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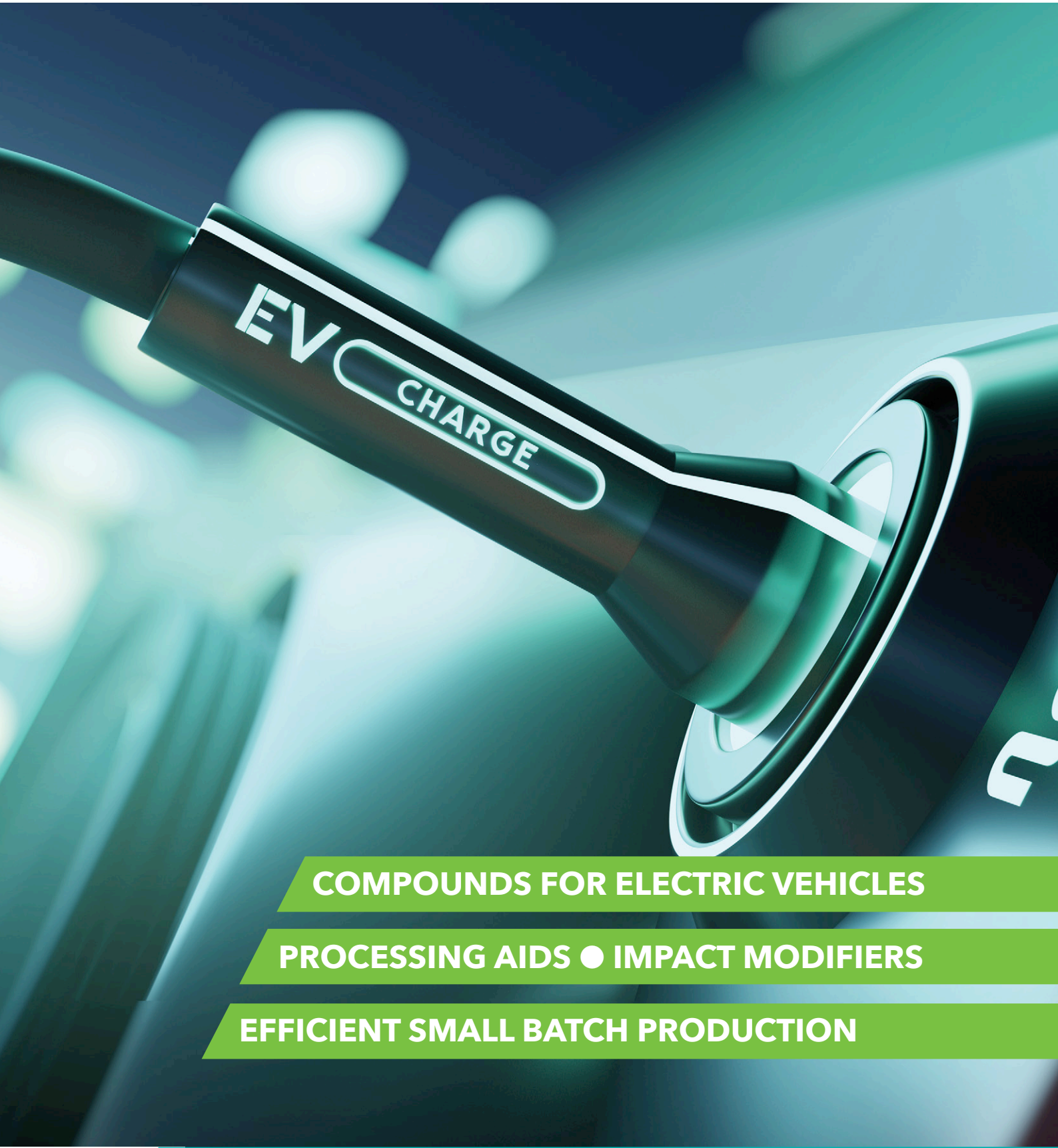

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Third Floor, One Brunswick Square,
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Tel:+44 (0)117 924 9442
Fax:+44 (0)117 311 1534
www.amiplastics.com
www.twitter.com/plasticsworld
Registered in England No: 2140318

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EDITORIAL

Editor-in-Chief: Chris Smith
cs@amiplastics.com

Technology Editor: Peter Mapleston
editorial@compoundingworld.com

Contributing Editor (USA): Jennifer Markarian
editorial@compoundingworld.com

Contributing Editor (UK): Mark Holmes
editorial@compoundingworld.com

Events and Magazines Director: Andy Beevers
abe@amiplastics.com

ADVERTISING

Advertisement Manager: Claire Bishop
cb@amiplastics.com T/ +44 (0)7905 848744

Head of Business Development: Paul Beckley
pb@amiplastics.com T/ +44 (0) 117 311 1529

Advertising Sales (China/Hong Kong): Maggie Liu
maggieliu@ringiertrade.com T/ +86 13602785446

Advertising Sales (Taiwan): Ms Sydney Lai
sydneylai@ringier.com.hk T/ +886-913625628

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Ascend steps into India

Ascend Performance Materials is to acquire the compounding division of Formulated Polymers Limited, an engineered polymer materials manufacturer located at Chennai in India.

The move follows recent Ascend compounding acquisitions in Mexico, China, France and Italy. Ascend said this latest acquisition gives the company its first manufacturing base in the subcontinent and strengthens its global reach in the electrical and e-mobility application space.

Established in 1991, Formulated Polymers is currently a licensee of Ascend's Starflam flame retardant PA formulations. The acquisition includes the manufacturing facility at Chennai as well as the business's warehouses throughout India.

IMAGE: ASCEND PERFORMANCE MATERIALS

Above: Formulated Polymers is a significant player in India's compounding industry

"Demand for our materials in India is strong and growing," said Phil McDivitt, Ascend's President and CEO. "The team at Formulated Polymers has built an excellent, diversified business with a proven track record of technology development in polyamides."

The acquisition is expected to close on 1 May 2022. Terms of the agreement have not disclosed.

› **www.ascendmaterials.com**
› **www.formulatedpolymers.com**

Lati adds to its Laramid range

Italian compounder Lati is extending its Laramid range with a new grade –Laramid T – based on semi-aromatic PA9 resin, which is said to be characterised by lower moisture absorption, enhanced surface appearance, and improved dimensional stability.

With a glass transition temperature close to 130°C and a melting point of 290-310°C, PA9T provides a performance window similar to other PPA and PPS-based alternatives. It is said to be suitable for continuous use at temperatures up to 160°C.

The Laramid T family includes compounds reinforced with 60% glass fibres, 30% high carbon fibres, or 40% high modulus carbon fibres.

› **www.lati.com**

Project to lightweight car parts

Spanish plastics technology centre Aimplas has joined the LightCar Project, which aims to develop new long fibre reinforced thermoplastic composite materials to help vehicle weight reduction.

The project is coordinated by Industrias Alegre and funded by the Valencian Innovation Agency within the framework of the Programme of Strategic Cooperation Projects. Other participants include Itera Soluciones de Ingeniería and Sinfiny Smart Technologies.

Aimplas said the new materials are expected to offer lightness, impact resistance and rigidity, good recyclability, and processability using conventional manufacturing methods with low waste generation. The project will include design of a flexible, high-speed production cell for manufacturing of parts within which electronic components can be fitted.

› **www.aimplas.net**

Second compounding plant for Barlog

Barlog Plastics, a German specialist in high-performance plastics and engineering, has outlined plans to open a new compounding plant at Windeck Dattenfeld in the Rhein-Sieg district this summer.

The firm, which is headquartered at Overath near Cologne, acquired an 11,100m² plot of land, including a 1,500m² production hall, in Windeck Dattenfeld in late 2021. "We could no longer meet the increasing space requirements in Overath. Dattenfeld now offers an opportunity for expansion," said Managing Partner Peter Barlog.

Barlog distributes compounds manufactured by EMS Grivory, RIA Polymers and Kolon Plastics, as well as producing its own compounds. These are focused on applications requiring high strength and heat resistance, and attributes such as thermal and electrical conductivity. Typical end markets include e-mobility, household appliances, and drinking water supply.

The company also offers engineering design, prototyping, and low volume injection moulding services.

› **www.barlog.de**

Hexpol buys into recycler Almaak

Sweden's Hexpol is to pay €70m to acquire 70% of the shares of Almaak, a German specialist in production of recycled engineered polymer compounds.

Hexpol CEO Georg Brunstam said that the deal was in line with its strategy of growing its presence in production of thermoplastic compounds and speciality polymer compounds with high levels of recycled content. He said it also strengthens the group's presence in Europe.

Almaak employs some 190 people and posted sales of around €75m last year. Its production plants at Krefeld and Doberlug-Kirchain house 16 compounding lines and provide a capacity of around 60,000 tonnes/yr. It handles PP, PA, PC, PBT and a variety of PC blends. Previous owners Olaf Eichstädt and Thomas Schmeinta will stay with the company.

According to Hexpol, Almaak has made significant investments in equipment and technology to secure growth in its market, which is focused largely on the European automotive industry. "Almaak is very well positioned in a growing market with a high level of specialty expertise. Together with Hexpol's knowledge and resources, we see many opportunities for accelerated growth," said Jan Wikström, President of Hexpol Thermoplastic Compounding.

The deal is expected to complete in Q2 2022, subject to customary closing conditions, and includes an option for Hexpol to buy the remaining shares.

Sweden-headquartered Hexpol has production operations in 14 countries and generated sales in 2021 of SEK16bn (€1.55bn).

› **www.hexpol.com**
› **www.almaak.de**

IN BRIEF...

Domo Chemicals said its caprolactam production site at Leuna in Germany passed the 5m tonne milestone earlier this year. The facility has been in operation since 1942 and was the world's first industrial-scale caprolactam production plant, the company said. It now makes both caprolactam and PA6 and has a capacity of 176,000 tonnes/yr.
www.domochemicals.com

Nexeo Plastics is to distribute the **AFC Ecoplastics** portfolio of bio-compounds for the blow moulding and film production markets in the US, Canada and Mexico. These include grades that meet the ASTM D6400 standard for industrial composting and includes 30% and 80% bio-based grades, according to Nexeo.
www.nexeoplastics.com

Silon increases its capacity

Silon commissioned a new compound production line at its site at Planá nad Lužnicí in the Czech Republic last month. The expansion, plans for which were originally announced in September 2021, has increased the capacity of the compounding division by 15,000 tonnes/year.

The new line includes two co-rotating and two counter-rotating screws. The company said it incorporates a number of technical features designed to improve its ability to disperse high levels of fillers and flame retardants.

› **www.silon.eu**

IMAGE: SILON

Above: Silon's new compounding line lifts capacity by 15,000 tonnes/yr

Avient launches Nymax Bio

Avient has launched a new line of PA materials under the Nymax Bio name that incorporate 16-47% of natural filler from renewable plant sources – including corn, straw and wheat – while also offering low levels of water absorption.

The materials are available with or without glass reinforcement. According to Avient, the Nymax Bio grades offer lower warpage plus very good surface appearance and colourability compared to traditional PA66 glass fibre-reinforced alternatives. The company also claims very good dimensional stability and property retention after conditioning.

Applications are foreseen in automotive, consumer, industrial and construction markets, for production of injection moulded and extruded parts.

› **www.avient.com**

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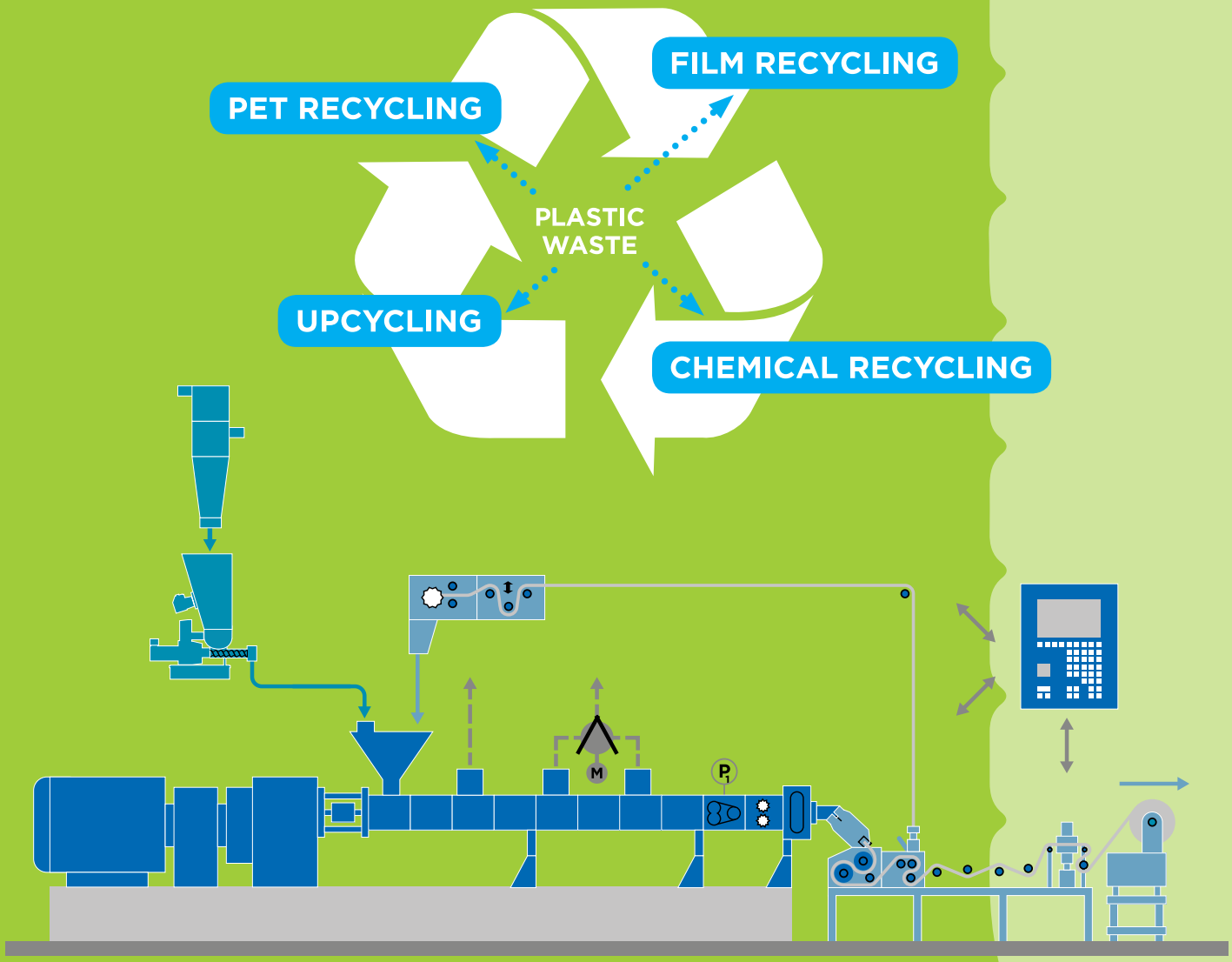

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"Green" benefits for Sirmax

IMAGE: SIRMAX

Above: Recycled "green" products helped Sirmax push sales up 66% last year

Italian compounding group Sirmax reported sales of €480m for 2021, up by nearly 66% on its €315m result for 2020. Volumes were up by near 20%.

