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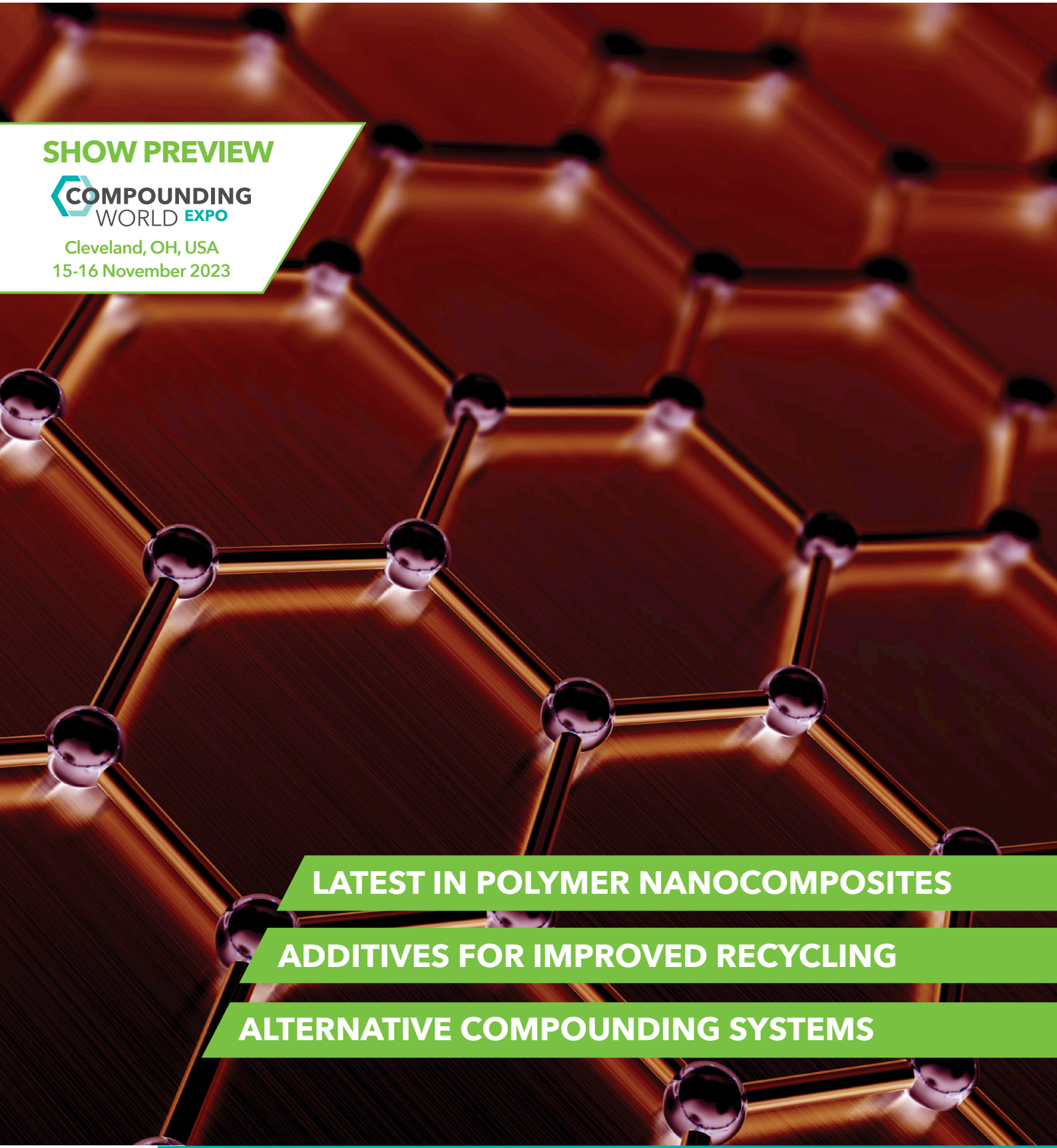
Compounding WORLD



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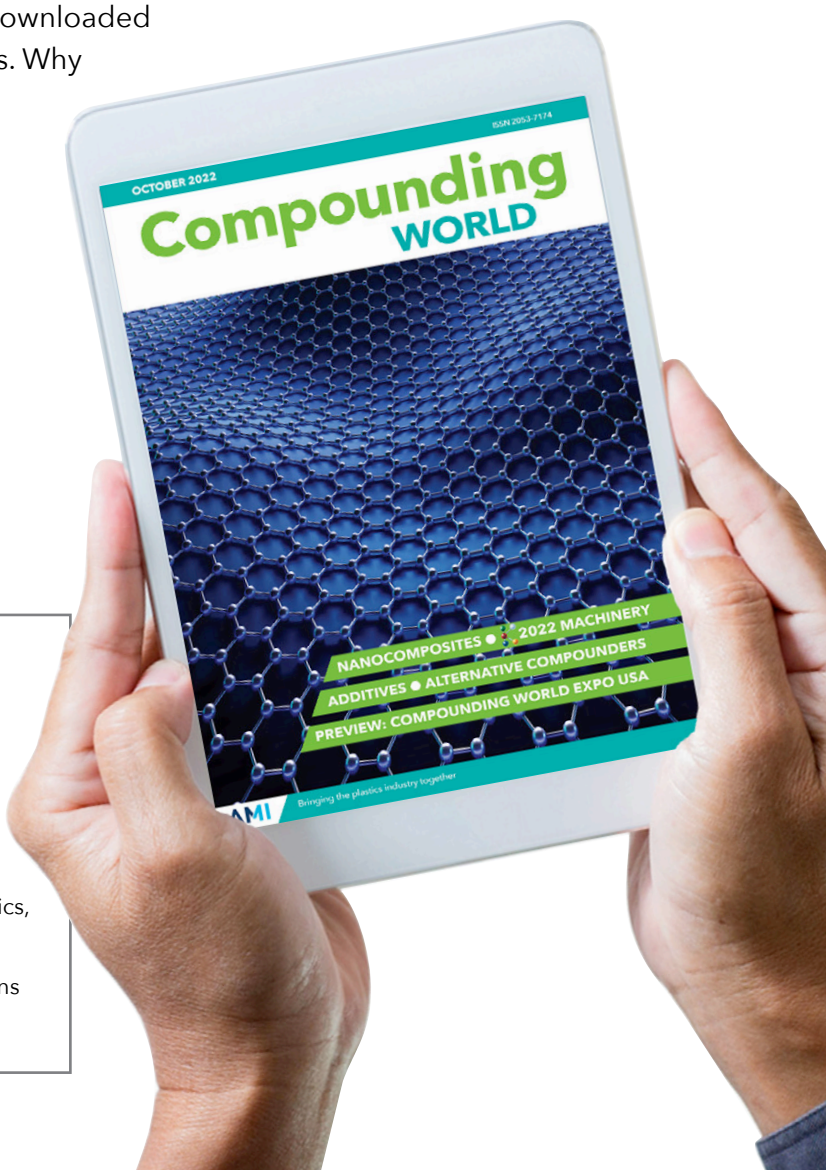

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Compounding WORLD


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Tosaf steps up for PC

Specialty compounder Tosaf is stepping up its activities in additive masterbatches for PC processing following the installation of a new compounding line at its plant at Alon Tavor in Israel.

The company has introduced a number of new products, including light diffuser masterbatches for PC (and PMMA), heat blockers for the near IR range (NIR blockers), and additives for creating matt surfaces with either a fine or rough structure. The latter two products are intended to be applied to the surface of PC sheets by coextrusion in combination with a UV absorber.

Tosaf develops and produces its entire portfolio of polycarbonate compounds at its Alon-Tavor additives factory, where its technical centre is also located.

Tosaf is targeting PC applications such as lighting

"For some years now, we have been registering a steadily growing demand for our products on the part of PC processors," said Gabi Bar, Polycarbonate Product Manager. "Our new facility in Alon-Tavor will increase our flexibility in supplying our broad portfolio of polycarbonate products and further reduce lead times."

› **www.tosaf.com**

Ineos acquires Eastman plant; will operate plasticiser assets

Eastman Chemical has agreed the sale of its Texas City Operations, which are located at Texas City in the US and include part of its plasticisers business, to Ineos subsidiary Ineos Acetyls for a sum of $490m.

Under the deal, Eastman retains ownershjp of the plasticisers business at the site but it will be operated on its behalf by Ineos. The companies have also signed an MoU for long term supply of vinyl acetate monomer by Ineos to Eastman.

"We are happy to have reached this agreement with Ineos," said Erwin Dijkman, Division President Chemical Intermediates at Eastman. "We look forward to working closely with Ineos as we prepare for a seamless transition later this year, and longer-term as operators of our plasticiser assets at the site."

The sale is subject to regulatory approvals but is expected to be completed in the fourth quarter of 2023.

› **www.eastman.com**
› **www.ineos.com**

IN BRIEF...

FRX Innovations is to explore strategic alternatives, which may include potential JVs or a sale of the business, to enhance value and accelerate use of its Nofia fire retardants. The company said it continues to see "compelling long-term opportunities."
www.frx-innovations.com

Covestro has broken ground on a new previously announced Thermoplastic Polyurethanes (TPU) production site at Zhuhai in China. The investment had been announced in February. First phase of the project will be complete in 2025 and have a capacity of 30,000 tonnes/yr. Capacity is forecast to reach 120,000 tonnes by 2033.
www.covestro.com

September's **Plast** exhibition in Milan, Italy, attracted 38,000 visitors, according to event organiser Promaplast. Attendance was down by around 40% on the previous show in 2018, which took place before the global Covid pandemic. Even so, the organisers described it as a "good result in an increasingly complex international context."
www.plastonline.org

LyondellBasell plans Brindisi PP line closure

LyondellBasell has announced its intention to close one of its two polypropylene (PP) production units at its Brindisi location in Italy.

"After thorough analysis, we believe that closure of this unit is the most sustainable solution from a strategic and financial standpoint," said Jim Guilfoyle, Senior Vice President Olefins and Polyolefins EAMEI at LyondellBasell.

"This unit is the oldest of its kind in the world and it has become uncompetitive. The market environment for our polypropylene products of this Brindisi unit has become increasingly challenging, and the outlook provides little improvement," he said.

› **www.lyondellbasell.com**

M Holland goes for recycling

M Holland Company is launching Mfinity, a proprietary brand of compounds containing up to 100% recycled content in commodity and engineering resins.

The company said the new brand is intended to provide a practical solution for processors, brand owners, and original equipment manufacturers (OEMs) looking for custom solutions that will help meet sustainability goals.

In addition to recycled resins, Mfinity grades include proprietary additives and bio-compounds and are said to be suitable for applications in markets such as automotive, consumer goods, electrical and electronics, and packaging.

The company said that many Mfinity resins are third-party certified based on the percentage of recycled content. Some select grades have Food and Drug Administration's Letter of No Objection (LNO) or other agency certifications.

› **www.mholland.com**

Omya acquires Bublon

Global minerals company Omya has acquired Bublon, an Austrian producer of lightweight fillers and microspheres based on closed cell expanded perlite manufactured with its own proprietary technology.

Bublon products are said to combine enhanced hermeticity and high mechanical strength with a low carbon footprint. Omya said the acquisition gives it a processing capability for lightweight fillers, adds an energy-efficient production process, and provides it with a team of experienced technical experts.


IMAGE: BUBLON

Inside the Bublon production plant at Gleisdorf in Austria

"With the acquisition we are a step closer to offering a one-stop-shop experience for our customers with a broad portfolio of lightweight fillers," said David González Amago, Director Global Business Development Lightweight Fillers at Omya. "The technology complements our existing product range and fits perfectly with our commitment to providing advanced, sustainable materials and solutions."

› **www.omya.com**
› **www.bublon.com**

Toray to team up with Honda on chemical recycling of PA6

Toray Industries and car maker Honda are to jointly develop a chemical recycling technology for glass-fibre reinforced PA6 parts recovered from end-of-life vehicles.

The two companies said they have already commenced verifying the technology, which entails depolymerising of the PA compounds with subcritical water and regenerating the material as the raw monomer caprolactam.

The high temperature, high pressure technology is said to be able to depolymerise PA6 in minutes to create a high yield of raw monomer. Separating, refining, and repolymerising this monomer results in a PA6 that performs like a virgin grade, the developers claim.

Toray and Honda said in a statement they are now planning to set up a pilot depolymerisation facility with a processing capacity of around 500 tonnes/yr of raw resin for validation of the technology.

› **www.toray.com**

Clear innovation for Trinseo in footwear


IMAGE: TRINSEO

Speciality materials solutions provider Trinseo has launched a new transparent TPE grade for footwear applications. The Apilon 52 XB-75A Cristallo grade is the company's first ester-based transparent thermoplastic polyurethane (TPU).

The company said the new TPU fulfils a demand in the footwear industry for transparent outsoles and shoe parts. It is said to offer good processability and fast cycle times along with superior mechanicals.

"We are adding a solution that will enable us to better serve footwear manufacturers and help them keep up with the trends," said Marlie Koekenberg, Sales Director EMEA.

› **www.trinseo.com**

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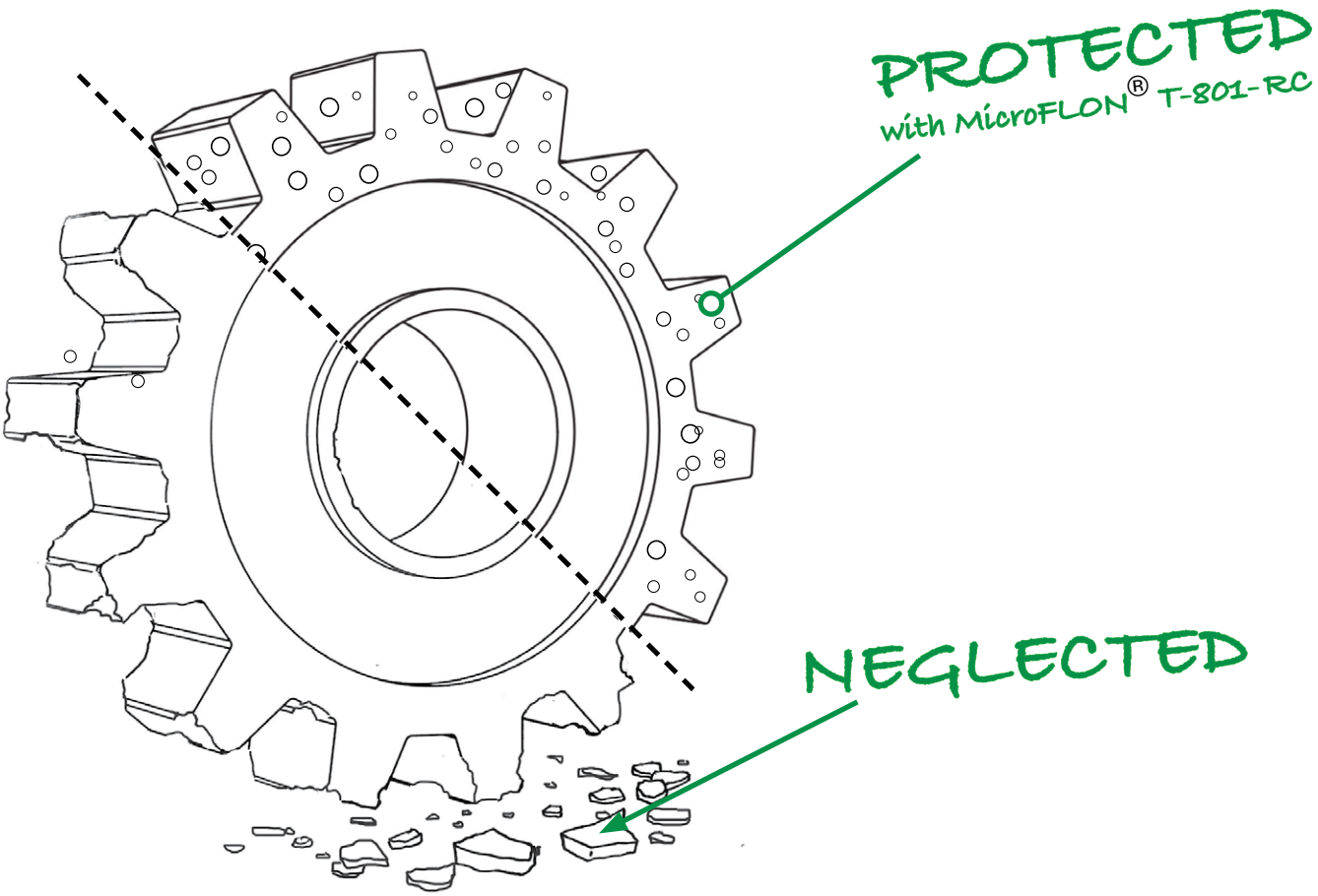

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www.shamrocktechnologies.com

Shamrock Recycles

Lehvoss expanding in China

Germany's Lehvoss Group has expanded the compounding and technology centre it opened in China in 2016, relocating it to new and significantly larger premises in the Kunshan German Industrial Park.

The company said the move doubles the total area of the plant and technology centre to 5,000m² and increases production capacity to cater for the high demand for Luvotech eco compounds and Luvobatch masterbatches it is seeing in China.

"We are proud to have achieved a very strong presence and significant growth in China in just a few years," said Xuesong Zhang, Managing Director of Lehvoss Chemical (Shanghai) and President of Lehvoss China. "With this move, we are well prepared for further growth and new challenges. We can continue to offer our customers excellent service and leading products."

Separately, Levhoss has established a strategic partnership with Evonik to develop new Luvosint formulations for industrial 3D printing based on Evonik's PA613 polymer chemistry.

Under the agreement, Lehvoss will include Evonik's Infinam PA 6005 P (PA613) polymer powder in its own product portfolio. Compared to other resins from the PA6 family, it is said to be characterised by low water absorption (below 3%), which positively affects the 3D printing process.

› **www.lehvoss.de**
› **https://corporate.evonik.com**

BASF app delivers CO_2 data

BASF has released a new digital application designed to give customers a better overview of the sustainability status of the product portfolio they purchase while helping them identify solutions to reach sustainability targets.

The app, called MyCarbonFootprint, contains data on more than 700 selected large volume BASF products. Using the app, the company says customers can determine how adjustments in their purchasing portfolio affect their sustainability status in terms of CO_2 emissions and use of renewable raw materials.

The MyCarbonFootprint app carries data on more than 700 BASF products

IMAGE: BASF

BASF has also launched what it claims are the first biomass balance plastic additive offering. The first two introductions are Irganox 1010 BMBcert and Irganox 1076 FD BMBcert, both certified by TÜV Nord for mass balance according to the ISCC Plus scheme. The grades are drop-in replacements for Irganox 1010 and Irganox 1076.

› **www.basf.com**

Mitsubishi ups EVOH capacity

Mitsubishi Chemical Group (MCG) is increasing its annual production capacity of Soarnol ethylene vinyl alcohol copolymer (EVOH) resin at its plant in the UK by 21,000 tonnes to 39,000 tonnes.

Construction is already underway, with the new capacity expected online in July 2025. It will take the group's global capacity, which is spread across sites in Japan, the US and the UK, to 90,000 tonnes.

Soarnol is a high gas-barrier resin suitable for use in long shelf-life food packaging. Multilayer films containing the resin are certified as recyclable when used with the group's recycling compatibiliser Soaresin, according to the company.

The group said it anticipates solid growth in global demand for Soarnol in the coming years.

› **https://mitsubishichemical.co.uk**

Cabot gains ISCC status

Cabot announced that it has gained International Sustainability and Carbon Certification (ISCC) Plus certification for six of its global facilities, including two carbon black masterbatch and compounding locations in Europe.

Earlier this year Cabot introduced the Evolve Sustainable Solutions platform, which is designed to deliver products that offer sustainable content with reliable performance at industrial scale. That currently includes two ISCC PLUS certified reinforcing grades.

Cabot said it anticipates expanding the Evolve platform to other businesses and is focused on developing new solutions for plastics. Obtaining ISCC PLUS certification at its masterbatch and compounding facilities is a step towards that.

› **www.cabotcorp.com**

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Mechanical recycling plans

TotalEnergies is building a new mechanical recycling unit at its Grandpuits site in Seine-et-Marne in France.

Scheduled to be commissioned in 2026, the plant will produce 30,000 tonnes/yr of high value-added compounds containing up to 50% recycled plastics. It will target the high-performance packaging market, in particular the pharmaceutical and cosmetics industries, and will include a customer technical assistance and product development centre.

"This new investment is good news for the Seine-et-Marne region and an additional step in the Grandpuits zero-oil platform project," says Bernard Pinatel, General Manager of the Refining-Chemicals branch of TotalEnergies.

"This plastics recycling unit is fully in line with the company's ambition to develop the circular economy and will contribute to... producing 1m tonnes of circular polymers by 2030."

› **https://totalenergies.com**

Neste leads renewable path to construction

Finnish renewable feedstocks group Neste, working together with polymer producer LyondellBasell, and bio-based compound developer Biofibre and bio-composite processor Naftec (the latter both based in Germany) claim to have developed a value chain for production of construction elements using natural fibre reinforced bio-based polymers.

The matrix material for the new products is LyondellBasell's CirculenRenew C14 polyproylene, which is manufactured using a Neste feedstock produced from waste residues and includes a measurable bio-based content.

According to the project partners, the bio-based elements – suitable for use in applications such as fence posts – temporary store the carbon sequestered during the biomass growth stage while in use. An LCA study carried out by GreenSurvey for Biofibre shows that the carbon removed from the atmosphere exceeds supply chain emissions from the logistics and manufacturing of the plastic granules.

