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TotalEnergies to add recycled PP compounds line in France

TotalEnergies is to build a new production line for high-performance recycled PP compounds for automotive applications at its site at Carling in France.

Scheduled to start operation in 2024, the line will have a capacity for 15,000 tonnes/yr of hybrid PP compounds containing up to 100% recycled plastic materials (post consumer and post industrial). Production will include grades for the company's recently launched RE:clic portfolio, as well as its RE:use mechanically-recycled grades.

"After the doubling of capacity at Synova, a subsidiary of TotalEnergies and the French leader in the production of recycled polypropylene, this investment further strengthens the company's leading position in high value-added recycled polymers," said Nathalie Brunelle, Senior Vice President, Polymers at TotalEnergies.

"This new line will allow us to meet the growing demand from the automotive market for more efficient and sustainable polymers, in line with our ambition of producing 30% circular polymers by 2030," Brunelle said.

› **www.polymers.totalenergies.com**

Hexpol acquires McCann

Sweden's Hexpol is to acquire McCann Plastics, a US-based niche thermoplastic compounder with a special focus on roto moulding applications, for $120m.

"McCann has a strong position within its market niche that complements and widens our customer offer," said Jan Wikström, President of Hexpol Thermoplastic Compounding. "The company is well invested with high competence in specialised thermoplastic compounds. We are looking forward to continued growth with McCann being part of Hexpol."

McCann operates from two locations in Ohio, US, and has around a hundred employees. Over the past 12 months the company delivered sales of around $72m.

› **www.hexpol.com**
› **www.mccannplastics.com**

Mitsui invests in low CO_2 carbon fibre technology

Mitsui Chemicals and Microwave Chemical are to set up a facility within Mitsui Chemicals' Nagoya Works to demonstrate a new low energy technology for manufacturing carbon fibre.

Microwave Chemical's Carbon MX production technology combines oxidation, the most energy-intensive part of carbon fibre production, with the carbonisation process. When compared to existing methods, it is said to significantly reduce heat treatment time, resulting in a shorter heating process line and more compact facilities.

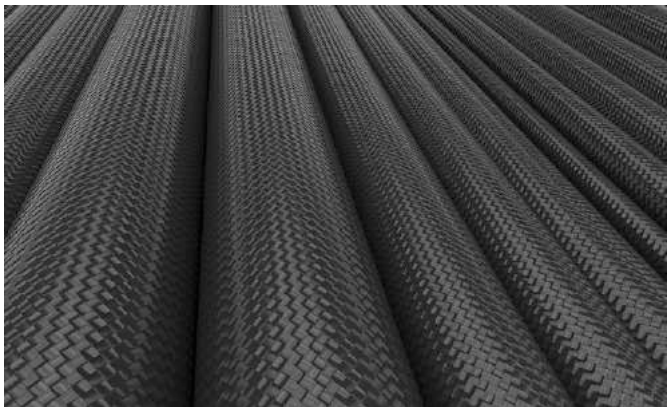

IMAGE: SHUTTERSTOCK

Above: Carbon MX carbon fibre technology promises reduced CO_2 emissons

The approach is expected to cut energy consumption by around 50% and, if the source of the power used to generate the microwaves is switched to renewable energy, CO_2 emissions can be reduced by over 90%.

› **https://jp.mitsuichemicals.com/en/**

DSM/Compounding Solutions deal

DSM has set up a strategic partnership with US-based Compounding Solutions to provide medical device customers with improved access to its Care polymer portfolio, including its Arnitel Care product family that is said to provide an alternative to current catheter materials.

According to DSM, the deal will help US medical device companies speed up their time to market through Compounding Solutions' material customisation and fast turnaround development capabilities, which include custom colours, radiopacifiers, lubricants and other additives.

› **www.dsm.com**
› **www.compoundingsolutions.net**

Solvay and Ostium aim for medical recycling

Solvay has joined forces with French medical device start-up Ostium in a project designed to enable mechanical recycling of end-of-life single-use surgical instruments moulded in its glass-fibre reinforced Ixef PARA specialty polymers.

The initiative is claimed to be a first in its aim to allow valuable polymers to be recycled and upcycled from used healthcare devices. Solvay said it aims to ensure the medical safety provided by high-performance polymers in single-use surgical instruments can be reconciled with the need for greater sustainability and resource efficiency.

"Our customers in the healthcare industry must meet strict regulatory demands while at the same time striving to minimise the carbon footprint of their products and support the reduction of hospitals and clinics' end-of-life waste," said Claire Guerrero, Global Marketing Manager Sustainability at Solvay.

IMAGE: SOLVAY

Above: New project aims to recycle Ixef surgical instruments

"We identified a gap between these challenges, which prompted us to forge this unique collaboration for developing a breakthrough recycling process for used surgical instruments that are commonly disposed of by incineration rather than reclaiming their high material value."

Ostium Group specialises in the design and manufacture of instruments for hip, knee, shoulder, and trauma orthopaedic surgery. It will supply hospitals with new custom surgical kits made using Solvay's Ixef PARA and will collect the contaminated instruments after use for recycling.

› **www.solvay.com**

ICIG completes Benvic purchase

International Chemical Investors (ICIG) has completed its acquisition of the compounds business of Benvic Group from PVC Europe, an investment subsidiary of Investindustrial Growth. The latter acquired the business from Solvay four years ago.

Luc Mertens, CEO of Benvic (pictured right), said that Investindustrial Growth has helped establish Benvic as a separate brand and its 10 add-on acquisitions have, over the four years, opened up new markets in terms of technologies, markets and territories.

IMAGE: BENVIC

He added the new owner with its industrial focus would provide a "long view" and would continue to develop the company. "Our two US acquisitions give us a platform for growth starting with specialties, such as medical and cable compounds", Mertens said. "We are not so strong in Germany, so that will be a focus for growth too".

Benvic still has a lot of synergies to explore, according to Mertens, and future growth will be organic bolstered by more acquisitions. "We still have a list of targets."

› **www.benvic.com**

IN BRIEF...

Wanhua says its plant for production of bio-based PA12 is now in operation in China. PA12 is made from bio-based raw materials and is said to offer low density and good resistance to elevated temperatures, impact and chemicals.
www.whchem.com

Taiwan's **ChiMei** is to launch its Ecologue line of bio-ABS products in the first half of 2023. The move follows its obtaining ISCC Plus certification for its plant at Tainan covering all of its main products, including ABS, SAN, MS (SMMA), HBR, and SSBR,
www.chimeicorp.com

Invista has commenced construction of a new PA 66 production site in South Carolina in the US. The plant is part of a $64m investment and is expected to begin production in 2024.
www.invista.com

Toray is to sell PA6 fibres and other products chemically recycled from waste fishing gear in Japan next year.
www.toray.com

Teijin and **Itochu** are to set up a JV - RePEaT - to license the former's dimethyl terephthlate (DMT) technology for chemical recycling of PET. It is claimed to allow removal of dyes and pigments during the decomposition/repolymerisation process.
www.teijin.com
www.itochu.co.jp

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Ascend invests in Circular Polymers

Ascend Performance Materials has acquired a majority stake in US-based Circular Polymers, which recycles PA6, PA66, PET and PP from carpet waste.

Ascend says the move – which sees the recycler renamed Circular Polymers by Ascend – will provide it with a consistent supply of high quality post-consumer recycled material for use in sustainable products such as the ReDefyne PA compounds it launched at the K show in October.

"Circular Polymers by Ascend provides materials that offer strong performance with a considerably smaller environmental footprint compared to other technologies like pyrolysis," said Ascend President and CEO Phil McDivitt. "The quality of material that comes out of Circular Polymers is extremely high and consistent."

IMAGE: ASCEND PERFORMANCE MATERIALS

Above: Ascend President and CEO Phil McDivitt

The US is a major consumer of carpet and Circular Polymers claims to have used its proprietary technology to redirect more than 38,000 tonnes of carpet waste from landfill since its formation in 2018. Founder David Bender remains with the business as CEO.

McDivitt expects to see the recycling business expand through Ascend's investment. "We would expect that Circular will expand both its existing footprint in California as well as in other parts of the US," he said. "ReDefyne is a global grade and we would expect to serve our customers on a global basis."

Ascend has made a number of significant acquisitions in the Americas, Europe and Asia over the past five years, including the acquisition of Italian compounder Poliblend in 2020. "One of the reasons we acquired Poliblend was for its ability to take PCR and reformulate that back into compounds," McDivitt said.

› **www.ascendmaterials.com**

ECJ rules on TiO_2 regulation

The European Court of Justice has ruled to annul parts of the European Commission's Delegated Regulation 2020/217 covering harmonised classification and labelling of TiO_2 as a carcinogenic substance by inhalation.

In its **judgement**, the court ruled that the requirement under existing EU law to base the classification of a carcinogenic substance on reliable and acceptable studies was not satisfied. It also ruled the Regulation infringed the criteria that classification of a substance as carcinogenic can only apply to a substance that has the intrinsic property to cause cancer.

IMAGE: SHELL

Above: Shell's 1.6m tonne PE plant in Pennsylvania is now in operation

Shell starts up US PE plant

Operations have commenced at the Shell Polymers Monaca (SPM) facility in Pennsylvania,, the first major PE manufacturing complex to be located in the north-eastern US shale region with a nameplate output of 1.6m tonnes/yr.

Strategically located with an estimated 70% of the US PE market within 700 miles, SPM sits on 384 acres of land adjacent to the Ohio River in Beaver County, Pennsylvania. The plant is expected to ramp up to full production by the second half of 2023.

Huibert Vigeveno, Shell Downstream Director, said: "With great market access, innovative offers and connected infrastructure, Shell Polymers Monaca is well positioned and ready to serve customers with high-quality, competitive products."

SPM is targeting customers that manufacture commodity and specialty films, pipes, blow-moulded containers, and injection-moulded parts.

› **www.shell.com**

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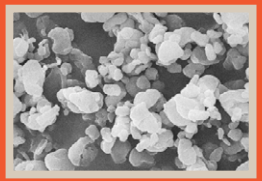

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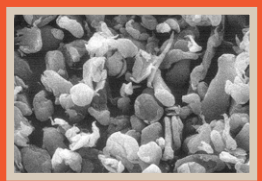

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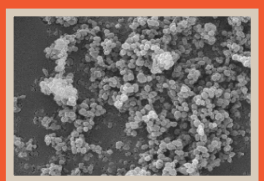

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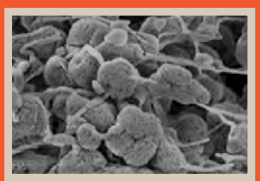

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Polyvisions to use Nofia FR

US compounder Polyvisions is to use Nofia polyphosphonate flame retardants from FRX Innovations in its high performance DuraPET 624 FR and DuraPET PCR FR products, which are used in a range of demanding applications including electronic equipment and medical components.

DuraPET 624 FR is a graft modified PET material that carries a UL V0 listing for flame retardancy while maintaining high impact and wear characteristics and excellent chemical resistance.

DuraPET PCR FR is graft PET copolymer formulation made with up to 92% post-consumer recycled PET.

› **www.polyvisions.com**
› **www.frx-innovations.com**

ZF opts for KM's direct compounding system

Automotive components group ZF has invested in a Direct Compounding Injection Moulding (DCIM) system for its manufacturing plant at Vigo in Spain.

Launched at the K show, DCIM is the latest evolution of KraussMaffei's Injection Moulding Compounder (IMC) system. While the original ICM system linked a twin screw compounder with an injection moulding machine, the new DCIM variant uses an intermittently operating 30 L/D single screw unit.

According to KM, the ICM system allows the moulder to compound virgin and recycled resins with fibres, fillers and additives to create custom fromulations at the machine. It is said to be able to handle low and medium viscosity resins, as well as bio-based fillers. The company says the technology is most suitable for production of parts with shot weights in the 50-2,000g range and cycle times of more than 20s.


IMAGE: KRAUSSMAFFEI

Above: The ZF Vigo team in front of the new IMC direct compounding system

According to ZF Core Engineer Plastics Achim Härtel, a key attraction of the ICM system is the energy savings and CO_2 emission reduction resulting from combining compounding and moulding in one step, which also minimises thermal polymer degradation.

› **www.kraussmaffei.com**

LyondellBasell invests in chemical recycling

LyondellBasell is to build a chemical recycling plant at its site in Wesseling, Germany. Using its proprietary MoReTec technology, the commercial scale plant will convert pre-treated plastic waste into feedstock for new plastic production.

"Progressing our MoReTec technology represents another step LyondellBasell is making to accelerate the development and implementation of scalable sustainable and circular technology," said Yvonne van der Laan, LyondellBasell Executive Vice President, Circular and Low Carbon Solutions.


IMAGE: LYONDELLBASELL

Left: MoReTec chemical recycling technology to be used at Wesseling

"This high yield, differential technology will allow us to convert plastic waste into pyrolysis oil and pyrolysis gas for use in our crackers as feedstock leading to the production of new plastic materials," van der Laan said. "Solid process residues can be re-used or consumed in other applications, making this technology an energy efficient, zero waste process for the recycling of plastic waste."

Start-up is planned for the end of 2025 with a capacity of 50,000 tonnes/yr.

› **www.lyondellbasell.com**

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GCR opens new tech centre

GCR Group has opened a dedicated R&D centre at La Bisbal del Penedés, near Tarragona in Spain, where it plans to develop circular and low carbon emission polymer-based compounds.

The company plans to invest up to €100m in the 2,000m² "Innovation Hub" by 2025. It said it will provide a new focused location for its technical specialists and will be equipped to take projects from inception, through development and on to pilot and final production.

"We firmly believe that we have the capability, agility and vision to accelerate the circular economy," says Santiago Sans, Innovation Director at GCR. "Through this investment, we demonstrate our belief in collaboration with like-minded partners in the value chain."

GCR's product line already includes some low carbon footprint products. Its Ciclic R-polyolefins are based on 'up-cycling' of traceable waste streams and are claimed to deliver similar properties to virgin plastics with 60-80% lower carbon footprint; Granic mineral-filled masterbatches and compounds offer up to a 30% reduction in proces energy cost.

› **www.gcrplasticsolutions.com**

IMAGE: GCR

Above: GCR plans to invest €100m in its new Innovation Hub by 2025

Covestro recycling with Hasco

Covestro is partnering with Chinese automotive lighting supplier Hasco to establish a closed-loop recycling path for PC.

Under the agreement, the company will link up with other partners in the recycling sector to collect used plastics from Hasco before turning them into high-quality PIR PC and PC blends.

"This collaboration, which allows full transparency and traceability along the value chain, will ensure the supply of consistently high-quality PIR plastics to meet the growing demands for more sustainable materials and lower emissions in the automotive industry," said Lily Wang, Head of the Engineering Plastics segment at Covestro in China.

› **www.covestro.com**

Bolder advances in Antwerp

Bolder Industries – the circular solutions provider for reclaiming products, including carbon black, from used tyres – has taken a step forward in its plans to establish its first EU facility at Antwerp in Belgium with the announcement of a partnership with Antea Group, Cyclops, and OSQB

IMAGE: SHUTTERSTOCK

The company plans to establish three reactors on a site in the NextGen District of the Port of Antwerp to process more than 3m end-of-life tyres a year to its BolderBlack carbon black and BolderOil materials. Commercial operations are set to begin in 2024.

"The Bolder Industries Antwerp location is changing the game for our international clients," said Bolder Industries Founder and CEO, Tony Wibbeler. "Once operational, we can more easily serve our customers and expand our delivery to major markets, including EU-based tyre manufacturers."

The company claims its technology can reuse up to 98% of each tyre and, compared to traditional carbon black production, generates up to 98% less CO_2 emissions.

› **www.bolderindustries.com**

Evonik extends in plasticisers

Evonik has signed a memorandum of understanding with Czech chemical company DEZA for production of a new plasticiser product – tri-isononyl trimellitate (TINTM) – under a tolling arrangement.

The new TINTM plasticiser will be launched at the beginning of next year under the brand name Elatur TM. According to Evonik, it is characterised by high temperature resistance, low volatility and low migration, properties that are said to make it a good choice for high-temperature cables and for automotive interiors.

The introduction of the new TINTM product follows Evonik's launch at the beginning of this year of its latest-generation Elatur DINCD plasticiser for fabrics, membranes and floor coverings.

› **www.evonik.com**

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AMI's latest US plastics expos hit record visitor numbers

The Plastics World Expos – which include the Compounding World Expo, Plastics Recycling World Expo, Plastics Extrusion World Expo and Polymer Testing World Expos and are organised by *Compounding World* publisher AMI – attracted record numbers of exhibitors and visitors for their third edition in Cleveland, OH, US, last month.

"We were delighted to welcome over 300 exhibitors and more than 4,600 attendees to this year's exhibitions, representing year-on-year increases of 36% and 53% respectively," said Kelly DeFino, Exhibition Sales Manager at AMI. "The numbers were also well ahead of our pre-pandemic launch expos in 2019, showing a strong return to live events and an enthusiasm for doing business face-to-face."

The five conference theatres hosted more than 100 speakers and proved once again to be a major attraction for visitors, with standing-room only for some talks and panel discussions. The evening networking party also proved very popular, with more than 450 people joining in the fun and games at the Punch Bowl Social Cleveland.

Visitors welcomed the information exchange and collaboration that the expos encouraged. Daniel Mata, Process Engineer at flooring manufacturer Mohawk Industries, said: "I would definitely like to come back. I think it's a great opportunity for anyone and everyone that would like to learn. There's a lot of information here."

IMAGE: AMI

Above: The US Plastics World Expos attracted more than 4,600 attendees over two days

Manfred Hackl, CEO of the Erema Group, highlighted the attraction of the complementary nature of the focused expos. "The combination of recycling, compounding, analytics and extrusion is the high value of the show," he said.

Exhibitors were also pleased with the size and quality of the audience. Slayton Altenburg, Application Specialist at TPEI, said: "The show is super well attended, and the quality of conversations has been great." Christian Tittensor, Director of Sales and Marketing at Zeppelin, said: "It's really important for people to attend these kinds of expos to get face-to-face. We've had a lot of success here." And Jim Norris, Market Manager at Palmer Holland, said: "Our audience is here… We find a tremendous reach at this expo."