"Driving these highly positive figures is the strong push towards 100% recyclable recycled compounds, biopolymers and TPEs," the company said in a statement. Recycled content products saw 40% growth in sales volumes, it said. Technical compounds for applications in the automotive and electrical sectors saw similar volume gains.

"2021 was a year that exceeded all expectations," said Sirmax President and CEO Massimo Pavin. "Our investments, as well as favoring regionalised and loyal supply chains, have gained us market share."

The US was the fastest-growing region in sales terms for Sirmax in 2021, 30% up on 2020. The company has recently opened a second US plant, which is located close to the first in Anderson, Indiana. This latest facility is dedicated to production of PP compounds containing mineral fillers or glass fibre reinforcement from post-industrial waste materials.

For 2022, Sirmax said it plans to focus its research efforts on flame retardant technical polymers for the electrical sector, antibacterial grades for automotive use, and biopolymers for packaging and agricultural mulching fabrics. The company said it will also continue its post-industrial PE and PP recycling research project with UMass Lowell and MIT.

Employing around 800 people worldwide, Sirmax has production in Italy, Poland, US, Brazil, and India.

› **www.sirmax.com**

PCR TPE from Teknor Apex

Teknor Apex has launched the Monprene RX CP-15100 series of TPEs, which contain 25-35% post-consumer recycled content sourced from waste. The TPE materials are also said to be fully recyclable at end of life.

The new products are available in standard natural grades covering a range of hardness values from 55 to 80 Shore A. They are designed for injection moulding applications, including overmoulding onto PP, and are said to be suitable for typical virgin TPE uses in markets such as personal care products, lawn and garden tools, writing instruments, appliances, and sporting goods.

"This introduction represents the first of several sustainable product launches slated for this year that include other types of recycled content, bio-based raw materials, and carbon negative additives," said Jonathan Plisco, New Business Development Manager.

IMAGE: TEKNOR APEX

Above: Monprene TPEs contain 25-35% PCR content

Teknor Apex said it is able to manufacture and supply the materials globally. The company also said the recycled material content will be sourced locally to its production operations.

› **www.teknorapex.com**

Elix adds to E-loop range

Styrenics specialist Elix Polymers has introduced a new addition to its recently announced E-Loop family of sustainable compounds – E-Loop H801.

The H801 grade is a PC/ABS blend produced with post-industrial PC resin and is said to be a counter-type for its standard high-heat, high-impact Elix ABS H80 grade.

The grade is targeted primarily at exterior and interior painted applications and has already been validated and approved by a global automotive OEM for exterior use, according to Elix.

› **www.elix-polymers.com**

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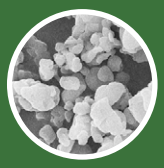

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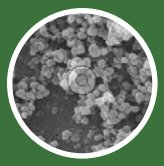

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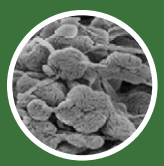

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Pressure is on German processors

Sales by German plastics processors during 2021 increased by 12% to reach a value of €69.4bn, according to the General Association of the Plastics Processing Industry (GKV). However, it said the sector is "under a lot of pressure" from hugely increased raw materials and energy costs, delayed deliveries and resulting order suspensions, particularly in the automotive market.

In all, the association estimates that 15m tonnes of plastics were processed in Germany in 2021, 5.6% up on 2020, of which 2.2m was recycled material. Employment levels remained stable at just under 322,000.

GVK President Roland Roth said that the economic outlook for 2022 is mixed. Half of its member companies expect sales growth, but around 25% expect further falling results and some are thinking about relocating or terminating their production.

"Politicians urgently need to reduce government surcharges on energy prices," Roth said.

› **www.gkv.de**

Repsol and Ravago to compound in Morocco

Spanish petrochemicals and plastics giant Repsol has reached an agreement with polymer compounder, recycler and distributor Ravago to build what it claims will be the largest PP automotive compounds plant in Morocco.

The new plant will be located in the Tangier free zone and will have a production capacity of 18,500 tonnes/yr when it starts up in mid-2023. It will be operated by Ravago using material supplied by Repsol. The facility will produce compounds for interior and exterior applications, including door and instrument panels, consoles, bumpers and under-bonnet components.

Under the agreement, most of the plant's PP production will be marketed under Repsol's Isplen and Repsol Impacto brand names. Ravago will also manufacture some PA, PC/ABS and PBT compounds for the automotive sector at the facility.

The project is sponsored by the Moroccan Ministry of Industry and supported by several local OEMs, as well as Renault Group, and Stellantis Group.

› **www.repsol.com**

› **www.ravago.com**

Borealis hopes for PP batteries

Borealis and German battery firm Ansmann are working together on the development of a second generation of the latter's GreenPack exchangeable battery system.

Borealis is providing material selection advice, simulating performance such as battery drop tests, and optimising the conversion process with the aim of creating a PP housing and cell holder system for the lithium-ion battery. It believes the lower density and processing temperatures of PP will help contribute to production energy savings and reduced CO_2 emisssions compared to alternatives.

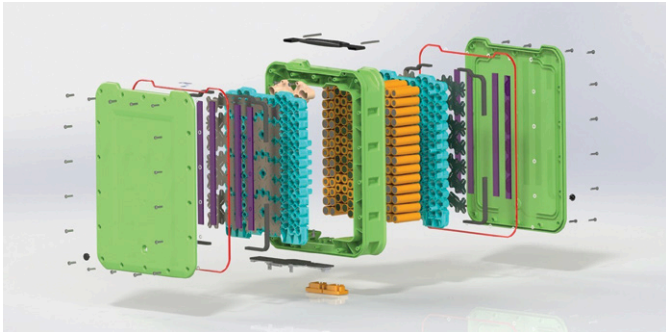

IMAGE: BOREALIS/ANSMANN

Above: Ansmann's GreenPack exchangeable battery system could use PP structural parts

The first GreenPack design offers 48V nominal voltage, 1,400 Wh capacity and a maximum continuous current load of 25 A. The concept employs intelligent communication and standardised interfaces to support use in multiple devices from different producers. They can be found in lawn mowers, snow blowers and weed trimmers used in gardening and landscaping.

› **www.borealisgroup.com**

› **www.ansmann.de**

Renewable partnership to target PA66

Biotechnology company Genomatica and polymer producer Asahi Kasei have established a strategic partnership that aims to commercialise renewably-sourced PA66 made from Genomatica's bio-based hexamethylenediamine (HMD).

Asahi Kasei intends to apply the Geno HMD process technology, which uses renewable feedstocks such as plant-based sugars, to produce a more sustainable PA66 material for use in products.

› **www.genomatica.com**

› **www.asahi-kasei.com**

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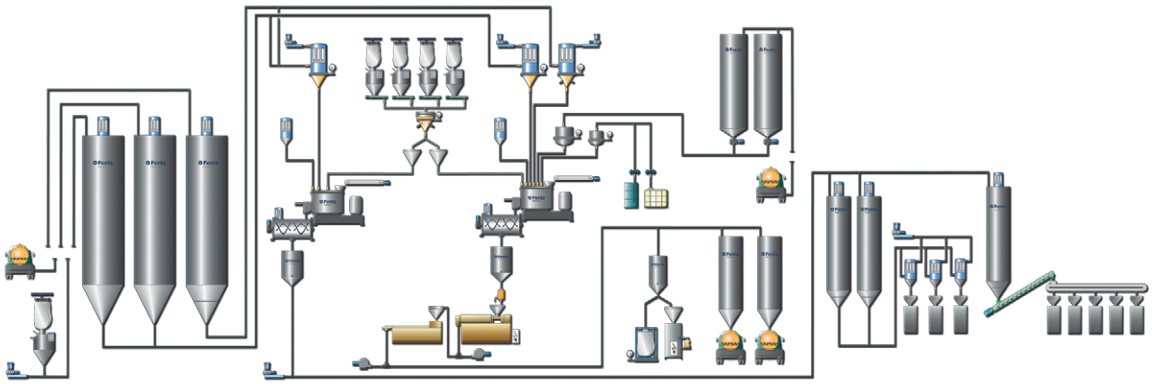

penta.piovan.com

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KraussMaffei delivers for Lanxess in Changzhou

KraussMaffei Extrusion has designed, installed and commissioned a turnkey compounding line for the Lanxess production unit at Changzhou, China, and has been awarded a contract to supply a second line during 2022.

The two new lines increase capacity at the site by 30,000 tonnes/yr and will lift Lanxess's total capacity for PA6, PA66 and PBT compounds across its locations at Changzhou and Wuxi to 110,000 tonnes/yr. Products produced on the lines include grades containing up to 60% glass fibre content. They are destined primarily for the fast growing e-mobility sector in China.

IMAGE: KRAUSSMAFFEI EXTRUSION

The first of two new lines for the Lanxess site at Changzhou

The first line is built around a KraussMaffei ZE 110 UT twin-screw extruder; the second line will be based around a ZE 98 twin-screw machine from the company's BluePower series. Each compounder will be supplied with an optimised set of screws for both PA and PBT matrix materials. Both lines also feature optimised wear protection, plus versatile metering stations, side feeders and degassing units.

› **www.kraussmaffei.com**
› **www.lanxess.com**

Polystyrene Loop closes down

The Polystyrene Loop solvent-based recycling initiative, established at Terneuzen in the Netherlands, went out of business on 8 March, according to a statement on the project website.

This combined EPS and brominated flame retardant industry project had aimed to build and operate a demonstration plant to recycle EPS construction industry waste, removing the flame retardant HBCD and recovering the PS and bromine using the CreaSolv solvent-based purification process.

The project owners said scaling up the technology from pilot scale had been challenging and start-up delayed by a number of unexpected issues. They said Covid and rising energy prices also severely impacted liquidity.

› **www.polystyreneloop.eu**

Solvay plans to split

Solvay is planning to separate into two independent publicly traded companies. Subject to general market conditions and shareholder approval, it hopes to complete the move in the second half of 2023.

The larger 'SpecialtyCo', which had about €6bn in net sales in 2021, will include the Specialty Polymers and Composites business, as well as most of the current Solutions segment. The 'EssentialCo' component (with 2021 sales of around €4.1bn) will comprise the single technology businesses in the current Chemicals segment.

"The plan to separate into two leading companies represents a pivotal moment in our journey to transform and simplify Solvay," said CEO Ilham Kadri. "We expect to create opportunities in each company…and we are confident that both companies will maintain the same levels of customer focus and commitment to value creation."

› **www.solvay.com**

Polyplastics launches bio-LFT products

Polyplastics Group has announced commercial availability of a new addition to its recently launched Plastron LFT product line, a PP-based grade reinforced with regenerated cellulose fibres.

The company says that the long continuous cellulose fibre it uses is produced using a solvent-based wet spinning technique, which is said to result in low CO_2 emissions. Almost all of the solvent is recovered.

According to Polyplastics, cellulose-reinforced PP resin has a lower density than glass-filled alternatives and a 3% higher flexural modulus. Charpy impact strength, tensile strength and flexural strength are also said to be better, providing further weight reduction potential.

› **www.polyplastics-global.com**

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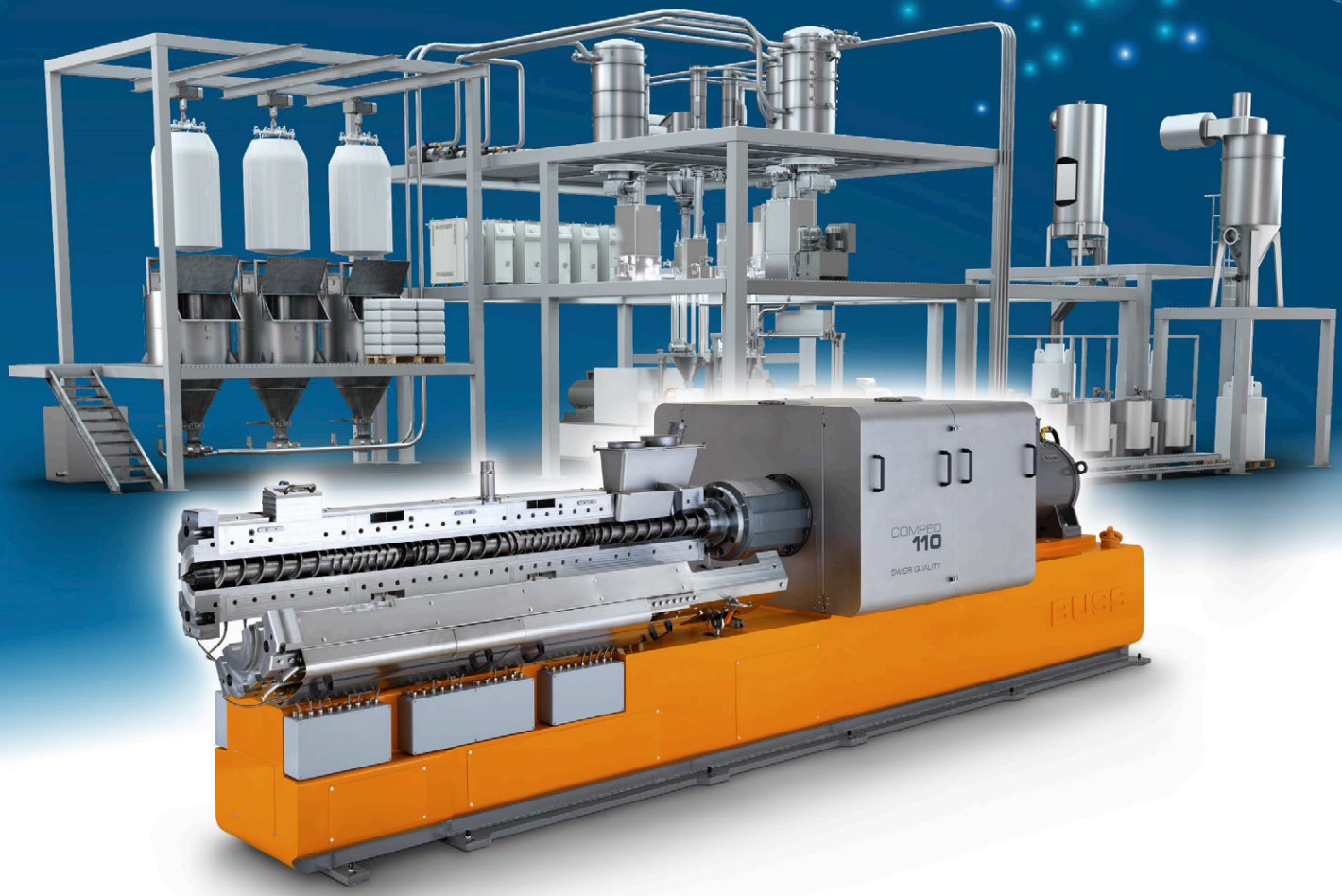

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Optimised formulation with processing aids

Sustainability and security of supply top the current wish list for users of polymer lubricants and processing aids. Jennifer Markarian reports on some of the latest developments

IMAGE: VOELPKER SPEZIALPRODUKTE

Supply-chain challenges have affected, to a lesser or greater extent, every aspect of industry over the past year. PVC compound producers have faced a particular challenge as PVC formulations typically contain a complex blend of stabilisers, lubricants, and other additives that are designed to work together in careful balance.

