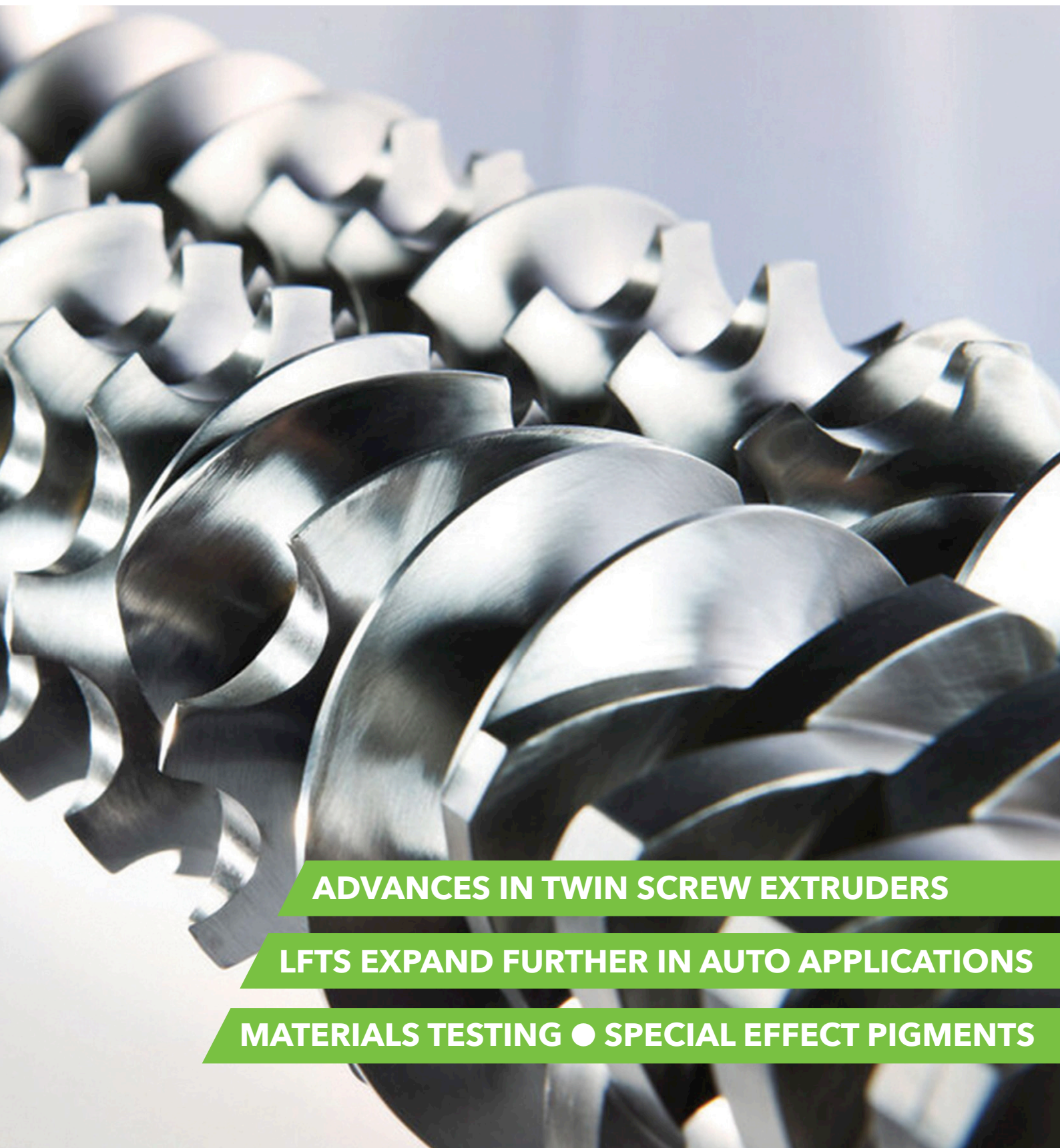


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5 News

News from the global plastics compounding industry

15 Adding intelligence to extruder technology

Advances in twin screw extruder technology, including modularity and artificial intelligence, are enhancing performance, efficiency and precision. Chris Saunders reports on what's new

COVER PHOTO: LEISTRITZ

25 Achieving the right effect

Pigment and masterbatch suppliers are offering increasingly effective technologies to create a wide range of aesthetics in plastic parts, and improve the appearance of recycled material.

By Jennifer Markarian

37 Advances in materials analysis technology

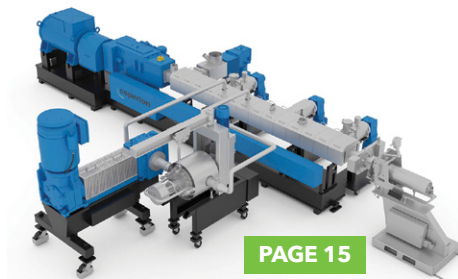
Analysing the composition and properties of polymers, additives, and compounds is crucial for product development and quality control. Jennifer Markarian finds that test methods are evolving for compostable compounds

49 LFTs expand further in auto applications

Long fibre reinforced compounds are winning roles in applications where high strength, stiffness and mechanical performance are needed with lower carbon emissions. By Simon Robinson

56 Diary

PAGE 5



PAGE 15

PAGE 25



PAGE 37



PAGE 49



COMING NEXT ISSUE

➤ Impact Modification ➤ Medical Compounds ➤ Polyamide Additives ➤ Processing Aids

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Borealis and Borouge in polyolefins merger

Oil and chemicals groups OMV and Adnoc have announced their intention to combine their polyolefins businesses and they will have equal shareholdings. OMV-owned Borealis and Borouge – which was formed in 1998 in a joint venture between Borealis and Adnoc – will come together under a new jointly controlled company named Borouge Group International.

It is envisaged the Borouge 4 project to boost polyolefins capacity by 1.4m tpa, making the Abu Dhabi facility the world's largest single-site polyolefin complex, will be retransferred to Borouge Group International at the end of 2026.

Nova Chemicals is also set to become part of the new group once Adnoc completes its acquisition of the North American polyolefins producer. When combined, the three complementary businesses will create the fourth largest polyolefins group in the world with 12.2m tpa capacity.



The Borouge 4 project in Abu Dhabi is scheduled to be completed by the end of 2025

The combination of businesses is expected to realise synergies of around \$500m run-rate EBITDA per annum, coming from improved procurement, cross-selling opportunities, optimisation and efficiencies.

"Together with Adnoc, our strategic partner of 25 years, we are creating a global polyolefins leader, exceptionally positioned for value creation by accessing the largest and most cost advantaged markets," said Alfred Stern, Chairman of the Executive Board and CEO of OMV. "We aim to

significantly increase the sales volumes of innovative polyolefin premium products and be at the forefront of renewable and circular economy solutions."

OMV will make a €1.6bn cash injection into Borouge Group International to equalise shareholdings with Adnoc.

Borouge Group International will have more than 11,000 employees at its locations in the Americas, Europe, Asia and the Middle East.

> www.omv.com

> www.adnoc.ae

Sirmax JV in India expands

Italy-headquartered Sirmax and local partner Autotech have inaugurated the expansion of their joint venture plant in Palwal, India, increasing its production capacity to 30,000 tonnes/yr of PP compounds.

Sirmax said it is growing in India by 15% annually, and the redevelopment of the Palwal site has transformed it into a modern, technologically advanced facility with four new extrusion lines, state-of-the-art laboratories, and a new automated warehouses.

"The completion of the Palwal plant expansion reflects our commitment to provide world-class materials and solutions to our customers," said Achal Thakkar, Managing Director of Autotech-Sirmax India.

Sirmax's turnover for 2024 was €420m, up from €410m in 2023, thanks to a 10% increase in global production volumes. Driving the strong performance were India, Brazil, and the US.

> www.sirmax.com

RadiciGroup to sell off polymers business

Investment group Lone Star has entered into a definitive agreement to acquire the Specialty Chemicals and High Performance Polymers business areas of Italian engineering plastics compounder RadiciGroup.

The transaction is expected to close in the second half of 2025. The Radici family will retain control of the Ad-

vanced Textiles Solutions Business Area.

"The agreement with Lone Star Funds marks the beginning of a new chapter in the global expansion of RadiciGroup's Specialty Chemicals and High Performance Polymers businesses which boast a strong mutual integration," said Angelo Radici and Maurizio

Radici, President and Vice President of RadiciGroup.

RadiciGroup serves customers in Europe, the Americas, and Asia and is predominantly known for its PA products but it also produces compounds based on PPS, POM and other engineering plastics.

> www.radicigroup.com

New FR factory in China

Chinese flame retardant manufacturer Zhejiang Wansheng has opened a new 400,000 m² factory in Shandong province and launched WSFR3104, its first solid halogen free flame retardant for use in polyamides.

The company says that when used in 30% glass fibre filled PA66, the new additive shows improved flame retardant efficiency and better mechanical properties compared to competitive products.

Compounds with WSFR3104 were capable of reaching GWIT 775°C in combination with UL94-V0 at 0.8 mm thickness at addition levels considerably lower than combinations of ADP, melamine polyphosphate, and zinc borate. After recycling three times in a twin-screw extruder, all properties remained intact.

Full-scale production of the FR additive is expected to begin in 2026.

➤ <http://ws-chem.com>

Ratcliffe warns of EU chemicals 'extinction'

Sir Jim Ratcliffe, Chairman and CEO of Ineos, has written a strongly worded open letter to European politicians. His intervention follows the EU announcing its Clean Industrial Deal outlining plans for jointly pursuing competitiveness and decarbonisation.

In the letter, Ratcliffe claims the chemical industry has been hugely important to the success of the European economy over the last century, but now faces "extinction" due to convoluted government policies which have resulted in very high energy prices and carbon tax bills for Europe-based operations.

The letter states: "Ineos operates one of the largest and most advanced, integrated petrochemical facilities in Europe in Cologne... The gas bill is €100m higher than its US equivalent. The electricity bill is €40m higher than in the US. The carbon tax bill is rising towards a shocking €100m. The industry is in



Sir Jim Ratcliffe, Chairman and CEO of Ineos

crisis with such huge disadvantages. Instead of investing in growth for the future, it is fighting for survival."

The letter goes on to express Ratcliffe's fear that government policies will eventually shut all petrochemicals in Europe, necessitating imports of raw materials from the US and China. A more viable solution would be to mirror the US approach by banning carbon tax, providing competitive energy for industry, and incentivising growth and clean technology. The letter ends by claiming the US is "leaving Europe

behind in their dust."

Plastics Europe said in a statement that "the Clean Industrial Deal lacks the urgency needed to restore the competitiveness of EU plastics manufacturing and get its transition toward net zero and circularity back on track".

Virginia Janssens, Managing Director of Plastics Europe, said that while the EU is showing ambitious political leadership, "policymakers cannot afford to continually overlook the essential contribution plastics make to the EU economy, providing essential inputs to strategic EU sectors like automotive, net-zero technologies, healthcare, construction and defence, or the role they are playing in the transition of these industries".

She added: "Sadly, there is a real danger that the competitiveness benefits the Clean Industrial Deal delivers will be realised far too late. Time is not on our side."

➤ www.ineos.com

➤ <https://plasticseurope.org>

Notpla's bio-based rollout is complete



The Wales versus Ireland Six Nations rugby union match at the Principality Stadium in Cardiff on 22 February marked the completion of Notpla's rollout across Welsh stadiums, replacing 750,000 single-use plastic packaging items with seaweed-based plastic.