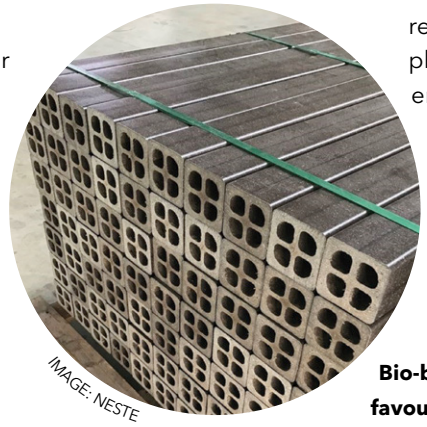


IMAGE: NESTE

Bio-based composites offer a favourable carbon footprint

› **www.neste.com**
› **www.lyondellbasell.com**
› **www.biofibre.de**
› **www.naftex.de**

Metal-detect grades from Ascend

Ascend Performance Materials has introduced pre-coloured, metal-detectable Vydyne PA66 compounds for production of cable ties and fasteners used in industries where foreign object contamination causes health concerns and reputational damage, such as in pharmaceutical and food processing facilities.

The new compounds are said to meet the most stringent performance standards and simplify the supply chain for cable tie and fastener producers. "This new metal-detectable Vydyne reduces the need for additional tolling or masterbatch steps and ensures the material performs as intended right out of the box," said Tim Goossens, cable tie segment leader for Ascend.

Beyond cable ties and fasteners, the compounds could also find application in safety-critical applications in other sensitive market segments, such as machined plastic stock shapes and consumables that require HACCP-managed food safety.

› **www.ascendmaterials.com**

ExxonMobil invests in polymer modifiers

ExxonMobil has announced the startup of two new chemical production units at its manufacturing facility at Baytown in Texas in the US as part of a $2bn investment intended to focus its US Gulf Coast facilities on higher value products.

A new performance polymers line will produce 400,000 tonnes/yr of Vistamaxx and Exact-branded polymer modifiers, which are used to make automotive parts, construction materials, hygiene and personal care products, and various packaging products.

The second new unit is a linear alpha olefins line that will produce 350,000 tonnes/yr of Elevexx-branded product, a new market entry for the company.

"With startup of these two new lines, ExxonMobil is delivering high-value materials for a variety of products that society depends on every day," said Karen McKee,Ppresident of ExxonMobil Product Solutions.

› **https://corporate.exxonmobil.com**

Baystar JV starts up $1.4bn US PE plant

Baystar, a joint venture between TotalEnergies and Borealis, has started up its $1.4bn 625,000 tonnes/yr Bay 3 polyethylene (PE) unit, more than doubling current production capacity at the site in Bayport, Texas.

The Bay 3 unit completes the JV's integrated petrochemicals venture, which also includes the site's two legacy PE lines plus an ethane cracker at the TotalEnergies Platform in Port Arthur, Texas.

It increases the Baystar site's total production to more than one million tonnes per year and is the first PE unit to use the Borealis Borstar 3G technology in North America.

"The start-up of the new PE unit is the second milestone of this joint venture aimed at establishing Baystar as a fully integrated US petrochemical player," said Bernard Pinatel, President, Refining & Chemicals, TotalEnergies.

Borealis CEO, Thomas Gangl said: "Expanding and deepening our footprint through Baystar enables us to better serve customers and partners by offering improved access to Borstar-based products produced right here in North America."

› **www.baystar.com**

Eigen integrates Ampacet colour control technology

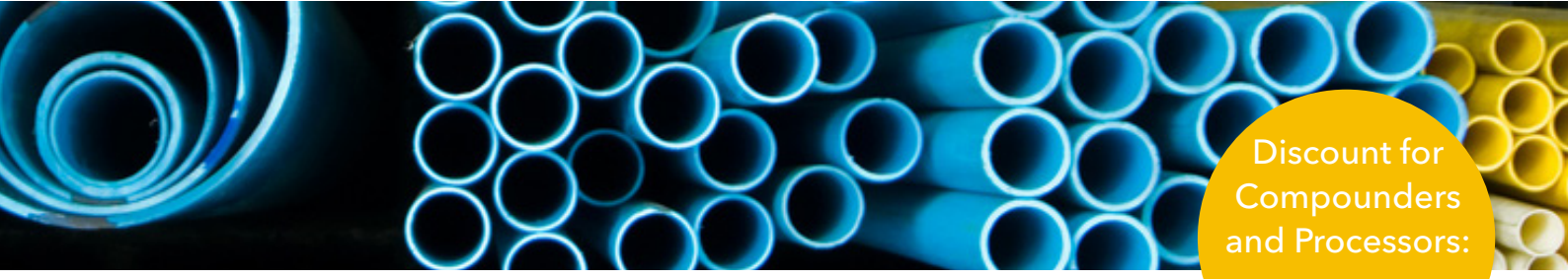
Eigen Innovations has partnered with Ampacet to integrate its Spectro 4.0 colour monitoring and management solution into machine vision solutions, allowing colour metrics captured by a sensor to be correlated with digital part records during the production process for continual quality assessment.

Eigen's machine vision solutions feature camera sensors and edge processors plus machine and network connectivity to capture and generate digital records with critical quality and process data on every part produced.

"We created Spectro4.0 to allow plastic processors to accurately measure colour during production in real-time to reduce scrap and lost production due to poor colour quality," says Douglas Brownfield, Commercial Director of LIAD Smart at Ampacet.

› **https://eigen.io**

› **www.ampacet.com**



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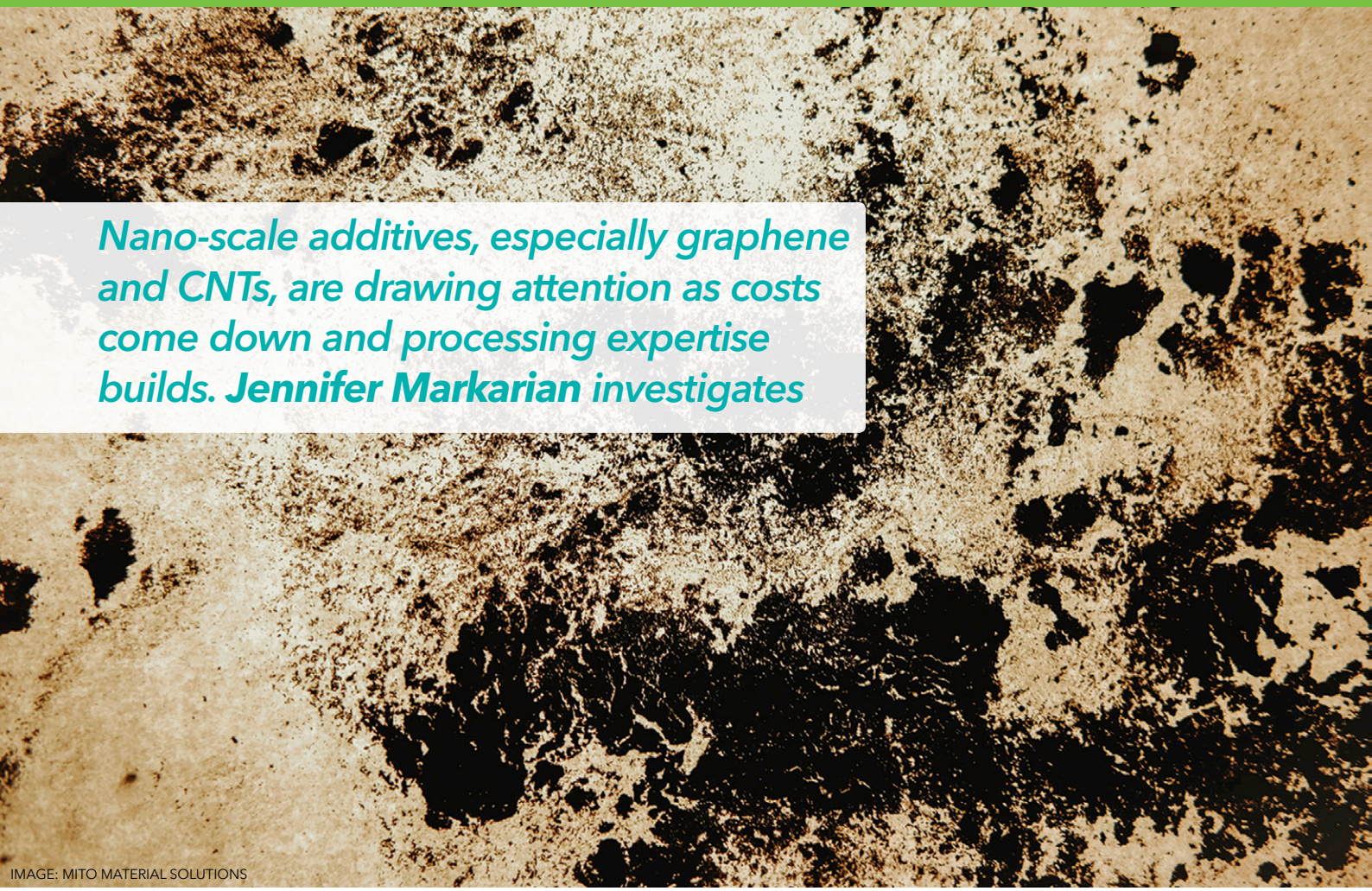

Nano-scale additives, especially graphene and CNTs, are drawing attention as costs come down and processing expertise builds. ***Jennifer Markarian*** *investigates*

IMAGE: MITO MATERIAL SOLUTIONS

Nanocomposite challenges ease as experience grows

In the realm of nano-scale materials the rule is that a little goes a long way, with significant property improvements obtainable at very low loading levels. In the past, however, realising the potential benefits has meant overcoming challenges, including difficulty in adequately dispersing the additives as well as their high cost. Technology providers are finding solutions to these challenges, though, and nano-scale additives such as graphene and carbon nanotubes are now finding their way into new thermoplastic applications.

Graphene, for example, offers property improvements for various plastics applications. Thermoplastic composites enhanced with graphene (a single layer thick sheet of carbon atoms arranged in a hexagonal lattice structure) can reduce weight and improve strength in a range of applications requiring miniaturisation, low weight and high functionality, according to Alexandre Corrêa, CEO of Brazil-based **Gerdau Graphene**. He cites aerospace and wearable electronics as just two of many potential application sectors.

Properties such as electrical and thermal conductivity and high-temperature resistance are driving graphene's use in thermal management applications, such as plastic tubes in heat exchangers for water desalination, power stations and refrigeration. In addition, the flexibility of graphene-filled films and sheets makes them suitable for displays, touchscreens and photovoltaic cells, he notes.

As global availability of graphene increases, the cost is decreasing, Corrêa says. And regulations are being put in place that will provide essential standards for users. "In Europe, the Graphene Flagship – a multi-country consortium between industries and government agencies in Europe – has laid a fundamental groundwork on relevant regulations and norms. Similar work has begun in the United States, and now we see other countries, such as Brazil, following suit adapting locally these new regulations," he says.

Corrêa adds that three ISO standards have been

Main image: Tackling the challenge of effective dispersion – in this case by MITO using functionalisation – is opening up opportunities to exploit the novel performance benefits of graphene-based nano particles

Right: MITO's E-GO functionalised graphene oxide has been formulated to maximise dispersion and resist agglomeration

IMAGE: MITO MATERIAL SOLUTIONS

published (ISO/TS 80004-13:2017 on vocabulary, ISO/TR 19733:2019 on properties and measurement techniques, and ISO/TS 21356-1 on structural characterisation). These were recently adopted by the Brazilian National Standards Organisation (ABNT).

The latest commercial nanocarbon-enhanced material from Gerdau Graphene is its Poly-G PE-07GM polyethylene masterbatch, which is designed for use in non-stretch films, profiles, and sheets formed by extrusion. Products made with the masterbatch are said to be stronger, to cost less to manufacture, and result in less production waste, the company reports.

Poly-G has been pilot-tested in a number of industrial wrap applications in the factories of Gerdau's steel-producer parent company. In the case of a plastic film containing 1% Poly-G used for wrapping construction nails, film thickness was reduced by around 20% and a 7% increase in film productivity was measured. In addition, because fewer nails perforated the new packaging compared to the old, there was also a 40% reduction in the overall volume of damaged packaging, the company reports.

Below: Graphene masterbatches from Gerdau Graphene can improve performance and sustainability

Gerdau Graphene has also recently partnered with Packseven, a Brazilian flexible film maker, to commercialise an ultra-thin, graphene-enhanced stretch film using Poly-G. In initial tests, the films showed they could pack 120% more product without breaking compared with comparable flexible films, the company says. It cites benefits from using the more durable and thinner films including reduced film consumption as well as improved safety in packing and loading. Puncture resistance is also enhanced.

Laboratory-scale testing also showed the nanocarbon-enhanced masterbatch could allow a greater amount of recycled plastic to be used in a stretch film formulation. It also allows further downgauging to cut polymer consumption.

Corrêa says both benefits enhance sustainability and are a primary value of interest in the plastics market. "Adding as little as 1% in mass of our Poly-G to a thermoplastic matrix provides a 20–30% reduction in virgin resin. We continue to test and pilot recycling applications," he says.

IMAGE: GERDAU GRAPHENE

Recycled masterbatch

The latest development from Canada-based **Nanoxplore** is a graphene masterbatch made with recycled PP and recycled TPO. The aim of the new masterbatch is to boost performance of recycled resins, to improve the compatibility of blends, and to homogenise colour to a more appealing hue, according to Nima Moghimian, Global Director of R&D. He says the graphene is easy to process using standard equipment.

Automotive applications are a primary target for the new product. "Our graphene is affordable, available in large quantities and has regulatory approval in North America and Europe," says Moghimian.

Meanwhile, US-based **MITO Material Solutions** has developed a patented process to functionalise graphene to create a hybrid of graphene oxide with polyhedral oligomeric silsesquioxane (POSS) that can be used in thermosets or in thermoplastic compounds. The company says its MITO E-GO additive of micron-sized particles is formulated to "reactively disperse and resist agglomeration". In 2022, the Graphene Council awarded the additive the title of "Verified Functionalized Graphene," which MITO says means users can be assured of its product consistency and quality.

Canadian graphene manufacturer **Universal Matter** (UMI) aims to "upcycle" carbon-based materials and waste streams to manufacture turbostratic graphene, where the individual crystal layers are twisted out of alignment. This misaligned stacking is said to mitigate interlayer coupling, which increases interplanar spacing and yields better physical properties relative to alternative graphene structures when compared on a similar weight basis.

The company's proprietary "Flash Joule Heating" graphene manufacturing process can use a wide range of carbon-based feedstocks, including tyre or plastics waste streams. "With plastics, we have typically utilised post-pyrolysis carbon from this stream, but we can also utilise the raw plastic streams. Generally speaking, higher carbon content and fewer volatiles are preferred," says Dru Kefalos, Chief Marketing Officer.

Kefalos says the company is actively developing graphene solutions for thermoplastic composites, with most of the development work to date taken place with HDPE, PP, and PA.

The company has Innovation Centers located at

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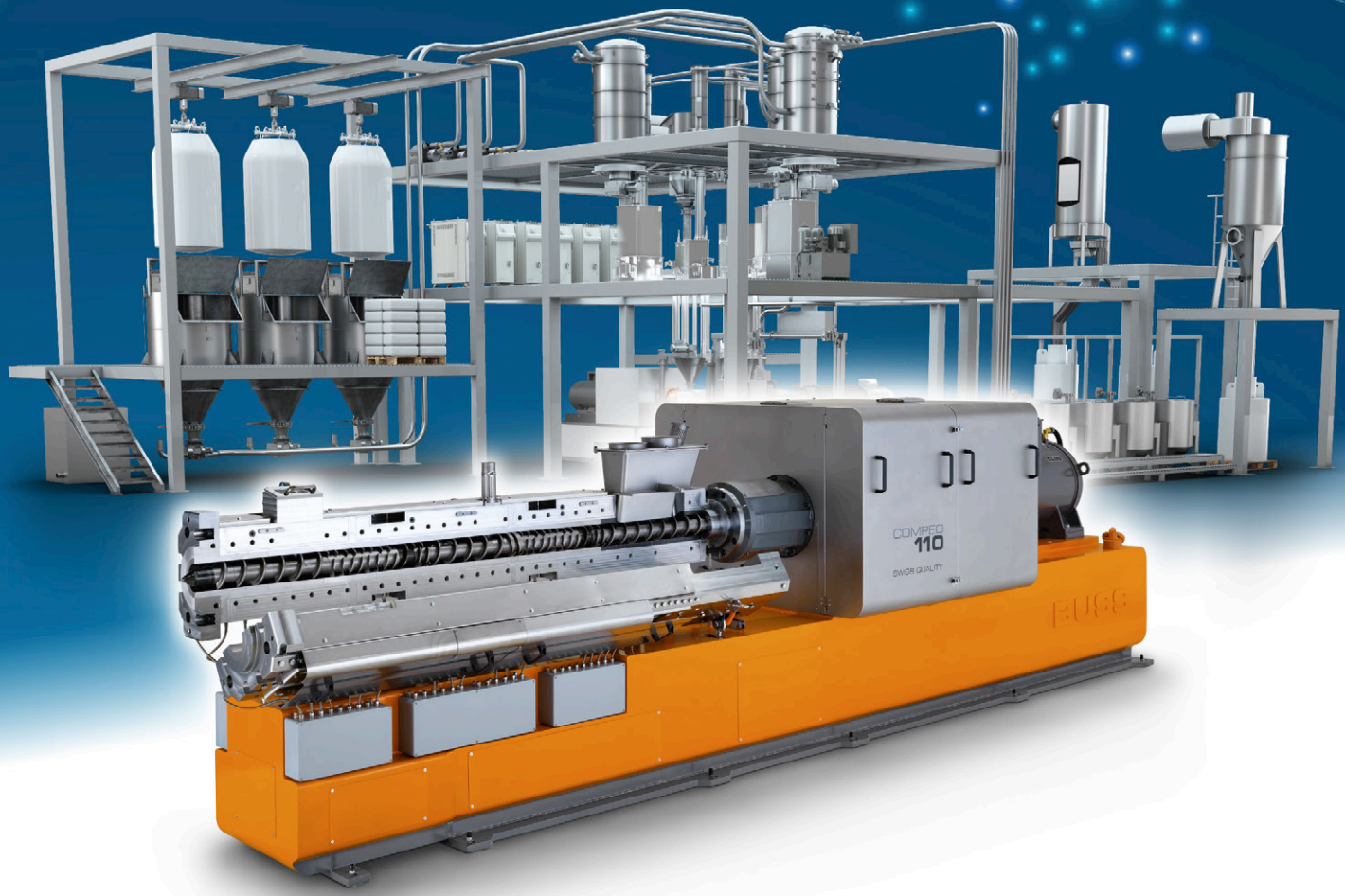

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IMAGE: GERDAU GRAPHENE

Right: Gerdau Graphene's commercial Poly-G masterbatch has been pilot-tested in industrial wrap applications, including stretch film production at Brazilian packaging group Pack-seven

Mississauga in Ontario in Canada and Houston in Texas in the US. A new demonstration plant at Burlington, also in Ontario, is expected to commence startup during the 4th quarter of 2023 and is designed to produce up to around one tonne of graphene a day when fully operational.

UMI acquired UK-company Applied Graphene Materials in March 2023, renaming it Universal Mattters GBR, and is expanding dispersion capacity and capability at the UK site. This expansion is expected to be completed late this year and will accelerate the company's capabilities to produce graphene-based dispersions, says Kefalos.

Valuable graphene

Canada-based **Black Swan Graphene**'s Graph-Core bulk graphene nanoplatelet powder is designed to be incorporated into masterbatches or compounds as a property-enhancing additive. "We aim to bring a graphene product to the market that can provide value to the customer by fitting in to the existing supply chain," says Michael Edwards, Chief Operating Officer and Director of the company.

"Our graphene nano-particles are multi-layer rather than single-layer or a few layers, so they are not intended for electrical conductivity enhancement in polymers. They do, however, provide multi-functional benefits including thermal conductivity, water barrier, and particularly mechanical properties," he explains.

Black Swan's graphene is already being used commercially as an additive in both concrete and polymers. In both markets, the additive is said to enhance sustainability by reducing carbon emissions. In polymers, the improvement in mechanical properties can support light-weighting of parts.

The company sees potential in the automotive sector, and particularly in electric vehicles, where interest in light-weighting is intensifying due to its ability to reduce carbon emissions and increase vehicle range. It says the additive can benefit parts in nearly every part of the vehicle—wire and cable, under the hood, sealing systems, interior, exterior, and chassis.

Black Swan says it worked with the Graphene Engineering Innovation Centre (GEIC) in Manchester in the UK to identify appropriate loadings for polymer applications and says it is now working with compounders who typically have customers with specific needs that can be met with the additive. "The technology has evolved to the point that these compounders have grown in the sophistication to process graphene and disperse it properly," says Edwards.

The GraphCore additive is being used in TPU, PC, and HDPE and is also being tested in PP and PLA. "In PLA, we found a more than 40% reduction in water vapour transmission compared to the standard formulation. And in PP with 2.5% Graph-

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Core, impact resistance and bending strength at yield improved compared to the standard formulation," Edwards says.

In TPU with 1% GraphCore, tests have shown an 80% improvement in abrasion resistance compared to a standard formulation. In an inflatable TPU application, the additive provided both weight reduction and puncture improvement.

Black Swan Graphene was set up in 2021 as a joint venture between UK chemical company Thomas Swan, which was a pioneer in graphene production, and Canada's Mason Graphite to rapidly expand production of bulk graphene from graphite. Edwards says the company's production technology has the capability to produce graphene from various sources of graphite, ranging from mine-flakes to off-cuts from anode production.