"Shortages in raw materials have led us to be more creative in the solutions we offer to our customers," says Stu Parks, Technical Manager at **Norac Additives**. "Our customers have in turn had to be more adaptable with their formulations. For example, any change in stabiliser technology requires a change in lubrication to make the manufacturing process and its end product successful, and that balance can be hard to find."

Parks points to the example of a stabiliser change where two solutions were found: one reworked the lubricant package to adapt to the new stabiliser system while the other used the company's Norstab 85 booster. "The booster is a stabiliser that allows our customers to reduce their tin stabiliser loading without the need to adjust their other additives. We've seen the booster solution work in multiple rigid PVC building products," he says.

Stearic acid and its derivatives (most typically calcium stearate and zinc stearate) are also common components of PVC formulas. In North America, stearic acid is usually tallow-based, but Parks sees increasing interest in plant-based (for example palm oil) stearic acid products. From a technical performance perspective there is little difference, he says, and it is easy to switch from one to the other, which is a benefit if there are sourcing difficulties.

Renewable sourcing

The company has long offered a range of plant-based products. "About a third of our core COAD [metallic stearate] products are available in a plant-based formulation. We also frequently develop plant-based blends for custom projects," Parks says. In 2021, Norac became a member of the Roundtable on Sustainable Palm Oil (RSPO), which certifies that products are sustainably sourced.

Norac has also developed plant-based lubricants that provide an alternative to paraffin waxes for PVC formulations. The plant-based Norac XL-65A carries Plastics Pipe Institute (PPI) and NSF certification, which is required in the US for many PVC applications. "We've found that our customers tend to see enhanced extrusion performance with our paraffin-free Norac XL blends and we've increased our focus on developing custom blended lubricants that use natural waxes," says Parks.

Paraffin waxes are commonly used in PVC formulations as part of a lubricant additive package,

Main image: Easy-to-handle lubricants and processing aids are in high demand and producers such as Voelpker are increasing capacity

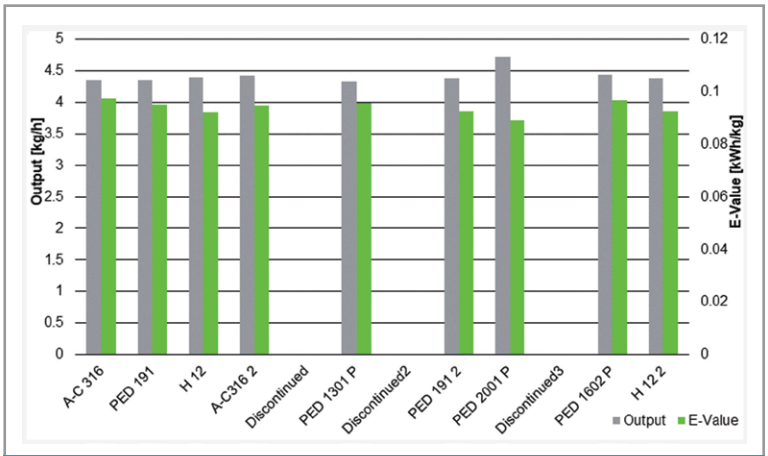

Figure 1: Output rates and energy inputs for Clariant's Licolub PED 2001 P oxidised olefin waxes compared to legacy alternatives
Source: Clariant

according to Madelyn Bekker, Principal Engineer for Waxes at **ExxonMobil**. "Paraffin waxes allow a wide processing window, enable consistency in technical performance, and facilitate consistent fusion times with different filler levels, which provides flexibility for the PVC product manufacturer," she says.

Supply chain disruption and the need to seek alternatives has been a priority for many compound formulators over the past 12 months. "Shortages in currently used raw materials have forced companies to devote a lot of time identifying and assessing alternatives for use in lubricants and processing aids," says Frank Neuber, Regional Technical Segment Manager for the Americas at **Clariant**. "This has opened the door to 'non-traditional' options, such as highly crystalline PP waxes (for example, Clariant's Licocene PP 6102), that can improve output and surface appearance."

In recent laboratory tests, Clariant compared a range of montan ester waxes, including the standard Licowax E versions and the Licocare equivalents (Licocare grades are based on renewable feedstocks containing rice bran wax - RBW). Neuber shared results of these tests at AMI's PVC Formulation conference held in March 2022 in the US. He reported that the montan ester wax Licowax E and Licocare RBW 102 yielded the highest Vicat softening point when compared to common stearate ester waxes, such as GMS, in a tin-stabilised sample system.

The lab tests showed that montan ester waxes (and their new biobased RBW clones) also provide less volatility than stearate ester waxes, reports Neuber. Lower volatility reduces plate-out, blooming, hazing and odor in Ca/Zn-stabilized PVC systems, he explains. "In addition, the melt strengths of formulas with montan esters were superior to stearate ester formulas, suggesting a more robust product may be made with montan esters. Importantly, our clients reported better fill of difficult geometries in asymmetric dies with montan and RBW waxes," reports Neuber.

Clariant also compared its relatively new oxidised olefin waxes (such as Licolub PED 2001 P) compared to "legacy" versions (Figure 1). As reported in the July 2021 issue of *Compounding World*, these products are designed to enable higher outputs, maintain low relative energy inputs, and keep pressure, gelation and fusion properties comparable to the legacy lubricants. Clariant's non-polar olefin waxes, such as Licocene PE 4201 and PP 6102, offer external lubrication with reduced energy consumption in PVC formulations says Neuber. ›

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Optimising output

"Better economies can be achieved by choosing the best wax for each formula to optimise hourly output on flood-fed extruders and reduce energy consumption," concludes Neuber. "Better physical [properties] and product integrity can be achieved by lubrication packages that use montan/RBW waxes in place of stearate waxes, yielding improved melt/tensile strength. Fusion and gelation times may also be improved, resulting in better mixing and less shear-damaged polymer." He says that these processing and property benefits are beneficial for any application, but are especially critical for asymmetric extrudates, such as window frames or decorative moldings.

Neuber says that the tests demonstrated that Licocare RBW bio-based lubricants are an option for PVC. "Physical attributes can be improved in extruding asymmetric geometries, while reducing the yellowing seen with previous generations of montan analogues."

In Europe, Clariant's Licocare RBW Vita range – Licolub FA 1 and Licowax C – were awarded an "OK compost Industrial" certificate in June 2020, which makes them suitable as processing and dispersing additives in compostable biopolymers. "Converting bioplastics into commercially viable goods has long been limited, among the others, by the lack of suitable bio-based additives. … As [the new additives] do not compromise the compostability or biodegradability of the final products, they make a valuable contribution to creating truly circular packaging and consumer goods, and reducing fossil waste generation", according to Manuel Mueller, Global Market Segment Leader, Clariant BU Additives.

IMAGE: CLARIANT

Above: Clariant's Licocare RBW grades are montan wax equivalents based on renewable feedstocks such as rice bran wax

Right: Emery Oleochemicals developed its Loxiol G 19 is an alternative to castor-based PVC lubricants such as 12-HAS

While compostability is not as big of a concern in the US market, the market is concerned about sustainability, according to Neuber. "Licocare RBW waxes are based on renewable feedstock and are non-food-competing. Solutions carrying the Vita designator have at least a 98% Renewable Carbon Index. So, through smart chemistry they are helping in the drive towards plastics circularity," he says.

Demand for sustainable lubricants, including bio-based additives, could continue to grow as compounders and their customers look for ways to reduce the environmental footprint of plastic materials.

Emery Oleochemicals' Green Polymer Additives business unit developed a new, bio-based combination lubricant for rigid PVC applications, which the company says is already being used at industry scale. Loxiol G 19 is a functional alternative to castor-based PVC lubricants, 12 hydroxystearic acid (12-HSA), which are also bio-based but come with supply concerns.

Supply security

"The only large-scale source of 12-HSA is castor oil. However, security of supply can be quite a challenge since approximately 90% of the world's castor seed is sourced from just one country – India," says Dr Christian Mueller, Global Technical Market Manager for Green Polymer Additives at Emery Oleochemicals. "To effectively support the PVC industry's global demand, having adequate alternatives to 12-HSA is necessary, due to the ongoing scarcity of cargo space combined with dramatically increased shipping costs. Uncertain delivery times caused by the issue at the Suez Canal

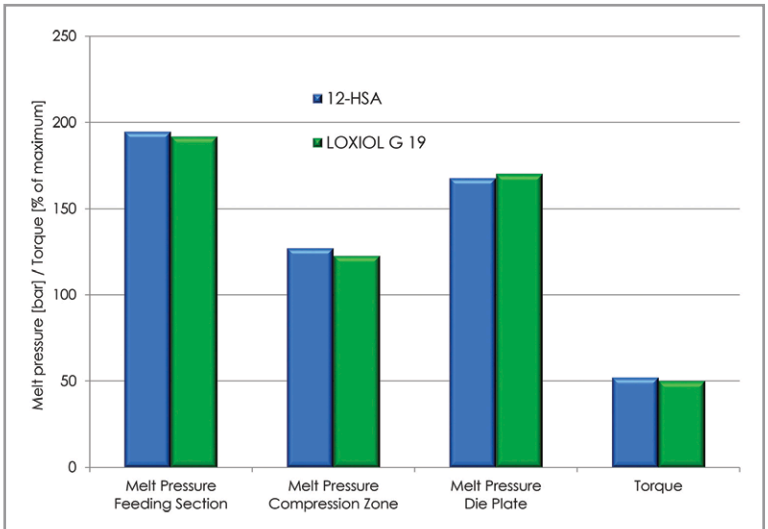

Figure 2: Melt processing characteristics for a rigid PVC formulation using Emery Oleochemicals' Loxiol G 19 additive compared to a castor oil-based 12-HAS alternative
Source: Emery Oleochemicals

IMAGE: EMERY OLEOCHEMICALS

[in March 2021] further exacerbate the situation."

The new additive has nearly identical processing characteristics to 12-HSA in rigid PVC, says Mueller (Figure 2). It is compatible with PVC, reduces stickiness, and provides good anti-plate-out properties, as determined by laboratory tests on a lab kneader and on a conical twin-screw extruder. The figure shows that melt pressure and torque on the twin-screw extruder were comparable for the two types of lubricants. In addition, in extensive trials on an industrial line, Loxiol G 19 did not cause changes in Vicat softening point, mechanical properties, or the colour of the end product.

Loxiol G 19 is produced from a raw material supply chain available in any region of the globe and is supplied as fine-grained beads that provide dust-free handling and prevent agglomeration during processing, transport or storage, says Mueller. The additive complies with chemical regulations such as the EU's REACH and has indirect food contact approval.

In the US, 12-HSA is not commonly used, according to Mueller, but paraffin wax is a key lubricant for tin-stabilised, rigid PVC formulations. However, he sees a drive to replace paraffin waxes with bio-based alternatives.

"Loxiol G 24 is a 100% bio-based alternative with very similar characteristics to paraffin wax," says Mueller. He adds that it displays comparable lubrication characteristics and also helps to reduce or eliminate plate-out challenges.

Canada's **GreenMantra Technologies** uses chemical recycling technology to manufacture specialty polymers and synthetic waxes from discarded plastics for a range of applications, including polymer lubricants. The company expanded into the European market in mid-2021. It also recently announced a partnership with Omani-based Western Technologies and Innovation (Westec) and Romanian consultancy Rethink

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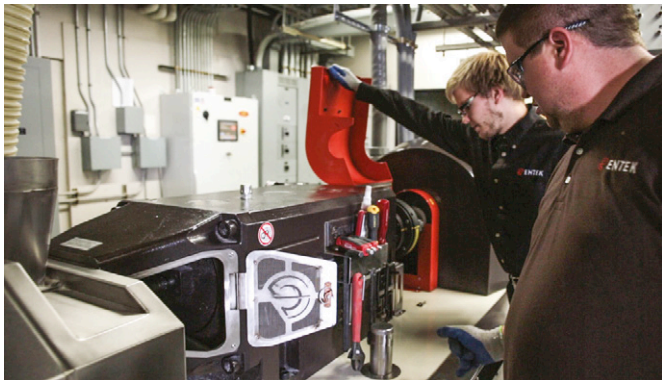

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The CEVO range of wax-based additives from **Voelpker Spezialprodukte** are said to act as viscosity-regulating combination lubricants, dispersion aids and surface improvers in a range of polymer compounds and recycled polymers. For example, CEVO-process A-3105 improves distribution homogeneity – of fillers, pigments and flame retardants, for example – and enhances flow and demolding, according to Lutz Matthies, Head of Business Development at the company.

Voelpker manufactures additive formulations tailored to specific polymers and production challenges, in physical forms desired by plastics manufacturers and compounders, such as dust-free powders and compacted prills. The company is currently building a new plant at its existing site at Völpke in Germany to meet increasing demand for these ready-to-use additive formulations. It is expected to commence operation in the summer of this year.

Matthies expects to see increasing demand for biodegradable additives, saying there is more than one way to meet this need. "Research has demonstrated that montan ester waxes with suitable emulsifiers are easily biodegradable (test method OECD 301 B; > 80%)," he says. Biobased materials are also sought after. Voelpker's CEVO-process J-4418 grade, for example, is based on renewable raw materials and is used in engineering thermoplastics. The additive is chemically equivalent to a montan ester wax so is expected to have similar biodegradability; tests are underway, reports Matthies.

Recycling focus

Reprocessed content in compounds containing mechanically recycled plastics can downgrade processability, aesthetics, and mechanical properties of film or moulded articles but adding a processing aid can counteract these issues, according to Robert Lowrie, Field Sales Engineer and Market Manager at **Arkema**. Processing aids in film can reduce melt pressure (for easier or faster processing), improve flow stability, reduce or eliminate melt fracture, reduce gels, and reduce die build-up. In injection moulding, processing aids can help reduce cycle times, reduce processing temperatures, and enable better moulding of lower

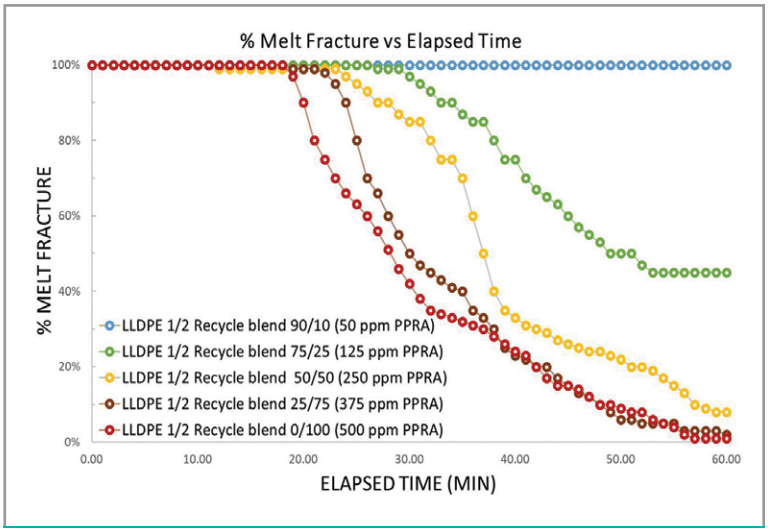

Figure 3: Study showing % melt fracture as a function of elapsed time for blends of two LLDPE grades with and without PPRA additives (LLDPE 1 with no PPRA, LLDPE 2 with 500 ppm PPRA)
Source: Arkema

melt index materials, he says.