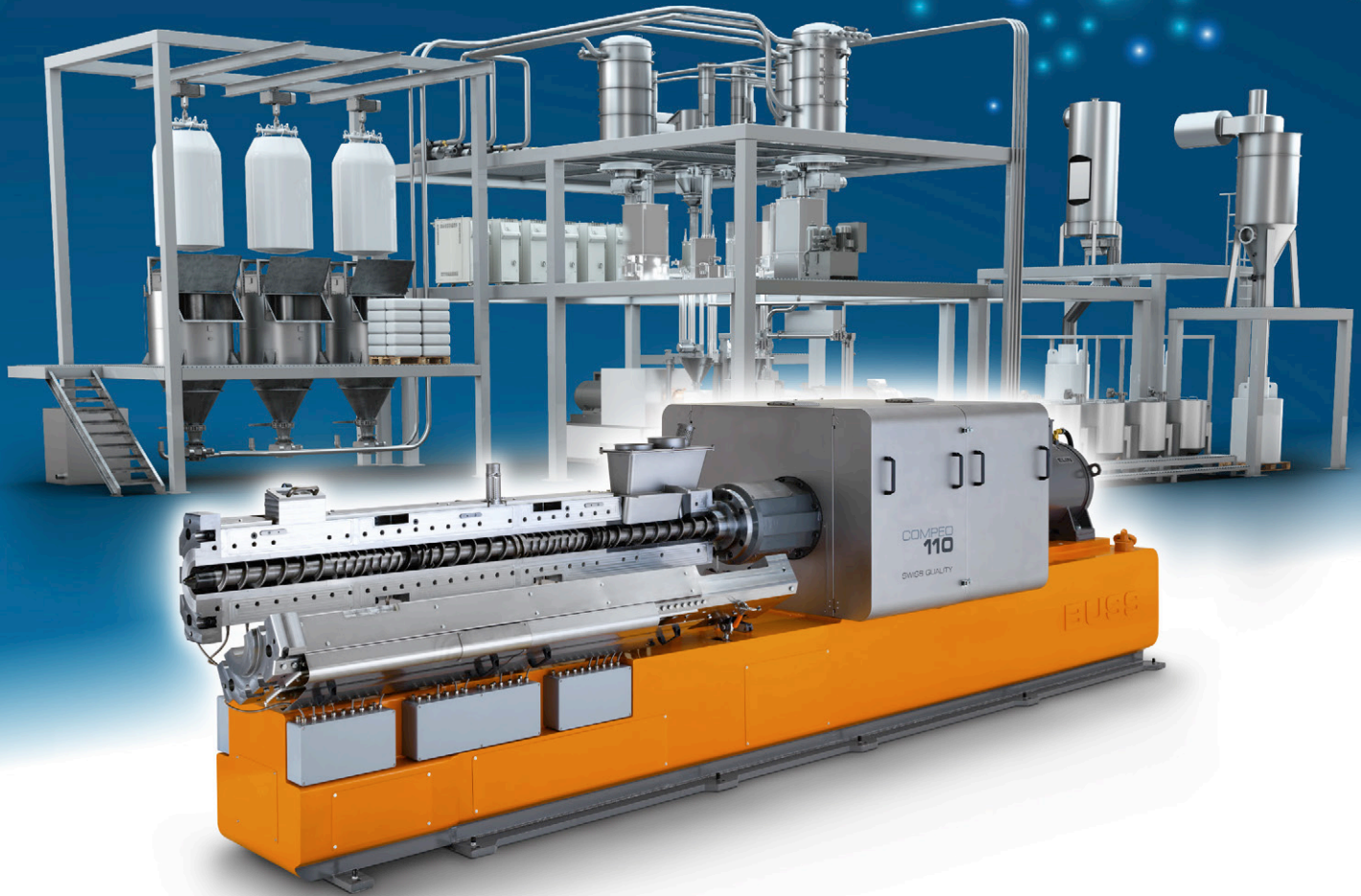
The switch to Notpla packaging is expected to prevent 1.4 tonnes of plastic per year from entering the waste stream, and reduce carbon emissions by an estimated 14.2 tonnes annually, supporting Wales' net-zero ambitions.

Pierre Paslier, Co-CEO and Co-Founder at Notpla, said: "We're demonstrating that eliminating plastic in stadium foodservice is both scalable and commercially viable [and] can't wait to see this example inspiring further action across the UK and beyond."

➤ <https://notpla.com>

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Americhem targets growth as PPC buys majority stake

Investment firm PPC has signed an agreement to acquire a majority stake in Americhem, the family-owned manufacturer of custom colour masterbatch, performance additives, and engineered compound solutions. The investment will provide Americhem with additional financial resources and expertise to accelerate growth, innovation, and expansion across its end markets.

Founded in 1941 and headquartered in Cuyahoga Falls, Ohio, US, Americhem produces colour master-

batch and custom compounds for a variety of markets including health-care, transportation and construction. The company, which operates 10 manufacturing plants with approximately 1,000 employees located throughout North America, Europe, and Asia, says it is uniquely positioned to benefit from tailwinds across large and attractive end markets.

"PPC's investment is a powerful recognition of the strong, growth-oriented business we have built," said John Richard, CEO at Americhem. "I

am proud to lead our talented team as we innovate new products, serve our customers with excellence, and expand our platform in our highly compelling markets. With PPC as our partner, I am confident in our trajectory to accelerate growth, expand R&D and innovation, and enhance our ability to solve our customers' most complex challenges."

Americhem's current leadership team will continue to head the company.

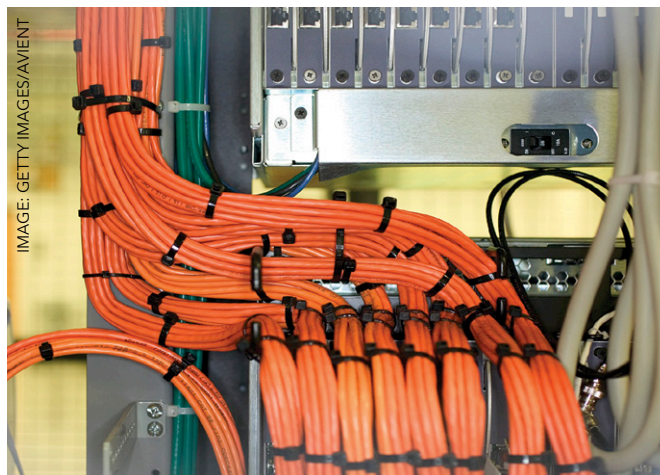
> www.americhem.com

Avient announces higher sales in 2024, starts recompounding in Turkey

In its full year 2024 results, US-headquartered Avient announced sales of \$3.24bn, up from \$3.14bn in 2023.

"We grew organic sales in each of the regions with both our Color, Additives and Inks and Specialty Engineered Materials segments growing at 3% and 6%, respectively, while expanding adjusted EBITDA margins 90 and 110 basis points, respectively, over 2023," said Dr Ashish Khandpur, President and Chief Executive Officer, Avient Corporation.

"Our goal was to generate organic sales growth with margin expansion, and we delivered both in 2024. By continuing to focus on our customers, our team achieved these results against a choppy macro environment," he said.



Avient has expanded its ECCOH XL cross-linkable flame retardant additives

Avient has also announced production of its Nymax REC Recycled Nylon Formulations is expanding to Istanbul, Turkey, increasing accessibility for customers in Middle Eastern countries.

These PA6-based Nymax REC formulations contain 20-100% recycled content

from registered sources approved under REACH. Avient says they offer comparable performance to virgin nylon grades, including high strength, durability, impact resistance, and weather resistance.

"Expanding production of these grades to Istanbul [and] using locally sourced

recycled content means we can offer Turkish and Middle Eastern countries these REACH-compliant solutions while helping to reduce the environmental impact of transporting these materials," said Matt Mitchell, Director, Global Marketing of Specialty Engineered Materials at Avient.

■ Avient has expanded its ECCOH XL cross-linkable flame retardant additives with ECCOH XL 8054, which has been specially developed for low smoke and fume wire and cable insulation and can meet stringent electrical and electronic fire safety regulations in Europe.

The company says the additive can be used in a variety of applications, including shipbuilding, railways and construction.

> www.avient.com

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Nexam teams up in film work

Reactive additive supplier Nexam Chemical and Swedish packaging manufacturer Kullaplast have entered into a collaboration to increase the share of recycled plastic in blown film using Nexamite R305 additive.

"We see this as a prime example of how collaboration and innovation can drive the transition towards more circular material flows," said Ronnie Törnqvist, CEO of Nexam Chemical. "By combining our expertise, we can ensure that recycled material functions optimally in demanding applications such as blown film."

By combining the additive, which improves melt strength and process stability, with Kullaplast's expertise in film production, recycled raw materials can be used to a greater extent.

➤ <https://nexamchemical.com>
➤ <https://kullaplast.se>

Germany's processors suffer more poor sales

Total sales at German plastics processors fell by 4.3% to €69.7bn in 2024, the second annual decline in a row, according to the TecPart trade organisation. At its annual press conference in Berlin on 19 February, the industry body presented data showing how market and structural problems are continuing to depress Germany's plastics processing companies.

The worst performing segments in 2024 were Technical Parts (including automotive and E&E), where sales were down by 5.6% to €19.7bn, and Construction, 6.4% lower at €22.0bn. Sales in the Packaging segment fell by 1.6% to €16.4bn and in Consumer Products the decline was 1.4% to €11.6bn.

A second year of weak demand has led to more than 80% of German plastics processors complaining of a severe to very



Michael Weigelt, Managing Director at TecPart, reporting 2024 results at the organisation's annual conference

severe lack of orders, and only 20% expecting an increase in profits, said TecPart, reporting the findings of its annual member survey.

"We are looking at drastic cost increases, migration and capacity reductions among our plastics processors and internationally sourcing customers. The situation is alarming," said Felix Loose, chairman of TecPart.

There are other indicators of the severity of the impact

on Germany's plastics manufacturing industry in 2024: profits fell for more than half of the companies surveyed, and the number of employees fell by 2% to around 310,000.

The survey showed that a consequence of poor market conditions in Germany is that 84% of plastics processors intend to maintain or reduce their investment levels. But plans for rationalisation measures are increasing.

➤ www.tecpart.de

SK plans recycling centre in South Korea



SK Chemicals is establishing a Recycle Innovation Centre at its plant in Ulsan, South Korea.

The company will form an integrated research and production system at the centre. All processes from depolymerisation to demonstration research, polymerisation, and mass production, will be integrated at one location and be supported by a polymerisation pilot that produces recycled PET and a commercial production facility.

The company also plans to invest in new pilot facilities for recycling PET intermediate BHET, linking them with existing commercial copolyester production facilities.

The depolymerisation pilot facility is scheduled to begin operations in 2026.

➤ www.skchemicals.com



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IN BRIEF...

Lati, which celebrates its 80th anniversary this year, has officially been recognised as a Historical Trademark of National Interest, a certification that rewards production continuity and the historical value of Italian companies. www.lati.com

At their respective shareholder meetings, shareholders of both **Amcor** and **Berry Global** voted overwhelmingly to approve the combination of the two companies. The deal is expected to close in mid-2025.

www.amcor.com
www.berryglobal.com

German distributor **KD Feddersen** has signed a sub-distribution agreement with the Spanish Plastic Agents concerning the products of manufacturers such as Celanese, Hyosung, and Teijin on the Spanish market. <https://kdfeddersen.com>

UK pigment and additive manufacturer **Venator** has appointed Karen Askwith as Senior Vice President, Operations, Nicolas Joly as Executive Vice President, Commercial, and Bart de Jong as CFO. www.venatorcorp.com

Coperion expands test centre in Switzerland

Compounding and equipment group Coperion K-Tron has announced the expansion of the test centre at its facility in Niederlenz, Switzerland.

The expansion will allow the company to conduct more comprehensive and diverse tests, providing customers with a broader range of solutions for their material handling needs.

"Coperion is committed to delivering the best possible solutions to our customers," said Marco Hadrys, Test Centre Manager in Niederlenz. "The expansion of our Test Centre is a significant step towards achieving this goal."

The company says the new facility will be equipped with the latest technology, ensuring the highest standards of safety and



IMAGE: COPERION

The expansion is set to benefit customers and in-house R&D

efficiency, and will also include advanced containment systems, including an airlock system with filtration, ensuring the safety of the testing process, the staff, and the environment. This will allow the company to better serve customers in industries where containment and hygienic require-

ments are critical.

The test centre also provides opportunities for Coperion's R&D teams to test prototypes when developing new products or improving existing equipment and processes. The new addition is expected to be completed by April this year.

> <https://coperion.com>

Invista granted recycling patent

Invista has been granted a patent for a nylon (polyamide) recycling process that could improve nylon 66 manufacturing by making more high-quality post-industrial recycling (PIR) feedstock available.

The company has also submitted a second patent application for a process that enables the use of up to 100% post-consumer recycled (PCR) content in the production of new nylon 66 components. Alongside

its internal efforts to advance nylon 66 recycling technologies, Invista's R&D team is supporting external technology leaders and startups working on their own solutions.

> <https://invista.com>

NatureWorks launches new 3D printing grade

Bio-based polymer producer NatureWorks is launching Ingeo 3D300, its latest specially engineered 3D printing grade of PLA.

Designed for faster printing while maintaining excellent surface finish

and detail, the company says Ingeo 3D300 offers enhanced efficiency combined with exceptional performance at reduced production costs.

"Ingeo 3D300 offers an ideal solution to meet the expanding

demand for fast, clean, and precise printing," said Roger Tambay, Chief Growth Officer at NatureWorks. He said the company is helping to push the boundaries in 3D printing.

> www.natureworkslc.com

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Demand volumes for black, white, colour and additive masterbatch **by country**

Production and demand of masterbatch for each region **by product type**

Demand for black, white, colour and additive masterbatch **by polymer**

Demand for black, white, colour and additive masterbatch **by end-use sector**



Contact me to discuss your data requirements

Astrid Della Porta, Commercial Manager, Market Intelligence

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Advances in twin screw extruder technology, including modularity and artificial intelligence, are enhancing performance, efficiency and precision. Chris Saunders reports on what's new

Adding intelligence to extruder technology

The latest innovations in twin-screw extruder technology are reshaping the plastic industry by improving efficiency, flexibility, and the ability to process more complex materials and recyclate, enabling manufacturers to meet ever-growing demands for high-quality, cost-effective, and sustainable products. Energy reduction, modularity and use of artificial intelligence are among the features in new developments from machinery manufacturers.