The AMI Plastics World Expos move to Europe for the next edition, which takes place in Essen, Germany on 14-15 June 2023, and return to Cleveland in the US on 15-16 November 2023.

› **www.ami.international/exhibitions**

Celanese completes DuPont polymer deal

Global chemical and specialty materials company Celanese has completed its acquisition, announced back in February 2022, of the bulk of the Mobility & Materials (M&M) business of DuPont.

The move provides the company with a portfolio of speciality materials including PA6, PA66, speciality PAs such as HPPA, PET, PBT and thermoplastic elastomers. It includes the Zytel, Rynite, Crastin and Hytrel brands, and a global production network of 29 facilities.

"We are excited to welcome the M&M team to Celanese and I want to thank the teams that worked diligently to successfully close this acquisition," said CEO Lori Ryerkerk.

DuPont's Delrin POM business, Auto Adhesives, Multibase additives, and Tedlar PVF products were not included in the Celanese acquisition.

› **www.mobility-materials.com**

› **www.celanese.com**

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IMAGE: BASF

Innovation in both halogenated and halogen-free free flame retardants aims to maximise performance while limiting health and environmental issues, writes Peter Mapleston

Flame retardant focus turns to green gains

Producers and users of flame retardants for plastics of all types share the same goal: achieving the best possible performance with the lowest risk of harm to health, safety, and the planet. They don't all agree on the path to get there, though, and the debate on the pros and cons of halogenated and non-halogenated flame retardants continues. It is clear that interest in non-halogenated chemistries remains high, and the rate of development of all sorts of halogen-free systems continues at pace.

Clariant is expanding its Exolit OP 14XX range of phosphinate-based flame retardants. Two new grades – Exolit OP 1466 (for PA6 and PA6T) and Exolit OP 1480 (for PA66) – are blends containing new nitrogen/phosphorus-based synergist formulations and are aimed principally at applications in unattended electrical appliances. They make it possible to produce compounds that not only achieve UL94 V-0 at thin wall sections, but which also meet particularly tough requirements in glow wire tests (GWIT). The company says this makes it possible to use the same FR compounds for appliances sold in different regional markets.

Sebastian Hörold, Head of Technical Service Thermoplastics and Market Manager Flame Retardants at the company, says that, until now, in most applications, it has not been possible for components for household appliances moulded in HFFR PA compounds to pass the GWIT test according to IEC 60695-2-11 at 750°C. "Brominated flame retardants have been used in these applications, but many customers would like to go halogen-free," he says.

One driving force pushing the market to change has been proposed –and contentious – restrictions

Main image: Whatever flame retardant chemistry and technology is employed, the focus of current developments remains on achieving maximum safety with minimum risk

IMAGE: CLARIANT

Right: China is an increasingly important market for flame retardant producers and construction is well advanced at Clariant's Daya Bay flame retardant plant, shown here, which opens next year

tabled in Canada on the use of decabromodiphenyl ethane, (DBDPE). A prohibition order is targeted for publication in early 2023 (it would contain various exceptions). DBPDE should not be confused with decabromodiphenyl ether (decaBDE), which has already been phased out in many regions.

The new grades of Exolit are already registered under REACH in the European Union and are currently being registered in China and under TOSCA in the US. "Exolit OP 14XX types are now a preferred solution in terms of performance and sustainability profile," says Hörold. For pure performance, Exolit OP 13XX technologies lead, which means that Exolit OP 13XX grades can be used in lower doses, making them more cost efficient. Clariant has added to this range too, with the introduction of Exolit OP 1380. This also contains a new synergist and is suitable for use with PA6 and 66.

Clariant is now planning new Exolit grades for PBT compounds intended for e-mobility applications. Some of the development work will be carried out at its new technical centre in Shanghai, which opened in April this year.

New options for PA

New to the **Lanxess** flame retardant product line is Emerald Innovation NH 500, a phosphorus-based non-halogen flame retardant intended primarily for use in glass fibre-reinforced polyamides (PA66 in particular) used in for electrical and electronics applications. The new grade, which will first be applied for PA6 and PA66, is now in large scale pilot production and the company says feedback has been good. Customers will have to wait until 2026 before it is fully available, however.

Emerald Innovation NH500 is pitched at the same types of applications as Clariant's Exolit OP products, but Lanxess says its chemistry is completely different. For now, though, the company is not disclosing exactly what chemistry it is using.

The new additive is said to exhibit very good flame retardant properties in combination with other additives and to easily meet relevant fire safety tests. For example, a glass fibre-reinforced PA66 formulated with Emerald Innovation NH 500 passed the UL 94 fire test with a V-0 classification at 0.8 mm thickness. "In glow-wire testing, the highest intended glow-wire flammability Index (GWFI) of 960°C is achieved without difficulty by a specimen of 3 mm thickness," the company says. "The glow-wire ignition temperature (GWIT) was measured up to 875°C, which is significantly higher than that of the reference (775°C)."

Lanxess has developed formulations around the new flame retardant with different synergists. "They ensure that the mechanical properties and other functional characteristics of the end products are maintained," it says (Figure 1). "The combination of very good flame retardant properties and high dimensional stability in engineering thermoplastics, such as PA6 and PA66, offers compounders and processors promising applications."

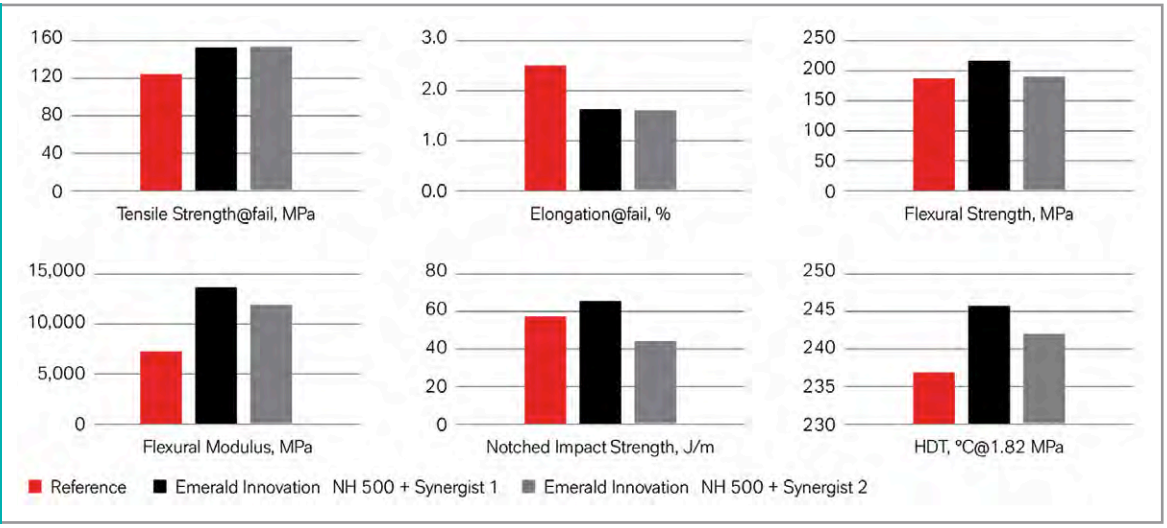

Figure 1: Mechanical properties of glass fibre reinforced PA66 containing combinations of Lanxess's new Emerald Innovation NH 500 flame retardant and different synergists

Source: Lanxess

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IMAGE: LANXESS

Above: Emerald Innovation NH 500 is a new phosphorus-based flame retardant from Lanxess, designed primarily for use in glass fibre-reinforced PA66

Extending in electronics

The latest development from **FRX Innovations** – which has developed HFFRs based on phosphonates and polyphosphonates for various polyesters (including polycarbonate) and polyurethanes – is a new Nofia product line that it says extends the performance of its copolymer flame retardants in to the consumer electronics and appliance industries. Nofia CO6010-EX is the first in this family.

The company says Nofia CO6010-EX – which removes the need to dry the polymer before processing – targets a growing need for polycarbonates and PC/ABS and PC/ASA blends in applications where neither brominated flame retardants nor perfluoro butyl sulphonates can be used.

"The exceptional heat distortion and physical properties of Nofia flame retardants have long been desirable in UL94 V-0 or VTM-0 [for film] formulations, but now processing is simpler, impact resistance is improved, and the new material offers the ability to meet the bluer shades of white required for certain brands of electronic equipment and electrical appliances," the company says.

"Polycarbonate has been a polymer of high interest," according to Marc Lebel, CEO of FRX Innovations. "This is due to restrictions announced in Europe and the US on the future use of brominated FRs in enclosures for TVs and monitors, and the high probability that those restrictions will soon be broadened to enclosures for most indoor electrical equipment."

FRX is developing other products based on technology similar to that used in Nofia CO6010-EX. It says future grades will offer enhanced properties for other polyesters and will present the opportunity for inherently flame-retardant resins with low colour transparency achieving VTM-0 (a

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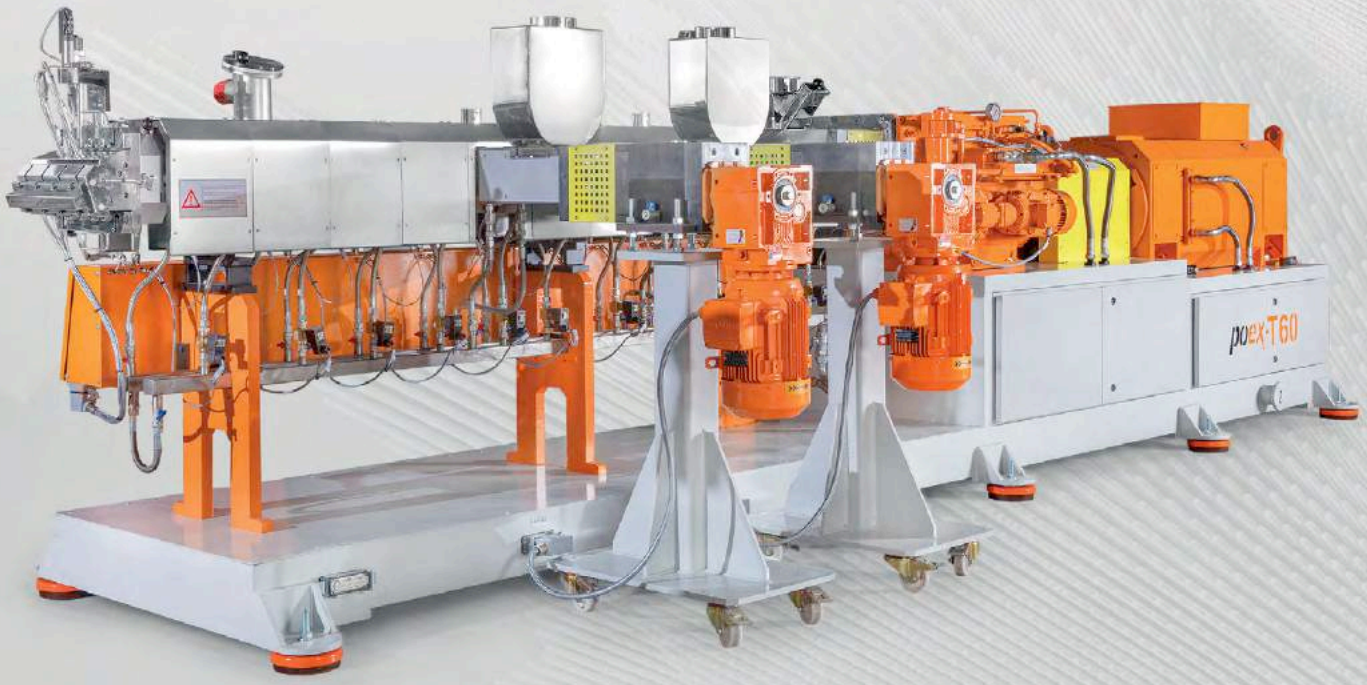

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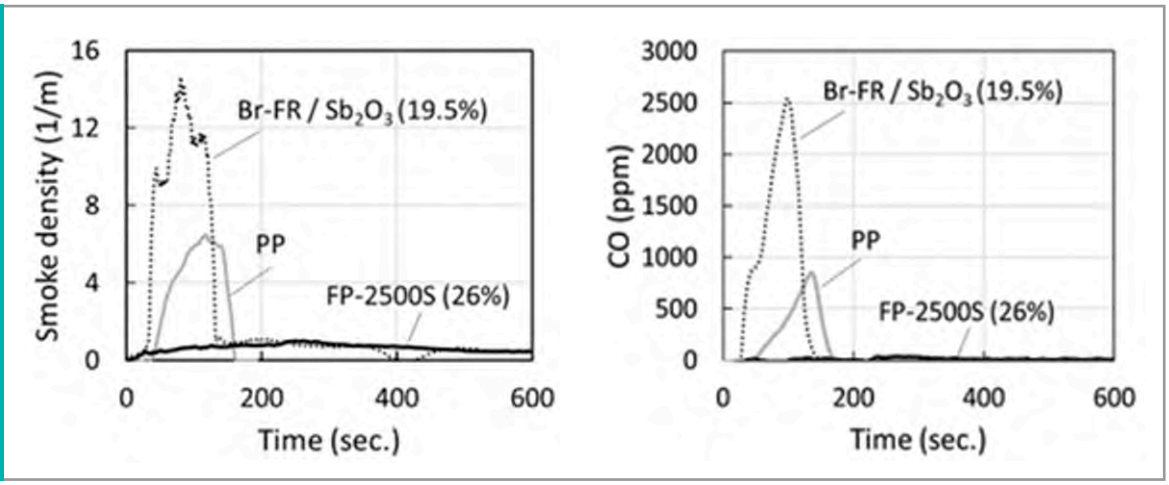

Figure 2: Comparisons of smoke density and OC emissions of different flame retardant PP compounds using Adeka's ADK Stab and conventional flame retardant systems

Source: Adeka

classification used for films) at 0.075mm.

Mike Goode, Chief Commercial Officer at FRX, says the most common way currently to improve flammability in PC sheet is to use a perfluoro butyl sulphonate (KPFBS), which is a so-called forever chemical. "Regulators are focused on the family of PFAS forever chemicals and brand-owners increasingly want KPFBS to be removed," he says. "Several companies are trying the new formulations, with some already at customer trials. Nofia CO 6000 is the main recommendation together with the new product Nofia CO 6010 EX, which is mainly intended for white polycarbonate sheets."

Goode also points to the importance of PC/ABS in applications where performance requirements are increasing. He says one driver is ecodesign legislation in the European Union and upcoming restrictions in a number of states in the US, most notably Washington. He says legislation has already passed there banning the use of halogenated flame retardants in enclosures and stands for TVs and monitors.

"There is an opportunity for us in thinwall PC/ABS. It is possible to obtain V-0 at 0.8mm and to do so with an HDT at least 30°C higher," he says. "A lot of components are already in PC/ABS, but there is a growing need for thinner walls."

Goode says FRX also anticipates further growth in flame retardant PET in a variety of applications, including fibres as well as moulded and extruded products for applications in consumer electronics and medical equipment. "There is a general perception that PET is a greener material than other thermoplastics," he says.

Multifunctional gains

Evolution of the Phoslite family of halogen-free flame retardant technology based on inorganic phosphinates continues at **Italmatch Chemicals**. Despite their simple molecular structure, inorganic phosphinates show a relatively complex and multiple mode of action, according to Ugo Zucchelli, Global Sales and Technical Assistance Manager for Plastics Additives. "This peculiar 'multifunctional' feature means that specific synergic additives have to be carefully evaluated to balance the most efficient FR formulations, tailor-made to specific polymer systems," he says.

Phoslite grades have been in use from some years in PP rated V-2, in PC and PC alloys, and more recently in TPU for wire and cable. "The recent challenges represented by electrical vehicle needs has pushed further development of new solutions based on Phoslite," Zucchelli says.

Halogen-free formulations are now available for various glass fibre reinforced polymers. Italmatch says that in PA6 compounds, Phoslite offers a very good balance of high GWIT, resistance to colour change in orange compounds, and low corrosion. The company says a GWIT of 850°C can be achieved at thicknesses lower than 1mm. In glass fibre-reinforced PP compounds, very good electrical properties are maintained in humid environments. PBT compounds can be formulated with a UL94 V-0 rating, high CTI (more than 600V), and resistance to hydrolysis.

Italmatch recently started construction of a second flame retardant line in China, which is a major market for flame retardants for electrical and electronic applications. The new capacity will serve domestic and overseas markets and is expected to start-up in 2023.

Smoke is also a major concern in fire situations and **Adeka** points to the ability of its ADK Stab phosphorus-nitrogen intumescent flame retardants (IFRs) to suppress smoke emissions (Figure 2). "IFRs are very successful as they lead to flame retardancy and smoke suppression while used at a significant lower dosage compared to metal hydroxides," the company claims. ›

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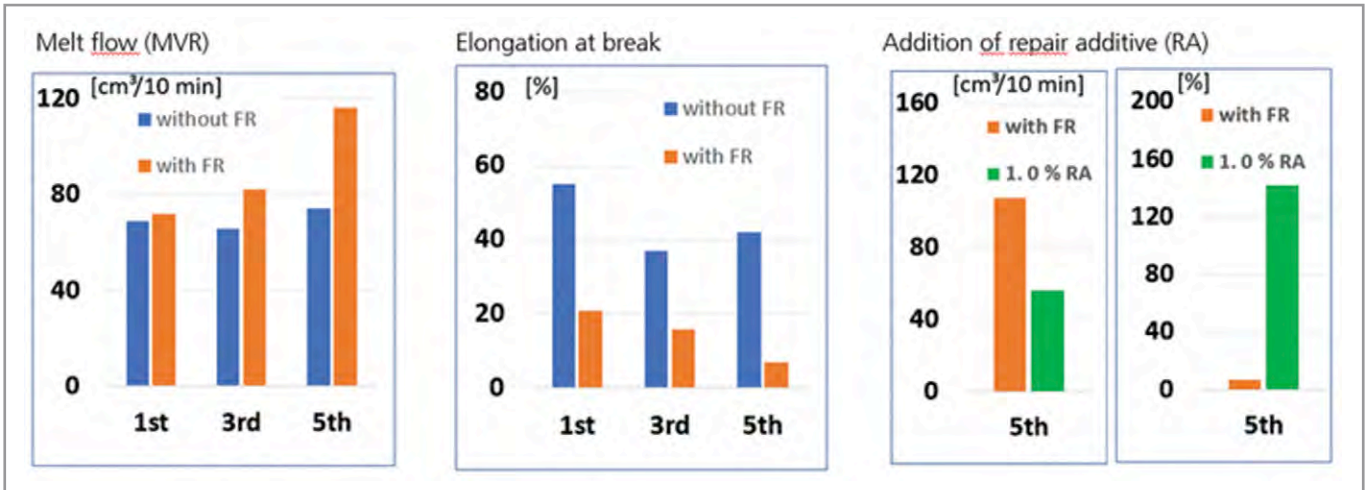

Figure 3: Investigation of upcycling of recycled PA6 compounds containing melamine cyanurate flame retardant
Source: Fraunhofer LBF

ADK Stab FP-2500S is intended for use in polyolefins, where it protects by producing a thermally insulating char that suppresss toxic gas emissions. The company claims that its ADK Stab FP-2000 series is the only functional material to have received the UL Verified mark, which indicates that claims made by the brand owner have been validated by UL. It says that tests carried out according to ISO 5659-2 and EN17084 method 1 specified in the in European standard on fire protection in railway vehicles EN45545 show that PP compounds containing the additive are suitable for railway applications. Tests to ASTM E662 in NFPA130 show that ADK Stab FP-2500S in PP/glass fibre or in LDPE can prevent dripping in the vertical test and allow significant smoke reduction.