When used in recycled polymer compounds, processing aids can also relieve processing variation and reduce degradation and discoloration. Arkema has come up with a new name for additives that provide these benefits and are intended to be added to a recycled polymer or one that is expected to be recycled – a polymer processing and recycling aid (PPRA).

The company says PPRAs should not contain added per- or polyfluoroalkyl substances (PFAS) as these environmentally persistent organic chemicals are being regulated or phased out in many applications, including recycling. Arkema says that its fluorinated processing aids – the Kynar Flex line of polyvinylidine fluoride [PVDF] copolymers – are manufactured without use of PFAS surfactants and so meet this requirement.

"PFAS has not been used in manufacturing of Kynar Flex PVDF since 2016," says David Seiler, Americas Business Manager, Industrial and Fluoropolymers Global Advisor at Arkema. "PVDF is known to be nonreactive. It is used, for example, in pharmaceutical manufacturing equipment, and is FDA food-contact compliant."

Given the many pledges to increase recycled content, particularly in plastics packaging, processors are expected to be adding higher percentages of recyclate. "A lot of companies are blending in 10-20% recyclate now, but this percentage will go up. People are looking even at 100% recyclate," says Lowrie.

This shift is expected to affect product appearance and processability. "PPRA can help with the aesthetics of these high-recycled content products. And even if the market would accept a lower-quality appearance, a PPRA can be important for reducing the pressure in the machine to improve output," says Lowrie. "PPRA can be added to virgin resin by resin producers who want their materials to process well even when recycled. In addition, PPRA can be added by a compounder or as a masterbatch to help recyclers with processing and product appearance."

Proven benefits

In a controlled experiment (Figure 3), the company compared an LLDPE containing 500 ppm PPRA to LLDPE with no PPRA by first extruding each into a monofilament, grinding, and extruding again into a pellet. The reprocessed materials were then extruded with a flat die to compare processing pressure and melt fracture of the pure materials and blends of the two. Having just 25% of the LLDPE containing PPRA in the blend had some effect on reducing melt fracture and extruder pressure. Increasing the level of the PPRA-containing reyclate helped to more quickly reduce melt fracture and pressure.

The **Evonik** range of processing aids are based on organo-modified siloxane (OMS) chemistry and are designed primarily for compounds and masterbatches going into film extrusion applications, including highly filled compounds and compounds containing recycled polymers. The additives act as internal lubricants to improve processing, aid homogenous dispersion of pigments and fillers, and to improve final part properties such as long-term scratch resistance, reduced coefficient of friction, enhanced haptic properties, increased hydrophobicity, and prevention of bloom over the lifetime of the polymer, says Ido Offenbach, Americas Segments Manager for Compounds & Adhesives at Evonik Interface & Performance.

The company's newest OMS polymer processing aids (PPAs) for film extrusion include Tegomer 6810 (for PE) and Tegomer 6850 (for PP). They are being positioned as halogen-free PPAs that provide alternatives to fluorine-based elastomer PPAs. The company reports that the OMS PPA also functions as a permanent slip enhancer.

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IMAGE: SHUTTERSTOCK

*The switch to electric vehicles is accelerating and demand on plastics in terms of electrical performance is intensifying. **Mark Holmes** reports on some of the latest compound innovations*

Preparing for the EV charge

Penetration of electric vehicles (EVs) in both the public and private transport sectors continues to grow steadily and forecasts are for further acceleration in the e-mobility trend. Development of high performance polymer compounds that meet the specific – and often very new – requirements of EV powertrains will be instrumental in this progression.

Substitution of metals by plastics for weight reduction and fuel economy reasons has been widespread in the automotive and transport sectors for many years. Weight reduction will also be essential in the further development of electric vehicle technology, compensating for the heavy battery packs and helping to extend vehicle range.

However, plastics will also need to provide new performance characteristics in EV components, such as EMI shielding and radar absorption properties, electrical insulation, thermal conductivity and flame retardancy, while maintaining proven performance in terms of impact strength and robustness. These requirements extend beyond EV electrical components to include batteries and electric charging infrastructure.

The combination of EV electrification together with increasing on-board digitalisation brings more risk of interference, according to **Witcom Engineering Plastics**. "There needs to be wider use of EMI shielding plastics in electric vehicles," says Christine Van Bellingen, Business Development Manager, Conductive Compounds. "Witcom has developed a new generation of environmental-friendly, cost-effective EMI shielding compounds to fulfil new e-mobility targets for lighter, safe-to-use plastics housings with shielding effectiveness of 40-60 dB.

"Although progressing more slowly, an additional driver for plastic compounds is that metal replacement should also occur in batteries, where EMI shielding and thermal conductivity is required. However, this is a large market with many suppliers and competing technologies, such as composite-based materials," she says.

For more than 15 years, Witcom has been supplying radar absorption compounds used in ADAS radar sensors. "These are mainly used for blind spot detection and cross traffic alert, in the form of RF absorbers or brackets for example," says Van Bellingen. "Their role is now extended to side impact protection and lane assistance." ›

Main image: Electric vehicles, and the infrastructure to support them, are placing new performance demands on plastics


IMAGE: EVONIK

Above: Evonik's latest halogen-free flame retarded Vestamid compound protects busbars in high-voltage batteries

The company's radar grades are based on many different polymers, including PA, PP, PBT and PC, and use special mixes of conductive additives. They are designed to suppress unwanted multi-path reflections from ghost targets to make sure that the radar sensors and electronics only receive the correct signals.

"Some partners have now developed their seventh generation ADAS radar sensors with us," van Bellingen says. "This safety technology is now key for electric vehicles. There are usually six radar sensors in a car and the move towards more autonomous driving will increase this number in the future. The ADAS system of the more autonomous cars will always consist of a combination of three sensor technologies - radar, lidar and camera."

Electric vehicles are also much quieter than current internal combustion engine powered equivalents, which means that even the slightest squeaking noises inside the vehicle cabin may be uncomfortable. Witcom says its PTFE-free lubricated compounds are providing new options for noise reduction and low wear for gears and bushings.

Busbar insulation

Battery systems are a key area of development in the EV sector and plastic compounds are expected to play a significant role in improving performance and reducing weight and cost. **Evonik**, for example, has expanded its range of PA 12 compounds for insulation of electrical conductors used in high-voltage EV batteries. The company says that its halogen-free flame retardant Vestamid LX9050 OR grade meets the requirements for UL94 V-0 classification in accordance with IEC 60754. Busbars insulated with the new RAL 2003 signal orange coloured grade (orange is used to indicate high-voltage components) can be used at operating temperatures of up to 125°C.

In the future, copper or aluminium busbars in the high-voltage batteries of electric or partially electric vehicles will be expected to provide protection against electrical breakdown to 1,000V and above, as well as the associated risk of fire. Evonik says that Vestamid LX9050 OR meets insulation e-mobility requirements for busbar profiles from 30-150mm^2 at a coating thickness of 0.5-0.7mm. The copper or aluminium profiles are coated by co-extrusion and the company says the compound's processing properties allow high extrusion speeds. Adhesion to the metal core is good, so promoters are not required, and the high elasticity of the grade means coated busbars can be shaped after extrusion and bent without losing the protective effect of the insulation.

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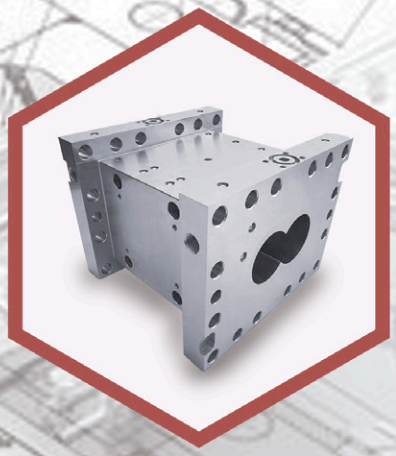

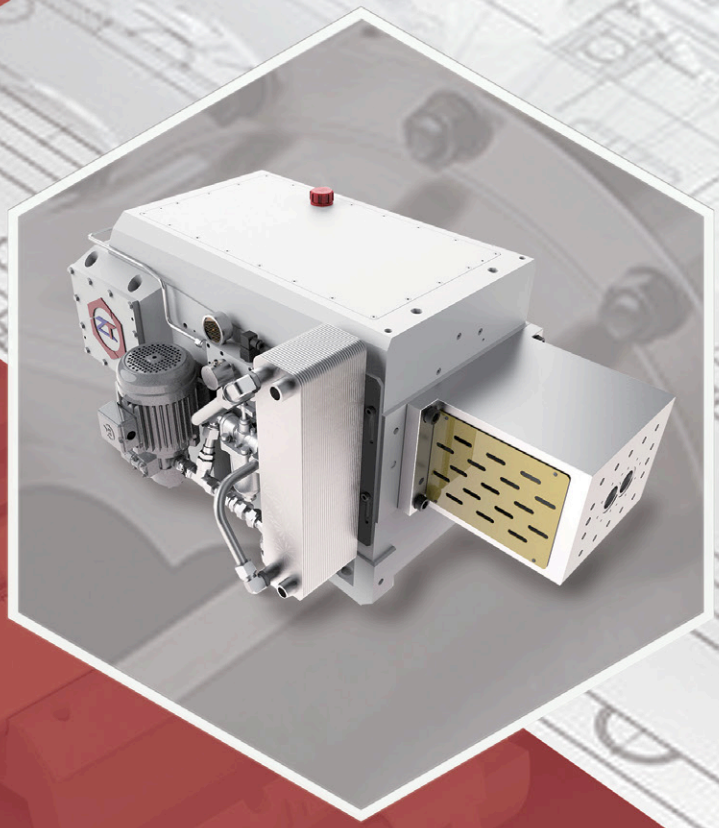

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Right: Noryl NHP6011 and NHP6012 resins from SABIC address key performance requirements for electric vehicle battery enclosures

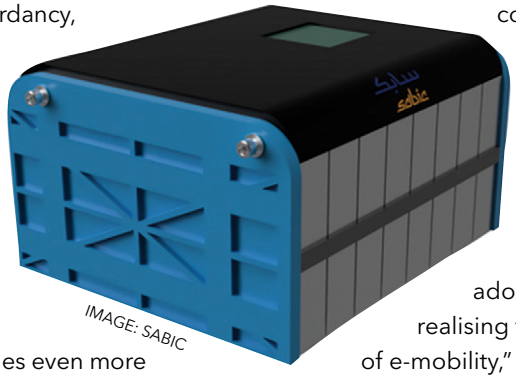
IMAGE: SABIC

"With its highest flame retardancy, excellent insulating properties, and very favourable processing from extrusion to the finished moulded busbar component, Evonik's new high-performance plastic developed especially for e-mobility offers the possibility of making energy management in electric vehicles even more efficient and, above all, significantly safer," says Eckart Ruban, responsible for e-mobility in Evonik's High Performance Polymers Business Unit.

The newly developed compound joins Evonik's existing range of other RAL signal orange PA12 products with V-2 and HB classifications. The company says that the compound is also suitable for processing by injection moulding and, due to its halogen-free flame retardant system, can also be used to manufacture other components for automotive electrical applications.

Battery modules

Two new Noryl resin grades from **SABIC** are said to have been developed to support demand for lighter, thinner and more crash-resistant battery modules and housings in EVs. The company says that Noryl NHP6011 and NHP6012 deliver enhanced flame retardancy and impact strength to meet stringent industry-related safety standards, as well as thin-wall moulding capability to reduce weight and accommodate more cells, helping to extend vehicle range and boost performance. The glass fibre-reinforced grades are based on the company's polyphenylene ether (PPE) copolymer technology and are the latest additions to its growing NHP family for mobility applications.

"Optimisation of batteries is crucial to expanding adoption of electric vehicles and realising the full sustainability benefits of e-mobility," says Darpan Parikh, Global Product Management Leader, Resins & Compounds in SABIC's Specialties business. "By helping to enhance electric vehicle batteries through better safety, higher energy density and lower weight, our new Noryl resins can also help manufacturers increase the consumer appeal of their vehicles."

SABIC says strict flame retardance demands are now in force, driven primarily by concern about the safety of lithium-ion batteries. In Europe and Asia, battery module materials must now meet the UL94 V-0 standard. The Noryl NHP6011 and NHP6012 resins utilise a non-chlorinated/non-brominated flame retardant system that meets UL94 V-0 requirements at 1.5 mm. The two products differ in their glass fibre loadings, allowing them to accommodate specific customer requirements for stiffness and impact performance.

Another key trend in EV battery manufacturing is miniaturisation, according to SABIC. Battery manufacturers are working hard to fit more cells in existing or smaller spaces to increase vehicle power and range. The dimensional stability and good flow properties of the two Noryl grades

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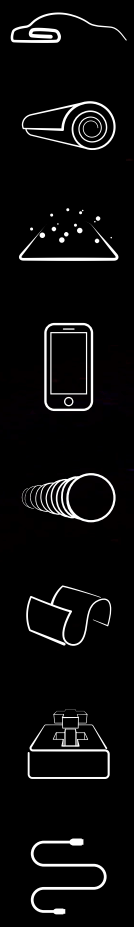

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IMAGE: COVESTRO

Right: Covestro's Bayblend flame-retardant PC blends provide the dimensional stability and electrical properties needed for battery modules

enable space-saving thin-wall designs for cell frames, retainers and battery pack top covers. Furthermore, they provide good dielectric performance with a comparative tracking index (CTI) of 2 to help avoid electrical shorting among tightly packed cells. The new resins are also said to provide improved resistance to acid compared to PC, better resistance to moisture compared to PA, and a low specific gravity.

Beyond power

Weight saving initiatives in the EV sector also extend beyond the powertrain. SABIC recently undertook a design study on automotive rear quarter windows to highlight the advantages of using its Lexan PC resins to save weight while creating differentiated styling, consolidating components, integrating functions and enhancing aerodynamics. The company says that the concepts reveal new opportunities to expand design freedom, control cost and reduce weight by replacing traditional glass.

"As industry trends, such as vehicle electrification, continue to evolve, SABIC is seeing major new opportunities for our materials to radically change automotive styling, while simultaneously addressing the longstanding challenges of weight-out, cost-out and sustainability," says Abdullah Al-Otaibi, General Manager, ETP & Market Solutions. "The latest concepts from our study aim to inspire exciting new window designs that address these needs by combining beautiful aesthetics with practical performance and established processing methods."