At Fakuma 2024 in Friedrichshafen, Germany, **KraussMaffei** unveiled updates to its well-established BluePower line of twin-screw extruders, in particular the ZE 28. In response to customer requirements, new features include an improved head design which offers better protection of electrical parts and simplifies cleaning, a redesigned strand extrusion head, and a separated control cabinet. The standard version also adds two more optional positions for the operator panel, allowing the machine to be controlled from the left or right side.

The ZE 28 BP extruder has a free volume outer-diameter-to-inner diameter (Do/Di) ratio of 1.65, an L/D ratio ranging from 32:1 to 64:1, and can add up to three side feeders. It is equipped with KraussMaffei's processControl HMI software, which provides step-by-step instructions for various procedures, while common upstream and downstream systems can be integrated. In addition, the ZE 28 BP combines advanced technologies and intelligent control systems to optimise energy consumption by up to 10% compared to conventional models. The company says: "In a world where sustainability and efficiency are high priorities, the ZE 28 BluePower presents itself as the ideal solution for companies that value environmentally friendly technologies."

Leistriz Extrusionstechnik launched its LinXX controls at the Fakuma show, which can be used flexibly, from compact extruders to entire production lines. The company says the technology "offers

Main image:
Machinery companies continue to make strides in twin-screw extrusion technology

IMAGE: ENTEK



Above: Entek's VFT technology was originally developed for use when compounding fluffy materials

a fully integrated solution for digital and future-proof control, monitoring and maintenance of extruders of any size". Features include an overview of the entire extrusion line, quick access to all main units, storage of recipes for reproducibility, and OPC-UA interface and web-based control technology for digital integration.

"Introducing LinXX, we are revolutionising the way extrusion processes are controlled and monitored," said Daniel Nagl, Managing Director of Leistritz. "Our goal is to increase efficiency, achieve reproducible results and drastically reduce errors. At the same time, we offer our customers an answer to the current shortage of skilled workers by facilitating the daily work of machine operators and enabling even less experienced operators to achieve optimum results."

Leistritz also presented its LinXX Customer Service Portal. Customers can see relevant machine information such as machine number, operating hours, current warning messages and machine documentation in the portal. Other features include maintenance schedules and spare parts identification and ordering. The company has paid particular attention to data security and says the customer retains full control at all times on the integration of the machines into the internet and on what information is transmitted.

Customer collaboration

Also at Fakuma 2024, **Feddem** presented the latest model of its FED 26 MTS twin-screw extruder equipped with 32 L/D and a 10 L/D extension module, 34 kW installed drive

power with maximum screw speed of 1,200 rpm, a FSB side feeder, a FSV vacuum side degassing unit, and a FSK extrusion head with the company's patented sheet die plate.

Another item on display was the Feddem Automatic AirBlade (FAA) which has been developed to minimise beard formation in twin-screw extrusion. Bearding occurs when thermoplastic material or filler accumulates around the die outlet and hardens. In the case of complex compounds with a high filler content, this can lead to strand breaks which can impair both productivity and the throughput rate. Residues can also impact the optical and mechanical quality of the end product. The FAA offers an efficient solution to this problem by removing residues with a targeted stream of hot air.

"The FAA was developed in close collaboration with one of our customers and tested under real production conditions," said David Constroffer, Head of Engineering at Feddem. "[It] effectively minimises the negative effects of product residues at the nozzle outlet and thus ensures improved productivity and product quality."

Feddem also recently announced the commissioning of a new pilot plant where customers have the opportunity to carry out tests on a wear-protected FED 43 MTS twin-screw extruder. The process length of the extruder can be adjusted from 32 L/D to 42 L/D and 52 L/D meaning a wide range of plastics can be processed. The system also features additional units such as the FSB side feeder, FSB V side feeder with vacuum support, and FSV vacuum side degassing.

Meanwhile, at NPE 2024 in Orlando, Florida, US machine manufacturer **Entek** issued an update on its new high-output HT 162 twin-screw extruder (*Compounding World* June 2024). The company also announced that another new model, the HT

92, was in development representing the latest addition to the HT line which

began in 2020 with the HT 72. The display also included vent flow sensor technology shown mounted on a 103mm twin-screw extruder barrel, Vacuum Feed Technology (VFT) for increased output and improved product quality, 37mm QC3 stuffer with mounting arm and 4 x 43mm barrels to show reach/flexibility, as well as a range of live demonstrations.

Entek also reported that its replacement wear parts business for twin-

Right: The new Feddem Automatic AirBlade



IMAGE: FEDDEM

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Above: CPM's new Global eXtruder Technology (GXT) line of twin-screw extruders offers a standardised platform that ensures uniformity

screw extruders is continuing to grow. Since its launch in February 2023, the company says it has increased its offerings, added manufacturing capabilities, stocked inventory, and reduced delivery times.

In another market-supporting move, **Bausano** has introduced a new initiative called the Reward Formula, which provides enhanced valuation for used MD series twin-screw extruders, incentivising their replacement with next-generation models (*Compounding World* January-February 2025). Before collection, a team of Bausano Experts will assess the condition of the extruder, offering up to 30% above market value for the machine. This creates a virtuous cycle, turning obsolete machinery into a valuable resource. "The goal is to offer our customers the opportunity to update their machinery and enhance the productivity of the plants according to a more eco-friendly business model," said Giorgio Critelli, Area Manager of Bausano.

Modular designs

To accommodate the growing diversity of materials and product demands, modular screw designs have become increasingly popular as they allow manufacturers to customise the screw configuration for specific tasks without having to invest in new equipment. Screw elements are now often designed to be easily interchangeable, which not only adds flexibility but helps to streamline the manufacturing process and reduce downtime. The debate between co-rotating and counter-rotating screws continues, with the former seeing recent advancements in screw geometry enabling them to handle more complex materials such as highly filled compounds. Also, recycled plastic feedstocks are often supplied in the form of flakes, and the co-rotating extruder can offer an appropriate barrel configuration to handle the intake.

"The main feed barrel can be supplied in the form of a 6D design versus the standard 4D design for increased open area to accommodate low bulk density flakes," said **CPM** Process Engineer Daron Fraim. "There are various options for the conveying

screw elements to facilitate increased channel volume or improved conveyance efficiency for handling such low bulk density flakes. Several options exist in the conveying screw elements such as two-flight 'under-cut' design or single-flight

elements with increased conveyance efficiency. The process section can also include additional side feed locations [where] additives such as thermal stabilisers or reactive components can be fed into the process section for polymer preservation. When reprocessing plastics, there is always a loss in some properties. Specific additives can be supplied and incorporated to minimise degradation and repair the polymer during processing."

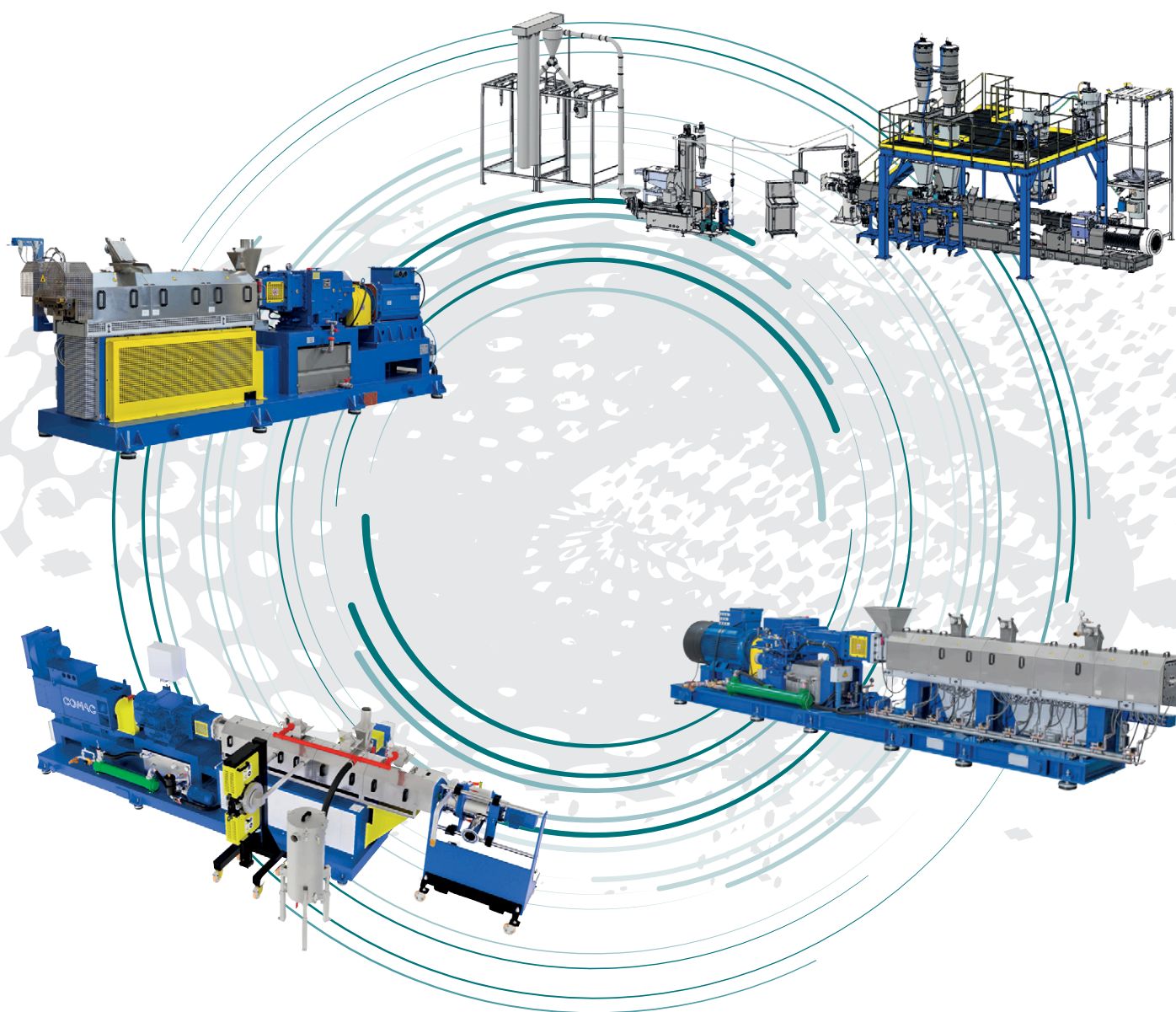
Fraim continued: "The co-rotating twin screw extruder is known for its mixing capability and the versatility of utilising industry standard or specialty mixing elements to reduce the overall shear stress on the material. For instance, there are offerings of a two-lobe kneading block with a modified tip clearance. Utilisation of these specialty elements can offer a gentler melting and mixing characteristic to preserve the polymer properties. The extruder is operated under starve fed conditions and can be conditioned to operate under low degree of fill with the incorporation of large pitch conveying elements for efficient devolatilisation. It can incorporate open barrel designs along the process section, which is particularly important in polycondensation polymers. Devolatilisation can be utilised early in the process section as the polymer is heated and melted to remove moisture. Single or multiple stage venting can also be incorporated to remove residual levels of undesired volatile content that may arise from side reactions or even VOC content that can cause odour or other undesired properties."

CPM's new Global eXtruder Technology (GXT) line of twin-screw extruders offers a standardised platform that ensures uniformity in design and technology regardless of a customer's location. The platform consists of pre-designed or pre-engineered machines that can be built ahead of sale and delivered quickly, allowing customers to choose from various options. They are available with screw diameters ranging from 32 mm to 133 mm, torque densities of 13 Nm/cm³ and L/D ratios of between 40 and 48, with screw speed options of 600, 900 and 1,200 rpm at maximum power output.

A modular design key allowing increased flexibility is seen as one of the most marketable

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IMAGE: JSW

Above:
Recycling
post-consumer
plastics at JSW
Europe's
extrusion
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in Benrath, near
Düsseldorf,
Germany

features of the DSE twin-screw extruder series from **Intelligent Pelletizing Solutions (IPS)**. Additionally, a combination of torque and volume enables a high filling level of the screw, as well as energy-saving and product-friendly processing. The IPS-DSE is clearly laid out, easily accessible and simple to operate, ensuring fast product changes. Pellets, fillers, powders, or fibres, are fed into the processing section via co-rotating, tightly intermeshing side feeders. The IPS-DSE is particularly suitable for recycling applications, regranulation, and compounding tasks. Simon Weis, Managing Director of IPS, said: "In the last two years, we have invested a lot of time in the control/visualisation of our extruder and especially in the control system (integration) of all components for a complete production line."

Taiwanese company **Sheng Yang** is another that provides modular machinery solutions. The company's key products include modular segment type twin-screw extruders featuring flexible component configurations and superior operational stability, effectively addressing high shear force, precise mixing, and temperature sensitivity requirements. The modular screw element design can be adjusted according to material characteristics, allowing precise control over shearing, mixing, and dispersion during compounding. This is especially important for producing highly filled compounds, fibre-reinforced plastics, and functional plastics.