Combined expertise

In July **BASF** and **Thor** said they were combining their expertise in non-halogenated flame retardant additives to provide customers with a comprehensive solution that will enhance the sustainability and performance for specific plastic compounds, as well as meeting stringent fire safety requirements.

BASF says the two companies have collaborated for many years in developing solutions to meet the demanding flame retardant specifications, with a focus on alternatives to halogen containing additives. The combined expertise in flame retardant additives will provide customers and end-users with information highlighting the synergistic benefits of BASF's halogen-free flame Flamestab retardant when used with Thor's Aflammit phosphonate-based technologies for polyolefins. It says this is typically a challenging flame resistance application.

Meanwhile, Prof Rudolf Pfaendner at **Fraunhofer LBF** says the German research organisation is tackling development of next generation flame retardants in a couple of applied research projects. Researchers led by Dr Elke Metzsch-Zilligen and Dr Frank Schönberger are addressing megatrends in electromobility and circular economy. "Objectives are optimised flame retarded thermoplastics for high-voltage applications and the reduction of the carbon footprint in FR plastics," he says. "The latter is achieved by novel flame retardants and additive packages for upcycling post-consumer/post-industrial recyclates or by developing new bio-derived flame retardants for both petrochemical and biobased polymers."

In a collaborative project with industrial partners including Clariant, BASF, Brüggemann, and Radici, the fundamentals of high-voltage tracking of flame-retardant engineering thermoplastics are being investigated, Pfaendner says. In another, upcycling of various types of thermoplastic recyclate with commercially available halogen-free flame retardants is being investigated and tailored for specific applications such as cable insulation and E&E housings (Figure 3).

"Although most industrial halogen-free FR formulations show good recyclability in multiple extrusion and aging with regard to maintenance of flame retardancy, loss in mechanical properties can be a challenge," Pfaendner says. "For example, melamine cyanurate flame retarded PA6 shows molecular weight degradation (MVR increase) and consequently significant reduction of elongation at break. By adding a repair additive (1%), mechanical properties can be fully regained together with achieving UL 94 V-0 classification."

Novel flame retardants based on ionic liquids from **Inovia Materials** are now being used in grades of PMMA from compounder **Mocom** that are said to show transparency on a par with that of

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IMAGE: LEHVOSS

Right: Displays of various types are a potential application for PMMA containing Inovia's ionic flame retardants, which do not affect light transmission

unmodified PMMA. The additives are said to have mild or negligible effects on the physical properties of the plastics.

"We are opening up entirely new markets for the application of PMMA," says Eric Möller, Product Specialist at Mocom. "PMMA can be used in all areas where installed electronic components require a higher level of flame retardancy. These could be plastic displays on e-charging stations, in cars or on mobile phones and TV screens."

The FR solution was developed in close cooperation with additive specialists at LuvoAdd, a business team within the **LehVoss Group**, which distributes the Inovia flame retardants. Nadia Kursawe, Global Business Team Manager Masterbatches and Plastic Additives at LehVoss says the specification for the new material was that V-0 should be achieved without discoloration. In the glow wire test according to GWFI at a temperature of 960 °C, the plastic meets requirements with a layer thickness of 2mm.

Clay PA synergists

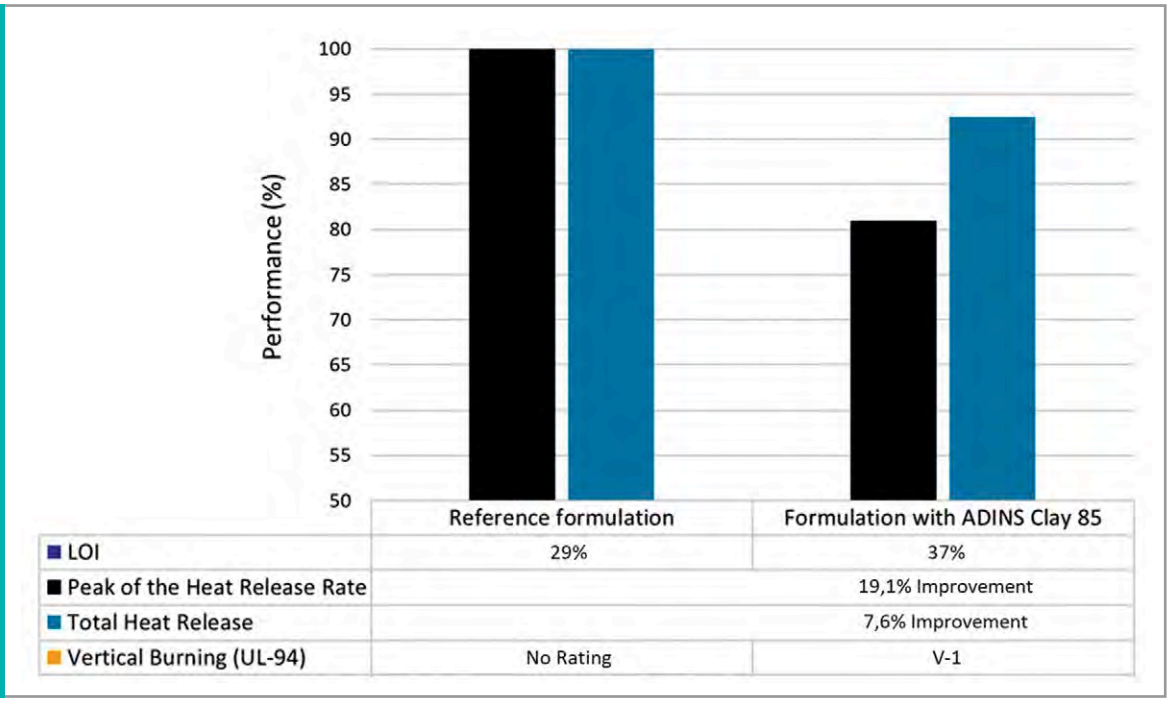
Following two years of testing, **Tolsa** says it has been able to transfer its Adins Clay synergists, which are based on organically modified special silicates, to PA-based applications in electrical and electronics, automotive, textile, and transportation markets. The company reports seeing considerable interest in use of the additives in parts intended for EVs. The latest product in the range is Adins Clay 85 (Figure 4).

Adins Clay products can reduce Total Heat Release (THR) levels by more than 20% compared to competitive additive solutions, Tolsa claims. They work in halogenated and halogen-free flame retardant systems and can be considered as an alternative to antimony trioxide. Grades have already been shown to help reduce or even eliminate the ATO content from formulations based on PVC or PP, for example, when combined with flame retardant systems such as ATH or MDH.

The synergists promote char formation and create a physical barrier, protecting the material and reducing heat and smoke emission as well as volatile organic compounds (VOC). The required dosage is low, ranging from 1 to 5% for commonly used formulations.

Tolsa now also offers its additives in masterbatch form. It has started to commercialise products for different systems within the wire and cable sector, including EVA, TPEs and TPU. ❯

Figure 4: Performance of Adins Clay 85 in PA6 formulations with 15 wt% of phosphinate-based FR



Source: Tolsa

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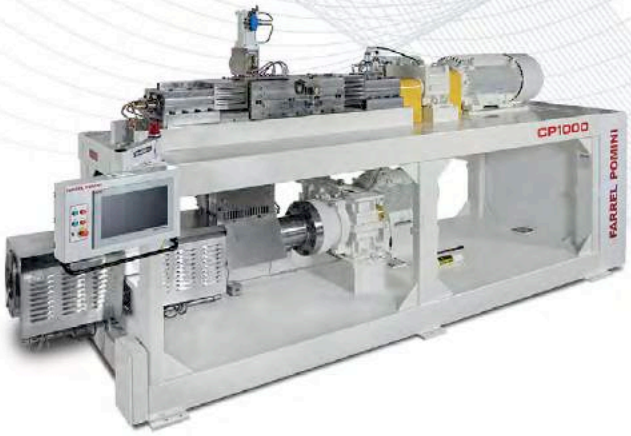

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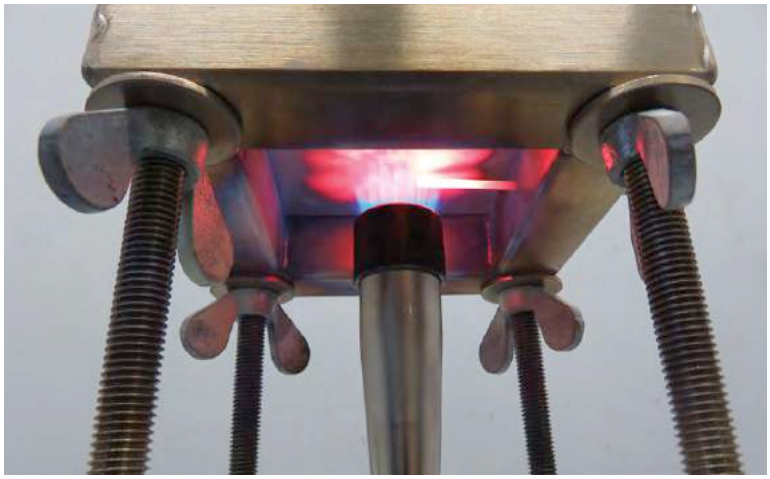

Above and below: Test set up and test plaque for a PP-compound containing 12.5 wt% glass fibre and 65 wt% Actilox HTB PP exposed for 20 minutes to a torch flame test (propane/butane-burner, 1650 W). The test specimen stayed intact (no burn-through) with a closed surface and high structural stability

IMAGE: NABALTEC

Mineral moves

In August of this year, **Imerys** introduced its ImerShield mineral-based synergists, which is says offer an engineered high aspect ratio morphology and chemistry, for use in intumescent FR systems. Michael Schmidt, Technical Service Manager, Plastics, says the company is on the way to developing a full range of ImerShield synergists to cover various polymers.

Imerys says it has initially been exploring how the additives can be used, not only to reduce the required level of the principal flame retardant (with potential to make cost savings) but also to partially replace glass in reinforced flame retardant PA6 and 66 compounds while maintaining fire properties and mechanicals. It says the use of ImerShield can also help in efforts to improve flow length and weld line strength.

Schmidt cites the example of a 30% glass reinforced PA6 in which one third of the glass was replaced by ImerShield and a V-0 rating at 3.6mm was obtained while reducing the phosphinate level from 20 to 15%. "We are exploring more and more opportunities," he says. "We are now also looking at PBT. We are developing several solutions, including combinations with ammonium polyphosphate (APP) for polyolefins."

Imerys also offers engineered minerals for use in flame retardant polyolefins. The company says it is possible to replace 10-15% of metal hydroxides such as ATH and MDH with its talcs and still get the same cone calorimeter results. Mechanical properties of the compound can be improved, heat release rate can be reduced, or the peak heat release rate can be pushed back. Applications include EVA cable compounds.

Another minerals major, **Nabaltec**, points to work it is carrying out to help improve fire safety in cars. The company points out that China already has a safety standard for EV batteries (GB 38031-2020) that includes a thermal propagation test. A key requirement is to ensure a minimum of five minutes escape time for passengers before thermal propagation leads to battery fire or explosion.

Automotive OEMs in Europe and North America, raw material suppliers and independent testing labs are working on their own fire propagation test procedures. "Industry has not yet agreed on a harmonised standard, but a high energy torch flame test will be the core part of it," says a Nabaltec spokesperson. "The test duration is expected to be in the range of 10 to 20 minutes. Nabaltec has developed Actilox HTB mineral-based filler blends which are designed to fulfil such increasingly severe fire propagation tests."

Three new FR products – one for PP, one for PA, and one for unsaturated polyester – will be launched shortly, Nabaltec says. The company will also develop customised formulations with partners.

Flame retardant synergist manufacturer **Paxymer** says its technology works in the condense phase, providing drip suppression for polyolefins and engineering plastics. Company CEO Amit Paul says its Paxymer synergist also increases the gas phase activity of the PN-based additives. "The value proposition includes cost savings and improved mechanical and processing performance in compounding and moulding," he says.

"A key focus during the year has been to expand the use of Paxymer in engineering resins as well as improve our toolkit for comparative evaluation. The toolkit offers us an exciting possibility to do comparative evaluation between formulations that address larger scale testing like for the building and construction industry. It significantly shortens the time to market and increases precision in

developing formulations to pilot."

Graphene is also proving to be an interesting option for improving flame retardance in thermoplastics. Not so long ago, graphene was considered a very exotic material with very high costs to go with it. However, new production technologies are bringing it closer to the mainstream.

Nano innovation

Netherlands-headquartered **MPI Chemie** says when graphene is used in formulations already containing organic flame retardants, the improvement to the flame retardant properties is very promising. "An increase of the Limiting Oxygen Index (LOI) of 9 was observed at one of our customers solely through the addition of graphene. This is a statistically significant finding, but further research needs to be done," says Sales Manager Jochem Krijnen.

"Low dosing, around 1-2% of graphene, could allow for reducing the amount of other FR additives in a compound, thus reducing cost, improving mechanical properties and resulting in a more sustainable solution," he says. "Our graphene sourcing partner, NanoXplore, is the world's largest producer, with a capacity of 4000t/yr, which delivers the economics of scale to allow many commercially viable and cost-effective applications."

A potential downside is that graphene isn't suitable for light and bright coloured applications due to its anthracite colour, Krijnen says. "However, this may serve as a benefit by allowing the reduction or removal of carbon black, which is a hot topic due to the CO_2 footprint that inherently comes with the use of carbon black." CO_2 emissions associated with graphene production are said to be 80% less than those of the same weight of carbon black.

HFFR supplier **Huber Advanced Materials** reports on a development project for flame retardant wire and cable compounds based on polyolefin elastomers (POEs) that it has conducted in partnership with **ExxonMobil**. This aimed to evaluate ExxonMobil's POEs as a polymer carrier alternative to ethylene-vinyl acetate (EVA) in HFFR formulations.

Huber says use of POE in HFFR formulations requires fine-tuning and higher levels of flame retardant in order to achieve the performance typical of EVA-based HFFR W&C formulations. The

project involved determining how much extra FR material (ATH) was required when replacing an EVA with a 28% VA content (Escorene UL00328) with a POE (Exact 5371), as well as optimisation of the POE-based formulations.

While a compound based on EVA with 28% VA content would typically require 60% (160phr) ATH (Martinal OL-104 LEO) it was possible to achieve comparable flame retardant performance from a compound based on POE with 68% Martinal OL-104 LEO (220phr) or 66% (200phr) of a finer grade, Martinal OL-111 LE. Higher values of elongation were achieved with the POE formulations, despite higher loadings of the flame retardant, says Huber.

Further benefits from the POE compounds included lower water uptake and much lower smoke production. Lower values of tensile strength, hot knife behaviour and melt flow were countered by adding LLDPE to the formulation. And as the density of POE is less than EVA, the required higher loadings of flame retardant could be achieved while keeping compound density at an "appropriate" level, according to Huber.

One of the most interesting potential customer benefits of using the POE/Martinal OL-104 LEO combination is in the opportunity to reduce material costs for HFFR compounds. Gains in the the range of around 10% are possible driven by the higher FR loading than in the reference compound, Huber says.

Norwegian start-up **Bioenvision** has developed flame retardants for various thermoplastics based on POSS (polyhedral oligomeric silsesquioxane) technology. The company describes POSS additives as organic/inorganic hybrid polymers that have the potential to improve product performance without sacrificing mechanical properties.

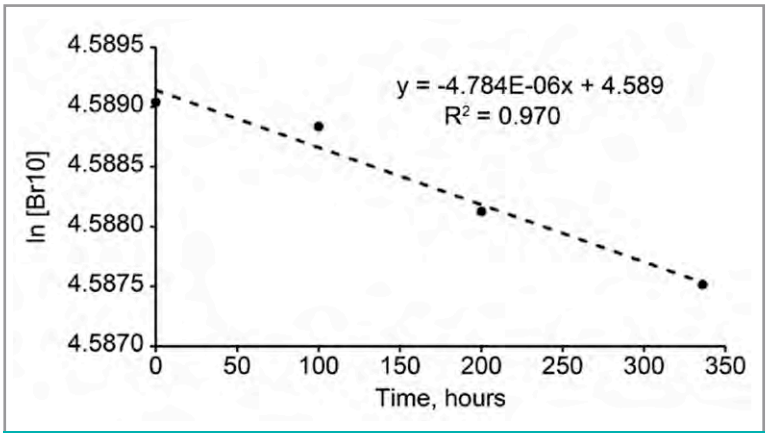

Figure 5: UV photolysis of EBP in HIPS using a Xenon lamp (to mimic aging due to solar exposure under ca. 13-fold accelerated conditions) showed no formation of lower brominated species of concern and very slow loss of bromine (estimated half-life more than 200 years)
Source: Albemarle

Bioenvision markets its POSS-based flame retardants as D-Pyre. It is the holding company of Funzionano, originally part of Norway's SINTEF research institution, which developed a nanotechnology platform for flame retardants, water repellents, and barrier materials over a period of more than 15 years.