"This ability to work with different sources of graphite helps guarantee our supply, particularly as demand for graphite for battery anode production grows," he says.

The company operates a pilot plant in the UK with more than 40 tonnes/yr capacity and has just completed a scoping-study stage for a commercial production facility to be built in Quebec, Canada, close to both low-cost hydroelectric power and its graphite source. The plan is to build a 3,700m^2 facility that will use the same technology as the UK plant but with a capacity of close to 10,000 tonnes/yr.

Shielding options

Production of plastic parts with an inherent capability to shield electronics from electromagnetic interference (EMI) is a potential "good fit" application area for graphene-enhanced composites.

Earlier this year, Portuguese graphene technology company **Graphenest** received €1.8m in funding to scale-up production and business development for graphene-based EMI-shielding products. Plastics containing graphene provide better shielding effectiveness, are lighter weight, and reduce production costs compared to traditional metal systems, the company says. It sees potential applications in areas such as 5G/6G cables and wiring, housings for batteries and electronics, and printable electronics for radar and LiDAR sensors.

Graphenest has partnered with UK-based black masterbatch and compound producer **Hubron** to develop masterbatches and compounds for EMI shielding for e-mobility and electronics. Work in this area will begin with a graphene-based PP.

The G+Board project from the EU's **Graphene Flagship** research initiative was established to develop a graphene-based conductive composite automotive dashboard with lighter weight. The project targets electric vehicles in particular and participants include car maker Stellantis, which is collaborating with **Lyten** (which manufactures a 3D graphene product) and others to apply Lyten's 3D Graphene materials to automotive applications.

The G+Board automotive dashboard design replaces copper wiring with graphene-based integrated conductive paths, sensors, and switches to reduce the number of production steps required and to improve recyclability. Graphene is embedded into the polymer and a laser treatment used to selectively modify the electrical conductivity to provide the required circuits. Project leaders say that the project, which was originally launched in 2020, is now showing promise in terms of industrial applica-

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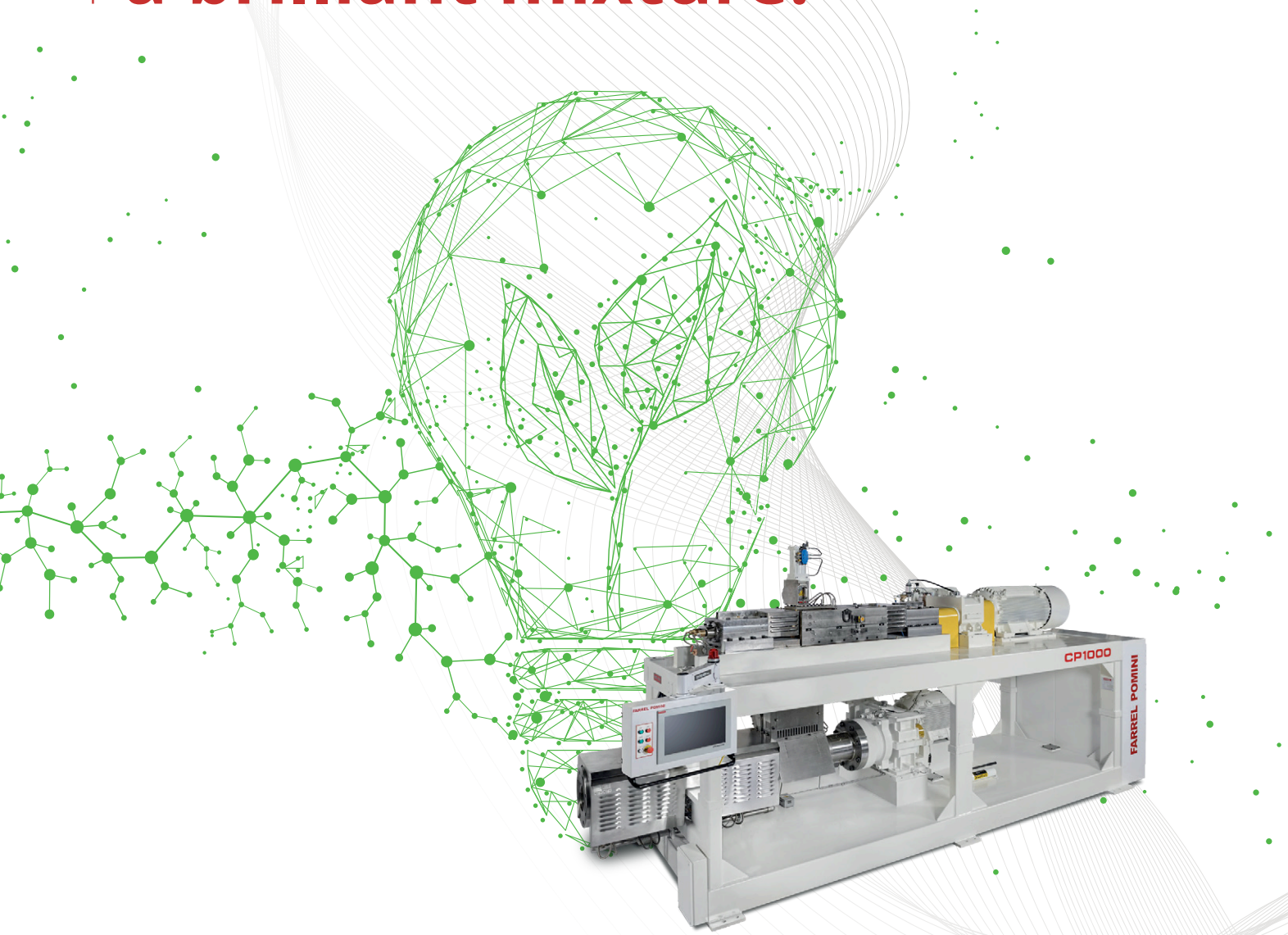

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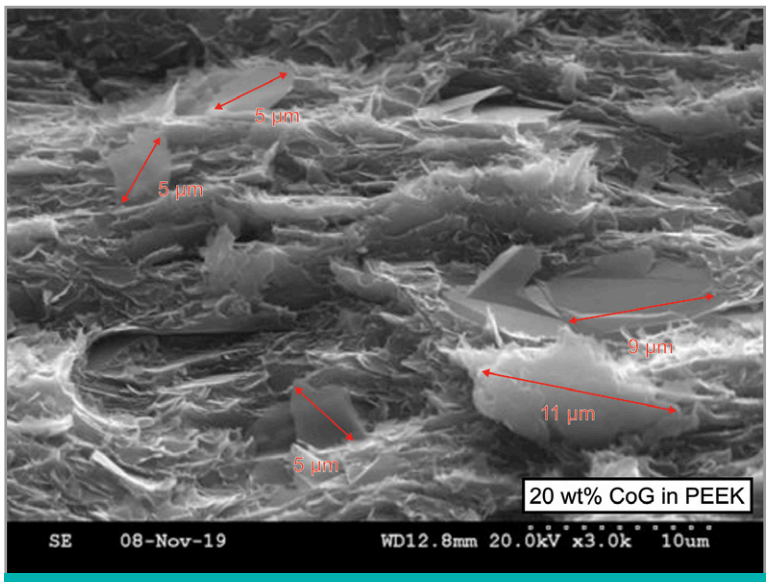

This SEM image of a cryogenic fracture surface for a PEEK compound with 20 wt% of TLC Products' exfoliated graphite graphene nanoparticles shows an even dispersion. The red markers show the dimensions of several graphene nano-flakes.
Image: TLC Products

tion but that they see a challenge in building a solid industrial value chain to shorten time to market.

Tackling exfoliation

US-based **TLC Products** offers graphene polymer matrix composites (G-PMCs) using a patented technology, licensed from Rutgers, the State University of New Jersey, claimed to enable in-situ exfoliation of graphite into graphene in a single-step process. In addition to supplying custom pelletised compounds and masterbatches, TLC plans to license its technology. It says it currently has one licensee and is negotiating with another.

TLC claims its process is low-cost, suitable for large-volumes, and is scalable. It says starting with graphite as a raw material and exfoliating it into graphene in situ provides a cost benefit. Its process is also said to provide more intimate bonding, create more even dispersion, and prevent reagglomeration.

The extent of bonding with the polymer matrix and the property improvement achievable depends on the polymer type, the company says. Improvements have been seen with a wide range of polymers tested to date, with the largest increases in more polar polymers such as PET and PEEK.

"When a continuous material (for example, graphite) is split in two, bonding opportunities are created on both sides of the fracture. Through multiple high-shear events, graphite is successively reduced down to few-layer graphene, exposing secondary π bonding opportunities at graphene faces," says Mark Mazar, Technical Director at TLC Products.

"For high-aspect ratio flakes (for example, 300 micron flakes), the shear forces are enough to tear graphene apart, creating primary covalent bonding opportunities at graphene edges. These dangling bonds are satisfied by the molten polymer itself, resulting in strong effective bonding between graphene and the host polymer," he explains.

TLC has recently commenced an upgrade of its process that includes a new way of feeding raw materials into the proprietary exfoliator that will allow loadings of 35% by weight. In some cases this has allowed the throughput to be tripled, Mazar says. It will also allow higher speeds and larger scale.

To date, TLC says it has successfully scaled a batchwise laboratory process to larger continuous processes. "We have gone through two scale-ups, [each with] about an order of magnitude increase in throughput. We are currently designing the next scale-up, which will have a throughput of about 2,500 lb/hr [around 1,100 kg/hr]," Mazar says.

Graphene-enhanced polymers may find use in a wide range of applications. TLC says G-PMCs are currently being considered for automotive parts such as car body panels, bumpers, housings and electronics where, in many cases, they can replace carbon fibre composites. "Graphite is less expensive and more environmentally friendly compared to carbon fibres and G-PMCs dramatically improve stiffness and strength. G-PMCs also absorb a wide range of radiation, from radio waves to UV," Mazar says.

Moving in CNTs

Carbon nanotubes (CNTs) also offer the opportunity to significantly improve electrical conductivity and/or mechanical properties, but dispersing CNTs is a challenge due to the strong intermolecular attraction (caused by van der Waals forces) that entangles the structure and causes clustering or agglomeration, says Nadav Goldstein, Vice-President of Business Development and Innovation at Israel-headquartered compounder **Kafrit Group**.

In the agglomerated state, CNTs tend to lose their beneficial properties, the company says, so exfoliating the CNTs and dispersing them in the matrix is key to unlocking the material benefits.

Kafrit recently invested in an Israeli start-up, **Nemo Nanomaterials**, which claims to have developed a proprietary process to break down agglomerates and produce a masterbatch containing well-dispersed CNTs. This masterbatch can then be used with standard processes to produce plastic parts with dispersed CNTs.

Property improvements include enhanced strength, high Young's modulus, and high electrical conductivity. Goldstein reports that in EMI shield-

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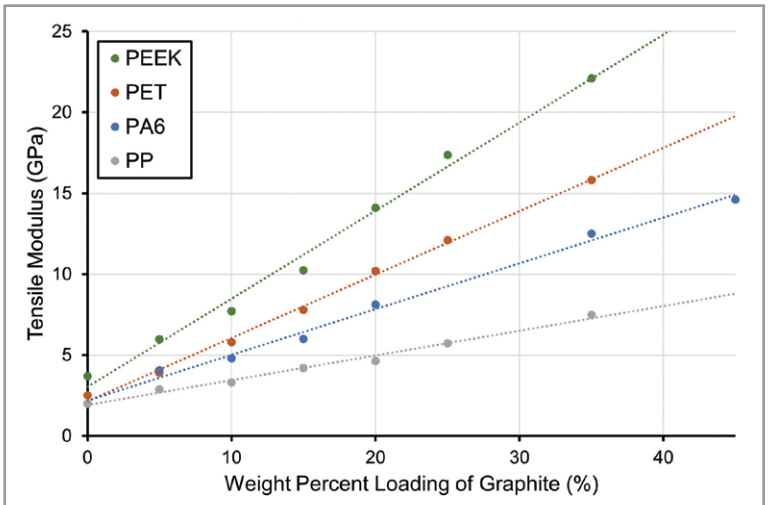

Figure X: Tensile modulus data of four G-PMCs (Graphene-Polymer Matrix Composites) with different loading of TLC Products' graphene nanoparticles, which are produced using an in-situ graphite exfoliation process
Source: TLC Products

ing applications, the CNT-containing material achieved results that would allow the material to replace metal foils currently used for EMI shielding.

CNTs can allow the formulator to remove significant amounts of carbon black from the compound recipe and gives greater freedom of design to optimise compounds and make them easier to process but to display better properties, Goldstein says. These formulas can also contribute to light-weighting efforts.

Belgium-based **Nanocyl**, which celebrated its 20th anniversary last year, produces multiwall (MW) CNTs as well as MWCNT-based compounds and masterbatches. With sustainability a growing concern, its researchers recently completed a project to determine whether the company's NC7000 MWCNTs maintain electrical properties through mechanical recycling.

HDPE and HIPS resins were loaded with NC7000 and submitted to several extrusion cycles, with melt flow rate and electrical resistivity (surface and volume) measured at each cycle. "An increase in resistivity of the samples proves breakage of the nanotubes, whilst an increase in MFR can be related to both breakage of polymer chains and nanotubes," says Carla Sottili, Business Unit manager for Polymers at Nanocyl. "Preliminary results have shown that nanotubes are able to resist several recycling cycles without losing significantly in electrical conductivity."

Sottili says that the polymer type has an effect. "Plasticyl HIPS compounds were extruded five times without a significant increase of MFR or any loss of conductivity. Plasticyl HDPE samples withstood three cycles before MFR increased significantly. The compound was conductive up to the third cycle and became dissipative on the fourth," she says. "It is possible to recycle compounds containing NC7000 as the compound will lose properties related to the presence of the CNTs only when or after the polymer structure is damaged."

CNT investments

Korea's **LG Chem** announced this summer that it has started construction of its fourth carbon nanotube (CNT) plant at its Daesan Complex in Gyeonggi Province. The plant is expected to open in 2025 and the additional capacity will double the company's annual CNT production capability to 6,100 tonnes. LG says that demand is growing for CNTs for use as conductive additives in electric vehicle batteries, which will account for the bulk of the new CNT capacity. However, it will also improve availability for plastics applications in markets such as automotive.

Meanwhile, single wall carbon nanotube producer (SWCNT) **OCSiAl** has been given permission to build a production plant near Belgrade in Serbia. The company – headquartered and listed in Luxembourg but currently manufacturing all its Tuball SWCNTs at an 80 tonnes/yr plant at Novosibirsk in Russia where the technology was developed – says the new plant will start production in 2024 with 60 tonnes/yr capacity.

It will make raw nanotubes, suspensions for lithium-ion battery production, and concentrates for plastic compounds and will operate in conjunction with its R&D centre and planned production operation, currently under construction, in Luxembourg. "The project will facilitate logistics and lower supply chain costs. European-produced nanotubes and nanotube derivatives will be primarily supplied to our customers in central and western Europe, North America, and Asia," says OCSiAl Group Senior Vice President Gregory Gurevich.

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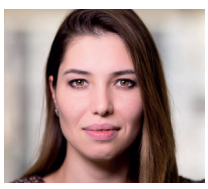

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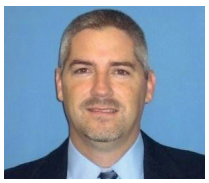

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Additives hold the key to better recycling

*Lifting the quality – and quantity – of recycled plastics will require specialty additives. **Chris Saunders** reviews the latest developments*

IMAGE: EVONIK

Main image: Lifting the quality of recycled plastics is being made possible using targeted additive technologies

With plastic producers and their customers placing an ever-increasing focus on sustainability goals, demand for recycled content is growing and its use proving critical in meeting targets. However, the mechanical recycling process subjects polymer materials to intensive mechanical forces and elevated temperatures, leading to degradation that can compromise mechanical, thermal, or rheological qualities. To overcome this challenge a growing range of additives designed to restore diminished properties are being developed and employed.

Alper Aksit, Marketing Manager Compounds and Circular Plastics EMEA at specialty chemical company **Evonik**, puts the challenge into perspective. "Despite recent improvements in plastic waste streams and better recycling infrastructure across the globe, the high costs and technical challenge of yielding polymers of high enough quality have meant only around 100 million tonnes of plastic has been recycled so far."

Earlier this year, Evonik introduced a range of additives under the brand name Tego Cycle intended to help lift recycling volumes. Designed primarily to save energy during the recycling process, the additives are said to also improve the quality of recycled polymers and can be used at each stage of the value chain.

During the wet stage, Tego Cycle additives can enhance the cleaning process, allowing more effective removal of contaminants and residues, such as inks. High moisture content can negatively impact the quality of recycled plastics, and can be managed with Teco Cycle DW dewatering agents. Unpleasant odours, another common issue, can be mitigated using Tego Sorb. And Tego Cycle CP, a compatibiliser, can help achieve acceptable blending of diverse and incompatible plastics, allowing creation of high-quality recycled materials with consistent properties.

DeltaMax Performance Modifiers are a family of masterbatch products designed by **Milliken** for use with polypropylene (PP), which when recycled seldom provides a suitable balance of high impact with stiffness and melt flow for many injection moulded applications. DeltaMax Performance Modifiers are designed to enable converters to enhance the impact and melt flow of their resins, allowing them to design parts with higher impact resistance and thinner wall sections, to run machines on faster cycle times or at lower temperatures, and to reduce the use of costly impact modifiers.

Introduced late last year, Milliken's latest DeltaFlow viscosity modifiers are designed specifically to help recyclers increase the melt flow rate of rPP for extrusion and injection moulding applications. This allows for lower processing temperatures, which in turn enables manufacturers to reduce cycle times, raise productivity and improve processability. The additive is offered as a free-flowing dust-free masterbatch, which makes it easy to feed and handle. ›

IMAGE: MILLIKEN

Right: Milliken's DeltaMax and DeltaFlow recycling additives can be applied in many application areas

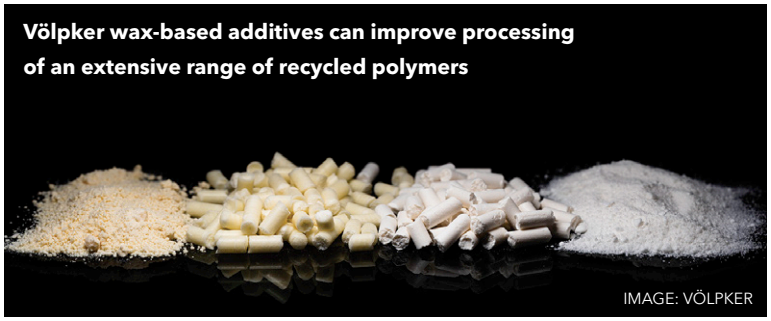
"Additive solutions, like Milliken's DeltaMax and DeltaFlow, level the playing field to improve the physical properties and performance of recycled plastic resin," says Allan Randall, Global Product Line Manager for Plastics Additives at Milliken. "With characteristics that meet and exceed that of virgin resin, brands and manufacturers can increase PCR streams to achieve minimum recycled content goals. Addressing the performance elements of PCR resin helps increase its use within the brand space and makes the case for greater utilisation across applications."

Aesthetic gains

Swiss speciality chemical company **Clariant** has also recently introduced a number of new additive solutions aimed at facilitating more sustainable plastics and reducing resource use. It says that surface aesthetics play a crucial role in the perceived quality of many consumer goods, a characteristic said to be improved using its latest renewable-based anti-scratch additive for PP and thermoplastic olefins (TPO). Licowax AS 100 TP can enable moulded plastic items to maintain their original look and feel longer and is said to be particularly beneficial in scuff-prone applications such as interior automotive parts and cosmetics packaging.

"By extending a product's service life and by boosting reuse potential, the plastics industry can contribute positively towards reducing wasteful consumption, and increase circularity in key segments. With these new additives, including renewable-based solutions, we're excited to offer plastic processors and value chains more support to collaborate and further innovate together," says Martin John, Head of Advanced Surface Solutions at Clariant.

The company's latest light stabiliser solution for polyethylene (PE) agricultural films – AddWorks AGC 970 – also aims to enhance sustainability by improving product durability by increasing resistance to UV and agrochemicals. Meanwhile its bio-based Licocare RBW 560 TP Vita wax can help reduce cycle times and aid mould release.



Völpker wax-based additives can improve processing of an extensive range of recycled polymers

IMAGE: VÖLPKER

Licocare RBW 560 TP Vita marks the latest extension to Clariant's Licocare range of additives derived from crude rice bran wax, a byproduct of rice bran oil. Compared to conventional products, the company says it can withstand higher processing temperatures, works more effectively at low dosage, and displays good colour stability. It says this combination of performance attributes make Licocare RBW 560 TP Vita particularly attractive to formulators of polyester compounds for use in the E&E or transportation industries.

Montan waxes are widely used as multifunctional additives as they can simultaneously act as viscosity reducers (flow enhancers), mould release agents, and dispersion aids. Under the brand name Cevo, Germany-based **Völpker** develops ready-to-use wax additives for a wide range of specific processing challenges and end-product requirements. Depending on the individual task, the additives can improve dispersion, stabilisation and compatibilisation.

One area of application is in reprocessing of post-consumer HDPE/LDPE waste, which typically contains unwanted polymer particles or other contaminants. Cevo 3680 can disperse these. Meanwhile, Cevo 6000 can reduce compatibility problems arising from contamination of polyolefin waste streams with foreign polymers. It also promotes stabilisation of the resulting product.