The adjustable screw configuration ensures efficient production while avoiding common issues such as fibre degradation or uneven filler distribution. The technology also allows for precise control of key process parameters such as screw speed, shear rate, and temperature, making it highly suitable for processing high-viscosity materials and highly filled masterbatches. For example, when processing fibre-reinforced plastics, the equipment protects fibre structures and evenly disperses fibres,

significantly improving material performance.

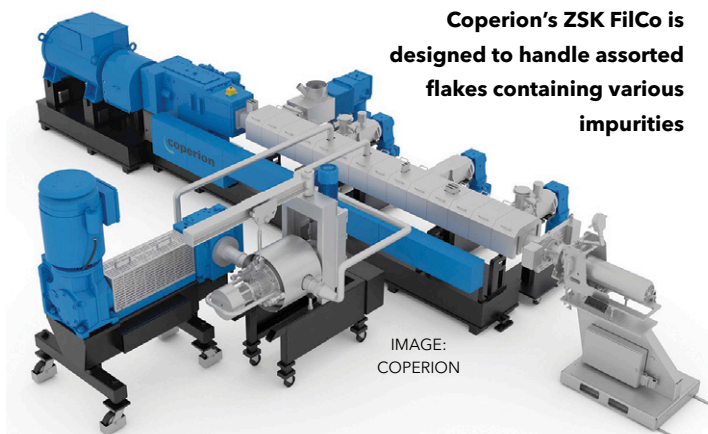
The extruders are also designed to manage multi-functional compounding processes, ensuring stable quality for formulations that require multiple stages of mixing and dispersion. Based on customer feedback, the company says its systems can reduce energy consumption by up to 10%, while significantly improving output stability for high-demand materials. The company's equipment is sold globally, with its major markets being Asia, Europe, and North America. As demand for high-performance composite materials continues to rise, it says its modular twin-screw extrusion technology has proven particularly effective in high-demand sectors such as automotive, electronics, and medical devices where precision and efficiency are considered paramount.

At TaipeiPlas 2024, Sheng Yang showcased the latest generation of its modular twin-screw extruders, which have undergone significant upgrades and optimisations including more precise reconfiguration of screw elements, allowing for a broader range of shear zones and adjustable mixing intensities.

Recycling applications

Generally speaking, plastic waste needs to be available in good quality and in large volumes for chemical recycling. This involves shredding, washing and sometimes drying the material before it is melted in an extruder. **Japan Steel Works (JSW)** says its range of TEX twin-screw extruders are superbly suited for this role. "With the range of our extruders we can provide the right models and sizes up to 400 mm diameter to meet the industrially viable volumes of mixed post-consumer plastic waste of about more than five tons per hour economically. And we are now improving our machines to accomplish customer targets with larger performances," said Shota Kikukawa, Sales Manager at JSW Europe. To improve feeding capacity, JSW proposes use of its compactor stuffing unit, which has two screws. One acts as an agitator to mix the waste, while the other pushes it in compacted form into the extruder. (Read more about JSW's work in mechanical and chemical recycling in *Plastics Recycling World's* January-February 2025 issue.)

Dealing with impurities is a major challenge in all recycling processes. Plastic waste often contains dirt, oils, and mixed polymers that drastically reduce the marketability and usability of recyclates if not removed from the melt. One solution is the **Coperion ZSK FilCo** filtration compounder which removes such impurities by first melting the material then feeding it through a series of fine



Coperion's ZSK FilCo is designed to handle assorted flakes containing various impurities

IMAGE:
COPERION

filters. The raw material only needs to be melted once which reduces the mechanical and thermal stress on the plastic when compared to conventional two-step processes.

One added value this model provides is that the throughput and screw speed can be set independently of one another. To achieve a constant throughput of 900 kg/h, for example, the extruder's screw speed can vary. At low screw speed, the process is especially gentle on product and the Specific Energy Input (SEI) is low. At an increased speed, the mixing behaviour and SEI are higher. In both cases, the energy input and thus the stress on the plastic remain under 0.200 kWh/kg, which is in a similar range to that of new material processing. Moreover, the ZSK FilCo improves the efficiency of the recycling process as it allows continuous processing which reduces residence times in the recycling equipment. This not only makes the recycling process more economical, but ensures that more materials are processed within a specific timeframe.

AI-supported development

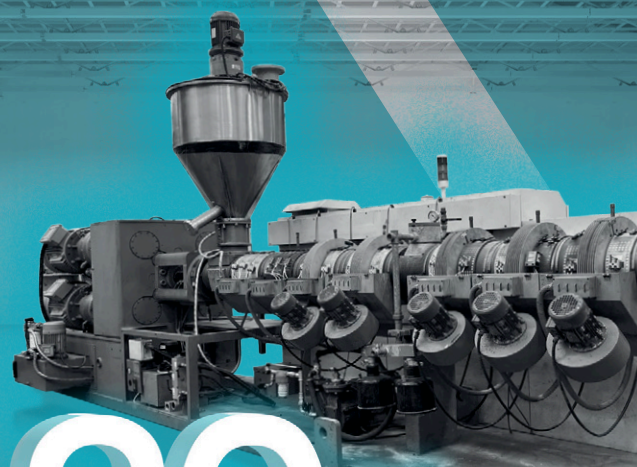
In October 2024, Austrian company **MAS** presented the result of a short but intensive AI-supported development project, the MAS 110 extruder, which is now capable of delivering significantly higher output. In the case of PET recyclate, for example, 6 tonnes/hr can be processed. The MAS 110 is suitable for all types of plastics and can be used in a wide range of applications, including chemical recycling. Despite the leap in output, the new extrusion system is compact and can be easily integrated into larger recycling and compounding systems. It can also be used to upscale existing systems. AI-supported simulations were successfully used during the MAS 110 development process, which contributed to the relatively short time to market. The company said: "Development work and the close integration of artificial intelligence and human expertise are creating the basis for the next generation of MAS solutions. The MAS 110 can also add tangible and sustainable value to your recycling and upcycling applications. Future developments in the MAS family will certainly not be long in coming."

The integration of smart technology is bringing change to the twin-screw extruder industry. Advanced sensors allow

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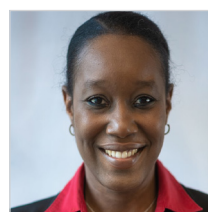
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extruders to be monitored via the internet in real-time, providing data that can be analysed to optimise production efficiency, quality control, and maintenance schedules. The data can also be used in conjunction with AI algorithms, allowing operators to predict and mitigate potential issues before they affect production. C-Beyond from Coperion bundles together all its digital products and service applications, with the focus on creating secure digital solutions that add value to compounding plant operators. It encourages Coperion compounding plants to fully embrace digital transformation throughout their entire lifecycle with real-time tracking of performance parameters, detailed Overall Equipment Effectiveness evaluations which provide instant access to comprehensive production data through an intuitive interface, and advanced AI-driven maintenance tools, all of which maximise operational efficiency while safeguarding critical data. Deviations in output and quality can easily be detected and their causes diagnosed more quickly without complex laboratory tests. In short, C-Beyond provides real-time production process data, allowing managers to make more informed business decisions.

Also, maintenance concepts based on data analytics can be implemented more easily and the Smart Monitoring & Alarm Management tool provides a customisable overview of the machine or even the entire plant, allowing production performance assessment at a glance. Markus Schmudde, Head of Research and Development, Compounding & Extrusion at Coperion, said: "With C-Beyond, we offer customers a comprehensive and mature digital platform that is consistently tailored to the requirements of the extrusion and compounding sector."

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Pigment and masterbatch suppliers are offering increasingly impressive features to create a wide range of aesthetics in plastic parts, and improve the appearance of recycled material. By Jennifer Markarian

Achieving the right effect

Special effect pigments play an important role in enhancing the appearance of plastic parts, particularly for replacing metal or coated components with moulded-in-colour plastics. Pigment effect suppliers continue to enhance their technologies to provide robust and unique effects.

"The trend of replacing painting with mass colouring of metallic [effect] plastic parts continues worldwide. This also applies to the automotive industry, which is looking for ways to reduce costs and find sustainable solutions," said Helmut Wenzlik, Head of Technical Services & Marketing, Plastics, at effect pigment manufacturer **Eckart**. The metallic moulded-in-colour effect allows lower production costs and eliminates painting problems such as overspray, which improves sustainability. Eckart's Stapa AC Reflexal effect pigments, for example, have been successfully used to produce mass-coloured parts for interior automotive applications with almost identical appearance to coated parts. "Smooth and structureless effects are currently in very high demand," said Wenzlik.

Eckart's NIR Silver, which is a silver effect pigment that is detectable by near-infrared sorting in recycling operations, is also seeing interest from many customers, added Wenzlik.

Other effects highlighted by Eckart at the US NPE show in 2024 and first released in 2022 include a pearlescent, an extreme interference flop, and a highly chromatic blue. Luxan C842 Spotlight Red is a pearlescent pigment with more than twice the sparkle intensity of alternatives. "A small amount of this colour-strong, new pigment is enough to bring even simple base colours to an optical high gloss. Incoming light has the effect of a spotlight on Luxan C842 Spotlight Red, and the pronounced sparkle is immediately visible because it reflects the light in an impressive way," the company says. Eckart attributes the reflective effect to a highly efficient coating technology and says that the effect is shown at both very low and very high pigment concentrations.

Eckart's Mastersafe SYMIC Sahara Blue is based on synthetic mica, coated with a combination of metal oxides, that provides an extreme interference flop "oscillating from soft shimmering rose with a beige undertone colour to interference sky blue reflection". The company notes that in flat viewing angles, the beige-rose hue dominates, and the blue shimmer becomes strongest at a 45° reflection angle. The product is recommended for applications where a new special colour effect is

**Main image:
Eckart's
Mastersafe
SYMIC Sahara
Blue is based
on synthetic
mica, coated
with a combi-
nation of metal
oxides**

Right: Eckart's NIR Silver is detectable by near-infrared sorting in recycling operations

needed, particularly in cosmetic and food packaging, household appliances, and toys.

Eckart's Edelstein highly chromatic effect series is designed for use in applications such as household appliances and consumer electronics. Edelstein Sapphire Blue, which shows a deep, highly chromatic blue colour from any viewing angle, is an addition to the series that includes Edelstein Ruby Red, Topaz Orange, and Sunstone Champagne.

Eckart's latest pigment for laser marking, Lasersafe 020, is especially suited for bright marking on dark backgrounds. It is effective at low pigment concentrations in the final product and is suitable for a wide range of polymers or for liquid masterbatches. It is compliant for food contact applications. The new product for dark substrates complements the already established Lasersafe 040 for bright substrates.

In February 2024, Eckart parent Altana acquired US-based special effect pigment manufacturer Silberline Group. Wenzlik said that the acquisition allows the group to react to market demands and meet customer needs.

Added sparkle

Shepherd Color has added to its StarLight line of silver coated glass flake pigments that uses the company's MicroMirror technology, which provides brilliant sparkle and shine. The flatness of the glass flake substrate maximises reflection, and the metallic silver coating is passivated to prevent tarnishing when exposed to water or weathering. The pigments are also very robust and survive high-intensity extrusion processing, the company reports.

The company's proprietary manufacturing process yields durable, high-temperature and long-term light reflectivity, it says. The latest product, StarLight FL170, has a particle size that complements other Shepherd Color products, such as the sparkling undertone of FL37 and the dazzling speckle effect of FL500. The company says that FL170 can be used to emphasise contours or combined with colour pigments to create eye-

Below: StarLight FL170 contains silver coated glass flake pigment



catching effects. In a clear application, the degree of sparkle can be scaled by changing the loading. The loading range varies, but in injection moulded parts it is typically between 0.2 and 0.75 wt.%. Significantly higher loadings have been used in a few pieces, which moves the effect from a subtle sparkling effect to dazzling.