Results presented at AMI Fire Resistance in Plastics conferences have shown D-Pyre can improve performance of diverse polymers such as PVC, PP and PUR foam, reducing dripping and cutting the time to flame extinguishing of PP in the UL94 test, for example. Required dosages are low – typically between 0.6 and 1.7% – and when used in combination with other flame retardants such as ATO or ATH they can reduce the required amount of the FR by as much as 30%.

Investigating halogens

Fire retardant research, innovation and product development is not limited to halogen-free chemistry. Fire retardant producer **Albemarle** continues its strong Advocacy and Product Stewardship programme in brominated flame retardants, investing in new analytical instrumentation, including a high-resolution LC mass spectrometer, to address questions from regulatory agencies. For example, it recently published a study on photolytic performance of ethane-bis(pentabromophenyl) (EBP), which it produces and markets as Saytex 8010.

The company says this accelerated weatherometry study conclusively showed that in HIPS, a commonly used resin for electronic enclosures, the EBP molecule has a much slower loss of a single bromine atom. The estimated half-life is more than 200 years (Figure 5), whereas the half-life of the decabromodiphenyl ether (decaBDE) molecule can be measured in days.

"More importantly, no further loss of bromine atoms to smaller molecules of concern occurred. In polypropylene (PP), there was no observed loss of bromine, even though the FR loading is nearly twice that in HIPS. The key takeaway of this study was that a read-across comparison from DecaBDE is misleading and that EBP is a safe polymer additive," it says.

"Albemarle continues to advocate for a data-based approach in determining the health and environmental impact of any material. We know structural differences matter, and that they affect chemistry and performance. Over-generalisation by putting all molecules into one class is inappropriate," says Bob Miller, VP of Product Stewardship.

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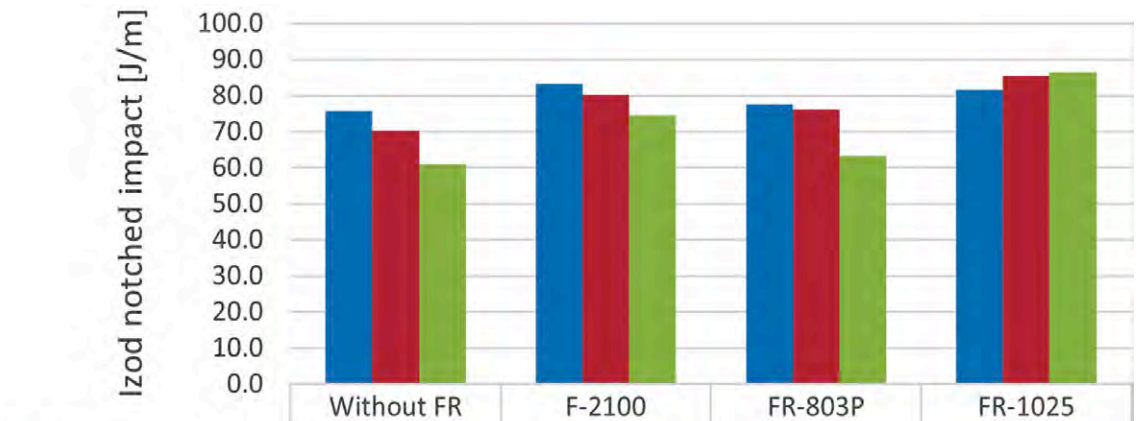

	Without FR	F-2100	FR-803P	FR-1025
Izod Impact, 3.2 mm	75.8	83.2	77.6	81.6
Izod Impact, 1,6 mm	70.2	80.2	76.1	85.4
Izod Impact, 0.8 mm	61.0	74.5	63.2	86.5

Figure 6: Impact strength as a function of sample thickness in 30% glass fibre-reinforced PBT compounds containing different brominated flame retardants

Source: ICL

as the one on EBP photolysis, and others on thermal and hydrolytic stability, compatibility and non-blooming performance, and recyclability, to promote the benefits of brominated FRs to key stakeholders, including regulatory agencies, customers and consumers. The new generation of BFRs have been extensively studied and are safe and sustainable polymer additives."

At **ICL**, another leader in brominated FRs (as well as an important supplier of phosphorus-based compounds), Sustainability Director Lein Tange says the carbon footprint of its BFRs is roughly half that of competing phosphorus-containing types, since the company obtains its bromine from the Dead Sea in what he says is a clean and energy-efficient process.

Polymeric gains

The trend continues towards polymeric flame retardants (and, to a lesser extent, reactive types), Tange says, citing ICL's polymeric flame retardant FR-122P block copolymer of polystyrene and brominated polybutadiene for expanded polystyrene thermal insulation, as well as FR-1025 brominated PMMA for various types of engineering thermoplastics and styrenic copolymers, where it provides extra advantages in terms of processability, thermal stability, and also impact properties.

ICL has recently carried out work to explore the effect of sample thickness on Izod impact strength in 30% glass fibre reinforced PBT compounds containing different brominated FRs. All formulations were rated V-0 at 0.8 mm and 0.4 mm. Three different ICL BFRs were used in this work, containing 8% bromine and 5% ATO: FR-1025, FR-803P (a brominated polystyrene), and F-2100 (a brominated epoxy). Results showed that all three BFRs improved compound impact strength. With FR-1025, the effect increased in thinner samples (Figure 6).

The same observation was found in the Falling Dart (Gardner) Impact test with 3.2 mm and 1.6 mm samples, with FR-1025 again producing the best results. "These findings are in-line with reports from ICL customers who claim that especially with thin-walled products there is a significant advantage for using FR-1025 over other flame retardants available in the market," says Eyal Eden, Plastic Lab and Technical Support Manager at ICL.

CLICK ON THE LINKS FOR MORE INFORMATION:

- **www.clariant.com**
- **www.lanxess.com**
- **www.frx-innovations.com**
- **www.italmatch.com**
- **www.adeka.co.jp**
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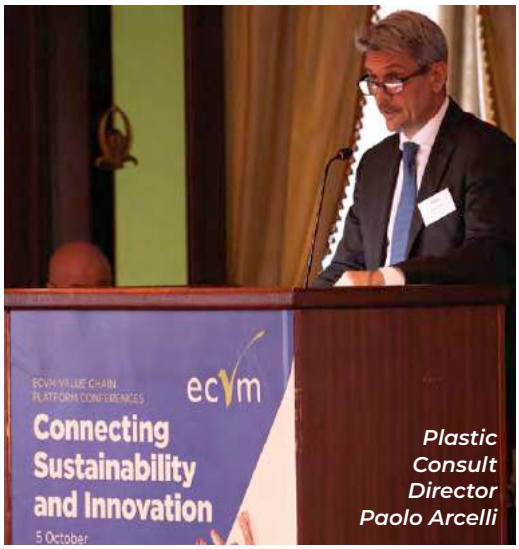
- **https://mpi.eu/chemie/**
- **www.hubermaterials.com**
- **www.exxonmobil.com**
- **https://bioenvision.no/**
- **www.albemarle.com**
- **www.icl-ip.com**

Some 140 members Europe's PVC cable supply chain attended the third PVC4cables conference in Bologna, Italy, in October



Plastic Consult Director Paolo Arcelli

PVC4Cables conference sees sustainable future for cables

PVC is over 100 years old, but its potential for growth endures in durable applications. That was the message delivered to some 140 members of the European supply chain at the third PVC4cables conference, which was held on 5 October in Bologna, Italy. Organized by ECVM, the European Council of Vinyl Manufacturers, the event covered sustainability and the importance of using science-based standards to ensure a level playing field for all materials used in cable insulation and coverings.

According to Paolo Arcelli, Director of Milan-based consultant Plastic Consult, new opportunities for PVC cables are tied to the development of low voltage applications, where they remain the preferred solution. He said growth will occur in markets such as smart homes and electric vehicles.

One reason for this optimism is new compound formulations that make it possible to produce PVC cables with very low emissions of acid fumes in fires. Gianluca Sarti, Head of R&D at additive developer and producer Reagens, said it is now possible to produce PVC cables with very low emission of acidic smoke and which conform to Class Bca according to the EU Construction Products Regulation 305/11.

Smoke toxicity is a thorny issue. Camillo Cardelli, head of IPool, a spin-off from Italy's National Council of Research (CNR), said acidity provides an inadequate indication of smoke toxicity in fires and has little relevance when considering human safety in fires. Much more important in this context is smoke density, he said. Tests conducted on innovative compounds developed within a PVC4Cables sponsored project have produced excellent results in terms of reduced smoke (reaching Class Bca d0 s1b) as well as low CO emissions (smoke density is closely related to CO levels). IPool has been supporting academic research into new additives for PVC cable compounds and more sustainable PVC plasticisers.

Laura Mazzocchetti, Associate Professor at the Department of Industrial Chemistry at the University of Bologna, highlighted the potential for new PVC formulations containing more sustainable components, including a non-classified FR alternative to antimony trioxide, in charging cables for EVs and showed they compare favourably with alternatives based on TPU.

Speaking in his role as chair of the Sustainable Use of Additives Committee of VinylPlus, Reagens CEO Ettore Nanni presented the Additive Sustainability Footprint (ASF) methodology, which allows users to evaluate and promote the production and sustainable use of PVC additives throughout the entire product life cycle. He said it has been successfully applied in various building and construction applications in Europe, becoming a key element in obtaining the ECVM VinylPlus Product Label.

Recycling is a key element in the sustainability of PVC cables. Daniele Redaelli, Italian Regional Representative of Recovinyl, explained how, thanks to the collection and recycling schemes established within VinylPlus, around 1.5m tonnes of PVC from used cables have been recycled since 2000, with a saving in CO_2 emissions of almost 3m tonnes. He discussed RecoTrace, a data collection system to monitor, verify, and report PVC recycling and uptake in Europe.

Recycling PVC cables, rather than sending them to incinerators or landfill, can bring significant economic benefits, said Alessandro Marangoni, CEO of Althesys. He cited a new Cost-Benefit Analysis (CBA) on cable recycling in France, Germany and Italy. While recent increases in energy costs have reduced the net benefits of recycling versus incineration with energy recovery, the possible future inclusion of incineration in the scope of the EU Emissions Trading Scheme (ETS) could reverse this trend.

For more information visit **www.pvc4cables.org**

PVC4CABLES

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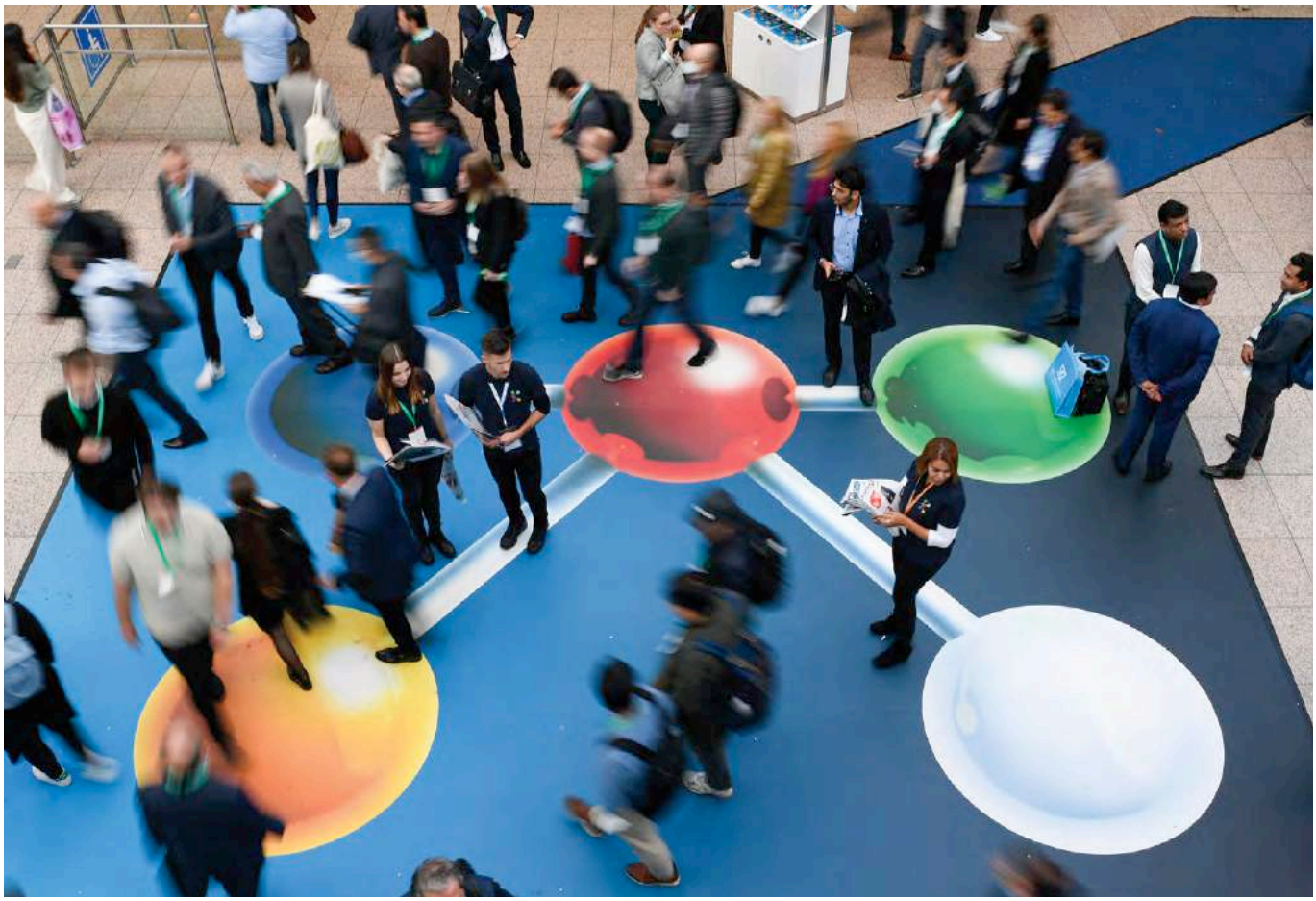

IMAGE: MESSE DUSSELDORF

A few of the 176,000 K2022 attendees make their way across the giant K logo on route to the exhibition halls

K2022 – the show in review

The international plastics industry once again travelled to Dusseldorf in Germany for the triennial K plastics fair in October. The 70th anniversary event brushed aside fears of a post-pandemic hangover, delivering an audience of 176,000 and being labelled a big success by organisers and exhibitors alike.

In last month's **edition** of *Compounding World* we took a look at some of the new business and strategic announcements made during the show. Over the next few pages we follow up with details on a selection of material and machinery introductions of interest to the compounding industry.

And, for the forward-thinkers, a reminder that K2025 is less than three years away. Dates for the next K show have been set for 8-15 October 2025.

› **www.k-online.com**

AGC Chemicals Europe showed the latest addition to its Fluon+ Modifiers functionalised fluoropolymer range, a new series of PTFE additives aimed at modifying the tribology of plastic compounds.

The company said the new grades offer optimised compatibility with matrix materials such as polyphthalamide (PPA) and polyoxymethylene (POM), which means a more uniform dispersion is achievable compared to conventional PTFE micropowders. It also said the usual wear-in period is eliminated.

Tests on a PPA modified with Fluon+ Modifiers PTFE showed a reduction in wear of approximately 70% and a 30% reduction in friction losses, compared to a compound with a conventional PTFE additive. In addition, the functionalised PTFE is said not to measurably affect the mechanical properties of the base polymer.

› **www.agcce.com**

Ampacet showed two new masterbatch products. GasStop-Flex is designed to reduce gas transmission rates in flexible packaging films, particularly optimised structures intended for circular economy-aligned applications. ProVital+ is a medical-grade white and colour masterbatch intended for


IMAGE: ASCEND

Right: Ascend showed its HiDura Med range of medical grade PA66 compounds

use in pharmaceutical packaging, medical devices and in-vitro diagnostic equipment. It is formulated with raw materials pre-tested for European Pharmacopeia and biocompatibility according to ISO 10993 standards.

› **www.ampacet.com**


IMAGE: RÖCHLING

Above: Röchling's BioBoom PLA has been developed with Benvic and BASF for automotive applications

Ascend Performance Materials launched its ReDefyne portfolio of sustainable PAs, which are available with up to 100% pre and post-consumer recycled PA6 or 66 and are said to provide low carbon footprint and high performance.

ReDefyne products are third-party certified and Ascend said it is partnering with ITW Global Fasteners to pilot blockchain traceability through Plastic Finder's Certified Circular Plastic programme.

The company also presented its recently introduced HiDura Med medical grade PA66 resins, which meet ISO 10993-5 and 10993-10 testing criteria and can be used in a variety of healthcare applications, including medical durables, drug delivery system components, surgical instruments, and wound care products.

› **www.ascendmaterials.com**

Bay Plastics Machinery showed improved versions of two of its plastics pelletisers. The AXP (HD) is the latest addition to its A-Series X-Class Pelletiser for medium duty production scenarios.

Offered in 12-inch (300mm) and 16-inch (400mm) cutting widths, the HD series is intended for heavy duty applications and includes larger motor options, easy-adjust push-pull knife holder, and larger diameter rolls and bearings. Options include a gearbox to engage both upper and lower rolls and a rotor coupling drive.

At the other end of the scale, the BT25X is an updated version of the company's Bench Top 25 Lab Series pelletiser. It now uses AC motors and drives and includes the company's Safe Torque Off (STO) function. The new model also offers a broader range of speeds and can be used in batch or continuous modes.