SABIC says many of the new concepts feature curved wraparounds that seamlessly flow into other portions of the vehicle, while integrating rear lighting, door latches, D-pillar trims and even sunroofs. Such integrations and complex curvatures cannot typically be achieved with glass. Part and function integrations can enhance aerodynamics to improve battery efficiency and range while also creating a highly streamlined look for the vehicle.

PC has been considered for automotive glazing applications on ICE vehicles in the past and there have been some successes. However, glass has remained the dominant option, which SABIC attributes mainly to its low cost for making simple curved components. However, the company sees disruptors such as EVs prompting the industry to re-imagine vehicle design. In the process, traditional materials such as glass have come under scrutiny and there is a strong interest in replacement with safer, lighter, higher performing engineered plastics. The company has invested in development of a production plant to produce three component injection moulded sunroof elements to build competence in moulding large transparent and semi-transparent parts.

A number of high-performance plastics have been developed by **Covestro** for automotive battery components such as cell holders, which must provide dimensionally accurate placement of the cells in the housing. These include flame-retardant PC blends from the company's Bayblend FR range, which are said to offer good dimensional stability as well as good electrical properties and high impact strength. They enable tight tolerance production of dimensionally stable parts at the volumes required for battery manufacturing.

The company has also developed a thermally conductive PC grade – Makrolon TC. This is intended to provide new options for cooling battery modules (thermal control is very important to ensure long battery life and, depending on the design of the battery system, to enable fast charging). Battery modules using the Makrolon TC materials could be used in electric vehicles, in stationary energy storage systems, and in replaceable batteries for cycles and scooters.

Below: Electrical charging stations can benefit from lightweight, impact resistant performance of Covestro's PC and PC blends

IMAGE: COVESTRO

Charging systems

harging systems are also a key area of development in the EV sector and demands for high speed charging will place heavy demands on plastics.

Right: EMS-Grivory supplied a flame retardant long-glass fibre semi-aromatic Grivory compound for this Huber+Suhner rapid charging system

According to Covestro, charging stations have to withstand all types of weather and be highly robust. They also need to be able to be mass produced and offer design freedom, while providing high functionality, lightness, toughness and good electrical insulation. All are prime benefits of plastics.

Netherlands-based EVBox Group is using Covestro's Makrolon RE for production of charging infrastructure. It is an ISCC PLUS-certified PC produced from mass-balanced biowaste. "It is important to us to think about the entire life cycle of charging stations right from their development and design," says Wijnand Diemer, Senior Director, Product Management at EVBox Group. "These include circular materials as source materials, a modular design that facilitates repairs, and last but not least, the remanufacturing of components and entire charging stations."

Swiss performance polymer specialist **EMS-Grivory** has supplied Huber+Suhner with long-glass fibre reinforced semi-aromatic PA compounds for production of its latest electric vehicle rapid charging system. The company says that the tough, long-glass fibre reinforced and flame-retardant high-performance Grivory GVL-4H V0 grade provides high reliability in rough daily use for charging of electric vehicles.

The high power charging (HPC) systems developed by Huber+Suhner operate at up to 500A and 1,000V, which allows rapid charging times that are not a great deal longer that refilling a conventional fossil-fuel vehicel. Even batteries in large electric vehicles can be recharged up to 80% in less than 15 minutes. The systems use a liquid-cooled cable. The active cooling means the cable

IMAGE: EMS-GRIVORY

can be smaller than would otherwise be required, which makes it easier to handle. The cooling lines are of Grilamid L PA12.

Modular design

Durethan PA and Pocan PBT compounds from **Lanxess** are being used in electric vehicle charging inlets, which accommodate the charging coupler from the external charging station. "Our approach is aimed at using a modular configuration to get the right material in the right place to meet the complex requirements applicable to the various components with the utmost precision," says Gregor Jaschkewitz, Application Developer at the company's High Performance Materials (HPM) business unit. "At the same time, a high level of functional integration is intended to make it as easy as possible to assemble the entire unit, which means screwless assembly and minimal components in order to keep costs low."

According to Lanxess, collaboration with

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manufacturers of charging systems allows the company to incorporate the experience it has accumulated in numerous previous charging infrastructure development projects. "This means that it also satisfies a desire expressed by many manufacturers to have the ability to be as flexible as possible when it comes to charging inlet sealing," says Jaschkewitz. O-rings, sealing cords or family seals can be used, for example, as can lip seals manufactured in a two-component injection moulding process.

The key elements of the charging inlet design the company has developed are the front and rear housings, socket for the connector from the charging station, and an actuator. The latter locks the connector in place to prevent it from being accidentally or deliberately pulled out during the charging process. A pin holder secures the metallic connector pins in place, as well as a printed circuit board (PCB) with cables for charging with direct or alternating current. Particular attention was paid to the design of the pin holder, which positions the cables such that the heat produced during charging is dissipated through the cables in use as well as the other cables not in use. This means the pin holder becomes part of the thermal management system and makes fast charging at high currents easier.

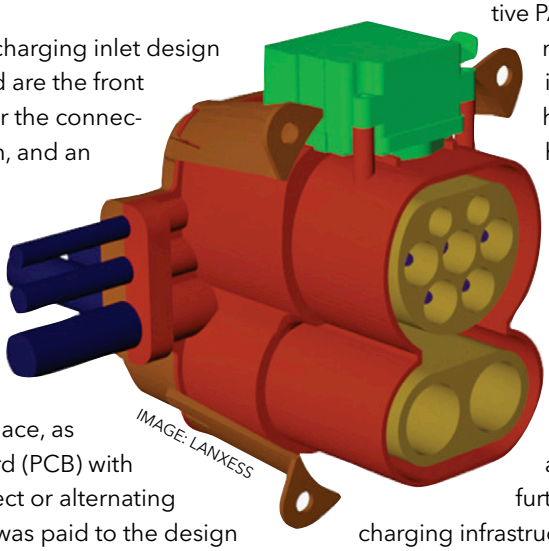

IMAGE: LANXESS

Right: Lanxess has developed several compounds for this new highly integrated electric vehicle charging inlet design

Once the cables and contact pins have been placed in the holder and the PCB clipped in, all the charging inlet components are secured with snap fits. The cables are fastened in place under minimum strain so that they cannot become detached in the housing. The ability to join the components without the need for screws simplifies the assembly process and associated logistics, which cuts manufacturing costs.

Lanxess says plastics for charging inlets are required to comply with the IEC 62196-1 standard and deliver high electrical insulation resistance, as well as high dielectric strength and tracking resistance. Good flame retardant properties are also essential. Parts that come into direct contact with live components must pass a glow-wire end product test (GWEPT), in accordance with IEC 60695-2-11, at a glow-wire ignition temperature of 850°C. After being stored at 80°C for seven days, the plastic parts must not exhibit any surface changes – such as cracks – caused by ageing. High-grade mechanical properties, such as toughness, are also required to ensure that the charging inlet is not susceptible to bumps or vandalism.

"Our material solutions include compounds that are ideally suited to this range of requirements," says Sarah Luers, Application Developer at HPM. "In some cases, versions developed specifically for electric vehicles are also available. This includes, for example, highly weather and UV-resistant products for housings, as well as materials exhibiting low shrinkage and warpage for components that need to be particularly dimensionally stable. Thermally conductive PA6 compounds with good mechanical properties are intended for use in the pin holder, which is subject to heavy thermal loads. This also includes product types that pass the UL94 flammability test prescribed by the US Underwriters Laboratories Inc. testing institute with a V-0 rating."

Lanxess says it is currently considering applying the new design to further assemblies of the charging infrastructure – such as the charging plug. It says much of the design and materials expertise built-up during work on vehicle charging inlets can be deployed because the requirements are very similar.

Compound options

Italian compounder **Lati** has developed a number of self-extinguishing compounds for e-mobility applications such as charging systems, as well as supports and housings for electrical and electronic parts, engine parts and batteries. It says that in terms of compound development, knowing the most important parameters to monitor – such as flame retardancy, glow wire resistance, thermal and physical ageing, resistance to environmental conditions and creeping currents, dielectric rigidity and mechanical strength – is as important as choosing the right material. Its range of self-extinguishing grades covers all resins, including include PA and PBT for typical applications, PPS and PPA for high temperatures, and PEEK for extreme conditions.

Turkish compound specialist **Tisan Engineering Plastics** developed its Tislamid PA and Tisester PBT compounds for components of electric vehicles, such as electric motors, high voltage connectors, battery parts and electric vehicle charging stations. The company says that the compounds provide the required flame retardancy and mechanical performance, as well as electrical performance with high

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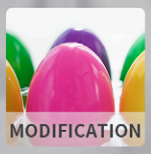
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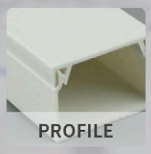
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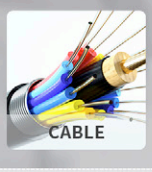
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IMAGE: BASF

Above: BASF supplied a glass fibre reinforced Ultradur PBT for this MD Elektronik high speed data connector for EVs

comparative trace index (CTI) values.

Tislamid A 30 D03 K02 F02 R01, for example, is a 30% glass reinforced heat stabilised PA6 that displays a good balance between mechanical strength and stiffness and is said to be well suited for battery components. Tislamid B 30 D11 K02 HS R01 is a new compound based on PA66 reinforced with carbon fibre for use in electric motor parts, while Tislamid B 30 D11 K02 HS R01 has good mechanical performance and thermal stability for electric vehicle applications.

Tisan says it is also able to address problems such as water absorption and loss of insulating properties for high voltage parts used in harsh environments through its Tisester compound line. Tisester F 30D03 F01 K02 HS R01, for example, is based on glass fibre reinforced, heat stabilised and flame retardant PBT and is described as a good choice for connectors.

With EV developers looking to use ever higher voltage power systems, **DSM Engineering Materials** recently announced it was to upgrade its comparative tracking index (CTI) test laboratory. The company says it will be able to support manufacturers in increasing the voltage of electric vehicle batteries safely, which will enable them to shorten charging times.

Long charging times, the company says, remain a key barrier to the wider adoption of electric vehicle. Shortening charging times requires higher battery voltages of 1,000V or above. DSM says to enable this ultra-fast charging at the required safety and reliability levels, will require plastic compounds with improved insulation and resistance to high voltages. The DSM CTI test laboratory will have equipment to validate tracking resistance to voltages up to 1,500V AC and 1,000V DC.

Ultradur B 4300 G4, a glass fibre-reinforced PBT from **BASF,** is being used by MD Elektronik for a new connector system – C-KLIC – based on the USB Type-C standard and designed to provide faster data transmission in automotive electronic devices. The company says the system enables space saving of up to 60% compared to standard USB ports, providing a data transfer rate of greater than 10GB/s and optional USB power delivery.

According to MD Elektronik, its aim was to produce as many individual parts of the connector system as possible with one material. It says this simplifies processing, is more efficient, and contributes to sustainability by reducing the number of material changes on the production machines.

Amodel Supreme PPA is a new line of high-performance polyphthalamide (PPA) compounds from **Solvay** designed for demanding e-mobility and metal replacement applications. The company says the Supreme grade is aimed at systems requiring good thermal, mechanical and electrical properties. Applications include high-temperature automotive components used in electric drive units such as e-motors, power electronics, housings for high-temperature electrical connectors, and electric and electronic devices.

Solvay adds that the compound offers the stiffness and toughness required to replace metal in more traditional and structural automotive applications, including body in white. Features include a glass transition temperature of 165°C, which enables higher mechanical performance versus traditional PA4T and PA6T-based materials at elevated temperatures. The compound also offers a closer coefficient of linear thermal expansion (CLTE) match to metals, which can simplify design of overmoulded components.

As well as its good thermo-mechanical performance, Amodel Supreme PPA is claimed to offer improved electrical properties, including volume resistivity and dielectric strength above 150°C. The materials are also said to maintain critical electrical properties, such as comparative tracking index (CTI), after exposure to high temperatures over extended periods.

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A new way to handle cable industry EVA shortages

Since the end of 2020, the prices of polymers — and especially EVA copolymers — has been following a consistent upward direction. While comparing the price development of polyolefin elastomers (POE) and EVA polymers, one notes a rather stable price level for POEs since April 2021, whereas EVA has been rising to new all-time highs. Therefore, we at Innospec expect current and long-term price advantages for POE-based formulations that can provide a suitable alternative for many polymeric cable compounds. As a showcase example, we have explored their use in CPR-compliant (EU Construction Products Regulation) HFFR (Halogen Free Flame Retardant) sheathing compounds, which typically contain 20% or more of EVA copolymer.

For the trials we used a standard formulation with a 28% vinyl acetate content EVA copolymer (MFI = 3) as the base polymer and an LLDPE (MFI = 3.5) as a property improver. Besides the additives, the standard flame-retardant system contained a mixture of precipitated ATH and natural milled MDH (See Table 1, Formulation EVA).

In the study, the EVA copolymer was replaced by POE and different VISCOSPEED products. The test formulations included the new development VISCOSPEED HP (high polarity), resulting in better properties during fire tests (Table 2, Formulation POE 2) and VISCOSPEED HP-X (developmental), allowing for the use of simple uncoated natural milled MDH (Table 2, Formulation POE 3). The previously-mentioned replacement yielded a minimum 16% decrease in cost and an improvement in mechanical properties and flowability (Table 2, Formulation POE 1).

To fully assess cost optimisation potential, a complete replacement of price-increasing precipitated ATH with natural MDH was included to yield a 30 % decrease in the total compound cost. As has been reported in many scientific papers and patents, the full replacement of pp-ATH with n-MDH is only possible with a POE-based polymeric matrix. Polarity and low molecular weight, in synergy with maleated coupling agents, is the reason for the efficiency of VISCOSPEED as an active ingredient at the POE/fillers interface.

CPR-complaint cables need to fulfil required flame-retardant measures through fire tests. As the industry standard, EVA-based compounds work well in vertical fire tests and they also yielded the highest rate in this study. Nonetheless, when using the VISCOSPEED products the big issue of burning droplets can be eliminated while using the POE-polymer as the base component (Table 2, Formulation POE 1-3).

Further optimising the standard formulation and increasing the filler content, possible due to the VISCOSPEED dosage, helped increase the internal burning rate, preparing the POE formulation for CPR-compliance (Table 2, Formulation POE 2).

In summary, it can be seen that, with the help of the VISCOSPEED product line, a POE-based formulation can be fine-tuned to eliminate the presence of burning droplets and to allow the flame retardant filler content to be raised to a higher level. This can make the final formulation suitable for CPR-compliance. The exchange of EVA for POE allowed for a strong increase in elongation at break (Table 1, Formulation POE 2) and decreased the total compound cost by up to 30 % (Table 1, Formulation POE 3). In sight of the ongoing crisis in EVA copolymer availability, this approach can be considered as a timely next step in the evolution of CPR compliant cables.

