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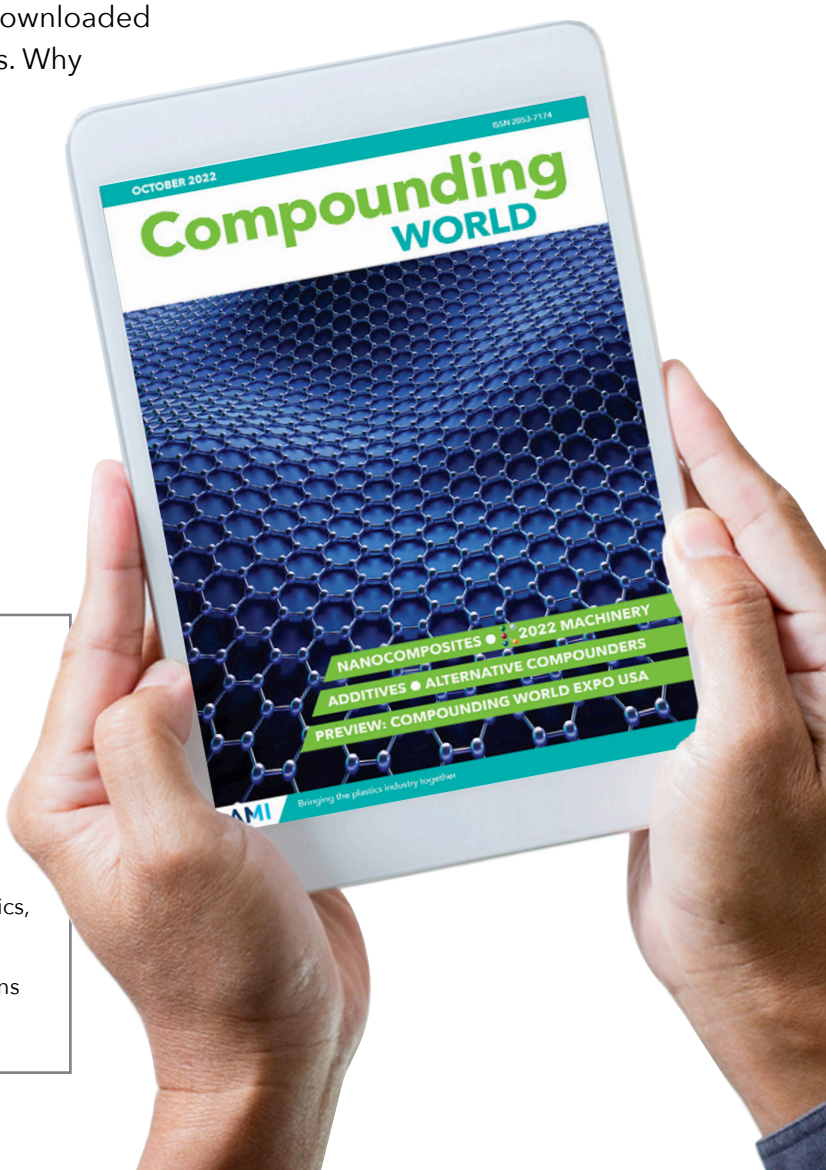

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Silon to spin off R&D to win external contracts

Czech compounder Silon is to spin off its R&D division into a separate company from the beginning of 2024 as part of plans to develop a commercial materials development and testing business.

Currently, the division carries out R&D for Silon's own polyolefin-based technical compounds, including materials testing and regulatory compliance, processibility assessment; and quality testing and analysis. The new entity, Silon R&D, will extend this to offer research and development services to external customers.

The aim of the separation is to make the most of the resources and technologies available to the company. "The establishment of a separate company will enable us to further deepen our development and research activities with the potential for obtaining public research grants," said Martin Sedláček, Head of the R&D Centre.

Silon's HQ in Czech Republic

IMAGE: SILON

Silon operates two production plant, one at Planá nad Lužnicí in the Czech Republic and one at Peach Tree in Georgia in the US. Annual production capacity is around 100,000 tonnes and sales amount to around CZK4bn (€165m).

› **www.silon.eu**

Clariant opens Exolit FR plant

Clariant has opened its production facility for its Exolit OP range of halogen-free flame retardants at Daya Bay, Huizhou, China.

The $67m investment includes two production lines, the first is in production and the second under construction and expected to be onstream next year.

According to Angela Cackovich, President of BU Adsorbents & Additives and Clariant EMEA Region, the new plant will strengthen Clariant's position in sustainable fire safety solutions while its location will improve its ability to service customers in China and across the Asia Pacific region.

› **www.clariant.com**

IN BRIEF...

Trinseo has ended operations at its ethylbenzene styrene monomer (EBSM) facility at Terneuzen in the Netherlands. The move means the company will now purchase all its styrene monomer requirements from third party suppliers to support its downstream businesses.
www.trinseo.com

Westlake Global Compounds has appointed polymer distribution group **Resinex** to handle sales of its speciality PVC compounds in Europe and Turkey. The two companies aim to start shipping products before the end of this year.
www.westlakeglobalcompounds.com
www.resinex.com

Albis is to distribute **Evonik**'s Vestakeep PEEK products in Europe. The distribution company says the arrangement adds a further premium line of high-performance thermoplastics to its portfolio and strengthens its international position.
www.albis.com
https://corporate.evonik.com/en

Direct compounding recognition for KM

Krauss Maffei, together with Wirthwein SE, won first place in the Process and Methods category of this year's AVK (German Federation of Reinforced Plastics) Innovation Awards for its Chopped Fiber Processing (CFP) technology, which allows direct addition of chopped fibre glass reinforcements on a near-standard injection moulding machine.

Compared to conventional continuous-fibre-reinforced technologies, KM claims CFP provides an up to 46% reduction in material cost and around a 0.8 kWh/kg energy saving, depending on the specific part and material formulation.

The technology, which uses a special screw design and fibre feeder, is retrofittable and is said to be most suitable for use with large shot weights, particularly large-volume glass reinforced PP components. Typical applications include automotive door modules, front ends, and dashboard panels, as well as logistics.

› **www.kraussmaffei.com**

Imerys grows in China

Imerys has inaugurated its new talc processing plant at Wuhu in China. The €43m investment will allow it to produce high-value specialty talcs for the automotive polymers market.

The company said that the facility will have an annual production capacity of 35,000 tonnes by 2025 and represents its most ambitious project in the region in recent years. It will be capable of producing its range of engineered high aspect ratio, ultrafine, and micro lamellar talcs, including HAR, Jetfine, and Steamic brands, which are currently supplied to China from Europe.

"With booming EV production in China, Imerys's capacity to provide a local source of critical minerals is crucial to local automotive part manufacturers," said Guillaume Delacroix EMEA and APAC VP at Imerys Performance Minerals.

› **www.imerys.com**

Celanese LFT frunk wins SPE innovation award

The Engineered Materials team at Celanese – together with Cascade Engineering and Commercial Tool Corp – won the Grand Award and Body Interior category at the 52nd Annual Society of Plastics Engineers (SPE) Automotive Innovation Awards in the US for the LFT PP 'frunk' used in the 2023 Ford F-150 Lightning.

The speciality materials producer supplied a Celstran 40% long glass fibre reinforced polypropylene (LFT-PP) injection moulding grade for the MegaBin frunk (pictured) project, replacing a compression moulded and painted SMC design.

The part, which incorporates an optimised rib structure to match the physical properties of the thicker SMC version, meets all durability and crash safety requirements and also eliminates the need for painting. It is produced on a 4,000ton (36,000KN) injection moulding machine using a 16-drop hot runner mould and provides a weight reduction of 16 pounds (7.3kg) per vehicle together with a 37% cycle time saving.

The switch is expected to deliver annual savings of around $15m. "In the fast-paced realm of the automotive industry, our dedicated team is not merely keeping pace but setting the tempo," said Carl Sullivan, Celanese automotive market development director.

› **www.celanese.com**

Toray ups strength of carbon fibre

Toray Industries claims that its newly introduced Torayca T1200 high performance carbon fibre sets a new global standard in terms of tensile strength.

According to the company, it has developed a proprietary nanoscale structural control technology that allows the creation of internal structure with enhanced toughness. The result is a tensile strength of 8.0 GPa, more than 10% higher than its previous high strength Torayca T1100 grade.

The company developed the T1200 fibre at a new facility within its Ehime Plant in Japan. It expects it to find application in a diverse range of markets, including sports and leisure as well as aviation and space.

› **www.toray.com**

Orion Carbons opens second plant in China

IMAGE: ORION ENGINEEREED CARBONS

Orion Engineered Carbons has opened a second carbon black production plant in China. The greenfield project at Hubei in eastern China has a capacity of 70,000 tonnes/yr and will produce carbon blacks for the coatings, plastics, rubber and fibre markets.

"The Huaibei facility is a huge milestone for Orion. The state-of-the-art plant enables us to better support our Chinese customers with products that are made in China," said Orion CEO Corning Painter. "Now we can reallocate production lines in the US and Europe so that we can increase supply to customers in those markets."

The company already has a plant at Qingdao in Shandong province.

› **https://orioncarbons.com/**

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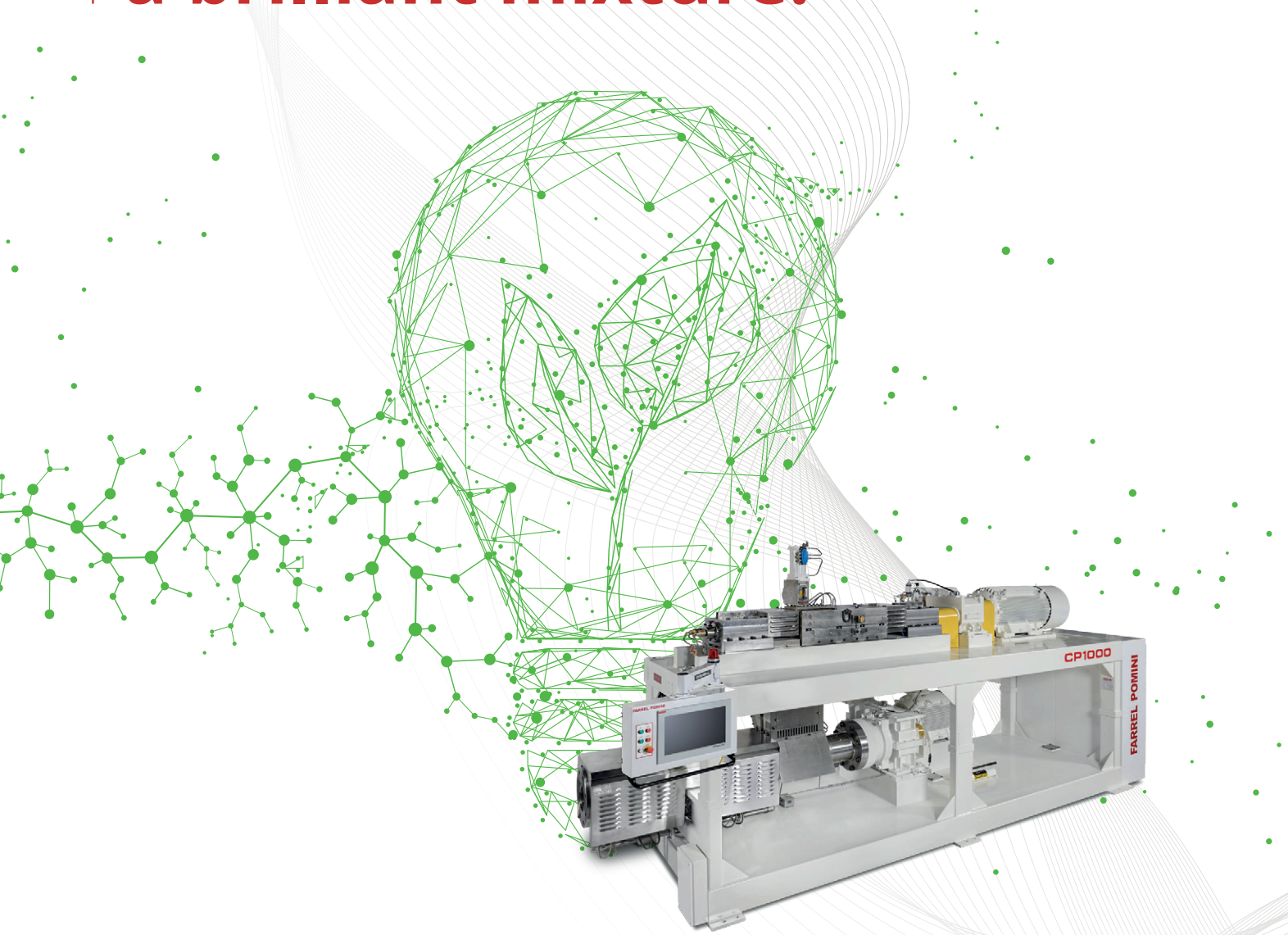

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ECHA completes PVC safety investigation

The European Chemicals Agency's (ECHA) has completed its **investigation** into the potential risk to human health and the environment from PVC and certain PVC additives and has passed it to the European Commission, which will decide whether to request REACH restriction.

The investigation, which focused on 63 PVC additives including plasticisers, heat stabilisers and flame retardants, suggested that regulatory action may be required with regard to certain plasticisers (primarily ortho-phthalates), heat stabilising organotins such as DOTE, flame retardants, and PVC microparticle emissions during use and also from recycling facilities and landfills.

European PVC trade association VinylPlus said it had submitted evidence to the investigation, which also considered alternatives and assessed societal impact of potential risk management measures, and would respond to data gaps and concerns highlighted by ECHA.

"VinylPlus constructively worked with ECHA in its task of performing a whole lifecycle assessment of PVC, its additives, and potential alternatives, highlighting their performance, costs, and lifecycle benefits alongside the impact on human health and our environment," said Brigitte Dero, Managing Director of the association.

"VinylPlus will carefully examine the report and its annexes…we question the risks identified by ECHA for some ortho-phthalates and other plasticisers, organotin stabilisers and microparticles, and we are committed to working with regulators to provide information as needed."