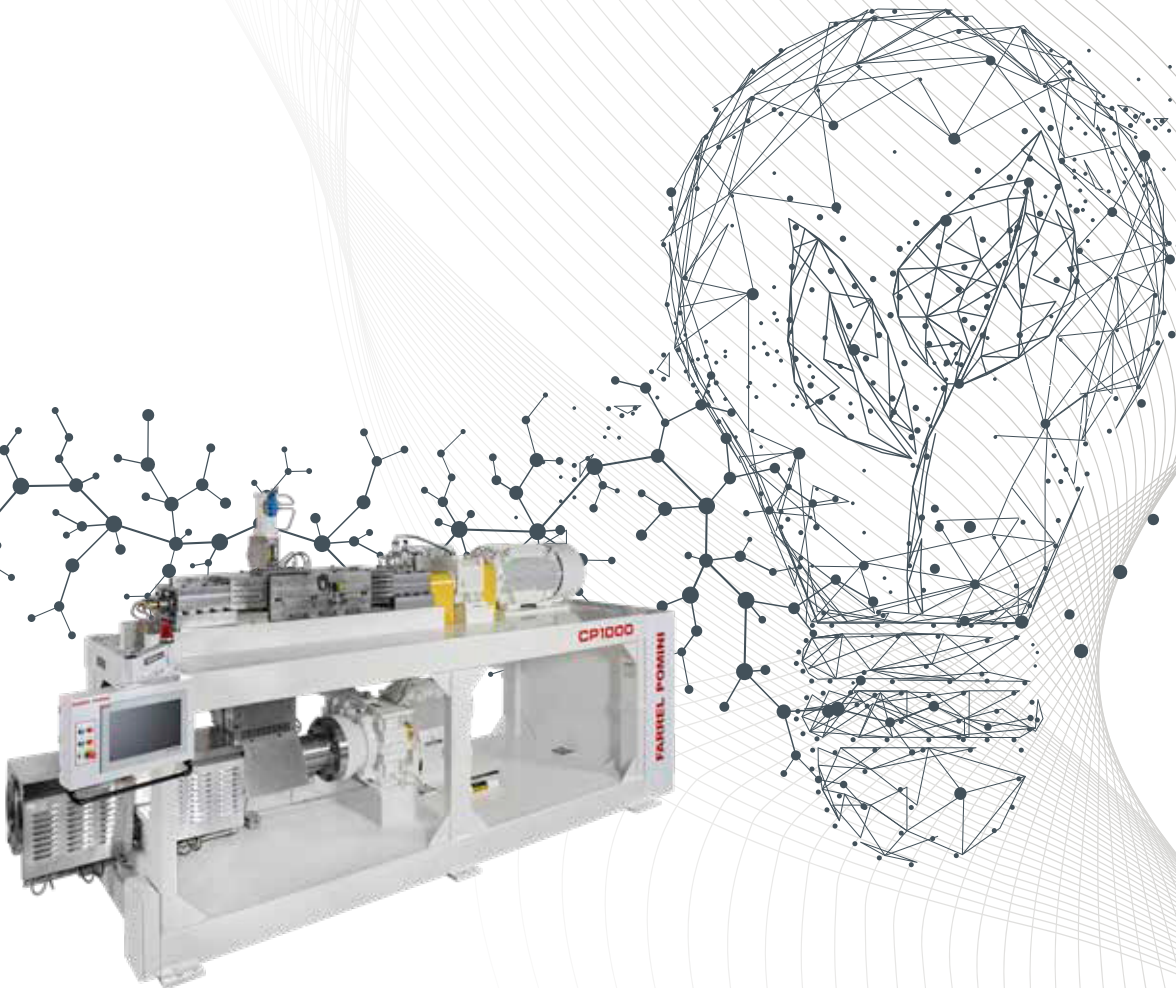
Avient's ColorForward 2026, which is the 20th edition of the annual forecasting tool, predicts an ongoing importance of special effects. "Lighter, harmonious shades and more complex neutrals partner with vibrant colours to embody cautious optimism and brightness in a complex world. Special effects continue to provide depth and dynamism to a palette that is generally less saturated than the previous edition," said Roberto Romanin, Designer at ColorWorks EMEA, Avient. Of the 20 featured colour aesthetics in the forecast, special effects are included in 13.

"The extensive use of special effects in the 2026 edition of ColorForward reflects the overarching theme of redefining ourselves through the exploration of new and unfamiliar ideas to address global challenges, including revisiting old concepts," said Romanin. He explained that effects featured in the forecast include pearls and iridescent effects, from thin and thick pearlescent to cool and warm interferential; metallics (gold, silver, aluminium); marble and even glitter.

"Digital Bone is an example of one of the five colour aesthetics in the ColorForward 2026 Bio-funk trend story, that invites us to dive into technologies like brain organoids and quantum computers, which could help meet the growing data processing needs of our digitalised world," he said. "Developed to symbolise the digital-organic connection at the heart of bio-computing, it

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combines a greenish off-white colour base with irregular red speckles together with a thin red pearlescent effect. Similarly, another colour aesthetic in the same trend story uses a deep, rich colour with a marble effect and laser etchings to create an unexpected look that resonates with the uncanniness of the Bio-funk narrative."

Romanin added: "A growing trend expected to influence the aesthetics of consumer products in the coming year is the layering of effects to create a more sophisticated look."

Avient's ColorWorks centres work with the company's colour matching labs, technology and product safety experts, and sustainability group to transfer the ColorForward aesthetics into concentrates adapted to customers' requirements.

New from Avient are the Colorant Chromatics Metallic Effect Pre-Colored Sulfone Formulations, which allow moulders to produce parts with a brilliant metallic effect in gold, silver, and bronze without any secondary processing. Avient collaborated with BASF to offer the metallic effect in BASF's Ultrason polyarylethersulfones (PAES). The high-performance polymers are targeted for aerospace, healthcare and reusable household

applications, particularly those that need to withstand multiple sterilisation cycles.

"There is an ongoing market demand for lightweight, high-performance, aesthetically pleasing, and cost-effective solutions with greater sustainability," said Deborah Sondag, Colorant Chromatics Global Marketing Manager at Avient. "Our newest metallic effect pre-coloured sulfone formulations, developed to emulate finishes that use metal without the weight, can help design engineers address these trends by achieving heat and chemical resistance, increasing design freedom, and eliminating the need for secondary processing."

Sky and earth

Ampacet's new Artemis Collection is a series of translucent colour and effects masterbatches for injection moulded parts that the company says evoke the beauty of celestial phenomena. The effects use advanced pigment technologies to create three-dimensional, crater-like surfaces. "Lunar Gold and Darkside [are] two softly shimmering pearlescents that echo the pockmarked surface of lunar landscapes or bask in the red-violet intensity of Amethyst Supernova. Midnight Star-



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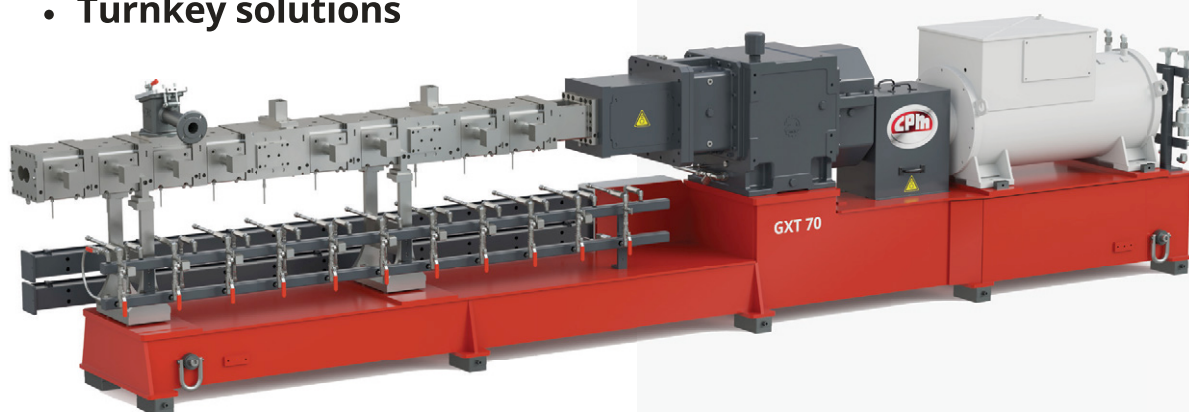
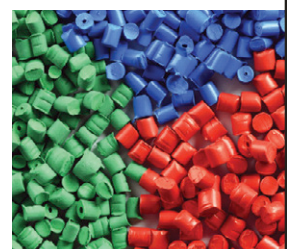


IMAGE: AMPACET



Above:
Ampacet's
Earthen Clay
Collection is
designed for
PE multilayer
blow moulding
and extrusion
applications

dust, Aurora Emerald and Cosmic Noir capture the ethereal depths of the night sky," the company says.

"The radiant hues and visual tactility of the Artemis Collection produce stunning otherworldly effects that transport us to the far reaches of the galaxy," said Mercedes Landazuri, Ampacet Market Insight Manager. "The collection is ideal for applications where visual appeal is paramount."

The effects are compatible with PS and PP polymers and are suitable for a wide range of applications, including consumer electronics, home goods, caps and closures and lighting.

Ampacet's latest is the Earthen Clay Collection, which emulates natural matte colours and textures of the earth. It is targeted for PE multilayer blow moulding and extrusion for personal care, hair care and beauty packaging, and home and garden products. The collection is available in six colours: Clay-Fired Red, Sunbaked Adobe, Golden Argilla, Limestone Loam, Volcanic Blue and Ancient Nettle.

German masterbatch producer **Lifocolor** has added to its range of natural-look effect concentrates with additional variations of its granite masterbatches as well as new sandstone and cork effects. The new looks are targeted for consumer goods in beauty and care, garden, household, furniture, sports, leisure, and office, for example.

"We know from our business partners that many customers would like to see polymers with a stone or wood look that is as authentic as possible," said Marco Meixner, Head of Research and Development at Lifocolor Farben, in a press release.

The new masterbatches are

suitable for polyolefins (PE, PP), engineering polymers (ABS, PMMA, TPE) and polystyrene (PS). Masterbatches in a PS carrier can be used in styrenic materials (ABS, SAN, ASA and blends).

Lifocolor has also added to its laser-marking Lifolas M portfolio with masterbatches suitable for bright markings in coloured polymers. These products allow labelling of caps in signal tones such as blue, green, red and yellow, for example.

Benefits for recycle

Special effects are finding use in post-consumer or post-industrial recycled resins, where the effect can either mask appearance problems or seek to incorporate swirls, flecks, and particles into the appearance design.

The latest from **Lyondell Basell** (LYB) is an NIR-detectable Polybatch Effects Frost masterbatch designed to improve the appearance of recycled PET by masking the 'dirty' appearance of some rPET and creating a matte effect. It is FDA-compliant for food and cosmetic packaging and can also be combined with colours or special effects.

LYB has collaborated with Dacia for the exterior design of the All-New Dacia Duster model. Exterior parts such as bumpers, trims, and body side mouldings across the model use Starkle, based on a CirculenRecover PP compound containing 20% rPP, derived from recycle diverted from the manufacturing process of goods such as flexible packaging. CirculenRecover polymers offer a mould-in-colour special effect with particles to highlight the use of recycled content.

"It serves as a powerful demonstration that recycled materials can be both aesthetically pleasing and high-performing," said Damien Laplane, Cross Car Line & Brand Experience Leader at Dacia, in the press release.

The latest from Germany's **Grafe Group** include masterbatches with metallic shimmering effects, sun-like effects, and a Terazzo effect, which emulates the look of traditional

Terazzo that contains chips of marble or other stone. Careful compounding process design is crucial to achieving these effects.

"When flakes and fibres are combined with colour and plastic, the challenge is not to change the macroscopic structure during processing in order to achieve the desired effect," explained Michael Dirauf, Head of



IMAGE: LYB

Right: Lyondell
Basell's
NIR-detectable
Polybatch
Effects Frost
masterbatch is
designed to
improve the
appearance of
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Analytics at Grafe. "These combinations are currently often requested by customers, as interesting effects can be achieved using flakes and fibres in addition to the desired colour. The added particles create a varying appearance. Minimal visual differences are desirable and emphasise the individual character. When selecting the effect pigments, our in-house expertise in analytics helps us to identify the suitable pigments based on microscopy images of the extruded material."

For 3D printing or injection moulding, for example, the particles or fibres must be small enough to not impair flow properties.

"Quality assurance is a particular focus here," added Dirauf. "Possible quality fluctuations in the plastics used and in the added flakes or fibres require continuous monitoring in order to meet the quality requirements."

Acquisition news

Global New Material International Holdings

(GNMI), one of the largest pearlescent pigment producers, signed an agreement with Merck in Germany in July 2024 to acquire its Surface Solutions business unit, which includes effect pigments and other products. The companies expect closing of the deal to occur in the second half of 2025, subject to regulatory approvals and other closing conditions. GNMI, also known under the brand name Chesir, has sites in China and Korea and is listed on the Hong Kong stock exchange.

GNMI reports that it plans for the Surface Solutions business unit to have three regional headquarters (Germany, US and Asia) while

maintaining its existing production facilities in Gernsheim, Germany; Onahama, Japan; and Savannah, Georgia, USA. Merck will remain the owner of the property at the Gernsheim site with a long-term lease contract with GNMI and a clear separation plan for the area used by Surface Solutions, according to the press release.

Heubach Group, which produces pigments and special effects, announced in October 2024 that it had entered a definitive agreement to be acquired by Sudarshan Chemical Industries (SCIL), a listed Indian company and a global pigment producer, subject to customary closing conditions, including regulatory approvals. Heubach had announced in April that it had filed for insolvency.

"I am delighted that the insolvency proceedings in Germany have succeeded in preserving the Heubach Group in its entire breadth and global positioning and leading it into a new future," said Andreas Kleinschmidt, trustee and insolvency administrator of the German Heubach companies, from White & Case. The combined entity will be led by Rajesh Rathi, Managing Director of SCIL.