Table 1: Comparison of different EVA and POE-based cable compound formulations with basic mechanical properties and system cost

FORMULATIONS	EVA	POE 1	POE 2	POE 3
EVA28 MFI 3	23.5	-	-	-
POE MFI 1.5	-	21.5	20	22.5
mLLDPE MFI 3.5	8	8	7	7
VISCOSPEED	-	2	-	-
VISCOSPEED HP	-	-	3	-
VISCOSPEED HP-X (dev)	-	-	-	3
LLDPE-g-MAH	4	4	3.5	3
Silicone MB, Stabiliser	1.5	1.5	1.5	2.5
Fine precipated ATH	45	45	45	-
Fine milled MDH	12	12	20	62
Coated $CaCO_3$	6	6	-	-
Cost advantage	-	-16%	-16%	-30%
PROPERTIES	**EVA**	**POE 1**	**POE 2**	**POE 3**
MFI @ 190°C	5.4	7.3	5.4	5.4
TS (MPa)	14.3	15.8	13.4	11.3
EB (%)	145	212	180	158

Table 2: Vertical fire test results for different EVA and POE-based cable compound formulations (according to DIN 4102)

Vertical fire test	EVA	POE 1	POE 2	POE 3
Burning drops	NO	NO	NO	NO
Flame width	2.5	5.5	3	6
Total burning rating	6	3.5	4.5	3.5

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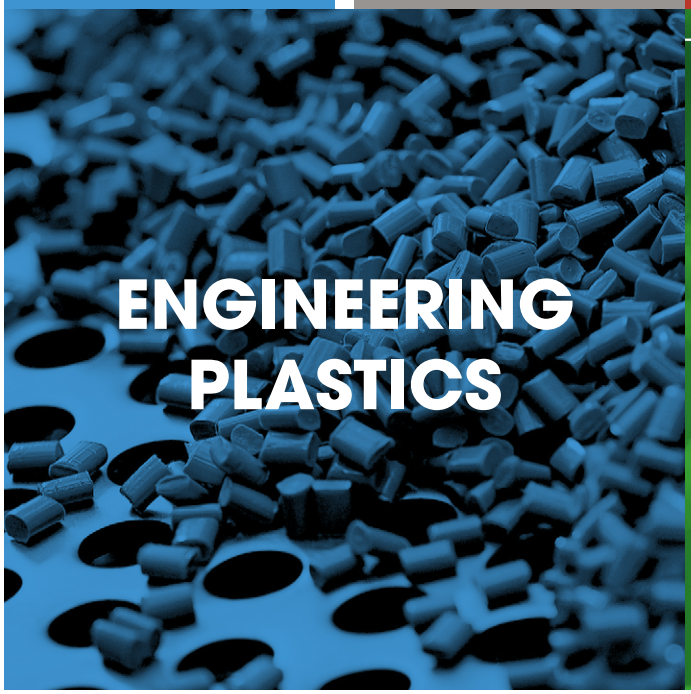

Plastics Engineer

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IMAGE: SHUTTERSTOCK

Making a big impact

*The impact performance of many plastics can suffer at low temperatures. **Peter Mapleston** looks at some recent developments in impact modifiers*

There are many applications where thermoplastic compounds can benefit from improved impact resistance and there is quite a range of additive technologies available to do just that. Impact modifiers can prevent PP containers from cracking when they fall from the freezer, they can help motorists avoid costly repairs to bumpers when they are involved in minor shunts (and at the same time make it easier to create lighter parts), can improve the low-temperature performance of PA compounds, and can increase the recyclability of PET packaging.

The latest development from **Milliken** is a new additive – NX UltraClear MaxImpact – that the company claims "opens new doors" for the use of PP by improving impact performance at very low temperatures. Anyone that has dropped a PP container onto the kitchen floor when taking it out of the freezer will know that at temperatures of around -20°C, the resin will very easily crack or break.

This low temperature impact resistance has limited the use of PP in certain key applications, according to Milliken. "With e-commerce booming, high-impact, cold-temperature-resistant plastics are in strong demand as a packaging solution but have been limited by issues with container breakage during transport and use – until now."

NX UltraClear MaxImpact is said to improve impact resistance in clear, cold-temperature PP applications. Milliken says it provides a very good balance of impact resistance, clarity and stiffness. The company says this can be used both to improve existing PP applications and to broaden the potential use of PP to include products that are currently made instead with polymers such as PS, PET, and PETG.

Using the ASTM Gardner Impact test, researchers have verified the improved impact performance of PP modified with MaxImpact, the company says. Tested samples have demonstrated a four-fold improvement in failure height at -20°C while also maintaining excellent clarity and stiffness.

"This vast improvement in performance makes polypropylene highly suitable for a variety of potential applications, including food storage, food packaging, housewares, sports bottles and household industrial chemical containers," Milliken claims. The company says the additive may be blended at the machine used to make finished parts, or via tumble blending prior to processing.

Earlier this year Netherlands-based **The Compound Company** acquired the German production site (CMP Cologne), product portfolio and customer base for ExxonMobil's Exxelor polymers. This is the latest step in ExxonMobil's plans to divest

Main image: Impact modifiers can help polymers such as PP and PA maintain performance at sub-zero temperatures

Right: Typical applications for Milliken's new NX UltraClear MaxImpact include PP parts requiring clarity and low temperature performance

non-core polymer businesses (it finalised the sale of its Santoprene TPV business to Celanese in December).

Exxelor grades are chemically modified polyolefin and elastomer-based polymeric performance enhancers for various types of thermoplastics. They can be used as impact modifiers as well as compatibilisers, coupling agents and adhesion promoters. The Compound Company says the Exxelor products complement its existing range of functionalised and grafted polyolefin-based solutions, which include its Yparex extrudable adhesive resins and the Eco-Forte compound portfolio, and expects the acquisition to significantly expand the group's reach into new markets.

"While Exxelor has traditionally been targeting different application areas than Yparex or EcoForte, it will benefit from the sales support by our experienced commercial team," says Wouter van den Berg, Commercial Director at the company.

While Yparex has traditionally been strong in building, construction and packaging applications, Exxelor is a well-established compounding additive brand, he says. Grades such as VA1801, VA1803 and VA184 are well-known for PA impact modification, for example.

The Compound Company will continue to operate both production sites (one for Yparex, one for Exxelor) after the deal closes.

As the case of Exxelor demonstrates, the supplier base for functional additives continues to change. In recent years, some major names have divested themselves of such product lines, while others have announced grade rationalisations. **SACO AEI Polymers** is building its presence in the sector. "With deep roots in reactive extrusion and in the safe handling of the chemicals involved, SACO AEI Polymers delivers a variety of grafted and compounded solutions, including maleic anhydride functional additives under the Armidan and Linxidan trademarks," the company says.

IMAGE: THE COMPOUND COMPANY

Above: Exxelor functional polymer resins expand The Compound Company's functionalised polyolefin-based product portfolio

The SACO AEI Polymers brand dates to 2016 but the company's compounding history extends back to 1998 and the formation of Padanplast USA, initially a joint venture with Italy's Padanaplast. Padanaplast USA bought the compounding assets of Eaton Corp in 2007. It changed its name to SACO Polymers in 2010, then to SACO AEI Polymers following its acquisition of UK-based AEI Compounds.

PA compounds are well known for their good mechanical properties and easy processability, but sometimes impact properties at ambient and low temperatures let them down. For applications where impact performance is very important, SACO AEI Polymers says grafted maleic anhydride (MAH) polymers are an effective solution.

Grafting solutions

Armidan is a family of impact modifiers for PA (and also PBT), produced by grafting MAH onto a variety of polyolefinic, elastomeric, or rubber-based resins. Danielle Sherman, Commercial and Product Manager – Custom Solutions at SACO AEI, says the portfolio has been designed to provide a wide range of impact and mechanical property improvements across a broad temperature range.

One example is Armidan NT7410. Formulated for use with PA66, it has high melt flow (39g/10 min) as well as a high concentration of maleic anhydride to achieve good dispersion and morphological properties. A low glass transition temperature ensures it will achieve good impact properties down to -40°C. The company says the additive is easy to process and, depending upon the desired performance target, can be used at loading levels from 8-25%.

Turkish technical compounder **Tisan Engineering Plastics** offers MAH-grafted polymers under the Olebond brand. The company says grafting is achieved by reactive extrusion and makes it

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IMAGE: SHUTTERSTOCK

Above: Dow's Engage 11000 series modifiers can improve impact performance of TPO bumper compounds

possible to optimise the compromise between chain breakage and grafting efficiency.

Olebond 7403 IM-C is an MAH-grafted polyethylene that is developed for use as an impact modifier for PA. It is said to enhance low-temperature impact properties through adhesion to the PA through the reaction of amine or carboxylic acid end-groups of the PA polymer with the functional group of the Olebond.

Olebond 7403 IM-C has a Tg below -50°C, which the company says means it provides "outstanding" performance at low temperatures. Tisan does not provide a figure for the level of grafting but says that its high functionality means that only a small amount of Olebond 7403 IM-C is required to see a positive effect. To reach high levels of impact resistance in PA compounds, the company says addition levels of up to 20% may be required.

In the automotive sector, **Dow** says it has been expanding technology options for its Engage impact modifiers. The company says that reducing greenhouse gas emissions is a critical concern in the automotive industry and that lightweighting through replacement of metal parts with polymeric alternatives such as modified polypropylenes (TPOs) is one of the key approaches to emission reduction. It cites the Engage 11000 range of polyolefin elastomers (POEs) as one example – these can be used not only for impact modification of PP compounds used for body panels (and other parts) but also to reduce coefficient of linear thermal expansion (CLTE) closer to levels of the metal parts that the panels fit next to.

"Engage 11000 allows TPO compounders, part manufacturers and OEMs to develop solutions with reduced part weight and improved system costs through processing advantages," says Zshelyz Lee, Senior Marketing Manager at Dow. "It also enables more complex designs and thinner parts with a higher balance of flow, stiffness and toughness. Such POEs are suitable for TPO compounds for a range of applications: instrument and door panels, air bag covers and bumper fascia, rocker panels and tail gates."

Lee says that, with its Engage 11000 POEs, Dow has "expanded the design space for OEMs while improving performance for end consumers."

Some months ago, Swiss masterbatch specialist **Sukano** launched a newly formulated transparent impact modifier for cold, flash frozen and room temperature applications under the umbrella of the Sukano RPET Product Portfolio. It says the Sukano Impact Modifier Masterbatch can enable virgin or recycled PET to replace specialised co-polyester resins, so allowing the end application to be mono-material and recyclable.

"Customers have a recyclable alternative at hand to replace products made of, for instance, copolyester or GAG film structures, while enjoying the benefits that go beyond mechanical properties modification," says Alessandra Funcia, Head of Marketing at Sukano.

Improved durability and toughness are said to be achieved without a loss in transparency. "It also allows safe packaging for consumers by reducing sharp edges and it leads to less shards, avoiding contamination," says Funcia. "Our customers can

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IMAGE: SABIC

Above: Kraton is working with SABIC to source renewable butadiene for SBC production produced from wood pulp by-products

also testify that these high-performance masterbatches provide additional functionality as a cutting aid, improving die cutting in production, speeding up the lines and avoiding any cross-contamination potential by splinters."

Bio-based specialty producer **Kraton Corporation**, which produces a range of polymers and high-value bio-based products derived from pine wood pulping co-products (and was recently acquired by the Korean company DL Chemical), announced last December that it had received the International Sustainability and Carbon Certification (ISCC) Plus covering production of styrenic block copolymers (SBCs) from renewables at its Berre, France facility.

ISCC Plus certification supports traceability of recycled and renewable-based materials across the supply chain and verifies that companies meet social and environmental standards. Traceability is a key element in the mass balance accreditation of production systems. In this approach, both renewable and fossil feedstocks are combined in the production process and products are attributed a certain amount of renewable content, which can be tracked in the value chain.

SBCs are used to modify impact performance in numerous polymers, including styrenics, PP and engineering thermoplastics. Kraton says its SBC polymers are stronger than some other olefinic elastomers due to their phase separation morphology. The company says this makes them effective at lower addition rates – typically 3-10%.

The renewable-based SBC polymers have been launched as the CirKular+ ReNew Series, which is an extension of Kraton's existing CirKular+ product line of upcycling and circular economy solutions. The company says that, with up to 70% renewable content, the ReNew Series offers customers the opportunity to use the mass balance approach and adopt ISCC PLUS certification to produce renewable products.

The SBC polymers are produced using certified renewable butadiene and Kraton says output of this is expected to increase gradually to meet growing market demand over the coming years.

ISCC certified butadiene is currently available from several suppliers. In mid-March, **SABIC** said it was collaborating with Kraton to deliver certified renewable butadiene from its Trucircle portfolio. SABIC says the product is derived from 'second generation' renewable feedstock such as tall oil, a by-product from the wood pulping process in the paper industry. The company says each kilogram of this butadiene reduces CO_2 emissions by an average of 4kg compared to fossil-based virgin alternatives.

According to a Kraton representative, the CirKular+ ReNew Series "expands Kraton's existing suite of solutions designed to advance the circular economy…The unlocked sustainability benefits with CirKular+ ReNew Series can help compounders support the sustainability objectives set by brand owners and automotive OEMs."

In February, Kraton also announced that its CirKular+ Performance Enhancement Series C2000 and C3000 have been approved as fully compatible with recycling of PP containers in Europe according to RecyClass. This is a comprehensive cross-industry initiative that works to advance plastic packaging recyclability and to establish a harmonised approach to recycled content calculation and traceability in Europe.

Pellets containing 5 wt% of either CirKular+ C2000 or C3000 resin blended in an injection moulding PP grade matrix were tested according to the Association of Plastic Recyclers (APR) Critical Guidance for PP Rigid Containers. According to Fabrizio di Gregorio, Technical Director of Plastics Recyclers Europe (RecyClass), when used at up to 5% of total packaging weight, the CirKular+ C2000 and C3000 resins are fully compatible with the existing European industrial recycling processes for PP containers. The resins also improve the recyclate impact strength by up to 500%.

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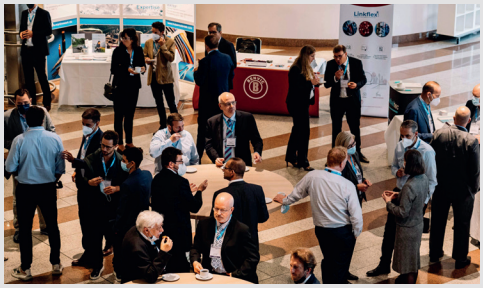

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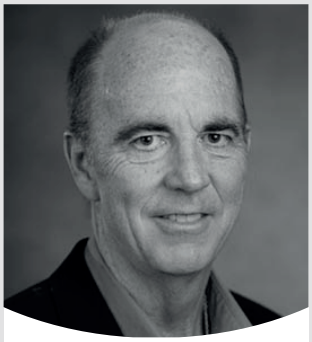

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Making a success of small batches

As production batches get smaller the need to get compounding lines turned around and back into stable production grows. ***Peter Mapleston*** *learns more*

IMAGE: SHUTTERSTOCK

If you want to be a successful small batch compounder, you need to get up to optimal production quickly, stay there without wavering, come down quickly, take as little time as possible moving to the next job, and then do it all over again with a different compound. The idea is simple enough – the difficulties often appear in the execution.