› **www.echa.europa.eu**
› **www.vinylplus.eu**

LG targets thermal runaway

Korean companies LG Chem and LX Hausys claim to have jointly developed a polymer composite that can withstand a flame at 1,500℃ for over 20 minutes in electric vehicle battery thermal runaway applications.

The Special Flame Retardant Continuous Fiber Thermoplastic is said to withstand intense flame and high pressure for more than 14 times longer than existing thermoplastic solutions. The material provides the rigidity required for battery covers.

› **www.lgchem.com**
› **www.lxhausys.com**

Envalior completes Chinese expansions

Envalior has completed compounding expansions at its production sites in Jiangyin and Changzhou in China, with new lines at the extended plants producing a range of engineering compounds including Akulon PA6/PA66, Arnite PET/PBT, Arnitel TPC, Durethan PA6/PA66, EcoPaXX PA410, ForTii PA4T/PPA, Pocan PBT, and Stanyl PA46.

"China is the largest automobile market in the world with demand continuing to increase, making the expansion of our production capabilities in this region a natural next step," said Christophe Cazabeau, EVP Performance Materials at Envalior, which brings together the former engineering plastics activities of DSM and Lanxess.

› **https://envalior.com**

Tosaf opens production plant in Sweden

Colour and additive masterbatch manufacturer Tosaf has opened a production and service centre at Löddeköpinge in Sweden to support the Scandinavian market. The new plant will supply small to medium-scale quantities of masterbatch and includes a fully equipped laboratory.

"The immediate proximity to our customers in the region achieved with the opening of the Löddeköpinge site now enables us to quickly provide our customers with our products and to drive forward the development and production of tailor-made solutions for local customers," said Dennis Kjellberg, General Manager & Sales Manager at Tosaf Color Service Sweden.

› **www.tosaf.com**

IMAGE: TOSAF

Right: Tosaf's new plant in Sweden will bolster its Scandinavian presence

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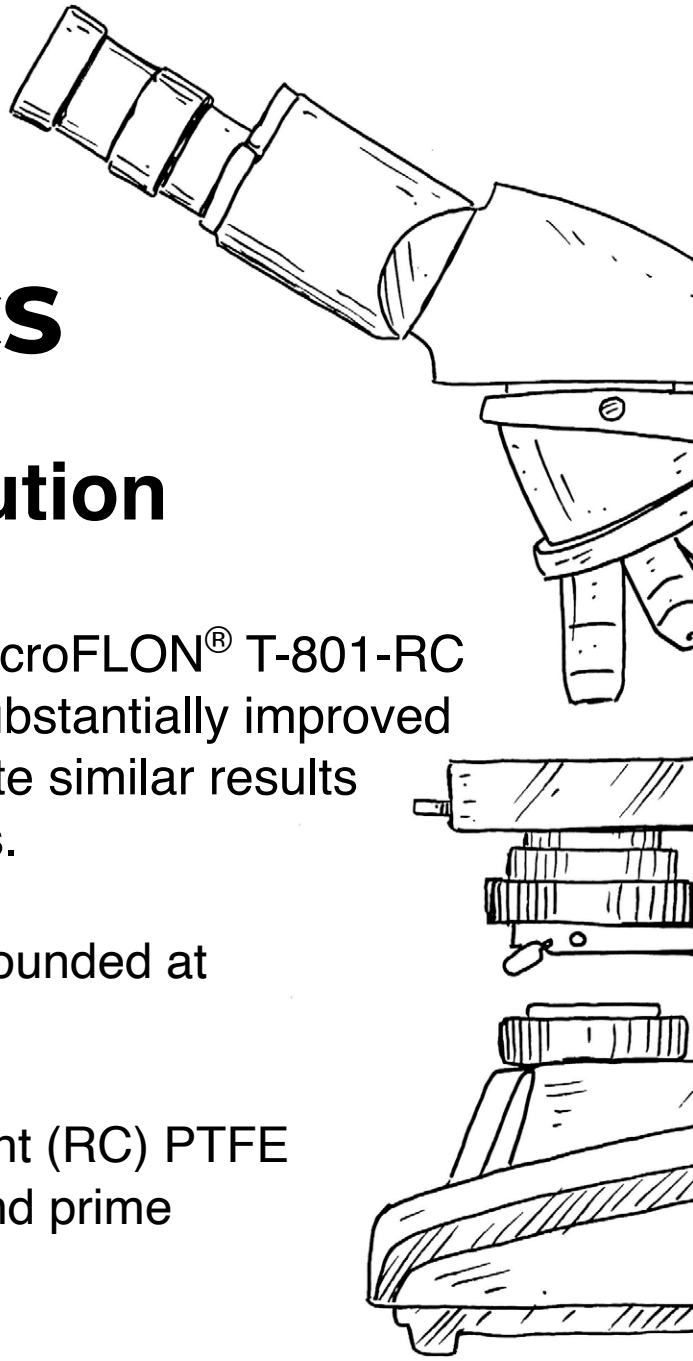

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US Plastics World Expo sets new exhibitor/visitor records

The Plastics World Expos, which took place in Cleveland in the US last month, attracted record numbers of exhibitors and visitors. The event, organised by *Compounding World* publisher AMI, brought together the Compounding World, Plastics Recycling World, Plastics Extrusion World and Polymer Testing World Expos.

"We were thrilled to welcome 347 exhibitors and 5,134 attendees to this year's exhibitions, representing year-on-year increases of 15% and 12% respectively," said Kelly DeFino, Exhibition Sales Manager at AMI. "The expos are now well established as the biggest annual event for the North American plastics industry, and more than 250 companies have already booked their booths for next year's show in Cleveland".

The five conference theatres hosted more than 100 speakers, with standing-room only for many talks and panel discussions. The evening networking party also proved popular, with more than 500 people joining in at the Punch Bowl Social Cleveland.

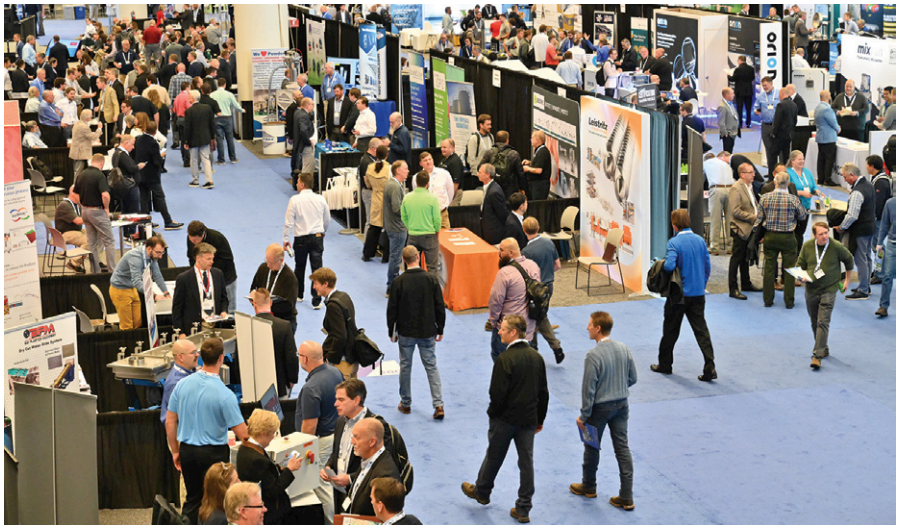
Visitors appreciated the opportunity to meet a wide range of suppliers under one roof. "The Expo is an excellent opportunity for catching up with current suppliers and learning about other products and services in the industry," said Josh Hensley, Technical Services Engineer at Westlake Royal Building Products.

"This is a spectacular event to meet new clients, while the information provided by the many speakers is one of the best ways to stay current in today's environment," said exhibitor Timothy Michalowski, President of Berlyn ECM.

AMI said the Plastics World Expos will return to the Huntington Convention Center in Cleveland on November 13-14, 2024. To find out more about exhibiting, visit

› **www.ami.ltd/Plastics-World-Expo-NA**

IMAGE: APPLIED MARKET INFORMATION



Visitor numbers were up by 12% at AMI's fourth North American Plastics World Expo

Röhm ups PMMA capacity

Germany's Röhm has commissioned a new polymerisation plant for its Plexiglas-branded PMMA moulding compounds in Shanghai, China.

The company has been supplying Plexiglas moulding compounds since the 1990s, serving local customers from Shanghai since 2008.

› **www.roehm.com**

Solvay targets EV batteries

Solvay has launched XencorTM XTreme, a new family of long glass fibre reinforced PPA compounds intended for EV battery applications.

According to the company, XencorTM XTreme PPA LGF grades are designed to offer resistance to direct flame exposure at 1000°C for more than 10 minutes, providing time for passengers to exit a vehicle in the event of a thermal runaway and meeting the latest global regulations in Europe, China, the US, and other countries.

"XencorTM XTreme is designed for battery components such as overmoulded busbars, module end plates and fixtures and extends our broad portfolio of battery solutions," said Brian Baleno, Head of Marketing Automotive at the company.

In a separate move, Solvay has confirmed plans to build a new battery-grade polyvinylidene fluoride (PVDF) facility at Augusta, Georgia, US, in partnership with Orbia. The project, which is based on a raw material supply JV with Orbia, will provide materials for more than 5m EV batteries per year at full capacity.

The two companies said they intend to use two production sites in the southeastern US, one producing raw materials and the other finished PVDF products. Both are expected to be operational in 2026.

› **www.solvay.com**

› **www.orbia.com**

IMAGE: COPERION

Above: Coperion says two plant using its ABS blend technology already in operation

Coperion claims a lead in ABS

Coperion said last month it has developed a process solution for energy-efficient manufacturing of acrylonitrile-butadiene-styrene copolymer (ABS) blends, with its ZSK Mc^{18} twin screw extruder playing a key role.

Chinese process engineering company Zhejiang Zonepic Petrochemical Technology is a licensor for the emulsion grafting-bulk polymerisation ABS blend method, which allows the production of ABS blends in various grades. It has designed several large installations using multiple 133mm diameter ZSK Mc^{18} twin screw extruders, with two already in production.

The ABS emulsion emerges wet from a reactor following its manufacture and in Coperion's solution passes through a screw press before its introduction downstream via a ZS-B side feeder into the process section of a ZSK extruder, so eliminating energy-intensive thermal pre-drying.

Coperion said this solution delivers reduced energy consumption and minimal residual monomer.

› **www.coperion.com**

Kraiburg extends PCR options with new TPE

TPE manufacturer Kraiburg is expanding its Thermolast R product line, extending the opportunity to use post-consumer recycled-content TPEs to include grades with low Shore A hardness.

The new TPE grades are said to be tailored to meet the requirements of multiple applications, including single and multi-component parts (they provide adhesion to PA, PC/ABS or PP). They contain up to 79% recycled content.

› **www.kraiburg-tpe.com**

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IMAGE: BIOENVISION

Producers of performance flame retardants are developing grades that meet increasingly stringent global regulations covering safety and sustainability. Mikell Knights reports

Regulation shapes flame retardant developments

The global plastics industry is seeing a growing emphasis on flame retardants that offer reduced toxicity risk but provide equal or improved performance, durability and processibility. This includes traditional as well as bio-based and non-halogenated types derived from an expanding range of source materials that includes minerals, clays, phosphorous-based inorganics and more. At the same time, developments in traditional brominated flame retardants are focusing on delivering performance while meet increasingly stringent regulatory demands. This article reviews progress.

The Exolit OP Terra line from **Clariant** is said to particularly useful for use with bio-based polyamides such as PA 5,6, PA 10T, PA 6,10 to reduce carbon footprint. The organic phosphorus Terra grades are based on renewable carbon feedstocks such as plant residues, so are not food competing. The company says the use of mass balance certified renewable ethylene means there is no loss of performance and there is no need for additional testing or approvals.

Progress is also claimed in the development of new Exolit flame retardant grades based on its Exolit OP 1240 for polyester injection moulding applications. The new blends are showing improved Comparative Tracking Index (CTI) and hydrolysis stability required for applications including high voltage connectors in orange colour. Clariant says it has also gained its first approvals for its latest Exolit OP grades for polyamides addressing high Glow Wire Ignition Temperature (GWIT) requirements for unattended household appliances.

The company's Exolit OP1400 phosphinate-based grade is being used in polyamides for e-mobility, appliance, and consumer electronics applications as well as in energy storage. High thermal stability permits high output in compounding and injection moulding processes and performs well when it comes to recycling, the company says, citing a study by Fraunhofer LBF that shows that PA6 and PA66 GF containing Exolit OP 1400 maintains a UL 94 V-0 rating when recycled

Main image: Stricter regulation and tightening environmental regulations are driving development of new flame retardant solutions

IMAGE: CLARIANT

Above: Clariant has added capacity for Exolit OP flame retardant production at its plant at Daya Bay in China

back into production streams multiple times.

Clariant recently increased production capacity for its Exolit OP organophosphorus flame retardants with the opening of a new production facility at Daya Bay, Huizhou, China. The plant will supplement its two Exolit OP production lines in Germany. The first Daya Bay production line will be joined by a second in 2024.

Clariant is also working on several joint projects with customers, such as PA producer Domo Chemicals, to help OEMs define the technical requirements for flame retardant grades in emerging applications such as e-mobility thermal management, where the industry has not yet defined a single standard.

One of these joint projects looks to make flame-retardant polyamides more glycol resistant to meet the emerging need to adapt cooling technology for electric vehicle batteries. This partnership brings together Domo's glycol-resistant Technyl grades with Clariant's Exolit OP flame retardants. Test have shown the new PA66-based solution displays lower coolant uptake, offers improved dimensional and colour stability, reduced phosphorus leakage and potentially improved mechanical performance over ageing, according to Clariant.

Inorganic focus

Targeting applications in challenging electrical parts in renewable energy markets such as solar panels, electrical vehicles and green appliances, **Italmatch** continues its focus on inorganic phosphorous-based materials. These include its Phoslite inorganic phosphinate-based materials and Masteret red phosphorous-based grades, according to Ugo Zucchelli, Global Sales and Technical Assistance Manager, Plastics Additives.

