA that will be both PFAS-free and siloxane-free.

Houston, US-based **Ingenia Polymers** recently introduced two PFAS-free PPA masterbatches – IP1171 and ITZ-526 – for clearing sharkskin melt fracture and preventing die-lip buildup. The two new products sit alongside the company’s initial IP1170 PPA, which was launched in 2022. Speaking at the AMI Polyethylene Films Conference in Tampa, FL, US, last month, Ingenia Polymers Scientist Manal Khan shared data comparing these masterbatches to other non-fluorine materials used as processing aids, explaining that some of the alternative materials caused screw slippage and surging, which reduced output, while taking longer to clear melt fracture.

Khan also presented a study of combinations of the Ingenia PPAs with other alternative PFAS-free PPA chemistries. It showed that the new Ingenia grades primarily had positive interactions with other PFAS-free PPA chemistries. However, a combination of siloxane and IP1171 showed an antagonistic effect in the time to clear sharkskin melt fracture testing and a combination of polyethylene glycol (PEG) blend and IP1171 resulted in an antagonistic effect on die-lip buildup prevention. IP1171 and ITZ526 on their own provided the best performance in terms of prevention of die-lip buildup. ➤

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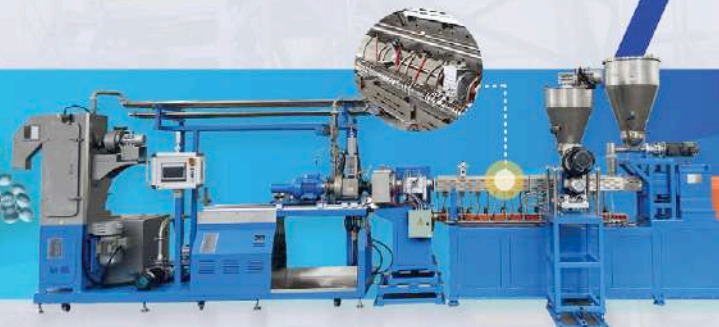
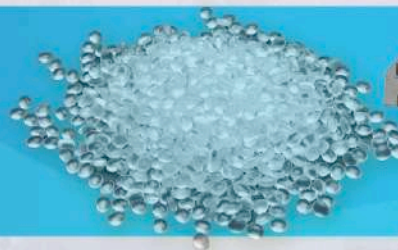
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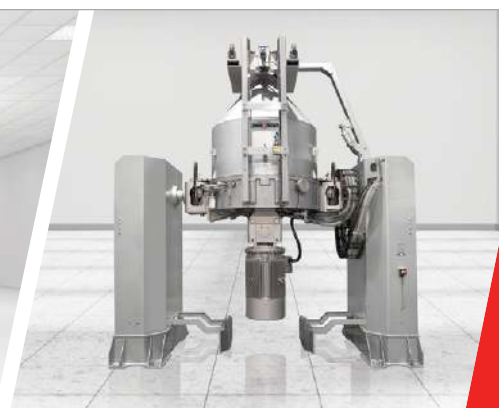
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Khan concluded that when choosing a master-batch, film producers should be aware of possible interactions with any PPAs in the base resin formulation and preferably use a single chemistry of PFAS-free PPA to avoid the potential of antagonistic effects.

The latest introduction from **CAI Performance Additives** is the ST-PA229C series of lubricant additives for polyesters. The company says the new additives offer improvements over traditional lubricants (including silicone, Montan wax and others) and can be used in PET, PBT, and PET/PBT alloys. Benefits are said to include improved dispersion and compatibility of fillers such as flame retardants and enhanced flow (increased melt flow index). The additive can also broaden the temperature range at which PET crystallisation begins, which can lead to shorter cycle times and energy savings in converting processes, such as injection moulding or film or sheet extrusion.

CAI's ST-PA210 lubricating agent is suitable for use in resins including polystyrene and bioplastics such as PLA, where it can also increase flow and enhance dispersion of fillers such as carbon black and talc. The company says that data from a

third-party lab study that simulated the impact of processing on the additive material suggests only trace amounts remain after processing. CAI CEO Richard Marshall says this means that using such an additive would not affect food-contact suitability of end-use products such as food and beverage containers.

**Bio-based solutions**

A recent study investigating the performance of **Cargill's** bio-based IncoMax 100 additive in biaxially oriented PET (BOPET) films found it provided advantages in the orientation process as well as efficient lubrication during extrusion and in post-extrusion processing. The organic migrating additive is made from 100% bio-based carbon content (tested according to ASTM D6866) and has food contact approval statements available.

IncoMax 100 provides multiple benefits across the BOPET manufacturing process, according to Emile Homsy, Associate Director of R&D for Polymer Additives at the company. During film extrusion, it acts as both an internal and external lubricant; post-extrusion it helps with release from the film rollers; and in the final film product it provides