Völpker's Cevo 5515 grade can improve the compounding and reprocessing of acetal (POM homo and co-polymers, which can release formaldehyde when exposed to multiple thermal loads. The addition of Cevo 5515 can suppress the formation of the associated unpleasant odours during compounding as well as reducing degradation.

Tackling odour

US-based **CAI Performance Additives** says one of its most popular products for recycling applications is LDV1035T, which can permanently remove

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IMAGE: SHUTTERSTOCK

Above: Imerys says talc functional fillers and modifiers are not affected by multiple extrusion passes

unwanted odour and VOCs from polyolefins during compounding without the need for additional specialist equipment.

Another CAI product – ST-CE37 – acts as a chain extender for recycled PA, PC, polyester, and other condensation polymers. This additive, which can also be used with some bio-based and biodegradable plastics, is said to help rebuild the polymer backbone of recycled plastics and copolymer blends. It is very effective at low loadings due to its highly available epoxy functionality sidechain.

The company also offers various high performance compatibilisers. For PP they offer ST-G-PP-30LO and for ABS ST-4210, both of which are based on maleic anhydride technology and are claimed to provide good efficiency and minimal unwanted emissions. Both are manufactured without extrusion, so they bring no unwanted heat history, and the company says they show hydrophobicity, a lack of stickiness, and anhydride reactivity.

Fibre waste provides a source for polymer for recycling, with PA carpet fibre a good example. However, melt flow can be a challenge so CAI has developed a specialised melt flow improver for use with PA, as well as PE, PC, PET, PBT, PEI, PLA, PBAT. Elsewhere, ST-HT10 can protect PA against hydrolysis, with tests showing a 72% increase in tensile strength after ageing in high humidity for two months at 70 °C. ST-HT312 is a heat stabiliser said to provide good heat resistance for PA6 and PA66 compounds up to 180 °C.

Lightweighting is seen as a key sustainability trend but reducing the thickness of plastic parts can lead to fragility and warpage. Talcs can be added to plastics to help restore dimensional stability and – as the mineral is chemically inert, thermally stable, and not affected by multi-pass extrusion – it can be recycled many times without losing its initial properties.

As a rule, finer talcs provide the greatest effect on flexural modulus. **Imerys** offers a full range of talc grades with different fineness of grind, which it says allows compound formulators to obtain the optimum cost/performance ratio for their requirement. It says the reinforcement attained using 30% coarse talc is equivalent to that obtained with 25% of its fine Steagreen grade, enabling a 4% reduction in compound density. The company says a plastic compound reinforced with fine Steagreen talc demonstrates a 30% improvement in dimensional stability.

Specific demands

Imerys also offers high aspect ratio (HAR) talcs. These are said to meet the specific demands of the

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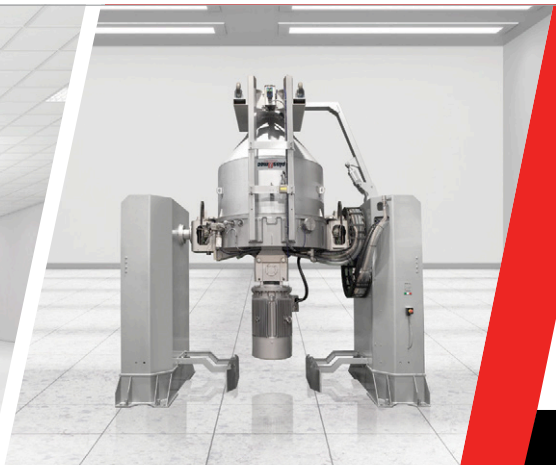

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Reactive approach to polymer recycling

Swedish company **Nexam Chemical** developed its Reactive Recycling technologies to enable modification of the viscosity of PET and polyolefins through chain-extension and/or chain-branching. Its recently-patented heat-activated reactive processes are designed to be used within the standard mechanical recycling process and can be performed on a regular compounding line or extruder.

An example of the technology at work can be seen in recycling of LDPE from beverage cartons. This post-consumer recyclate has undergone several process steps to separate it from the cardboard carton. Nexam's proprietary technology can be used to reduce MFR and enhance the mechanical properties of the melt so it can be processed in blown film plant. The technology can also reduce the MFR of rPP.

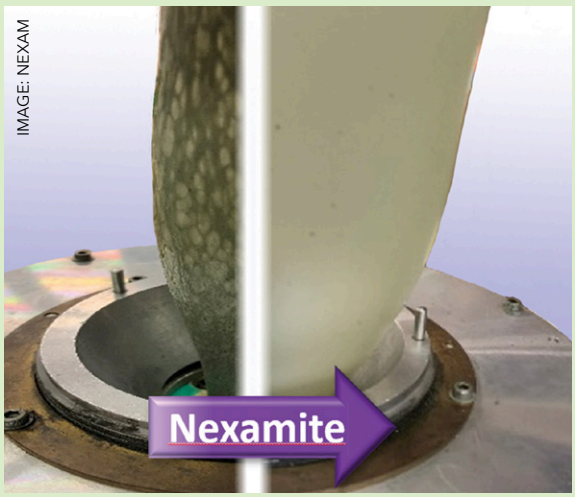

IMAGE: NEXAM

Left: Nexam Chemical's Nexamite reactive additives can improve processing of LDPE recycled from beverage cartons

"Nexam has developed the Reactive Recycling Technology to address the unmet needs of our customers, i.e. to have similar processing and final properties when using larger amounts of recycled polymers," says Christer Svanberg, Chief Technology Officer at the company. "This contributes to a more circular and sustainable use of plastics."

› **www.nexamchemical.com**

Below: Ampacet is among many companies offering additive solutions to boost the quality of recycled PET

IMAGE: SHUTTERSTOCK

car industry and are produced using a proprietary delaminating process. They are claimed to improve mechanical properties without impairing the ductility of the moulded part. Tests comparing a HAR talc and a reference talc compounded using a twin-screw co-rotating extruder with talc introduced to the PP via a side-feeder showed the HAR version displayed a 20% higher flexural modulus, 20% lower Coefficient of Linear Thermal Expansion (CLTE), and 8% lower shrinkage.

Imerys says HAR talc can provide an alternative to short glass fibre reinforcement in applications where stiffness is not critical. With regard to recycling, the company says they offer the additional benefit that, unlike glass fibres, the talc particles do not suffer degradation during processing or recycling.

Traditional mineral fillers alter PP density and this can affect the recyclability of PP compounds, at least in facilities using sink-float separation and sorting methods. To address this issue, **Ampacet** has developed Nucleant PP 4000389-E. It is a nucleating additive that improves the mechanical properties of injected or thermoformed PP parts without increasing density or sacrificing transparency. The company says it allows downgauging of PP parts while maintaining the same rigidity and allowing flotation separation.

Ampacet has also extended its OdorClear range of odour-absorbing masterbatches. Originally introduced under the Odor Scavenger name, the OdorClear masterbatches minimise odour and keeps it enclosed inside the polymer. They can also be used in combination with other Ampacet R3 Sustainable Solutions products cush as ThermProtect, a range of rPET stabilising masterbatches designed to reduce yellowing.

A challenge for any company using rPET bottles to package mineral waters is to manage the risk of acetaldehyde (AA) contamination. AA is produced as a by-product of thermal degradation of the PET during extrusion, injection moulding or recycling and can taint the flavour of the packaged beverage. Ampacet has developed AA Scavenger 0846 to reduce the level of acetaldehyde in PET and rPET bottles and to help preserve the organoleptic properties of water. Acting as a scavenger agent and intended for use at very low addition rates, AA Scavenger 0846 reduces migration of acetaldehyde by up to 80%.

The masterbatch producer has also introduced Gastop-Flex, which is claimed to help reduce gas transmission rates in flexible packaging applications and to allow some multi-material laminate constructions to be replaced with more easily recycled simpler alternatives. Ampacet says Gastop-Flex reduces oxygen and water vapour transmission rates by up to 60%. It enables downgauging to reduce weight and supports manufacturing of high barrier packaging with less than 5% EVOH to comply with circular economy design guidelines. ›

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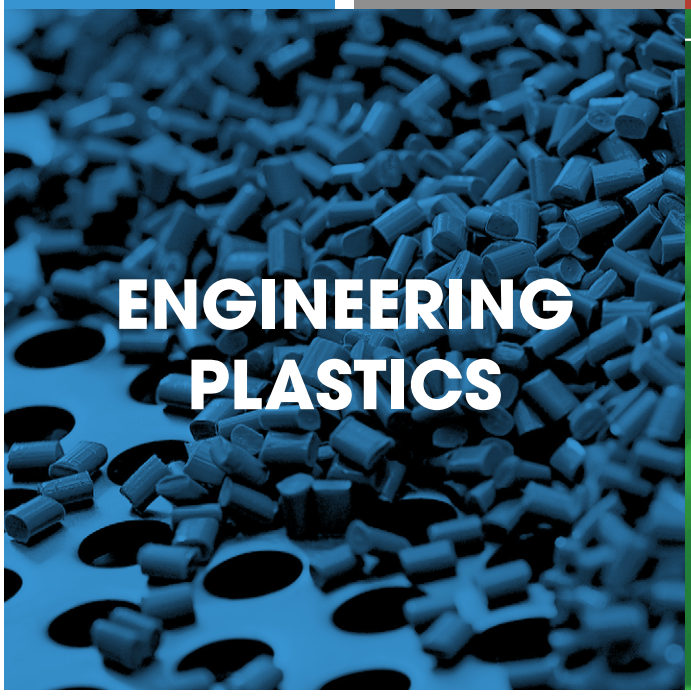
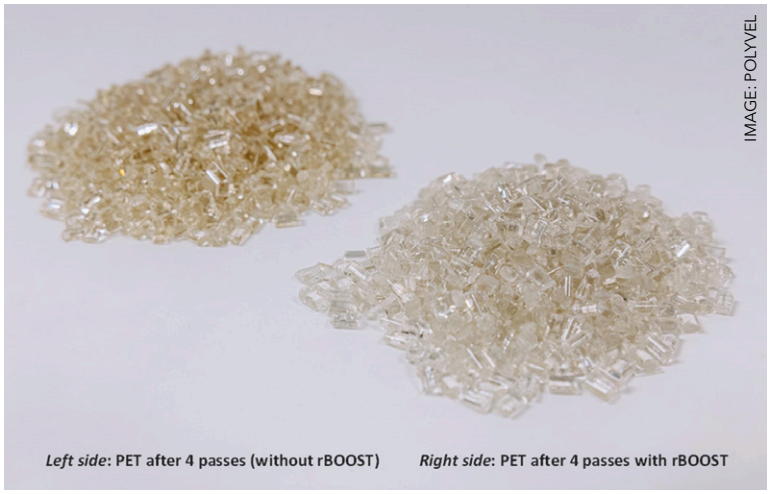


Plastics Engineer

www.tisan.com.tr



Above: PET pellets reprocessed four times with and without use of Polyvel's rBoost additives

Tuned performance

US-based materials design company **Techmer PM** specialises in modifying and fine-tuning properties of technical polymers. Developed primarily for the fibre and non-woven market, its PP Recycle Enabler is designed to retain Melt Flow Rate (MFR) and impact properties in both PP homopolymer and copolymer during recycling.

The company is also addressing the issue of PE contamination. "There is a recurring challenge in nonwoven production when recycled resins combine both PE and PP components, especially through bi-component nonwoven lines," says Kaan Serpersu, Product Development and Sustainability Manager. "Techmer PM's Recycled PP/PE Stabiliser addresses these complexities by employing a stabilisation process to harmonise the properties. The additive reduces interfacial tension between the polymer types, promoting better mixing and enhancing mechanical properties. The process also retains the MFR and colour properties of the recycled resins."

The company has also developed additives for use in PET recycling. HiTerra rPET Revive, launched earlier this year, aims to rebuild the resin's polymer chains, increasing viscosity and reducing yellowness. "rPET Revive can allow for a higher regrind/recycle rate and improve productivity," says Steve Smith, Techmer PM's Market Manager for Rigid Packaging. "We selected the active ingredient to be compatible with PET resins used in fibre and moulding applications. Converters can use it in the production of thermoformed sheets, and the product is showing good potential for use in bottles."

Also targeted at PET recycling challenges, **Polyvel**'s ReVal additive masterbatches now include its rBoost PET Chain Extender, which is designed to increase the intrinsic viscosity (IV) and impact strength of recycled PET. Developed for use in compounding, fibre, extruded sheet, injection moulding and blow moulded bottle applications, it also reduces the yellowness index of rPET and is claimed to improve processability.

CLICK ON THE LINKS FOR MORE INFORMATION:

- **https://corporate.evonik.com**
- **www.clariant.com**
- **https://voelpker.com**
- **www.caiadditives.com**
- **www.imerys.com**
- **www.ampacet.com**
- **www.cotrep.fr**
- **www.techmerpm.com**
- **www.polyvel.com**

From Light to Lettering: Laser Marking on Silicones

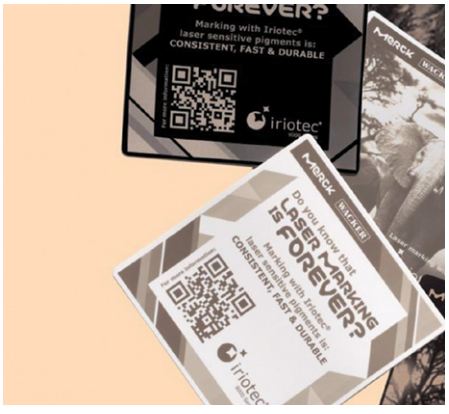
The lettering remains even after the light has faded away: the use of a laser beam for purposes of marking and labeling – or simply laser marking – is an excellent method for high-precision, permanent marking on silicone products. Among its several applications, laser marking is used, for instance, on medical devices, cables, or household goods – in other words, wherever distinct, razor-sharp, and permanent labeling is required.

In the ever-evolving world of product labeling and marking, one method stands out for its precision, durability, and adaptability – laser marking on silicones. Whether it's for medical devices, cables, or everyday household items, the need for clear, long-lasting labels is undeniable. From series and batch numbers to QR codes and expiration dates, laser marking provides a solution that meets these diverse requirements.

The Need for Laser Marking

The reasons for labeling are as varied as the products themselves. In the medical field, the focus is on shelf life, distinctiveness, and preventing mix-ups. In other industries, it's about tracking options, streamlined logistics, copy protection, and preventing counterfeiting. Regardless of the purpose, the marking must meet specific criteria: it should be easily readable by humans or machines, and, above all, it should be permanent and durable.

However, silicone products, despite their numerous advantages, present a challenge for conventional printing techniques. Inkjet or pad printing may yield poor results, including blurred outlines, abrasion, or ink dissolution when exposed to chemicals or UV light. Laser marking emerges as the solution to these limitations.



Light Is the Answer: Laser Marking

Laser marking is an exceptional alternative for achieving permanent, razor-sharp labels on silicone parts. This non-contact process relies on the heat generated by a laser beam to trigger a chemical reaction within the material itself. Unlike traditional printing, laser marking is less sensitive to abrasion, heat, UV rays, or chemicals. It can be implemented on translucent silicone products and even curved surfaces like cables.

Advantages of Laser Marking

- Non-contact, high-speed marking process that uses a laser beam to deliver precise and sharp outlines
- High-precision, high-contrast marking is achieved on a wide range of colored and translucent silicone products
- Excellent readability, even with small font sizes and intricate graphics or QR codes
- Permanently low level of sensitivity to wear, heat and chemicals
- Suitable for a wide range of shapes; can be implemented even on uneven surfaces, flexible components and hard-to-reach areas
- Requires no labels or solvents.
- Adaptable to various shapes: Suitable for uneven surfaces, flexible components, and hard-to-reach areas.
- No need for labels or solvents: Simplifies the marking process.

For successful laser marking, you only need a special formulation and a suitable laser, typically with an emission wavelength of approximately 1,064 nm. This non-contact process involves directing the laser beam onto the target surface for a short duration, triggering a chemical reaction in the material. Depending on the laser-sensitive pigment's composition, this reaction can lead to discoloration or foaming of the substrate.

What can be laser marked?

Iriotec® 8000 laser-sensitive pigments are ideal for marking plastics and powder coated surfaces. Laser-sensitive pigment powders and pigment granules

Laser marking technology is already well established in a variety of applications:

- Expiration dates on bottle caps, adhering to the most stringent food regulations
- Serial numbers, ID codes, and barcodes on technical parts, adding indestructible and permanently visible markings
- Important information on caps and closures, in high resolution with strong, fine lines
- Markings on liquid containers in the automotive industry capable of withstanding chemicals (including oil) and heat. No more need for labels that could become detached.
- Containers used in medical diagnosis: marked lines (e.g. filling levels) instead of labels. Also, suitable for end users.
- Cables and wires: precise labeling on every cable for future identification purposes
- Iriotec® 8000 is recommended in this area because it delivers clear and durable marking.

… and many more

In collaboration with WACKER and König & Bauer Coding GmbH, Merck Electronics KGaA conducted the "Laser Marking on Silicones" webinar in February 2023. Find out more on dedicated webpage https://www.merckgroup.com/en/s/silicone-laser-marking.html

Merck Electronics KGaA | Frankfurter Str. 250 | Postcode: C011/439 | 64293 Darmstadt | Germany
www.merckgroup.com

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SECURE YOUR PLACE TODAY

Cleveland set to welcome US compounding industry

Doors open next month on the fourth – and what is set to be the largest – Compounding World Expo in Cleveland, Ohio, in the US. We take a look at what's in store for visitors

IMAGE: AMI/ HUNTINGTON CONVENTION CENTER

Main image: The Compounding World Expo returns to the Huntington Convention Center in Cleveland in the US next month

The fourth North American edition of the Compounding World Expo takes place at the Huntington Convention Center in Cleveland, Ohio, US, on November 15-16, 2023. Organised by *Compounding World* parent company and publisher AMI, the event is part of the Plastics World Expo series and runs alongside the Plastics Recycling World Expo, Plastics Extrusion World Expo, and Polymer Testing World Expo.

As in previous years, the Compounding World Expo is free to attend and comprises an exhibition bringing together many of the key players in the compounding industry supply chain, plus a comprehensive free conference programme including business debates and technology talks. Last year's show attracted more than 4,600 attendees, up 53% on the previous event.

Visitors to this year's Cleveland Plastics World Expo will gain access to more than 300 exhibitors across the Compounding World Expo, Plastics Recycling World Expo, Plastics Extrusion World Expo, and Polymer Testing World Expo. Attendees will also benefit from free entry to the five conference theatres, which will host technical presentations, educational seminars and business debates.

Plastics World Expo visitors staying over in Cleveland also have the option to buy tickets for the event's networking party, which takes place at the Punch Bowl Social on the evening of November 15 ($50 each). More than 450 people joined this popular informal party last year.

To register for your free expo ticket, which will give you access to all four exhibitions and their associated five conference theatres, click **HERE**.

Over the following pages we take a look at some of the companies exhibiting at the show, including leading manufacturers of compounding extruders, feeders, pelletisers, filtration technology, and materials handling plant, plus suppliers of materials, colorants and additives for enhancing performance and adding value. To see the complete exhibitor list, click **HERE**. ›

3V Sigma USA
3V Sigma USA is a global plastic additives manufacturer and supplier. Its portfolio includes a wide range of HALS products, which are available in monomeric, oligomeric, and polymeric forms.
› **www.3vsigmausa.com**

AdvanSix
Advansix manufactures PA6 resin and PA6/66 co-polymer for use in sectors such as automotive, electrical, electronics, carpet, sports apparel, fishing nets, and food and industrial packaging.
› **www.advansix.com/nylonsolutions**

Akdeniz Chemson Additives
Akdeniz Chemson is a leading manufacturer of polymer additives, particularly PVC stabilisers. The company supplies tailor-made stabilisation system solutions designed to meet specific end-product performance requirements.
› **www.akdenizchemson.com**

Alandro Plastic Resources
Located in Brownsville, TX, US, Alandro Plastic Resources is a polymer compounder offering a range of PA, PC/ABS, ABS, PC and PBT compounds mostly based on recycled resins.
› **https://alandro.com**

American Cutting Edge
American Cutting Edge & Great Lakes Industrial Knives manufacture knives and blades for plastic pelletising and recycling applications, offering stock and custom options.
› **https://americancuttingedge.com**

American Industrial Products
American Industrial Products (AIP) is a US-based filtration company that specialises in sales of filtration elements, gaskets and seals, spare parts and equipment.
› **www.ameinpro.com**

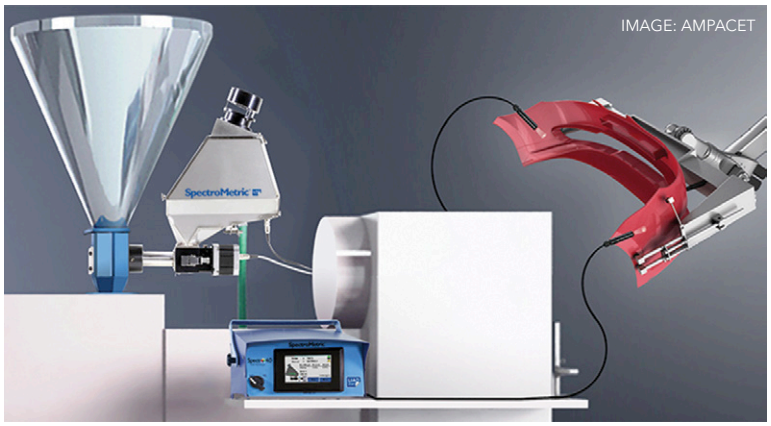


IMAGE: AMPACET

Below: Ampacet will show its new Spectro 4.0 inline colour management system

Amfine Chemical Corp
Amfine Chemical is the distribution, manufacturing and sales division of Adeka Group in North America. The company offers additives for a wide range of polymer compounding and recycling applications.
› **www.amfine.com**

Ampacet
Ampacet will demonstrate its new Spectro 4.0 in-line machine colour vision, measurement and correction technology, which allows customers to measure colour compounded in real-time. It will also introduce its Command Integrated Color Weighing and Blending system.
› **www.ampacet.com**

Apex Engineering
Apex Engineering's modular extrusion systems can be designed for any compounding plant requirement. Its robust modular designs extend from line upgrades to complete compounding plant.
› **www.apex-engineering.com**

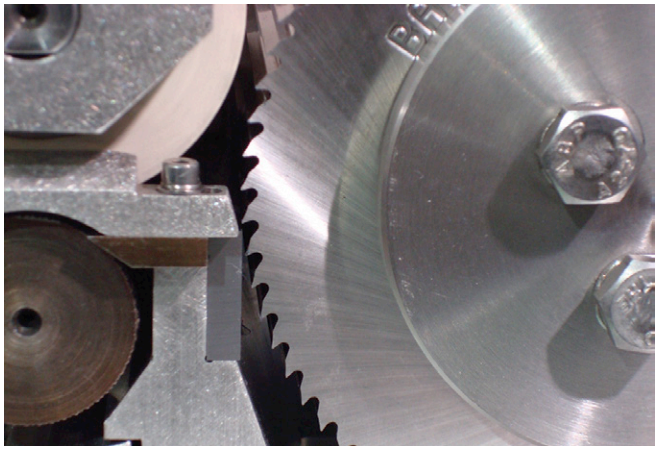
ArrowPoint Corp
ArrowPoint Corp supplies high-quality fluorescent pigments and specialty products suitable for uses in a wide range of polymer processing applications.
› **www.arrowpnt.com**

Arxada
Arxada (formed from the combination of Troy and LSI) is a leading player in microbial control and performance additives. It will show its Micropel, Plastiguard, and Vanquish biocides at the Cleveland expo, plus its Acrawax and Glycolube lines of plastic lubricants.
› **www.troycorp.com**

Asaclean Purging Compounds
Asaclean supplies mechanical, chemical, and concentrate purging compounds for use in applications including extrusion, compounding, injection moulding, blow moulding, and film and sheet production.
› **www.asaclean.com**

Aurora Plastics
Aurora Plastics, which merged with Enviroplas earlier this year, will present its range of high-quality advanced polymer compounds, custom plastics and compounds engineered for a wide variety of applications.
› **https://auroraplastics.com**

IMAGE: BAY PLASTICS MACHINERY



Bay Plastics Machinery show its strand pelletiser innovations

AZO

AZO provides bulk and raw material handling, pneumatic conveying systems, mixer feeding systems and screeners, plus bulk containers for the reliable automation of production processes.