Italmatch says Phoslite B407A, for example, is one of only a few suitable halogen-free additives suitable for polypropylene V2 applications, according to Zucchelli. Its key features include zero smoke, no decomposition or corrosion during processing, no migration or yellowing on final items, and high UV stability. The grade works with most fillers at loadings to 10% and does not change the performance of the compound after multiple passes through the extruder, which is said to enable recycling possibilities.

The company has recently more than doubled its capacity for production of its Phoslite line of products in China. It has also installed a state-of-the-art plant for production of liquid Masteret grades at Spoleto in Italy.

Italmatch says it is directing considerable R&D effort on increasing the inorganic phosphinate's thermal stability for engineering applications in extreme conditions and to further decrease red phosphorus emissions via special reactive coatings and catalysts. It is also one of 17 partners involved in the FlashPhos project, which is co-funded by the European Commission to drive the sustainable production of high-quality white phosphorus (P4) from sewage sludge. During the four-year innovation programme, the FlashPhos process will be demonstrated in a pilot plant with a throughput of up to 250 kg/hr dry sewage sludge. The aim is to build a first full-scale FlashPhos pilot plant in Europe by 2025.

Brominated fire retardants producer **Albemarle** continues to tout the benefits of its fire safety products using what it describes as an evidence-based approach, which includes new developments in this area, to prove that the health and safety and environmental impacts of the materials can be lower than other flame-retardant chemistries. The company says it is concerned by current and proposed (BFR) regulations and is committed to addressing concerns raised by regulatory agencies in different jurisdictions.

In particular, the company argues that BFRs should not be treated as a single class and therefore should not be regulated as such as that approach could lead to "regrettable substitution." It also says that regulatory agency concerns are often based on comparisons to brominated flame retardant (BFR) chemistries that have been phased out, such as decabromodiphenyl ether (DecaBDE) and hexabromocyclodecane (HBCD.

Next year, Albemarle says it will launch Saytex Alero, its newest polymeric BFR material supported with evidence-based sustainable, versatile, recyclable, and safety profiles enabling a wide array of processing conditions and customisable material properties. Time-dependent studies of FR/ABS formulations show very good colour retention at elevated temperatures, which indicates high

thermal stability, a key requirement when assessing the recyclability of these materials.

"Due to the excellent thermal stability of Saytex Alero, the data presented in the radar chart (Figure 1] demonstrates that formulations containing the polymeric BFR material can be mechanically recycled through multiple passes with minimal impact on material properties," says Kyle Bodine, Senior Director of Albemarle's Specialties Applications and Customer Technical Service, "Albemarle has conducted mechanical recycling studies with Saytex Alero in multiple resin systems including polyolefin and styrenic resins that all confirm this outcome."

Albemarle says its data also demonstrates that its Saytex 8010 product, an ethane-bis- pentabromophenyl (EBP), is acutely nontoxic to animals or aquatic life, which it says some PFRs cannot claim. "In addition to health and toxicology criteria, many PFRs have higher carbon footprint than competitive BFRs based on our analysis…PFRs may release more greenhouse gas emissions because they are often more energy intensive to produce than BFRs," says Wesley Hamilton, Albemarle's Chief Technology Officer – Specialties.

"Albemarle's R&T Team has demonstrated that even minor structural differences can play a large role in altering key properties such as degradation," says Bridget Goode, VP of Albemarle's Fire Safety Solutions business. "Comparing the newer BFRs or grouping all BFRs into one class disregards the scientific evidence and contradicts a report by the National Academy of Sciences, Engineering, and Medicine," she says.

The National Academy offered guidance to the Consumer Product Safety Commission (CPSC) on how to conduct a hazard assessment of nonpolymeric, additive organohalogen flame retardants (OFRs). The report identified fourteen subclasses that CPSC can use to conduct a class-based hazard assessment of OFRs.

Albemarle has been an innovator in fire safety solutions for decades, according to Gregg Ublacker, Senior Director of Global Product Stewardship. "The company's newest FRs are being developed to meet strict fire safety standards, without sacrificing product performance or compromising environmental and/or human health," he says.

Actilox high temperature barrier (HTB) is a new class of flame-retardant high temperature barrier functional fillers from **Nabaltec** that generate strong thermal barrier effects in electric vehicle battery housings based on thermoplastic or thermoset composites. According to the company, the development of EV batteries with a higher energy density has increased fire safety concerns and prompted a trend towards higher flame-retardant filling levels and new

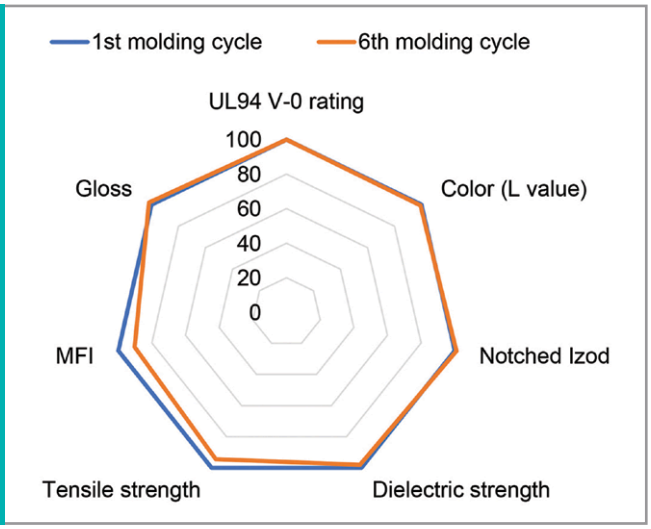

Figure 1: Radar chart showing how Albemarle's new Saytex Alero brominated flame retardant performs after multiple recycling passes in polypropylene

Source: Albemarle

strategies in flame retardancy formulations. It says this is driving development of standards that go beyond the UL94-V0 classification towards a heat barrier that can enclose the thermal runaway of a battery for a certain time.

Nabaltec says that since the first of January 2021, China, which is making big strides in electro-mobility, has already defined a new traction battery standard (GB 38031-2020) that demands a thermal propagation test. It requires that in the event of thermal runaway in an individual cell inside a Lithium-ion battery, there must be at least five minutes until thermal propagation leads to battery ignition or explosion. This will allow passengers enough time to escape an EV.

According to Nabaltec, no final targets for a potential fire standard for battery enclosures currently exist outside of China, but substantial work is ongoing at OEMs and suppliers to develop them. "It is expected that new standards all around the world will be implemented to tackle this thermal propagation issue of the battery module in EVs," it says.

"Currently, aluminium metal-based housings are used for EV battery covers but the metal starts to melt at 660°C and can break down very quickly. The challenge is to encapsulate the generated heat inside the battery and to improve the pressure strength of the battery housing," Nabaltec says.

The company's Actilox HTB specialty filler blends are developed for use in glass-fibre reinforced unsaturated polyester resins, PP or PA. Actilox HTB provides thermosets and thermoplastics with an integral heat barrier by ceramification of the polymer phase while maintaining a solid mechanical stability even after exposure times of 20 or 30 minutes to heat flux at 1,000°C, says Carsten Ihmels, Head of the Department R&D and Technical Service for Thermoset Applications.

In lieu of a standard, Nabaltec developed a screening test based on a torch test for its Actilox HTB ceramifying fillers. The torch test can be performed with either horizontal or vertical test specimens. In the case of a horizontally-oriented test specimen, weight can be added to the top of the specimen during the test to study the kinetics of the ceramification and simulate mechanical abrasion.

The specimens were subjected to a propane/butane torch flame at 1,650 Watts at 5cm distance

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and 90° angle. Requests from automotive industry experts for burn through times, were initially set at a minimum of 10 minutes and extended to 20 and 30 minutes. Nabaltec performed the tests to a maximum 30 minutes where it discovered that, when a polymer filled with its Actilox HTB ceramifying fillers was torch tested for 20 minutes at 1,000°C it remained solid with no expansion, intumescence, cracks, or holes visible. A hard, ceramic-like layer was formed during the torch testing that created a stable ash crust. Comparable results occurred with the test extended to 30 minutes. It is expected that an increased glass fibre content would further improve stability.

Antimony concerns

The long-term use of antimony trioxide (ATO) is a topic of concern to PVC compound suppliers and their end user customers, says Christian Panofen, Global Marketing Director for **Huber Advanced Materials**. Existing and emerging regulatory mandates continue to drive an industry-wide effort to minimise use of ATO in PVC while maintaining adequate fire performance in applications such as rigid profiles, pipes, laminated textiles, thin films, adhesives and the production of wire and cable products, he says.

ATO alone has no useful fire retardant (FR) function. However, when used together with halogenated compounds, a synergistic effect creates improved FR properties. ATO reacts with a halogenated compound to form antimony chlorides and oxychlorides, which function as radical scavengers in the gas phase. Finding a safe and cost-effective alternative in PVC on a 1:1 basis has been a major challenge for the global research community for decades, according to Panofen.

Kemgard products from Huber have been specifically designed to be effective smoke suppressants, char formers and fire retardants. They are manufactured using a process in which molybdates are precipitated on a functional core material, making more efficient use of the molybdate species by maximising its active surface area, and combining it with a selected core material that can offer additional benefits such as additional fire retardancy, improved processability or increased thermal stability, Panofen says. This technology has successfully replaced ATO and zinc borate in some demanding PVC applications.

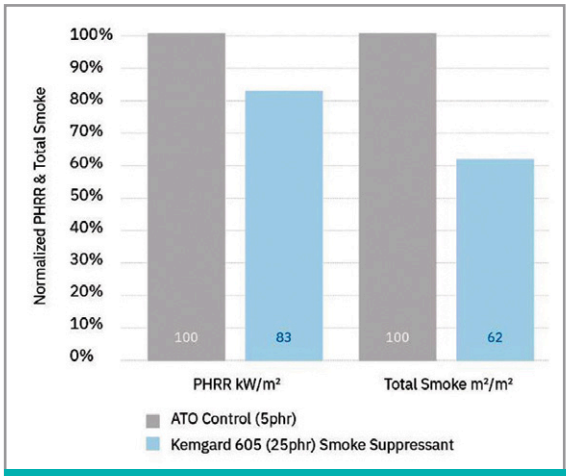


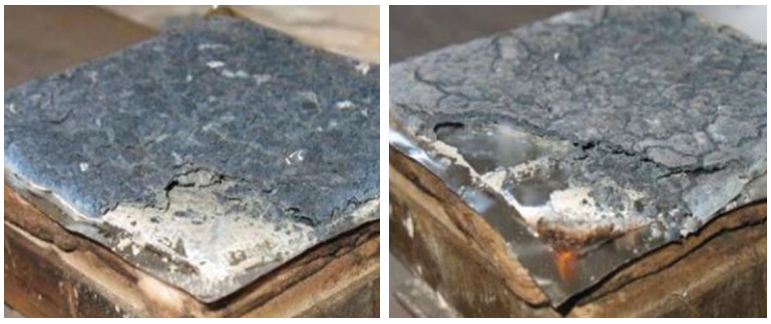
Figure 2: Replacing equal parts of CaCO3 +ATO + zinc borate in a PVC cable compound with Kemgard 605 results in reduced smoke generation and improved fire performance
Source: Huber Advanced Materials

Huber's Kemgard 605 smoke suppressant is offered as a cost-effective solution to fully replace ATO and zinc borate in PVC wire and cable applications. Replacing equal parts of $CaCO_3$ + ATO + zinc borate with Kemgard 605 results in a significant reduction in smoke generation and improved fire performance while maintaining LOI performance, says Panofen (Figure 2). Kemgard 3001 can be used where even more smoke suppression is required.

Evonik has expanded its range of liquid organo-modified siloxanes for surface treatment of hydroxide, nitrogen, and phosphorus flame retardant under its Tegopren product line, says Dr Michael Hagemann, Segment Head Compounds at Interface & Performance. The technology is finding increasing use in halogen-free flame retardant compounds (HFFR) where the additives are used for in-situ hydrophobisation and dispersion of hydroxides such as ATH and MDH.

Evonik has two solid products for the cable compounding industry available in addition to the standard liquid product Tegomer V-Si 4042. It now offers Tegomer FR 100 and Tegomer FR 120 for cable products with the possibility to provide improved flame resistance determined by UL 94, pronounced charring which leads to a delayed HRR (heat release rate), and less smoking with an

IMAGE: EVONIK



Above: Images showing the improved char formation resulting from the addition of 3% of Evonik's Tegomer FR100 additive in a cable compound sample (right)

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Right: Bioenvision says it is developing a new anti-drip additive using its flexible POSS synergist technology

increase of LOI, says Hagemann. They are especially relevant for cable applications for transportation and building applications where legislation such as the European Construction Products Directive (CPD) and EN 45545 is getting more important, according to Evonik.

A recent introduction from **Budenheim** is Budit 669S, a flame-retardant additive based on ammonium polyphosphate (APP) that is halogen-free and features a novel coating designed specifically for polyolefin applications, particularly tubes and housings for white goods. Compounds incorporating the flame retardant demonstrate improved mechanical properties and attain a V-0 rating at a thickness of 1.6mm, says Julia Eichhon, Marketing Manager for the company's Material Science Division.

Another new addition to the portfolio is a flame retardant additive that boosts CTI (Comparative Tracking Index) in high voltage components without compromising on flame retardancy performance. It is formulated for the e-mobility market, where it can protect against electrical faults, short circuits and meets rigorous safety standards, Eichhorn says.

The new grade allows for miniaturisation of the final part, allowing manufacturers to achieve their desired level of fire safety without sacrificing space or efficiency. This promotes innovation in product design and manufacturing, opening doors to more compact and streamlined solutions, says Dr Tobias Moss, Budenheim's Manager of Innovation and Application Development.

Budenheim is also developing dust-free flame-retardant solutions. "Traditionally, flame retardants were incorporated into materials in the form of powders. However, the presence of dust from these additives poses several challenges, including potential health hazards and environmental concerns," Moss says.