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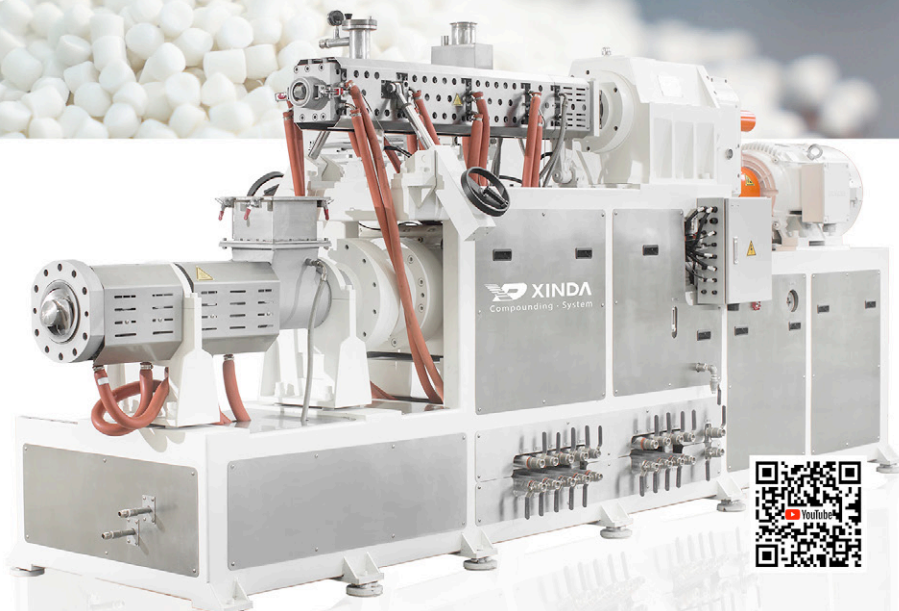
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IMAGE: METTLER TOLEDO



Analysing the composition and properties of polymers, additives, and compounds is crucial for product development and quality control. Jennifer Markarian finds that test methods are evolving for compostable compounds

Advances in materials analysis technology

Materials testing is essential for both developing and ensuring production quality of plastics compounds. Analytical equipment companies continue to develop user-friendly and automated features that bring the power of high-tech analysis to a broader user group, providing new tools for analysing polymers, additives and contaminants.

Thermal analysis techniques – including differential scanning calorimetry (DSC), simultaneous thermal analysis (STA), thermomechanical analysis (TMA) and dynamic mechanical analysis (DMA) – are widely used in polymer industries to identify polymers, quantify impurities, evaluate crystallinity, measure mechanical properties, and troubleshoot production issues, said Terri Chen, Director of Business Development at **Cannon Instrument**. “However, certain thermal measurement results can be difficult to understand,” said Chen. “In these cases, great strides are gained by adding a real-time image or video capability, leading to a better understanding of the analytical results. In recent

years, more researchers have moved toward combining a visual/imaging capability with their analytical tools.”

Last year, Cannon began partnering with **Hitachi High-Tech**, and the companies are collaborating to grow Hitachi’s thermal analysis business in the US, said Chen. The Hitachi DSC-RealView system offers real-time visual capabilities integrated with thermal analysis equipment (DSC, STA and DMA).

“Being able to visualise the changes of the sample during a thermal measurement can elucidate unexpected testing results by supplying supplemental information regarding the sample under test,” explained Chen.

“For example, in a DSC measurement, the Hitachi DSC-RealView system can capture images or record videos during the measurement, which allows identifying and interpreting any fake transitions. When testing crystalline polymers with the Hitachi DSC, the real-time observation allows researchers to better understand

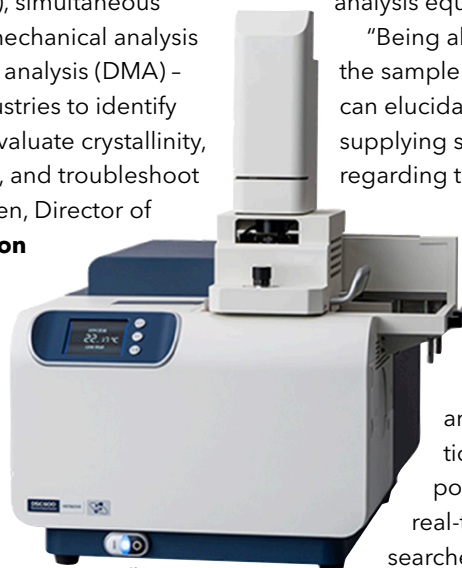
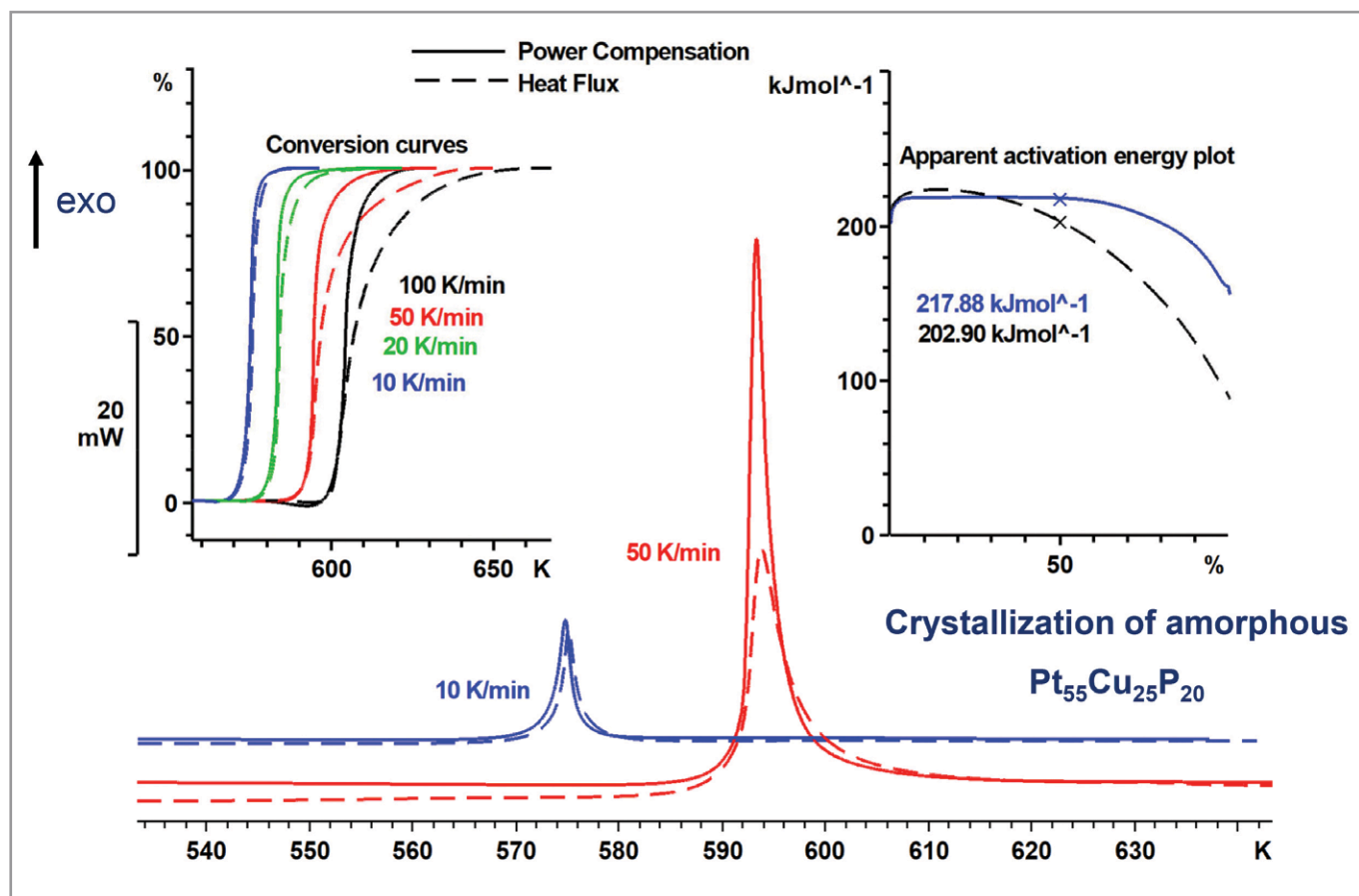


IMAGE: HITACHI

Main image:
Sample tray in Mettler Toledo’s new DSC 5+ test instrument with MultiStar sensor technology

Left: Hitachi NEXTA DSC with polarised microscope



The Power Compensation mode in Mettler Toledo's DSC 5+ can produce more accurate crystallisation kinetics. The solid lines show data collected in the DSC 5+ using Power Compensation, and the dashed lines show data from a standard Heat Flux DSC. The longer time constant of the Heat Flux DSC skews the crystallisation data at higher rates, which leads to an improper activation energy plot and incorrect crystallisation kinetics

Source: Mettler Toledo

polymer crystal formation and melting. This capability also allows quantifying the size of the crystals under different processing conditions. In a thermal oxidation and decomposition analysis, the Hitachi STA-RealView system is capable of performing color analysis, which allows users to precisely capture at what temperature the sample is oxidised, manifested as a change in colour – such as a transition to yellow.”

Another tool is the Hitachi NEXTA software, designed for both instrument control and data analysis on all four of the thermal analysis instruments (DSC, STA, TMA and DMA). It is integrated with a built-in wizard to guide instrument calibrations, sample handling, and experimental setup. It also provides a fully automated data analysis function. The software has many built-in ASTM, ISO and other industry standard methods. “This integration of a method library allows users to easily comply with standardised procedures and regulations,” said Chen.

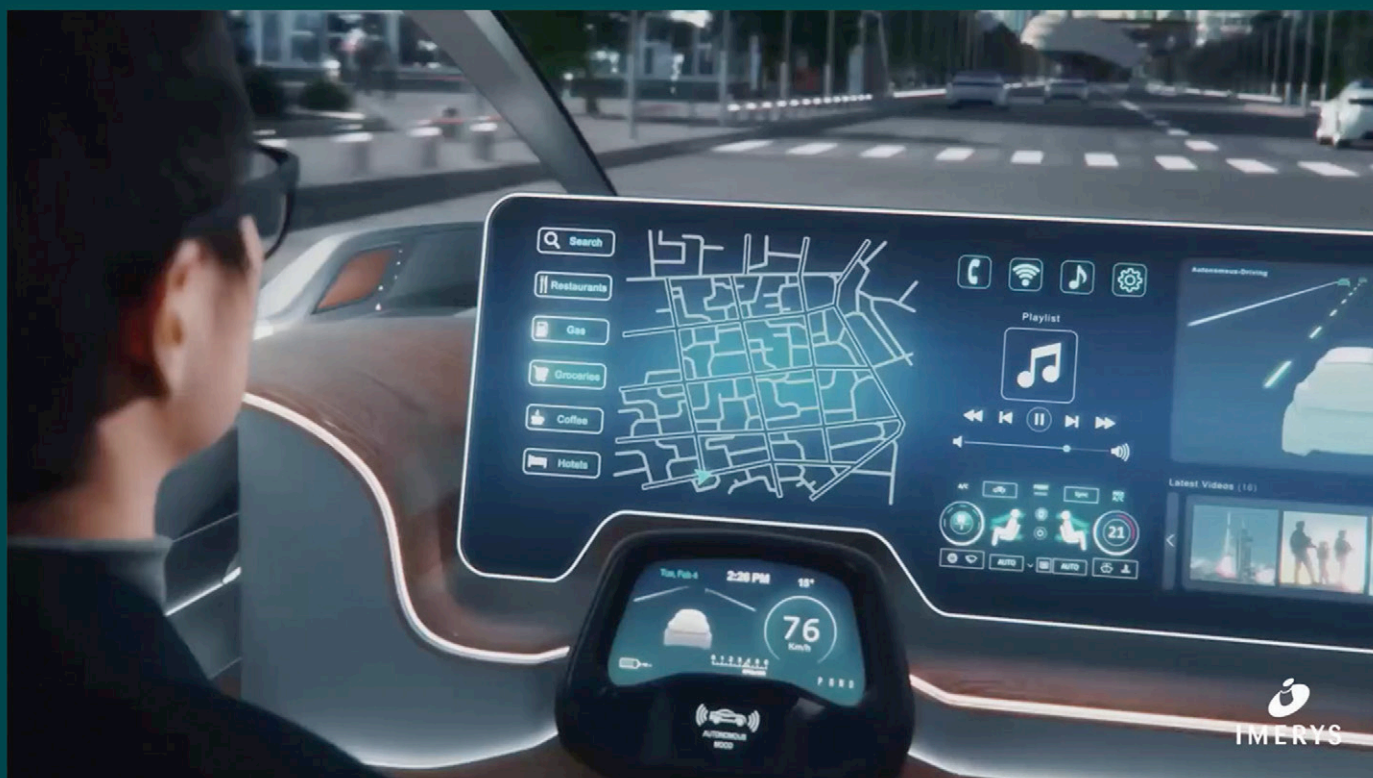
Automation is also useful for intrinsic viscosity (IV) measurement, which is widely used in quality control and testing of incoming materials. Cannon’s

automated viscometers provide unattended, safe operation using an integrated autosampler and computer-controlled operation. The instruments offer reliability, rapid throughput, and other benefits.