› **www.azo.com**

Baerlocher USA

The Baerlocher Group is a leading manufacturer of additives for the plastics industry. Its portfolio includes a broad range of stabilisers and other polymer additives.

› **www.baerlocher.com**

Barentz

Barentz is a leading global life science ingredients and specialty chemicals distributor. The company supplies a broad range of specialty additives, resins, and pigments to plastics producers and compounders.

› **www.barentz-na.com**

Bay Plastics Machinery

Bay Plastics Machinery develops strand pelletisers, conveyors, water baths, air knives/strand dewatering units, and spare parts. It also offers rotor sharpening, rebuild/repair, and technical support.

› **https://bayplasticsmachinery.com**

Birla Carbon USA

Birla Carbon operates 16 carbon black manufacturing units across five continents. Its Raven and Conductex products provide colour, conductivity, viscosity, and UV protection for a wide range of plastics applications.

› **www.birlacarbon.com**

BKS Knives

Founded in 1983 in Belgium, BKS Knives produces and grinds high performance knives and blades for compounding and masterbatch manufacturing applications using its CNC grinding technology.

› **www.bks-knives.com**

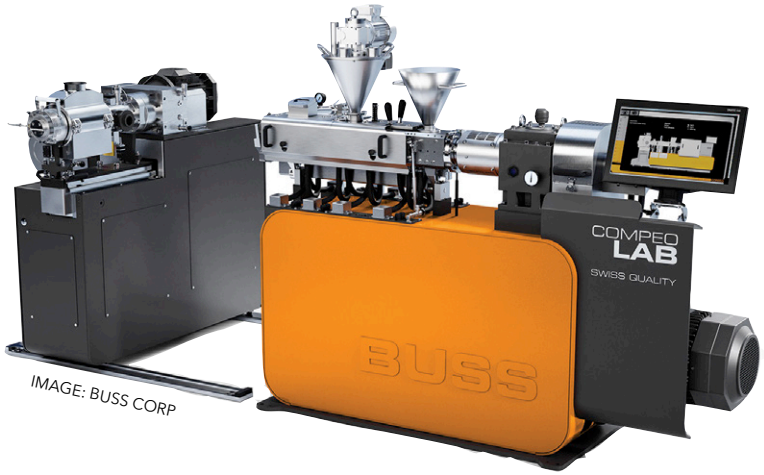


IMAGE: BUSS CORP

Above: Buss will focus its presence on its latest Compeo kneader extruder, shown in a lab version

Bomet Polymer Solutions

Bomet is a dedicated e-scrap plastics processor with operations in Brantford, Ontario, and Albion, New York. It is a significant supplier of PCR ABS and also recycles HIPS and PC/ABS.

› **http://bometpolymersolutions.com**

Bronkhorst

Bronkhorst provides solutions for low-flow liquid dosing, control and blending of gases, and vaporisation of precursors. Its equipment is used in production and research labs across a wide range of industries.

› **www.bronkhorst.com**

Budenheim USA

Budenheim will show its Budit halogen-free flame retardant systems, which are intumescent formulations suitable for use in technical thermoplastics in E&E, building and construction, and transportation industries.

› **www.budenheim.com**

Buss Corp

Buss supplies high-end compounding and pelletizing systems based around its Buss Kneader extruder, which is a versatile compounding option for handling shear and temperature sensitive and highly filled formulations.

› **https://busscorp.com**

BYK USA

BYK is a leading supplier of specialty chemicals and functional additives. Its portfolio includes additives to provide anti-fog, anti-scratch, and anti-static effects, as well as enhancing UV and fire resistance.

› **www.byk.com**

CA Picard

CA Picard manufactures standard and custom replacement parts, such as screw elements, new and relined barrels, and shafts, for all leading twin-screw extruders. It has factories in the US, Germany, and China.

› **www.capicard.com**

Calcean Minerals & Materials

Calcean processes oolitic aragonite, an ocean-sourced naturally precipitated biogenic calcium carbonate. The finely-milled OceanCal product is offered as a filler in a range of particle sizes with or without surface treatment.

› **www.calcean.com**

Carbon Polymers

Carbon Polymers is a custom compounder offering high quality, competitively priced thermoplastic products including PP, TPO and TPE grades.

› **www.carbonpolymersco.com**

Carolina Filters

Carolina Filters offers cleaning technologies and services that support users of metallic filtration equipment, including plastics producers, processors and recyclers.

› **www.carolinafilters.com**

CFI Carbon Products

CFI is a privately-owned filler supplier. It says its Austin Black 325 is a versatile alternative to clay, talc and calcium carbonate products that can reduce product weight, while increasing processability and flowability.

› **www.cficarbonproducts.com**

Chemigon

Chemigon specialises in polymer additives and engineered plastics, offering the US manufacturing industry technical support and supply of functional additives, fillers, polymers and compounds.

› **https://chemigon.com**

Chemyork

Chemyork is a supplier of petrochemical raw materials, petroleum derivatives, industrial chemicals, and related additives, including polymers and additives used in construction, packaging, agriculture, household, and other applications.

› **https://chemyork.com**

Chroma Color Corp

Chroma Color Corp is a specialty colour concentrate supplier serving markets, including wire and cable, packaging, healthcare, pharma, and consumer products. With its recent acquisition of Epolin, it is also now a notable player in the supply

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mocom.eu

of near-infra-red (NIR) absorptive dyes.
› **https://chromacolors.com**

Cimbar Performance Minerals

Cimbar Performance Minerals is a producer of mineral-based talc fillers. It operates 16 production and mining sites in the United States, Mexico, China and Pakistan.
› **https://cimbar.com**

Clariant

Clariant is a leading supplier of flame retardants, performance additives and advanced surface solutions designed to achieve functional effects in plastics for a broad range of end use markets.
› **www.clariant.com**

ColVisTec

ColVisTec is a provider of inline spectroscopy solutions for the use in 24/7 production operations that can detect quality variations due to fluctuating raw material quality or material feeding and report in real time.
› **www.colvistec.de**

Coperion & Coperion K-Tron

Coperion is a technology leader in the production of twin screw compounding extruders. It is also a key provider of material feeding equipment, bulk material handling, compounding and recycling plant design, sorting, size reduction and washing systems.
› **www.coperion.com**

Copptech

Copptech's antimicrobial masterbatches use copper and zinc technology to prevent growth of bacteria and other micro-organisms in polyolefins, polyester, ABS, PVC, PC, PU and other plastics.
› **www.copptech.com**

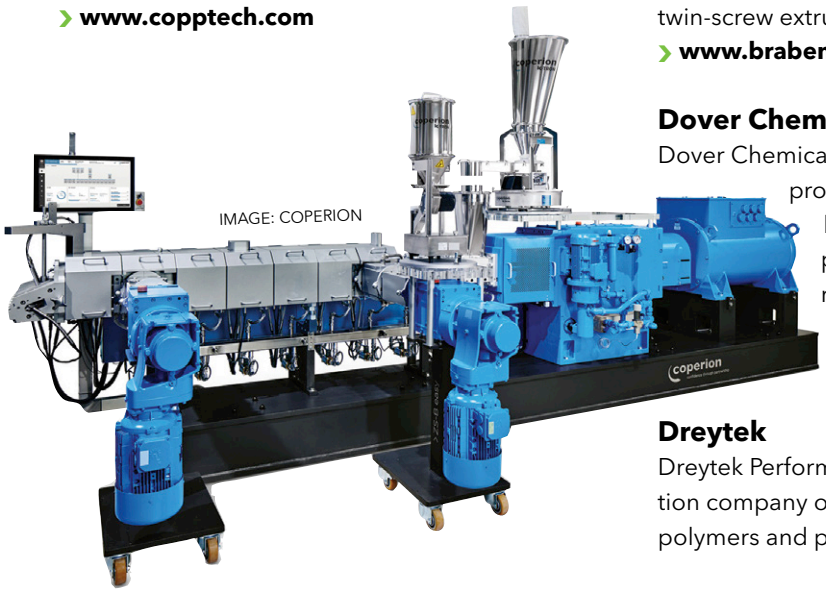

IMAGE: COPERION

Left: A high performance ZSK series compounding extruder from Coperion

IMAGE: CPM EXTRUSION GROUP

Left: CPM offers a full range of compounding extruders, including the RingExtruder

Corporacion Sierra Madre

Corporacion Sierra Madre is a leading Mexico-based manufacturer of stearates, blends, EBS and GMS, lubricant packages, as well as a provider of additive one packs for plastics applications.
› **www.corpsierramadre.com**

Covia

Covia, which is founded on the legacy of Fairmount Santrol and Unimin Corporation, offers a portfolio of mineral fillers and additives marketed under the Hifill N, Minibloc HC, Imsil and Snobrite names.
› **www.coviacorp.com**

CPM Extrusion Group

CPM offers co-rotating twin and multi-screw extrusion systems for a wide range of compounding tasks. It has manufacturing operations, service locations and development labs in North America, Europe and China.
› **https://cpmextrusiongroup.com**

CW Brabender

CW Brabender manufactures extruders and mixers for plastics development applications. Its portfolio includes lab-scale single, parallel twin, and conical twin-screw extrusion systems.
› **www.brabender.com**

Dover Chemical Corp

Dover Chemical Corp develops and supplies process stabilisers for plastics, particularly polyolefins where its Doverphos LGP12 grade is used in to reduce gels in film produced with recycled content.
› **www.doverchem.com**

Dreytek

Dreytek Performance Products is a global distribution company offering an array of specialty polymers and polymer additives for compounded

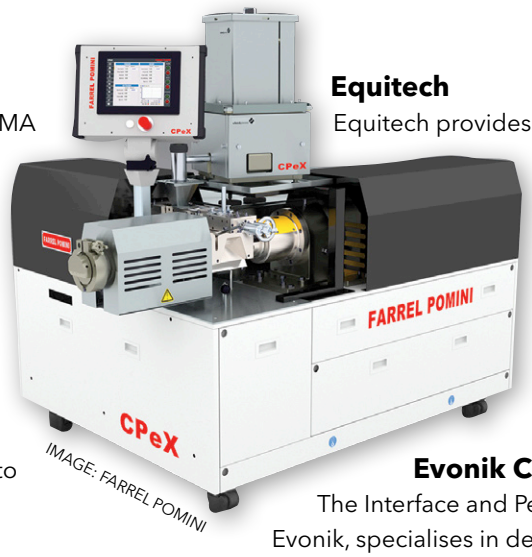

IMAGE: FARREL POMINI

Right: Farrel Pomini marks the 60th anniversary of its continuous mixer technology this year

products, including chopped carbon fibre, glass flake and SMA blend compatibilisers.
› **www.dreytek.com**

Ecopuro

Ecopuro's Boundary Breaker engineered structured particle technology has been developed for thermoplastic processing, where it can improve material flow and up to 30% increase in throughput.
› **https://ecopuro.com**

Ensign Equipment

Ensign engineers, manufactures, and integrates bulk material handling equipment and automated systems that convey, mix, load, unload, weigh, feed, and store dry bulk materials.
› **https://ensigneq.com**

Entec

Distribution group Entec Polymers offers a full portfolio of commodity, engineering, high performance, and specialty resins, as well as thermoplastic elastomers, custom blends and masterbatch products.
› **www.entecpolymers.com**

Entek

Entek is a US-based manufacturer of turnkey production extrusion systems, twin-screw extruders, and replacement components. It supplies systems for compounding, pelletizing, and compound and masterbatch production.
› **www.entek.com**

Entex/Triad Sales

Entex is a German producer of planetary roller extruders, which can be used for continuous distributive and dispersive mixing, devolatilisation, heating/cooling and reactive processing of plastics.
› **www.entex.de**

Below: A high output 72mm twin screw compounding extruder from US manufacturer Entek

IMAGE: ENTEK

Equitech

Equitech provides a full line of individual analytical instruments and process analysers designed primarily for inline measurement and control of colour in plastics compounding applications.
› **https://equitechintl.com**

Evonik Corp

The Interface and Performance division of Evonik, specialises in development and supply of novel additives designed to modify and/or improve surface properties of polymers.
› **https://corporate.evonik.us**

Extreme Coatings

Extreme Coatings specialises in high performance wear-resistant tungsten carbide encapsulations for coating of parts such as plastics extrusion screws and continuous mixing rotors.
› **https://extremecoatings.net**

Exxel Polymers

Canada's Exxel Polymers produces compounds from post industrial and post consumer recovered plastics. Its PP, PE and PS products are fully certified and formulated to offer near virgin performance.
› **https://exxelpolymers.com**

Farrel Pomini

Farrel Pomini delebrates the 60th anniversary of its continuous mixer technology this year. The compact machines are particularly suited to handling highly filled, shear and temperature-sensitive polymers.
› **www.farrel-pomini.com**

Finite Fiber

Finite Fiber's polymer reinforcement product line includes cellulose, cotton, polyamide, polyester, carbon, and aramid fibres and fibre blends, which can be supplied in a range of formats.
› **https://finitefiber.com**

FP-Pigments

FP-Pigments is a technology-focused producer of high opacity pigments. The products offer potential for significant cost-saving compared to conventional combinations of TiO_2 and extenders through partial TiO_2 replacement.
› **www.fp-pigments.com**

Gefran
Gefran designs, engineers, and manufactures sensors, power and process controls, and other devices and components used in industrial equipment and operations management.
› **www.gefran.com**

Gehring-Montgomery
Gehring Montgomery is a chemical distributor offering a range of products for the compounding sector, including flame retardants (halogen free and brominated), processing aids, waxes, and dispersants.
› **www.gehring-montgomery.com**

Goettfert
Göttfert produces flexible rheological testing equipment for plastic materials, including melt index testing instruments for quality control and capillary rheometers for research and characterisation.
› **www.goettfert.com**

Harwick Standard
Harwick Standard is a distributor of raw materials and additives for plastics, rubber, coatings, and adhesives. The company is headquartered in Akron, Ohio, and operates a nationwide distribution network.
› **www.harwick.com**

Helluva Container
Helluva Container specialises in high quality used and new Gaylord boxes, FIBC bulk bags, liners, films, tapes and pallets. The company has distribution centres across the US with inventory ready to go.
› **www.helluva.com**

Heritage Plastics
Heritage Plastics develops and manufactures novel calcium carbonate concentrates for use in a wide variety of plastic applications. Its Minapol Additive Technolgoy is particularly applicable where high loadings are required.
› **www.heritage-plastics.com**

Horizon Systems
HorizonPSI focuses on provision of plastics bulk material handling solutions. Each system is custom designed and manufactured to ensure proper specification and integration for the customer.
› **www.horizonPSI.com**

Hydrograph
HydroGraph Clean Power was founded in 2017 to fund and commercialise green, cost-effective processes to manufacture high-purity graphene, hydrogen and other strategic materials in bulk.
› **https://hydrograph.com**

Right: JSW will promote its expertise in high performance compounding extruders

IMCD

Operating coast-to-coast in the US with a wide portfolio of specialty chemicals and ingredients from leading global producers, distributor IMCD is a major supplier to the compounding and plastics industry.

› **www.imcdus.com**

Imperial Industries

Imperial Industries manufactures bulk storage silos and tanks. All are fabricated in a state-of-the-art facility at Rothschild in Wisconsin using the latest design and production systems.

› **www.imperialind.com**

Incoa Performance Minerals

Incoa is a supplier of high purity grades of ground calcium carbonate. Products include fine, ultrafine and treated grades that are formulated for use in film, fibre, pipe, conduit, and vinyl profile.

› **https://incoa.com**

IRRH Specialty Chemicals

IRRH Specialty Chemicals, which is based in India, is a producer of a range of functional plastics additives, including thickeners, lubricants and release agents.

› **www.irrhusa.com**

J Rettenmaier USA

J Rettenmaier USA (JRS) Produces fibre additives from sustainable raw materials such as grain, fruit, vegetables, seaweed and trees, upcycled post-consumer materials and recycled pre-consumer materials.

› **www.jrsusa.com**

Japan Steel Works America

JSW is a major manufacturer of plastics machinery with a portfolio including extruder/pelletizing systems, twin screw compounding extruders, film and sheet machinery and spinning plant.

› **https://jswamerica.com**

Jeil Polychem

Compounder Jeil Polychem was established in South Korea in 2010 offering products that meet certification requirements of leading OEMs including Canon, Hyundai Renault/Nissan, and Panasonic.

› **http://jpoly.co.kr**

Jiangmen PromaXX Extrusion Technology

PromaXX manufactures twin-screw extruder spare parts, including high wear and corrosion-resistant extruder screw elements, barrels, high torque shafts and other compounding extruder accessories.

› **www.promaxx.com.cn**

J-Tec Material Handling

J-Tec has been designing and installing automated material handling systems for more than 50 years. It is supplier independent, and says it provides a customised solution for each customer.

› **https://j-tec.com**


IMAGE: INSIGHT POLYMERS & COMPOUNDING

Insight Polymers & Compounding

Tennessee-based custom compounder Insight Polymers & Compounding will highlight its latest compounding systems investment, an 18mm Leistritz twin-screw extrusion line that will go into production before the end of the year.

The investment follows the installation of a new 40mm compounding line, which joined its existing 16 and 27mm lines, earlier this year. "The new line has capabilities that enable us to work with sustainable and biomass-derived fibres, fillers and composites," says AJ Pasquale, Insight Polymers Co-Founder and Director of Operations. Bio-sourced fillers, polymers, reinforcements, and recycled plastics make up a significant percentage of Insight Polymers' development programs.