› **www.bayplasticsmachinery.com**

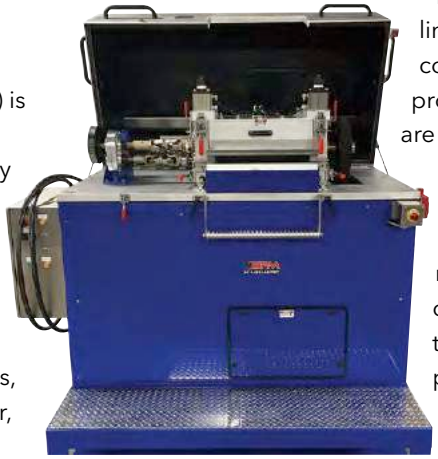
IMAGE: BAY PLASTICS MACHINERY

Right: The AXP (HD) is a heavy duty version of BPM's proven A-Series X-Class pelletiser

Benvic used the show to promote a range of new compounds and applications from its increasingly diversified portfolio.

The company is collaborating with BASF and Röchling to develop automotive components using its Plantura bioplastics compounds that are produced in Italy. The three companies presented their latest advances in a joint presentation on the BASF stand (the company is providing its additive expertise in development of Plantura PLA-based compounds that meet the requirements for the parts produced by Röchling).

A primary aim of the Röchling project is to cut CO_2 emissions – the company claims a 65% saving for a PLA component compared to a PP one of the same weight. It said it has commercialised three car components made from Benvic's Plantura PLA compounds: an engine cover for Stellantis that was previously made in PP; active grille shutters (AGS) for Volvo that were previously made in PP and PA; and another AGS application for the Chinese electric car maker Human Horizons.

For the cables market, Benvic introduced its LinkFlex HF polyolefin compounds, which are designed to meet demands for halogen-free flame-retarded (HFFR) and low-smoke zero-halogen LSZH) products. They comply with the IEC60754-2 standard for low acidity emissions and meet EN 50575 standard classes from ECA up to B2CA.

Produced on new compounding lines in Spain, the LinkFlex HF compounds are said to offer good processability and flexibility. They are aimed at applications such as data communications, fibre-optics and photovoltaics.

Benvic also launched its Dot range of engineered polyolefin compounds at the show. Part of the company's Xtended materials portfolio, the materials are initially aimed at applications in white goods and consumer products. ›

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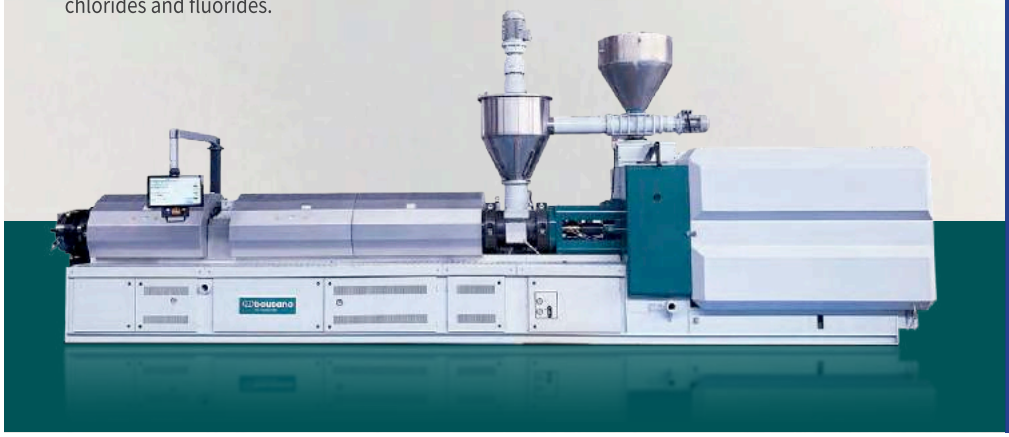
Bausano uses special coating with ceramic properties developed to withstand aggressive environments. The presence of a surface oxide layer makes it suitable for applications in which abrasion, corrosion, cavitation, adhesion and erosion occur, for example during the extrusion and moulding of polymers containing chlorides and fluorides.



Excellent resistance to wear

High corrosion resistance

Low friction coefficient

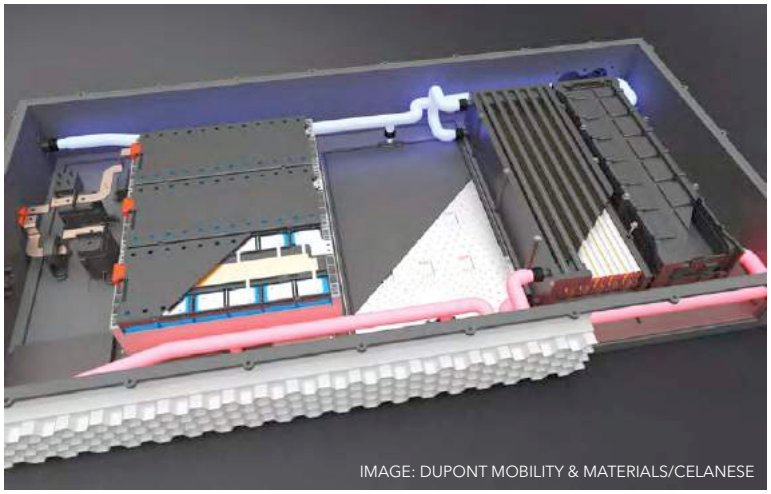


IMAGE: DUPONT MOBILITY & MATERIALS/CELANESE

Below: Novares developed the metal/plastic hybrid cooling plate in this EV battery design using Zytel PA

The Dot range includes four product families. DotCore is a line of engineered and bespoke compounds mostly based on PP. DotFlex products will be based on thermoplastic elastomers, while Dotech compounds are aimed at highly demanding engineering applications. Dot-R products use recycled content.

› **www.benvic.com**

Clariant introduced a new renewable anti-scratch additive for PP and TPC compounds. Licowax AS 100 TP is said to help prevent scratches and mar on the surface of items during handling, transportation, and end-use. It is particularly beneficial for interior automotive parts such as dashboards and door panels, household appliance casings, cosmetics packaging, and lightweight luggage.

The company also introduced AddWorks AGC 970, a new light stabiliser for agricultural PE mulch films, where it offers improved resistance to UV and agrochemicals, amd Licocare RBW 560 TP Vita, a new bio-based additive for injection moulding PET compounds for application in E&E.

RBW 560 TP Vita is said to offer good thermal stability and low volatility. Other benefits include low dosage, good colour stability and easy mould release.

› **www.clariant.com**

Coperion showed C-Beyond, its control platform that bundles its digital products and service applications together, including the new OEE (Overall Equipment Effectiveness) dashboard.

C-Beyond takes data from the company's extruders, compounding machines and other systems to provide a comprehensive digital representation of production via a user-friendly interface. The OEE dashboard provides production managers with an overview of ongoing production performance of individual machines or entire plants at any time.

According to the company, deviations in output and quality can easily be detected on the platform and causes diagnosed more quickly without the need for complex laboratory tests. Live dashboards can be customised by the user to fit their needs, while maintenance concepts based on data analytics, such as predictive or condition-based maintenance, can be implemented.

An enhanced subscription package is offered where specialists analyse the data and benchmark performance. The first customer trials of the service are currently being conducted.

› **www.coperion.com**

DuPont Mobility & Materials, which since 1 November has become part of **Celanese**, showed the first in a new range of PA66 grades formulated to provide improved noise and vibration characteristics in automotive EV applications.

The Zytel NVH70G35HSLA2 grade is a 25% glass reinforced PA66 compound that offers high damping and high frequency vibration isolation along with robust structural properties and extended fatigue resistance.

The company said the grade – the first in the Zytel NVH Gen 2 product series – is cost-efficient, weight-saving, and can be tuned to suit the electric drive units in today's EVs. Already commercialised in North America in an EV motor mount application, it is meeting performance requirements with a 20% weight saving over aluminium.

Remaining in the EV sector, the company also showed a concept hybrid plastic/metal cooling plate it is developing with automotive Tier 1 Novares. Developed at the company's Automotive Electrification Center of Excellence, it uses a patented plastic/metal bonding technology that results in cost savings and better thermal management.

This technology – which can be integrated into the injection moulding process – enables hot plate welding of aluminum to injection-moulded Zytel or Zytel HTN parts, resulting in a bond strong enough to withstand extreme temperatures and chemicals despite the difference in thermal expansion.

The company also marked the 50th anniversary of its Hytrel thermoplastic copolyester, with a focus on this year's introduction of the new Eco B grades, which deliver the performance of standard Hytrel materials but have a biomass content up to 72% by weight. Designed as drop-in solutions, six grades are currently offered with a range of hardness values. The company also launched the Hytrel Eco F grades, which it describes as fossil-fuel based, lower carbon footprint TPC-ET thermoplastic elastomers. They use monomers that deliver global

warming potential (GWP) reductions of 30% or more for a finished part. Target applications include automotive boots and bellows.
› **https://www.mobility-materials.com/**

Eckart launched its Mastersafe BCR line of bio-based aluminum pigment masterbatches, which is claimed to reduce carbon footprint by 50%. Other additions to its line-up included the SynAdd masterbatches for providing matte effects in engineering plastics such as PS, MABS, PC and transparent PA, and the Mastersafe Symic Sahara Blue flop effect pigment.
› **www.eckart.net**

Evonik presented its latest solutions for plastics recycling applications, including processing aids and additives for defoaming, wetting, de-inking, de-labeling and odour control. It also showed its Dynasylan Silfin 301 for halogen free, flame retardant HFFR cable sheathing and water pipe production, Spherilex 30 AB and Sperilex 60 AB antiblocking agents for film production, Tegomer H-Si 6441 P high-performance flame retardants, and Tegomer H-Si 6441 H flow promoter.

On the polymer side, the company focused on its Vestamid eCO E40 sustainable high-performance PA12 polymer. It is produced using renewable energy with 50% of its material content obtained from chemically recycled end-of-life tyres (mass balance). The company said carbon footprint is reduced by 42% compared to traditional Vestamid product.
› **www.evonik.com**

Imerys launched its Pioneer sustainability initiative, which includes its high aspect ratio HAR and Jetfine 3 talcs and focuses on low environmental impact in production and application.

HAR talcs enhance compound stiffness and enabe compounders to downgauge parts while maintaining good impact and scratch performance. They are particularly suitable for production of automotive parts and rigid packaging. Jetfine 3 C talc is an ultrafine engineered mineral solution developed for use with biodegradable and bio-based plastics.

The company also highlighted its €40m investment in talc production in China, which it says will be commissioned early next year. It said the plant will particularly target automotive lightweighting markets, offering regional customers shorter lead times and more favourable cost.
› **www.imerys.com**

KraussMaffei introduced its new Direct Compounding Injection Moulding (DCIM) machine at the K show, which allows moulders to compound their own formulations in-house at the injection unit using recycled or virgin materials.

The company says the single screw DCIM technology is complementary to its current Injection Moulding Compounder (IMC) system, which uses a twin-screw compounding extruder combined with an injection moulding machine. The IMC requires a minimum shot of 2kg for efficient operation; the DCIM solution works with shot weights from 50g to 2kg.

In the DCIM system, a 30:1

IMAGE: KRAUSSMAFFEI

KraussMaffei's new Direct Compounding Injection Moulding (DCIM) system

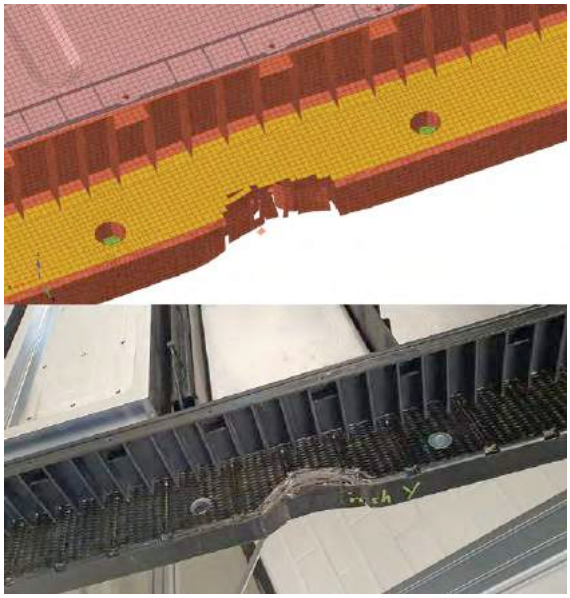


IMAGE: LANXESS

Right: This rugged PA6 battery casing demonstrator has been developed by Lanxess and Kautex Textron and is now at the trial stage

single-screw extruder is installed in a piggyback position directly over the injection unit of an otherwise standard hydraulic injection moulding machine and the compounded melt is conveyed directly into the plasticising unit. The compounding extruder operates intermittently and the one-step process is claimed to trim energy consumption and reduce CO_2 footprint.

At the K show, a DCIM unit was shown on an 1,100 tonne GX 1100-4300 injection press producing a five-piece polyolefin collapsible crate on a 35s cycle using three scrap materials with different viscosities – a PP staple fibre fleece from masks, a shredded HDPE material used in packaging and HDPE blow moulding scraps from toy production – plus masterbatch, stabiliser additives and micaceous iron oxide.

› **www.kraussmaffei.com**

Lanxess launched Emerald Innovation NH 500, a new phosphorus flame retardant for engineering plastics claimed to provide high thermal stability with minimal impact on mechanical properties.

Designed primarily for use in glass fibre-reinforced plastics for electrical and electronics applications, the new flame retardant allows a UL94 V-0 rating at 0.8m to be achieved in glass reinforced PA66. Glow-wire tests show a flammability Index (GWFI) of 960 °C at 3mm thickness.

The company also showed a new EV battery enclosure concept developed in PA6 in conjunction with Kautex Textron. The "near-series" part measures 1,400mm by 1,400mm and is said to pass all mechanical and thermal tests. A prototype is currently being road tested to verify its suitability for daily use. According to Lanxess, the carbon footprint of the plastic enclosure is more than 40% less than an aluminum design.

The part is compression moulded in a compound based on Durethan B24CMH2.0. Crash-relevant areas are reinforced with locally placed blanks made from a PA6-based Tepex continuous fibre reinforced sheet - Dynalite 102-RGUD600.

› **www.lanxess.com**

Maag filled its stand at K with new and updated products from across it businesses. For strand pelletising, the company launched the Primo SI, an updated version of its Primo S with a more open base frame for improved accessibility. The entire cutting head now sits on four vibration dampers and beneath a revised acoustic hood for reduced noise levels. The pelletiser now also boasts Bluetooth connectivity.

Underwater pelletiser developments included the new Pearlo XXL high-capacity systems aimed at polyolefin and large-scale engineering plastics applications with production rates up to 80 tonnes/hour. Special attention has been paid to the water flow, with one tangential inlet and one through the cutter hub – the balance between the two can be adjusted to optimise production. The design ensures that all pellets have a similar residence time in the cutting chamber, while the latter's asymmetric two-piece housing has been designed to provide easy access and start-up.

The new Pearlo XXL takes advantage of die-plate technology from AMN, the French company that Maag acquired in May this year. At K it showed a 1500mm diameter die-plate with a central water injection system designed to improve pellet cooling and ejection. The company said the Central Injection System (CIS) is particularly suited to the high-volume pelletising of high-melt-index materials.

Maag also used the K show to present its

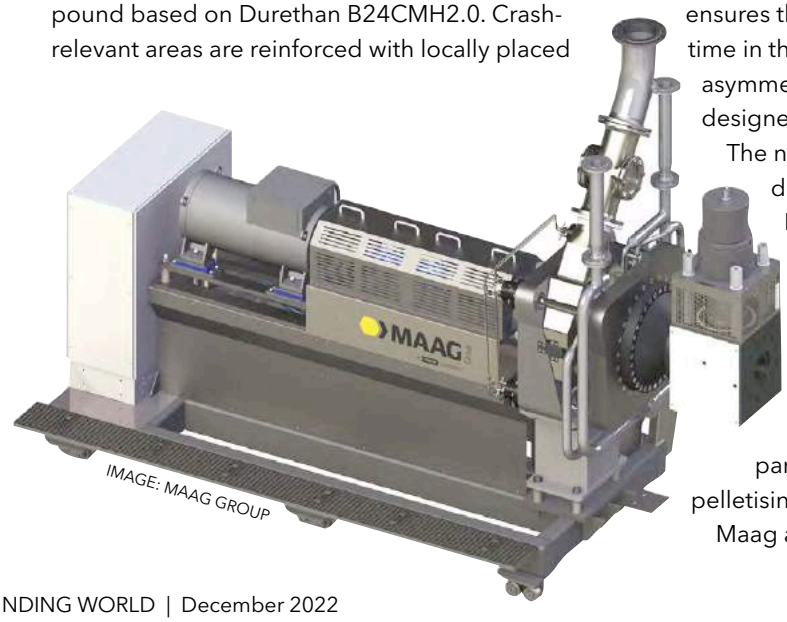


IMAGE: MAAG GROUP

Right: Maag showed the Pearlo XXL, a new high capacity version of its proven Pearlo underwater pelletiser

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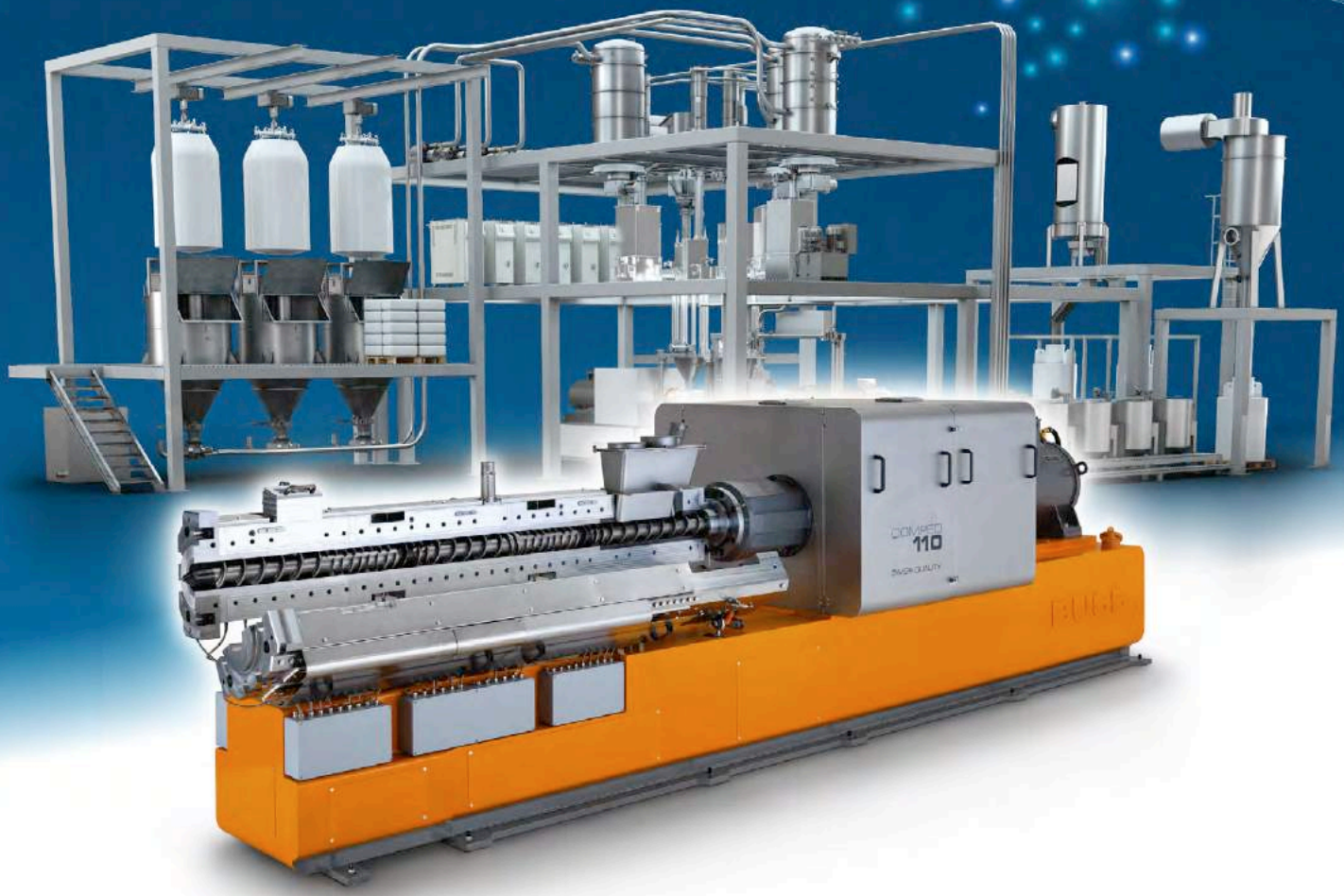

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new eXso centrifugal pellet dryer, which has a reduced footprint plus a three-door housing giving improved access for faster and more effective cleaning. It can handle throughputs up to 8,200 kg/hour.