Below: Avient is expanding its reSound Bio and reSound Rec product lines with halogen-free FR versions for applications such as USB-C cables

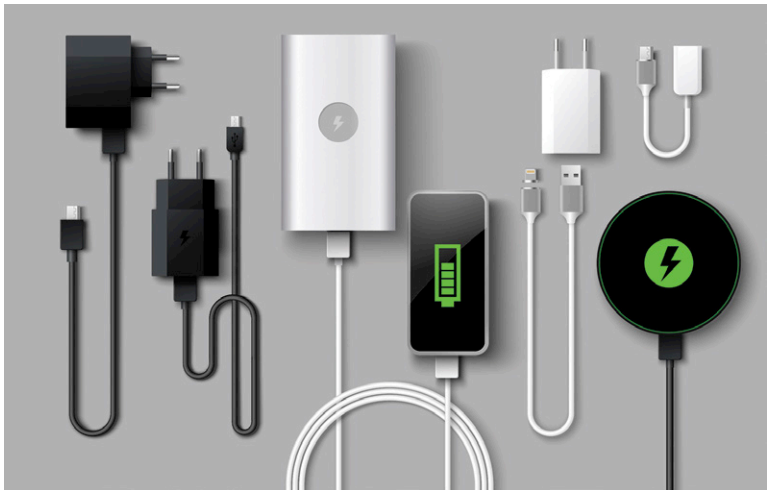

IMAGE: AVIENT/GETTY IMAGES

IMAGE: BIOENVISION

POSS synergists

Recent R&D developments at **Bioenvision** include work to include less than 1% loadings of its polyhedral oligomeric silsesquioxane (POSS) FR synergists in compounds to improve char quality (silicon ceramification), accelerate char formation, and increase ignition time. The company says the organic group on POSS enables tailoring of the FR for specific polymers, either as reactive or additive. In addition to use in polyurethane foams, PP and PVC, recent trials have also shown effectiveness in adhesives and additional testing is in progress to investigate its efficiency in epoxy resins, the company says.

Joint development projects are said to be taking place within several segments where non-toxic and more sustainable flame retardants are needed. During 2023, Bioenvision joined forces with a Norwegian industrial company to build up production capacity for its non-toxic D-Pyre flame-retardant and ensure delivery at large scale.

Bioenvision has also been developing a new anti-drip type of additive based on POSS technology. The company believes there is a need for such a product to replace materials such as PTFE, for instance, which could in the future be subject to restrictions in the EU.

Swedish company **Paxymer** has continued its development of synergists for use with phosphorus and nitrogen based HFFR flame retardants and is now in the final stages of approving the technology in EV applications. Managing Director Amut Paul says the company is developing a toolbox testing kit for assessment, quantification and comparison of FR technologies.

The testing toolkit includes sophisticated quantitative analytical methods that can show the efficiency of HFFR additives with high precision. Relying on a comprehensive methodology that

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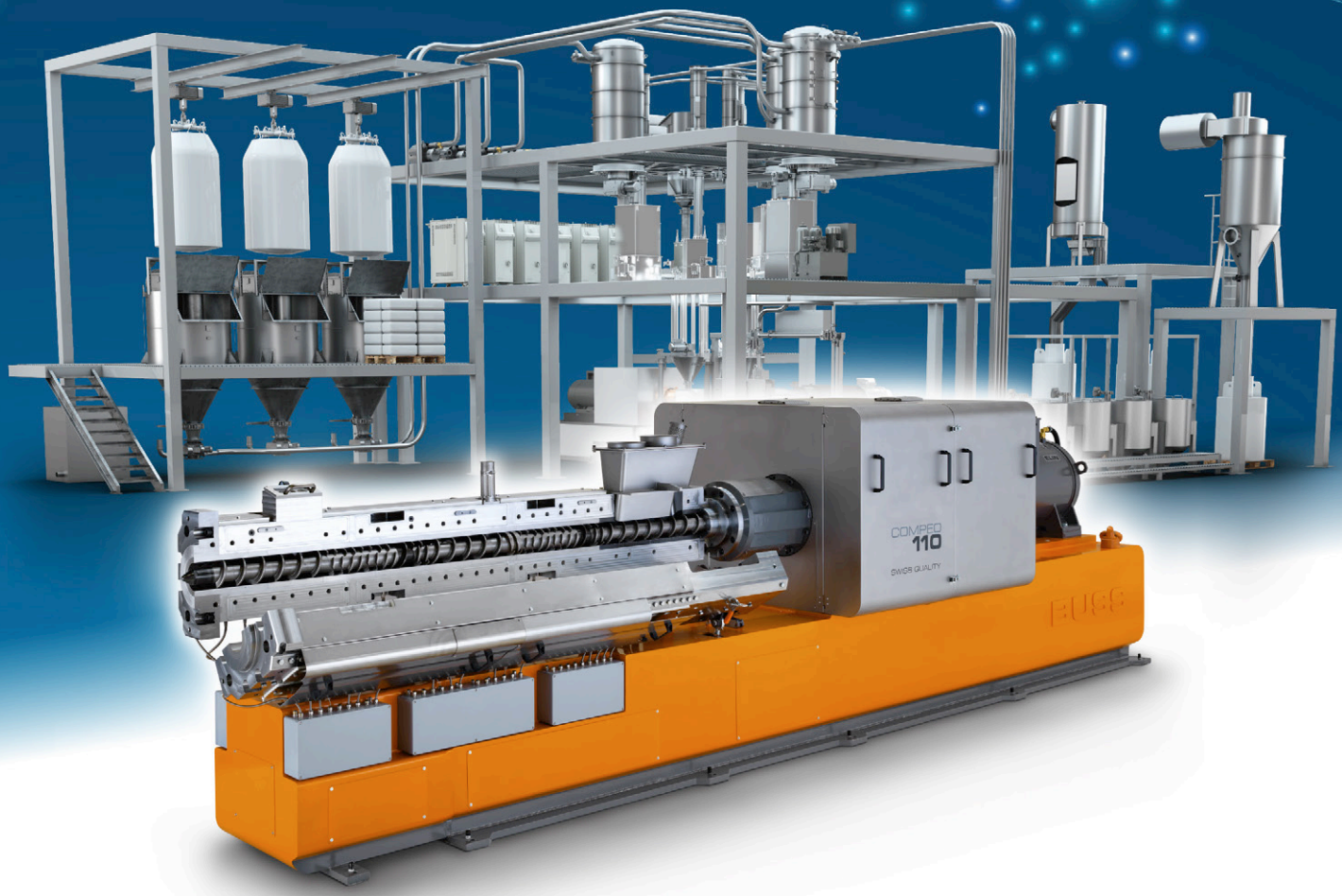

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IMAGE: CAI PERFORMANCE ADDITIVES

Above: CAI says its latest silsesquioxane-based halogen-free flame retardant can achieve UL 94 V-0 in PC films down to 0.25mm

includes evaluation and assessment of gas phase activity, char as well as ignition temperatures, the toolkit has already been correlated against UL94 testing, says Paul.

Paxymer's synergist technology is based on functional polymers. It allows for reduction of up to 33% of FR additive in formulations with maintained performance and reduced cost of the final application as a result, according to the company. The material employs a crosslinking technology with a high activation temperature for a broad processing window. It acts as a drip suppressant and char reinforcement, Paul says. He says it also increases the gas phase activity of several PFR systems so can achieve self-extinguishing performance at lower concentrations of additive.

Paxymer has developed masterbatch systems for PP and HDPE and is also working with synergistic systems in PP and HDPE as well as verifying performance in PA, PC and PC/ABS. It is said to be particularly efficient as a drop suppressant and has proven a critical ingredient in more complex formulations for strengthening char in larger scale testing such as the Steiner Tunnel test.

PTFE-free for E&E

Cesa, from **Avient**, is a new line of PTFE-free and non-halogen flame retardant additives specifically engineered for use in polycarbonate for electrical and electronic products. Traditionally, flame-retardant additives for this material and application often contained PTFE as an anti-drip additive. However, the polymer may be included in restrictions on per- and polyfluorinated substances (PFAS) in the future.

The Cesa formulations are halogen-free in accordance with the International Electrochemical Commission's (IEC) 61249-2-21 standard, which defines halogen-free as having total halogens equal to or less than, 1500 ppm. They are suitable for a variety of PC grades, including materials with recycled content, says Avient. The additives can help achieve Glow-Wire Flammability index temperatures up to 960°C according to IEC 60695-2-12 testing protocols.

In addition, Avient is expanding its reSound Bio bio-based and reSound Rec recycled content thermoplastic elastomer (TPE) portfolios with the launch of a new range of halogen-free flame-retardant (HFFR) grades. The new grades have been developed to meet growing demand in consumer electronic applications such as USB-C connector cable jackets made with sustainable raw materials that also meet strict flame-retardant compliance without compromising performance or processability, according to Matt Mitchell, Global Marketing Director.

The latest flame retardant from **CAI Performance Additives** is a silsesquioxane-based halogen-free additive claimed to achieve UL 94 V-0 in polycarbonate films down to 0.25mm at less than 1% loading. The company says the product also improves resistance of PC film to weathering and yellowing, and to hydrolysis in water-contact applications.

"We are in the era of removing halogens and other unwanted long-lasting chemicals from the supply chain. Flame retardants are one clear area where this is needed. ST-SR487 is one such option for polycarbonates. Thin PC film, for example, is prone to fail the drip tests. This additive is a clever way to do that while avoiding unwanted halogens in the process," says Torey McCleskey, COO for CAI.

Technical compounder **Akro Plastic** offers several recently developed flame-retardant products that are halogen free, free of red phosphorous and do not contain any zinc borates, says Thilo Stier, Global Sales Director & Innovation Manager.

The company recently presented Akromid C3 GF 25 1 FR, which yields an RTI Listing up to 150°C

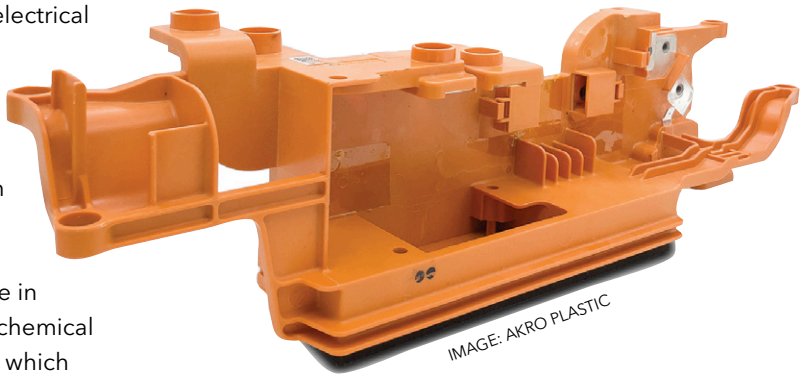

IMAGE: AKRO PLASTIC

Right: Akrotek PK-VM GF FR polyketone is designed especially for busbar applications in electric vehicles

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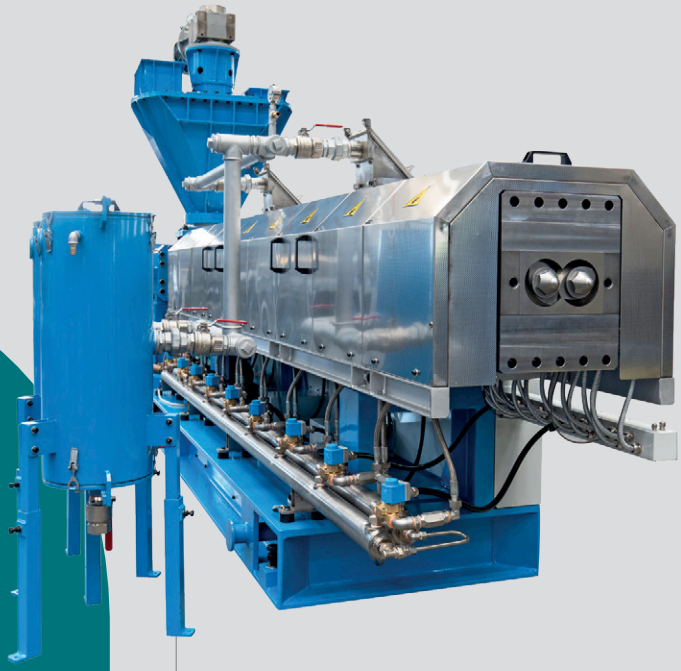

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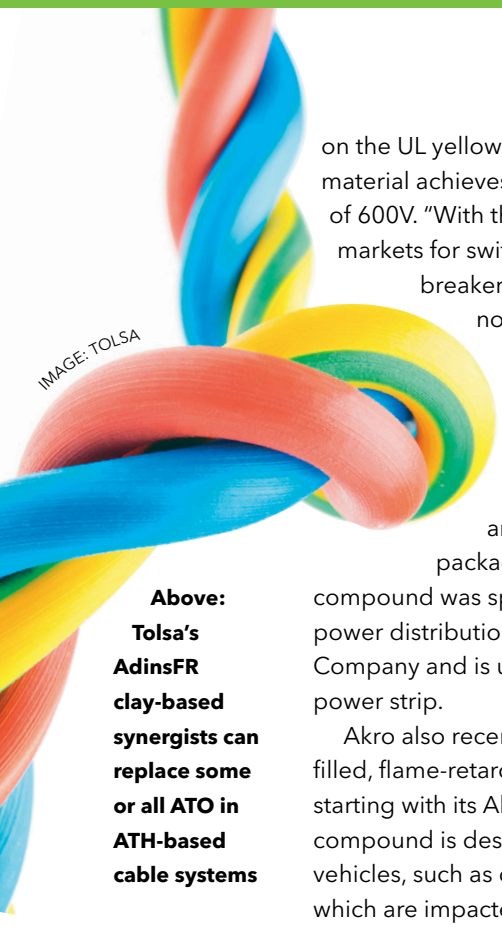

IMAGE: TOLSA

Above: Tolsa's AdinsFR clay-based synergists can replace some or all ATO in ATH-based cable systems

on the UL yellow card, according to Stier. The material achieves a V-0 rating at 0.4 mm and CTI of 600V. "With this material Akro targets the E&E markets for switch gears and high-power circuit breakers. As the heat stabilisation does not contain any halides, which are usually used, there is no danger of contact corrosion," he says.