› **https://insightpolymers.com**

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Dr. Knoell Consult Thai

*Subject to approval

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Kalpataru Plast
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› **www.kalptaruchemical.com**

Kal-Polymers
Kal-Polymers is a specialist compounder of recycled plastics. It is equipped to remove paint from automotive parts, remove cross-linking agents from dashboard skins, and to de-metallise BOPP film/auto parts.
› **http://kalpolymers.com**

Kaneka North America
Kaneka Americas, a subsidiary of Kaneka Corp, provides material solutions for a wide range of applications. Its portfolio includes CPVC resins and polymer impact modifiers.
› **www.kaneka.com/kaneka-americas**

Keller USA
Keller USA provides dust collection and wet scrubber filtration systems for the plastics compounding industry, including capturing elements, and equipment for explosion protection and fire suppression.
› **www.kellerusa.com**

Kisuma
Kisuma Americas, a subsidiary of Kyowa Chemical Industry, provides a range of hydrotalcite fillers and magnesium-based flame retardant products for use in the plastics sector.
› **https://kisuma.com**

KraussMaffei Corp
KraussMaffei's offering for the compounding industry extends from standalone twin screw compounding extruders through to the design and installation of fully configured turnkey production plant.
› **www.kraussmaffei.com**

Kubota Brabender Technologie
Kubota Brabender Technologie manufactures loss-in-weight, weigh belt and volumetric feeders featuring a complete range of feed systems, including FlexWall, agitated, single/twin screw, vibratory tras, fibre and pellet feeders.
› **https://www.brabender-technologie.com/en/**

Leistritz Extrusion
Leistritz Extrusion manufactures co-rotating, intermeshing twin screw extruders with screw diameters from 12 to 260 mm and supplies systems for compounding, devolatilisation, reactive processing, foaming and direct extrusion.
› **www.leistritz-extrusion.com**

Lianda Corporation
Lianda Corporation distributes high-performance elastomers and specialty chemicals including fluoroelastomers, silicone HCR, fluorosilicone, chlorinated polyethylene (CPE), chlorosulphonated polyethylene (CSM), polychloroprene (CR) and polyepichlorohydrin (ECO).
› **www.liandacorp.com**

IMAGE: MAAG GROUP

MAAG Group
MAAG Group provides high performance strand and underwater pelletisers, melt filtration systems, and melt pumps for use in demanding compounding and plastics recycling applications.
› **https://maag.com**

Left: The eXso pellet dryer is a recent addition to the Maag pelletiser systems portfolio

Magris Talc
Magris Talc is a world-scale talc filler producer, claiming to supply around 15% of world demand from its mines and processing plants located in Canada and the US.
› **www.magrispm.com**

Marvel Marking Products
Marvel Marking Products will show its Model 4015 Hot Print Brander, which is said to be well suited to marking of ABS, PVC, HDPE, PBT, PE, and styrenic plastics.
› **www.marvelmarking.com** ›

IMAGE: LEISTRITZ

Left: Leistritz will showcase its Maxx line of twin screw compounding extruders

Right: Mixaco manufactures a comprehensive range of mixing plant for plastics

Mettle Filtration

Family-owned Mettle Filtration makes high quality, high-performance extruder screen filtration products. It specialises in sourcing hard-to-find mesh and extra heavy wire cloth.

› **www.mettlefiltration.com**

Milana Colors

Milana Colors was established in 2023 to sell pigments across the US. Its portfolio includes phthalocyanine pigments, azo pigments and high-performance pigments for printing, coatings and plastics.

› **https://milanacolors.com**

Milliken

Milliken's product portfolio extends across multiple industries. Its plastics products include nucleators, clarifiers, and performance enhancing additives for use with recycled polymers.

› **www.milliken.com**

Mine Plastik

Mine Plastik is a colour masterbatch and plastic additive manufacturer located in Ankara, Turkey. It has more than a decade of experience in the European plastics industry and is now planning to expand in the US.

› **https://minecolours.com.tr**

Mitsubishi Chemical America

Mitsubishi Chemical Group's additives team has worked with compounders and plastics manufacturers for more than 50 years to develop advanced products using its materials.

› **www.mcgc.com**

Below: Milliken's Delta series of additives are designed to ease plastics recycling

Mitsui Chemicals America

Mitsui Chemicals America produces and supplies specialty chemicals and high-performance polymers, including performance compounds, elastomers, engineering plastics, chemicals/intermediates, films, tapes, sheet, and electronic materials.

› **https://us.mitsuichemicals.com/index.htm**

IMAGE: MILLIKEN

IMAGE: MIXACO

Mixaco USA

MIxaco USA is a supplier of mixing systems for plastics such as PVC. Its solutions include high speed, heating/cooling batch and container mixers, which it supports with service, spare parts, and engineering assistance.

› **www.mixaco.com**

Mixron

Mixron is a producer of advanced batch mixers based in Italy. Its product line includes turbo mixers, container mixers and PVC dry blend cooling mixers.

› **www.mixron.it**

Modern Dispersions

Modern Dispersions is a compounder and colour and additive masterbatch maker with a specialisation in carbon black masterbatches, conductive concentrates and compounds, and wood polymer composites.

› **www.moderndispersions.com**

Monolith

Monolith is a technology firm that is developing a process to manufacture carbon black additives that uses renewable electricity rather than combustion to provide emission reductions.

› **www.monolith-corp.com**

NanoXplore

NanoXplore is a manufacturer and supplier of industrial volume graphene. The company uses what it says is a low cost proprietary technology that makes additives suitable for thermoset and compounds.

› **https://nanoxplore.ca**

NASCA Elastomers

NASCA Elastomers designs and develops high-functional polymer compounds, including thermoplastic elastomers, natural material TPEs, functional

composite materials, highly-filled masterbatch, and high heat resistance infill.

› **www.nascatpe.com**

National Bulk Equipment

National Bulk Equipment designs, engineers, and manufactures material handling equipment and automated material processing systems. Its portfolio includes solutions for discharging, storing, conveying, filling, mixing, and weighing.

› **www.nbe-inc.com**

National Gear Repair

National Gear Repair is a specialty precision re-manufacturing machine shop with more than 40 years of experience in repairing a wide range of industrial equipment.

› **www.nationalgearrepair.com**

Neomat Distribution

Canada-headquartered Neomat Distribution describes itself as a "customer focused" distributor of plastic and elastomer products for use in markets ranging from packaging to construction.

› **www.neomatdistribution.com**

Niche Polymer

Niche Polymer is a custom compounder and toll processor specialising in production of engineering products based on PP, PET, PA6, PA66, PA12, PC, PS, ABS, PC/ABS and TPEs.

› **www.nichepolymer.com**

NOF America Corp

NOF Corporation's portfolio of plastic additives includes the Modiper A and AS and NOF-Alloy KA series, designed to improve wear resistance and anti-scratch properties, reduce friction, and prevent squeaking.

› **https://www.nofamerica.com**

Norac Additives

Norac Additives manufactures and markets PVC additives including ester lubricant blends and calcium/zinc heat stabilisers, along with other proprietary blends for the thermoplastic and thermoset market.

› **www.noracadditives.com**

North Wind Technical Services

NorthWind has more than 20 years of experience in designing and building automation systems for PVC compounding. Projects extend from modernising older controls systems to adding new blend towers and extrusion lines.

› **www.northwindts.com**

NYCOA

Nylon Corporation of America (NYCOA) makes specialty

engineered nylon resins and compounds including impact modified, plasticised, glass fibre or mineral-reinforced, and flame-retardant formulations.
› **http://nycoa.com**

OA Newton
OA Newton makes dilute and dense phase pneumatic and various types of mechanical conveying systems. It says its systems are designed to maximise flow and minimise product degradation and separation.
› **www.oanewton.com**

Orbetron
Orbetron is a manufacturer of precision feeding equipment with feed rate capabilities of less than 1 g/hr. The company says it offers made-to-spec and production-ready equipment.
› **www.orbetron.com**

Orion Performance Compounds
Orion Performance Compounds produces a broad range of custom engineering compounds, including formulations based on styrenics, PA, PC PEI, PSU and PPS, as well as bio-based polymers.
› **https://orioncompounding.com**

Cables are a target market for Orion's new circular specialty carbon black

IMAGE: ORION ENGINEERED CARBONS

Orion Engineered Carbons
Orion Engineered Carbons will present its first circular specialty carbon black for polymer applications. Produced from end-of-life tyre pyrolysis oil, the new grade offers the same dispersibility, purity level, jetness and tinting strength as regular specialty carbon blacks and is suitable for pipe, film, fibre, packaging and automotive applications.

"Current customers confirm that the new circular black is performing as well as regular specialty carbon blacks," says Kevin Milks, Orion Marketing Manager, Polymers and Batteries.

The company will also present its other carbon blacks, including its Printex and Arosperse products that are said to modify rheology and impart UV-resistance and conductivity characteristics. All grades are formulated to disperse readily in polymers and show low levels of ionic contamination.
› **www.orioncarbons.com**

Orrex
Orrex is an independent toll compounder that is focused on reactive extrusion and complex compounding. Its specialties include functionalisation, neutralisation, viscosity modification, and vulcanisation.
› **https://orrex.com**

Palmarole
Palmarole is a trading and marketing consultantcy based in Basel, Switzerland, that offers additive sourcing, product promotion, project consulting, research and development, and market trend expertise.
› **www.palmarole.com**

Palmer Holland
Palmer Holland is a distributor of specialty chemicals and plastic additives and resins for the compounding, composites, film/packaging, rubber, colour, and wire and cable markets.
› **www.palmerholland.com**

Performance Additives
Performance Additives focuses on the supply of specialty PVC additives, including acrylic impact modifiers and processing aids, CPE, ACM, MBS and ABS impact modifiers, SAN processing aids, and heat distortion additives.
› **https://performanceadditives.us**

Perry Videx
Perry Videx is a used plastics processing machinery specialist. The company deals in equipment including single and twin screw extrusion lines, pelletisers, and mixers.
› **www.perryvidex.com**

Pinfa North America
Pinfa-NA (North America) is a non-profit trade organisation that represents manufacturers and users of halogen-free flame retardant technologies, including phosphorus, nitrogen and inorganics.
› **www.pinfa-na.org**

Plas Mec
Plas Mec makes equipment for mixing of plastics such as PVC, PE, PP and ABS, technical and special polymers such as PA, PC, PU, PET and PTFE, wood-plastics composites, masterbatch, and pigments.
› **https://www.plasmec.it**

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Right: Plas Mec's mixer portfolio includes heating/ cooling models

IMAGE: PLASMEC

Plastic Systems USA
Plastic Systems produces advanced plastics material handling solutions for use in the automotive, pharmaceutical, PET, electrical, packaging, construction and industrial industries.
› **www.plasticsystems.it**

PlastiCal
PlastiCal is a calcium carbonate masterbatch producer located in Sylacauga in Alabama. It produces a pelletised polyolefin-based product containing 80% calcium carbonate.
› **https://plasti-cal.com**

Plastics Machinery Group
Plastics Machinery Group buys and sells plastics equipment for thermoforming, blow moulding, injection moulding, extrusion, grinding and shredding.
› **www.plasticsmg.com**

PMC Group
PMC Polymer Products is the compounding arm of PMC Group. It specialises in development of flame retardant masterbatches and compounds for a variety of industries and applications.
› **https://pmc-group.com**

Polybol SAS
Polybol is an extruded and laminated plastic bag manufacturer. It specialises in tubular form-fill-seal films and barrier liner products.
› **https://polybol.com**

Polychem Dispersions
Polychem is a specialist in dispersion and blending of plastic compound ingredients, offering a wide variety of mixing, de-agglomeration and surface treatment capabilities.
› **www.dispersions.com**

Polystar Containment
Polystar Containment manufactures and installs custom spill prevention systems that satisfy all SPCC requirements.
› **www.polystarcontainment.com**

Polyvel
Polyvel is a speciality additive masterbatch and custom compound producer supplying the film, fibre, moulding and compounding industries. It also offers tolling services.
› **www.polyvel.com**

PRET Advanced Materials
Part of Welllman, PRET Advanced Materials focuses on compounding of recycled PA6, PA66, PP, PPLGF, ABS and PC/ABS resins. It uses proprietary methods for mechanically and chemically separating waste polymers.
› **http://wellmanam.com**

Prime Materials
Prime Materials is a supplier of additives, fillers, pigments and waxes for the plastics, rubber, coatings, adhesives, food, and personal care industries.
› **https://primematerials.com**

Prism Worldwide
Prism Worldwide aims to develop and manufacture performance-oriented circular polymer materials from recycled tyre rubber. Products include Ancora TPEs and Ennova polymer modifiers.
› **https://prismww.com**

Prognost Systems
Prognost Systems supplies machinery protection and condition monitoring systems. It also has extensive experience in diagnostic services for rotating equipment.
› **www.prognost.com**

PSC
PSC (Polymer Services & Consulting) is a specialty compounder producing engineering products, including UL flame retarded compounds, based on a wide range of polymers including copolyesters, polyolefins and PVC-based TPEs.
› **https://polymersc.net**

Re-cre8
Re-Cre8 Recycling is a general and industrial plastics recycling import/export company offering recycling solutions and sourcing services.
› **https://re-cre8.com**

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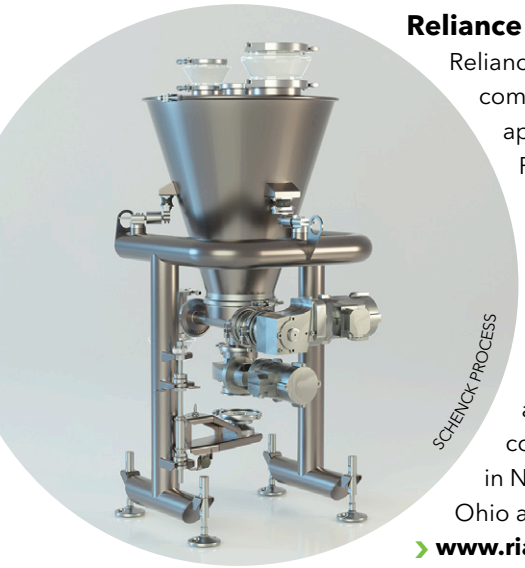

Above: A loss-in-weight feeder from the Schenck Process materials handling product portfolio

Reliance Mixers

Reliance Mixers produces mixing and compounding equipment for application in manufacturing of PVC blends, colour concentrates, and pigment blends.

› **www.reliancemixers.com**

Rianlon Americas

Rianlon is a global supplier of antioxidants, light stabilisers and U-pack solutions. The company has its US headquarters in New York and has warehouses in Ohio and Texas.

› **www.rianlon.com**

Routsis Training

Routsis Training provides plastic processing skill development courses that range from traditional one-to-one onsite courses for companies and educational establishments to individual online sessions.

› **www.traininteractive.com**

Rowe Equipment

Rowe Equipment is a manufacturer of extruder screens, spot weld packs, and aluminium bound packs for the plastic recycling, blown film, cast film, and compounding industries.

› **www.roweequipment.com**

Royce Global

Royce Global is a speciality dye producer and specialty chemical supplier. Products range from polymer soluble dyes to colour and additive masterbatches and flame retardants.

› **https://royceglobal.com**

SACO AEI Polymers

SACO-AEI Polymers is a distributor of specialty masterbatches, compounds and additives including products from Fine-Blend, Javachem and Suili.

› **www.saco-distribution.com**

Sasol Chemicals (USA)

Sasol's Polymer Additives business includes the supply of processing aids and mould release agents that help resolve common process defects in the production of injection moulded parts.

› **www.sasol.com**

Schenck Process

Schenck Process provides bulk material handling equipment including dry powder pneumatic conveying, mixing, blending, milling, sifting, weighing and feeding.

› **www.schenckprocess.com**

Schwing Technologies North America

Schwing Technologies manufactures thermal and fluidised bed cleaning equipment for safe removal of plastic from dies, filters, extruder screws, breaker plates, hot runners, and other process tooling.

› **www.schwing.tech**

Sciences Computers Consultants

SC-Consultants is a developer and supplier of computer-based simulation software for advanced modelling of extrusion, compounding and mixing processes.

› **www.scconsultants.com**

Sesotec

Sesotec is a leading manufacturer of metal detection, X-ray, metal separation, check weighing, and optical sorting systems for process, packaging, and production.

› **www.sesotec.com**

Shamrock Technologies

Shamrock Technologies offers specialty micronised powders, dispersions, emulsions, and compounds, including PTFE, PE, PP, fluoropolymers, custom and natural waxes, and other specialty additives.

› **https://shamrocktechnologies.com**

Sikora

Sikora is a specialist in online and laboratory-based measurement and inspection technology for compounded pellets as well as for wire, cable, hose, tube, pipe, sheet, and plastics production.

› **https://sikora.net**

Right: Sikora's pellet inspection systems include lab and inline options

IMAGE: SIKORA

Silon

Silon is a producer of polyolefin-based performance compounds, including crosslinked PE compounds suitable for construction, automotive, renewable and industrial cables.

› **https://silonllc.com**

Solex Thermal Science

Solex Thermal Science is a developer of high-efficiency, indirect heat exchange technology for heating, cooling

and drying of free-flowing granular materials.
› **www.solexthermal.com**

SonicAire
SonicAire's dust control fans are durable, energy-efficient products designed to keep fugitive dust from collecting. Its BarrierAire Technology is said to minimse costly, time-consuming cleaning.
› **www.sonicaire.com**

Southeast Machinery
Southeast Machinery offers affordable extrusion and recycling solutions. It is the exclusive distributor for Nanjing Giant Machinery and Genox Recycling Technology.
› **www.semachinery.com**

Spherix
Spherix Mineral Products manufactures and markets treated and untreated aluminosilicate ceramic microsphere additives, which are claimed to reduce plastics processing time and energy consumption.
› **www.spherixproducts.com**

St Louis Group
St Louis Group is an established flame retardant supplier offering antimony, bromine, chlorine, and phosphorus chemistries, as well as custom blends.
› **https://thestlouisgroup.com**

Stadler America
Stadler is a global specialist in the design, production and assembly of automated sorting systems and machines for the recycling industry.
› **https://w-stadler.com**

Star Plastics
Star Plastics produces custom-colour, high-performance thermoplastic compounds, including materials with recycled content. It also offers tolling and polymer sourcing services.
› **www.starplastics.com**

IMAGE: STEER

Above: An Omega series twin screw compounding extruder from Steer America

Steer America
Steer manufactures twin screw extruders for plastics compounding applications. It also provides a variety of standard elements, barrels and shafts for other makes of twin screw extruders.
› **www.steerworld.com**

Struktol
Struktol is a producer of lubricants and processing additives for polymers including PE, PP, PVC, ABS, PC, and PA. Its products are particularly useful in highly filled systems where good flow and surface properties are required.
› **www.struktol.com**

Technogenia Lasercarb Oklahoma
Technogenia is the developer of the LaserCarb coating process, used to apply its Spherotene spherical cast tungsten carbide finish designed to provide high abrasion resistance to metal parts.
› **www.technogeniausa.com**

The Polymers Center
Based in Charlotte in North Carolina, The Polymers

Right: Wacker produces a range of silicone-based processing aids and additives

Centre offers the opportunity to collaborate with compounding industry experts in its state-of-the art technical facility to optimise materials selection and design of products and processes.
› **www.polymers-center.org**

Thermo Fisher
Thermo Fisher Scientific provides a broad range of laboratory equipment, including polymer materials analysis and testing systems and lab compounding extruders.
› **www.thermofisher.com**

Toyota Tsusho America
Toyota Tsysho's Plastic and Performance Materials Unit develops specialty additives to improve performance of thermoplastic compounds in multiple industries, including automotive, medical, and packaging.
› **www.toyota-tsusho.com**

TPEI
TPEI is a developer and manufacturer of plastics mixers and compounding plant. It also maintains a stock of replacement high-wear parts available for immediate shipment.
› **www.tpei.com**

Unibrom Corp
Unibrom is a leading manufacturer of brominated flame retardants with an extensive product offering suitable for use with commodity and engineering plastics.
› **www.unibrom.com**

Vac-U-Max
Vac-U-Max is a leading designer and manufacturer of bulk material handling systems incorporating pneumatic, aero-mechanical and flexible screw conveying technologies.
› **www.vac-u-max.com**

Wacker Chemical Corp
Global chemical supplier Wacker has a track record in silicone-based additives for improving the performance and processing of polymer compounds.
› **www.wacker.com**

Welset Americas
India-based Welset Plast Extrusions manufactures a range of plastic compounds. It also produces a full range of colour, white and black concentrates, and additive dispersions.
› **https://welset.com**


IMAGE: WACKER

Westlake Corp
Westlake offers a broad portfolio of carriers, dispersing agents, compatibilisers, and other specialty resins. It also produces an extensive range of PVC compounds.
› **www.westlake.com**

Witte Company
The Witte Company designs and manufactures an wide range of pellet drying, cooling, and classifying systems, which it supports with related process equipment.
› **www.witte.com**

X-Compound
X-Compound manufactures continuous kneader compounding machines and designs and builds complete compounding plants, ranging from material storage through to bagging and packing of finished product.
› **www.x-compound.ch**

Zeppelin Systems USA
Zeppelin is a leading player in the design and production of high performance bulk material handling systems, including turnkey plant projects.
› **www.zeppelin-systems.com**

Zhejiang Silverpool
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The growing interest in new bio-based and recycled plastic compounds is creating significant opportunities for alternative extruder designs, writes ***Mark Holmes***

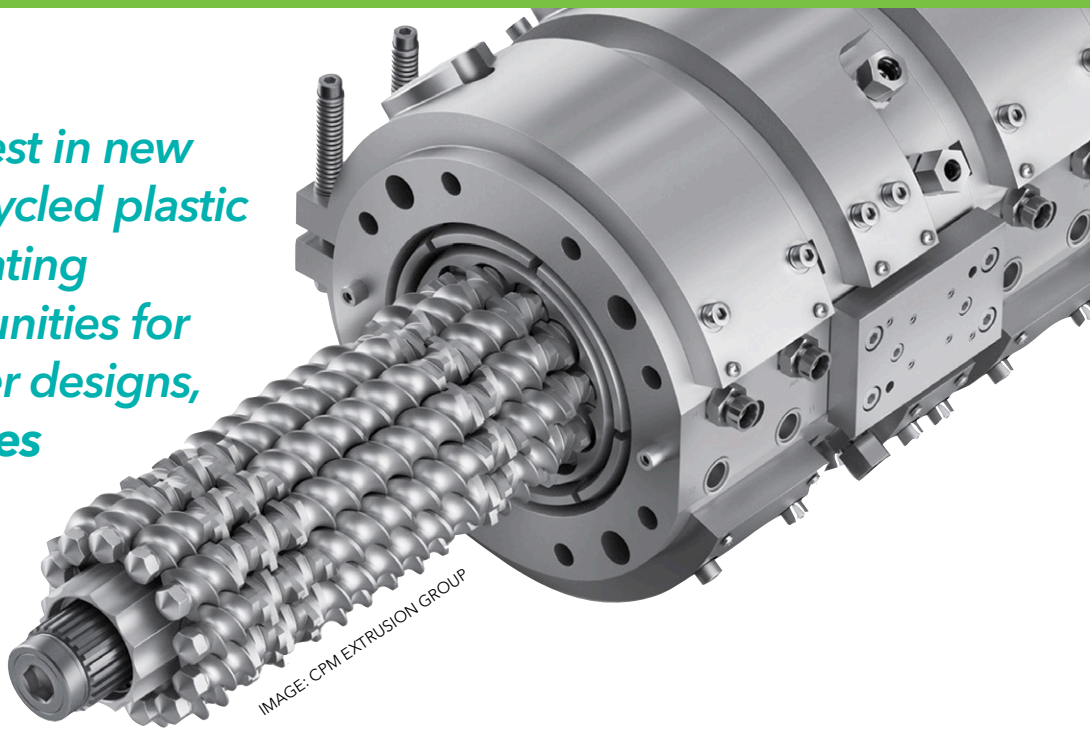

IMAGE: CPM EXTRUSION GROUP

Engineering an alternative approach

Twin-screw extruders are the workhorse of for the compounding industry but there are alternatives. Multi-screw extruders, as well as kneaders and planetary roller extruders, have long been used in special application areas where their specific performance attributes, such as low shear and high dispersion, can pay dividends. The growing interest in processing of bio-based and recycled plastics, as well as compounds with sensitive additives, is presenting further opportunities.