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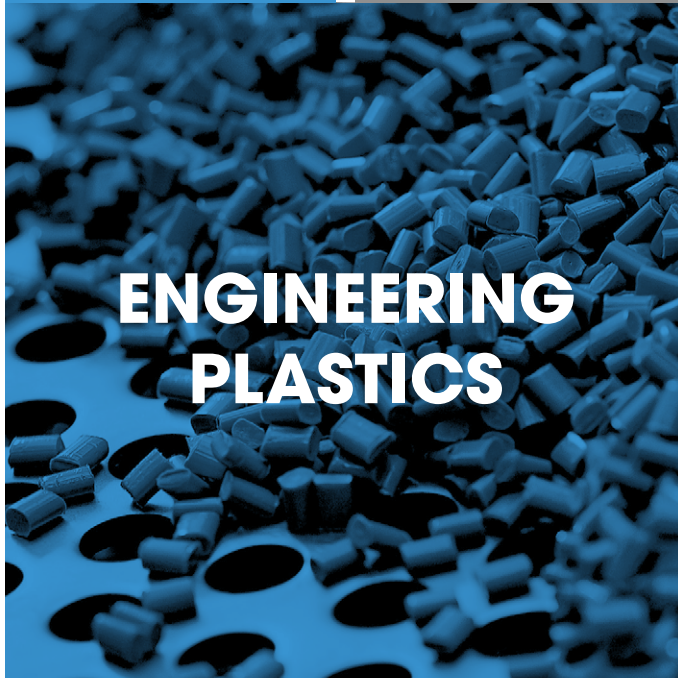
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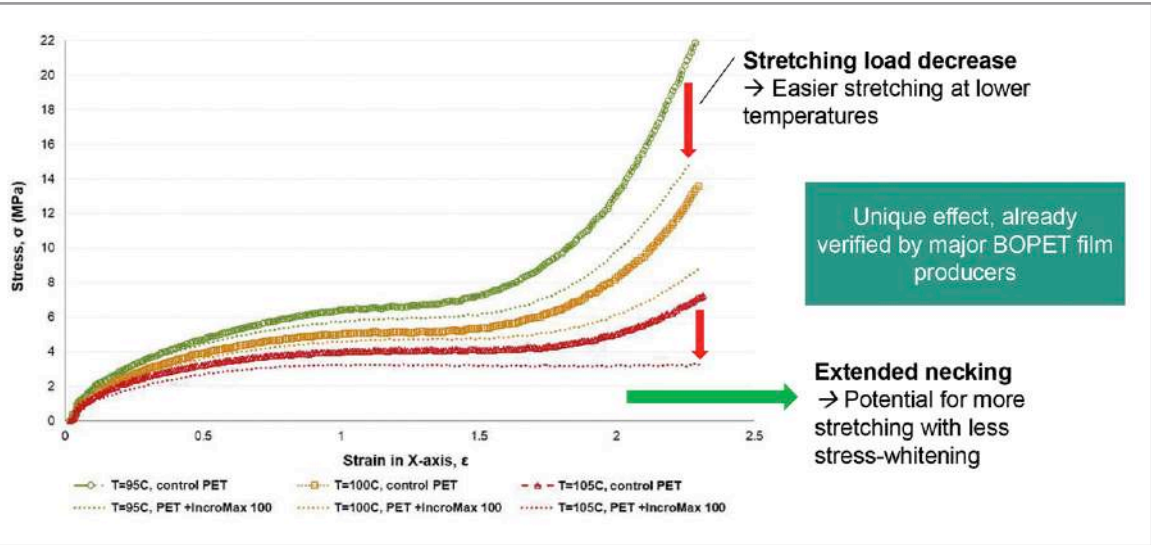


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Chart showing the positive effect of the use of IncroMax 100 additive on stretching load requirement and stress whitening during production of biaxially oriented PET (BOPET) films

Source: Cargill



resistance to scratches and scuffing. “The IncroMax 100 additive does not act as a plasticiser, therefore PET’s (and BOPET’s) morphology and mechanical properties remain intact. Also, it does not cause any haze when dosed within the recommended levels, which makes it ideal for transparent applications,” he says.

**Biaxial process**

Honsi adds that a particular aspect of the IncroMax 100 additive is that it acts as a processing aid during extrusion of the film and through the biaxial orientation process, which takes place in the temperature range of 95-115°C. He says the additive lubricates the molecular chains, which makes the film easier to stretch and reduces the required stretching load when compared to a control PET without the additive.

“As a result, IncroMax 100 additive enables orientation of PET at lower temperatures, which can contribute to energy savings,” he says. “Additionally, when polymers in general are stretched at lower temperatures, the orientation is more effective in terms of mechanical property improvement. However, the risk of causing stress-whitening increases and that can be detrimental in packaging applications. By reducing the stretching load of PET, IncroMax 100 additive can also enable PET to stretch more (at higher stretch ratios) with less stress-whitening. With improved elongation at lower temperatures, converters can potentially achieve higher throughput and yield while maintaining product integrity.”

BOPET films are gaining interest as a potentially more recyclable alternative to BOPP films, according to Cargill, and the company is currently testing whether IncroMax additive has any effect during mechanical recycling of PET. Results to date

indicate that it does not increase degradation during subsequent recycling steps, with reduced discoloration suggesting it may actually slow PET degradation.

In addition to BOPET films, the additive is also said to be useful for use in films and sheets made from PET, PETG, PLA and blends of PLA with other polymers, such as PBAT, PBS, and PHA. In such applications it provides both internal and external lubrication, allowing extrusion at lower temperatures and pressures, reducing energy consumption and improving output rate.

Sourcing additives from bio-based raw materials is a growing trend as companies are more closely examining carbon footprint and working to meet sustainability goals. **Clariant’s** Licocare Vita RBW 560 TP, for example, is based on renewable crude rice bran wax. It is used mainly in engineering thermoplastics applications as a lubricant and dispersion aid.

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IMAGE: SHUTTERSTOCK/CAI PERFORMANCE ADDITIVES

# Pushing performance with PA additives

*Additive technologies allow PA performance to be optimised to meet new and demanding requirements, providing opportunities to cut cost. Chris Saunders reports*

Due to their inherently favourable combination of good mechanical properties, thermal stability and chemical resistance, polyamides are widely used in engineering applications across a broad variety of industries. However, keeping pace with the diverse and ever-changing demands of end-users means enhancing formulations to optimise and improve specific properties. Compounders able to identify and select the right choices from the extensive range of additives available for polyamide (PA) formulations are well positioned to tailor products to deliver precisely the levels of performance and functionality their customers require.

US-based **CAI Performance Additives** markets a wide range of additives for compounders of polyamides, including ST-NA22D. It says what sets this particular additive apart from alternatives is its improvement in Heat Deflection Temperature (HDT), which it claims exceeds the performance of typical competing nucleator additives by 14°C in

side-by-side testing.

In unfilled resins, ST-NA22D can elevate HDT by 28°C compared to the original base polymer, delivering an improvement in both thermal performance and dimensional stability. The company says improvements in thermal stability are becoming more important than ever as compounders look to supply electric vehicle (EV) manufacturers with materials that meet their lightweighting demands but also allow for operation at higher peak temperatures.