Tabletop SEM

The latest from Hitachi High-Tech are the TM4000III and TM4000PlusIII tabletop scanning electron microscopes (SEM), which are used in the plastics industry for a range of applications including analysis of contaminants in polymers, analysis of particles and foreign matter in pulverised materials, observation of the grain shape of fine particles, observation of layers in laminated films, and fracture surface analysis after strength tests. The compact size of the desktop microscopes enables their use in more environments, including quality control at manufacturing sites.

“In manufacturing environments, the trend of decreasing feature size and stricter quality control has led to an increase in the number of SEM users. However, not all new users have specialised knowledge and operating skills,” the company



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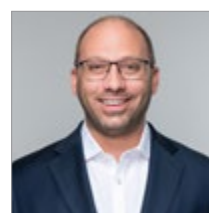
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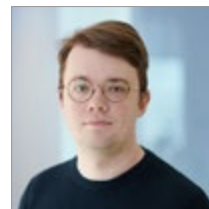
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notes. The new systems are designed for streamlined operations to allow efficient sample observation and use by those with limited expertise. A high-current mode shortens measurement time to reduce the overall time involved in analysing a large number of measurement points.

The automation features of the TM4000PlusIII allow the creation of recipes for conditions to control functions such as stage position adjustment and magnification, which previously needed to be manually configured every time for each sample. Routine tasks can thus be automated. Another feature is a monitoring system that checks the condition of the tungsten filament and graphically reports its condition. This function allows users to track the filament lifetime and plan ahead for regular filament replacement.

Thermal analysis

New from **Mettler Toledo** is the DSC 5+ with MultiStar sensor technology. The instrument has high sensitivity that allows measurement of weak effects and can be operated in either Heat Flux or Power Compensation mode. In the latter mode, the power introduced by the two integrated sensor heaters is precisely measured in both the sample and reference crucibles, allowing separation of close-lying thermal effects. The patented electrical heat flow adjustment automatically adjusts the DSC over the whole temperature range. Up to 96 sample crucibles and 7 reference crucibles can be stored in the crucible chamber for robotic handling and automated measurement.

A DSC can also be used to perform thermogravimetric analysis (TGA). TGA in combination with gas chromatography/mass spectrometry (GC/MS) can be used to detect low concentrations of volatile organic chemicals such as dimethylformamide.

The latest in thermal analysis from **Perkin Elmer** is the Pyris TGA 9, DSC 9, and STA 9 systems for material characterisation, product development and quality assurance. New features include an intuitive touchscreen with indicator lighting, a redesigned 50-position autosampler, and a wider temperature range that is beneficial at the low-end for materials with lower glass transition temperatures (eg silicone) and at the higher end for materials like ceramics, alloys and composites, the company says. A small footprint with a compact and modular furnace design allows easier serviceability.

Knowing what polymer types are in a compound is a particular challenge when using post-consumer recycled (PCR) materials. Near-

infrared spectroscopy and Fourier-Transform infrared spectroscopy have limits in complex and highly pigmented polymers, but thermal analysis with DSC and TGA can be a useful tool, said Alec Redmann, Sector Manager at **Netzsch Analyzing & Testing**, which showcased its new computational tools for the automatic identification of mixed plastic waste, along with software for process modeling and optimisation, at AMI's Polymer Testing World Expo North America in November 2024. The Netzsch fully automatic AutoEvaluation tool for its DSC uses automatic peak separation and a database of more than 1,500 polymers for automatic identification. DSC can identify and quantify polymer components.

Combination

"Combining DSC with TGA, you can also identify residues," said Redmann. For example, in a recent study with the German Institute for Polymer and Production Technologies (IPT) of PCR, TGA identified cellulose, which decomposed at a lower temperature than the polymers, and aluminium, which did not thermally degrade. The DSC analysis, combined with the TGA information, allowed the researchers to quantify the amounts of LDPE, LLDPE/HDPE and PP and distinguish between organic fibre residue and inorganic components.

Anton Paar TriTec is expanding the Revetest scratch tester series with the new RST 100, which the company says is a simplified, user-friendly instrument for surface analysis, including scratch testing and conventional hardness measurements. The software enables automatic detection of indentation imprints and scratch features.

The company says that the RST 100 was developed to meet the requirements of educational institutions, research departments and companies with limited budgets. The instrument is suitable for quality assurance in production as well as for material development in research.

Compostability testing

In the growing market of biodegradable or compostable thermoplastics, testing to substantiate claims is crucial. Since the general term "biodegradable" does not have a measurable definition and cannot be claimed in the US or Canada without also stating specific environmental



Above: Work is continuing in the further development of compostability standards

conditions, there is a move to describe these products as compostable and to support the description with third-party testing of the end product according to the standards that the product is designed to meet, such as ASTM or EN specification standards for industrial or home compostability. Compostability tests include disintegration (the breakdown to small particles) and mineralisation (full biodegradability to carbon dioxide, humus and water, as well as methane if anaerobic) tests along with plant toxicity, heavy metal and other tests.

At AMI's first Bioplastics in North America conference (in Cincinnati, September 2024), Kelvin Okamoto, PhD, Chair of the ASTM D20.96 Subcommittee on Environmentally Degradable Plastics and Biobased Products and President of consultancy **Green Bottom Line**, described the relevant ASTM specification standards and some of the upcoming revisions. For example, in the ASTM methods for industrial compostability (D6400 for single-layer plastic products and D6868 for multilayer products), there is currently a 1% limit for a single additive and a combined 5% limit on additives not tested for biodegradability,

but there is discussion about reducing the combined limit to 1 or 3%. ASTM is also working on developing a new test method and specification for home compostability, as an update or replacement to the current ASTM D5929 test method that some users see as unworkable.

In addition to the existing specifications for industrial composting, three ASTM field disintegration test method standards are being developed, with one based on the 18-year old mesh bag method from the Compost Manufacturing Alliance (CMA) and two from the Biodegradable Products Institute (BPI) for a bagged and a bagless method. Field test methods are important because they show how products may perform in a "real world" commercial composting environment. CMA and BPI have also added protocols for total fluorine testing to their lab test requirements. CMA and BPI are third-party certifiers of compostable products in the US that provide certification marks.

In Europe, compostable products can be certified to the European standard EN 13432 and can apply for the seedling mark from DIN Certco, which is an organisation run by the TÜV Rheinland Group and DIN, the German Institute for Standardi-

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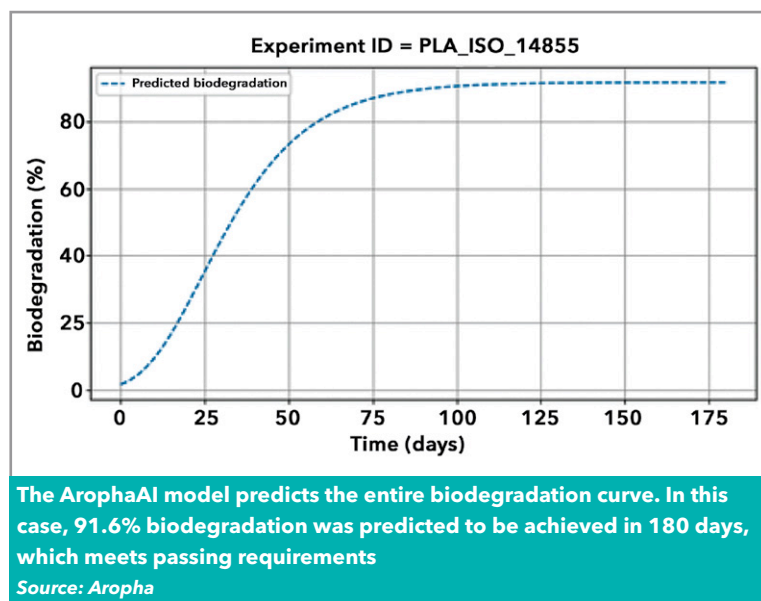


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Trends in testing

Testing service provider **Normec OWS** sees increasing interest in home compostability testing and more requests for soil, freshwater and marine biodegradability testing. "While companies understand that in the real world, environmental conditions are highly variable and cannot be perfectly approximated by any one set of laboratory conditions, they are still curious to understand how their bioplastics would perform if it were littered," said Mahya Wood, North American Technical Sales Officer at Normec OWS.

An evolution in the market is the desire to bring these end-of-life considerations to the beginning of product development rather than only testing after the product is designed, said Sam Deconinck, Business Development Director at Normec OWS. Because biodegradability tests are time-consuming and expensive, however, there is a need for new test methods. Normec OWS is meeting this need by introducing a High-Throughput Screening platform to accelerate R&D, with two pre-screening tests being launched in Q2 2025 and additional tests under development.

The first test uses proprietary enzyme technology to amplify early biodegradation stages and predict product behavior. This accelerated method gives results in a few hours and can be used in early R&D to identify candidates for further development. The second test is a miniaturised, high-throughput biodegradation test and allows for analysing dozens of samples simultaneously under diverse environmental conditions. Both methods

produce large data sets that can then be used to develop artificial intelligence (AI)-driven modeling. "High-throughput testing will enable companies to design for biodegradability," said Deconinck.

AI for biodegradability

AI and machine learning are increasingly being used in materials discovery, where "in silico" models are used in place of lab experiments for initial screening of different polymer types to save time and cost in early research and development.

Ohio-based start-up **Aropha** has developed ArophaAI, an advanced quantitative structure/activity relationship (QSAR) model that the company uses to predict material properties, including biodegradability and compostability, with an intent to expand into ecotoxicity. For example, a commercial PLA homopolymer was examined using ArophaAI with the parameters of ISO 14855, which is a standard test method for testing materials under industrial composting conditions. The polymer was predicted to achieve more than 90% biodegradation in 180 days. Some testing has shown that the predictive model generated results that were accurate compared to results generated later in the lab.

"As we continue to further integrate our predictive models into our lab, we also aim to produce true digital twins that update predicted results as lab measurements are received throughout testing. This can provide a path to even quicker experimental screening," said Travis Johnston, Co-founder and CEO of Aropha.

Although the model can be used for screening, physical testing of actual parts is required to confirm the results and to provide certification. Aropha has an ISO/IEC 17025:2017 accredited laboratory that performs tests according to national and international standards for biodegradation, compostability, and ecotoxicity (eg ASTM, ISO, OECD, and EN methods or specifications). "We are also coordinating with certification and ecolabel bodies in the compostability space to enhance how our customers can use our results," said Johnston.

US centre

In 2023, **BASF** opened a North American Biodegradability & Microplastics Center of Excellence in Wyandotte, MI that supports BASF's customers with scientific studies and consulting. The new lab is supporting biodegradable product development in a range of industries, including compostable products for food service and packaging, which can be used to help divert organic waste from landfills.

"The lab is an important tool, which enables us

to directly support our customers by accelerating their product development processes with measurable data they would not have had access to in-house," said Dr. Jeanette Hanna, Biopolymers Market Development Manager for North America.

The North American lab is part of a broader network of similar labs at BASF globally. "For BASF to develop fully biodegradable products for our customers, this requires a fundamental understanding of chemistry and of biological processes combined with digital tools. It is essential to test these products under various framework conditions, which, among others, means, in different environments around the globe," said Prof. Andreas Kunkel, Vice President, Biopolymers Research in Ludwigshafen, Germany.

BASF's global investment in analytical methods to study chemistry at the molecular level allows for development in detection and characterisation methods for microplastics. This work has led to multiple publications reflecting that intrinsically biodegradable components used to make compostable products do not cause persistent microplastics.

"From the technical perspective, we are advancing

cutting edge analytics and sound scientific breakthroughs in the field of microplastics and biodegradables while we support our customers' needs," said Dr. Jeanne Hankett, Manager of the Center of Excellence. "By advancing our understanding of current materials and the characterisation techniques needed to examine next generation materials, we help pave the way for increasingly sustainable products. This same logic can be applied towards advocacy – through extensive external collaborations, colleagues help us drive the development of increasingly circular products and processes."

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LFTs expand further in automotive applications



IMAGE: SHUTTERSTOCK

Long fibre compounds are winning roles in applications where high strength, stiffness and mechanical performance are needed with lower CO₂ emissions. By Simon Robinson

Increasingly tough specifications for rigid, strong, relatively simple to process materials with good green credentials are opening the door wider for long fibre reinforced thermoplastic (LFT) compounds. This combination of properties is particularly interesting to automotive companies, which perpetually try to reduce the weight of components while maintaining or improving performance.