Akromid NEXT 5.6 3 GF 30 FR Black (8465) is a biobased polyamide 56 with a mass-balanced flame retardant additive package reaching UL94 V-0 rating. The compound was specifically designed for German power distribution units manufacturer Bachmann Company and is used in its Connect Line-Compact power strip.

Akro also recently launched a range of glass-filled, flame-retardant polyketone materials, starting with its Akrotek PK-VM GF FR product. The compound is designed especially for electric vehicles, such as demanding busbar applications which are impacted by the very different Coefficient of Linear Thermal Expansion (CLTE) of the metallic busbar and its insulation. The high weld line strength of the polyketone grade helps to make the compound a good candidate for these applications, according to the company. Akrotek PK-VM GF 30 FR orange (8537) recently completed RTI listing on the UL yellow card, says Stier.

For high-end applications which need remarkably high mechanical properties and outstanding dimensional stability, Akro offers flame retardant compounds based on aromatic polyarylamide. Its Akroloy Para GF 35 FR black (7496) offers high mechanical properties over a wide temperature range. With a tensile modulus of 14,500 MPa and a tensile strength of 200 MPa, the material provides strength so far only achieved by red phosphorous compounds, according to Stier. Akroloy Para's easy flow, good surface, and low moisture uptake make it a promising candidate for use in separators in vehicle batteries that need to pass the propagation tests, he says.

Clay synergists

Flame-retardant synergist and specialist additive supplier **Tolsa** says its flame-retardant clay materials present a highly suitable alternative to antimony trioxide (ATO), one of the most widely used FR additives but one that is facing regulatory pressure due to toxicity and carcinogenicity concerns, according to Almudena Vidal, Marketing Manager in the company's industrial business. In addition, fluctuating ATO prices and supply issues have generated some concerns among end users.

The company says there is, therefore, a need for alternatives such as its Adins clay synergists that can reduce ATO dosage without damaging performance and processability. Adins helps to reduce or eliminate ATO content in PVC or PP formulations when combined with flame retardant systems such as ATH or MDH. The synergists also drastically reduce dripping and can reduce Total Heat Release (THR) levels by more than 20% compared to competing additive solutions, the company claims.

Vidal says Tolsa continues to expand its FR technology, making its Adins synergists suitable for a wide range of systems that require the highest standards of flame retardancy. The company launched a new masterbatch version of its Adins range of additives for flame retardancy at last year's K 2022 exhibition, for example. It has now started to commercialise new masterbatch products for different systems within the wire and cable sector, including EVA, TPE/TPU, and CPE.

In a recent development, Tolsa has transferred its Adins FR technology to PA matrices for applications in electrical/electronics, automotive, textile, and transportation markets. It says the Adins technology allows the development of customised grades that guarantee compliance with specific

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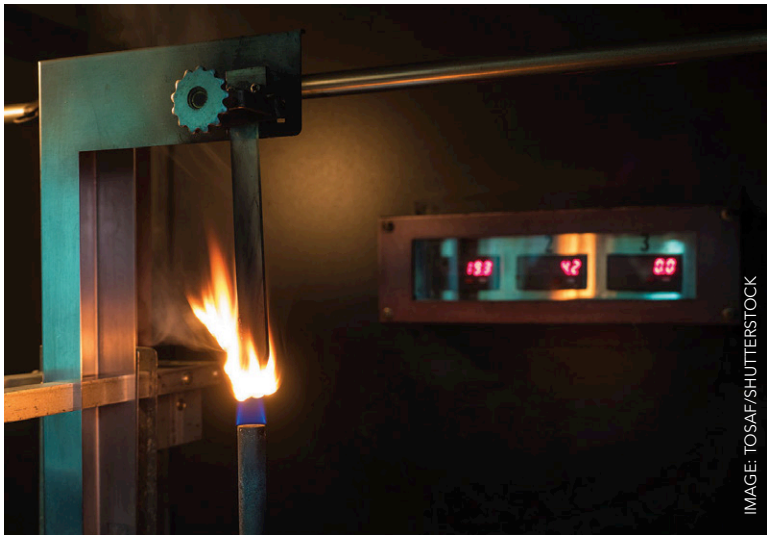
IMAGE: TOSAF/SHUTTERSTOCK

Above: Tosaf has developed a range of halogen and antimony-free compounds that meet the UL94 5VA classification

client and industry requirements. In addition, the required dosage is low, ranging from 1 to 5% for commonly used formulations, akthough the impact on properties is significant, even allowing a reduction in FR doses, says Vidal.

Specialty compounder **Techmer PM** now offers two non-halogenated flame-retardant materials for polyethylene films and extrusion coatings that are free of antimony and PFAS, according to Kaan Serpersu, Product Development and Sustainability Manager. PM116050 can be used for low density polyethylene (LDPE) and linear low-density PE (LLDPE) blown film applications with maximum processing temperature of 205°C (400°F), while PM117000 product can be used for blown film and extrusion coating applications with a maximum processing temperature of 315°C (600°F). The two materials are based on non-halogen technologies and pass NFPA 701 Test Method 1 and 2.

Techmer PM also offers its HiFill FR engineering resin portfolio, which encompasses polyolefins with a process temperature up to 160°C through to ultra-high-performance resins such as PEEK with a 400°C process temperature. The HiFill FR product line includes flame retardant grades with all types of fillers, fibrous reinforcements, special effect additives and custom colours, and employs numerous flame-retardant technologies in its product lines that are all REACH / RoHS-2 globally compliant. This includes halogen and antimony oxide compositions, non-halogen polyamide grades, PC and PC blends, and other non-halogen flame retardant additives, says Serpersu.

Appliance science

In recent months **Tosaf** has developed a halogen and antimony-free flame-retardant compound based on PP that meets the latest White Goods and Home Appliances Regulations and has passed the demanding UL 94 5VA fire standard without compromising mechanical properties, says Wael Geries, Flame Retardant Product Manager.

The company says the global market is gradually shifting to halogen-free flame retardants and FR suppliers face the challenge of offering new halogen-free FRs (HFFR) that provide high FR efficiency, said Geries. To meet the FR needs of home appliance manufacturers, such as lower part thickness, Tosaf has launched several products in masterbatch or compound form for diverse polymers such as ABS, HIPS, PP and PE. This includes its FR7903PP EU PP compound. It uses a halogen-free FR based on a ceramification mechanism that, while burning, creates a char layer and ceramific structure that meets UL94 5VA standards at 2mm. Additional characteristics include low smoke and low heat release, which Geries says allows it to pass FR standards such as EN13501-1 BS1do, NFPA 286, ASTM E162, NF P 92 503/507 M1 and LPS 1207 standards.

Tosaf has also developed FR2655PE EU, an HFFR masterbatch form of the new compound, which can be used in polyolefins. The masterbatch was challenging to develop due to the high dose of active ingredient needed to meet the EN13501-1 BS1do standard, says Geries.

In the halogenated FR category, Tosaf has also developed an antimony free-halogenated FR masterbatch line that meets the home appliance market demand for antimony-free products. Tosaf says it has formulated a solution that performs at the same FR efficiency level for PE, PP, ABS and HIPS applications. This includes FR8997PS EU, an antimony-free commercially available FR HIPS compound that meets several standards including UL94 V0, UL94 5VA 1.6mm, ASTM E162, NF P 92 503/507 M1-2, and LPS 1207 standards, says Geries.

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Taggants beat the fakers

Markers and taggants embedded into plastic compounds can serve to identify counterfeit products and to provide critical material traceability. Jennifer Markarian finds out more

The use of microscopic taggants and tracers in plastic compounds or masterbatches has, for quite some time, been used to provide a secure, covert method for verifying the authenticity of plastic parts and products. The additives often form part of a multi-layer defence against counterfeiting, which can also include the use of visible identifiers (including laser marking) or covert markings on parts, packages, or labels. This combination of overt and covert marks can be used to verify that a part is authentic or by manufacturers that need to know that a part is their own, such as when dealing with product-failure claims. More recently, however, product verification has been applied to recycled plastics, where it can prove the veracity of recycled-content claims.

US-based **Stardust Secured** offers multiple types of tracers that can be embedded into polymers or fibres. The company, which was founded in 1998 and operates under the "Stardust Secured" trademark, employs a range of tracer technologies that are chemically inert and can be checked at any point in the supply chain with a hand-held device, according to Adam Herbenson, Vice President of Sales and Marketing at the company.

"Our tracers are detectable optically and forensically, some working covertly in the infrared part of the light spectrum, while others function in the UV and visible spectrums. Clients often combine multiple tracers and security features that we manufacture to create a layered security solution," he says.

Herbenson says the Covid-19 pandemic led to a surge in demand for tracer solutions in polymers because both commercial and government entities, being vigilant about safety, wanted to verify antimicrobial protection. "Also, during this time, prices increased due to inflation, while goods became scarcer—a prime motivator for counterfeit activities, with efforts to dilute and substitute components as well as to skirt around certifications, standards, and legislation."

The company reports that demand continues today. "The reasons to incorporate a physical tracer in polymer has never been greater, as anti-counterfeiting and traditional brand protection has evolved well beyond merely protecting a label. The value of physical traceability now includes establishing provenance bona fides (where the product and its components originate), content verification and anti-dilution protection, brand promotion via compelling sustainability stories, and added internal supply chain visibility for individual stakeholders in the value chain for those who require it," says Herbenson.

With regard to supply chain traceability for mechanically recycled polymers, he suggests that legislation and regulations will be needed for widespread adoption of tracing technology in the industry at large, but adds that the discussion is just beginning. "Looming legislation and increased discussions around climate impact, carbon foot-

Main image: Tracer masterbatches from companies such as Grafe can be used with simple handheld detectors to provide immediate confirmation of authenticity, protecting profit and consumers

Above: Grafe has worked with Tailorlux to develop tracer masterbatches to provide high speed authentication of 3Dprinted parts

print, pollution, sustainability, and general transparency and accountability, serve as significant drivers in the growing trend and call-to-action for establishing veritable traceability of polymers," he says.

Herbenson says that "paper trails" and "creative accounting methods" are easier and cheaper but, in his opinion, not as effective as physical tracers at providing "real traceability." However, he adds that it remains to be seen what legislation will require. "There are a few technologies providing real traceability, each with their own advantages and disadvantages. Early adopters of one or more of these technologies will have a significant advantage over those who do not [adopt an existing technology]," he says.

3Dprint tracers

German masterbatch producer **Grafe** provides customer-specific tracer masterbatches, including products in combination with colour recipes. According to Lars Schulze, Head of Colour Development and Material Sciences at Grafe Polymer Solutions, anticounterfeiting measures are especially important for ensuring genuine components where failure of the part would cause an unsafe condition. As more parts—and spare parts—are coming from 3D printers today, the company is launching a tracer masterbatch technology targeted specifically at the sector.

"The number of parts from 3D printers is already increasing rapidly today, both in private and industrial use. If one now imagines that spare parts for licensed products are printed from inferior and untested material, recourse claims or warranty claims would be void and, in the worst case, property damage or personal injury would occur," Schulze says.

"We incorporate a marker into the filament that can be used to check whether the correct material was used. It is permanently in the component and cannot be removed. Due to its nature, the marker offers perfect protection against counterfeiting or proof of originality. Another advantage of this solution is that a sensor can be used during the printing process to ensure that the correct material is used," he adds.

Grafe says the marking technology has been developed together with security inks maker Tailorlux, which also supplies the required handheld measuring device. Schulze says the markers can be developed to be specific to a region, company, industry or product.

To date, the marker technology has been used with PLA and PETG filaments. However, Shculze says it can also be used in PA and PC, as well as other polymers provided the processing parameters are considered during marker selection. The colour of the part is not affected but colour can impact on dosage.

"The batch dosages are comparatively low and can be realised from one percent," Schulze says. "Components coloured with carbon black require a slightly higher dosage than others. Carbon fibres also influence the result. Ultimately, it can be said that each filament can be marked with a maximum dosage of three percent."

Looking to the future, Schulze says tracer masterbatches will be increasingly used for identifying recycled plastics. "It would be possible to identify where waste comes from and even what quality it is in. The advantage of tracers is that they are very difficult to eliminate and are therefore contained in the polymer in every new value creation process. Traceability over several recycling steps is possible."

Tracking material

Germany's **Polysecure** also offers marker technology, detectors and sorting machinery for sorting, product tracking, product authentication and material tracking. It says its Particle-Fingerprint technology (TrackByStars) can be used as a robust and forgery-proof unique identifier technology, such as for Digital Product Passports and authentic production tracking, while its PolTag technology, which is suitable for liquids or solids, can be used for Digital Material Passports and to monitor recycled content (via quantitative measurement using mass spectroscopy).

Recently, Polysecure's inorganic fluorescent markers passed the required tests for compliance with food contact regulations in Europe, allowing their use in food contact material and on surfaces of food packaging. The company anticipates FDA food contact approval to be obtained early in 2024. ❯

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Figure 1: Data showing the relative cost and performance available from different authentication options (Security levels range from 0-3 where 3 is the highest).

Technology	Cost to implement ($/lb.)	Size of technology (µm)	Level of security
DNA	0.01	0.001	3
Ferromagnetic	0.45	20	1
Holograms*	1.89	10000 (l,w), 36 (h)	1
IR	0.1	5	2
Multicoloured particles	0.08	20	1.5
Paper labels*	0.3	10000 (l,w), 20 (h)	0.5
UV	0.07	5	1
Source: Eluceda			

** based on producing 1000 parts/lb. of masterbatch*

In the area of recycling, the company offers the Sort4Circle solution that uses Tracer-Based-Sorting (TBS) based on Polysecure fluorescent particles and a new detector being developed with Carl Zeiss AG. The detector sorts waste streams using NIR, the object image, colour, MIR (for black plastics), tracer and—optionally—digital watermarks. Jochen Moesslein, Managing Director, says it sorts items specifically and reliably. Objects containing tracers can also be sorted after shredding.