PA6T, PA9T and PA10T polymers offer exceptional mechanical, thermal and chemical resistance, making them especially useful in EV parts such as motor mounts, battery enclosures, and thermal management systems. CAI says another of its additives - ST-PA216 - has been developed to improve melt flow to allow parts produced in compounds based on these performance PA grades to be more easily processed, to accept higher filler

**Main image:**  
**Electric vehicles are just one end-use market driving demand for enhanced polyamide compounds**



IMAGE: SHUTTERSTOCK/ XIA WEIQING



**Above:**  
**Stadium seating is a target market for Gabriel-Chemie**

loadings, and to achieve better dispersion. In the area of flame retardancy, two CAI products – ST-FR388 and ST-FR395 – are helping to improve PA performance. ST-FR395, which is said to be characterised by its cost-saving benefits and environmental credentials, offers a good solution for formulations containing bromine-antimony flame retardants. It can be used to replace 3 to 5 parts per hundred resin (phr) of bromine and antimony, reducing cost and also minimising bromine and antimony content. The ST-FR388 grade focuses primarily on cost savings.

With interest growing in PA compounds using recycled content, CAI last year introduced ST-CE37, a polymeric epoxy functional chain extender suitable for upgrading the performance of a variety of virgin and recycled polycondensation polymers, including PA as well as PET. The company claims the additive can significantly improve viscosity characteristics and mechanical properties, as well as inhibiting hydrolysis. It says the reactive side chain present in the ST-CE37 additive gives it an edge over competitive products because it is more accessible to the host polymer.

**Additive focus**

Austrian masterbatch maker **Gabriel-Chemie** has recently released a number of new additive products focused on PA materials. Again, one of the company's prime areas of focus has been on flame retardants for various applications, most notably for stadium seating and electrical components and conduits. Both of these are areas where the company is seeing a strong push towards more sustainable, halogen-free alternatives.

**Right:**  
**Optimised additive dispersion can enhance flame resistance in PA6 and PA66 compounds**

IMAGE: SHUTTERSTOCK/VOELPKER



Among its newest introductions in this area is PA7MA2190FR, which is based on a PA12 carrier and is aimed towards the electrical conduit market. It is capable of delivering PA compounds with a UL94 V-2 classification at 3mm thickness. Also new is PA7MA4797UVFRB1, which is based on a PA6 carrier and is primarily aimed at stadium seating. It is capable of meeting various flame standards at 3mm thickness, including UL94 V-2, DIN 4102 B1 or the Italian C1 standard.

Gabriel-Chemie says that some players in the stadium seat industry have also been encouraging a move to more sustainable solutions, in particular using recycled materials, and it says it has been working closely with customers in this area. It has already developed various products with customers, including one stadium seating project based on rPA6 that is able to achieve German class B1 certification.

In addition to flame retardants, the company has also introduced a new polymer processing aid – PA7AB4830PPA. This is polysiloxan-based in a PA carrier and is non-leaching, which makes it a good option for applications where post-production marking or printing on the polymer surface is required.

**Compatibilisers**

Looking to the future, Gabriel-Chemie Corporate Head of Marketing Mark Hannah says: "We are currently in the process of launching a new range of compatibilisers to help support increased use of mechanically recycled materials and drive the circular economy. Often a certain level of foreign polymer is present in recycled polymers due to imperfections in the sorting and recycling process, and our compatibilizers are designed to improve the material properties. Although most of the range is focused on polyolefins, there are various products that can also be used in PA, such as

Maxiloop UNS7AB5220COM, which reduces

processing issues and improves mechanical properties such as impact strength and elongation at break."

Getting the best performance from any additive, filler or reinforcement often depends on the level of dispersion achieved. For example, optimal flame retardancy and mechanical properties can be achieved by selection of the most suitable incorporation conditions (screw geometries) and/or use of a suitable dispersing lubri-

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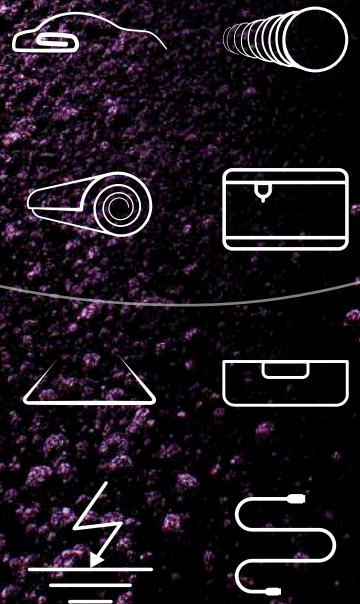
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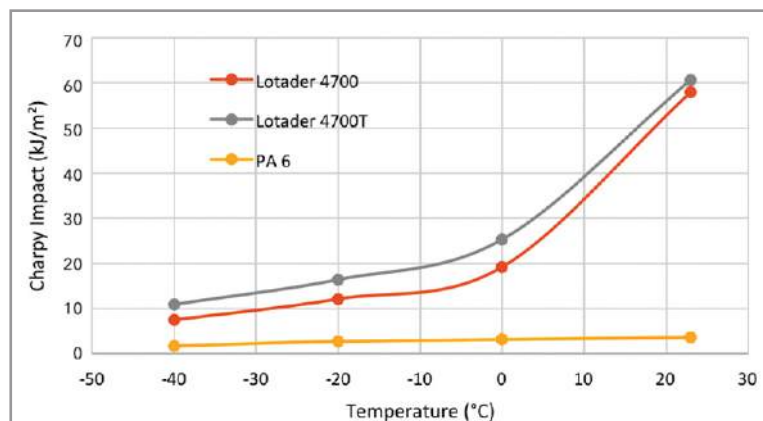
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**Figure 1: Chart showing improvement in low temperature Charpy impact of PA6 using SK's Lotader 4700 and its new 'tubular technology' version**  
 Image: SK Functional Polymer

cant formulation. Cevo-process A-3105 from **Voelpker** is a processing aid that is said to provide a synergistic combination of lubricating, release- and dispersing agents that can help in distributing the flame retardant additive evenly in the PA matrix.

The A-3105 mixture was engineered especially for applications in PA compounding and is suitable for use in filled and reinforced compounds (where it can improve homogeneity of glass fibre distribu-

tion). It can also reduce PA degradation and promote improved surface quality.