› **www.maag.com**

Milliken introduced its latest performance colorant for use with engineering polymers. Resist XTR 9798 is a high chromatic orange designed specifically for demanding applications such as high-voltage battery connectors in electric vehicles (EVs).

Customers can formulate the desired RAL 2003 shade using Resist XTR Orange 9798 in multiple high-performance polymers, including PA6, PA66, PA46, PBT, PPA and PSU. The company said it shows good performance and compatibility with other performance additives and fillers, including glass fibres, glass beads, flame retardants (halogen as well as halogen-free), and both short and long-term heat stabilisers.

Offering thermal stability up to 300°C, the new grade meets the colour and performance requirements of both short and long-term thermal stability tests such as 1,000 hours at 120°C.

› **www.milliken.com**

Below: Milliken's latest orange Resist colorant targets demanding EV applications

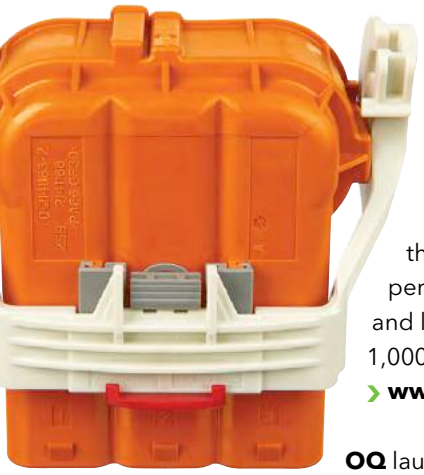

IMAGE: MILLIKEN

OQ launched Luban HP2151T – a high-flow (60MFI) reactor grade PP homopolymer aimed at thin wall injection moulded transparent rigid packaging applications.

The new grade is said to combine high flow with increased top load and stiffness, opening up more opportunities for packaging designers to reduce material use. It also offers a high gloss surface and up to 25% improvement in haze.

IMAGE: OQ

Above: OQ's Luban HP2151T 60MFI PP homopolymer is designed for transparent thin wall packaging applications

IMAGE: SABIC

SABIC focused on its BlueHero programme for low carbon applications such as EVs

According to the company, the new grade requires up to 15% less energy to convert, which can lead to as much as an 8% reduction in CO_2 emissions during moulding, while its nucleation chemistry can help cut cycle times by up to 5%.

The company said the HP2151T grade is the first in a new line of high flow impact and random copolymer products it is developing for thin wall packaging applications.

› **www.oq.com**

SABIC's main theme for the show was its BlueHero initiative, which it describes as an "ecosystem" of materials, solutions and expertise to support moves to electric power and low carbon technologies.

Its initial focus is on polymer solutions for battery pack components and electrical systems for EVs. On its stand it showed a battery module housing developed by Lucid Motors for its Air EV using a flame retardant 20% glass reinforced Lexan PC compound that meets UL94 V-0 requirements at 1.5mm. The part integrates the electrical conductor directly into the housing in a one-shot moulding process that eliminates the need for adhesives, simplifies production, and cuts weight compared to metal designs.

The company also highlighted the potential for the use of plastics in EV front and rear-end panels. It showed a large front panel manufactured by an injection-compression two-shot moulding process using clear Lexan LS PC and a black Cycloy (PC/ABS) for the second shot. It includes integrated lighting and decorative elements.

A structural tailgate carrier produced using a mechanically recycled Stamax resin was also on display. Part of SABIC's TruCircle portfolio of

circular solutions, the company said the material is part of a new line of recycled-content LGF-PP grades offering similar performance to that of their virgin resin equivalents. Three grades are available: Stamax T2E-40YR240, T2E-30YR240 (high stiffness), and T5E-40YR270E (high impact).

› **www.sabic.com**

Schenck Process Control unveiled the latest extension to its Coniq Control system for its Loss-in-Weight feeders.

The new controller combines a modular, web-based design with a simplified intuitive operating interface. Full feeder data is available to the user at any time and from any terminal device. The company says the combination of powerful controller hardware and an optimised control system ensures high dosing accuracy while supporting the use of a range of optional digital add-ons from the Coniq Cloud.

The company also highlighted the use of its loss-in-weight feeders to provide efficient and gentle feeding of sustainable bio-based raw materials and hard-to-recycle plastic flakes.

› **www.schenckprocess.com**

IMAGE: TEKNOR APEX

Above: The latest addition to Teknor Apex's Sarlink TPV line uses post-industrial content

Songwon showed its two latest additive introductions – Songnox 9228 antioxidant and Songsorb 1164 UV stabiliser are said to both be suitable for packaging, agriculture, building and construction, and home and personal care applications.

Songnox 9228 is said to provide very good hydrolytic stability, which overcomes the challenges some traditional high performance phosphites/phosphonites present when being processed in polyolefins at high temperatures. It also offers good colour protection for Cr-type HDPE, PP and

Right: Veolia launched its new PlastiLoop recycled material sourcing initiative

IMAGE: VEOLIA

engineering resins, the company says.

Developed primarily for food contact polyolefins, Songsorb 1164 is a triazine UV stabiliser that is claimed to provide longer service lifetimes than conventional benzotriazole UV absorbers in both polyolefin and engineering plastics.

The company also presented its re-stabilisation solutions for mechanical recycling of post-consumer polyolefins. The company said its Songnox Binary Blends, which contain both primary and secondary antioxidants, have been shown to improve processing and long-term thermal stability.

› **www.songwon.com**

Teknor Apex presented its latest developments in sustainable PCR-containing TPEs – the Monprene RX-CP15100 series – including a grade using waste reprocessed by Israel-based start up UBQ Materials.

UBQ Materials claims to have developed a process that allows unsorted municipal waste – including organics – to be converted to a material suitable for use in plastic compounds.

Teknor Apex is working with UBQ and is using its recovered material (together with PCR plastic) in its Monprene S3 CP-15170 BLK grade, a black 70 Shore A high-flow TPE incorporating 30% sustainable content. It is designed for injection moulding applications or overmoulding onto polypropylene and is said to offer very good haptics. The company said it is the first in a series that will provide hardness values from 55 to 80 Shore A.

Below: Altiris near infrared reflective pigments extend service life of white and coloured plastics

The company also showed the new Sarlink R2 3180B TPV, which is based on the existing Sarlink 3180B product but incorporates 25% PIR content. It said the black grade is essentially equivalent to its virgin counterpart in terms of processing and performance.

› **www.teknorapex.com**

IMAGE: VENATOR

Venator showed the latest additions to its Altiris range of near-infrared TiO_2 pigments, which can improve the thermal stability and durability of plastics and reduce warpage of parts exposed to solar radiation.

Altiris W400 is a near infrared reflecting pigment intended for use with white, bright, and light-coloured plastics used in exterior applications such as window and door profiles, sidings, decking, soffits and fascias. The company's Altiris 550 and 800 grades are intended for use with for mid to dark coloured plastics.

› **www.venatorcorp.com**

Veolia launched its PlastiLoop initiative at the show. It is designed to integrate the capabilities of its 37 global plastic recycling plants – which combined processed more than 470,000 tonnes of material last year – to provide customers with high-performance ready-to-use recycled PET, PP, HDPE, PS, ABS, LDPE, and PC resins.

"The new PlastiLoop offer brings together all our technical and commercial expertise in recycled plastics to provide our customers with the best possible support with customised solutions. It offers the strength of the Group, through its experts and its various recycling plants, to ensure the best access to recycled plastic deposits," said Estelle Brachlianoff, Chief Executive Officer of Veolia .

The company said its circular resins are suitable for use across many sectors – including packaging, automotive, industrial, consumer, and construction – and offer clients a simple way to reduce product carbon footprint without sacrificing quality.

› **www.plastiloop.veolia.com**

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IMAGE: CPM EXTRUSION GROUP

***Jennifer Markarian** speaks to CPM Extrusion's Adam Dreiblatt and Polymer Technology Center's Thomas McHouell to find out how to run an effective lab compounding trial*

Getting the most from your laboratory trials

Laboratory-sized twin-screw extruders are essential for running experiments before moving to larger-sized compounding lines.

Compounders have a number of options available to them: buying their own laboratory-sized equipment to run in-house trials; outsource the task to a lab operated by the extruder manufacturer they plan to buy production-scale equipment from; or use an independent academic or commercial lab.

To learn more about the process of planning and running a lab trial, *Compounding World* spoke to Adam Dreiblatt, Director of Process Technology for extruder manufacturer **CPM Century Extrusion**, and Thomas McHouell, President of the **Polymers Technology Center**, which is a non-profit compounding lab in Charlotte, NC, US.

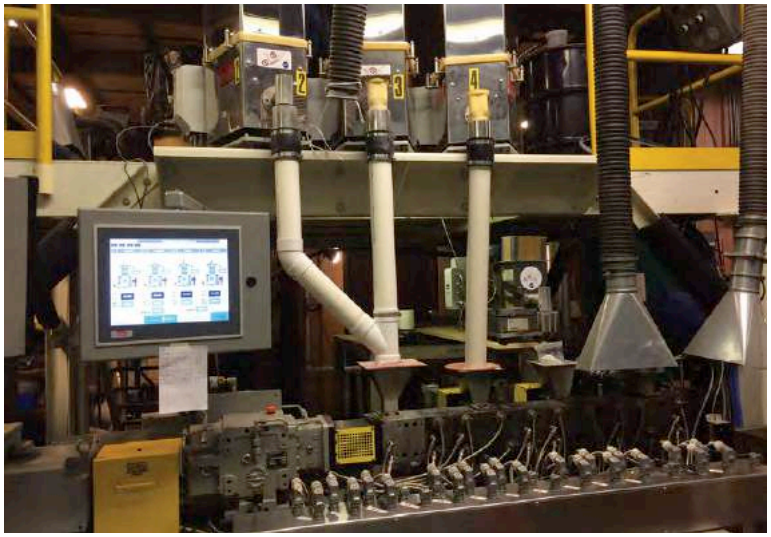
***CW:** What are some of the types of experiments to be run in a compounding trial?*

Dreiblatt: Laboratory compounding trials could be thought of in three categories. In formulation development experiments, a wide range of formulations are produced—typically holding the compounding conditions constant but varying the formulation so that properties can be compared by further testing. Other experiments prepare a particular compound formulation for scale-up to a commercial machine. And some tests look to see if a brand-new material can be compounded at all.

McHouell: Customers may be looking for solutions to materials questions or trying new materials. We've seen a lot of experiments looking at compostable compounds and using all types of biobased fillers.

Main image: CPM's Extrusion Process Technical Centre at Lauffer in Germany is equipped with four extruders plus essential auxiliary equipment for trials

IMAGE: CPM EXTRUSION GROUP



Above: Arranging feeding equipment around small lab-scale machines can present a challenge. This image shows a CPM CXE26 lab compounding extruder with four gravimetric feeders

CW: *What are some best practices for planning a compounding trial?*

McHouell: Communication about the raw materials and the final goals of the experiment are key. Does the mix just need to be distributed evenly? Or is it an additive that needs exfoliation and dispersive mixing? Is the material shear or heat-sensitive? We can draw on our past experience as a starting point for screw design depending on the type of mixing needed, materials being used and the desired final properties of the compound.

Safe handling and properties of the material should be communicated ahead of time. Details are not always available on the safety datasheets. With some liquid additives, one concern could be knowing the flash point in comparison to the processing temperatures needed for the base material. Another question (not related necessarily to safety) is whether we need to be concerned about moisture before or after compounding. For bio-based materials, in particular, how much starting moisture is in the material is critical to know for optimising the process to give us the best chance of success. Also, these materials may be best processed using dry pelletising instead of water cooling to eliminate moisture wicking during this process.

Having the correct feeder for the material is critical for a successful trial. If you know the flow characteristics of the material ahead of time, you can make sure you have the right feeder for the job. You might need a solid-wall feeder with a bridge breaker, a flexible-wall feeder, or a single or twin-screw feeder, as examples. The feeders might need a different augur or pitch to dose the material accurately.

Dreiblatt: The first essential practice is to define clear objectives for the trial—and to put them in writing. The definition of success depends on the type of experiment. If you're working with a brand-new material, you are first trying to find out if it is possible to compound this material at all. The customer should understand that this is a 'trial,' not a demonstration. The result of the trial for a new material may be that the material cannot be compounded as expected.

Another essential is to plan in advance to have the necessary auxiliary and feeding equipment, especially if the materials are not a standard pellet or powder. For example, is a liquid feeder needed, and does it need to be heated to be pumped? Is a screen changer needed? Are the materials free-flowing or are special feeders needed? Just having an extruder is not enough for a successful trial—all the needed pieces of equipment must be available.

The raw material format is an important component to plan and to communicate. The material format shouldn't be a surprise on the day of the trial. We were once surprised to receive a gaylord of whole post-industrial parts as a raw material for a trial. Another time, an additive raw material arrived as a large, solid block of rubber, rather than as granules. Companies requesting trials must remember that an extruder is not a grinder! We have often seen cases where the raw material is too big to feed into an extruder, especially as companies are trying to use recycled materials. Post-industrial recycle material may be ground, but it is often not ground to small enough particle sizes for extrusion. A large production-sized twin-screw extruder (TSE) has a 0.50 inch [12.5mm] channel at the largest, and a laboratory-sized machine might have a 0.25 inch [6.4mm] channel. The smaller the machine, the more the material size will affect the process.

All incoming raw materials should be clearly identified (after non-disclosure agreements are signed, if necessary) with safety datasheets to ensure the safety of those running the process. For example, if materials are flammable, they would require specialised explosion-proof equipment and facilities. The trial plan should also include the disposition of materials after the trial—where they should be shipped, for example.

CW: *What are some best practices for conducting a successful trial?*

Dreiblatt: A successful trial is a symbiotic relationship between the test facility and the customer—the customer should have experience with the material and the process engineer understands the equipment and process. The reality, however, is that many start-ups are doing unique things with materials they've never used before, and so material experience that would be beneficial to the trial is often not available. The customer and process engineer must work together and be

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flexible to revise the plan as the trial progresses.

A typical screw design, given what is known about the trial materials, is a reasonable starting point. Small, lab-sized machines below 30mm are less sensitive to screw design, although on a larger size machine, screw design is more critical. Computer simulations can be useful for helping a process engineer choose an initial screw design and processing conditions based on simulation of similar materials. However, simulation is not a good substitute for an actual trial – getting materials into the extruder in the right proportions is often the most challenging aspect of a trial, and this can't be simulated.

It is important to recognise that extrusion is only the first step – typically the quality of the compound has to be measured after the trial in another lab. You can do an immediate visual check to see if the compound appears to be mixed and not burnt and you may do a quick melt flow test, but other properties—tensile, impact, or long-term stability, for example—are a separate step.

While the trial is running, people can easily take videos and pictures—this can become part of the documentation of the trial. When the trial concludes, it is a best practice to do a verbal debriefing between customer and engineer while the details are fresh in everyone's minds. A formal summary report should then be generated to document the conditions tested, the equipment, and any test results.

CPM Extrusion Group's 26mm CXE-26 and 32mm CXE-32 laboratory twin-screw compounding extruders can be scaled-up directly to production machines. If you're going to very large-scale production (for example, more than 10,000 lb/h [4,500 kg/hr]), it is beneficial to go from lab-scale at less than 100 lb/h [45 kg/h] to a pilot-scale trial at 3000-5000 lb/h [1,350-2,250 kg/h] before going to commercial scale.

McHouell: If a formulation is successful on the lab line, it is a good indication that it can be scaled up to an intermediate size and then to a larger size, if needed. We have a 21mm lab line. Our 27mm line scales easily to our 50mm line; both have the same OD/ID [outer-diameter/inner-diameter] ratios and same downstream pelletising equipment.