First trials with large stakeholders are ongoing, with results to date said to have shown that purity of the sorted fraction can be close to 100%. Sorting yields in diverse waste streams are greater than 90%, while sorting costs are comparable to the sorting costs of today's stepwise NIR-sorting process, according to Moesslein. "This proves that Sort4Circle enables by far the largest step towards a circular economy for plastics," he says, adding that Polysecure's pilot plant facility is open for testing.

Authentic solutions

UK-headquartered **Eluceda** says its taggants are also designed to be embedded into polymers and detected using the company's proprietary readers. Uses include verifying authenticity of pharmaceutical packaging, tracking medical devices through the supply chain, and protecting components from counterfeiting.

"One recent trend in anti-counterfeit technologies for polymers using Eluceda technology is the use of taggants to ensure that the correct grade of polymer has been used in areas where specification is key. For example, Eluceda taggants can be used to verify if an antimicrobial or flame-retardant grade of polymer has been used, where testing for such a feature is difficult or expensive when in situ," says a company spokesperson.

Another recent trend is the use of Eluceda taggants to selectively identify recycled materials, which can help to ensure that they are recycled into the correct products.

"The three most important factors in determining the value of an authentication system are cost of implementation per pound of master batch, size of the authentication feature, and level of security," the company explains (Figure 1).

"Holograms and paper labels are overt, but they still require some knowledge and equipment to recreate them in an accurate way. The other technologies are covert and require knowledge of their presence. If a counterfeiter does not know the authentication method being employed, then it is more difficult to copy," the company says. "This information downgrades ferromagnetic and multicolored particles because they are not fully covert; it is difficult, but possible to see them without assistance in most applications."

Eluceda says the three remaining technologies – DNA, IR, and UV – all require the authenticator to have a piece of equipment and the knowledge of the material's presence and location. This can be considered a 2-factor authentication, which it says doubles the burden for a counterfeiter to bypass.

In the case of certain IR and UV materials, the company says the user needs to know a specific wavelength or wavelengths of excitation and the common nature of the UV makes it less secure than IR taggant. Where DNA is concerned, the user needs to have a very specific set of test

IMAGE: SHUTTERSTOCK

Right: Taggant technologies could play a key part in sorting systems for plastics waste, according to Polysecure

equipment and DNA precursors to enhance detection. It describes DNA as "the highest level of forensic security."

Taking these factors into consideration, Eluceda focuses on IR and DNA tracers as viable options to authenticate polymeric materials at reasonable cost. Information such as batch or production facility location can be uniquely identified with the company's DNATagg technology. The taggants are said to be unaffected by polymer processing.

Engineered materials company **Avient** has worked with Swiss security inks specialist SICPA to develop the Plastiward system, which includes proprietary taggants in a masterbatch, a handheld detector and a secure monitoring platform for real-time detection of counterfeits. In electrical and electronic components or automotive parts, as just two examples, the development partners say counterfeit parts can pose a risk of poor quality that may causs malfunction and potential injury. Plastiward additives can be combined with colours.

Established as a not-for-profit spinout from the UK's University of Manchester, **Recon²** is continuing development of a patented fluorescent marker technology to both identify and quantify recycled content. The company says its technology can be printed on product labels – in partnership with the UK's OPRL (The On-Pack Recycling Label) – and that it can also be used for reporting requirements associated with the UK's plastic packaging tax. It has been shown that it can be used in a range of plastics used in packaging, including PE, PP, and PET.

In 2022, packaging company ProAmpac partnered with Recon². "In an effort to address recycled content that did not previously have quantifiable capabilities, we believe the Recon² technology has the potential to provide a clear indication of the quantity of recycled content in packaging where today there is no method to quantify," ProAmpac Technical Director for Blown Films in Europe Robert Crowe said at the time.

IMAGE: BASF/ RECICHAIN

Left: This schematic shows how the reciChain blockchain-based system aims to track and validate recycled materials

Blockchain ideas

A variety of methods other than embedding tracers into the polymer are being investigated for tracing recycled content, such as labels, barcodes, surface features (see box story, page 34), and blockchain technology. The last of these – blockchain – benefits in both sharing necessary information and keeping supplier data confidential and, in some cases, can be combined with physical tracers. ›

Above: Fraunhofer's SmartID system uses barcodes that capture unique surface characteristics

Scratching the surface of product security

Taggants and tracers may not be the only options for providing product security – a number of programmes are underway that aim to use surface features as authentication tools.

Three of Fraunhofer Institute's core technical units – Applied Polymer Research IAP, Secure Information Technology SIT and Open Communication Systems – are developing a labeling system that aims to uniquely verify and authenticate products using a tamper-proof barcode and a smartphone app.

The SmartID system takes advantage of the fact that every part has a unique characteristic surface texture, which it likens to a fingerprint. The system converts this information to a barcode, which is then compared against surface data captured using the authentication app and a standard smartphone. The system does not use databases or blockchain.

Meanwhile, Bosch is working on a similar smartphone-based solution that promises highly secure, invisible product tracing and instant verification. The company says its Origify Product Authentication uses a "fingerprint technology to optically capture the natural surface of a product."

The idea is that the brand owner or manufacturer registers the surface 'fingerprint' in a predefined region of each product during production and stores it in the Bosch cloud. The Origify app then guides the stakeholder through the authenticate authentication process, the company says.

Polymer applications are hugely varied and could include housings for automotive steering control units, frames for sunglasses, tinted plastic lenses for eyeglasses, plastic sports shoe soles, and many others, according to Bosch.

› **https://www.iap.fraunhofer.de/en/projects/smartid.html**
› **https://www.bosch-origify.com/**

The reciChain program created by **BASF** and first demonstrated in 2020 with a proof-of-concept pilot in British Columbia, Canada, was expanded to Alberta, Canada in 2022. The concept uses a physical tracer that is compounded into the polymer so that it can be identified and tracked throughout the value chain. In combination with blockchain technology, the system translates the physical tracer into a digital twin to provide auditable "transfer of ownership".

The purpose of reciChain is to enable circularity for plastics by improving tracking and sorting of recycled materials. Blockchain technology's capacity for auditing will support extended producer responsibility programs and provide a way to assign incentives to participants who will be able to earn digital credits.

Physical limitations

Netherlands-based **Circularise** provides supply chain traceability software using blockchain for digital product passports. The company, which was established in 2016, has been working with partners in various industries that use plastics. It says it has found that in some cases physical tracers provide a benefit for supply chain traceability, but in other cases face limitations.

Circularise founder Mesbah Sabur says that physical tracers embedded in plastics, combined with blockchain technology that provides a decentralised digital ledger, creates "an immutable record" of the product's life cycle. "When physical tracers are integrated with blockchain, it ensures that every single change in the product's status is recorded, he explains.

Sabur suggests, however, that scalability issues and cost can limit the use of physical tracers for product passport purposes. "While physical tracers can provide perfect traceability, they can pose scalability issues. In large-scale operations, managing numerous tracers can become a daunting task, increasing the risk of errors and inconsistencies. This can limit the effectiveness of the traceability system, especially when dealing with high product volumes," he says.

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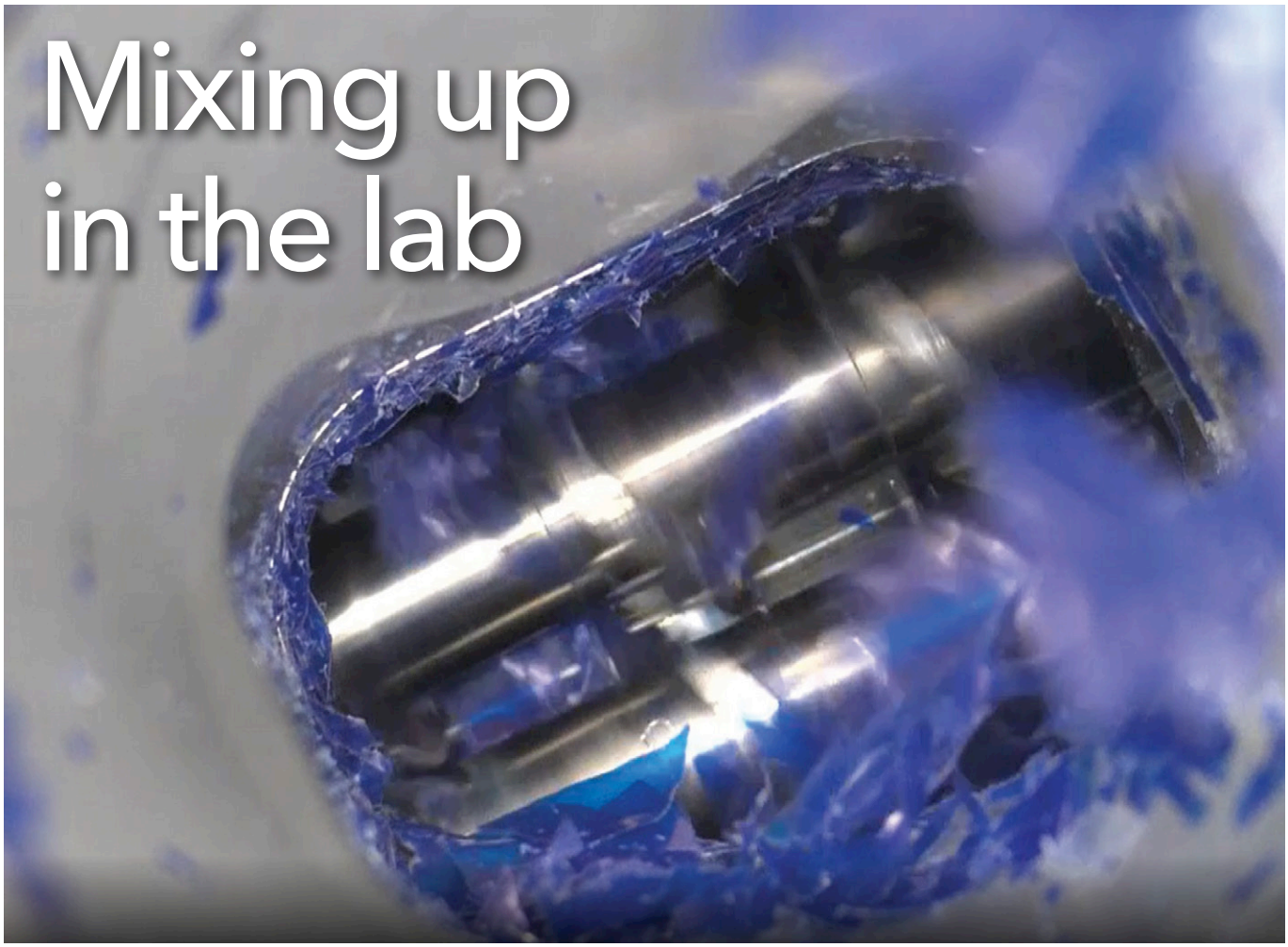

IMAGE: THERMO FISHER SCIENTIFIC

Laboratory-scale compounding equipment that can simulate production conditions is vital for successful development of performance compounds. Chris Saunders finds out more

Laboratory or pilot scale twin screw compounders provide a cost-effective means for development of new formulations and processes, freeing up time on production plant and keeping material usage to the minimum. Key features of a good lab compounder include the flexibility to mix and blend a broad range of additives and materials, as well as integration of an effective control system that allows precise control of temperatures, pressures and speeds so researchers can optimise processing and have confidence in scaling findings to production plant.

Late last year, German equipment maker **Brabender** launched its latest lab-scale twin-screw extruder – the B-TSE-S 30/40 Big Compounder which, contrary to its name, features a compact design combining drive and the processing unit making one of the smaller compounding systems in its category on the market.

The machine is intended to be used as a link between laboratory and large-scale production. Direct scalability from laboratory to production plant is only possible to a limited extent, says Brabender. The Big Compounder is designed to take over as a pilot plant where process parameters can be optimised for subsequent production on large-scale equipment. Upscaling can be performed both at laboratory-to-pilot level and at the pilot-to-production level, it says.

The Big Compounder offers a throughput of up to 100 kg/h and comparatively high torque. The ability to produce small sample quantities saves on material costs and is particularly advantageous when working with materials that are difficult to procure. Smaller batches also mean less energy is used and the cost of disposing of unused test materials is reduced .

"Manufacturers of innovative products have yet

Main image: The growing interest in recycled compounders means lab compounders may have to handle challenging feedstocks such as shredded films

Above: KraussMaffei has updated its ZE 28 BluePower lab compounder, which now features it ppC control

to establish their products on the market and therefore keep their production volumes small," says Simon Hill, Sales Engineer at Brabender. "The Big Compounder is particularly suitable for these companies because they need larger throughput volumes but want to keep their material costs at a low level."

The B-TSE-S 30/40 uses co-rotating screws featuring a modular design and interchangeable screw elements. Various screw element geometries are available, depending on individual requirements, and screws can be easily removed or swapped out. The machine also has a foldable liner system, giving the operator complete access during and after the extrusion operation, while the hinged design allows for easy cleaning.

BluePower update

At the Fakuma international trade fair in Germany this year, **KraussMaffei Extrusion** showed the newest version of its ZE 28 BluePower laboratory extruder, which features high energy efficiency, good temperature control, improved surface cleaning, enhanced power electronics protection, and an optimised strand extrusion die.

The company says processing sections, including screw configurations, can be fully customised and all process-engineering results can be scaled across the entire BluePower extruder range, which extends from size ZE 42 up to the ZE 186.

The new model provides a high free volume (OD/ID =1.65) and high torque density (13.6 Nm/cm³). The processing section can be configured within a length range of 32 to 64 D and can be equipped with up to three side feeders, depending on the process task. Like other extruders in the ZE series, KraussMaffei says the ZE 28 BluePower is available in three material variants to provide the wear resistance and corrosion protection required for customer-specific applications.