A recent study carried out by Voelpker found that using it to replace calcium stearate in a UL94 V-0 classified formulation could reduce the amount of flame retardant by around 20%. According to the company, in achieving the V-0 rating with a standard lubricant such as calcium stearate requires a dosage rate of 12/5% melamin cyanurate in PA6 and 10% in PA66. Replacing the calcium stearate with Cevo-process A-3105 allowed flame retardant dosage to be reduced to 10% for PA6 and 8% for PA66. Comparable results are said to have been achieved with other halogen-free flame retardants such as phosphorus-based flame retardants.

Lotader 4700T, from **SK Functional Polymer (SKFP)**, is described as a "highly reactive terpolymer specifically designed for high impact resistant polyamide compounds." The new grade is produced using the company's tubular technology (indicated by the T in the grade name) and is said to offer a higher melt temperature and improved dispersion in PA resins than the Lotader 4700 grade it is based on.

According to SK, Lotader 4700T has been successfully tested in several polyamides, includ-



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ing PA6 and PA66, where it delivers high toughness along with the good flow required for injection moulding of complex shapes. It is particularly useful for enhancing performance of recycled PA grades for use in automotive applications. The company says Lotader 4700T can be processed as a dry blend in injection moulded PA applications, offering a cost-effective route to medium-toughness parts. It is also said to be well suited to production of parts that require a painted finish.

### Carbon gains

While carbon black is often viewed more for its pigment use, **Cabot Corporation** says the additive is frequently used to enhance attributes of PA compounds. This is achieved through careful selection of the type of carbon black, along with its surface area, particle size, and the dispersion technique within the polymer matrix.

"The automotive industry is actively exploring paths to enhance the performance capabilities of polyamide compounds, seeking attributes like reduced odour, and elevated heat stability, notably Long-Term Heat Stability (LTHS)," says Dominique Strassler, Global Segment Manager

Plastics within Cabot Corporation.

"Regarding LTHS, certain carbon blacks, added to the formulation for UV protection, tend to interact with antioxidant or heat stabilisers, and sometimes limit their effectiveness in stabilising the polymer chains," he adds.

Cabot says its Vulcan XTP50 specialty carbon black is well suited for use in applications requiring LTHS as it presents a favourable combination of UV protection and minimal interaction with the antioxidants and anti-UV agents used in engineering thermoplastics.

The company's Plasblak XP6559A black masterbatch, the next generation version of Plasblak PA3785 masterbatch, enables compounders to boost the performance of PA compounds. It is suited for applications in the automotive sector that require high mechanical strength.

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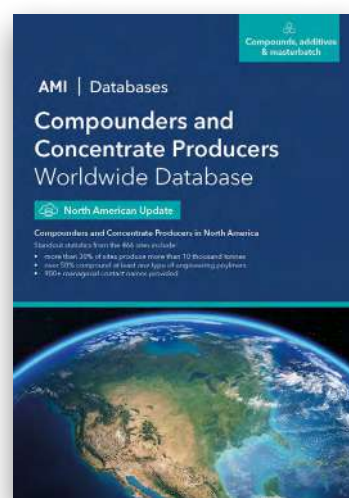
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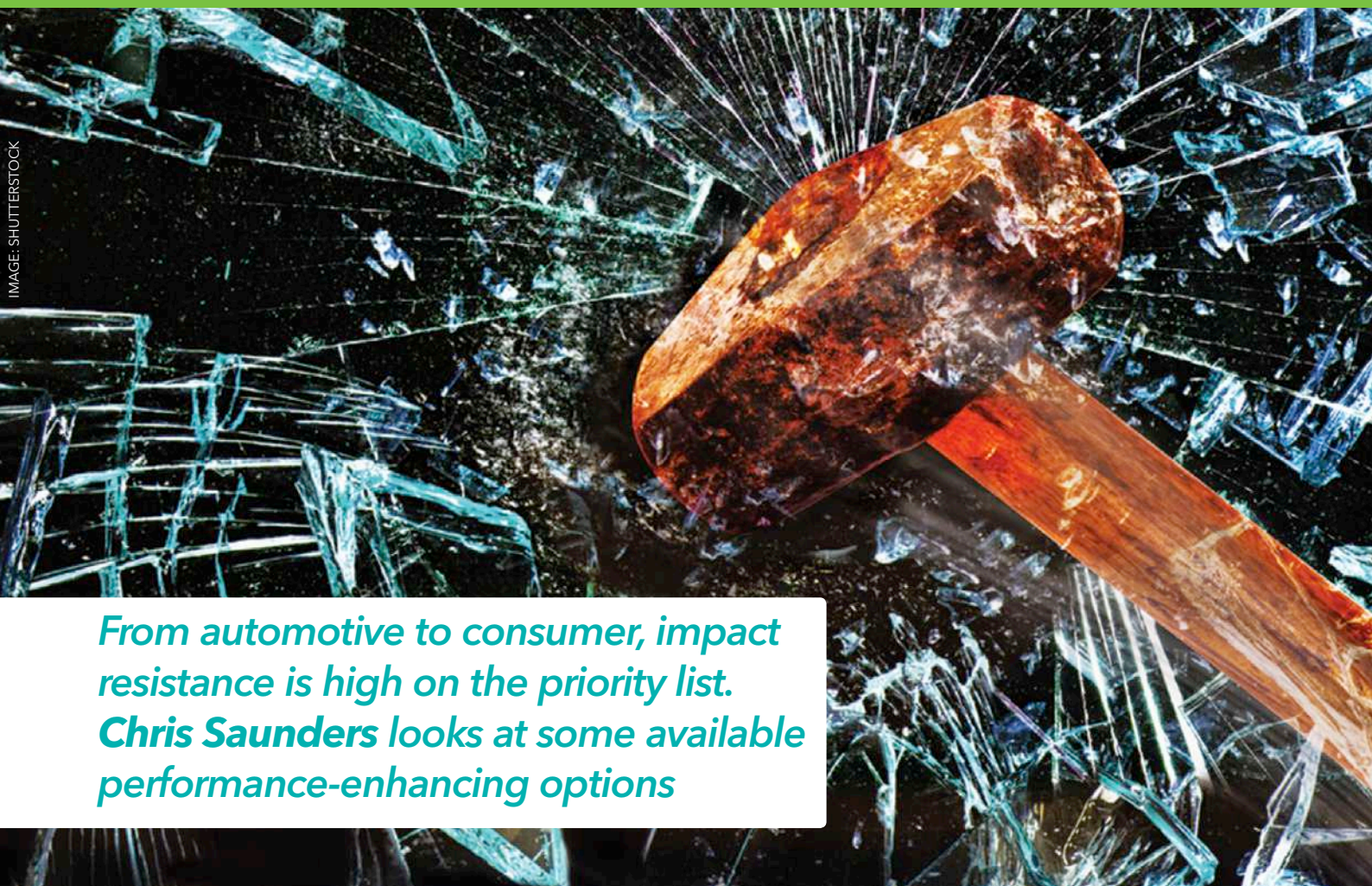
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*From automotive to consumer, impact resistance is high on the priority list. Chris Saunders looks at some available performance-enhancing options*