Key advice for a successful trial

The client engineer providing the materials and the process engineer running the extruder for the experiments need to work together to make a trial a success. Adam Dreiblatt, Director of Process Technology at **CPM Century Extrusion** advises following these four key communication guidelines:

- Define clear objectives and put them in writing.
- Clarify expectations and define how success will be measured.
- Plan ahead—communicate what types of materials will be used and ensure that appropriate equipment will be available.
- Be flexible—the plan may need to be revised.

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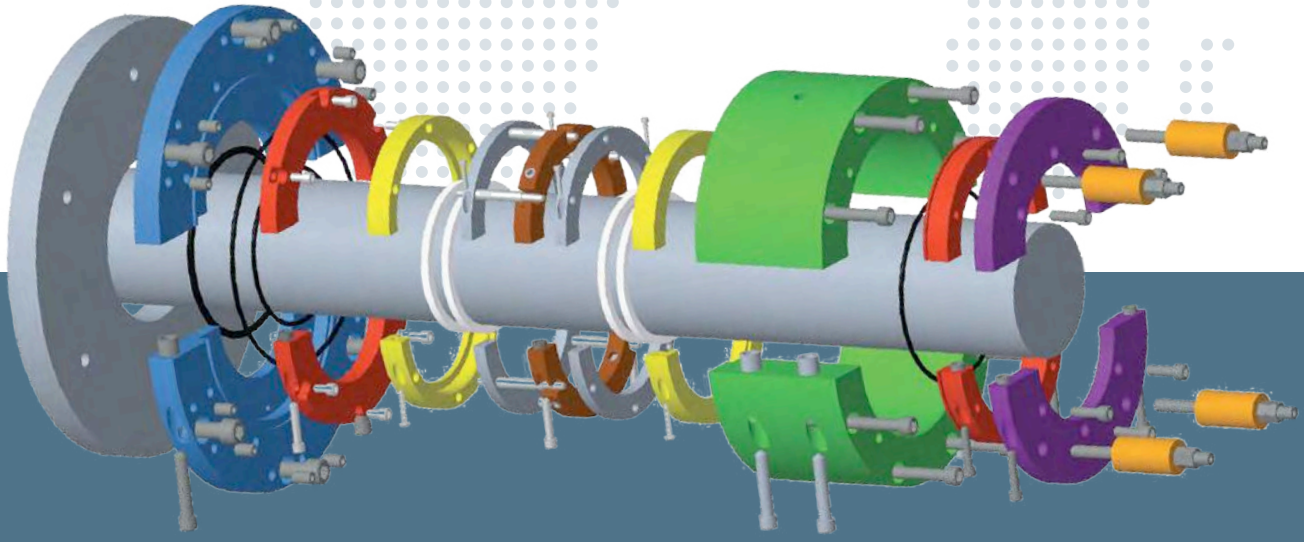

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Lab systems enable new compound development

*Laboratory-scale extruders are the first step in new compound and process development. **Jennifer Markarian** learns more*

As the starting point for many compound and compounding process development projects, laboratory scale compounding extruders are critical items of equipment. And they come in a variety of sizes, extending from what might genuinely be considered to laboratory equipment through to small production units. This article takes a look at some of the latest developments.

IMAGE: BUSS

Main image: The latest addition to the Buss Compeo kneader extruder family is this lab machine, shown with detached twin-screw discharge unit

Brabender, which will mark 100 years of manufacturing instruments and equipment for testing materials in 2023, recently launched its 12mm diameter, 36 D Mini-Compounder B-TSE-A 12/36. The machine is designed for formulation and process development duties or for production of very small quantities.

Like all Brabender extruders, the new model features a clamshell design for easy access and cleanability. "When working with several different compounds in the lab, it is easy to changeover quickly, for example from a high-temperature polymer to a low-temperature polymer," says Shane Harton, North American Sales Manager at Brabender. "You can also switch out the liner and screw and clean it offline, if desired."

The lab extruder attaches directly to Brabender's MetaStation drive unit, which is a modular torque rheometer that directly measures mechanical force to determine torque. Torque measurements are important for determining the process conditions for scaling up to a larger extruder, according to Harton.

In addition, a rheometric capillary die can be added at the extruder output to continuously measure viscosity. Harton says there is increasing interest in this type of real-time, in-line measurement data. He says the capillary rheometer can also be used as a development tool – by varying screw speed and temperature, a plot of viscosity as a function of shear rate can be obtained.

The company's MetaStation 4E (for torque up to 200 NM) and 8E (for torque up to 400 NM) units have been updated from Windows-based software to an open-source, Linux operating system. "A new, intuitive industrial design is used on all the Brabender equipment, so that operators who are familiar with the system can easily operate any equipment," says Harton.

The modular drive can be attached to a twin-screw extruder or to a mixer, for example, and the software has a similar structure for both so it is easy to switch between systems. "For small-scale development, you can use the mixer for quick batches to choose a formula and then scale-up to the 12mm twin-screw extruder to compound pellets," Harton says.

Brabender's next-size larger twin-screw extruder is a stand-alone TwinLab-C20/40, with the newest twin-screw extruder to date the 30mm B-TSE-S 30/40 Big Compounder, which can serve as a transition between the lab and pilot plant. The Big Compounder offers a throughput of 100 kg/hr. It also has a clamshell design and uses the MetaBridge software.

Earlier this year, kneader extruder maker **Buss** introduced a laboratory version of its latest Compeo machine design, offering throughputs of

Right: Brabender's latest lab compounder is design to link to its MetaStation drive with integrated modular torque rheometer

50-100 kg/h. Intended for formulation and process development or for sampling and small scale production batches, the new machine offers all the features of the larger Compeo models, including the combination of two, three and four-flight screw elements, to ensure it can provide reliable scale-up of process parameters to production conditions.

IMAGE: BRABENDER

"The most important requirements for a versatile machine are flexibility in terms of processing conditions, materials use, dosing of small amounts and scalability by means of temperature, throughput, and general processing parameters," says Krischan Jeltsch, Head of Business Development - Innovation & Digitalization.

With demand growing for recycled compounds, **Coperion** is building a new testing centre at its Niederbiegen/Weingarten production site in Germany. The Coperion Recycling Innovation Centre is located close to the company's existing Test Centre for Bulk Solids Handling.

"Companies are asking for higher quality recyclate," says Frank Lechner, General Manager of Process Technology and R&D at Coperion. "Higher quality wasn't as much of a concern in the past for recycled material, but it is dominant today. Quality can be improved by using twin screw compounders or proper material handling or best in combination."

Equipment in the facility will include materials conveying, feeding, extrusion, pelletising, and post-processing. "We want to investigate all parts of the process, including material handling," says Lechner. "For example, post-consumer recycled flakes, fibres and regrind are more difficult to handle than pellets and virgin powder or flake. We will have the capability to store materials in silos with flat bottom discharge, and will have a mixer to homogenise different lots."

The feeding equipment will include Smart Weigh Belt feeders from Coperion K-Tron, and feeders that can handle fluffy, low bulk density material. Extruders in the lab will cover a wide range from 10 kg/h up to 2 tonnes/h. The lines will have capabilities for manual, semi-automatic and fully automated systems and will support scale-up to commercial lines that can run up to 15-20 tonnes/h, according to Lechner.

The centre will use in-line testing to ensure a steady and robust process. Coperion says the intention is to use if for its own research projects and to test new products and processes for customers. It is scheduled to open in the first quarter of 2023.

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IMAGE: SHUTTERSTOCK

Additives take on fakers

*Counterfeit products present a risk to brand value and consumer safety. **Mark Holmes** finds out how taggant technologies are improving supply chain security and traceability*

The need for anti-counterfeiting features in plastic compounds continues to grow. Anti-counterfeiting additives have a clear benefit in providing protection and authentication for high value products and OEM brands across many market sectors. Beyond that, the technologies also provide the option to add traceability features to plastic materials to guarantee their provenance in terms of recycled content and broader circular economy compliance.

"The threats to consumers and international trade from counterfeiting and diversion of plastics are well documented," says Barry McDonogh, Senior Vice-President of Sales and Business Development at **TruTag Technologies**. "The illegitimate production and unauthorised distribution of products continues to threaten consumer safety and result in significant commercial losses. While efforts have been made to counter these threats through secure packaging, more can be done to reduce supply-chain risk and protect consumers by integrating authentication and traceability solutions directly into plastics," he says.

"In addition to counterfeiting, the requirement for traceability of plastics is increasingly being driven by the need to ensure the provenance of materials utilised in the economy," McDonogh adds.

"Taggants have long-provided plastic manufacturers and brands with a secure means of product authentication and traceability. These solutions work by emitting a distinct chemical or spectral signature. Taggants can be incorporated into a masterbatch and extruded into films or applied directly to plastics," he says.

However, McDonogh says traditional taggant solutions are limited by the need to use a proprietary imager for verification. This means only those with those imagers can detect the taggants, and this significantly reduces the potential for authenti-

Main image: The latest anti-counterfeit taggant technologies provide a means to protect brand value as well as enhancing material and product traceability

cation and engagement in the supply chain. "New digital taggants have been developed that address this limitation. These digital taggants can be detected by common cell phones. This means that anyone in the supply chain can interact with products through their smartphones," he says.

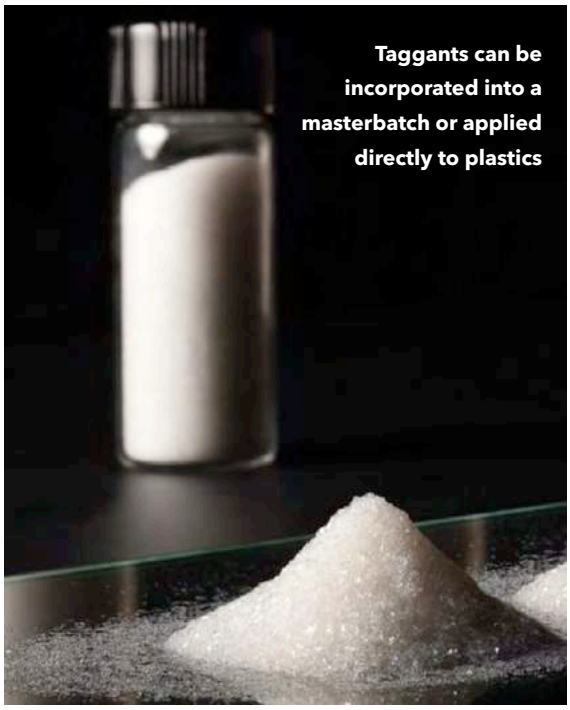
This digitisation offers not only a potential to secure the supply chain but for consumer engagement too, according to McDonogh. Consumers and brands can have immediate visibility of suspect events as they occur in the supply chain. This will enable customers to react in real-time to events that have the potential to impact consumer safety and have significant brand impacts. This can benefit all consumer products, specifically those impacting consumer safety. In addition to the security benefits, digitisation offers the potential for consumer engagement with end products – allowing brands to communicate and sell directly to consumers. This is particularly of importance for medium- to high-value products.

A further benefit is validating the circular economy. Many brands are investing heavily in the use of recycled materials for environmental reasons, says McDonogh. Digitisation provides a means by which the provenance of plastic material can be validated, particularly for high volume recycled plastics. The technology can also assist in warranty situations, for example, with products utilised in industrial applications such as gaskets, where failure can result in significant claims.

The latest developments by TruTag Technologies include a series of products for plastic films – such as PE, PVC, and PTFE, as well as shrink wraps for pharmaceutical and beverage packaging – which combine physical security with digital authentication. "For all technologies in this space, offerings are judged on the basis of a number of criteria," says McDonogh. "All solutions should have a base level of security that is sufficient to deter counterfeiters from targeting a specific product.

IMAGE: TRUUAG TECHNOLOGIES

Right: This TruTag taggant is extruded into a plastic film and can be identified by a cell phone torch light



Taggants can be incorporated into a masterbatch or applied directly to plastics

IMAGE: TRUUAG TECHNOLOGIES

Beyond that, customers are looking for low cost, ease of implementation and a something that can be authenticated on mass."

Global challenges

According to **Circularise**, as supply chains have become increasingly global and complex, the risk of counterfeit products and false claims of the characteristics of products grows. "This has resulted in a growing market for anti-counterfeiting technologies that can protect companies, who face legal liability that can cost millions as well as reputational damage, and consumers, who receive poor quality products," says Dr Shyaam Ramkumar, Lead in Business Development & Strategy at the company.

"An OECD study in 2019 identified that the value of counterfeit goods has reached US$509bn. And one of the companies developing solutions against counterfeiting, Kafrit Group, estimates that US$284bn will be spent by governments and companies to combat counterfeiting," he claims.

"One of the key roles for anti-counterfeiting focuses on traceability and marking technologies. The main aim is to authenticate and verify the properties of products through unique barcodes, QR codes, speciality inks, or chemical tracers as they move along the supply chain," Ramkumar says.

"While these technologies provide a way to identify counterfeit products, an underlying data infrastructure is required to track and trace these products in order to identify their sources and where in the supply chain problems occur. By combining these technologies with the hyperledg-

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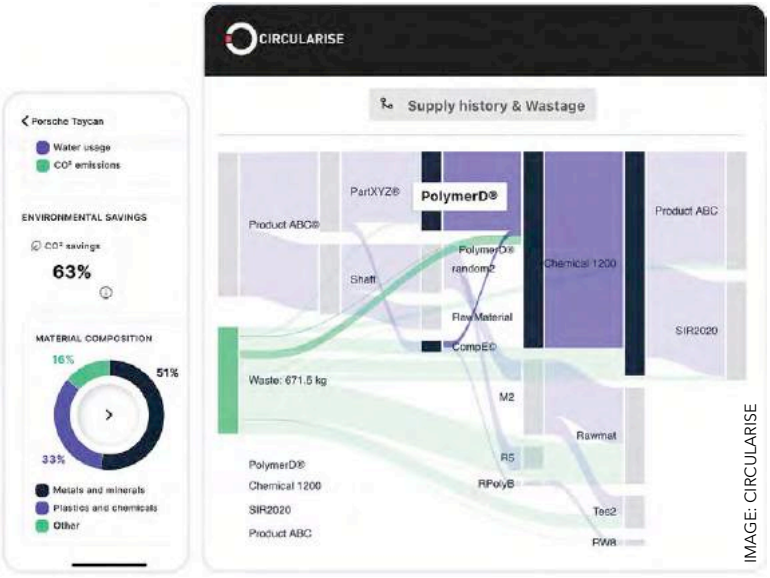

Circularise aims to combine anti-counterfeiting technologies such as labels, QR codes and chemical tracers with blockchain technology to provide a comprehensive anti-counterfeiting and traceability solution

er technology of blockchain, companies can track and trace all the transactions that take place across the supply chain," he says.

This hyperledger enables the creation of a complete ownership and authentication history, allowing companies to detect counterfeits at an early stage and identify their origin, according to Circularise. Moreover, the decentralised nature of the technology removes the need for trust among the parties involved (there are no intermediaries involved in managing and storing the data and all transactions are validated by all network participants).

Ramkumar adds that many industries can benefit from anti-counterfeiting and traceability measures for plastics compounds. For example, the automotive industry is recognised as a key market for counterfeit products. He says the US Federal Trade Commission has valued the counterfeit auto-part market at roughly US$12m per year. In 2020, he says Daimler identified nearly 1.7m counterfeit parts, three times the amount identified in 2019.

The most widely counterfeited products are clothing, and anti-counterfeiting and traceability solutions can have significant impact in this industry. In addition to the negative consequences of fake products that try to imitate brands, estimated to cost companies some US$30bn. There are also issues around greenwashing and verifying claims made by companies about the products, such as if they are made from sustainable or recycled synthetic fibres. Ramkumar cites a recent high profile case involving H&M that highlighted how a lack of transparency and traceability about the sustainability of products could see companies facing legal challenges.

Greater transparency of supply chains can be one of the most effective anti-counterfeiting measures. "Access to reliable data, such as material composition, product origin and environmental impacts, for example, can enable brands, OEMs and suppliers to improve reporting, reduce supply chain costs, strengthen their brands and avoid counterfeits," says Ramkumar. "However, many actors in the plastics value chain are hesitant to share information and data because of concerns around exposing sensitive and proprietary material composition information that could affect their competitive advantage."

Circularise argues that a distributed and decentralised public blockchain solution in combination with its Smart Questioning technology can provide an answer to this transparency challenge. "This technology allows safeguarding of the identity, business relations, production processes, and confidential information across all parties within the value chain. Through our Smart Questioning technology, only essential and useful insights will be shared between parties, and, if necessary, regulators. Since it utilises a public blockchain, the data cannot be tampered with and can be confidently trusted by all parties," Ramkumar says.

"We are continuing to explore how various anti-counterfeiting technologies like labels, QR codes and chemical tracers can be combined with our blockchain traceability technology to provide a comprehensive anti-counterfeiting and traceability solution for the plastics industry," he says. "With chemical tracers, we are identifying how spectroscopy data can be added as a data point on our system and how scanning hardware can directly interface with our solution to read plastic pellets and compounds in order to verify its authenticity."

Circularise says it is collaborating with companies that develop tracer technologies to test their application in the plastics industry. For example, it says it has worked with a sustainable textile entrepreneur and start-up based in Amsterdam, which applies tracer particles and blockchain to guarantee the recycled content of polyester and cotton fibres and fabrics.