The ZE 28 BluePower is designed to support a wide variety of configuration options, including high-temperature processing section elements with thermal resistance of up to 420°C. In addition, the automatic screw removal towards the drive (Ultra-Glide) feature further expands versatility. Since October 2022, the standard version of all ZE BluePower extruders has been equipped with KraussMaffei's pioneer processControl (ppC) system, which uses 'wizards' to provide the operator with step-by-step instructions for key procedures.

"After intensive discussions with our customers, we have responded to current market requirements and improved our twin-screw extruder accordingly," says Michael Tieben, Product Manager for the ZE BluePower series at the company.

The TM20 Hi-Tech co-rotating twin-screw extruder from Italian company **Maris**, which celebrated its 60th anniversary last year, has been specifically designed and manufactured for laboratory applications. The company says it features the operational and performance characteristics typical of production equipment, so it can accurately reproduce the behaviour of materials on a reduced scale.

One of the most interesting aspects of the TM20 Hi-Tech, the company says, is the level of flexibility, which allows fast changes of configuration depending on the raw materials used and the type of process required. This is achieved through the use of interchangeable and modular mechanical components, which do not need the input of specialised technicians.

Right: High performance and low noise make the TM20 HiTech extruder from Maris well suited to lab operation

The machine is also very quiet, which is said to be an important benefit for use in a lab environment. The gearbox is lubricated using an oil bath, while barrel cooling is provided by a closed loop water circuit which, starting from a main distributor, cools each part separately. ›

Construction materials for the barrels and screw elements can be selected from a range of nitrited, anti-corrosion, and anti-wearing steels, while the screw geometry is self-cleaning and features a tried-and-tested two lobe design.

The electrical cabinet is located inside the supporting frame on the TM20 Hi-Tech to provide a more compact footprint. It includes the driver for main motor speed regulation, PLC, ancillary motor drives, transformers, solid-state relays for heating element control, relays for electro valve control, and the general main switch. A touch screen graphical operator panel provides full control of every aspect including screw speed regulation, temperature control for each heating zone, and functioning conditions of the various parts and the relative parameters.

Calculating scale-up

Maris says that scale-up from this type of equipment is not immediate, but it can be calculated by consideration of the different factors of thermal exchange and feeding configuration. The company offers a calculation program as an extra service.

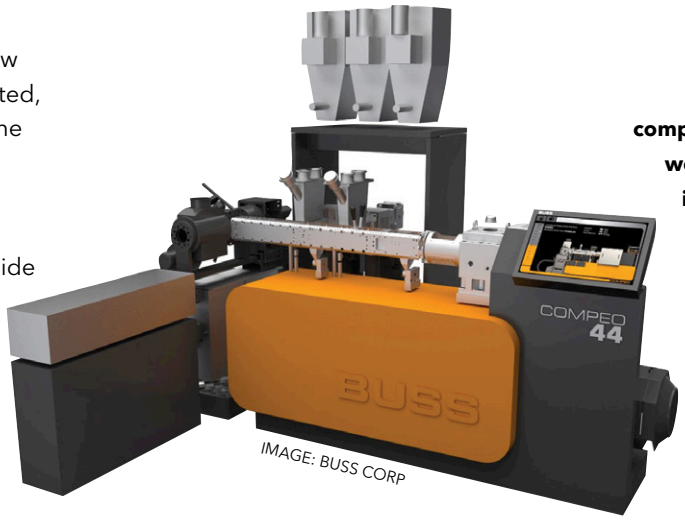

IMAGE: BUSS CORP

Left: The Buss Compeo 44 lab compounder recently won a Focus Silver industrial design award

Earlier this year, the Compeo Lab, the newest and smallest compounding system from Swiss company **Buss**, was among 10 industrial equipment producers to receive a Focus Silver design award from the Design Center Baden Würtemberg in Germany. With throughputs ranging from 110 pounds/h (50kg/h) to 220 pounds/h (100kg/h), the kneader compounding extruder has a 45.5mm screw that is said to be able to handle a variety of materials, including shear-sensitive plastics and engineering plastics.

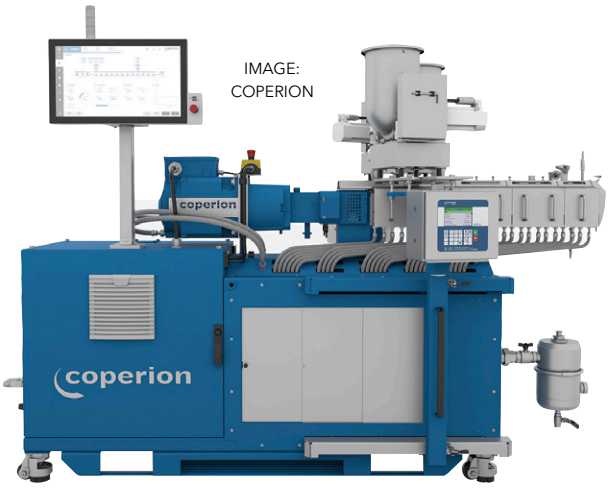

IMAGE: COPERION

Right: Coperion has added a number of new functions to its high performance ZSK 18 Megalab extruder

The machine is described by Buss as a versatile laboratory and pilot compounding line for development applications, which makes it useful for research and development, process optimisation, and small production runs. Its temperature-controlled screw shaft ensures reliable scale-up to production conditions while the ability to combine three and four-flight screw elements opens up further process engineering possibilities. Other machine features include precision temperature control and compact ergonomic design, while options include dosing units, side feeder, a melt pump or filter, and pelletisers.

The ZSK 18 Megalab laboratory twin screw extruder, based on ZSK technology from **Coperion**, has been developed specifically for processing small batch sizes. The machine offers a screw diameter of 18 mm with a specific torque of 11.3 Nm/cm³ and achieves a maximum screw speed of 1,200 min^{-1}.

The company says its reliable scaling-up to larger ZSK twin screw extruders makes it a very good choice for formulation development. "Every single component of the ZSK twin screw extruder is an example of top-class high technology. With the know-how and experience of the pioneers in the development of the co-rotating twin screw extruder we design every single process step of the extrusion system to meet individual product requirements."

Coperion recently equipped the ZSK 18 Megalab with several new functions giving it significantly more flexibility and safety in handling. Pluggable, instead of hard-wired, heating cartridges now enable fast barrel modifications and uncomplicated heating cartridge replacement. An electrically-lockable maintenance door on the gearbox lantern increases operating safety and at the same time enables quick access and therefore shorter downtimes for screw changes and system maintenance.

Optimised feeding

The company says its new, patent-pending optimised feeding rack makes it easier to add ingredients. Connected to the extruder, it enables flexible positioning of up to four feeders on all barrel elements in the process section as well as on the ZS-B side feeders. The feeders are height-adjustable and rotatable with the new feeding rack mounted at the side so feeding can be carried out at different points and in accordance with the

Continuous mixing in the laboratory

The CPeX from Farrel Pomini is a laboratory scale compact processor that uses the company's continuous mixing technology. It is based on the use of two counter-rotating, non-intermeshing rotors and a large free volume mixing chamber, which allows for liberal material circulation and good distributive mixing while the special rotor geometry ensures efficient levels of shear.

The machine features a single large feed port that allows for high filler loadings and handling of irregularly sized materials. Mixing intensity can be adjusted by making changes to rotor speed, working volume, thermal conditions, and orifice position. The company says the standard 6 L/D format provides a short residence time and a low heat history while providing a high-quality homogeneous mixture.

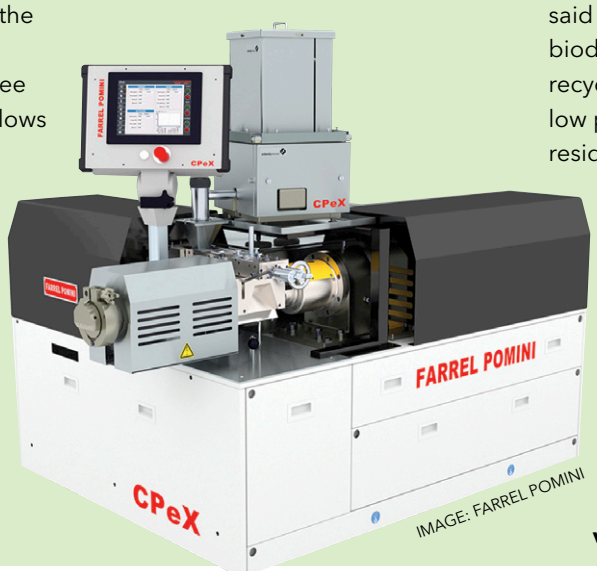

IMAGE: FARREL POMINI

Continuous mixing technology is said to be well suited to processing biodegradable polymers, as well as recyclates, because both benefit from low processing temperatures, short residence times, and efficient shear mixing. Farrel Pomini has conducted extensive development work in processing of PHA biopolymers, both independently and with partners such as CJ BioMaterials.

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Left: Farrel Pomini's CPeX continuous processor provides a versatile option for laboratory work

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IMAGE: CPM

Right: CPM's lab at Lauffen in Germany includes twin screw and RingExtruder compounding systems

respective process requirements. It also reduces the need for additional racks and time-consuming conversion work while making cleaning easier as the feeders can be easily swivelled outwards.

Global compounding machinery maker **CPM** says that its technical laboratory at Lauffen in Germany is unique in being able to develop extrusion processes side-by-side on both co-rotating twin screw extruder and its RingExtruder. The centre is equipped to trial specially-designed screw profiles to provide a more energy efficient compounding process while recent filtering investments support a focus on high quality recycling technologies – particularly rPET.

Underlining the importance of recycling projects, the company's lab machines are equipped with feeders that can easily handle flake feedstocks. High capacity side feeders are also available for development of compounds containing high levels of fillers.

Built for the lab

Thailand -based **Labtech Engineering** has been very active on the trade show circuit this year, exhibiting its machines at Fakuma in Germany, Packprintplas in the Philippines, and Vietnamplas in Vietnam.

The company's UK and Ireland agent **Millmerran** says the Scientific range of twin-screw extruders are built with a clamshell-type barrel design which ensures leak-free operation and provides easy access to the screws for cleaning or changing of elements and/or barrel inserts. On the 20 and 26mm versions, the barrel can optionally be supplied in a fully closed version.

The barrel, whether clamshell or of fully closed design, is built in modular, interchangeable sections of 4D lengths and the surfaces facing the screws are nitrided, giving a low friction coating with a surface hardness of 65 to 70 HRC.

The drive motor is flange mounted to the gear box through a torque-limiting coupling protecting the screws from overloads. The torque limiter is electronically connected to the motor controls and a programmable frequency inverter regulates the motor speed. The 26mm twin screw extruder is available in standard motor power of 11 kW and max RPM of 800, and as a high RPM version with 22 kW motor drive. Both the 20 and 26mm extruders can be equipped with one or more twin-screw side-feeders.

Lab technology company **Thermo Fisher Scientific** offers twin-screw extruders on both lab and pilot scale, with throughputs ranging from 200 g/h to 30 kg/h depending on the material.

As interest in recycled materials grows, laboratory compounding plant needs to be able to handle a wider range of raw material input types. Shredded plastics, for example, have a wide particle size variation and low bulk density, which calls for a compounder with a high free volume. The company says that feeding fluffy shredded films and fibres with low bulk density presents a particular challenge, which its Process 16 Twin-Screw Extruder is designed to address. It says the machine offers a particularly wide feed throat for a lab-scale extruder, which eases feeding of film shreds and prevents blockages. In addition, special wide throat screw elements are designed to provide fast conveying into the extruder barrel.

Another problem experienced when handling shredded plastic film waste is electrostatic charge, which results in material tending to attach to surfaces such as the feeder outlet and the feed funnel, where it can then pile up. Thermo Fisher says it can provide an accessory called an Ionisator, which is placed at the outlet of the feeder tube and neutralises the charge on the material to prevent blockage and allowing feeder output and efficacy of the extruder to be maximised.

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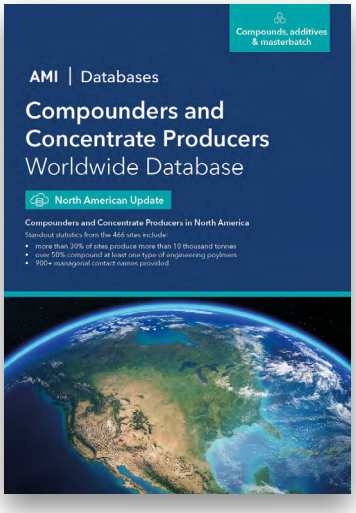


IMAGE: CHEM-TREND NORTH AMERICA

Compounders find the urge to purge

*Traditionally focused on the injection moulding market, manufacturers of commercial purging compounds now see compounding as a significant growth area. **Mark Holmes** reports*

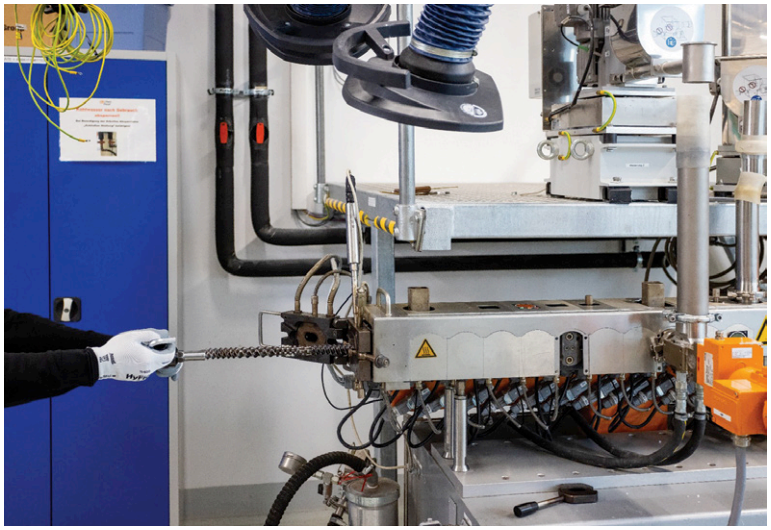
Frequent material and colour changeovers, as well as the need to reduce scrap and minimise down-time, are key factors encouraging compounders to use commercial purging compounds (CPCs) to help them keep their extruders running at maximum productivity and efficiency. Manufacturers of CPCs – which have traditionally focused their products at injection moulders – are now developing products that address compounding needs specifically and providing guidance and training that promotes their benefits over 'in-house' alternatives.