# Delivering tough solutions

Plastics are certainly versatile but can also be susceptible to fracture under impact. Fortunately, this is a manageable challenge and impact modification is used across many industrial sectors where mechanical integrity of plastics is critical. In automotive, for example, toughened plastics are used in bumpers, interior trim components, and safety parts to enhance crashworthiness and durability. While the consumer electronics industry relies on impact-resistant housings and casings to protect delicate electronic components.

Some of the latest developments in impact modification have focused on improving the efficiency and versatility of toughening techniques. Advances in polymer blending and compatibilisation techniques have boosted performance of multi-phase systems, enabling developers to tailor material properties to meet specific application requirements. Nanostructured materials such as graphene and carbon nanotubes are also showing some potential as performance modifiers.

Established through the acquisition of Arkema's Functional Polyolefins business by SK Geo Centric

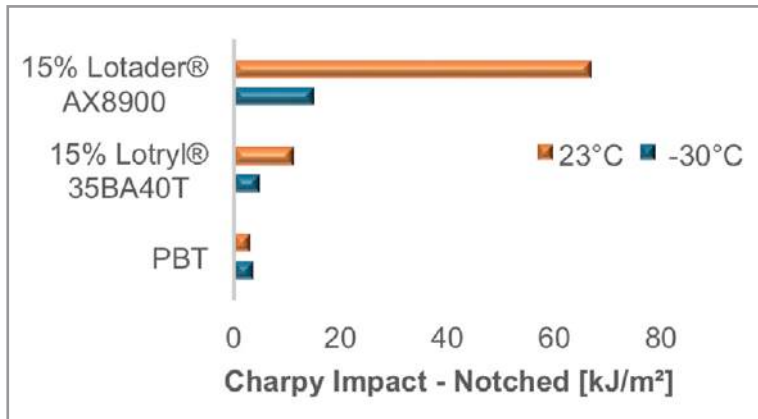
in 2020, **SK Functional Polymer (SKFP)** is a global supplier of performance modifiers. Among its core products are Lotader resins, a portfolio of ethylene terpolymers with reactive functions such as maleic anhydride or epoxide that makes them especially effective impact modifiers.

The latest addition to this product line is Lotader 4700T, which is primarily targeted at PA and ABS applications but will also function in polyolefins and thermoplastic polyesters. Lotader AX8900 is mainly used to produce super tough PBT, PET and PPS compounds (Figure 1), as well as PA6, PA66, PA12 and ABS. The AX product range has been recently extended with the introduction of Lotader AX8850, an experimental grade with higher reactivity aimed at impact modification of engineering plastics such as PPS and thermoplastic polyesters, where it improves impact resistance while maintaining good fluidity.

Over the past few years, SK has developed its tubular process for production of heterogeneous ethylene-acrylate copolymers. The technology is said to produce impact modifiers with high acrylate

**Main image:**  
**Impact modifiers are essential in development of plastic compounds that can meet demanding exposure and operational conditions**





**Figure 1: Charpy impact modification of PBT or PET at -30 and 23° with 15% addition of Lotader AX8900 from SK Functional Polymer**  
 Source: SK Functional Polymer

content and/or high fluidity, with Lotryl 40MA05T the latest to be commercialised. Its high acrylate content contributes to its high flexibility and the company says it has already shown some success in improving the properties of several styrenic resins.

Orevac IM800 is a highly reactive impact modifier designed for high impact resistance PA grades. It has been tested in several polyamides, including PA6, PA66, and long chain PA polymers, and is said to provide ‘exceptional’ impact performance at temperatures as low as -40°C. The company says that the modifier’s adjusted high reactivity and finely tuned viscosity helps maintain controlled viscosity of the compound.

Impact modifiers remain a part of the **Arkema** product portfolio and include BioStrength impact modifiers for PLA and other bioplastics, ClearStrength methylmethacrylate-butadiene-styrene (MBS) core-shell impact modifiers for engineering plastics such as PC, PC/ABS, PC/PBT and PC/PET as well as PVC and epoxy and ester-based thermosets, and DuraStrength acrylic impact modifiers for PC, PC/ABS, PC/PBT, PC/PET and PVC.

According to Alexandre Vermogen, Arkema’s Global Market Manager for Plastic Additives, The company’s products are used across a wide range of industries, including construction, flooring, transportation, packaging, and E&E where they address challenges such as brittleness, cracking, fading, thermal shock, and UV exposure.

“Notably, these impact modifiers enhance the toughness, durability, and appearance of plastics and composites, extending their service life and reducing the need for replacement and maintenance,” he says. “Additionally, they help create lighter and stronger materials that can reduce greenhouse gas emissions and fuel consumption. For example, they can improve the performance and aesthetics of foam decking and flooring, which

are lighter than traditional wood or concrete and offer better insulation and noise reduction.”

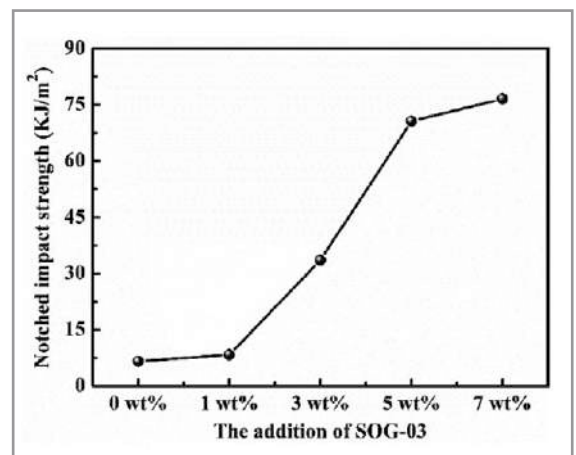
Vermogen says the company’s emulsion based acrylic technology leads to good compatibility and stability with a broad variety of polymer matrices and additives, allowing for higher filler loadings. This, in turn, can lower the cost and environmental impact of formulations, he says.