Researchers at the Spanish technology centre **Aimplas** report two main trends in alternative compounders in recent times. "Firstly, there is a breakdown of barriers and traditional fields of application. For example, compounding natural fibres in reciprocating extruders, as well as reactive extrusion and devulcanisation in planetary roll extruders," says Luis Roca, Leader of Compounding at the institute.

"Secondly, alternative compounders are consolidating new niches that are appearing, such as multiple screw extruders for recycled plastic in food contact applications, and reciprocating extruders for glass fibre-filled applications, highly filled materials and technical compounds," Roca adds.

"Normally, these extruders feature alternative mixing methods compared to co-rotating twin-screw extruders. This includes less intensive mixing, which is more suitable for shear-sensitive materials where mixing takes place to extend the surface contact of the plastic with the metal parts of the extruder. This avoids possible degradation through high-temperature peaks due to shear," he says.

"In addition, PVC has been a major application for reciprocating extruders and planetary roll extruders," Roca says. "Halogen-free compounds are also made using reciprocating extruders due to their capacity to mix considerable amounts of mineral fillers. Due to their capacity, multi-screw extruders are also used to spread polymers in very thin films, which enhances devolatilisation. This is especially useful when recycling PET for food contact applications."

Roca also highlights the use of alternatives to twin screw extruders in applications such as devulcanisation or reactive extrusion (REX), as well as in processing of bioplastics, where less aggressive mixing conditions are needed. Other potential applications include polymers with higher filler contents, natural fibre compounds and recycled polyolefins for food contact use. The main reasons for the selection of alternative compounding systems for such applications include lower shear peaks, longer residence times, improved control of heat exchange and good mixing capacities.

Given the potential scale of future opportunities, Roca says equipment developers are aiming to further improve their ability to handle shear-sensitive materials – both polymers and fillers – and to

Main image: Novel compounding extruders such as CPM's RingExtruder RE offer specific benefits in processing sensitive materials such as bioplastics

Right: Researchers at Aimplas see increasing opportunity in compounding of shear sensitive and very highly filled formulations

incorpotate higher amounts of fillers and fibres. Work is also underway to lift devolatilisation capacity for decontamination processes and to increasing residence times for more complex REX systems.

According to Hans-Ulrich Siegenthaler, Technology Expert at **Kneading Experts** and Researcher/Professor within **Institut iRAP** at the Institute for Applied Plastics Research at Fribourg in Switzerland, the main reason alternative compounders still exist on the market and can maintain their niches, even expanding them in some cases, is that they have highly specific property profiles. "They simply match the requirements in their applications better than the standard solution of co-rotating twin-screw extruders," he says.

"We also notice this in the development of new processes at iRAP. For certain applications, qualitatively better results can be achieved with alternative systems. For us, this means that we use the pilot plants of suppliers or appropriately equipped compounding companies for our work, because standard systems have been in place at the institute up to now," he says.

"In one of the last technology reviews on this topic, we introduced the 'Compounding Analytics' toolbox, which we continue to use intensively and successfully. We also intend to use AI and machine learning methods as further resources to enhance it," he says.

Below: Institut iRAP professor Hans-Ulrich Siegenthaler says compounding extruders such as the Buss kneader can "simply match the requirements in their applications better"

Siegenthaler highlights some examples of projects where the benefits of alternative compounders have been key. One included work with an industrial partner on natural fibre-reinforced compounds derived from the edge sections of thermoforming processes, so tapping into an otherwise lost source of raw materials. The components made from them are used in the same assembly process in the automotive industry, fulfilling a single-polymer strategy.

In the second project, blended fabrics (polyester/cotton) derived from waste collected from the fashion industry are being investigated as a resource for reinforcing polyester-based technical components.

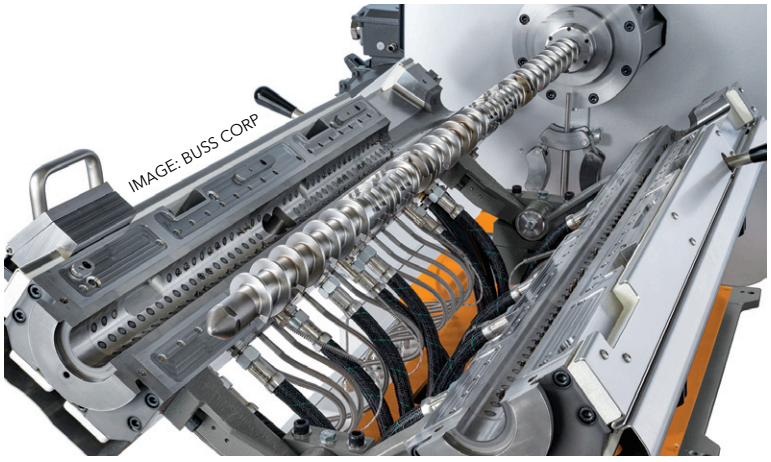

IMAGE: BUSS CORP

IMAGE: AIMPLAS

Siegenthaler says another project explores the use of bio-based raw materials to achieve a reduced carbon footprint and novel property combinations. "By-products from the food, feed and wood industries are used. The gentle and specifically adjustable shear rates of alternative systems are the key to success here," he says.

"Other projects with expanded recycling approaches are currently in development. For example, in material recycling, compounds made from PET flakes from recycled bottles and short glass fibres are being evaluated for their use as extrusion materials for applications in the construction industry. Also, in a pilot project for raw material recycling, the basic principles were developed to return thermoset compounds to their starting material through a solvolysis approach. The conversion of the batch to the continuous process is currently underway. The large free volumes of alternative systems are being utilised in this process," he says.

Siegenthaler also sees AI technology and its improved insight into the compounding process benefiting the application of alternative extrusion technologies. "AI is already being used successfully in the design of new pharmaceutical compounds. These approaches and the use of data sets from the development and production of plastics are to be used for faster and more efficient recognition and selection of, for example, formulation candidates for targeted application fields," he says.

"In the production of battery masses, many players are exploring the possibilities for the DBE (dry battery electrode). In contrast to the slurry process, much higher viscosities have to be handled with gentle mixing processes," he explains. "Low shear rate levels combined with excellent mixing effects – dispersive and distributive – are

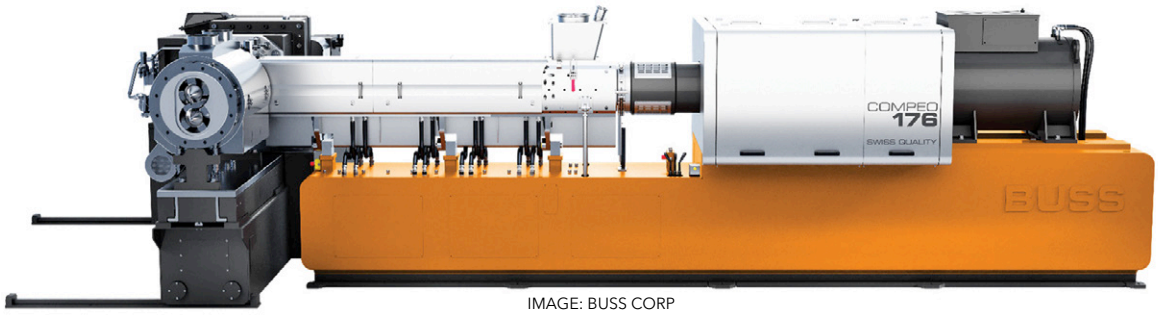

IMAGE: BUSS CORP

Left: A Buss Compeo 176 kneader compounding extruder with CDP (conic discharge pump) unit attached

the strengths of alternative compounding systems."

According to **Buss**, the ongoing trend for performance differentiation and innovation means alternative compounding systems such as the company's Compeo kneader are being tested and applied continuously. "Key applications for Buss remain heat and shear sensitive materials, polymers and filler materials, especially at high filler loadings, reactive compounding and abrasive materials," says Dr Krischan Jeltsch, Head of Business Development – Innovation and Digitisation.

"Bioplastics and recycled polymers show potential due to either the shear sensitivity or because the material suffers from each additional processing step, such as recycling, where the milder Buss process can show its benefits. In addition, the Buss kneader shows valuable performance benefits for highly viscous compounds, for example for electrode materials using the upcoming dry process," he says.

Jeltsch adds that some of the influencing factors driving new developments include energy efficiency and machine condition monitoring to increase uptime and assess production efficiencies. He says further work is also underway in high-end compounds, where the extra-performance is needed for differentiation.

He says that the company is also in ongoing collaboration with partners to establish the Buss kneader in several emerging markets, including bioplastics, battery electrodes, fuel cell bipolar plates, wood-plastic composites and natural-fibre composites.

Twin screw compounding extruder maker **CPM** entered the alternative compounding market with its 2017 acquisition of German company Extricom, the developer of the RingExtruder RE. It reports that market opportunities for this alternative compounder are growing in some interesting application areas.

"There are two applications where we are really finding a nice niche for the RingExtruder RE," says Anton Fuerst, Director, Market Segment Sustainable Products. "The ring is extremely good at mixing and has low shear. In addition, it can spread the material out. The RingExtruder allows for greater surface area and exposure and acts more like a mixer with increased devolatilisation. This is ideal for rPET, and other recycling process, especially with high moisture content. We can now pull off volatile compounds and remove moisture, which we believe sets a new standard."

The current main application areas for the RingExtruder are challenging degassing processes, as well as heat and shear sensitive applications. However, Fuerst adds that the company sees potential in many other application areas, including reactive extrusion processes where the 12 apex areas in the RingExtruder allow for more intensive mixing compared to the single apex in a twin-screw extruder. There are also advantages in terms of improved temperature control and longer residence times.

Recycling, sustainability and material reuse are also extremely important drivers. That trend is moving faster in Europe, but CPM also supports recycling and sustainability initiatives in the US and believes the RingExtruder's advantages will allow it to play a leading role in this area.

The company says developmental work is also ongoing with biopolymers, where the heat sensitive materials require a softer compounding approach. In addition, it says it is returning to the rPET market where it sees many opportunities and potential for the RingExtruder RE.

CPM continues to optimise and improve the RingExtruder RE. "We have a new feed barrel and degassing port with better wear protection provided as standard," says Fuerst. "We have a state-of-the-art lab facility for the RingExtruder RE

Below: A RingExtruder RE 3 XPV from CPM

IMAGE: CPM EXTRUSION GROUP

Polycompound opens new production plant

Switzerland-based specialty toll compounder Polycompound has long been committed to kneader extruder technology. This year the company opened a new facility at its Sissach location that it says prepares it for changing future market demands.

Construction of the production centre – which also includes additional warehousing and office space – commenced two years ago. Some office-based functions moved in at the beginning of this year, with the new production and storage areas now starting operation.

The investment includes a new Ko-Kneter CK-100 system from Swiss kneader extruder maker X-Compound, part of Germany's Troester Group. The 100mm diameter machine joins the company's six other Ko-Kneter machines ranging from 45mm to 200mm diameter and expands its capacity by around 2,000 tonnes/year. The new line has been specially configured to handle temperature and shear sensitive materials.

"This investment places the company in the perfect position to meet the market's increasing requirements. The considerable financial expense reflects Polycompound's efforts to be an industry leader," says Polycompound CEO Thomas Manetsch.

The existing Polycompound development centre has also been relocated to the new building and a spacious area set up alongside it where its customers can work undisturbed during both short-term and long-term visits.

Right: Specialty toll compounder Polycompound's new production plant at Sissach in Switzerland

Below: Polycompound has extended its kneader extruder inventory with the installation of a seventh machine

IMAGES: POLYCOMPOUND/MARC GILGEN

Polycompound offers a toll compound development and manufacturing service and reports growing demand for application-oriented, custom formulated high-performance materials. Its kneader-based production plant targets markets as diverse as automotive, pipe, electrical and medical with compounds including challenging conductive, flame retardant, and heavily-filled formulations.

"Polycompound goes beyond standard solutions and customises its compounding systems to the customer's needs. This tailor-made approach has not only contributed to customer loyalty, but also strengthened the company's competitive position," says Head of Sales Peter Imhof.

The new building has been planned to meet the company's forecast future growth as well as its sustainability goals. It includes a powerful rooftop photovoltaic system with an area of 1,030m², a new refrigeration plant with free cooling, and a building heating system with 100% heat recovery.

› **www.polycompound.ch**
› **www.x-compound.ch**

in Lauffen, Germany, where development is continuously ongoing, especially in sustainability and recycling. We have also developed a reaction process technology with two well-known industry leaders. In addition, we are enhancing process automation, controlled process loops and automatic process optimisation, and how that may be tied into our Industry 4.0 initiative."

According to **Farrel Pomini**, the developer of continuous mixing equipment, the general plastics market is experiencing fluctuations and challenges due to global economic conditions including the slowdown in the European Union, China's economic deceleration and recession concerns in the US. It says global polymer demand is increasing at a conservative 2.5% CAGR through 2025 and there has been a decrease in virgin and recycled polymer prices. However, it reports that its traditional markets are active.

"These include black and white masterbatches, as well as rigid and flexible PVC, flooring compounds and flame retardants. We are seeing regional differences, but since we operate globally, the growth areas are offsetting others so overall, our outlook is positive," says Paul Lloyd, President and Business Unit Director.

"When considering 'newer' applications, such as biopolymers and other sustainable options, it feels like opportunities increase almost daily. It is a very exciting time to be in the plastics industry. Our

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IMAGE: FARREL POMINI

Above: A CPeX Laboratory Compact Processor (right) and CP550 continuous mixer in Farrel Pomini's development lab

continuous mixing technology is inherently well suited to the processing of biopolymers and recyclates, for example, because they require low processing temperatures, short residence times and efficient shear mixing," he says.

"Biopolymer and recycled material applications are also temperature sensitive, subject to molecular weight degradation. Over 70% of customer demonstration trials in both our US and UK facilities are currently within this landscape and include PLA, PHA and wood fibre/cellulose," says Lloyd.

"Farrel Continuous Mixers offer efficient and uniform mixing shear, in combination with lower processing temperatures and residence time, effectively reducing molecular degradation. The one large feed port offered by the continuous mixer lends itself to the irregularly shaped material that is often seen with recycled feedstock."

Compounding recycled plastic materials is a complex process because recyclates are intrinsically contaminated, partially degraded, and contain different pigments and granule sizes that make processing challenging. Lloyd says Continuous Mixers offer some advantages for compounders of recycled materials, including the large single-entry feed port that is capable of ingesting irregularly sized feedstocks as well as large volumes of additives and fillers. Large rotor tip to wall clearances and mixing chamber volume also allow for efficient processing at controlled temperatures, increased material flow, high filler levels and reduced sensitivity to any foreign materials that may be incorporated in feedstocks.

Last year, Korean bio-products group CJ Bio conducted research comparing the Farrel Continuous Mixer with a twin-screw extruder for processing bioplastic formulations including PHB, PHA and talc, and PHB, PLA and talc under a variety of conditions. The research concluded that the Farrel Continuous Mixer processed both formulas with lower specific energy resulting in enhanced molecular weight retention, lower melt index and higher impact strength than a comparably sized twin-screw extruder.

Lloyd says the company is also seeing significantly increased activity in traditional markets such as PVC flooring compounds and decking products. "PVC is extremely temperature sensitive and Farrel Continuous Mixers excel at processing heat sensitive material because of its short residence time, low processing temperatures and efficient rotor shear, which imparts less energy and therefore temperature into the polymer. Our equipment also has multiple temperature controls zones and rotor cooling."

Energy reduction is important from two perspectives, Lloyd explains. "Firstly, with escalated energy costs, it is important to be energy efficient to maintain profitability. Secondly, it is often important to impart less specific energy into the polymer to minimise heat history and maintain molecular structure."

Continuous mixing technology is based on two counter-rotating, non-intermeshing rotors and a large free volume mixing chamber. The large mixing chamber allows for liberal material circulation and good distributive mixing, while the specialised rotor geometry facilitates efficient levels of shear and good dispersive mixing. The standard 6 L/D rotor provides a short residence time and a low heat history for the polymer, while still providing a high-quality homogeneous mixture at the exit of the processor.

With a single-entry feed port, materials are fed into the mixer separately or as a pre-blend while liquids can be injected directly into the mixing chamber. This straightforward feeding method eliminates the need for side feeders. Continuous mixing technology also utilises atmospheric

The concave feed flight design in Farrel Pomini's new High Dispersion Rotor increases conveying efficiency of lower bulk density materials

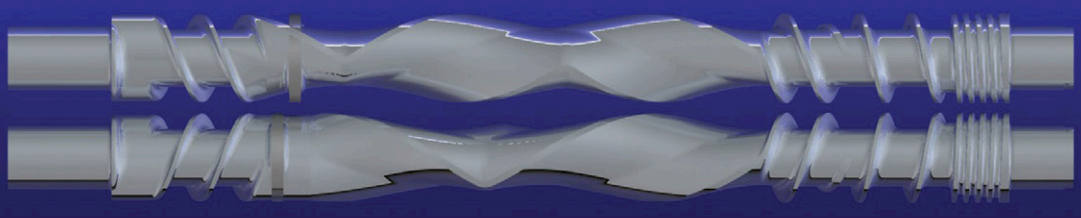
IMAGE: FARREL POMINI

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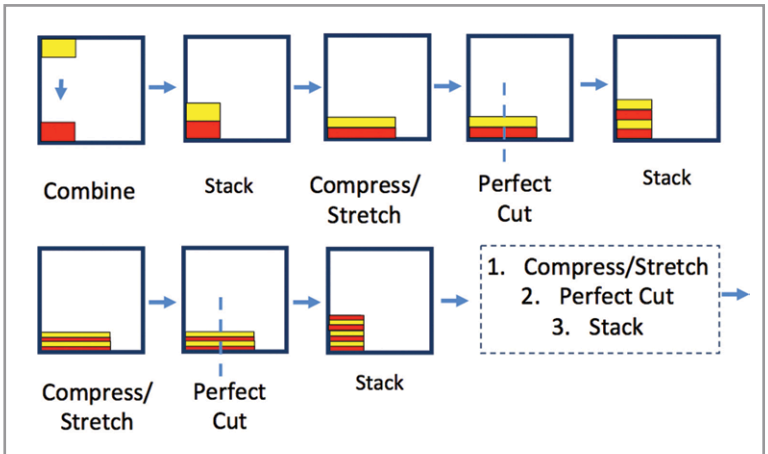

Figure 1: A schematic representation showing the basic principle of the Bakers' Transformation in melt mixing
Source: Randcastle Extrusion Systems

venting, eliminating the need for additional vacuum systems.

Recent developments include a new rotor with a concave feed flight design. The High Dispersion Rotor increases conveying efficiency at the infeed of the mixer, aiding intake of lower bulk density materials. It is well suited to applications requiring high dispersion such as processing fibre grade, high colour carbon black and colour concentrates.

Farrel Pomini is also working with **FPInnovations**, a Canadian non-profit Research and Technology Organisation, on biocomposite applications. Together with wood products producer West Fraser and bio-based products manufacturer Good Natured Products, the companies are developing engineering bio-based alternatives to traditional plastics. biocomposites. Central to the research is the integration of various products from West Fraser operations into biopolymer blends to create 100% bio-based and compostable compounds.

US-based single-screw systems maker **Randcastle Extrusion Systems** has developed a new option for compounding applications. "It is in a class that I call 'multiplicative mixers', of which there are two kinds - static and dynamic," says Keith Luker, Chief Executive Officer. "This new single screw compounder is a dynamic, multiplicative mixer, known as the Molecular Homogenizer."

Static multiplicative devices emulate the Baker's Transformation (Figure 1), he says, and the most common is the twisted ribbon which has a multiplier of two (meaning that it doubles the layers with every twist). After eight twists, it makes 256 layers (2^8). The second device is the layer multiplier, which is a static device used to make layered film and sheet. They also have a multiplier of two and as many as 4,096 layers (2^{12}) are known.

"Conceptually, static multiplicative mixers are plumbing. Like the Baker's Transformation, they are only better mixed in two dimensions. That is their fundamental flaw because what is wanted is better mixing in three dimensions," Luker argues. "Our dynamic multiplicative mixer has a multiplier of 100. Treated like a two-dimensional static mixer, its seven mixing elements make 100 trillion layers (100^7). As a three-dimensional mixer acting on polymer chains, it mixes and homogenises at the polymer molecular level."