Aside from that long-standing aim, demand for LFTs is being accelerated for several other reasons. As the automotive sector moves increasingly to electric and hybrid power systems, new opportunities for long-fibre reinforced thermoplastic composites are opening up in battery components. And because batteries are relatively heavy there is increasing interest in materials that can be used to make other automotive components lighter weight, which in turn, could spur demand for LFT compounds in the future. Simultaneously, as the

automotive sector demands more recyclability from polymeric components; materials that can replace metals to make parts that not only contain recycled content, but which are themselves recyclable, are increasingly attractive.

Focusing on reduced emission and reduced odour post-consumer recycled (PCR) materials, **TechnoCompound** launched a new range of LFTs aimed at the automotive sector at the most recent Fakuma meeting. These long glass fibre compounds are aimed at applications in automotive interiors. These are primarily based on a polypropylene matrix and are marketed as TechnoGreen grades which can be blended with the company's long glass fibre compounds with PCR to greatly reduce the carbon footprint of the finished parts.

For example, the company's TechnoGreen PP LGF60 grade, with 100% virgin PP as the base, can be blended in machine with TechnoFin rPP, which is

Main image:
The development of electric vehicles is offering market potential for long fibre reinforced thermoplastics

IMAGE: HYUNDAI



Above: SABIC LFT compounds are being used in battery systems in the Hyundai Ioniq 6 2023 model

100% PCR material. If the grades are blended in a 2:1 ratio, carbon savings of up to 55% can be made compared to using similarly long-glass fibre reinforced compounds with 100% virgin PP matrix materials, the company claims.

Blending your own LFT can help to simplify inventory, said TechnoCompound. This is because in-house blending via extruder enables different ratios of base materials to be produced as needed. And, the company said, it may be possible to simplify inventory to possibly only two base materials.

TechnoCompound said that several of its compounds have passed automotive industry testing and are being used in two mass-production Audi models, and the 2024 models of the Porsche Macan and Mini Cooper. The materials are used in IP carriers. To win the applications the materials had to meeting strict physical requirements, and since these are internal components they must also meet stringent odour and volatile emission standards.

ConClimate, a sister company, is working with TechnoCompound to calculate the carbon savings by considering the Class 1, 2 and 3 carbon emissions which includes product packaging at the TechnoCompound factory gate.

Dirk Breitbach, Managing Director at TechnoCompound, said: "It's 35 years that we've been using recycled materials to produce high quality compounds... these meet stringent requirements across a wide range of applications."

The automotive sector values LFT materials for their high specific strength. The key property of being strong and lightweight helps car makers to reduce the weight of components and so improve the fuel efficiency of their vehicles.

It is especially important that the non-battery components of electric vehicles are as light as possible because it is difficult to reduce the weight of batteries and maintain range or performance. One of the dangers of large battery systems is that

they can get very hot, and this can lead to thermal runaway and then fire unless the cells are properly protected.

At NPE 2024, **SABIC** announced a set of test results for its Stamax 30YH570 long-fibre reinforced PP material which could help in automotive fuel cells. SABIC used four different scenarios to highlight the benefits of the grade in this type of insulation role. In one, a cluster of 15 18650 lithium-ion cells were protected with injection moulded Stamax 30YH570, and one was left without. These two scenarios were repeated with two clusters of 11 21700 fuel cells. All of the cells were sealed in steel containers.

To test the effectiveness of the LFT material as an insulating material, each of the separate setups were heated using electrical tape to begin thermal runaway. The unprotected cells quickly started releasing high-temperature gas, open flames, high speed particles and the pressure inside the steel containers holding the batteries quickly increased. At the same time the runaway propagated to all the neighbouring cell as heat transferred easily between the cells.

Systems protected with Stamax 30HY570 components behaved differently. In these systems, the PP LFT material surrounding the heated cell melted, turned to gas and charred. The changes in state from solid to liquid to gas removed energy from the heated cell because of the latent heat needed to change the physical state of the polymer. At the same time, the remaining material formed an insulating char which helped slow the spread of heat and fire.

SABIC said that PP LFT compounds are being used commercially in battery systems in the 2023 Hyundai Ioniq 6. The model features module enclosures made from H1030 PP compound. This is a non-halogenated formulation that contains 30% glass fibre. The grade also meets China's GB/T 41467.3-2015 fire safety regulation for electric vehicles surviving 5 mins at 1,000° C.

In addition to showing these battery parts, SABIC used the NPE 2024 exhibition to show how its long-fibre reinforced PP materials could be used in a range of other automotive applications where low-weight, high-strength, enhanced electrical and thermal insulation could be useful properties on their own or combined with parts integration for additional benefits. Some of the parts on display included enclosures, end plates and busbars which were either in production or prototypes. As well as electrical and battery applications, other structural applications such as tailgates, lighting components and smart panels were on display. ➤

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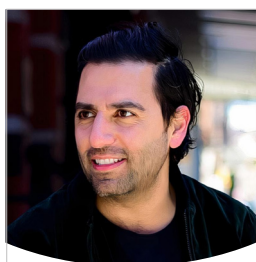
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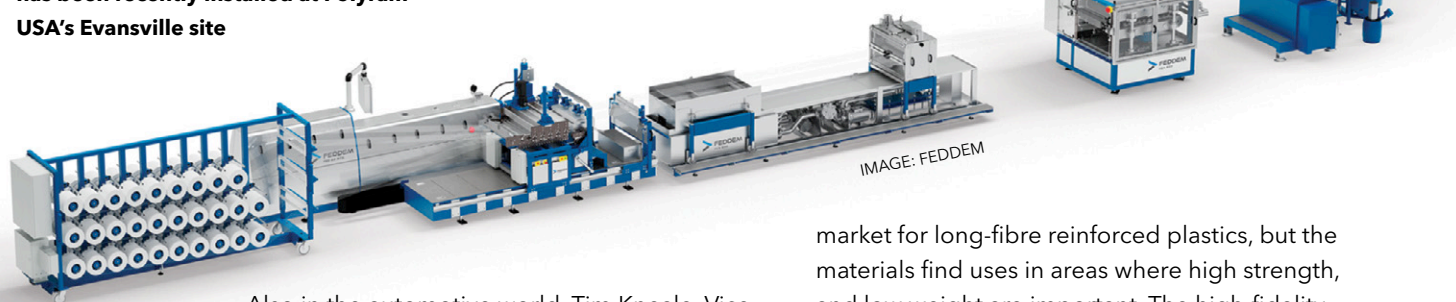


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Feddem said its LFT compounding technology has been recently installed at Polyram USA's Evansville site



Also in the automotive world, Tim Kneale, Vice President at **Polyplastics USA** (part of Japan's Daicel Corp), told *Compounding World*: "Our materials are used where low weight and high strength are required. One big application is automotive where our materials are used in parts behind and panels in automotive interiors, for example."

The company produces a wide range of LFT compounds based on engineering thermoplastic matrices, said Polyplastics' National Development Manager Tushar Birje. "Our Plastron range contains PP, PA6, PA66, PA9T, PA12 and PAMXD6 which can be reinforced with a range of fibres including glass, carbon and cellulose," he explained.

Kneale stressed that his company is developing products that help automotive manufacturers as they drive for greener production. "Lower emissions are increasingly important," he said. "We are examining the possibility of using a recycled PP with regenerated cellulose to further reduce the carbon footprint."

Fibres of cellulose are regenerated using a solvent method which produces little waste, said Birje. "Since it has nearly 10% lower density than glass fibre-reinforced PP resin, its greenhouse gas emissions are also even lower when compared in equal volumes," he added.

The company's most recent LFT product launch, Plastron RA627P, features cellulose reinforcement too. The automotive sector may be an important

market for long-fibre reinforced plastics, but the materials find uses in areas where high strength, and low weight are important. The high-fidelity music industry is one area where inertia often has to be minimised to improve performance. So long-fibre reinforced thermoplastics are frequently a good fit in applications such as speaker diaphragms.

Polyplastics said Plastron LFT RA627P grade uses regenerated cellulose fibre reinforcement and at 30% addition this reduces the environmental footprint of the grade by 30% compared with a 30% glass-filled material.

The new grade uses uninterrupted cellulose fibres in a PP matrix. The fibres are all of the same length and oriented in the same direction. The spun recovered cellulose has high strength and elasticity. The grade has approximately the same flexural modulus as 30% short glass fibre-reinforced PP compounds but is 10% lower in density and so its specific rigidity is higher than the equivalent 30% glass-filled PP, said the company. In addition, Polyplastics said RA627P has a low loss coefficient, which combines with its high specific rigidity to make it useful as the material for diaphragms in audio systems.

In extrusion technology, **Feddem's** LFT compounding line concept has been updated recently and the company has supplied a second-generation line to Polyram USA's Evansville, Indiana site. Polyram said that the new Feddem FLF600 plant with 58 strands delivers the same production rate as its two conventional LFT lines running 120 strands at the 100,000 sq ft Evansville site.

Sebastian Jost, Feddem's Senior Technical Expert, said: "The high performance of the line is based on the optimised strand run through the impregnation tool and the refined control of the production parameters." There are also considerable space savings compared to traditionally designed lines, he added.

Below: Speaker diaphragms are a non-automotive application area for LFTs



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- > www.technocompound.com
- > www.sabic.com
- > www.polyplastics-global.com
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Compounding World January/February 2025

Compounding World's January-February edition has a cover feature on additives for film applications. Other articles look at electrically conductive thermoplastic compounds and the latest pelletising technology

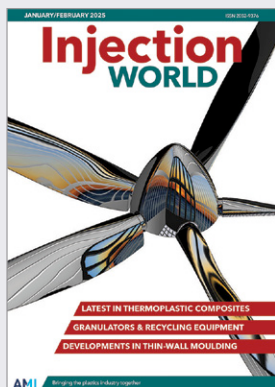
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Compounding World December 2024

The December 2024 issue of Compounding World looks at strong currents in global markets affecting companies in the flame retardants sector and trends such as recycled content leading the strategies of masterbatch producers.

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Injection World January/February 2025

The January/February 2025 issue of Injection World provides injection moulding companies with the latest on recycling and granulator technology, recent advances in thin wall moulding and an update on reinforced thermoplastics.

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Plastics Recycling World January/February 2025

Plastics Recycling World's January-February edition looks at technology partnerships in recycling flexible packaging waste, plus trends and products in pelletising and the ongoing sustainability drive of the PVC sector.

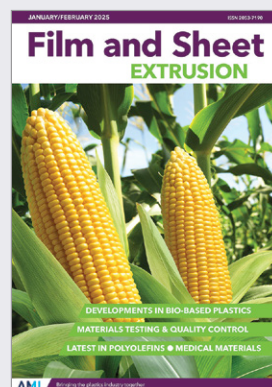
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Pipe and Profile Winter 2024

Pipe and Profile Extrusion's Winter 2024 edition has a cover feature showing how R&D is helping wood-plastic composites continue to improve, while other features are on large-diameter pipe, materials handling products and PVC additives.

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Film and Sheet January/February 2025

The January/February edition of Film and Sheet Extrusion looks at how bioplastics producers are broadening the appeal of their offerings for film and sheet companies, plus new materials for medical applications, polyolefin-based developments and a testing/quality control update.

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GLOBAL EXHIBITION GUIDE

2025	11-14 March	Plastimagen, Mexico City	www.plastimagen.com.mx
	18-20 March	Plastics & Rubber Vietnam, Ho Chi Minh City, Vietnam	https://plasticsvietnam.com
	24-28 March	Plástico Brasil, São Paulo, Brazil	www.plasticobrasil.com.br
	15-18 April	Chinaplas, Shenzhen, China	www.chinaplasonline.com
	6-9 May	Moulding Expo, Stuttgart, Germany	https://www.messe-stuttgart.de/moulding-expo
	7-8 May	PlastTeknik Nordic, Malmö, Sweden	www.plasttechniknordic.com
	8-10 May	RePlast Eurasia, Istanbul, Turkey	www.replasteurasia.com
	14-15 May	Compounding World Expo India, Mumbai	www.compoundingexpoindia.com
	14-17 May	Plastics & Rubber Thailand, Bangkok, Thailand	www.plasticsrubberthailand.com
	20-23 May	Plastpol, Kielce, Poland	www.targikielce.pl/en/plastpol
	27-30 May	GreenPlast, Milan, Italy	www.greenplast.org
	3-5 June	UTech Las Americas, Mexico City	www.utechlasamericas.com
	4-5 June	Textiles Recycling Expo, Brussels, Belgium	www.textilesrecyclingexpo.com
	8-15 October	K2025, Dusseldorf, Germany	www.k-online.com
	4-7 December	PlastEurasia, Istanbul, Turkey	https://plasteurasia.com

AMI CONFERENCES

18-19 March 2025	Compounding and Recycling, Bangkok, Thailand
8-9 April 2025	Fire Retardants in Plastics, Pittsburgh, PA, US
8-10 April 2025	Stretch and Shrink Film, Malaga, Spain
19-21 May 2025	Polymer Sourcing and Distribution, Malaga, Spain
2-3 June 2025	PFAS Workshop, Brussels, Belgium
10-11 June 2025	Plastics Recycling Technology, Long Beach, CA, US
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