**Toughening up**

Research carried out by Chinese functional additive supplier **Fine Blend** shows that its latest toughening compatibiliser can provide significant benefits in production of blends of PC and PBT. Simple melt blending results in separation the crystalline and non-crystalline polymers, leading to poor adhesion at the phase interface and contributing to poor impact performance.

Toughening compatibilisers such as ethylene-methyl acrylate-glycidyl methacrylate terpolymer (EMA-co-GMA), ethylene-butyl acrylate-glycidyl methacrylate terpolymer (EBA-co-GMA), and methyl methacrylate-butadiene-styrene terpolymer (MBS) with core-shell structure have all proved effective in PC/PBT blends. However, the company claims better results for a new POE-g-GMA product (SOG-03).

The company says that the brittle-ductile transition in a PC/PBT alloy began to occur at an addition of 3wt% SOG-03, which it says dispersed in the PBT phase while exhibiting a typical rubber toughened polymer morphology. Compared with EMA-co-GMA and SOG-03, MBS showed lower toughening efficiency and more obvious property degradation after multiple extrusion cycles. PC/PBT alloys containing MBS also showed lower impact properties than an equivalent with EMA-co-GMA or SOG-03 after long-term thermal oxygen ageing. ➤



**Figure 2: Chart showing the effect of increasing addition of Fine Blend’s SOG-3 modifier on notched impact strength**  
 Source: Fine Blend



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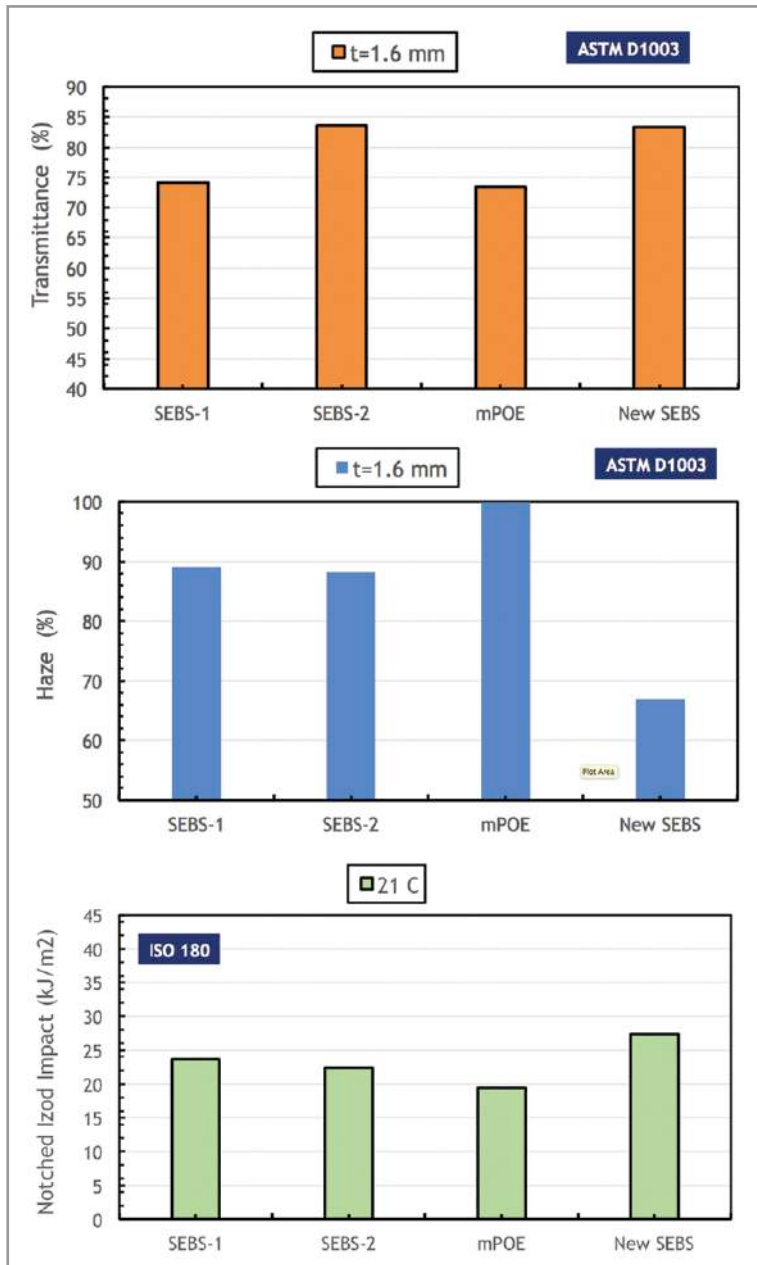


Figure 3: Charts showing notched Izod impact performance at 21°C and haze (1.6mm) of Kraton's latest SEBS polymer (SEBS 3) in a TPO compound compared to formulations based on current SEBS and mPOE grades  
Source: Kraton

Polyester polycaprolactone-based TPU solutions from **Lubrizol** are said to enhance the properties of a wide range of plastics and elastomers, including PVC, ABS, EPDM, EVA, POM, SEBS, TPV, and silicone, improving low temperature flexibility, adhesion, conductivity, and dimensional stability (due to reduced moisture absorption). They can also enhance impact resistance. For example, Pearlcoat DIPP 119 TPU, a soft, transparent, and plasticiser-free grade that exhibits good abrasion resistance, is widely used to improve impact performance and flexibility at low temperatures in PVC compounds and plastisol.

The company says that, when adding glass fibre, its rigid Estaloc series has one of the best impact notched resistances and a translucent surface, even at more than 3mm thickness. It adds that its Estane Silk, Pearlcoat TPU, and Estaloc RETPU ranges offer numerous possibilities for impact modification, while the ability to customise TPU compounds with additives further enhances their suitability for specific requirements.