Luker says that the essence of the static mixer is its simplicity. Once installed, it does its job. Operators do not need to take it apart to reassemble parts to make it work better, he says, it works the same, no matter how the mix changes. He says that the dynamic multiplicative mixer shares this advantage – it does not require taking apart and reassembling with other expensive parts on shafts.

Randcastle claims the Molecular Homogenizer overcomes some of the drawbacks of static mixers – it does not use pressure to convey the mix, so output is not compromised, and it is dispersive in three dimensions. It also has an advantage over twin screw extruders in that the entire flow is processed through the sequential mixing zones, so all is mixed the same.

Luker believes that the Molecular Homogenizer can replace twin-screw extruders in many applications. "It is simple to operate, produces a more uniform mixture and is far less expensive."

Preliminary experiments carried out by the company show significantly slowed water vapour absorption in PMMA, from hours to over three days. "Potentially, we may be able to influence water absorption for other hygroscopic materials and that could reduce the amount of drying necessary for hygroscopic materials."

Luker adds that that single screw venting, as represented by the conventional two stage screw, is not especially good but says there are many elongational flows in the Molecular Homogenizer that can all be accessed by a single vent processing at zero pressure. These constantly remix the flow and expose new, stretching surfaces that greatly enhance bubble break-up and gas release.

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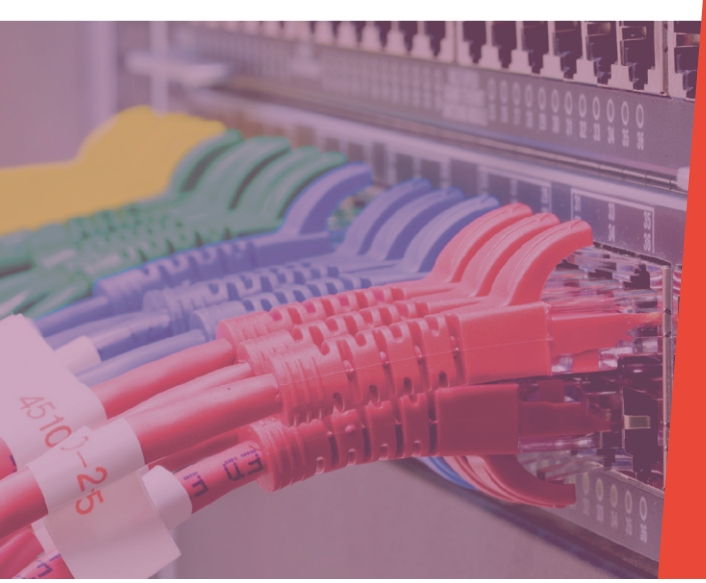

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IMAGE: PE SCHALL

Fakuma opens for business

The 28th Fakuma fair takes place this month in Germany and organisers are predicting an inspiring show. We take a look at some of the innovations for compounders

The Friedrichshafen exhibition centre in Germany hosts the 28th Fakuma trade fair from 17-21 October, presenting what will be the biggest collection of injection moulding and raw material innovations in Europe this year.

"Spirits are high, the exhibitors are excited about presenting their future-oriented solutions and the expert visitors can look forward to an inspiring trade fair," says Annemarie Schur, Fakuma Project Manager at show organiser PE Schall. She identifies key themes for this year's event as circular economy, recycling and sustainability with a particular interest on "ecologically compatible" plastics production and processing.

Fakuma was last held in 2021 when it attracted 1,470 exhibitors. The organisers did not disclose the total number of visitors to that edition of the show, which took place as Germany's post-pandemic exhibition restrictions eased, but attendance appeared reasonably strong with the usual 40% share of visitors from outside of Germany. This year's event may not match the record 47,650 visitors of 2018 – the last Fakuma show before the pandemic – but it is likely to be well attended once again and just as international.

Over the following pages, we take a look at some of the companies that will be showing materials or equipment of interest to the compounding sector.

Main image: The Fakuma fair takes place in Friedrichshafen in the south of Germany from 17-21 October

About the show

Organiser: PE Schall **Dates:** 17-20 October 2023
Location: Messe Friedrichshafen, Neue Messe 1, 88046 Friedrichshafen, Germany
Hours: Tuesday-Friday 09:00-17:00, Saturday, 09:00-15:00
Tickets: €30 day ticket (€22 students)
www.fakuma-messe.de/en/

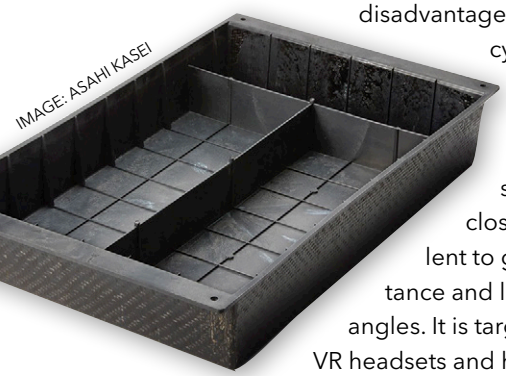
IMAGE: ASAHI KASEI

Below: Lencen continuous fibre reinforced PA66 from Asahi Kasei is aimed at EV battery applications

Asahi Kasei will show its new continuous fibre reinforced thermoplastic composite, which has been developed for electric vehicle battery enclosures. Lencen is comprised of multiple layers of glass reinforcement between PA66 films and is said to offer high tensile strength, heat resistance, and impact properties similar to metal.

The company will also show its AZP transparent polymer, which it claims overcomes many of the disadvantages of conventional plastics such as cyclic olefin copolymers (COCs) and PC in optical applications. The company has not disclosed the specific polymer types but says the thermoplastic AZP offers close-to-zero birefringence, equivalent to glass, as well as high transmittance and low colour distortion at all viewing angles. It is targeted at applications such as AR/VR headsets and head-up-displays (HUDs).

› **www.asahi-kasei.com**

BASF will present its latest developments for new markets such as e-mobility as well as detailing how its materials can be used to meet sustainability targets.

For e-mobility applications, the company will show its Ultramid Advanced polyphthalamide (PPA) compounds, which offer constant mechanical properties at high continuous-use temperatures as well as meeting the sector's demanding colour matching requirements. It will also show its coloured Ultrason polyarylethersulfone (PAES) products, which are produced in partnership with Avient to allow it to respond more quickly to customer demands for faster turnaround.

Visitors will also be able to trial the company's new Pacific software, which provides PCF (Product Carbon Footprint) data to allow customers to quickly calculate PCF values for their finished products. The software will be launched later this year.

› **www.basf.com**

Benvic will be showing compound offerings applicable to its traditional PVC product "legacy" market sectors as well as its fast developing polyolefin, elastomeric and bio-based portfolios.

Recently brought together under the ProVinyl name, the company's PVC offering includes rigid, plasticised and recycled grades, the latter presenting more sustainable PVC options for its customers.

Polyolefin products include Benvic's recently introduced Dotcor specialty PP compounds, including the Dotcore R ranges of materials produced from up to 100% second use material recovered from post-consumer consumer goods and automotive parts. The company will also present its SET (sustainable engineered thermoplastic) concept for development of PP compounds offering performance similar to PA. Benvic says it is now at the sampling stage.

Dotflex TPEs will also be presented, as will the company's Plantura bio-based materials. It will display some applications where Plantura grades have substituted engineering plastics, such as a joint automotive grille development with BASF and Röchling.

› **www.benvic.com**

ColVisTec will present its GiANT 3-in-1 spectroscopy platform, which is claimed to allow realtime defect detection inline on the extruder through the combination of UV-VIS, NIR and Raman spectroscopy.

The system is said to allow detection of process drifts, colour changes, yellowing and degradation, distribution and dispersion quality, and influence of feeders and pumps on the raw material and quality of the processed product. It uses a saphire-window probe that measures directly in the melt flow at temperatures up to 400 °C and pressures up to 250 bar.

› **www.colvistec.de**

Coperion, which will be exhibiting together with group company Herbold Meckesheim, will show its latest equipment developments for the plastics compounding and recycling markets. The newest introduction to the Coperion product line – the preconfigured ProRate PLUS feeder – will be displayed in a size S version with integrated refill. The single screw feeder is said to be an especially economical solution for reliable feeding of free-flowing bulk materials.

IMAGE: COPERION

Right: Coperion will show the latest addition to its ProRate Plus feed line

The company will also present its ZSK and STS twin screw extruders, as well as other feeding and conveying such as the ProRate PLUS feeder line with

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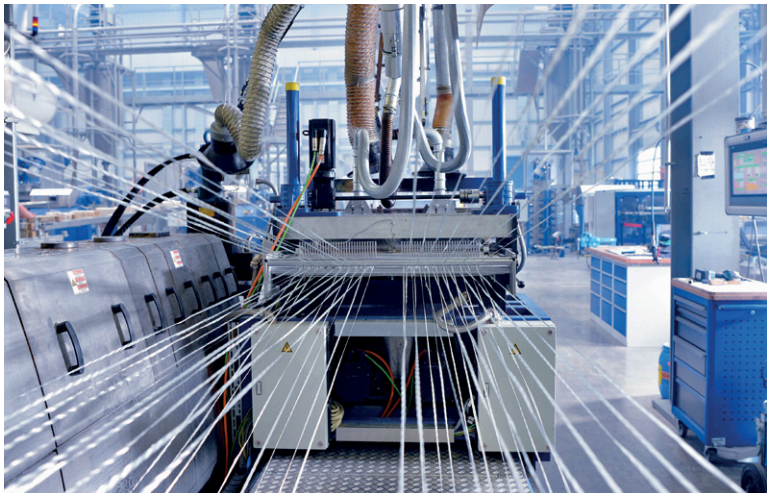
IMAGE: FEDDEM



Above: Feddem will promote its LFT production line options

PLUS-MT twin screw feeder for feeding powders.

A virtual representation of a PET recycling plant will underline the added value coming from the merger of Coperion and mechanical recycling specialist Herbold Meckesheim. The two companies now build entire systems for plastics recycling, extending from mechanical processing – size reduction, washing, separating, drying and agglomerating of plastics – to bulk material handling, feeding and extrusion, through to compounding and pelletising.

› **www.coperion.com**

ELIX Polymers will show its E-LOOP portfolio, which includes mechanically and chemically recycled products. The mechanically recycled offering includes E-LOOP H801 MR, E-LOOP Ultra 4105 MR and E-LOOP PC/ABS 5120 MR all of which display properties equivalent to their traditional prime equivalents but bring CO_2-emission reduction of 29%.

The company will also promote its E-LOOP CR products, which are manufactured from a combination of fossil, bio-based and chemically recycled feedstocks. Recycled or bio-based contents can be provided based on ISCC Plus certification and mass balance principles. Depending on the final mix , CO_2 emission reduction of up to 60% are claimed.

› **www.elix-polymers.com**

EMF Motor will display its SQME Extruder Torque Motor, a direct drive motor designed for low speed, high torque applications which is claimed to require no gearbox or cooling. Features of the motor design include an integrated thrust bearing, hollow motor shaft, and improved accuracy in speed control while claimed benefits include reduced maintenance, optimal dynamic performance and high torque density.

› **www.emfmotor.com**

Feddem will show the latest version of its FED 43 MTS twin screw extruder, which is now available with up to 157kW of drive power. The machine will be shown in its standard processing length of 32 L/D, although a 10 L/D extension is available to convert that to 42 L/D in as little as two hours. It will be equipped with a liquid feed port just after the melting zone.

MTS extruders can accommodate multiple feeding and degassing points. At the show, the company will display the latest version of its vacuum-assisted side feeding unit. The FSB-V unit is now equipped with a viewing window, which allows direct observation of flow patterns within the device during processing of lightweight fillers.

The company will also promote its pultrusion lines for production of LFT-G pellets (Long Fibre Thermoplastic Granules), which can operate at strand speeds of up to 60 m/min. It's systems are characterised by a more compact footprint and use proprietary modular impregnation tooling.

› **www.feddem.com**

Lifocolor Group will present its latest masterbatch solutions for colouring, stabilisation and functionalisation of thermoplastics including its Eternity Colours, which are formulated with natural pigments and are primarily suited for use with bio-based and biodegradable polymers.

The company has also expanded its Expressive colour and effect concentrates, which are typically used in production of bottles and films. As part of its Lifostab portfolio, it has also developed a line of UV additives that provide protection for packaged products that are free of benzotriazoles. The company will also show a range of four authentic granite-effect additives for use in polyolefin consumer goods.

› **www.lifocolor.de**

Maag will display examples from across its range of compounding ancillary equipment, include pelletisers, melt filters and gear pumps.

The company will highlight the die plate technology it acquired last year through the acquisition of French company AMN. Engineered for throughputs of up to 100 tonnes/h, the die plates are suitable for high melt index and complex polymer formulations. A key feature is their CIS cooling system, which provides increased localised water flow to improve cutting and improve pellet quality and to reduce cavitation phenomena.

In the pelletiser area, Maag will show a Pearlo 350 EAC underwater pelletiser with liquid-heated die plate. The unit is suitable for throughputs of up

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IMAGE: SIKORA

Above: Sikora will put visitors' pellets to the test on its Purity Concept V lab inspection system

to 18,000 kg/h and is said to offer very high pellet quality and extended operation between blade maintenance. It will also display an EBG strand pelletising system suitable for highly filled, hydroscopic and water-sensitive compounds.

Maag will also show its ECO 500 high performance melt filter, which is designed for for filtration of heavily contaminated polymer feedstock and is also said to be particularly suitable for use in chemical recycling plant. A selection of Extrex gear pumps complete the display.

› **www.maag.com**

Mocom will be emphasising its latest technical compound developments for lighting and lightweight applications, as well as its newest sustainable introductions.

The company's Eco portfolio and compounds for lightweight applications used primarily in e-mobility will head up the display. This includes grades based on post consumer (PCR) and post-industrial recyclates (PIR), which are offered under the Altech Eco and Alfater XL Eco names, and compounds.

The latest addition to the Altech Eco line is a high-impact PA6 with 30% glass fibres that consists of up to 51% post industrial recyclate. It offers a 67% GWP reduction over virgin grades without sacrificing performance, the company says.

› **www.mocom.eu**

RTP Company will show its recently developed RTPrene compound, a fully vulcanised thermoplastic rubber material that is said to be easy to process, lightweight, and resistant to wear and tear. The company says it is a good choice for demanding applications in automotive, consumer, industrial, and medical applications that require excellent performance in harsh environments.

The company will also display its sustainable PA and PA materials that are manufactured with post industrial and post consumer recycled content, as well as its extensive range of high performance Long Fiber (LFT) Compounds.

› **www.rtpcompany.com**

Sikora will demonstrate its Purity Scanner Advanced system for inline inspection and sorting of plastic materials. In addition to optical 25 µm high-resolution cameras, which detect black specks and discolorations, the system also uses an X-ray camera to ensure detection of metallic contamination. The company says the interaction of reliable detection and intelligent sorting ensures high material quality and contributes to cost-efficient production. Visitors to the company's stand can put the technology to the test on the company's laboratory-scale Purity Concept V system. Capable of detecting black and coloured contamination from 50 µm, as well as discolorations, the system can be used as a quality control tool.

› **www.sikora.net**

Solvay will place its focus on its latest products for electric vehicle applications, including two new additions to its Ryton polyphenylene sulphide (PPS) product family. The new Supreme grades are produced with 100% renewable electricity and complement the company's Amodel polyphthalamide (PPA) Supreme resin grades. It will also show a new Xencor Xtreme PPA grade that has been developed to provide improved safety in battery thermal runaway events.

Also new is the Echo product family. Using bio-based and recycled materials, Echo products are said to allow users to meet carbon reduction and circular economy goals without compromising on performance.

› **www.solvay.com**

Tosaf will present the latest additions to its portfolio of additive and colour masterbatches, including a new laser additive family suitable for making transparent parts without affecting optical properties.

The new laser marking products are said to provide contour-sharp, high-contrast markings on thermoplastics that typically show poor or no colour change during laser marking, as well as on compounds with fillers such as calcium carbonate, talcum, titanium dioxide or carbon black. Depending on the substrate, marking colours ranging from white to grey to black are possible.

Tosaf will also show its latest universally applicable colour masterbatch carrier system.

› **www.tosaf.com**

AMI | Events

Plastics Recycling Technology

10-12 October 2023 | Vienna, Austria

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Be part of Europe's focused event for mechanical plastics recycling

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COPERION: STS EXTRUDERS

Coperion's STS Mc11 line of twin screw extruders provides performance at a competitive price. This brochure describes the full features of the range, from the newly launched 90 kg/h 25mm diameter laboratory model to the 4,200 kg/h 96mm version.

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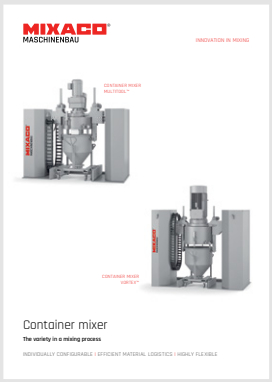
MIXACO: CONTAINER MIXERS



Mixaco's range of container mixers extends from laboratory models offering batches of as little as 700g through to high capacity production Vortex and Multitool designs capable of mixing batches of more than 1.9 tonnes.

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BUSS: COMPEO KNEADER

The Compeo is the latest generation of kneader extruder from Buss and is designed to provide the utmost flexibility in application. This 12-page brochure details key features and model specifications.

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CABOT: SPECIALTY CARBON BLACK

This brochure from Cabot details the company's range of Vulcan specialty carbon blacks for formulation of low moisture absorption electrically conductive plastics for applications such as ESD packaging.

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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 are green ingredients for PVC additives/plasticisers

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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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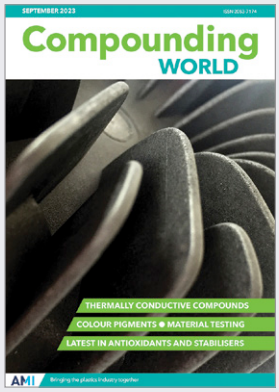

Compounding World September 2023
The September issue of Compounding World has been published with a cover feature on how electronic miniaturisation is driving interest in polymer-based thermal management solutions, plus articles on conductive plastics, pigments, stabilisers and material testing.

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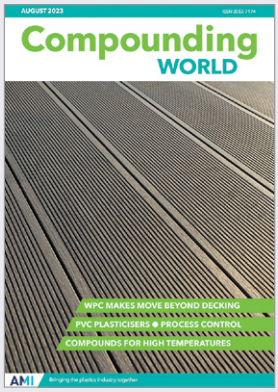

Compounding World August 2023
The August edition of Compounding World looks at wood plastic composites, PVC plasticisers, high temperature compounds, and the latest in process control; plus all the regular features and news from the global industry.

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Injection World September 2023
The September edition of Injection World magazine takes a look at how plastics suppliers are adapting to OEM demands for materials with recycled content. Plus an update on the latest developments in machine control technology and medical moulding.

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Plastics Recycling World September 2023
The September edition of Plastics Recycling World magazine looks at the latest developments in automated NIR and robotic sorting technologies. It also reviews some of the newest innovations in size reduction equipment and recycling of polyolefin-based packaging waste.

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Pipe and Profile October 2023
The October 2023 edition of Pipe and Profile Extrusion magazine looks at the latest in pipe inspection techniques and standards. It also explores developments in materials handling equipment, pipe for the oil and gas industry, and innovations in oriented PVC pipe.

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Film and Sheet September 2023
The September edition of Film and Sheet Extrusion looks at the latest innovations in multi-layer packaging films. It also reviews developments in thermoforming and PVC plasticisers, and looks at how laboratory extruders can help bring new film concepts to market.

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Plastics Recycling WORLD

GLOBAL EXHIBITION GUIDE

2023	**17-21 October**	Fakuma, Friedrichshafen, Germany	www.fakuma-messe.de
	15-16 November	Compounding World Expo USA, Cleveland, USA	www.compoundingworldexpo.com/na/
	15-16 November	Plastics Extrusion World Expo USA, Cleveland, USA	www.extrusion-expo.com/na/
	15-16 November	Plastics Recycling World Expo USA, Cleveland, USA	www.plasticsrecyclingworldexpo.com/na/
	15-16 November	Polymer Testing World Expo USA, Cleveland, USA	www.polymertestingexpo.com/na/
	22-25 November	PlastEurasia, Istanbul, Turkey	https://plasteurasia.com/en/
	28 Nov-2 Dec	IPF Japan 2023, Chiba, Japan	https://www.ipfjapan.jp/english/
	13-15 December	Arabplast, Dubai, UAE	https://arabplast.info/
2024	**4-6 March**	Plast-Alger, Algiers, Algeria	https://www.plastalger.com/
	23-26 April	Chinaplas 2024, Shanghai, China	www.chinaplasonline.com
	6-10 May	NPE 2024	www.npe.org
	4-7 September	Indoplas, Jakarta, Indonesia	www.indoprintpackplas.com
	11-12 September	Compounding World Expo EU, Brussels, Belgium	https://eu.compoundingworldexpo.com/

AMI CONFERENCES

1-2 November 2023	Medical Tubing and Catheters, Tampa, FL, USA
20-22 November 2023	Fire Resistance in Plastics, Berlin, Germany
22-23 November 2023	Recycling Flexible Packaging, Barcelona, Spain
29-30 November 2023	PVC Formulation Asia, Bangkok, Thailand
14-16 November 2023	Waterproof Membranes, Cologne, Germany
5-6 December 2023	Polymers in Footwear, Nuremberg, Germany
5-6 December 2023	Polymer Engineering for Energy, London, UK
29-31 January 2024	Thermoplastic Composites, Tampa, FL, USA

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

www.amiplastics.com

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