"Since the chemical tracer technologies are still in their nascent stage, we are also exploring how we can collaborate with auditors and certification bodies within our platform," says Ramkumar. "We are developing solutions to enable these parties to conduct independent, third-party audits more easily and to reduce the administrative burden to gather all the relevant data and information. We have recently launched the MassBalancer tool to

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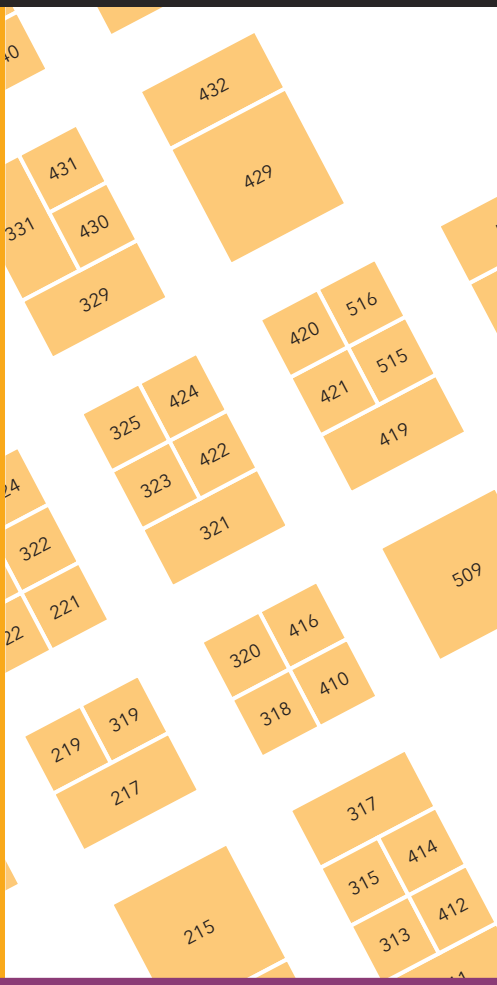

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IMAGE: DOTZ NANO

Above: Taggant technologies available from Dotz Nano include the ValiDotz range of liquid and solid markers

support the ISCC Plus certification scheme to manage credit balances for various production sites, automate reports on declarations, and gain in-depth insights, all from one place."

Track and trace

Over the past few years, **Dotz Nano** reports a significant increase in demand for plastics additives and marked masterbatches. "Track and trace for the circular economy and authentication for anti-counterfeiting are two main applications. Additional applications we have seen demand for are quality assurance, control of supply chain, and authentication of safety and biomedical products," says Shirley Shoshaney-Kleiner, the company's Marketing Director.

"As opposed to on-product techniques, such as RFID and NFC, in-product markers that can withstand often extreme production temperatures and pressures are the only means that allow for traceability and transparency of raw materials, rather than finished components or products, enabling full transparency of source materials across the supply chain. This also provides increased security because reverse engineering of these materials is extremely difficult," she says.

Shoshaney-Kleiner identifies three key application areas. Firstly, traditional anti-counterfeiting and authentication of polymer-based products or components that require higher security levels. These generally include high-value or sensitive products, such as biomedical and bioprocessing consumables and aviation and automotive plastic parts. A second area is supply chain control and transparency for ESG and related circular-economy initiatives, which are often driven by regulatory activities and consumers' growing awareness of sustainability issues. The third area of application is in-field quantification of materials for quality assurance and dosage management.

One of the most prominent trends driving technological advances in anti-counterfeiting and traceability of plastic compounds is the mandating of stricter circular economy-related programs, regulations and policies within the European Union and other regional jurisdictions. Full traceability of plastics compounds is a prerequisite of plastic recycling as there is a need to understand the composition and the quality of the plastic product prior to the recycling processes. The latest advances in in-product marking technologies allow for real-time quantification of plastic compounds to enable a much higher level of supply chain and product management than was previously possible.

Dotz Nano has identified a number of current technical areas of interest. "These include the development of markers and masterbatches that can withstand extreme conditions, such as high temperatures exceeding 300°C and prolonged exposure to direct UV sunlight," says Dr Michael Shtein, Chief Technical Officer and Co-founder. "These are needed for a range of applications including an area where we see high demand, such as agricultural greenhouses. Dotz Nano has developed a series of markers that can withstand temperatures of up to 500°C and have photostability of years and we see our next challenge in developing food-grade markers that may have direct contact with food ingredients. We have already started work on that both in terms of R&D and regulation."

The company has developed a family of ValiDotz markers that can be added in small quantities to any kind of plastics, from simple polymers to high-performance plastics, during processing. "These markers do not change the plastic properties or appearance, and are able to withstand extreme conditions such as high temperatures and pressures during production, or conditions of use such as high photostability that allows integration of those markers into products exposed to direct sunlight," says Shoshaney-Kleiner.

"Detection takes place using our miniature hand-held InSpec detectors that are pre-programmed to detect the specific marker, giving real-time indications of whether the product is authentic. This is a huge advantage to previously needing to take samples off-site to have them externally tested for authenticity," she says.

Dotz Nano has recently been involved in a project with a customer from the healthcare industry looking for a solution to mark its plastic-made testing consumables to prevent fraud. In order to meet the customers' requirements, a unique ValiDotz marker was inserted to the thermoplastic material as a masterbatch, prior to

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Right: The InSpec-S miniature handheld surface optical detector from Dotz Nano can be pre-programmed to a specific marker

injection moulding. Detection took place using the InSpec miniature handheld detector to offer real-time authentication and prevent fraud.

Product passports

German company **Polysecure** reports that while signs of interest are visible, anti-counterfeiting additives for plastic compounds remains a niche market. "Traceability for individual products appears to have some momentum, especially in the context of product passports and Industry 4.0 applications. In addition, supply chain monitoring for the circular economy is also drawing increasing interest. The EU commission is also putting forward legislation pertaining to Digital Product Passports (DPP) and Digital Material Passports (DMP)," says Jochen Moesslein, Managing Director.

"Original product manufacturers (OEMs) are also looking to anti-counterfeiting measures to protect themselves from unjustified liability and warranty claims. With our Particle-Fingerprint (PFP) technology, OEMs can combine anti-counterfeiting with individual traceability because the PFP pattern are both individual and forgery-proof. They are created by random processes in the material and therefore cannot be copied," he says.

Moesslein adds that the main technical area of development is the need for robust and forgery-proof unique identifier technology and detection. While there are many companies and people involved in the creation of product pass databases, for example, he says few resources are available and focused on the physical unique identifier technology. To meet this need, the company has developed its PFP technology for DPP and Poltag technology for DMP applications.

The company says the uniqueness and counterfeit protection of individual product identification is of central importance when mapping DPPs. With its PFP technology, upconversion fluorescence particles are added to the plastic compounds. These arrange themselves randomly during the solidification process and their position is measured.

Due to the upconversion effect, only the fluorescent particles emit visible light when excited with suitable radiation. All other material components remain dark. This results in a comparatively high contrast, which in turn enables reliable, fast measurement at very low particle concentrations. Due to the randomness, the resulting 'fingerprint' is unique and cannot be copied and reproduced. In contrast to barcodes, RFID tags or digital watermarks, PFPs are forgery-proof, according to Polysecure.

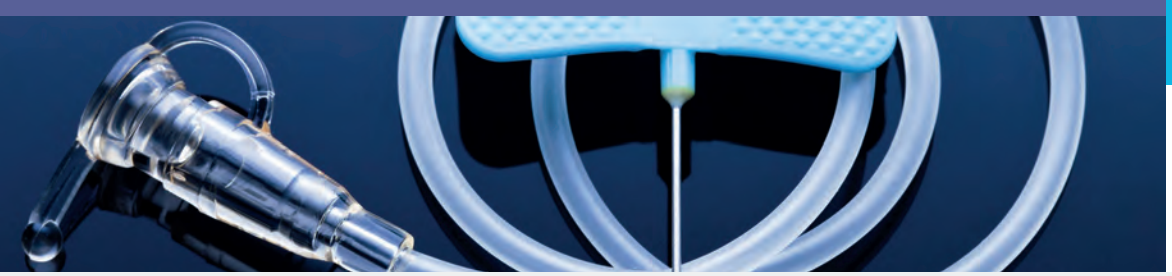
The fluorescent particles are crystalline particles (greater than 1 micron) that are thermally and chemically stable. They have good biocompatibility and are compliant with EU substance law requirements. The company says EU approval for contact with drinking water has already been granted and approval for food contact is expected soon (it says toxicological tests have been completed with good results).

Polysecure says PFP applications include electronic goods, medical products and general products that are at risk of counterfeiting, requiring a secure return system or that need a product passport for regulatory reasons.

Secure authentication

In collaboration with the Charles Sadron Institute (ICS), the company has developed its Poltag technology to allow DMPs to be anchored in the material. Poltag provides a secure and accurate identification technology for materials that can solve challenges such as authentication of materials or material components to ward off unjustified warranty claims triggered by other materials or counterfeits. It can also be used to trace materials or material components for origin, certification, composition, manufacturing and batch data to meet regulatory or organisational requirements. Monitoring of recyclates and materials in the circular economy can also be undertaken.

Poltags are organic macromolecules with a monomer arrangement that can be specifically synthesised. Due to the practically unlimited combinational possibilities, the company says millions of individual molecules, and therefore distinguishable codes, can be generated. This allows the identification of a correspondingly large number of materials in a 'material DNA'. Data in the



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identification codes can include any information, such as manufacturer, batch number or production date, so that materials can be traced back to their origin.

Technical properties of the Poltag molecules can be adjusted and adapted to ensure maximum stability and compatibility with the target product and its specific application. They are designed and synthesised individually for each customer by Polysecure, which ensures a particularly high level of protection against counterfeiting and manipulation.

Poltags are thermally stable up to 380°C, chemically stable through resistance, for example, to UV radiation, acidic and basic solutions and organic solvents, as well as being mechanically stable. These robust properties, together with the anchoring of the Poltags directly in the material, means they can be preserved and detected for many years.

Poltags can be homogeneously processed in solids (for example, thermoplastics and duroplastics) and liquids, such as organic solutions, fuels and water-based liquids.

Poltag macromolecules are identified by tandem mass spectroscopy (MS/MS). Only a few 100mg of labelled material is required for precise detection, which in polymers is around 1ppm. The quantitative nature of mass spectroscopy means detection of Poltags can also be used to monitor and measure the concentration of marked materials in an end product, such as recyclate content.

Moesslein says that Polysecure has received legal confirmation that its Brandproof mobile pocket detector technology is now accepted in German courts for authentication of products. In future, the company says that it will also provide its PFP identification software via a secure internet database so that customers can link the individual hash codes with their DPP databases.

Right: Particle-Fingerprint technology from Polysecure allows OEMs to combine anti-counter-feiting features with individual traceability

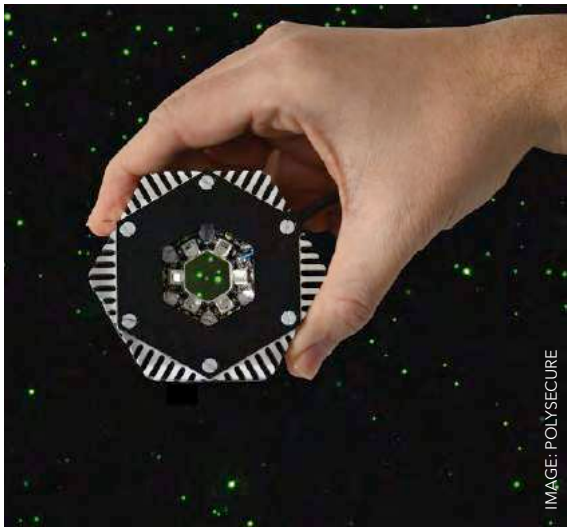

IMAGE: POLYSECURE

Below: Avient says its Plastiward technology has already been applied in the E&E sector

IMAGE: AVIENT

Taggant integration

Avient has developed its Plastiward counterfeiting technology to provide protection for plastic articles in multiple applications. Offering fake checking in real-time, the company says Plastiward brings counterfeiting protection of plastic articles close to the end consumer by integrating taggants into a product using a polymer masterbatch. It describes it as a fully integrated turnkey solution that allows an enforcement team to take swift action against fraud.

Plastiward combines Avient's polymer modification expertise with the in brand protection technologies developed by banknote security ink specialist Sicpa. It uses proprietary taggants integrated directly within the polymer together with a handheld detector to offer instant fake checking in the field. A secure monitoring platform running on a smartphone or tablet captures field inspection data, which is transmitted in real-time.

BASF Venture Capital (BVC) recently made a strategic investment in Oceanworks, a sustainable plastic solutions provider that aims to deliver traceability and transparency to recycled plastics through digitalisation. Based in the US, Oceanworks offers a platform for brands looking to reliably secure high-quality sources of ocean, ocean-bound, and averted post-consumer recycled (PCR) plastics. Its offering to clients includes digitised blockchain-based traceability, material quality assurance, global logistics and marketing support.

CLICK ON THE LINKS FOR MORE INFORMATION:

- **www.trutags.com**
- **www.circularise.com**
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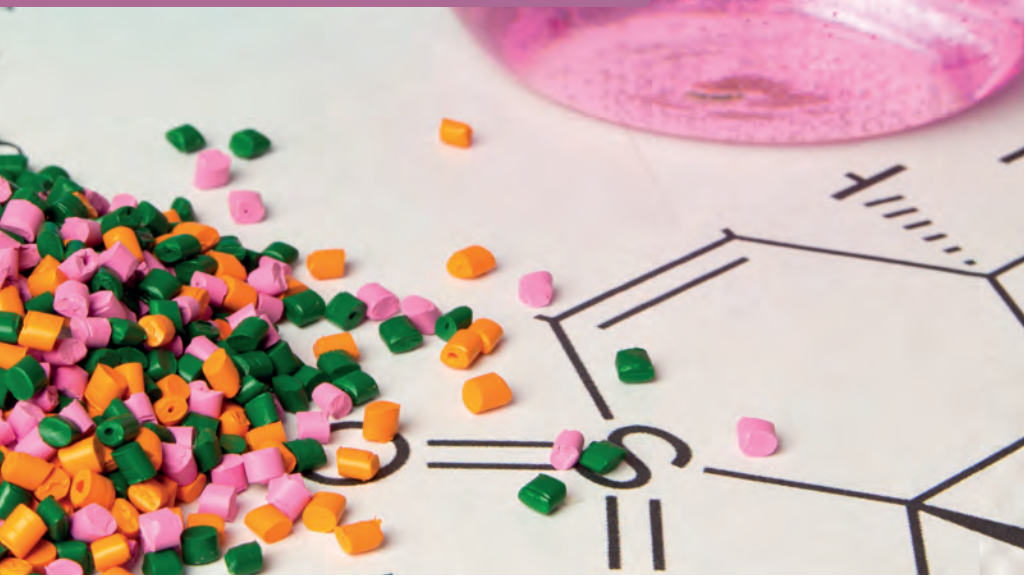

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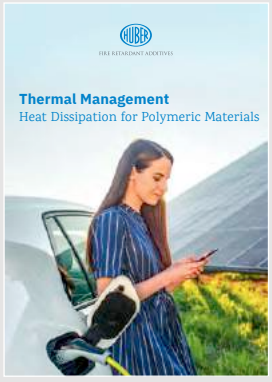

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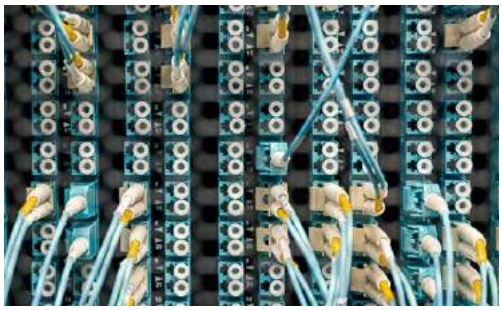

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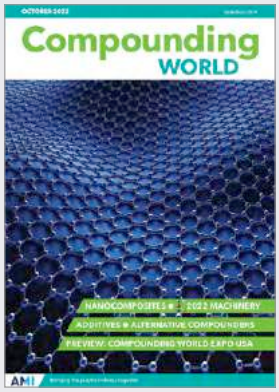

Compounding World October 2022
Compounding World delves into nano additives in the October edition. The cover story looks at new developments in graphene and CNTs. Other features cover additives for recycling and alternative compounding technology. Plus a preview of K2022 machinery exhibitors.

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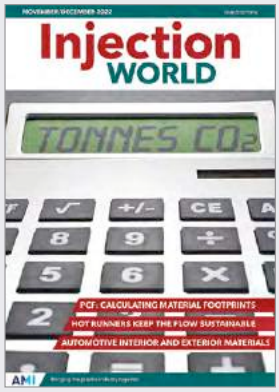

Injection World November/December 2022
The November/December edition of Injection World magazine looks at the fast emerging area of Product Carbon Footprints. It also explores developments in hot runners and automotive plastics, plus a review of key news from October's K exhibition.

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Plastics Recycling World November/December 2022
This edition of Plastics Recycling World takes a look at the latest PET recycling equipment that was on show at K2022 in Germany. It also explores new EU regulations on food contact process authorisation and reviews progress in chemical recycling.

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Pipe and Profile November-December 2022
The November-December of Pipe and Profile Extrusion investigates how formulations with high recycled content are making wood-plastic composites more sustainable. Other features look at what's new in pipe joining and batch mixing, plus there is a review of K2022.

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Film and Sheet November 2022
The most recent issue of Film and Sheet Extrusion magazine has a cover story that explores recent developments in the sheet sector. The November edition also has features looking at thin-wall packaging, plastics in construction and smart packaging.

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	30 May – 2 June	Equiplast, Barcelona, Spain	www.equiplast.com
	14-15 June	Compounding World Expo Europe, Essen, Germany	www.compoundingworldexpo.com/eu/
	5-8 September	Plast 2023, Milan, Italy	www.plastonline.org/en
	20-21 September	Injection Molding & Design Expo, Novi, MI, USA	www.injectionmoldingexpo.com
	26-28 September	Interplas, Birmingham, UK	www.interplasuk.com
	17-21 October	Fakuma, Friedrichshafen, Germany	www.fakuma-messe.de
	8-9 November	Compounding World Expo USA, Cleveland, USA	www.compoundingworldexpo.com/na/
2024	**6-10 May**	NPE 2024	www.npe.org

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7-8 February 2023	Reinforced Thermoplastics, Cologne, Germany
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28 Feb -1 March 2023	Compounding and Masterbatch Asia, Bangkok, Thailand
6-8 March 2023	Cables Europe, Cologne, Germany
18-20 April 2023	Masterbatch Europe, Cologne, Germany
26-27 April 2023	Fire Retardants in Plastics, Philadelphia, PA, USA
16-17 May 2023	Functional Fillers, Philadelphia, PA, USA
6-7 June 2023	Plastics in Electric Vehicles, Munich, Germany

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