### Increasing demand

US-based styrenic block copolymers (SBCs) producer **Kraton** says its products are known for their good impact modifying performance. The company says it sees increasing demand for TPO material solutions with good impact performance and stiffness properties together with a high level of transparency.

Enhanced TPO transparency elevates the visual appeal and aesthetics of end products and holds particular significance for the automotive industry, the company says, adding that many OEMs and suppliers are today seeking optimised solutions for transparent exterior components. It attributes this to the on-going electrification of vehicles, which obviates the need for traditional air inlets in front grilles and encourages diverse backlighting options.

The challenge for compound developers is to

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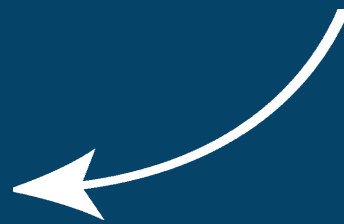
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IMAGE: EDILPLAST

**Above: Italian company Edilplast is using a bio-mass attributed impact-modified ASA from Ineos Styrolution in its new roofing sheet**

strike a balance between transparency and physical and flow characteristics. Kraton says its latest SBC innovation offers improved impact performance, maintains the stiffness profile, and offers very good transparency while providing flow characteristics conducive to thin wall injection moulding. It also provides a reduction in haze value of more than 20% against a standard SEBS solution (more than 30% over a typical POE solution). It also outperforms existing POE and SEBS solutions with a 20% impact improvement over existing SEBS and a 30% impact performance improvement over existing POE alternatives.

**Nano developments**

Nano-additives present a new and developing alternative to traditional impact modifiers. Earlier this year, **Black Swan Graphene** announced availability of a range of Graphene Enhanced Masterbatch (GEM) products claimed to provide a 30% improvement in impact resistance. The GEM grades are the result of independent development and verification carried out with the Graphene Engineering Innovation Centre (GEIC) in Manchester, UK, and a strategic partnership with specialist UK-based compounder **Hubron**.

GEM grades are available with a graphene loading ratio of up to 20% are in various polymers. Initial production volumes are focused on applications in PP, which Black Swan says is a versatile and cost-effective polymer but is hampered by a relatively low impact resistance. The company says the incorporation of 1% of graphene results in a 30% improvement in impact resistance (notched Izod). It says graphene enhanced products offer multiple performance benefits, including enhanced processability and cost-effectiveness.

Black Swan says the GEM products have potential across multiple industries, but particularly highlights packaging and lightweighting in the

transportation sector. It says it is working with Hubron and a major polymer manufacturer to develop plastic materials for electric vehicles aimed at reducing weight, expanding design freedom, reducing complexity, enhancing thermal management, and reducing overall environmental impact. The programme has so far resulted in a 20% improvement in tensile strength based on a loading ratio of just 0.2%.

“These results further add weight to the potential benefits of incorporating graphene materials into thermoplastics,” says Robert Laurent, Technical Director at Hubron. “A 30% impact resistance improvement is exciting, and we are looking to expand these trials into commercial applications. We are also able to fine-tune compound properties to deliver customer specific solutions.”

Among the latest additions to the Luran S line of styrenic compounds from **Ineos Styrolution** is Luran S MED 797S SPF30, an ASA grade targeted at small injection moulded housings for portable medical devices. Available in natural and white, the new grade provides the impact resistance required over the predicted operating temperature range and, like many grades in the Ineos Styrolution product portfolio, is available with a mass balance attributed renewable feedstock content.

The company says sustainability is becoming an increasingly important consideration with regard to impact modification. It says styrenics in general, and PS in particular, can be recycled using almost any existing recycling technology, can be produced with bio-circular feedstock, and can be readily modified to suit applications where impact resistance is crucial. (Also see [page 16](#) in this issue.)

Mass balance bio-attributed ECO styrenic grades are now being used in a number of applications. Last year, Italy’s **EdilPlast**, part of First Corporation group, selected Ineos Styrolution’s Luran S ECO ASA material for use in its Cover Innovation roofing sheet. And last month toy producer Playmobil said it is to convert items in its Playmobil Junior playsets to Terluran ECO GP-22 BC100 ABS, with impact modified MBS Zylar ECO 960 BC90 used for the transparent parts.

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

- > <https://sk-fp.com>
- > <https://plasticadditives.arkema.com/>
- > [www.fineblend.com.cn](http://www.fineblend.com.cn)
- > [www.lubrizol.com/Engineered-Polymers](http://www.lubrizol.com/Engineered-Polymers)
- > <https://kraton.com>
- > [www.blackswangraphene.com](http://www.blackswangraphene.com)
- > <https://hubron.com>
- > [www.ineos-styrolution.com](http://www.ineos-styrolution.com)

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Our most popular and recently released market reports and database titles are listed below, please click on the title of the report to find out more and enquire.

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- ▶ Introduction to Recycling of Engineering Polymers Europe
- ▶ Chemical Recycling Global Status
- ▶ Feedstock Availability for Plastics Recycling Europe
- ▶ The Recycling of Agricultural Films Europe
- ▶ Mechanical Plastics Recycling European Market
- ▶ The Recycling of Flexible Polyolefin Films in Europe
- ▶ Rigid Polyolefin Recycling in Europe



# Upcoming Events

Our upcoming recycling and sustainability events, please click on the title of the event to find out more and purchase your ticket.

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## Feedstocks for Plastics Recycling

4 June 2024  
Brussels, Belgium

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## Plastics Recycling World Expo

13-14 November 2024  
Cleveland, OH, USA

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## Chemical Recycling

4-6 June 2024  
Brussels, Belgium

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## Recycling Flexible Packaging

10-11 December 2024  
Vienna, Austria

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## Plastics Recycling World Expo

11-12 September 2024  
Brussels, Belgium

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## Chemical Recycling

11-12 March 2025  
Houston, TX

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## Bioplastics

17-18 September 2024  
Cincinnati, OH, USA

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## Plastics Recycling World Expo

14-15 May 2025  
Mumbai, India

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## Plastics Recycling Technology

23-24 October 2024  
Vienna, Austria

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## KLK OLEO: GREEN ADDITIVES



KLK OLEO provides a series of products for industrial application. PALMOWAX and PALMESTER provide a green lubricant solution to polymer processing. PALMERE and PALMERA as green ingredients for PVC additives/plasticiser.