"Most injection moulders are aware that CPCs exist, and most have explored this option to reduce scrap and downtime," says Andrew Reeder, Sales Manager Thermoplastics at **Chem-Trend North America**. "CPC manufacturers are now engineering products for other types of plastic processors so they can also benefit from reducing downtime and scrap as injection moulders have for many years. Growth areas for CPCs are forecasted for a variety of industries, such as compounding/masterbatch, blown film, extrusion and blow moulding. These types of plastic processors will continue to see more viable CPC options for their purging needs.

In many areas, compounding and masterbatch production companies have very similar needs as injection moulders. "Chem-Trend has focused on developing a purge compound that reduces the downtime and scrap for colour changes, carbon removal and material changes in the compounding and masterbatch industries," says Reeder. "Additionally, the Chem-Trend purge compound also significantly reduces the labour required when pulling and cleaning a screw."

Main image: Purging compounds such as Ultra Purge 3615 from Chem Trend are being specifically formulated for compounding applications

IMAGE: CHEM-TREND



Above: The need to perform screw pulls differentiates compounding purging from injection moulding

Chem-Trend says companies are interested in CPCs that are easy-to-use, provide an effective and efficient cleaning of the screw/die, and are recyclable in a closed loop system. Processors are challenged with becoming more sustainable and utilising a recyclable CPC is a great way for a company to reduce their footprint. A recyclable CPC is also beneficial from an economic standpoint because it allows companies to utilise the purge scrap rather than send it to landfill.

Ultra Purge 3615 has been specifically designed for the compounding and masterbatch industries, according to Chem-Trend. The company says the product is 100% chemical – meaning no abrasive components are present. It is a self-emptying technology that makes screw pulls and material changes fast and easy and is said to result in a screw free of any type of residue after just one purge cycle. This also makes machine shutdowns/startups easier as there are no remnants left to degrade and show up as carbon.

Closing the loop

Ultra Purge 3615 is also recyclable and can be used in a closed loop system. A 2022 study performed by Fraunhofer Institute showed that recycling Ultra Purge with up to 5% virgin resin does not affect the chemical and physical properties of the final product.

According to Reeder, companies also need to consider the basics when purging their machines. "First and foremost, when performing a colour change make sure the hopper, feed throat and conveying system has been cleared of all previous colorant," he says. "All CPCs have unique procedures to maximise their performance. Make sure to use the CPC manufacturer's recommended procedures."

The market for purging compound is strong, according to US company **RapidPurge**. "Obviously, it ebbs and flows along with the larger market for resin," says Joseph Serell, President and Owner of the company. "However, over the past 20 years the growth rate has been somewhat stronger than the resin market itself. This seems to remain the case."

Serell says that, fundamentally, purging compound is a cost saving product. "As operating costs increase, such as resin and electricity, purge compound has become increasingly important as a cost reducing product," he says. "A small amount of purge compound can eliminate a large amount of scrap."

Serell also says that new developments in purge compounds have generally been evolutionary as opposed to revolutionary. Purge compound producers are continually looking for more effective resin carriers, scrubbing minerals and surfactants (and their combinations), but the primary driver of new developments is the need to offer improved solutions to customers at a better overall price – as opposed to radically new technology for new applications. As new resins are developed, new purge compounds are as well. This is especially the case for the newer super engineering resins that are processed at high temperatures and there are now a number of purge compounds that are effective and safe at temperatures of 700˚F (371˚C) and above.

Purging compounding machines does not differ greatly from purging most standard profile extruders. "The key to getting the interior of the machine clean is to get the cleaning mechanism of the purge compound into contact with the surfaces of the metal in the machine," says Serell.

"This sounds simple but is not always so. This is easier to accomplish with injection moulding machines because friction and pressure can be generated with the reciprocating screw. Compounders must take a different course," he says. "Firstly, mechanical purging compounds rely on scrubbing minerals to remove resin and contaminants from the interior surfaces of the machine. To benefit from the scrubbing minerals, purge compound makers often add a foaming agent to their products. This helps expand the cleaners to the metal surfaces and increase pressure within the machine."

Foaming agents are also employed with chemical purge compounds for the same reason. "Chemical purge compounds also rely on heat and time to be activated. So, it is generally recommended to allow the chemical purge to soak for anywhere from 5-30 minutes," Serell says. "Whether using a mechanical or chemical purge compound, the most important tip is to follow the manufacturer's instructions completely. Not all products are used the same way, so following the supplier's

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IMAGE: VÖLPKER SPEZIALPRODUKTE

Above: Völpker sees its universal Cevo-clean J-1819 grade offering a flexible purging option for compounders

procedures is very important for best results."

Another Serell tip for compounders is to use the 'disco purge' - a simple but effective process that can be applied to twin-screw as well as single-screw extruders. It involves stopping the machine screws for a short period of time (ten seconds is sufficient) and then restarting and bringing them back up to speed. This exerts more cleaning/scrubbing force against the screw flights and can be done several times during a purge. It works whether a purging compound is being used, or just flushing with the next resin.

RapidPurge is currently focusing on a purge compound specifically for masterbatch colorant manufacturers. "The extremely high concentration of pigment makes changeovers especially difficult in these applications," says Serell. "Our approach will be a little bit different than traditional mechanical or chemical compounds. We are focusing in this case on the pigments more than the resins. Since the chemical makeup is different, we need to employ a novel technology. We have some final technical hurdles to overcome, but we expect to be launching these grades before this time next year."

The current market for purging and cleaning compounds in plastics manufacturing is expected to grow at a significant rate in the next few years, reports **Völpker Spezialprodukte**. It cites a report from Precision Business Insights that forecasts 8.5% CAGR globally over the 2023-2029 period and identifies extrusion as a growing application area.

According to Dr Lutz Matthies, Head of Business Development at Völpker, there are a number of influences driving new developments in purging and cleaning. "These include the increasing demand for high-quality and consistent plastic products in various end-use industries, such as automotive, construction, packaging and electronics. These industries require plastic products that have specific properties, such as colour, strength, durability, and resistance to heat, chemicals and abrasion. To achieve these properties, plastic manufacturers need to use purging compounds that can effectively remove any contamination, degradation or colour change from the processing equipment."

He says environmental concerns also play a part. "There is also rising awareness and regulatory pressure to reduce the environmental impact of plastics. Manufacturers are looking for purging compounds that are economical in use and compliant with the environmental standards and regulations. Purging compounds can also help to reduce energy consumption, greenhouse gas emissions, and waste generation of plastic manufacturing processes."

The latest development from Völpker is its Cevo-clean 'one 4 all concentrate'. The Cevo-clean J-1819 grade is a cleaning concentrate that can be used for extruders, injection moulding machines and hot runner systems. It is designed to be used diluted with the polymer to be processed, which the company says means only one cleaning concentrate is required for nearly all commonly used polymers.

Völpker says Cevo-clean J-1819 is designed to enable a fast material and colour change, so

reducing downtime and scrap costs. The resulting cleaning extrudate can be granulated and reused, especially in cases of low contamination. It is also recommended for cleaning extruders during extended shutdowns, where it can help prevent contamination or deposit formation.

According to the company, the J-1819 purging material uses a combined chemical and physical mode of action that can clean both the surface and the inner layers of the equipment. Cevo-clean J-1819 has can be used up to 360°C (depending on the carrier polymer used) and will clean extrusion screws and barrel as well as die heads and adapters.

Matthies offers some specific practical tips to compounders for effective and efficient purging and cleaning of extruders with Cevo-clean J-1819. These include preparing a dryblend mixture of Cevo-clean J-1819 with the unfilled polymer type that is to be used in production, or that which forms the basis of the new compound to be processed. The recommended mixing ratio is 20-25 parts Cevo-clean J-1819 to 75-80 parts polymer. The mixture should be processed on the extruder using the normal processing parameters of the polymer and an amount sufficient to fill the entire extruder and die head should be used.

Efficiency savings

US purging compound producer **Dyna Purge** sees industry concerns over the impacts of labour shortages, the drive for manufacturing efficiencies, offsets to volatile resin prices and increasing interest rates encouraging use of CPCs. "Growth opportunities in the market are associated with those not using CPCs. These companies need to understand the savings and efficiencies associated with CPCs compared with 'in-house' remedies," says Bob Grzegorek, Technical Product Manager at the firm.

"Other current market influences include that many companies prefer to use one universal purge with all types of resins. This makes it easier on the associates who perform the purging. Having to use multiple types creates opportunities for mistakes. Recyclability is becoming more important as well, with the ability required to grind and reuse clean purges," he says.

Grzegorek says ease of 'post-purging' is particularly important. "Compounders need assurance that a CPC is completely removed from the system before starting the next production run. Ease-of-use with defined procedures is also required. A CPC provider that offers training and optimisation of the purge process is highly valued."

Dyna-Purge says its focus is on mechanical purges with wide heat ranges, providing ease-of-use across multiple processes and resin types. The company provides a non-abrasive scrub utilising a 'scrubbing polymer' for this purpose, with its latest development being Dyna-Purge L, a CPC that is said to use an easier flow carrier matrix that works well in both single- and twin-screw applications.

IMAGE: ASACLEAN

Left: Asaclean purging compound being peeled away from the screws

Grzegorek's practical tip for compounders for effective and efficient purging and cleaning of extruders is to fill the flights completely without overfilling for twin-screw applications. "Utilising a 'disco purge' procedure while maintaining full flights is best practice," he says. "Increasing die and adaptor heats, if applicable, will also help release stubborn pigments and dyes at 10˚C (50˚F) minimum or hotter, without exceeding recommended temperatures for your equipment or resin system."

The challenges posed by new resins, compounds and alloys in plastics compounding for effective and efficient cleaning of extrusion machines are highlighted by **Asaclean**. "To meet the needs of sustainable and competitive businesses, purging compounds have been developed to offer solutions such as concentrates and specific purges for different processing needs including broader temperature ranges, as well as providing compatibility with various production mixes or base resins," says Hector Sanchez, National Sales Manager.

"The current market for purging compounds is growing and competitive, as plastic processors are increasingly aware of the benefits of using a commercial purging compound for waste reduction and process efficiency. Any machine with a screw

IMAGE: ASACLEAN

Above: A clean pair of compounding screws after removal of the Asaclean purge

and barrel, such as twin-screw extruders, can use purging compounds," Sanchez says.

"The main trends and influences driving new developments in purging compounds are environmental and economic pressures, as well as academic education. These factors demand waste and energy reduction, risk prevention, and quality and efficiency improvement in compounding processes. New developments addressing these needs include purging concentrates, high-temperature purging compounds and glass-filled mechanical purging compounds, that can clean different resins, additives and contaminants at various processing temperatures," he says.

In practical terms, Asaclean also emphasises the importance of selecting the right type and amount of purge for different applications, resins and additives. It also points out it may be necessary to adjust the processing parameters to enhance purging efficiency. Factors such as screw speed, feed rate, temperature, pressure and vacuum devices may need to be managed, depending on the purge and the resin used, and higher screw speed and lower feed rate generally improve cleaning performance.

Asaclean says its latest developments include the Plus concentrate, PF and PX2 grades. "This purging concentrate is especially suitable for hot runner colour changes, blow moulding and most extrusion applications," says Sanchez.

"They are easy-to-use because they match the production resins' MFR, do not require changing processing temperatures, and their loading ratios can be adjusted to optimise cleaning power. PX2 and PF grades are both high-temperature purging compounds that can clean super-engineering resins at processing temperatures of up to 420°C. They have excellent thermal stability. The PX2 grade has superior cleaning power for hard-to-clean resins, such as PPS, PEEK, LCP and PEI, while the PF grade is suitable for hot runner cleaning and can be used as a sealing material during machine shutdowns," he says.

Asaclean recently tested its Plus grade to optimise colour changeover efficiency from grey to orange on a twin-screw extrusion production line. The test results showed that thorough equipment cleaning before purging and regular breaker plate and screen maintenance are critical factors for achieving efficient colour transitions. Implementing these best practices reduced purge time, material usage and contamination risks, enhancing productivity output.

Maintenance and production departments are now more open to using premium purging compounds to optimise cost and time in a more efficient way, says Mathieu Rioult, Commercial Manager at **Polytechs**. He says that current trends influencing new developments in purging compounds include supporting the reintroduction of recycled resins in extruders, which are more sensitive to gels and carbonisation. Solutions are also being developed that clean polymer production systems in a more sustainable way through recyclable purging compounds and purges for biopolymers, for example.

The latest Polytechs developments include Clean HP for cleaning barrier polymers. The company says that purging EVOH production with Clean HP is four times faster than a special purge for EVOH and requires four times less material. Contaminants remain within the EVOH purge. Developed for biopolymers, Clean Xpress is said to purge three to six times faster than virgin resins with up to ten times less material. The company adds that it has also refined its procedures to provide guidelines for cleaning specific recipes.

Polytechs says it can provide advice on the right product required for a colour or resin change, problems with black specs or purging with a weekend compound. This will also include ensuring that the purging compound is suitable for the processing equipment. Polytechs highlights a recent example in cable production, where cleaning an XLPE production line, four times a month, generated a cost saving of 15% and created more than 100 extra hours in capacity.

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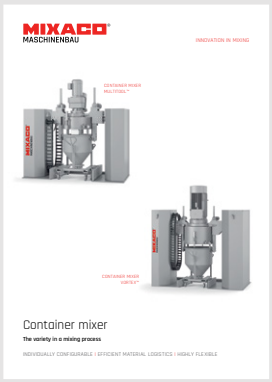

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