"Small batch compounding requires flexibility, fast response, short lead times and – obviously – shorter production times than conventional compounding. Getting up to regime faster and keeping the steady state provides a competitive advantage, especially when you are formulating thousands of recipes per year," says Luis Roca, Leader of Compounding at Spanish research organisation **Aimplas**.

"Besides looking closely at changeovers, companies should analyse the time it takes to arrive at the steady state for collecting the compound, what are the main causes of any drifts away from that steady state during compounding, and to find the origin of both issues. Over time, they could represent an important amount of lost time and money," he adds.

Roca identifies a number of key factors to consider, starting with having a reliable and robust process, where all the equipment and ancillaries are working accurately (feeding, pelletising, vacuum venting and the like), with the right configuration for each type of filler or compound. He says he has seen cases where configurations remain the same even when the polymer or a filler generates problems when feeding and pelletising, possibly leading to blocked vents and production halts.

When it comes to process control, different aspects need to be considered. "The first is the state of the sensors on the extruder. When melt temperature or pressure sensors are not working properly, problems like die build-up can arise if temperature profiles that are too high are set up, or vacuum is not working in the right way," Roca says.

Another issue to pay attention to is the possible lack of response procedure when response variables – such as melt temperature, pressure or torque – change.

"Understanding what range of deviations on torque, SMI, Tm and Pm are acceptable and its evolution in time is mandatory to keep quality standards. Besides alarms, it is highly advisable to establish a range of acceptance in the extruder response variables, which all the technicians should know in order to detect compounding problems and to minimise rejects," Roca says.

"A standardised procedure that correlate the possible deviations of response variables with the possible problem and its sources will minimise the time of reaction and also the consequences of the problems. Troubleshooting and how to react against unexpected events should be part of the quality system of any compounding company," he adds. ›

Main image: Efficient small batch compounding requires a good understanding of process set-up and control

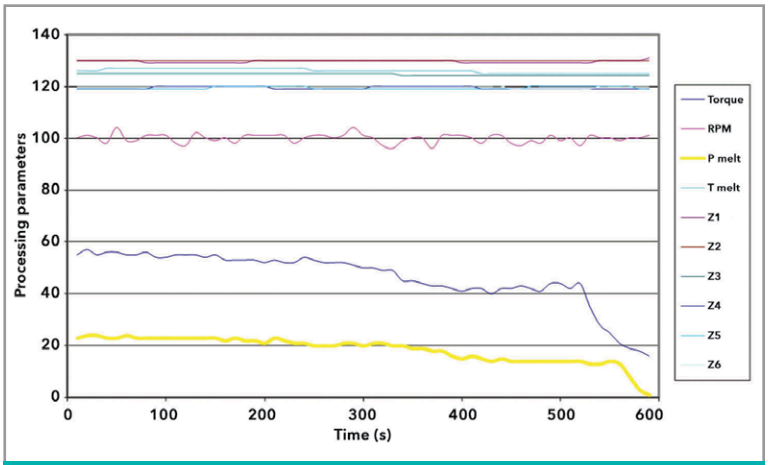

Figure 1: Graphical representations make it easy to see process drift, according to Luis Roca, Leader of Compounding at Aimplas. In this example, the dark blue and yellow lines show a progressive decrease in torque and pressure due to a side feeder flooding. This was obviously affecting the final formula of a mineral-filled compound, and causing the material to be rejected
Source: Aimplas

Graphical gains

Roca recommends running the compounding extruder control display in graphical mode to help detect deviations faster. "Without knowing the compounding details, everybody should know that when the graph is not constant, you have a quality/safety problem," he says (see example in Figure 1)

At compounding extruder maker **Feddem**, Business Development/Account Manager Klaus Hojer says the company has put a lot of thought into optimising its lines for heavy-duty production with frequently changing recipes and efficiently processing smaller batches.

Hojer highlights the company's Innovative Compounding and Extrusion (ICX) technology concept. This was jointly developed with sister company Akro-Plastic, which is one of the largest producers of technical compounds in Germany. "Generating a substantial share of their business from toll compounding, Akro-Plastic may have several product changes per extrusion line daily, depending on the constellation of orders," he says.

To minimise changeover times between recipes, the ICX concept provides for up to eight gravimetric feeders above the main feed throat of the extruder and up to two gravimetric feeders per FSB side feeder. Some of these feeders can be dedicated to frequently repeating recipe components to reduce the frequency of feeder changeovers.

When this feeding concept is combined with Feddem's kneading-block-free screw geometries, the need for replacing screw geometries between recipes is drastically reduced, according to Hojer. "For example, with a given base polymer employing Feddem FME mixing elements in place of kneading blocks allows for producing powder filled products and fibre reinforced compounds on the same screw geometry in excellent quality," he says.

Consider the basics

When assigning lot sizes to individual extruders, Hojer says a compounder needs to consider basic performance and production time relations. "When employing a larger extrusion line for processing a relatively small lot size the run will be short. However, the challenge is that the processing parameters barely have time to reach stable running conditions. This, in turn, may lead to shortcomings in the repeatability of the product quality when the job is run on a production line with a smaller capacity the next time," he says.

Using a larger extruder also means more potential for wasted materials. "Start-up and shut-down waste is proportional to the extruder size. Larger extruders need more feed stocks to fill the cavities during start-up of the line and will hold more product that goes to waste when the production run is finished. Employing a small extrusion line for processing a relatively large lot size will lead to a long duration of the production run and will block this line for more appropriate job assignments," he says.

"Decades of experience in production planning have shown that it is far more important to focus on having the lines running per se rather than striving for utilising the individual extrusion lines to their highest throughput capacities," Hojer adds.

For flexible production with frequent product changes, strand pelletising is the technology of choice for Feddem. The company's FSK-series die heads have a low-volume melt channel for efficient distribution of the melt to the die holes, Hojer says, and are available with an oval breaker plate that can carry screens or – for small batches – with a

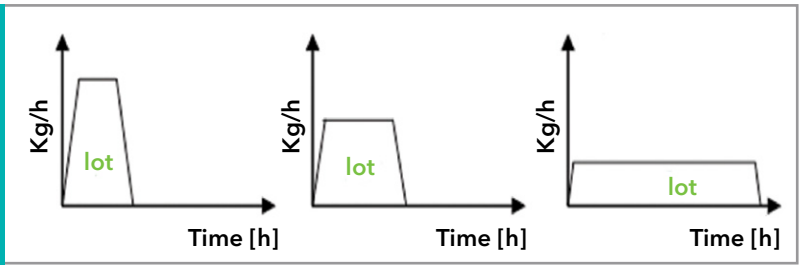

Figure 2: There is a balance to be found between line output and run size in terms of quality and efficiency, according to Feddem. A larger extrusion line (left) will offer a short production time but a lot of material can be wasted reaching stable running conditions. A smaller line (right) reduces material waste but even small jobs can tie up capacity for long periods
Source: Feddem

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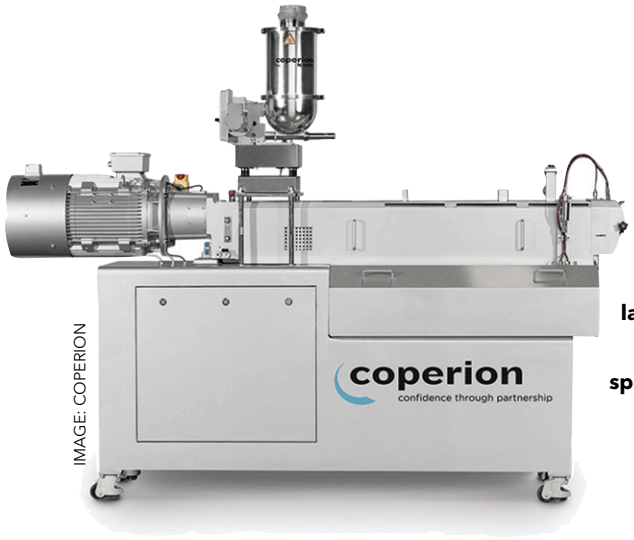

IMAGE: COPERION

Left: Coperion's STS 25 Mc11 twin-screw laboratory extruder now has a screw speed of 1,200r/min and outputs up to 100 kg/hr

screen carrier plate that can be easily removed from the die head by just loosening two bolts.

Lifting throughput

To extend the process window of its STS 25 Mc^{11} twin-screw laboratory extruder, **Coperion** has increased the screw speed from 900 to 1,200rpm. The company says this makes it well suited for recipe development and basic scientific research with small batch sizes of 2kg while being able to reach throughput rates of up to 110 kg/h.

"The STS 25 Mc^{11} has a simple design, is operator-friendly and easy to clean," says Peter von Hoffmann, General Manager Business Unit Engineering Plastics & Special Applications at Coperion. "By having the same screw diameter ratio D_o/D_i of 1.55 and the same maximum specific torque Md/a^3 of 11.3 Nm/cm³ as the whole STS Mc^{11} extruder series, production parameters can be reliably scaled up to larger STS units."

Last year, **Polimer Teknik** presented its Scientific Serie compounders, which were designed as laboratory machines for R&D applications as well as for optimising new product formulations. The poex T16 model was the first in the new series (the 16 refers to the L/D ratio). At the time of the launch, the company said screw and barrel materials are chosen depending on the application conditions and the materials to be processed.

In addition, and depending on the process conditions such as very low viscosity chemical reactive extrusion where extra sealing protection is required, high temperature and abrasion resistant gaskets are used between the sleeves. Various other options can be fitted, again depending on the process.

The company now says that, due to high demand on different capacities and barrel type, it has also decided to offer larger units with a clam-shell system as an alternative to a modular segmental barrel construction. The clam-shell system provides full and easy access to the process section by opening the divided barrels horizontally. "Thus, the system supplies both high flexibility in operation and easy

Right: Polimer Teknik's poex T27 compounder is now available with an easy-to-clean clam shell barrel system

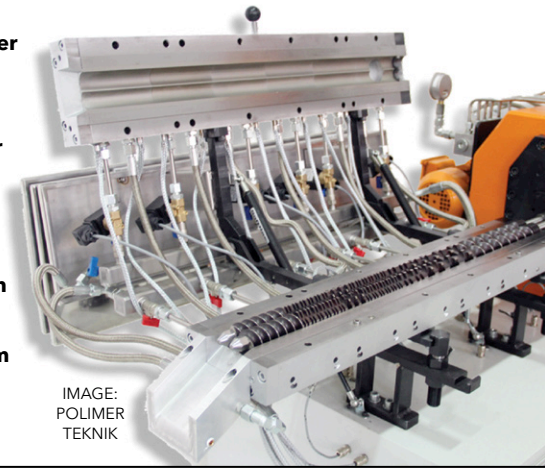

IMAGE: POLIMER TEKNIK

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Sensitive solution for bioplastics

ICMA SanGiorgio has delivered a second compounding line for production of biodegradable and bio-based compounds to SabioMaterials, an Italian company founded in 2016 and based at Forlì.

The first ICMA line installed at SabioMaterials was specially designed for small production batches. This second line expands its industrial capabilities and will be used for production of its Terralix and Biodura ranges.

"Our expertise includes polyhydroxyalkanoates (PHA), additives, and the production process of materials," says SabioMaterials founder Alessandro Carfagnini. "We are expert in assessing novel ingredients, designing novel formulations and prototyping novel materials. For these activities we rely on our laboratories and pilot scale plant."

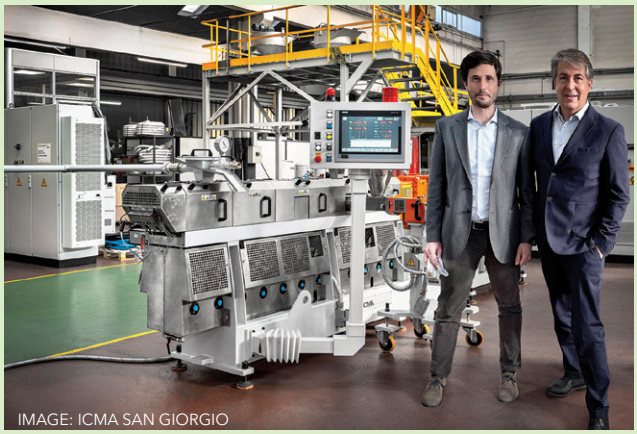

IMAGE: ICMA SAN GIORGIO

Left: SabioMaterials' founder Alessandro Carfagnini (left) and Giorgio Colombo, President of ICMA San Giorgio, with the company's new 50mm compounder

The new extruder is a 50 mm model and is equipped with a side feeder, liquid injection and degassing system. Screw configuration has been optimised within ICMA's Innovation Hub and is specifically designed for mixing sensitive materials.

The Carfagnini name may well be familiar to some in the compounding sector. Alessandro Carfagnini is the son of Italo Carfagnini, founder and CEO of So.F.Ter, the Forlì -based thermoplastic elastomer and engineering plastics compounder acquired by Celanese in 2016. It now operates as Celanese Production Italy.

› **www.icmasg.it**
› **www.sabiomaterials.com**

cleaning of the barrels and screw segments at the end of each production cycle," according to Reha Yelken, Sales and Marketing Director.

The first new project to use the clam-shell arrangement was a powder coating application that called for a poex T27 clamshell extruder with high free volume. This has screws with a 27 L/D and 28.8mm diameter.

The process section was designed to meet the specific requirements of the task: OD/ID value is 1.80 to provide maximum free volume, the length of the process section is 24D, and the screw speed is 1,200 rpm to achieve the high shear required. Torque density is 12Nm/cm^3. The project also required the use of a poex cooling drum and poex twin screw feeder with stirring agitator, which runs based on a premix principle.

"Due to the fact that it requires only a small area and can easily be moved, the user gets the flexibility of a lab machine which can be designed and improved based on customer demands," Yelken says.

The QC3 concept from **Entek** was developed very much with small batch compounding in mind. Its QC^3 33mm co-rotating twin-screw extruder, originally introduced in 2018, includes all of the company's QC^3 features – Quick-Change, Quick-Clean, and Quality Control. It has since become one of Entek's most popular machines, plugging the gap between its 27mm and 43mm versions.

"Our 27mm twin-screw extruder is excellent for lab environments, and our 43mm is designed for small to medium-sized lots of compounds," says Linda Campbell, Entek's VP of Extrusion Sales. "We were getting a lot of requests from customers for something in between – a machine specifically designed for small lots, but with more output than the lab machine."

Below: Entek's QC3 concept features are particularly beneficial for compounders running shorter runs with frequent changeovers

IMAGE: ENTEK

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Looking forward to Europe's Compounding World Congress

IMAGE: SHUTTERSTOCK

We take a look at some of the speakers lined up for AMI's fifth Compounding World Congress, which takes place in Cologne in Germany in June

IMAGE: AMI

Top image: Cologne in Germany is the location for AMI's Compounding World Congress, which presents a learning and networking opportunity for Europe's technical compounders

Now in its fifth edition, the Compounding World Congress has established itself as an important meeting place for thermoplastics compounders from across Europe and beyond. Organised by *Compounding World* publisher AMI, the two-day event is primarily focused on technical compounds based on engineering thermoplastics, thermoplastic elastomers and performance polyolefins for demanding applications in markets such as automotive, electrical/electronic and industrial.