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## SUKANO: BIO-MASTERBATCHES



Switzerland's Sukano offers a full range of bioplastic masterbatches and compounds to allow processors to maximise the performance of bio-based resins such as PLA and PHA and to simplify and speed up processing.

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If you would like your brochure to be included on this page, please contact Claire Bishop [claire.bishop@amiplastics.com](mailto:claire.bishop@amiplastics.com). Tel: +44 (0)1732 682948

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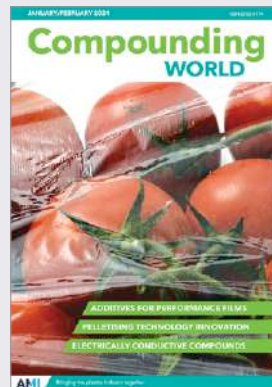
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## Compounding World March 2024

The March 2024 issue of Compounding World looks at the most recent innovations in long fibre thermoplastics, as well as the latest developments in twin screw extruders, special effect pigments, and materials testing equipment. Plus news from the global compounding industry.

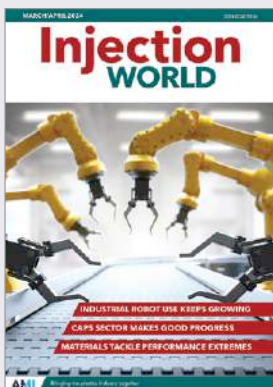
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## Compounding World January/February 2024

The January/February edition of Compounding World takes a look at developments in additives for performance films, pelletising technology and electrically conductive compounds. Plus, this edition also includes our annual update on the fast moving chemical recycling market.

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## Injection World March/April 2024

The March-April 2024 issue of Injection World magazine reports on the fast pace of adoption of industrial robots in response to skills shortages, plus it contains features on caps and closures moulding and high-temperature materials.

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## Plastics Recycling World March/April 2024

The March/April edition of Plastics Recycling world explores some of the latest innovative ideas in recycling of textile waste. It also takes a look at some recent developments in additives for recycled compounds and melt filtration technology.

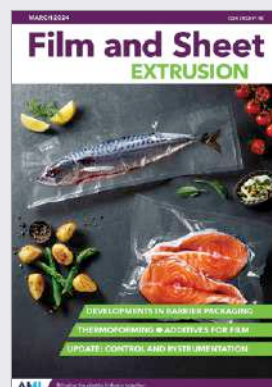
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## Pipe and Profile Spring 2024

The Spring 2024 edition of Pipe and Profile Extrusion magazine has features looking at the latest polyolefin pipe materials, melt filtration, and process control developments. Plus, a preview of the US NPE plastics show.

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## Film and Sheet March 2024

Film & Sheet Extrusion's March edition has a cover feature looking at how flexible packaging companies and their materials suppliers are further developing barrier products, while other features look at the latest in film additives, thermoforming and extrusion controls.

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2024	<b>23-26 April</b>	Chinaplas 2024, Shanghai, China	<a href="http://www.chinaplasonline.com">www.chinaplasonline.com</a>
	<b>2-4 May</b>	Replast Eurasia, Istanbul, Turkey	<a href="http://www.replasteurasia.com">www.replasteurasia.com</a>
	<b>6-10 May</b>	NPE 2024, Orlando, FL, USA	<a href="http://www.npe.org">www.npe.org</a>
	<b>14-17 May</b>	Elmia Polymer 2022, Jönköping, Sweden	<a href="https://www.elmia.se/en/polymer/">https://www.elmia.se/en/polymer/</a>
	<b>15-18 May</b>	Plastics & Rubber Thailand, Bangkok, Thailand	<a href="https://www.plasticsrubberthailand.com/">https://www.plasticsrubberthailand.com/</a>
	<b>21-24 May</b>	Plastpol, Kielce, Poland	<a href="http://www.targikielce.pl/en/plastpol">www.targikielce.pl/en/plastpol</a>
	<b>4-7 June</b>	FIP, Lyon, France	<a href="http://www.f-i-p.com/en/index">www.f-i-p.com/en/index</a>
	<b>26-28 June</b>	Central Asia Plast World, Almaty, Kazakhstan	<a href="https://plastworld.kz/?lang=en">https://plastworld.kz/?lang=en</a>
	<b>11-12 September</b>	Compounding World Expo EU, Brussels, Belgium	<a href="https://eu.compoundingworldexpo.com/">https://eu.compoundingworldexpo.com/</a>
	<b>24-28 September</b>	TaipeiPLAS 2022, Taipei, Taiwan	<a href="https://www.taipeiplas.com.tw/en/index.html">https://www.taipeiplas.com.tw/en/index.html</a>
	<b>8-11 October</b>	Plastex, Brno, Czech Republic	<a href="http://www.bvv.cz/en/plastex/">www.bvv.cz/en/plastex/</a>
	<b>15-19 October</b>	Fakuma, Friedrichshafen, Germany	<a href="http://www.fakuma-messe.de">www.fakuma-messe.de</a>
<b>13-14 November</b>	Compounding World Expo US, Cleveland, OH, USA	<a href="https://na.compoundingworldexpo.com/">https://na.compoundingworldexpo.com/</a>	
<b>4-7 December</b>	PlastEurasia, Istanbul, Turkey	<a href="https://plasteurasia.com/en">https://plasteurasia.com/en</a>	


## AMI CONFERENCES

<b>9-10 April 2024</b>	Medical Tubing and Catheters, Dusseldorf, Germany
<b>23-24 April 2024</b>	Fire Retardants in Plastics North America, Philadelphia, PA, USA
<b>14-15 May 2024</b>	Masterbatch Europe, Vienna, Austria
<b>15-16 May 2024</b>	Polymers in Flooring, Hamburg, Germany
<b>4-5 June 2024</b>	Plastics in Electric Vehicles, Cologne, Germany
<b>4-6 June 2024</b>	Chemical Recycling Europe, Brussels, Belgium
<b>11-12 June 2024</b>	Polymers in Cables, Philadelphia, PA, USA
<b>25-26 June 2024</b>	Rigid Packaging, Cincinnati, OH, USA

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