Taking place on 7-8 June 2022 in Cologne, Germany, the 2022 edition offers the opportunity to gain insight into global market trends, to debate key technical and commercial issues with leading experts in thermoplastic compounding, and to network with key industry professionals from across the plastics compounding supply chain.

The event will provide attendees with valuable analysis of key market trends and updates, while its debate session will bring together expert participants to discuss the future outlook and direction of development in technical compounding and its end-user markets.

The high-level programme also provides practical advice on getting the most from compounding lines and covers a raft of new additive and material technologies. Dedicated sessions focus on new developments in the compounding of renewable raw materials, as well as fillers and formulations for adding value and enhancing properties. Expert speakers will also cover technical PP compounds, identifying new opportunities for compounders and examine advances in nanocomposites.

The Compounding World Congress 2022 will kick off with a presentation by **Rhian O'Connor**, Senior Consultant at UK-based **AMI**, who will explore market trends in technical compounds, including PP and engineering plastics. She will be

Speakers at the Compounding World Congress include (top L-R): Sumika Polymer Compounds Technical Manager Nicolas Schlutig, INNO-COMP KFT Managing Director Péter Torma, Celanese Global OEM Manager Automotive (BMW Group) Olaf Herd, (bottom L-R): Kingfa Sci. & Tech. (Europe) General Manager Leo Wu, Nanocyl Technical Sales Manager Alicia Rul, and Coperion Head of Process Engineering Plastics and Chemical Applications Frank Mack.

followed by **Judith Friesl**, Managing Director of **Yordas Group** in Germany, who will look at how polymers are regulated in the EU and under different REACH-like regulations around the globe.

The second session will be opened by **Kathrin Lehmann**, Global Senior Expert Technical Director Plastics Business Line Interface & Performance at **Evonik Operations** in Germany, who will speak about developing additives and compounds that extend the use of bioplastics into demanding automotive and E&E applications. Then **Ari Rosling**, R&D Director at **ABM Composite** in Finland, will explore some advanced biocomposites based on biodegradable bioplastics and degradable glass fibre reinforcements. The session will end with a presentation by **Luis Valencia**, Director Material Development and Application at **Biofiber Tech** in Sweden, who will focus on implementing innovations in wood-fibre-reinforced plastics.

Reinforced compounds

The next session will feature **Nicolas Schlutig**, Technical Manager at **Sumika Polymer Compounds** in France, who will speak about developing reinforced PP compounds with reduced carbon footprint without compromising on performance. Then **Péter Torma**, Managing Director at **INNO-COMP KFT** in Hungary, will present a perspective on the use of PP compounds to reduce weight and save cost. Development of PP-Long Glass Fibre vs PP-Short Glass Fibre and PP-TV compounds to meet the latest automotive requirements will be discussed by **Olaf Herd**, Global OEM Manager Automotive (BMW Group) at **Celanese** in Germany.

The final session in the first day will include a presentation by **Dr Walter Ramirez**, CEO & Founder of **Innventik** in Spain, which explores recent advances in functional fillers and additives for enhanced performance in polymer compounds. He will be followed by **Thorsten Hilgers**, Project Manager Plastics at **Quarzwerke HPF The Mineral Engineers** in Germany, who will detail an investigation into special additives for odour optimisation.

The second day of the congress will be opened by **Chris Smith**, Editor-in-Chief of Compounding World Magazine the UK, who will discuss a number of emerging areas of compounding innovation. This will be followed by a panel discussion exploring the future of technical compounding. The discussion will moderated by **Chris Smith** and includes **Leo Wu**, General Manager at **Kingfa Sci. & Tech. (Europe)** in Germany. More panellists will be announced over the coming weeks.

Nano innovations

Session six starts with a presentation on multiwall carbon nanotubes focusing on a comparison of masterbatch dilution and direct compounding for conductive applications, which will be given by **Alicia Rul,** Technical Sales Manager at **Nanocyl** in Belgium. Then **Dr Günter Beyer**, CEO of **Fire and Polymer** in Belgium, will present his perspective on what we know and what must still be solved with regard to nanocomposites.

The final session of the congress focuses on process optimisation. **Frank Mack**, Head of Process Engineering Plastics and Chemical Applications at **Coperion** in Germany, will speak about the potential for automation of the compounding plant. Then **Klaus Hojer**, Business Development / Project Manager at **Feddem** in Germany, will explain how gentle compounding without the use of kneading blocks can improve product quality and line flexibility. **Luis Roca Blay**, Leader of Compounding at **AIMPLAS** in Spain, will close the event with discussion of compounding temperature profiles and the influence they have on compound mechanical properties.

The 2022 edition of the Compounding World Congress takes place at the Pullman Hotel in Cologne, Germany, on 7-8 June 2022. To find out more about the two-day conference, to book your place, or to learn about sponsorship and exhibition opportunities, visit the **conference website**.

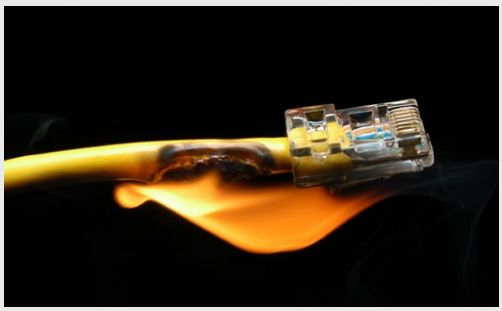
AMI | Events

Fire Resistance in Plastics

28-30 November 2022 | Cologne, Germany

Save €300* if you book before 27 May 2022

Discover the latest developments in fire retardant technologies



Join us in November

- Discover new developments in fire retardant technologies
- Learn about the latest in performance for different applications
- Discuss market trends and the future of flame retardants
- Benchmark your company against other leading players
- A unique opportunity to network with key professionals from the global FR industry

*This discount cannot be used in conjunction with other offers.

SECURE YOUR DISCOUNTED PLACE

AMI | Events

Chemical Recycling

14-15 June 2022 | Cologne, Germany

Discover the developments in advanced recycling and its integration into the European recycling supply chain

Agenda out now! Speakers include:

Hanne Jones
Business Unit Manager
AMI

John Sewell
Secretary General,
Chemical Recycling
Europe

Patrick Child
Deputy Director
General
European Commission-
DG Environment

Dr. Richard von Goetze
Head of Chemical
Recycling,
Alba Group

Other speaking companies include: P&G, Audi, Clariter, CEFLEX, SABIC and European Chemical Industry Council - CEFIC

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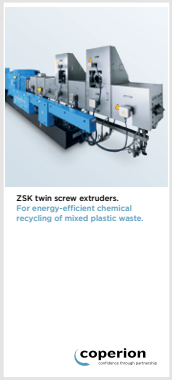
COPERION: CHEMICAL RECYCLING



Chemical recycling promises a new way to handle certain end-of-life plastics. Learn how Coperion's high performance ZSK twin screw extruders can be effectively applied in this fast developing plastics processing sector.

❯ CLICK HERE TO DOWNLOAD

MIXACO: MIXING TECHNOLOGY

Mixaco has been driving innovation in PVC mixing technology for more than 50 years and has 7,500+ machines installed worldwide. This brochure explains some of the details that make its HM and KMH heating cooling mixers stand out.

❯ CLICK HERE TO DOWNLOAD

BUSS: COMPEO KNEADER

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

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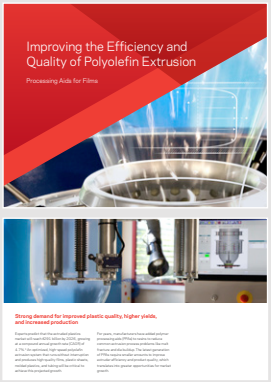
CHEMOURS: PROCESSING AIDS



In this brochure, Improving the Efficiency and Quality of Polyolefin Extrusion, Chemours explains how issues including melt fracture and extrusion instabilities can be addressed with its Viton FreeFlow products, the next generation of polymer processing aids.

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KLK OLEO: GREEN ADDITIVES

KLK OLEO provides a series of products for industrial applications. PALMOWAX and PALMESTER provide green lubricant solutions for polymer processing; PALMERE and PALMERA are green ingredients for PVC additives/ plasticisers.

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HUBER: THERMAL MANAGEMENT

Heat dissipation has become an important consideration in many plastics applications. Find out how the thermal properties of Huber's Martoxid, Magnifin and Martinal fillers can be used to create thermally conductive polymer compounds.

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

CONNECT WITH THE ASIAN PVC INDUSTRY

AMI | Events

PVC Formulation

8-9 December 2022 | Bangkok, Thailand

Discover the latest Asian and global trends in PVC innovations to optimise and add value to your formulations

- Explore the latest global and local trends in PVC trade and technology
- Find out how recent market changes have affected the PVC compound supply
- Learn about sustainability initiatives for the ASEAN region and how global sustainability drivers affect the PVC industry in Asia
- Discover the latest advances in a range of PVC additives
- Get details on how advances in additives can affect formulations for both rigid and flexible PVC applications

Save $400* if you book before 10 June 2022

Secure your place today

Other ways to get involved:

Become a Founding Sponsor: Build your brand awareness, develop targeted contacts, and deliver key messages.

Join as a speaker: Showcase your knowledge and your company's experience of PVC formulations to a global audience.

Exclusive discount for compounders and processers: attend for just $195**

Contact Shubhita Chaturvedi for more information and to access the discount.

Founding sponsors:

BÆRLOCHER HCA HOLLAND COLOURS SUNACE SONGWON TROY The Gold Standard for Performance TRONOX

*Discounts cannot be used in conjunction with other offers.
**Subject to approval.

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AMI publishes five process-specific FREE plastics industry magazines. Simply click on the cover below to read each magazine. Or download the issue in the relevant Apple or Android app

Compounding World March 2022
Compounding World's March issue reports on manufacturers of twin screw compounding machinery that are optimising and tuning equipment to meet specific customer needs. Other features cover LFTs, special effect pigments and masterbatches, and odour control.

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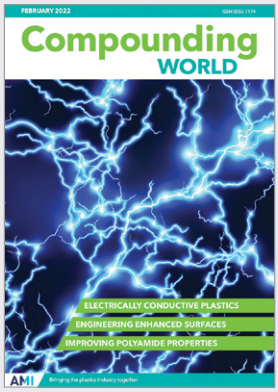

Compounding World February 2022
The February issue of Compounding World reports that for polymer compounders, the route to a low carbon future is likely to mean a greater use of electrically conductive carbon additives, while other features focus on polyamide additives and surface modification.

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Injection World March 2022
The March edition of Injection World magazine looks at how furniture designers are using plastics – especially recycled some of the latest grades. It also explores developments in thin wall moulding and material drying technology.

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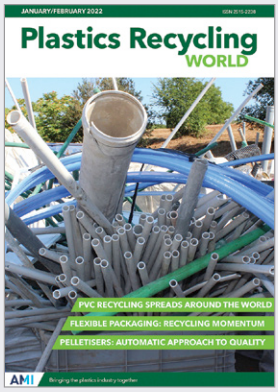

Plastics Recycling World January/February 2022
The January-February issue of Plastics Recycling World looks at how PVC recycling is spreading around the world and the growing momentum in flexible packaging recycling, plus new developments in pelletisers.

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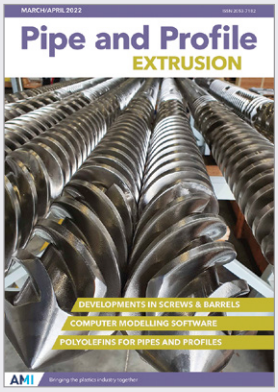

Pipe and Profile March/April2022
The March/April edition of Pipe and Profile Extrusion looks at how optimised screw designs can lift production efficiency. This issue also explores some new highly demanding application areas for PO pipes and reviews the latest in computer simulation tools.

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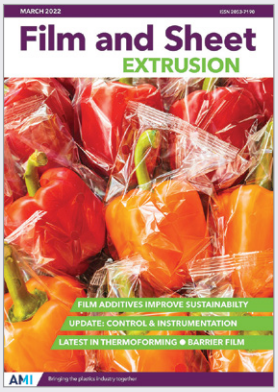

Film and Sheet March 2022
The March 2022 edition of Film and Sheet Extrusion explores the latest innovations in additives for packaging films. It also looks at developments in process control and instrumentation, barrier film technology, and thermoforming.

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Compounding WORLD
Film and Sheet EXTRUSION
Pipe and Profile EXTRUSION
Injection WORLD
Plastics Recycling WORLD

GLOBAL EXHIBITION GUIDE

2022	**25-28 April**	Chinaplas, Shanghai, China **POSTPONED**	www.chinaplasonline.com
	3-5 May	JEC 2022, Paris France	www.jec-world.events
	3-6 May	GreenPlast, Milan, Italy	www.greenplast.org
	16-18 May	Plast Alger, Algiers, Algeria	https://www.plastalger.com/
	18-19 May	PlastExpo Nordic, Helsinki, Finland	https://pfsptec.messukeskus.com/
	24-27 May	Plastpol, Kielce, Poland	https://www.targikielce.pl/en/plastpol
	25-26 May	Injection Moulding & Design, Detroit, MI, USA	https://injectionmoldingexpo.com/
	10-13 June	IPLAS, Chennai, India	www.iplas.in
	26-30 September	Colombiaplast, Bogota, Colombia	www.colombiaplast.org
	27-29 September	Fachpack 2022, Nuremburg, Germany	www.fachpack.de
	3-7 October	Plastex, Brno, Czech Republic	www.bvv.cz/en/plastex/
	19-26 October	K2022, Dusseldorf, Germany	www.k-online.com
	9-10 November	Compounding World Expo USA, Cleveland, USA	www.compoundingworldexpo.com/na/
	1-3 December	Plast Print Pack West Africa, Accra, Ghana	www.ppp-westafrica.com
2023	**17-19 January**	Swiss Plastics Expo, Lucerne, Switzerland	https://swissplastics-cluster.ch/
	1-5 February	PlastIndia, New Delhi, India	www.plastindia.org
	13-16 May	Moulding Expo, Stuttgart, Germany	https://www.messe-stuttgart.de/moulding-expo/en/
	14-15 June	Compounding World Expo Europe, Essen, Germany	www.compoundingworldexpo.com/eu/
	5-8 September	Plast 2023, Milan, Italy	www.plastonline.org/en

AMI CONFERENCES

26-27 April 2022	Fire Retardants in Plastics, Houston, TX, USA
11-12 May 2022	Masterbatch Europe, Frankfurt, Germany
23-25 May 2022	Pipeline Coating Europe, Vienna, Austria
7-8 June 2022	Compounding World Congress Europe, Cologne, Germany
15-16 June 2022	Chemical Recycling Europe, Cologne, Germany
28-29 June 2022	Polymers in Cables North America, Philadelphia, PA, USA
28-30 June 2022	Polymer Sourcing & Distribution Europe, Hamburg, Germany
6-7 July 2022	Functional Fillers Global **ONLINE**

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

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